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UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Butte County, California Project No. 803-087

NOTICE OF AVAILABILITY OF ENVIRONMENTAL ASSESSMENT

(December 29, 2008)

In accordance with the National Environmental Policy Act (NEPA) of 1969 and the Federal Energy Regulatory Commission's (Commission) regulations, 18 CFR Part 380 (Order No. 486, 52 F.R. 47879), the Office of Energy Projects has reviewed the application for a new license for the DeSabla-Centerville Hydroelectric Project (project), located on Butt Creek in Butt County, California, and has prepared an Environmental Assessment (EA). In the EA, Commission staff analyze the potential environmental effects of licensing the project and conclude that issuing a license for the project, with appropriate environmental measures, would not constitute a major federal action significantly affecting the quality of the human environment.

A copy of the EA is on file with the Commission and is available for public inspection. The EA may also be viewed on the Commission's website at http://www.ferc.gov using the "eLibrary" link. Enter the docket number excluding the last three digits in the docket number field to access the document. For assistance, contact FERC Online Support at FERCOnlineSupport@ferc.gov or toll-free at 1-866-208-3676, or for TTY, (202) 502-8659.

Any comments should be filed within 60 days from the issuance date of this notice, and should be addressed to the Secretary, Federal Energy Regulatory Commission, 888 First Street, N.E., Room 1-A, Washington, D.C. 20426. Please affix "DeSabla-Centerville Hydroelectric Project No. 803-087" to all comments. Comments may be filed electronically via Internet in lieu of paper. The Commission strongly encourages electronic filings (See 18 CFR 385.2001(a) (1) (iii) and the instructions on the Commission's website under the "eFiling" link). For further information, contact Kenneth Hogan at (202) 502-8434.

Kimberly D. Bose,
Secretary.

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ENVIRONMENTAL ASSESSMENT

FOR

MINOR-PART HYDROPOWER LICENSE

DeSabla-Centerville Hydroelectric Project

FERC Project No. 803-087

California

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

December 2008

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ACRONYMS AND ABBREVIATIONS

Advisory Council	Advisory Council on Historic Preservation
APE	area of potential effect
APEA	applicant-prepared environmental assessment
Cal Fish & Game	California Department of Fish and Game
CFR	Code of Federal Regulations
cfs	cubic feet per second
Commission	Federal Energy Regulatory Commission
CRLF	California red-legged frog
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
EA	environmental assessment
EFH	essential fish habitat
EPAct	Energy Policy Act of 2005
ESA	Endangered Species Act
FERC	Federal Energy Regulatory Commission
Forest Service	U.S. Forest Service
FONSI	finding of no significant impact
FPA	Federal Power Act
FWS	U.S. Fish and Wildlife Service
FYLF	foothill yellow-legged frog
HPMP	historic properties management plan
IFIM	instream flow incremental methodology
ILP	Integrated Licensing Process
Interior	Department of the Interior
kW	kilowatt
kWh	kilowatt-hour
msl	mean sea level
MW	megawatt
MYLF	mountain yellow-legged frog
National Register	National Register of Historic Places
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
PG&E	Pacific Gas and Electric Company
PURPA	Public Utility Regulatory Policies Act
PA	programmatic agreement
USC	U.S. Code
VELB	valley elderberry longhorn beetle
WQC	water quality certification
WUA	weighted usable area

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EXECUTIVE SUMMARY

On October 2, 2007, the Pacific Gas and Electric Company (PG&E or Licensee) filed an application for a new minor-part license for its DeSabla-Centerville Hydroelectric Project, Project No. 803 (project). The 26.6-megawatt project is located on Butte Creek and the West Branch Feather River (West Branch Feather River) in Butte County, California, and consists of three developments (Toadtown, DeSabla, and Centerville), which collectively include three reservoirs, three powerhouses, 14 diversion and feeder dams, five canals, and associated equipment and transmission facilities. The project is described in more detail in sections 2.1.1 *Existing Project Facilities*. The project occupies 147.8 and 21[1] acres of federal land under the jurisdiction of the U.S. Forest Service and the U.S. Bureau of Land Management, respectively, for a total of 168.8 acres of federal lands.

Proposed Action

PG&E's proposed changes in operation under the Licensee's Proposed Project versus current operations include higher minimum instream flow releases at the following locations:

•West Branch Feather River below Hendricks diversion dam
•Butte Creek below Butte diversion dam
•Butte Creek below Lower Centerville diversion dam

No new facilities are being proposed by PG&E; however, PG&E does propose to rehabilitate and upgrade existing recreation facilities. Additional measures being proposed by PG&E include: the removal of five feeder diversions; monitoring the anadromous fishery in lower Butte Creek; protection of Forest Service special status species; invasive species control on Forest Service lands; funding to stock DeSabla reservoir with catchable trout, maintain all project roads; implementing a visual, fire management, and hazardous substance land management plan; and implementing a Historic Properties Management Plan. PG&E's measures are described in more detail in section 2.2 *Applicant's Proposal*.

Alternatives Considered

[1] In the license application PG&E states that the DeSabla-Centerville Project occupies 11.6 acres of federal lands administered by the BLM. In a letter dated September 10, 2008 the BLM indicated that the project occupies an additional 9.4 acres of land administered by the BLM.

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This draft Environmental Assessment (EA) analyzes the effects of the proposed action and recommends conditions for any license issued. In addition to the proposed action, the EA considers: (1) PG&E's proposal with additional staff-recommended measures (staff alternative); (2) the staff alternative with mandatory conditions; and (3) a no-action alternative.

Under the staff alternative the project would generally be operated as proposed by PG&E, and with the following additional measures: (1) monitor fish populations and water temperatures in project affected stream reaches; (2) provide velocity based ramping rates for project bypass reaches; (3) provide a 1 cfs minimum instream flow in Helltown Ravine below the lower Centerville Canal; (4) stabilize the Philbrook spillway channel; and (5) extend the boat launch at Philbrook reservoir. We include most of the section 4(e) measures, but not all of the measures specified by the Forest Service[2] and the U.S. Bureau of Land Management in the staff alternative. Measures not included in the staff alternative include: the Bureau of Land Management's condition 19 to fund law enforcement; and the Forest Service's condition 18 for minimum instream flows, condition 19 to monitor West Branch Feather River Rainbow Trout, and condition 32 for the resolution of PG&E encumbrances on National Forest System Lands.

Public Involvement and Areas of Concern

PG&E utilized the Commission's Integrated Licensing Process (ILP) to prepare its license application. The intent of the Commission's pre-filing process under the ILP is to initiate public involvement early in the project planning process and to encourage citizens, governmental entities, tribes, and other interested parties to identify issues and information needs prior to an application being formally filed with the Commission. As part of the pre-filing process, Commission staff distributed Scoping Document 1 to interested parties on October 19, 2004 and issued Scoping Document 2 on March 18, 2005. Scoping meetings were held in Chico, California, on November 17 and 18, 2004. On May 1, 2008, after the final license application filing, we requested comments, conditions and recommendations in our application acceptance and ready for environmental assessment notice.

[2] While we adopt most of the Forest Service's 4(e) recommendations, we do so as amended by staff and as described in section 5.2 *Comprehensive Development and Recommended Alternative.* However, we recognize that any 4(e) condition that meets the requirements of the law must be included in any license issued by the Commission, regardless of whether we include or amend the condition in our Staff Alternative.

The primary issue with this project is effects on cool water habitat for federally listed threatened Central Valley spring-run Chinook salmon (Chinook salmon) and Central Valley steelhead (steelhead) in lower Butte Creek by transferring cool water in the summer from the Project's reservoirs on the West Branch Feather River to lower Butte Creek.

We will give 60 days for entities to comment on the EA and will consider all comments received on the EA before final action is taken on the application.

Project Effects

The table below summarizes the environmental effects of the four alternatives considered in the EA.

Comparison of Alternatives for the DeSabla-Centerville Hydroelectric Project (Source: staff).

Resource	**No Action Alternative**	**Proposed Action**	**Staff Alternative**	**Staff Alternative with Mandatory Conditions**
Generation	155.7 GWh	146.6 GWh	146.4 GWh	139.4 GWh
Geology	Continued erosion along roads and at many project facilities such as Round Valley Reservoir Spillway and Philbrook Spillway Channel	Implement Best Management Practices to reduce erosion in project area including roads, Round Valley Reservoir Spillway, and project canals	The proposed action and the reconstruction areas of the Butte Creek Canal, slope, and road, and development and implementation of a Philbrook Spillway Channel Stabilization Plan	Same as staff alternative
Aquatic Resources	Provide existing minimum flows, operate project to manage water temperatures in lower Butte Creek for federally listed anadromous fish	Same as no action with higher minimum instream flows for resident fish, remove barriers on five feeder diversions, and conduct fish rescues from project canals.	The proposed action with monitoring of resident fish populations and water temperatures in project affected stream reaches	Same as staff alternative with more extensive resident fish monitoring and even higher minimum flows on the West Branch Feather River

Terrestrial Resources	Provide and maintain deer protection facilities (bridges, escape structures, etc.) at project canals	Same as no action with protection of special status species and invasive species control on Forest Service lands	Provide velocity based ramping rates to protect egg masses and tadpoles of the foothill yellow legged frog, provide monitoring of foothill; yellow legged frog; extend protection of special status species and invasive species control to non-Forest Service lands; bald eagle monitoring; and summary report of animal mortality and additional protection measures, as appropriate	Same as staff alternative with more extensive monitoring of foothill yellow-legged frog
Threatened and Endangered Species	Operate project to manage water temperatures in lower Butte Creek for federally listed anadromous fish, impellent Valley Elderberry Longhorn Beetle Conservation Program	Higher minimum instream flows for federally listed anadromous fish, reduce project affects on water temperature increases at DeSabla forebay, monitor adult Chinook salmon and steelhead in lower Butte Creek and continue to implement beetle conservation program	Same as proposed action with additional monitoring of Chinook salmon movements and habitat responses to changes in minimum instream flows	Same as proposed action

Recreation Resources	Continue to operate and maintain existing recreation facilities at the project	Same as no action the rehabilitation and upgrades to existing recreation facilities to ADA standards, work with the Forest Service to discourage dispersed camping and OHV use, install informational signs, fund Cal Fish & Game to stock DeSabla reservoir, provide streamflow information and access for whitewater boating	Same as proposed action with additional upgrades to existing boat launch on Philbrook reservoir and existing user-created trail, and recreation monitoring throughout the term of the new license	Same as staff alternative with the addition of a trail on the SE shoreline of Philbrook reservoir, a portion of camping fees from Philbrook Campground distributed to Forest Service, and providing project patrol
Land Use and Aesthetics	Continue to maintain all project roads and facilities	Work with the Forest Service to identify roads, survey existing road conditions, and maintain all project roads and develop and implement a visual, fire management, and hazardous substance land management plan.	Same as proposed action with additional erosion measures and traffic controls during construction	Same as staff alternative with the addition of a 5-year traffic monitoring plan and road maintenance and/or reconstruction on several non-project roads
Cultural Resources	Previously identified eligible sites protected, but no treatment measures for newly identified sites and no policies for avoidance	Historic Properties Management Plan that provides site-specific protection measures and general guidance for protecting cultural sites	Modified HPMP that includes additional information and collection policies	Same as staff alternative

Conclusions

Based on our analysis, we recommend licensing the project as proposed by PG&E with some staff modifications and additional measures (staff alternative) as described under Alternatives Considered.

In section 4.1 of the EA, we estimate the annual net benefits of operating and maintaining the project under the four alternatives identified above. Our

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analysis shows that the annual net benefit would be $763,000 under the proposed action; $332,000 under the staff alternative; and $5,569,000 under the no-action alternative. For the staff recommended alternative with mandatory conditions, our analysis shows that the net benefit of the project would be negative ($624,000).

On the basis of our independent analysis, we conclude that issuing a license for the project as proposed by PG&E, with the staff-recommended environmental measures (staff alternative) would not be a major federal action significantly affecting the quality of the human environment.

We chose the staff alternative as the preferred alternative because it would: (1) provide a dependable source of electrical energy for the region (146.4 GWh annually); (2) the 26.7 MW of electric energy generated from a renewable resource may offset the use of fossil-fueled, steam-electric generating plants, thereby conserve nonrenewable energy resources and reduce atmospheric pollution; and (3) the recommended environmental measures proposed by PG&E, as modified 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 PG&E's proposed and staff's recommended environmental measures.

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

DeSabla-Centerville Hydroelectric Project
FERC Project No. 807-087 – California

1.0 INTRODUCTION

1.1 Application

On October 2, 2007, the Pacific Gas and Electric Company (PG&E or Licensee) filed an application for a new minor-part license for its existing DeSabla-Centerville Hydroelectric Project, Project No. 803 (project). On November 21, and December 31, 2007, PG&E supplemented its application with the filing of its response to the Commission's October 31, 2007, request for additional information, and with its updated study reports, respectively. The 26.7 megawatt (MW) project has historically produced an average annual generation of 155.7 gigawatt hours (GWh). Located on Butte Creek and West Branch Feather River in Butte County, California, the project consists of three developments (Toadtown, DeSabla, and Centerville), which collectively include three reservoirs, three powerhouses, 14 diversion and feeder dams, five canals, and associated equipment and transmission facilities (see figures 1, 2, and 3). The project occupies 147.8[3] and 21[4] acres of federal land under the jurisdiction of the U.S. Forest Service (Forest Service) and the U.S. Bureau of Land Management (Bureau), respectively, for a total of 168.8 acres of federal lands. No new capacity or construction at the project is being proposed by PG&E.

1.2 Purpose of Action and Need for Power

1.2.1 Purpose of Action

[3] The project occupies 145.7 acres of the Lassen National Forest and 2.1 acres of the Plumas National Forest for a total of 147.8 acres of project lands located in national forest.

[4] In the license application PG&E said the DeSabla-Centerville Hydroelectric Project occupies 11.6 acres of federal administered by the Bureau. In a letter dated September 10, 2008 the Bureau indicated that the project occupies an additional 9.4 acres of land administered by the Bureau.

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The Commission must decide whether to issue a license to PG&E for the project, and what conditions should be placed in 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 (e.g., flood control, irrigation and water supply), the Commission must give equal consideration to the purposes of energy conservation, the protection, mitigation of damage to, and enhancements of fish and wildlife (including related spawning grounds and habitat), the protection of recreational opportunities, and the preservation of other aspects of environmental quality.

Issuing a new license for the DeSabla-Centerville Hydroelectric Project would allow PG&E to generate electricity at the project for the term of a new license, making electric power from a renewable resource available to its customers.

This draft EA assesses the effects associated with operation of the project, alternatives to the proposed project, and makes recommendations to the Commission on whether to issue a new license, and if so, recommends terms and conditions to become a part of any license issues.

In this draft EA, we assess the environmental and economic effects of continuing to operate the project: (1) as proposed by PG&E; and (2) with our recommended measures. We also consider the effects of the no-action alternative. Important issues that are addressed include: the establishment of appropriate flow regimes in project-affected stream reaches and water temperature reductions within DeSabla Forebay, erosion, ramping rates and monitoring for the Foothill Yellow-Legged Frog, recreation, road maintenance/management, and cultural/tribal issues.

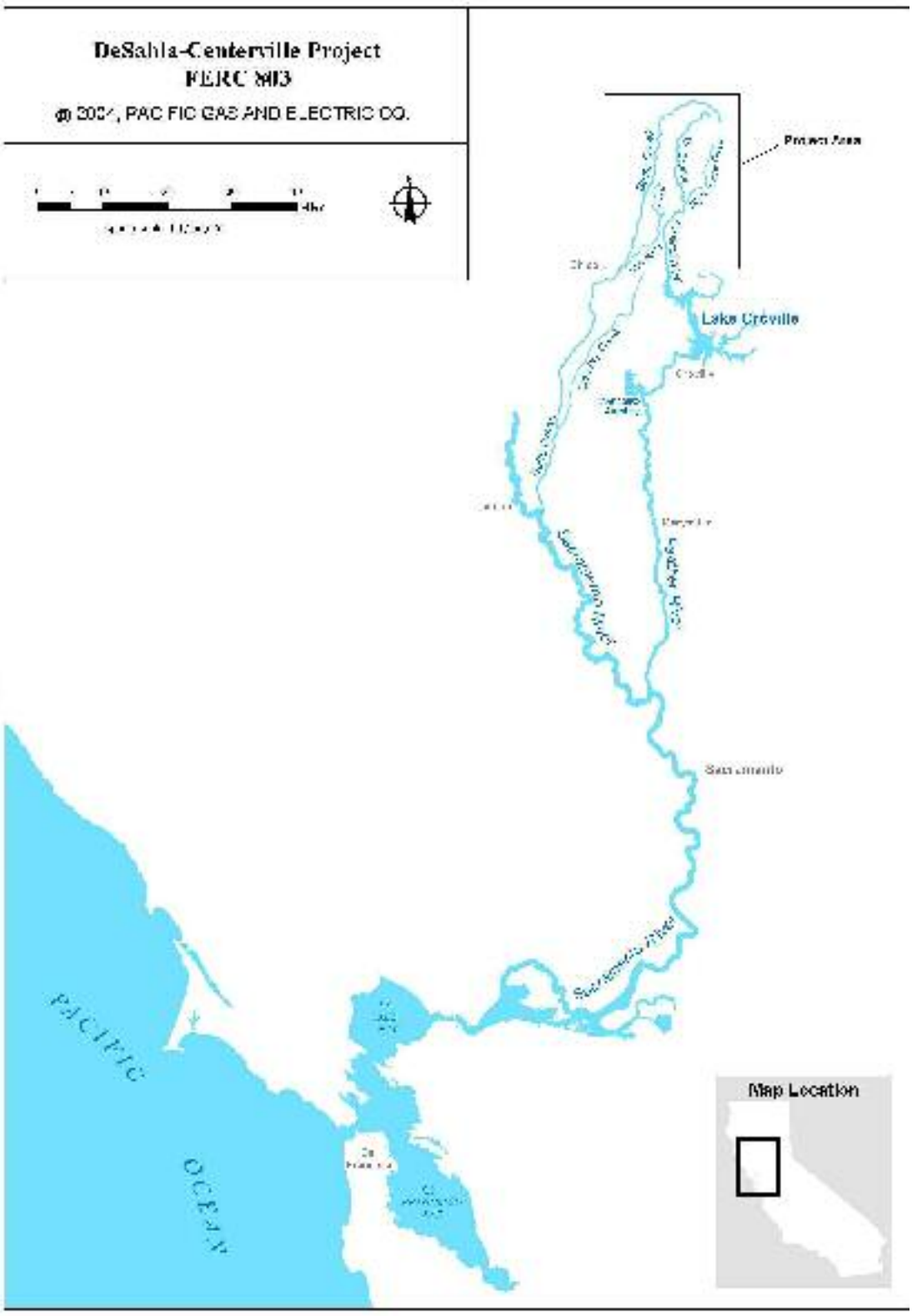

Figure 1-1. Overview Map of the Butte Creek and West Branch Feather River Drainage (Source: PG&E as modified by staff).

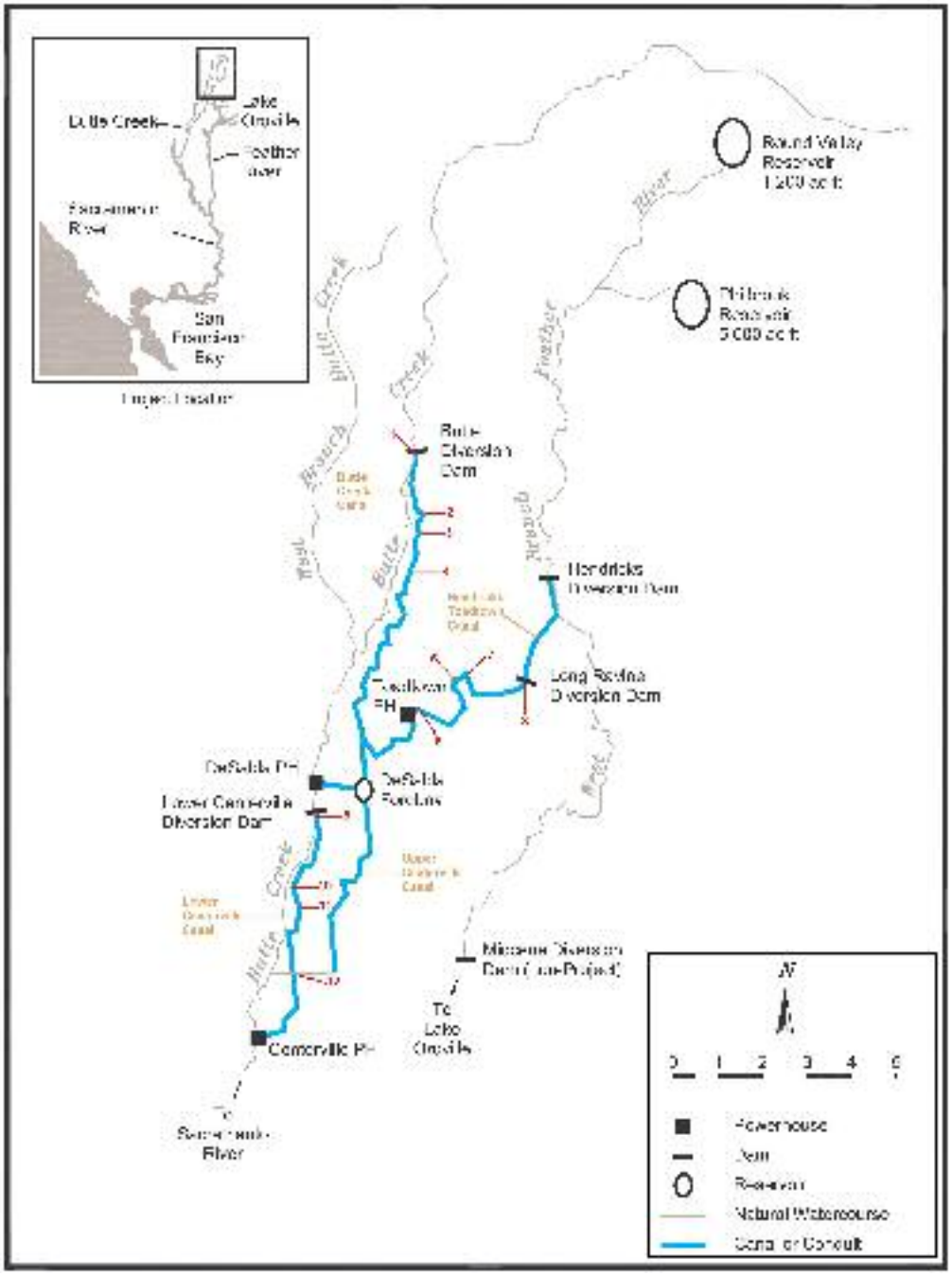

Figure 1-2. Locations of Major Project Facilities (Source: PG&E as modified by staff). 1-Inskip Creek, 2-Kelsey Creek, 3-Stevens Creek[5], 4-Clear Creek, 5-Little Butte Creek[3], 6-Little West Fork, 7-Cunningham Ravine, 8-Long Ravine, 9-Oro Fino Ravine[3], 10-Emma Ravine[3], 11-Coal Claim Ravine[3], 12-Helltown Ravine[6].

[5] Diversions from these tributaries have been discontinued.

[6] When in use, flows from Upper Centerville Canal are diverted into Helltown Ravine before being delivered to the lower Centerville Canal.

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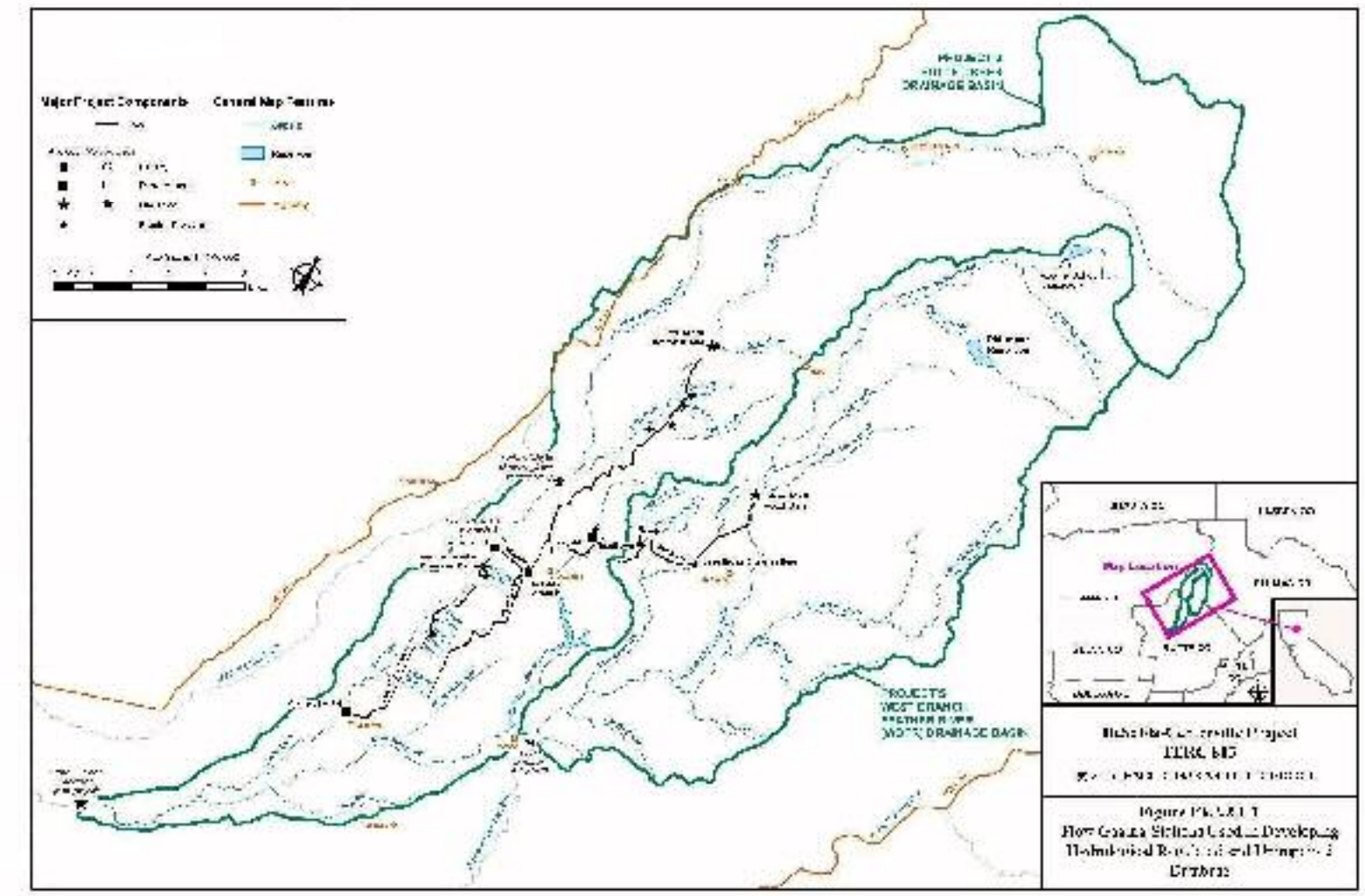

Figure 1-3. Locations of Project Facilities within project drainage basins (Source: PG&E as modified by staff).

1.2.2 Need for Power

The DeSabla-Centerville Hydroelectric Project has an installed capacity of 26.7 megawatts (MW) and produces about 145.9 GWh annually with a dependable capacity of 7.9 MW. PG&E will continue to use power from the project to meet the needs of its electric customers. The DeSabla-Centerville Hydroelectric Project is a resource that contributes to PG&E's resource diversity, and plays a part in meeting the power requirements of both PG&E and the state of California.

PG&E is an electric and gas utility with a service area that stretches from Eureka, California in the north to Bakersfield, California in the south, and from the Pacific Ocean in the west to the Sierra Nevada in the east. PG&E maintains 123,054 circuit miles of electric distribution lines and 18,610 circuit miles of interconnected transmission lines and provides electric service to about 5.1 million customers. PG&E produces or buys its power from a mix of conventional and renewable resources.

In July 2007, the California Energy Commission released "California Energy Demand 2008-2018, Staff Draft Forecast[7]. This report shows that in the PG&E Planning area electricity consumption and peak load is forecast to increase about 1.3% per year over the next ten years.

The DeSabla-Centerville Hydroelectric Project is in the California-Mexico Power Area (CA/MX) of the Western Electricity Coordinating Council (WECC) within the North American Electric Reliability Council. WECC forecasts electrical supply and demand for the regional for a 10-year period.[8] According to the July 2006, 10-Year Coordinated Plan Summary annual capacity requirements are projected to grow at an annual compound rate of 1.9 percent through 2015 for the CA/MX region. Also, the July 2006 10-Year Coordinated Plan Summary projects the annual energy usage to increase at 2.1 percent through 2015 for the CA/MX region.

If licensed, the power from the DeSabla-Centerville Hydroelectric Project would continue to be useful in meeting PG&E's needs as well as part of the local and regional need for power. The project provides low-cost power that displaces non-renewable, fossil-fired generation and contributes to a diversified generation mix. Displacing the operation of fossil-fueled facilities may avoid some power plant emissions and creates and environmental benefit.

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[7] California Energy Commission. July 2007. California Energy Demand 2008-2018, Staff Draft Report, CEC-200-2007-015SD.

[8] Western Electricity Coordinating Council. July 2006. 10-Year Coordinated Plan Summary, Planning and Operation for Electric System Reliability.

1.3 Statutory and Regulatory Requirements

A license for the DeSabla-Centerville Hydroelectric Project is subject to requirements under the Federal Power Act (FPA) and other applicable statutes. The major regulatory and statutory requirements are summarized in Table 1 and described below.

Table 1-1. Statutory and regulatory requirements for the DeSabla – Centerville Hydroelectric Project.

Requirement	Agency	Status
Section 18 of the FPA (fishway prescriptions)	FWS, NMFS	FWS and NMFS filed a reservation of authority on June 27, 2008, and June 30, 2008, respectively.
Section 4(e) of the FPA (land management conditions)	Forest Service, Bureau	Forest Service and Bureau provided preliminary 4(e) Conditions on June 27, 2008 and September 11, 2008, respectively.
Section 10(j) of the FPA	Cal Fish & Game, FWS, NMFS	The agencies provided section 10(j) recommendations on July 8, 2008, June 27, 2008, and June 30, 2008, respectively.
Clean Water Act—water quality certification	California Water Resources Control Board	Application for certification received on June 17, 2008; due by June 18, 2009.
Endangered Species Act	FWS, NMFS	This draft EA serves as our Biological Assessment under Section 7 of the Endangered Species Act.

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 the construction, operation, and maintenance by a licensee of such fishways as may be prescribed by the

Secretaries of Commerce (Commerce) or the FWS (FWS). FWS, by letter dated June 27, 2008, and Commerce, by letter dated June 30, 2008, requests 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 4(e) Conditions

Section 4(e) of the FPA provides that any license issued by the Commission for a project within a federal reservation shall be subject to and contain such conditions as the Secretary of the responsible federal land management agency deems necessary for the adequate protection and use of the reservation. On June 27, 2008 and September 11, 2008, the Forest Service and U.S. Department of FWS's Bureau respectively, filed preliminary conditions pursuant to section 4(e) of the Federal Power Act. These conditions are described under section 2.2.5, *Modifications to Applicant's Proposal—Mandatory Conditions*.

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

The Energy Policy Act of 2005 (EPAct) provides parties to this licensing proceeding the opportunity to propose alternatives to preliminary conditions. On July 30, 2008, PG&E filed a copy of it's filing to the Forest Service and the Bureau proposing alternative 4(e) conditions in response to their preliminary section 4(e) conditions and seeking a trial-type hearing with respect to both Forest Service and Bureau 4(e)s. As a result of PG&E's alternative 4(e)s, the Bureau withdrew their preliminary 4(e) conditions filed on June 27, 2008, and filed revised preliminary 4(e) conditions on September 11, 2008. On September 18, 2008, PG&E filed with the Commission their withdrawal of their request for a trial-type hearing of the Bureau's 4(e) conditions. On December 11, 2008, PG&E's withdrawal of their alternative 4(e) conditions to the Bureau's preliminary 4(e)s, was filed with the Commission. Additionally, On July 30, 2008, the California Sportfishing protection Alliance, Friends of Butte Creek, Friends of the River, and American Whitewater, (collectively the Conservation Groups), filed alternative 4(e) conditions.

Both PG&E's and the Conservation Groups' alternative 4(e) conditions to the Forest Service's preliminary 4(e) include alternatives to: provide minimum stream flows and aquatic biological monitoring. These alternative conditions provided by PG&E and the Conservation Groups are analyzed within the corresponding resource areas in section 3, Environmental Analysis, and section 5.2, *Comprehensive Development and Recommended Alternative*.

1.3.1.3 Section 10(j) Recommendations

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

FWS (on June 27, 2008), and NMFS and the Cal Fish & Game (each on June 30, 2008) timely filed, recommendations under section 10(j), as summarized in table 4, in section 5.4.1, Recommendations of Fish and Wildlife Agencies. In section 5.4, we also discuss how we address the agency recommendations and comply with section 10(j). The 10(j) recommendations are discussed in section 5.4 of this EA.

1.3.2 Clean Water Act

Under the section 401 of the Clean Water Act (CWA), a license applicant must obtain certification from the appropriate state pollution control agency verifying compliance with the CWA. On June 17, 2008, PG&E applied to the California Water Resources Control Board (Water Board) for 401 water quality certification (WQC) for the DeSabla – Centerville Hydroelectric Project. The Water Board also received this request on June 17, 2008. The Water Board has not yet acted on the request. The WQC certificate is due by June 18, 2009.

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. The federally listed species known to occur in the DeSabla – Centerville Hydroelectric Project's vicinity are the Central Valley spring-run Chinook salmon and the Central Valley steelhead, each of which have designated critical habitat within the project's area, the valley elderberry longhorn beetle (VELB) and the California red-legged frog (CRLF).

We conclude that continued operation of the project could adversely affect the threatened valley elderberry longhorn beetle (VELB) (*Desmocerus californicus dimorphus*). Even with the implementation of the proposed VELB Conservation Program, there would still be the loss of elderberry habitat and potential adverse effects on the VELB during the term of the license. Therefore, we conclude that relicensing the

project may adversely affect this species. We will request formal consultation with FWS upon issuance of this draft EA.

We conclude that the project would not likely adversely affect the threatened California red-legged frog (*Rana aurora draytonii*) because lack of suitable habitat. Further, the project is not located within designated or proposed critical habitat for the frog.

We conclude that continued operation of the project could adversely affect the Central Valley Chinook salmon and steelhead and the Central Valley Chinook salmon's designated critical habitat. Even with the benefits the project provides to the Chinook salmon and the steelhead and their habitats, and with our recommended measures, the project may still result in the incidental take of these species or adversely modify their habitat as a result of an unanticipated shut-down of project facilities or other malfunctions. Therefore, we conclude that relicensing the project may adversely affect these species and the Central Valley Chinook salmon's designated critical habitat. We will request formal consultation with the NMFS upon issuance of this draft EA.

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 5.2, *Comprehensive Development and Recommended Alternative.*

1.3.4 Coastal Zone Management Act

Under section 307(c)(3)(A) of the Coastal Zone Management Act (CZMA), 16 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 DeSabla – Centerville Hydroelectric Project is not located within the state-designated CZMA, which extends from a few blocks to 5 miles inland from the sea (www.ceres.ca.gov/coastal.com), and relicensing the project would not affect California's coastal resources. Therefore the project is not subject to California coastal zone program review and no consistency certification is needed. We will seek the concurrence of the California Coastal Commission with our determination.

1.3.5 National Historic Preservation Act

Section 106 requires that federal agencies "take into account" how the agency's undertakings could affect historic properties. Historic properties are districts, sites,

buildings, structures, traditional cultural properties, 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 operation of the DeSabla – Centerville Project. The terms of the PA would ensure that PG&E addresses and treats all historic properties identified within the project's area of potential effects (APE) through the implementation of the existing Historic Properties Management Plan (HPMP).

1.3.6 Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) requires federal agencies to consult with the National Marine Fisheries Service (NMFS) on all actions that may adversely affect Essential Fish Habitat (EFH). Within the project area, Essential Fish Habitat has been established by the NMFS in the project area in Butte Creek between Parrott-Phelan diversion dam and Lower Centerville diversion dam for spring-run Chinook salmon, fall-run Chinook salmon, and late fall-run Chinook salmon, (collectively Chinook salmon).[9]

With this EA, we recommend a number of measures, for the betterment of Chinook salmon. As a result we conclude licensing the project, as proposed by PG&E, with staff's additional measures would not adversely affect EFH. With this draft EA, we are requesting NMFS's concurrence with our conclusion on EFH.

1.3.7 California Environmental Quality Act

The California Environmental Quality Act (CEQA) is the California counterpart to the National Environmental Policy Act. CEQA went into effect in 1970 for the purpose of monitoring land development in California through a permitting process. This statute, enacted to protect the health of the environment from current and future development, requires state and local agencies to identify the significant environmental impacts of their actions and to avoid or mitigate those impacts, if feasible. CEQA applies to all discretionary activities proposed to be undertaken or approved by California state and local government agencies. For the DeSabla – Centerville Hydroelectric Project,), the California State Water Resources Control Board is a responsible state permitting agency under CEQA, as they must act on PG&E's request for a water quality certificate for the project (see section 1.3.2, Clean Water Act).

[9] Section 4.7 of PG&E's Final License Application.

Under CEQA, an environmental impact report (EIR) is prepared when the public agency finds substantial evidence that the project may have a significant effect on the environment. An EIR is the public document used to analyze the significant environmental effects of a proposed project, to identify alternatives, and to disclose possible ways to reduce or avoid the possible environmental damage. CEQA guidelines state that when federal review of a project is also required, state agencies are encouraged to integrate the two processes to the fullest extent possible, which may include a joint EA or EIS and EIR. While this document is not a joint EA/EIR, the Water Board has the opportunity to use this document, as appropriate, to satisfy its responsibilities under CEQA. As such, we invite the Water Board's comments on this EA as they may pertain to the agencies' use of the final EA for CEQA purposes.

One element needed in an EIR, but not required by the National Environmental Policy Act, is a discussion of a program for monitoring or reporting on mitigation measures that were adopted or made conditions of project approval. The monitoring or reporting program must ensure compliance with mitigation measures during project implementation. The program may also provide information on the effectiveness of mitigation measures. Although discussion of the mitigation reporting or monitoring program can be deferred until the final environmental impact report or, in some cases, after project approval, it is often included in the draft environmental impact report to obtain public review and comment.

In section 3 of this EA, Environmental Analysis, we describe each potential environmental resource impact, our analysis of each recommended mitigation measure, and our conclusion with respect to the effectiveness of each measure in addressing the impact. In section 5.2, Comprehensive Development and Recommended Alternative, we list the mitigation measures and monitoring and reporting requirements we recommend for inclusion in any license issued for the DeSabla – Centerville Hydroelectric Project. In Appendix C, we have included draft license articles if the project were to be licensed as recommended by staff, and inclusive of mandatory conditions provided by other agencies. Additionally, any conditions of a water quality certificate that may be issued for this project will become an enforceable part of any license issued for this project.

Regarding growth inducing impacts caused by the project, an analysis required under CEQA but not required in an EA or EIS, for this relicensing, we find that the higher minimum instream flows being required by the Forest Service's mandatory conditions would translate to less annual power generation of the project. A net reduction in power generation would not facilitate population growth or remove an obstacle to growth.

1.4 Public Review and Consultation

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

1.4.1 Scoping

Before preparing this draft EA, 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 19, 2004. It was noticed in the Federal Register on October 25, 2004. Two scoping meetings were held on November 17-18, 2004, in Chico, California, to solicit oral comments on the project. 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 Entities	**Date Filed**
U.S. Forest Service	January 28, 2005
U.S. Fish and Wildlife Service	January 31, 2005
California Dept. of Fish and Game	January 31, 2005
Sacramento River Preservation Trust	January 31, 2005
Friends of the River	February 1, 2005
Pacific Gas and Electric Company	February 1, 2005
U.S. National Park Service	February 1, 2005
California Water Resources Control Board	February 1, 2005
Chico Paddleheads	February 2, 2005
U.S. Department of Commerce National Marine Fisheries Service	February 2, 2005

A revised Scoping Document (Scoping Document 2), addressing these comments, was issued on March 18, 2005.

1.4.2 Interventions

On May 1, 2008, the Commission issued a public notice accepting the application and soliciting motions to intervene, with a filing deadline of Monday, June 30, 2008. In response to the notice, the following entities filed motions to intervene:

Intervening Party	**Date Filed**

California Sportfishing Protection Alliance, et. Al.	June 16, 2008
California State Water Resources Control Board	June 23, 2008
U.S. Department of the FWS	June 27, 2008
U.S. Department of Agriculture, Forest Service	June 27, 2008
Sackheim Consulting	June 30, 2008
California Department of Fish and Game	June 30, 2008
National Oceanic Atmospheric Administration	
National Marine Fisheries Service	June 30, 2008
Gerald M. Lutticken, P.E.	June 30, 2008

1.4.3 Comments on the License Application

In addition to interventions, the May 1, 2008 notice solicited comments on the license application. The following entities filed comments:

Commenting Agencies and other Entities	**Date Filed**
Greenville Rancheria	June 19, 2008
M&T Ranch	June 25, 2008
Lars Estrem	June 26, 2008
U.S. Department of the FWS	June 27, 2008
California Sportfishing Protection Alliance	June 27, 2008
U.S. Department of Agriculture	June 27, 2008
Sacramento Valley Land Owners Assoc.	June 30, 2008
John S. Blacklock	June 30, 2008
Butte County, California	June 30, 2008
California Department of Fish and Game	June 30, 2008
National Oceanic Atmospheric Administration	
National Marine Fisheries Service	June 30, 2008
California Sportfishing Protection Alliance	June 30, 2008
James Gaumer	July 2, 2008
Richard Theiriot	July 7, 2008
Butte Creek Watershed Conservancy	July 15, 2008
California Salmon and Steelhead Association	September 22, 2008

PG&E filed reply comments on Thursday, August 14, 2008.

2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 No-action Alternative

Under the no-action alternative, we use existing conditions as the baseline environmental condition for comparison with other alternatives. Thus the project would continue to operate under the terms and conditions of the current license. The no-action alternative includes the existing facilities and current project operation.

2.1.1 Existing Project Facilities

The DeSabla – Centerville Hydroelectric Project is divided into three developments: Toadtown, DeSabla, and Centerville. The physical elements of each development are described below generally following the flow of water through each development. The Toadtown Development diverts water from the West Branch of the Feather River (West Branch Feather River). The DeSabla Development diverts water from upper Butte Creek as well as using the outflow of the Toadtown Development. The downstream Centerville Development diverts the flow of Butte Creek downstream of the DeSabla Development (See Figure 2).

The Toadtown Development, which diverts water from the West Branch Feather River basin to the Butte Creek basin, consists of the following constructed facilities: (1) Round Valley Reservoir, a 98 acre reservoir with a gross storage capacity of 1,700 acre-feet; (2) Round Valley dam, an earthfill dam, 29-feet high and 810-feet long; (3) a 40-foot wide overflow spillway; (4) a 15-inch outlet pipe at the base of Round Valley dam, and manual low level outlet valve; (5) Philbrook Reservoir, a 173 acre reservoir with a gross storage capacity of 4,985 acre-feet; (6) Philbrook main dam (located on Philbrook Creek), a compacted earthfill dam, 87-feet high and 850-feet long; (7) Philbrook auxiliary dam (170 feet to the right of the main dam), a compacted earthfill dam, 24-feet high and 470-feet long; (8) a 29.7-foot wide spillway with 5 flashboard bays; (9) a 10.75-foot long and 14.75-foot wide spillway with a single, manual radial gate; (10) a 33-inch diameter, 460-foot long outlet conduit from Philbrook Reservoir; (11) a 17-foot high, 8-feet diameter submerged vertical concrete intake, controlled by a 30-inch diameter manual needle valve; (12) Hendricks Head Dam, a concrete gravity dam, 15-feet high with an overflow spillway section 98-feet wide; (13) an 8.66-mile long Hendricks Canal, composed mostly of earthen ditch with several flume and tunnel sections, with a capacity of 125 cubic feet per second (cfs); (14) feeder diversions from 4 creeks into Hendricks/Toadtown canal; (15) a 40-inch diameter, 1,556-foot long steel penstock; (16) Toadtown powerhouse, a 28 by 44 foot reinforced concrete building, with one turbine-generator unit and a normal operating capacity of 1.5 MW; (17) a 1500-foot long 12 kv tapline connecting Toadtown powerhouse to a distribution system; and (18) appurtenant facilities.

The DeSabla Development, which diverts water from upper Butte Creek and uses the outflow of the Toadtown Development, consist of the following constructed facilities: (1) the 2.4-mile long Toadtown Canal, an earthen canal with a capacity of 125 cfs; (2) Butte Creek diversion dam, a 50-foot high, 100-foot long, concrete arch dam with an

overflow spillway; (3) a 11.4-mile long Butte Canal, composed of earthen berm sections, gunited sections, tunnel sections, a siphon, and flume sections, with a capacity of 91 cfs; (4) a 0.7-mile long canal that combines Butte Canal with Toadtown Canal, with a capacity of 191 cfs; (5) feeder diversions from 4 creeks that flow into Butte Canal (1 not in use); (6) DeSabla Dam, a 50-foot high, 100-foot wide earthen embankment with a spillway canal; (7) DeSabla Forebay, a 15 acre reservoir with a gross storage capacity of 163 acre-feet; (8) a 66-inch diameter, reduced to 42-inch diameter, 1.3-mile long steel penstock; and (9) DeSabla powerhouse, a 26.5 by 41 foot reinforced concrete building, with one turbine generator unit and a normal operating capacity of 18.5 MW; (10) a 0.25-mile long transmission tapline connecting DeSabla powerhouse to the 60kV Oro Fino Tap Line; and (11) appurtenant facilities.

The Centerville Development, which diverts the flow of Butte Creek downstream of the DeSabla Development, consists of the following constructed facilities: (1) the Upper Centerville Canal, that originates at DeSabla powerhouse and ends at Helltown Ravine (currently carries a few cfs for local water uses and has not been used for power generation for many years); (2) Lower Centerville diversion dam, a 12-foot high, 72.5 foot-wide concrete arch dam with an overflow spillway; (3) an 8-mile long Lower Centerville Canal, composed of earthen canal and several flume sections, with a capacity of 183 cfs; (4) feeder diversions from 3 creeks that flow into Lower Centerville Canal (all 3 no longer in use); (5) one 30-inch diameter and one 42-inch diameter, reduced to 36-inch diameter, 2,559-foot long steel penstocks; (6) Centerville Forebay, a 27 by 37 foot concrete header box with a spillway channel; (7) Centerville powerhouse, a 32 by 109 foot reinforced concrete building, with two turbine-generator units and a total normal operating capacity of 6.4 MW; and (8) appurtenant facilities.

As proposed by PG&E, the project boundary would enclose the following facilities: (1) Round Valley Dam and Reservoir; (2) Philbrook Dam and Reservoir; (3) DeSabla Dam and Forebay; (4) Hendricks Diversion with flow supplemented by the following feeder diversions: Long Ravine, Cunningham Ravine, and Little West Fork; (5) Butte Creek Diversion with flow supplemented by the following feeder diversions: Inskip Creek, Kelsey Creek, and Clear Creek; (6)Lower Centerville Diversion; (7) Hendricks Canal; (8) Butte Creek Canal; (9) Toadtown Canal; (10) Lower Centerville Canal; (11) Upper Centerville Canal; (12) Toadtown powerhouse; (13) DeSabla powerhouse; (14) Centerville powerhouse; (15) Toadtown powerhouse tap line; and (16) DeSabla powerhouse tap line.

The existing project includes the following recreation facilities located at Philbrook Reservoir: Philbrook Campground; Philbrook Picnic and Camping Overflow Area; and Philbrook Angler Access (boat launch). The existing project includes the DeSabla Group Picnic Area located at the DeSabla Forebay. Also, PG&E has issued 21 private, residential boat docks on the east end of Philbrook Reservoir and a courtesy dock

to the Pacific Service Employees Association Camp DeSabla on the DeSabla Forebay. These boat docks are within the project boundary but they are not project facilities.

PG&E proposes the deletion of five stream[10] diversions since they have not been used for over 10 years.

2.1.2 Project Safety

The project has been operating for over 28 years under the existing license and during this time, Commission staff has conducted operational inspections focusing on the continued safety of the structures, identification of unauthorized modifications, efficiency and safety of operations, compliance with the terms of the license, and proper maintenance. Table 1 is a list of all project dams for the DeSabla – Centerville Hydroelectric Project.

Table 2-1. DeSabla - Centerville Hydroelectric Dams

FERC Dam Name	Type	NAT DAM No.
Round Valley	Storage	CA00346
Philbrook Main	Storage	CA00345
Philbrook Saddle	Storage	CA83035
DeSabla	Forebay	CA00343
Cunningham Ravine	Feeder	CA83036
Little West Fork	Feeder	CA83037
Butte Creek (also referred to as Butte Head)	Diversion	CA83038
Inskip Creek	Feeder	CA83039
Kelsey Creek	Feeder	CA00698
Clear Creek	Feeder	CA83040
Little Butte Creek	Feeder	CA83041
Lower Centerville	Diversion	CA83042
Header Box	Intake	CA83043
Hendricks Head	Diversion	CA00702
Hendricks (also referred to as Long Ravine)	Diversion	CA83044

[10] The five stream diversions are: Oro Fino Ravine, Emma Ravine, Coal Claim Ravine feeder diversions located the Lower Centerville Canal; Stevens Creek feeder on the Butte Canal; and Little Butte Creek feeder on the Hendricks Canal.

All project dams are classified as "Low Hazard Potential" dams by FERC guidelines and are exempted from Part 12, Subpart C, of the Commission's Regulations for Emergency Action Plans (EAP) with the exception of the Philbrook Dams. Currently, the Philbrook Dams are the only project dams subject to the Part 12, Subpart D, of the Commission's Regulations (Five-Year Consultant Safety Inspection (CSI) Report Program) for which CSI Reports are currently being prepared.

Under the Part 12(D) requirements the Philbrook Dams are inspected and evaluated every 5 years by an independent consultant and a consultant's safety report has been submitted for Commission review. As part of the relicensing process, the Commission staff would evaluate the continued adequacy of the proposed project facilities under a new license. Special articles would be included in any license issued, as appropriate. Commission staff would continue to inspect the project during the new license term to assure continued adherence to Commission-approved plans and specifications, special license articles relating to construction (if any), operation and maintenance, and accepted engineering practices and procedures.

2.1.3 Existing Project Operation

The DeSabla – Centerville Hydroelectric Project is operated primarily as run-of-the-river and operates on a continuous basis. During the winter and spring, base flows in the West Branch Feather River and Butte Creek typically provide adequate flow for full operation of the project's powerhouses. However, during the summer months, the available base flow water is augmented by water releases from storage at Round Valley and Philbrook reservoirs. During the fall months project powerhouses are operated at reduced capacities due to low stream flows. Figure 2 provides a schematic diagram of how water is diverted for project operation.

The seasonal operation of the project manages the basin runoff throughout the annual hydrologic cycle to best achieve project purposes/objectives including regulatory requirements, recreation, flood control, irrigation, municipal water supply and power generation. Additionally, in 1999, the Central Valley spring-run Chinook salmon (Chinook salmon) were designated as a threatened species under the Endangered Species Act (ESA). Since that time, PG&E has operated the project under an annual Project Operations and Maintenance Plan developed each spring in consultation with the California Department of Fish and Game (Cal Fish & Game), National Marine Fisheries Service (NMFS), and the U.S. Fish and Wildlife Service (FWS). This Operations and Maintenance Plan outlines the procedures and practices followed by PG&E in the operation and maintenance of the project facilities to enhance and protect this habitat for Chinook salmon. This Operations and Maintenance Plan is also intended to provide the

basis for the reservoir temperature release criteria established in the Commission's August 21, 1997 order[11], as amended August 20, 1998.[12]

Direct precipitation and snowmelt runoff are captured in the project's storage reservoirs (Philbrook and Round Valley) and are also partially diverted at each of the project's diversion dams. Releases from the storage reservoirs are conveyed by the West Branch Feather River first to the Hendricks diversion dam.

During normal hydrologic conditions, as determined by snowpack on approximately April 1, the flow through the low level valve at Round Valley Dam is typically reduced to supply only a minimum stream flow requirement of 0.5 cfs to the West Branch Feather River. Once the valve opening is reduced, the reservoir fills and then spills during the spring snowmelt. As spring runoff subsides and the natural stream flow of the West Branch Feather River is no longer adequate to meet the 125 cfs carrying capacity of the downstream Hendricks Canal plus the minimum instream flow requirements for downstream of the Hendricks Head Dam, the low level valve is again opened and water is released from storage to augment the natural stream flow for diversion at the Hendricks Canal. In normal water years this typically begins in mid-June and Round Valley Reservoir will typically be completely drained in about one month. The low level valve will remain fully open until it is partially closed the following spring and the cycle is repeated.

During all water year types Philbrook Reservoir is operated to meet a continuous 2 cfs minimum instream flow requirement in Philbrook Creek. This release is made through the single low level outlet. The reservoir is allowed to fill during the spring months when the radial gate is closed around April 1. Flow from Philbrook reservoir is controlled by two spillways. The reservoir is allowed to fill during the spring months when the radial gate, on the newest spillway, is closed around April 1. Flashboards, on the oldest spillway, are also used to control flow from the Philbrook reservoir. Care is taken that the reservoir water level does not exceed the maximum water surface elevation. As the natural stream flow of the West Branch Feather River and storage flows provided by Round Valley Reservoir are no longer adequate to meet carrying capacity of the downstream Hendricks Canal (up to 125 cfs) and minimum flow requirements for the West Branch Feather River, storage flows from Philbrook Reservoir are released.

To help maintain the cool water habitat in Butte Creek and below Centerville powerhouse for Chinook salmon, accelerated releases are made from the reservoir during periods of high temperature in July and August in accordance with the annual Operations

[11] 80 FERC ¶ 62171 (1997)
[12] 84 FERC ¶ 62165 (1998)

and Maintenance Plan. Releases from storage in Philbrook Reservoir typically end by mid-September.

At the Hendricks diversion dam, up to 125 cfs of the West Branch Feather River's flow is diverted into the Hendricks Canal while the remainder of flow is allowed to pass downstream. However, during low flow periods the entire flow of the West Branch Feather River is diverted into the canal and an instream flow release of 15 cfs and 7 cfs, during normal and dry years, respectively, are made from the canal back into the river immediately downstream of the dam. The Hendricks Canal has a maximum hydraulic capacity of 125 cfs. Flows within the Hendricks Canal are also augmented through several feeder diversions (Long Ravine, Cunningham Ravine, and Little West Fork Feather River, and Little Butte Creek). Ultimately flows within the Hendricks Canal are passed through the Toadtown powerhouse and then discharged into Toadtown Canal which travels to its confluence with Butte Canal.

Butte Canal originates at the Butte Creek diversion dam. Flows are diverted at this structure into Butte Canal, and three feeder diversions (Inskip Creek, Kelsey Creek, and Clear Creek) augment flows over the length of the canal. Butte Canal ultimately joins with Toadtown Canal and is then carried 0.7 miles downstream to the DeSabla Forebay. Water is discharged from the DeSabla Forebay to DeSabla powerhouse via the 1.3-mile long steel penstock. Also, from the DeSabla Forebay approximately 3 cfs is provided to the Upper Centerville Canal to satisfy local water rights.

Water used at DeSabla powerhouse is discharged into Butte Creek above the Lower Centerville diversion dam. Up to approximately 183 cfs of the Butte Creek stream flow is diverted from Butte Creek into the Lower Centerville Canal at the Lower Centerville diversion dam. The 8-mile long Lower Centerville Canal carries water to Centerville penstock and powerhouse where it is then released back into Butte Creek.

The project includes four in-basin (Butte Creek to Butte Creek) water transfers (table 2) and six out-of basin (West Branch Feather River to Butte Creek) water transfers (table 3) resulting in ten "project reaches" in which stream flows are affected by project operations. Each reach is named after the project facility from which the flow is affected.

Table 2-2. DeSabla – Centerville Hydroelectric Project in-basin project reaches for water transfers (Source: PG&E as modified by staff).

Name	Description
Butte Creek diversion dam Bypass Reach	The 10.1-mile-long (gradient of 162 feet per mile, or 0.031%) section of Butte Creek from the base of the Butte Creek diversion dam (El. 2,880 ft) to the DeSabla powerhouse tailrace (El. 1,240 ft). Note that this reach includes the Forks of Butte diversion dam (non-project) and the Forks of Butte powerhouse tailrace and inflow (non-project).

DeSabla powerhouse Reach	The 0.1-mile-long (gradient of 400 feet per mile, or 0.076%) section of Butte Creek from the DeSabla powerhouse tailrace (El. 1,240 ft) to the Lower Centerville diversion dam (El. 1,200 ft).
Lower Centerville diversion dam Bypass Reach	The 6.4-mile-long (gradient of 108 feet per mile, or 0.020%) section of Butte Creek from the base of the Lower Centerville diversion dam (El. 1,200 ft) to the Centerville powerhouse tailrace (El. 510 ft).
Centerville powerhouse Reach	The 9.0-mile-long (gradient of 28 feet per mile, or 0.005%) section of Butte Creek from the Centerville powerhouse tailrace (El. 510 ft) to the Parrott-Phelan diversion dam (El. 260 ft).

Table 2-3. DeSabla – Centerville Hydroelectric Project out-of-basin reaches for water transfers (Source: PG&E as modified by staff).

Name	Description
Round Valley Dam Reach	The 4.9-mile-long (gradient of 169 feet per mile, or 0.032%) section of the West Branch Feather River from the base of Round Valley Dam (El. 5,627.0 ft) to the confluence with Philbrook Creek (El. 4,800 ft).
Philbrook Dam Reach	The 2.3-mile-long (gradient of 291 feet per mile, or 0.055%) section of Philbrook Creek from the base of Philbrook Dam (El. 5,469 ft) to the confluence with West Branch Feather River (El. 4,800 ft).
West Branch Feather River and Philbrook Creek Confluence Reach	The 9.6-mile-long (gradient of 163 feet per mile, or 0.031%) section of the West Branch Feather River from the confluence with Philbrook Creek (El. 4,800 ft) to Hendricks diversion dam (El. 3240 ft).
Hendricks diversion dam Bypass Reach	The 14-mile-long (gradient of 121 feet per mile, or 0.023%) section of the West Branch Feather River from the base of Hendricks diversion dam (El. 3,240 ft) to the Miocene diversion dam (El. 1,540 ft).
Hendricks Canal at Long Ravine Confluence Reach	The 0.7-mile-long (gradient of 171 feet per mile, or 0.032%) section of Long Ravine from the outlet of the Hendricks Canal (El. 3,230 ft) to the base of Long Ravine diversion dam (El. 3,110 ft).
Long Ravine diversion dam Bypass Reach	The 1.7-mile-long (gradient of 218 feet per mile, or 0.041%) section of Long Ravine from the base of Long Ravine diversion dam (El. 3,110 ft) to the confluence with the Little West Fork (El. 2,740 ft).

2.1.4 Existing Environmental Measures

Water Quality

Table 2-4. Current minimum instream flows (in cfs) downstream of project diversions (Source: PG&E, 2007a).

	Volume of Discharge (in cfs) During Normal and Dry Water Year Types		
Point of Diversion	**Normal**	**Dry**	**Time Period**
Round Valley Reservoir	0.5	0.1	
Philbrook Reservoir	2	2	
Hendricks Diversion dam	15	7	
Butte Creek Diversion dam	16	7	
Lower Centerville Diversion dam	40	10	Sept. 15-Oct. 31 and Dec. 15 –May 31
	30	10	Nov. 11-Dec. 14
	40	40	June 1-Sept. 14
Inskip Creek	0.25	0.1	
Kelsey Creek	0.25	0.1	
Stevens Creek	0.25	0.1	Discontinued
Emma Ravine	0.25	0.1	Discontinued
Coal Claim Ravine	0.25	0.1	Discontinued
Oro Fina Ravine	0.25	0.1	Discontinued
Little West Fork	0.25	0.1	
Cunningham Ravine	0.25	0.1	
Clear Creek	0.5	0.25	
Long Ravine	0.5	0.25	

Fishery Resources

For the protection of fishery resources, PG&E: conducts fish rescues from project canals, provided minimum instream flows to project bypass reaches, operates project for the benefit of the federally listed Chinook salmon and steelhead.

Terrestrial Resources

For the protection of terrestrial resources, PG&E: maintains deer protection facilities on project canals, including fencing, wooden crossings, and escape ramps; partially funded the purchase of Butte Creek House Meadow, funded restoration projects and installed five waterfowl nesting platforms at the meadow; and implements the March 2003 *Valley Elderberry Longhorn Beetle Conservation Program.*[13,14] This conservation

[13] The Valley Elderberry Longhorn Beetle Conservation Program was developed by PG&E and U.S. Fish and Wildlife Service.

program requires Licensee to conduct pre-construction surveys, where necessary, and to provide educational training for construction crews responsible for operation and maintenance activities.

Recreation Resources

For the protection of recreation resources, PG&E: provides for stocking of catchable trout for a put-and-take fishery in DeSabla forebay and Butte Creek; and maintains and operates recreation facilities at project impoundments.

2.2 Applicant's Proposal

2.2.1 Proposed Project Facilities

PG&E does not propose any new facilities; however, they do propose to remove 5 feeder diversions. See table 3-16.

2.2.2 Proposed Project Operation

PG&E's does not propose any change to existing project operations except for the following proposed minimum instream flows at the following locations:

West Branch Feather River below Hendricks diversion dam

- March 1st to May 31st: 30 cfs (Normal water year); 20 cfs (Dry water year)
- June 1st to February 28th/29th: 20 cfs (Normal water year); 7 cfs (Dry water year)

Butte Creek below Butte diversion dam

- March 1st – May 31st: 30 cfs (Normal water year); 20 cfs (Dry water year)
- June 1st – February 28th/29th: 16 cfs (Normal water year): 7 cfs (Dry water year)

Butte Creek below Lower Centerville diversion dam

- September 15th – January 31st: 75 cfs (Normal water year); 60 cfs (Dry water year)
- February 1st – April 30th: 80 cfs (Normal water year); 75 cfs (Dry water year)
- May 1st – May 31st: 80 cfs (Normal water year); 65 cfs (Dry water year)
- June 1st – September 14th: 40 cfs (Normal water year); 40 cfs (Dry water year)

2.2.3 Proposed Environmental Measures

[14] The deer protection measures and waterfowl measures are license requirements (original license article 39) and the VELB plan is voluntary.

For the purpose of protecting resources from, or mitigating impacts that may result from the continued operation and maintenance of the project, or for the purpose of enhancing the project affected environment, PG&E proposes that the following 33 measures be included in any new license issued by the Commission.

2.2.3.1 General Measures

- **Measure 1 - *Employee Training*** - PG&E proposes to provide annually, to their operations and maintenance staff, awareness training on special-status species, invasive plants, and sensitive areas (special-status plant populations, noxious weed populations, and historic property sites) that are known to occur within the FERC project boundary on National Forest System Land.
- **Measure 2 - *Consultation*** - PG&E proposed to annually consult with the Forest Service on measures needed to ensure protection and utilization of the National Forest resources affected by the project.
- **Measure 3 - *Special-Status Species* -** PG&E proposes to annually review the current lists of special-status plant and wildlife species for those that might occur on NFSL in the project area and may be directly affected by project operations. For such newly added species, PG&E proposes to develop and implement a study plan in consultation with the Forest Service to reasonably assess the effects of the project on the species, if warranted.

2.2.3.2 Geology and Soils

- **Measure 4 - *Project Transportation System Management Plan*** - PG&E proposes to develop and implement a plan would include a map showing all roads with respect to the project boundary and maintenance responsibilities and associated with the project, identify the uses of the roads, include condition surveys, construction/ reconstruction needs, road closure, safety, jurisdiction (e.g., county, state). PG&E also proposes to rehabilitate existing erosion damage and minimize further erosion of the project access roads on National Forest System Lands and use best management practices when doing so.
- **Measure 5 - *Round Valley Dam Spillway Stabilization Plan*** - PG&E proposed to develop and implement the plan to: (1) assess areas to be stabilized; and (2) provide feasibility-level design drawings for stabilization measures.
- **Measure 6 - *Canal Maintenance and Inspection Plan* -** PG&E proposed to develop and implement the plan to inspect and maintain project canals annually.

2.2.3.3 Aquatic Resources

- **Measure 7 - *Install and Maintain New Gages* -** PG&E proposes to install and thereafter maintain a flow data logger for measuring stream flow downstream of

Hendricks diversion dam on the West Branch Feather River, a real-time flow gaging station upstream of Butte Creek diversion dam, and modify the existing stream gaging station near Lower Centerville diversion dam for real-time data access.

- **Measure 8 - *Monitor Water Quality in Receiving Stream during Canal Cleaning*** - PG&E proposes to conduct water quality monitoring (water temperature, dissolved oxygen, and turbidity) in receiving streams prior to, during, and after returning project canals to service. PG&E also proposes to conduct routine monitoring of water quality in the receiving stream at one site upstream and downstream of the mouth of the canal. If herbicides are used along project canals, PG&E proposes to include sampling for herbacides when conducting their routine monitoring.
- **Measure 9 - *Hazardous Substance and Spill Prevention Plan*** - Prior to any land-disturbing activities on National Forest System Lands, PG&E proposes to file with the Commission, a plan for oil and hazardous substances storage, and spill prevention and cleanup.
- **Measure 10 - *Canal Fish Rescue Plan* -** PG&E proposes to develop and implement a plan that: (1) defines activities that would trigger canal fish rescue efforts; (2) provides for prior notification and coordination with the California Department of Fish and Game; and (3) identifies methods implemented.
- **Measure 11 - *Fund California Department of Fish and Game for Fish Stocking*** - PG&E proposes to provide up to $10,000 annually to the California Department of Fish and Game for the stocking of Fish in to the DeSabla Forebay (in years in which the California Department of Fish and Game stocks rainbow trout in to DeSabla Forebay).
- **Measure 12 - *Maintain a Minimum Pool in Philbrook Reservoir*** - PG&E proposes to maintain a minimum pool in Philbrook Reservoir of 250 acre-feet.

2.2.3.4 Terrestrial Resources

- **Measure 13 - *Wildlife Bridges and Deer Escape Facilities*** - PG&E proposes to assess existing wildlife bridge crossings and escape structures annually to ensure they are functional and in proper working order. Additionally, prior to replacing or retrofitting existing wildlife bridge crossings or deer escape facilities along project canals, PG&E proposes to consult with the California Department of Fish and Game regarding specifications and design.
- **Measure 14 - *Monitor Animal Loss in Project Canals*** - PG&E proposes to record in log books all dead animals observed on canal trash racks (grizzlies) and otherwise in the canal. PG&E intends to record the location of the dead animal (i.e., which project canal and where in the canal the dead animal was found), species, date of the observation, and other pertinent information.

- **Measure 15 - *Vegetation Management Plan*** - For project lands within National Forest System Lands, PG&E proposes to develop and implement a plan that addresses: (1) hazard tree removal and trimming; (2) Powerline/transmission line clearing; (3) vegetation management for habitat improvement, including for visual screening; (4) revegetation of disturbed sites and the use of weed free seed with a preference for locally collected seed; (5) soil protection and erosion control, including use of certified weed free straw; and (6) the establishment of and/or revegetation with culturally important plant populations.
- **Measure 16 - *Invasive Weed Management Plan*** - PG&E proposes to develop and implement a plan to: (1) inventory and mapping of new populations of invasive aquatic and terrestrial weeds; (2) prevent and control spread of known populations or introductions of new populations; and (3) monitor known populations of invasive weeds for the life of the license in locations tied to project actions or effects. As needed, PG&E also proposes to implement methods for prevention of aquatic invasive weeds such as public education and signage, boat cleaning stations, and by preparing an Aquatic Plant Management Plan.
- **Measure 17 - *Fire Prevention and Response Plan*** - PG&E proposes to develop and implement a plan that set forth in detail their responsibility for the prevention, reporting, control, and extinguishing of fires in the vicinity of the project resulting from project operations.

2.2.3.5 Threatened and Endangered Species

- **Measure 18 - *Implement Minimum Stream Flows*** - To maximizing the project's cool water benefits to support to holding, spawning, and rearing of Chinook salmon and steelhead in the reaches of Butte Creek below the Lower Centerville diversion dam (below Quartz Bowl Pool) and below the Centerville powerhouse PG&E proposes to continue to release the minimum instream flow requirements currently provided under the existing condition as identified above in section 2.1.3 *Existing Environmental Measures,* except as modified in section 2.2.3 *Proposed Project Operations*.
- **Measure 19 - *DeSabla Forebay Water Temperature Improvement Plan*** - Utilizing results from its feasibility study, PG&E proposes to develop and implement a plan to reduce thermal loading in DeSabla Forebay and to maximizing the project's cool water benefits to support to holding, spawning, and rearing of Chinook salmon and steelhead in downstream project reaches.
- **Measure 20 - *Facility Monitoring, Maintenance and Refurbishment Plan*** - PG&E proposes to develop and implement a long-term facility monitoring, maintenance, and refurbishment plan for the purpose of minimizing the potential for facility failures that could cause adverse flow-related impact to Chinook salmon and steelhead.

- **Measure 21 - *Long-term Operations Plan* -** PG&E proposes to develop and implement a long-term operations plan with the primary goal of seeking to provide cold water for holding, spawning, and rearing Chinook salmon and steelhead in Butte Creek upstream and downstream from the Centerville powerhouse. The plan will also consider the feasibility of increasing spawning habitat availability by increasing flows in-between the Lower Centerville diversion dam and the Centerville in late-September to February, while balancing power production.
- **Measure 22 - *Monitoring Plan for Butte Creek Central Valley Spring-run Chinook Salmon Populations* -** PG&E proposes to develop and implement a plan to monitor salmon populations in Butte Creek. The plan would include annual snorkel survey to monitor adult distribution and abundance, an annual pre-spawning mortality survey, and an annual carcass survey to monitor spawning to establish a correlation between the snorkel survey data and the carcass survey data. The plan would also provide for the consideration of juvenile emergence and outmigration monitoring in extreme drought years.
- **Measure 23 - *Annual Report* -** PG&E proposes to file annual reports summarizing the prior year's implementation of measure 21 and the effects of project operations had on Chinook salmon and their habitat, and 2) the results of the prior year's Chinook salmon monitoring (measure 22).
- **Measure 24 - *Valley Elderberry Longhorn Beetle Protection* -** PG&E proposes to continue to implement the March 2003 *Valley Elderberry Longhorn Beetle Conservation Program* developed by PG&E and the FWS as discussed in section 2.1.3 above.

2.2.3.6 Recreation, Land Use, and Aesthetics

- **Measure 25 - *Maintain and Operate Philbrook Reservoir and DeSabla Forebay Recreation Facilities* -** PG&E proposes to develop and implement a Recreation Operation Plans for the existing recreation facilities within the FERC project boundary at Philbrook Reservoir and the DeSabla Forebay. The plan will detail the routine upkeep and operation of the facilities.
- **Measure 26 - *Recreation Facility Rehabilitation and ADA Upgrade Plans* -** For each of the existing recreation facilities located at Philbrook Reservoir and the DeSabla Forebay, PG&E proposes to develop plans to rehabilitate the facilities and make them compliant with the Americans with Disabilities Act (ADA).
- **Measure 27 - *Develop and Implement Project Information and Sign Plan* -** To inform the public about accessible recreation areas within the FERC project boundary and on National Forest System Lands, PG&E proposes to develop a plan that will list the location, type, construction and content of each Project sign on NFSL and types of information to be developed.
- **Measure 28 - *Obtain Public Access to DeSabla powerhouse and Miocene diversion dam Impoundment* -** With this measure, PG&E proposes to facilitate

discussions between private landowners and American Whitewater in an effort to provide public access to the DeSabla powerhouse and the Miocene diversion dam (not a project facility).

- **Measure 29 - *Make Stream flow Information Available to Public* -** PG&E proposes to make daily average stream flow information available to the public annually from May 1 through November 30: on the West Branch Feather River at United States Geological Survey (USGS) flow gage 11405200 (below Hendricks Head Dam); and on Butte Creek at USGS flow gages 11389720 (below Butte Creek Head Dam) and 111389780 (below Lower Centerville diversion dam).
- **Measure 30 - *Remove Philbrook Lake Tender House* -** PG&E proposes to remove the Philbrook Lake Tender House and other structures no longer needed for project operations.
- **Measure 31 - *Consult with Forest Service when Painting/Reconstructing Facilities* -** PG&E proposes that prior to painting or reconstructing project facilities or re-vegetating areas on National Forest System Lands, they will consult with the Forest Service to assure the facilities are consistent with current Visual Quality Objectives.
- **Measure 32 - *Maintain Improvements and Premises on Nation Forest System Lands* -** PG&E proposes to maintain all its improvements and premises, including disposal piles and dispersed recreation areas within the project boundary, on National Forest System Lands to standards of repair, orderliness, neatness, sanitation, and safety acceptable to the Forest Service.

2.2.3.7 Cultural Resources

- **Measure 33 - *Historic Properties Management Plan* -** To address measures for the protection of historic properties, and potential historic properties, within the Area of Potential Effect (APE), PG&E proposes to develop and implement a HPMP that complies with the Commission's guidelines.

2.2.3.8 Socio-Economic Resources

PG&E does not propose any measures related to socio-economic resources.

2.2.4 Modifications to Applicant's Proposal

2.2.4.1 Section 18 Prescriptions

The U.S. Fish and Wildlife Service (FWS) and the National Marine Fisheries Service each filed a reservation of authority to file their section 18 prescriptions on June 27, and June 30, 2008, respectively.

2.2.4.2 Section 4(e) Land Management Conditions

The preliminary conditions provided by the Forest Service on June 27, 2008, and filed under section 4(e) of the FPA are as follows: conditions 1 through 17 are administrative in nature and are standard conditions that would involve obtaining Forest Service approval on final project design and project changes, and yearly consultation with the Forest Service to ensure the protection and development of natural resources, etc. The remaining Forest Service preliminary 4(e) conditions include:

Geology and Soils

- **Condition 21 -** ***Develop Designs and Implement Actions to Stabilize the Round Valley Spillway Channel*** - requires PG&E to consult with the Forest Service and other mandatory conditioning agencies to develop designs and implement actions to stabilize the Round Valley Dam Spillway Channel to minimize erosion and reduce sediment contributions to the West Branch Feather River.
- **Condition 22 -** ***Implement the Philbrook Spillway Channel Stabilization Plan*** - requires PG&E to stabilize and maintain the Philbrook Spillway Channel.
- **Condition 23 -** ***Develop and Implement a Project Canal Maintenance, Inspection and Hazard Prevention Plan*** - requires PG&E to develop and implement a project canal maintenance, inspection and hazard prevention plan.

Aquatic Resources

- **Condition 18 -** ***Streamflow*** **-** requires a specific minimum flow regime and measuring for project bypass reaches, and ramping rates.
- **Condition 19 -** ***West Branch Feather River Rainbow Trout Population Monitoring Study*** - requires PG&E to develop and implement a rainbow trout population monitoring study and a habitat and population improvement plan for the West Branch Feather River.
- **Condition 20 -** ***Aquatic Biological Monitoring*** **-** requires aquatic biota monitoring including fish, amphibians, and benthic macroinvertebrates in project affected bypass reaches.
- **Condition 24 -** ***Develop and Implement Long-Term Operations Plan*** - requires PG&E to develop and implement a long-term operations plan that has a primary goal of seeking to provide cold water for holding, spawning, and rearing Chinook salmon and steelhead in Butte Creek upstream and downstream from the Centerville powerhouse.
- **Condition 25 -** ***Maintain Minimum Pool in Philbrook Reservoir*** **-** sets the minimum pool volume of Philbrook Reservoir at 250 acre-feet.

Terrestrial Resources

- **Condition 26 - *Special Status Species* -** requires PG&E to annually review current lists of special status species and if new species are identified to likely be found on National Forest System lands, this condition would require PG&E to develop and implement a study to determine the effects of the project on said species.
- **Condition 27 - *Protection of Forest Service Special Status Species* -** requires PG&E to prepare a biological evaluation before any ground disturbing activities on National Forest System Lands for the continued protection of Forest Service special status species.
- **Condition 28 - *Canal Wildlife Crossing or Escape Facilities*** - requires PG&E to consult with the Forest Service and the California Department of Fish and Game before retrofitting or replacing wildlife bridge crossings or deer escapement facilities along project canals.
- **Condition 29 - *Monitor Animal Losses in Project Canals*** - requires PG&E to monitor and record animal mortality in project canals.
- **Condition 31 - *Vegetation and Invasive Weed Management Plan*** - requires PG&E to develop and implement a vegetation and invasive weed management plan.

Threatened and Endangered Species

- **Condition 30 - *Valley Elderberry Longhorn Beetle Protection*** - requires PG&E to comply with the *Valley Elderberry Longhorn Beetle Conservation Program*

Recreation, Land Use, and Aesthetics

- **Condition 32 - *Resolution of PG&E*** Encumbrances - requires PG&E to develop a resolution of encumbrances plan to facilitate the removal of, or provide cost recovery for, PG&E controlled improvements on National Forest System lands, such as PG&E's cabin lessees at Philbrook Reservoir whose domestic waterlines tap springs on National Forest System Land for their domestic water supply.
- **Condition 33 - *Recreation Facilities on or Affecting National Forest System Land*** - requires PG&E to develop and implement a recreation management plan, and also requires measures to prevent dumping and control OHV activities on National Forest System lands, provide for a half-time law enforcement position, support reservoir based recreation, and monitor and report recreation usage.
- **Condition 34** - ***Land Resource Plans for Mitigating Project Effects to National Forest Service Resources*** - requires PG&E to develop and implement a land resource management plan including a fire management and response plan, visual management actions plan, sign and information plan, and a hazardous substance plan.
- **Condition 36** - ***Project Transportation System Management Plan*** - requires the protection of maintenance of roads associated with the project through the

development and implementation of a project transportation system management plan, including traffic and road air quality monitoring.

Cultural Resources

- **Condition 35** - ***Heritage Properties Management Plan*** - requires PG&E to develop and file a Heritage Properties Management Plan for the purpose of protecting and interpreting heritage resources.

The revised preliminary conditions provided by Bureau on September 11, 2008, and filed under section 4(e) of the FPA are as follows: conditions 1 through 17 and 22 are administrative in nature and are standard conditions that would involve obtaining the Bureau's approval on final project design and project changes, annual consultation with the Bureau, prior approval for pesticide use, other various measures to ensure the protection and development of natural resources on Bureau lands, and a reservation of their section 4(e) authority, etc. The remaining Bureau preliminary 4(e) conditions include:

Geology and Soils

- **Condition 21** - ***Control of Erosion*** - requires PG&E to control erosion at specified locations.

Recreation, Land Use, and Aesthetics

- **Condition 18** - ***Recreation Use Monitoring and Reporting*** **-** requires monitoring of recreation use and reporting.
- **Condition 19** - ***Funding to Address Patrol and Maintenance Activities*** **-** requires PG&E to pay the Bureau $30,000 annually for patrol and maintenance activities at the Forks of Butte Creek Recreation Area other lands as agreed to by PG&E and the Bureau.
- **Condition 20** - ***Maintenance of Portion of Ditch Creek Road*** **-** requires the maintenance of portions of Ditch Creek Road.

2.2.4.3 Alternative Section 4(e) Conditions Pursuant to EPAct of 2005

The Energy Policy Act of 2005 (EPAct) provides parties to this licensing proceeding the opportunity to propose alternatives to preliminary conditions. On July 30, 2008, PG&E filed, with the Commission, a copy of it's filing to the Forest Service and the Bureau proposing alternative 4(e) conditions in response to their preliminary section 4(e) conditions and seeking a trial-type hearing with respect to both Forest Service and Bureau 4(e)s. As a result of PG&E's alternative 4(e)s, the Bureau withdrew their

preliminary 4(e) conditions filed on June 27, 2008, and filed revised preliminary 4(e) conditions on September 11, 2008. On September 18, 2008, PG&E filed with the Commission their withdrawal of their request for a trial-type hearing of the Bureau's 4(e) conditions. On December 11, 2008, PG&E withdrawal of their alternative 4(e) conditions to the Bureau's preliminary 4(e)s were filed with the Commission. Additionally, On July 30, 2008, the Conservation Groups filed alternative 4(e) conditions.

PG&E filed alternatives to the following Forest Service preliminary conditions:

- Condition No. 18 (Streamflow), Part 1 - Minimum Streamflow Requirements and Measurement
- Condition No. 18 (Streamflow), Part 5 - Ramping Rates
- Condition No. 19 - West Branch Feather River Rainbow Trout Population Monitoring Study
- Condition No. 20 (Aquatic Biological Monitoring), Part 1 - Fish Monitoring Plan
- Condition No. 20 (Aquatic Biological Monitoring), Part 2 - Amphibian Monitoring Plan
- Condition No. 20 (Aquatic Biological Monitoring), Part 3 - Benthic Macroinvertebrate Monitoring

The Conservation Groups filed alternatives to the following Forest Service preliminary conditions:

- Condition No. 18 (Streamflow)
- Condition No. 19 - West Branch Feather River Rainbow Trout Population Monitoring Study

2.3 Staff Alternative

In addition to the PG&E's proposed measures listed above, the staff alternative would include the following measures:

Geological Resources

- Reconstruct and maintain any areas of the Butte Creek canal, slope, and road that are detrimentally impacted by project activities.
- Develop and implement a Philbrook Spillway Channel Stabilization Plan to mitigate for the current erosion problem below the Philbrook Spillway Channel. The plan should also include a schedule for filing status reports with the Commission on the ongoing monitoring associated with erosion below the

Philbrook spillway channel. Implementation of this plan shall be complete by December 1, 2010, unless extended by the Forest Service;
- Include lands, starting at the Philbrook spill channel, extending from the two Philbrook spillways, and ending at the confluence with Philbrook Creek, in the project boundary.

Aquatic Resources

Water Resources
- Promptly resume minimum instream flow requirements after a non-compliance event and notify the Forest Service, FWS, NMFS, Cal Fish & Game, the Water Board, and the Commission within 48 hours of this modification
- Provide a minimum instream flow of 1 cfs, or inflow, during normal water years, and a minimum instream flow of 0.5 cfs, or inflow, during dry water years downstream of the Helltown Ravine diversion dam
- Consult with the Forest Service, Cal Fish & Game, FWS, and NMFS on information collected from foothill yellow-legged frog population monitoring to determine if the following ramping rate criteria is protective of foothill yellow-legged frog populations, or if there is a need to modify these ramping rates
- If sufficient water is not available to hold stream levels constant during periods when foothill yellow-legged frog egg masses are present, ramp flows downstream of the Hendricks diversion dam, Butte Creek diversion dam, and Lower Centerville diversion dam such that:
    - During down-ramping, stage changes shall not exceed 0.2 feet per second per hour at foothill yellow-legged frog egg mass sites and water levels shall not drop so that more than 20 percent of egg masses are de-watered;
    - During up-ramping velocity shall not change more than 0.2 feet per second per hour and shall not exceed 0.8 feet per second at the most sensitive foothill yellow-legged frog egg mass sites;
    - When foothill yellow-legged frog tadpoles or juveniles are present, the up- and down- ramping rate shall be 0.4 feet per second per hour or less and shall not exceed 1.0 foot per second at the site
- Develop, in consultation with the Forest Service, Cal Fish & Game, NMFS, and FWS, and implement, upon Commission approval, a Ramping Rate Monitoring Plan
- Schedule Hendricks, Butte, and Lower Centerville canal outages as early in the year as possible to avoid the foothill yellow-legged frog breeding and rearing season
- Schedule the timing of maintenance or other planned Project outages to avoid negative ecological effects to foothill yellow-legged frog and spring-run Chinook salmon and provide written notice, including proposed measures to minimize the magnitude and duration of spills, at least 90 days prior to such outages, to the

Forest Service, FWS, NMFS, Cal Fish & Game, the Water Board, and the Commission

- Obtain approval from the Forest Service and BLM on the use of pesticides on Forest Service or BLM lands and submit a request for approval of planned uses of pesticides for the upcoming year during annual consultation
- Utilize only pesticides registered by the EPA and do not utilize them within 500 feet of known locations of California red-legged frog, mountain yellow-legged frog, foothill yellow-legged frog , and Yosemite toad
- Implement minimum instream flow requirements within two business days of the publication of the California Department of Water Resource's Bulletin 120
- Within 30 days of making the final water year type determination, provide notice of this determination to Cal Fish & Game, FWS, NMFS, Forest Service, the Water Board, and the Commission
- As soon as drought conditions are evident, notify the Forest Service, Cal Fish & Game, NMFS, FWS, the Water Board and the Commission, and consult with these agencies on potential proposals for modified project operations
- Notify the Forest Service, Cal Fish & Game, NMFS, FWS, the Water Board and the Commission by March 15 of the second or subsequent dry water year and consult with these agencies by May 15 of the same years
- File, for Commission approval, any proposed modifications to project operations as a result of drought conditions consultation with the agencies
- Construct, operate, and maintain, in consultation with the USGS, a stream flow gage with real-time capability in Philbrook Creek, downstream of the confluence of both the low level release and spill channel in Philbrook Creek
- Operate and maintain, in consultation with the USGS, the existing gaging stations on the West Branch Feather River downstream of Round Valley Reservoir and the Hendricks diversion dam
- Measure minimum instream flows as the 24-hour average of the flow (mean daily flow) and as an instantaneous flow, with instantaneous 15-minute stream flow as required by the USGS standards at all gages
- Measure and document all minimum instream flow releases in publicly available and readily accessible formats, and provide this data to the USGS in an annual hydrology summary report
- Construct, operate, and maintain, in consultation with the USGS, a water temperature and reservoir level gage in Philbrook Reservoir with real-time capability
- Provide a roving operator to maintain and monitor the feeder diversions on a weekly basis
- Develop, in consultation with Forest Service, Cal Fish & Game, NMFS, FWS, the Water Board, and implement, upon Commission approval, a Water Temperature Monitoring Plan, to be incorporated as part of the Long-term Operations Plan

- Submit an annual report detailing temperature monitoring results to the Forest Service, Cal Fish & Game, NMFS, FWS, the Water Board, and the Commission prior to annual consultation
- Include the Water Board and the Conservation Groups as members of the Operations Group
- As part of the *DeSabla Forebay Water Temperature Improvement Plan,* include a provision to monitor water temperatures in Butte Creek for a period of 5 years after a temperature reduction device is operating and submit an annual report on these results to FWS, NMFS, Forest Service, California Fish & Game, the Water Board, and the Commission
- Monitor resident fish populations to evaluate its response to changes in project operations such as minimum flows
- Monitor benthic macroinvertebrate populations to evaluate their response to changes in project operations such as minimum flows.
- Annually monitor anadromous fish and their habitats in Butte Creek.
- Develop and implement adaptive management plan to guide the long-term operations of the project to protect the ESA listed anadromous fish within Butte Creek.

Terrestrial Resources

- Monitor foothill yellow-legged frog populations on both the West Fork Feather River and Buttte Creek annually for the first 3 years and every 5 years thereafter Note—this is part of aquatic monitoring)
- Expand annual review of special status species to include federally listed species and Bureau sensitive/watch list species
- Provide a summary report of animal mortality every 5 years with recommendation for additional protection measures as needed
- Extend the vegetation management plan and invasive weed management plan to include non-Forest Service lands within the project boundary where access is available
- Conduct surveys for bald eagle nesting every 3 years and prepared management plan if nesting is detected

Recreational Resources

- Extend concrete boat launch at Philbrook reservoir.
- Upgrade and maintain user-created trail and parking along Toadtown canal.
- Develop and implement a fish stocking plan for project reservoirs and reaches after consultation with Cal Fish & Game.
- Develop recreation use monitoring, reporting, and use triggers in order to periodically monitor changes in recreation use patterns at the Project.

Land Use and Aesthetic Resources

- Develop and implement a Fire Management and Response Plan to prevent and handle potential fires at the project.
- Develop and implement a Hazardous Substance Plan to handle and prevent hazardous substance spills at the project.

Cultural Resources

- Implement the current HPMP with the following revisions: 1) Update the HPMP with the additional historic context information provided by Bureau, the Forest Service, and the Mechoopda Tribe; 2) develop a collection policy for discovery, curation, and disposition of artifacts; 3) develop a detailed HPMP section addressing identification, restoration, accessibility, and stewardship collaborations for traditional plant gathering/tending in wetlands and riparian habitat communities culturally important to participating tribes; 4) identify specific management measures to be undertaken and include them within PG&E's best practices or procedural manuals; and 5) include the required mitigation measures for Round Valley reservoir site CA-BUT-1225/H.

2.4 Staff Alternative with Mandatory Conditions

Of the Forest Service's and the Bureau of Land Management's preliminary 4(e) conditions (described in section 2.2.4) we include in the Staff Alternative 15 conditions as specified by the agencies, 12 from the Forest Service and 3 from the Bureau, modify four of the Forest Service conditions to adjust the scope of the measures, and did not recommend three conditions, two from the Forest Service and one from the Bureau; the measures we modify or do not adopt in total are discussed in more detail in section 5.2, *Comprehensive Development and Recommended Alternative*. However, we recognize that the Commission is required to include valid section 4(e) conditions in any license issued for the project.

Under this alternative, each of the measure that staff recommend's be modified or does not recommend at all would be added to the Staff Alternative. Incorporation of these mandatory conditions into a new license would cause us to modify or eliminate some of the environmental measures that we include in the Staff Alternative. Our recommendations for: water temperature and aquatic biota monitoring in the West Branch Feather River, minimum instream flows at Hendricks's diversion dam, and recreation facilities on National Forest System Lands would no longer be necessary given the Forest Service provides a counter part measure in their 4(e) conditions to our recommended measure.

In addition, this alternative would include the following measures: (1) funding for law enforcement and trout monitoring in the vicinity of the Hendricks diversion dam. Proposed and recommended measures are discussed under the appropriate resource sections and summarized in section 4 of the EA.

2.5 Alternatives Considered but Eliminated from Further Analysis

We considered several alternatives to the applicant's proposal, but eliminated them from further analysis because they are not reasonable in the circumstances of this case. They are (list alternatives considered): (1) issuing a non-power license; (2) Federal Government takeover of the project; (3) the Conservation Groups' recommended alternative; and (4) retiring the project.

2.5.1 Issuing a Non-power License

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

2.5.2 Federal Government Takeover of the Project

We don't consider federal takeover to be a reasonable alternative. Federal takeover and operation of the project would require Congressional approval. While that fact alone wouldn't preclude further consideration of this alternative, there is no evidence to indicate that federal takeover should be recommended to Congress. No party has suggested federal takeover would be appropriate, and no federal agency has expressed an interest in operating the project.

2.5.3 Conservation Groups' Alternative

In their joint letter filed June 27, 2008, the California Sportfishing protection Alliance, Friends of Butte Creek, Friends of the River, and American Whitewater, (collectively the Conservation Groups), proposed a set of license measures and requested that they be evaluated by the Commission as a complete and formal alternative in its NEPA analysis. Some of the measures proposed by the Conservation Groups include: (1) the phased-in decommissioning of the Centerville powerhouse, Lower Centerville Canal, and Lower Centerville diversion dam; (2) the optimization of anadromous fishery resources, water quality and quantity; (3) the prevention of widespread pre-spawn mortality to sensitive populations of federally listed salmon; (4) the optimization of

rearing habitat for federally listed juvenile steelhead; and (5) the provision of reasonable recreational opportunities. However, because the alternative being proposed is not supported in its entirety by any of the resource agencies, especially those with mandatory conditioning authority, we do not consider the Conservation Groups' alternative to be a reasonable, complete NEPA alternative. Also, the existence of the project's diversion dams and canal system allow for the conveyance of needed cold water from the West Branch Feather River to lower Butte Creek and the expedited deliver of cold water from upper Butte Creel to lower Butte Creek to support ESA listed anadromous salmonid populations. Therefore, dam removal, as proposed by the Conservation Groups, is not a reasonable alternative to relicensing the project with appropriate protection, mitigation and enhancement measures. We do however; analyze each of the individual measures of their recommended alternative within the appropriate resource areas.

2.5.4 Retiring the Project

Project retirement could be accomplished with or without removal of the dams. Either alterative would involve denial of the relicense application and surrender or termination of the existing license with appropriate conditions. No participant has suggested that dam removal would be appropriate in this case, and we have no basis for recommending it. Again, because the existence of the project's diversion dams and canal system allow for the conveyance of needed cold water from the West Branch Feather River to lower Butte Creek and the expedited deliver of cold water from upper Butte Creel to lower Butte Creek to support ESA listed anadromous salmonid populations dam removal is not a reasonable alternative to relicensing the project with appropriate protection, mitigation and enhancement measures.

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

3.0 ENVIRONMENTAL ANALYSIS

In this section, we present: (1) a general description of the project vicinity; (2) an explanation of the scope of our cumulative effects analysis; and (3) our analysis of the proposed action and other recommended environmental measures. Sections are organized by resource area (aquatic, recreation, etc.). Under each resource area, historic and current conditions are first described. The existing condition is the baseline against

which the environmental effects of the proposed action and alternatives are compared, including an assessment of the effects of proposed mitigation, protection, and enhancement measures, and any potential cumulative effects of the proposed action and alternatives. Staff conclusions and recommended measures are discussed in section 5.2, Comprehensive Development and Recommended Alternative of the EA.

Unless noted otherwise, the sources of our information are the license application (PG&E 2007) and additional information filed by PG&E (2007, and 2008).

3.1 General Setting

The Project is located in northern California in the Butte Creek and West Branch Feather River drainage basins. Both drainages are located in Butte County along the western slopes of the Sierra Nevada and Cascade Range geomorphic provinces. Butte Creek originates in the Jonesville Basin, Lassen National Forest, at an elevation of 7,087 feet[15] and flows southwesterly to its confluence with the Sacramento River at Butte Slough and Sacramento Slough near the town of Colusa, as shown in Figure 1. The river originates in an area east of Round Valley Reservoir, at an elevation of just over 6,960 feet, and flows southwesterly before draining into Lake Oroville.

Butte County is divided into six broad hydrologic regions, or water inventory groups, that were developed on the basis of hydrologic basins and common water sources. These hydrologic regions are named as follows: Mountain, Foothill, Vina, West Butte, East Butte, and North Yuba. The six hydrologic regions are shown in Figure 3-1a.

The Mountain Region comprises the easternmost area of Butte County, with elevations ranging from approximately 300 feet at the southernmost boundary of Butte County near the confluence of Honcutt and Wilson creeks to over 7,000 feet in the northeastern part of the county at Humbolt Peak (Butte County 2001). The Foothill Region of Butte County lies between the Valley and Mountain regions, and ranges in elevation from approximately 200 feet at the base of the Campbell Hills on the margin of the Sacramento Valley to approximately 4,100 feet north of Stirling City, where it merges into the Mountain Region (Butte County 2001). The Vina, West Butte, East Butte, and North Yuba regions are located at low elevations in the Sacramento Valley portion of Butte County.

Within the overall Butte Creek and West Branch Feather River drainage basins, there are two areas that are specifically related to the Project. These areas are referred to herein as the "Project's Butte Creek drainage basin" and the "Project's West Branch Feather River drainage basin." The Project's Butte Creek drainage basin is defined as the

[15] Elevations are US Department of FWS, Geological Survey (USGS) datum.

sub-watershed area that includes the headwaters of Butte Creek and all Project-affected reaches from the Butte Creek Diversion dam down to the Parrott-Phelan Diversion dam. The Project's West Branch Feather River drainage basin includes the headwaters of the West Branch Feather River and all Project-affected reaches from the Round Valley Reservoir down to the Miocene Diversion dam. In addition to these definitions, the term "Project Drainage basins" is also used in this document to collectively refer to the Project's Butte Creek and West Branch Feather River drainage basins.

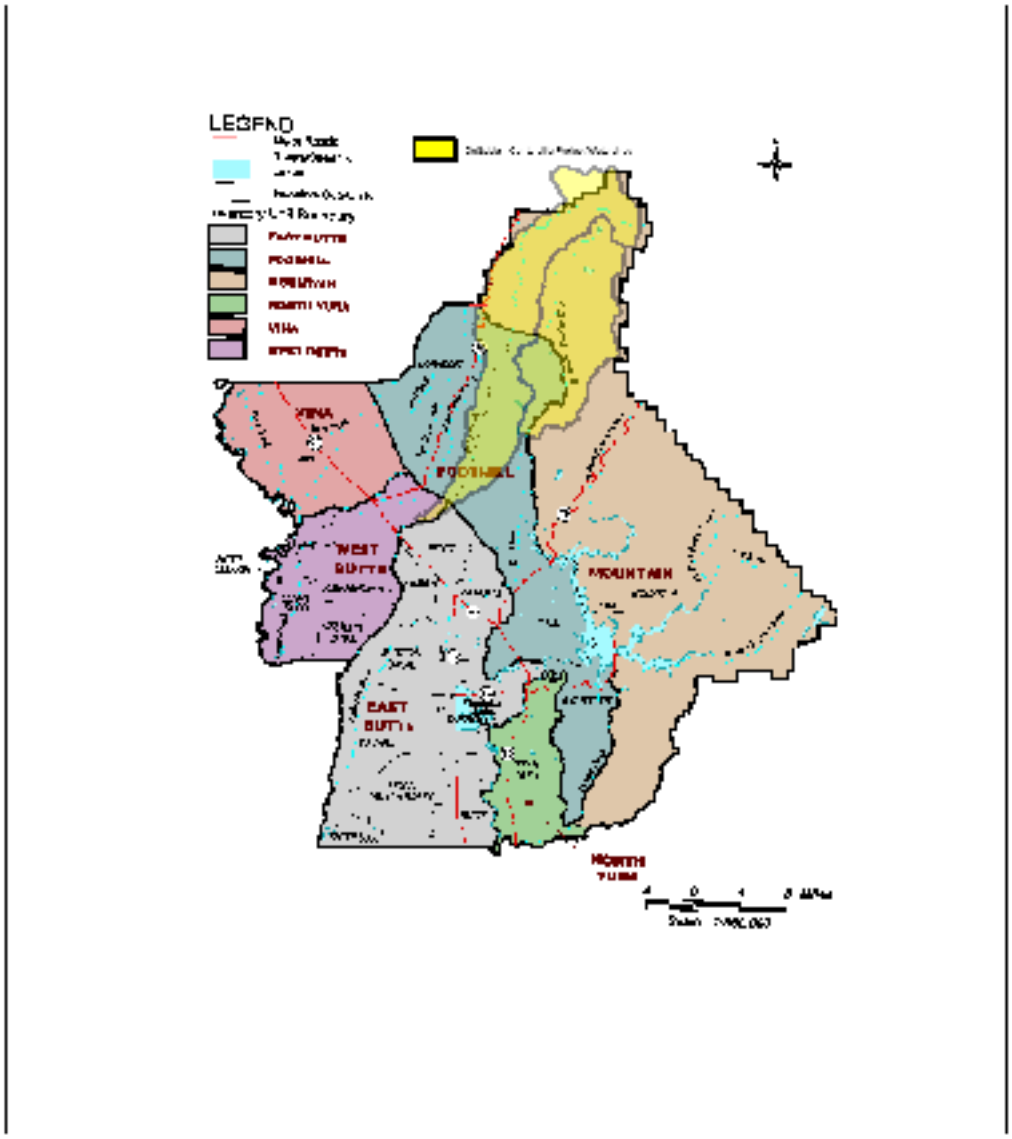

Figure 3-1a. Butte County's Six Hydraulic Regions

The Project Drainage basins span the two hydrologic regions of Butte County known as the Foothill and Mountain regions. Below the Mountain and Foothill regions and below the Project Drainage basins lies the Sacramento Valley area of Butte County, which includes the four hydrologic regions known as the Vina, West Butte, East Butte,

and North Yuba regions (Butte County 2001). These valley regions are located to the west-southwest and downstream of the Project Drainage basins, as shown in Figure 3.

The Project's Butte Creek drainage basin is an area of 96,012 acres that includes 41.5 miles of Butte Creek. The Project's West Branch Feather River drainage basin is an area of 70,003 acres that includes 39 miles of the West Branch Feather River. The total drainage area of the combined Project Drainage basins is 166,015 acres. Water in the Project Drainage basins is supplied by fall and winter rain in the lower elevations, and spring and early summer snowmelt from the higher elevations of the basins.

Within the Project Drainage basins lies the "project area." The project area is defined as the zone of potential, reasonably direct impact, typically extending 0 to 100 feet from the Project Boundary and including Butte Creek from Butte Creek Diversion dam down to, but not including, Parrott-Phelan Diversion dam, and West Branch Feather River from Round Valley Reservoir down to, but not including, Miocene Diversion dam. The project area within the Project's Butte Creek drainage basin is located almost entirely in the Foothill Region. The project area within the Project's West Branch Feather River drainage basin extends from the Mountain Region down to the Foothill Region. The locations of Project facilities are shown in Figure 2.

The Project has three powerhouses supplied by water from three principle diversions within the Project Drainage basins, as well as eight smaller feeder diversions situated along the tributaries to Butte Creek (four of which are not in use) and three feeder diversions along the tributaries to the West Branch Feather River. Three non-Project diversions (Forks of Butte, Miocene, and Parrott-Phelan) and one non-Project powerhouse (Forks of Butte) also exist within the Project Vicinity.

3.2 Scope of Cumulative Effects Analysis

According to the Council on Environmental Quality's regulations for implementing NEPA (40 CFR, section 1508.7), 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 other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time, including hydropower and other land and water development activities.

Based on our review of the license application and agency and public comments, we have identified water quality and quantity, and fisheries, including the federally listed Central Valley spring-run Chinook salmon and Central Valley steelhead trout (steelhead), as having potential to be cumulatively affected by the project in combination with other past, present, and future activities.

3.2.1 Geographic Scope

The geographic scope of the analysis defines the physical limits or boundaries of the proposed action's effects on the resources. In this case, each of the resource that may be cumulatively affected by the proposed action share the same geographic scope. We have defined that scope as follows: (1) Butte Creek from the headwaters to, but not including, Parrot-Phelan Diversion dam including tributary streams to Butte Creek that currently are or historically have been diverted for the Project; and (2) the West Branch Feather River from its headwaters to, but not including, the Miocene Diversion dam including tributary streams to the West Branch Feather River that currently are or historically have been diverted for the Project.

3.2.2 Temporal Scope

The temporal scope of analysis includes a discussion of the past, present, and reasonably foreseeable future actions and their effects on water, fishery, and recreational resources. Based on the term of the proposed license, we will look 30 to 50 years into the future, concentrating on the effects on water quantity and quality, and spring-run Chinook salmon and Central Valley steelhead from reasonably foreseeable future actions. The historical discussion is limited, by necessity, to the amount of available information. We identified the present resource conditions based on the license application, agency comments, and comprehensive plans.

3.3 Proposed Action and Action Alternatives

In this section, we discuss the effects of the project alternatives on environmental resources. For each resource, we first describe the affected environment, which is the existing condition and baseline against which we measure effects. We then discuss and analyze the specific cumulative and site-specific environmental issues.

Only the resources that would be affected, or about which comments have been received, are addressed in detail in this EA. Based on this, we have determined that water quality and quantity, aquatic, geologic, terrestrial, threatened and endangered species, recreation, land use/aesthetics, and cultural, resources may be affected by the proposed action and action alternatives. We present our recommendations in section 5.2, *Comprehensive Development and Recommended Alternative*.

3.3.1 Geologic and Soil Resources

3.3.1.1 Affected Environment

General Geology of Butte County

According to Butte County's Seismic Element Plan in their County General Plan, Butte County includes portions of three major physiographic provinces. The western one-third of the county is in the Sacramento Valley province, which is underlain by sedimentary rocks 15,000 feet thick, with 100-200 feet of recent sediment overlying the rocks (Tertiary Formations). The eastern two-thirds of the county is in the Sierra Nevada province and is underlain by igneous and metamorphic rocks.

The portion of the county near Jonesville and Inskip lies partly in the Cascade Range physiographic province. The Cascade Range province is represented by a chain of volcanic cones where there are extrusive volcanic flows and pyroclastic sediments along with mudflows of volcanic and pyroclastic origin.

Sacramento Valley Province: The Sacramento Valley is a nearly level alluvial plain, separated geologically from the San Joaquin Valley by a buried northeast-trending fault in the vicinity of Stockton. On the north, the valley terminates at the Klamath Mountain foothills. The valley is drained by the Sacramento River, which passes through flood basins that include the Butte Basin west of Oroville. Both natural and man-made levies border the Sacramento River through much of the lowlands.

Recent alluvium underlying the greater part of the valley intermingles with numerous stream deposits of silt, sand, and gravel which were deposited by streams from the hills to the east. These recent deposits consist mainly of reddish, sandy clay and black humus topsoil overlying unconsolidated sand, silt, clay, and gravel. The valley alluvium deposits increase in thickness from east to west, ranging from only a few inches along the foothills to more than 200 feet near the Sacramento River. The ground-water table is commonly high (within 10 feet of the surface) throughout the lowlands.

Pleistocene deposits of poorly consolidated, deeply red stained gravel, sand, silt, and clay are found as terraces along many of the stream channels near the eastern edge of the valley. The terraces were apparently formed as ancient flood plains of the Feather River and other streams during glacial periods.

Sierra Nevada Province: The Sierra Nevada is a westward tilted fault block of great magnitude. The block has a high, multiple-fault scarp face on the east front and a gentle, fault-bound west front which disappears under the sediments of the Sacramento Valley. The bedrock of the Sierra Nevada province consists commonly of Paleozoic and Mesozoic metasediments and volcanics intruded by a Mesozoic granitic batholith. The Sierra Nevada Mountains form the major portion of the eastern half of Butte County.

Along the western slope of the Sierra Nevada range, Tertiary sediments, volcanics, and isolated areas of upper Cretaceous sediments of the Sierra Nevada foothills dip westward beneath the Sacramento Valley. The Sierra Nevada Range terminates abruptly in the north where it disappears beneath the younger Cenozoic volcanic rocks of the

Cascade Range. Highly metamorphosed sedimentary and igneous rocks lie along the west and northern edges of the Sierra Nevada.

In Butte County the western foothills of the Sierra Nevada gradually merge into the Sacramento Valley. The foothills are comprised commonly of younger Tertiary sediments, extrusive flows, volcanic mudflow material, and old alluvial sediments. One of the dominant features of the foothills is the Tuscan monocline, a flexing of surface rocks which trends northwest between Chico and Red Bluff. The average dip of the surface east of this line of flexure is 2-3 degrees. West of this line, the dip changes and averages from 5-9 degrees, continuing at this angle until the surface rock penetrates the valley alluvium. The Tuscan monocline is a linear feature similar to that of a fault.

Cascade Range Province: The Cascade Range extends from Washington to northern Butte County. Mount Lassen, one of the few active volcanoes in the continental United States, lies within this province approximately 23 miles north of the County. Late Cenozoic extrusive volcanic rocks comprise the mass of the Cascades. In Butte County, these rocks overlie portions of the sediments of the Sacramento Valley and the rock of the Sierra Nevada.

Project Area Geology

The project is located on the western slope of the Sierra Nevada, at the northern limit of the Sierra Nevada Geomorphic Province at its interface with the Cascade Geomorphic Province. The general project area may therefore be considered as transitional between the Sierra Nevada and Cascade Geomorphic Provinces. The Cascade Range is composed of a chain of volcanoes extending from northern California to southern British Columbia. The nearest Cascade volcanic center is Lassen Peak, located about 50 miles north of the project. Basement rock underlying the project area consists of Pre-Cretaccous metasedimentary and metavolcanic rocks. These rocks were subsequently intruded during the Cretaccous and early Cenozoic by granite plutons of the Sierran batholith. A sequence of late Cretaceous and early Cenozoic sedimentary and volcanic rocks, termed the Superjacent Series, unconformably overlies the metamorphic and plutonic basement. The Superjacent Series in the project area consists of unmetamorphosed Pliocene Tuscan Formation rocks and other older formations that are locally faulted and warped into a monoclinal fold known as the Chico Monocline, which is believed to be the surface expression of a suspected buried fault. The monocline trends northwest and dips southwest towards the Sacramento Valley. Folding was accomplished by extensive fracturing and faulting.

The late Cenozoic uplift and resulting westward tilt of the Sierra Nevada has produced a series of westward-flowing drainages that are deeply incised through the Cenozoic cover rocks, exposing the older metamorphic and sedimentary rocks below. These processes have resulted in steep slope in many portions of the project area. The

project area ranges in elevation from approximately 270 feet to 5,651 feet; from Round Valley and Philbrook reservoirs at the upper extent, and down to the point where the lowest project-affected reach of Butte Creek enters the impoundment above the Parrot-Phelan diversion dam (a non-project facility).

The geology is varied and complex across this span of elevation. At the upper elevations of the project near Round Valley and Philbrook reservoirs, the local geology includes Pliocene and older Tertiary volcanic rocks, which are generally masked by Pleistocene glacial moraine deposits. The moraine deposits are composed of a heterogeneous mixture of volcanic boulders, cobbles, and gravel set in a dense matrix of clay and silt.

At mid elevations of the project, such as the vicinity of Butte Creek Canal and DeSabla powerhouse, bedrock is primarily composed of Mesozoic to Paleozoic metavolcanic rocks with a few isolated blocks of metasedimentary rock. The foliation and bedrock structure follow a northwest to southeast trend, which parallels that of the Chico monocline and the Paradise-Magalia-Cohasset Ridge Fault Zone. The area is capped by extensive remnants of volcanic sedimentary rocks of the late Cenozoic (Pliocene) Tuscan Formation that overly the metamorphic rocks. The Tuscan Formation is the predominant geologic unit, covering all other geologic formations and effectively caps the landscape in the mid-section of the Butte Creek watershed. The Tuscan Formation consists of thickly bedded lahars (volcanic mudflow deposits), fluvial volcanic conglomerate, volcanic sandstone and siltstone, with individuals beds ranging in thickness from about 3 feet to over 50 feet. Individual lahar beds commonly form steep cliffs in the Butte Creek canyons.

At lower elevations of the project, the Sierran Basement units are overlain by geologic units ranging in age from Quaternary to Cretaceous. Heterogeneous deposits of colluvium cover the slops. The valleys contain coarse alluvial deposits of the Modesto Formation, consisting primarily of unconsolidated gravel, sand, silt and clay derived from the Tuscan Formation. Beneath the Modesto Formation lies the Tuscan Formation, the Magalia Channel Deposits, and the Chico Formation, a cretaceous fossiliferous marine sandstone.

Project Area Soils

Soil types in the project area vary according to geology, elevation, and climate. In the upper elevations of the project, near Round Valley and Philbrook Reservoirs, the soil type is generally characterized as stony sandy loam, and gravelly or cobble sandy loams. The erosion hazard rating for most of these soils is moderate. In the mid-elevations of the project, from Hendricks diversion dam to Toadtown powerhouse, soil types range from loam to coarse sandy loam and gravelly sandy loam. In the lower elevations of the project, including DeSabla Forebay and powerhouse as well as lower Centerville Canal

and Centerville powerhouse, soil types vary from loam to gravelly loam and very stony loam.

Slopes are relatively gentle in the upper elevations of the project area near Round Valley and Philbrook reservoirs, become generally steep in the deeply incised stream channels in mid-elevation areas and generally level-out to form relatively gentle profiles in the lower elevations of the project area where Butte Creek approaches the Sacramento Valley. Landslides have occurred in the Butte Creek canyon before and after the development of the project due to the combination of steep slopes, episodic high rainfall events, and geologic conditions. The geomorphic processes that have shaped the project drainages, particularly landslides in the steep-sloping canyons, are described below. Butte Creek and the West Branch Feather River have deeply incised canyons. Along the mid-elevation areas, Butte Creek and other streams are still actively eroding and downcutting without significant deposition of alluvium along these relatively steep channel reaches. The upper canyon side slopes are undergoing continual modification by mass wasting (landsliding, erosion, and soil creep). Some large, deep-seated ancient landslides involving bedrock units have occurred in the canyon walls, both upstream and downstream of Centerville powerhouse. These larger landslides appear to have formed thousands of years ago, based on the amount of surface modification by erosion, soil development, degree of vegetation establishment, and a lack of geomorphic evidence of recent sliding.

Roads and structures located on the ancient slide masses do not exhibit evidence of recent largescale movements. The ancient landslides most likely developed during the Late Pleistocene to mid-Holocene, when the region probably experienced a much higher average annual rainfall than in the present, and have reached a relatively stable configuration under the current climatic conditions. It is also possible that the ancient slides were initiated by prehistoric large magnitude earthquakes. Two large ancient landslides, in the vicinity of Centerville powerhouse, involved large transported blocks of Tuscan Formation, which appear to have failed at or above the contact with the underlying Magalia Channel deposits or Chico Formation bedrock. The toe of the ancient slide located north of the Centerville powerhouse site appears to have deflected Butte Creek, and overlaps Modesto Formation deposits estimated between 10,000 and 14,000 years old. The canyon slope above the powerhouse site does not appear to have been affected by ancient, large-scale sliding.

Some smaller, old slides, more recent in age than the large ancient slides, have developed in the canyon slopes, often within or along the edges of the ancient landslide masses. These features are estimated to be on the order of many tens to hundreds of years old, and are not currently active. These old slide masses have been somewhat modified by erosion, but their geomorphic expression is generally more pronounced than that of the ancient slides. Trees have become established on the older slide masses, suggesting a relatively long period of quiescence.

Shallow recent and active landslides and debris flows that have failed within the last several decades have been identified in the project vicinity. One such slope failure appears to have occurred during the winter of 1982-83 and/or 1986, periods during which the region experienced very high, sustained rainfall. These recent/active failures are generally shallow and involve weathered bedrock and surficial deposits. Other shallow slides and erosion gullies have been observed in the area of project facilities. These slides have formed in the surficial mantle of colluvium, soil, or terrace deposits, and are therefore shallow. They have largely formed where the surficial soil/colluvium has been saturated by concentrated runoff, or undermined by erosion.

Reservoir Shoreline and Streambank Conditions

There are two project storage reservoirs: Round Valley and Philbrook. Both reservoirs have limited storage capacity. Round Valley Reservoir has a capacity of 1,196 acre-feet, and Philbrook Reservoir has a capacity of 5,009 acre-feet. Along with limited reservoir storage capacity, the project has canal-flume flow capacities, ranging from about 85 cfs to 110 cfs. Given the low canal-flume flow capacities relative to stream flows in Butte Creek and the West Branch Feather River, especially during higher flow periods such as during flood events and/or snowmelt, the project operates as a "run-of-river" system, with most of the stream flow remaining instream during medium to high flow periods; hence, project impacts to streambanks are minimal.

The upper storage reservoir, Round Valley Reservoir, is formed by Round Valley dam and is located on the West Branch Feather River. Round Valley Reservoir has a total drainage area of 2.25 square miles, a surface area of 98 acres and shoreline length is 10,050 feet at maximum water surface elevation of 5,651.1 feet. The maximum depth of Round Valley Reservoir is about 25 feet. Water releases from the reservoir are made through a manually operated low-level outlet valve at the upstream end of the outlet pipe at the base of the dam. It discharges to the natural channel of the West Branch Feather River. Shoreline conditions at Round Valley Reservoir are stable. Shoreline slopes are low and the stony sandy loam soils are in part protected by a lag of gravel that has developed since construction of the Round Valley dam in 1877. Vegetation above the high-water line is undisturbed. There is no boating access at Round Valley Reservoir and the shoreline is not affected by erosion from boat wakes.

The lower storage reservoir, Philbrook Reservoir, is formed by Philbrook dam and is located on Philbrook Creek, approximately three miles south of Round Valley Reservoir. Philbrook Reservoir has a total drainage area of 5.0 square miles, a surface area of 173 acres and shoreline length of 15,753 feet at maximum water surface elevation of 5,552.5 feet. Philbrook Reservoir has a maximum depth of about 60 feet. Water releases from Philbrook dam are controlled by a manually-operated, 30 inch-diameter needle valve at the downstream end of the pipe. The valve is frequently adjusted. It

discharges water to the natural channel of Philbrook Creek. The maximum discharge capacity is about 72 cfs.

Shoreline slopes are generally low and the coarse sandy loam soils are partly protected by a lag deposit of gravel soils that have developed since construction of the Philbrook dam in 1926. Vegetation above the high-water line is undisturbed except for minor disturbance near camping and picnic areas. Boating is allowed on Philbrook Reservoir but is primarily slow moving boats related to fishing and rowing; therefore, the shoreline is not affected by erosion from boat wakes.

3.3.1.2 Environmental Effects

Project and Ancillary Road-Related Erosion

PG&E conducted an Inventory and Assessment of Project and Ancillary Road-Related Erosion (Study 6.3.1-1) as part of their relicensing studies. The study concluded that, overall, the roads within the project boundary are in good condition. The roads are generally stable and do not pose significant erosion concerns, and most of the culverts have little potential for sediment transport to local streams and function without problems. There are, however, a number of localized road-related drainage areas identified in the road surveys that have erosion issues. These roads tend to be a source of sediment production due to their geologic and topographic setting, as they are areas with fine grained native sediments and relatively steep terrain (e.g., Burma Road, Clear Creek Road, Butte Creek diversion dam Road).

PG&E proposes improvements such as increased drainage controls (e.g., additional culverts or rolling dips) on several roads to reduce production of fine sediments, replacing a number of damaged and/or temporary culverts, installing velocity dissipators at culvert outlets; and improved management of side cast materials during annual road blading activities. These activities would minimize erosion and sediment transport potential during future project operations and management.

PG&E also proposes to develop and implement a project Transportation System Management Plan to be included as a condition of any new license issued. The plan will be approved by the Forest Service, for the protection and maintenance of roads associated with the project on National Forest Service Lands. PG&E, in consultation with the Forest Service, proposes to take appropriate measures to rehabilitate existing erosion damage and minimize further erosion of the project access roads located on National Forest Service Lands. The plan also calls for PG&E to install gates or other vehicle control measures where necessary to reduce or eliminate potential erosion resulting from on- or off-road vehicle use.

The Transportation System Management Plan proposed by PG&E is consistent with plans recommended by the FWS [FPA § 10(a) Recommendation 1], the NMFS [FPA § 4(e) Recommendation 3], and the Forest Service [FPA § 4(e) Condition 36] as they relate to geologic resources, erosion, and sedimentation control. The Forest Service's recommendation also includes the following erosion control elements:

- Remove or minimize sidecast; particular care shall be taken near streams and channel crossings;
- Outslope roads where feasible and utilize long, gradual rolling dips to disperse runoff;
- When roads are insloped, use sufficient drainage structures to minimize runoff in inside ditches;
- Disconnect road sediment sources to watercourses and incorporate erosion control measures by/through the use of rolling dips, waterbars, filter strips, cross-drains, etc.;
- Address need for increased frequency of cross-drains, waterbars, and/or rolling dips;
- Where berms and through-cuts have been created, lead outs shall be installed, where feasible, to minimize concentrated flow and allow road drainage from waterbars or other structures; and
- Treat potential erosion or mass wasting sites (removal of fill, or erosion control implememtation).

This plan, as it pertains to road use and maintenance, is further discussed in section 3.3.6, *Land Use and Aesthetic Resources*.

Our Analysis

Continued project operations and management has the potential to create hard-surface runoff and drainage from project roads and ancillary roads, thus potentially increasing erosion and associated sediment transport to the mainstem stream channels of Butte Creek, the West Branch Feather River, and their primary tributaries. Implementation of the above PG&E-proposed improvements as well as the inclusion of a Project Transportation System Management Plan, as proposed by PG&E and recommended by the FWS, the NMFS, and the Forest Service, in any license issued will result in reducing erosion to minimal levels.

Round Valley Reservoir Spillway-Related Erosion and Sediment Transport

According to the Round Valley Reservoir Spillway-Related Erosion and Sediment Transport Survey (Study 6.3.1-2) conducted by PG&E as part of their relicensing studies, observation of the West Branch Feather River indicates that it has not been affected by

sediment input from the Round Valley Spillway. The rock underlying the spillway channel is relatively hard and indurated, and resistant to erosion. Some alluvial debris has accumulated at the mouth of the spillway channel north of the channel of the West Branch Feather River. It is likely that other materials eroded from the channel over the past 130 years have been carried away down the West Branch Feather River.

PG&E proposes to armor the plunge pool with rip rap and place warning signs to keep visitors away from the steep plunge pool slopes as a means to reduce sediment input to the spillway and also to improve safety. These high banks are steep and located close to the parking area on the west end of the dam. This proposed work would also help protect the downstream end of the concrete spillway apron from being undermined in the future. If the plunge pool slopes are laid back, off-highway vehicles may begin to enter this area and cause future erosion. If earthwork is performed along the spillway, additional sediment will likely be generated during the initial spillway flows at the start of the following winter season due to the ground disturbance.

PG&E also proposes to develop a Round Valley Dam Spillway Stabilization Plan to be included as a condition of any new license issued. The plan shall include at a minimum: (1) an assessment of areas to be stabilized; (2) feasibility-level design drawings for stabilization measures; and (3) a schedule for implementation of the measures. PG&E plans to provide a draft of the plan to the Forest Service and the Water Board for review and file the plan including evidence of consultation with FERC.

The Round Valley Dam Spillway Stabilization Plan proposed by PG&E is consistent with the plan recommended by the Forest Service (FPA §4(e) Condition 21). The Forest Service's recommendation also includes the following elements:

- Within 6 months of license issuance, the licensee shall conduct a minimum of one field reconnaissance/design meeting jointly with the Forest Service and other mandatory conditioning agencies and develop, for Forest Service approval, construction level designs needed to implement several geologic concepts;
- Within 1 year of license issuance, the licensee shall complete implementation of Forest Service approved designs that address the above concepts;
- Monitor mitigation measures above, annually for the first 3 years following completion. If any mitigations are not providing adequate resource protection, consult with the Forest Service to develop alternative mitigations and implement Forest Service approved mitigations; and
- Monitor the entire spill channel every 5 years, or following a 10 year plus flood event, for the life of the license. Consult with the Forest Service is erosion is occurring, to develop and implement Forest Service approved mitigations.

Our Analysis

Continued project operation and management has the potential to result in erosion from the Round Valley Dam spillway channel and sediment transport to the West Branch Feather River, although in its current geomorphic condition, the spillway channel is not expected to be a significant source of future erosion and sediment transport to the West Branch Feather River. The inclusion of a Round Valley Dam Spillway Stabilization Plan, as proposed by PG&E and recommended by the Forest Service, in any license issued will ensure the clear identification of the reaches of the channel that are most likely to be a future source of erosion and subsequent sediment transport to the West Branch Feather River and the development of plans for stabilizing such areas of the spillway channel to minimize future erosion and sediment transport on the National Forest Service Lands.

Philbrook Spillway Channel Stabilization

Studies and surveys pertaining to the Philbrook Spillway Channel were originally included in PG&E's PAD under a study called Reservoir Spillway-Related Erosion & Sediment Transport. Shortly before the relicensing site visit which occurred on June 20, 2005, a significant head cut, also known as the knickpoint, was discovered in the Philbrook Spillway channel on National Forest System lands, outside the FERC project boundary. Due to the level of concern expressed by agencies specifically on the head cut portion of this study and the coincidental scheduling of the Part 12 Philbrook Dam 5 year safety inspection for July 26, 2005, it was decided, at a July 8, 2005 relicensing meeting amongst stakeholders, to discuss mitigation of this project-induced effect as a component of the Part 12 Process. However, during the July 26, 2005 inspection, dam safety participants and the Commission's Division of Dam Safety and Inspections did not feel that the Part 12 process was the appropriate venue to resolve the issues associated with the Philbrook spill channel since the head cut did not pose an imminent threat to the integrity of Philbrook Dam. Discussions at the field meeting centered on use of both/either the existing license conditions as well as the relicensing process to resolve this issue.

In his August 17, 2005 Study Plan Determination for the project, the Director of the Commission's Office of Energy Projects noted that this Philbrook Reservoir erosion problem was currently under review by the Division of Dam Safety and Inspections' San Francisco Regional Office (Regional Office) and referred the Forest Service's comments on PG&E's revised study plans to the Regional Office so they could be addressed under the current license. Additionally, PG&E was required to consult with Forest Service in this process. However, if the Forest Service was not satisfied with the Regional Office's decision, the Forest Service could request study modification under this relicensing proceeding, pursuant to §5.15 of the regulations.

In a September 27, 2005 letter to the Regional Office, PG&E attached a proposed plan and schedule to investigate and potentially remediate the 3000 foot-long spillway channel below the Philbrook Dam. The plan addressed the concerns of the Forest Service. Some site investigations were proposed for the fall of 2005 with the majority of the investigation and engineering to take place during 2006. PG&E stated that remediation work would take place after permits and environmental review processes were complete, most likely in 2007.

In a letter filed on October 2, 2007, PG&E provided the Commission with a status report on follow-up items from the project inspection held on July 9 - 12, 2007. The letter stated that PG&E provided the Forest Service with a report containing potential remediation options and met on September 27, 2007 to discuss these options. The Forest Service provided several comments and PG&E would develop a final project description by fall 2007. The proposed work would require the disposal of spoil material and the potential development of a borrow site for rip-rap material. PG&E stated that a process was underway to identify possible sites. They planned to work as quickly as possible to complete the project description and prepare documents for the required permits. PG&E futher stated that it was possible that the time required for generating this material and securing the permits may not allow sufficient time for completion of construction in 2008. Finally, PG&E stated that as the project description and schedule were finalized, they will be evaluating what work could be accomplished in 2008 and whether some activities would need to be scheduled for 2009.

PG&E filed another status report on April 24, 2008 which stated that they determined that a borrow site would be required to secure the rock necessary for remediation work on the Philbrook spill channel. PG&E and the Forest Service identified possible sources that were in the vicinity of the Philbrook Reservoir, and during the spring and summer of 2008, would be conducting site exploration and environmental studies necessary to complete the project description. After this information is compiled, permit application would be completed. PG&E anticipated that no construction work, other than borrow area exploration, would be accomplished in 2008.

In their FPA §4(e) Conditions (No. 22), the Forest Service recommends that PG&E implement the Philbrook Spillway Channel Stabilization Plan. The Forest Service's recommendation includes the following elements:

- Construct a ford or low water crossing on the project spill channel (accessing Philbrook gage below Philbrook Dam) to Forest Service standards;
- Implement all actions, not already completed prior to license issuance, of the Philbrook Spillway Channel Stabilization Project Plan, approved by the

Forest Service. Implementation of this plan shall be complete by December 1, 2010, unless extended by the Forest Service;

- Monitor the entire spill channel every five years, or following a 10 year plus flood event, for the life of the license. Consult with the Forest Service if erosion is occurring to develop and implement Forest Service approved mitigations; and
- Monitor mitigation measures addressed in the final Forest Service approved Philbrook Spillway Channel Stabilization Project Plan, annually for the first three years following completion, unless that plan stipulates more stringent monitoring. If any mitigations are not providing adequate resource protection, consult with the Forest Service to develop alternative mitigations and implement Forest Service approved mitigations.

Our Analysis

Based on the communications between PG&E and the Commission/Regional Office contained in the record for this project and the information provided by the Forest Service in their FPA §4(e) Condition No. 22, we assume that the remediation and mitigation for the erosion occurring below the Philbrook Spillway Channel has not yet been completed. According to a Regional Office report, the erosion migration rate below the Philbrook Spillway Channel is a function of high discharge spillway events.

The inclusion of a Philbrook Spillway Channel Stabilization Plan, as recommended by the Forest Service, in any license issued will ensure that measures are taken to mitigate for the current erosion problem below the Philbrook Spillway Channel. The plan will also allow for routine monitoring to identify and address any future erosion problems that may arise. The plan should include a schedule for filing status reports with the Commission on the ongoing monitoring associated with erosion below the Philbrook spillway channel.

The erosion problem, or knickpoint, below the Philbrook Spillway Channel is caused by a spill channel that is necessary for project operations. Since the erosion is located on lands that are outside the FERC project boundary, we recommend that these lands, starting at the Philbrook Spill Channel, extending from the two Philbrook spillways, and ending at the confluence with Philbrook Creek, be brought into the project boundary.

Canal Spillway-Related Erosion and Sediment Transport

Results from PG&E's Canal Spillway-Related Erosion and Sediment Transport Survey (Study 6.3.1-3) indicate that half of the 24 channels had a low amount of sediment available to active channels and low risk of sediment being added to either the receiving stream or a mainstem channel. Five out of 24 had moderate sediment availability due to the channels having discontinuous erodible sections, with possible or intermittent transport of sediment to an active channel. Seven spillways were actively eroding. Of these seven, two had a large amount of sediment potentially available to an active channel because of direct erosive action by the spilling. The other five had sediment available because they were created in drainages that had either unstable and erosive parent material or other actions in the basin initiated erosion (e.g., not directly related to spillway use but spillway use may have exacerbated the problem).

Our Analysis

In the project area, the mainstems of Butte Creek and the West Branch Feather River are generally transport reaches. Even though there are several spillways that are actively eroding and have the potential to add (and likely have added) sediment to Butte Creek or the West Branch Feather River, the effects of this added sediment on these mainstems may not be quantifiable. In the project area, Butte Creek and the West Branch Feather River are generally sediment supply-limited. Butte Creek substrate is very coarse, and dominated by bedrock and boulders. In the case of Butte Creek only, the gradient does not decrease sufficiently to allow more alluvial/depositional conditions until downstream of the Centerville powerhouse. West Branch Feather River has very few alluvial sections in the project area, and which reflects limited opportunities for storage of finer material. Because the storage of gravel and finer material is limited in the mainstems, a little gravel and sand that may be added by the spillways could be seen as positive.

Water Conveyance Geologic Hazards Risk

The Water Conveyance Geologic Hazards Risk Assessment (Study 6.3.1-4) conducted by PG&E as part of their relicensing studies identified 428 geologic hazards and potential geologic hazards in 36.5 miles of water conveyance facilities, an average of 12 hazards per mile. The Butte Creek Canal had the highest number of total hazards and the highest number of hazards per canal mile, followed by Lower Centerville, Hendricks, Upper Centerville, and Toadtown canals.

However, in terms of assigned risk of engineering and operational concerns, Butte Creek Canal is virtually indistinguishable from the Lower Centerville Canal, which might be expected given their similar geologic and geomorphic settings. Nearly half (48%) of the length of these canals was scored moderate or higher risk and 11 percent of each was

assigned a score of moderately high or higher risk. The only significant distinction was that one approximately 200-foot-long section of the Butte Creek Canal did receive a very high risk score. For comparison, the Hendricks Canal received a moderate or higher score over 14 percent of its length and only 7 percent was given moderately high or higher score. Both the Upper Centerville and Toadtown canals received comparable but considerably lower overall risk assignments, again which might be expected given their similar geologic and geomorphic settings.

PG&E stated that past failures of project conveyances are attributable to two main causes: (1) geologic hazards (activation of rockslides and debris flows); and (2) hazard trees (diseased, dead, or dying trees) that present a direct or indirect risk to the conveyances and appurtenant facilities. Project experience shows that most canal and flume failures have occurred during inclement weather and are typically associated with rockslides and hazard trees that breach the conveyance directly or that enter the project canal, obstruct flow, and result in overtopping of the berm.

Since the early 1990s, PG&E have been implementing Best Management Practices that have substantially reduced, though not eliminated, the adverse effects of canal failures. The most effective measure has been to reduce water levels in the conveyance before and during storm events to increase available freeboard and reduce the risk of overtopping from a minor rockslide or hazard tree entering the canal. Regular aerial and ground patrols, periodic canal repairs and removal of hazard trees, and the abandonment of passively automatic siphonic spill equipment, have also proven beneficial in reducing risk.

PG&E proposes to develop a Project Canal Maintenance and Inspection Plan to be included as a condition of any new license issued. The plan sets forth in detail PG&E's responsibility for the regular maintenance and inspection of project canals to address hazard trees and geologic hazards within the FERC project boundary that may impact the integrity of project water conveyances and includes the following elements:

- Annual inspections of the project water conveyance system to identify potential short-term and long-term hazards (e.g., hazard trees, landslides, etc.) and to prioritize maintenance and/or mitigation;
- Protocols for routine (non-emergency) canal operations and the use of canal spillways; and
- Stabilization measures to reduce the likelihood of catastrophic canal failure due to hazard trees and geologic hazards and to mitigate, as appropriate, sources of chronic erosion and sediment transport into canals.

The Project Canal Maintenance and Inspection Plan proposed by PG&E is consistent with plans recommended by the Forest Service [FPA § 4(e) Condition 23], the NMFS [FPA § 10(j) Condition 3], the FWS [FPA § 10(j) Condition 4], and the California

Fish & Game (Recommendation 7). Additionally, the Forest Service, the FWS, and the California Fish & Game recommend that the plan contain specific preventative measures to address geologic hazards identified in relicensing Study Plan 6.3.1-4, *Water Conveyance Geologic Hazards and Risk Assessment*.

This plan, as it pertains to water quality, is further discussed in section 3.3.2, *Aquatic Resources*.

Our Analysis

The continued operation of Project water conveyances, particularly the Butte Creek and Lower Centerville canals, presents an ongoing risk of adverse environmental impacts to mainstem streams. The risk of erosion and sediment transport due to uncontrolled releases of water is an unavoidable consequence of the geographically remote and geologically unfavorable area in which Project conveyances are located. Future conveyance failures during or immediately following inclement weather are of less consequence to fisheries in the mainstem streams of Butte Creek and the West Branch Feather River because they occur when these watercourses are already flowing at high velocity with a high carrying capacity for sediment transport. Continuation of PG&E's Best Management Practices and the inclusion of a Project Canal Maintenance and Inspection Plan as proposed by PG&E and recommended by the Forest Service, the NMFS, the FWS, and California Fish & Game, in any license issued will ensure that hazard trees and geologic hazards, the two primary causes of past failure of project water conveyances, will be identified and, in the most serious cases, mitigated for. The plan will formalize existing non-emergency canal operations protocols and will provide a consistent point of reference for routine canal operations while permitting PG&E the flexibility to operate the project in accordance with their Best Management Practices. The plan will also address a possible range of options (operational and geotechnical) that may be considered in reducing the risk of catastrophic failure due to hazard trees or geologic instability.

General Project-Related Erosion

In their FPA §4(e) Conditions (No. 21), the Bureau recommended that PG&E, in consultation with Bureau, shall:

- Fix and maintain all areas of the Butte Creek Canal on or adjacent to Bureau land that show signs of erosion deemed significant by Bureau, and which Bureau believes would lead to canal failure/blowouts and spills; and
- Reconstruct and maintain areas of Ditch Creek Road that are affected by project-caused erosion. This includes damage caused by any spills, blowouts, canal erosion, or seepage onto Ditch Creek Road.

In a June 27, 2008 letter, the Conservation Groups requested that PG&E stabilize and remediate the spill channel located just above Centerville powerhouse, to avoid continuing and repeated incidents of turbidity in Butte Creek at and below the spill channel outflow. This channel spills with some frequency; in fact, when the smaller generating unit at Centerville powerhouse is operating, water is necessarily spilled into this channel because the head required to operate the turbine requires more water than the capacity of the turbine. The lower end of this channel has been gunited. However, the upper end is unlined and unstable, and sediment is spilled into Butte Creek when this channel operates, especially after a period of non-use. The bottom of this channel spills into that portion of Butte Creek on which resource agencies have explicitly placed greatest emphasis, since it is at the top of the reach where the greatest amount of spawning habitat is located, and where a substantial percentage of Spring-run Chinook salmon hold below thermal barrier. The Conservation Groups further stated that they have no cost estimate for remediating this channel. Relicensing participants were informed in meetings that the upper end of this channel is very unstable, and the effort needed to remediate would be financially significant and logistically challenging.

Our Analysis

The inclusion of the measures, recommended by Bureau, in any license issued will ensure that any lands impacted by project-related effects (damage caused by any spills, blowouts, canal erosion, or seepage onto Ditch Creek Road) will be mitigated for and will be maintained during the course of a new license.

In their reply to comments, filed on August 14, 2008, PG&E stated that they conducted a study of the spill channel located above the Centerville powerhouse to develop recommendations for spill channel stabilization and to reduce turbidity effects as a result of spill channel operations. During 2005, PG&E implemented remediation measures recommended by the study and now considers the spill channel to be stable and functioning well. PG&E believes further upgrades to the spill channel are unnecessary at this time.

The Conservation Groups do not provide significant information in their comment letter that indicates that a problem still exists at the spill channel located above the Centerville powerhouse. We conclude that no further measures, by PG&E, are necessary to stabilize or remediate the spill channel.

We discuss the cost of developing and implementing measures relating to erosion, sediment transport and control, and geologic hazards in section VI, Developmental Analysis. We present our final recommendations pertaining to erosion, sediment transport and control, and geologic hazards in section VII, Comprehensive Development and Recommended Alternative.

3.3.2 Aquatic Resources

3.3.2.1 Affected Environment

Water Quantity

The Project is located on the western slopes of the Sierra Nevada Mountain Range, and utilizes the flows of two drainage basins; Butte Creek to the west and the West Branch Feather River (West Branch Feather River) to the east (figure 1-3). The Butte Creek basin drains into the Sacramento River near Colusa, California and has no major lakes or reservoirs along its course. The Butte Creek basin ranges in elevation from approximately 7,100 feet above mean sea level (msl) at the headwaters to 475 msl at the Centerville powerhouse. The Project's Butte Creek drainage basin is 150 square miles (96,012 acres) in area and encompasses 11 sub-basins extending from the headwaters of Butte Creek downstream to the non-Project Parrott-Phelan diversion dam at Butte Creek river mile (RM) 46.2.

The Project's 109 square mile (70,003 acre), West Branch Feather River drainage basin encompasses nine sub-basins and extends from the headwaters of the West Branch Feather River (upstream of Round Valley Reservoir) downstream to the non-Project Miocene diversion at West Branch Feather River RM 15.0 (figure 3-1). The West Branch Feather River flows into Lake Oroville which flows into the Sacramento River. The West Branch Feather River ranges in elevation from approximately 7,000 to 3,200 feet msl at the Hendricks diversion dam (also known as Hendricks Head dam). There are two reservoirs, Round Valley (also known as Snag Lake) and Philbrook reservoirs, located in the West Branch Feather River basin's headwaters, which are used to store winter runoff. Flow releases from these two reservoirs are made to supplement summer flows in the West Branch Feather River and in Butte Creek, via the interbasin transfer of water through Project canals (figure 3-1), as described below.

The Project region experiences warm, dry summers and cool winters with significant snowfall in the higher elevations (above 5,000 feet msl) and extensive rain in the lower elevations. As measured at Paradise, CA (elevation 1,778 feet msl), July air temperatures range from an average maximum high of 91.7°F to an average minimum low of 63.9°F, while January air temperatures range from an average maximum high of 53.7°F to an average minimum low of 37.6°F. The annual average maximum and minimum temperatures for Paradise, CA are 70.9°F and 49.5°F, respectively.

Rainfall and snowmelt are the major sources of water in the Butte Creek and West Branch Feather River watersheds and over 95 percent of the average annual precipitation in the Project area occurs between October through May. Below 3,500 feet msl, rain is the dominant form of precipitation in the Project area. However, between 3,500 and 5,500 feet msl, winter precipitation is mostly in the form of snow which, below 4,000 feet

msl often melts between storms. Above elevations of 5,500 feet msl, the dominant form of precipitation is usually snow, with only occasional rain-on-snow below 6,500 feet msl (Forest Service, 1998). Snowmelt occurs in late spring and early summer months, typically producing the largest stream flows during spring. By late summer, the stream flows are usually at their lowest levels as snowmelt has subsided.

The mean annual natural runoff for the portion of the Butte Creek drainage basin upstream of the Butte Creek diversion dam (also referred to as Butte Creek Head dam) based on analysis of a 50-year period from 1934 through 1983 is approximately 122,500 acre-feet. This is equivalent to about 38.3 inches/year of water over the drainage area of about 65 square miles. The mean annual natural runoff for the West Branch Feather River drainage basin at the non-Project Miocene diversion dam is approximately 285,000 acre-feet with a drainage area of about 109 square miles. This is equivalent to about 49.5 inches/year of water over the drainage area.

There are no known groundwater aquifers within the existing Project area (DWR, 2000). Where groundwater occurs, it is typically associated with the Tuscan Formation and is contained within the fractures and joints of volcanic mudflows, as well as in the weathered horizons between buried mudflows (Slade, 2000). The volcanic deposits and the inter-bedded stream deposits with which they are associated are readily infiltrated by precipitation because of their porosity and permeability. Although the deposits are not aquifers in the sense of being developed, they do provide water to springs and contribute to base flow in the area's streams. Seasonal groundwater of varying depth and continuity follows, in modified form, the contours of the land. However, summer base flows for both the Butte Creek and West Branch Feather River basins are relatively high during the late summer months, indicating a relatively abundant groundwater storage supply.

Project Reservoirs

Round Valley Reservoir - The highest elevation storage reservoir for the Project is Round Valley Reservoir, formed by Round Valley Reservoir dam, located on the West Branch Feather River approximately 12 miles upstream from the Hendricks diversion dam (figure 3-1). Round Valley Reservoir has a total drainage area of 2.25 square miles, a surface area of 98 acres at a maximum water surface elevation of 5,651.1 feet msl, and a total usable capacity of 1,196 acre-feet. The maximum depth of Round Valley Reservoir is 25 feet. Historic daily water surface elevations for Round Valley Reservoir for the period of record (1986 to 2005) are shown in figure 3-2.

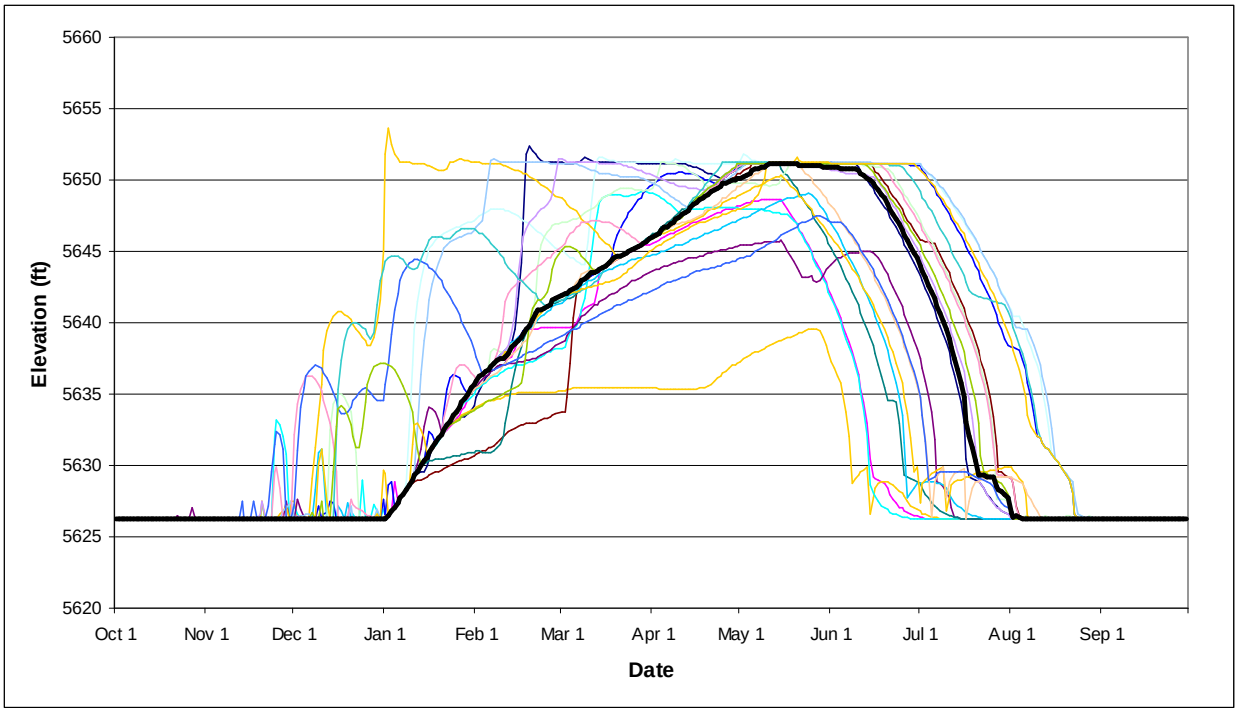

Figure 3-2. Round Valley Reservoir water surface elevations during the period of record (1986 through 2005). The bold line represents the average water surface elevations for a particular date. (Source: PG&E, 2007a)

Under the 1983 Fish and Wildlife Agreement between Pacific Gas and Electric Company (PG&E) and the California Department of Fish and Game (Cal Fish & Game), in normal water year types, PG&E did not draft Round Valley Reservoir until after July 15 for waterfowl habitat management. However, on August 21, 1997, the Commission issued an order placing a restriction on the release of water from Round Valley Reservoir when the water temperature exceeded 17°C.[16] The Commission concluded that water released in excess of 17°C from Round Valley Reservoir would warm by an additional 3°C before reaching the lower Centerville diversion dam, thus exceeding the 20°C goal for enhancing spring-run Chinook salmon habitat in lower Butte Creek. On August 20, 1998, to better allow for short-term operational flexibility for the benefit of spring-run Chinook salmon, the Commission revised its order to allow for modification of the temperature criteria upon mutual agreement of the National Marine Fisheries Service (NMFS), Cal Fish & Game, and the U.S. Fish and Wildlife Service (FWS).[17] Since 1999, this agreement has been accomplished through an annual Project Operations and Maintenance Plan developed by PG&E in consultation with the agencies, which governs water releases from both Round Valley and Philbrook reservoirs.[18]

[16] 80 FERC ¶ 62, 171 (1997).
[17] 84 FERC ¶ 62, 165 (1998).
[18] The annual Project Operations and Maintenance Plan is developed in consultation with NMFS, Cal Fish & Game, and FWS.

The annual Project Operations and Maintenance Plan has called for the release of water from Round Valley Reservoir as soon as space is available for the water in Hendricks canal (see description below), which typically occurs in June. This action is designed to minimize the potential for water temperature increases in Round Valley Reservoir as water temperatures increase later in the summer, and to preserve the cool water benefits of Philbrook Reservoir. Once the water releases from Round Valley Reservoir are initiated, the reservoir is completely drained in about one month's time, as shown in figure 3-2. Round Valley Reservoir has no minimum storage requirement under the current license.

Philbrook Reservoir - Philbrook Reservoir is formed by Philbrook dam and located on Philbrook Creek, approximately 3 miles south of Round Valley Reservoir (figure 3-1). Philbrook Creek discharges into the West Branch Feather River about two miles downstream of Philbrook dam. Philbrook Reservoir has a total drainage area of 5 square miles, a surface area of 173 acres at a maximum water surface elevation of 5,552.5 feet msl, and a total usable capacity of 5,009 acre-feet. The maximum depth of Philbrook Reservoir is 60 feet. The current license requires a minimum pool of no less than 250 acre-feet in Philbrook Reservoir. Historic daily water surface elevations for Philbrook Reservoir for the period of record (1986 to 2005) are shown in figure 3-3.

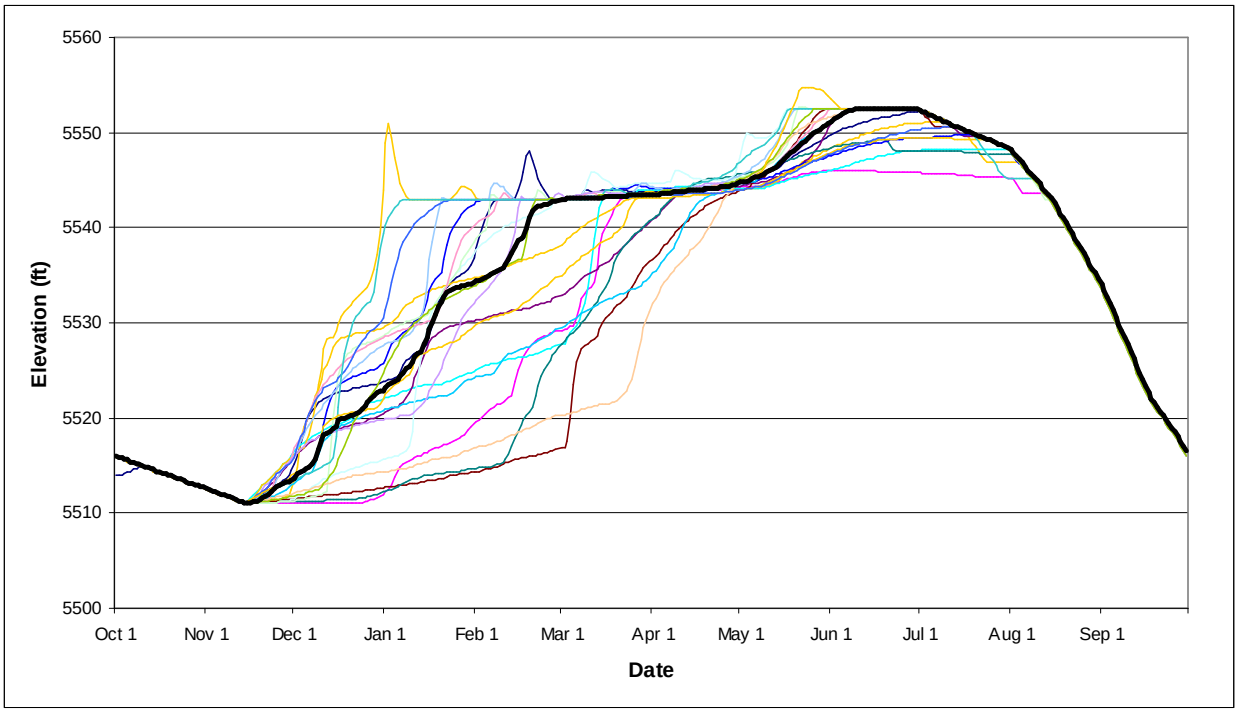

Figure 3-3. Philbrook Reservoir water surface elevations during the period of record (1986 through 2005). The line in bold represents the average water surface elevations for a particular date. (Source: PG&E, 2007a)

Although the Commission's 1997 order placed a maximum temperature restriction of 18°C on water released from Philbrook Reservoir, the Commission's 1998 order allowed for modification of the temperature criteria upon mutual agreement of NMFS, Cal Fish & Game, and FWS. Pursuant to the annual Project Operations and Maintenance Plan developed in consultation with the agencies, as previously discussed, water releases from Philbrook Reservoir are typically made as soon as the releases from Round Valley Reservoir begin to diminish in mid-July, with releases from Philbrook Reservoir occurring through mid-September. Drafting is typically planned so that approximately 500 to 750 acre-feet remain in Philbrook Reservoir in mid-September to insure that water is available to make minimum instream flow (MIF) releases until the winter rains begin.

DeSabla Forebay - DeSabla forebay is located between the Butte Creek and West Branch Feather River drainage basins at an elevation of 2,700 feet msl on a fairly flat plateau above Butte Creek (figure 3-1). The natural drainage area of the forebay is 0.25 square miles and has a surface area of 15 acres at a maximum water surface elevation of 2,755 feet msl. The original storage capacity of DeSabla forebay was 188 acre-feet; however, sedimentation has reduced the storage capacity to 166 acre-feet, with a total usable capacity of 124 acre-feet. The mean depth of the forebay is currently 7.8 feet with a maximum depth at the dam of 21.7 feet.

DeSabla forebay is used as a regulating facility for the DeSabla powerhouse. Except during the routine annual maintenance period, the forebay fluctuates minimally, typically less than 0.2 feet, throughout the year and is managed to avoid spill, which rarely occurs.

Project Bypassed Reaches, Dams and Canals

Stream flow and canal flows in the Project area are measured throughout the Project area at gages maintained by PG&E in cooperation with USGS as shown in table 3-1. The stream flow gages are primarily designed to measure compliance with MIFs in the bypassed stream reaches and diversion flows in the Project canals. Consequently, when stream flows are spilling over the diversion dams (typically late winter and spring), the estimates of flow within the bypassed reaches of Butte Creek and the West Branch Feather River are low because these stream flows often exceed the rating curve of the stream flow gages. The only stream flow gages in the area that are rated to measure all of the stream flow is the USGS gage no. 11390000 on Butte Creek near Chico, CA and USGS gage no. 11405300 on the West Branch Feather River near Paradise, CA, downstream of the non-Project Miocene diversion dam (table 3-1).[19]

[19] USGS gage no. 11390000 data also includes non-Project stream flow from Little Butte Creek, which joins Butte Creek about 5 miles downstream of Centerville Powerhouse.

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Table 3-1. Reservoir level gages and stream flow gaging stations in the Project vicinity. (Source: PG&E, 2007a)

	Watershed	PG&E ID	USGS No.	Station Name	USGS Period (WY)	PG&E Period (WY)	Status
1	Butte	BW97	11389720	Butte Creek below Butte Creek diversion dam near Stirling City CA	86 - 04	86 - 05	--
2	Butte	BW13	---	Butte Creek diversion dam Spill (estimated)	--	87 - 05	--
3	Butte	BW14	---	Butte canal at Butte diversion dam	--	70 - 05	--
4	Butte	BW15	---	Butte canal above Toadtown canal	--	70 - 05	--
5	Butte	BW82	11389750	DeSabla powerhouse near Paradise CA	80 - 04	75 - 05	--
7	Butte	BW98	11389780	Butte Creek below Centerville diversion dam	86 - 04	86 - 05	--
8	Butte	BW19	---	Centerville diversion dam Spill (estimated)	86 - 04	87 - 05	--
9	Butte	BW20	---	Centerville canal near diversion dam	--	70 - 05	--
10	Butte	BW22	---	Centerville canal near Forebay	--	70 - 05	--
11	Butte	BW80	11389775	Centerville powerhouse near Paradise CA	80 - 04	75 - 05	--
12	Butte	---	11390000	Butte Creek near Chico CA	30 - 04	--	--
13	West Branch Feather River	BW1	11405075	Snag Lake (Round Valley Reservoir) near Jonesville CA	--	80 - 05	--
14	West Branch Feather River	BW45	11405085	West Branch Feather River below Snag Lake near Jonesville CA	93 - 03	86 - 05	--
15	West Branch Feather River	BW2	11405100	Philbrook Reservoir near Butte Meadows CA	--	80 - 05	--
16	West Branch Feather River	BW3	11405120	Philbrook Creek below Philbrook Reservoir near Butte Meadows CA	89 - 04	86 - 05	--
17	West Branch Feather River	BW95	11405200	West Branch Feather River below Hendricks diversion dam	86 - 04	86 - 05	Site moved
18	West Branch Feather River	BW7	---	Hendricks diversion dam Spill (estimated)	--	86 - 05	--
19	West Branch Feather River	BW8	---	Hendricks canal at Head Dam	--	70 - 05	--
20	West Branch Feather River	BW96	11405220	Long Ravine below diversion dam near Stirling City CA	96 - 03	86 - 05	--
21	West Branch Feather River	BW12	11389800	Toadtown canal above Butte canal near Stirling City CA	84 - 04	70 - 05	--
22	West Branch Feather River	---	11405300	West Branch Feather River near Paradise CA	57 - 86	--	Discontinued
23	West Branch Feather River	BW100	11389775	Toadtown powerhouse	--	86 - 05	--
24	Combined	BW17	---	DeSabla Forebay	--	94 - 05	--
25	Combined	BW18	---	Upper Centerville canal - release from DeSabla Forebay	--	70 - 05	--
26	West Branch Feather River	BW24	---	Upper Miocene canal (Non-FERC License facility)	--	70 - 05	--
27	West Branch	BW23	---	West Branch Feather River below Miocene Diversion (Non-FERC	--	76 - 05	--

	Feather River			License facility)			

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PG&E estimated the flows for Butte Creek upstream of the Butte Creek diversion dam and upstream of the Lower Centerville diversion dam, for the West Branch Feather River upstream of the Hendricks diversion dam. In general, the flows were obtained by adding the diversion flows recorded for the associated Project canal with the flow records from the stream flow gage downstream of the diversion (most often a USGS gage). Only a fraction of the total data available had information from both the canal and stream flow gages at each of the diversions. Using the combined gage data only, an estimate of the monthly minimum, maximum, and mean stream flows by month for the period of record was calculated upstream at each of these diversion structures (tables 3-4, 3-6, and 3-7). Instances where gage limitations resulted in low-biased flows are shown in bold. Due to the limitation of the rating curves associated with the stream flow gages, the mean and maximum data from February through May are biased low. The actual means and maximum stream flows are larger because discharges for spill events could not be measured at these USGS gages. Usually the summer through fall months (e.g., June through November) were the only periods where sufficient data existed to construct meaningful flow duration curve estimates upstream of these diversion dams (i.e., a majority of the total data available had flow measurements from both the canal and stream flow gages at a given diversion).[20]

Utilizing a combination of recorded and synthesized data, PG&E developed a summary of hydrologic information, such as mean annual flows, and maximum and minimum recorded flows, for the period of record (1986 to 2005) in the Project area, as shown in table 3-2.

[20] Appendix E of the DeSabla-Centerville Hydroelectric Project Pre-Application Document (PAD) filed on October 4, 2004, contains the monthly flow duration curves for Butte Creek and the West Branch Feather River where sufficient data was available to construct meaningful flow duration curves. Flow duration curves are presented for Butte Creek upstream of the Butte Diversion dam (July through November), upstream of the Lower Centerville Diversion dam (June through September), and near Chico, CA (January through December), as well as for the West Branch Feather River upstream of Hendricks Diversion dam (January, and June through December).

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Table 3-2. Hydrologic data for the period of record (water years 1986 through 2005). (Source: PG&E, 2007a)

	PG&E ID	Station Name	Units	POR Median	POR Mean	Annual Mean-Hi	Annual Mean-Low	Monthly Mean-Hi	Monthly Mean-Low	Daily Mean-Hi	Daily Mean-Low
1	BW97 & BW13	Butte Creek below Butte Creek diversion dam[1]	cfs	25	111	280 (1995)	27 (1990)	286 (Feb)	19 (Aug)	10,989 (01/01/97)	8 (Periodic)
3	BW14	Butte Canal at Butte diversion dam[2]	cfs	50	49	66 (1988)	26 (1997)	62 (Jun)	38 (Oct)	108 (01/15/02)	0 (Periodic)
4	BW15	Butte Canal above Toadtown Canal[2]	cfs	51	51	66 (1988)	27 (1997)	68 (Apr)	33 (Oct)	130 (12/16/97	0 (Periodic)
5	BW82	DeSabla powerhouse[2]	cfs	105	107	129 (1993)	58 (1997)	148 (Apr)	60 (Oct)	193 (01/05/86)	0 (Periodic)
7	BW98 & BW19	Butte Creek below Centerville diversion dam[1]	cfs	70	208	497 (1995)	67 (1990)	501 (Feb)	43 (Aug)	12,961 (12/31/96)	10 (Periodic)
9	BW20	Centerville Canal near diversion dam[2]	cfs	111	105	131 (1993)	67 (1997)	151 (Apr)	50 (Oct)	183 (03/22/94)	0 (Periodic)
10	BW22	Centerville Canal near Forebay[2]	cfs	114	107	131 (1988)	59 (1997)	156 (Apr)	50 (Oct)	1,100 (12/17/88)	0 (Periodic)
11	BW80	Centerville powerhouse[2]	cfs	109	102	129 (1993)	57 (1997)	150 (Apr)	46 (Oct)	190 (02/29/92)	0 (Periodic)
12	---	Butte Creek[3]	cfs	203	405	834 (1995)	207 (1994)	872 (Feb)	112 (Sep)	26,600 (01/01/97)	45 (08/25/92)
13	BW1	Snag Lake (Round Valley Reservoir)[4]	ft, elev.	5,632.8	5,635.9	5,639.5 (1998)	5,630.3 (1988)	5,649.1 (May)	5,626.2 (Sep)	5,653.6 (01/02/97)	5,626.2 (Periodic)
14	BW45	West Branch Feather River below Snag Lake[1]	cfs	1.4	6.2	14.3 (1995)	1.3 (1988)	11.4 (Mar)	1.4 (Oct)	571 (01/01/97)	0 (Periodic)
15	BW2	Philbrook Reservoir[4]	cfs	5,539.2	5,533.8	5,536.8 (2003)	5,529.4 (2001)	5,550.9 (Jun)	5,512.0 (Nov)	5,554.8 (05/24/05)	5,511.0 (Periodic)
16	BW3	Philbrook Creek below Philbrook Reservoir[1]	ft, elev.	4.3	16.7	29.8 (1995)	7.5 (1992)	28.3 (Aug)	5.3 (Nov)	1,413 (01/01/97)	1 (Periodic)
17	BW95 & BW7	West Branch Feather River River below Hendricks diversion dam[1]	cfs	21	109	279 (1995)	25 (1994)	239 (Mar)	18 (Oct)	12,580 (01/01/97)	7 (02/26/89)
19	BW8	Hendricks Canal at Head Dam[2]	cfs	64	65	86 (1999)	31 (1997)	94 (Apr)	35 (Oct)	1,013 (07/05/05)	0 (Periodic)
20	BW96	Long Ravine below diversion dam[2]	cfs	--	--	--	--	--	--	--	--
21	BW12	Toadtown Canal above Butte Canal[2]	cfs	62	64	84 (1993)	36 (1997)	93 (Mar)	31 (Oct)	127 (02/12/95)	0 (Periodic)
23	BW100	Toadtown powerhouse[2]	cfs	--	--	--	--	--	--	--	--
24	BW17	DeSabla Reservoir[4]	ft, elev.	2,753.0	2,753.0	2,753.0 (Periodic)	2,753.0 (Periodic)	2,753.0 (Periodic)	2,753.0 (Periodic)	2,753.0 (Periodic)	2,753.0 (Periodic)
25	BW18	Upper Centerville Canal from DeSabla Forebay[2]	cfs	3.0	2.9	4.2 (1988)	1.9 (1997)	4.3 (Apr)	2.5 (Jul)	15.0 (Periodic)	0.0 (Periodic)

Notes: (1) Combination of PG&E recorded data and synthesized data; (2) PG&E recorded data; (3) USGS recorded data; (4) HEC-ResSim DeSabla-Centerville Operations Model data.

Upper West Branch Feather River-Downstream of Round Valley Reservoir Dam

Flows from Round Valley Reservoir are released to the upper West Branch Feather River from either an overflow spillway or through a manually operated low level outlet valve. Currently, there is a minimum instream flow (MIF) requirement to the upper West Branch Feather River of 0.5 cfs from Round Valley Reservoir during normal water year types and 0.1 cfs during dry water year types (table 3-3). Coon Hollow Creek enters the West Branch Feather River approximately 1.3 miles downstream of Round Valley Reservoir dam (figure 3-1).

Table 3-3. Current minimum instream flow requirements (in cfs) downstream of Project diversions. Feeder creeks are in bold. (Source: Staff, 2008)

	Volume of Discharge (in cfs)		
Point of Diversion	**Normal**	**Dry**	**Time Period**
Round Valley Reservoir	0.5	0.1	
Philbrook Reservoir	2	2	
Hendricks diversion dam	15	7	
Butte Creek diversion dam	16	7	
Lower Centerville diversion dam	40	10	Sept. 15-Oct. 31 and
	30	10	Nov. 11-Dec. 14
	40	40	June 1-Sept. 14
Inskip Creek	0.25	0.1	
Kelsey Creek	0.25	0.1	
Stevens Creek	0.25	0.1	Discontinued
Emma Ravine	0.25	0.1	Discontinued
Coal Claim Ravine	0.25	0.1	Discontinued
Oro Fina Ravine	0.25	0.1	Discontinued
Little West Fork	0.25	0.1	
Cunningham Ravine	0.25	0.1	
Clear Creek	0.5	0.25	
Long Ravine	0.5	0.25	

Flows for the West Branch Feather River downstream of Round Valley Reservoir dam as measured at PG&E's gage no. BW45 during the period of record are shown in table 3-2 and flow duration curves for this reach are shown in figure 3-4.

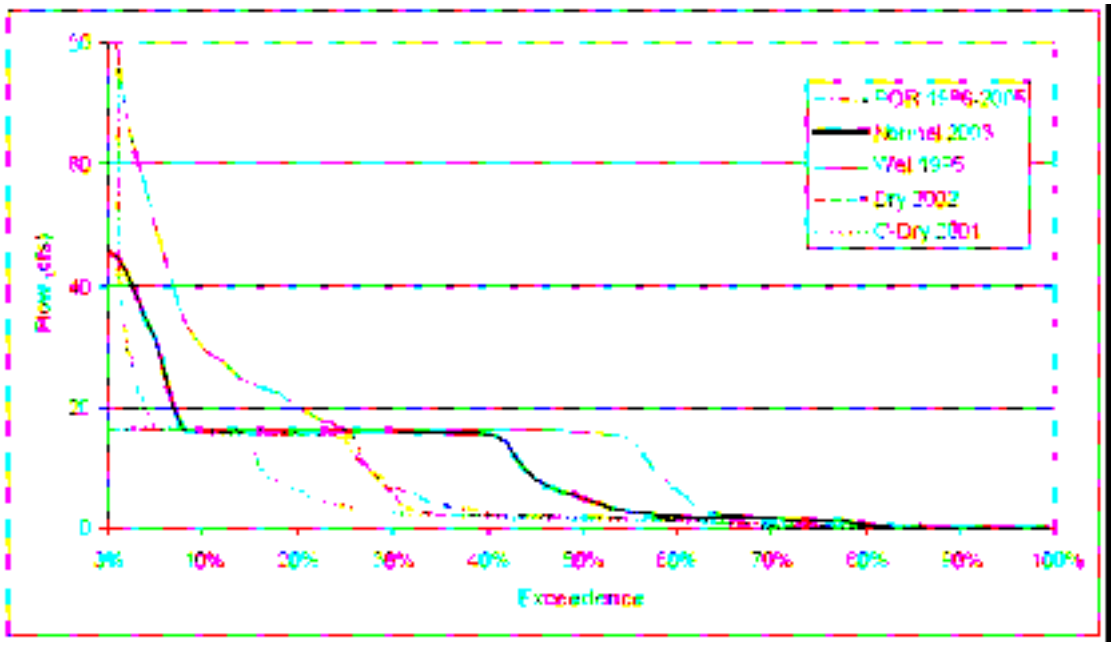

Figure 3-4. Flow duration curves for the West Branch Feather River downstream of Round Valley Reservoir dam including the average for the period of record (1986 to 2005), normal, wet, dry, and critically dry water year types. (Source: PG&E, 2007a).

Upper West Branch Feather River-Downstream of Philbrook Reservoir Dam

Under the current license there is a year-round MIF of 2 cfs from Philbrook Reservoir dam (table 3-3). Flows for the West Branch Feather River downstream of Philbrook Reservoir dam as measured at PG&E's gage no. BW3 during the period of record are shown in table 3-2 and flow duration curves for this reach are shown in figure 3-5.

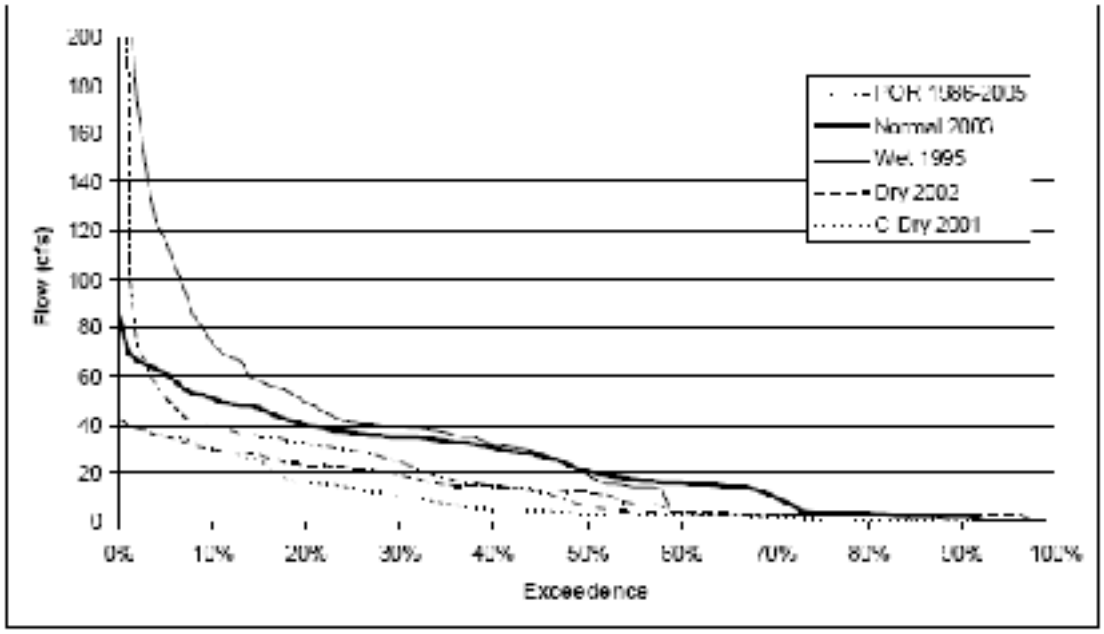

Figure 3-5. Flow duration curves for the Philbrook Creek downstream of Philbrook Reservoir dam including the average for the period of record (1986 to 2005), normal, wet, dry, and critically dry water year types. (Source: PG&E, 2007a).

Lower West Branch Feather River-Downstream of Hendricks Diversion dam – The Hendricks diversion dam is located on the West Branch Feather River approximately 12 miles downstream of Round Valley Reservoir. Hendricks diversion dam is 15 feet high and is utilized to divert water into the 8. 66 mile long Hendricks canal (figure 3-1). The canal is composed mainly of earthen ditch with several flume and tunnel sections and carries a maximum of 125 cfs to the Toadtown powerhouse. Table 3-2 contains flows for the period of record for Hendricks canal, as measured at PG&E's gage no. BW8.

The first section of Hendricks canal includes a tunnel under Stirling City that carries water to Long Ravine Creek where it is released. A short section of Long Ravine Creek is used for water conveyance, connecting two portions of Hendricks canal. Long Ravine diversion dam is 2.4 miles downstream from the West Branch Feather River at the Hendricks diversion dam. The Long Ravine diversion dam is a small dam, approximately 40 feet long with a concrete foundation and timber flashboards approximately six feet high. Hendricks canal then follows the contour of the land and is well shaded and includes another tunnel section.

PG&E estimated the flows for the West Branch Feather River upstream of the Hendricks diversion dam by adding the diversion flows recorded for Hendricks canal (PG&E gage no. BW8) with the flow records from the USGS gage downstream of Hendricks diversion dam (USGS gage no. 11405200). Table 3-4 shows the monthly minimum, mean, and maximum stream flows obtained for the period of record upstream of Hendricks diversion dam. Instances where gage limitations resulted in low-biased flows are shown in

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bold. Only 63 percent of the total data available had information from both gages concurrently.

Table 3-4. Mean monthly flows for the West Branch Feather River upstream of Hendricks diversion dam when both gages (PG&E gage no. BW8 and USGS gage no. 11405200) were available to estimate flow. (Source: PG&E, 2004)

Month	Minimum (in cfs)[1]	Maximum (in cfs)	Mean (in cfs)
January	22	118	80
February	56	**131**	**100**
March	80	**148**	**127**
April	127	**157**	**138**
May	120	**172**	**138**
June	65	134	100
July	38	136	82
August	31	130	74
September	27	128	58
October	30	128	52
November	29	74	54
December	31	120	73

1 Data are from October 1, 1986 through September 30, 2002. Flows in bold show flows based on limited data sets that produce an underestimate of the mean and maximum monthly flow.

During low flow periods, Hendricks diversion dam diverts the entire West Branch Feather River flow. However, a year-round MIF of 15 cfs during normal water year types and 7 cfs during dry water year types is released to West Branch Feather River downstream of the Hendricks diversion dam (table 3-3). Flows for the West Branch Feather River downstream of Hendricks diversion dam as measured at PG&E's gage nos. BW95 and BW7 during the period of record are shown in table 3-2 and flow duration curves for this reach are shown in figure 3-6.

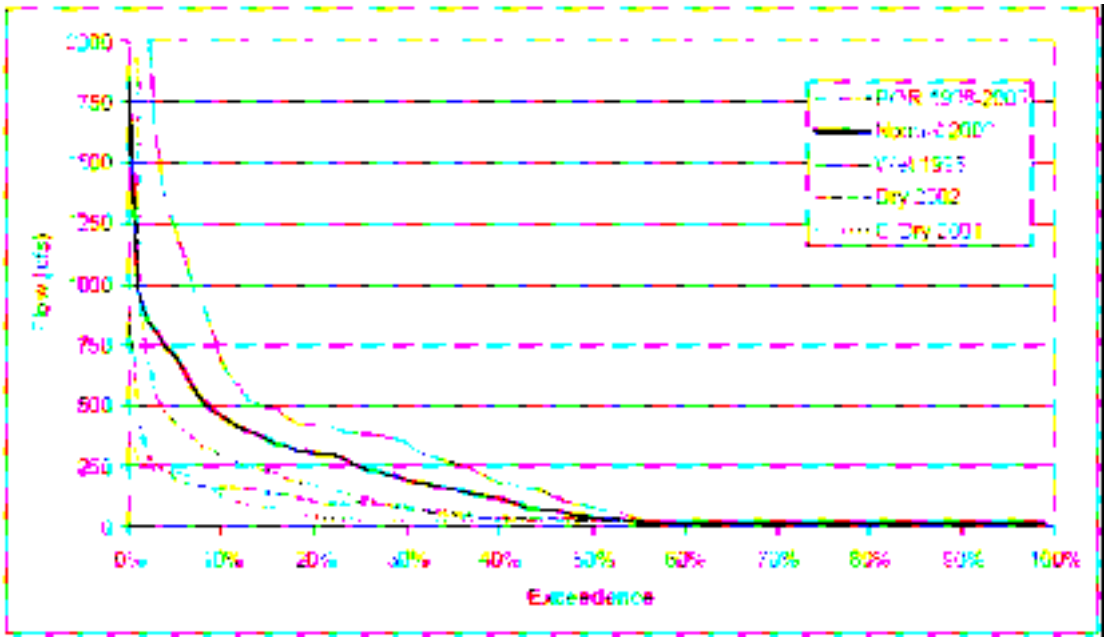

Figure 3-6. Flow duration curves for the West Branch Feather River downstream of Hendricks diversion dam including the average for the period of record (1986 to 2005), normal, wet, dry, and critically dry water year types. (Source: PG&E, 2007a).

Long Ravine– There are no estimates of the flow parameters for Long Ravine upstream of the discharge from Hendricks canal that has been diverted from the West Branch Feather River, as previously described. Water from Hendricks canal enters Long Ravine Creek approximately 1 mile upstream of the Long Ravine diversion dam, where it is diverted back into the continuation of Hendricks canal (figure 3-1). The gaging station that historically measured flows in Hendricks canal downstream of the diversion dam (PG&E gage no. BW52) was discontinued in 1985. The USGS gage located in Long Ravine, downstream of the diversion dam (USGS gage no. 11405220), began operation in 1996. This USGS gage is intended to measure compliance with MIF requirements. Consequently, there is currently no way to determine the quantity of flow from Long Ravine that is intercepted by Long Ravine diversion dam. Table 3-5 shows the mean monthly minimum, mean, and maximum stream flows obtained for the period of record at the USGS gage downstream of the diversion for the period of record (1996 to 2002).

Table 3-5. Mean monthly flows for Long Ravine downstream of Long Ravine diversion dam as measured at USGS gage no. 11405220. (Source: PG&E, 2004)

Month	Minimum (in cfs)[1]	Maximum (in cfs)	Mean (in cfs)
January	1.00	1.00	1.00
February	1.00	1.00	1.00
March	1.00	1.00	1.00
April	0.82	1.00	0.91
May	1.00	1.00	1.00
June	0.61	1.00	0.91

July	0.56	1.00	0.93
August	0.56	1.00	0.93
September	0.53	1.00	0.91
October	0.60	1.00	0.93
November	0.97	1.00	0.99
December	0.99	1.00	1.00

1 Data are from October 1, 1996 through September 30, 2002.

Current year-round MIFs released to Long Ravine downstream of Long Ravine diversion dam are 0.5 cfs during normal water year types and 0.25 cfs during dry water year types (table 3-3).

Butte Creek Diversion dam – Water is first diverted from the Butte Creek drainage for Project operations at the Butte Creek diversion dam (figure 3-1), which is about 50 feet high). Water is diverted into Butte canal, which is 11.4 miles long and has a capacity of approximately 91 cfs. Flows for Butte canal as measured at PG&E's gage nos. BW14 and BW15 are shown in table 3-2. The canal is comprised of earthen berm, gunite, tunnel, a siphon, and flume sections. The canal follows the contour of the hillside and is well shaded. Approximately 0.7 mile upstream of DeSabla forebay, Butte canal and Toadtown canal (carrying water diverted from the West Branch Feather River) join together and flow into DeSabla forebay (figure 3-1). The confluence of Butte canal with Toadtown canal is approximately 10.7 miles downstream from Butte Creek diversion dam and the canal capacity downstream of this confluence increases to 191 cfs.

PG&E estimated the flows for Butte Creek upstream of the Butte Creek diversion dam by adding the diversion flows recorded for Butte canal (PG&E gage no. BW14) with the flow records from the USGS gage downstream of the diversion (USGS gage no. 11389720), as described previously. Table 3-6 shows the monthly minimum, mean, and maximum stream flows obtained for the period of record upstream of the Butte Creek diversion dam. Instances where gage limitations resulted in low-biased flows are shown in bold. Only 29 percent of the total data available had information available from both the instream flow and the canal gage concurrently.

Table 3-6. Mean monthly flows for Butte Creek upstream of Butte Creek diversion dam when both gages (PG&E gage no. BW14 and USGS gage no. 11389720) were available to estimate flow. (Source: PG&E, 2004)

Month	Minimum (in cfs)[1]	Maximum (in cfs)	Mean (in cfs)
January	20	**119**	**78**
February	59	**112**	**81**
March	104	**123**	**112**
April	111	**113**	**112**
May	83	**124**	**106**
June	66	**127**	**90**
July	56	114	76

August	49	100	67
September	46	89	61
October	48	88	64
November	51	86	66
December	34	99	75

1 Data are from October 1, 1986 through September 30, 2002. Flows in bold show indicate flows based on limited data sets that produce an underestimate of the mean and maximum monthly flow.

Current year-round MIFs released to Butte Creek downstream of the Butte Creek diversion dam are 16 cfs during normal water year types and 7 cfs during dry water year types (table 3-3). Flows for Butte Creek downstream of Butte diversion dam as measured at PG&E's gage nos. BW97 and BW13 during the period of record are shown in table 3-2 and flow duration curves for this reach are shown in figure 3-7.

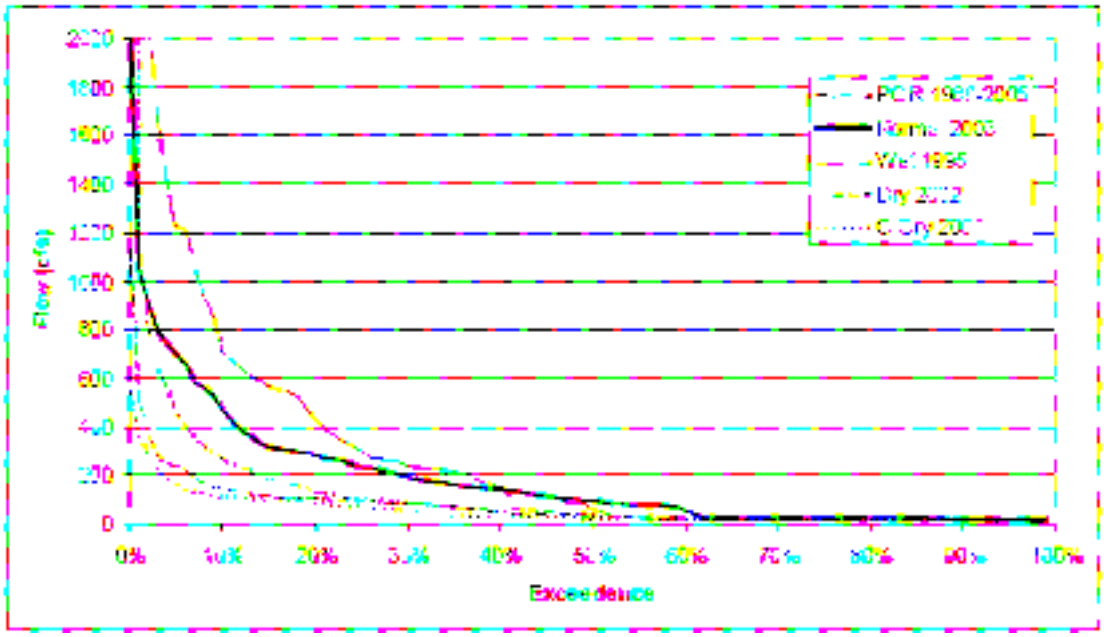

Figure 3-7. Flow duration curves for Butte Creek downstream of Butte Creek diversion dam including the period of record (1986 to 2005), normal, wet, dry, and critically dry water year types (PG&E, 2007a).

Approximately 7 miles downstream of Butte Creek diversion dam on Butte Creek is the non-Project Forks of Butte Project diversion dam (FERC Project No. 6896), which diverts water for use at Forks of Butte powerhouse (figure 3-1).[21] The Forks of Butte powerhouse is about 9.7 stream miles downstream from Butte Creek diversion dam, and 0.25 miles upstream of DeSabla powerhouse. The Forks of Butte Project can divert up to 275 cfs, with a required year-round MIF of 47 cfs, or inflow, whichever is less, downstream of the diversion dam. As a result of the 47 cfs MIF requirement at the Forks of Butte Project diversion dam, the Forks of Butte powerhouse does not operate through

[21] These facilities are owned by Energy Growth Partnership, Inc.

most of the summer due to inadequate flows being available to meet the MIF requirement and provide water for operations at the Forks of Butte powerhouse.

Lower Centerville Diversion dam – Lower Centerville diversion dam is a 12-foot-high dam located 0.2 miles downstream of the DeSabla powerhouse (figure 3-1). Lower Centerville diversion dam diverts up to 183 cfs from Butte Creek into the Lower Centerville canal. Lower Centerville canal is approximately 8 miles long and carries water to Centerville powerhouse (figure 3-1). Lower Centerville canal is composed of earthen canal with several flume sections, and is exposed to more solar radiation than either the Hendricks or Butte canals. Flows for Lower Centerville canal as measured at PG&E's gage nos. BW20 and BW22 for the period of record are shown in table 3-2.

PG&E estimated the flows for Butte Creek upstream of Lower Centerville diversion dam by adding the diversion flows recorded for Lower Centerville canal (PG&E gage no. BW20) with the flow records from the USGS gage downstream of Lower Centerville diversion dam (USGS gage no. 11389780). Table 3-7 shows the monthly minimum, mean, and maximum stream flows obtained for the period of record upstream of Lower Centerville diversion dam in Butte Creek. Instances where gage limitations resulted in low-biased flows are shown in bold. Only 45 percent of the total data available had information from both the instream flow and canal gages concurrently.

Table 3-7. Mean monthly flows for Butte Creek upstream of Lower Centerville diversion dam when both gages (PG&E gage no. BW20 and USGS gage no. 11389780) were available to estimate flow. (Source: PG&E, 2004)

Month	Minimum (in cfs)[1]	Maximum (in cfs)	Mean (in cfs)
January	86	**192**	**154**
February	98	**249**	**161**
March	212	**253**	**233**
April	203	**240**	**219**
May	156	**238**	**195**
June	127	**223**	**169**
July	122	203	147
August	**71**	223	**130**
September	54	160	97
October	58	**182**	**109**
November	82	**175**	**115**
December	79	**212**	**143**

1 Data are from October 1, 1986 through September 30, 2002. Flows in bold show flows based on limited data sets that produce an underestimate of the mean and maximum monthly flow.

During low flow periods, Lower Centerville diversion dam diverts the entire flow of Butte Creek into the canal. Current year-round MIFs released to Butte Creek downstream of the Lower Centerville diversion dam range between 30 to 40 cfs in normal water year types, and 10 to 40 cfs in dry water year types, as shown in table 3-3.

Flows for Butte Creek downstream of Lower Centerville diversion dam as measured at PG&E's gage nos. BW98 and BW19 during the period of record are shown in table 3-2 and flow duration curves for this reach are shown in figure 3-8.

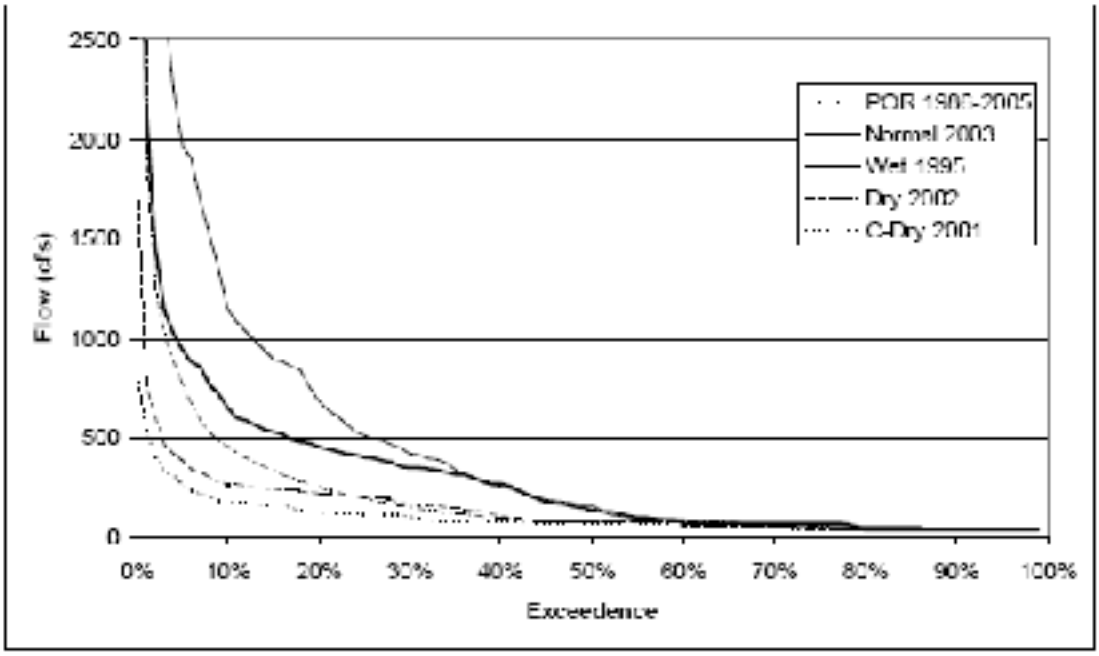

Figure 3-8. Flow duration curves for Butte Creek downstream of Lower Centerville diversion dam including the period of record (WY 1986 to 2005), normal, wet, dry, and critically dry water year types (PG&E, 2007a).

Flows for Toadtown, DeSabla, and Centerville powerhouse Intakes

Toadtown powerhouse -Toadtown powerhouse is located on Hendricks canal approximately 8.6 miles downstream of Hendricks diversion dam (figure 3-1). There is no storage reservoir associated with this powerhouse. The Toadtown powerhouse contains one Francis turbine with a maximum hydraulic capacity of 134 cfs and a minimum hydraulic capacity of 25 cfs. If the flow in the Hendricks canal is less than the 25 cfs minimum operating flow, the water is directed through a bypass into Toadtown canal downstream of the powerhouse. PG&E estimated the flows for Toadtown powerhouse using powerhouse outflow records from PG&E's gage no. BW100. Table 3-8 shows the monthly minimum, mean, and maximum flows by month for the period of record for Toadtown powerhouse.

Table 3-8. Mean monthly flows for Toadtown powerhouse outflow as measured at PG&E's gage no. BW100. (Source: PG&E, 2004)

Month	Minimum (in cfs)[1]	Maximum (in cfs)	Mean (in cfs)
January	4	118	73
February	4	135	84
March	1	154	112

April	0	155	109
May	0	182	126
June	51	179	139
July	78	171	117
August	27	157	90
September	21	127	68
October	0	97	41
November	2	85	51
December	23	111	68

1 Data are from October 1, 1986 through September 30, 2002.

Toadtown canal is in essence the continuation of Hendricks canal from the tailrace of the Toadtown powerhouse to its confluence with Butte Creek canal (figure 3-1). Toadtown canal joins Butte canal approximately 0.7 miles upstream of DeSabla forebay. Toadtown canal is principally an earthen canal with a capacity of 125 cfs and a total length of approximately 2.4 miles. Flows for Toadtown canal as measured at PG&E's gage no. BW12 during the period of record are shown in table 3-2.

DeSabla powerhouse - The intake for DeSabla powerhouse is located in DeSabla forebay, a 166 acre-feet reservoir that is supplied with water from the combined flow of Butte and Toadtown canals, as described previously. DeSabla powerhouse is located approximately 1.3 miles downstream from DeSabla forebay on Butte Creek (figure 3-1). DeSabla powerhouse contains one Pelton turbine, with a maximum hydraulic capacity of 191 cfs. Discharge from the powerhouse enters Butte Creek 0.2 miles upstream of the Lower Centerville diversion dam. PG&E estimated the flows for the DeSabla powerhouse intake using the flow records from the USGS gage that measures outflow from the powerhouse (USGS gage no. 11389750; PG&E gage no. BW82). Table 3-9 shows the monthly minimum, mean, and maximum flows by month for the period of record for DeSabla powerhouse outflow.

Table 3-9. Mean monthly flows for the DeSabla powerhouse outflow (USGS gage no. 11389750; PG&E gage no. BW82). (Source: PG&E, 2004)

Month	**Minimum (in cfs)[1]**	**Maximum (in cfs)**	**Mean (in cfs)**
January	7	184	122
February	7	183	131
March	1	191	155
April	0	190	160
May	0	184	148
June	51	182	142
July	78	180	119
August	27	177	96
September	21	127	68
October	25	123	70
November	47	178	96

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December	45	183	118

1 Data are from October 1, 1980 through September 30, 2002. No adjustments to these estimates were made for evaporation, leakage, or water rights releases (into the Upper Centerville canal) from DeSabla forebay.

The Upper Centerville canal originates at the DeSabla forebay and historically was used as an alternate route to direct water to Centerville powerhouse when DeSabla powerhouse was out of service (figure 3-1). The canal ends at Helltown Ravine, where water can be released and then recaptured by a diversion dam located where Helltown Ravine crosses Lower Centerville canal. Upper Centerville canal has not been used to carry water for power generation for many years and currently carries only a few cfs for local water users. Flows for Lower Centerville canal as measured at PG&E's gage no. BW18 are shown in table 3-2.

Centerville powerhouse - The intake for the Centerville powerhouse is located at the terminus of Lower Centerville canal (figure 3-1). The Centerville powerhouse contains one Francis and one Pelton turbine. The two units have a combined maximum hydraulic capacity of 183 cfs. The Centerville powerhouse discharges water directly into Butte Creek, approximately 5.3 miles downstream of Lower Centerville diversion dam.

PG&E estimated the flows for the Centerville powerhouse intake using the flow records from the USGS gage that measures the outflow from the powerhouse (USGS gage no. 11389775; PG&E gage no. BW80). Table 3-10 shows the monthly minimum, mean, and maximum flows by month for the period of record for Centerville powerhouse outflow.

Table 3-10. Mean monthly flows for Centerville powerhouse outflow (USGS gage no. 11389775; PG&E gage no. BW80). (Source: PG&E, 2004)

Month	**Minimum (in cfs)[1]**	**Maximum (in cfs)**	**Mean (in cfs)**
January	0	191	118
February	0	190	134
March	0	190	150
April	43	186	160
May	101	190	159
June	71	186	140
July	64	182	114
August	17	177	92
September	0	142	67
October	3	102	50
November	22	174	73
December	39	190	112

1 Data are from October 1, 1980 through September 30, 2002. No adjustments to these estimates were made for evaporation or leakage (from Lower Centerville canal).

Lower Butte Creek-Near Chico, CA

The gage (USGS gage no. 11390000) near the downstream end of the Project-affected reach in Butte Creek has the most complete set of hydrological records. Table 3-11 shows the monthly minimum, mean, and maximum stream flows by month for the period of record (1930 through 2002) at this gage.

Table 3-11. Mean monthly flows for Butte Creek near Chico, CA as measured at USGS gage no. 11390010. (Source: PG&E, 2004)

Month	Minimum (in cfs)[1]	Maximum (in cfs)	Mean (in cfs)
January	91	2847	687
February	114	2925	815
March	123	2601	765
April	114	1848	673
May	134	1314	498
June	79	773	285
July	54	356	165
August	46	223	133
September	52	183	119
October	66	775	138
November	78	1269	225
December	89	2061	454

1 Data are from October 1, 1930 through September 30, 2002.

Feeder Creeks

There are twelve feeder creeks that have small diversion structures which are currently used or have been used in the past to divert flow into Project canals (figure 1-2). Except for Long Ravine (previously discussed), there are no instream flow gages on these feeder creeks. The feeder creeks include:

- Creeks diverted into Butte canal: Inskip Creek, Kelsey Creek, and Clear Creek. (Use of the diversion at Stevens Creek has been discontinued.)
- Creeks diverted into Hendricks/Toadtown canal: Long Ravine, Cunningham Ravine, Little West Fork and Little Butte Creek (Little Butte Creek diversion can only be used when the downstream Paradise and Magalia Reservoirs are spilling).
- Creeks diverted into Lower Centerville canal: Helltown Ravine. (Use of the Oro Fina Ravine, Coal Claim Ravine, and Emma Ravine diversions has been discontinued.)

MIFs released downstream of these feeder creek diversions range from 0.25 to 0.5 cfs during normal water year types and 0.1 to 0.25 cfs during dry water year types, as shown in table 3-3.

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Water Use

PG&E holds water rights to store, divert, and use water from Butte Creek, the West Branch Feather River, and their tributaries, for the production of power as well as fishery, recreation, and irrigation activities. Record searches of the California State Water Resources Control Board (the Water Board) by PG&E indicate a total of 138 water rights applications were on file (appendix A). PG&E's rights to divert and use water for operation of the Project are primarily non-consumptive in nature.

Small-scale suction dredging for gold occurs in Butte Creek pursuant to permits issued by Cal Fish & Game. Like fishing permits, these dredging permits are general in nature and do not restrict activity to a specific site. The total number of active permits varies yearly and is not readily available.

Although PG&E has no public utility obligation to deliver water for consumptive uses, Project features are at times used for the delivery of water to others for such uses. PG&E provides minor amounts of Project water for irrigation uses along the Upper Centerville, Hendricks, and Lower Centerville canals. There are no steam electric or industrial uses of Project waters within the Project area. Little Butte Creek flows into Paradise Lake, a municipal water supply (figure 3-1). In addition, Del Oro Water Company uses Hendricks canal water to meet municipal water supply demands in Stirling City by diverting up to 100 acre-feet per year from this canal. This quantity of water was retained by Del Oro from an original 365 acre-feet that once belonged to Diamond Match. Diamond Match used its water for its mill in Stirling City and also provided domestic water service in the area. The remaining 265 acre-feet was purchased by PG&E with the condition that Del Oro retains the ability to purchase this amount upon request, each year, pending availability. This water, when delivered, is delivered at an existing slide gate on the Toadtown canal at a point approximately 1,440 feet downstream of Toadtown powerhouse, which releases into Little Butte Creek.

Minor consumptive uses have historically occurred along the Upper Centerville canal and a flow of approximately 3 cfs is maintained in this canal for such uses (table 3-2). Additional water deliveries are made at the Toadtown header box to Eldon Duinsing and on the Lower Centerville canal near Helltown to Alan Harthorn.

In addition to the deliveries previously discussed, which are made from Project facilities, PG&E makes deliveries of water to the California Water Service Company (CWSC) and PG&E customers downstream of the Hendricks diversion dam. These deliveries are made at the end of PG&E's small Miocene system which discharges into CWSC's Powers canal. CWSC uses these deliveries to serve irrigation customers and a portion of the needs of the City of Oroville. The current MIF release at Hendricks diversion dam plus accretion flows to the West Branch Feather River typically provide an adequate supply of water to meet CWSC's needs.

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Water Quality

Water quality standards applicable to surface waters in the Project area are defined in three primary documents and are summarized in table 3-12: the California Regional Water Quality Control Board's Water Quality Control Plan (Basin Plan) for the Central Valley Region (CVRWQCB, 2006), the California Toxics Rule (40 CFR Part 131) (CTR; USEPA, 2000), and drinking water standards set in California Code of Regulations Title 22 (CDHS, 2006).

The water resources of Butte Creek basin are divided into two sub-basins by the CVRWQCB in its Basin Plan. The two sub-basins are defined as upper Butte Creek from its source to Chico, CA, and lower Butte Creek from Chico, CA, to the Sacramento River. Designated uses for Upper Butte Creek include municipal and domestic supply, irrigation and stock watering, contact recreation, power production, warm and cold freshwater habitat, cold water migration, warm and cold water spawning, and wildlife habitat. Designated uses for lower Butte Creek include irrigation and stock watering, contact recreation and canoeing-rafting, warm and cold freshwater habitat, cold water migration, warm water spawning, and wildlife habitat.

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Table 3-12. Summary of applicable water quality objectives to support beneficial uses in the study area. (Source: CVRWQCB, 2006; USEPA, 2000; and CDHS, 2006)

Parameter	Objective/Standard	Reference
Temperature	The natural receiving water temperature of interstate waters shall not be altered unless it can be demonstrated to the satisfaction of the Regional Water Quality Control Board that such alteration in water temperature does not adversely affect beneficial uses. Increases in water temperatures must be less than 2.8°C above natural receiving-water temperature.	CVRWQCB, 2006
Dissolved oxygen	Monthly median of the average daily dissolved oxygen concentration shall not fall below 85 percent of saturation in the main water mass, and the 95 percent concentration shall not fall below 75 percent of saturation. Minimum level of 7 mg/L. When natural conditions lower dissolved oxygen below this level, the concentrations shall be maintained at or above 95 percent of saturation.	CVRWQCB, 2006
pH	The pH of surface waters will remain between 6.5 to 8.5, and cause changes of less than 0.5 in receiving water bodies.	CVRWQCB, 2006
Fecal coliform bacteria	In terms of fecal coliform. Less than a geometric average of 200 per 100 mL water on five samples collected in any 30-day period and less than 400 per 100 mL on ten percent of all samples taken in a 30-day period.	CVRWQCB, 2006
Turbidity	In terms of changes in turbidity (NTU) in the receiving water body: where natural turbidity is 0 to 5 NTUs, increases shall not exceed 1 NTU; where 5 to 50 NTUs, increases shall not exceed 20 percent; where 50 to 100 NTUs, increases shall not exceed 10 NTUs; and where natural turbidity is greater than 100 NTUs, increase shall not exceed 10 percent.	CVRWQCB, 2006
Tastes and odor	Water shall not contain taste- or odor-producing substances in concentrations that impart undesirable tastes and odors to domestic or municipal water supplies or to fish flesh or other edible products of aquatic origin, or that cause nuisance, or otherwise adversely affect beneficial uses.	CVRWQCB, 2006
Sodium	30-60 mg/L	USEPA, 2004

Parameter	Objective/Standard	Reference
Chemical constituents	Waters shall not contain chemical constituents in concentrations that adversely affect beneficial uses. Although certain trace element levels have been applied to particular water bodies, no portion of the Project affected area is cited within the Basin Plan (CVRWQB, 2006). Other limits for organic, inorganic and trace metals are provided for surface waters that are designated for domestic or municipal water supply. In addition, waters designated for municipal or domestic use must comply with portions of Title 22 of the California Code of Regulation.	CVRWQCB, 2006
Mercury	50 ng/L	USEPA, 2000a
	Primary MCL of 0.002 mg/L	CDHS, 2006
Methyl Mercury	70 ng/L	USEPA, 2001

[1] The Basin Plan's toxicity water quality objective is to maintain waters free of toxic substance concentrations that produce detrimental physiological responses in human, plant, animal, and aquatic life. Therefore, we use criteria set in the California Toxics Rule (40 CFR Part 131) to assess the support of these beneficial uses. These criteria are for dissolved metals, rather than total metals, are based on sample hardness and dissolved concentrations of copper, nickel, and silver.

mg/L milligrams per liter
µg/L micrograms per liter
mL milliliter
NTU nephelometric turbidity units
MCL maximum contaminant level

General Water Quality

Water quality in the Project area generally reflects the geology, physiography, and climatology of the area. Variations in water quality occur seasonally and inter-annually depending upon hydrological conditions, including responses to high-flow events (i.e., precipitation, snow melt), runoff from roadways, diversions, and inter-basin transfers.

As part of this relicensing, PG&E monitored water quality at 15 locations throughout the Project area (tables 3-13 and 3-14), including: Philbrook and Round Valley reservoirs, DeSabla forebay, five locations along the West Branch Feather River, and seven locations along Butte Creek. Water samples were collected during the 2006 spring runoff period (May), the 2006 and 2007 summer low-flow period (August), and in fall 2006 following overturn of summer thermal stratification (October, prior to first major rain event).[22] More specific details about sampling sites, frequency, and parameters measured are contained in the license application (PG&E, 2007a).

[22] Round Valley Reservoir was dry by the time of the fall 2006 sampling (October 10, 2006) and summer 2007 sampling (August 7, 2007) occurred.

Table 3-13. Range of general water quality parameters measured in the West Branch Feather River by PG&E in the spring, summer, and fall 2006, and fall 2007. (Source: PG&E, 2007b)

Parameter (units)	Spring 2006	Summer 2006	Fall 2006	Summer 2007
DO (mg/L)	9.2-11.5	8.7-10.3	9.4-10.6	7.45-9.37
DO (%)	94-105	98-109	94-105	88-104
Specific Conductivity (µS/cm at 25°C)	32-70	61-90	86-108	61-104
pH	7.1-7.4	7.1-7.8	7.1-8.1	7.4-8.1
Turbidity (NTU)	0.5-2.1	<0.5-1.0	0.2-0.4	0.3-1.4
Water Temperature	6.0-19.7	10.2-18.5	5.4-14.1	6.1-19.8
Total Suspended Solids (mg/L)	ND-4.0 ^{J}	ND	ND	-
Total Dissolved Solids (mg/L)	ND^{BA}-71	ND^{BA}-110	36^{BA}-130	44-78
Hardness as $CaCO_3$ (mg/L)	13-100	19-41	35-45	34-45
Total Alkalinity (mg/L)	19-37	28-58	37 ^{JD} -61^{JD}	40-58
Calcium (mg/L)	3.1-28.0	4.1-10.0	9.7-11.0	11.0-12.0
Magnesium (mg/L)	1.2-8.6	1.8-3.8	2.3-4.3	3.0-5.0
Potassium (mg/L)	ND-6.1	ND	ND	0.5^{J}-2.0 ^{J}
Sodium (mg/L)	0.4-81.0	1.0-3.5	1.2-3.8	1.0-4.0
Chloride (mg/L)	1.4 ^{J}	ND	ND-1.2	0.2^{JD}-2.4 ^{JD}
Sulfate (mg/L)	ND	ND	ND-2.1	0.21 ^{J} -2.4
Nitrate + Nitrite (mg/L)	ND-1.9 ^{J}	ND	ND	ND-0.1^{BA}
Ammonia Nitrogen (mg/L)	ND	ND	ND	ND
Total Kjeldahl Nitrogen (mg/L)	ND ^{JD} -1.1 ^{JD}	ND $^{JD, BA}$-2.2 $^{JD, BA}$	ND ^{BA}-0.9 ^{BA}	ND-0.2
Total Phosphorus (mg/L)	0.015 ^{JD}	ND-0.066	ND	ND-0.03 ^{J}
Orthophosphate (mg/L)	ND-0.011	ND-0.02	ND-0.095	ND-0.02 ^{J}
Chlorophyll-a (mg/L)	0.0013	ND	ND	ND
Total Copper (µg/L)	0.21 ^{J} -3.6	ND-0.6	0.2 ^{J}-0.7	NR
Dissolved Copper (µg/L)	0.34 ^{J} -1.4 ^{J}	0.3 ^{J} -0.8	0.2 ^{J} -0.6	0.4 ^{J} -1.3
Total Nickel (µg/L)	ND-1.1 ^{J}	ND-0.9 ^{J}	0.2 ^{J} -0.9 ^{J}	ND-0.8 ^{J}
Dissolved Nickel (µg/L)	ND-1.1 ^{J}	0.2 ^{J} -0.8 ^{J}	0.2 ^{J} -0.6 ^{J}	ND-1.1 ^{J}
Total Silver (µg/L)	ND	ND	ND	ND-0.6
Dissolved Silver (µg/L)	ND	ND-0.1 ^{J}	ND	ND
Total Iron (µg/L)	ND-170.0 ^{J}	ND-54	ND-129	ND-107
Total Manganese (µg/L)	0.97 ^{J} -21.2	0.9-7.4	0.7-28	0.7-64.3

-	No data collected
ND	Result below laboratory MDL (method detection limit)
NR	Data that were excluded during the quality control review are indicated as "NR" (not reported).
X^{J}	Result below method reporting limits "MRL", but above laboratory MDL and reported here as a J-flag.
X^{BA}	Result adjusted based on equipment or filed blank result
X^{JD}	Duplicate results > MRL, but differed by 10 %, suggesting uncertainty

Table 3-14. Range of general water quality parameters measured in Butte Creek by PG&E in the spring, summer, and fall 2006, and fall 2007. (Source: PG&E, 2007b)

Parameter (units)	Spring 2006	Summer 2006	Fall 2006	Summer 2007
DO (mg/L)	9.9 -11.5	8.8-9.6	10.4-11.1	8.7-10.6
DO (%)	99-109	99-106	99-102	94-115
Specific Conductivity (µS/cm at 25°C)	35-59	88-116	102-133	68-101
pH	6.7-7.5	7.4-8.2	7.1-7.5	7.78-8.6
Turbidity (NTU)	1.2-42.6	0.4-1.3	0.3-1.2	0.9-2.2
Water Temperature	5.8-13.5	13.5-19.5	8.5-11.5	12.8-20.9
Total Suspended Solids (mg/L)	ND-5.0	ND-2.0$^{BA, J}$	ND	-
Total Dissolved Solids (mg/L)	8^{BA}-31^{BA}	7^{BA}-102 ^{BA}	69^{BA}-93	66-98
Hardness as $CaCO_3$ (mg/L)	17-25	37-47	41-50	40-55
Total Alkalinity (mg/L)	24-43	50-75	57 ^{JD} -81^{JD}	50-67
Calcium (mg/L)	4.4-5.8	9.2-11	10-12	12-14
Magnesium (mg/L)	1.6-2.5	3.4-4.7	3.6-5	4-6
Potassium (mg/L)	ND	ND	ND	1.0
Sodium (mg/L)	1.3-2.3	2.7-3.9	2.9-4	3-5
Chloride (mg/L)	NR	ND-4.4	ND-1.1	0.3-2.2
Sulfate (mg/L)	ND	ND	0.6-2.9	0.5 -2.2
Nitrate + Nitrite (mg/L)	ND-0.7^{J}	ND	ND	ND-0.1^{BA}
Ammonia Nitrogen (mg/L)	ND	ND	ND	ND-0.03 ^{J}
Total Kjeldahl Nitrogen (mg/L)	ND ^{JD} -1.1 ^{JD}	ND $^{JD, BA}$-3.3 $^{JD, BA}$	ND ^{BA}-0.9 ^{BA}	ND-0.1
Total Phosphorus (mg/L)	NR	ND-0.063	ND	ND
Orthophosphate (mg/L)	ND-0.01	ND-0.1	ND	ND-0.01 ^{J}
Chlorophyll-a (mg/L)	NR	ND	ND	ND
Total Copper (µg/L)	0.3 ^{J} -1.8	ND-0.2	0.2 ^{J}-0.3 ^{J}	NR
Dissolved Copper (µg/L)	0.31 ^{J} -1.3 ^{J}	0.3 ^{J} -0.6	0.3 ^{J} -0.6	0.3 ^{J} -1.7
Total Nickel (µg/L)	0.37 ^{J} -1.4 ^{J}	0.2 ^{J} -0.5 ^{J}	0.3 ^{J} -0.6 ^{J}	ND-0.7 ^{J}
Dissolved Nickel (µg/L)	0.29 ^{J} -2.6	0.3 ^{J} -0.6 ^{J}	0.2 ^{J} -0.5 ^{J}	ND-0.7 ^{J}
Total Silver (µg/L)	ND-0.2 ^{J}	ND	ND	ND-0.7 ^{JD}
Dissolved Silver (µg/L)	ND	ND	ND	ND-0.2 ^{J}
Total Iron (µg/L)	ND-120.0 ^{J}	30-111	ND-46	ND-105
Total Manganese (µg/L)	1.4 ^{J} -9.7	0.8-8	0.8-3	1.2-7.6

- No data collected
- ND Result below laboratory MDL (method detection limit)
- NR Data that were excluded during the quality control review are indicated as "NR" (not reported).
- X^{J} Result below minimum reporting limit (MRL), but above laboratory MDL and reported here as a J-flag.
- X^{BA} Result adjusted based on equipment or filed blank result
- X^{JD} Duplicate results > MRL, but differed by 10 %, suggesting uncertainty

The reservoir surveys included *in situ* profiles of basic water quality parameters, as well as grab samples for water chemistry, nutrients, and biological parameters, as described below. In order to represent reservoir water quality and water column structure, *in situ* measurements were taken throughout the water column. Grab samples for laboratory analysis were taken in both the epilimnion (near surface) and hypolimnion (0.5 m from bottom) of the reservoir.

In order to assess impacts of recreational use on reservoir water quality, PG&E also collected samples once each during the Independence Day (July 3, 2006) and Labor Day (September 5, 2006) holiday weekends, and once on August 7, 2007. In 2006, surface grab samples were taken near the dam in Philbrook Reservoir for hydrocarbons, and near sites with greater potential for localized fecal coliform contamination in Philbrook Reservoir and DeSabla forebay. In 2007, Philbrook Reservoir and DeSabla forebay were sampled for fecal coliform only. The sample sites were selected because of known recreational use, including sites near swimming, camping, and picnic areas with restroom facilities near the shore.

Water Temperature

Round Valley Reservoir – Round Valley Reservoir is shallow, approximately 23 feet deep in spring when full, and was dry during fall 2006 and summer 2007 sampling. Water temperatures in Round Valley Reservoir ranged from 10.3°C at 13 to 16.4 feet deep (spring 2006) to 21.3°C throughout (summer 2006). Water temperatures declined by approximately 1°C from the surface of the reservoir to the bottom in spring and remained uniform in temperature from surface to bottom during the summer.

Upper West Branch Feather River - Data collected by PG&E in 2004 through 2006 indicate that water temperatures in the upper West Branch Feather River are driven by the Coon Hollow Creek/Spring complex and to a limited extent releases from Round Valley Reservoir. Managed releases from Round Valley Reservoir are typically initiated in late June or early July and extend for one month into July or early August. Figure 3-9 compares daily average water temperatures from several stations in the upper West Branch Feather River upstream of the Philbrook Creek confluence for the 2006 monitoring period. Water temperature sampling locations are indicated in table 3-15. Mean daily water temperatures in the West Branch Feather River immediately downstream of Round Valley Reservoir during the July through August period ranged from 17.5 to 24.1°C during the 2004 through 2006 monitoring efforts. However, water temperature in the West Branch Feather River downstream of the confluence with Coon Hollow/Spring Complex ranged from 6.2 to 13.5°C during the same period in 2004 through 2006. Releases from Round Valley can cause a slight increase

(up to about 2°C) in West Branch Feather River water temperatures while being utilized to supplement West Branch Feather River flows during the early summer period. This influence is dependent upon the timing and magnitude of releases from Round Valley Reservoir.

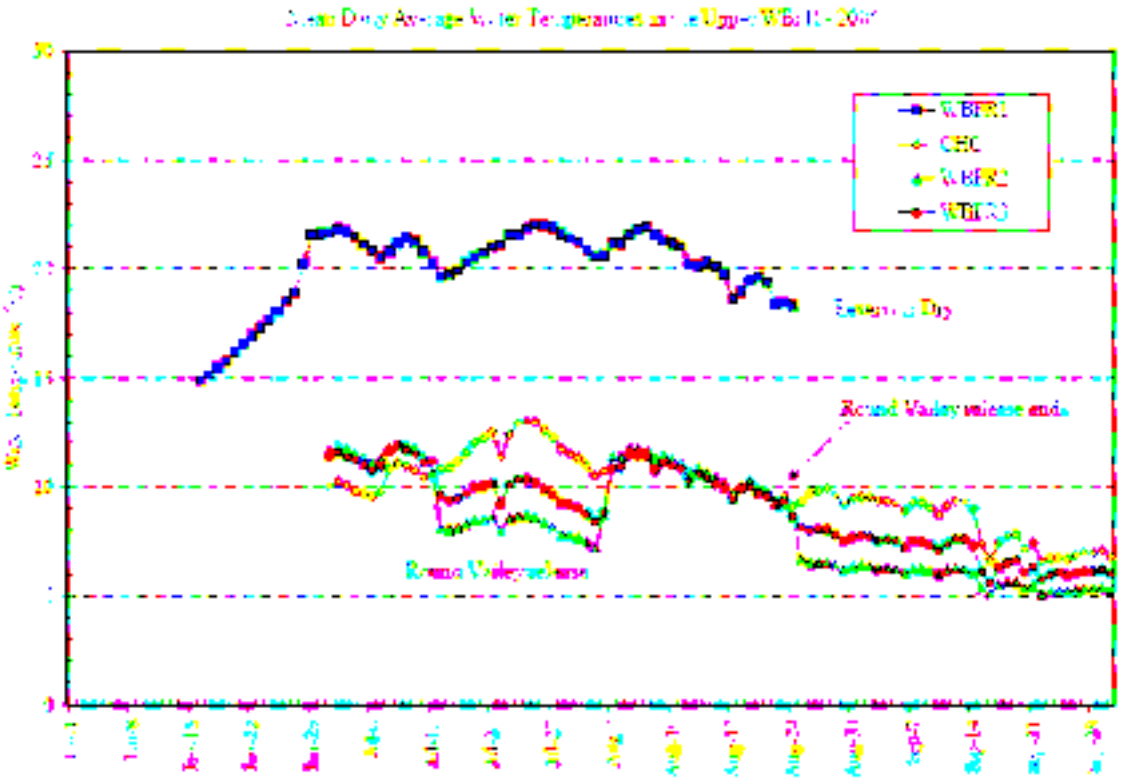

Figure 3-9. Comparison of daily average water temperatures from four stations in the upper West Branch Feather River during the June through September 2006 monitoring period. (Source: PG&E, 2008b)

Table 3-15. Water temperature monitoring-model locations. (Source: PG&E, 2008b)

Station Work Group	Station ID	Description
Upper West Branch	RVR	Round Valley Reservoir
Feather River	WBFR1	WBFR below Round Valley Reservoir
	CHC	Coon Hollow Creek
	WBFR2	WBFR below confluence with Coon Hollow Creek
	WBFR3	WBFR above confluence with Philbrook Creek
	WBFR4	WBFR below confluence with Philbrook Creek
	LCCrk	Last Chance Creek near mouth
	WBFR5	WBFR at Hendricks Diversion Dam
Philbrook Creek	PC1	Philbrook Creek above Philbrook Reservoir
	PCR	Philbrook Reservoir
	PC2	Philbrook Creek below dam
	PC3	Philbrook Creek at mouth
Hendricks-Toadtown	HTC1	Hendricks Canal at Long Ravine Diversion
Canal	HTC2	Toadtown Canal at Toadtown Powerhouse (TTPH)
	HTC3	Toadtown Canal at BW-12
	BTC2	Butte Canal above TTC (BW15)
	BTC3	Butte Canal inflow to Forebay
DeSabla Forebay	DSFBY	DeSabla Forebay
	DSPH	DeSabla Powerhouse
Upper Butte Creek	BTC1/BC1	Butte Creek at Butte Diversion Dam
	BC2	Butte Creek above West Branch Butte Creek
	WBBC	West Branch Butte Creek
	BC3	Butte Creek below West Branch Butte Creek
	BC5	Butte Creek above DeSabla Powerhouse
	BC6/LCC1	Butte Creek at Lower Centerville Diversion Dam
Lower Butte Creek	BC7-A	Butte Creek at PG&E Pool 4
	BC7-B	Butte Creek near Helltown Bridge
	BC7-C	Butte Creek near Hawthorn property
	BC8	Butte Creek above Centerville Powerhouse
	LCC2	Centerville Powerhouse at Header box
	BC9	Butte Creek below Centerville Powerhouse
	BC10	Butte Creek above Little Butte Creek confluence
Lower WBFR	WBFR8	WBFR above Big Kimshew Creek
	BkCk1	Big Kimshew Creek on USFS property
	WBFR9	WBFR below Big Kimshew Creek
	WBFR10	WBFR above Fall Creek (RM 21.5)
	WBFR12	WBFR above Little West Fork
	LWF3	Little West Fork near mouth
	WBFR13	WBFR below Little West Fork
	WBFR14	WBFR above Upper Miocene Div. (near RM15)
Butte Canal Feeder	InpCrk1	Inskip Creek at diversion into Butte Canal
Diversions	KlyCrk1	Kelsey at diversion into Butte Canal
	ClrCrk1	Clear Creek at diversion into Butte Canal
Hendricks/Toadtown	LngRav1	Long Ravine above of Hendricks tunnel
Canal Feeder	LngRav3	Long Ravine above Little West Fork
Diversions	CunRav1	Cummingham Ravine above Hendricks Canal
	CunRav2	Cummingham Ravine above Little West Fork
	LWF1	Little West Fork above Hendricks Canal
	LWF2	Little West Fork above Cunningham Ravine

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Philbrook Reservoir –Water temperatures measured in Philbrook Reservoir ranged from 4.0 (16 m depth, spring 2006) to 21.4°C (0.5 to 2 m depth, summer 2006). Observed water temperature profiles indicate that Philbrook Reservoir was stratified in spring and summer 2006, and in summer 2007, with thermocline deepening by approximately 1 to 2 m between the 2006 sampling events. By the time of the fall 2006 sampling event, the mixed layer extended to the bottom of the reservoir. Thermocline in summer 2007 was steeper and deeper (a 9.8°C decline between 12 and 14 m depth in summer 2007, as opposed to a 8.7°C decline between 7 and 14 m depth in summer 2006). Philbrook Reservoir exhibits stronger thermal stratification than Round Valley Reservoir due largely to the greater depth and hydraulic retention time. Thermal stratification in Philbrook Reservoir is modified by the timing of management releases through the low-level outlet. Maximum stratification occurs in early summer and begins to decline as soon as management releases begin as shown in figure 3-10. Differences in drawdown rate or timing between 2006 and 2007 may account for the observed differences in the 2006 and 2007 summertime temperature profiles for Philbrook Reservoir.

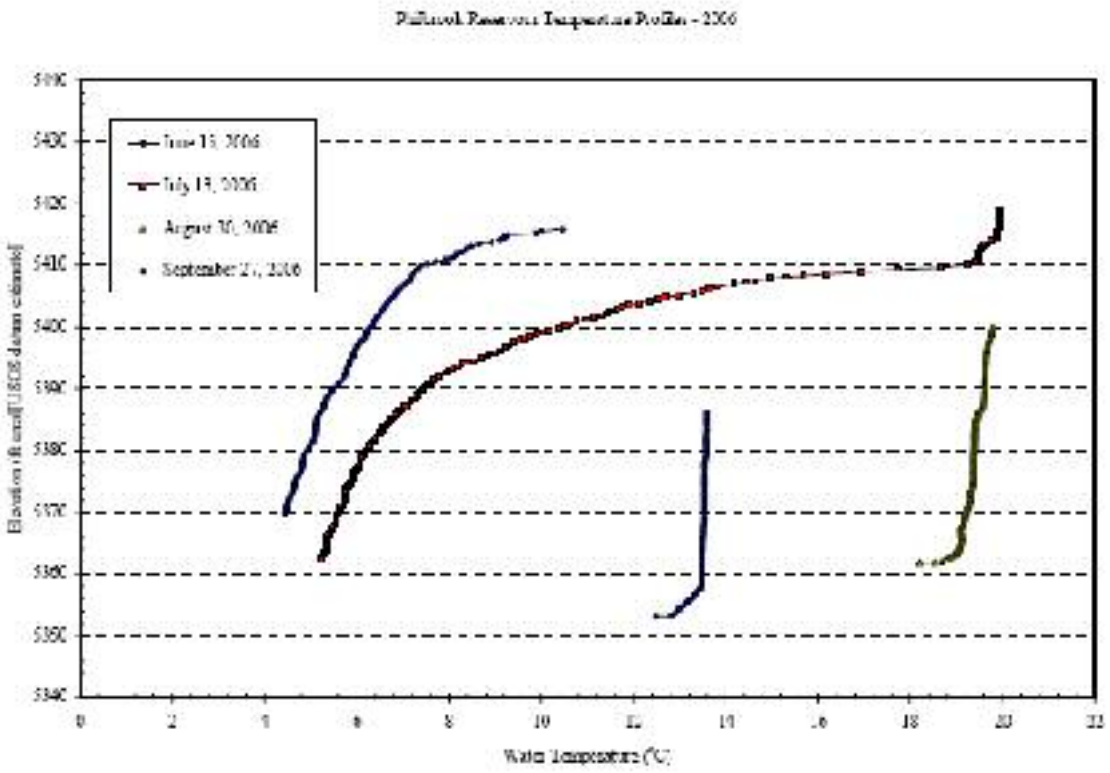

Figure 3-10. Comparison of monthly water temperature profiles from Philbrook Reservoir during the 2006 monitoring period. (Source: PG&E, 2008b)

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Philbrook Creek - Water temperatures in Philbrook Creek are driven by conditions in Philbrook Reservoir. During non-spill periods, all flows in lower Philbrook Creek are derived from releases originating from the low-level reservoir release at the main dam. As a result, water temperatures immediately downstream of the dam have a small diel fluctuation and correspond to temperatures in the hypolimnion of the Philbrook Reservoir. As management releases are initiated and the small supply of cool water in the reservoir is depleted, release water temperatures begin to increase. The peak release water temperature typically occurs in late August or September and can exceed 20°C. Water temperatures near the confluence of Philbrook Creek with the West Branch Feather River vary temporally compared with conditions downstream of Philbrook Reservoir dam. Factors affecting this variability include, spill from Philbrook Reservoir (warmer water), magnitude of management release, duration and timing of releases, as well as accretion occurring between the reservoir and the downstream monitoring station. Typically, conditions in Philbrook Creek near its mouth are warmer than those in the West Branch Feather River upstream of the confluence.

Figure 3-11 compares the daily average water temperatures from several stations in Philbrook Creek for the 2006 monitoring period and illustrates the cooling effect in Philbrook Creek once releases from Philbrook Reservoir are initiated. Mean daily water temperatures in Philbrook Creek near the confluence with the West Branch Feather River during the July through August period ranged from 8.4 to 18.8°C for the 2004 through 2006 monitoring efforts. For comparison, water temperature data from the West Branch Feather River upstream of Philbrook Creek had mean daily water temperatures during the July through August period that ranged from 7.5 to 13.3°C.

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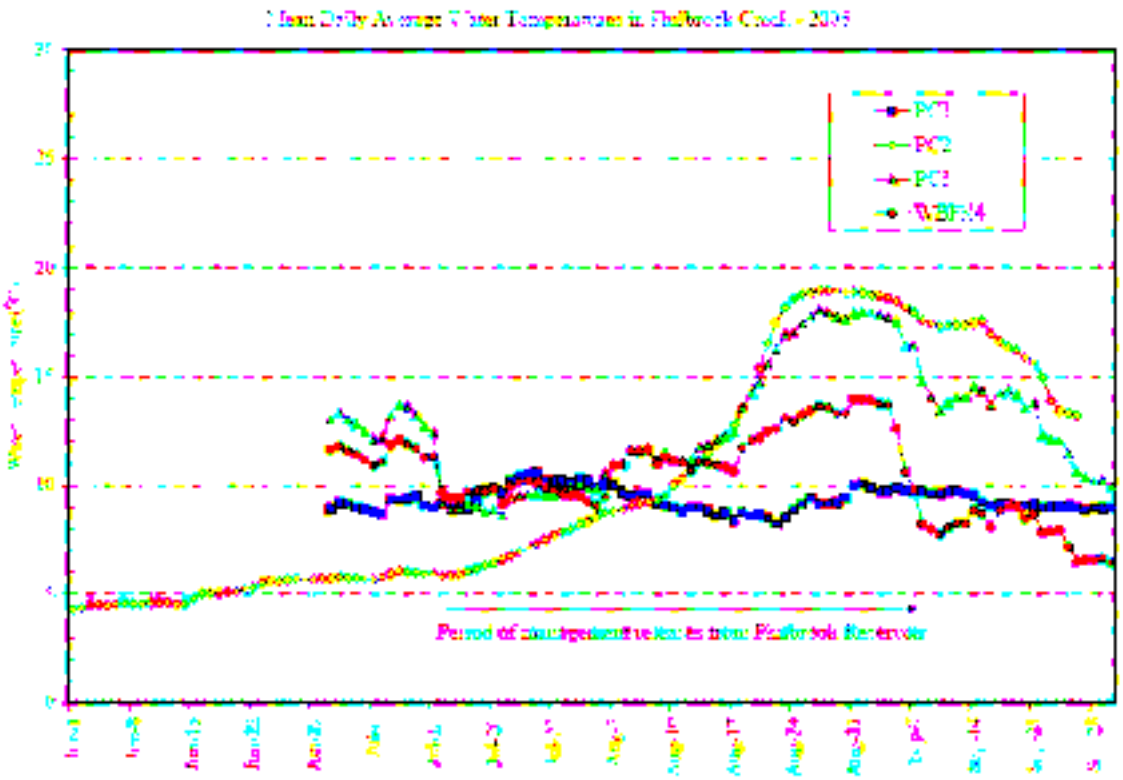

Figure 3-11. Comparison of daily average water temperatures from three temperature monitoring stations in Philbrook Creek and one station in the West Branch Feather River during the June through September 2006 period. (Source: PG&E, 2008b)

Middle West Branch Feather River - As flows in the West Branch Feather River move through the channel between the confluence of Philbrook Creek and Hendricks diversion dam, water temperatures in the July through August period typically increase 2 to 4 °C. The long travel time (approximately 13 hours at 80 cfs; PG&E, 1994) is such that the effect of upstream management manipulations are often masked or minimized in this reach. Two creeks enter this reach, Fish and Last Chance creeks (figure 3-1). Figure 3-12 compares the daily average water temperatures from stations in the West Branch Feather River, Philbrook Creek, and Last Chance Creek, between Philbrook Creek and Hendricks diversion dam for the 2006 monitoring period. Figure 3-12 again demonstrates the cooling effect of flow releases from Philbrook Reservoir. Water temperature data from the West Branch Feather River at Hendricks diversion dam indicate that mean daily water temperatures during the July through August period ranged from 12.4 to 17.0°C during the 2004 through 2006 monitoring efforts.

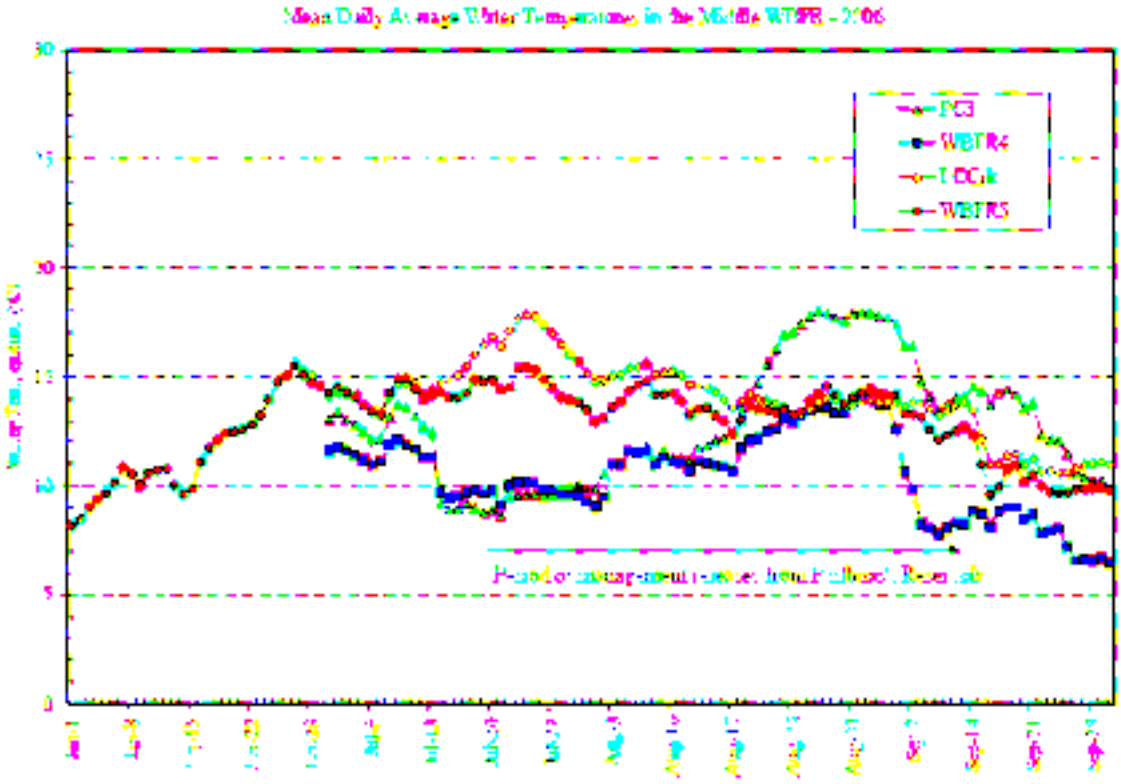

Figure 3-12. Comparison of daily average water temperatures from stations in the middle West Branch Feather River reach during the June through September 2006 monitoring period. (Source: PG&E, 2008b)

In order to quantify conditions in the West Branch Feather River at Hendricks diversion dam, a frequency distribution analysis was performed using PG&E's 2004 through 2006 water temperature database. This information indicates that 77 percent of daily average water temperatures in the July through August period were less than 15°C; with 100 percent of daily average water temperatures during the same period less than or equal to 17°C.

Lower West Branch Feather River - Conditions in the lower West Branch Feather River downstream of Hendricks diversion dam are driven by the inflow from several major tributary streams (figure 3-1). The largest of these, Big Kimshew Creek, enters the West Branch Feather River approximately 7 miles downstream of Hendricks diversion dam. A second large tributary, the Little West Fork, enters the West Branch Feather River in the middle of the reach. Conditions in the West Branch Feather River upstream of PG&E's non-Project Upper Miocene diversion represent the most downstream area in the West Branch Feather River affected by Project operations. Mean daily water temperatures at this location during the July to August 2005 through 2006 period ranged from 17.2 to 22.7°C.

Mean daily water temperatures from the monitoring stations in the lower West Branch Feather River for the 2006 monitoring effort are compared in figure 3-13. This figure highlights the influence of inflow from the various large tributaries and the effect of the long travel time on water temperatures in this reach of the West Branch Feather River. Mean daily water temperatures in the West Branch Feather River upstream of PG&E's non-Project Upper Miocene diversion during the July through August 2007 period ranged from 18.3 to 22.8°C, similar to temperatures observed during the same period in 2005 and 2006.

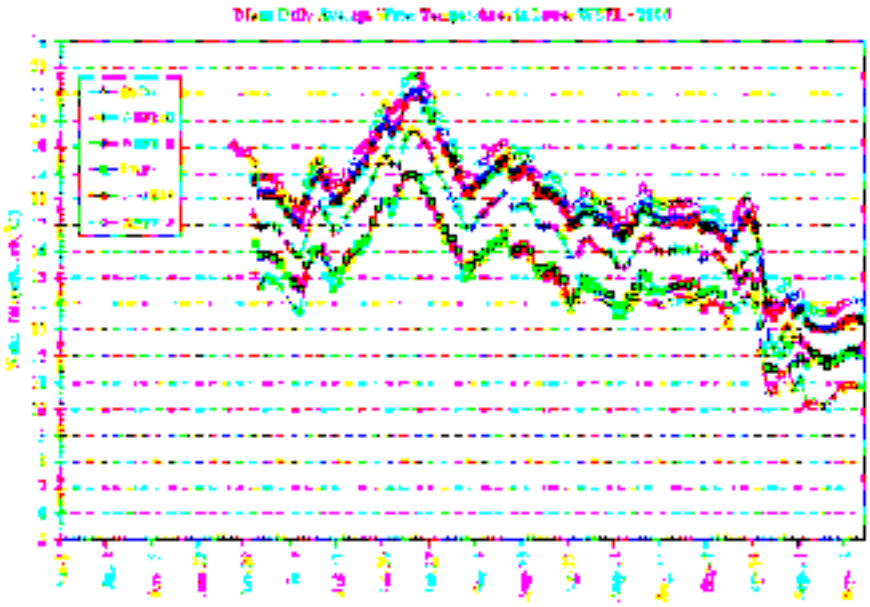

Figure 3-13. Comparison of daily average water temperatures from stations in the lower West Branch Feather River during the June through September 2006 monitoring period. (Source: PG&E, 2008b)

Hendricks-Toadtown Canal - Flows are diverted from the West Branch Feather River into the Hendricks-Toadtown canal where they travel through the system relatively quickly and, as a result, do not exhibit a significant change in water temperature (less than 1°C). Water temperature data from Hendricks/Toadtown canal near its confluence with Butte canal indicate that mean daily water temperatures during the July through August period ranged from 12.7 to 17.6°C during the 2004 through 2006 monitoring efforts.

Flows in the Hendricks canal are supplemented by diversions from three feeder creeks. All of these feeder creeks are tributaries to the Little West Fork Creek. These diversions are small and on average the contribution from each is less than 3 cfs during the summer period. Long Ravine is the first of the feeder

creeks diverted into Hendricks canal. This diversion is active all year long as it is used to re-divert flows back into the canal following release from Hendricks Tunnel. The second feeder diversion is located on Cunningham Ravine and is located approximately 2.6 miles downstream of the Long Ravine diversion and is only active during the non-runoff period. The third feeder diversion is located on Little West Fork Creek and is located approximately 3.5 miles downstream of the Long Ravine diversion and is only active during the non-runoff period. During the 2005 through 2006 monitoring efforts, only locations upstream of the diversion facilities were monitored. During the 2005 through 2006 monitoring period all Hendricks canal feeder diversions were active with leakage and minimum release flows remaining in the tributaries. Figure 3-14 shows the daily average water temperatures from all three active feeder diversions on the Hendricks canal system from 2006 temperature monitoring. The data in these figures indicates that average water temperatures at all three streams are similar.

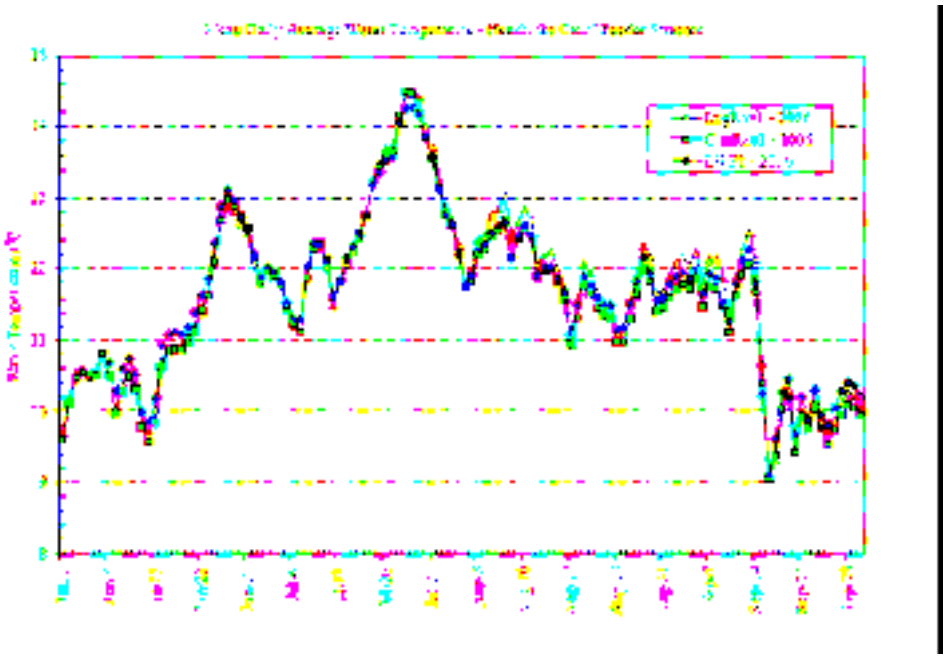

Figure 3-14. Comparison of daily average water temperatures from stations in the three Hendricks Canal feeder creeks during the June through September 2006 monitoring period. (Source: PG&E, 2008b)

Butte Canal - Flows from upper Butte Creek are diverted at the Butte Creek diversion dam. These flows are passed through the Butte canal system quickly and as a result do not exhibit a significant change in water temperature (less than 1°C). Flows from the West Branch Feather River (Hendricks-Toadtown canal) are mixed with Butte canal upstream of DeSabla forebay. Water temperature data from Butte canal upstream of the confluence with Toadtown canal indicate that mean daily water temperatures during the July through August period ranged from 12.9 to 18.0°C during the 2004 through 2006 monitoring efforts.

Flows in the Butte canal are supplemented by diversions from three feeder creeks. All of these feeder creeks are tributaries to Butte Creek downstream of Butte diversion dam (figure 3-1). Inskip Creek is the first of the feeder creeks diverted into Butte canal and is located approximately 0.5 mile downstream of Butte diversion dam. Kelsey Creek is the second of the active feeder creeks diverted into Butte canal and is located approximately 2 miles downstream from Butte diversion dam. Clear Creek is the third and final feeder creek on Butte canal and is located 3.7 miles downstream of Butte diversion dam. During the 2005 through 2006 monitoring period only Inskip and Clear Creek diversions were active with leakage and minimum release flows remaining in these tributaries to Butte Creek. Figure 3-15 compares mean daily water temperatures from the three active feeder creeks on the Butte canal system during the 2006 monitoring efforts and indicates that these streams have similar thermal regimes.

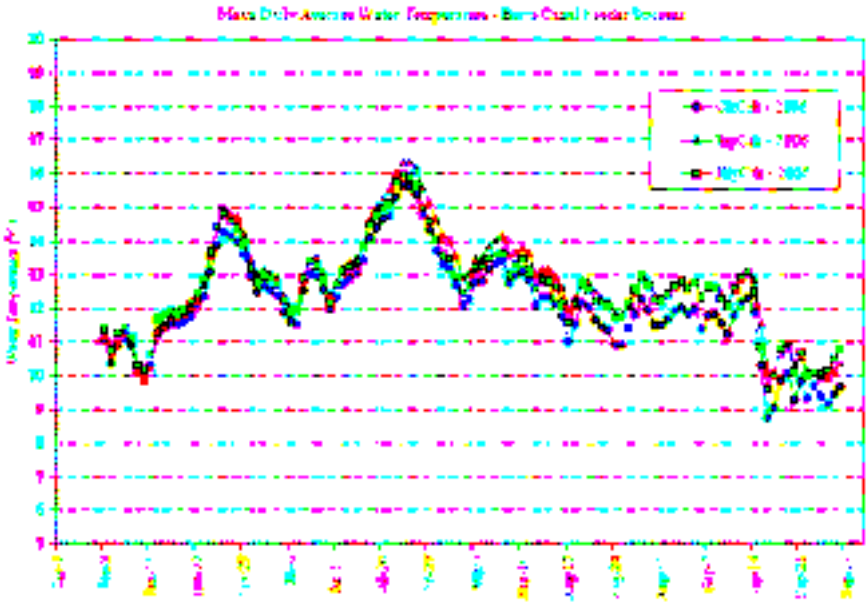

Figure 3-15. Comparison of daily average water temperatures from stations in the three Butte Canal feeder creeks during the June through September 2006 monitoring period. (Source: PG&E, 2008b)

Upper Butte Creek - The total length of the bypass reach between Butte diversion dam and DeSabla powerhouse (DeSabla Reach) is approximately 11 miles. Water temperature was monitored by PG&E from 2004 through 2006 at four locations including: Butte Creek upstream of the confluence with the West Branch Butte Creek (WBBC), the WBBC near its confluence with Butte Creek, Butte Creek downstream of WBBC, and Butte Creek upstream of DeSabla powerhouse.

Mean daily water temperatures in Butte Creek downstream of Butte diversion dam during the July through August period ranged from 11.7 to 17.2°C during the 2004 through 2006 monitoring efforts. Mean daily water temperatures in Butte Creek upstream of the confluence with the West Branch Butte Creek ranged from 15.0 to 20.4°C for the July through August period in 2004 and 2005; 2006 data was not available. Figure 3-16 shows temperature monitoring results from 2006 in the upper Butte Creek reach and illustrates thermal warming that occurs downstream of the Butte Creek diversion dam.

Figure 3-16. Comparison of daily average water temperatures from stations in the upper Butte Creek reach during the June through September 2006 monitoring period. (Source: PG&E, 2008b)

The West Branch Butte Creek is the largest tributary to Butte Creek in the DeSabla Reach. Water temperature data from the WBBC indicate that mean daily water temperatures during the July through August period ranged from 13.7 to 18.4°C for the 2004 through 2006 monitoring efforts.

The most downstream location in the DeSabla Reach monitored for water temperature was at a station just upstream of DeSabla powerhouse. This station was situated downstream of the Forks of Butte powerhouse and therefore captured periods when this facility was in operation. Typically, end of operation at Forks of Butte powerhouse coincides with the end of spill flows in the DeSabla Reach. Data from this location indicate that mean daily water temperatures during the July through August period ranged from 15.8 to 21.5°C for the 2004 through 2006 efforts.

DeSabla Forebay and DeSabla powerhouse - The combined flow from Butte and Toadtown canals discharges directly into DeSabla forebay. DeSabla forebay acts as a regulating facility for the DeSabla powerhouse. Maximum canal flow into DeSabla forebay is approximately 191 cfs. Mean daily water temperatures in Butte canal upstream of DeSabla forebay during the July to August 2004 through 2006 monitoring periods ranged from 12.7 to 17.8°C.

In order to characterize water temperatures entering DeSabla forebay, a frequency distribution analysis was performed using PG&E's 2004 through 2006 water temperature database. The results of the frequency analysis indicate that 82 percent of daily average water temperatures in the July through August period for Butte canal were less than 16°C; with 100 percent of daily average water temperatures during the same period less than or equal to 18°C. Similarly, 73 percent of daily average water temperatures for the DeSabla powerhouse were less than or equal to 17°C; with 100 percent of the daily average water temperatures less than or equal to 19°C. This indicates a shift, of about 1°C, in the July through August water temperature as the water passes through DeSabla forebay.

PG&E collected vertical water temperature profiles from the DeSabla forebay in 2004 through 2006. Figure 3-17 shows the monthly water temperature profiles during the 2006 monitoring efforts.

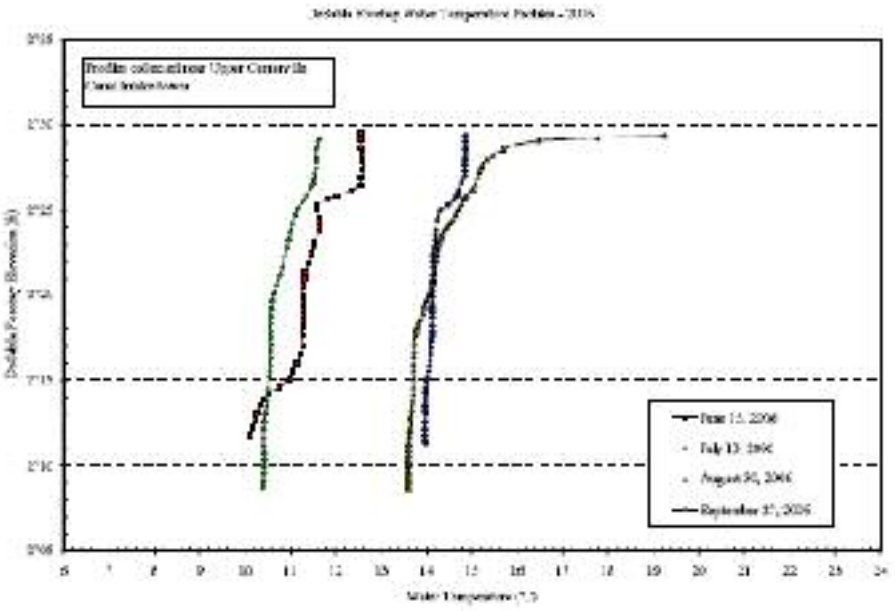

Figure 3-17. Comparison of monthly water temperature profiles from DeSabla forebay during 2006 water temperature monitoring. (Source: PG&E, 2008b)

DeSabla powerhouse is fed by DeSabla forebay through a welded steel penstock (maximum capacity of approximately 200 cfs) and discharges directly

into Butte Creek, 0.2 miles upstream of Lower Centerville diversion dam. During the July to August (2004 through 2006) monitoring periods, mean daily water temperatures at DeSabla powerhouse ranged from 13.9 to 19.0°C.

Water temperature changes associated with DeSabla forebay have long been the subject of discussion as a means for reducing water temperatures downstream of Lower Centerville diversion dam for the benefit of spring-run Chinook salmon. Water temperature increases within DeSabla forebay occur as a result of increased residence time and greater surface area than in the canal sections upstream. Based on data collected by PG&E during the 2004 through 2006 monitoring programs, average water temperatures increased by 1.1°C within the DeSabla forebay during the July through August period. PG&E states this water temperature increase is consistent with previous monitoring efforts.

Lower Butte Creek - Conditions in Butte Creek at the Lower Centerville diversion dam are the result of mixed West Branch Feather River and Butte Creek diversions following passage through DeSabla forebay and flows remaining in Butte Creek downstream of Butte diversion dam. Most of these combined flows are redirected into Lower Centerville canal and transported to Centerville powerhouse. Lower Centerville canal has a short travel and therefore little change in water temperature (less than 1°C) occurs as flows move through this part of the system (low per mile thermal loading). During the July through August monitoring periods in 2004 through 2006, mean daily water temperatures in Lower Centerville canal upstream of Centerville powerhouse ranged from 14.8 to 20.3°C.

A MIF of 40 cfs is released downstream of the Lower Centerville diversion dam to the lower bypass reach of Butte Creek (Centerville Reach). This reach is not supplemented with flows from any major tributaries. As flows move through the natural Butte Creek channel between the Lower Centerville diversion dam and Centerville powerhouse, water temperatures can increase between 2 to 4°C. Water temperature data from the Lower Centerville diversion dam indicate that mean daily water temperatures during the July through August period ranged from 14.4 to 19.6°C for the 2004 through 2006 monitoring efforts. This represents initial conditions in the Centerville Reach of Butte Creek. Mean daily water temperatures at the downstream end of the Centerville Reach (upstream of Centerville powerhouse) ranged from 17.4 to 23.0°C for the 2004 through 2006 monitoring efforts.

Flows from Centerville powerhouse are discharged directly into Butte Creek. Conditions downstream of Centerville powerhouse are the result of mixing canal flows with those from the Centerville Reach bypass section. Under normal operating conditions, water temperatures immediately downstream of Centerville powerhouse are similar to those observed near the half-way point of the

Centerville Reach. During the July to August monitoring periods in 2004 through 2006, mean daily water temperatures in Butte Creek immediately downstream of Centerville powerhouse ranged from 15.8 to 21.2°C. Mean daily water temperatures from the monitoring stations in lower Butte Creek during the 2006 monitoring period are compared in figure 3-18 and highlight the influence of the long travel time (approximately 20 hours for 45 cfs; PG&E, 1994) on water temperatures in the Centerville Reach of Butte Creek.

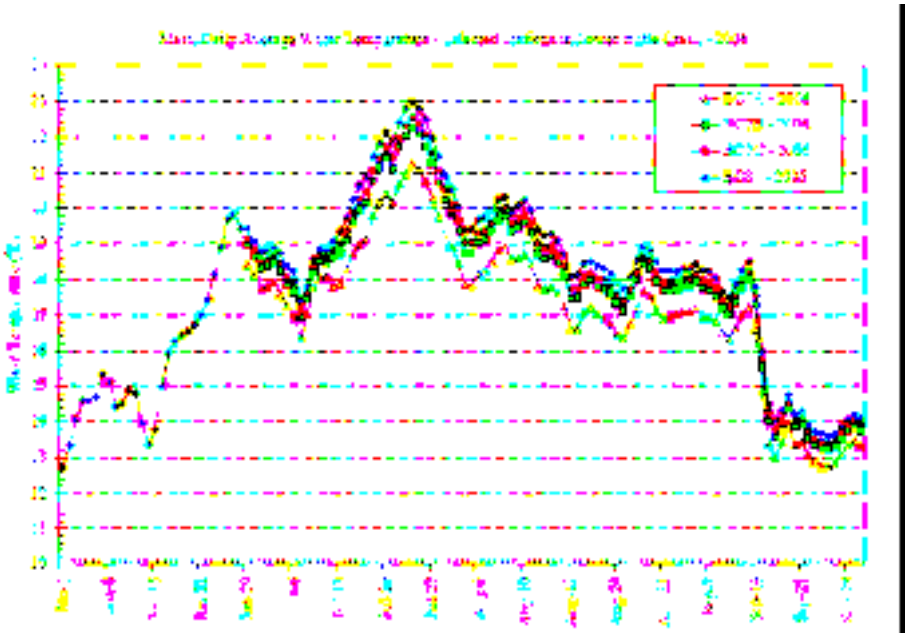

Figure 3-18. Comparison of daily average water temperatures from stations in the lower Butte Creek reach during the June through September 2006 monitoring period. (Source: PG&E, 2008b)

To quantify conditions in Butte Creek in the vicinity of Centerville powerhouse, a frequency distribution analysis was performed using PG&E's 2004 through 2006 water temperature database. This frequency analysis indicates 27 percent of daily average water temperatures downstream of Centerville powerhouse for the July through August period were less than 18°C; with 89 percent of daily average water temperatures during the same period less than or equal to 20°C. Conversely, only 2 percent of daily average water temperatures in the July through August period upstream of Centerville powerhouse were less than 18°C; with 45 percent of daily average water temperatures during the same period less than or equal to 20°C. This shows the cooling influence of Lower Centerville canal water on Butte Creek flows downstream of the powerhouse. In 2004 through 2006, Butte Creek downstream of Centerville powerhouse averaged 1.1°C cooler than the creek upstream of the powerhouse, during the July to August period.

Water Temperature Modeling

PG&E parameterized two sets of models to evaluate water temperature in the streams impacted by the Project. Ten CE-QUAL-W22.v.3.2 (W2) water temperature models were developed for the stream reaches that directly affect lower Butte Creek (i.e. downstream of Lower Centerville diversion dam) and are operationally adjusted to control water temperatures in spring-run Chinook salmon summer holding habitat. These locations include the West Branch Feather River upstream of Hendricks diversion dam, Hendricks/Toadtown canal, DeSabla forebay, and lower Butte Creek from DeSabla powerhouse to Centerville powerhouse (figure 3-19). The W2 model is a two-dimensional, laterally averaged, hydrodynamic and water quality model which has been applied to rivers, lakes, reservoirs, estuaries, and combinations thereof. The W2 temperature model was chosen because it is well suited to handle the combination of reservoirs, stream sections, canals, powerhouses, and diversion reaches characteristic of this Project.[23]

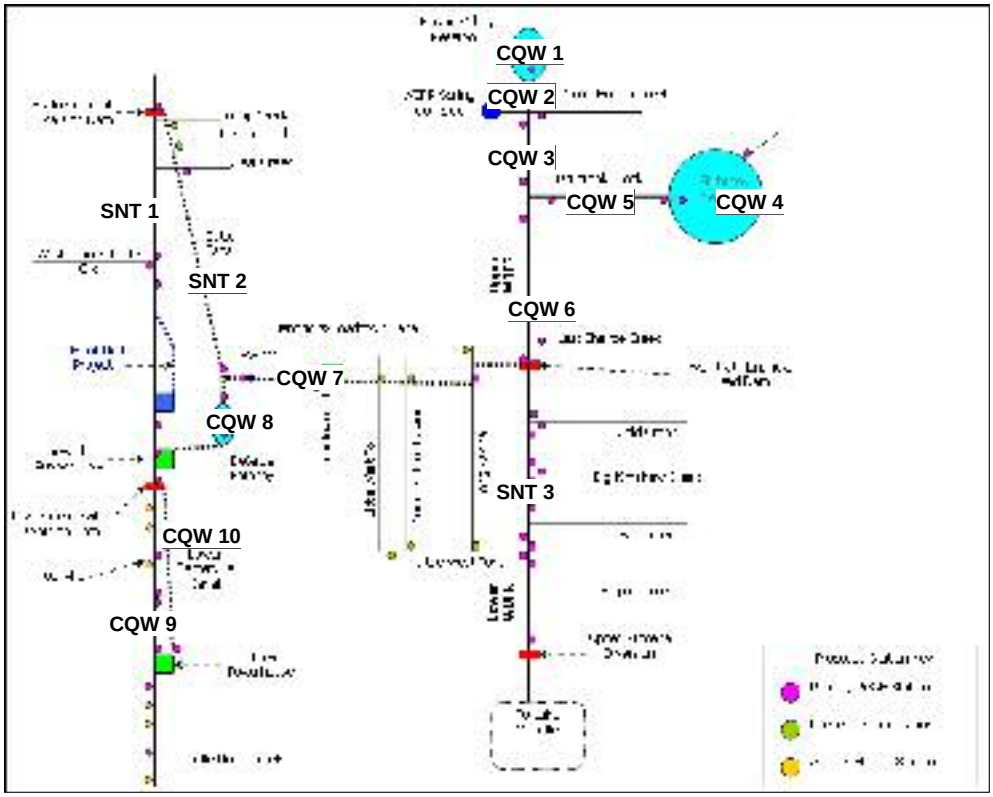

Figure 3-19. DeSabla-Centerville system temperature model configuration for CE-QUAL-W2 (CQW) and SNTEMP (SNT) water quality modeling. (PG&E, 2007a, as modified by Staff).

[23] Additional information about the W2 temperature model can be found in the license application filed on October 2, 2007 (PG&E, 2007a).

For the three less complex stream reaches (i.e. upper Butte Creek, Butte canal, and Lower West Branch Feather River), models were developed using the Stream Temperature Model for Windows (StreamTemp), an adaptation of the Stream Network Temperature (SNTEMP) program by the USGS (figure 3-19). The lower West Branch Feather River and upper Butte Creek reaches are affected by MIF releases at their respective diversion structures and are not subject to operational fluctuations in flow related to management of water temperatures to protect spring-run Chinook salmon. The model uses identical algorithms as the SNTEMP model, but includes improved reports and graphs of program results, and employs a steady-flow, dynamic water temperature algorithm to determine the mean daily water temperature in a study reach.[24]

Our evaluation of the calibration and validation models provided by PG&E suggest that the models were parameterized correctly and are useful for evaluating the various flow alternatives as discussed below.

Dissolved Oxygen

During relicensing studies conducted by PG&E in 2006 and 2007, overall dissolved oxygen (DO) concentrations in Butte Creek ranged from 8.7 to 11.5 mg/L and overall DO concentrations in West Branch Feather River ranged from 7.45 to 11.5 mg/L (table 3-13 and 3-14).

Concentrations of DO in Round Valley Reservoir from sampling in 2006 ranged from 7.0 mg/L (2 m depth, summer) to 9.2 mg/L (3 m depth, spring).

Concentrations of DO in Philbrook Reservoir from sampling in 2006 and 2007 ranged from < 1mg/L (14 to 17 m depth, summer) to 12 mg/L (10 m depth, summer). Profiles of DO indicated metalimnetic maximums near 8 m in depth in spring and summer 2006 and were constant with depth in fall 2006. In summer 2007, DO concentrations were highest in the epilimnion and decreased to <1 mg/L in the hypolimnion. Since nutrient and chlorophyll-a observations were consistently low in Philbrook Reservoir, the development of low oxygen conditions in the hypolimnion suggests that a highly stable thermal stratification may have persisted for several months in 2007, with a slow, steady depletion of DO in bottom waters during that period. DO saturation ranged from 8 (14 m depth, summer 2007) to 148 percent within the summer 2006 metalimnetic DO maximum (9 m depth).

[24] Additional information about the SNTEMP temperature model can be found in the license application filed on October 2, 2007 (PG&E, 2007a).

In DeSabla forebay, concentrations of DO measured in 2006 and 2007 ranged from 7.38 (1 m depth, summer 2007) to 11.5 mg/L (5 m depth, spring 2006). DO saturation ranged from 82 (1, 2, 3, and 5 m depth, summer 2007) to 106 percent (3 m depth, fall 2006). Profiles of DO were relatively constant with depth, but showed a slight increase in DO from surface to near-bottom waters during all sampling events.

Turbidity

Turbidity was low during all routine 2006 and 2007 sampling events, ranging in Butte Creek from 0.3 (fall 2006) to 3.9 NTU (spring 2006) (table 3-14). Across all seasons in 2006, there was a general longitudinal increase in turbidity from upstream to downstream in Butte Creek, while in summer 2007 turbidity was highest in Butte Creek upstream of DeSabla powerhouse and decreased by approximately 1 NTU progressing downstream to the site upstream of Centerville powerhouse.

Turbidity in the West Branch Feather River was low during all 2006 sampling events, ranging from 0.2 to 2.1 NTU (spring) (table 3-13). Turbidity generally decreased from upstream to downstream stations in 2006. Two stations, including one in Hendricks canal and one upstream of the non-Project Miocene diversion were exceptions to this pattern, exhibiting increased turbidity as compared to upstream stations during all sampling events. In 2007, turbidity was less than 1 NTU for all the West Branch Feather River stations and was within the range of turbidity observed in 2006. No longitudinal trend in 2007 turbidity data was observed.

In Round Valley Reservoir, Secchi depth exceeded the reservoir depth during both trips. Turbidity was low throughout, ranging from 0 (2 and 3 m depth, spring) to 1.1 NTU (1 m depth, summer).

In Philbrook Reservoir, Secchi depth for fall 2006 is not reported because high winds and surface waves impeded both visibility and the ability to maintain a vertical cast. Secchi depth for summer 2007 was not recorded. With the exception of reservoir bottom in summer 2007, turbidity was low during all sampling events, ranging from 0 (several depths) to 27.3 NTU (17 m, summer, 2007). During 2006, turbidity increased with depth in spring and remained relatively constant with depth in fall. Turbidity in summer 2006 reached a maximum just above thermocline. In summer 2007, layers of slightly elevated turbidity (1.7–2.4 NTU) over background levels (0.8–1.3 NTU) were observed at 3–5 m and 10–14 m depths. More elevated levels of turbidity (up to 27.3 NTU) were observed in the bottom two meters of the reservoir, but these elevated levels

may have been due to sediment kicked up by the sampler contacting the reservoir bottom.

In DeSabla forebay, turbidity was low during all 2006 sampling events, ranging from 0 (4 and 5 m depth, fall) to 2.6 NTU (3 to 4 m depth, spring). However, turbidity was substantially higher in summer 2007, ranging from 17.2 NTU at 0.5 m depth to 20.4 NTU at 6 m depth. As 2007 chlorophyll-a and nutrient concentrations for DeSabla Reservoir were low, the increased turbidity observed in 2007 did not appear to be related to algal growth in the water column. Secchi depths ranged from 5.4 (summer 2007) to 6.9 m (spring 2006). In 2006, Secchi depths in DeSabla forebay were slightly lower than those measured in Philbrook Reservoir, however the presence of submerged aquatic vegetation in DeSabla forebay may have reduced the accuracy of these readings.

Turbidity Monitoring During Scheduled and Unscheduled Canal Outages

Targeted turbidity monitoring was conducted on eight occasions during 2006, including four planned operational outages for scheduled Butte canal debris cleanup or routine maintenance of Centerville powerhouse, and four unscheduled operational outages when the powerhouse tripped off-line. During most turbidity sampling events, background samples were collected once per day from sites upstream of the powerhouse canals and compliance samples were collected downstream of the canal confluence approximately every hour until conditions returned to near background or sampling was deemed unsafe (e.g., darkness).

Turbidity was low throughout 2006 and 2007 at all stations (<4 NTU), except for two occasions on which unscheduled outages occurred in Butte canal, resulting in turbidity levels of 43 and 19 NTU's. The relatively high turbidity levels measured following these two unscheduled outages were reduced to near background levels within 24 and 4 hours, respectively. However, the elevated turbidity observed during both of these unscheduled outages exceeds the Basin Plan criteria of <1 NTU increase. Four other scheduled or unscheduled canal outages produced downstream turbidity increases >1 NTU during 2006, however peak turbidity was relatively lower, ranging from 3.4 to 7.1 NTU with recovery times below 4 to 5 hours.

Although the two highest turbidity levels observed in 2006 occurred during unscheduled outage events, the historical data record indicates that turbidity increases occurred during both scheduled and unscheduled canal outages. Generally, the unscheduled outage events occurred during summer and fall months when background turbidity is naturally low, which resulted in exceedances of the Basin Plan objective of <1 NTU increase in all but one event (October 7, 2004). Scheduled operational outages took place mainly during winter and spring months

when seasonal storm events are likely to transport higher sediment loads through Project streams. Despite the potential for higher allowable increase in turbidity at higher background levels (e.g., 10 NTU allowable increase for background measurement from 50 to 100 NTU), there was only one scheduled canal outage during naturally high turbidity conditions (February 28, 2006) and most events exceeded Basin Plan water quality objectives in one or more samples.

Fecal coliform

Sampling for fecal coliform was conducted in Philbrook Reservoir and DeSabla forebay during all sampling events. Fecal coliform values ranged from below laboratory detection limits to >3,000 CFU/100 mL. High fecal coliform levels were measured in DeSabla forebay during spring (1600 CFU/100 mL), Independence Day Weekend (>2420 CFU/100 mL), summer 2006 (668 CFU/100 mL), as well as during a follow-up sampling event conducted in response to the high 2006 summer results (>1,600 CFU/100 mL). High levels of fecal coliform were also measured in DeSabla forebay at the eastern shore sites, ranging from 450 CFU/100 mL to 830 CFU/100 mL in summer 2007.

The Basin Plan includes a water quality objective for fecal coliform bacteria in waters designated for contact recreation. The Basin Plan objective for fecal coliform is a geometric mean of < 200 MPN per 100 mL of water from five samples within a 30 day period and < 400 MPN per 100 mL in ten percent of all samples taken within a 30-day period. However, because no five samples were collected within the same 30-day period in 2006, the five sample geometric mean objective cannot be calculated to evaluate compliance with the objective during that year. However, individual samples from DeSabla forebay exhibited fecal coliform concentrations above 200 MPN (or CFU)/100 mL on a one-time basis during spring, Independence Day and summer sampling events. Also, individual samples at this site were also greater than 200 MPN/100 mL during follow-up sampling conducted in response to the high results from the spring and summer events. DeSabla forebay samples were also above 400 CFU per 100 mL in 100 percent of samples taken between spring and summer events. Finally, the geometric mean of the four samples collected at this site during the 42 day period between July 3 and August 14, 2006 was 1,127 CFU/100 mL, or greater than 200 MPN per 100 mL. Thus, while the sampling protocol did not allow evaluations versus water quality objectives, fecal coliform levels in DeSabla forebay were high enough to elicit concern during much of the summer.

Accordingly, during 2007, coliform samples were taken at five locations in DeSabla forebay on a single date (August 7, 2007). The spatially averaged geometric mean of these samples was 166 CFU/100mL. Nonetheless, the summer

2007 fecal coliform results indicate that fecal coliform levels may be of concern periodically at certain locations in the DeSabla forebay.

Chemical Constituents

SCE sampled 25 chemical constituents during spring, summer, and fall 2006, and summer 2007.[25] The Basin Plan requires that water designated for use as domestic or municipal supply shall not contain concentrations of chemical constituents in excess of the Maximum Contaminant Levels specified in the provisions of Title 22 of the California Code of Regulations. Low levels of inorganic and trace metal constituents occurred throughout the study area with no exceedances of the Basin Plan criteria, demonstrating generally high water quality typical of snow-melt fed river systems of the Sierra Nevada.

Tastes and Odor

The Basin Plan requires that waters shall not contain taste- or odor-producing substances in concentrations that impart undesirable tastes or odors to domestic or municipal water supplies or to fish flesh or other edible products of aquatic origin, or that cause nuisance, or otherwise adversely affect beneficial uses. SCE monitored 12 substances during water quality studies with only sodium found in excess of the applicable criterion (30 to 60 mg/L) at one station in the West Branch Feather River above Hendricks diversion dam during the spring sampling event at a concentration of 81 mg/L.[26]

Total and Methyl Mercury

One site on Butte Creek downstream of Centerville powerhouse was sampled for total mercury in 2006 and 2007, and two sites on the West Branch Feather River (one in Philbrook Reservoir and one upstream of the Hendricks diversion) were sampled for total and methyl mercury in 2006 and 2007. In Butte Creek total mercury ranged from 0.33 to 0.85 ng/L and in West Branch Feather River total mercury ranged from 0.28 to 0.88 ng/L. Methyl mercury in West Branch Feather River ranged from 0.011 to 0.056 ng/L. All samples were well below acceptable Basin Plan criteria.

[25] More specific details about sampling sites, frequency, and parameters measured are discussed more fully in PG&E's Updated Study Results and License Application Sections filed on December 31, 2007 (PG&E, 2007a and b).

[26] More specific details about sampling sites, frequency, and parameters measured are discussed more fully in PG&E's Updated Study Results and License Application Sections filed on December 31, 2007 (PG&E, 2007a and b).

Fish tissue total mercury samples, measured in both whole body and filet samples, were collected from Philbrook Reservoir and DeSabla forebay during August 2006. Fish were collected from multiple locations in each reservoir over two to three days, with twenty individuals of varying lengths included for analysis. Measured values for total mercury in filet samples ranged 24.1 to 27.0 ng/g for individual rainbow trout and 25.0 to 49.3 ng/g for composite samples of rainbow and brown trout. Measured values in whole body samples were generally lower, ranging from 22.8 to 29.6 ng/g for individual rainbow trout and 25.8 to 35.4 ng/g for composite samples of rainbow and brown trout. All samples were well below the National Recommended Water Quality Criteria for Human Health Consumption for Organism Only at 0.3 mg/kg (300 ng/g) (USEPA, 2001).

Hydrocarbons

Water samples for hydrocarbons analysis were collected in Philbrook Reservoir and DeSabla forebay during the Independence and Labor Day weekend sampling events. The Basin Plan requires that water not contain hydrocarbons, oils, greases, waxes or other material in concentrations that cause nuisance, result in visible film or coating on the surface of the water or on objects in the water, or otherwise adversely affect beneficial uses. No exceedances of the Basin Plan criteria were identified.

Fisheries

The DeSabla-Centerville Project is located on both, Butte Creek and the West Branch Feather River. Fourteen tributaries (eight to Butte Creek and six to the West Branch Feather River) are located in the project. Twelve of the fourteen triburtaries have have feeder diversions that provide flows directly to project canals. Table 3-16 list each of these tributaries by drainage basin, identifies whether or not they have a feeder diversion and if so, which of the project canals flows are diverted to. See figure 1-3 for project facilities and drainage basins.

Table 3-16. Tributaries to Butte Creek and the West Branch Feather River affected by the DeSabla-Centerville Project from upstream to downstream by drainage basin.

Tributary	Feeder Diversion	Canal Diverted to
Butte Creek		
Inskip Creek	Yes	Butte
Kelsey Creek	Yes	Butte
Stevens Creek[1]	Yes	Butte
Clear Creek	Yes	Butte
Little Butte Creek[1]	Yes	Toadtown
Oro Fino Ravine[1]	Yes	Lower Centerville
Emma Ravine[1]	Yes	Lower Centerville
Coal Claim[1]	Yes	Lower Centerville
Helltown Ravine	Yes	Lower Centerville
West Branch Feather River		
Coon Hollow Creek	No	N/A
Philbrook Creek	No	N/A
Little West Fork	Yes	Hendricks
Cunningham Ravine	Yes	Hendricks
Long Ravine	Yes	Hendricks

[1]Diversions from these tributaries have been discontinued.

Butte Creek and Butte Creek Tributaries

Within the project area, Butte Creek supports two distinct fish assemblages. The upper reach of Butte Creek, from Butte Creek diversion dam to the Lower Centerville diversion dam (upper Butte Creek) supports resident "trout assemblage," consisting primarily of resident rainbow trout (*Oncorhynchus mykiss*) and brown trout (*Salmo trutta*). The lower reach of Butte Creek between Lower Centerville diversion dam and the downstream Parrott-Phelan diversion dam,[27] (lower Butte Creek), on the other hand, supports both anadromous and resident fish communities. The lower reach of Butte Creek, supports the "pikeminnow-hardhead-sucker assemblage," and includes a large self-sustaining population of the federally- and state-listed Central Valley spring-run Chinook salmon (O. tshawytscha), as well as a population of the federally-listed Central Valley steelhead (O. mykiss). Restoration efforts in lower Butte Creek, initiated in the 1990's under the Central Valley Project Improvement Act (CVIA), have resulted in large numbers of adult spring-run Chinook salmon returning to lower Butte Creek in recent years. The cool water diverted by the project from the West

[27] The Parrot-Phelan diversion dam is not a project facility.

Branch Feather River provides approximately 40 percent of the entire flow in lower Butte Creek during the summer months of July through September.

The upper reach of Butte Creek is confined in a steep rocky canyon with substrates primarily of boulder, cobble and bedrock, and smaller amounts of gravel. The upper reach is composed mostly of plunge/step pool and cascade habitats and contains several large waterfalls. Sixteen natural barriers were mapped in a 3.5 mile reach upstream of the Lower Centerville diversion dam. In particular, in the first mile upstream of the Lower Centerville diversion dam, six waterfalls 10 feet or greater in height occur; the largest waterfall is 35 feet high and located 0.58 miles upstream of the Lower Centerville diversion dam.

The Butte Creek stream gradient between Lower Centerville diversion dam and Parrott-Phelan diversion dam is approximately 1.2 percent. The lower Butte Creek is a transition zone between the Upper Butte type of high gradient riffles, falls, and plunge pools to a lower gradient depositional reach near Honey Run Covered Bridge. Two miles of stream below Lower Centerville diversion dam is characterized by deep pools, large boulders, and a narrow rocky canyon. The Quartz Bowl pool and barrier is located within this section, approximately one mile downstream of Lower Centerville diversion dam, and forms the typical upper limit of spring-run Chinook salmon migration. The stream section below the barrier provides some of the better summer holding habitat for spring-run Chinook salmon and has a good pool-to-riffle ratio, small boulders and more gravel. The lowermost section is wider and shallower, and is characterized by slower water velocities. From Centerville powerhouse to the Honey Run Covered Bridge, the stream channel further widens and more sediment is stored in the in the channel and banks. Discharge increases in this reach from return flow at the Centerville powerhouse and, near the lower end of the reach, flow from Little Butte Creek.

In Butte Creek, fish species composition was exclusively trout in the upper watershed, changing to transitional zone species (e.g., hardhead and Sacramento pikeminnow), and anadromous species (Chinook salmon and steelhead [O. mykiss]) below the Lower Centerville diversion dam. The anadromous fish range within the project area was identified in PG&E (2004) as from Butte Creek up to the Lower Centerville diversion dam. For the purpose of the relicensing studies, O. mykiss observations downstream of the Lower Centerville diversion dam were reported as steelhead/rainbow trout because differentiating between steelhead and rainbow trout was not possible during snorkel surveys. Table 3-17 identifies current and previously reported fish species known to occur in the project's study area. Table 3-18 documents the fish observed during September-October 2006 stream surveys in the DeSabla-Centerville Project Study Area.

West Branch Feather River

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The West Branch Feather River within the project area extends from Round Valley Reservoir downstream to the non-Project Miocene Diversion. The primary fish assemblage on the West Branch Feather River is the "trout assemblage," consisting primarily of rainbow and brown trout. The West Branch Feather River can be divided into two subreaches: the upper West Branch Feather River from Round Valley Reservoir to Hendricks diversion dam, and the lower West Branch Feather River from Hendricks diversion dam to the Miocene Diversion (see Figure 2).

In the lower reaches of the West Branch Feather River, stream habitat contained larger run and pool habitat in the lower sections of the Study Area compared to the upper reaches; however, unlike Butte Creek, the upper reaches of the West Branch Feather River were not confined in steep canyons and the stream habitat contained fewer boulders. The upper West Branch Feather River varies considerably between Round Valley Reservoir and the downstream Hendricks diversion dam. The channel downstream of Round Valley reservoir is narrow with a higher percentage of canopy cover. In addition, flow between Round Valley Reservoir and Coon Hollow Creek is intermittent with no surface flow by summertime. Channel conditions between Coon Hollow Creek and just below Philbrook Creek are similar; however, the flow source below Philbrook Creek alternates between releases from Round Valley Reservoir in the spring, to releases from Philbrook Reservoir through the summer and fall months. Below Hendricks diversion dam, downstream to the Miocene Diversion, the habitat in the West Branch Feather River is characterized as good trout habitat. Two major tributaries, Big Kimshew Creek and Cold Creek, join the West Branch Feather River below Hendricks diversion dam.

The fishery between Round Valley Reservoir and Philbrook Creek is described as "marginal", but improves below Philbrook Creek in response to increased flow and improved trout habitat. Brown trout and rainbow trout are common in the West Branch Feather River below Philbrook Creek. Habitat is dominated by long riffle/runs, and large pools. The substrate is composed primarily of small boulders and rubble, with some spawning gravels present.

In the upper watershed of the West Branch Feather River, fish species composition was exclusively trout but changed to transitional zone species (e.g., hardhead and Sacramento pikeminnow) at the lowermost survey site. The species composition at all West Branch Feather River survey locations is depicted in Table 3-18. As observed during the relicensing studies, fish species composition in the tributaries to the West Branch Feather River was exclusively trout. Brook, brown, rainbow, and hybrid trout were the species observed as identified in Table 3-17.

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Project Reservoirs

Rainbow trout and brown trout are the primary fish species in Philbrook Reservoir and DeSabla Forebay. The California Department of Fish and Game maintains the trout populations in Philbrook Reservoir through an annual stocking program. The California Department of Fish and Game maintains a put-and-take fishery in DeSabla Forebay with biweekly plants of catchable rainbow trout during the spring and summer months. The forebay maintains a population of brown trout, with many fish over one pound. Due to the annual draining of Round Valley Reservoir, no fish are stocked and fish populations are assumed to be minimal.

Reservoir sampling was conducted in Philbrook Reservoir and DeSabla Forebay in August–September 2006 using gillnetting, beach seine, and/or boat electrofishing methods. Fish species observed included rainbow trout and brown trout in both study impoundments as well as golden shiner within DeSabla Forebay. Both juvenile and adult lifestages of trout were present in Philbrook Reservoir whereas, only adult trout were observed in DeSabla Forebay.

Project Canals and Feeder Diversions and Tributaries

Fish are entrained into the project canals at the project's diversion dams. The Project's active canals are Butte, Hendricks/Toadtown, and Lower Centerville. The PG&E has routinely conducted cooperative fish rescues, for fish entrained into the canals, with California Department of Fish and Game in the Butte, Lower Centerville, Hendricks and Toadtown canals when the canals are dewatered for annual maintenance. Rainbow trout and brown trout are the only fish species that have been observed during these fish rescues.

Butte Canal is supplemented by feeder diversions on three tributary streams to upper Butte Creek, Inskip Creek, Kelsey Creek, and Clear Creek, (see table 3-16). These diversions are located at approximately 3,000 feet in elevation and located 0.5, 2 and 3.7 miles downstream, respectively of the Butte Creek diversion dam. These feeder tributaries are small high gradient perennial streams that exhibit flashy flows during portions of the winter season. Only Rainbow trout have been observed both upstream and downstream of each of the feeder diversions on Inskip and Kelsey Creeks. In Clear Creek; however, both brown and rainbow trout have been observed above and below its feeder diversion (See table 1).

The channel gradient in the West Branch Feather River feeder tributaries was not as steep as in Butte Creek tributaries. As a result, the stream habitat within the West Branch Feather River feeder tributaries generally contained more riffle habitat with smaller particle-size substrates (including gravels and cobble).

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In addition to the feeder tributaries surveyed, fish surveys were also conducted on Coon Hollow Creek and Philbrook Creek. The stream habitat in Coon Hollow Creek was similar to the stream conditions in the West Branch Feather River downstream of Coon Hollow Creek. The stream habitat in Philbrook Creek varied considerably between sites above the reservoir and below the reservoir. Philbrook Creek is intermittent above the reservoir with broad meandering channels composed of gravel and cobble, whereas the channel downstream of Philbrook Reservoir is more confined with larger substrates (boulder and bedrock).

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Table 3-17. Fish species documented in the DeSabla-Centervillle Project Study Area (Source PG&E as modified by Staff)**.**[1]

Stream Reaches and river miles	Butte Creek				Butte Creek Tributaries				West Branch Feather River Tributaries					Reservoirs			References
	Upstream of Butte Div.	Butte Creek Div. Dam to Lower	Lower Centerville Div. Dam to	Centerville PH to	Inskip Creek	Kelsey Creek	Clear Creek,[4]	West Branch Feather River	Coon Hollow	Philbrook [5]	Long Ravine	Cunningham [4]	Little West [4]	DeSabla	Round Valley Reservoir[3]	Philbrook	
Petromyzontidae (Lamprey family)																	
Pacific lamprey			●	●													PG&E, 2004
Salmonidae (Salmon and trout family)																	
Chinook salmon (spring run)			● ○	● ○													PG&E, 2004
Chinook salmon (fall run)				●													PG&E, 2004
Steelhead / rainbow			● ○	● ○													PG&E, 2004
Rainbow trout	○	● ○	●	●	○	○	● ○	● ○	○	● ○	○	○	● ○	● ○	●	● ○	PG&E, 2004
Rainbow hybrid / color morph		○						○	○	○							
Brown trout	○	● ○	●	●			● ○	● ○	○	● ○	○	○	● ○	● ○	●	● ○	PG&E, 2004

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Brook trout								○	○								
Cyprinidae (Minnow family)																	
California roach			● ○	● ○													PG&E, 2004
Golden shiner														○			
Hardhead			● ○	● ○													PG&E, 2004
Sacramento pikeminnow			● ○	● ○													PG&E, 2004
Pikeminnow/ hardhead			○	○													
Cyprinid species			○	○				○									
Catostomidae (Sucker family)																	
Sacramento sucker			● ○	● ○				○									PG&E, 2004
Cottidae (Sculpin family)																	
Riffle sculpin		●	●	●													PG&E, 2004
Cottus species			○	○													
Embiotocidae (Surfperch family)																	
Tule perch			●	● ○													PG&E, 2004

1 ○ denotes species documented during 2006 surveys; ● denotes species documented historically (before 2004)
2 No historic data available;
3 Not sampled in 2006;
4 Includes stream area upstream and downstream of feeder diversion,
5 Includes upstream and downstream of Philbrook Reservoir

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Table 3-18. Number of fish observed during September-October 2006 stream surveys in the DeSabla-Centerville Project Study Area (Source: PG&E as modified by staff).

Site Name	Site Description	Survey Method	Number Observed															
			Brook trout	Brown trout	Chinook salmon	Rainbow trout	Rainbow hybrid / color morph	Steelhead / rainbow	Sacramento sucker	Cottus species	Cyprinid species	Hardhead	Sacramento pikeminnow	Pikeminnow / hardhead	California roach	Tule perch	Golden Shiner	Total Number Observed
BUTTE CREEK																		
Butte 72.2	Upstream of Butte diversion dam	Snorkel		2		11												13
Butte 71.8	Downstream of Butte Div. Dam	Snorkel				1												1
Butte 65.3		E-fish		1		94	1											96
Butte 61.9	Downstream of DeSabla powerhouse	Snorkel				57												57
Butte 61.7	Downstream of Lower Centerville Div.	Snorkel						238										238
Butte 60.8		Snorkel						263		1								264
Butte 59.0		Snorkel						142	242	9	435		22		1			851
Butte 56.5		Snorkel			90			74	2,735	8		29	166	3,586	199			6,887
Butte 54.6	Downstream of Centerville powerhouse	Snorkel			107			68	102	7	32	21	17	16	31			401

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Table 3-18. Number of fish observed during September-October 2006 stream surveys in the DeSabla-Centerville Project Study Area (Source: PG&E as modified by staff).

Site Name	Site Description	Survey Method	Number Observed																
			Brook trout	Brown trout	Chinook salmon	Rainbow trout	Rainbow hybrid / color morph	Steelhead / rainbow	Sacramento sucker	Cottus species	Cyprinid species	Hardhead	Sacramento pikeminnow	Pikeminnow / hardhead	California roach	Tule perch	Golden Shiner	Total Number Observed
Butte 53.4		Snorkel			72			58	164	1		20	59	227	23			624
Butte 50.5		Snorkel			4			33	911	1	280	22	789		800	2		2,842
BUTTE CREEK TRIBUTARIES																			
Inskip-F1	Inskip Creek - upstream of diversion	E-fish				14												14
Inskip-F2	Inskip Creek - downstream of diversion	E-fish				42												42
Kelsey-F1	Kelsey Creek - upstream of diversion	E-fish				22												22
Kelsey-F2	Kelsey Creek - downstream of diversion	E-fish				20												20
Clear-F1	Clear Creek - upstream of diversion	E-fish		13		30												43
Clear-F2	Clear Creek - downstream of diversion	E-fish				11												11
WEST BRANCH FEATHER RIVER																			
West Branch Feather	Downstream of Round Valley Reservoir	E-fish	2			5												7

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Table 3-18. Number of fish observed during September-October 2006 stream surveys in the DeSabla-Centerville Project Study Area (Source: PG&E as modified by staff).

Site Name	Site Description	Survey Method	Number Observed																
			Brook trout	Brown trout	Chinook salmon	Rainbow trout	Rainbow hybrid / color morph	Steelhead / rainbow	Sacramento sucker	Cottus species	Cyprinid species	Hardhead	Sacramento pikeminnow / hardhead	California roach	Tule perch	Golden Shiner	Total Number Observed
River 43.6																	
West Branch Feather River 41.1	Downstream of Coon Hollow Creek	E-fish		25		45	2										72
West Branch Feather River 35.0	Downstream of Philbrook Creek	E-fish		5		65											70
West Branch Feather River 30.2		Snorkel		1		3											4
West Branch Feather River 28.5	Downstream of Hendricks diversion dam	E-fish		3		105											108
West Branch Feather River 23.3		Snorkel		1		34											35

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Table 3-18. Number of fish observed during September-October 2006 stream surveys in the DeSabla-Centerville Project Study Area (Source: PG&E as modified by staff).

Site Name	Site Description	Survey Method	Number Observed															
			Brook trout	Brown trout	Chinook salmon	Rainbow trout	Rainbow hybrid / color morph	Steelhead / rainbow	Sacramento sucker	Cottus species	Cyprinid species	Hardhead	Sacramento pikeminnow / hardhead	California roach	Tule perch	Golden Shiner	Total Number Observed
West Branch Feather River 16.0		Snorkel		4		76			32		1,212						1,324
WEST BRANCH FEATHER RIVER TRIBUTARIES																	
Coon-F1	Coon Hollow Creek upstream of West Branch Feather River	E-fish	17	4		160	29										210
Philbrook-F1	Philbrook Creek - upstream of reservoir	E-fish		599													599
Philbrook-F2	Philbrook Creek - downstream of reservoir	E-fish		5		41	3										49
Long-F1	Long Ravine - upstream of diversion	E-fish		2		29											31
Long-F2	Long Ravine - downstream of diversion	E-fish		28		42											70
Cunningham-F1	Cunningham Ravine - upstream of div.	E-fish				45											45
Cunningham-F2	Cunningham Ravine - downstream of div.	E-fish		37													37

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Table 3-18. Number of fish observed during September-October 2006 stream surveys in the DeSabla-Centerville Project Study Area (Source: PG&E as modified by staff).

Site Name	Site Description	Survey Method	Number Observed															
			Brook trout	Brown trout	Chinook salmon	Rainbow trout	Rainbow hybrid / color morph	Steelhead / rainbow	Sacramento sucker	Cottus species	Cyprinid species	Hardhead	Sacramento pikeminnow / hardhead	California roach	Tule perch	Golden Shiner	Total Number Observed
Little West Fork-F1	Little West Fork - upstream of Diversion	E-fish				23											23
Little West Fork-F2	Little West Fork - downstream of Div.	E-fish		28		1											29
PHILBROOK RESERVOIR																	
G1	Western edge, near southwest shoreline	Gill net		3		48											51
G2	Western edge, near northwest shoreline	Gill net				8											8
G3	Northwest edge of reservoir	Gill net		3		13											16
S1	Southern edge of reservoir at small island	Seine															0
S2	Eastern edge of reservoir near stream channel	Seine															0
S3	West bank of reservoir	Seine				3											3
S4	West end of reservoir near spillway	Seine															0
DESABLA FOREBAY																	

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Table 3-18. Number of fish observed during September-October 2006 stream surveys in the DeSabla-Centerville Project Study Area (Source: PG&E as modified by staff).

Site Name	Site Description	Survey Method	Number Observed															
			Brook trout	Brown trout	Chinook salmon	Rainbow trout	Rainbow hybrid / color morph	Steelhead / rainbow	Sacramento sucker	Cottus species	Cyprinid species	Hardhead	Sacramento pikeminnow / hardhead	California roach	Tule perch	Golden Shiner	Total Number Observed
G1	Near western shore	Gill net		5		5											10
G2	Shallow southwest shore	Gill net		6		3											9
E1	Western shore	E-fish				1											1
E2	Northwest shore	E-fish														16	16
E3	Northern edge near shoreline	E-fish														0	
E4	Southwest shoreline near dam	E-fish		1		2											3

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Fish Entrainment at Project diversion dams

Rainbow trout and brown trout, which occur in both the West Branch Feather River and Butte Creek watersheds, are present in the diversion canals, and are assumed to enter the canals via the mainstem and tributary diversions from each stream. Fish can move back and forth between the canal and the stream at each mainstem diversion point and fish can move upstream and downstream within sections of each canal; however once a fish leaves the lower end of a canal, it is assumed that fish cannot move back in (a drop structure and grizzly structure may serve as a partial barrier or deterrent). At the feeder tributary diversions, fish that pass into the canals are assumed to be unable to return to their natal streams, because of an approximately 1-m outfall from diversion pipes to the canal. There is probably some loss of canal immigrants by predation from other fishes in the canals, and conversely, there is evidence of limited production via spawning of canal "residents" also.

Historically, when PG&E planned to dewater a canal for a scheduled outage, PG&E coordinated with Cal Fish & Game to rescue fish from the canal as it was dewatered. Fish rescue efforts typically required electroshocking fish in the canal as the water surface declined, placing the fish in a fish hatchery holding truck, and then introducing the fish into a nearby stream chosen by Cal Fish & Game. During some of these fish rescue efforts, PG&E counted and recorded fish species and lifestages, by quick visual observation as the fish were moved from the canal to the holding truck. Records of some of these fish rescue efforts are available between the 1990s, 2002, and 2005 (Table 3-19).

Table 3-19 Summary of PG&E's fish rescue efforts between 1989 and 2005. Counts were sometimes categorized by life stage (Source: PG&E as modified by staff).*

Date	Month	Life Stage	Trout Species		Total
			Rainbow	Brown	
BUTTE CANAL					
1989	June	**All**	**954**	**408**	**1,362**
1991	-----	**All**	**723**	**311**	**1,034**
1992	September	**All**	**1,200**	**1,530**	**2,730**
1995	October	**All**	**422**	**1,360**	**1,782**
		YOY	*225*	*1,027*	*1,252*
		Other	*197*	*333*	*530*
HENDRICKS/TOADTOWN CANAL					
1990	September	**All**	**550**	**1,297**	**1,847**
1992	August	**All**	-----	-----	**2,167**
1995	September	**All**	**840**	**1,043**	**1,883**
		YOY	*322*	*260*	*582*
		Other	*518*	*783*	*1,301*
LOWER CENTERVILLE CANAL					
1991	-----	**All**	**1,736**	**75**	**1,811**
1995	August	**All**	**332**	**72**	**404**
		YOY	*256*	*2*	*258*
		Other	*76*	*70*	*146*

2002	October	**All**	**3,314**	**74**	**3,388**
		YOY	*2,147*	*62*	*2,209*
		Other	*1,167*	*12*	*1,179*
2005	January	**All**	**546**	**3**	**549**
		YOY	*238*	*0*	*238*
		Other	*208*	*3*	*211*

Relicensing Preparation Data (2005)

As part of its licensing studies, PG&E weighed and measured each captured fish and noted its general capture location from the Butte and Hendricks/Toadtown canals during the spring 2005 and 2007, scheduled canal outages.

Butte Canal was taken out of service in late April 2005, and fish rescue occurred on April 25 and 26, 2005. PG&E collected 986 trout in eight segments. Roughly two-thirds (69% of the trout collected) were rainbow trout, with the balance being brown trout. Most of the fish (45% of the trout collected) were found in the segment from Butte Canal Siphon to Pete Woods Mine Road (Table 3-20). Both the rainbow and brown trout were in good condition with average K condition factors of 1.17 for rainbow trout (n=681) and 1.14 for brown trout (n=305). The length-frequency distribution for rainbow trout in Butte canal indicates that all age classes were present (Figure 3-20).

The Hendricks/Toadtown Canal was also taken out of service in April 2005; a fish rescue effort similar to that performed at Butte Canal occurred from April 25 through 27, 2005. PG&E collected 1,300 trout in 10 segments. The catch was composed of roughly equal proportions of rainbow and brown trout (53% and 47%, respectively). Most fish (45% of the trout collected) were found in the segment from Velliquette Bridge to the confluence with Butte Canal (Table 3-21). Both the rainbow and brown trout were in good condition with average K condition factors of 1.17 for rainbow trout (n=694) and 1.05 for brown trout (n=606) and the length-frequency distribution for both rainbow and brown trout indicates that all age classes were present (Figures 3-21 and 3-22).

Table 3-20 Summary of PG&E's fish rescue effort in Butte Canal on April 25 and 26, 2005 (Source: PG&E as modified by Staff).*

Segment	Size of Fish	Trout Species		Total
		Brown	Rainbow	
Butte Creek diversion dam to Cape Horn Road (≈6,000ft)	**All**	**3**	**49**	**52**
	0-4"	*0*	*2*	*2*
	4-8"	*1*	*37*	*38*
	8+"	*2*	*10*	*12*
Cape Horn Road to Kelsey Creek (≈4,500 ft)	**All**	**2**	**73**	**75**
	0-4"	*0*	*9*	*9*
	4-8"	*0*	*56*	*56*
	8+"	*2*	*8*	*10*
Kelsey Creek to Clear Creek Point (≈5,500 ft)	**All**	**3**	**140**	**143**
	0-4"	*0*	*21*	*21*
	4-8"	*1*	*96*	*97*
	8+"	*2*	*23*	*25*
Clear Creek Point to Camp 2 Road (≈7,000 ft)	**All**	**1**	**142**	**143**
	0-4"	*0*	*21*	*21*
	4-8"	*0*	*111*	*111*
	8+"	*1*	*10*	*11*
Camp 2 Road to Butte Canal Siphon (≈7,000 feet)	**All**	**2**	**7**	**9**
	0-4"	*0*	*2*	*2*
	4-8"	*0*	*3*	*3*
	8+"	*2*	*2*	*4*
Butte Canal Siphon to Pete Woods Mine Road (≈10,500 ft)	**All**	**189**	**256**	**445**
	0-4"	--	*27*	--
	4-8"	--	*137*	--
	8+"	--	*92*	--
Pete Woods Mine Road to 9/1 Spill (≈4,000 ft)	**All**	**62**	**4**	**66**
	0-4"	*2*	*2*	*4*
	4-8"	*40*	*1*	*41*
	8+"	*20*	*1*	*21*
9/1 Spill to BW 15 (≈3,500 ft)	**All**	**43**	**10**	**53**
	0-4"	*2*	*1*	*3*
	4-8"	*33*	*8*	*41*
	8+"	*8*	*1*	*9*
TOTAL		**305**	**681**	**986**

* Totals are in bold, subtotals are in italics.

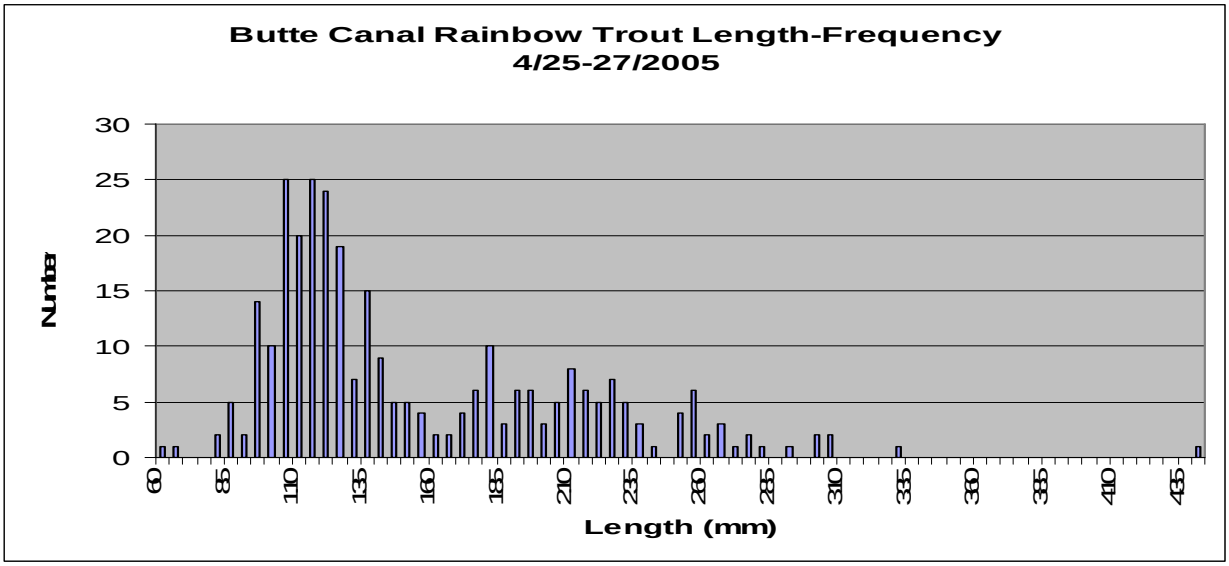

Figure 3-20. Length-frequency distribution of rainbow trout collected in Butte Canal on April 25 and 27, 2005 (Source: PG&E as modified by staff).

Table 3-21. Summary of PG&E's fish rescue effort in Hendricks/Toadtown Canal from April 25 through 27, 2005 (Source: PG&E as modified by Staff).*

Segment	Size of Fish	Trout Species		Total
		Brown	Rainbow	
Hendricks Canal Tunnel to diversion dam (≈4,500 ft)	**All**	**4**	**249**	**253**
	0-4"	*1*	*156*	*157*
	4-8"	*3*	*88*	*91*
	8+"	*0*	*5*	*5*
Long Ravine to 2/3 Flume (≈5,000 ft)	**All**	**6**	**3**	**9**
	0-4"	*0*	*0*	*0*
	4-8"	*0*	*0*	*0*
	8+"	*6*	*3*	*9*
2/3 Flume to Cunningham Ravine (≈6,500 ft)	**All**	**50**	**50**	**100**
	0-4"	*3*	*13*	*16*
	4-8"	*21*	*31*	*52*
	8+"	*26*	*6*	*32*
Cunningham Ravine to Bob Isom's (≈9,500 ft)	**All**	**50**	**26**	**76**
	0-4"	*20*	*12*	*32*
	4-8"	*26*	*12*	*38*
	8+"	*10*	*2*	*12*
Bob Isom's to Lovelock Tunnel (≈1,000 ft)	**All**	**10**	**6**	**16**
	0-4"	*1*	*2*	*3*
	4-8"	*9*	*4*	*13*
	8+"	*0*	*0*	*0*
Lovelock Tunnel to Skyway (≈1,,500 ft)	**All**	**13**	**2**	**15**
	0-4"	*0*	*0*	*0*
	4-8"	*0*	*0*	*0*
	8+"	*13*	*2*	*15*
Skyway to Toadtown Diversioner Box (≈2,000 ft)	**All**	**28**	**7**	**35**
	0-4"	*7*	*1*	*8*
	4-8"	*14*	*5*	*19*
	8+"	*7*	*1*	*8*
Toadtown powerhouse to Toadtown Bridge (≈1,500 ft)	**All**	**64**	**21**	**85**
	0-4"	*18*	*5*	*23*
	4-8"	*40*	*14*	*54*
	8+"	*6*	*2*	*8*
Toadtown Bridge to Vellicuette	**All**	**95**	**25**	**120**

Bridge (≈2,000 ft)	*0-4"*	*49*	*19*	*68*
	4-8"	*43*	*4*	*47*
	8+"	*3*	*2*	*5*
Velliquette Bridge to confluence with Butte Canal (≈7,500 ft)	**All**	**280**	**305**	**585**
	0-4"	*200*	*212*	*412*
	4-8"	*72*	*83*	*155*
	8+"	*8*	*10*	*18*
	TOTAL	**600**	**694**	**1,294**

* Totals are in bold, subtotals are in italics.

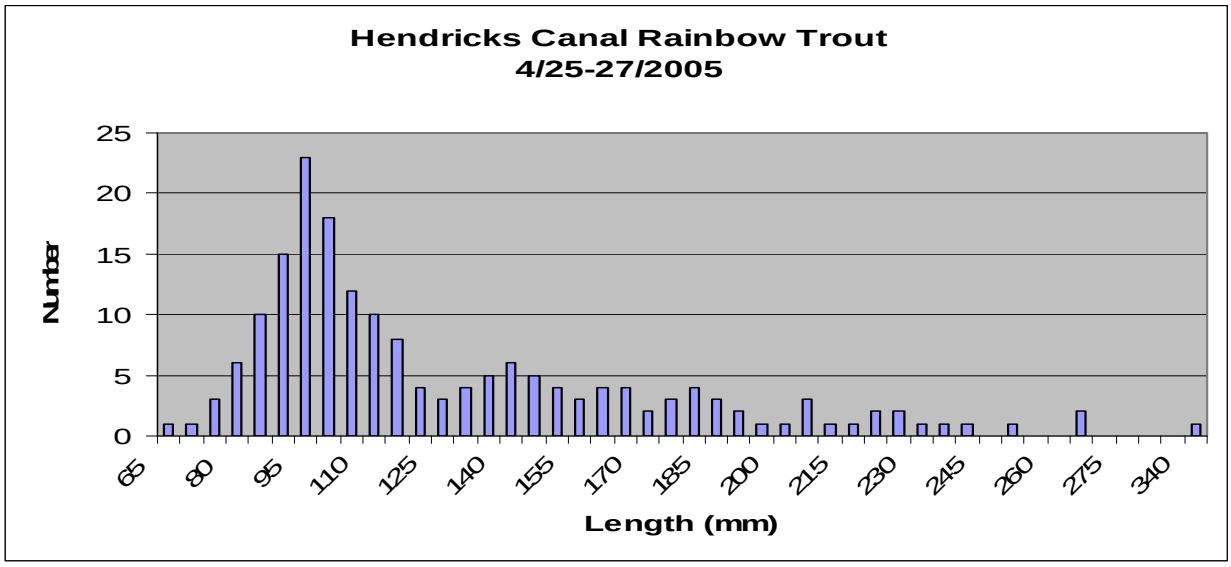

Figure 3-21. Length-frequency distribution of rainbow trout collected in Hendricks/Toadtown Canal from April 25 through 27, 2005 (Source: PG&E as modified by staff).

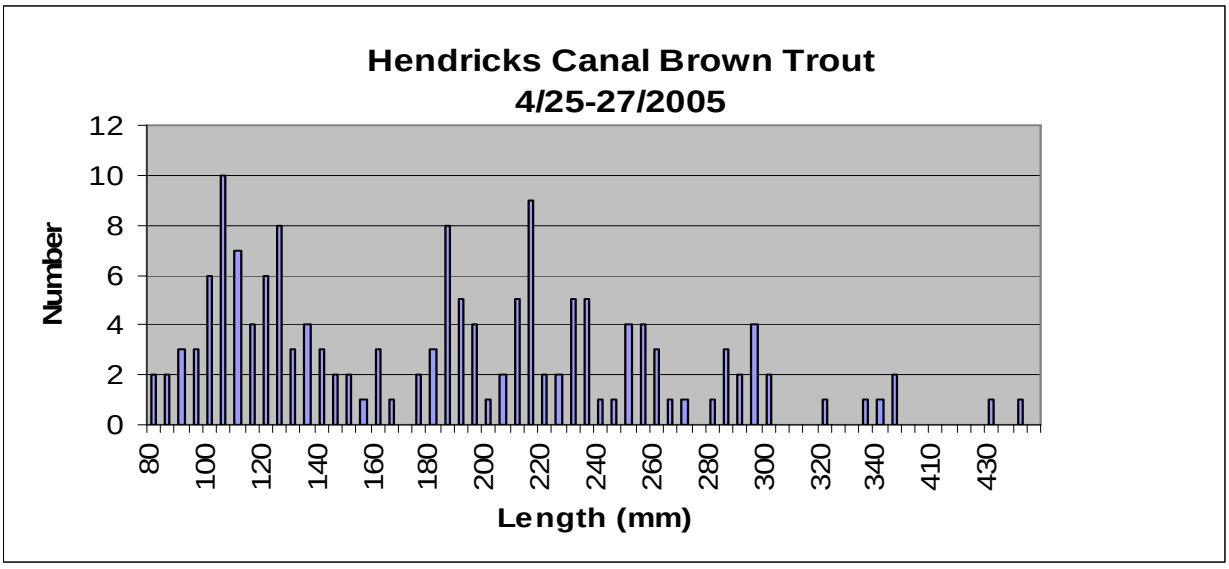

Figure 3-22. Length-frequency distribution of brown trout collected in Hendricks/Toadtown Canal from April 25 through 27, 2005 (Source: PG&E as modified by staff).

Due to the heavy precipitation in Winter/Spring 2006, PG&E was required to perform an unscheduled outage of the canals for safety purposes. Because the 2006 outage was unscheduled, PG&E was only able to identify and count the number of fish rescued and was unable to collect length, weight and location data from the fish rescued in 2006; however, this detailed information was collected during the 2007 canal outage (see table 3-22).

In February 2007, PG&E conducted a fish rescue on the Lower Centerville Canal, and in April 2007, fish rescue efforts were conducted on the Hendricks/Toadtown Canal and the Butte Canal. The canals were dewatered immediately prior to fish rescue efforts as part of regularly scheduled maintenance (i.e., the morning of April 23rd for the Hendricks Canal, and the morning of the 25th for the Butte Canal).

A total of 694 fish were removed from the Hendricks/Toadtown Canal; 1,371 fish were removed from the Butte Canal (127 from the Forks-to-Forebay section); and 724 fish were removed from the Lower Centerville Canal. Rainbow trout and Brown trout were the only species captured and Rainbow trout was the most abundant species of the two (see table 3-22).

Table 3-22. Summary of PG&E's fish rescue efforts in 2006-2007 during outages.*

Date	Month	Size of Fish	Trout Species		Total
			Rainbow	Brown	
BUTTE CANAL					
2006	May	**All**	**271**	**179**	**450**
		0-4"	*118*	*54*	*172*
		4-8"	*99*	*91*	*190*
		8-12"	*33*	*22*	*55*
		12+"	*21*	*12*	*33*
2007	April	**All**	**783**	**588**	**1,371**
		0-4"	*477*	*237*	*714*
		4-8"	*232*	*276*	*508*
		8-12"	*60*	*70*	*130*
		12+"	*14*	*5*	*19*
HENDRICKS/TOADTOWN CANAL					
2006	April	**All**	**185**	**441**	**626**
		0-4"	*159*	*322*	*481*
		4-8"	*11*	*88*	*99*
		8-12"	*13*	*25*	*38*
		12+"	*2*	*6*	*8*
2007	April	**All**	**375**	**319**	**694**
		0-4"	*312*	*130*	*442*
		4-8"	*47*	*152*	*199*
		8-12"	*16*	*34*	*50*
		12+"	*0*	*3*	*3*
LOWER CENTERVILLE CANAL					
2006	January	**All**	**147**	**22**	**169**
		0-4"	*49*	*9*	*58*
		4-8"	*36*	*13*	*49*
		8-12"	*62*	*0*	*62*
		12+"	*0*	*0*	*0*
2007	February	**All**	**697**	**27**	**724**
		0-4"	*74*	*0*	*74*
		4-8"	*606*	*4*	*610*
		8-12"	*6*	*15*	*21*
		12+"	*11*	*8*	*19*

* Totals are in bold, subtotals are in italics.

Spring-run Chinook salmon of the Central Valley ESU

Butte Creek spring-run Chinook salmon belong to the Central Valley evolutionarily significant unit (ESU) and are a California state and federally listed threatened species. California listed the species as threatened in February 1999. They were federally listed shortly thereafter in September 1999 [Federal Register Vol. 64, No. 179]. Critical Habitat for Butte Creek was designated in February 2000 [Federal Register Vol. 65, No. 32], and covers the reach downstream of Lower Centerville diversion dam to the confluence with the Sacramento River. In the Project-affected reach, this includes Butte Creek from Lower Centerville diversion dam downstream to the Parrott-Phelan diversion dam.

The spring-run Chinook salmon is one of three runs occurring in Butte Creek, along with the fall- and late-fall runs. Because of its early migration timing, only the spring-run regularly utilize habitat upstream of the Parrott-Phelan diversion dam. The fall- and late-fall runs only rarely migrate up to or beyond the Parrott-Phelan diversion dam. Adult fall-run and late-fall-run Chinook salmon

enter Butte Creek downstream of the project area primarily from October through February and spawn shortly thereafter. Juvenile fall-run and late-fall run Chinook salmon emigrate as both young-of-the-year and yearlings, and are not readily distinguishable from downstream migrant spring-run Chinook salmon.

Butte, Deer, and Mill creeks support the majority of self-sustaining Central Valley spring-run Chinook salmon. Between 1995 and 2002, Butte Creek supported an average of 70 percent of the total Central Valley spring-run population (low = 45 percent; high = 89 percent).

Until the early to mid-1990s, the spring-run Chinook salmon had been in substantial decline. During a 10 year period from 1956 through 1965, the annual spring-run Chinook salmon escapement (run size) averaged about 2,800 fish, with an estimated high of 8,700 fish in 1960. During the next three decades, annual spring-run escapement averaged approximately 337 (1966 to 1975), 162 (1976 to 1985), and 1,354 (1986 to 1995). Ten fish were estimated for 1979.

Modifications to Project operations to benefit spring-run Chinook salmon beginning in the 1980's and restoration actions initiated in the early 1990's under the Central Valley Project Improvement Act, have resulted in large numbers of adult spring-run Chinook salmon returning to Butte Creek in recent years, far in excess of historical numbers and restoration expectations. According to the FWS report, Final Restoration Plan for the Anadromous Fishes Restoration Plan: January 9, 2001, the production goal for spring-run Chinook salmon in Butte Creek was 2,000 returning adults. Since 1991, the Butte Creek population of spring-run Chinook salmon has far exceeded that goal, averaging 5,254 returning fish. In 1998, a year characterized as a wet water year with above normal precipitation, the Butte Creek spring-run Chinook salmon escapement hit a record high (since the population was monitored) of 20,212 fish. Recent data suggests even more fish returned to Butte Creek in 2001, based on mark-recapture carcass count data. The most recent data for 2003 estimated that over 17,000 fish returned to Butte Creek.

Adult spring-run Chinook salmon migrate from the ocean to the Sacramento River as immature fish beginning in early February, and arrive in Butte Creek in late February. The last adults to reach Butte Creek generally arrive by mid-June.

Prior to the installation of large dams, spring-run Chinook salmon used to migrate as far as they could travel in the large tributary streams to the Sacramento and San Joaquin Rivers. In most years, the upstream migration limit in Butte Creek is the natural barrier at Quartz Bowl. For the next several months, the fish

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hold in deep pool habitats primarily from the confluence of Little Butte Creek upstream to the Quartz Bowl while they mature.

During the summer, spring-run Chinook salmon do not feed and continue to mature in the deep pools before spawning. Due to the low elevation of the Butte Creek holding and spawning habitat, ambient stream temperatures often exceed the reported temperature tolerances of spring-run Chinook salmon; although severe heat storms can result in temperatures that lead to spring-run Chinook salmon mortality in Butte Creek.

For example, during the last two weeks of July 2003, air temperatures exceeded 37.6°C (100°F) for 10 of the last 14 days. These air temperatures were in the upper ten percent for the period of record. Consequently, water temperatures in key over-summer holding pools reached average daily temperatures of 20.9°C. The combination of the high numbers of returning adults confined to the limited number of holding pools and elevated air and water temperatures led to disease outbreaks of columnaris and ich (caused by the pathogens *Flavobacterium columnare* and *lchthyophthirius multiphilis*, respectively), resulting in pre-spawn mortalities.

As temperatures cool in the fall, the mature fish move into nearby suitable spawning habitats. When suitable spawning habitat is found, female salmon dig nests called redds. Females then lay their eggs in the redds as the male fertilizes them. Once the eggs are covered with loose gravel and the spawning act is complete, the salmon die shortly thereafter. Eggs hatch after 40 to 60 days (depending on oxygen and temperature). The young fry remain in the gravel until their yolk sac is completely absorbed (4 to 6 weeks). Juvenile fish either emigrate shortly after emergence or rear in the stream up to 15 months. In Butte Creek, the fry begin their downstream emigration shortly after emerging from the gravel. Their downstream migration usually begins in mid-November and peaks between December and April. Between 1995 and 1998, and 1998 and 2000, 98.2 percent and 96.3 percent, respectively, of all YOY spring-run Chinook salmon emigrated between December 1 and January 31; the average length of fry was 36 mm fork length for both sampling periods. A lesser number of fry emigrated in late spring or early summer.

Sutter Bypass serves as a major nursery to the emigrating Butte Creek spring-run Chinook fry [Hill and Webber 1999]. Butte Creek fry rear in Sutter Bypass for a period of time before beginning their migration to the ocean. A small number of Butte Creek spring-run Chinook salmon emigrate as yearling fish (i.e., age 1÷) during the following fall and winter. Most yearling spring-run Chinook salmon emigrate in October, but a few may emigrate as late as April.

Historically, spawning adult Central Valley spring-run Chinook salmon were mostly large four or five year old fish. Based on the size of present-day spawners, three year old fish are now generally the most common. Likely the result of intense commercial fishing that removes the largest fish.

Steelhead trout of the Central Valley ESU

Steelhead are the anadromous form of rainbow trout. The Central Valley California ESU of steelhead trout is known to occur only in the Sacramento and San Joaquin rivers and their tributaries. The Sacramento and San Joaquin rivers provide the only migration route for anadromous fish to the drainages of the Sierra Nevada and southern Cascade mountain ranges. The Central Valley California ESU of steelhead trout, is federally listed as threatened [March, 1998, Federal Register Vol. 63, pages 32996 to 32998] but only for those runs in the Sacramento and San Joaquin Rivers and their tributaries.

Data on Butte Creek steelhead in the project area are restricted to limited visual observations by anglers and Cal Fish & Game game wardens. There are no estimates of steelhead numbers for Butte Creek. Scientific data for these fish are also scarce. Available data is limited to Cal Fish & Game sampling conducted in various years at the irrigation diversions downstream of the Project. Several steelhead adults have been reported at the Parrott-Phelan diversion dam during Cal Fish & Game trapping efforts in the winter and spring for juvenile spring-run Chinook salmon. However, it is doubtful that steelhead or salmon regularly ascended beyond the Quartz Pool barrier and the present site of the Lower Centerville diversion dam.

In California, adult steelhead are typically three to four years old before returning to the stream to spawn in gravel redds from December though March. Steelhead trout are also capable of spawning more than once during their lifetime. Six to seven weeks after the eggs are laid the young fish emerge from the gravel. Juvenile fish generally spend their first two years residing in freshwater before smoltification and migrating to the ocean.

Steelhead are believed to ascend Butte Creek in the late fall and winter. Spawning likely takes place through the winter and into the spring (generally December through April), upstream of Helltown bridge. Steelhead prefer to spawn in clean gravel at the pool-riffle transition. There is often substantial gene flow between anadromous and resident trout. It is not uncommon for male anadromous steelhead to mature and then assume a resident life style.

Rainbow Trout

Rainbow trout are perhaps the most popular gamefish in California, and in the project area. Rainbow trout are also regularly stocked in DeSabla Forebay, Philbrook Reservoir, and in Butte Creek near Butte Meadows upstream of the Project.

As demonstrated by their flexible biology and life history behavior, individual growth rates and life span in rainbow trout can be variable. In small streams and high mountain lakes, rainbow trout seldom live longer than six years of age or grow larger than 40 cm total length. Most wild rainbow trout reach sexual maturity in their second or third year and usually spawn between February and June, depending on water temperature and strain. Rainbow trout spawn in gravel, usually in riffles. The eggs hatch in 80 days at 40°F (4.4°C) and 24 days at 55°F (12.7°C). The fry emerge from the gravel beginning two to three weeks later, depending upon temperature. Juvenile and adult rainbow trout may migrate into a lake or other downstream areas or remain in the stream defending a small home range.

For the first year or two of life rainbow trout inhabit clear, cool, fast flowing water. Rainbow trout prefer streams with ample aquatic cover such as riparian vegetation or undercut banks. As the fish grow in size, habitats generally shift from riffles for the smallest fish to runs for intermediate sized fish and pools for the largest fish. Stream dwelling fish feed mostly on drifting invertebrates, but will also take benthic invertebrates. In lakes, feeding habits depend on the availability of prey. Rainbow trout in lakes may feed on zooplankton, benthic invertebrates, or small fish.

Brown Trout

Brown trout are known to occur in Butte Creek from Butte Meadows downstream to the Parrott-Phelan diversion dam, in Butte, Hendricks/Toadtown and Lower Centerville canals, in DeSabla Forebay, and in West Branch Feather River. Brown trout are native to Europe, North Africa, and Western Asia. They were first introduced into California waters in 1893, and have since become a popular gamefish.

Brown trout prefer medium to large streams with swift riffles and large, deep pools, but can be found inhabiting a wide range of water bodies from small streams to large lakes and reservoirs. Growth in brown trout is variable and depends on a number of habitat conditions. Usually brown trout grow faster in large lakes and reservoirs than in streams.

Brown trout mature in their second or third year and, depending on stream temperature, will spawn during the fall or winter months (commonly, November

or December in California). Brown trout begin their spawning migration as water levels rise (this may be as early as September). However, spawning sites are not chosen until stream temperatures have cooled to 6 Io 10°C (43 to 50°F). Once the stream reaches the preferred temperature, females select a spawning site and begin digging a redd. This activity attracts a male who defends the female and nest against other males. When the pair have spawned, the eggs are covered with gravel upstream of the redd. Peak spawning activity generally does not occur until November and tapers off in December.

Eggs typically hatch in 7 to 8 weeks, depending on the stream temperature. After the brown trout hatch, they spend some time in the gravel absorbing the yolk sac. Once the yolk sac is absorbed, the young fry leave the redd and inhabit quiet water close to banks among large rocks or overhanging vegetation, typically June though October. Juvenile trout can inhabit a variety of habitats, from riffles to pools. Adults inhabit deep pools with deep cover and defend a feeding territory from other fish. Large brown trout are piscivorous and may prey on young of their own or of other fish species.

California Roach

California roach is a small minnow that is found in the reach of Butte Creek between Lower Centerville diversion dam and Parrott-Phelan diversion dam. California roach belong to the native assemblage of fish in the pikeminnow-hardhead-sucker zone and are native to the Sacramento River basin. Based on a combination of morphology, meristics, and zoogeography, eight forms of the CA roach have been recognized. The Sacramento-San Joaquin roach is found in the drainages of the Sacramento and San Joaquin river system, except for the Pit River (which has its own form), and tributaries to San Francisco Bay.

California roach can be found in a wide variety of habitats, but are usually absent where normative piscivorous fishes are present. They are generally found in small warm streams, and are most abundant in the foothill streams of the western slope of the Sierra Nevada Mountains, and some coastal streams. Their tolerance for high temperatures (up to 30 to 35°C; 86 to 95°F) and low oxygen levels (1 to 2 ppm) gives them the ability to inhabit habitats too harsh for most other species of fish.

Roach are omnivorous and feed on filamentous algae and benthic invertebrates. In some instances, roach may even take drift invertebrates suspended in the water column. Growth is seasonal and variable in roach. Roach grow fastest during the warm summer months, and depending on the stream, may take one or two years to reach 40 mm (1.6 inches) standard length.

Roach mature after reaching 45 to 60 mm (1.8 to 2.4 inches) standard length, usually at two to three years old. Spawning typically occurs when stream temperatures reach 16°C (61°F), from March through July. Spawning roach move from pools to areas of flowing water and a medium sized gravel substrate. Spawning occurs in large groups; females deposit a few eggs at a time among the crevices of the rocks. Males follow closely behind and fertilize the eggs as they are deposited. Eggs hatch in 2 to 3 days and the larvae remain in the rock crevices until they are large enough to actively swim.

Hardhead

Hardhead belong to the native assemblage of fish in the pikeminnow-hardhead-sucker zone and are native to the Sacramento River basin. In Butte Creek within the project area, hardhead are found from the Lower Centerville diversion dam to the Parrott-Phelan diversion dam. Although hardhead are not listed as threatened or endangered by either the stale or Federal governments. They are, identified as a sensitive species by the Forest Service.

Hardhead have a wide distribution, occurring in undisturbed mid- to low-elevation streams in the Sacramento-San Joaquin drainage and the Russian River. Hardhead prefer well-oxygenated water with summer temperatures in excess of 20°C (68°F). Laboratory experiments have determined that optimal temperatures for hardhead are between 24 and 28°C (75 and 82°F). They prefer deep pools (greater than 1 meter deep) with a sand-gravel-boulder substrate and slow velocities. In streams, adult hardhead typically position themselves in the lower half of the water column.

Hardhead usually occur in the same habitats as Sacramento suckers and Sacramento pikeminnow, and are almost never found in areas where pikeminnow are absent. Hardhead also tend to be absent from streams where nonnative centrarchids are the dominant fishes or in an environment that has been impacted by man. They are rarely found in large reservoirs.

Hardhead mature after they reach three or four years of age and spawn mainly in April and May, but may extend through August in some places. In small streams hardhead move only short distances either upstream or downstream to spawn.

Based on the fecundity of hardhead (10,000 to 20,000 eggs) mass spawning is the most likely means of spawning; eggs are likely broadcast over gravel riffles in streams, or over gravel areas along the margins of lakes and reservoirs.

Hardhead juveniles feed on aquatic insect larvae. At 20 cm (7.8 inches)

standard length, hardhead begin feeding on aquatic plants and invertebrates in quiet water. Hardhead grow an average of 60 to 70 mm (2 to 3 inches) per year; as the fish get older the rate of growth eventually decreases. Usually hardhead can live up to six years, and can reach 460 mm (18 inches) fork length.

Sacramento Pikeminnow

Sacramento pikeminnow belong to the native assemblage of fish in the pikeminnow-hardhead-sucker zone and are native to the Sacramento-San Joaquin river basin. In Butte Creek within the project area, Sacramento pikeminnow are found from the Lower Centerville diversion dam to Parrott-Phelan diversion dam.

Sacramento pikeminnow are most abundant in intermittent and permanent streams (elevation of 100 to 650 meters (328 to 2,132 feet) with warm summer temperatures. Pikeminnow generally inhabit waters with summer temperatures of 18 to 28°C. Within this range, pikeminnow often seek out the warmer temperatures, if other aspects of the habitat are suitable.

Sacramento pikeminnow reach maturity at three or four years of age, and reach 22 to 25 cm (8.6 to 9.8 inches) standard length. The spawning migration generally occurs after water temperatures reach 14°C (57°F) in April and May. In large streams (such as the Eel and Sacramento Rivers), some Sacramento pikeminnow make spawning migrations of 100 to 400 km. Spawning begins April and May, and may extend through June. Sacramento pikeminnow spawn in gravel riffles or in shallow flowing areas at the tails of pools when water temperatures rise to 15 to 20°C (59 to 68°F).

Males appear on the spawning habitat first and congregate in nearby pools, waiting for passing females. When a female approaches the spawning habitat, she is immediately pursued by one to six males. Spawning occurs when the female dips down to release a small batch of eggs, while one to six males follow closely behind and simultaneously fertilize the eggs. The fertilized eggs sink to the bottom and adhere to the gravel substrate.

Sacramento pikeminnow fecundity is high (15,000 to 40,000 eggs per female, for fish 31 to 65 cm standard length). In a closely related species, the eggs of northern pikeminnow hatch in four to seven days at 18°C, and the fry begin to school in another seven days. After hatching, the young Sacramento pikeminnow require habitats with low velocities due to their limited swimming abilities and school in shallow pool edges.

Juvenile pikeminnow inhabit shallow pools and runs and prey on surface and benthic aquatic insects. Once the pikeminnow grow to 18 cm (7 inches)

standard length, they become piscivorous and begin feeding on smaller fish and crayfish. Pikeminnow tend to occupy one area in a stream, but are also known to migrate upstream (when water level is high) or downstream (when water level is low) for food.

Unlike juveniles, adult pikeminnow are solitary and do not school, preferring to occupy deep pools with an adequate amount of shade, and a sandy/boulder substrate. During the day, adults tend to take cover underneath rock ledges and logs, coming out at night to actively seek out prey.

Sacramento Sucker

Sacramento suckers belong to the native assemblage of fish in the pikeminnow-hardhead-sucker zone and are native to the Sacramento-San Joaquin river basin. In Butte Creek within the project area they are found from Lower Centerville diversion dam to Parrott-Phelan diversion dam.

Sacramento suckers are found in a wide variety of water bodies, from cold mountain streams to warm, sluggish rivers on the valley floor. Suckers are also found in many lakes and reservoirs. They are most abundant in clear, cool rivers and streams and lakes and reservoirs at moderate elevations (200 to 600 m; 656 to 1968 feet). Adults prefer large streams and juveniles are most common in the small tributary streams where they hatched.

Sacramento suckers do well in a wide range of temperatures. They can be found in cold mountain streams where temperatures rarely exceed 15 to 16°C (59 to 61°F), or small foothill streams where summer temperatures may reach 29 to 30°C (84 to 86°F), but seem to prefer temperatures of 20 to 25°C (68 to 77°F), which may be best for growth.

Sacramento suckers first spawn between four and six years of age at 200 to 320 mm (7.8 to 12.5 inches) fork length. The spawning migration is triggered when water temperatures warm to 5.6 to 10.6°C (42 to 51°F) and flows increase, and may begin as early as late December. A sudden cold snap can also halt the run until warmer temperatures return. Suckers have been known to migrate more than 50 km (31 miles) upstream to spawn.

Depending on water temperatures, spawning generally takes place from February through June, and peaks in March and April. Spawning behavior is typical of most suckers. Large congregations of suckers gather in the spawning area and individual females are accompanied by two to seven males. In tributaries, suckers will spawn over gravel riffles; in lakes they may spawn along shorelines; when spawning is complete, adults return to the larger streams/rivers or

lakes/reservoirs.

Habitat requirements for the Sacramento sucker vary with life stage. Larval suckers concentrate in the warm, quiet, protected stream margins. Juvenile suckers (less than 50 ram; 1.9 inches standard length) commonly remain in the tributary streams where they hatched and stay on or close to the bottom at depths of 20 to 60 cm (8 to 24 inches), foraging in shallow, slow-flowing (less than 10 cm/sec; less than 0.3 feet/see) water along the stream margins.

Sub-adult suckers may leave the spawning tributaries and migrate downstream to larger bodies of water where they inhabit deep pools, runs, or undercut banks near riffles during the day. Adult suckers are commonly found in aggregations in pools, each sucker orientating itself to optimal foraging positions in a stream. Adults prefer depths greater than three feet deep where they are relatively safe from avian predators such as herons, osprey, and bald eagles.

Suckers are most active at night, when they move into riffles to forage. Their diet consists mainly of algae, diatoms, and invertebrates. Post-larval suckers have a short digestive tract and terminal mouth and feed primarily on early instars of insects in the water column and at the water's surface. As they develop, their mouths become subterminal and digestive tracts lengthen. During this time, their diet shifts toward diatoms, filamentous algae, and protozoa. The diet of adult suckers is made up mostly of filamentous algae, diatoms, and detritus. Less than 20 percent of their diet is made up of invertebrates. Depending on local conditions, Sacramento suckers may grow 12 to 87 mm (0.7 to 3.4 inches) per year and exceed ten years of age and 50 cm (20 inches) in length in large water bodies.

Tule Perch

Tule perch primarily inhabit low elevation streams, where they inhabit a range of habitat types from sluggish turbid channels to clear, swift-flowing sections. Tule perch have been observed in Butte Creek downstream of Centerville powerhouse, but are likely to occur upstream of the powerhouse as well.

Tule perch give birth to live young. Mating occurs during July to September, with the female storing the sperm until about January, when the eggs are fertilized. Young are born in May or June. From 22 to 83 young are produced per female, with larger females having more young. Tule perch become sexually mature shortly after birth. Growth in tule perch is most rapid during the first 18 months after birth, when they are 3 to 4 cm (1.2 to 1.4 inches) standard

length. Tule perch seldom exceed 16 cm (6.3 inches) standard length, or five years of age.

Riffle Sculpin

Riffle sculpin are commonly associated with both the pikeminnow-hardhead-sucker and rainbow trout assemblages and are native to the Sacramento River basin. In Butte Creek in the project area, they are found from Lower Centerville diversion dam to Parrott-Phelan diversion dam.

Riffle sculpin are most commonly found in permanent cool mountain streams with abundant riffle habitat. They prefer relatively shallow water that flows swiftly over a rocky substrate. In small streams, they may occupy well-shaded pools with good cover such as undercut banks, submerged logs, boulder/cobble substrate, or other complex cover. Riffle sculpin are abundant in streams where temperatures do not exceed 25 to 26°C for extended periods, and dissolved oxygen levels are at or near saturation.

Riffle sculpin first spawn at two years of age at 60 to 80 mm (2.3 to 3.1 inches) standard length. Spawning begins in late February and continues through April. Riffle Sculpin spawn on the underside of rocks or inside the cavities of submerged logs. After spawning, males guard the developing embryos and emerged larvae in the nest until the fry, have developed and left the nest. Riffle sculpin grow about 6 mm (0.02 inches) per month during their first year, reaching a length of 25 to 45 mm (1 to 1.7 inches) standard length by the end of the first growing season. Two year old fish average 40 to 50 mm (1.6 to 2 inches) standard length, and three year old fish, 50 to 60 mm (2 to 2.3 inches). Riffle sculpin rarely live longer than four years.

Aquatic Molluscs

Aquatic molluscs previously identified in the project area included four species in the families Lymnaeidae and Physidae, which were collected in lower Butte Creek by Cal Fish & Game during BMI sampling in 1999 and 2000. All of these snails have a relatively high tolerance to disturbance or pollution (California tolerance values of 6-8) and are not special status species.

Two aquatic mollusc species were targeted for survey during this study because of their sensitive status and the possibility that they might exist in areas affected by the Project: *Anodonta californiensis* (California floater mussel) and *Juga occata* (scalloped juga), which are Forest Service sensitive species. Historically, the California floater is believed to have been found throughout the western United States, ranging from Washington, Oregon, and California. This

species was found within the Susan River drainage (Lassen County) to the NE of the project area (Brim Box 2002). The scalloped juga historically occurred in the Sacramento River and in the Pit River. Neither target mollusc species were found during the licensing studies in projected affected stream reaches or in the unaffected reference reaches. However, licensing studies did identify, in total, seven gastropod species in the families Pleuriceridae, Physidae, Hydrobiidae, Lymnaeidae, and Planorbidae, and one bivalve species in the family Spheridae.

Benthic Macroinvertebrates

During licensing studies, PG&E collected samples of benthic macroinvertebrates at 25 sites: 8 sites in the Butte Creek watershed and 17 sites in the West Branch Feather River watershed. This included eight reference sites, each one sampled upstream of the following Project dams/diversions: Inskip, Kelsey, Clear, Cunningham Ravine, Little West Fork, Long Ravine, and Coon Hollow upstream of Hendricks diversion dam. Benthic sample processing was performed as outlined in the California Stream Bioassessment Procedure. From the 25 sites, including one of the site duplicates, 23,600 organisms were subsampled comprising 135 distinct taxa, 65 EPT taxa and 17 Coleoptera taxa.

3.3.2.2 Environmental Effects

Water Quantity

Minimum Instream Flows

PG&E proposes as soon as reasonably feasible and within three months of license issuance, to release the minimum instream flows (MIFs) proposed and discussed below. PG&E proposes their MIF schedule shall be at the rates proposed, or actual inflow at the point of diversion, whichever is less. PG&E also proposes, consistent with Forest Service 4(e) condition no. 18, FWS 10(j) recommendation no. 2, and NMFS 10(j) recommendation no. 2, that a specific MIF release may be temporarily modified if required by equipment malfunction, law enforcement/rescue activity, operating emergencies reasonably beyond their control, or by the specific request of the resource agencies and that if this occurs, PG&E would provide notice and an explanation to the Commission as soon as possible, but no later than 10 days after each incident. The Forest Service further specifies, and FWS and NMFS further recommend, that in such instances, PG&E would make all reasonable efforts to promptly resume performance of requirements and notify the resource agencies within 48 hours of the modification.

The Forest Service specifies in 4(e) condition no. 18, that PG&E schedule the timing of maintenance or other planned Project outages to avoid negative

ecological effects from the resultant spills and that written notice be provided to the Forest Service 90 days prior to any planned maintenance outages that would affect stream flows in Philbrook Creek and in reaches of the West Branch Feather River. The Forest Service also specifies that this notification include a description of Project and coordinated measures PG&E proposes to minimize the magnitude and duration of spills into the Project reach.

Where facility modification is required to implement a specific MIF, PG&E, consistent with Forest Service 4(e) condition no. 18, proposes to complete such modifications as soon as reasonably practicable and no later than three years after license issuance. FWS in 10(j) recommendation no. 2 and NMFS in 10(j) recommendation no. 2, recommend, that where facility modification is required to implement the efficient release of MIFs, PG&E shall submit applications for permits within one year after license issuance and complete such modifications as soon as reasonably practicable but no later than two years after receipt of all required permits and approvals.

In its July 30, 2008, alternative 4(e) conditions filed with the Forest Service, PG&E states that facility modifications such as those needed for flow releases or temperature control device design and installation in DeSabla forebay may prevent MIFs from commencing within 90 days of license issuance, as recommended by FWS, Cal Fish & Game, and NMFS. This proposal by PG&E is consistent with Forest Service 4(e) condition no. 18, except the Forest Service specifies Project facility modification may prevent MIF releases from being implemented within 90 days.

The Conservation Groups state in their recommendations they support those MIFs proposed by PG&E, except for those proposed for downstream of the Hendricks diversion dam in dry water year types, as described below.[28]

Our Analysis

Implementing MIFs required by any license issued within 90 days of license issuance, as proposed by PG&E and as recommended by Cal Fish & Game, FWS, and NMFS would ensure these MIFs would be provided as soon as possible to protect aquatic resources in Project-affected bypass reaches. It is likely that if Project facilities need to be modified, MIFs in certain bypass reaches may not be able to be implemented within 90 days of any license issued for this Project. However, implementing MIFs immediately after these modifications would ensure aquatic resources are also protected as soon as possible.

[28] The Conservation Groups are composed of representatives from the California Sportfishing Protection Alliance, Friends of Butte Creek, American Whitewater, and Friends of the River.

If a specific MIF is temporarily modified due to equipment malfunction, law enforcement/rescue activity, or operating emergencies reasonably beyond PG&E's control, PG&E's proposal, which is consistent with the requirements of the Forest Service, and recommendations by FWS and NMFS, to provide notice and an explanation to the Commission as soon as possible, but no later than 10 days after each incident, would assist the Commission in documenting compliance with any license issued for this Project.

Resuming any required MIFs as soon as possible, as specifies by the Forest Service, and as recommended by FWS and NMFS, and providing notice to the agencies within 48 hours of the modification, would help minimize any negative effects to aquatic resources and ensure the agencies would be informed about these modifications which may affect resources in Project-affected reaches. Also, as specified by Forest Service 4(e) condition no. 18, scheduling the timing of Project maintenance activities or other planned outages to avoid negative ecological effects and providing a description of measures PG&E would implement to minimize the magnitude and duration of spills into the Project reach at least 90 days prior to any planned outages would further reduce any negative effects on aquatic resources in the Project bypass reaches.

Upper West Branch Feather River-Downstream of Round Valley Reservoir Dam

Consistent with Forest Service 4(e) condition no. 18, FWS 10(j) recommendation no. 2.4, and Cal Fish & Game 10(j) recommendation no. 1, PG&E proposes to release 0.5 cfs, or inflow, during normal water year types, and 0.1 cfs, or inflow, during dry water year types, on a year-round basis downstream of Round Valley Reservoir dam on the upper West Branch Feather River. This proposal is consistent with the MIFs under the current license.

The California Salmon and Steelhead Association recommends that Round Valley Reservoir be increased in size to increase available cold-water storage for the benefit of downstream aquatic resources in both Butte Creek and the West Branch Feather River.

Our Analysis

Under current and proposed Project operations, water is released from Round Valley Reservoir to supplement flows in the upper West Branch Feather River, which are then diverted at Hendricks diversion dam in an effort to increase flows and reduce water temperatures in lower Butte Creek for the benefit of

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spring-run Chinook salmon. Flows are released from Round Valley Reservoir as soon as space becomes available in Hendricks canal, typically in June.

Water temperatures warm quickly in Round Valley Reservoir due to its shallow nature, with releases from 2004 through 2006 (July to August) ranging from 17.5 to 24.1°C. Round Valley Reservoir, which currently does not have a minimum pool requirement, is typically drained in one months time to minimize negative impacts on aquatic resources due to releases from this reservoir being warmer later in the summer. Therefore, by late July or early August, the West Branch Feather River downstream of Philbrook Reservoir dam is an intermittent stream containing only isolated pools. Because of the intermittent flows in the upper West Branch Feather River from downstream of Round Valley Reservoir to its confluence with Coon Hollow Creek, a wetted-perimeter study was conducted by PG&E to quantify aquatic habitat in this reach.

Figure 3-23 illustrates the results of this wetted-perimeter study for the upper West Branch Feather River between Round Valley Reservoir and Coon Hollow Creek, which enters the West Branch Feather River approximately 1.3 miles downstream of Round Valley Reservoir dam. Results indicate that wetted area increases with flow in a generally non-linear pattern, with the greatest gains (per cfs) in wetted area occurring in the 1 to 6 cfs range. Limited additional gains in wetted area were observed between 6 and 13.5 cfs.

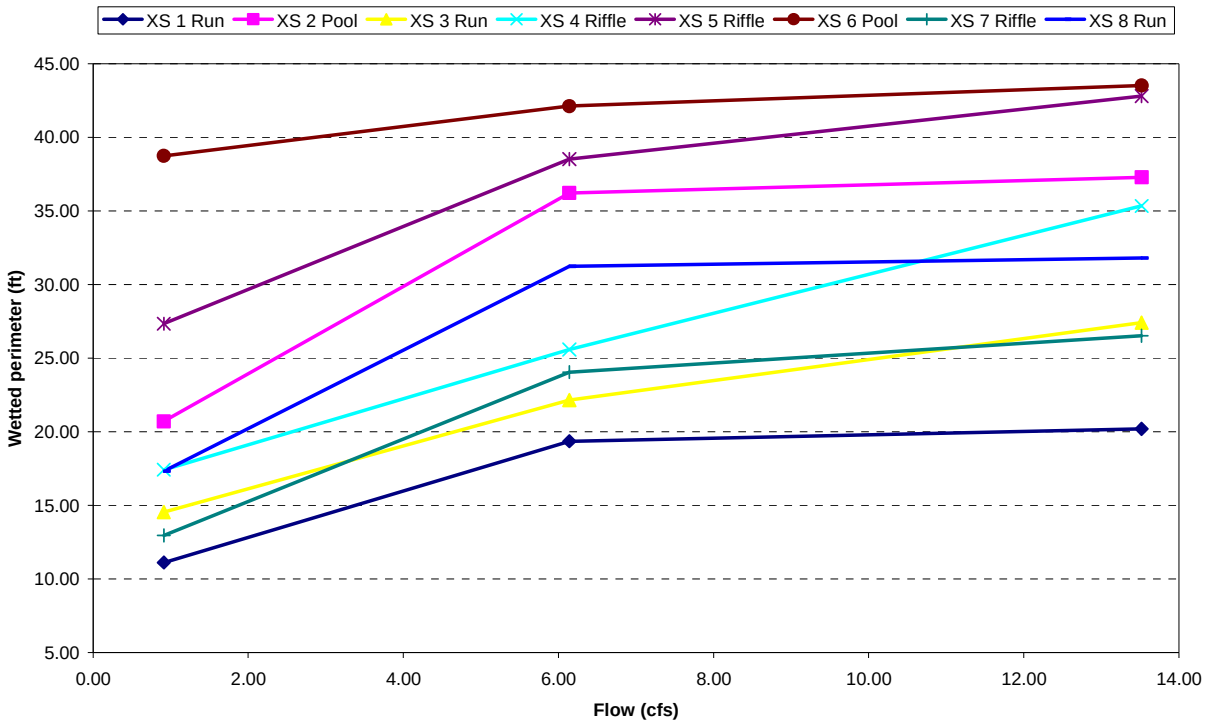

Figure 3-23. Wetted-perimeter versus (in cfs) flow at the Round Valley study site on the upper West Branch Feather River (Source: PG&E, 2007a).

As discussed above, storing water for release from Round Valley Reservoir may create conditions which are likely to negatively affect aquatic resources in the reach downstream of Round Valley Reservoir, especially later in the summer when releases have subsided. PG&E's proposal, which is consistent with Forest Service 4(e) condition no. 18, FWS 10(j) recommendation no. 2.4, and Cal Fish & Game 10(j) recommendation no. 1, would release 0.5 cfs, or inflow, during normal water year types, and 0.1 cfs, or inflow, during dry water year types, on a year-round basis downstream of Round Valley Reservoir dam. As shown in figure 3-23, these MIFs would likely provide minimal habitat for aquatic species in this reach and potentially elevated water temperatures due to the quickness in which water temperatures warm within the reservoir and in the upper West Branch Feather River. Based upon figure 3-23, a MIF upwards of 6 cfs would provide a greater amount of habitat for aquatic species present in this reach.

However, a complex tradeoff exists because in the upper West Branch Feather River. To provide additional, cooler water temperatures in lower Butte Creek, water needs to be stored in Round Valley Reservoir for rapid release in early-summer, before water temperatures warm to levels likely to adversely affect aquatic resources in the Butte Creek drainage. Although releasing a MIF upwards of 6 cfs would result in a greater amount of available habitat for aquatic organisms, this would also result in draining the reservoir much sooner compared

to existing and proposed Project operations, and reduce the storage pool of available water. Draining Round Valley Reservoir prior to the onset of warmer summer temperatures by increasing MIF releases would likely lead to releasing water from Philbrook Reservoir sooner that what currently occurs. This has the potential to increase water temperatures in Philbrook Reservoir as reduced storage would lead to increased rates of thermal loading within the reservoir, and increase water temperatures during instream flow releases. Therefore, a MIF of 0.5 cfs, or inflow, during normal water year types, and 0.1 cfs, or inflow, during dry water year types, would continue to ensure an ample storage pool of water is available to reduce water temperatures within lower Butte Creek. Also, under existing conditions, MIFs support self-sustaining populations of rainbow trout, indicating that continuing to implement these MIFs would likely continue to support these populations.

There is little evidence that increasing the size of Round Valley Reservoir would increase the cold water storage of this reservoir, as increasing the size of this reservoir would also increase its surface area, potentially making it susceptible to greater thermal warming. Further, it is likely that either excavating the reservoir, or increasing the height of the dam, would have numerous negative environmental affects, including the inundation of an unknown amount of land surrounding the reservoir, and increased erosion and sedimentation.

Upper West Branch Feather River-Philbrook Creek

PG&E proposes a year-round MIF of 2 cfs, or inflow, in Philbrook Creek, regardless of water year type. PG&E also proposes that when the inflow into Philbrook Reservoir is less than 0.1 cfs, a MIF of 0.1 cfs would be released. This proposal is consistent with MIFs under the existing license.

PG&E's proposal for a 2 cfs MIF is consistent with FWS 10(j) recommendation no. 2.5, Cal Fish & Game 10(j) recommendation no. 1, and Forest Service 4(e) condition no. 18.1; however, the Forest Service further specifies, and FWS and Cal Fish & Game further recommend, that increases to MIFs in Philbrook Creek could occur and would be determined by the snow water equivalent measured at the Humburg DWR snow pillow sensor (HMB #823). In years where the snow water equivalent at this site is at least 40 inches on April 1st, and 30 inches on May 1st, FWS and Cal Fish & Game recommend a MIF of 10 cfs between April 1st and May 15th. The Forest Service requirement is consistent with FWS and Cal Fish & Game's recommendations; however, only a snow water equivalent at this site of at least 40 inches on April 1st would trigger an increase in MIF, and the Forest Service specifies a MIF of at least 10 cfs. The Forest Service specifies that the actual MIF in this reach would be agreed to by PG&E and the Forest Service based on the snow water equivalent measurements and the

prediction of spill magnitudes. The Forest Service specifies, and FWS and Cal Fish & Game recommend, that if PG&E determines that Philbrook Reservoir will not fill to capacity despite the snow pack levels, MIFs may be altered or reduced to 2 cfs following consultation with the resource agencies.

FWS in 10(j) recommendation no. 2.5, further recommends that when the inflow into Philbrook Reservoir is less than 1 cfs, a MIF of at least 1 cfs would be discharged into Philbrook Creek. The Forest Service in 4(e) condition no. 18.1 specifies that if instantaneous inflows into Philbrook Reservoir are less than 0.5 cfs, the mean daily MIFs released to Philbrook Creek shall be 1 cfs.

The California Salmon and Steelhead Association recommend that PG&E provide a minimum instream flow downstream of Philbrook dam, and that PG&E manage the cold water of Philbrook Reservoir to provide cold water for downstream reaches.

Our Analysis

Currently, rainbow trout and a small number of brown trout are present in Philbrook Creek, which are maintained via Cal Fish & Game's yearly stocking program. The existing year-round MIF in this reach is 2 cfs, which is consistent with PG&E's proposal, Forest Service requirements, and recommendations from Cal Fish & Game and FWS. This would also be consistent with the California Salmon and Steelhead Association recommendation. A 2 cfs MIF provides a Weighted Usable Area (WUA) of approximately 16 percent of the available rainbow trout spawning habitat in both wet and dry years.[29] In Philbrook Creek, WUA for adult rainbow trout is maximized at moderate discharges (between 75 and 95 cfs; figure 3-24). WUA for rainbow trout fry is maximized at the lower modeled discharges (between 5 and 10 cfs) and decreases with increasing discharge, as fry rear in slow, shallow water (figure 3-24). Juvenile and spawning rainbow trout habitat are maximized at flows between 35 and 60 cfs (figure 3-24).

[29] Weighted Usable Area is the amount of usable habitat available for a given fish species.

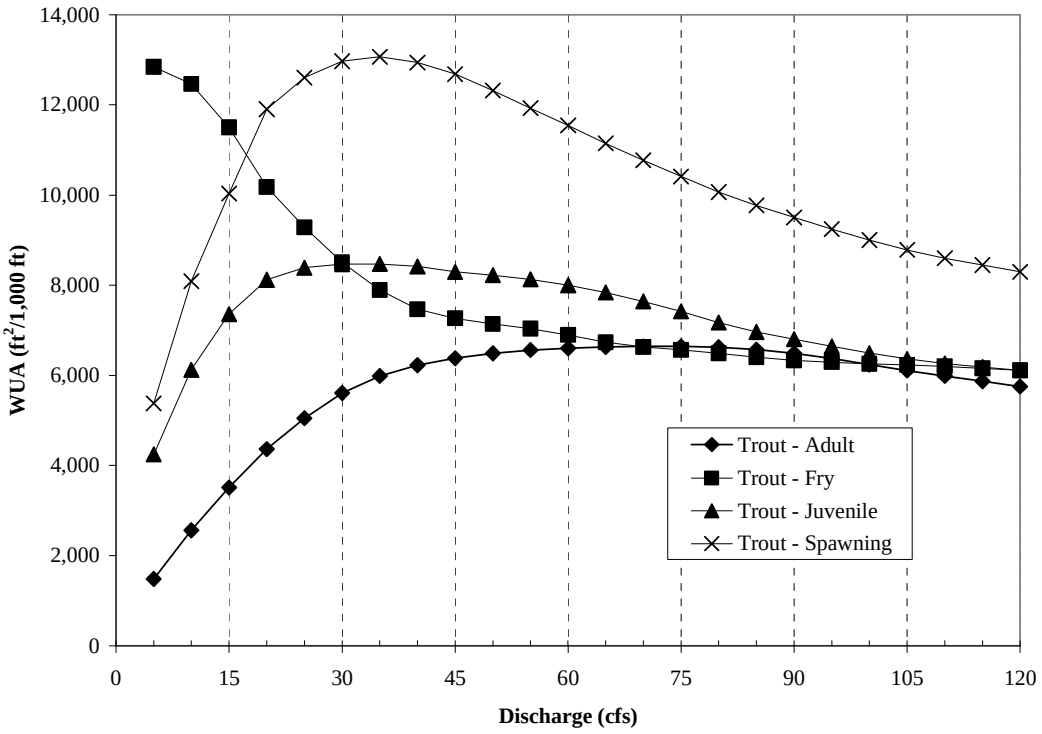

Figure 3-24. Weighted Usable Area (habitat) versus discharge (flow) relationship for spawning, adult, juvenile, and fry life stages of rainbow trout in Philbrook Creek. (Source: PG&E, 2007a)

Typically, rainbow trout in Philbrook Creek would spawn between April and June, when unregulated, natural flows in Philbrook Creek would likely be the greatest as a result of snowpack runoff. However, PG&E's existing and proposed year-round MIF of 2 cfs would likely continue to limit spawning habitat for this species during this time period. Under the Forest Service's requirement, and recommendations from the FWS and Cal Fish & Game, MIFs would be increased from 2 to 10 cfs from April 1 through May 15 in designated wet years, based upon snowpack levels, in an effort to provide additional stream flow in Philbrook Creek to increase rainbow trout spawning habitat. Increasing MIFs in this reach to 10 cfs would increase the available WUA of rainbow trout spawning habitat from 16 to 62 percent, as well as increase adult rainbow trout and juvenile rainbow trout habitat (figure 3-24), providing approximately 6,000 additional square feet of suitable habitat. However, although providing an 8 cfs increase in MIF from Philbrook Reservoir during April 1 to May 15 in designated wet years would likely benefit rainbow trout spawning habitat and other aquatic resources within Philbrook Creek, it would also reduce the water supply within Philbrook Reservoir. Filling Philbrook Reservoir plays an essential role in being able to have cold water storage available to draw from during the warmer summer months. As a result, potentially decreasing this storage may have negative effects on downstream water temperatures in the West Branch Feather River and lower

Butte Creek later in the year during periods of hot weather, which may in turn have additional negative effects on spring-run Chinook salmon.

Flows into the upper West Branch Feather River are affected by releases from Round Valley and Philbrook reservoirs, and other natural inflow. PG&E modeled conditions in Round Valley Reservoir and the temperature evolution of releases into the upper West Branch Feather River, as well as conditions in Philbrook Reservoir and temperature evolution of releases into Philbrook Creek and into the upper West Branch Feather River. Neither PG&E nor the agencies proposed changes to the MIF requirements downstream of Round Valley Reservoir, as previously discussed. Thus, additional simulations of MIF changes elsewhere in the system use base case results (calibration runs with existing MIF requirements) from W2 models 1, 2, and 3 (figure 3-19). The MIFs proposed for Philbrook Creek by PG&E do differ from Forest Service requirements and recommendations from Cal Fish & Game and FWS; thus, Commission staff modified the release schedule for Philbrook Reservoir (model 4) and routed the perturbed outflow and temperature series into Philbrook Creek (model 5). The perturbed flow and temperature time series from Philbrook Creek were flow-weighted with those from upper West Branch Feather River (model 3, base case) and provided as inputs to the model of West Branch Feather River between Philbrook Creek and Hendricks diversion dam (model 6). Results of these perturbations on temperature at Hendricks diversion dam are discussed below. Reservoir inflows, lateral inflows, and corresponding temperatures specified in the base-case model simulations were not altered for the perturbed simulations.

PG&E provided W2 calibration simulations for 2004 (cool meteorology, wet hydrology) for Philbrook Reservoir and Philbrook Creek. Historical summertime (June 19 through August 8) releases adhered to the all existing and proposed month-to-month MIF requirements for this period (i.e. releases were never less than 2 cfs). Because the models were neither setup nor calibrated for the spring period during which sufficient snowpack would trigger a 10 cfs MIF for Philbrook Creek, we were not able to model the spring period with the 10 cfs MIF implemented. We have included a sensitivity run for the summertime period with a 10 cfs MIF for Philbrook Creek implemented from June 17 through July 31 to provide an example of how a 45-day, 10 cfs MIF affects release temperatures for Philbrook Reservoir and propagates through to Hendricks diversion dam (figure 3-25). In this example, the early increases in Philbrook Reservoir outflows lower temperatures initially, but lead to higher temperatures later because Philbrook Reservoir storage is depleted and subject to increased heating. However, influence of this water temperature perturbation on the temperature of water entering the DeSabla forebay is significantly reduced by passage through the Hendricks-Toadtown canal (figure 3-26).

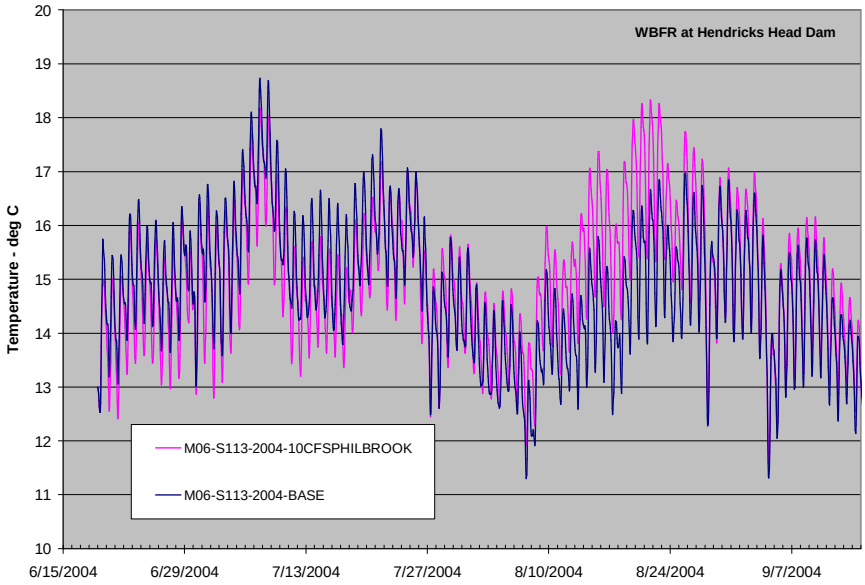

Figure 3-25. Comparison of West Branch Feather River temperatures at Hendricks diversion dam: a 10 cfs MIF requirement imposed from June 17 through July 31 for Philbrook Reservoir is compared with the base case (simulated-calibrated actual) conditions of 2004 hydrology and meteorology. (Source: Staff, 2008)

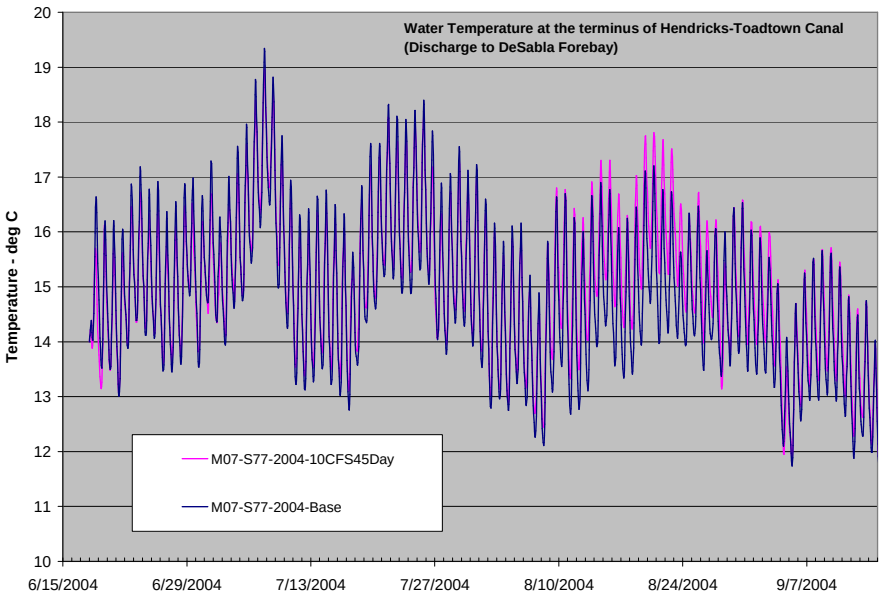

Figure 3-26. Comparison of water temperatures at the Hendricks-Toadtown canal discharge to DeSabla forebay. The influence of a 10 cfs MIF for Philbrook Creek for June 17 through July 31 is significantly diminished by passage through the canal. (Source: Staff, 2008)

PG&E also provided scenario simulations for dry year hydrology inputs (2001) using meteorology data inputs from a cool year (2005). In this case, the historical releases from Philbrook Reservoir were never less than 2.0 cfs—meeting existing and proposed dry-year MIF requirements. To analyze the influence of alternative MIFs during dry periods, we perturbed the 2001 release schedule for Philbrook reservoir by decreasing the release during this period from just above 2 cfs to 0.1 cfs from Julian day 214 to 220. The resulting effect on the release temperature of Philbrook Reservoir was small. The impact of decreased flow during this period in Philbrook Creek is significant, but as it combines with flow in the upper West Branch Feather River, that significance is diminished, such that the effect is small in the upper West Branch Feather River at Hendricks Head diversion dam (figure 3-27).

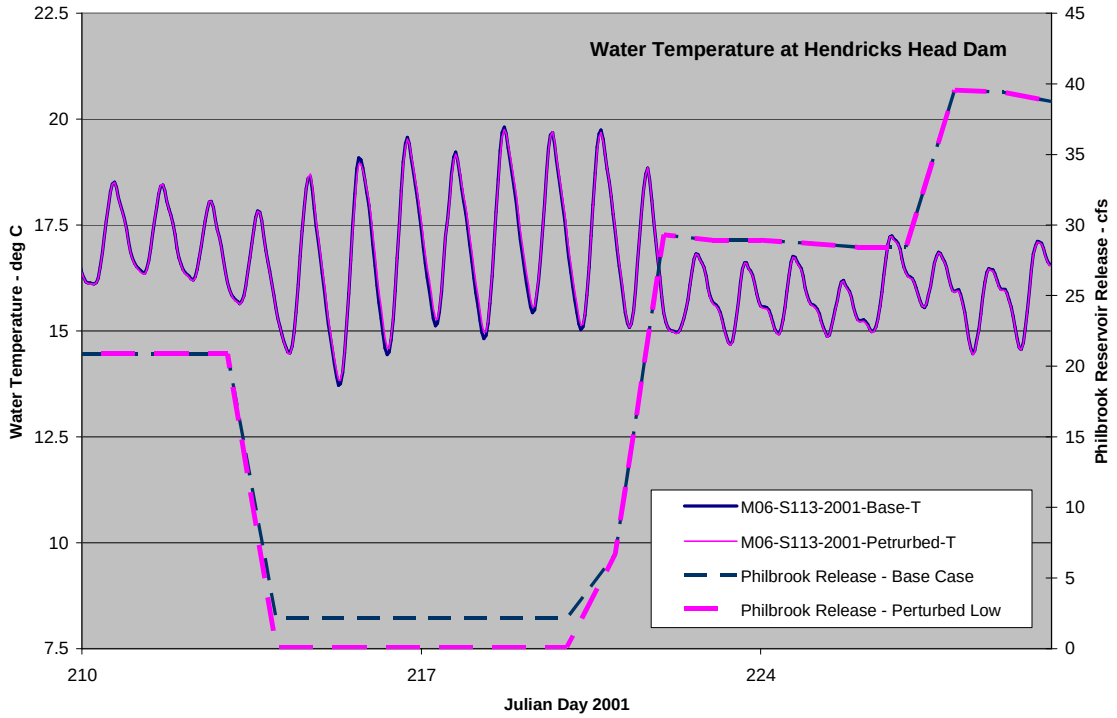

Figure 3-27. Effect of alternative dry-year (2001) MIF lower thresholds for Philbrook Reservoir on water temperature at Hendricks diversion dam. The release from Philbrook Reservoir is lowered temporarily from 2 cfs to 0.1 cfs. (Source: Staff, 2008)

The California Salmon and Steelhead Association's recommendation for PG&E to manage the cold water storage within Philbrook Reservoir for the benefit of downstream reaches is consistent with PG&E's proposal. We further discuss managing Philbrook Reservoir operations below under the *Long-Term Project Operations* section below.

Lower West Branch Feather River-Downstream of Hendricks Diversion dam

The existing license requires that PG&E release on a year-round basis, 15 cfs downstream of Hendricks diversion dam during normal water year types and 7 cfs during dry water year types. PG&E proposes to release the MIFs shown in table 3-16 downstream of the Hendricks diversion dam. Table 3-23 also shows MIFs specified by the Forest Service, and recommended by the agencies and Conservation Groups for this reach, including those contained in: Forest Service 4(e) condition no. 18.1, FWS 10(j) recommendation no. 2.3, Cal Fish & Game 10(j) recommendation no. 1, and the Conservation Groups proposed alternative 4(e) condition no. 18.[30] The California Salmon and Steelhead Association recommends that MIFs be increased downstream of the Hendricks diversion dam to provide additional habitat for resident brown and rainbow trout.

Table 3-23. Comparison of PG&E's existing and proposed, Forest Service required, and agency and Conservation Groups recommended MIFs for the lower West Branch Feather River downstream of Hendricks diversion dam. (Source: Staff, 2008)

Lower West Branch Feather River Creek Reach	**PG&E's Existing MIF (cfs) by Water Year**		**PG&E's Proposed MIF (cfs) by Water Year**		**Agency MIF (cfs) by Water Year Type[1]**		**Conservation Groups Alt. 4(e) MIF (cfs) by Water Year Type[2]**	
Month	Normal	Dry	Normal	Dry	Normal	Dry	Normal	Dry
Sept.	15	7	**20**	**7**	20	7	20	15
Oct.	15	7	**20**	**7**	20	7	20	15
Nov.	15	7	**20**	**7**	20	7	20	7
Dec.	15	7	**20**	**7**	20	7	20	7
Jan.	15	7	**20**	**7**	20	7	20	7
Feb.	15	7	**20**	**7**	20	7	20	7
Mar.	15	7	**30**	**20**	30	20	30	20
Apr.	15	7	**30**	**20**	30	20	30	20
May	15	7	**30**	**20**	30	20	30	20

[30] We note that recommendations filed by the Conservation Groups on June 27, 2008, recommend a minimum instream flow release of 15 cfs in dry water year types downstream of Hendricks Diversion dam from June 1 through February 28; however, we assume their proposed alternative 4(e) conditions filed on July 29, 2008, are their current recommendation.

June	15	7	**20**	**7**	30	15	20	15
July	15	7	**20**	**7**	30	15	20	15
Aug.	15	7	**20**	**7**	30	15	20	15

1 Agencies include Forest Service, FWS, and Cal Fish & Game.
2 Conservation Groups include California Sportfishing Protection Alliance, Friends of Butte Creek, American Whitewater, and Friends of the River.

The Forest Service in 10(a) recommendation no. 20 and Cal Fish & Game in 10(j) recommendation no. 13, recommend that flows made available through MIF release at Hendricks diversion dam should be maintained within the West Branch Feather River downstream along the natural stream course to its discharge at the high-water line of Lake Oroville. The Forest Service further recommends that PG&E should make a good faith effort to ensure that MIFs measured at the gage immediately downstream of Hendricks diversion dam (PG&E gage no. BW 95) are not diverted from the West Branch Feather River through methods under the control of the PG&E, for any purpose.

The Forest Service in 10(a) recommendation no. 20 and Cal Fish & Game in 10(j) recommendation no. 13, recommend that PG&E consult with the Water Board and other resource agencies with responsibilities for the protection of aquatic resources, to identify water rights associated with the diversion of water from the West Branch Feather River and file with the Water Board, *Petitions to Change* the purpose of use for existing water rights held by PG&E that define the West Branch Feather River as an authorized point of diversion. These agencies further recommend that petitions for change on each West Branch Feather River water right should specify the desired change to include the addition of a purpose of use described as Water Code section 1707 *instream flow dedication* to the West Branch Feather River and that PG&E, in consultation with the Water Board and other resource agencies, develop a plan for flow measurement that will demonstrate continued maintenance of Section 1707 MIF dedication within the West Branch Feather River drainage.

California Sportfishing Protection Alliance, Friends of Butte Creek, American Whitewater, and Friends of the River (Conservation Groups) filed alternative 4(e) conditions on July 29, 2008 (Conservation Groups, 2008). The Conservation Groups proposed an alternative condition to the section of Forest Service 4(e) condition no. 18 which addresses MIFs downstream of the Hendricks diversion dam, as shown in table 3-16. In their recommendations, the Conservation Groups also recommend that MIFs downstream of Hendricks diversion dam would become effective only upon completion of a temperature reduction device at DeSabla forebay.

The California Salmon and Steelhead Association recommends that PG&E release sufficient water and maintain flows below the Miocene diversion dam in the West Branch Feather River to Oroville Reservoir on a year-round basis. The California Salmon and Steelhead Association further recommends a daily flow of at least 30 cfs when the Miocene diversion dam is not spilling. Lastly, the California Salmon and Steelhead Association recommends that water be piped from the Hendricks diversion dam to the DeSabla powerhouse to prevent water loss and retain this cold water for lower Butte Creek.

Our Analysis

WUA versus flow relationships were developed for the lower West Branch Feather River and are presented in figures 3-28 through 3-30. The reach of lower West Branch Feather River downstream of Hendricks diversion dam was segmented into three Project-affected sub-reaches, including: 1) the non-Project Miocene diversion to Fall Creek (RM 15.0 to 21.4); 2) Fall Creek to Big Kimshew Creek (RM 21.4 to 23.2); and 3) Big Kimshew Creek to the Hendricks diversion dam (RM 23.2 to 29.2). Generally, WUA for all three sub-reaches for adult rainbow trout is maximized at higher modeled discharges (between 135 and 190 cfs; figures 3-28 through 3-30). This is likely due to the increasing floodplain/margin habitat that becomes available as discharge increases. WUA for all three sub-reaches for rainbow trout fry is maximized at the lower modeled discharges between 10 and 25 cfs and decreases with increasing discharge, as fry rear in slow, shallow water (figures 3-28 through 3-30). Rainbow trout spawning habitat for all three reaches is maximized at flows between 60 and 105 cfs, while juvenile rainbow trout habitat is maximized between 70 and 120 cfs.

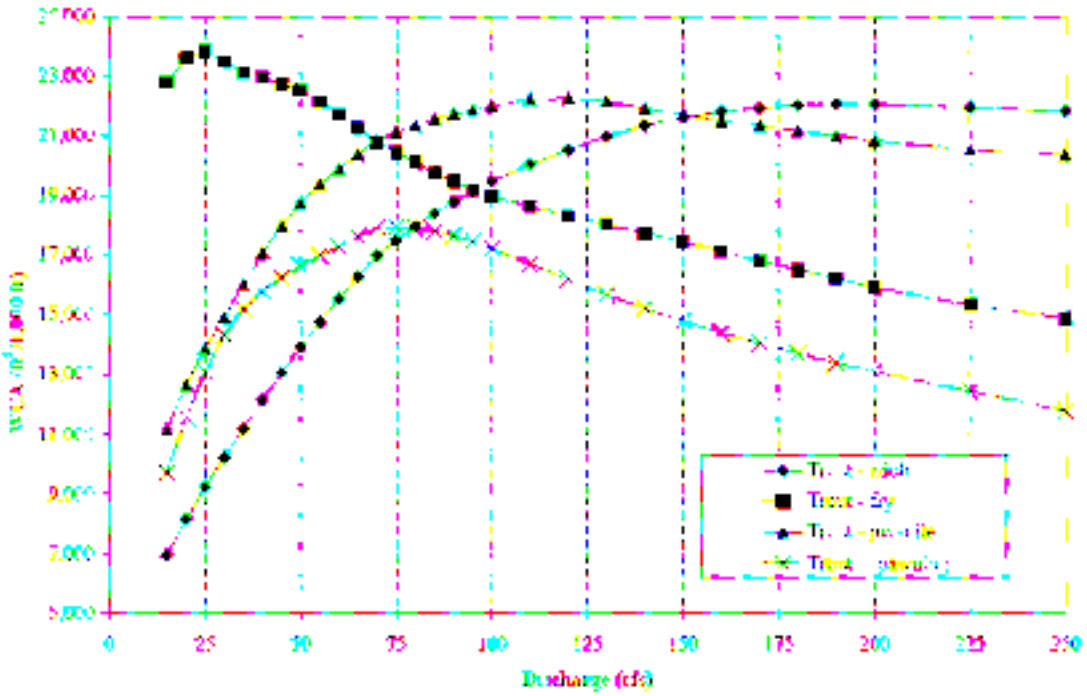

Figure 3-28. Weighted Usable Area (habitat) versus discharge (flow) relationship for spawning, adult, juvenile, and fry life stages of rainbow trout in the lower West Branch Feather River between the non-Project Miocene diversion and Fall Creek (RM 15.0 to 21.4). (Source: PG&E, 2007a)

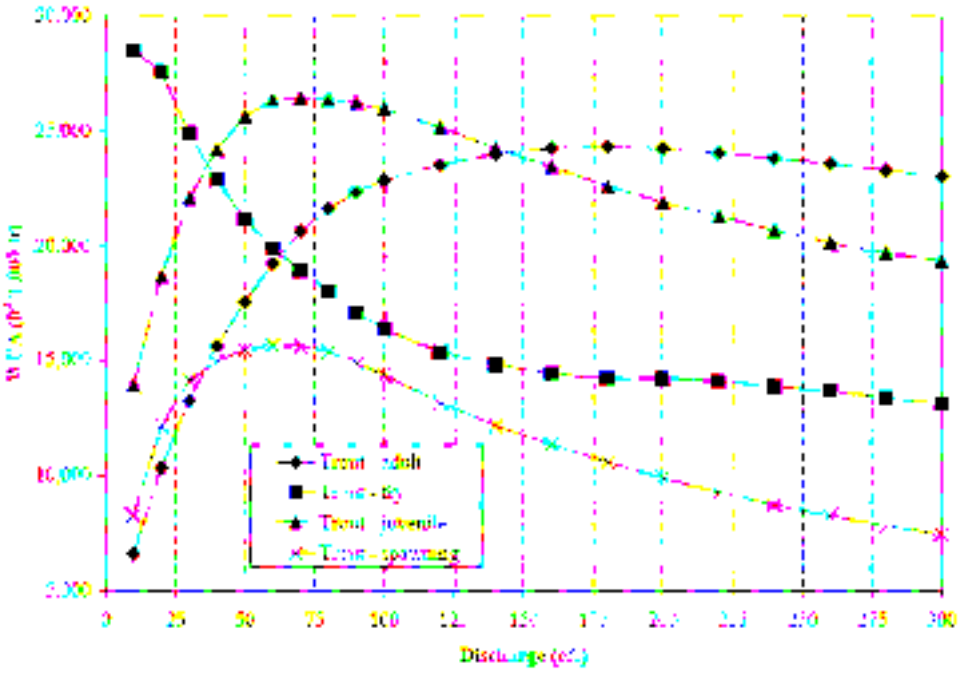

Figure 3-29. Weighted Usable Area (habitat) versus discharge (flow) relationship for spawning, adult, juvenile, and fry life stages of rainbow trout in the lower West Branch Feather River between Fall Creek and Big Kimshew Creek (RM 21.4 to 23.2). (Source: PG&E, 2007a)

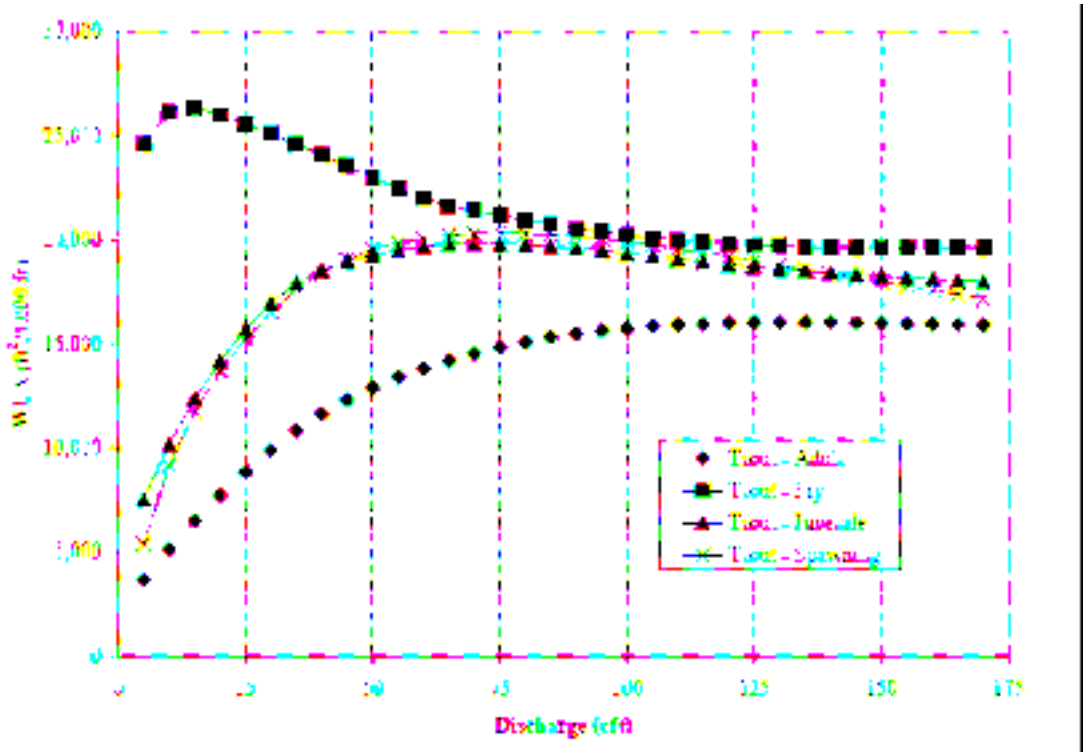

Figure 3-30. Weighted Usable Area (habitat) versus discharge (flow) relationship for spawning, adult, juvenile, and fry life stages of rainbow trout in the lower West Branch Feather River between Big Kimshew Creek and Hendricks diversion dam (RM 23.2 to 29.2). (Source: PG&E, 2007a)

Compared to existing conditions, PG&E's proposed MIFs downstream of the Hendricks diversion dam would provide increased flows during both dry and normal water years, except from June 1 through August 31 in dry years (table 3-23). This proposal by PG&E would therefore provide additional adult rainbow trout, juvenile rainbow trout, and spawning rainbow trout habitat, as further described below (table 3-24). Further, PG&E's proposed MIFs of between 7 to 30 cfs in normal and dry water years would likely provide excellent habitat for trout fry as the WUA for rainbow trout fry is maximized at flows ranging from 10 to 25 cfs. In dry years from June 1 through August 31, PG&E's proposed MIF of 7 cfs would be consistent with existing MIF requirements in this reach and likely continue to maintain the current habitat conditions downstream of Hendricks diversion dam.

Table 3-24. Percent WUA for a given flow (shown in parentheses) in the lower West Branch Feather River. (Source: Forest Service, 2008)

Percentage of Habitat (%WUA) Available at Flows (cfs) for Trout Lifestages are shown below from the Applicant's Final License Application (PG&E 2007). "nm" = not modeled					
Sub-reaches (RMs 29.2 - 15.0) are downstream from Hendricks Diversion Dam					
Trout Habitat in the Above Big Kimshew Creek Subreach (RMs 29.2-23.2): % WUA at (Flow)					
Adult	100 (140)	80 (30)	62 (30)	48 (20)	41 (15)
Fry	94 (5)	98 (10)	100 (15)	99 (20)	95 (30)
Juvenile	100 (70)	97 (50)	86 (30)	71 (20)	62 (15)
Spawning	100 (75)	90 (40)	81 (30)	67 (20)	58 (15)
Trout Habitat in the Big Kimshew to Fall Creeks Subreach (RMs 23.2-21.4): % WUA at (Flow)					
Adult	100 (180)	72.2 (50)	54.5 (30)	42.5 (20)	34.8 (15)
Fry	100 (10)	96.5 (20)	80.1 (40)	69.7 (60)	65.3 (70)
Juvenile	100 (70)	96.9 (50)	83.4 (30)	70.6 (20)	61.7 (15)
Spawning	100 (60)	90.1 (30)	80.1 (22)	65.2 (15)	52.8 (10)
Trout Habitat in the Below Fall Creek Subreach (RMs 21.4-15.0): % WUA at (Flow)					
Adult	100 (190)	63.1 (50)	46.3 (30)	36.9 (20)	31.4 (15)
Fry	95.6 (15)	99.3 (20)	100 (25)	96.3 (40)	84.4 (50)
Juvenile	100 (180)	84.2 (50)	61.7 (30)	56.8 (20)	50.1 (15)
Spawning	100 (75)	96.4 (60)	79.8 (30)	64.4 (20)	54.2 (15)

The Forest Service requirement in 4(e) condition no. 18, and Cal Fish & Game and FWS recommendations for MIFs downstream of Hendricks diversion dam are consistent with PG&E's proposal, except during the June 1 to August 31 period in dry years when MIFs would be increased to 15 cfs, compared to PG&E's proposal of 7 cfs, and in normal water year types when MIFs would be increased to 30 cfs, compared to PG&E's proposal of 20 cfs. In the sub-reach upstream of Big Kimshew Creek, the Forest Service specified and agency recommended MIF of 30 cfs in a normal year would provide 62 percent WUA for adult trout habitat, 86 percent WUA for juvenile trout habitat, and 81 percent WUA for spawning trout habitat, compared to PG&E's proposed MIF of 20 cfs which would provide 48 percent WUA for adult trout habitat, 71 percent WUA for juvenile trout habitat, and 67 percent WUA for spawning trout habitat (table 3-17). The Forest Service's required and Cal Fish & Game, FWS, and Conservation Groups recommended dry year proposal of 15 cfs provides 41 percent WUA for adult trout habitat, 62 percent WUA for juvenile trout habitat, and 58 percent WUA for spawning trout habitat, whereas PG&E's dry year proposal of 7 cfs would provide 27 percent WUA for adult trout habitat and 43 percent WUA for juvenile trout habitat in this sub-reach. The remaining two sub-reaches were not modeled below 10 to 15 cfs.

PG&E conducted a variety of simulation runs for minimum flow scenarios for the lower West Branch Feather River using SNTEMP models to compare the

resulting effects on downstream water temperatures.[31] Simulations were produced for flows between 7 and 50 cfs, at semi-monthly intervals during the warm summer period of late-June through September 15. Figures 3-31 and 3-32 are two examples of these simulations using a normal (2005) and dry year (2007), which compare the various MIF proposals, requirements, and recommendations for the lower West Branch Feather River and illustrate the subsequent downstream cooling effects these different releases yield. Figure 3-31 indicates that in a normal water year type under PG&E's proposal (20 cfs MIF), water temperatures in July would be reduced downstream of the Hendricks diversion dam compared to existing conditions (15 cfs MIF). This figure also indicates that in normal water years, water temperatures would only be slightly further reduced under the agency required or recommended MIF of 30 cfs. However, this figure also shows that the majority of cooling from increased MIF releases occurs within the first four miles downstream of Hendricks diversion dam. Downstream of RM 25 the 10 cfs increase in MIFs between PG&E's proposal and agency requirements or recommendations, has minimal effects on further reducing water temperatures, likely as a result of tributary inflow and equilibrium conditions being reached between air and water temperatures.

[31] Additional SNTEMP temperature model results are provided in the license application (PG&E, 2007a) and in PG&E alternative 4(e) conditions (PG&E, 2008c).

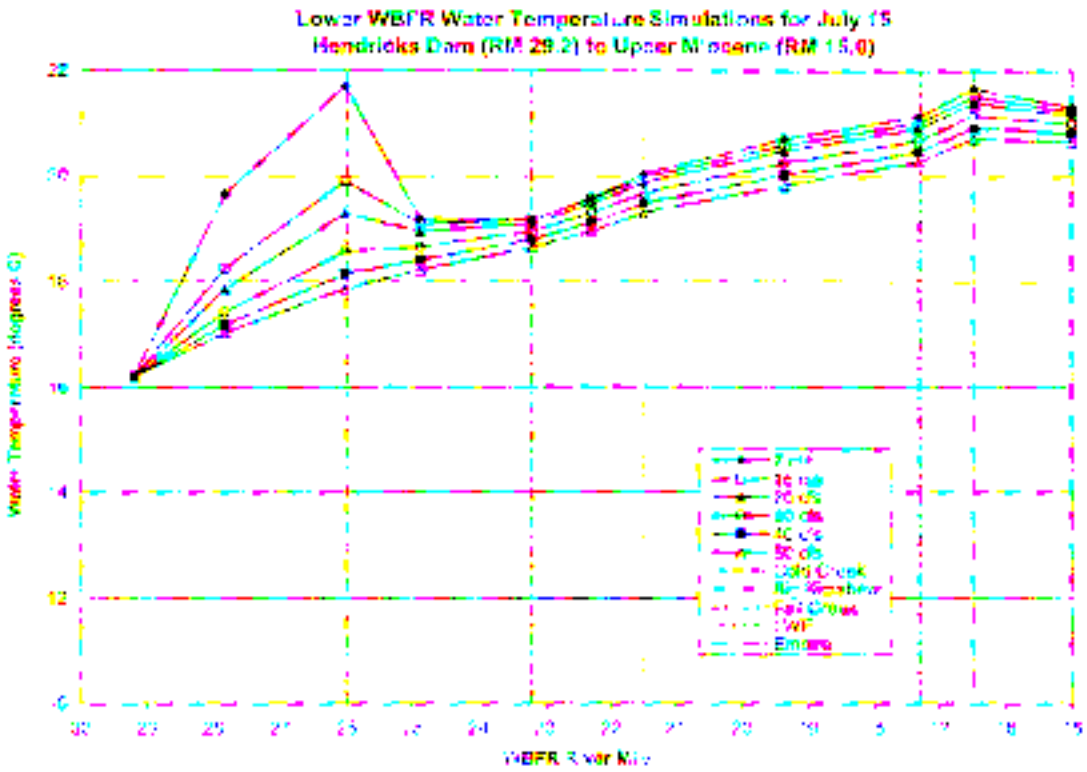

Figure 3-31. Mean daily water temperature simulation results (from SNTEMP) for the West Branch Feather River below Hendricks diversion dam using 2005 hydrology (above normal) and meteorology (hot). (Source: PG&E, 2008c)

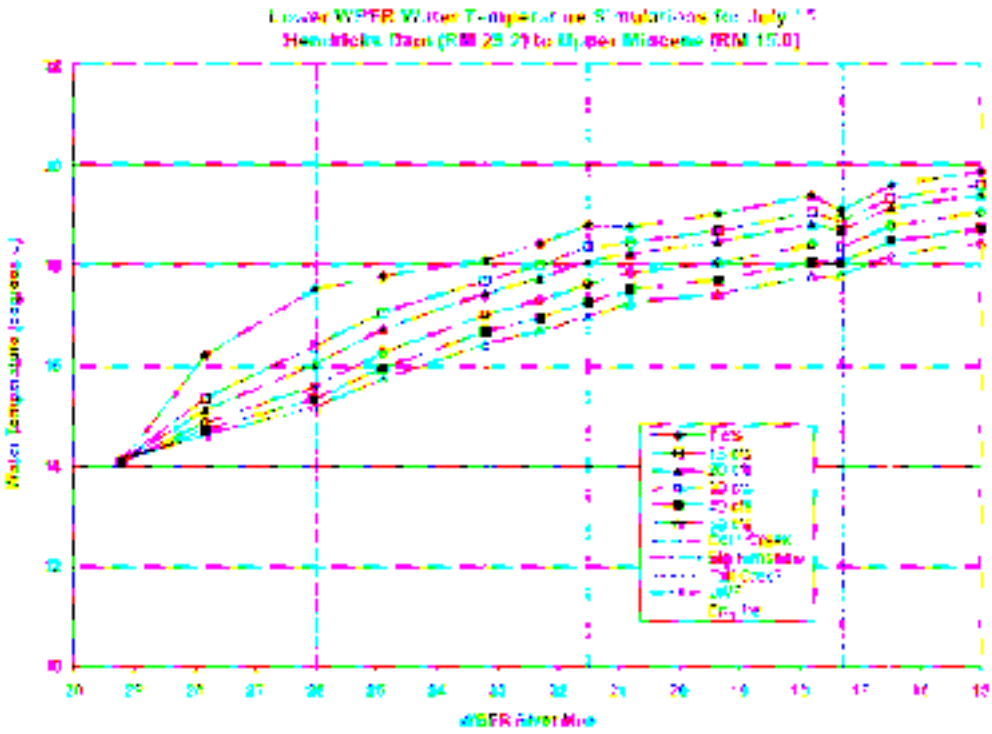

Figure 3-32. Mean daily water temperature simulation results (from SNTEMP) for the West Branch Feather River below Hendricks diversion dam using 2007 hydrology (dry year). (Source: PG&E, 2008c)

In a dry water year, figure 3-32 illustrates that PG&E's proposed MIF of 7 cfs would result in downstream water temperatures that are approximately 1°C warmer than those that would occur under the Forest Service specified and agency recommended MIF of 15 cfs for the first five miles downstream of Hendricks diversion dam. However, similar to conditions that would occur under a normal water year, tributary inflow appears to minimize the effects of increased MIFs from Hendricks diversion dam downstream of approximately RM 23 in the lower West Branch Feather River.

For rainbow trout, the literature suggests that maximum growth rates occur at water temperatures less than 17ºC, with preferred temperatures occurring between 13º to 20ºC (Moyle and Marchetti, 1992). Upper incipient lethal water temperatures for rainbow trout were generally about 25ºC. As shown in figure 3-31, both PG&E's proposed MIF (20 cfs) in normal water years and Forest Service specified and agency recommended MIF (30 cfs) in normal water years would result in water temperatures within the preferred range for rainbow trout upstream of approximately RM 21 in the lower West Branch Feather River. However, as discussed above, a 10 cfs increase in MIFs during normal water years has relatively little effect on maintaining water temperatures below 20 ºC downstream

of RM 21. In dry water years both PG&E's proposed MIF (7 cfs) and that specified or recommended by the agencies (15 cfs) would result in downstream water temperatures in the preferred range for rainbow trout downstream to the non-Project Miocene diversion. Figures 3-31 and 3-32 also indicate that under all flow scenarios in both normal and dry water years, water temperatures are well below the rainbow trout lethal temperature of 25ºC.

Releasing additional flows downstream of Hendricks diversion dam would result in less flow being available for diversion through Hendricks canal to lower Butte Creek. Therefore, as a result of providing additional MIFs to improve rainbow trout habitat in lower West Branch Feather River, water temperatures could in turn be increased in lower Butte Creek, especially during the hottest times of years (June through August) when PG&E is proposing and the agencies are requiring or recommending increased flows for rainbow trout in the lower West Branch Feather River.

PG&E conducted water temperature simulations to evaluate the effect of increased MIFs downstream of the Hendricks diversion dam and the resulting effects on temperatures in lower Butte Creek in both normal and dry water years (Appendix B; tables 1 and 2). Three temperature metrics were considered: change in mean temperature across the simulation period; the largest change in daily maximum temperature (combined with the date of this change); and the change in the weekly mean of the daily maximum temperature (WMMT) during the hottest part of the summer (i.e. a heat storm event). The mean change in temperature is useful in characterizing long-term thermal exposure, the largest change in daily maximum gives insight into single events that could cause acute thermal stress related mortality, and WMMT is intended to characterize a significant heat storm event of sufficient duration to be a major mortality factor.

PG&E's temperature modeling indicates that in normal water years with hot meteorology, removing 5 cfs from the Hendricks canal to supply their proposed MIF of 20 cfs to lower West Branch Feather River would increase the WMMT in lower Butte Creek below the Centerville powerhouse by 0.12°C with the WMMT above the Centerville powerhouse increasing by only approximately 0.03°C (Appendix B; table 1). However, removing 15 cfs at Hendricks canal to provide a MIF of 30 cfs as specified by the Forest Service and recommended by the agencies to lower West Branch Feather River would increase the WMMT in lower Butte Creek by 0.38°C with the WMMT above the powerhouse increasing by approximately 0.11°C (Appendix B; table 1). During dry years, PG&E proposes to maintain a MIF of 7 cfs; however, again, the Forest Service condition and recommendations from FWS and Cal Fish & Game would increase this MIF in lower West Branch Feather River to 15 cfs. As a result, temperature modeling by PG&E indicates providing this 15 cfs MIF would result in a 0.28°C increase in

the WMMT downstream of the Centerville powerhouse, compared to PG&E's proposal which would result in a 0.18°C increase in the WMMT downstream of the Centerville powerhouse (Appendix B; table 2). In dry years, little increase (0.02 to 0.04°C) in the WMMT upstream of Centerville powerhouse would occur under any of the proposed, required, or recommended MIF scenarios downstream of Hendricks diversion dam. We further discuss the affects of a DeSabla forebay temperature reduction device on water temperatures within lower Butte Creek below in the *DeSabla Forebay* section.

The Conservation Groups recommendation to implement MIFs at Hendricks diversion dam only after construction of a temperature reduction device would assist in reducing the effects of increased water temperatures within Hendricks canal and in DeSabla forebay, which may result from reducing flow quantities within Hendricks canal. However, as discussed above, PG&E's proposed MIFs downstream of Hendricks diversion dam would result in only slight temperature increases within lower Butte Creek compared to the agency recommended MIFs. This indicates that if agency recommended MIFs were implemented below Hendricks diversion dam, this temperature reduction device would likely need to be constructed and in operation prior to releasing these increased MIFs so temperature effects in lower Butte Creek would be minimized.

Ensuring that any MIFs released at Hendricks diversion dam be maintained within the West Branch Feather River downstream along the natural stream course to its discharge at the high-water line of Lake Oroville and not diverting flows from the West Branch Feather River through methods under PG&E's control would ensure all aquatic resources in this reach would benefit from any minimum instream flow releases made at Hendricks diversion dam. However, the Miocene diversion dam, located approximately 14 miles downstream of the Hendricks diversion dam, is a non-project structure located outside the project boundary, which extends to, but does not include, the Miocene diversion dam. Because this facility is not subject to the terms and conditions of the license, this recommendation is unenforceable and as a result we do not discuss it further.

The Forest Service and Cal Fish & Game recommendation for PG&E to consult with the Water Board and the resource agencies to identify water rights is a State of California issue. Therefore, we do not further discuss this recommendation further.

The California Salmon and Steelhead Associations recommendation to pipe flows from Hendricks diversion dam to DeSabla powerhouse would likely reduce thermal loading and water loss compared to existing and proposed Project operations which utilize a series of canals, tunnels, and a forebay to divert water to lower Butte Creek. However, the feasibility of using a pipe to divert flows to

DeSabla powerhouse is unknown, without first conducting a thorough engineering analysis. Further, installing such a pipeline would likely be cost prohibitive.

Upper Butte Creek-Downstream of Butte Creek diversion dam

The existing license requires that PG&E release on a year-round basis, 16 cfs downstream of Butte Creek diversion dam during normal water year types and 7 cfs during dry water year types. PG&E proposes to release the MIFs shown in table 3-25 downstream of the Butte Creek diversion dam in upper Butte Creek. Table 3-25 also shows MIFs recommend by the agencies for this reach, including those contained in: Forest Service 10(a) recommendation no. 2.2, FWS 10(j) recommendation 2.2, and Cal Fish & Game 10(j) recommendation no. 1.

Table 3-25. Comparison of PG&E's existing and proposed, and agency recommended MIFs for upper Butte Creek downstream of Butte Creek diversion dam. (Source: Staff, 2008)

Upper Butte Creek Reach	**PG&E's Existing MIF (cfs) by Water Year**		**PG&E's Proposed MIF (cfs) by Water Year**		**Agency MIF (cfs) by Water Year Type[1]**	
Month	Normal	Dry	Normal	Dry	Normal	Dry
Sept.	16	7	**16**	**7**	16	10
Oct.	16	7	**16**	**7**	16	10
Nov.	16	7	**16**	**7**	16	10
Dec.	16	7	**16**	**7**	16	10
Jan.	16	7	**16**	**7**	16	10
Feb.	16	7	**16**	**7**	16	10
Mar.	16	7	**30**	**20**	30	20
Apr.	16	7	**30**	**20**	30	20
May	16	7	**30**	**20**	30	20
June	16	7	**16**	**7**	16	10
July	16	7	**16**	**7**	16	10
Aug.	16	7	**16**	**7**	16	10

1 Agencies include Forest Service, FWS, and Cal Fish & Game.

The California Salmon and Steelhead Association also recommends that the existing minimum instream flows in this reach be increased to improve cold water downstream of the diversion dam to support and maintain cold water species and their habitat during all water year types. The California Salmon and Steelhead Association further recommends that during critical dry and drought water years, all water be released downstream of the Butte Creek diversion dam and that no water be diverted at Butte canal to provide cold water for aquatic species

downstream of the diversion, including spring-run Chinook salmon in further downstream reaches.

Our Analysis

WUA versus flow relationships were developed for the upper Butte Creek reach downstream of the Butte Creek diversion dam (RM 72 to 61.9) and are presented in figure 3-33. For three of the four trout life-stages (adult, juvenile, and spawning trout habitat), WUA is maximized at discharges between 65 and 100 cfs. However, trout fry habitat is maximized at 15 cfs and continues to decrease with increasing discharge, as fry rear in slow, shallow water.

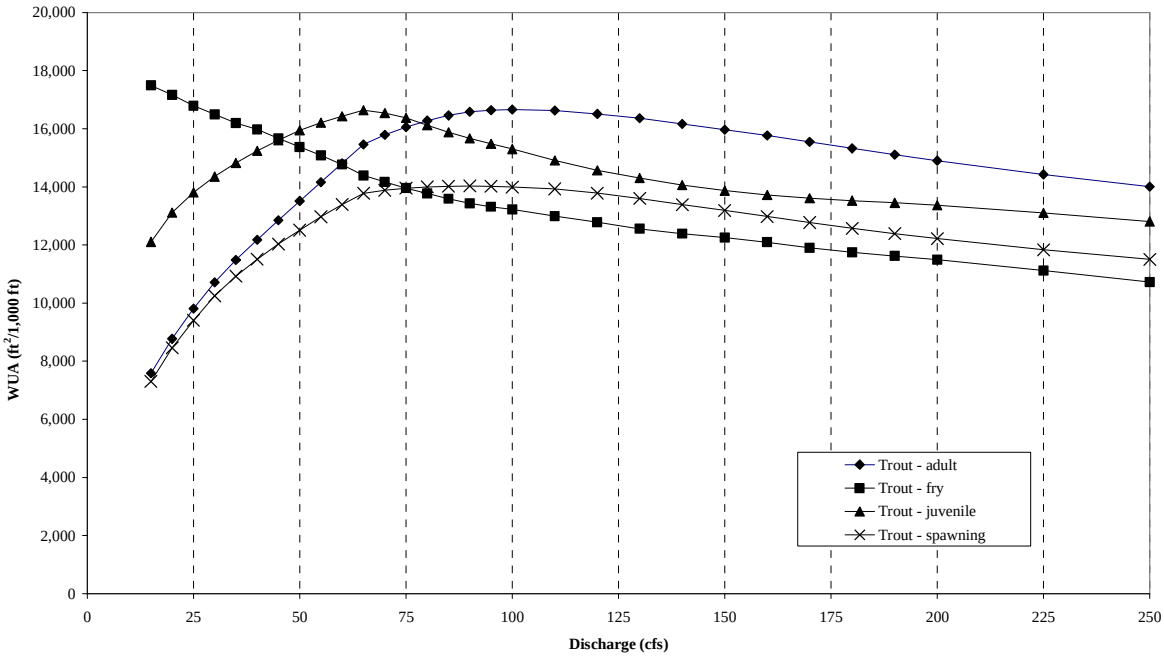

Figure 3-33. Weighted Usable Area (habitat) versus discharge (flow) relationship for spawning, adult, juvenile, and fry life stages of rainbow trout in upper Butte Creek, downstream of the Butte Creek diversion dam. (Source: PG&E, 2007a)

PG&E's proposed MIFs for this reach are consistent with existing license conditions, except PG&E proposes and the agencies recommend an increase in MIFs from March 1 to May 31 in normal years from 16 to 30 cfs, and in dry years from 7 to 20 cfs. Although this reach was not modeled below 15 cfs, in normal water years this increase in MIFs would provide approximately an additional 18 percent of the WUA for adult trout habitat, 13 percent of the WUA for juvenile habitat, and 21 percent of the WUA for trout spawning habitat compared to existing conditions (table 3-26). Adult trout habitat, juvenile habitat, and spawning trout habitat would also be increased during dry years by increasing MIFs from 7 to 20 cfs.

Table 3-26. Percent Wetted Usable Area for a given flow (shown in parentheses) in upper Butte Creek. (Source: PG&E, 2007a)

Percentage of Habitat (%WUA) Available at Flows (cfs) for Trout Lifestages are shown below from the Applicant's Final License Application (PG&E 2007).					
	Trout Lifestage % WUA at (Flow)				
Adult	100 (150)	81 (50)	64 (30)	53 (20)	46 (15)
Fry	100 (15)	98 (20)	94 (30)	88 (50)	80 (75)
Juvenile	100 (65)	96 (50)	86 (30)	79 (20)	73 (15)
Spawning	100 (90)	89 (50)	73 (30)	60 (20)	52 (15)

PG&E's MIF proposals for upper Butte Creek are consistent with recommendations from the Forest Service, FWS, and Cal Fish & Game, except during dry water year types from June 1 to February 28/29, MIFs recommended by the agencies would be increased to 10 cfs, compared to PG&E's proposal of 7 cfs. Although the reach downstream of Butte Creek diversion dam was not modeled below 15 cfs, it is likely that the agency recommended increase in MIFs below this diversion dam would increase adult trout habitat, fry habitat, juvenile trout habitat and trout spawning habitat for trout present in this reach compared to existing conditions.

PG&E conducted a variety of simulation runs for minimum flow scenarios for upper Butte Creek using SNTEMP models.[32] Simulations were produced for flows ranging between 7 and 50 cfs, at semi-monthly intervals during the warm summer period of late June through September 15. Figure 3-34 illustrates simulations for peak temperature conditions in upper Butte Creek. As shown in figure 3-34, an increase in MIFs downstream of Butte Creek diversion dam of 3 cfs would reduce temperatures downstream of this diversion in the summer months. However, this 3 cfs increase in MIFs results in only slightly cooler water temperatures compared to PG&E's proposal, and the effects of this water temperature reduction appear to be minimized downstream of RM 68, providing cooler water temperatures for only 4 to 5 miles downstream of the dam.

[32] Additional SNTEMP temperature model results are provided in the license application (PG&E, 2007a).

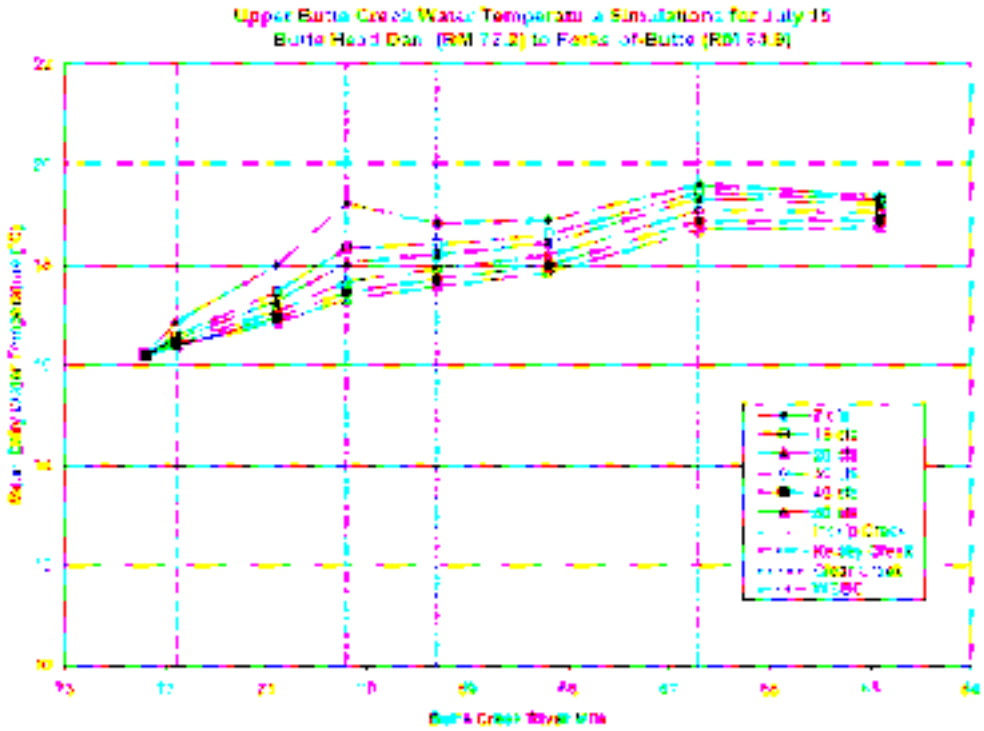

Figure 3-34. July 15 Simulation for upper Butte Creek 2005 calibration model. (PG&E, 2008b)

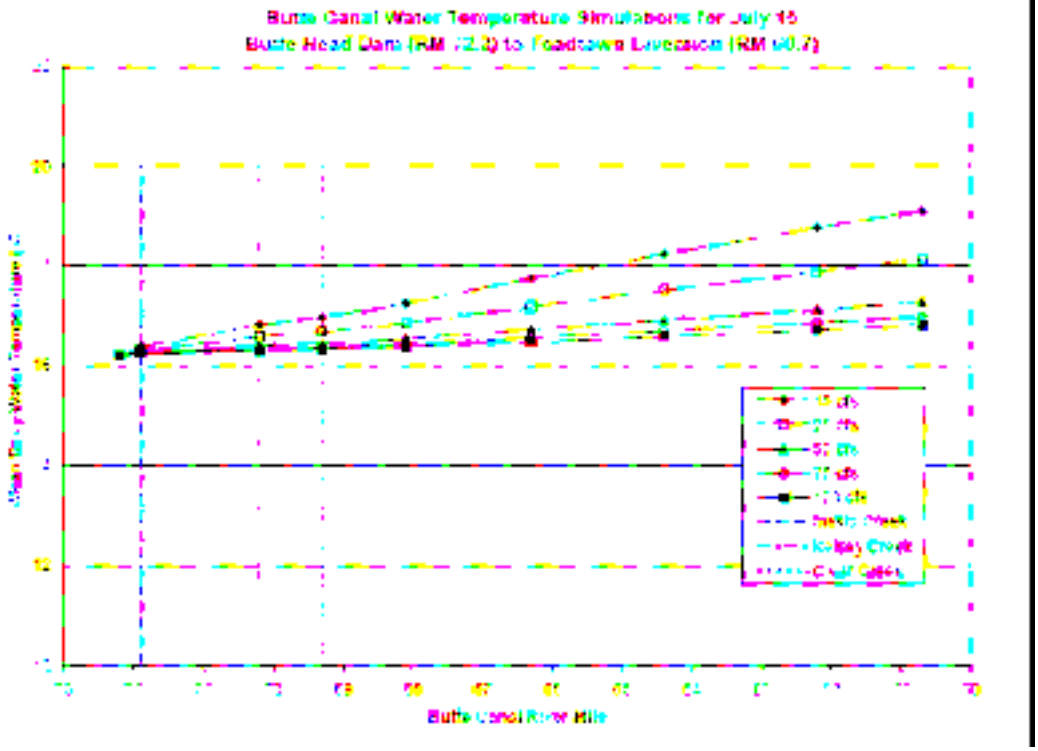

Figure 3-35. July 15 Simulation for Butte canal 2005 calibration model. (PG&E, 2008b)

By providing this additional 3 cfs downstream of the Butte Creek diversion dam, less water would be available for diversion into Butte canal, which during the warmer summer months, may result in increased thermal loading within Butte canal, and in DeSabla forebay, potentially leading to warmer water temperatures downstream of DeSabla powerhouse. Figure 3-35 demonstrates the increase in thermal loading that occurs in Butte Canal as the quantity of water diverted at the diversion dam is reduced and subsequently released as MIFs. This modeling validates other temperature monitoring conducted by PG&E which indicated thermal loading within the natural stream channel in upper Butte Creek from July through August is greater (0.37°C per mile) due to the longer travel time and increased surface area, compared to diverting water through Butte canal (0.06°C per mile). Therefore, it is likely that providing all stream flow downstream of Butte Creek diversion dam, as recommended by the California Salmon and Steelhead Association, and not diverting water through Butte canal, would result in increased water temperatures and increased negative effects on spring-run Chinook salmon in downstream reaches.

Lower Butte Creek-Downstream of Lower Centerville Diversion dam

The existing license requires that PG&E release on a year-round basis, the MIFs shown in table 3-27, downstream of Lower Centerville diversion dam. PG&E proposes to release the MIFs shown in table 3-20 downstream of Lower Centerville diversion dam in lower Butte Creek. Table 3-20 also shows MIFs recommend by the agencies for this reach, including those contained in: Forest Service 10(a) recommendation 2.1, NMFS 10(j) recommendation no. 2.1, FWS 10(j) recommendation 2.1, and Cal Fish & Game 10(j) recommendation no. 1. The California Salmon and Steelhead Association also recommends that additional daily flows and cold water be provided for spring-run Chinook salmon in this reach.

Table 3-27. Comparison of PG&E's existing and proposed, and agency recommended MIFs for lower Butte Creek downstream of Lower Centerville diversion dam. (Source: Staff, 2008)

Lower Butte Creek Reach	**Licensee's Existing MIF (cfs) by Water Year**		**Licensee's Proposed MIF (cfs) by Water Year[1]**		**Agency MIF (cfs) by Water Year Type[2]**	
Month	Normal	Dry	Normal	Dry	Normal	Dry
Sept. 1-14	40	40	**40**	**40**	100	75
Sept. 15-30	40	10	**75**	**60**	100	75
Oct.	40	10	**75**	**60**	100	75
Nov.	30	10	**75**	**60**	100	75
Dec. 1-14	30	10	**75**	**60**	100	75
Dec. 15-31	40	10	**75**	**60**	100	75
Jan.	40	10	**75**	**60**	100	75
Feb.	40	10	**80**	**75**	100	75
Mar. 1-14	40	10	**80**	**75**	100	75
Mar. 15-31	40	10	**80**	**75**	80	75
Apr.	40	10	**80**	**75**	80	75
May	40	10	**80**	**65**	80	65
June	40	40	**40**	**40**	40	40
July	40	40	**40**	**40**	40	40
Aug.	40	40	**40**	**40**	40	40

1 The Operations and Maintenance Plan implemented in 1999 and updated annually in consultation with the agencies has controlled minimum flow releases downstream of Centerville Diversion dam. June through January values are current Operations and Maintenance Plan flow targets for Lower Centerville Diversion dam during normal and dry water year types. February through May values are proposed MIF requirements for lower Centerville Diversion dam to address steelhead spawning during normal and dry water year types.

2 Agencies include Forest Service, FWS, NMFS, and Cal Fish & Game.

Our Analysis

At Lower Centerville diversion dam, water can either be released downstream of the dam into the natural channel of Butte Creek, or be diverted into the lower Centerville canal for power generation at Centerville powerhouse (figure 1-2). Study results have indicated that the short travel time of water through the canal causes minimal thermal loading and only results in minimal water temperature increases before being discharged back into Butte Creek, approximately 6.4 miles downstream of Lower Centerville diversion dam. This creates conditions where flows discharged from the powerhouse are approximately 2°C cooler during the July through August period compared to flows in Butte

Creek above the powerhouse which are exposed to greater a travel time and increased thermal loading in the natural stream channel.

W2 temperature simulations conducted by PG&E further demonstrate the effects of increasing flows at the Lower Centerville diversion dam from June through August on downstream water temperatures. As shown in Appendix A; tables 1 (normal water year) and 2 (dry water year), during the summer months, as flows are increased beyond 60 cfs at the Lower Centerville diversion dam, water temperatures are cooled in the reach above Centerville powerhouse, which would likely provide better holding habitat conditions for spring-run Chinook salmon. However, as a result of increasing flows at Lower Centerville diversion dam, water temperatures downstream of Centerville powerhouse increase 1.0 to 1.22°C in dry years, and 0.08 to 0.67°C in normal years, compared to existing conditions as cooler flows from Lower Centerville canal are reduced. Although there is less holding habitat below Centerville powerhouse, increasing flows at the Centerville diversion dam could potentially have negative effects on any fish holding in the reach downstream of Centerville powerhouse during the summer months. Additionally, further reducing temperatures above the Centerville powerhouse may result in more spring-run Chinook salmon overcrowding, preventing the utilization of spawning habitat below Centerville powerhouse since there is little redistribution of salmon to downstream areas once spawning is initiated (NMFS, 2006).

Based upon study results from 2001 through 2004, Cal Fish & Game estimated that approximately 65 percent of the observed spring-run Chinook salmon held upstream of the Centerville powerhouse and 35 percent held downstream of the powerhouse prior to initiating spawning. Butte Creek upstream of Centerville powerhouse also contains only an estimated 14 percent of the overall suitable spawning habitat in Butte Creek, with the remainder of spawning habitat occurring downstream of the Centerville powerhouse. During this same period (2001 through 2004), approximately 53 percent of these salmon spawned in the reach upstream Centerville powerhouse and 47 percent downstream of the powerhouse (NMFS, 2006).

In an effort to increase spawning habitat for spring-run Chinook salmon from mid-September through February, the annual Operations and Maintenance Plan developed by PG&E, in consultation with the agencies, has implemented increased MIFs downstream of Lower Centerville diversion dam based on an adaptive management approach. For example, during the 2007 spawning season (mid-September through February) the release at Lower Centerville diversion dam was initially set to a target flow of 60 cfs. This target flow was increased to 80 cfs after flows were held at this higher level for several days in early October due to operational problems with the diversion into the Lower Centerville canal.

Estimates indicate that at MIFs of 40, 60, 70, and 130 cfs (no water diverted at Lower Centerville canal) downstream of Lower Centerville diversion dam, the available spawning habitat upstream of Centerville powerhouse would support between 152 to 1,316, 180 to 1,566, 216 to 1,870, and 270 to 2,352 spawning spring-run Chinook salmon, respectively (NMFS, 2006). Similarly, PG&E states that their proposed MIF of 75 cfs from September 15 through January 31 would support between 228 and 1,992 spawning salmon, while the agency recommended 100 cfs MIF would support between 242 to 2,093 spawning salmon (PG&E, 2008b). Based on a seven year period (2001 through 2007) between 6,547 and 12,608 Chinook salmon attempted to spawn in this reach on an annual basis (PG&E, 2008b). This data indicates that the available spawning habitat upstream of Centerville powerhouse has been consistently over utilized in recent years, likely resulting in redd superimposition, reducing egg and pre-emergency fry mortality. Although increased MIFs from the Lower Centerville diversion dam would likely increase spawning habitat, as discussed below, it is likely that providing all flow downstream of the Lower Centerville diversion dam would not provide enough spawning habitat to accommodate the number of salmon attempting to spawn. Consistent with NMFS conclusions in the preliminary biological opinion, it appears that the spring-run Chinook salmon population has reached or exceeded its limits in this reach (NMFS, 2006).

WUA versus flow relationships were developed for the middle Butte and lower Butte sub-reaches and are presented in figures 3-36 and 3-37, respectively. The lower Butte sub-reach extended from the Honey Run Covered Bridge to Centerville powerhouse (RM 49.6 to 55.2) and the middle Butte sub-reach extended from Centerville powerhouse to Lower Centerville diversion dam (RM 55.2 to 61.8).

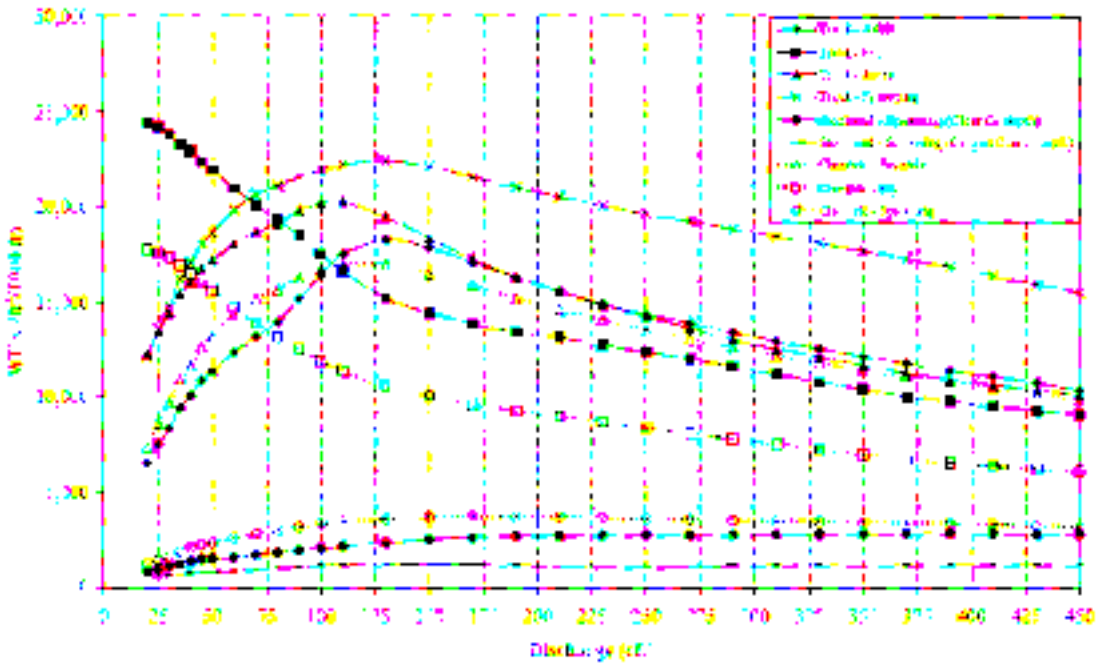

Figure 3-36. Weighted Usable Area (habitat) versus discharge (flow) relationship for nine species/life stages in the middle Butte Creek sub-reach of the lower Butte Study Area. (Source: PG&E, 2008b)

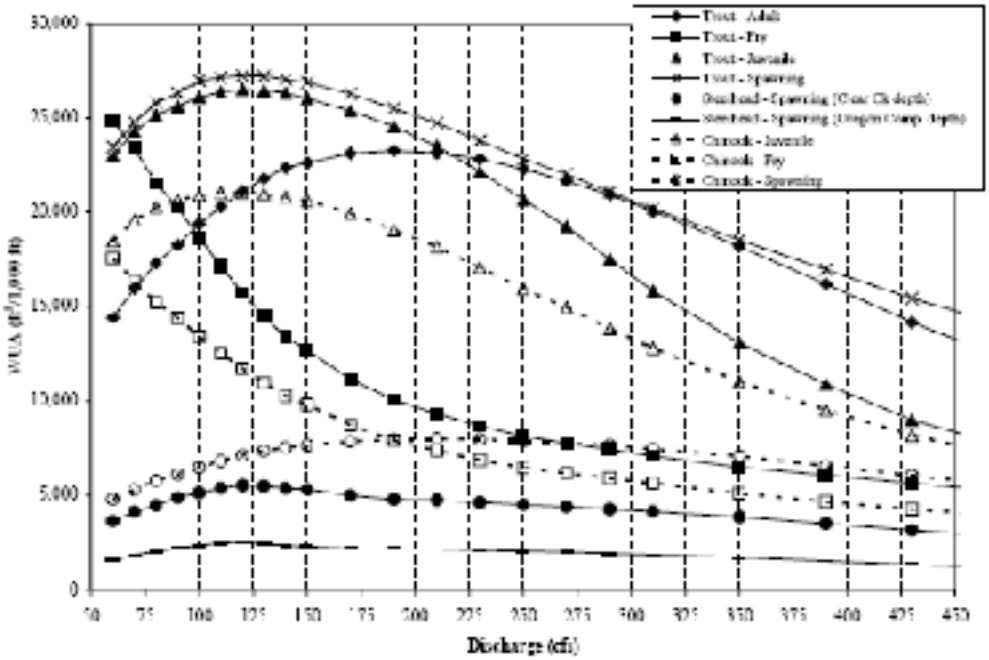

Figure 3-37. Weighted Usable Area (habitat) versus discharge (flow) relationship for nine species/life stages in the lower Butte Creek sub-reach of the lower Butte Study Area. (Source: PG&E, 2008b)

In the middle Butte sub-reach, trout (and Chinook salmon) fry habitat continues to increase with decreasing discharge, as fry rear in slow, shallow water (figure 3-36). Steelhead spawning WUA begins to flatten after 100 cfs (e.g., a 25 cfs increase in discharge result in very little increase in WUA, though it is maximized at 310 cfs using Clear Creek depth criteria and 100 cfs using Oregon composite depth criteria). Habitat for juvenile Chinook salmon peaks at about 110 cfs, while spawning habitat peaks at 170 cfs (figure 3-36). Figure 3-38 shows the habitat-discharge relationship for spawning Chinook estimated using USFWS' 2D model of only selected spawning areas (not a reach-wide assessment) above the Centerville powerhouse wherein maximum WUA continues to increase after 400 cfs but the rate of increase is very slow after 150 cfs (e.g., most of the WUA occurs at 150 cfs) (PG&E, 2008b).

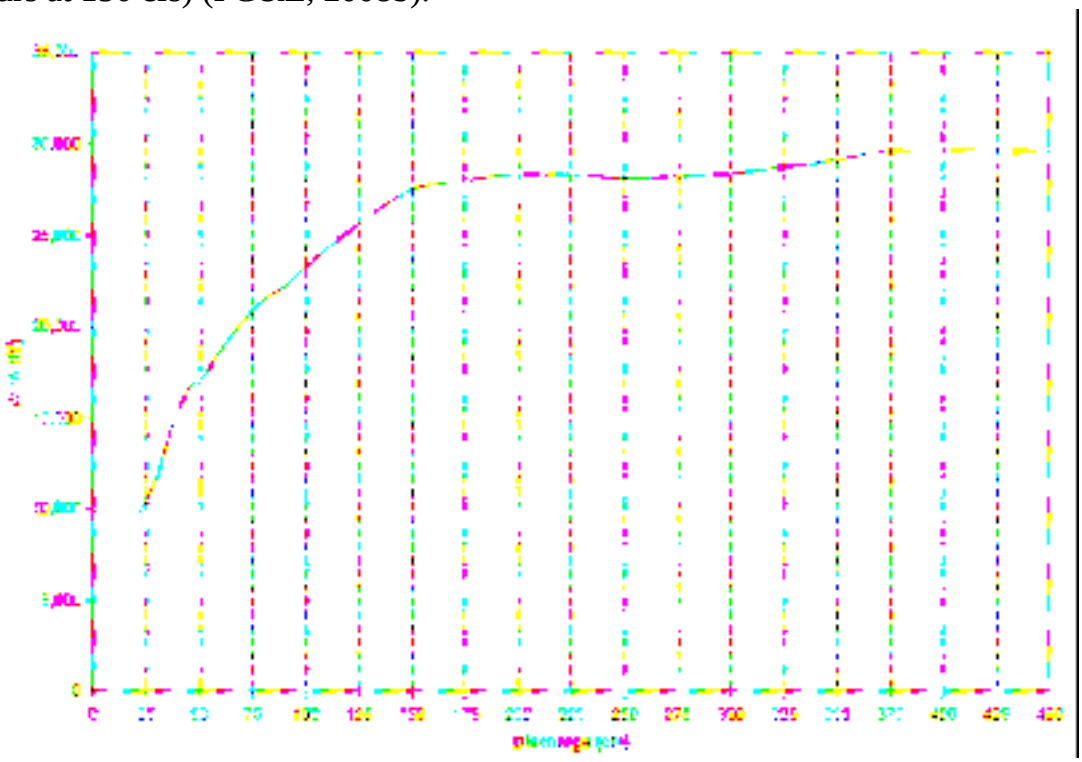

Figure 3-38. Weighted Usable Area (habitat) versus discharge (flow) relationship for spring-run Chinook salmon spawning in selected spawning areas in the middle Butte sub-reach of the lower Butte Study Area using USFWS 2D modeling data (Figure 9, Gard 2003). (Source: PG&E, 2008b)

In the middle Butte Creek reach, PG&E's proposed MIF in a normal year (75 cfs) would provide 68 percent of the WUA for spring-run Chinook salmon spawning, compared to the agency recommended MIF (100 cfs) which would provide 78 percent of the WUA for spring-run Chinook salmon spawning. The agency recommended MIF of 100 cfs would provide approximately 29, 9, and 8 percent more WUA for spring-run Chinook salmon spawning based upon PG&E's proposed MIFs of 40, 75, and 80 in a normal water year. In dry water years

PG&E's proposed MIFs of 40 and 60 cfs would provide 49 and 62 percent, respectively, of the WUA for spring-run Chinook salmon spawning. The agency recommended MIF in dry years (75 cfs) would provide 68 percent of the WUA, or a 20 percent increase in WUA for spring-run Chinook salmon spawning based upon PG&E's proposed MIF of 40 cfs, or a 7 percent increase based upon a MIF of 60 cfs.

Generally, it can be expected that improvements to Chinook salmon habitat conditions are also beneficial to steelhead. Therefore, because most steelhead spawning takes place in the middle Butte Creek sub-reach from December through April, both PG&E's proposed MIFs of 75 to 80 in normal years, and 60 to 75 cfs in dry years during December through April would provide additional spawning habitat for steelhead compared to existing conditions. However, as previously discussed, the agency recommended MIFs would provide greater flows, and therefore additional spawning habitat for this federally-listed species.

In the lower Butte sub-reach, trout (and Chinook salmon) fry habitat decreases with increasing discharge, as fry rear in slow, shallow water (figure 3-37). Steelhead spawning WUA begins to flatten after 125 to 150 cfs, depending upon whether Clear Creek or Oregon Composite depth criteria are used. Chinook salmon juvenile life stage WUA peaks at about 100 cfs, while spawning habitat continues to increase after 150 cfs, but at a very slow rate through 175 cfs (figure 3-37). Figure 3-39 shows the habitat-discharge relationship for spawning Chinook estimated using USFWS' 2D model of only selected spawning areas (not a reach-wide assessment) below the Centerville powerhouse wherein maximum WUA occurs about 190 cfs. (Source: PG&E, 2008b)

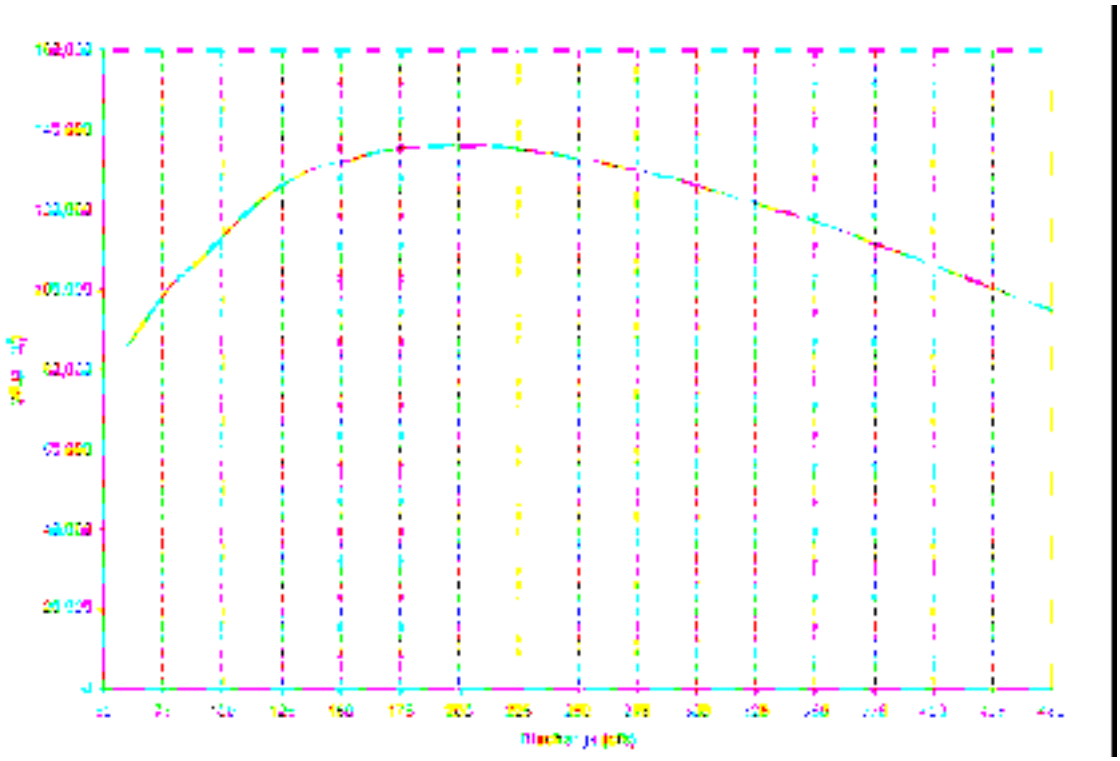

Figure 3-39. Weighted Usable Area (habitat) versus discharge (flow) relationship for spring-run Chinook salmon spawning in selected spawning areas in the lower Butte sub-reach of the lower Butte Study Area using USFWS 2D modeling data. (Source: PG&E, 2008b)

In the lower Butte sub-reach, the Forest Service, FWS, NMFS, and Cal Fish & Game recommend a MIF of 100 cfs be released after the onset of spring-run Chinook spawning activity. This 100 cfs would provide 86 percent of the maximum WUA for Chinook spawning habitat, compared to the 74 percent of the maximum WUA that would be provided with PG&E's proposed MIF of 75 cfs. In normal years, the agency recommended MIF of 100 cfs would provide an additional 21, 11, and 8 percent WUA for spring-run Chinook salmon spawning habitat in the lower Butte Creek sub-reach based on flows of 40, 75, and 80 cfs, respectively, as proposed by PG&E. In dry years, the agency required or recommended MIF of 75 cfs would provide 74 percent of the maximum WUA for spring-run Chinook salmon spawning compared to PG&E's proposal of 60 cfs which would provide 65 percent of the maximum WUA for spring-run Chinook spawning.

The agencies recommend that their increase in MIFs for spring-run Chinook spawning begin on September 1, while PG&E's proposed increase in MIFs begin on September 15. Water temperatures in Butte Creek create conditions where spring-run Chinook spawning does not begin until late September (NFMS, 2006; Hill and Webber, 1999). Therefore, it is likely that

increasing flows to increase spawning habitat would not be beneficial until mid-September.

Inskip Creek

PG&E proposes to release a MIF of 0.25 cfs, or inflow, during normal water year types, and 0.1 cfs, or inflow, during dry water year types, on a year-round basis downstream of the diversion on Inskip Creek. This proposal is consistent with MIFs under the existing license.

FWS in 10(j) recommendation no. 2.6 and Forest Service in 10(a) recommendation no. 2.6 recommend that until the time that natural flows upstream of this diversion decrease to 1 cfs, PG&E shall release a bypass flow of 1 cfs or natural flow during normal water year types and 0.5 cfs or natural flow during dry water year types.

Our Analysis

FWS and the Forest Service recommendations would provide additional flows downstream of the Inskip Creek feeder diversion compared to PG&E's proposal. These additional flows would likely provide a greater amount of habitat for aquatic organisms such as trout, benthic macroinvertebrates, and amphibians residing downstream of this diversion. However, as previously discussed, trout populations both above and below the feeder diversions are self-sustaining. In addition, existing MIFs provide good water quality with temperatures in the optimal range (15 to 18°C) for rainbow trout growth. Therefore, it is likely that PG&E's proposal to continue to release a MIF of between 0.25 and 0.1 cfs would continue to provide adequate habitat to maintain self-sustaining populations of aquatic organisms present in this bypass reach. Additionally, these differences in MIFs between PG&E's proposal and recommendations from FWS and the Forest Service create virtually no difference in the daily maximum temperature at the lower end of the upper Butte Creek reach for either 2004 or 2005 (figures 3-40 and 3-41).

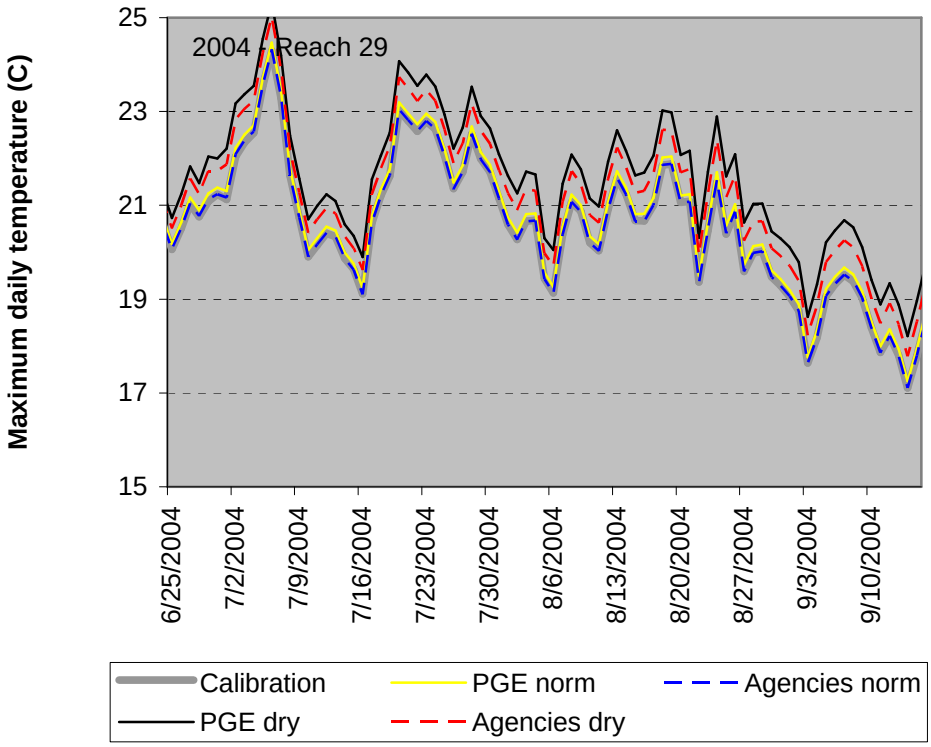

Figure 3-40. Predicted maximum daily temperature of the most downstream reach of upper Butte Creek for PG&E's and agency recommended minimum instream flow requirements for both dry and normal years for 2004. Results from the original calibration model run (actual flows for 2004) are included for comparison. (Source: Staff, 2008)

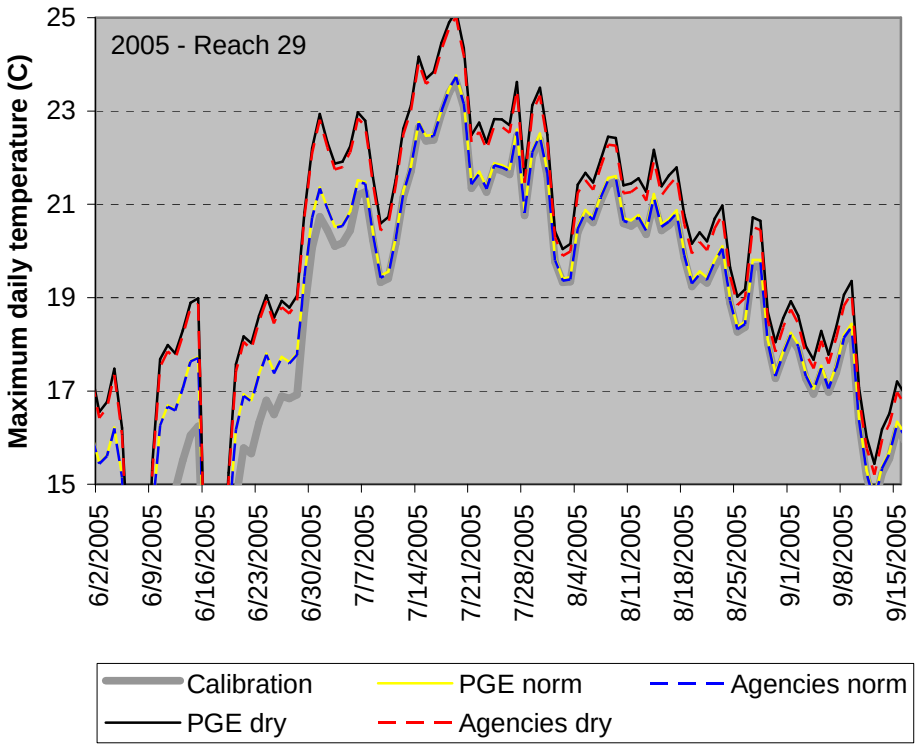

Figure 3-41. Predicted maximum daily temperature of the most downstream reach of upper Butte Creek for PG&E's and agency recommended minimum instream flow requirements for both dry and normal years for 2005. Results from the original calibration model run (actual flows for 2005) are included for comparison. (Source: Staff, 2008)

Kelsey Creek

PG&E proposes to release a MIF of 0.25 cfs, or inflow, during normal water year types, and 0.1 cfs, or inflow, during dry water year types, on a year-round basis downstream of the diversion dam on Kelsey Creek. This proposal is consistent with MIFs under the existing license.

FWS in 10(j) recommendation no. 2.6 and Forest Service in 10(a) recommendation no. 2.6 recommend that until the time that natural flows upstream of this diversion decrease to 1 cfs, PG&E would release a bypass flow of 1 cfs or natural flow during normal water year types and 0.5 cfs or natural flow during dry water year types.

Our Analysis

FWS and the Forest Service recommendations would provide additional flows downstream of the Kelsey Creek feeder diversion compared to PG&E's proposal. These additional flows would likely provide a greater amount of habitat

for aquatic organisms such as trout, benthic macroinvertebrates, and amphibians residing downstream of this diversion. However, as previously discussed, trout populations both above and below the feeder diversions are self-sustaining. In addition, existing MIFs provide good water quality with temperatures in the optimal range (15 to 18°C) for rainbow trout growth. Therefore, it is likely that PG&E's proposal to continue to release a MIF of between 0.25 and 0.1 cfs would continue to provide adequate habitat to maintain self-sustaining populations of aquatic organisms present in this bypass reach. Additionally, these differences in MIFs between PG&E's proposal and recommendations from FWS and the Forest Service create virtually no difference in the daily maximum temperature at the lower end of the upper Butte Creek reach for either 2004 or 2005 (figures 3-40 and 3-41).

Clear Creek

PG&E proposes to release a MIF of 0.5 cfs, or inflow, during normal water year types, and 0.25 cfs, or inflow, during dry water year types, on a year-round basis downstream of the diversion dam on Clear Creek. This proposal is consistent with MIFs under the existing license.

FWS in 10(j) recommendation no. 2.6 and Forest Service in 10(a) recommendation no. 2.6 recommend that until the time that natural flows upstream of this diversion decrease to 1 cfs, PG&E would release a bypass flow of 1 cfs or natural flow during normal water year types and 0.5 cfs or natural flow during dry water year types.

Our Analysis

FWS and the Forest Service recommendations would provide additional flows downstream of the Clear Creek feeder diversion compared to PG&E's proposal. These additional flows would likely provide a greater amount of habitat for aquatic organisms such as trout, benthic macroinvertebrates, and amphibians residing downstream of this diversion. However, as previously discussed, trout populations both above and below the feeder diversions are self-sustaining. In addition, existing MIFs provide good water quality with temperatures in the optimal range (15 to 18°C) for rainbow trout growth. Therefore, it is likely that PG&E's proposal to continue to release a MIF of between 0.25 and 0.1 cfs would continue to provide adequate habitat to maintain self-sustaining populations of aquatic organisms present in this bypass reach. Additionally, these differences in MIFs between PG&E's proposal and recommendations from FWS and the Forest Service create virtually no difference in the daily maximum temperature at the lower end of the upper Butte Creek reach for either 2004 or 2005 (figures 3-40 and 3-41).

Helltown Ravine

PG&E did not propose a MIF for Helltown Ravine. PG&E states that Helltown Ravine is an intermittent stream whose current flow is present only because of unused water (i.e., return flow) that is coming from the Upper Centerville canal and that a MIF is therefore unwarranted (PG&E, 2008).

FWS in 10(j) recommendation no. 2.6 and Forest Service in 10(a) recommendation no. 2.6 recommend that until the time that natural flows upstream of this diversion decrease to 1 cfs, PG&E would release a bypass flow of 1 cfs or natural flow during normal water year types and 0.5 cfs or natural flow during dry water year types. FWS and Forest Service further recommend, that once natural flows upstream of this diversion reach 1 cfs, PG&E would stop diverting water.

The Conservation Groups recommend that if the Commission does not adopt the Conservation Groups' proposed preferred alternative, then PG&E shall provide a minimum bypass flow of 1 cfs in Helltown Ravine downstream of Lower Centerville canal to benefit a known population of foothill yellow-legged frogs (foothill yellow-legged frog).

Our Analysis

Upper Centerville canal has not been used for Project operations for many years and currently carries only a few cfs for local water users. Water can be released from the end of Upper Centerville canal where it discharges directly into Helltown Ravine. Historically, Helltown Ravine was used as an alternate route to carry flows from Upper Centerville canal to Centerville powerhouse when the DeSabla powerhouse was offline. PG&E states in their reply comments to recommendations, preliminary terms and conditions, that any unused water from Upper Centerville canal travels down Helltown Ravine until it is intercepted by the Helltown diversion dam and flows into Lower Centerville canal where it is picked up for generation. Water that is not diverted into Lower Centerville canal continues to flow through Helltown Ravine until it discharges into Butte Creek upstream of the Centerville powerhouse. Further, FWS states in their justification for 10(j) recommendation no. 2.6 that all of the current flows in Helltown Ravine are diverted into Lower Centerville canal (NMFS, 2008).

During preliminary field observations by PG&E, observations indicated that immediately downstream of the Lower Centerville canal diversion dam, Helltown Ravine was dewatered with water occurring only in pools from subterranean inflow. Also during these observations, many foothill yellow-legged frog s and California newts were observed, as well as a trout. Because Project

operations can potentially dewater the bypass reach in Helltown Ravine, recommendations by FWS and Forest Service for a MIF of 1 cfs or natural flow during normal water year types and 0.5 cfs or natural flow during dry water year types would ensure the bypass reach in Helltown Ravine would not become dewatered as a result of Project operations. Providing this MIF would also provide habitat for amphibians, trout, and other aquatic species present.

The Conservation Groups recommend that if the Commission does not adopt the Conservation Groups' proposed preferred alternative, then PG&E shall provide a minimum bypass flow of 1 cfs in Helltown Ravine downstream of Lower Centerville canal to benefit a known population of foothill yellow-legged frogs (foothill yellow-legged frog). This recommendation from the Conservation Groups is similar to that recommended by FWS and the Forest Service during normal years; however, this recommendation by the Conservation Groups would provide an additional amount of flow, and therefore, additional habitat during dry water year types.

Long Ravine

PG&E proposes to release a MIF of 0.5 cfs, or inflow, during normal water year types, and 0.25 cfs, or inflow, during dry water year types, on a year-round basis downstream of the diversion dam on Long Ravine. This proposal is consistent with MIFs under the existing license.

The Forest Service in 4(e) condition no. 18.1 specifies, and FWS in 10(j) recommendation no. 2.6 and Cal Fish & Game in 10(j) recommendation no. 1 recommend that PG&E release a year-round bypass flow of 1 cfs or natural flow, during normal water year types and 0.5 cfs or natural flow, during dry water year types.

In its July 30, 2008, alternative 4(e) conditions filed with the Forest Service, PG&E restates their original proposal contained in their license application, and as described above.

Our Analysis

Forest Service requirements and recommendations from FWS would provide additional flows downstream of the Long Ravine diversion dam compared to PG&E's proposal. These additional flows would likely provide a greater amount of habitat for aquatic organisms such as trout, benthic macroinvertebrates, and amphibians residing downstream of this diversion. However, as previously discussed, trout populations both above and below the feeder diversions are self-sustaining. In addition, existing MIFs provide good water quality with

temperatures in the optimal range (15 to 18°C) for rainbow trout growth, and are similar both upstream and downstream of the diversion dam. Therefore, it is likely that PG&E's proposal to continue to release a MIF of between 0.25 and 0.1 cfs would continue to provide adequate habitat to maintain self-sustaining populations of aquatic organisms present in this bypass reach.

Cunningham Ravine

PG&E proposes to release a MIF of 0.25 cfs, or inflow, during normal water year types, and 0.1 cfs, or inflow, during dry water year types, on a year-round basis downstream of the diversion dam on Cunningham Ravine. This proposal is consistent with MIFs under the existing license. FWS in 10(j) recommendation no. 2.6 and Cal Fish & Game in 10(j) recommendation no. 1 recommend that PG&E release a bypass flow of 1 cfs or natural flow during normal water year types and 0.5 cfs or natural flow during dry water year types.

The Forest Service specifies in 4(e) condition no. 18.1 that PG&E release a mean daily flow of 1 cfs or the natural flow in all water year types.

In its July 30, 2008, alternative 4(e) conditions filed with the Forest Service, PG&E restates their original proposal contained in their license application, and as described above.

Our Analysis

Forest Service requirements and recommendations from FWS and Cal Fish & Game would provide additional flows downstream of the Cunningham Ravine diversion dam compared to PG&E's proposal. These additional flows would likely provide a greater amount of habitat for aquatic organisms such as trout, benthic macroinvertebrates, and amphibians residing downstream of this diversion. However, as previously discussed, trout populations both above and below the feeder diversions are self-sustaining. In addition, existing MIFs provide good water quality with temperatures in the optimal range (15 to 18°C) for rainbow trout growth, and are similar both upstream and downstream of the diversion dam. Therefore, it is likely that PG&E's proposal to continue to release a MIF of between 0.25 and 0.1 cfs would continue to provide adequate habitat to maintain self-sustaining populations of aquatic organisms present in this bypass reach.

Little West Fork

PG&E proposes to release a MIF of 0.25 cfs, or inflow, during normal water year types, and 0.1 cfs, or inflow, during dry water year types, on a year-

round basis downstream of the diversion dam on Little West Fork Creek. This proposal is consistent with MIFs under the existing license.

FWS in 10(j) recommendation no. 2.6 and Cal Fish & Game in 10(j) recommendation no. 1 recommend that until the time that natural flows upstream of this diversion decrease to 1 cfs, PG&E would release a bypass flow of 1 cfs or natural flow during normal water year types and 0.5 cfs or natural flow during dry water year types.

The Forest Service specifies in 4(e) condition no. 18.1 that PG&E release a mean daily flow of 1 cfs or the natural flow in all water year types.

In its July 30, 2008, alternative 4(e) conditions filed with the Forest Service, PG&E restates their original proposal contained in their license application, and as described above.

Our Analysis

Forest Service requirements and recommendations from FWS and Cal Fish & Game would provide additional flows downstream of the Long Ravine diversion dam compared to PG&E's proposal. These additional flows would likely provide a greater amount of habitat for aquatic organisms such as trout, benthic macroinvertebrates, and amphibians residing downstream of this diversion. However, as previously discussed, trout populations both above and below the feeder diversions are self-sustaining. In addition, existing MIFs provide good water quality with temperatures in the optimal range (15 to 18°C) for rainbow trout growth, and are similar both upstream and downstream of the diversion dam. Therefore, it is likely that PG&E's proposal to continue to release a MIF of between 0.25 and 0.1 cfs would continue to provide adequate habitat to maintain self-sustaining populations of aquatic organisms present in this bypass reach.

Little Butte, Stevens, Emma Ravine, Coal Claim Ravine, and Oro Fina Ravine Creeks

PG&E proposes to remove five feeder diversions since use of these feeder diversions have been discontinued and not used for over 10 years. These feeder diversions include: Oro Fina Ravine, Emma Ravine, and Coal Claim Ravine feeders on the Lower Centerville canal; Stevens Creek feeder on the Butte canal; and Little Butte Creek feeder on the Hendricks canal. This proposal is consistent with Cal Fish & Game in 10(j) recommendation no. 9, which further recommends that PG&E obtain all necessary permits and approvals to remove these five diversion facilities. Cal Fish & Game also recommends that PG&E should notify

the Water Board of the need to amend their water right to remove these points of diversion and that PG&E notify Cal Fish & Game prior to any ground disturbing activities.

The Forest Service in 10(a) recommendation no. 3 and FWS in 10(j) recommendation no. 3 recommend that PG&E develop and implement a Feeder Creek Diversion Facility Removal Plan in consultation with the resource agencies to address the removal of the following diversions in the Butte Creek watershed: Stevens Creek, Oro Fina Ravine, Emma Ravine, and Coal Claim Ravine creeks. We further discuss this plan and how the removal of these feeder diversions may affect water quality below.

FWS in 10(j) recommendation no. 2.6 and Forest Service in 10(a) recommendation no. 2.6, recommend, that until the time that natural flows upstream of the Little Butte Creek diversion decrease to 1 cfs, PG&E shall release a bypass flow of 1 cfs or natural flow during normal water year types and 0.5 cfs or natural flow during dry water year types.

Our Analysis

Because the feeder diversions on Little Butte, Stevens, Emma Ravine, Coal Claim Ravine, and Oro Fina Ravine creeks have not been in operation for over 10 years, PG&E is proposing to remove these diversions. PG&E's proposal, consistent with Cal Fish & Game's 10(j) recommendation no. 9, to remove the Project feeder diversions on Oro Fina Ravine, Emma Ravine, Coal Claim Ravine, Stevens Creek, and Little Butte Creek would restore the natural hydrology to these feeder creeks, and improve passage for aquatic organisms inhabiting these creeks. It is likely that the process of removing these feeder diversions, as proposed by PG&E and as recommended by Cal Fish & Game, would require instream and ground disturbance which could lead to increased turbidity levels, and potential negative effects on downstream water quality, as discussed below.

FWS in 10(j) recommendation no. 2.6 and Forest Service in 10(a) recommendation no. 2.6 recommend that PG&E provide a MIF downstream of the Little Butte Creek diversion dam, as described above. However, we note that PG&E proposes to remove this feeder diversion along with the four others that are also no longer used. As discussed above, removing this diversion would allow for stream flows in this reach to return to natural conditions and eliminate any Project-related effects on this creek, or the need for a MIF.

Developing and implementing a Feeder Creek Diversion Facility Removal Plan, as recommended by the Forest Service and FWS, would allow for a removal schedule and methods for removal to be developed, as well for mitigation

measures to be developed to reduce potential environmental effects such as increases in instream turbidity or sedimentation levels. Including Little Butte Creek in the Feeder Creek Diversion Facility Removal Plan would also minimize any negative effects on aquatic resources in this creek, as discussed above. Further, Cal Fish & Game's recommendation for PG&E to provide notification prior to any ground disturbance related to removing the diversions would allow for Cal Fish & Game to be made aware of these efforts that could potentially affect aquatic resources in the bypass reach.

Ramping Rates

Ramping rates are the rate at which flow is changed when moving from one MIF release level to another. Rapid flow reductions in a stream channel could potentially desiccate aquatic habitat or strand fish and other aquatic organisms in areas of the channel that are relatively low-gradient, or where pockets or side channels exist in the river channel. Smaller juvenile fish (less than about 2 inches long) are most vulnerable to potential stranding due to weaker swimming ability and preference for shallower, near-shore areas with slower velocities in a stream channel. Up-ramping flows generally do not affect fish stranding; however, the magnitude of flow change both upward and downward can affect fish behavior and habitat use, as well as affect production of benthic macroinvertebrates, which are an important source of food for most fish species. Rapid changes in flow also can affect benthic macroinvertebrates, which become vulnerable to stranding and drift. Similarly, during relicensing studies conducted by PG&E, populations of foothill yellow-legged frogs (foothill yellow-legged frog s) were observed throughout the Project area in both Butte Creek and the West Branch Feather River; therefore, also making early life stages of foothill yellow-legged frog egg masses or tadpoles susceptible to up- or down-ramping rates caused by Project operations.

Currently, the only ramping rates implemented in Project-affected stream reaches are those specified by the annual Operations and Maintenance Plan developed in consultation with the resource agencies under which PG&E has operated from 1999 through present. Under these annual plans, a ramping rate of 0.1 ft/hour change in water surface elevation has been implemented since 2005 from mid-November through July downstream of Lower Centerville diversion dam on Butte Creek. These ramping rates are implemented to protect federally-listed salmonid fry, which are present in this reach from November (spring-run Chinook) through July (steelhead). However, from August through mid-November the plan states lower Centerville canal flow restoration events are unlikely and that if higher ramping rates are desirable, PG&E would consult with Cal Fish & Game and NMFS to determine appropriate ramping rates.

NMFS recommends in 10(j) recommendation no. 2, that during up-ramping, PG&E shall control ramping in lower Butte Creek so that velocity does not change more than 0.2 feet per second per hour. NMFS states that these recommended ramping rates would be protective of amphibian species and that because these ramping rates mimic the natural hydrograph, they would also protect steelhead and spring-run Chinook salmon present in lower Butte Creek.

The Forest Service specifies in 4(e) condition no. 18.5 and FWS recommends in 10(j) recommendation no. 2 that if sufficient water is not available to hold stream stage levels constant during periods when foothill yellow-legged frog egg masses are present in lower West Branch Feather River, downstream of Hendricks diversion dam, the flow releases shall be based on combined conditions of water velocity and stage in foothill yellow-legged frog breeding areas. Further, FWS recommends and the Forest Service specifies: (1) if eggs are laid at a high flow level, then during down-ramping, stage changes shall not occur at a rate greater than 0.2 foot per second per hour at the egg mass site and water levels shall not drop to the extent that more than 20 percent of egg masses are de-watered; (2) during up-ramping, velocity shall not change more than 0.2 foot per second per hour and shall not exceed 0.8 foot per second at the egg mass site; and (3) when foothill yellow-legged frog tadpoles or juveniles are present, the up- and down-ramping rate shall be 0.4 foot per second per hour or less and shall not exceed 1 foot per second at the site. The Forest Service in 10(a) recommendation no. 2 and FWS, recommend the ramping rate provisions described above also be applied to upper Butte Creek, downstream of the Butte Creek diversion dam, and in lower Butte Creek, downstream of Lower Centerville diversion dam.

Consistent with Forest Service 4(e) condition no. 18.5, FWS recommends in 10(j) recommendation no. 2, that the information from monitoring of foothill yellow-legged frog populations as recommended in FWS's 10(j) recommendation no. 7, and as specified by Forest Service 4(e) condition no. 20, be used to determine the timing and to assess the level of allowable stream flow change that causes minimal loss of foothill yellow-legged frog egg masses or tadpoles. Also, the Forest Service specifies, and FWS recommends, that results from the Fish and foothill yellow-legged frog Monitoring Plans, as discussed below, be reviewed by the resource agencies and the Commission to determine if their required and recommended ramping criteria is protective of the fish and foothill yellow-legged frog populations in the Project reaches or if there is a need for modification. We discuss these measures pertaining to fish monitoring below and foothill yellow-legged frog monitoring in section 3.3.3.3, *Terrestrial Resources*.

The Forest Service specifies, and FWS and NMFS further recommend, that in the event that monitoring during the term of the license identifies the need for

modifications to the ramping rates, PG&E shall consult with the resource agencies to establish more appropriate ramping rates.

The Conservation Groups in their recommendation no. 8, recommend that PG&E time canal maintenance outages on Butte and Hendricks/Toadtown canals to take place as early in the spring as is it is reasonably safe to do so, in order to prevent scouring or dewatering of foothill yellow-legged frog egg masses in the West Branch Feather River downstream of Hendricks diversion dam.

In its alternative 4(e) conditions filed with the Forest Service, PG&E proposes that to protect foothill yellow-legged frog populations and address ramping rates, they would:

- Schedule outages as early in the year as possible to avoid the foothill yellow-legged frog breeding and rearing season;
- Changes in releases at the diversion will be avoided at critical times in the life history of foothill yellow-legged frog ;
- Up-ramping, while taking the canal off-line after a seasonal maintenance outage, and down-ramping, while bringing the canal back online after a seasonal maintenance outage, will occur slowly in order to avoid the potential for dislodging foothill yellow-legged frog egg masses, or flushing or stranding tadpoles, as well as the potential for other ecological impacts;
- Should an unscheduled emergency outage occur during foothill yellow-legged frog tadpole rearing, down-ramping, while bringing the canal back online, will occur slowly in order to allow tadpoles the opportunity to move with the waterline and avoid stranding;
- Up-ramping and down-ramping rates under the above conditions shall be limited to:
    - April-October-0.1 ft per hour
    - November-March-0.2 ft per hour

PG&E further proposes in their alternative 4(e) condition that in the case of equipment malfunction, emergency and law enforcement activity, and critical electric system emergencies beyond the control of PG&E, PG&E would communicate with the Forest Service as soon as practicable.

Our Analysis

Fluctuations in Project-related flows may result in dramatic changes over the short-term to the wetted-perimeter of stream channels. The magnitude and temporal progression of the change is a function of the stream channel morphology, and the extent of flow fluctuations in the reach. Impacts associated with ramping are variable, depending on the aquatic species present, life-stage, and timing or duration of the ramping event. Limiting ramping rates would

decrease the potential for stranding of aquatic organisms to occur in shallow areas, and lessen the potential to disrupt these organisms, including salmonid fry and foothill yellow-legged frog s, inhabiting shallow edge water habitats.

High flows such as those caused by storms, runoff, or uncontrolled Project-related flows have been shown to scour foothill yellow-legged frog egg masses from the substrate (Ashton et al., 1998). Studies have also shown that broad, shallow channels, with stable large boulder substrates that do not move during high flows are necessary for the successful reproduction of foothill yellow-legged frog , which can often conflict with habitat conditions needed for the benefit of salmonids (i.e., high volume spring releases to trigger smolt migration) (Kupferberg, 1996).

The Forest Service, FWS, and NMFS state their respective conditions and recommendations are based upon studies which indicate reducing changes in both river stage and water velocity are important to protect foothill yellow-legged frog populations in natural stream conditions, with changes in velocity being more important than stage when ramping up flows, and that changes in stage where de-watering is possible has a greater effect on foothill yellow-legged frog survival than changes in velocity. Therefore, these agencies state their respective conditions and recommendations are based upon both a rate of change and maximum velocity for the protection of both foothill yellow-legged frog egg masses and tadpoles, which are vulnerable to stranding during down-ramping and detachment from the substrate during high flows. Establishing ramping rates based upon changes in velocity could be accomplished by determining the relationship between the change in stage at a Project diversion and the resulting downstream stream flow velocities at locations such as foothill yellow-legged frog egg mass and tadpole sites, which could be located through population monitoring studies. It is likely a plan would need to be developed for addressing methodologies to determine this relationship between Project operations and subsequent downstream water velocities, and for being able to document compliance with these velocity based ramping rates.

It is likely that PG&E's proposed ramping rates in their alternative 4(e) condition would be more protective of foothill yellow-legged frog s downstream of the Hendricks diversion dam compared to existing conditions since no ramping rates currently exist. However, the Forest Service specified and FWS recommended approach to ramping rates would allow for more of an adaptive management approach. This approach would allow for the effects of their specified ramping rates on foothill yellow-legged frog populations to be evaluated to determine the need for any modifications to these ramping rates that would better protect foothill yellow-legged frog populations. Further, the Forest Service and FWS approach could also potentially allow for ramping rates to be modified

in a reach by reach basis, depending upon foothill yellow-legged frog habitat and population conditions.

The degree to which these proposed and recommended changes in project operations adversely affect foothill yellow-legged frog populations is unknown. Monitoring the effect of flow releases on foothill yellow-legged frog populations would be needed to determine whether proposed changes in project operation adversely affect foothill yellow-legged frog s, and to develop measures such as modified ramping rates that may be warranted to reduce adverse effects. As discussed below in section 3.3.3.2, *Terrestrial Resources*, Forest Service 4(e) condition no. 18.5 and FWS 10(j) recommendation no. 2 support monitoring foothill yellow-legged frog populations, which would allow for an assessment of the affects of any required ramping rates on these populations. If ramping rates were determined to be negatively affecting foothill yellow-legged frog s, the information gathered as a result of this foothill yellow-legged frog population monitoring would help support potential modifications to the ramping rates. Consulting with the resource agencies, as specified by the Forest Service and recommended by NMFS and FWS, on any proposed modifications to the ramping rates would ensure a collaborative approach with input from the agencies.

PG&E also proposes in their alternative 4(e) conditions to schedule canal outages as early in the year as possible to avoid the foothill yellow-legged frog breeding and rearing season, and to implement changes in releases at the diversion to avoid critical times in the life history of foothill yellow-legged frog . These proposals would likely further protect foothill yellow-legged frog populations downstream of Hendricks diversion dam by minimizing effects on the critical life stages such as the egg and tadpole stages. Based upon the life history of foothill yellow-legged frog s in the Project area, completing canal outages prior to the breeding season, which typically begins in May, would benefit the frog.

PG&E further proposes in their alternative 4(e) condition that in the case of equipment malfunction, emergency and law enforcement activity, and critical electric system emergencies beyond the control of PG&E, PG&E would communicate with the Forest Service as soon as practicable. Providing this notification would allow for a rapid response by the Forest Service to take any actions deemed necessary to protect resources on Nation Forest Service Lands downstream of the Hendricks diversion dam on the lower West Branch Feather River.

Water Year Type

PG&E proposes that a dry water year is any 12-month period beginning May 1 in which the natural runoff of the Feather River at Oroville for the April 1

to July 31 period, as forecast on April 1 by the State of California Department of Water Resources (Water Resources), and as may be adjusted by the State on May 1, will be 50 percent or less of the average for such period as computed by the State for the 50-year period used at the time. If during a designated dry water year the February 1 or later water year prediction indicates that dry water year conditions no longer prevail, PG&E proposes to resume normal year flow releases immediately upon notification by Cal Fish & Game. This proposal is consistent with Cal Fish & Game 10(j) recommendation no. 10, FWS 10(j) recommendation no. 2, NMFS 10(j) recommendation no. 2, and Forest Service 4(e) condition no. 18; however, FWS and NMFS further recommend that each February through May, PG&E would determine the water year type based on the Water Resources Bulletin 120 water year forecast and operate for that month based on that forecast, with the May forecast being used to establish the final water year type for the remaining months of the water year. FWS and NMFS also further recommend that the water year type for the months of October through January shall be based on the DWR's Full Natural Flow record for the Feather River at Oroville for the preceding water year.

The Forest Service in 4(e) condition no. 18, FWS in 10(j) recommendation no. 2, Cal Fish & Game 10(j) recommendation no. 10, and NMFS in 10(j) recommendation no. 2 further require or recommend that a normal water year type is any 12-month period beginning May 1 in which the natural runoff of the Feather River at Oroville for the April 1 to July 31 period, as forecast on April 1 by the DWR, and as may be adjusted by the DWR on May 1, will be greater than 50 percent of the average for such period as computed by the DWR for the 50-year period used at the time. If during a designated normal year the February 1 or later water year prediction indicates that normal year conditions no longer prevail, PG&E would resume dry water year flow releases immediately upon this determination.

The Forest Service further specifies and Cal Fish & Game, FWS and NMFS further recommend that PG&E provide notice to the resource agencies and the Commission of the final water year type determination within 30 days of making the determination.

Forest Service in 4(e) condition no. 18, FWS and NMFS recommend in their respective 10(j) recommendation no. 2, and Cal Fish & Game in 10(j) recommendation no. 8, recommend that by March 10 of the second or subsequent Dry water year, PG&E notify the resource agencies of drought concerns and by May 1 of these same years, consult with the resource agencies to discuss the Project's operational plans to manage the drought conditions. If the parties agree on a revised operational plan ("drought" plan), then PG&E may begin implementing the revised operational drought plan as soon as it files

documentation of the agreement with the Commission. If unanimous agreement is not reached, then the PG&E would submit the revised proposed operational drought plan (that incorporates as many of the resource agencies' issues as possible and any assenting and dissenting comments) to the Commission, request expedited approval, and implement the proposed drought plan until directed otherwise by the Commission.

In response to the Forest Service 4(e) condition no. 18, PG&E proposes minimum instream flows triggered by the water year type (as determined by the Water Resources' publication of Bulletin 120 April through July Forecast) be implemented within two business days after Bulletin 120 is published. PG&E states the Water Resources tends to publish (via email) the Bulletin 120 April through July Forecast on the 8th day of the month during February, March, April and May; however, the date of publication sometimes varies, hence the need for an implementation date that is referenced to the actual date of publication of Bulletin 120 (PG&E, 2008). Also in response to Forest Service 4(e) condition no. 18, PG&E proposes that: (1) they should notify the Forest Service and other interested governmental agencies of their drought concerns by March 15 of the second or subsequent dry water year; and (2) consultation with the Forest Service and other interested governmental agencies should occur by May 15 of the same years (PG&E, 2008). PG&E states that Water Resources' Bulletin 120 April through July Forecasts are typically not available until about the 8th day of March and May. PG&E further states the extra days will have no effect upon operations in March, but most importantly, this schedule will allow consultation with the agencies in May to include the results of Water Resources' final April through July Forecast for the year, as determined by around May 8 of each year when the Water Resources typically publishes Bulletin 120.

Our Analysis

PG&E's proposed criteria used to determine wet and normal water year types are mainly consistent with those specified by the Forest Service and those recommended by Cal Fish & Game, FWS, and NMFS. Basing MIF releases on natural runoff forecasts for the April 1 to July 31 period from the Water Resources would ensure ample water is available in any given year to make the appropriate MIFs releases previously discussed. Also, utilizing the February 1 or later water year prediction to potentially modify the water year type upon notification from Cal Fish & Game would further ensure appropriate MIFs are being released. These criteria would also ensure water storage within Round Valley and Philbrook reservoirs were not compromised as a result of releasing too much water during dry conditions.

Implementing MIF's triggered by the water year type within two business days after Bulletin 120 is published, as proposed by PG&E in response to the Forest Service 4(e) conditions would allow for the appropriate MIF's to be quickly adjusted and released. It is assumed that the intent of the Forest Service's 4(e) and PG&E's proposal in their response to the 4(e) conditions are the same. In many instances, a delay in the publication of Bulletin 120 could potentially impact decisions of water year types and MIFs; therefore, triggering an implementation date that is referenced to the actual date of publication of Bulletin 120 as proposed by PG&E would be more practical that triggering implementation off a date that may not be met by Water Resources or a date in which PG&E has no control of.

Providing notification to the Commission, and the resource agencies, of the final water year type determination within 30 days of making the determination, as specified by the Forest Service, and recommended by Cal Fish & Game, FWS and NMFS, would ensure the Commission and agencies were aware of the MIFs to be released.

Drought conditions in the Project area have the potential to decrease the quantity of water available to operate the Project and to increase water temperatures, which may have negative affects upon aquatic species in the Project area. Currently, the Project operates such that water is stored and released from Round Valley Reservoir, followed by the release of water from Philbrook Reservoir as temperatures warm during the summer months, as previously discussed. Providing notification to the resource agencies and the Commission of potential drought conditions and consulting with the resource agencies as specified by the Forest Service and recommended by FWS, NMFS, and Cal Fish & Game, would allow for potential changes to Project operations to be considered that may be necessary to protect aquatic resources prior to prolonged drought conditions and the onset of extreme summer temperatures. Such consultation would likely involve discussing how best to manage reduced water quantities in the Project reservoirs and minimum instream flows as they pertain to protecting aquatic resources in the Project area, including spring-run Chinook salmon in lower Butte Creek. Any proposed changes to Project operations as a result of any drought related consultation would need to be filed with the Commission for approval, prior to implementation.

The Forest Service specifies, and FWS, NMFS, and Cal Fish & Game recommend that PG&E provide notification of drought conditions by March 10 of the second or subsequent Dry water year, and to consult with these agencies by May 1. PG&E in response to Forest Service 4(e) conditions proposes notification of drought concerns should occur by March 15 of the second or subsequent dry water year and that consultation should occur by May 15 of the same years. Again, we assume that the intent of the Forest Service's 4(e) and PG&E's proposal

in their response to the 4(e) conditions are the same. Providing notification and consulting by May 15 would ensure the Water Resources' Bulletin 120 April through July forecasts are available since PG&E states that are not available until about the 8th day of March and May. This would also allow consultation with in May to include the results of Water Resources' final April through July forecast for the year.

Alternatively, a revised operational plan ("drought" plan) developed in consultation with the resource agencies, as recommended by the Forest Service and recommended by FWS, NMFS, and Cal Fish & Game would allow for a revised project operations protocol to be in place prior to the onset of multiple dry water years. However, we note that such a plan would need to be filed with the Commission prior to implementation and that any potential changes to Project operations as deemed necessary by the Commission would be made, regardless of any agreement between PG&E and the agencies.

Instream Flow and Reservoir Level Monitoring

Compliance measures such as flow monitoring allows the Commission to ensure that a licensee complies with environmental requirements such as MIFs or ramping rates of a license. Currently, MIFs are measured at the gages identified in table 3-1.

Consistent with FWS 10(j) recommendation no. 17, NMFS 10(a) recommendation no. 2, and Cal Fish & Game 10(j) recommendation no. 5, PG&E proposes to install and maintain, a flow data logger for measuring stream flow downstream of Hendricks diversion dam on the West Branch Feather River, a real-time flow gaging station upstream of Butte Creek diversion dam, and to modify the existing stream gaging station near Lower Centerville diversion dam for real-time data access. PG&E proposes to consult with the United States Geological Survey (USGS) to site, maintain and report information from these gages. The Forest Service in 10(a) recommendation no. 16 also recommends that PG&E install and maintain a gaging station upstream of the Butte Creek diversion dam, and for the gaging station upstream of Lower Centerville diversion dam to have real-time access.

The Forest Service specifies in 4(e) condition no. 18, and FWS in 10(j) recommendation no. 17 and NMFS in 10(a) recommendation no. 2, recommend that PG&E install a new gaging station that has real-time capability of reading river stage and minimum stream flow, downstream of the confluence of both the low level release and the spill channel in Philbrook Creek.

The Forest Service in 4(e) condition no. 18 specifies, and FWS in 10(j) recommendation no. 17 and NMFS in 10(a) recommendation no. 2, recommend: (1) that PG&E operate and maintain the existing gages on the West Branch Feather River located downstream of Round Valley Reservoir and Hendricks diversion dam, consistent with all requirements of the Commission and under the supervision of the USGS; and (2) that any modification to the gage facilities at any of these gaging locations that may be necessary to measure the new MIFs shall be completed within three years after issuance of the new license.

Cal Fish & Game in 10(j) recommendation no. 5 further recommends that over the term of the license, should additional gages become necessary based on the outcome of annual consultation and adaptive management, up to three additional gages may be required.

The Forest Service in 4(e) condition no. 18 specifies, and Cal Fish & Game in 10(j) recommendation no. 5, FWS in 10(j) recommendation no. 2, and NMFS in 10(j) recommendation no. 2, recommend, that MIFs shall be measured in two ways: as the 24-hour average of the flow (mean daily flow) and as an instantaneous flow, with instantaneous 15-minute stream flow as required by the USGS standards at all gages.[33] The Forest Service, FWS and NMFS further require and recommend that the minimum instantaneous 15-minute stream flow shall be at least 80 percent of the prescribed mean daily flow for those minimum stream flows less than or equal to 10 cfs and at least 90 percent of the prescribed mean daily flow for those minimum stream flows required to be greater than 10 cfs. Should the mean daily flow as measured be less than the required mean daily flow set forth in MIF schedules, but more than the instantaneous flow, FWS and NMFS recommend, and the Forest Service specifies, that PG&E begin releasing the equivalent under-released volume of water within 7 days of discovery of the under-release. Credit for such additional releases will not exceed 20 percent of the instantaneous flow amount, when used to attain the equivalent of the under-released volume. Consistent with PG&E's proposal, FWS and NMFS recommend that instantaneous instream flows may deviate below the specified MIF releases by up to 10 percent or 3 cfs, whichever is less.

PG&E proposes to make the following daily average stream flow information available to the public annually from May 1 through November 30: on the West Branch Feather River at USGS gage no. 11405200 (downstream of Hendricks diversion dam) and on Butte Creek at USGS gage nos. 11389720

[33] The instantaneous flow is the flow value used to construct the average daily flow value and shall be measured in time increments of at least 15-minutes. The 24-hour average flow is the average of the incremental readings from midnight of one day to midnight of the next day.

(downstream of Butte Creek diversion dam) and 111389780 (downstream of Lower Centerville diversion dam). PG&E further recommends that this flow information would be made available to the public via the Internet, which may be accomplished through a third party. Because this proposal by PG&E is intended to provide more readily available stream flow data to recreationists in key Project reaches, we further discuss this measure in section 3.3.5.2, *Recreation and Land Use*.

The Forest Service specifies in 4(e) condition no. 18, and Cal Fish & Game in 10(j) recommendation no. 5, NMFS in 10(a) recommendation no. 2, and FWS in 10(j) recommendation no. 17, recommend that data recorded at these stream flow gages should be made publicly available and in readily accessible formats, be provided to the USGS in annual hydrology reports after a quality control review so data can be posted on-line, and be made available to the resources agencies upon request.

The Conservation Groups in 10(a) recommendation no. 12 recommend that PG&E provide stream flow and reservoir level information on the internet for project streams and reservoirs.

NMFS further recommends in their 10(j) recommendation no. 8 that a long-term operations plan, as further discussed below, would contain provisions for the installation of remote operating capability as well as addition real-time water temperature and reservoir elevation and flow gages in Round Valley and Philbrook reservoirs. NMFS recommends the location of these gages would be agreed upon by Cal Fish & Game and NMFS.

The California Salmon and Steelhead Association recommend that stream flow gages be installed below all dams and diversions and that PG&E be required to check all gages on a monthly basis, at a minimum. This recommendation by the California Salmon and Steelhead Association is consistent with Forest Service requirements and recommendations made by the agencies. Therefore, we discuss below the need for stream flow gages in the Project-area on a reach by reach basis.

Our Analysis

Currently, stream flow and reservoir elevations in the Project area are measured at the locations identified in table 3-1, which are maintained by PG&E in cooperation with the USGS. Except for the USGS gages on Butte Creek near Chico (USGS gage no. 11390000) and the West Branch Feather River near Paradise, CA (USGS gage no. 11405300), estimates of flow within the bypass reaches of Butte Creek and West Branch Feather River are incomplete because these stream flows often exceed the rating curve of these stream flow gages,

especially during late winter through early spring when the Project area experiences high runoff. Enhanced gaging at select locations within the Project area in both the Butte Creek and West Branch Feather River watersheds would be beneficial given the inter-basin transfer of water and the importance of monitoring and managing flows for spring-run Chinook salmon and steelhead within lower Butte Creek.

Currently, no stream flow gage exists upstream of the Butte Creek diversion dam and the flows above this diversion dam are estimated by summing flows recorded in Butte canal (PG&E gage no. BW14) with flows from the stream flow gage downstream of the diversion (USGS gage no. 11389720). However, as discussed above, the stream flow gage downstream of Butte Creek diversion dam oftentimes does not record all flows during periods of high runoff. This also holds true for the stream flow gage downstream of Hendricks diversion dam on the West Branch Feather River (USGS gage no. 11405200). Further, the current stream flow gage downstream of Lower Centerville diversion dam (USGS gage no. 11389780) does not have real-time capability. PG&E's proposal, which is consistent with Forest Service 4(e) condition no. 18, Forest Service 10(a) condition no. 16, FWS 10(j) recommendation no. 17, NMFS 10(a) recommendation no. 2, and Cal Fish & Game 10(j) recommendation 5 to install and maintain a real-time flow gaging station upstream of Butte Creek diversion dam, to install and maintain a flow data logger for measuring stream flow downstream of Hendricks diversion dam, and to modify the stream flow gage downstream of Lower Centerville diversion dam to have real-time capability would provide additional and more accurate stream flow data at key locations on Butte Creek and the West Branch Feather River. This data would assist in managing Project operations for the benefit of aquatic resources in both watersheds, including spring-run Chinook salmon in lower Butte Creek. Real-time capability would also allow for flows in Butte Creek to be immediately available and would allow for any sudden stream flow changes as a result of weather conditions or Project-related emergencies to be quickly identified and for a rapid response in Project operations, if necessary. A stream flow gage upstream of Butte Creek diversion dam would also allow for all flows entering the Butte Creek drainage system upstream of the dam to be accurately monitored prior to flows being diverted for Project operations. PG&E's proposal to consult with the USGS to site, maintain and report information from these gages would further ensure these gages meet USGS standards and are collecting the most accurate data possible.

Non-spill releases and MIFs are made from the main dam on Philbrook Reservoir via a low-level outlet directly to Philbrook Creek. In addition, flows from two spillways join Philbrook Creek approximately 1,000 feet downstream of the main dam. Currently, PG&E's gage no. BW3 only measures flow releases

from the low-level outlet out of the main dam and does not capture any flow from over the spillways.

Water is released from Philbrook Reservoir as high temperatures occur during the summer months for the benefit of federally-listed species in lower Butte Creek. The storage and release of water from Philbrook Reservoir is vital to manipulating water temperatures in lower Butte Creek. Installation of a real-time flow gage in Philbrook Creek, downstream of the confluence of both the low level release and the spill channel, as specified by the Forest Service in 4(e) condition no. 18 and as recommended by FWS in 10(j) recommendation no. 17, NMFS 10(j) recommendation no. 8, NMFS in 10(a) recommendation no. 2, would allow for all stream flows and the river stage in Philbrook Creek to be monitored. Accurately monitoring flows in this reach would better allow for assessing how Project operations and flows in Philbrook Creek affect overall water temperatures in the West Branch Feather River and lower Butte Creek.

The Forest Service's 4(e) condition no. 18 and FWS's 10(a) recommendation no. 2 for PG&E to operate and maintain existing gages downstream of Round Valley Reservoir and downstream of Hendricks diversion dam, consistent with all requirements of the Commission and under the supervision of the USGS, and to make any modifications to stream flow gages within 3 years would ensure MIFs could be accurately monitored for compliance purposes in these reaches. NMFS 10(j) recommendation no. 8 is similar in that it recommends PG&E to install a new stream flow gage downstream of Round Valley reservoir with real-time capabilities. Similar to the discussion above for Philbrook Creek, constructing a stream flow gage in this reach to have real-time capability would allow for flows in this reach to be remotely monitored and allow for potential changes in Project operations based upon flows in the upper West Branch Feather River to be made more rapidly than what currently occurs. However, we note that the need for a real-time stream flow gage in this reach may be unnecessary as once Round Valley Reservoir is drained this reach typically goes dry several times a year.

The Forest Service specifies in 4(e) condition no. 18, and Cal Fish & Game and FWS recommend in 10(j) recommendation no. 5 and 10(a) recommendation no. 2, respectively, that PG&E: (1) measure and document all instream flow releases in publicly available and readily accessible formats, and that flow values used to construct the 24-hour average flows will be available to the resource agencies from PG&E upon request; (2) and that flow data collected by PG&E will be reviewed by PG&E's hydrographers as part of its quality assurance/quality control (QA/QC) protocol and that the data will be catalogued and made available to USGS in annual hydrology summary reports so the USGS can complete their QA/QC review of the data and subsequently publish the data and post it on-line.

These required and recommended measures would ensure all stream flow data from gages within the Project area are made available for quality review by the resource agencies and the USGS, and that the public would also have the opportunity to access this data once it is made available via the Internet. Having stream flow gages record minimum stream flows as the 24-hour average of the flow and as an instantaneous flow, with instantaneous 15-minute stream flow would ensure readings would meet USGS standards.

Providing stream flow and reservoir level information on the internet for project streams and reservoirs as recommended by the Conservation Groups in 10(a) recommendation no. 12 would allow this data to be available to the public and the resource agencies.

Currently, reservoir elevation data recorded for Round Valley and Philbrook reservoirs is synoptic and collected at weekly intervals when there is access to these sites. As part of a Long-term Operations Plan, as further discussed below, NMFS recommends that PG&E address the installation of real-time temperature and reservoir level monitors, as well as flow gages, in Round Valley and Philbrook reservoirs to allow for conditions in the reservoirs to be remotely monitored for Project operations. Further, NMFS recommends this plan address the installation of equipment at these two reservoirs to allow them to be remotely operated, which would assist in being able to control releases downstream into the West Branch Feather River or Philbrook Creek as weather conditions dictate. Overall, these recommendations by NMFS would enable PG&E to better monitor environmental conditions and allow for Project facilities to be remotely operated in an effort to further reduce and manipulate water temperatures in lower Butte Creek during hot times of year.

Cal Fish & Game recommends in 10(j) recommendation no. 5 that over the term of the license, up to three additional gages may be required based on the outcome of annual consultation and adaptive management. We are unable to analyze this portion of Cal Fish & Game's 10(j) recommendation no. 5 because it does not specify where these gages would be located and does not provide any justification for these three additional gages. Therefore, we do not discuss this recommendation further.

Instream Flow Monitoring for Feeder Creeks

Currently, the only feeder creek that contains a stream flow gage is Long Ravine Creek (USGS gage no. 11405220). The gaging station that determined flows in Hendricks canal after flows were diverted by Long Ravine diversion dam was discontinued in 1985, and the existing gage in Long Ravine Creek is intended to measure compliance with minimum instream flows. Therefore, there is

currently no way to determine the quantity of flow intercepted by the diversion dams on the various feeder creeks.

FWS 10(j) recommendation no. 17 and NMFS 10(a) recommendation no. 2 recommends that gaging stations be installed to measure river stage and minimum stream flows for compliance purposes at eight feeder creeks, including: the Butte Creek tributaries, Inskip, Kelsey, Helltown Ravine and Clear creeks, and the West Branch Feather River tributaries, Long Ravine, Cunningham Ravine, Little West Fork, and Little Butte Creek.[34] The Forest Service in 4(e) condition no. 18 specifies that PG&E devise a measurement procedure in consultation with the Forest Service and other interested governmental agencies to ensure compliance with MIFs downstream of Long Ravine, Cunningham Ravine, and Little West Fork creeks. Also, consistent with recommendations from FWS and NMFS, Forest Service 10(a) recommendation no. 16, recommends the construction of stream flow gages for Inskip, Kelsey, Helltown Ravine, Clear, and Little Butte creeks downstream of their respective diversion dams.

Our Analysis

The Butte Creek and West Branch Feather River feeder tributaries used for diversion purposes are small, perennial streams with medium to high gradient. All diversion dams are small, 4 to 10 ft across, and shallow, at less than 2 feet in depth. All MIFs made downstream of the feeder diversions in the Butte Creek and West Branch Feather River watersheds are made via small (3- to 4-inch-in-diamter) pipes at the base of the diversions; however, PG&E states potential for blockage does exist at these diversion dams. Given the remote locations of these feeder diversions, and the high gradient of these stream reaches, installing stream flow gages at these locations would likely be difficult. Further, calibrating gages in such environments would also be difficult given the rough channel characteristics and topography, likely resulting in large amounts of uncertainty, possibly making accurate stream flow estimates inaccurate.

Further, consistent with NMFS 10(a) recommendation no. 2, FWS recommends in 10(j) recommendation no. 17 and the Forest Service recommends in 10(a) recommendation no. 16, that PG&E install a new gaging station to measure river stage and MIFs in Little Butte Creek. Under PG&E's proposal, the diversion dam on Little Butte Creek would be removed, as it has not been used in many years, as discussed above. As a result, PG&E also does not propose any MIFs for this creek downstream of the diversion dam. Therefore, because this diversion would be removed under PG&E's proposal, Project operations would no

[34] The diversion on Little Butte Creek has only been used once during the past twenty years during spill events.

longer have any effect on stream flows in this creek, making a minimum instream flow and installation of a steam gage unnecessary.

NMFS in 10(a) recommendation no. 2, FWS in 10(j) recommendation no. 17, and the Forest Service in 10(a) recommendation no. 16, recommend that PG&E also install a new gaging station in Helltown Ravine. Upper Centerville canal, which ends at Helltown Ravine, was historically used as an alternative way to route water to Centerville powerhouse when the DeSabla powerhouse was offline. Water would be released from Upper Centerville canal into Helltown Ravine, where it would be captured via a diversion dam and flow into Lower Centerville canal. However, Upper Centerville canal has not been used for Project operations for many years and as a result PG&E is not proposing a MIF for Helltown Ravine, as described above. However, FWS in 10(j) recommendation no. 2.6 and Forest Service in 10(a) recommendation no. 2.6 recommend a MIF for Helltown Ravine. If MIFs are required for Helltown Ravine by any license issued for this Project, a stream flow gage would allow stream flows and compliance with MIFs to be monitored; however, as discussed above, terrain in the Project area would likely make installing a stream flow gage in Helltown Ravine difficult.

During normal Project operations, PG&E currently dispatches a roving operator to monitor and maintain these diversion dams on a weekly basis. Continuing to dispatch roving operators to monitor and maintain feeder diversions would ensure all feeder diversions are working properly, not blocked with debris, and that they are providing any required MIF releases downstream of the diversion dams.

Water Quality

Water quality studies conducted by PG&E indicate occasional seasonal exceedances of the Basin Plan water quality objectives for bacteria and turbidity. PG&E's proposal to alter project operations also has the potential to alter water quality conditions in Project reservoirs and in Project-affected stream reaches in Butte Creek, the West Branch Feather River, and Project feeder streams. Continued scheduled and unscheduled Project canal outages are likely to cause increases in turbidity. In order to confirm water quality standards are met under any new license issued, it would be necessary to monitor selected water quality parameters, as described below.

The California Salmon and Steelhead Association filed multiple recommendations and concerns regarding water rights in Butte Creek and the West Branch Feather River. We have determined that these recommendations are water right issues that pertain to the State of California; therefore, we do not discuss these recommendations below.

Monitor Water Quality in Receiving Stream during Canal Cleaning

Project canals intercept overland flow and feeder tributaries at a number of locations, which lead to sediment deposition and accumulation within the bottom of Project canals. Therefore, scheduled and unscheduled canal startup and shutdown has the potential to increase water velocities along the bottom of the canals as water levels fluctuate within the canal. This has the potential to mobilize these sediments and increase turbidity levels in the canals and in receiving streams discharge from the canal.

PG&E proposes to conduct water quality monitoring in receiving streams prior to, during, and after returning Project canals to service. PG&E proposes sampling would occur within 24 hours of taking the canal out of service, once in the middle of the canal outage, and within 24 hours of placing the canal back into service. Routine monitoring would include sampling water quality in the receiving stream at one site upstream and downstream of the location the canal discharges water into the stream. Monitoring parameters would include water temperature, dissolved oxygen, and turbidity sampled at regular intervals. PG&E also proposes that in the event herbicides are used along Project canals, herbicide sampling would also be included with the routine monitoring. Lastly, PG&E proposes to provide a summary of cleaning and maintenance activities as well as the monitoring results to the Water Board, and to file the summary report with the Commission.

The Conservation Groups in 10(a) recommendation no. 14 recommend that PG&E provide turbidity sensors at four locations on Butte Creek: one immediately downstream of DeSabla powerhouse, one immediately downstream of Centerville powerhouse, and two in between the powerhouses, as determined by the Operations Group. The Conservation Groups further recommend that these devices be telemetered and connected to the internet through the California Data Exchange Center and that if and when Centerville powerhouse is decommissioned, the Operations Group would consider reducing the number of turbidity sensors.

Our Analysis

Scheduled and unscheduled canal outages have been shown through PG&E's water quality monitoring studies to result in short-term turbidity increases in receiving streams downstream of canal discharge. As previously discussed, oftentimes these increases in turbidity have been show to exceed the Basin Plan water quality objectives of <1 NTU increase. Increases in turbidity within the Project area could potentially lead to a variety of negative effects on aquatic

organisms, including siltation of spawning and rearing habitat for various aquatic species, including federally-listed species.

PG&E's proposal to conduct water quality monitoring in Project waters receiving flows from Project canals, before, during, and after an outage would allow for any increases in water temperature, dissolved oxygen, and turbidity to be documented. This monitoring as proposed by PG&E would alert personnel to possible water quality problems associated with canal outages and allow any problems to be quickly identified and for appropriate response actions to be undertaken. This monitoring would also allow for any violations of the Basin Plan water quality objectives to be identified and would ensure canal outages do not negatively affect water quality for extended periods of time. To be useful, monitoring reports should be compiled at regular intervals, and all violations of the state standard should be reported to the proper agencies with a comprehensive filing to the Commission.

PG&E states they periodically clean Project canals, and sometimes use herbicides in the vicinity of the canals to control vegetation. During 2007, prior to and during the first rainfall event following herbicide application, PG&E sampled for herbicides. No herbicide residues or degradation by-products were identified at levels above the analytical method detection limits in any samples collected prior to application or following resumption of canal operation. Current water sampling indicates periodic use of herbicides is not affecting water quality in Project canals; however, in the event herbicides are utilized at a greater frequency, quantity, or different types are used, degradation of water quality in Project canals could potentially occur, affecting resident aquatic organisms downstream. Therefore, in the event herbicides are used along Project canals, herbicide sampling would allow for the presence of herbicides in Project waters to be rapidly identified and for corrective actions to be taken to ensure negative effects to water quality and aquatic organisms do not occur.

The Conservation Groups 10(a) recommendation no. 14 for PG&E to provide turbidity sensors at four locations on Butte Creek between the DeSabla powerhouse and just downstream of Centerville powerhouse would allow for continuous turbidity monitoring in Butte Creek. Having these monitors connected to the internet would allow for any increases in turbidity to be remotely monitored, quickly identified, and for a rapid response to correct any Project-related operations that could be causing these increases. Monitoring in lower Butte Creek would also help to protect spawning and rearing habitat of federally-listed salmonids which could be negatively affected as a result of increased turbidity and sedimentation. These recommended turbidity monitors would likely collect similar data to that PG&E proposes to collect under their proposed water quality monitoring in receiving streams, as discussed above.

Canal Water Loss

As further discussed in section 3.3.1, *Geologic and Soil Resources*, Project canals traverse a variable geologic setting. Point and non-point sources of leakage from Project canals have the potential to create localized areas of erosion. Increased erosion could lead to negative effects on water quality in either the Butte Creek or West Branch Feather River drainages, by increasing turbidity levels within these drainage basins. This has the potential to lead to increased levels of siltation, potentially having negative effects on the habitat of various aquatic species, including salmonid spawning habitat within Butte Creek and the West Branch Feather River.

Consistent with Forest Service 4(e) condition no. 23, Cal Fish & Game 10(j) recommendation no. 7, FWS 10(j) recommendation no. 4, and NMFS 10(j) recommendation no. 3, PG&E proposes to develop in consultation with the Forest Service and the Water Board, and implement, a Project Canal Maintenance and Inspection Plan. PG&E proposes the plan would detail their responsibility for the regular maintenance and inspection of Project canals to address hazard trees and geologic hazards within the Project boundary that may impact the integrity of Project water conveyances. The plan would provide for, at a minimum: (1) annual inspections of the Project water conveyance system to identify potential short-term and long-term hazards (e.g., hazard trees, landslides, etc) and to prioritize maintenance and/or mitigation; (2) protocols for routine (non-emergency) canal operations and the use of canal spillways; and (3) stabilization measures to reduce the likelihood of catastrophic canal failure due to hazard trees and geologic hazards and to mitigate, as appropriate, sources of chronic erosion and sediment transport into canals.

The Forest Service further specifies and Cal Fish & Game further recommends that the plan develop specific prevention measures to assure long-term integrity of the Project canal system. Lastly, the Forest Service specifies and FWS and Cal Fish & Game recommend, that this plan include current standard operating procedures and any new procedures that may be developed to minimize canal outages, sediment events, and winter storm events, etc., that are not currently license requirements, and that PG&E develop specific preventative measures to address geologic hazards identified in relicensing studies.

Our Analysis

Water leakage associated with canal loss was not quantified during relicensing studies; however, small amounts of leakage have been observed at a variety of locations such as flume seams or holes, canal spillway gates, or along

permeable berms. Leakage due to Project operations can have negative effects on water quality if the quantity of leakage is great enough to cause localized areas of erosion which could increase turbidity levels within the drainage area. Also, non-point sources of canal leakage could lead to soil saturation, which could make areas more prone to canal failure due to landslides.

As discussed in section 3.3.1, *Geologic and Soil Resources*, PG&E's proposed and the agency recommended, Project Canal Maintenance and Inspection Plan, would allow for the inspection of Project canals to identify areas which may become short- or long-term hazards that lead to increased siltation and degraded water quality. Further, this plan would allow for the stabilization of problem areas to reduce current and future levels of erosion.

Hazardous Substances/Pesticide Use

Construction, operation, and maintenance of existing and proposed Project facilities has the potential to contaminate waterways from the introduction of hazardous materials such as petroleum products resulting form accidental spill, equipment leakage, and from the use of herbicides/pesticides to control terrestrial and/or aquatic vegetation, insects, and other organisms in the Project area.

Consistent with Forest Service 4(e) condition no. 34, PG&E proposes to file with the Commission, a plan approved by the Forest Service for oil and hazardous substances storage and spill and prevention and cleanup. PG&E proposes that this plan would require PG&E to: (1) maintain in the Project area, a cache of spill cleanup equipment suitable to contain any spill from the Project; (2) to periodically inform the Forest Service of the location of the spill cleanup equipment on Forest Service lands and of the location, type, and quantity of oil and hazardous substances stored in the Project area; and (3) to inform the Forest Service immediately of the nature, time, date, location, and action taken for any spill on or affective Forest Service lands.

The Bureau of Land Management (BLM) and Forest Service in their respective 4(e) condition no. 11, specify that pesticides may not be used on BLM or Forest Service lands or in areas affecting BLM or Forest Service lands to control undesirable woody and herbaceous vegetation, aquatic plants, insects, rodents, trash fish, etc., without the prior written approval of the BLM or Forest Service. These agencies further require PG&E to submit a request for approval of planned uses of pesticides for the upcoming year during the annual consultation meeting required by their respective 4(e) condition no. 1, and that PG&E provide the following information at a minimum: (1) whether pesticide applications are essential for use on BLM or Forest Service lands; (2) specific locations of use; (3)

specific herbicides proposed for use; (4) application rates, dose and exposure rates; and (5) safety risk and timeframes for application.

BLM and Forest Service further specify that pesticide use will be excluded from BLM and Forest Service lands within 500 feet of known locations of California red-legged frog, mountain yellow-legged frog, foothill yellow-legged frog, and Yosemite toad.

BLM and Forest Service further specify that PG&E use on BLM and Forest Service lands only those materials registered by the U.S. Environmental Protection Agency (EPA) and consistent with those applied by the BLM and the Lassen and Plumas National Forests and approved through BLM and Forest Service review for the specific purpose planned.

Lastly, BLM and the Forest Service further specifies that PG&E may also provide an Integrated Pest Management Plan that describes planned pesticide use on a regular basis for the term of the license.

Our Analysis

The development and implementation of a Hazardous Substances Plan as proposed by PG&E and consistent with Forest Service 4(e) condition no. 34 would provide for materials and cleanup equipment to be available for a rapid response if a hazardous spill were to occur in the Project area. Further, this plan would serve as a reference for procedures to be followed in the event of a hazardous materials spill, potentially minimizing environmental impacts associated with a spill. Also, notifying the Forest Service of any such spills would allow the Forest Service to be involved in any spill cleanups on Forest Service lands.

BLM's and the Forest Service's respective 4(e) condition no. 11 would assist in preventing the unauthorized use of potentially hazardous pesticides in the Project area which could potentially degrade water quality and have negative affects on aquatic resources. Obtaining approval from the BLM and the Forest Service would ensure pesticides would be used only when necessary, and that they were used in an appropriate manner, as intended. Also, refraining from using approved pesticides within 500 feet of known locations of California red-legged frog, mountain yellow-legged frog, foothill yellow-legged frog, and Yosemite toad would minimize any negative effects to these sensitive aquatic species, if they are found to be present.

Removal of Feeder Diversions

The feeder diversions on Oro Fina Ravine, Emma Ravine, Coal Claim Ravine, Stevens Creek, and Little Butte Creek have not used for over 10 years. Consistent with Cal Fish & Game 10(j) recommendation no. 9, PG&E proposes to remove five feeder diversions, including those on Oro Fina Ravine, Emma Ravine, and Coal Claim Ravine creeks that are diverted into Lower Centerville canal; the feeder diversion on Stevens Creek that is diverted into Butte canal; and the feeder diversion on Little Butte Creek that is diverted into Hendricks canal. Removing Project facilities such as feeder diversions that are located within Project-affected stream reaches has the potential to decrease water quality conditions downstream of each diversion during the demolition and removal of these facilities. Removal of these facilities may lead to increased levels of turbidity and sedimentation, which in turn could increase siltation of spawning habitat, thus, negatively affecting various resident aquatic organisms.

The Forest Service in 10(a) recommendation no. 3 and FWS in 10(j) recommendation no. 3 recommend that PG&E develop and implement a Feeder Creek Diversion Facility Removal Plan in consultation with the resource agencies to address the removal of the following diversions in the Butte Creek watershed: Stevens Creek, Oro Fina Ravine, Emma Ravine, and Coal Claim Ravine creeks. The Forest Service and FWS further recommend that this plan include schedules, site plans, and mitigation measures for the removal of four specific feeder diversions.

Cal Fish & Game in 10(j) recommendation no. 10 further recommends that PG&E provide notification to Cal Fish & Game prior to any ground disturbance related to removing the feeder diversion dams.

PG&E does not propose any specific measures to mitigate any potential negative water quality effects associated with the removal of these feeder diversions. We further discuss feeder streams, including stream gage installation, and minimum instream flows above.

Our Analysis

Habitat studies conducted by PG&E indicate that overall, Project feeder creeks are located in high gradient streams dominated by larger substrates, including bedrock, boulders, and cobble. Due to the small size of these feeder diversions, it is likely that removing these facilities could occur relatively quickly with minimal ground disturbance. Any disturbance created in these streams would likely create only short-term increases in turbidity given the absence of fine sediments in these the feeder creeks which are dominated by large substrate types. Any increases in turbidity would likely be rapidly flushed from each respective

feeder creek as a result of the steepness of the terrain, preventing sediment accumulation and habitat degradation downstream.

Forest Service in 10(a) recommendation no. 3 and FWS in 10(j) recommendation no. 3, recommend, that PG&E develop and implement a Feeder Creek Diversion Facility Removal Plan in consultation with the resource agencies to address the removal of Project diversions on Stevens Creek, Oro Fina Ravine, Emma Ravine, and Coal Claim Ravine creeks. Developing and implementing this plan would ensure specific methods of removing these diversion dams are established that would minimize instream disturbance and any ground disturbing activity, and ensure proper mitigation measures are in place to address sedimentation and any other associated negative effects upon water quality. Further, providing notification to Cal Fish & Game, as recommended by Cal Fish & Game in 10(j) recommendation no. 9, prior to ground disturbance would allow for agencies to be kept informed of any demolition activities which may affect resources in the Project area.

As discussed above, the Forest Service in 10(a) recommendation no. 2.6 and FWS in 10(j) recommendation no. 2.6, recommend a MIF to be released to Little Butte Creek downstream of the feeder diversion and are not recommending it be removed as part of their recommended Feeder Creek Diversion Facility Removal Plan. Because this diversion dam has not been used in many years, PG&E is proposing for it to be removed. Therefore, including Little Butte Creek in the Feeder Creek Diversion Facility Removal Plan would also insure any potential water quality impacts associated with its removal were minimized.

Water Temperature

DeSabla Forebay

PG&E proposes to develop in consultation with NMFS, Cal Fish & Game, and FWS, a DeSabla Forebay Water Temperature Improvement Plan based on the results of their feasibility study regarding the potential for reducing thermal loading in DeSabla forebay. PG&E proposes that at a minimum, the plan would include a preliminary design of the proposed facility and a schedule for final design, permitting, and construction of the new facility. PG&E's proposal is consistent with FWS 10(j) recommendation no. 5, NMFS 10(j) recommendation no. 4, Forest Service 10(a) recommendation no. 5, Cal Fish & Game 10(j) recommendation no. 3, and the Conservation Groups recommendation no. 6, except these agencies further recommend that PG&E consult with the Water Board and that the plan address reducing thermal loading within DeSabla forebay by 80 percent or greater, which the agencies state is equivalent to limiting the warming within the forebay to $\leq 0.2^{o}C$.

Cal Fish & Game also recommends in 10(j) recommendation no. 3 that the plan be developed in consultation with the Forest Service and that the heat gain be measured as the change in temperature between Toadtown canal upstream of DeSabla forebay and DeSabla powerhouse. Cal Fish & Game further recommends that after construction of the physical modification is complete, continued temperature monitoring shall be conducted in Butte Creek at the following locations: Butte Creek upstream of DeSabla powerhouse, Butte Creek at Lower Centerville diversion dam, Butte Creek at Pool 4, Butte Creek upstream of CVPH, and Butte Creek downstream of CVPH. After two years of monitoring, Cal Fish & Game recommends that PG&E report the results of temperature monitoring to the resource agencies, and other interested parties. If the expected temperature benefits have been realized in Butte Creek, resource agencies shall determine whether it is feasible to go forward with flow increases in the West Branch Feather River and/or in Butte Creek. After five years of temperature monitoring, the Cal Fish & Game and other resource agencies will determine the need for continued comprehensive temperature monitoring in lower Butte Creek.

In response to the agencies recommendations to reduce thermal loading by 80 percent or greater, PG&E states conceptual engineering indicates certain structures could be constructed which would achieve a reduction in thermal loading by this amount; however, PG&E states they can not guarantee reductions by 80 percent or greater due to numerous factors which they have no control over, including air temperature, wind speed, flow, resistance time (PG&E, 2008a). PG&E also states that if the facility achieved an 80 percent reduction in temperature this would result in a 0.46 ºC reduction in warming through the forebay, and would not meet the ≤ 0.2 °C criteria recommenced by the agencies, which PG&E states would necessitate a 91 percent reduction in thermal loading to achieve this criterion recommended by the agencies. Therefore, PG&E states they are opposed to having an improvement plan that contains specific targets that must be met by the facility.

Our Analysis

DeSabla forebay is a regulating facility for DeSabla powerhouse, which receives flows diverted from upper Butte Creek via the Butte Creek diversion dam and canal, from the West Branch Feather River via the Hendricks diversion dam and canal, and from several small feeder creeks that are diverted into both of these canals, ultimately discharging into DeSabla forebay via the Butte canal. Because flows to the DeSabla powerhouse originate in the forebay, forebay water temperatures affect lower Butte Creek instream water temperatures once flows are discharged from the DeSabla powerhouse. As a result of the increased surface area of DeSabla forebay compared to the Project canals and the increased

residence time of water within the forebay itself, this creates conditions conducive to temperature warming, which in turn affects water temperatures in lower Butte Creek.

Under existing conditions, typical flows through DeSabla forebay range from between 50 to 200 cfs, with residence times of 6 to 24 hours. PG&E's water temperature studies indicate this equates to a temperature increase of 0.7°C at 200 cfs to 2°C at 50 cfs. During the July through August time period, daily average water temperatures in Butte canal upstream of DeSabla forebay ranged from 12.7 to 17.8°C, compared to water temperatures of 13.9 to 19.0°C downstream at DeSabla powerhouse. These results indicate that water temperatures increase on average approximately 1.1°C passing through the DeSabla forebay during the July through August period.

PG&E conducted a feasibility study evaluating 11 options designed to reduce the residence time, and therefore temperatures in DeSabla forebay. [35] The objective of this study was to reduce water temperature increases in the forebay by 50 percent during the months of July and August, consistent with the terms and conditions of NMFS' preliminary biological opinion. Study results indicate that the high level of mixing between the cold inflows from Butte canal and the warmer water in the forebay (entrained flow of 110 to 160 percent) are mainly responsible for the temperature increases and that a 50 percent reduction in temperature change would require a large reduction in the mixing, with an entrainment in the 5 to 10 percent range. Study results also indicated that a number of potential options exist for reducing heating in DeSabla forebay by 50 percent or more, each with separate operational, environmental, and cost factors. PG&E states the most desirable option to reduce temperatures in the forebay is to construct a partial baffle or sheet pile wall, which would route the inflow along the bank of DeSabla forebay and exit close to the intake structure.

PG&E's proposal to develop, in consultation with the agencies, a DeSabla forebay Water Temperature Improvement Plan, is consistent with recommendations from FWS, NMFS, the Forest Service, Cal Fish & Game, and the Conservation Groups. This plan would allow for PG&E to work with the resource agencies to further discuss the advantages and disadvantages to each of the feasible options for reducing temperatures within the forebay. Upon implementation of this plan, water temperatures discharged from DeSabla forebay

[35] More specific details about the options evaluated for reducing water temperatures within DeSabla Forebay are discussed in PG&E's Updated Study Results and License Application Sections filed on February 19, 2008 (PG&E, 2008a).

would be reduced compared to existing conditions, and as a result decrease water temperatures within lower Butte Creek. Reducing water temperatures during the summer months would be beneficial for spring-run Chinook salmon and likely reduce summer mortality rates of salmon holding downstream of lower Centerville diversion dam and Centerville powerhouse by enhancing thermal habitat and increasing summer holding habitat.

The preliminary biological opinion issued by NMFS requested that PG&E study the feasibility and effectiveness of reducing thermal loading in DeSabla forebay, during the months of July and August, with a goal of reducing thermal loading by 50 percent. However, recommendations from FWS, NMFS, the Forest Service, Cal Fish & Game, and the Conservation Groups recommend that thermal loading in DeSabla forebay be reduced by 80 percent or greater, which would further reduce temperature loading within the forebay and result in cooler water temperatures in lower Butte Creek compared to a 50 percent reduction in thermal loading.

As previously discussed, PG&E provided a variety of W2 water temperature simulations comparing base case and simulations from June 19 to August 8 using the 2005 calibrated model (above normal hydrology, hot meteorology) and the 2001 hydrology (dry hydrology) and 2005 meteorology (hot meteorology). Appendix B; tables 1 and 2 illustrate the downstream effects of a 50 versus 80 percent reduction in thermal loading within DeSabla forebay in lower Butte Creek. Various simulations also take into account PG&E's proposed, Forest Service specified, and agency recommended MIFs downstream of various diversion dams. This table illustrates that engineered solutions to reduce heating in the DeSabla forebay have a direct impact on water temperature throughout lower Butte Creek and that it does so without the need for additional flow from the West Branch Feather River, providing additional flexibility in operating the system. However, based on existing license requirements these temperature simulations indicate that in a normal water year the difference in the WMMT between a 50 and 80 percent reduction in thermal loading would be approximately a 0.24 ºC decrease in water temperatures in lower Butte Creek below Centerville powerhouse, above Centerville powerhouse, and at Helltown (Appendix B; table 1). In a dry year the difference in the WMMT between a 50 and 80 percent reduction in thermal loading would be approximately a 0.13 ºC reduction in water temperature below Centerville powerhouse, a 0.14 ºC reduction in water temperature above Centerville powerhouse, and 0.29 ºC reduction in water temperature at Helltown (Appendix B; table 2).

Upon construction of a water temperature improvement facility, continued temperature monitoring in Butte Creek, as recommended by Cal Fish & Game, would help to determine the extent of temperature reductions as a result of

reducing thermal loading within the forebay. Providing these results to the resource agencies, and other interested parties, would also allow for this data to be distributed and analyzed by others.

However, Cal Fish & Game's further recommendation to determine the need for continued comprehensive temperature monitoring in lower Butte Creek after five years would be unlikely to provide any additional data on the effects of reducing thermal loading in the forebay and the resulting downstream water temperatures.

Water Temperature Monitoring

The Forest Service specifies in 4(e) condition no. 20, and FWS in 10(j) recommendation no. 16, NMFS in 10(j) recommendation no. 5, and the Forest Service in 10(a) recommendation no. 6, recommends, that PG&E develop and implement a Water Temperature Monitoring Plan in consultation with FWS, NMFS, Cal Fish & Game, the Water Board, and the Commission.[36] These agencies require and recommend that this plan be incorporated as part of a Project Operations Plan, as discussed below, to monitor thalweg water temperature in the Project-affected stream reaches and that PG&E provide results of water temperature monitoring to the resource agencies in a technical report prior to an annual consultation meeting. The agencies require and recommend that this plan include a comparison of the results with those of the previous years and a discussion of the implications of the water temperature effects of diversion to Butte Creek through the Hendricks canal diversion. The plan would be based on the previous year's Project Operations Plan's water temperature monitoring sites, methods, and reporting.

The Forest Service specifies in 4(e) condition no. 20 and the Forest Service in 10(a) recommendation no. 6 and FWS in 10(j) recommendation no. 7, recommend, that PG&E develop a temperature monitoring study to monitor water temperatures in the Project-affected stream reaches, especially in the margins where foothill yellow-legged frog eggs and tadpoles occur, to assess water temperature effects on eggs and tadpoles. We discuss temperature monitoring as it relates to foothill yellow-legged frog below in section 3.3.3, *Terrestrial Resources*.

Our Analysis

Water temperatures in the Project area are of critical importance to a variety of aquatic species in Project-affected stream reaches. Currently, PG&E operates

[36] Forest Service 4(e) condition no. 20 only requires that this monitoring occur in the West Branch Feather River on National Forest Service Lands upstream of the Miocene Diversion (non-Project facility), while Forest Service 10(a) recommendation no. 6 expands this monitoring to all Project-affected stream reaches.

the Project based upon an annual Project Operations and Maintenance Plan that is developed each spring in consultation with resource agencies with the goal of operating the Project such that water temperatures are reduced in lower Butte Creek during the hottest times of year for the benefit of federally-listed spring-run Chinook salmon. Modifications to MIFs in Project-affected stream reaches, reductions of water temperatures in DeSabla forebay as a result of a DeSabla Forebay Water Temperature Improvement Plan, and PG&E's annual Operations Plan, as discussed above, all have the potential to separately and cumulatively reduce instream water temperatures in the Project area. Developing and implementing a Temperature Monitoring Plan as part of a Long-term Operations Plan as specified by the Forest Service and as recommended by FWS, NMFS, and the Forest Service would allow for any changes in water temperatures resulting from Project operations to be detected and help to quantify the results of mitigation measures designed to reduce instream temperatures in lower Butte Creek. Water temperature monitoring would be especially important during adverse weather conditions such as drought and/or extreme periods of hot weather which can have negative effects upon aquatic species. Also, water temperature monitoring could provide valuable information regarding the biological response of spring-run Chinook salmon in lower Butte Creek as a result of implementation of new license conditions.

Providing the results of temperature monitoring prior to an annual consultation meeting with the resource agencies would allow time for review by the agencies prior to discussion. Further, comparing the temperature data to that from previous years, and a discussion of the implications of the water temperature effects of diversion to Butte Creek through the Hendricks canal diversion would allow for a thorough analysis of potential water temperature trends over time and assist with developing any needed changes to Project operations which may useful in further reducing water temperatures in lower Butte Creek. This would likely be most efficiently accomplished by including any temperature monitoring as part of a Long-term Operations Plan, as further specified by the Forest Service, and as recommended by the agencies. Further, basing the plan on the previous year's Project Operations Plan's water temperature monitoring sites, methods, and reporting would ensure sampling sites and methodologies are consistent from year-to-year and ensure results would be comparable over time for purposes of analysis.

Fisheries

Stream Diversions, Fish Entrainment, and Passage

Stream flow diversion and reservoir operations affect aquatic biota in Butte Creek, the West Branch Feather River, 12 feeder tributaries (see table 3-16 and

figure 1-2), and five project canals, (Butte, Toadtown, Hendricks, and Upper and Lower Centerville).

The diversion of stream flow into project canals results in the well documented entrainment of fish into the project's canal system.[37] Some of these fish may become entrained into project intakes. Entrainment of fish into hydroelectric project intakes typically causes injury or mortality to a portion or the fish that are entrained, with mortality rates tending to be lower for smaller fish and higher for turbines that operate under higher levels of head, with higher rotational speeds, and with smaller passageways (Cook et al., 1997; Franke et. al., 1997; Winchelle et. al., 2000). Although PG&E evaluated the level of entrainment in to project canals, the Forest Service's 10(a) recommendation 21 provides for PG&E to conduct a fish entrainment study to quantify the number of fish being entrained there.

As a result of its licensing studies, PG&E proposes to develop a Project Canal Fish Rescue Plan, as recommended by the FWS's in their 10(j) recommendation 14 and the NMFS 10(j) recommendation 9, and consistent with PG&E's current fish rescue activities. The proposed measure would include: 1) definition of activities that would trigger canal fish rescue efforts; 2) prior notification and coordination with the California Department of Fish and Game; 3) fish rescue methods including counting fish and placement of fish in active streams; and 4) providing a letter summary of fish rescue activities to the California Department of Fish and Game. This plan is consistent with the Forest Service's 10(a) recommendation 14, except that the Forest Service also recommends that fish rescues be conducted twice annually. Cal Fish & Game [10(j) recommendation 12], also recommends that fish rescues be conducted until such time that fish screens are installed to prevent entrainment into the canals.

In their comments on the final license application, the National Marine Fisheries Service (NMFS), California Department of Fish and Game (Cal Fish & Game), and the U.S. Fish and Wildlife Service (FWS) each filed 10(j) recommendation for the screening of various canal intakes, these recommendations are consistent with the U.S. Forest Service's, the Conservation Groups and the California Salmon and Steelhead Associations (CSSA) 10(a) recommendations for fish screens.[38] The location of the recommended fish ladders and screens are identified in table 3-28.

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[37] PG&E, in its final license application, estimates at least 3,000 trout (rainbow and brown trout) are entrained into the project's canal system annually.

[38] The Forest Service's 10(a) 22 provides that if the Hendricks Canal Fish Entrainment Study, and the results of the trout monitoring plan [Forest Service 4(e) 19] do not meet its resource management objectives outline in its 10(a)

Project diversion dams also result in a loss of habitat connectivity preventing upstream migration of fish from downstream habitats into habitats upstream of the diversions for foraging, rearing and spawning activities; thereby, also preventing the upstream movement of genetic material from fish populations below the diversion structures to upstream populations. This is also the case with the project's 12 feeder diversions. The Cal Fish & Game, FWS, Forest Service,[39] and the Conservation Groups recommend that a fish ladder be installed at the Hendricks Head Dam to improve the habitat connectivity in the West Branch Feather River. The Forest Service in its 10(a) recommendation 23 specifies that PG&E should conduct a fish migration study, to determine if the Hendricks Head dam is an impediment to fish movement in the West Branch Feather River. The Conservation Groups and the CSSA also recommend that the Centerville development be decommissioned including the removal of the Lower Centerville Diversion dam.

Table 3-28. Recommended fish passage and intake screen locations and criterion

Location	**Requester**	**Criterion**
Fish Screen Recommendations		
Hendricks Canal Entrance	Cal Fish & Game, CSSA, Conservation Groups, FWS, Forest Service	Meet Cal Fish & Game's criteria for rainbow trout fry; Screen shall be automatically cleaned; Screen shall incorporate sediment sluice back to the West Branch Feather River.
Lower Centerville Canal Entrance	NMFS, U.S. Forest Service, CSSA, Conservation Groups, FWS	NMFS Criteria for Anadromous Salmonids & Cal Fish & Game's criteria for rainbow trout fry
Butte Creek Canal Entrance	CSSA	
Fish Ladder Recommendations		

recommendation 21 and its 4(e) condition 19 (830 rainbow trout per acre), PG&E would construct a fish exclusion facility (fish screen) at the Hendricks Canal.

[39] The Forest Service's 10(a) 24 provides that if the Hendricks is found to be a impediment to fish movement in the West Branch Feather River as a result of the Fish Migration Study [Forest Service 10(a) 23], PG&E would construct a fish passage facility (fish ladder) at the Hendricks Head dam.

Hendricks Head Dam	Cal Fish & Game, FWS, Conservation Groups, Forest Service	FWS – Specifies that a fish ladder be installed to allow for passage of all life stages of trout. Cal Fish & Game specifies that the fish ladder provide adult rainbow trout passage from March 1, through October 31.

[1]While FWS does not specify an operational window; the Cal Fish & Game recommends that the fish ladder be operated from March 1 to October 31 each year.

PG&E in its reply comments filed on August 14, 2008, states that the need for fish screens or ladders at the Butte Creek, Hendricks, and Lower Centerville Diversions dams is unsupported. PG&E does; however, propose to remove the diversion structures from five of the 12 feeder diversions (Stevens and Little Butte creeks, Oro Fino, Emma, and Coal Claim ravines).[40] Cal Fish & Game's 10(j) recommendation no. 9 and consistent also recommends the removal of these five feeder diversions. PG&E's proposal is also consistent with the Forest Service's 10(a) recommendation no. 3, and the FWS's 10(j) recommendation no. 3, to remove four[41] of the 12 feeder diversions. PG&E does not support the decommissioning of the Centerville powerhouse and the subsequent removal of the Lower Centerville Diversion dam as recommended by the Conservation Groups.

Our Analysis

Fish Entrainment and Passage

Relicensing studies found that fish are entrained in to project canals as a result of project operations (see tables 3-19, 3-20, and 3-21). As a result we do not find that additional entrainment study within the Hendricks Canal, as recommended by the Forest Service, is warranted.

[40] The five feeder diversions have not been utilized by the project in approximately 10 years.

[41] Stevens Creek, OroFina Ravine, Emma Ravine, and Coal Claim Ravine.

PG&E's proposal to continue the implementation of fish rescues from project canals would limit the projects effects on the fish populations in the project stream reaches. However, do to the infrequency of the fish rescues, it is likely that some of the fish that become entrained into the project's canal system would also be entrained into project intakes before a fish rescue occurs; thereby resulting in the injury or mortality of some of the fish that become entrained into the project's canal system.

Screening of the diversion intakes as specified by the resource agencies at the Hendricks diversion dam and the Lower Centerville diversion dam would limit the entrainment of fish into the projects canal system from the West Branch Feather River and lower Butte Creek. As a result, the number of fish that are likely injured or fatally wounded as a result their entrainment in to project intakes would decline. We note however, that fish will continue to be diverted into the project's canal system at the Butte Creek Head dam and each of the operating feeder diversions.

The presence of the diversions structures continue block the natural upstream movements of fish throughout the project affected stream reaches. As a result, it is unclear why the Forest Service recommends a fish migration study to demonstrate this fact.

The installation of a fish ladder on the Hendricks Head dam would allow for the connectivity of the West Branch Feather River's habitat from the downstream Miocene Diversion (non-project facility) upstream to the headwaters of the West Brach Feather River. This connectivity would support natural behavioral movements of the native trout population for foraging, rearing and spawning.

Feeder Diversions

PG&E proposes removal of five feeder diversions because they have been discontinued for more than 10 years and are no longer serving a project purpose. Although no specific fish surveys were conducted in these feeder tributaries, they were surveyed as part of Study 6.3.3-11, *Canal Feeder Stream Study Plan.* As a result of the habitat surveys conducted we find that each of these tributaries is likely to support fish populations above and below the diversion structures and that removing the five feeder diversion as proposed would reestablish the habitat connectivity within the tributary streams and with Butte Creek.

Lower Centerville diversion dam Removal

Removal of the Lower Centerville Diversion dam, as recommended by the Conservation Groups and the CSSA, would eliminate the need for PG&E's proposed Project Canal Fish Rescue Plan or a fish screen at the entrance to the Lower Centerville Canal. While removing this structure would open up a small amount of fish habitat below a large 35 foot high natural barrier to upstream fish passage that exist 0.58-mile upstream of the diversion dam, it would also prevent the delivery of cold water to lower Butte Creek below the Centerville powerhouse, as discussed above.

As discussed above, if all the flow from DeSabla powerhouse remained in the channel, as would occur if the Lower Centerville Diversion dam were to be removed, the mean temperatures in the stream reach below Centerville powerhouse would increase by 0.67 ºC in a normal water year and 1.0 ºC in a dry water year . This warmer water below Centerville powerhouse would place the spring-run Chinook holding in the lower reach at greater risk of temperature induced stress and mortality. Therefore, it is likely that these fish would move upstream above Centerville powerhouse in search of the colder water, exacerbating the already crowded conditions.[42]

It is clear that the project is preventing the upstream migration of fish past project diversions and the entrainment of fish into project canals is likely affecting the density of the trout populations in project affected stream reaches. However, results reported in the study reports for study 6.3.3-4 *Characterize Fish Populations in Project Reservoirs and Project-Affected Stream Reaches* and study 6.3.3-6 *Assessment of Fish Entrainment and Upstream Fish passage Issues as DeSabla Centerville Project Facilities* generally demonstrate that age class structure of the trout populations within project affected stream reaches is sufficient to demonstrate viable fish populations. The condition of trout sampled from the project's canal system is good, with rainbow trout and brown trout having a mean condition factor of 1.17 and 1.05-1.14, respectively.[43] Additionally, species composition for project affected stream reaches in 2006 were similar to historical observations (see table 3-17). Therefore, we find that trout

[42] Cal Fish & Game studies conducted between 2001 and 2007 found that the population of adult spring-run Chinook in the Upper Centerville Reach exceeded the available spawning habitat, while during this same period, spawning habitat downstream of Centerville Powerhouse was underutilized (Source: PG&E's reply comments filed with the Commission on August 18, 2008.

[43] We recognize that these fish were sampled from the project's canal system and not the project affected stream reaches; however, because the canals are not screened and these fish could move freely to project stream reaches, we find that the condition factor represented for fish sampled from the canal system is likely representative of those residing within the project effected stream reaches.

populations within project affected stream reaches, both above and below the project diversions are viable.[44]

We discuss the cost of developing and implementing measures relating to entrainment and fish passage in section 4, *Developmental Analysis*. We present our final recommendations pertaining to entrainment and fish passage in section 5, *Conclusions and Recommendations.*

Aquatic Monitoring

PG&E does not propose to monitor the fishery resource within the projected affected stream reaches during the term of a new license. However, the Forest Service condition 19 would require the development and implementation of a rainbow trout population monitoring plan for the West Branch Feather River. As discussed below, the Forest Service, NMFS, FWS and the Cal Fish & Game also recommend the development and implementation of an aquatic biological monitoring plan. The aquatic biological monitoring plan is made of three components a fish monitoring plan for monitoring resident and anadromous fish, Amphibian monitoring plan, and a benthic macroinvertebrate monitoring plan.

Forest Service 4(e) Condition 19, Trout Population Monitoring

The Forest Service's 4(e) condition 19 would require the development and implementation of a plan to monitor rainbow trout populations in the West Branch Feather River, for a minimum 4 year period of time,[45] in the three miles of stream reach above and below the Hendricks Head dam and that the sampling design conform to the methods developed for the relicensing study plan 6.3.3-4. If monitoring indicates that the average population of rainbow trout (across all sample years) is less than 830 rainbow trout per acre,[46] the Forest Service would

[44] In its filing with the Commission on June 27, 2008, the FWS concurred with this finding.

[45] Two years shall be dry water year types and two years shall be normal water year types.

[46] The Forest Service used the Cal Fish & Game's wild trout monitoring data for rainbow trout to develop its "rainbow trout healthy population reference data" (filed with the Commission on April 18, 2008) for use in hydropower relicensing in Northern California sierran streams. This reference data utilized three reference stream reaches in three unimpaired Northern Calilfornia west slope Serrian streams located in the project's vicinity (Lavezolla, Nelson, and West Branch Nelson creeks). Forest Service used the mean population estimates (1108 from the three reference reaches and applied a correction factor of 0.75 to set their goal of an average of 830 rainbow trout per acre in the West Branch Feather River (above

require the development of a rainbow trout habitat and population improvement plan.

If the Forest Service deems it necessary, the rainbow trout population habitat improvement plan would require the development and implementation of unspecified measures to improve the rainbow trout population in an effort to achieve an average of 830 fish per acre, and the monitoring of the rainbow trout population's response to the measures through the Forest Service's condition 20.

On July 30, 2008, PG&E filed an alternative 4(e) to the Forest Service's 4(e) condition 19. PG&E provides its alternative 4(e) as it questions the Forest Service's goal of achieving 830 rainbow trout per acre rather than identifying and providing mitigation for project related impacts on fish populations in the West Branch Feather River. To accomplish this PG&E's alternative includes monitoring the fish populations (not just rainbow trout) within three sample sites, located within approximately 3 miles above and below the Hendricks Head dam on the West Branch Feather River. To support a statistical comparison of water year types and fish populations PG&E's alternative includes sampling for a minimum of eight years, of which, a minimum of 3 years of the sampling will occur in each dry and normal water year types instead of the Forest Service's required 2 year for each water year type. PG&E states that its alternative would allow for the development of a target population goal that more appropriately addresses project affect on the West Branch Feather River's rainbow trout population. PG&E's alternative would also utilize backpack electrofishing as a means of sampling instead of direct observation. PG&E propose to utilize electrofishing to better support a statistical comparison of the results to the rainbow trout healthy population reference data being utilized by the Forest Service.

Our Analysis

Regarding Forest Service's 4(e) condition 19, we find that the Forest Service's use of 830 rainbow trout per acre as a target reference for healthy rainbow trout populations on Northern Serrian National Forest System Lands provides a noble goal for the Forest Service to strive toward when applying fishery management measures on their lands. However, applying this goal as a target that must be met or result in the mitigative measure to be carried out solely by PG&E until the goal is met, is not appropriate. Forest Service's condition 19 does not take into consideration other activities or conditions within the West Branch Feather River's watershed that may be affecting rainbow trout populations, such as

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and below the Hendricks Head dam).

competition with other trout species (e.g. brown trout). By evaluating the fishery resources in their entirety, PG&E's alternative to the Forest Service's condition 19, would better identify project related affects on the fishery population within the West Brach Feather River, establish a target population goal that is correlated to the project's affects, and would cater mitigative measures to specifically address those effects.

Although an assessment of trout population trends is not possible where multiple years of data are not present, based on PG&E's relicensing study, the Forest Service estimates the number of rainbow trout above and below the Hendricks Head dam in 2007, were approximately 911 and 695 fish per acre, respectively.[47] As discussed above, while we acknowledge the project is likely affecting the overall population density of rainbow trout in the West Branch Feather River, we find that the trout populations above and below the Hendricks Head dam are viable and question the need for either the Forest Service's condition 19 or PG&E's alternative.

We discuss the cost of developing and implementing the trout monitoring plan section 4, *Developmental Analysis*. We present our final recommendations pertaining to this plan in section 5, *Conclusions and Recommendations.*

Resident Fish Monitoring

The Forest Service 4(e) condition 20 requires that PG&E monitor fish species composition and relative abundance in project affected bypass reaches, utilizing the same sampling methods and location used during the relicensing surveys. Table 3-29 lists the monitoring locations. The Forest Service specifies that surveys would be conducted in two successive years, beginning in the fifth full year after implementation of the minimum instream flows required by its 4(e) condition 18, or following completion of the rainbow trout monitoring study prescribed by its 4(e) condition 19, whichever is later. The Forest Service specifies that surveys would be conducted in years 5, 6, 11, 12, 17, 18, 23, 24, 29, and every five years thereafter for the life of the license after the condition 18 stream flows have been implemented.[48]

Table 3-29. Forest Service 4(e) condition 20 fish monitoring sites.

Fish Monitoring Sites	
Site No.	Site Description

[47] Forest Service's comments filed with the Commission on April 18, 2008.

[48] Pursuant to the Forest Service's condition, scheduled sampling would not occur during a wet water year and would be postponed until the following normal or dry water year type.

F-2	West Branch Feather River Downstream of Philbrook Reservoir
15.1	West Branch Feather River Downstream of Rattlesnake Creek
21.2	West Branch Feather River Downstream of Fall Creek
35.6	West Branch Feather River (8 Amphibian sampling site)
41.1	West Branch Feather River Downstream of Coon Hollow Creek
43.6	West Branch Feather River Downstream of Round Valley Reservoir

The FWS's and the NMFS's 10(j) recommendation 6 and 5, respectively, differ from the Forest Service's 4(e) condition 20, in that they would require the development and implementation of a plan to monitor of resident fish populations in project affected stream reaches within Butte Creek,[49] in addition to the West Branch Feather River as required by the Forest Service, and that surveys be conducted for two consecutive years for every five year period for the term of the license, beginning the first of license issuance. However, this is consistent with the Forest Service's 10(a) recommendation 6 as it pertains to Butte Creek. The Cal Fish & Game's 10(j) recommendation 5 is consistent with both the NMFS and FWS recommendations and the Forest Service's 10(a) recommendation 6, for resident fish monitoring except that it specifies the development of the monitoring plan be completed within 6 months of license issuance, does not include monitoring of the project's reservoirs, and does not specify a sampling frequency.

PG&E in its alternative 4(e) provides only a few adjustments to the Forest Service's 4(e) condition 20. These adjustments are largely in the location of the sample sites as depicted in table 3-30. For site numbers F-2 and 15.1, PG&E believes that the edited text purely editorial and consistent with the Forest Services intent. Regarding the deletion of site number 43.6, PG&E provides justification by stating (1) that the specified site is located within an intermittent stream reach that typically is not flowing during the specified time of the survey, and (2) there are no proposed changes to the minimum instream flow releases in the sample reach.

Table 3-30. PG&E's Alternative monitoring sites to Forest Service 4(e) condition 20 fish monitoring sites.

Fish Monitoring Sites	
Site No.	Site Description
F-2	~~West Branch Feather River~~ *Philbrook Creek* Downstream of Philbrook Reservoir
15.1	West Branch Feather River ~~Downstream~~ *Upstream* of Rattlesnake

[49] The FWS's recommendation 6 also includes fish monitoring in the project's impoundment (DeSabla Forebay, Round Valley Reservoir, and Philbrook reservoir.

	Creek
21.2	West Branch Feather River Downstream of Fall Creek
35.6	West Branch Feather River (8 Amphibian sampling site)
41.1	West Branch Feather River Downstream of Coon Hollow Creek
~~43.6~~	~~West Branch Feather River Downstream of Round Valley Reservoir~~

In its reply comments filed on August 18, 2008, PG&E contends that because the DeSabla Forebay and Philbrook Reservoir are stocked by the Cal Fish & Game and managed as put-and-take fisheries and that Round Valley reservoir is typically emptied by late summer, monitoring the fishery in project impoundments, as recommended by the FWS in its 10(j) recommendation 6 and the Forest Service's 10(a) recommendation 6 would not result in added beneficial information.

Our Analysis

Fish species composition and abundance would likely respond to changes in project operations, specifically, alteration in minimum flows provided to project bypass reaches. Habitat enhancement, fish passage at project diversion dams, and screening of project canal intakes could also promote a response in the fishery within affected stream reaches. Monitoring the fishery's response would enable an evaluation of the habitat modification and/or alterations in project operations and provide for future evaluation of any required alteration of minimum flows, and/or habitat enhancements, supporting future habitat enhancements or modifications to project operation or minimum flow, through adaptive management as recommended by the Cal Fish & Game in it 10(j) recommendation 5. Because there are no recommended changes in the minimum flow regime being provided to the West Branch Feather River downstream of Round Valley reservoir, and because no habitat enhancements have been proposed or recommended within this reach, there would be no project related actions for the fishery to respond to; therefore, we find PG&E's alternative to remove site number 43.6 from the fish monitoring sites to be appropriate.

Regarding the timing of the resident fish monitoring, the Forest Service's recommendation to begin monitoring in the fifth full year after implementation of any required changes in the minimum instream flows would allow for the fishery to respond to the new flow regime. Where as the recommendations to develop and implement the resident fish monitoring within 1 year of license issuance (6 months in the case of the Cal Fish & Game's 10(j) recommendation 5) would capture the fishery's response while in it is still in a state of flux, resulting in the information being gathered having little value.

However, monitoring the resident fishery's response to alteration to the minimum flow provided to a project bypass reach or following a habitat enhancements for the duration of the project's license as recommended, is excessive and unnecessary. The response in the fishery can likely be determined by monitoring trout populations for two successive years, beginning in the fifth full year after implementation of the minimum instream flow or the habitat enhancement.

Monitoring of the put-and-take fisheries within the DeSabla Forebay and Philbrook reservoir would serve little purpose as any population data gathered would be largely reflective of the Cal Fish & Game's management of the put-and-take fishery, numbers of fish stocked and angling pressure. While this information could be used to inform fishery management decisions of the Cal Fish & Game, it would serve little use for informing adaptive management provisions for the project. Also, because Round Valley reservoir is typically drained each year, and the watershed upstream of the reservoir typically goes dry during the summer,[50] we find that surveying the fishery at this location would serve no purpose.

We discuss the cost of developing a plan for and implementing resident fish monitoring in section 4, *Developmental Analysis*. We present our final recommendations for resident fish monitoring in section 5, *Conclusions and Recommendations.*

Anadromous Fish Monitoring

NMFS and the FWS in their 10(j) recommendation 5(A) and 6(A) respectively, and the Forest Service in its 10(a) recommendation 6(A) provide that PG&E should annually monitor the ESA listed spring-run Chinook salmon and the Central Valley steelhead in Butte Creek. NMFS recommends that PG&E develop a plan for the monitoring that includes annual snorkel surveys to monitor adult distribution and abundance, annual pre-spawn mortality surveys, and annual carcass surveys to monitor spawning. The plan as recommended would also provide for the consideration of juvenile emergence and outmigration monitoring in extreme dry years. The plan would also consider modifications to facility operations and maintenance necessary to avoid, minimize or improve project related impacts to Chinook salmon and steelhead. While consistent with the above recommendations by the NMFS and the FWS, the Cal Fish & Game's 10(j) recommendation 6 would also include monitoring of movement patterns of adult Chinook salmon in response to any flow changes, and the monitoring of Chinook holding habitat and spawning gravels.

[50] *See* Study Report 6.3.3-4, *Characterization of Fish Population in Project Reservoirs and Project-Affected Stream Reaches.*

The Conservation Groups' 10(a) recommendation 1(c) also provides for monitoring of Chinook salmon including monitoring of their migration, holding, and spawning. However, the Conservation Groups propose that the jurisdictional resource agencies[51] install a removable weir to limit upstream migration of Chinook salmon and enable the monitoring. The Conservation Groups state that the specific task of the monitoring would be to set a default protocol for the weir's installation and removal, for the better management of Chinook salmon habitat and spawning.

PG&E in its reply comments state that they will develop a plan to monitor ESA listed anadromous salmonids in consultation with the resource agencies. However, PG&E does not commit to monitoring the additional measures provided by the Cal Fish & Game to monitor the movement patterns of adult Chinook salmon, and Chinook holding habitat and spawning gravels, stating that they need further clarification on these monitoring recommendations. PG&E does not support the Conservation Groups' recommendation for the installation of a weir as this recommendation is part of the Conservations Groups larger recommendation to decommission the Centerville powerhouse as discussed in section 2 *Proposed Action and Alternatives*.

Our Analysis

The ESA listed status of the anadromous fishery in lower Butter Creek and its dependence on the DeSabla-Centerville project's operations and the inter-basin transfer of flows from the West Branch Feather River warrants annual monitoring of the this fishery and its response to project operations. Annually monitoring the behavioral changes of the ESA listed fish to changes in project operations resulting from adaptive management provisions of any license issued, and the resultant changes in habitat will allow PG&E and the resource agencies to adaptively manage project operations, throughout the term of the license, to ensure the effective protection of spring-run Chinook salmon and Central Valley-run steelhead trout in lower Butte Creek. Information resulting from the monitoring would likely generate a library of information to be used to inform the long-term project operations plan (discussed below) and needed to evaluate future habitat enhancements or modifications to project operation or minimum flows, through the adaptive management provisions recommended by the Cal Fish & Game in it 10(j) recommendation 5.

Benthic Macroinvertebrate Monitoring

[51] We assume the Conservation Groups are referring to the National Marine Fisheries Service and the California Department of Fish and Game.

Forest Service 4(e) condition 20 and 10(a) recommendation 8, the NMFS and FWS's 10(j) recommendation 6 and 8, respectively, provide for the development and implementation of a benthic macroinvertebrate monitoring plan. The plan would describe the sampling to be conducted within project bypass reaches in years 1 through 4, and in years 8, 12, 16, 20, 24, and every five years thereafter. The monitoring plan would include provisions for monitoring species composition and relative abundance and that PG&E will use the data to determine trends in the macroinvertebrate community structure, as represented by matrix (e.g., taxa, richness, EPT index, and tolerance value), in the California Stream Biomass Procedure, and provide a comparison of trends in metrics within reaches, between reaches, and a comparison with previous results.

PG&E in its reply comments and alternative 4(e), provides an alternative sampling frequency to the agencies' sampling frequency. PG&E stipulates that surveys should be conducted in years 1, 3, 5, 11, 17, 23, 29 and every five years thereafter through the term of the license and in coordination with PG&E's alternative 4(e) condition 20 for the fish population monitoring. Additionally, PG&E's alternative would adopt the bioassessment sampling methodology outlined in the California Statewide Ambient Monitoring Program, which replaced the California Stream Biomass Procedures as California's standard methodology for collecting aquatic macroinvertebrates for bioassessment.

Our Analysis

Benthic macroinvertebrate monitoring would assist with determining the effectiveness of measures implemented in the new license for enhancing trout populations, and for assessing whether any modifications or additional measures are needed. Sampling benthic macroinvertebrates in the same years as fish population monitoring would help to identify relationships between fish populations and the abundance of the aquatic macroinvertebrate prey base, which would improve understanding of the relationship between measures that are implemented and aquatic productivity.

Additionally, like with the resident fish population monitoring, monitoring the benthic macroinvertebrate composition and relative abundance response to alteration in project operations for the duration of the project's license as recommended, seems excessive and unnecessary. The response in the benthic community would likely be determinable within two successive years of an alternation to stream flows.

Utilizing the most recent state standard methodology to conduct the monitoring would be appropriate. However, we recognize that the relicensing

study 6.3.3-5 *Survey Benthic Macroinvertebrates in Project-Affected Stream Reaches using CSBP protocols* utilized the former state standard and is consistent with the agencies' recommendations, and that for consistency between study data, pre-licensing and post-licensing, it may be appropriate to remain consistent in the methodology.

Annual Consultation, Long-Term Operations, and Adaptive Management

Annual Consultation Meeting

The Forest Service's 4(e) condition 1 requires PG&E to annually meet with the Forest Service to consult on measures needed to ensure protection and utilization of the National Forest resources affected by the project. As required by the Forest Service, consultation would include but not be limited to:

- A status report regarding implementation of license conditions;
- Results of any monitoring studies performed over the previous year in formats agreed to by the Forest Service and South Feather during development of study plans;
- Review of any non-routine maintenance;
- Discussion of any foreseeable changes to project facilities or features;
- Discussion of any necessary revisions or modifications to plans approved
- as part of this license;
- Discussion of needed protection measures for species newly listed as
- threatened, endangered, or sensitive or, changes to existing management
- plans that may no longer be warranted due to delisting of species or, to
- incorporate new knowledge about a species requiring protection; and
- Discussion of elements of current year maintenance plans, such as for road maintenance.
- PG&E would keep a record of the meeting, which would include any recommendations made by the Forest Service for the protection of National Forest lands and resources. PG&E would file the meeting record, if requested, with the Commission no later than 60 days following the meeting. A copy of the certified record for the previous water year regarding instream flow, monitoring reports, and other pertinent records would be provided to the Forest Service at least 10 days prior to the meeting date, unless otherwise agreed. Copies of other reports related to project safety and non-compliance would be submitted to the Forest Service concurrently with submittal to the Commission. These would include, but are not limited to: any non-compliance report filed by PG&E, geologic or seismic reports, and structural safety reports for facilities located on or affecting Forest Service lands. Subject to any restrictions contained in any

agreement with PG&E, the Forest Service reserves the right, after notice and opportunity for comment, to require changes in the project and its operation through revision of the Section 4(e) conditions to accomplish protection and utilization of National Forest lands and resources.

Long-term Operations Plan

PG&E proposes to develop in consultation with NMFS, Cal Fish & Game, and FWS, and implement upon Commission approval, a Long-term Operations Plan. PG&E proposes the plan would be implemented for the duration of any new license issued with the primary goal of seeking to provide cold water for holding, spawning, and rearing spring-run Chinook salmon and steelhead in Butte Creek upstream and downstream from the Centerville powerhouse. PG&E proposes the plan would consider the feasibility of increasing spawning habitat availability by increasing flows in-between the Lower Centerville Diversion dam and the Centerville powerhouse during the spawning and egg incubation period (late-September to February), while balancing power production. PG&E also proposes the plan would consider modifications to facility operations and maintenance necessary to avoid, minimize, or improve Project-related impacts to spring-run Chinook salmon.

PG&E's proposed Long-term Operations Plan is consistent with Forest Service 4(e) condition no. 24, Forest Service 10(a) recommendation no. 15, Cal Fish & Game 10(j) recommendation no. 4, FWS 10(j) recommendation no. 13 and NMFS 10(j) recommendation no. 8. However, FWS, Cal Fish & Game, and NMFS further recommend that PG&E consult with the Water Board and the Commission and that this plan specify how other Project facilities are to operate in both Butte Creek and the West Branch Feather River, how and when water is diverted, and likely times for maintenance activity of Project facilities. These agencies further recommend the plan would be filed with the resource agencies. The Forest Service also requires in 4(e) condition no. 24 that when developing this plan, they also should be included in the consultation.

The Forest Service in 10(a) recommendation no. 15, FWS in 10(j) recommendation no. 13, and NMFS in 10(j) recommendation no. 4 further recommend that the Long-term Operations Plan would contain a water temperature monitoring plan that would be developed in consultation with NMFS, FWS, Cal Fish & Game, Water Board, and the Commission. This plan would be consistent with the water temperature monitoring as recommended by these agencies and as discussed below in Water Temperature Monitoring, and would be based on the previous year's Project operations plan's water temperature monitoring sites, methods, and reporting. We discuss agency recommendations

pertaining to water temperature monitoring below under Water Temperature Monitoring.

NMFS further recommends in their 10(j) recommendation no. 8 that this long-term operations plan would contain provisions for the installation of remote operating capability as well as addition real-time water temperature and reservoir elevation and flow gages in Round Valley and Philbrook reservoirs. NMFS recommends the location of these gages would be agreed upon by Cal Fish & Game and NMFS. Because this measure addressed reservoir and stream gages, it is discussed above under Instream Flow and Reservoir Level Monitoring.

NMFS further recommends in their 10(j) recommendation no. 8 that this plan contain: (1) modifications to project facilities and operations necessary to release project flows from various locations from Centerville Canal into the diverted reach below Centerville Diversion dam; (2) gravel enhancement and pool development to increase physical habitat; and (3) develop operational alternatives in the event that Centerville powerhouse is shut down during the spawning period.

Comprehensive Monitoring Report and Adaptive Management

Cal Fish & Game's 10(j) recommendation 5 provides that, during the sixth year of license issuance, PG&E would develop, in consultation with the agencies, and submit a comprehensive monitoring and adaptive management summary report. Cal Fish & Game states that PG&E shall implement any adaptive management measures specified in the report upon Commission approval.

Our Analysis

Conducting annual meetings to review the results of monitoring reports and to consider any need to modify project operation or environmental measures would help to ensure that National Forest System lands and other important environmental resources are protected. Opening the meeting to other resource agencies would assist with interpretation of monitoring results and ensure that the full range of effects of any proposed changes in operation or measures are fully considered.

Since 1999, PG&E has operated the Project based upon an annual Project Operations and Maintenance Plan that is developed in consultation with Cal Fish & Game, NMFS, and FWS. This plan outlines the procedures and practices followed by PG&E in the operation and maintenance of the Project facilities with the goal of protecting and enhancing habitat for spring-run Chinook salmon in lower Butte Creek. Under this annual plan, water is released from Round Valley Reservoir, followed by the release of water from Philbrook Reservoir as high

temperatures occur during the summer. These releases, together with the diversion of natural flow from the West Branch Feather River, provide an additional source of cool water to lower Butte Creek for the benefit of Chinook salmon and steelhead.

PG&E's proposal to develop and implement a long-term operations plan, consistent with Forest Service 4(e) condition no. 24, Forest Service 10(a) recommendation no. 15, Cal Fish & Game 10(j) recommendation no. 4, FWS 10(j) recommendation no. 13 and NMFS 10(j) recommendation no. 8, is similar with the goals of the current annual Project Operations and Maintenance Plan. This Long-term Operation Plan would utilize information from previous year's operating plans and results collected through recent relicensing studies, and the results of future monitoring to define long-term procedures and practices in an attempt to provide habitat conditions that support healthy populations of spring-run Chinook salmon and steelhead in lower Butte Creek, and other aquatic species in all of the project-affected reaches of Butte Creek and the West Branch Feather River.

Because water temperatures in the Project area are manipulated and controlled to some extent by project operations, including any water temperature monitoring in a Long-term Operations Plan, as recommended by the Forest Service in 10(a) recommendation no. 15, FWS 10(j) recommendation no. 13, and NMFS 10(j) recommendation no. 4, would allow for this information to complied together, allowing for any temperature data to be analyzed in conjunction with Project operations. Results from any water temperature monitoring would also likely become a basis for any discussions between PG&E and the agencies regarding potential proposals to adaptively manage and modify Project operations or facilities in an effort to provide more ideal habitat conditions for aquatic resources. Further, it would be prudent to consider all monitoring information, not just temperature, gathered as a result of new license conditions when evaluating modifications to project operations or facilities, as recommended by the Cal Fish & Game. However, any proposals to modify project operations or facilities as a result of this information would need to be approved by the Commission prior to implementation.

3.3.3 Terrestrial Resources

3.3.3.1 Affected Environment

Vegetation

The project area is predominantly forested. Douglas fir-ponderosa pine is the dominant vegetation type in the study area,[52] encompassing about 40 percent of the study area (PG&E, 2007, section 6.5.2.2). At mid- to upper-elevations, black oak, sugar pine, and incense cedar are found. Tan oak is often present in the shrub and tree layers. Large amounts of canyon live oak (11.5 percent), white fir (10.1 percent), and ponderosa pine (9.8 percent) vegetation types are also found in the study area.

Wetlands/Riparian Vegetation

Montane riparian forest (white alder series) is found along the West Branch Feather River and upper Butte Creek, and their tributaries. The riparian corridor is typically narrow and discontinuous, due largely to gradient and bedrock constraints. Other characteristic species include: black cottonwood, arroyo willow, redtwig dogwood, California wild grape, thimbleberry, Bolander's sedge, hedgenettle, bracken fern, ciliate willow-herb, and American brooklime.

Riparian scrub is found along West Branch Feather River and Butte Creek, as well as various tributary streams, and may also be associated with project canals and reservoir shoreline (littoral) areas. The riparian corridor is vegetated primarily with winter-deciduous shrubs to small trees. Plant species characteristic of the region include shining willow, Lemmon's willow, sandbar willow, and arroyo willow.

Freshwater marshes may occur locally as a narrow fringe of emergent vegetation associated with the reservoir shorelines.

Noxious Weeds

PG&E and SPI surveyed areas within about 200 feet of the project boundary, project-affected stream reaches, and project roads located within the project boundary between May and September 2006 (PG&E, 2007, section 6.5.2.3). The Willow Day Use Area and roads that provide direct access to Philbrook reservoir from the main county road were also surveyed. Nine target noxious weed species were found during the surveys: (1) black locust, (2) common fig, (3) English ivy, (4) French broom, (5) Johnsongrass, (6) periwinkle, (7) Spanish broom, (8) tocalote, and (9) tree-of-heaven. A total of 213 occurrences and about 72 acres were found in the surveyed area. None of these species have a California Department of Food and Agriculture pest rating of A or B (known economic importance). Weeds were prevalent at high traffic, disturbed,

[52] The study area consists of 6,780.4 acres concentrated around project-affected stream reaches, and including the project boundary and project roads.

mid- and low-elevation areas, such as powerhouses and recreation sites. Large populations were also located on less-disturbed flume reaches along Butte Creek Canyon, and flume reaches that cross residential areas.

The most common weed species were Spanish and French broom, totaling about 68 percent of the weed occurrence and 95 percent of the acreage. These shrubs are abundant in Butte Creek Canyon along the flumes and creek. A substantial population of Spanish broom exists near the DeSabla powerhouse. Large occurrences of both species grow around the DeSabla forebay and associated flume trails and public access roads.

Special-status Plant Species

PG&E conducted rare plant surveys in July and August 2006 and April and May 2007 of areas within about 200 feet of the project boundary, project-affected stream reaches, and project roads located within the project boundary, excluding SPI lands (PG&E, 2007, section 6.5.2.1). The target sensitive species found in the in the study area are summarized in table 3-31.

Table 3-31. Target special-status plant species identified by PG&E during 2006 field surveys (Source: PG&E, 2007, section 6.5.2.1).

Species	**Rating (Forest Service/ CNPS)**	**Number of Mapped Points**	**Number of Mapped Polygons**	**Acreage of Plants**	**Approximate Number of Total Plants**
Ahart's sulfur-flower *(Eriogonum umbellatum* var. *"ahartii")*	sensitive / --	1	2	1.56	80
Butte County calycadenia *(Calycadenia oppositifolia)*	sensitive / 4.2	1	--	--	5
Butte County morning glory *Calystegia atriplicifolia* ssp. *buttensis*	sensitive / 1B.2	120	13	41.07	6,872
Dissected-leaved toothwort *(Cardamine pachystigma* var. *dissectifolia)*	special interest / 3	24	--	--	862
Clarkia (past flowering, unidentifiable to species)	Unknown until identified	12	--	--	150
Cut-leaved ragwort *(Senecio (Packera) eurycephalus* var. *lewisrosei)*	special interest / 1B.2	7	--	--	40
Humboldt lily *(Lilium humboldtii* ssp. *Humboldtii)*	special interest / 4.2	11	--	--	45
Potential Humboldt lily (not flowering)	special interest / 4.2	22	--	--	78
Butte County missionbells *(Fritillaria eastwoodiae)*	sensitive / 3.2	31	1	0.31	508
Jepson's onion *(Allium jepsonii)*	sensitive / 1B.2	6	3	1.35	200-250
Sanborn's onion *(Allium sanbornii* var. *sanbornii)*	special interest / 4.2	9	2	14.11	650-700
shield-bracted monkeyflower *(Mimulus glaucescens)*	special interest / 4.3	41	3	5.71	10,000-12,2000
tall checkerbloom *(Sidalcea "gigantea")*	special interest / --	2	--	--	10-15
white-stemmed clarkia *(Clarkia gracilis* ssp. *Albicaulis)*	sensitive / 1B.2	6	2	0.55	1,000-1,100

* Status definitions:

California Native Plants Society (CNPS)

List 1B = Plants rare, threatened, or endangered in California and elsewhere

List 2 = Plants rare, threatened, or endangered in California, but more common elsewhere
List 3 = Plants about which more information is needed – a review list
List 4 = Plants of limited distribution – a watch list
Extension codes:
.3 = Not very endangered in California
.2 = Fairly endangered in California
.1 = Seriously endangered in California

Seven of the species (white-stemmed clarkia, Humboldt lily, Butte County calycadenia, shieldbracted monkeyflower, Butte County missionbells, dissected-leaved toothwort, and cut-leaved ragwort) may have been more widespread in the study areas, particularly in inaccessible serpentine areas.

Surveys also noted inaccessible or unsafe areas that contained serpentine habitat and/or provided potential habitat for lady's-slippers (11.27 acres), Cantelow's lewisia (68 acres), and the aquatic lichen *Hydrotheria venosa.*

Surveys conducted by SPI on their lands between May and September 2006 detected eight special-status species (PG&E, 2007, section 6.5.2.1) (table 3-32).

Table 3-32. Target special-status plant species identified by SPI during 2006 field surveys (Source: PG&E, 2007, section 6.5.2.1).

Species	**Status***	**No. locations**	**No. plants**
Mildred's farewell-to-spring (*Clarkia mildrediae* ssp. *mildrediae*)	CNPS list 1B.2	2	1,000
Butte County morning glory (*Calystegia atriplicifolia* var. *buttensis*),	CNPS list 1B.2	20	1,000
moonwort (*Botrychium ascendens*)	CNPS List 2	4	50
Gordon True's manzanita (*Arctostaphylos mewukka* ssp. *truei*)	CNPS List 4	13	275
Marsh claytonia (*Claytonia palustris*)	CNPS List 4	17	3,000
Clustered lady's slipper (*Cypripedium fasciculatum*)	CNPS List 4	1	3
Shield-bract monkeyflower (*Mimulus glaucescens*)	CNPS List 4	11	450
Obtuse starwort (*Stellaria obtuse*)	CNPS List 4	9	2,100

*See table T1 for status designations.

Wildlife Resources

The project area supports a diverse array of habitats and associated wildlife species. Black-tailed and California mule deer are the most common big game species in the project area. The deer are part of the East Tehama deer herd that inhabits portions of Tehama, Plumas, Lassen, Shasta, and Butte Counties.

Migration routes to and from seasonal ranges are the longest in the state, a distance of 50 to 100 miles. Deer migrate from the high elevation forest in Lassen National Park to their winter habitat in eastern Tehama County.

Game bird species include California quail, mountain quail, blue grouse, mourning dove, ring-necked pheasant, and wild turkey. Canada geese nest at Round Valley reservoir.

Pacific tree frogs, long-toed salamanders, bullfrogs, various species of garter snake, California newts, rough-skinned newts, western toads, and rattlesnakes were observed in the project area (PG&E, 2008, section 6.3.2.1).

Special-status Wildlife Species

Surveys were conducted for the bald eagle, osprey, peregrine falcon, willow flycatcher, and special-status bat species (PG&E, 2007, section 6.4.2.1), as well as special-status amphibian and aquatic reptile species (PG&E, 2007, section 6.3.2.1); the results are discussed below. For other potential special-status wildlife species, PG&E used the California Wildlife Habitat Relationship (CWHR) System to predict their potential occurrence and distribution within the study area (PG&E, 2007, section 6.4.2.4).

Bald eagles (federally delisted; California endangered)— Bald eagles are permanent residents and uncommon winter migrants throughout the state of California. They breed primarily in Butte, Lake, Lassen, Modoc, Plumas, Shasta, Siskiyou, and Trinity counties. Bald eagles forage near large aquatic ecosystems such as lakes, reservoirs, or free flowing rivers. Nesting usually occurs in large trees along shorelines in relatively remote areas. Breeding occurs in February through July, with the peak activity in March through June.

PG&E conducted bald eagle nesting surveys by helicopter in April, May, and June 2006. No bald eagles or bald eagle nests were found. Nesting habitat and prey base in lower Butte Creek appear adequate to support breeding bald eagles. The bald eagle population is expanding in California, and their colonization of new breeding locations adds to the state breeding population every year.

PG&E conducted bald eagle wintering surveys from November 2006 to February 2007. One adult bald eagle was observed perched along Butte Creek upstream of Centerville powerhouse. Single observations of bald eagles during December and January surveys indicated that the project area supports only low numbers of wintering bald eagles.

Osprey (Forest Service management indicator species)— Osprey nest close to large lakes and rivers and feed almost exclusively live fish. PG&E conducted osprey nesting surveys in conjunction with bald eagle helicopter surveys in April, May, and June 2006. Two active osprey nests were located: one along Butte Creek near the Butte siphon and one along the north shore of Philbrook reservoir. Two additional nests were found along the shoreline of Paradise Lake, a non-project reservoir east of DeSabla forebay, during bald eagle wintering surveys.

Peregrine falcon (federally delisted; California endangered)—Peregrine falcons frequent bodies of water in open areas with cliffs and canyons nearby for cover and nesting. PG&E identified five areas along lower Butte Creek as potential peregrine falcon nesting cliffs during habitat assessments conducted by helicopter concurrent with nesting bald eagle and osprey surveys and wintering bald eagle surveys. Ground searches were conducted for nesting peregrine falcons at survey locations during March and May 2007. Two previously unknown peregrine falcon territories were discovered during ground surveys (March 2007); falcons successfully nested at one territory and occupied but did not nest at the other territory.

Willow flycatcher (California endangered; Forest Service species of concern)—Willow flycatcher habitat typically consists of riparian habitat, often dominated by willows and alders. PG&E identified suitable, but marginal, habitat on the eastern side of Philbrook reservoir at the inlet of Philbrook Creek and at the northeastern end of Round Valley reservoir; no flycatchers were detected during surveys (PG&E, 2007, section 6.4.2.2).

Bat species—Man-made structures provides important roosting habitat for many bat species. Surveys conducted by PG&E identified the following bat species in the project area: Yuma myotis, western red bat, big brown bat, little brown bat, and California myotis (PG&E, 2007, section 6.4.2.3). In addition, one bat roost was identified at the Centerville powerhouse used by the Yuma myotis. The only special-status bat species identified was the western red bat (Forest Service sensitive); this species, located at the Hendrix diversion dam, was likely using that area for foraging.

foothill yellow-legged frog (California species of special concern) –The foothill yellow-legged frog (foothill yellow-legged frog) occurs in the coast ranges from the Oregon border south to the Transverse Mountains in Los Angeles County; in most of northern California west of the Sierra Cascade crest; and along the coast ranges north of Monterey from sea level to 6,000 feet in the Sierra Nevada mountains.

The foothill yellow-legged frog is typically found in small, low gradient, rocky streams with exposed boulders that provide sunning spots for adults. During the non-breeding season, frogs are resident in tributary streams. Breeding frogs use wide, shallow reaches near the mouths of tributaries. The females attach egg masses to cobbles and boulders in shallow, slow-moving backwaters and in depositional areas such as point bars and cobble/boulder bars at pool outlets.

Newly emerged tadpoles remain around the egg masses for several days before dispersing into the gravel or moving downstream to areas of moderate flow. Breeding sites are often separated by large distances of hundreds or thousands of meters. After breeding, adults disperse to deep pools. By fall and winter adult males and females are found primarily near pools, while juveniles are found at riffles on mainstem rivers. Tributaries are used by both juveniles and adults as refuges from summer heat and high water flows in winter and spring.

After evaluating potential sites using video, aerial photographs, and ground reconnaissance, PG&E conducted full-reach surveys at nine sites on Butte Creek (6.8 river miles surveyed) and seven sites on the West Branch Feather River (2.1 river miles) (PG&E, 2008, section 6.3.2.1). PG&E observed foothill yellow-legged frog in various life stages, and were well distributed at the visual encounter survey (VES) sites throughout the study area (table 3-33). Evidence of foothill yellow-legged frog breeding (presence of egg masses or tadpoles) was observed in 7 of the 11 VES sites on Butte Creek, and in four of the seven sites on the West Branch Feather River. foothill yellow-legged frog egg masses were slightly more abundant in Butte Creek than they were in the West Branch Feather River. Evidence of foothill yellow-legged frog breeding was observed as far downstream as RM 49 on Butte Creek and RM 15 on the West Branch Feather River. Post-metamorphic foothill yellow-legged frog were observed as far downstream as the Parrott-Phelan diversion dam (RM 46.2) on Butte Creek. foothill yellow-legged frog post-metamorphic frogs and evidence of breeding were observed as far upstream as RM 66.1 on Butte Creek, and RM 22 on the West Branch Feather River.

Mountain yellow-legged frog (federal candidate species and California species of special concern) and Cascade frog (California species of special concern)— No suitable habitat areas for the Cascade frog or mountain yellow-legged frog (MYLF) or individuals were identified during stream surveys for the foothill yellow-legged frog . Although there are incidental reports of MYLF using riverine habitat as low as 4,500 feet elevation in the South Fork Feather River watershed, all the sites surveyed in Butte Creek were well below the elevational range for MYLF (all sites surveyed were below 3,000 feet elevation). Cascade frogs have similar elevational restrictions as MYLF, and no lentic habitat was identified for this species in either Butte Creek or the West Branch Feather River.

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Northwestern Pond Turtle (California species of special concern)—The southwestern pond turtle occurs throughout the Sierra Nevada, typically below 4,500 feet (Lovich, 1995). This species occurs in rivers, streams, lakes, ponds, and seasonal wetlands where still or slow-moving water is present. In streams, pools are the preferred habitat (Bury, 1972). Although pond turtles spend much of their lives in water, they require terrestrial habitats for nesting. Females excavate nests up to 0.25 mile from water, usually on south to southwest-facing slopes. They also often overwinter on land, disperse via overland routes, and may spend part of the warmest months in estivation on

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Table 3-33. Summary of Foothill Yellow-legged Frog Observations, 2006 (Source: PG&E, 2008, section 6.3.2.1).

FYLF Lifestage	Observation of Lifestage	Lifestage Observation Point Characteristics						Site Characteristics	
		Water Temperature (°C)*	Max. Depth (cm)	Water Velocity (cm/sec)	Canopy / Shade Cover (%)	Algal Cover (%)	Detritus Cover (%)	Non-Native Predator Presence?	Native Predator Presence?
BUTTE CREEK BETWEEN BUTTE CREEK DIVERSION DAM AND LOWER CENTERVILLE DIVERSION DAM (INCLUDES SITES BC-6, BC-7, BC-8, BC-9, BC-12)									
Egg Masses	Y	16 (14–24) [2.4]	24 (0–64) [21]	0.7 (0–4) [1.3]	-	-	-	None	Observed at all sites in reach. Species included: trout, aquatic garter snakes, terrestrial garter snakes, and California newts
Tadpoles	Y	19 (9–27) [3.3]	27 (2–250) [33]	2 (0–21) [4.1]		53 (0–100) [33]	28 (0–100) [32]		
Young of Year	Y	Edge: 16 (11–20) [2.3]	-	-	24 (0–100) [35]	-	-		
Juveniles	Y	Mainstem: 16 (14–19) [1.7]	-	-	30 (0–100) [34]	-	-		
Adults	Y				38 (0–100) [32]				
BUTTE CREEK BETWEEN CENTERVILLE POWERHOUSE AND PARROT-PHELAN DIVERSION DAM, A NON-PROJECT STRUCTURE. (INCLUDES SITES BC-1, BC-2, BC-3, BC-4)									
Egg Masses	N							American bullfrogs observed at sites BC-1, BC-2, and BC-3	Observed at all sites in reach. Species included: trout, aquatic garter snakes, terrestrial garter snakes, and California newts
Tadpoles	Y	18 (15–22) [1.5]	14 (0.5–43) [10]	2.6 (0–23) [5.5]	-	69 (25–100) [26]	5.8 (0–25) [6.1]		
Young of Year	Y	Edge: 18 (15–22) [2.2]			14 (0–100) [29]				
Juveniles	Y	Mainstem: 17 (15–20) [2.3]	-	-	12 (0–100) [28]	-	-		
Adults	Y				0				
WBFR BETWEEN ROUND VALLEY RESERVOIR AND HENDRICKS DIVERSION DAM (INCLUDES SITES WBFR 7, WBFR 8, WBFR 9)									
Egg Masses	N							None	Trout and aquatic garter snakes observed at sites WBFR 7 and WBFR 8
Tadpoles	N								
Young of Year	N	Edge: 12 (8–15) [2.3]							
Juveniles	N		-	-	-	-	-		
Adults	N	Mainstem: 11 (8–12) [1.8]	-	-	-	-	-		
WBFR BETWEEN HENDRICKS DIVERSION DAM AND THE MIOCENE DIVERSION, A NON PROJECT STRUCTURE (INCLUDES SITES WBFR 1, WBFR 2, WBFR 5, WBFR 6)									
Egg Masses	Y	17 (15–20) [1.4]	32 (8.5–90) [20]	2.9 (0–10) [4]				None	Observed at all sites in reach. Species observed included California newts, rough-skinned newts, and aquatic garter snakes
Tadpoles	Y	19 (15–26) [2.5]	20 (5–100) [17]	0.7 (0–6) [1.1]		23 (0–93) [26]	16 (0–70) [19]		
Young of Year	Y	Edge: 19 (13–25) [4]	-	-	23 (0–100) [34]	-	-		
Juveniles	Y	Mainstem: 19 (13–26) [1.9]	-	-	30 (0–100) [31]	-	-		
Adults	Y				32 (0–100) [29]				

*Edge and mainstem water temperatures listed for post-metamorphic lifestages were averaged from the general site data and are not measures of specific point observations, as most individuals were not observed in the water.

land. Pond turtles are generally wary, but they may be seen basking on emergent or floating vegetation, logs, rocks, and occasionally mud or sand banks.

One northwestern pond turtle yearling was observed in Butte Creek at site BC-2 and two adult northwestern pond turtles were observed basking on logs on the right bank of site BC-2 in a backwater area (PG&E, 2007, section 6.3.2.1). No other western pond turtles were observed in the study area.

Other species—the CWHR predicted the presence of suitable habitat for 57 special-status wildlife species within the study area. The species list was comprised of 2 reptiles, 45 birds, and 10 mammals (PG&E, 2007, section 6.4.2.4, table E6.4.2.4.4-1). The California spotted owl has been recorded in the project area near Philbrook and Round Valley reservoirs and near the headwaters of Clear Creek. American martens have been recorded in the vicinity of Philbrook reservoir. More information on the habitat requirements of these is found in the license application (PG&E, 2007, Appendix E6.4.2.4-A).

3.3.3.2 Environmental Effects

Vegetation and Invasive Species Management

The presence of noxious weed species near project facilities has the potential to alter natural plant communities. Vegetation management at project facilities could adversely affect native plant communities, rare plants, and wildlife habitat.

PG&E proposes to prepare an Invasive Weed Management Plan that addresses aquatic and terrestrial invasive weeds within the project boundary and adjacent to project features directly affecting Forest Service lands, including roads and distribution and transmission lines.

The Invasive Weed Management Plan would address the following elements:

- Inventory and mapping of new populations of invasive weeds
- Action and/or strategies to prevent and control spread of known populations or introductions of new populations, such as vehicle/equipment wash stations
- Development of a schedule for control of all known A, B, Q[53] and selected other rated invasive weed species, designated by resource agencies

[53] As rated by the California Department of Food and Agriculture.

- On-going annual monitoring of known populations of invasive weeds for the life of the license in locations tied to project actions or effects, such as road maintenance, at project facilities, O&M activities, new construction sites, etc., to evaluate the effectiveness of revegetation and invasive weed control measures
- An adaptive management element to implement methods for prevention of aquatic invasive weeds, as necessary, such as: public education and signing of public boat access, preparation of an Aquatic Plant Management Plan, and boat cleaning stations at boat ramps for the removal of aquatic invasive weeds

PG&E proposes to control new infestations of A and B rated weeds shall within 12 months of detection or as soon as is practical and feasible. Monitoring would be done in conjunction with other project maintenance and resource surveys, so as not to require separate travel and personnel. To assist with this monitoring requirement, training in invasive plant identification would be provided to project employees and contractors by the Forest Service.

PG&E would restore/revegetate areas where treatment has eliminated invasive weeds in an effort to eliminate the reintroduction of invasive weed species. Project-induced ground disturbing activities would be monitored annually for the first 3 years after disturbance to detect and map new populations of invasive weeds. PG&E would re-vegetate disturbed areas utilizing only native plant material, guaranteed weedfree. Seed shall come from local collection sites, whenever possible, to protect the local plant genotypes.

PG&E proposes to develop a Vegetation Management Plan for Forest Service lands within the project boundary. The plan would include and/or address the following elements:

- Hazard tree removal and trimming
- Powerline/transmission line clearing
- Vegetation management for habitat improvement, including for visual screening
- Revegetation of disturbed sites
- Soil protection and erosion control, including use of certified weed free straw
- Establishment of and/or revegetation with culturally important plant populations
- Use of clean, weed free seed with a preference for locally collected seed.

These measures are consistent with Forest Service 4(e) condition 31 and FWS 10(j) condition 12, except as noted below.

PG&E also proposes to clear vegetation necessary to reduce fire hazards as part of its proposed fire prevention, response, and investigation plan.

In addition to PG&E's adaptive management measures to prevent the spread of aquatic weeds, the Forest Service specifies and FWS recommends that PG&E prepare an aquatic invasive/noxious plant management plan that outlines best management practices for the prevention of invasive aquatic species.

The Forest Service also specifies that PG&E develop a source of local native plant materials for revegetation projects so that a sufficient source would be available throughout the life of the project. The Forest Service also specifies that use of persistent non-native, non-invasive plant material would only be allowed when timely reestablishment of a native plant community, either through natural regeneration or with use of native plant materials, is not likely to occur. In those cases, cereal barely or wheat could be used.

Our Analysis

Noxious weeds can displace native plants, reduce biodiversity, affect threatened and endangered species, alter normal ecological processes (e.g., nutrient cycling, water cycling), decrease wildlife habitat, reduce recreational value, and increase soil erosion and stream sedimentation. PG&E has identified nine target noxious weed species in the project area.

Development of an invasive/noxious species management plan covering both terrestrial and aquatic species would ensure that these species are controlled throughout the term of the license and would help maintain native plant diversity and habitat quality. Expanding these measures to all project lands and not just Forest Service lands would ensure more complete control of these species.

Vegetation management such as roadside mowing, weed control, and revegetation could have positive and negative effects on natural resources, cultural values, and aesthetics.

Development of a vegetation management plan would ensure that these activities are conducted in a manner that minimize disturbance to vegetation and provides for the revegetation of disturbed areas. Many of these activities would occur on lands outside the National Forest. Expanding PG&E's management plan to all accessible project lands would provide additional resource protection.

Vegetation management could also be important in fuels reduction and fire prevention. Inclusion of such measures as part of the proposed fire prevention, response, and investigation plan would protect project resources from fire hazards.

Special-status Species

Recreational activities have the potential to affect special-status plant species. Further, the project could potentially affect special status species in the future as a result of new construction activities or existence of newly listed species. The foothill yellow-legged frog and bald eagle is discussed in separate sections below.

PG&E proposes to conduct an annual review of the current list of special status species (federal endangered and threatened, Forest Service sensitive, or Lassen and Plumas National Forest Watch List) to determine if any new species have been added to the lists. In the event that a species is likely to occur on Forest Service lands in the project area and would be directly affected by the project, PG&E would assess the effects, develop necessary information, and recommend resource measures. This proposal is consistent with Forest Service 4(e) condition 26, except the Forest Service condition does not apply to federally listed species. FWS [10(j) condition 9B] would expand the measure to include Bureau sensitive/watch list species and federal and state rare, threatened, or endangered species and would apply to all project lands.

PG&E also proposes to provide training to operations and maintenance staff on the identification of special-status species, methods to avoid sensitive areas and minimize disturbance during critical life-stages, and consultation.

In addition, Forest Service [4(e) condition 27] specifies that before construction of any new project features on Forest Service lands that may affect special status species (Forest Service sensitive and/or management indicator species) or their critical habitats, PG&E prepare a biological evaluation of the potential effects of the action on the species or its habitat. Based on the evaluation, the Forest Service may specify mitigation measures for the protection of the affected species. FWS [10(j) condition 9A] would expand the condition to include federally listed and candidate species and their habitats and would apply to all project lands.

Our Analysis

Numerous special-status plant species are found in the project area; however, the only identified project-related effects are associated with informal

recreation at low elevation reservoirs and stream reaches (PG&E 2007a, section 7.5.4).

The DeSabla reservoir and associated flume areas are easily accessible and well-traveled. Large occurrences of Butte County morning glory are present; Humboldt lily was also noted at this location. The eastern side of the reservoir and trails to the north experience a great deal of human disturbance, most notably littering, foot traffic, and informal parking on road shoulders and reservoir banks. A formal camp and cabins on the west side of the reservoir may also contribute to disturbance, but effects on the west side of the reservoir appear to be less intense. French broom, a noxious weed species, is also becoming well-established at the DeSabla forebay and along trails to the north, potentially affecting habitat suitability of rare plants.

Informal recreation occurs around the access area at the Miocene dam at the base of the "Magalia Serpentine." Several special status plants (Ahart's sulfur flower, Jepson's Onion, cut-leaved ragwort, Butte County calycadenia, and shield-bracted monkeyflower) are located in proximity to this dam. The majority of the recreational activity appears to be focused on the river access and little disturbance was noted in rocky upland areas where special status plants were typically observed. An informal camp was noted in proximity to individuals of Jepson's onion, and may be impacting individuals of this species found near the West Branch Feather River. Noxious weeds, notably Spanish broom, were also mapped at this access point.

At other project-affected stream reaches at mid- to low-level elevations, informal recreation does not appear to be affecting special status plants because most potentially occurring species are not found in conjunction with water access. Shield-bracted monkeyflower is an exception, occurring commonly in rocky, wet drainages throughout the project area. However, informal recreation does not appear to be limiting the distribution or persistence of this species.

PG&E did not document any special-status plants near the project's high elevation reservoirs (areas in the vicinity of Philbrook reservoir and Snag Lake), whether in undisturbed or highly-used areas. As a result, the potential for effects of informal recreation on special status plant species in these areas appears low.

The annual review of the current list of federally listed species and Forest Service Sensitive or Lassen and Plumas National Forest Watch List and development of protective measures, as needed, proposed by PG&E, would provide a mechanism for the evaluation of effects of project operation and maintenance on newly listed species and development of appropriate protective measures. Expanding the review beyond the scope of the proposed measure to

include Bureau sensitive/watch list species and federal and state rare, threatened, or endangered species and all project lands, as recommended by FWS, would provide additional protection to special status species.

The biological evaluation of the potential effects of future actions on Forest Service sensitive and/or management indicator species or their critical habitats specified in Forest Service 4(e) condition 27 would ensure that special status species would not be adversely affected by new project-related construction. Expanding the evaluation beyond the scope of the 4(e) condition to include federally listed and candidate species and their habitats and all accessible project lands, as recommended by FWS, would provide additional protection to special-status species.

Effects of Minimum Flows on Foothill Yellow-legged Frogs

Changes in flow releases can affect habitat suitability, water temperature, riparian vegetation, and river geomorphology, with resultant effects on foothill yellow-legged frog populations. Effects of flow fluctuation is discussed above in section 3.3.2, *Aquatic Resources*.

PG&E proposes, Forest Service prescribes, and FWS, California Fish & Game, and Conservation Groups recommend minimum flow releases to improve fish habitat, as discussed in section 3.3.2, *Aquatic Resources*. In addition, the Conservation Groups recommend that if the Centerville development is not removed as they recommend, PG&E should provide a minimum bypass flow of 1 cfs in Helltown Ravine below Lower Centerville canal to benefit a known population of foothill yellow-legged frog .

Our Analysis

Habitat Availability

Change in flow can affect suitability of foothill yellow-legged frog habitat. Eggs and tadpoles are particularly vulnerable to changes in flows because these life stages are confined entirely to the aquatic environment (Kupferberg et al., 2007). PG&E modeled foothill yellow-legged frog egg masses and tadpole life stages (PG&E 2008) at one location (Whiskey Flat study site on the West Branch Feather River) using habitat criteria developed by the FSC (Lind and Yarnell, 2008) (figure 3-42). According to the model, habitat (weighted useable area) for egg masses and tadpoles decreases most as flow increases from 10 cfs to about 50 cfs and continues to decline through the range of modeled flows (300 cfs). As flows increase, the availability of shallow, slow-moving areas of the West Branch Feather River are less available.

The current year-round normal water-year minimum flow of 15 cfs for the West Branch Feather River below Hendricks Head Diversion dam would be raised to 30 cfs during the early part of the breeding season (March through May) under all flow proposals and recommendations. Habitat for FLYF egg masses would decrease by about 15 percent. From June through October, minimum flows proposed by PG&E and recommended by the Conservation Groups would decrease to 20 cfs, increasing habitat for tadpoles by about 10 percent.

PG&E proposes and the resource agencies recommend normal water-year minimum flow increases from 16 cfs to 30 cfs during March through May downstream of Butte Creek dam and no changes to current flows from June through September; and 40 to 80 from March 16 through end of October downstream of Lower Centerville Diversion dam. PG&E proposes to increase flows to 75 cfs from September 15 through the end of October while the agencies recommend increasing flows to 100 cfs from September through October.

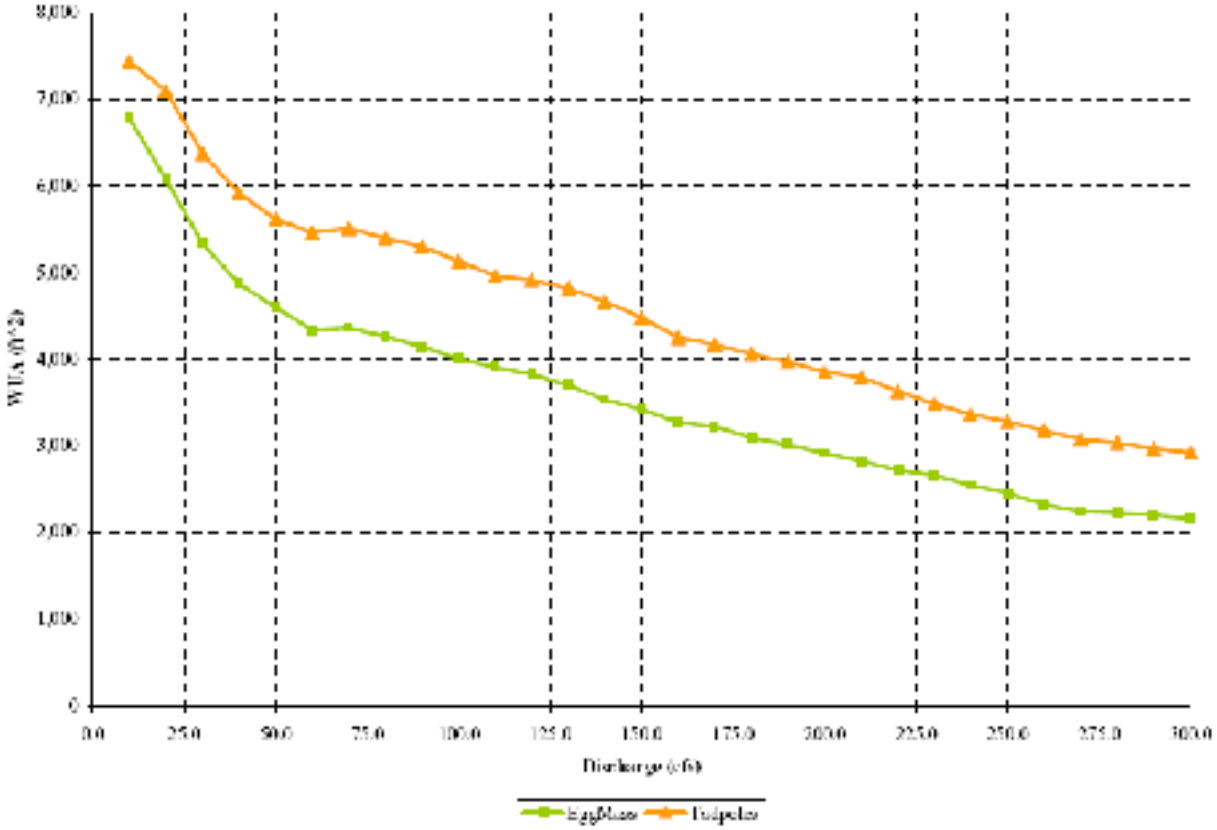

Figure 3-42. Weighted usable area (WUA) for foothill yellow-legged frog egg mass (lower curve) and tadpole (upper curve) life stages for the Whiskey Flat study site (PG&E, 2008).

Although habitat availability data is not available for Butte Creek, it is likely that habitat would decrease at the higher flows.

The relationship between suitable habitat and population size has not yet been tested, as populations may be limited by other factors such as temperature, competition and predation, and barriers to dispersal and re-colonization (Kupferberg et al., 2007). As with many rare species, populations at depressed levels may not be limited by available habitat.

Water Temperature

Increased minimum flows to provide fish habitat and cooler water to benefit coldwater fish populations could have indirect effects on foothill yellow-legged frog breeding. Water temperatures are important to foothill yellow-legged frog for two main reasons: temperatures must be high enough to initiate egg laying; and water must be warm for a sufficient period to allow for complete larval development. Delaying the initiation of breeding may result in insufficient time to complete development. Cooler water temperatures during the spring and summer months could potentially slow down foothill yellow-legged frog egg and tadpole development because it is outside the range of natural conditions for the foothill yellow-legged frog . Breeding is initiated between March and June and tadpoles take 3 to 4 months to complete metamorphosis.

Riparian Vegetation and Channel Morphology

Increased minimum flows during the growing season could alter the aquatic and riparian communities in the West Branch Feather River and Butte Creek. For some reaches, minimum flows would be increased 2- to 3-fold. Some vegetation would be seasonally inundated and lost while some upland and unvegetated areas would be converted to riparian vegetation from inundation and a rise in the water table. Changes in vegetation as a result of increased flows could affect habitat suitability for the FLYF through shading of breeding areas. Further, changes in flows could influence sediment deposition and channel shape and structure, affecting foothill yellow-legged frog habitat. The extent of these changes cannot be predicted with any certainty. Monitoring would detect any changes in breeding habitat.

Foothill Yellow-legged Frog Monitoring

FWS recommends in 10(j) recommendation no. 7 and the Forest Service recommends in 4(e) condition no. 20.2, that PG&E develop and implement a long-term foothill yellow-legged frog monitoring plan to monitor populations of foothill yellow-legged frog found during relicensing studies in the Project-affected reaches of Butte Creek and West Branch Feather River.

Monitoring would measure the response of foothill yellow-legged frogs to changes in project flow timing and magnitude, population distribution and viability, reproductive success, verification of suitable habitat and an inventory of available habitat as compared to habitat that is actually used. Specific components of the monitoring plan would include the following:

- Populations monitoring: monitor the numbers of foothill yellow-legged frog egg masses, tadpoles and adults on an annual basis for the first 10 years of the license and every 5 years thereafter for the term of the license; develop a population model linking various life stage data; relate egg mass counts quantitatively to adult population size or overall population growth rate; and conduct a population viability analysis

- Temperature Monitoring: monitor water temperatures in the river to assess water temperature effects on eggs and tadpoles; and determine the species-specific effects of temperature (warmth, cooling, and stability) on development rates of embryos (eggs) and larvae (tadpoles), growth rates of tadpoles, and size at metamorphosis

- Geomorphology and Riparian Encroachment Monitoring: monitor the geomorphologic and riparian vegetation response to the new flow regime in foothill yellow-legged frog habitats through the course of the license; and reassess stream flow prescriptions if substantial changes in bar geomorphology and/or riparian vegetation encroachment

- Habitat Monitoring: develop an experimental methodology to empirically determine the relationship between discharge and velocity, and discharge and stage at egg mass and tadpole sites; and monitor overall availability of suitable breeding/rearing habitats for the foothill yellow-legged frog in relation to both short and long-term changes

FWS's recommends that monitoring, after the initial 10 years, should occur at 3-year intervals as opposed to every 5 years as recommended by the Forest Service.

PG&E did not propose any foothill yellow-legged frog monitoring. PG&E comments that the agency plan is a series of costly research projects beyond the needs of the project. PG&E filed an alternative condition, proposing to survey of all reasonably accessible foothill yellow-legged frog habitats (i.e., full-reach visual encounter survey [VES]) for 3 consecutive years after the issuance of the license, then every 5 years thereafter. Monitoring would be conducted at the four lower West Branch Feather River sites on Forest Service lands that were surveyed during the relicensing studies. If monitoring documents adverse effects, PG&E would conduct focused studies and/or implement protective measures.

Our Analysis

As discussed above, the proposed and recommended changes in ramping rates and minimum flows and associated changes in water temperature can

potentially affect the various life history stages of the foothill yellow-legged frog. Monitoring all life stages of foothill yellow-legged frog over time would allow an evaluation of potential effects of operational changes, along with the need for protective measures or additional studies. Early detection of potential effects would provide more time for the development and implement of any appropriate measures.

The agencies' plan would allow for the detection in changes in numbers of foothill yellow-legged frog life stages during the term of the license that would be useful in determining effects of changes in project operation on the frog. Many of the components of the monitoring plan, however, involve basic research efforts (e.g., development of a population model, population viability analysis, and determining effects of water temperature on growth).

PG&E's monitoring proposal would also allow the detection of changes in numbers of foothill yellow-legged frog in the West Branch Feather River over time. The monitoring would not include the Butte Creek populations, located outside the National Forest.

It is difficult to predict how higher minimum flows and lower water temperatures would influence the rate of tadpole development (Kupferberg, 2006). Although cool temperatures are required for foothill yellow-legged frog breeding (river water temperatures must meet a strict temperature threshold before foothill yellow-legged frogs initiate breeding), foothill yellow-legged frogs evolved in relatively low elevation systems with warm summer temperatures that facilitate the rapid maturation of young of the year. Cooler temperatures during the foothill yellow-legged frog rearing period may slow development of foothill yellow-legged frog eggs, tadpoles, and metamorphs to some unknown degree. Possible effects include increased risk of predation or displacement due to longer periods of immobility or low mobility. Water temperature monitoring of foothill yellow-legged frog breeding areas would be important to determine the initiation of breeding and whether temperatures are suitable for growth.

The proposed and recommended population monitoring would provide an index of long-term changes in amphibian populations, following sufficient response time to stream flow modifications and other potential impacts. Water temperature monitoring data and the visual survey data could be used to determine how the proposed minimum flows would affect other foothill yellow-legged frog life stages. If the foothill yellow-legged frog populations are negatively affected by changes in flows and ramping rates specified in a new license and subsequent water temperature changes, then monitoring could identify these factors and could provide a means to develop protective measures.

Increases in flows could also alter existing riparian plant communities and channel morphology as discussed above. Monitoring these changes could changes that could potentially affect foothill yellow-legged frog breeding sites.

Further study of this species beyond population monitoring, as recommended by FWS and as specified by the Forest Service, is unlikely to provide significant additional information that would be useful in assessing the effects of changes in project operation on this species. Monitoring could be used to determine the need for additional focused studies to better understand any identified adverse effects.

Bald Eagle Management

As discussed above, the project receives limited use by bald eagles. Bald eagles, however, may be subject to potential adverse effects if eagles inhabit the project area in the future. FWS [10(j) condition 10] and Forest Service [10(a) condition 10] recommend that PG&E develop and implement a bald eagle monitoring plan. They recommend that eagles be monitored at least once per year or at a frequency to be determined in the monitoring plan.

In response to the agency recommendations, PG&E suggests one breeding and one wintering survey every of project waters every 3 years. If a new nesting territory is established, PG&E would develop specific recommendations for the protection, conservations, and management of the nesting territory.

Our Analysis

Bald eagles do not currently breed in the project area even though suitable habitat is present. Populations of eagles, however, are expanding in California. Bald eagles have experienced a comeback as a result of the implementation of protective measures since the 1970s, including the banning of the pesticide DDT, protection of nest sites, and protection from shooting. Nesting has become common in the Feather River Basin. For example, 14 eagle nests are found in the vicinity of the North Fork Feather River Project No. 2105 (U.S. Fish and Wildlife Service, 2005), 4 nests in the vicinity of the Oroville Project No. 2100 (U.S. Fish and Wildlife Service, 2007), and 1 nest in the vicinity of the Poe Project No. 2107 (FERC, 2007).

Given the limited use of the project area, continued project operation would not adversely affect bald eagles. In the event that eagles nest in the project area or use the project area in greater numbers, they could be subject to project-related affects (e.g., disturbance from recreational use and maintenance activities). Monitoring would be useful in detecting changes in use and determining the need for

protective measures. Monitoring would be increasingly important as bald eagle populations in California continue to grow and expand their range.

Deer Protection

The Butte, Lower Centerville, Hendricks, and Toadtown canals, totaling about 30 miles, have the potential to entrap deer and other animals, limit animal movements, and fragment habitats and populations.

PG&E proposes to assess existing wildlife bridge crossings and escape structures annually to ensure they are functional and in proper working order. Inspections would occur during the same time other types of maintenance activities or canal assessments are being conducted. PG&E also proposes to record animal losses in all project canals. Further, prior to replacing or retrofitting existing wildlife bridge crossings or deer escape facilities along project canals, PG&E proposes to consult with California Fish & Game regarding specifications and design.

The Forest Service conditions (conditions 28 and 29) and California Fish & Game's [10(j) recommendation 6] and FWS's [10(j) conditions 4B and 4C] recommendations are generally consistent with PG&E's proposal. The agencies, however, specifies that PG&E implement additional measures be implemented if an increasing trend in animal mortalities is noted (Forest Service condition 29). California Fish & Game also recommends that PG&E prepare a summary mortality report be prepared every 5 years.

Our Analysis

Between 1965 and 2006, a total of 520 deer have been killed by project canals. To correct this problem, PG&E installed deer protection facilities starting in 1978; these measures contributed to a significant decline in deer mortality in 1979 (figure 3-43). Additional deer protection facilities were constructed and modifications were made to some existing facilities in 1983, 1992-1993, and 2005. The types of deer protection devices installed included fencing, wooden bridge crossings, and flasher sets with either escape ramps or cyclone fencing (traction surface) bolted to the canal wall. As a result, average deer losses dropped from 31.4 deer per year (1965-1978) to an average 2.86 deer losses/year (1979-2006) (PG&E 2006).

Deer mortality is at relatively low levels and has little effort on the health of the East Tehama deer herd, which totals at least 15,000 individuals. Inspecting deer protection devices annually to ensure that they are functional, complying with current specifications when existing facilities are replaced or retrofitted,

monitoring wildlife losses in the canals, and taking corrective actions in the event that mortalities increase would ensure that impacts to wildlife populations are kept to minimal levels.

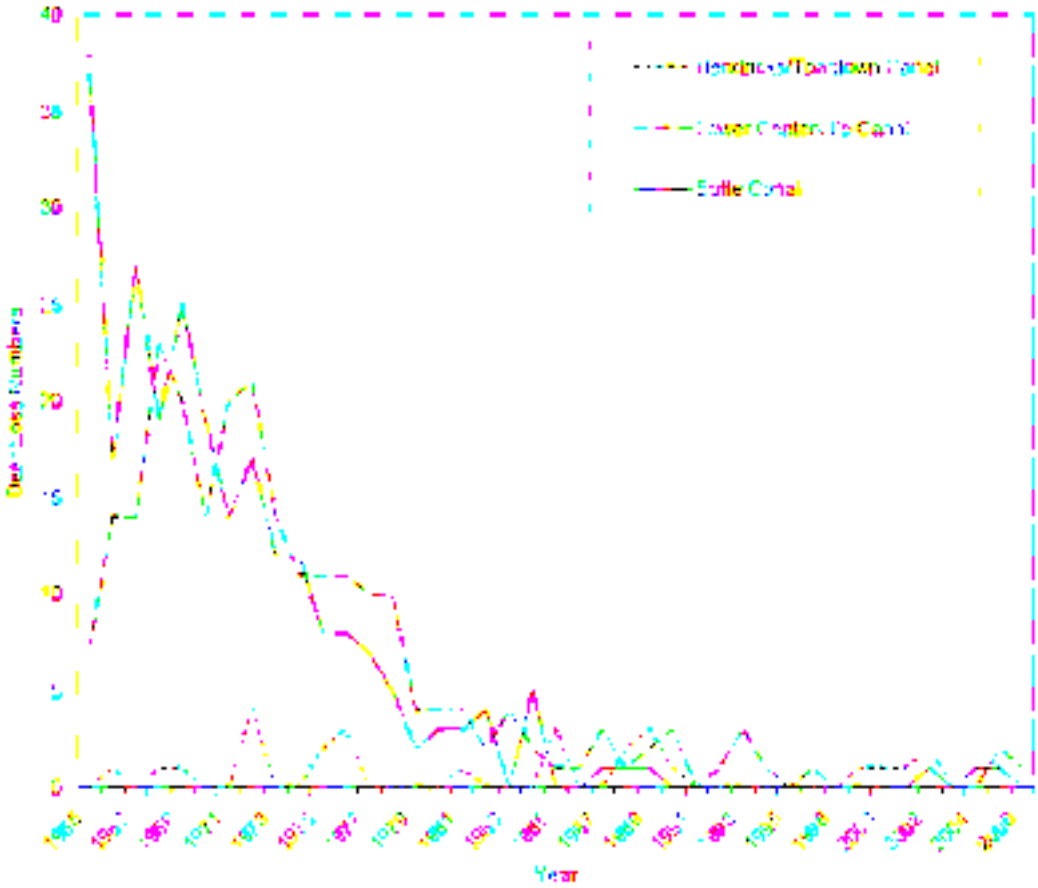

Figure 3-43. Deer losses at the DeSabla-Centerville Project from 1965 through 2006 (PG&E, 2006).

3.3.4 Threatened and Endangered Species

3.3.4.1 Affected Environment

Valley Elderberry Longhorn Beetle

The valley elderberry longhorn beetle (VELB), a federally listed threatened species, is found in the riparian areas of streams and rivers in the lower Sacramento and upper San Joaquin Valleys, where elderberry grows. The range of the VELB extends throughout California's Central Valley and associated foothills from about the 3,000-foot elevation on the east to the watershed boundary of the Central Valley on the west. The VELB is completely dependent on its host plant, elderberry (*Sambucus* spp.), which is a common component of the VELB.

PG&E performed field surveys in June, July, and August 2006 and found a total of 14 blue elderberry shrubs (*Sambucus mexicana*) at nine different sites (occurrences) (PG&E, 2007, section 6.7.2.2). Nine of these elderberry shrubs (occurrences #1 and #6–8) are considered suitable VELB habitat, as they occur below 3,000 feet and contain stems equal to or greater than one inch in diameter at ground level (Table 3-33). The remaining five of the 14 elderberry shrubs are located above 3,000 feet elevation, outside of the known range for the VELB: (1) three shrubs (occurrences #3–5) were located at approximately 3,200 feet, in elevation near the Hendricks diversion dam along the West Branch Feather River, and (2) two of these shrubs (not included in table) are located well above 3,000 feet in elevation--one elderberry shrub (occurrence #2) was found near the east side of Philbrook reservoir at 5,560 feet, and a second shrub (occurrence #9) was located along Retson Road at 3,445 feet.

Table 3-33. Blue elderberry shrubs located during surveys and their physical characteristics (Source: PG&E, 2007, section 6.7.2.2).

Occurrence #	**1**	**3**	**4**	**5**	**6**	**7**	**8**
Location	Riparian	Riparian	Riparian	Riparian	Riparian	Riparian/ Chaparral	Riparian/ Chaparral
Elevation (ft)	1,640	3,200	3,200	3,200	1,120	2,200	2,280
Stems <1”	5	5	1	10	0	0	0
Stems ≥1” & <3”	3	0	1	0	-	2	2
Stems >3” & <5”	2	0	0	0	4*	-	-
Stems >5”	0	0	0	0	-	-	-
No. of Plants	1	1	1	1	4*	2	2
Exit Holes	No	No	No	No	No	No	No
VELB habitat	Yes	No	No	No	Yes	Yes	Yes

*These plants were inaccessible, located in a drainage below a suspended flume. These were good-sized shrubs that likely had stems between 3 to 5 inches in diameter. However, these shrubs were not directly examined.

Blue elderberry plants located during surveys appeared to be healthy. Occurrence #1 consisted of a small, heavily branched shrub that was growing in a disturbed area between the road leading to the Magalia diversion dam and the flume coming from the West Branch Feather River. Occurrence #6 consisted of four larger shrubs that were growing in an undisturbed thicket of riparian vegetation below a suspended flume. Occurrence #7 and #8 consisted of two shrubs each, and were located in openings near roadsides, but undisturbed. No exit holes attributable to VELB were observed at occurrences #1, #3–5, and #7–8. Because of limited access, occurrence #6 was viewed from a distance, not allowing the determination of the presence/absence of exit holes.

Inaccessible parts of the study area have the potential to support suitable VELB habitat but were not able to be surveyed. PG&E located blue elderberry shrubs upstream and downstream of bypass reaches of the West Branch Feather River on Forest Service lands, totaling about 39.47 acres of potentially suitable habitat. PG&E also calculated that 39.85 acres along Butte Creek may support suitable habitat.

California Red-legged Frog

The California red-legged frog (CRLF) is federally listed as threatened. The frog has specific aquatic and riparian components to its habitat requirements (FWS 1996). Breeding sites are varied, including marshes, springs, permanent and semi-permanent natural ponds, ponded and backwater portions of streams, as well as artificial impoundments such as stock ponds, irrigation ponds, and siltation ponds (FWS 1997). Jennings and Hayes (1994) found they occur primarily in isolated ponds or pools of intermittent or perennial stream courses where water remains long enough for breeding and development of young. Dense, shrubby, or emergent riparian vegetation closely associated with deep (> 2.3 feet), still or slow-moving, water are needed during the November to March breeding season for attachment of egg masses and escape cover (FWS, 1996; Hayes and Jennings, 1988). Larvae remain in these aquatic habitats until metamorphosis, which typically occurs between July and September. Another key CLRF habitat indicator is the absence or near-absence of predators such as bullfrogs and predatory fishes, particularly centrarchids (Jennings and Hayes, 1994).

Well-vegetated areas within the riparian corridor may provide important sheltering habitat in winter (FWS, 1996). Rocks, boulders, small mammal burrows, organic litter such as downed trees or logs, and leaf litter within 300 feet of riparian areas provide estivation habitat and refugia at anytime of the year (FWS 1996). Estivation habitat is used for relief from drought and predators and is essential for survival (FWS, 1996). During wet periods CRLF can move long distances between aquatic habitats, traversing upland habitats or ephemeral drainages up to a mile from the nearest known frog populations (FWS, 1997).

PG&E conducted a preliminary CRLF habitat evaluation (PG&E, 2007, section 6.3.2.1). PG&E identified several stock ponds downstream of Centerville; however, these areas were located on private property and permission to access the property was not granted. The DeSabla forebay was also initially selected as a potential lentic habitat for the frog. After a reconnaissance visit, however, it was deemed unsuitable due to heavy recreational use for angling, a lack of suitable aquatic or riparian vegetation, and the persistent stocking of trout, a known amphibian predator. No other CRLF habitat was identified in the project area.

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Central Valley Spring-run Chinook Salmon ESU

Butte Creek spring-run Chinook salmon belong to the Central Valley evolutionarily significant unit (ESU) and are a California state and federally listed threatened species. California listed the species as threatened in February 1999. They were federally listed shortly thereafter in September 1999 [Federal Register Vol. 64, No. 179]. Critical Habitat for Butte Creek was designated in February 2000 [Federal Register Vol. 65, No. 32], and covers the reach downstream of Lower Centerville diversion dam to the confluence with the Sacramento River. In the Project-affected reach, this includes Butte Creek from Lower Centerville diversion dam downstream to the Parrott-Phelan diversion dam.

The spring-run Chinook salmon is one of three runs occurring in Butte Creek, along with the fall- and late-fall runs. Because of its early migration timing, only the spring-run regularly utilize habitat upstream of the Parrott-Phelan diversion dam. The fall- and late-fall runs only rarely migrate up to or beyond the Parrott-Phelan diversion dam. Adult fall-run and late-fall-run Chinook salmon enter Butte Creek downstream of the project area primarily from October through February and spawn shortly thereafter. Juvenile fall-run and late-fall run Chinook salmon emigrate as both young-of-the-year and yearlings, and are not readily distinguishable from downstream migrant spring-run Chinook salmon.

Butte, Deer, and Mill creeks support the majority of self-sustaining Central Valley spring-run Chinook salmon. Between 1995 and 2002, Butte Creek supported an average of 70 percent of the total Central Valley spring-run population (low = 45 percent; high = 89 percent).

Until the early to mid-1990s, the spring-run Chinook salmon had been in substantial decline. During a 10 year period from 1956 through 1965, the annual spring-run Chinook salmon escapement (run size) averaged about 2,800 fish, with an estimated high of 8,700 fish in 1960. During the next three decades, annual spring-run escapement averaged approximately 337 (1966 to 1975), 162 (1976 to 1985), and 1,354 (1986 to 1995). Ten fish were estimated for 1979.

Modifications to Project operations to benefit spring-run Chinook salmon beginning in the 1980's and restoration actions initiated in the early 1990's under the Central Valley Project Improvement Act, have resulted in large numbers of adult spring-run Chinook salmon returning to Butte Creek in recent years, far in excess of historical numbers and restoration expectations. According to the FWS report, Final Restoration Plan for the Anadromous Fishes Restoration Plan: January 9, 2001, the production goal for spring-run Chinook salmon in Butte Creek was 2,000 returning adults. Since 1991, the Butte Creek population of

spring-run Chinook salmon has far exceeded that goal, averaging 5,254 returning fish. In 1998, a year characterized as a wet water year with above normal precipitation, the Butte Creek spring-run Chinook salmon escapement hit a record high (since the population was monitored) of 20,212 fish. Recent data suggests even more fish returned to Butte Creek in 2001, based on mark-recapture carcass count data. The most recent data for 2003 estimated that over 17,000 fish returned to Butte Creek.

Adult spring-run Chinook salmon migrate from the ocean to the Sacramento River as immature fish beginning in early February, and arrive in Butte Creek in late February. The last adults to reach Butte Creek generally arrive by mid-June.

Prior to the installation of large dams, spring-run Chinook salmon used to migrate as far as they could travel in the large tributary streams to the Sacramento and San Joaquin Rivers. In most years, the upstream migration limit in Butte Creek is the natural barrier at Quartz Bowl. For the next several months, the fish hold in deep pool habitats primarily from the confluence of Little Butte Creek upstream to the Quartz Bowl while they mature.

During the summer, spring-run Chinook salmon do not feed and continue to mature in the deep pools before spawning. Due to the low elevation of the Butte Creek holding and spawning habitat, ambient stream temperatures often exceed the reported temperature tolerances of spring-run Chinook salmon; although severe heat storms can result in temperatures that lead to spring-run Chinook salmon mortality in Butte Creek.

For example, during the last two weeks of July 2003, air temperatures exceeded 37.6°C (100°F) for 10 of the last 14 days. These air temperatures were in the upper ten percent for the period of record. Consequently, water temperatures in key over-summer holding pools reached average daily temperatures of 20.9°C. The combination of the high numbers of returning adults confined to the limited number of holding pools and elevated air and water temperatures led to disease outbreaks of columnaris and ich (caused by the pathogens *Flavobacterium columnare* and *lchthyophthirius multiphilis*, respectively), resulting in pre-spawn mortalities. Despite the losses observed in 2003 (prespawning mortalities of approximately 11,231 fish out an estimated total population of 17,294 fish).

As temperatures cool in the fall, the mature fish move into nearby suitable spawning habitats. When suitable spawning habitat is found, female salmon dig nests called redds. Females then lay their eggs in the redds as the male fertilizes them. Once the eggs are covered with loose gravel and the spawning act is complete, the salmon die shortly thereafter. Eggs hatch after 40 to 60 days

(depending on oxygen and temperature). The young fry remain in the gravel until their yolk sac is completely absorbed (4 to 6 weeks). Juvenile fish either emigrate shortly after emergence or rear in the stream up to 15 months. In Butte Creek, the fry begin their downstream emigration shortly after emerging from the gravel. Their downstream migration usually begins in mid-November and peaks between December and April. Between 1995 and 1998, and 1998 and 2000, 98.2 percent and 96.3 percent, respectively, of all YOY spring-run Chinook salmon emigrated between December 1 and January 31; the average length of fry was 36 mm fork length for both sampling periods. A lesser number of fry emigrated in late spring or early summer.

Sutter Bypass serves as a major nursery to the emigrating Butte Creek spring-run Chinook fry [Hill and Webber 1999]. Butte Creek fry rear in Sutter Bypass for a period of time before beginning their migration to the ocean. A small number of Butte Creek spring-run Chinook salmon emigrate as yearling fish (i.e., age 1÷) during the following fall and winter. Most yearling spring-run Chinook salmon emigrate in October, but a few may emigrate as late as April.

Historically, spawning adult Central Valley spring-run Chinook salmon were mostly large four or five year old fish. Based on the size of present-day spawners, three year old fish are now generally the most common. Likely the result of intense commercial fishing that removes the largest fish.

Central Valley Steelhead ESU

Steelhead are the anadromous form of rainbow trout. The Central Valley California ESU of steelhead trout is known to occur only in the Sacramento and San Joaquin rivers and their tributaries. The Sacramento and San Joaquin rivers provide the only migration route for anadromous fish to the drainages of the Sierra Nevada and southern Cascade mountain ranges. The Central Valley California ESU of steelhead trout, is federally listed as threatened [March, 1998, Federal Register Vol. 63, pages 32996 to 32998] but only for those runs in the Sacramento and San Joaquin Rivers and their tributaries.

Data on Butte Creek steelhead in the project area are restricted to limited visual observations by anglers and Cal Fish & Game game wardens. There are no estimates of steelhead numbers for Butte Creek. Scientific data for these fish are also scarce. Available data is limited to Cal Fish & Game sampling conducted in various years at the irrigation diversions downstream of the Project. Several steelhead adults have been reported at the Parrott-Phelan diversion dam during Cal Fish & Game trapping efforts in the winter and spring for juvenile spring-run Chinook salmon. However, it is doubtful that steelhead or salmon regularly ascended beyond the Quartz Pool barrier and the present site of the Lower

Centerville diversion dam.

In California, adult steelhead are typically three to four years old before returning to the stream to spawn in gravel redds from December though March. Steelhead trout are also capable of spawning more than once during their lifetime. Six to seven weeks after the eggs are laid the young fish emerge from the gravel. Juvenile fish generally spend their first two years residing in freshwater before smoltification and migrating to the ocean.

Steelhead are believed to ascend Butte Creek in the late fall and winter. Spawning likely takes place through the winter and into the spring (generally December through April), upstream of Helltown bridge. Steelhead prefer to spawn in clean gravel at the pool-riffle transition. There is often substantial gene flow between anadromous and resident trout. It is not uncommon in anadromous steelhead for males to mature and then assume a resident life style.

3.3.4.3 Environmental Effects

Valley Elderberry Longhorn Beetle (VELB)

Routine operation and maintenance activities could affect elderberry shrubs that provide potential habitat for the VELB.

PG&E proposes to comply with the March 2003 Valley Elderberry Longhorn Beetle Conservation Program developed by PG&E and FWS (2003) to cover service area-wide maintenance activities. The conservation program requires PG&E to: (1) conduct pre-construction surveys, where necessary; (2) provide educational training for construction crews responsible for operation and maintenance activities; (3) implement minimization, avoidance, and protective measures; and (4) provide monitoring reports. FWS issued a biological opinion for actions that would be covered under the conservation program (U.S. Fish and Wildlife Service 2003). This measure is consistent with Forest Service 4(e) condition 30 and FWS's 10(j) condition 11.

Our Analysis

Some of the elderberry shrubs or habitat identified above may have to be trimmed during the term of the license (PG&E 2007c). Shrubs could also be damaged from vehicle use. Although there is no evidence of VELB use of the identified elderberry shrubs at this time, the VELB could colonize this habitat in the future.

The elderberry shrubs located along the DeSabla powerhouse Road and Retson Road, and near the Hendricks Diversion dam may require occasional trimming in conjunction with roadside maintenance activities. In these cases, branches may be trimmed but it is unlikely that whole plants would be removed. The plants along Retson Road and near the Hendricks Diversion dam, however, are located above 3,000 feet elevation, and therefore may not be VELB habitat.

Blue elderberry shrubs located near the Miocene Diversion dam are located adjacent to a flume and an access road; this area also appears to have some recreation access. Given their location, these plants may also occasionally experience occasional disturbance due to regular maintenance activities. This disturbance would likely be limited to removing branches.

The elderberry shrubs located on the Lower Centerville canal are located well below a suspended flume in that area, and are unlikely to be disturbed by project operations and maintenance activities.

Inaccessible, unsurveyed areas that have the potential to support suitable VELB habitat are remote, and any blue elderberry plants in this area would be distant from any regular maintenance or operations activities. Any VELB in this area would be highly unlikely to have any direct or indirect disturbance from project operation and maintenance.

Any effects to elderberry shrubs during the term of the license, which is expected to be limited, would be offset by that habitat acquired or developed under the conservation program. Training of maintenance workers and implementation of minimization and avoidance would reduce the likelihood of potential incidental take of the VELB.

California Red-legged Frog

Continued operation and maintenance of the project would not have any effects on the red-legged frog because of lack of habitat (see *Affected Environment* section above).

Central Valley Spring-run Chinook Salmon and Steelhead ESUs

Project operations and maintenance will influence and affect the quality and quantity of habitat for both, the Central Valley Spring-run Chinook Salmon ESU and the Central Valley Steelhead ESU. The continue operation of the DeSabla Centerville Project is critical to the continued survival of these federally listed fish. The interbasin transfer of cold water from the West Branch Feather River to lower Butte Creek improves the habitat in lower Butte Creek and allows for

tolerable habitat conditions during summer heat storms where otherwise none would exist.

As discussed in section 3.3.2.2, providing greater minimum instream flows below the Centerville diversion dam would increase the amount of available spawning and holding habitat there, but would also influence water temperature downstream of the Centerville powerhouse where the bulk of the spawning habitat is located. Removal of the Lower Centerville diversion dam would have similar results in that following its removal, cold water could no longer be delivered to lower Butte Creek via the Centerville powerhouse, limiting the extent of the cold water habitat for the Chinook salmon and steelhead.

As discussed in greater detail in section 3.3.2.2, implementing a Long-term Operations Plan as proposed by PG&E and recommended by the agencies and the Conservation Groups would allow for project operations to manipulate the timing and location of the delivery of West Branch Feather River water to address water temperatures and the habitat needs of the federally listed fish. Under current conditions, and the proposed project, water could be delivered to lower Butte Creek via spill at the Lower Centerville diversion dam, or further downstream via the Centerville powerhouse tailrace, a release point that would extend the downstream extent of the cold water habitat in lower Butte Creek.

Providing higher minimum instream flows to the West Brach Feather River downstream of the Hendricks diversion dam and also within the feeder tributaries that feed the Hendricks/Toadtown canal, as discussed in section 3.3.2.2, would result in less cold water being available to lower Butte Creek and could result in warmer water temperatures potentially negatively effecting the quality and quantity of the Chinook salmon and steelhead habitat downstream of the Lower Centerville diversion dam.

However, installation of the DeSabla forebay water temperature reduction facility to reduce thermal loading in DeSabla forebay by either 50 or 80 percent would improve water temperatures downstream of the forebay thereby benefiting the listed fish in lower Butte Creek.

We present our final recommendations pertaining to all Aquatic Resources including those that may affect Chinook salmon and steelhead in section 5, *Conclusions and Recommendations.*

Future Consultation and Protection

Protection, mitigations, and consultation concerning new activities or newly listed species and annual consultation for federally listed species is discussed in section 3.3.3.2, *Terrestrial Resources*, under *Special-status Species*.

3.3.5 Recreation Resources

3.3.5.1 Affected Environment

Regional Recreation Resources

The DeSabla-Centerville Project is located on lands within the Lassen and Plumas National Forests. The Lassen National Forest, totaling 1.2 million acres, provides a variety of recreational opportunities such as camping, fishing, hunting, picnicking, off-road vehicles areas, biking, whitewater boating, and more than 460 miles of hiking trails, including 120 miles of the Pacific Crest National Scenic Trail that passes through the Lassen Volcanic National Park. The Lassen National Forest hosts nearly one million visitors per year.

The Lake Oroville State Recreation Area and Paradise Lake are other recreation areas located outside of the project area, but within the project region. Lake Oroville is located 30 miles south of the Project. The lake consists of 167 miles of shoreline and offers camping, picnicking, horseback riding, hiking, boating, water-skiing, fishing, and swimming. Lake Oroville State Recreation Area has a visitor center, swimming areas, marinas, day-use areas, picnic areas, a fish hatchery, three developed boat launches, five undeveloped boat launches, boat docks, parking, and house boat rentals that have made it a regionally significant recreation destination. Paradise Lake is also located just 20 miles south of the Project and offers activities such as picnicking, biking, hiking, and fishing. The lake also includes a scenic 4.5-mile-long trail paralleling its north shore.

Further boating opportunities can be found below the project area, roughly 2.3 miles downstream of the Miocene diversion on the West Branch Feather River. Ben & Jerry's Gorge Whitewater Run is a Class V+ whitewater boating run and is approximately 4 miles in length. However, the reach is one of many whitewater boating runs within the region.

The Upper Butte Creek Watershed is located upstream of the Project and offers several public recreation opportunities, including camping, fishing, cross-country skiing, winter ORV opportunities, biking, hiking, and equestrian opportunities. Additionally, several ecological reserves and wildlife areas are also located in the vicinity of the Project. Coon Hollow Wildlife Area, Butte Creek House Ecological Reserve, and Butte Creek Canyon Ecological Reserve are within

the project region and offer public opportunities for fishing, hiking, deer hunting, and wildlife viewing.

Project Area Recreation Resources

There are two developed recreation areas within the project boundary: Philbrook Reservoir Recreation Area and DeSabla Forebay Recreation Area (Figure 3-44). There are dispersed camping and hunting opportunities at a third project reservoir, Round Valley reservoir, but no developed facilities. Additionally, fishing and hiking access exists along the Hendricks, Butte, and Lower Centerville canals; however, these trails are meant to be used by PG&E for project maintenance purposes.

Recreation use also occurs along several of the river reaches associated with the Project, including the upper and lower reach of the West Branch Feather River, Philbrook Creek, and Butte Creek. These reaches are primarily accessed for fishing; however, other recreation activities including hunting, hiking, dispersed camping, and whitewater boating does occur. There are approximately four whitewater boating runs within the project vicinity.

Philbrook Reservoir Recreation Area

At full pool, Philbrook reservoir has a surface area of 173 acres, a maximum depth of 60 feet, and 3 miles of shoreline. Camping, boating, picnicking, swimming, and fishing are the primary recreational activities that occur at this reservoir. Largemouth and smallmouth bass, channel catfish, brown trout, rainbow trout, and eastern brook trout can be found in the reservoir and the Cal Fish & Game annually stocks the reservoir with catchable trout. The majority of boaters that use Philbrook reservoir are anglers. Most boats on the reservoir are primarily smaller, low or non-powered watercraft, but occasionally speed boats and personal watercrafts have been observed. Motorized boats may be prohibited on lakes with surfaces less than 300 acres by Butte County ordinance, if appropriately posted. There is no signage currently posted at Philbrook reservoir prohibiting the use of motorized boats.

The primary recreation season begins in mid-May and ends in mid-September; however, the beginning of the reservoir recreation season is dependent on the timing of the snowmelt runoff. Philbrook reservoir usually fills up by the end of May, but on occasion, the reservoir has not filled up until the beginning of June. Although PG&E's annual operation and maintenance plans require the reservoir to be drawn down at a relatively constant rate during the summer, PG&E normally maintains the reservoir elevation above 5,516 feet msl until mid-September.

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Philbrook Campground is located along the middle of the reservoir's North shore and consists of 20 campsites, potable water, restrooms, and includes access to fishing and swimming. Each campsite includes a picnic table, fire ring, and parking spur. The campsites can accommodate recreation vehicles (RV) and

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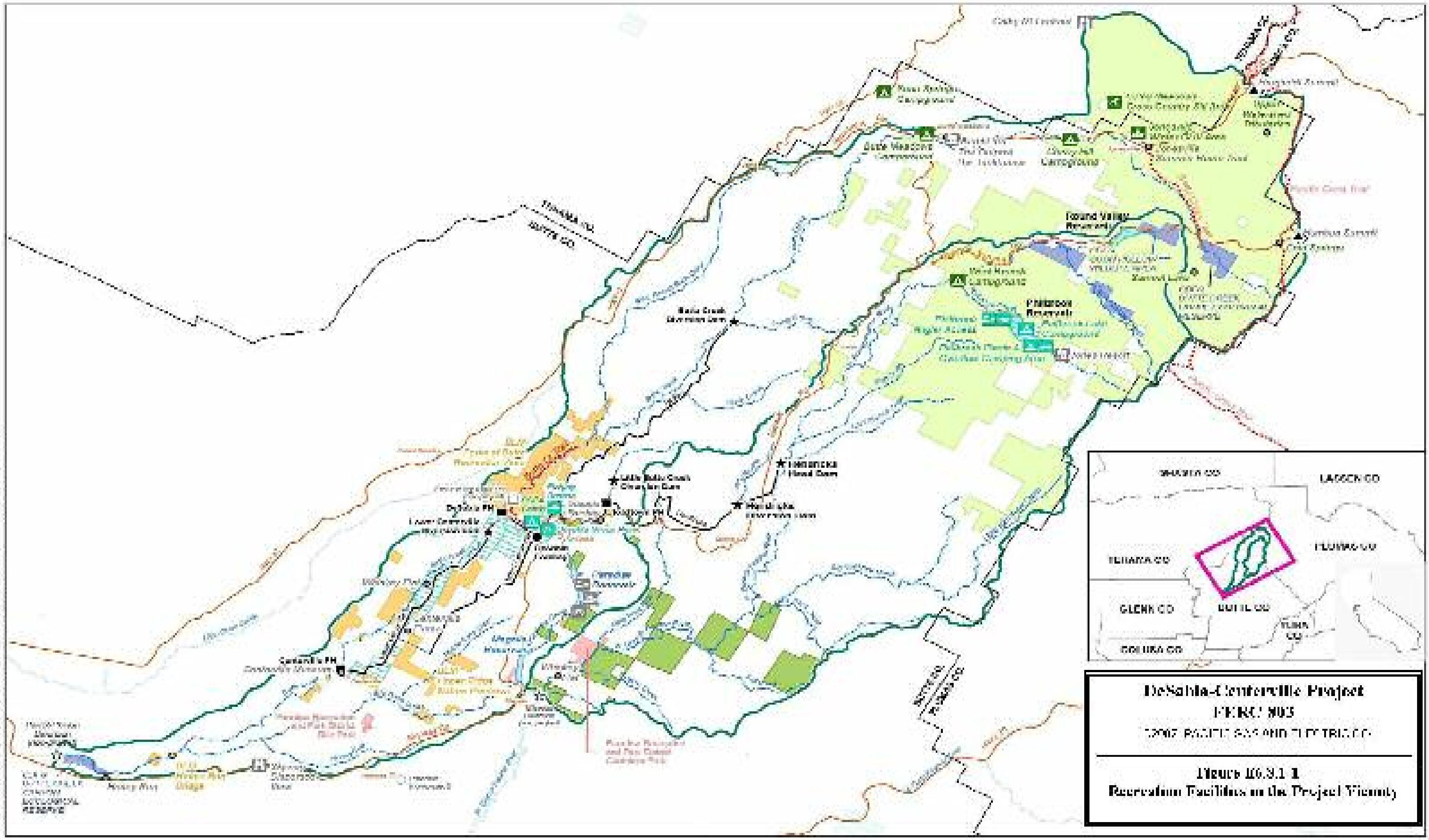

Figure 3-44. Recreation facilities in the vicinity of the DeSabla-Centerville Project. (Source: PG&E, 2007)

trailers up to 40 feet in length, but there are no utility hookups available at the campground.

Philbrook Picnic and Camping Overflow Area is located on the northeast shore and consists of five picnic tables, five parking spots, a double-vaulted restroom, and access to fishing and swimming. During peak use periods, the picnic sites serve as overflow campsites for Philbrook Campground.

Philbrook Angler Access is located adjacent to the spillway on the northwest and includes a small watercraft launch, vaulted restrooms, and 20 parking spots. Access is used primarily for boat launching, although some dispersed use does take place. Additionally, PG&E has issued 21 private residential boat dock permits on the east end of the reservoir. Although these docks are permitted to private owners, the docks are within the project boundary and therefore open to public use.

Non-project Recreation Facilities near Philbrook Reservoir

Some additional dispersed camping occurs at the Willows Area along Philbrook Creek, just one half-mile east of Philbrook reservoir. This area was previously the location of the Forest Service's Philbrook Creek Campground, which was used as a camping overflow area for large groups. On the east side of Philbrook reservoir there are 42 private summer homes located just outside the project boundary and Jones Campground, a privately owned group campground.

DeSabla Forebay Recreation Area

DeSabla forebay is a small forebay with a surface area of 15 acres and one mile of shoreline. This forebay is popular fishing spot with local residents. Public shoreline use primarily occurs on the east shore of the reservoir near the dam and parking is provided for a minimum of 20 vehicles. An accessible fishing site is also located at the northeastern end of the shore. PG&E provides funding for Cal DFG to stock the forebay every other week with catchable sized trout during the spring and summer, as well as other areas in Butte Creek as a part of a 1983 agreement. Non-power and low-power boats have been observed using the forebay, however, as with Philbrook reservoir, there is no signage posted prohibiting the use of motor boats. Parking for a minimum of 20 vehicles is located on the east shore. Additionally, PG&E has permitted a courtesy dock to a private organizational campground adjacent to the reservoir's western shoreline within the project boundary.

DeSabla Group Picnic Area is located on the east side of Skyway Road, across from DeSabla forebay. This area is open during the primary recreation season and

consists of a group barbeque, picnic tables, running water, and a public vault toilet facility.

Non-project Recreation Facilities Near DeSabla Forebay

Pacific Service Employees Association (PSEA) Camp DeSabla is located on the western shore of DeSabla forebay and consists of 17 cabins privately owned and operated by PSEA just outside the project boundary. This camp is open from early April through mid-October.

Recreation Use and Facility Capacity

Recreation use within the project boundary occurs at the two developed recreation areas, Philbrook reservoir and DeSabla forebay, and at undeveloped areas, including Round reservoir and several of the project streams.

In 2006, PG&E estimated use based on the extrapolation of visitor counts at Project reservoir recreation areas and project streams. The study evaluated the number of people at one time at each recreation area. PG&E relied on both visitor and vehicle data to estimate annual, peak, and off-peak season recreation days[54] at each site (Table 3-34). PG&E defines the peak recreation season as May 28 through September 19, 2006 for all sites, except the high elevation sites, which started on June 15 due to the late snowpack. The off-peak season was from September 20 through May 27, 2006, which included the opening fishing weekend, April 29 and 30, 2006.

It was estimated that over 15,000 people visited the DeSabla-Centerville Project recreation areas in 2006, with over 50 percent of the visitation occurring at the two project developed recreation areas, Philbrook reservoir and DeSabla forebay. Philbrook reservoir was the most popular place to recreate at the project receiving nearly 5,000 (62 percent) recreation days during the peak season.

[54] Recreation day is each visit by a person to a development for recreation purposes during any portion of a 24-hour period (as defined in the glossary of FERC Form 80 terms).

Table 3-34. 2006-2007 Project Area Use Estimates for the DeSabla-Centerville project area by Resource Area (within the FERC project Boundary). (Source: PG&E, 2007)

Resource Area	Annual Estimate	Peak Estimate	Off-Peak Estimate
PROJECT RESERVOIRS			
Philbrook reservoir	4,957	4,957	Not Applicable
DeSabla forebay	2,868	907	1,961
Round Valley reservoir	218	218	Not Applicable
TOTAL	**8,042**	**6,082**	**1,961**
PROJECT CANALS			
Butte Creek canal	3,020	1,118	1,901
Hendricks-Toadtown canal	1,886	587	1,298
Upper Centerville canal	0	0	0
Lower Centerville canal	2,146	823	1,323
TOTAL	**7,051**	**2,529**	**4,523**
PROJECT TOTAL			
Project Use Estimate	**15,094**	**8,610**	**6,483**

Project canals had an estimated 7,051 recreation days for overall annual visitation. Most recreation users visited the canals during the off-peak season (64 percent) compared to visitation during the peak season. Butte Creek Canal had the greatest estimated use with more than 3,000 recreation days, followed by Lower Centerville and Hendricks-Toadtown canal. There was no recreation use estimated at the Upper Centerville canal due to no vehicles being observed at the public access trail locations. Visitor and resident surveys indicated however, use of the canal trail for recreation via non-public lands surrounding the project.

Overall visitation was estimated at 23,725 recreation days with 77 percent of the visitation occurring during the peak season (Table 3-35). Lower Butte Creek accounted for 78 percent of the annual use compared to about 11 percent estimated annual use on both the West Branch Feather River/Philbrook Creek and Butte Creek Canyon.

Table 3-35. 2006-2007 Project Area Use Estimates for Resource Areas along Project Affected River Reaches (outside the FERC project Boundary). (Source: PG&E, 2007)

Resource Area	Annual Estimate	Peak Estimate	Off-Peak Estimate
PROJECT STREAMS			
West Branch Feather River/ Philbrook Creek	2,706	2,549	157
Butte Creek Canyon	2,586	1,372	1,197
Butte Creek Lower	18,451	14,390	4,061
TOTAL	**23,725**	**18,311**	**5,414**

Through the visitor and resident recreation study, PG&E found that an overwhelmingly amount of visitors come from Butte County to use the Project for recreation. The Butte County population is expected to increase through 2050 at a consistent rate of about 25 percent per decade. As a result, project recreation use would likely double. The 2006 estimates of existing recreation use were used to estimate future use at the Project (Table 3-36).

Table 3-36. Projected estimated annual recreation use at Project resource areas through 2050 based on the expected population growth rate of Butte County. (Source: PG&E, 2007)

Resource Area	2006-07	2010	2020	2030	2040	2050
*Butte County Growth Rate**	--	*1.13*	*1.38*	*1.64*	*1.9*	*2.16*
RESERVOIRS						
Philbrook	4,957	5,601	6,840	8,129	9,418	10,706
DeSabla forebay	2,868	3,240	3,957	4,703	5,448	6,194
Round Valley	218	246	301	358	414	471
Total	8,042	9,088	11,098	13,189	15,280	17,371
CANALS						
Butte Creek Canal	3,020	3,412	4,167	4,952	5,737	6,523
Hendricks/Toadtown Canal	1,886	2,131	2,602	3,092	3,583	4,073
Upper Centerville Canal	0	0	0	0	0	0
Lower Centerville Canal	2,146	2,425	2,962	3,520	4,078	4,636
Total	7,051	7,968	9,731	11,564	13,398	15,231
PROJECT TOTAL						
	15,094	17,056	20,829	24,754	28,678	32,602

* California Department of Finance, Economic Research (accessed at www.dof.ca.gov).

Although recreation use at the Project is expected to double, no developed recreation facilities at the project will be approaching full capacity by the year 2050 (Table 3-37). Philbrook Campground will be approaching only two-thirds of its physical capacity and both the DeSabla Group Picnic Area and Philbrook Campground Overflow will only be approaching 10 percent of capacity. Currently, overall parking capacity at the Project is at 24 percent, with the highest occupancy occurring on holidays with 56 percent capacity. Parking is expected to approach 60 percent capacity by 2050, with the likeliness of holidays reaching 100 percent capacity.

Table 3-37. Projected occupancy at Project recreation facilities at Project reservoir facilities through 2050 based on the expected population growth rate of Butte County. (Source: PG&E, 2007)

Resource Area	4-Year Average (2003-2006)	2010	2020	2030	2040	2050
*Butte County Growth Rate**	--	*1.13*	*1.38*	*1.64*	*1.9*	*2.16*
Philbrook Campground	30%	34%	41%	49%	57%	65%
Philbrook Campground Overflow	3%	3%	4%	5%	6%	6%
DeSabla Group Picnic Area	4%	5%	6%	7%	8%	9%

* California Department of Finance, Economic Research (accessed at www.dof.ca.gov).

Whitewater Boating

In 2006, PG&E conducted a recreation flow study to describe the relationship between flows and water-based recreation opportunities within the project area through a literature review and interviews of individuals knowledgeable about whitewater boating

opportunities in the region. Several reaches were identified in relation to whitewater boating opportunities, as summarized in Table 3-38.

Table 3-38. Recreation flow study reach segments and sites by Project-affected reach. (Source: PG&E, 2006)

Project-Affected Reach	Length (miles)	Study Segments	Length (miles)
Butte Creek: Butte Creek diversion dam to DeSabla powerhouse	10.0	Butte Creek Diversion to Doe Mill Creek Road	6.7
		Doe Mill Creek Road to DeSabla powerhouse	3.3
Butte Creek: DeSabla powerhouse to Centerville powerhouse	6.5	DeSabla powerhouse to Centerville powerhouse	6.5
Butte Creek: Centerville powerhouse to Parrott-Phelan diversion	9.0	Centerville powerhouse to Centerville Bridge	0.3
		Centerville Bridge to Covered Bridge	5.3
		Covered Bridge to Parrott-Phelan Diversion	3.4
Upper West Branch Feather River	14.5	Round Valley Dam to Philbrook Creek	4.9
		Philbrook Creek to Brown's Ravine Bridge	3.5
		Brown's Ravine Rd. to Hendricks diversion dam	6.1
Philbrook Creek	2.3	Philbrook Reservoir Dam to West Branch Feather River confluence	2.3
Lower West Branch Feather River	14.0	Hendricks Diversion to Robley Point Rd. Bridge	5.9
		Robley Point Rd. Bridge to Whiskey Flat	7.3
		Whiskey Flat to Miocene diversion	0.8

Beginner to advanced whitewater boating opportunities can be found throughout the project. On Butte Creek, a 3.5-mile-long, Class VI whitewater boating run exists between Doe Mill Bridge and the DeSabla powerhouse. There is also a 6.2-mile-long whitewater boating opportunity from DeSabla powerhouse to Centerville powerhouse during the winter and spring season. This run can be divided into three sections. The upper section from DeSabla powerhouse to Chimney Rock is a Class V run; the middle section from Chimney Rock to Helltown is a Class IV run; and the lower section from Helltown to Centerville powerhouse is a Class III+/IV- run. On the lower reach of Butte Creek there are two popular beginner/intermediate whitewater runs available during spring to early summer. The first run is a 6-mile-long, Class II+ run, extending from Centerville powerhouse to the Honey Run Bridge. The second run is a 3-mile-long, Class II run, extending from the Honey Run Bridge to the Parrott-Phelan diversion dam. Other boating opportunities can be within the Forks of Butte Creek Recreation Area. The boating put-in for this Class IV-V kayaking run on the West Branch Feather River can be found near Whiskey Flat.

3.3.5.2 Environmental Effects

Recreation Management Plan

In order to ensure a quality experience for recreation users over the term of the license, PG&E proposes to develop and implement a Recreation Facility Rehabilitation and American with Disabilities Act (ADA) Upgrade Plan for the existing recreation facilities at Philbrook reservoir and DeSabla forebay within one year of license issuance. The plan would include replacing, retro-fitting, and upgrading existing recreation facilities, as needed, and improving access by providing ADA facility enhancements, as necessary, according to Forest Service Outdoor Recreation Accessibility Guidelines (FSORAG) and ADA standards over the term of the new license. PG&E also proposes to continue to operate, manage and maintain recreation facilities at Philbrook reservoir and DeSabla forebay by conducting minor repairs and preventative, annual maintenance activities.

Forest Service (4)e condition no. 33 specifies that PG&E implement a Recreation Management Plan in consultation with the Forest Service and other appropriate agencies to include annual maintenance, operation, reconstruction, and monitoring of existing recreation facilities and use at the project to protect natural site conditions and promote user convenience. Under 10(a) recommendation no. 17, FWS also recommends PG&E implement a Recreation Plan.

The following sections describe the components of each recreation plan proposed by PG&E, the Forest Service, and FWS and our assessment of the potential effects of each plan on recreational resources at the DeSabla-Centerville Project.

Rehabilitation and Enhancements

As a part of their recreation plan, PG&E proposes to upgrade or replace existing recreation facilities that have deteriorated and bring all recreational facilities at Philbrook reservoir and DeSabla forebay up to an accessible level. PG&E provides a summary of the anticipated rehabilitation measures at each site, which we summarize below.

Developed Recreation Facilities at Philbrook Reservoir and DeSabla Forebay

- Philbrook Day Use and Overflow Camping Area: rehabilitate 1 picnic site, 1 restroom, and 1 parking space to be universally accessible; provide accessible route between existing restrooms, parking area, and accessible picnic sites.
- Philbrook Angler Access: rehabilitate 1 restroom and parking space to be universally accessible
- Philbrook Campground: rehabilitate 4 campsites (2 RV sites), 2 restrooms, and 1 overflow parking spaces to be universally accessible; provide accessible route between restrooms, parking area, and accessible campsites.
- DeSabla forebay: rehabilitate 1 parking space to be universally accessible; provide accessible route between parking area, proposed restroom, and shoreline.

- DeSabla Group Picnic Area: rehabilitate 1 parking space, 1 cooking grill, and 20% of picnic tables to be universally accessible and adjacent to an accessible route; provide an accessible route between parking area, restroom, and picnic tables/area.

The above ADA measures were also recommended by California Salmon and Steelhead Association.

The Forest Service's recreation plan also specified PG&E rehabilitate existing facilities on National Forest Service lands and improve access by making developed recreation sites accessible to the physically challenged according to FSORAG guidelines in their 4(e) condition no. 33. We summarize the rehabilitation measures specified by the Forest Service below.

Developed Recreation Facilities at Philbrook Reservoir

- Extend concrete boat launch to "normal fall" pool level with concrete or other permanent hardened surface.
- Reconstruct restrooms to meet FSORAG guidelines
- Construct accessible designated trail(s) to shoreline through campground
- Construct and maintain public recreation trail from new Forest Service access road and parking area to the SE shoreline of Philbrook Reservoir
- Install signage inviting public to access Project shore.
- Provide 15-20% of the camping fees collected from National Forest Service lands at Philbrook Campground to provide for compliance inspections, interpretation, and a Forest Service presence at the campground.
- Consider placing a portion of the Philbrook Campground under a reservation system to encourage trip planning and guarantee a space.
- Consider working in partnership with local communities and agencies to recruit disadvantaged youth to participate in "Kids in the Woods" or like programs.

River Reaches

- Upgrade and maintain an existing user-created trail and parking along Toadtown Canal east of HT 1 and HT 2 and parking area; provide a barrier at end of trail to discourage trespass.
- Manage invasive weeds along designated trails.

FWS recommends PG&E develop a separate site plan specifically for the Forks of Butte Creek Recreation Area in their 10(a) condition no. 18 recommendation. FWS provided the following recommendations to improve access and enhance recreation opportunities to these areas:

Forks of Butte Creek Recreation Area

- Construct an accessible restroom at the Forest of Butte Creek Campground.
- Develop a site plan for the Forest of Butte Creek Primitive Campground to include a toilet, fire rings, picnic tables, bear boxes, parking and tent site.
- Construct an accessible restroom at Ponderosa Bridge Parking Area
- Complete construction of the Butte Creek Trail on southwest shoreline of Butte Creek to Canyon Bottom; build a footbridge across Butte Creek to connect the trail.
- Manage fires/dispersed use around recreation area through Project patrol
- Install kiosk and reconstruct trail alignment at Indian Springs Trailhead.

Analysis

PG&E's proposed rehabilitation measures include upgrading existing facilities and improving accessibility at various times over the new license. These measures would provide for enhanced access to project facilities, trails, restrooms, campsites and amenities, picnic areas and amenities, and parking. Improving access for the disabled at the project would be consistent with the Commission's policy on recreation facilities at licensed projects under which licensees are expected to consider the needs of the design and construction of such facilities.[55] These measures would provide enhanced accessibility to recreation opportunities at the project over the term of a new license.

PG&E's proposal is consistent with the Forest Service's 4(e) condition no. 33, but the Forest Service's condition contains a few additional measures that PG&E did not propose. Forest Service specified PG&E extend the concrete boat launch on Philbrook reservoir to "normal fall" pool level due to public concerns with the boat launch. Currently, the boat launch is operational throughout the primary recreation season (Memorial Day weekend to mid- to late September); however, it does not extend to the low water line. PG&E states Philbrook reservoir is maintained at a minimum elevation of 5,516 feet elevation during the primary recreation season and the boat launch is still functional at this level due to the soil being compacted, benched, and cleared of debris to the low water line. Forest Service states stumps in the reservoir bottom, erosion from vehicle traffic, and rutting have been identified by the public at low pool. Based on the Visitor and Resident Recreation Survey conducted by PG&E in 2006, Philbrook reservoir was by far the most popular reservoir at the Project. Approximately 37 percent of those recreation users visiting the Philbrook reservoir recreation area accessed the boat launch during the peak recreation season. Demand for boating access coupled with the current

[55] See 18 CFR section 2.7

condition of the boat launch demonstrates the need for adequate recreational boating access at the project.

Forest Service specified PG&E upgrade and maintain an existing user-created trail and parking along Toadtown canal and manage invasive weeds along designated trails at the Project. Upgrading the existing trail and parking would provide enhance accessibility to recreation opportunities at the project and would help ensure that project recreation facilities meet future recreation demand over the term of the license. PG&E has proposed a Noxious Weed Management Plan to include managing invasive weeds along recreation trails, which is further discussed under *Terrestrial Resources,* section 3.3.2.1.

In addition, Forest Service specified PG&E construct and maintain a public recreation trail from a new Forest Service access road and parking area to the southeast shoreline of Philbrook reservoir. The Forest Service is currently developing an environmental document for a timber sale in the vicinity of Philbrook reservoir, which requires Forest Service to reconstruct roads across National Forest Service Lands that currently access PG&E leased recreation cabins on the southeast shoreline. Forest Service stated a need was indicated by visitors and local residents to improve access to the lakeshore without conflicting with the existing cabin user needs. Although providing trail access to the southeast shoreline would improve access, shoreline access is already being provided on the north end of the reservoir at Philbrook Angler Access, Philbrook Campground, and Philbrook Campground Overflow Area. Furthermore, the cabins located on the southeast shoreline are privately owned cabins located outside the project boundary. Accordingly, PG&E would not be responsible for providing recreation access to non-project facilities.

Forest Service specified PG&E provide the Forest Service with 15-20% of the camping fees collected from National Forest Service Lands at Philbrook Campground for compliance, interpretation, and Forest Service patrol and to consider placing a portion of the Philbrook Campground under a reservation system. All the campsites at Philbrook Campground, with the exception of one, are located on National Forest Service Lands. Placing Philbrook Campground under a reservation system might make it easier for visitors to reserve a camp site We note, PG&E has been and continues to be responsible for the operation and maintenance of recreation facilities within the project boundary. Furthermore, any camping fees collected at Philbrook Campground would be under the jurisdiction of the Licensee to use toward costs associated with the operation and maintenance of the campground.

Additionally, Forest Service specified PG&E to consider partnering with local communities and agencies to actively recruit disadvantaged youth to participate in “Kids in the Woods” or similar programs. It is not clear if this is a suggestion or a mandatory condition and moreover, “Kids in the Woods” does not have a nexus to the project.

FWS recommended a separate site plan for the Forks of Butte Creek Recreation Area located outside the project boundary. PG&E is currently meeting camping needs and providing public access to project lands and waters by the use of both the Philbrook and DeSabla recreation areas. Although developing rehabilitation and enhancement measures to improve recreation at Forks of Butte Creek campgrounds, the Ponderosa Bridge Parking area, and the Butte Creek trail would enhance accessibility to recreation opportunities, these facilities are located outside the project boundary and are not needed for project purposes.

California Salmon and Steelhead Association recommends that PG&E construct a public day use area with ADA accessible facilities Round Valley reservoir (Snag Lake), and stock the reservoir with trout during the spring season. Under current project operations, this reservoir is filled to its maximum level during the spring of each year and then drained completely in June. There are no fish currently stocked at this reservoir and there is little to no recreation use in this area of the project. Although constructing a public day use area and stocking the reservoir with fish would improve recreation opportunities at Round Valley reservoir, there is no evidence to support the need for developed recreation facilities in this area of the project.

Operation and Maintenance

PG&E proposes to develop a Recreation Operation Plan, in consultation with the Forest Service, for recreation facilities within the project boundary at Philbrook reservoir and DeSabla forebay within one year of license issuance. PG&E agrees to provide a draft to the Forest Service for a 60-day review period prior to filing the plan with the Commission.

Forest Service (4)e condition no. 33 specifies that PG&E address the roles and responsibilities between them and the Forest Service pertaining to coordination, user fees, user conduct and safety, annual inspections, annual operation and maintenance, trigger points initiating environmental analysis, and implementation of additional recreation mitigation. These measures would be developed in a plan and the plan would be reviewed and updated every five years, at minimum.

Analysis

PG&E is responsible for the management, operations, and routine maintenance of the recreation facilities within the project boundary. Operation and Maintenance associated with the project's recreation facilities help to ensure that these facilities and associated public recreational access are provided over the term of the license. Development of the plan in consultation with the Forest Service would help to address Licensee and Forest Service responsibilities. Submittal of a final plan to the Commission for review and approval after consultation with the Forest Service would help to ensure

that the proposed operation and maintenance measures are consistent with the terms and conditions of a new license.

Dispersed Camping and OHV Use

Besides the trash management measures that are already occurring through the operation and maintenance of the current license, PG&E proposes to work with the Forest Service to discourage dispersed camping, trash dumping, and OHV use through a combination of appropriate signage and installation of adequate vehicle barriers, specifically at the Willow Dispersed Area. Alternatively, PG&E proposes to close this area to motor vehicles only, as opposed to closing the recreation area completely.

In addition to PG&E's proposal, Forest Service specifies PG&E manage dispersed recreation and OHV use around the Project, including at Round Valley reservoir, Willow Dispersed Use Area, the West Branch Feather River Bridge crossing, and the former West Branch Campground site. This would include installing boulders or barriers to block vehicle access in these areas, installing signs for pack-in/pack-out and appropriate sanitation, and redirecting displaced campers to acceptable camping locations. Specifically for OHV use, PG&E would be required to construct kiosks displaying regulatory information about OHV use in approved locations, redirect waterflow and revegetate where OHV use has compacted or damaged natural resources, close and rehabilitate unauthorized OHV routes, and develop mitigations to minimize OHV resource impacts on adjacent lands as some areas become restricted.

Further, both Forest Service specifies and Butte County recommends PG&E manage dispersed use around the recreation area through Project patrol.

Analysis

Measures to block vehicle access and discourage dispersed camping and OHV use at the Project would benefit environmental resources by closing degraded areas to more intense recreational use. The applicant would continue to allow appropriate non-motorized access to all existing and future Project lands except where unsafe. By implementing additional visitor management controls where needed, such as signs, barriers, and enforcement, this would ensure a high quality recreational experience and enhance public safety. The Willows Dispersed Area, the West Branch Feather River Bridge crossing, and the former West Branch Campground site are all located outside the project boundary. PG&E is ultimately responsible for the operation and maintenance of the project's recreation facilities located within the project boundary. The Willows Dispersed Area, the West Branch Feather River Bridge crossing, and the former West Branch Campground site are all located outside the project boundary, but due to their close proximity to the reservoir, it is likely visitors to the project are utilizing these areas

and these one-time measures would be appropriate. The provision of providing Project patrol is further discussed later on in this section.

Fish Stocking

One of the primary recreational activities associated with the Project includes angling. California Fish & Game currently stocks DeSabla forebay to improve the recreational fishery. PG&E proposes to continue to fund California Fish & Game up to $10,000, approximately 3,311 lbs of trout, annually in years in which California Fish & Game stocks rainbow trout in DeSabla Forebay.

California Fish & Game recommends PG&E annually reimburse California Fish & Game for fish stocking, not limited to DeSabla Forebay, and increase the amount from 7,200 to 8,000 lbs of catchable trout.

Analysis

California Fish & Game contends that under a 1983 agreement with PG&E, the applicant agreed to annually reimburse California Fish & Game for the stocking of 14,435 trout, or approximately 7,200 lbs. Because of the projected increase in population in the state of California, California Fish & Game recommends increasing the 7,200 lbs of catchable trout to 8,000 lbs and they maintain that any decision made about where, when, and how many trout to stock should be made by the state and should not be limited to the DeSabla Forebay.

Angling is one of the most popular activities associated with the Project and because DeSabla forebay is a popular fishing spot with local residents, stocking catchable trout would help ensure that the recreational fishery is maintained for the term of the new license. However, based on the recreation studies completed through the relicensing process, there is no evidence that would support increasing the number of fish stocked at the project. Development of a fish stocking plan, in consultation with Cal DFG, would provide the means for coordinated development of the amount and location of fish to be stocked at the project. In addition, including creel surveys on both the Philbrook and DeSabla reservoirs as a part of recreation monitoring at the project would help to identify changes in trends and use patterns at the Project. We note that PG&E is ultimately responsible for the management of all project reservoirs, including DeSabla forebay, and project reaches.

Informational Signs

PG&E proposes to develop a Project Information and Sign Plan in consultation with the Forest Service within one year of license issuance. The plan would include the

types of informational signs to be developed, the design and content of each sign, and the locations on National Forest Service lands where the signs will be placed.

Both Forest Service 4(e) condition no. 33 and Bureau condition no. 18 specify PG&E develop and implement a Sign and Information Plan conforming to the manual of Uniform Traffic Control Devices, the Forest Service and the Bureau's sign handbook, and other applicable standards in consultation with the Forest Service, the Bureau, California DOT, appropriate County agencies, and other interested parties. The plan should include, at minimum, the location, design, size, color, theme, and message for all interpretive, educational, informational, regulatory, warning, directional, and safety signs.

Analysis

Development and implementation of a sign plan and associated measures for the DeSabla project would provide the means for coordinated and systematic development of signage associated with the project. The sign plan would also provide the means to ensure that signage within the DeSabla-Centerville Project is maintained and conforms to the Forest Service and Bureau standards on lands that are visible from National Forest Service and Bureau lands. Review and approval of the plan by the Commission would ensure that the recommended component of the sign plan conform to Commission regulations for licensed hydropower projects.

Streamflow Information

PG&E proposed to make the daily average streamflow information available to the public via the Internet on the West Branch Feather River below Hendricks Head dam and on Butte Creek below Butte Creek Head dam and below Lower Centerville diversion dam no later than one year after license issuance.

Forest Service 4(e) condition no. 33 specifies streamflow and reservoir level information be provided via the Internet on project streams and reservoirs. Both FWS under 10(a) recommendation no. 17 and the Conservation Groups recommend the same.

Analysis

PG&E's proposed provision of providing streamflow information to the public would provide the means for the public to gain information regarding streamflow and reservoir levels for specified stream reaches and reservoirs. This information could then be used by the public to determine if recreation opportunities and desired flow ranges for angling, boating, and other recreation activities would be available. This would allow the public to take better advantage of opportunities for public recreation use at the project.

Stream Access

PG&E proposes to provide vehicle access to river reaches at selected project facilities and to file a plan, in consultation with American Whitewater and appropriate local landowners, in an attempt to obtain whitewater boating access to DeSabla powerhouse and to Licensee's Miocene diversion dam impoundment, located outside of the project boundary, during the spring season. PG&E would file the plan for Commission approval within one year of license issuance.

FWS 10(a) recommendation no. 19 recommends PG&E provide recreational access to Butte Creek below the DeSabla powerhouse and Centerville powerhouse from December 1 to May 15 and the Conservation Groups recommend recreational access be provided from November 15 to May 15 each year upon license issuance. The Conservation Groups also recommend that PG&E convene an annual meeting of interested stakeholders to evaluate management issues arising from this provision of river access at these locations.

Analysis

American Whitewater, as a part of the Conservation Groups, met with PG&E in February 2007, to discuss the potential for recreational access at the DeSabla and Centerville powerhouses and releasing streamflow information on these two reaches in lieu of pursing mitigation measures that could result from phase 2 studies under the *Recreation Flow Study*. The *Recreation Flow Study* found both reaches to be popular boating opportunities; however, boaters were required to carry their boats down to the put-in sites at each reach, a 30-45 minute walk, resulting in poor access. American Whitewater states PG&E changed its position within the first months of 2008 and agreed only to give limited keyed access to members of the whitewater boating community and other "responsible" parties. Obtaining access would involve crossing private lands and PG&E has previously stated concerns with dumping trash and public safety in this area of the project. However, PG&E asserts it would make a good faith effort to facilitate discussions on access to the stream. This is a unique water-based recreation opportunity within the project. The provision of access during the winter and spring period at DeSabla and Centerville powerhouses would provide opportunities for increased whitewater boating at a time when whitewater boating opportunities within the region are not as abundant. PG&E's concerns with trashing dumping and public safety are valid. However, we note that there are several methods that may be employed to limit trash dumping and ensure public safety, such placing the gates further down the road and posting signage to prevent trash dumping and encourage pedestrian access. Consultation with American Whitewater, appropriate local landowners, and other appropriate stakeholders would also be a way to address PG&E's concerns and develop a plan to provide whitewater boating access at these locations.

Recreation Monitoring

Both the Forest Service 4(e) condition no. 33 and Bureau condition no. 18 specify PG&E develop recreation use monitoring, reporting, and use triggers, in consultation with both agencies, in order to periodically monitor changes in recreation use patterns at the Project. Monitoring would include conducting recreation user surveys, user counts and change in use patterns, and monitoring facility, ecological, and social capacity at all developed and dispersed project-affected recreation sites on National Forest Service and Bureau lands. PG&E would be required to conduct these monitoring efforts every five years, unless otherwise agreed to by the Forest Service and or the Bureau, and provide the results to all relicensing participants within 60 days, at minimum, prior to the annual consultation meeting. PG&E would be required to initiate an environmental analysis, to be completed within one year, when recreation monitoring indicates any of the following triggers during the primary recreation season: (1) 80% average occupancy during the weekends; (2) 65% average occupancy during weekdays; or (3) 100% occupancy on 50% of the holiday days.

Additionally, Forest Service requires PG&E to support reservoir-based recreation by developing and initiating an annual boat monitoring protocol on Philbrook reservoir to identify seasonal use trends on the reservoir. This information would be used to examine existing use and develop mitigation measures if use is excessive or creating conflict among reservoir-based recreation users.

Analysis

Recreation use at the Project is expected to double over the next 50 years. The level and type of recreation use and user preferences could change over the term of a new license. Periodic monitoring of recreation use, surveying user preferences, and assessment of facility capacity and recreation demand can help to determine if Project recreation facilities meet demand and provide adequate public recreation access to the project over the term of the license. Monitoring boat use would help to identify excessive use and potential user conflicts on Project reservoirs, however, this information is already required through the FERC Form 80. Including a boat monitoring protocol as a part of monitoring efforts every five years rather than on an annual basis would be adequate to ensure project recreation facilities, including reservoirs, are meeting recreation demand over the term of the license.

Law Enforcement

PG&E proposes to work with the Forest Service and County law enforcement officials to provide increased law enforcement at Philbrook reservoir recreation facilities during peak season. This includes consulting with officials on how best to inform them of services needed at the project and how to best deploy these services in the area.

Both the Forest Service and Bureau specify PG&E provide a half-time project patrol or law enforcement position for patrol and maintenance activities on National Forest Service and Bureau lands. Butte County recommends the same. Similarly, the Conservation Groups recommend PG&E provide financial support to cover the salary of one Butte county sheriff's deputy during the term of the license to address law enforcement and resource issues in the Butte and West Branch Feather River canyons.

Analysis

Law enforcement measures would help encourage visitors, including anglers and boaters, to comply with regulations. An increase in the number of visitors over the term of the new license would likely increase the need for public services, including law enforcement and fire protection, which are provided by the Butte County Sherriff's Office. More visible law enforcement patrol would help reduce conflicts between recreation users and improve visitor safety by providing an authoritative presence to encourage compliance with navigational laws. Additional law enforcement patrols at the more remote areas of the project would improve management of environmental resources by increasing visitor contact with enforcement agencies and help to educate visitors about appropriate and restricted uses.

However, within the project area, the state and county are responsible for law enforcement activities at public recreation sites. The applicants pay property taxes to the counties within the project area, which are partially used to fund law enforcement. In addition, under PG&E's sign plan, the applicant proposes to post signs that provide public information about acceptable and prohibited recreation uses, and have proposed new measures that would increase public education to help improve visitor compliance with project rules and regulations. Further, funding a full-time law enforcement/patrol, as proposed, provides no assurance the officer would be used exclusively within the project area. As such, there is no indication the proposed measure would reduce any existing recreation conflicts or further protect project environmental resources for the term of the license.

3.3.6 Land Use and Aesthetic Resources

3.3.6.1 Affected Environment

Land Ownership

The DeSabla-Centerville Project area is primarily made up of private lands owned by PG&E and Sierra Pacific Industries and federal, state, and county lands. Although Sierra Pacific Industries is the largest private landholder adjacent to the Project, the Forest Service, the Bureau, Cal Fish & Game, and Butte County all have lands within or adjacent to the Project.

The Plumas National Forest manages 0.4 miles of lands along Toadtown Canal and 3.5 miles of lands along the West Branch Feather River. These lands are within the Forest Service's Flea Mountain Management Area and are managed for wildlife protection, fire prevention, recreation, and protection of river resources.

The Bureau administers lands primarily located in the lower portion of Butte Creek drainage and also a small parcel on the West Branch Feather River roughly one mile above the Miocine diversion. These lands fall within the Ishi Management Area of the Bureau's Redding Resource Area, which include the Fort of Butte Creek Recreation Area and are managed for natural resource values and primitive to semi-primitive recreation opportunities.

Cal Fish & Game manages the Coon Hollow Wildlife Area and the Butte Creek Canyon and Butte Creek House ecological reserves, which are adjacent to Round Valley Reservoir and the nearby project-affected reaches. These lands are managed to protect and enhance a wide variety of plant and animal species habitats and provides the public with wildlife-related recreation.

Areas Adjacent to the Project Boundary

Lassen Forest Service administers approximately 55 percent of land uses adjacent to Philbrook reservoir and all the lands adjacent to Round Valley reservoir. Forest Service has designated lands along Philbrook reservoir's northern end as Late Successional Prescription, and lands along the southern end near the dam as Riparian/Fish Prescription. Land uses around the northwest shore of Round Valley reservoir are in accordance with the Lassen Recreation Management Plan View/Timber Prescription. PG&E owns the remaining lands at the upstream of Philbrook Reservoir and leases out land for 42 private summer homes just outside the project boundary at the north and south eastern shore.

PG&E owns all lands around the DeSabla forebay. These lands are zoned at Timber Mountain by Butte County and fall within the Paradise-Magalia Watershed Protection Overlay Zone. Skyway Road runs along the forebay's eastern shore. A private recreation group camp, Jones Campground, is located on the forebay's western shore, as well as PG&E's regional hydo office, Camp 1, on the south shore.

Butte County manages private land uses in accordance with the Butte County General Plan and the County zoning ordinance. County land use zoning categories relevant to the Project and project facilities are identified and defined in the Table 3-39 below.

Table 3-39. Land Use Category Descriptions from Butte County General Plan and Zoning Ordinance (Source: PG&E, 2007)

Facility	Land Use Category	Purpose/Primary Uses
Toadtown powerhouse	Timber Preserve (TPZ)	Growing and harvesting timber
Centerville powerhouse	Foothill Recreational (FR)	Single family dwellings, resource extraction and processing exempt from permits and reclamations plans, protection of lands from various hazards, trails, agricultural experimental areas, utilities, day care homes, animal husbandry, food crops.
DeSabla powerhouse	Timber Mountain	Forest management, harvesting and processing of forest products

Approximately two thirds of the lands along the Project's 34 miles of canals are zoned for Timber Preserve or Timber Mountain, as seen in Table 3-40. These lands are generally located in the upper project area along the Hendricks, Toadtown, and Butte canals. One third of lands adjacent to the canals are zoned as Agricultural or Foothill Recreational. These lands are located along the lower and upper Centerville canals in the lower portion of the Project. The Bureau manages about 0.4 mile of lands adjacent to Toadtown canal. In addition, Butte County's watershed overlay zone covers Toadtown canal and portions of Hendricks and Butte canals.

Table 3-40. Land Use Management Distribution Within and Adjacent to Canal Project Boundaries. (Source: PG&E, 2007)

Land Use Management Designations	Miles of Canal				
	Hendricks/ Toadtown	Butte	Lower Centerville	Upper Centerville	Total
Timber Preserve	8.1	8.9	0.5		17.5
Timber Mountain	1.7	0.8	2.1	0.3	4.9
Commercial Forestry		0.1			0.1
Agricultural-Residential				4.4	4.4
Foothill Recreational			5.2		5.2
Resource Conservation				0.2	0.2
Bureau	0.1	0.4			0.5
Plumas National Forest	0.4				0.4
Unclassified	0.2	0.5	0.1	0.2	1.0
Total Miles	10.6	10.7	7.9	5.1	34.2

Roads

Butte County has zoned lands along approximately 26 miles of project roads as Foothill Recreational, Timber Preserve or Timber Mountain, Unclassified, or Agricultural Residential (Table 3-41). The remaining lands along Project roads are managed by the Bureau and the Lassen National Forest.

Table 3-41. Land Use Management Within and Adjacent to the Project Boundary along Project Roads. (Source: PG&E, 2007)

Land Use Management or Agencies	Miles of Project Roads
Timber Preserve	15.1
Timber Mountain	4.5
Agricultural-Residential	0.1
Foothill Recreational	4.7
Land Use Management or Agencies	Miles of Project Roads
Bureau of Land Management	0.8
Lassen National Forest	0.1
Unclassified	0.9
Total Miles	26.2

Project River Reaches

The Project affects 55 miles of Butte Creek and the West Branch Feather River. About half of the lands along these rivers are zoned for Timber Reserve or Timber Mountain. About 11 miles of these lands are zoned for Foothill Recreational. Bureau manages lands along 5.8 miles of the rivers, Lassen National Forest Service manages 3.6 miles, and Cal Fish & Game manages 1.5 miles.

Aesthetic Resources

The visual aesthetic of the Project area ranges from flat-topped buttes that border Butte Creek Canyon to the start of the Sierra Nevada mountain range. The Project provides limited scenic vistas and attractions due to foothills and mountainous terrain dominated by steep canyons and ravines as well as densely forested areas that obscure any expansive views. Round Valley and Philbrook reservoirs are located at higher elevations and provide opportunities to view limited scenic vistas of the valley that they lie within. Unique vistas in the Project region are found along Butte Creek where the river has created steep, narrow canyons with large pools and drops.

Round Valley is at the upper end of the Project in a hilly volcanic terrain, surrounded by a Sierran mixed conifer forest. Lands around the reservoir are managed by Lassen National Forest as partial retention and modified visual quality objectives (VQO). Within partial retention areas, management activities should be visually subordinate to the natural surrounding character while management activities are dominant within modified VQO areas, but should conform to the surrounding natural character.

Philbrook reservoir, located near the head of Philbrook Creek, is roughly 35 miles downstream of Round Valley reservoir and is surrounded by dense forests of ponderosa pine, incense cedar, white fir, Douglas fir, and sugar pine as well. Forest Service lands around Philbrook reservoir are managed in accordance with retention, partial retention, and modified VQOs. Unlike partial rention areas, management activities should not be visually evident within retention areas.

DeSabla forebay is located on relatively flat terrain above Butte Creek on Paradise Ridge, which is a major geographical feature in Butte County. Although the forebay is surrounded by a ponderosa pine forest, DeSabla Forebay dam is a dominant visual feature that forms the southern shore.

Due to the rugged topography and dense forest cover, Hendricks and Toadtown canals are visible only for a hundred feet or less on each side where they cross Skyway road. Butte and Centerville canals cut a horizontal band along the eastern side of the Butte Creek Canyon. The canals and powerhouses located at the bottom of the canyon are dominant elements in the landscape. However, due to the limited accessibility of the

canyon, the public are less likely able to view these facilities. The facilities can only be seen by visitors who use the canals for hiking. For the same reason, Toadtown, DeSabla, and Centerville powerhouses have low to moderate visibility from public areas. There is no public access in these areas.

Project River Reaches

West Branch Feather Reach flows 20 miles from Philbrook reservoir to Miocene Diversion through steep wall canyons and dense forest. Views into the canyons are limited; however, there are some public roads that provide access to views of river. Forest Service lands surrounding the river are managed in accordance with retention, partial retention and modified VQOs.

A two-mile-lomg section of Philbrook Creek below the Philbrook dam flows through a steep, forest-covered valley before opening its confluence with West Branch Feather River.

Butte Creek extends from Butte Creek diversion dam a length of 26 miles to Parrott-Phelan diversion dam, through a deep, narrow incised canyon that is inaccessible for much of its length. This canyon sustains a dense vegetation cover ranging from riparian vegetation at the bottom of the canyon to foothill woodleaf along the canyon walls. The steep sloped canyon has limited developments and is typically reached via unimproved roads. Butte Creek diminishes downstream of Centerville powerhouse and is the most heavily settled portion of the watershed. The area is distinctive for canyon views from bottom and rim of the canyon.

3.3.6.2 Environmental Effects

Land Use

Transportation System Management Plan

PG&E proposes to develop and implement a Transportation System Management Plan (TSMP), in consultation with the Forest Service, for the protection and maintenance of roads associated with the project on National Forest Service lands within one year of license issuance. This plan would include, at minimum, a map showing all roads associated with the project with respect to the project boundary and maintenance responsibilities, identification of uses on each road, condition surveys, construction/reconstruction needs, road closures, safety, and jurisdiction (e.g. county, state) of each road. The plan would also include measures, such as installing gates, to rehabilitate existing erosion damage and minimize future erosion on project access roads on National Forest Service lands and measures for temporary traffic control and public safety when project construction is in progress, as according to the “Manual on Uniform

Traffic Control Devices for Streets and Highways." Both FWS recommendation no. 18 and NMFS recommendation no. 3 under 10(a) are consistent with PG&E's proposed Transportation System Management Plan for protection and maintenance of roads associated with the project on Bureau and other appropriate county, state, and federal lands.

Forest Service condition no. 36 specifies that PG&E file a TSMP, approved by the Forest Service, for the protection and maintenance of roads associated with this license that are on or affecting National Forest Service Lands within one year of license issuance. The purpose of the plan is to rehabilitate existing damage and minimize erosion from Project use of roads on or affecting National Forest Service lands in order to meet appropriate Forest Service Maintenance and Traffic Service Levels 1. The plan would include, at minimum, a cooperative road agreement to define road share costs and responsibilities, resource protection and erosion control measures, and a map and inventory of roads necessary for the Project that are on or affecting National Forest Service lands. Additionally, PG&E would be required to develop and implement a monitoring plan to determine project-associated use and trends pertaining to traffic, road maintenance conditions, and air quality conditions over a five year period after license issuance. This data would be used to assist in the development of proportionate road share costs. Upon implementation, PG&E would need to obtain an encroachment permit and/or meet any other applicable requirements when operating on National Forest Service lands.

Analysis

The Transportation System Management Plan would help to clarify PG&E use of Forest Service roads and establish a forum for coordination of road maintenance activities between PG&E and the Forest Service. The plan delineates PG&E's responsibilities for monitoring project roads used for project operations and maintenance and ensures that safety and environmental measures associated with these roads are addressed in the proper manner. Some of the Forest Service and other public roads the applicant uses to access Project facilities for operation and maintenance purposes are also used by the Forest Service for administrative and land management purposes, and the public for recreational activities. The development of a transportation management plan, in consultation with the Forest Service, would enable ongoing maintenance and associated planning responsibilities to be clearly defined. We note that any access road used primarily for Project purposes requiring routine maintenance would need to be included within the project boundary. However, roads located outside the project boundary are not subject to Commission jurisdiction or the terms and conditions of the license, therefore, they would be outside the scope of 4(e) conditions.

The Forest Service specifies the traffic monitoring plan would help to determine project-associated use on roads within the project area as well as assist in the

development of road share costs. Through the NEPA process, project and non-project roads have been clearly defined and as noted above, the Licensee is responsible for the maintenance of all project roads within the project boundary. Gathering additional information to determine project-associated use or cost sharing responsibilities on roads located outside the project boundary would not provide any information needed to manage project roads.

Road Maintenance

In addition to the Transportation System Management Plan, Forest Service condition no. 36 specifies that PG&E develop a design for reconstruction of the North Fork Feather River road crossing below Round Valley reservoir, reconstruct any existing roads listed in table 3-42 (below) not currently meeting Forest Service standards, and implement temporary traffic controls to provide the public with adequate warning and protection from hazardous or potentially hazardous conditions during project construction. PG&E would be responsible for the operation and maintenance of project-affected roads on or affecting National Forest Service lands, including snow plowing and removal when needed, outsloping, treating potential erosion, upgrade surfacing, etc.

Table 3-42 DeSabla-Centerville Project-associated Roads on or Affecting Forest Service Lands (Source, Forest Service 2008)

Road Name	On Forest Service Lands	In Project Boundary	Start	End
Round Valley Dam	Yes	Yes	Summit Road	Round Valley Dam
Gage BW 45	Yes	No	Summit Road	Gage BW 45
Philbrook Dam Road	Yes	Yes	Philbrook Road	Philbrook Dam
Philbrook Boat Launch Access Road	Yes	Yes	Phillbrook Road	Philbrook Dam
Philbrook Campground Loop	Yes	Yes	Philbrook Road	Philbrook Road
Philbrook Cabin Driveways	No, but affecting Forest Service Lands	No	Philbrook Road	Philbrook Road
Humbug Summit Road	Partially, and affecting	No	Skyway Road	Philbrook Road
Philbrook Road	Partially, and affecting	No	Humbug Road	Last lessee cabin driveway

Bureau condition no. 20 specifies PG&E annually repair and maintain that portion of Ditch Creek Road from Bureau's entrance gate to the point where the Project's 9/1 spillway crosses Ditch Creek Road. PG&E would also maintain the road to Bureau standards. Further, PGUE would install and maintain a new entrance gate at Bureau's entry point to Ditch Creek Road, when determined necessary by Bureau.

In order to improve road conditions and safety hazards caused by gravel, Butte County recommends PG&E update the guardrails to the current Caltrans standards and specifications for guardrails on county-maintained roads where project canals or flumes cross as well as pave back the apron to the County right-of-way at the project powerhouse road off Humbug Road, just south of the DeSabla reservoir. Furthermore, Butte County recommends PG&E pave the unimproved road sections on Skyway, Centerville, Nimshew, Doe Mill, Powellton, and Retson Roads to meet California Air Resources Boards requirement to reduce toxic air pollution from naturally occurring asbestos, as well as to meet the State's standards for other particular matter and sediment and soil erosion. At minimum, Butte County recommends PG&E pay the County an annual fee for the operation and maintenance of said roads and/or be responsible for the operation and maintenance of these roads according to National Forest Service standards.

Analysis

Implementing temporary traffic controls would ensure adequate access and public safety are provided during the construction of the project. As noted above, PG&E is responsible for any access road within the project boundary requiring routine maintenance and would also be responsible for the safety of the public on these roads. However, the North Fork Feather River road crossing and several of the roads listed in Table 3-9 for reconstruction fall outside of the project boundary. Furthermore, Skyway, Centerville, Nimshew, Doe Mill, Powellton, and Retson Roads are all outside of the project boundary as well. Roads located outside the project boundary are not subject to Commission jurisdiction or the terms and conditions of the license, therefore, they would be outside the scope of 4(e) conditions and not the applicant's responsibility.

Resolution of Encumberances

Forest Service condition no. 32 specifies PG&E develop a Resolution of Encumberances Plan and file it with the Commission within six months of issuance of the new license. This plan would spell out PG&E's responsibility for the resolution of these existing encumberances and would include, at minimum, facilitating removal of these current PG&E improvements on Forest Service lands or submitting appropriate documentation and funding for Forest Service consideration of authorizations of these improvements on Forest Service lands. Forest Service also specifies PG&E to include measures to insure native populations of Forest Service special status species plants are not adversely affected in the resolution of these emcumberances and an implementation schedule.

Analysis

The encumberances Forest Service is referring to are spring boxes placed by private cabin owners near springs on Forest Service lands. The private cabins are non-

project facilities located outside the project boundary on PG&E leased lands. Forest Service discovered waterlines coming from private cabins near Philbrook reservoir tapping into water from the springs through these spring boxes without permits (with one exception). Forest Service is concerned that the withdrawal of water by the cabin owners is affecting the quantity of water from these springs that could potentially be available for existing or additional habitat for Forest Service sensitive plant species. The springs are also located outside the project on Forest Service lands and are currently not affected by the project. Lands and facilities located outside the project boundary are not subject to Commission jurisdiction or the terms and conditions of the license. Furthermore, the spring boxes were placed near the springs by the private cabin owners, not PG&E. The Commission has jurisdiction over only its licensees, and therefore cannot enforce any condition to the extent that it purports to place responsibility on a non-licensee.[56] , As a result, this measure is unenforceable and we see no need to analyze this further.

Fire Management

Forest Service condition no. 34 specifies PG&E develop and implement a fire management and response plan in consultation with the Forest Service. This plan would include, at a minimum, identification of potential fire hazards and measures to reduce fire hazards at the project, prevention and public safety measures, emergency response preparedness measures, and a list of locations of available fire suppression equipment and personnel. PG&E would be required to cooperate with the Forest Service on all fire investigations.

Analysis

Recreation at the reservoirs and stream reaches, including at Project facilities and user-created dispersed sites, pose a potential fire risk and that risk will increase as recreation use increase in the future. Given the known high incidence of fire status and previously treated and untreated fuels in the area, PG&E should take reasonable preventative and pre-suppression actions at its Project facilities to help prevent wildfires and create safer conditions for the visitors brought to the area by the project facilities and reservoirs. Implementation of the proposed fire management and response plan would improve planning, management and coordination of wildfire protection and prevention measures, as well as lead to a reduction in the occurrence and suppression of wildfires that might be project-induced.

Hazardous Substance Plan

Forest Service condition no. 34 specifies PG&E develop and implement a plan, in consultation with the Forest Service, for oil and hazardous substances storage and spill

[56] Policy Statement on Hydropower Licensing Settlements 116 FERC ¶61,270

prevention and cleanup. The plan includes maintaining spill cleanup equipment in the project area to contain spills, identifying the location, type, and quantity of spill cleanup equipment stored in the project area, and informing the Forest Service of the nature, time, date, location, and action taken if a spill occurs on National Forest Service lands.

Analysis

Preparation and implementation of a hazardous materials plan would help to ensure that spills of hazardous materials are promptly contained and cleaned up, and would minimize the potential extent of adverse environmental effects. Provision of an outline of its procedures for reporting and responding to releases of hazardous substances would facilitate coordination of control efforts in the event of a hazardous substance spill.

Aesthetics

PG&E proposes to consult with the Forest Service prior to painting, reconstructing project facilities, or revegetating areas on National Forest Service lands and to use natural materials to blend with the environment. PG&E also proposed to maintain all its improvements at the project, including disposal piles and dispersed recreation areas within the project boundary, to Forest Service standards. Disposal would be at an approved existing location, except as otherwise agreed to by the Forest Service, and any problem areas would be discussed at the annual consultation meeting.

Forest Service condition no. 34 specifies PG&E develop and implement several Visual Management Action items, in consultation with the Forest Service that includes painting, revegetating, screening, and repairing facilities so they blend into the natural environment. This also includes removing, burning, or disposing of debris piles on National Forest Service lands prior to the primary recreation season and stabilizing and/or revegetating eroding channel banks to minimize erosion and allow for the restoration of a naturally appearing stream course. For those facilities that cannot be made less visible, the Forest Service specifies PG&E develop interpretive facilities and evaluate all project-associated signs for visual appeal. PG&E would be required to develop an implementation schedule for Forest Service and Commission approval.

Bureau condition no. 3 also specifies PG&E maintain all its improvements and premises on Bureau lands to standards of repair, orderliness, neatness, sanitation, and safety acceptable to the Bureau. Disposal would be at an approved existing location, except as otherwise agreed by the Bureau.

Analysis

PG&E's implementation of a Visual Resource Plan, specifically the selection of neutral paint color schemes that blend in with surrounding landscapes, would reduce

visual effects to the aesthetic resources at the project. Stabilizing and revegetating eroding channel banks to minimize erosion would also help to restore the natural habitat surrounding the streams. Developing interpretive facilities would also help to mitigate for project facilities impairing scenic views at the project and in turn, would educate the public about the project.

3.3.7 Cultural Resources

3.3.7.1 Affected Environment

Section 106 of the National Historic Preservation Act of 1966 (NHPA), as amended, requires the Commission to evaluate potential effects on properties listed or eligible for listing in the National Register. Historic properties are defined in section 106 as cultural resources listed or eligible for listing in the National Register. Historic properties represent things, structures, places, or archeological sites that can be either Native American or European-American in origin. In most cases, cultural resources less than 50 years old are not considered eligible for the National Register.

Area of Potential Effects

Pursuant to section 106, the Commission must take into account whether any historic property could be affected by a proposed new license within the project's APE. The APE is defined as 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 DeSabla project includes all the lands within the project boundary and lands outside the project boundary that may be affected by project operations, maintenance, and recreation activities. This expanded APE includes public lands between Philbrook Reservoir and adjacent roads, and public lands along the West Branch of the Feather River between Round Valley Reservoir and Philbrook Creek. Additionally, several project-related access roads not contained within the project boundary also were added to the APE.

As noted by PG&E, not all lands within the APE were accessible during the survey due either to steep terrain, lack of landowner permission in private residential areas, or other unsafe conditions (e.g. entering project tunnels). Areas not surveyed are listed in table 3-43.

Table 3-43. Portions of the APE Excluded from Archaeological Survey.

Locations Not Surveyed	Reason Not Surveyed
Two unsurveyed areas (approximately 1.75 miles) along West Branch Feather River and Philbrook Creek	Too steep
Two unsurveyed areas along West Branch Feather River (approximately 0.25 mile) and Philbrook Creek (approximately 0.75 mile)	Too steep
FWS of Philbrook Reservoir	Most of reservoir inundated
Approximate 11.5 acre-area on south side of Philbrook Reservoir	Too steep and too much natural tree fall
Hendricks Tunnel	Unsafe
Hendricks and Lovelock tunnels	Unsafe
All portions of the APE on this map are along the West Branch Feather River and were not surveyed, approximately 3.5 miles	Too steep
Approximately 4.0 miles of the Butte Creek Canal	Too steep
Approximately 2.0 miles of Butte Creek Canal	Too steep
Lovelock Tunnel, Toadtown penstock, Rapid pipe	Unsafe
Approximately 1.5 acres on LNF	Dense vegetation
DeSabla Forebay	Inundated
Approximately 1.5 acres on LNF	Dense vegetation
DeSabla Forebay	Inundated
Approximately 2.5 miles of the Lower Centerville Canal	Too steep
0.75 mile of Emma Road and a section of the Lower Centerville Canal, between Emma Road and Chimney Rock Tunnel	Restricted landowner access
1.0 mile of Upper Centerville Canal	Dense brush, no private landowners access permission
3.75 mile of Lower Centerville Canal	Too steep

In addition, surveys at Round Valley reservoir were delayed until the reservoir was empty and the underlying sediments were dry. Once accessible, all lands within the reservoir were accessible and examined during the survey. At Philbrook Reservoir, the existing FERC license requires PG&E to maintain a minimum pool of water, which precludes emptying the reservoir and eliminates the opportunity to survey within or below the minimum pool level. As a result, only the exposed upper portions of the reservoir and the adjacent lands outside the reservoir were examined.

Consultation

Five federally-recognized tribes with an ancestral connection to the project area were identified and contacted by both the Commission and PG&E. On July 9, 2004, the Commission sent letters to the Berry Creek Rancheria of Maidu Indians, the Enterprise Rancheria of Maidu Indians, the Greenville Rancheria of Maidu Indians, the Mooretown Rancheria of Maidu Indians, and the Mechoopda Indians of the Chico Rancheria. The Commission received acknowledgement of interest from both the Greenville Rancheria and the Mechoopda Indian Tribe and hosted an initial consultation meeting on September 23, 2004.

PG&E and the Commission proceeded to consult on a regular basis with the Lassen and Plumas National Forests, the Bureau, the Mechoopda Tribe, the Greenville Rancheria, the California State Historic Preservation Officer (SHPO) and other relicensing participants regarding cultural resources issues. This consultation has taken the form of written document submittals, meetings, site visits, phone calls, workshops, and a formal MOU between PG&E and the Mechoopda Indian Tribe to undertake the Traditional Cultural Properties (TCP) study. The MOU PG&E executed with the Mechoopda Tribe was designed to protect the confidentiality and ultimate control of new ethnographic information obtained from the tribe, who also provided assistance in the identification of potential respondents. Consultation with Greenville Rancheria has been more informal, consisting of two meetings and a verbal agreement.

All comments and concerns received during these consultations have been addressed by PG&E and the Commission. To date, few comments have been received by the California State Historic Preservation Officer (SHPO); however, on June 16, 2005, PG&E received comments from the SHPO on the project's APE. The SHPO requested that the APE include the entire West Branch of the Feather River and stated that the APE should be applied consistently, regardless of land ownership. In response, PG&E expanded the APE to include the West Branch Feather River down to and including Philbrook Creek. PG&E also made a good faith effort to access all land within the APE, including private lands, but not all landowners allowed access. The Commission approved the APE on August 18, 2005, with the understanding that if it should be demonstrated that project activities may be affecting area outside the current project APE, the APE would be expanded to include these areas. In addition to consultation on the APE, PG&E also has requested SHPO concurrence on various other section 106 requirements, including NRHP evaluations of specific resources.

Native American Monitoring

In response to PG&E's invitation, the Greenville Rancheria and the Mechoopda Tribe provided qualified monitors during the archaeological field work conducted for the relicensing. Prior to performing the field work, PG&E developed tribal monitoring protocol specific to the project and the Greenville Rancheria and Mechoopda Tribe

reviewed the protocol, which was finalized on September 15, 2005. In accordance with the monitoring protocol, tribal monitors were responsible for assisting the archaeological field supervisor in identifying potentially sensitive areas, reporting daily monitoring results to the tribes, ensuring that the appropriate parties were contacted if human remains were encountered, and completing daily field logs. The tribes oversaw tribal monitoring efforts, coordinated field work schedules, and ensured that a monitor was present during each field session. The field crew was assisted by one monitor at a time, with monitors from each tribe rotating sessions. PG&E included copies of the monitoring reports in final license application and HPMP.

Cultural History Overview

Prehistoric Archaeological Overview

Geographically, the project is located near the juncture of the northern Sierra Nevada and the southern Cascade Range. Until recently, archaeological investigations within the project area were limited and the area's prehistory poorly understood, relying heavily on the temporal-cultural sequences developed in neighboring locations. Information is relatively scarce, most likely due to limited human occupation. Recent studies, however, have provided more specific details about prehistoric human occupation in the project area.

Research indicates that human occupation in the project area dates to slightly before 10,000 BC and most of the sites identified in the project vicinity have been characterized by traits defined within the Eastern Sierra Front sequence for the northern Sierra Nevada. Development of the prehistoric chronology for the Eastern Sierra Front began more than 50 years ago and currently identifies seven phases of occupation that extended throughout the Holocene, demonstrating the longest cultural sequence identified for the Sierra Nevada. Table 3-44 identifies the cultural sequences associated with the Eastern Sierra Front.

Table 3-44. Prehistoric Chronology of the Eastern Sierra Front

Adaptive Strategy	Phase	Age (Years B.P.)	Diagnostic Artifacts
Late Archaic	Late Kings Beach	150-700	Desert Series Points
	Early Kings Beach	700-1,300	Rosegate and Gunther Series points, seed hullers, M1a (*Olivella*) shell beads
Middle Archaic	Late Martis	1,300-3,000	Martis Corner-notched, Elko Corner-notched, and Elko Eared points
	Early Martis	3,000-5,000	Martis Contracting Stem and Steamboat points
Early Archaic	Spooner	5,000-8,000	Unknown
Pre-Archaic	Tahoe Reach	10,000-8,000	Great Basin Stemmed Series points
	Washoe Lake	>10,000	Fluted points

The earliest phase of this sequence, the Washoe Lake Phase, is characterized only by large, fluted projectile points that suggest a small, highly mobile population. The Tahoe Reach Phase provides a regional comparison with the Western Stemmed Complex of the Great Basin and is defined by large, stemmed, edge-ground, isolated, basalt projectile points. These artifacts may indicate a highly mobile people or an initial occupation of the area following Sierran glacial retreats. The Spooner Phase represents an interval of prehistory that is poorly understood because it lacks clear, distinct, diagnostic evidence. This does not mean occupation did not occur at this time but could be due either to a paucity of time-sensitive remains or to low human population.

The Martis Complex is divided two phases, the Early Martis (5000-3000 BP) and Late Martis (3000-1300 BP). These phases correspond to the Middle Archaic adaptive strategy of the Great Basin when the archaeological record demonstrates a dramatic increase in human activity. Early Martis sites are defined by Martis Split Stem, Martis Contracting Stem, and Steamboat Leaf Shaped projectile points manufactured primarily of basalt. Late Martis sites are characterized by Martis and Elko Corner-notched and Elko Eared projectile points.

Paleo-environmental evidence indicates the Lake Tahoe area suffered severe droughts around 1000-900 years ago and 600-500 years ago, which appear to have given rise to the Late Archaic adaptive strategies evident in the Kings Beach Phases. The Early Kings Beach Phase represents the beginning of this era, as evinced by the use of the bow and arrow, increased used of chert tool-stone, smaller tools, shallow bedrock mortars, possible reduction in house size, and the introduction of flat, stone hullers for cracking nuts. Projectile point styles are represented by the Rosegate and Gunther series and during this time winter base camps being to appear in previously unoccupied locations or in areas previously reserved as field camps. The Early Kings Beach Phase appears to provide evidence of the early Washoe. The final stage prior to human contact, the Late Kings Beach Phase, is defined by temporary or seasonal camps ascribed to the late prehistoric Washoe. These camps provide evidence of hunting and fishing by small groups and are defined by Desert Series projectile points, chert cores, small, flaked chert tools, and some milling stones.

Previous research suggests that comparisons between the neighboring Great Basin and Tahoe Reach projectile point styles demonstrate the long-term influence of Great Basin culture on the Tahoe Basin and that, with the exception of the Late Kings Beach Phase, the cultural sequence of the Sierran Front reflects adaptations to the eastern front and high country throughout the early and middle Holocene. Human adaptive strategies during these times were strongly connected to, and influenced by, paleo-environmental conditions.

Ethnographic History

The project area is the ancestral home of the Northern Maidu. The Maidu family of languages can be distinguished into at least three different groups that include the Northwest (Koncow and Mechoopda), Northeastern (Mountain or Greenville), and Southern (Nisenan). The mountain Maidu occupied the high mountain meadows from Lassen Peak east to Susanville, south to Quincy, and west to Bucks Lake and the Humbug Valley. Koncow and Mechoopda territory encompassed portions of the Feather River, Butte and Chico creek watersheds, and part of the Northern Sacramento Valley, including all or most of the DeSabla-Centerville Project area.

The Maidu lived in village communities that formed the basis of their geography and political organization prior to Euro-American contact. The Maidu occupied their villages through the winter months and camped throughout the foothills and mountain areas during seasonal hunting and gathering cycles. The project lies within the ethnographic territories used as both semi-permanent wintertime villages and summertime hunting territories, which would have contained seasonal and temporary camps.

Annual cycles of gathering, hunting, and fishing were maintained to procure a wide variety of resources for subsistence and material needs. Plant gathering was one of the most important aspects of Maidu subsistence and was usually done by women. Fishing and hunting were largely conducted by men and the communities relied on the taking of elk and deer during the winter months. These activities necessitated the need for bows and arrows, knives, spears, and hooks, and nets and snares.

Basketry was a critical component of gathering, processing, and sorting subsistence materials and baskets were made from a variety of plants, predominantly willow, redbud, bear grasses, common brake, maidenhair fern, hazel shoots, and the ponderosa pine. The Maidu recognized hundreds of species of plants that were used for subsistence, material, and medicinal purposes and most parts of the plant were utilized in some fashion.

Contact between Maidu and Euro-Americans began in the early 1800s when Spanish explorers entered Maidu territory. An epidemic of malaria (smallpox) in 1833 decimated Maidu populations and the 1948 gold rush further displaced and diminished the tribes. These pressures altered traditional Maidu political and cultural organization and made traditional subsistence difficult or impossible.

The project APE and vicinity is very well known to present-day Maidu residents. Maidu decedents maintained residence in the vicinity of project well into the middle of the twentieth century and present-day Maidu communities are interested in maintaining (or reestablishing) access to important traditional resources within the project vicinity.

The project vicinity has been used on an occasional basis in the recent past for traditional and modern fishing along Butte Creek (downstream end of the APE). Present-day Maidu also maintain that the project vicinity contains an abundance of traditionally important plant resources.

The project vicinity is not well represented in the extant ethnographic literature. The dearth of ethnographic data does not reflect lack of ethnographic period use; rather, it speaks to the effects of rapid Euro-American settlement and disruption of traditional cultures and geographic distribution in the general region. While many people possess regional and geographically specific knowledge about the project APE and vicinity, however, no knowledge currently exists regarding specific sites of ongoing traditional uses (Traditional Cultural Properties, or TCPs).

Historic Context

Euro-American pioneers first began to settle in the project vicinity in the 1840s. Influences of the Euro-American lifestyle and technological ventures forever altered the project landscape as ranching, mining, lumber, transportation, turpentine production, hydroelectric power, turpentine production, organized forestry, and recreation were introduced. Such interests continued for extensive periods of time, with some still actively pursued today. Most of these pursuits depend on the waters of Butte Creek, the West Branch Feather River, and their various tributaries

Although trappers from the Hudson's Bay Company were hunting along the rivers of Butte County by 1829, ranching appears to be the first Euro-American activity to occur with any consistency within the project area. Before miners began flooding into California in the late 1840s, settlers trickled into the state earlier in the decade and ranching became the state's dominant industry. Available archival sources do not indicate any Euro-American settlement in the project area prior to 1848; however, with the discovery of gold in 1848, mining quickly became the primary force driving immigration to California.

With technological advances, the process of mining for gold became more and more efficient. Harnessing the power of water to blast away the sediments obscuring the elusive gold, a process known as hydraulic mining, became increasing popular and destructive. By the 1880s, the river courses throughout the project vicinity and beyond were choked by the gravel and other by-products of hydraulic mining and gold was becoming scarce. Small operations continued through the 1890s; however, the 1893 Caminetti Act, which prohibited the disposal of mining tailings into river courses, eventually brought an end to hydraulic mining and the golden age of gold mines.

The gold rush and the resulting increase in California's population influenced all aspects of the region's economy, from ranching, to lumber, recreation, transportation, and

hydroelectric development. As population grew, the demand for beef sent the price of cattle soaring. Also, in the project area, the development of roads not only improved access to the gold mines but facilitated the stockmen's annual trek up and down the Butte County highlands and increased access for the lumber industry. The California lumber industry arose as a direct result of the demands created by the gold rush for building materials. The stream engine also was associated with the growth of the lumber industry in the project area. In the early days of the gold rush, timber was hauled via teams of oxen and cut manually by whipsaw, but in 1863, the first steam-powered mill in the area was set up. Steam-driven saws greatly increased the output of board produced by the mills, and in time the new engines were applied in almost every operational aspect of the lumber industry.

The massive depletion of timber resources in the west during the late nineteenth century motivated Congress to pass legislation to reduce timber exploitation. In response, Congress approved the Forest Reserve Act (Section 24 of the General Revisions Act) which gave the U.S. President the power to establish forest reserves. Named for Mount Lassen, the Lassen Peak Forest Reserve was proclaimed in 1905 and renamed in 1908 as the Lassen National Forest. While maintaining forest reserves was the main mission of the Lassen National Forest, the National Forest System also was responsible for overseeing water resources. As such, hydroelectric development specific to Lassen National Forest began in the latter part of the 1800s. With the end of large-scale hydraulic mining, the National Forest and other hydroelectric developers began acquiring abandoned mining ditches and flumes for future hydroelectric developments such as the DeSabla-Centerville hydroelectric project.

John Martin and Eugene DeSabla formed Pacific Gas and Electric Company (PG&E) in 1905 and by 1915 it became one of the five largest utilities in the country and largest single producer of hydroelectric power. In 1902, PG&E decided to build a new hydroelectric system at the current DeSabla site and also purchased the existing Centerville powerhouse system (built in 1899) which included the dams, pipeline, and ditches of the local abandoned mines. PG&E then constructed a reservoir, penstocks, and powerhouse, and used the water carried by the old ditches to generate power in the new DeSabla hydroelectric system. At the same time, PG&E built the road to the DeSabla power plant site, enlarged the canals, rebuilt flumes, and refurbished the Centerville powerhouse.

Once the basic elements of the DeSabla-Centerville system—reservoirs, powerhouses, ditches, and transmission lines—were in working order, PG&E sought to enlarge its capacity and standardize the system. This included lining of canals to increase efficiency of water transport, replacing old canals and flumes with new materials, and constructing Philbrook storage reservoir in 1926. While some automated equipment was put in place to upgrade the system from time to time, prior to 1960, most of the DeSabla-Centerville hydroelectric system remained manually operated. powerhouses required

operators onsite 24-hours a day and the canals required constant patrolling. Due to this constant surveillance, the project also included numerous construction and tenders' camps to house employees.

In the 1960s, PG&E began overhauling the system for the sake of efficiency. The original DeSabla was demolished and rebuilt in 1961, new penstocks were constructed, and the DeSabla forebay was refurbished. At this time, DeSabla and Centerville powerhouse became semi-automated and other automated controls were put into place so 24-hour surveillance was no longer required.

Site Identification and NRHP Evaluation

At least 39 previous cultural resource investigations have occurred within or adjacent to the project's APE since the early 1970's. Thirty-four of these surveys were completed for timber harvest sales, land transfers, and project-specific ground-disturbing activities. During these investigations, 16 cultural resource sites were identified and documented within the APE. A search of the National Register identified five historic properties within the project vicinity, but no properties listed on the National Register are located within the APE.

During the DeSabla-Centerville project relicensing field surveys for archaeological and historic-era properties, the majority of lands that could be surveyed were examined by a qualified archaeologist using an intensive strategy (15-meter transects). Portions of the project containing moderately steep slopes or moderate to dense vegetation were examined using a moderate strategy (20-40-meter-wide transects), and other locations of dense brush were surveyed in a cursory fashion using opportunistic transects. All topographical features encountered in moderate areas and considered to be sensitive for cultural resources (i.e., springs, drainages, etc.) were thoroughly inspected. Newly discovered cultural remains were assigned temporary field numbers using a "DC" (DeSabla-Centerville) designation followed by a number (e.g., DC-1, DC-2, etc.). Numbers were assigned sequentially as cultural materials were encountered. All items encountered were assigned a number.

During the DeSabla-Centerville Project relicensing field surveys, 46 archaeological and historic-era sites and four isolated finds were recorded (see table CR-2). PG&E located and re-recorded the 14 previously documented sites and identified 32 new archaeological and historic-era sites within the APE. Of the 46 sites encountered, four are strictly associated with prehistoric occupation, eight contain both prehistoric and historic-era cultural remains, and 34 represent historic-era activities that characterize several themes in the prehistory and history of the American west.

Thirty-four of the 46 sites contained only historic-era cultural remains and PG&E conducted formal evaluations of these sites for National Register-eligibility. Five are

evaluated as being eligible to the National Register (CA-BUT-871-H, CA-BUT-873-H, DC-22-H, DC-46-H., and DC-51/H), and two sites (BCC-5, DC-22) require further study before an evaluation can be made. The remaining 27 sites are evaluated as ineligible for listing on the National Register. PG&E sent a letter to the SHPO on January 9, 2008, requesting concurrence on the National Register evaluations and has not yet received a response.

The remaining 12 sites contain prehistoric materials. Of these 12 sites, four contain strictly prehistoric remains while eight contain both prehistoric and historic components. Whenever possible, National Register eligibility assessments of prehistoric sites or sites containing prehistoric components were undertaken without ground-disturbing activities. When non-intrusive evaluation was not possible or where test excavation was opposed by participating tribes, unevaluated sites were presumed eligible and PG&E made an informal determination of eligibility. Until formal evaluation is undertaken, PG&E states that all 12 of these sites are considered potentially eligible for listing on the National Register. Informal evaluation; however, indicates that three of the sites that contain both prehistoric and historic-era elements may be ineligible for listing (DC-9, DC-15, and DC-44), and a fourth prehistoric and historic-era site (DC-51/H) is evaluated as being eligible as a contributing element to the hydroelectric system, as well as potentially eligible as an individual property.

During study plan development, PG&E and the Forest Service identified ongoing project-related effects at four previously identified archaeological sites containing both prehistoric and historic-era cultural remains and features. In order to address the ongoing project effects as soon as possible, PG&E began working with the Commission's Division of Hydropower Administration and Compliance under the current license to survey and identify mitigation measures at these sites. While delayed several times due to reservoir inundations, the surveys were finally completed and the four sites were found to be one continuous scatter of cultural remains and were re-recorded as a single resource (CA-BUT-1225/H).

Table 3-45 includes a list of all identified sites found within the project APE, their general location, a description of each site, and the result of PG&E's assessment on National Register eligibility.

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Table 3-45. Prehistoric and Historic-era Sites within the APE.

Site No. CA-BUT-XXX	Location[1]	Land Owner[2]	Description[3]	Impacts	NRHP[4]
597/H	Toadtown	Private/SPI	Lithic scatter, BRM, historic bottle frags	Logging roads, slash, public access	Potentially eligible
868-H	DeSabla	PG&E	Original DeSabla powerhouse site: foundations, pads, trash deposits	Current powerhouse built on the same site	Ineligible
871-H	Butte Creek Canal	PG&E	Camp 2 Butte Creek Canal: foundations	Structures removed, erosion	Eligible as contributing property
872-H	Toadtown	Private	Poumeratt Quartz Mine: foundation, drift, structures	Vandalism, erosion	Ineligible
873-H	Lower Centerville Canal	PG&E	Hog Ranch ditch tender's camp: foundations, pads, trash deposit	Trash dump, erosion	Eligible as contributing property
877-H	Toadtown	Private, possible Bureau	Mining ditch	Vegetation, disturbance from roads and tailings covering ditch	Ineligible
887-H	DeSabla	PG&E	Orofino Mine entrance	Culvert construction, road/creek alterations	Ineligible
965-H	DeSabla	Private	Indian Spring Mine	Disintegration, looting, modern prospecting	Ineligible
1111-H	Toadtown	Private	Corral with refuse scatter	Logging, vehicle access	Ineligible
1225/1226/1227/1228/H	RVR	LNF	LS, QRY, HTS, HR	Fluctuating reservoir levels, erosion, off-road vehicles	Potentially eligible
1229-H	RVR	LNF	Mine shaft, tailings ditch	Collapsed adit, fire	Ineligible
1465-H	Butte Creek Canal	Private	Ditch	Erosion, construction, developments	Ineligible
BCC-4	DeSabla	PG&E	BCC Camp 3, possible ditch tender's camp	Vandalism, overgrown	Ineligible
BCC-5	DeSabla	PG&E, Private	Hupp's Sawmill and residence	Structures removed over 25 years ago	Potentially ineligible
CC-4	Lower Centerville Canal	Private	Camp 2, Upper Centerville Canal ditch tender's camp	Private residence built on top of camp	Ineligible
DC-1/H	RVR	LNF	BRM, LS, HTS, TT	No observed impacts	Potentially eligible
DC-2-H	RVR	SPI	FEN	Disintegrating with age	Ineligible

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Site No. CA-BUT-XXX	Location[1]	Land Owner[2]	Description[3]	Impacts	NRHP[4]
DC-3/H	RVR	SPI	BRMs, LS, MID, HTS, LOG	Logging roads	Potentially eligible
DC-6-H	West Branch Feather River	SPI	HTS	Logging skid trail	Ineligible
DC-7-H	West Branch Feather River	SPI	HTS	No observed impacts	Ineligible
DC-8-H	West Branch Feather River	Private	HTS	Natural tree fall, (probable snow breakage), natural erosion	Ineligible
DC-9	RVR	SPI	BRM	Slight natural erosion	Potentially Ineligible
DC-12/H	RVR	Cal Fish & Game	LS, HTS	Erosion, modern trash, recent fire ring	Potentially eligible
DC-13/H	RVR	Cal Fish & Game	LS, HTS	Logging skid trail, possible natural erosion	Potentially eligible
DC-15	RVR	LNF	BRM	No observed impacts	Potentially ineligible
DC-16-H	West Branch Feather River	LNF	HTS	Modern campground	Ineligible
DC-17/H	West Branch Feather River	LNF	BRM, HTS	Modern campground, natural erosion	Potentially eligible
DC-18-H	West Branch Feather River	LNF	HTS	Natural tree fall (probable snow breakage) recreation use, natural erosion	Ineligible
DC-20-H	RVR	LNF	HIS Forest Service Camp	Modern campground, horseshoe pits, roads	Ineligible
DC-21	West Branch Feather River	Private	BRM, LS	Modern cabin inhabited on site, road, possible artifact collecting due to accessibility and vulnerability of surface artifacts to site occupants.	Potentially eligible
DC-22-H	West Branch Feather River	Private	Dewey Ditch	Portions of ditch filled in and used as road, slash	Potentially eligible
DC-23-H	PBR	PG&E	HTS	Natural tree fall (probable snow breakage), possible logging	Ineligible
DC-24-H	PBR	PG&E	HTS	Public access, natural tree fall, natural erosion	Ineligible
DC-26-H	PBR	LNF	HTS	Slash pile on top of site, fire line	Ineligible

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Site No. CA-BUT-XXX	Location[1]	Land Owner[2]	Description[3]	Impacts	NRHP[4]
DC-29-H	PBR	PG&E	HTS	Public access, pit manually excavated into cultural deposit with artifacts stacked around edge of pit, likely for artifact collection	Ineligible
DC-32-H	PBR	LNF	HTS	Public access, natural tree fall (possible heavy snow breakage)	Ineligible
DC-34-H	PBR	LNF	HTS	Public access, natural tree fall, natural erosion, large pit (approx 3ft deep) excavated into cultural deposit with artifacts stacked around edge of pit (looting)	Ineligible
DC-38-H	PBR	PG&E	HTS	Natural erosion	Ineligible
DC-39-H	PBR	PG&E	HTS	Public access, natural erosion	Ineligible
DC-40-H	PBR	LNF	Mining	Natural erosion	Ineligible
DC-43-H	PBR	LNF	Mining	Natural tree fall (possible heavy snow breakage), possible natural erosion	Ineligible
DC-44	PBR	LNF	BRM	No observed impacts	Potentially ineligible
DC-46-H	PBR	LNF	HTS, Philbrook Gate Tender's House	Recreational use, logging, natural erosion, vandalism, of cabin, natural decay	Eligible as contributing element of the hydroelectric district and potential individual eligibility
DC-51/H	West Branch Feather River	Private	BRMs, HTS, CAB, possible ditch tenders cabin	One cabin dismantled	Eligible as a contributing element of the hydroelectric district and potential individual eligibility
DC-52-H	DeSabla	PG&E	PSEA Camp	Modern developments and use of camp	Eligible as a contributing element and potential individual eligibility
DC-53-H	DeSabla	PG&E	Camp 1	Most original structures and features are gone	Eligible as a contributing element

1/PBR = Philbrook Reservoir ; RVR = Round Valley Reservoir; West Branch Feather River = West Branch Feather River
2/Cal Fish & Game = California Division of Fish and Game; LNF = Lassen National Forest; PG&E = Pacific Gas and Electric Company; SPI = Sierra Pacific Industries
3/BRM = Bedrock Mortars; CAB = Cabin site; HIS = Historic; HTS = Historic Trash Scatter; LOG = Logging; LS = Lithic Scatters; MID = Midden; MIN = Mining; TT = Turpentine Trees; Forest Service = United States Forest Service
4/Pending SHPO concurrence

Historic Structures Identification and NRHP Evaluation

PG&E also conducted an inventory for historic structures within the project's APE. During the historic structures field inventory, all project-related canals, dams, powerhouses, and associated features 45 years of age or older were documented and evaluated. To accomplish this, an architectural historian conducted field inspections of the project area to record or re-record all project features according to current National Park Service standards. Individual elements of the hydroelectric system were photographed in color format and project features were located using a global positioning system receiver, as allowed by weather and terrain. The features were compared to historic construction plans and photographs, when available, to help ascertain integrity and, in part, define the relationships between buildings, other project features, and the APE. The current condition and physical appearance of the features, as well as any evident impacts, were recorded, and maintenance and/or operation activities with the potential to adversely affect National Register-eligible features were identified.

PG&E found that the DeSabla-Centerville hydroelectric system is eligible for nomination to the National Register as a historic district that has contributed to the broad patterns of state and national history. It is significant under all four National Register-criteria[57] because of its association with the development of hydroelectric technology in California; its association with individuals instrumental in the development of the technology in the Pacific West; its distinctive characteristics that exemplify the Western regional style of hydroelectric development; its and its potential to yield information important in history. It also is a significant and distinguishable entity as a system of interconnected dams, reservoirs, canals and powerhouses. Several elements of the system also have been recommended individually for the National Register. Table 3-46 includes a list of features associated with the hydroelectric system and comments regarding their National Register-eligibility.

[57] The National Park Service, who administers the National Register, developed criteria designed to guide state and local governments, federal agencies, and others in evaluating potential entries to the National Register. To be included in the National register, a site must possess integrity of location, design, setting, materials, workmanship, feeling, and association, and must meet at least one of the following: A) associated with events that have made a significant contribution to the broad patterns of our history; or B) associated with the lives of persons significant in our past; or C) embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or D) have yielded or may be likely to yield, information important in prehistory or history.

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Table 3-46. DeSabla-Centerville Historic Project Features and/or Proposed Historic District Contributors.

Site No. (CA-BUT-X) or Temp No.	Feature	Landowner	Components	Construction	Contributing Element of NRHP District	Individually Eligible	Individually Ineligible	Comments
869-H	Hendrick's Canal	SPI	Tunnels, gates, wasteways, flumes, culverts, L-walls, spillways, gauging stations	1871-1906	X	X		Recommended as eligible for a 12-mile section of the canal that was replaced by a tunnel and is no longer in use
870-H	Centerville powerhouse	PG&E	powerhouse, switchyard, campsite	1899	X	X		Site eligible under Criteria A and B as part of the Centerville powerhouse District (1985); SHPO concurred in 1986
874-H	Butte Creek Canal	PG&E, Bureau, SPI, Private	tunnels, gates, wasteways, flumes, culverts, L-walls, spillways, gauging stations	1902	X	X		Originally built for mining purposes and recommended ineligible as a miner's ditch; as a hydro feature site is evaluated as individually eligible and a contributing element. Potential slide damage may have affected site integrity.
875-H	Toadtown Canal	PG&E, Bureau, LNF, Private	L-walls, spillways, flumes, wasteways, gauging stations	1871-1903	X		X	Originally built for mining purposes, it was recommended ineligible as a miner's ditch; as a hydro feature site is evaluated as a contributing element.
876-H	Lower Centerville Canal	PG&E, Bureau, Private	ditch tender's camps, tunnels, gates, wasteways, flumes, culverts	1875-1907	X	X		Recommended individually eligible as part of the Centerville powerhouse District. Site also is a contributing element of the DeSabla-Centerville district.
891-H	Upper Centerville Canal	PG&E, Private	Canal, gate	1871	X		X	Not individually eligible because it wasn't a key component of the system.

	Toadtown powerhouse	Private	powerhouse	1986			X	Less than 45 years old.
	Butte Creek diversion dam	SPI	Dam, ditch tender's camp	1916	X	X		Excellent representative of the Thin Arch Dam architectural type and method of construction.
	Centerville diversion dam	PG&E	Dam, ditch tender's camp	1906-1908	X		X	Though an integral part of the system, dam design and materials are not unique or representative.
	Hendricks Div./diversion dam	SPI	Dam, gates, fishwheel	Early 1900s	X		X	Previously evaluated as a wood crib dam rather than the concrete dam associated with the hydroelectric system
	Round Valley Reservoir	LNF	Reservoir, dam, spillway, gauging stations, and associated features	1877	X		X	Key component of the system but not individually distinctive or representative.
	Philbrook Reservoir	PG&E, NFSL	Reservoir, dam, spillways, lake tender's campsite, and associated features	1926	X		X	Key component of the system but not individually distinctive or representative.
	DeSabla powerhouse	PG&E	powerhouse	1960s			X	Less than 45 years old. However, may become eligible for the NRHP over any new license term.
	DeSabla Forebay and Dam	PG&E	Dam, reservoir, ditch tender's camp site, old and new intakes, spillway	1903	X		X	Key component of the system but not individually distinctive or representative.
	Flumes	Various	Flumes	Various	X		X	
	Penstocks	Various	Penstocks	Various	X		X	

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868-H	Original DeSabla powerhouse site	PG&E	Foundations, pads, trash	1903			X	Buildings and associated archaeological deposits destroyed
871-H	Camp 2: BCC ditch tender's camp	PG&E	Foundations	1902	X	?		Potential for buried archaeological deposits; test excavations required to confirm archaeological data potentials
873-H	Hogg Ranch camp, possibly LCC Camp 2	PG&E	Foundations, pads, trash	1930s-1940s	X	?		Potential for buried archaeological deposits; test excavations required to confirm archaeological data potentials
BCC-4	Possible ditch tender's cabin, BCC Camp 3	PG&E	Garage, fruit trees, fence, rock lined depression	1920s			X	Buildings and associated debris removed, integrity lost
BCC-5	Hupp's Sawmill; possibly BCC Camp 2	Private	Trash	1864-1890		?		Unevaluated; further investigations required
CC-4	LCC Camp 3	Private	Rock wall remnant				X	Lacks integrity
DC-22-H	DC-22-H: Dewey Ditch	Private	Ditch	1858		X		No longer part of DeSabla Centerville system
DC-46-H	Philbrook Reservoir Lake Tender's Cabin Site	NFSL	Cabin, , other structural remains, trash	1926	X	?		Potential for buried archaeological deposits; test excavations required to confirm archaeological data potentials
DC-52-H	PSEA Camp	PG&E	Cabins and other facilities	1920s	X	?		Potential for buried archaeological deposits; test excavations required to confirm archaeological data potentials
DC-53-H	Camp 1	PG&E	Original bunkhouse and superintendent's house	1900s	X		X	Structures removed or modified

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3.3.7.2 Environmental Effects

Effects on historic properties (properties eligible or listed on the National Register) within the APE can include, but are not limited to, inundation under the waters of the project reservoirs, the recreational use of the reservoirs and other project lands, vandalism, and modifications or repairs to project facilities. The type and level of effects on cultural resources can vary widely, depending on site location and setting, features and attributes, visibility of the resources, and public knowledge and access to a resource. For our analysis, we consider the effects of continued project operation and the implementation of proposed environmental enhancements on the known historic properties and on potential unanticipated discoveries and human remains.

Centerville powerhouse

PG&E proposes to continue operating the project with no change to generation facilities or features other than adoption of the resource management measures in the license application. The age of the Centerville powerhouse, however, has become prohibitive to efficient power production and PG&E anticipates rebuilding or refurbishing the powerhouse in the next 10 years.

In addition, as part of its proposal for DeSabla-Centerville Project, the Conservation Groups recommend a phased-in the decommissioning of the Centerville powerhouse, Lower Centerville canal, and lower Centerville diversion dam (collectively, the Centerville Development). The groups did not include any additional recommendations specific to cultural resources outside of what PG&E already proposed.

Our Analysis

The DeSabla-Centerville hydroelectric system as a whole, and the Centerville Development's facilities individually, has been evaluated as eligible for inclusion on the National Register. As such, any construction or modification to these structures would need to be done in consultation with the California SHPO and the Commission. The facilities are considered eligible because they are associated with events that have made a significant contribution to the broad patterns of our history and are associated with the lives of persons significant in our past. The Centerville powerhouse also meets the National Register's standards of significance individually and it possesses integrity as a structure that retains the physical characteristics it possessed in the past.

If the Centerville powerhouse were to be rebuilt, refurbished, or decommissioned, PG&E would be required to take its National Register-eligibility

status into account and consult with the California SHPO prior to any construction activities. An Historic American Buildings Survey and Historic American Engineering Record documentation would need to be completed to ensure that the structure and its features were recorded for future generations and to mitigate the negative effects upon our history and culture of rapidly vanishing architectural and engineering resources. As the powerhouse structure possesses both significance and integrity, another option if for PG&E to rehabilitate and refurbish the building for another use, such as a museum. This recommendation would allow the structure to be repurposed for a new use while continuing to remain culturally significant, thus preserving its integrity for future generations to enjoy. While no specific plans have yet been filed, any major modifications to the structure would require appropriate mitigation measures and consultation. The HPMP prepared by PG&E to mitigate for project effects on cultural resources would be the appropriate document in which to include such measures to ensure protections are in place to protect this historic resource.

Historic Properties Management Plan

In order to mitigate for project effects on cultural resources, PG&E prepared an HPMP, filed on February 15, 2008, that defines the project APE, lays out the project's prehistoric, historic, and ethnographic background, and recommends general and specific treatment measures for the management and protection of historic properties. General measures proposed by PG&E include:

- A preferred action of avoidance of historic properties during operations and maintenance activities;
- public education and employee training;
- the use of regulatory warning and interpretive signs and displays;
- designated travel routes and road closures to avoid historic properties, unless during an emergency or during project facility maintenance;
- development of a road maintenance plan that cites and considers the HPMP;
- consideration and consultation regarding cultural resources during the planning phases of any of all recreation development and improvements;
- establishment of an annual monitoring and condition assessment;
- development of a stabilization and erosion control plan for any sites adversely effected by erosion;
- following all applicable laws and statutes when dealing with the discovery and treatment of human remains;

- consulting with a qualified professional archaeologist and all necessary entities (tribes, SHPO, federal agencies) when unanticipated discoveries occur;
- notification of all necessary entities when an emergency action has the potential to affect historic properties;
- performing any additional cultural resource inventories in a manner that conforms to contemporary professional standards;
- preparation of an annual report summarizing the results of all historic properties monitoring activities; and
- periodic review and revision of the HPMP.

PG&E's HPMP also includes site specific protection measures for two of the 46 identified sites. For the two sites (CA-BUT-873-H and CA-BUT-3068-H), PG&E recommends blocking public access within three years of HPMP approval. For the remaining 44 of the sites, PG&E either identifies no management or no further management beyond annual monitoring and condition assessments.

Four previously identified sites at Round Valley reservoir were relocated and surveyed and found to be one continuous scatter of cultural remains. PG&E conducted further study, at the request of the Forest Service, and found that inundation of the resource throughout most of year and annual draw-down of the reservoir may be adversely affecting the site. As a result, PG&E currently is working with the Commission's Division of Hydropower Administration and Compliance to mitigate for the adverse effect under the current DeSabla-Centerville license. PG&E states that appropriate management measures would be identified in future consultations and addressed in subsequent revisions to the HPMP.

The DeSabla-Centerville hydroelectric project system also has been recorded and recommended as eligible for the National Register as a historic district and several elements of the system have been evaluated as individually eligible on their own merit. In 1986, the SHPO concurred with the eligibility of the system and its associated facilities. In the HPMP, PG&E states that throughout the term of any license issued for the project, activities such as maintenance, repair, alteration, replacement, and any necessary new construction would be performed in accordance with the *Secretary of the FWS's Standards for the Treatment of Historic Properties* (48 CFR 44738-44739) and in consultation with the SHPO.

The Forest Service's 4(e) condition 35 requires PG&E to file an HPMP approved by the Forest Service, the Bureau of Land Management, and other appropriate agencies within one year of license issuance. Condition 35 also requires: 1) PG&E to consult with the SHPO, applicable Native American tribes,

Forest Service, Bureau of Land Management, and other agencies during the preparation of the plan; 2) a defined APE; 3) measures to mitigate identified impacts; 4) a monitoring program; and 5) management protocols for the protection of archaeological resources. The Forest Service also states that due to on-going project effects at the potentially eligible Round Valley reservoir (CA-BUT-1225/H) and proposed removal and impacts to the Lake Tender Cabin and associated sub-surface site at Philbrook reservoir, the HPMP should include data recovery plans for both of these known and potentially eligible sites, if not completed sooner under existing project planning. The Forest Service states that data recovery is a reasonable alternative to mitigate for continued adverse project effects to these sites. PG&E completed surveys of these sites and currently is undertaking measures to protect them under the terms of the current license.

The Bureau, Greenville Rancheria, Mechoopda Tribe, and the Forest Service sent comments to PG&E on the HPMP and these comments were included with the February 15, 2008 filing. PG&E, however, requested comments on the HPMP by February 8, 2008, which did not leave enough time to allow PG&E to incorporate the comments into the HPMP by the February 15, 2008, filing date required by the Commission. PG&E stated that the comments would be addressed during future consultation and revisions to the HPMP.

The Bureau, in comments sent to PG&E, suggests additional resources PG&E can consult in an attempt to provide a more complete prehistoric and historic context for the project. Bureau also requests to be a party to development of interpretive information and any other consultations regarding cultural resources at the project. In addition, Bureau requests the amendment to three site records (CA-BUT-875-H, CA-BUT-876-H, CA-BUT-891-H) to indicate that the site occupy a small portion of Bureau land.

In Greenville Rancheria's comments on the HPMP filed with PG&E, the Tribe requested PG&E grant an extension for comments "due to an incomplete HPMP." The Tribe states that formal comments also would be filed when the rest of the HPMP is complete. Greenville Rancheria also filed comments directly with the Commission on June 19, 2008, (dated February 21, 2008) reiterating the belief that the HPMP was incomplete and stating that no written comments would be submitted until the HPMP was completed and submitted for tribal review.

In the Mechoopda Tribe's comments on the HPMP, the Tribe suggests several typographical and semantic corrections and requests clarification on several issues, including who determines when consultation or actions are necessary and whether opportunities to participate in resource stewardship would exist throughout the term of the license. The Tribe suggests several additions to the HPMP, including: 1) establishment of an consultation group that met annually

or bi-annually; 2) a dispute resolution section; 3) a paragraph detailing the purpose of the Tribe's consultation and its unique status as a Indian sovereign government for consultation purposes; 4) additional information on the post Euro-American Maidu contact indicating the Tribe's self sufficiency as a sovereign nation; 5) a collection policy for discovery, curation, and disposition of artifacts; 6) development of a tribal advisory group for consultation purposes; 7) a section detailing identification, restoration, accessibility, and stewardship collaborations for traditional plant gathering/tending in wetlands and riparian habitat communities and avian species cultural important to participating tribes; 8) expansion of employee training to identify the management measure undertaken and to formalize the measure within PG&E's best practices or procedural manuals; 9) update the signage measures to require five-year review; and 10) addition of section detailing and consolidating the reports and responsibilities of various agencies and participating tribes relative to the HPMP.

The Forest Service comments that the HPMP should be revised to include: 1) revised language regarding the current state of site testing at Round Valley reservoir occurring due to on-going project effects; 2) the inclusion of additional information, including the results of the Forest Service's cultural survey of the West Branch Feather River and information on a newly discovered site along Philbrook Creek; 3) more specific general and site-specific treatment measures; 4) development of associated cultural elements (i.e., detailed monitoring plans) as soon as possible; 5) more specific details regarding the influence of other resources on project cultural resources; 6) measures recommended by entities other than just PG&E. The Forest Service states that "decisions in the draft HPMP are only preliminary and not ready for approval." The Forest Service further concludes that the document is in a very early draft template and they look forward to developing the necessary details for long term protection of cultural resources.

Our Analysis

The HPMP filed by PG&E, and as would be required by Forest Service 4(e) condition 35, contains a number of measures to management and protect historic properties. The avoidance strategies, public and employee training proposals, signage plans, transportation plans, monitoring, consultation, annual report proposals, as well as the HPMP review proposals are all measures that would ensure cultural resources and historic properties within the project's APE are protected and maintained throughout the term of any license issued for the project. Filing an annual report with the Forest Service, Bureau, SHPO, Mechoopda Indian Tribe and Greenville Rancheria by March 15 of each year and holding an annual meeting between January 1 and March 30 of each year would keep all parties informed and encourage continued consultation. In addition,

meeting with the Forest Service, Bureau, SHPO, Mechoopda Tribe, and Greenville Rancheria to review and potentially revise the HPMP after five years and then again every 10 years would ensure the effectiveness of the document and provide a means to incorporated any new information or practices related to cultural resources. In addition, while the HPMP does not include many site-specific management proposals, the continued consultation and annual reports would allow for any sites that require specific protection measures to be addressed as necessary.

The Bureau suggested several revisions to the HPMP, including supplementing the historic context with additional information and ensuring that the Bureau is included during all consultations. The additional prehistoric and historic information would further complete the cultural record for the project and would help to inform future cultural management practices by allowing for a complete project history. Also, including Bureau in all consultations would ensure that Bureau expertise was accessed and all historic properties on federal were protected.

The Greenville Rancheria did not provide any specific comments on the HPMP, which the Tribe deemed incomplete. Without specific details on why the HPMP is incomplete, it is difficult to assess what additional information may be necessary. Further consultation with the Tribe during HPMP implementation and review would allow for the Tribe to express concerns regarding historic properties and allow PG&E to attempt to address those concerns.

The Mechoopda Tribe's recommendations for the HPMP also would ensure further protection of cultural resources. The recommended consultation group would ensure continued consultation throughout the term of any new license and already is covered under the HPMP. The suggested dispute resolution clause would allow for designated policy for discussion and resolution when disputes arise over cultural resources and would be included in any Programmatic Agreement issued by the Commission for the project, to which the Tribe would be invited to be a consulting party. The addition of more detailed information on the Tribe's status would better inform participants of the Tribe's unique standing but would be outside the scope of the HPMP, which is PG&E's document. More detailed information on the Tribe's post Euro-American history would better inform that participants of how the tribe currently uses the project area and may present ideas for future enhancement measures.

The development of a collection policy for discovery, curation, and disposition of artifacts and an HPMP section detailing identification, restoration, accessibility, and stewardship collaborations for traditional plant gathering/tending in wetlands and riparian habitat communities and avian species cultural important

to participating tribes would be useful in developing methods to ensure project resources are protect. The development of a tribal advisory group for consultation purposes also would assist in ensuring the tribes continued to be consulted and the project's cultural resources benefited from their expertise.

The recommended expansion of employee training to identify the management measure undertaken and to formalize the measured within PG&E's best practices or procedural manuals would ensure PG&E employees unfamiliar with cultural resources knew exactly what needed to be done to protect historic properties. In addition, review of the project signs ever five-years would ensure the signs always remained up to date. Finally, the addition of an HPMP section detailing and consolidating the reports and responsibilities of various agencies and participating tribes relative to the HPMP would assist all participants by presenting all the necessary actions and responsibilities in one, easy to find location.

Furthermore, the inclusion of the Forest Service's additional information would further complete the cultural resource record and ensure newly discovered sites were included in the HPMP. The Forest Service also requested more specific general and site-specific treatment measures and the development of associated cultural elements (i.e., detailed monitoring plans) as soon as possible. Developing more specific measures and including them in the HPMP as soon as possible would be the best way to ensure protection of cultural resources, as would the inclusion of more specific details regarding the influence of other resources on project cultural resources and measures recommended by entities other than just PG&E. While, the Forest Service states that the HPMP is only a very early draft template, the requests to work toward more specific management measures and more detailed information would be addressed through the continued consultation proposed by PG&E and already included in the HPMP.

Forest Service's 4(e) condition 35 would require PG&E and to file an HPMP within a year of license issuance; however, the HPMP filed by PG&E on February 15, 2008, already addresses many of the issues required by the 4(e) condition. The Forest Service preliminary 4(e) condition also requires that the HPMP should include a data recovery plan for the project-effected Round Valley reservoir site (CA-BUT-1225/H). PG&E currently is working with the Commission's Division Administration and Compliance on mitigation measures for this site and the work most likely would be completed by the time a new license is issued. While PG&E may complete the specific mitigation measures by the time a new license is issued, a chance exists that not all necessary work would be completed by that time. Including the site and required mitigation measures within the HPMP would ensure that impacts to CA-BUT-1225/H were properly mitigated.

Prior to license issuance, the Commission would execute a Programmatic Agreement with the California SHPO and the Advisory Council on Historic Preservation. The PA would require PG&E to implement its HPMP with any required modifications and would include a dispute resolution clause and a request for the Forest Service, Bureau, Greenville Rancheria, and the Mechoopda Tribe to be concurring parties. The PA then would be incorporated into the new license by reference. Execution of the PA and implementation of the HPMP with any recommended modifications would ensure that adverse effects of the project on cultural resources would be appropriately mitigated.

We analyze the costs of measures proposed or recommended for cultural resources in section 4, *Developmental Analysis*, and make our final recommendations in section 5, *Comprehensive Development and Recommended Alternative.*

3.4 No-Action Alternative

Under the no-action alternative, the project would continue to operate as it has in the past. None of the licensee's proposed measures or the resource agencies' recommendations and mandatory conditions would be required.

4.0 DEVELOPMENTAL ANALYSIS

In this section, we look at the DeSabla-Centerville Project's use of the West Branch of the Feather River and Butte Creek for hydropower purposes to see what effect various environmental measures would have on the project's costs and power benefits. Consistent with the Commission's approach to economic analysis, the power benefit of the project is determined by estimating the cost of obtaining the same amount of energy and capacity using the likely alternative generating resources available in the region. In keeping with Commission policy as described in *Mead*, 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.[158]

Our analysis includes: (1) an estimate of the net power benefit of the project for each of the licensing alternatives; and (2) an estimate of the cost of individual measures considered in the final EIS for the protection, mitigation and enhancement of environmental resources affected by the project. To determine the net power benefit for each of the licensing alternatives, we compare project costs

[58] See *Mead Corporation, Publishing Paper Division*, 72 FERC ¶ 61,027 (July 13, 1995).

to the value of the power output as represented by the cost of a likely alternative source of power in the region. For any alternative, a positive net annual power benefit indicates that the project power costs less than the current cost of alternative generation resources and a negative net annual benefit indicates that project power costs more than the current cost of alternative generation resources. This estimate helps to support an informed decision concerning what is in the public interest with respect to a proposed license. However, project economics is only one of many public interest factors the Commission considers in determining whether, and under what conditions, to issue a license.

4.1 POWER AND ECONOMIC BENEFITS OF THE PROJECT

Table 4-1 summarizes the assumptions and economic information we use in our analysis. Some of the information was provided by PG&E in its license application. We find that the values provided by PG&E are reasonable for the purposes of our analysis. Cost items common to all alternatives include: taxes and insurance costs; net investment (the total investment in power plant facilities remaining to be depreciated); estimated future capital investment required to maintain and extend the life of plant equipment and facilities; relicensing costs; normal operation and maintenance cost; and Commission fees.

Table 4-1. Parameters for economic analysis of the DeSabla-Centerville Project (Source: PG&E and Staff).

Assumption	Value	Source
Energy value (2008$) [1]	87.11 mills/kWh	PG&E
Capacity value (2008$)	Included in energy value	
Net investment	$31,400,000	PG&E
Cost of capital	8.79 percent	PG&E
Discount rate	8.79 percent	Staff
State and federal income tax rate	40.75 percent	PG&E
Local tax rate	3 percent	Staff
Insurance rate	0.25 percent of initial net investment	Staff
Term of financing	20 years	Staff
Period of analysis	30 years	Staff
Operation and maintenance	$2,500,000	PG&E
FERC fees	$120,000	PG&E
Escalation rate after 2006	0 percent	Staff
Relicensing costs	$14,500,000	PG&E
No-action average annual generation (GWh)	155.7	PG&E
No-action dependable capacity (MW)	7.9	PG&E

[1] The energy value is based on average of the short run avoided costs for PG&E for 2008.

4.2 COMPARISON OF ALTERNATIVES

Table 4-2 compares the power value, annual costs, and net benefits for the no-action alternative, PG&E's proposal, the staff alternative for the DeSabla-Centerville Project, and the staff alternative with mandatory measures which are discussed in details in sections 1, 2 and 3, respectively. Table 4-3 shows the effect on costs and power values of individual measures proposed by PG&E and recommended by others, and considered by staff for inclusion in the staff alternative. In section 5.2, Discussion of Key Issues, we discuss our reasons for including key measures in the staff alternative and why we consider the environmental benefits to be worth these costs.

Table 4-2. Summary of the annual net benefits in 2008 dollars for PG&E's proposal, the staff alternative, the staff alternative with mandatory conditions, and the no-action alternative for the DeSabla-Centerville Project (Source: Staff).

	No-Action	PG&E's Proposal	Staff Alternative	Staff Alternative with Mandatory Measures
Installed capacity (kW)	26,700	26,700	26,700	26,700
Annual generation (GWh)	155.7	146.6	146.4	139.4
Annual power value	$13,563,000	$12,770,000	$12,753,000	$12,143,000
(mills/kWh)	87.11	87.11	87.11	87.11
Annual cost	$7,994,000	$12,007,000	$12,421,000	$12,767,000
(mills/kWh)	51.34	81.90	84.67	91.46
Annual net benefit	$5,569,000	$763,000	$332,000	- $624,000
(mills/kWh)	35.77	5.21	2.27	-4.48

4.2.1 POWER AND ECONOMIC BENEFITS OF THE NO-ACTION ALTERNATIVE

Under the no-action alternative, the DeSabla-Centerville Project would include all of the facilities that are included under the current license. The project would continue to operate as currently operated. The project would continue to generate an average of 155.7 GWh of electricity annually, have an annual power value of $13,563,000 (87.11 mills/kWh), and total annual costs of $7,994,000

(51.34 mills/kWh), resulting in a net annual benefit of $5,569,000 (35.77 mills/kWh).

4.2.2 POWER AND ECONOMIC BENEFITS OF PG&E'S PROPOSAL

As proposed by PG&E, the DeSabla-Centerville Project Toadtown, DeSabla, and Centerville powerhouses. The proposed project would generate an average of 146.6 GWh of electricity annually, have an annual power value of $12,770,000 (87.11 mills/kWh) and total annual costs of $12,007,000 (81.90 mills/kWh), resulting in a net annual benefit of $763,000 (5.21 mills/kWh).

4.2.3 POWER AND ECONOMIC BENEFITS OF THE STAFF ALTERNATIVE

Resource agencies and non governmental organizations recommended implementing a variety of measures at the project. We reviewed each recommendation and determined the measures that were most appropriate for implementation. We also considered other recommendations that are warranted for inclusion in a new license to protect and enhance project resources.

The staff alternative project would generate an average of 146.4 GWh of electricity annually, have an annual power value of $12,753,000 (87.11 mills/kWh) and total annual costs of $12,413,000 (84.67 mills/kWh), resulting in a net annual benefit of $340,000 (2.32 mills/kWh).

4.2.4 POWER AND ECONOMIC BENEFITS OF THE STAFF ALTERNATIVE WITH MANDATORY CONDITIONS

FWS and the Forest Service have specified conditions in accordance with 4(e) of the FPA, these conditions will be included in any license issued to PG&E for the DeSabla-Centerville Project. The staff alternative with mandatory conditions includes those measures, and would in some cases; the mandatory conditions replace staff –recommended measures. Under this alternative, the project would generate an average of 139.4 GWh of electricity annually, have an annual power value of $12,143,000 (87.11 mills/kWh) and total annual costs of $12,767,000 (91.46 mills/kWh), resulting in a net annual benefit of -$624,000 (-4.48 mills/kWh).

4.3 COST OF ENVIRONMENTAL MEASURES

Table 4-3 gives the cost of each of the environmental measures considered in our analysis. We convert all costs to equal annual (levelized) values over a 30-

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year period of analysis to give a uniform basis for comparing the benefits of a measure to its cost.

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Table 4-3. Summary of capital costs, annual costs, annual energy costs, and total annualized costs of environmental measures proposed by PG&E and recommended by others and considered by staff for inclusion in the staff alternative for the DeSabla-Centerville Project (Source: Staff).

	Measure	Recommending Entity	Capital Cost (2008$)	Annual Cost (2008$)	Annual cost of measure (2008$)	Adopted By Staff?	Notes:
	General Resource Measures						
1	Train employees annually regarding location of sensative aareas, general identification of special-status species and invasive eweeds, process if sensative species might be distrubed, reporting procedures to the Forest Service and other agencies.	PG&E	$0	$20,000	$20,000	yes	
2	Consultation - annually meet with the Forest Service regarding proposed project o&m for the upcoming year and file a letter report including evidence of consultation within 60 days of the meeting.	PG&E	$0	$10,000	$10,000	yes	
	Water Quantity and Aquatic Resource Measures						

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1	Modify minimum instream flow releases if required by equipment malfunction, law enforcement, emergencies, or by the request of resource agencies, and provide notice and an explanation to the Commission no later than 10 days after the incident	PG&E, Forest Service, FWS, NMFS	$0	$0	$0	yes	The Commission retains the ablity to direct actions to be taken by the licensee.
2	Promptly resume performance of license requirements following a modified minimum instream flow release and notify the resource agencies within 48 hours	Forest Service, FWS, NMFS	$0	$0	$0	yes	This notification must also be provided to the Commission.
3	Schedule maintenance or other planned outages to avoid negative ecological effects and provide notice to the Forest Service at least 90 days prior any outage	Forest Service	$0	$0	$0	yes	This notification must also be provided to the Commission.
4	Complete facility modifications needed for the release of minimum instream flows as soon as possible, but no longer than three years after license issuance	PG&E, FWS, NMFS, Forest Service	$0	$0	$0	yes	Included in PG&E's costs.
5	Implement a minimum instream flow release schedule for Project-affected stream reaches	PG&E, Conservation Groups	$0	$10,000	$10,000	yes	

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6	Flows made available through minimum instream flow release at Hendricks Diversion dam should be maintained within the West Branch Feather River downstream along the natural stream course to its discharge at the high-water line of Lake Oroville	Forest Service, California Fish & Game			$0	no
7	Make a good faith effort to ensure that minimum instream flows measured at the gage immediately downstream of Hendricks Diversion dam (PG&E gage no. BW 95) are not diverted from the West Branch Feather River through methods under the control of the PG&E, for any purpose	Forest Service	$0	$0	$0	yes
8	Consult with the Water Board and other agencies to identify water rights associated with the diversion of water from the West Branch Feather River and file with the Water Board, Petitions to Change the purpose of use for existing water rights held by PG&E that define the West Branch Feather River as an authorized point of diversion	Forest Service, California Fish & Game	$0	$0	$0	no

9	Minimum flows proposed by the PG&E.	PG&E	$0	$0	$793,000	yes	Based on loosing 9.1 GWh of energy annually due to the proposed minimum flow.
10	Decommission Centerville powerhouse over a five year period with transitional project operation managed by PG&E and the operations group	Conservation Groups	$800,000	$0	$136,900	no	
11	During the decommissioning, beginning each June 15, divert into Lower Centerville Canal only the minimum amount of water needed to prevent damage to this canal, and continue to operate Lower Centerville Canal according to this exigency until at least the following February 15	Conservation Groups	$0	$7,500	$7,500	no	
12	After powerhouse decommissioning, decommission the Centerville Development, including removal of Lower Centerville Diversion dam and Lower Centerville Canal	Conservation Groups	$900,000	$0	$154,000	no	

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13	Develop a plan for the disposition of Centerville powerhouse and that should the agencies determine that decommissioning is counter-productive, the Commission would initiate a proceeding for the explicit purpose of determining the minimum instream flow for the Lower Centerville bypass reach	Conservation Groups	$100,000	$0	$17,100	no	
14	Remove feeder diversions on Oro Fina Ravine, Emma Ravine, Coal Claim Ravine, Stevens, and Little Butte Creeks and Lake Tender House.	PG&E, California Fish & Game	$250,000	$0	$42,800	no	We agree with PG&E on removal of the structures, but first they must develop a removal plan.
15	Develop and implement a Feeder Creek Diversion Facility Removal Plan for Stevens, Oro Fina Ravine, Emma Ravine, and Coal Claim Ravine Creeks.	Forest Service, FWS	$260,000	$0	$44,500	yes	We recommend that Little Butte Creek also be included in this plan.
16	Notify California Fish & Game prior to any ground disturbing activities related to removing the feeder diversions	California Fish & Game	$0	$0	$0	yes	We also recommend that notification be provided to the Commission, Forest Service, the Water Board,

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							FWS, and NMFS.
17	Control up-ramping in lower Butte Creek so that velocity does not change more than 0.2 feet per second per hour	NMFS	$0	$0	$0	yes	
18	Ramping rates shall be based on changes in water velocity and stage in foothill yellow-legged frog breeding areas in lower West Branch Feather River	Forest Service, FWS	$0	$0	$0	yes	
19	Ramping rates shall be based on changes in water velocity and stage in foothill yellow-legged frog breeding areas in upper Butte Creek, downstream of the Butte Creek Diversion dam, and in lower Butte Creek, downstream of Lower Centerville Diversion dam.	Forest Service, FWS	$0	$0	$0	yes	
20	Utilize information from foothill yellow-legged frog population monitoring to determine the timing and to assess the level of allowable stream flow change that causes	Forest Service, FWS	$0	$500	$500	yes	

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	minimal loss of foothill yellow-legged frog egg masses or tadpoles						
21	Results from the Fish and foothill yellow-legged frog Monitoring Plans would be reviewed by the resource agencies and the Commission to determine if the ramping criteria is protective of the fish and foothill yellow-legged frog populations or if there is a need for modification	Forest Service, FWS	$0	$500	$500	yes	PG&E should also be included in the review of monitoring results.
22	Consult with the resource agencies to determine more appropriate ramping rates if monitoring indicates required rates are insufficient	Forest Service, FWS, NMFS	$0	$500	$500	yes	
23	Up-ramping and down-ramping rates, downstream of Hendericks diversion dam, shall be limited to: April-October-0.1 ft per hour, November-March-0.2 ft per hour	PG&E	$0	$0	$0	no	
24	Schedule canal outages as early in the spring as possible to protect aquatic species	PG&E, Conservation Groups	$0	$0	$0	yes	

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25	In the case of equipment malfunction, emergency and law enforcement activity, and critical electric system emergencies beyond the control of PG&E, PG&E would communicate with the Forest Service as soon as practicable	PG&E	$0	$0	$0	yes	Notification should also be provided to the Commission, the Water Board, FWS, California Fish & Game, and NMFS.
26	Provide notice to the resource agencies and the Commission of the final water year type determination within 30 days of making the determination	Forest Service, California Fish & Game, FWS, NMFS	$0	$0	$0	yes	
27	By March 10 of the second or subsequent Dry water year, notify the resource agencies of drought concerns and by May 1 of these same year, consult with the resource agencies to discuss the Project's operational plans to manage the drought conditions	Forest Service, California Fish & Game, FWS, NMFS	$0	$500	$500	yes	
28	Implement a revised operational drought plan if agreed upon by the resource agencies	Forest Service, California Fish & Game, FWS, NMFS	$0	$0	$0	yes	Prior to implementing, PG&E must receive Commission approval.

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29	Implement minimum instream flows triggered by water year types within two business days after Water Resources Bulletin 120 is published	PG&E		$0	$0	yes
30	Notify the Forest Service and other interested governmental agencies of drought concerns by March 15 of the second or subsequent dry water year; and consult with the Forest Service and other interested governmental agencies by May 15 of the same years	PG&E		$0	$500	$500	yes
31	Install and maintain, in consultation with the USGS, a flow data logger for measuring stream flow downstream of Hendricks Diversion dam, a real-time flow gaging station upstream of Butte Creek Diversion dam, and modify the existing gaging station near Lower Centerville Diversion dam for real-time data access	PG&E, FWS, NMFS, California Fish & Game	$160,000	$10,000	$37,400	yes
32	Install and maintain, in consultation with the USGS, a realtime flow gaging station upstream of the Butte Creek Diversion dam and modify the gaging station upstream of Lower Centerville Diversion dam to have	Forest Service	$130,000	$6,600	$28,800	yes

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	real-time access					
33	Install a new gaging station with real-time capability of reading river stage and minimum instream flows downstream of the confluence of both the low level release and spill channel in Philbrook Creek	Forest Service, FWS, NMFS	$80,000	$3,300	$17,000	yes
34	Operate and maintain the existing gages on the West Branch Feather River located downstream of Round Valley Reservoir and Hendricks Diversion dam, consistent with all requirements of the Commission and under the supervision of the USGS	Forest Service, FWS, NMFS	$0	$6,600	$6,600	yes
35	Install up to three additional stream gages based upon annual consultation and adaptive management	California Fish & Game	$240,000	$10,000	$51,100	no
36	Make stream flow and reservoir data available to the public and in readily accessible formats, be provided to the USGS, and to the agencies upon request	PG&E, Forest Service	$0	$2,500	$2,500	yes

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37	Measure minimum instream flows as the 24-hour average of the flow and as instantaneous flow	Forest Service, California Fish & Game, NMFS, FWS	$0	$0	$0	yes
38	As part of a Long-Term Project Operations Plan, provide for the installation of remote operating capability as well as addition real-time water temperature and reservoir elevation and flow gages in Round Valley and Philbrook reservoirs	NMFS	$260,000	$10,000	$54,500	no
39	As part of a Long-Term Project Operations Plan, install a real-time water temperature and reservoir elevation gage in Philbrook reservoir	NMFS	$80,000	$3,300	$17,000	yes
40	The minimum instantaneous 15-minute stream flow shall be at least 80 percent of the prescribed mean daily flow for those minimum stream flows less than or equal to 10 cfs and at least 90 percent of the prescribed mean daily flow for those minimum stream flows required to be greater than 10 cfs. Should the mean daily flow as measured be less than the specified mean daily flow but more than the instantaneous flow, release the equivalent under-released	Forest Service, FWS, NMFS	$0	$0	$0	yes

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	volume of water within 7 days of discovery of the under-release.					
41	Instantaneous instream flows may deviate below the specified minimum instream flow releases by up to 10 percent or 3 cfs, whichever is less	PG&E, FWS, NMFS	$0	$0	$0	yes
42	Install new gaging stations downstream of the feeder diversion dams on Inskip, Kelsey, Clear, Helltown Ravine, Long Ravine, Cunningham Ravine, Little West Fork, and Little Butte creeks	FWS, NMFS	$400,000	$26,400	$94,860	no
43	Devise a measurement procedure in consultation with the Forest Service to ensure compliance with license requirements at Long Ravine, Cunningham and Little West Fork creeks	Forest Service	$150,000	$10,000	$35,700	no

44	Install new gaging stations downstream of the diversion dams on Inskip, Kelsey, Clear, Helltown Ravine, and Little Butte creeks	Forest Service	$250,000	$5,500	$48,300	no	
45	Maintain a minimum pool level of 250 acre-feet in Philbrook Reservoir	PG&E, Forest Service, FWS	$0	$1,000	$1,000	yes	
46	Operate the Project reservoirs in consultation with the Operations Group	Conservation Groups	$0	$500	$500	yes	Prior to implementing, PG&E must receive Commission approval.
47	Include the Water Board and the Conservations Groups as representatives of the Operations Group	Conservation Groups	$0	$0	$0	yes	
48	Develop and implement a Long-Term Project Operations Plan	PG&E	$10,000	$5,200	$6,900	yes	
49	Monitor water quality in receiving streams during canal outages and provide a summary of cleaning and maintenance activities as well as the monitoring results to the Water Board and the Commission	PG&E	$0	$22,000	$22,000	yes	
50	Install four turbidity sensors in Butte Creek	Conservation Groups	$20,000	$5,000	$8,420	no	
51	Develop and implement a Hazardous Substances Plan	PG&E, Forest Service	$0	$1,000	$1,000	yes	

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52	Obtain approval for the use of pesticides and implement restrictions on their use	Bureau, Forest Service		$0	$0	$0	yes
53	Develop in consultation with NMFS, California Fish & Game, and FWS, a DeSabla Forebay Water Temperature Improvement Plan	PG&E	$2,000,000	$70,000	$412,300	yes
54	Develop in consultation with the Forest Service, the Water Board, NMFS, California Fish & Game, and FWS, a DeSabla Forebay Water Temperature Improvement Plan to address reducing thermal loading within DeSabla Forebay by 80 percent or greater	Forest Service, FWS, NMFS, California Fish & Game, Conservation Groups	$3,000,000	$100,000	$613,400	no
55	Provide a roving operator to check on flow releases made at feeder diversions.	PG&E		$0	$20,000	$20,000	yes
56	If the expected temperature benefits have been realized in Butte Creek, resource agencies shall determine whether it is feasible to go forward with flow increases in the West Branch Feather River and/or in Butte Creek	California Fish & Game		$0	$0	$0	yes

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57	After five years of temperature monitoring in Butte Creek, California Fish & Game and other resource agencies will determine the need for continued comprehensive temperature monitoring in lower Butte Creek	California Fish & Game	$0	$0	$0	yes
58	Develop and implement a Water Temperature Monitoring Plan in consultation with FWS, NMFS, California Fish & Game, the Water Board, and the Commission to be included in the Long-term Operations Plan	Forest Service, FWS, NMFS	$15,000	$29,900	$32,500	yes
59	Fish rescue plan and annual implementation	PG&E, FWS, NMFS, Conservation Groups	$15,000	$40,300	$42,900	yes
60	Fish rescue plan with implementation twice annually	Forest Service	$15,000	$80,600	$83,200	no
61	Fish rescue plan with implementation until fish screens are installed	California Fish & Game, Conservation Groups	$15,000	$40,300	$42,900	yes

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62	Install and operate fish screening at Hendricks Head dam	California Fish & Game, CSSA, Conservation Groups, FES, Forest Service	$3,300,000	$25,000	$589,800	no
63	Install and operate fish screening at Lower Centerville Diversion dam	NMFS, Forest Service, CSSA, Conservation Groups, California Fish & Game	$7,650,000	$25,000	$1,334,200	no
64	Install and operate fish screening at Butte Creek Head dam	CSAA	$5,350,000	$25,000	$940,600	no
65	Install and operate fish ladder at Hendricks Head dam	California Fish & Game, FWS, Conservation Groups, Forest Service	$1,650,000	$5,000	$287,400	no
66	Conduct trout population monitoring in the vicinity of Hendricks Head dam for a minimum of 4 years (2 dry and 2 normal), we estimate that 1 in 5 years would be classified as a dry year; therefore, we assume sampling in years 1, 2, 5 and 10 of new license for cost calculations.	Forest Service	$18,000	$23,200	$26,200	no

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67	PG&E's Alternative 4(e) 19 to conduct trout population monitoring in the vicinity of Hendricks Head dam in for a minimum of eight years of monitoring, with a minimum of three normal and three dry years. We estimate that 1 in 5 years would be classified as a dry year; therefore, we assume sampling in years 1, 2, 3, 4, 5, 6, 10, and 15 of new license for cost calculations.	PG&E	$18,000	$24,968	$28,000	no	
68	Resident fish monitoring in the West Branch Feather River in years in years 5, 6, 11, 12, 17, 18, 23, 24, and 29.	Forest Service	$18,000	$16,300	$19,400	no	We recommend adoptation as modified below in measure 75.
69	PG&E's Alternative to 4(e) 20 for resident fish monitoring in the West Branch Feather River, in years 5, 6, 11, 12, 17, 18, 23, 24, and 29 (absent survey site 43.6).	PG&E	$18,000		$3,080	no	We recommend adoptation as modified below in measure 75.
70	Resident fish monitoring in all project affected stream reaches and reservoirs. Monitoring in years 1, 2, 5, 6, 10, 11, 15, 16, 20, 21, 25, and 26	FWS	$18,000	$85,700	$88,700	no	We recommend adoptation as modified below in measure 75.

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71	Resident fish monitoring in Butte Creek. Forest Service does not specify the sampling frequency so we assume it is to be consistent with their 4(e) 20 and sampling would occur in years 5, 6, 11, 12, 17, 18, 23, 24, and 29.	Forest Service	$18,000	$16,300	$19,400	no	We recommend adoption as modified below in measure 75.
72	Resident fish monitoring in Butte Creek. Monitoring in years 1, 2, 5, 6, 10, 11, 15, 16, 20, 21, 25, and 26	NMFS	$18,000	$29,500	$32,500	no	We recommend adoption as modified below in measure 75.
73	Resident fish monitoring in project effected stream reaches. Monitoring expected to occur in years 5 and 6, and maybe again in 11, 12.		$18,000	$21,700	$24,700	yes	
74	Annually monitor the ESA listed spring-run Chinook salmon and the Central Valley steelhead in Butte Creek, including annual snorkel surveys to monitor adult distribution and abundance, annual pre-spawn mortality surveys, and annual carcass surveys to monitor spawning, and juvenile emergence and outmigration monitoring in extreme dry years.	PG&E, NMFS, FWS, California Fish & Game, Conservation Groups, Forest Service	$30,000	$134,600	$139,700	yes	

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75	Monitor movement patterns of adult Chinook salmon in response to changes in project flows, and the monitoring of Chinook holding habitat and spawning gravels. (For our economic analysis, we assume monitoring would occur in years 1 and 2.	California Fish & Game	$5,000	$2,500	$3,400	yes	
76	Benthic macroinvertebrate monitoring in project affected bypass reaches in years in years 1 through 4, and 8, 12, 16, 20, 24, and 29.	Forest Service, FWS, NMFS, Forest Service	$5,000	$54,500	$55,300	no	We recommend adoption as modified below in measure 80.
77	Benthic macroinvertebrate monitoring in project affected bypass reaches in years in years 1, 3, 5, 11, 17, 23, and 29.	PG&E	$5,000	$36,600	$37,400	no	We recommend adoption as modified below in measure 80.
78	Benthic macroinvertebrate monitoring in project affected bypass reaches in years be conducted in years 1, 2, 3, and 4, but for a maximum of 2 years per water year type and then during the first of the two consecutive years of our recommended resident fish population monitoring, beginning in year 5.		$5,000	$49,400	$50,200	yes	

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79	Annual Consultation Meeting, with Forest Service and other interested resource agencies/parties.	PG&E, Forest Service	$0	$10,000	$10,000	yes
80	Long-Term Operations Plan	PG&E, Forest Service, Cal Fish & Game, FWS	$10,000	$5,200	$6,900	yes
81	Comprehensive Monitoring Report with adaptive management summary	Cal Fish & Game	$20,000	$0	$3,400	yes
82	Hendricks Canal Fish Entrainment Study to be conducted, simultaneously with the trout population monitoring (Forest Service 4(e) 19), and for minimum of 4 years (2 dry and 2 normal), we estimate that 1 in 5 years would be classified as a dry year; therefore, we assume sampling in years 1, 2, 5 and 10 of new license for cost calculations.	Forest Service	$15,000	$13,600	$16,200	no
83	West Branch Feather River fish Migration Study (radio telemetry, with 400 tags) to be implemented in years 1, 2, 3, and 4	Forest Service	$45,000	$15,500	$23,200	no
84	Provide a 1 cfs minimum instream flow to Helltown Ravine downstream of the lower Centerville canal	Forest Service	$0	$20,800	$20,800	yes

85	Provide velocity-based ramping rates[a]	Forest Service	$50,000	$0	$8,000	yes
	Terresterial Resource Measures					
1	Invasive Weed Management and Vegetation Management Plan, excludes PG&E and private lands located within the project boundary	PG&E, Forest Service, Cal Fish & Game	$0	$20,000	$20,000	yes
2	Invasive Weed Management and Vegetation Management Plan and the plan is expanded to accessible project lands outside the National Forest		$0	$10,000	$10,000	yes
3	Annual review of the current list of federally listed species and Forest Service sensative or Lassen and Plumas National Forest species and development of protective measures for the project lands located in national forest	PG&E, Forest Service,	$0	$1,250	$1,250	yes
4	Annual review of the current list of federally listed species and special status species and development of protective measures expanded to project lands located outside of national forest		$0	$1,250	$1,250	yes
5	Monitor foothill yellow-legged frog proposed by PG&E	PG&E	$0	$20,200	$20,200	no

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6	Monitor foothill yellow-legged frog proposed by FWS	FWS	$0	$110,000	$110,000	no
7	Monitor foothill yellow-legged frog proposed by Forest Service	Forest Service	$0	$37,600	$37,600	no
8	Monitor foothill yellow-legged frog - FERC plan		$0	$40,400	$40,400	yes
9	Bald eagle monitoring plan proposed by PG&E	PG&E	$0	$1,800	$1,800	yes
10	Bald eagle monitoring plan proposed by Forest Service and FWS	Forest Service, FWS	$0	$5,000	$5,000	no
11	Deer protection at canals	PG&E, California Fish & Game	$0	$9,600	$9,600	yes
12	Deer mortality report at the canals	California Fish & Game	$0	$100	$100	yes
13	Valley Elderberry Longhorn Beetle Conservation Program	PG&E, Forest Service	$0	$1,900	$1,900	yes
	Land Use and Geology Resource Measures					
1	Road Improvements: [increased drainage controls (e.g., additional culverts or rolling dips) on several roads to reduce production of fine sediments, replace a number of damaged and/or temporary culverts, install velocity dissipators at culvert outlets; and improved management of side cast materials during annual	PG&E	$0	$0	$0	yes

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road blading activities]

2	Armor the Round Valley Reservoir plunge pool with rip rap and place warning signs to keep visitors away from the steep plunge pool slopes as a means to reduce sediment input to the spillway	PG&E	$0	$0	$0	yes
3	Best Management Practices: regular aerial and ground patrols, periodic canal repairs and removal of hazard trees, and the abandonment of passively automatic siphonic spill equipment	PG&E	$0	$0	$0	yes
4	Reconstruct and maintain any areas of the Butte Creek Canal, slope, and road due to project-related erosion	Bureau	$15,000	$200,000	$202,600	yes
5	Round Valley Dam Spillway Stabilization Plan	PG&E, Forest Service	$480,000	$96,000	$178,100	yes
6	Philbrook Spillway Channel Stabilization Plan	Forest Service	$480,000	$96,000	$178,100	yes

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7	Project Canal Maintenance and Inspection Plan	PG&E, Forest Service, FWS, NMFS, California Fish & Game	$15,000	$150,000	$152,570	yes
8	Project Transportation System Management Plan	PG&E, Forest Service, FWS, NMFS	$15,000	$203,000	$205,600	no
9	Fire Management and Response Plan	Forest Service	$0	$1,000	$1,000	yes
10	Visual Management Action Plan	PG&E, Forest Service	$5,250	$1,500	$2,400	yes
11	Sign and Information Plan	PG&E, Forest Service, Bureau	$65,000	$2,300	$13,400	yes
12	Inventory of Roads	Forest Service, FWS	$10,000	$0	$1,700	yes
13	Traffic Monitoring Plan	Forest Service	$50,000	$0	$8,600	no
14	Maintenance of Portion of Ditch Creek Road	Bureau	$3,500	$1,000	$1,600	yes
15	Pave County Road Segements	Butte County	$6,265,210	$0	$1,072,200	no
16	Replace Guardrails on county maintained roads	Butte County	$208,700	$0	$35,700	no
17	Pave apron back on powerhouse Road off Humbug Road.	Butte County	$21,850	$0	$3,700	no
	Recreation Resource Measures					
1	Rehabilitation & Enhancements at Philbrook Reservoir and DeSabla Forebay	PG&E, Forest Service	$65,000	$19,200	$30,300	yes

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2	Constructing Accessible Trails	PG&E, Forest Service	$25,000	$2,500	$6,800	yes
3	Extend concrete boat launch at Philbrook Reservoir	Forest Service	$25,000	$500	$4,800	yes
4	Construct and maintain public trail at SE shorline of Philbrook Reservoir	Forest Service	$5,500	$550	$1,500	no
5	Construct accessible restroom at the Fork of Butte Creek Campground	FWS	$30,000	$0	$5,100	no
6	Develop a site plan for the Forks of Butte Creek Primative Campground	FWS	$5,000	$0	$860	no
7	Construct accessible restroom at Ponderosa Bridge Parking area	FWS	$30,000	$0	$5,100	no
8	Upgrade/Maintain user-created trail and parking along Toadtown Canal	Forest Service	$5,000	$500	$1,400	yes
9	Complete construction of the Butte Creek Trail on sw shoreline of Butte Creek to Canyon Bottom	FWS	$5,000	$0	$900	no
10	Build a footbridge across Butte Creek to connect the Butte Creek Trail	FWS	$15,000	$0	$2,600	no
11	Install kiosk and reconstruct trail alignment at Indian Springs Trailhead	FWS	$2,500	$0	$400	no
12	Install vehicle barriers at Willow Dispersed Area	PG&E, Forest Service	$1,000	$0	$200	yes

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13	Visitor management controls (dispersed camping/trash dumping/off highway vehicle)	PG&E, Forest Service, FWS, Conservation Groups	$5,000	$1,000	$1,900	yes
14	Recreation use monitoring, reporting, and future use triggers - The measure entails monitoring change in recreation user patterns, conducting user surveys, monitoring facility, ecological, and social capacity, and initiating an environmental analysis when rec monitoring of developed recreation facilities indicates any one of the triggers has been attained.	Forest Service, Bureau	$0	$25,600	$25,600	yes
15	Stream flow information	PG&E, Forest Service, Bureau, Conservation Groups	$0	$2,500	$2,500	yes
16	Restricted recreation access at DeSabla & Centerville powerhouse	PG&E	$0	$3,500	$3,500	yes
17	Complete recreation access at DeSabla and Centerville powerhouses	Conservation Groups	$0	$3,500	$3,500	no
18	Provide 15-20% of camping fees at Philbrook Campground	Forest Service	$0	$1,800	$1,800	no
19	Stocking 3,311 pounds of fish in	PG&E	$0	$10,000	$10,000	no

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	DeSabla forebay					
20	Stocking 8,000 lbs of in Project reservoirs and reaches	Cal DFG	$0	$24,000	$24,000	no
21	Develop a fish stocking plan in consultation with Cal DFG		$2,500	$21,700	$22,200	yes
22	Stock trout at Round Valley Reservoir during the spring	Cal Salmon and Steelhead Association	$0	$10,000	$10,000	no
23	Construct and maintain a public day-use area with ADA facilities at Round Valley Reservoir	Cal Salmon and Steelhead Association	$50,000	$2,500	$11,100	no
24	Half-time Law Enforcement	Forest Service; Conservation Groups	$0	$60,000	$60,000	no
25	Full-time Law Enforcement	Butte County	$0	$107,300	$107,300	no
26	Funding to address patrol and maintenance	Bureau	$0	$30,000	$30,000	no
27	O&M of existing recreation facilities	PG&E; Forest Service	$25,000	$25,000	$29,300	yes
	Cultural Resources Measures					
1	HPMP implementation	PG&E, Forest Service	$30,000	$20,000	$25,100	yes

[a] Cost of developing velocity-based ramping rates based on need for study; Forest Service's condition is not specific enough to determine if ramping rates would have an effect on generation.

4.3.1 Raising Minimum Instream Flow below Project Diversions

As we've said in fishery section, PG&E, along with various resources agencies and relicense participants, recommends increasing the minimum instream flow below some project diversions. Each alternative minimum instream flow the resources agencies and relicense participants recommend differ from PG&E's proposal by recommending higher minimum instream flows in some of the project reaches. Here, we show our estimated cost of both PG&E's proposed minimum instream flows and the increased cost of each minimum instream flow alternative.

The projects dams and diversion are as follows: Round Valley and Philbrook Dam, Hendrick's diversion dam, Butte diversion dam, Lower Centerville Dam, and the eight active feeder creek diversion dams.

Round Valley Dam

PG&E make releases from the Round Valley Dam, which is one of the two project storage reservoirs, to the Upper West Branch Feather River. PG&E proposes no change to the instream flow below Round Valley Dam and no other participant recommends an alternative flow.

Philbrook Dam

Philbrook Reservoir, with a usable storage of about 5,000 ac-ft, provides most of the storage for the project and releases into Philbrook Creek, a tributary to the Upper West Branch Feather River. PG&E proposes to continue releasing a minimum instream flow of 2 cfs or natural reservoir inflow below the dam, with a minimum of 0.1 cfs.

Alternative instream flow conditions were made by resource agencies and participants are as follows:

FWS, CDF&G, and Forest Service recommend a 10 cfs release from Philbrook Reservoir between April 1st and May 15th depending on snow pack conditions. Besides the 10 cfs release, FWS recommends the minimum instream flow below Philbrook be at least 1.0 cfs regardless of natural inflow to the reservoir; whereas Forest Service recommends at least 0.5 cfs regardless of natural inflow to Philbrook Reservoir.

Because releases from Philbrook Dam can be used for downstream generation, the changes to minimum instream flow the resource agencies recommend below the dam would not reduce project generation but would cause PG&E to draw Philbrook reservoir down sooner than PG&E's proposed flows.

Hendrick's diversion dam

As we've said, PG&E's proposes to raise the minimum instream flow in the West Branch Feather below Hendricks diversion dam in both normal and dry years. Forest Service, FWS and CDF&G want to increase the minimum instream flow above what PG&E proposes by 10 cfs in normal years and 8 cfs in dry years during the months of June, July, and August. The Conservation Group recommends PG&E's proposed minimum instream flows in normal runoff years but wants PG&E to increase their instream flow releases by 8 cfs from June through February of dry years.

Minimum instream flows released below Hendricks diversion dam can not be used to generate power at any of the project's three powerhouses. We estimate the agencies' alternative flows below the Hendricks diversion dam would reduce the project's power value by $260,000 during normal years and $210,000 in dry years. Because dry years occur at a frequency of about once every five years, the weighted annual cost of the agencies minimum instream flow alternative is $250,000. Our estimated annual cost of the Conservation Groups minimum instream flow alternative below Hendricks diversion dam is $125,000.

Butte Creek diversion dam

In the fishery section, we've said that PG&E proposes to raise the minimum instream flow in Butte Creek below the Butte creek Diversion dam in both normal and dry runoff years. In normal years, PG&E proposes to raise the minimum flow from 16 cfs to 30 cfs in March, April and May; in dry runoff years, PG&E would raise the minimum instream flow by 13 cfs in these same months.

Forest Service, FWS, and CDF&G agree with PG&E's proposed flow during normal runoff years but want an added 3 cfs raise in the minimum instream flow during June through February of dry runoff years.

Minimum instream flows released below Butte Creek diversion dam can not be used for generation at DeSabla powerhouses. We estimate the added 3 cfs the resource agencies recommend during dry runoff years would reduce the project's weighted power value by $31,000 annually compared to PG&E's proposal.

Lower Centerville diversion dam

PG&E proposes substantial increases in the minimum instream flow to Butte Creek blow the Lower Centerville Dam during both normal and dry runoff years. FWS, Forest Service, NMFS and Forest Service want higher minimum flows during both normal and dry runoff years.

We estimate the resource agencies alternative minimum instream flows would cost $197,000 more annually than PG&E proposal.

Feeder diversion dams

PG&E now releases a minimum instream flow of .25 cfs from each of the active feeder diversion dams during normal runoff years and 0.1 cfs during dry years. Forest Service and FWS recommend increasing the normal year minimum instream flow to 1 cfs and the dry year minimum flow of each of these feeder diversions to .50 cfs.

CDF&G recommends raising the instream flow of the three active feeders on Hendricks Canal to 1 cfs during normal runoff years and .50 cfs during dry years.

PG&E does not gage these feeder streams but did take flow measurements for 3-4 months during two of the study years. Based on these limited measurements, we estimated how increasing in minimum instream flow in these feeders would reduce project generation. We estimate the added annual cost of increasing the minimum instream flow as recommended by Forest Service and FWS to cost $133,000 more than PG&E's proposed existing minimum instream flows and Cal Fish & Game to cost $62,000 more than PG&E.

4.4 New Project Facilities Recommended to be Included in Any New License

Currently PG&E releases a small amount of water from the DeSabla forebay to the Upper Centerville Canal for local water users. Water not diverted by the local water users than drains into the Helltown Ravine. As stated in the license application PG&E has used the Upper Centerville Canal and Helltown Ravine as an alternate route to move water to the Centerville powerhouse when the DeSabla powerhouse was out of service. PG&E said in their August 14, 2008 filing that any unused water travels down Helltown Ravine is intercepted by the Lower Centerville Canal and picked up for generation. Therefore, the diversion that conveys water into the Lower Centerville Canal from Helltown Ravine and the portion of Helltown Ravine conveying water from the Upper Centerville Canal to the Lower Centerville Canal should be included within the project boundary as a project facility.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Comparison of Alternatives

In this section we compare the developmental and non-developmental effects of PG&E's proposal, PG&E's proposal as modified by staff, and the no-action alternative. We estimate the annual generation of the project under the three alternatives identified

above. Our analysis shows that the annual generation would be 146.6 GWh for the proposed action, 146.4 GWh for the staff alternative, and 139.4 GWh for the no-action alternative. We summarize the environmental effects of the different alternatives below.

Table 5-1. Comparison of Alternatives for the DeSabla - Centerville Hydroelectric Project (Source: staff).

Resource	**No Action Alternative**	**Proposed Action**	**Staff Alternative**	**Staff Alternative with Mandatory Conditions**
Generation	155.7 GWh	146.6 GWh	146.4 GWh	139.4 GWh
Geology	Continued erosion along roads and at many project facilities such as Round Valley Reservoir Spillway and Philbrook Spillway Channel	Implement Best Management Practices to reduce erosion in project area including roads, Round Valley Reservoir Spillway, and project canals	The proposed action and the reconstruction areas of the Butte Creek Canal, slope, and road, and development and implementation of a Philbrook Spillway Channel Stabilization Plan	Same as staff alternative
Aquatic Resources	Provide existing minimum flows, operate project to manage water temperatures in lower Butte Creek for federally listed anadromous fish	Same as no action with higher minimum instream flows for resident fish, remove barriers on five feeder diversions, and conduct fish rescues from project canals.	The proposed action with monitoring of resident fish populations and water temperatures in project affected stream reaches	Same as staff alternative with more extensive resident fish monitoring and even higher minimum flows on the West Branch Feather River

Terrestrial Resources	Provide and maintain deer protection facilities (bridges, escape structures, etc.) at project canals	Same as no action with protection of special status species and invasive species control on Forest Service lands	Provide velocity based ramping rates to protect egg masses and tadpoles of the foothill yellow legged frog, provide monitoring of foothill; yellow legged frog; extend protection of special status species and invasive species control to non-Forest Service lands; bald eagle monitoring; and summary report of animal mortality and additional protection measures, as appropriate	Same as staff alternative with more extensive monitoring of foothill yellow-legged frog

Threatened and Endangered Species	Operate project to manage water temperatures in lower Butte Creek for federally listed anadromous fish, impellent Valley Elderberry Longhorn Beetle Conservation Program	Higher minimum instream flows for federally listed anadromous fish, reduce project affects on water temperature increases at DeSabla forebay, monitor adult Chinook salmon and steelhead in lower Butte Creek and continue to implement beetle conservation program	Same as proposed action with additional monitoring of Chinook salmon movements and habitat responses to changes in minimum instream flows	Same as proposed action

Recreation Resources	Continue to operate and maintain existing recreation facilities at the project	Same as no action the rehabilitation and upgrades to existing recreation facilities to ADA standards, work with the Forest Service to discourage dispersed camping and OHV use, install informational signs, fund Cal Fish & Game to stock DeSabla reservoir, provide streamflow information and access for whitewater boating	Same as proposed action with additional upgrades to existing boat launch on Philbrook reservoir and existing user-created trail, and recreation monitoring throughout the term of the new license	Same as staff alternative with the addition of a trail on the SE shoreline of Philbrook reservoir, a portion of camping fees from Philbrook Campground distributed to Forest Service, and providing project patrol
Land Use and Aesthetics	Continue to maintain all project roads and facilities	Work with the Forest Service to identify roads, survey existing road conditions, and maintain all project roads and develop and implement a visual, fire management, and hazardous substance land management plan.	Same as proposed action with additional erosion measures and traffic controls during construction	Same as staff alternative with the addition of a 5-year traffic monitoring plan and road maintenance and/or reconstruction on several non-project roads

Cultural Resources	Previously identified eligible sites protected, but no treatment measures for newly identified sites and no policies for avoidance	Historic Properties Management Plan that provides site-specific protection measures and general guidance for protecting cultural sites	Modified HPMP that includes additional information and collection policies	Same as staff alternative

Under the no-action alternative, environmental conditions would remain the same and no enhancement of environmental resources would occur.

5.2 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, 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 relicensing the DeSabla-Centerville Hydroelectric Project. We weigh the costs and benefits of our recommended alternative against other proposed measures.

Based on our independent review of agency and public comments filed on this project and our review of the environmental and economic effects of the proposed project and its alternatives, we selected the staff alternative as the preferred alternative. This alternative includes elements of the applicant's proposal, section 4(e) conditions, resource agency recommendations, alternative conditions under EPAct, and some additional measures. We recommend this alternative because: (1) issuance of a new hydropower license by the Commission would allow PG&E to operate the project as an economically beneficial and dependable source of electrical energy for its customers; (2) the 26.7-MW project would eliminate the need for an equivalent amount of fossil-fuel derived energy and capacity, which helps conserve these nonrenewable resources and limits atmospheric pollution, including greenhouse gases; (3) the public benefits of this alternative would exceed those of the no-action alternative; and (4) recommended environmental protection measures, including minimum instream flows and ramping rates, erosion control measures, protection and monitoring of federally listed species (including the Valley

Elderberry Longhorn Beetle, Chinook salmon and steelhead trout), provisions to enhance recreation facilities, the implementation of a Historic Properties Management Plan, and various measures for the protection of terrestrial, would enhance the environmental resources at the project.

Finally, for the reasons outlined below, we recommend that certain section 4(e) conditions specified by the Forest Service and the Bureau not be included in the staff alternative. The conditions we are not recommending include: (1) Forest Service condition 19 to monitor trout populations above and below the Hendricks Head dam; (2) Forest Service condition 32 for the resolution of PG&E encumbrances; and (3) the Bureau's condition 19 to fund law enforcement patrols within the project's area.

Additionally, of the Forest Service conditions we do recommend, we recommend many of them with modification. These include: condition 18 for minimum instream flows, defining water year types, provisions for multiple dry water years, stream gaging and ramping rates; condition 20 for monitoring of resident trout, benthic macroinvertebrates, water temperature, and amphibians within project affected stream reaches; and condition 33 for recreation facilities on or affecting National Forest System Land. Below we discuss in detail our recommended modifications to the mandatory conditions and provide our reasoning for said modifications.

We do however; recognize that the Commission must include these conditions in their entirety, without modification in any license it may issue, due to their mandatory nature.

5.2.1 Recommended Alternative

Based on our environmental analysis of PG&E's proposal discussed in section 4 and the costs discussed in section 5, we recommend including the following environmental measures proposed by PG&E in any license issued for the project. Where we make minor modifications to PG&E's proposed measure we indicate these modifications in *italic* text.

Geological Resources

- Increased drainage controls (e.g., additional culverts or rolling dips) on several roads to reduce production of fine sediments, replacing a number of damaged and/or temporary culverts, installing velocity dissipators at culvert outlets; and improved management of side case materials during annual road blading activities to minimize erosion and sediment transport potential during future project operations and management.
- Develop a Project Transportation System Management Plan that includes (1) measures to rehabilitate existing erosion damage and minimize further erosion of the

project access roads on National Forest Service Lands; and (2) installation of gates or other vehicle control measures to achieve erosion protection.

- Armor the Round Valley reservoir plunge pool with rip rap and place warning signs to keep visitors away from the steep plunge pool slopes as a means to reduce sediment input to the spillway.
- Continue Best Management Practices such as regular aerial and ground patrols, periodic canal repairs and removal of hazard trees, and the abandonment of passively automatic siphonic spill equipment to reduce the adverse effects of canal failures.
- Develop a Round Valley Dam Spillway Stabilization Plan that includes (1) an assessment of areas to be stabilized; (2) feasibility-level design drawings for stabilization measures; and (3) a schedule for implementation of the measures.
- Develop a Project Canal Maintenance and Inspection Plan that includes (1) annual inspections of the project water conveyance system to identify potential short-term and long-term hazards and to prioritize maintenance and/or mitigation; (2) protocols for routine (non-emergency) canal operations and the use of canal spillways; and (3) stabilization measures to reduce the likelihood of catastrophic canal failure due to hazard trees and geologic hazards and to mitigate sources of chronic erosion and sediment transport into canals.

Aquatic Resources

- Develop and implement a Canal Fish Rescue Plan that: (1) defines activities that would trigger canal fish rescue efforts; (2) provides for prior notification and coordination with the California Department of Fish and Game; and (3) identifies methods implemented.
- Maintain a minimum pool in Philbrook Reservoir of 250 acre-feet to provide winter habitat for trout.
- Remove Stevens Creek, Little Butte Creek, Oro Fino Ravine, Emma Ravine, and Coal Claim feeder diversions preventing the diversion of water at these facilities and removing barriers to fish movements.
- In consultation with the United States Geological Survey (USGS), install and maintain a flow data logger for measuring stream flow downstream of Hendricks diversion dam on the West Branch Feather River (West Branch Feather River), a real-time flow gaging station upstream of Butte Creek diversion dam, and modify the existing stream gaging station near Lower Centerville diversion dam for real-time data access
- Complete any needed modifications to the stream flow gaging facilities necessary to measure the new minimum instream flows within three years after issuance of any new license
- Provide notice and an explanation to the Commission as soon as possible, but no later than 10 days after any temporary modification to minimum instream flow requirements

- Make the following stream flow information available to the public via the Internet: West Branch Feather River at USGS gage no. 11405200 (downstream of Hendricks diversion dam), Butte Creek at USGS gage nos. 11389720 (downstream of Butte Creek diversion dam) and 111389780 (downstream of Lower Centerville diversion dam)
- Monitor water temperature, dissolved oxygen, turbidity, and herbicides (if in use) in receiving streams, upstream and downstream, of canal discharge within 24 hours prior to, during, and within 24 hours of returning Project canals to service, and provide a summary of cleaning and maintenance activities as well as the monitoring results to the Water Board, and file a summary report with the Commission within 30 days of completing the monitoring and any associated laboratory analysis
- Develop, after consultation with the Forest Service, NMFS, FWS, and Cal Fish & Game, and implement, upon Commission approval, a Hazardous Substances Plan
- Maintain the following minimum instream flows, or inflow, whichever is less:

Point of Discharge	**Proposed Minimum Instream Flow (in cfs)**		
	Normal Water Year	**Dry Water Year**	**Time Period**
Round Valley Dam	0.5	0.1	Year-round
Philbrook Dam	2.0	2.0	Year-round
Hendricks diversion dam	30 20	20 7	March 1 to May 31 June 1 to Feb. 28
Butte Creek diversion dam	30 16	20 7	March 1 to May 31 June 1 to Feb. 28
Lower Centerville diversion dam	75 80 80 40	60 75 65 40	Sept. 15 to Jan. 31 Feb. 1 to April 30 May 1 to May 31 June 1 to Sept. 14
Inskip, Kelsey, Little West Fork, and Cunningham Ravine Creeks	0.25	0.10	Year-round
Clear and Long Ravine Creeks	0.5	0.25	Year-round

- Maintain a minimum instream flow of at least 0.1 cfs if inflow to Philbrook Reservoir is less than 0.1 cfs
- *Develop, in consultation with the Forest Service, FWS, NMFS, Cal Fish & Game, and the Water Board, and implement, upon Commission approval, a Feeder Creek Diversion Removal Plan* for the removal of feeder diversions on Oro Fina Ravine, Emma Ravine, Coal Claim Ravine, Stevens, and Little Butte creeks
- Develop, in consultation with the *Forest Service, the Water Board*, NMFS, Cal Fish & Game, and FWS, and implement upon Commission approval, a DeSabla Forebay Water Temperature Improvement Plan, *and include a provision to*

monitor water temperatures in Butte Creek for a period of 5 years after a device capable of reducing thermal loading by 50 percent is operating and submit an annual report on these results to FWS, NMFS, Forest Service, Cal Fish & Game, the Water Board, and the Commission

- Develop, in consultation with the *Forest Service, the Water Board*, NMFS, Cal Fish & Game, and FWS, and implement upon Commission approval, a Long-term Operations Plan

Terrestrial Resources

- Annually review current list of special-status species
- Inspect wildlife bridges and deer escape facilities and replace as necessary
- Monitor animal losses in project canals
- Implement a vegetation management plan
- Implement an invasive weed management plan

Threatened and Endangered Species

- Continue to implement the valley elderberry longhorn beetle conservation program

Recreational Resources

- Develop and implement a Recreation Facility Rehabilitation and ADA Upgrade Plan for capital and rehabilitation improvements to the existing recreation facilities at Philbrook reservoir and DeSabla forebay Recreation Areas.
- Provide streamflow information on project reaches for recreational boating.
- Provide restricted stream access at DeSabla and Centerville powerhouses.
- Develop and implement an Operation and Maintenance Plan for developed recreation facilities at Philbrook reservoir and DeSabla forebay recreation areas.
- Develop and implement a Sign and Information Plan to determine the type of signs, number, and locations of where the signs will be placed at the project.
- Develop and implement a Recreation Operation Plan for the annual operation and maintenance of the existing recreation facilities at Philbrook Reservoir and the DeSabla Forebay Recreation Areas. .

Land Use and Aesthetic Resources

- Develop a Visual Management Plan to include painting, revegetating, screening, and repairing facilities as well as disposing of debris piles.
- Develop a Project Transportation System Management Plan for the protection and maintenance of roads associated with the project.

In addition to the PG&E's proposed measures listed above, we recommend the following measures:

Geological Resources

- Reconstruct and maintain any areas of the Butte Creek canal, slope, and road that are detrimentally impacted by project activities.
- Develop and implement a Philbrook Spillway Channel Stabilization Plan to mitigate for the current erosion problem below the Philbrook Spillway Channel. The plan should also include a schedule for filing status reports with the Commission on the ongoing monitoring associated with erosion below the Philbrook spillway channel. Implementation of this plan shall be complete by December 1, 2010, unless extended by the Forest Service;
- Include lands, starting at the Philbrook spill channel, extending from the two Philbrook spillways, and ending at the confluence with Philbrook Creek, in the project boundary.

Aquatic Resources

Water Resources

- Promptly resume minimum instream flow requirements after a non-compliance event and notify the Forest Service, FWS, NMFS, Cal Fish & Game, the Water Board, and the Commission within 48 hours of this modification
- Provide a minimum instream flow of 1 cfs, or inflow, during normal water years, and a minimum instream flow of 0.5 cfs, or inflow, during dry water years downstream of the Helltown Ravine diversion dam
- Consult with the Forest Service, Cal Fish & Game, FWS, and NMFS on information collected from foothill yellow-legged frog population monitoring to determine if the following ramping rate criteria is protective of foothill yellow-legged frog populations, or if there is a need to modify these ramping rates
- If sufficient water is not available to hold stream levels constant during periods when foothill yellow-legged frog egg masses are present, ramp flows downstream of the Hendricks diversion dam, Butte Creek diversion dam, and Lower Centerville diversion dam such that:
    - During down-ramping, stage changes shall not exceed 0.2 feet per second per hour at foothill yellow-legged frog egg mass sites and water levels shall not drop so that more than 20 percent of egg masses are de-watered;
    - During up-ramping velocity shall not change more than 0.2 feet per second per hour and shall not exceed 0.8 feet per second at the most sensitive foothill yellow-legged frog egg mass sites;

  - When foothill yellow-legged frog tadpoles or juveniles are present, the up- and down- ramping rate shall be 0.4 feet per second per hour or less and shall not exceed 1.0 foot per second at the site
- Develop, in consultation with the Forest Service, Cal Fish & Game, NMFS, and FWS, and implement, upon Commission approval, a Ramping Rate Monitoring Plan
- Schedule Hendricks, Butte, and Lower Centerville canal outages as early in the year as possible to avoid the foothill yellow-legged frog breeding and rearing season
- Schedule the timing of maintenance or other planned Project outages to avoid negative ecological effects to foothill yellow-legged frog and spring-run Chinook salmon and provide written notice, including proposed measures to minimize the magnitude and duration of spills, at least 90 days prior to such outages, to the Forest Service, FWS, NMFS, Cal Fish & Game, the Water Board, and the Commission
- Obtain approval from the Forest Service and BLM on the use of pesticides on Forest Service or BLM lands and submit a request for approval of planned uses of pesticides for the upcoming year during annual consultation
- Utilize only pesticides registered by the EPA and do not utilize them within 500 feet of known locations of California red-legged frog, mountain yellow-legged frog, foothill yellow-legged frog , and Yosemite toad
- Implement minimum instream flow requirements within two business days of the publication of the California Department of Water Resource's Bulletin 120
- Within 30 days of making the final water year type determination, provide notice of this determination to Cal Fish & Game, FWS, NMFS, Forest Service, the Water Board, and the Commission
- As soon as drought conditions are evident, notify the Forest Service, Cal Fish & Game, NMFS, FWS, the Water Board and the Commission, and consult with these agencies on potential proposals for modified project operations
- Notify the Forest Service, Cal Fish & Game, NMFS, FWS, the Water Board and the Commission by March 15 of the second or subsequent dry water year and consult with these agencies by May 15 of the same years
- File, for Commission approval, any proposed modifications to project operations as a result of drought conditions consultation with the agencies
- Construct, operate, and maintain, in consultation with the USGS, a stream flow gage with real-time capability in Philbrook Creek, downstream of the confluence of both the low level release and spill channel in Philbrook Creek
- Operate and maintain, in consultation with the USGS, the existing gaging stations on the West Branch Feather River downstream of Round Valley Reservoir and the Hendricks diversion dam

- Measure minimum instream flows as the 24-hour average of the flow (mean daily flow) and as an instantaneous flow, with instantaneous 15-minute stream flow as required by the USGS standards at all gages
- Measure and document all minimum instream flow releases in publicly available and readily accessible formats, and provide this data to the USGS in an annual hydrology summary report
- Construct, operate, and maintain, in consultation with the USGS, a water temperature and reservoir level gage in Philbrook Reservoir with real-time capability
- Provide a roving operator to maintain and monitor the feeder diversions on a weekly basis
- Develop, in consultation with Forest Service, Cal Fish & Game, NMFS, FWS, the Water Board, and implement, upon Commission approval, a Water Temperature Monitoring Plan, to be incorporated as part of the Long-term Operations Plan
- Submit an annual report detailing temperature monitoring results to the Forest Service, Cal Fish & Game, NMFS, FWS, the Water Board, and the Commission prior to annual consultation
- Include the Water Board and the Conservation Groups as members of the Operations Group

- As part of the *DeSabla Forebay Water Temperature Improvement Plan,* include a provision to monitor water temperatures in Butte Creek for a period of 5 years after a temperature reduction device is operating and submit an annual report on these results to FWS, NMFS, Forest Service, California Fish & Game, the Water Board, and the Commission
- Monitor resident fish populations to evaluate its response to changes in project operations such as minimum flows
- Monitor benthic macroinvertebrate populations to evaluate their response to changes in project operations such as minimum flows.
- Annually monitor anadromous fish and their habitats in Butte Creek.
- Develop and implement adaptive management plan to guide the long-term operations of the project to protect the ESA listed anadromous fish within Butte Creek.

Terrestrial Resources

- Monitor foothill yellow-legged frog populations on both the West Fork Feather River and Buttte Creek annually for the first 3 years and every 5 years thereafter Note—this is part of aquatic monitoring)
- Expand annual review of special status species to include federally listed species and Bureau sensitive/watch list species

- Provide a summary report of animal mortality every 5 years with recommendation for additional protection measures as needed
- Extend the vegetation management plan and invasive weed management plan to include non-Forest Service lands within the project boundary where access is available
- Conduct surveys for bald eagle nesting every 3 years and prepared management plan if nesting is detected

Recreational Resources

- Extend concrete boat launch at Philbrook reservoir.
- Upgrade and maintain user-created trail and parking along Toadtown canal.
- Develop and implement a fish stocking plan for project reservoirs and reaches after consultation with California Fish & Game.
- Develop recreation use monitoring, reporting, and use triggers in order to periodically monitor changes in recreation use patterns at the Project.

Land Use and Aesthetic Resources

- Develop and implement a Fire Management and Response Plan to prevent and handle potential fires at the project.
- Develop and implement a Hazardous Substance Plan to handle and prevent hazardous substance spills at the project.

Cultural Resources

- Implement the current HPMP with the following revisions: 1) Update the HPMP with the additional historic context information provided by Bureau, the Forest Service, and the Mechoopda Tribe; 2) develop a collection policy for discovery, curation, and disposition of artifacts; 3) develop a detailed HPMP section addressing identification, restoration, accessibility, and stewardship collaborations for traditional plant gathering/tending in wetlands and riparian habitat communities culturally important to participating tribes; 4) identify specific management measures to be undertaken and include them within PG&E's best practices or procedural manuals; and 5) include the required mitigation measures for Round Valley reservoir site CA-BUT-1225/H.

5.2.2 Discussion of Measures Recommended by Staff

The following is a discussion of the basis for the measures recommended by staff.

Geological Resources

Butte Creek canal, slope, and road

Consistent with the Bureau's FPA §4(e) Condition 21, we recommend that PG&E reconstruct and maintain any areas of the Butte Creek canal, slope, and road that are detrimentally impacted by project activities. The inclusion of the measures, recommended by Bureau, in any license issued, would ensure that any lands impacted by project-related effects (damage caused by any spills, blowouts, canal erosion, or seepage onto Ditch Creek Road) will be mitigated for and would be maintained during the course of a new license. We estimate that these mitigations would have a one-time capital cost of $15,000 and an annualized cost of $200,000. We conclude that the expected benefits of reconstructing and maintaining areas of the Butte Creek canal, slope, and road that are impacted by the project are worth the cost.

Round Valley Dam Spillway Stabilization

Continued project operation and management has the potential to result in erosion from the Round Valley dam spillway channel and sediment transport to the West Branch Feather River. Consistent with the Forest Service's FPA §4(e) Condition 21, we recommend that PG&E develop a Round Valley Dam Spillway Stabilization Plan to be included as a condition of any new license issued. The inclusion of a Round Valley Dam Spillway Stabilization Plan in any license issued would ensure the clear identification of the reaches of the channel that are most likely to be a future source of erosion and subsequent sediment transport to the West Branch Feather River and the development of plans for stabilizing such areas of the spillway channel to minimize future erosion and sediment transport on the National Forest Service Lands. We estimate that the development of a Round Valley Dam Spillway Stabilization Plan would have a one-time capital cost of $480,000 and an annualized cost of $96,000. We conclude that the expected benefits of the development and implementation of such a plan are worth the cost.

Philbrook Spillway Channel Stabilization

Erosion at Philbrook Spillway is significantly more expansive than that at Round Valley Reservoir Spillway. Originally, this spillway was included in a Reservoir Spillway-Related Erosion & Sediment Transport survey. However, during an early reconnaissance field trip a 20-foot-plus hydraulic knickpoint was discovered that is migrating upstream. This caused such concern that the Forest Service required the PG&E to start undertaking actions immediately to resolve this issue, prior to the relicensing effort. Thus, the relicensing study was reduced to just address Round Valley Spillway and PG&E initiated a separate study outside of relicensing to restore the Philbrook Spillway. The Forest Service agreed with removing this study from the relicensing process with one caveat – that if restoration of this spillway was not complete prior to license issuance, that it be included as a mandatory license condition. PG&E concurred

with this strategy. Currently, much planning work has been completed. However, restoration activities are still at least a year away with the need to complete planning, locate rock borrow sites, and write the environmental analysis for this restoration. Therefore, the Forest Service is including a license condition that will cover completion of any remaining activities associated with restoration of this spill channel.

Consistent with the Forest Service's FPA § 4(e) Condition 22, we recommend that PG&E develop a Philbrook Spillway Channel Stabilization Plan to be included as a condition of any new license issued. The inclusion of a Philbrook Spillway Channel Stabilization Plan, as recommended by the Forest Service, in any license issued will ensure that measures are taken to mitigate for the current erosion problem below the Philbrook Spillway Channel. The plan will also allow for routine monitoring to identify and address any future erosion problems that may arise. In addition, we recommend that PG&E include the Commission on all correspondence, as well as status reports, related to the erosion problem below the Philbrook spillway channel.

Since the current erosion problem, or knickpoint, is located on lands that are outside the project boundary, we recommend that these lands, starting at the Philbrook spill channel, extending from the two Philbrook spillways, and ending at the confluence with Philbrook Creek, be brought into the project boundary. We estimate that the development of a Philbrook Spillway Channel Stabilization Plan would have a one-time capital cost of $480,000 and an annualized cost of $96,000. We conclude that the expected benefits of the development and implementation of such a plan are worth the cost.

Project Canal Maintenance and Inspection

Consistent with PG&E's proposal and conditions and recommendations filed by the agencies, we recommend that PG&E develop a Project Canal Maintenance and Inspection Plan to be included as a condition of any new license issued. The continued operation of Project water conveyances, particularly the Butte Creek and Lower Centerville canals, presents an ongoing risk of adverse environmental impacts to mainstem streams. The risk of erosion and sediment transport due to uncontrolled releases of water is an unavoidable consequence of the geographically remote and geologically unfavorable area in which Project conveyances are located. Future conveyance failures during or immediately following inclement weather are of less consequence to fisheries in the mainstem streams of Butte Creek and the West Branch Feather River because they occur when these watercourses are already flowing at high velocity with a high carrying capacity for sediment transport. Continuation of PG&E's Best Management Practices and the inclusion of a Project Canal Maintenance and Inspection Plan in any license issued would ensure that hazard trees and geologic hazards, the two primary causes of past failure of project water conveyances at this project, would be identified and, in the most serious cases, mitigated for. The plan would

formalize existing non-emergency canal operations protocols and would provide a consistent point of reference for routine canal operations while permitting PG&E the ability to operate the project in accordance with their Best Management Practices. The plan would also address a possible range of options (operational and geotechnical) that may be considered in reducing the risk of catastrophic failure due to hazard trees or geologic instability. We estimate that the development of a Project Canal Maintenance and Inspection Plan would have a one-time capital cost of $15,000 and an annualized cost of $150,300. We conclude that the expected benefits of the development and implementation of such a plan are worth the cost.

Aquatic Resources

Philbrook Creek

We recommend a year-round minimum instream flow of 2 cfs to be released from Philbrook dam in all water-year types to Philbrook Creek. Our recommendation is also consistent with Forest Service condition no. 18, and recommendations from FWS and Cal Fish & Game, except between April 1 through May 15th, as described below. A year-round minimum instream flow of 2 cfs would be consistent with existing license requirements and would maintain the existing rainbow trout spawning habitat in both wet and dry years. Further, PG&E's studies indicate that rainbow trout populations in this reach are currently viable and self-sustaining. Because this minimum instream flow is consistent with existing Project operations, we estimate that there is no cost associated with providing this flow. We recommend this minimum instream flow based upon the environmental benefits discussed further in section 3.3.2.3, *Aquatic Resources*.

Under Forest Service condition no. 18, and recommendations from FWS and Cal Fish & Game, minimum instream flows would be increased to 10 cfs from April 1 through May 15 in designated wet years, based upon snow pack levels, in an effort to provide additional stream flow in Philbrook Creek to increase rainbow trout spawning habitat. We do not support this increase in minimum instream flows during this period because as previously stated, current rainbow trout populations in this reach are viable and providing this additional flow may limit Philbrook reservoir storage, which could affect Project operations and the ability to provide cooler water for lower Butte Creek. Based upon our analysis in section 3.3.2.3, *Aquatic Resources,* increasing minimum instream flows to 10 cfs would also lead to increased water temperatures later in the year at Hendricks diversion dam, and in other downstream areas due to reduced storage within Philbrook reservoir, which would be subjected to increased warming. These increased temperatures would likely negatively affect trout populations within the reservoir, and in downstream reaches. Because releases from Philbrook Dam can be used for downstream generation, this increase in minimum instream flows would not reduce project generation. Therefore, we conclude there is no cost associated with providing this increased flow; however, based upon the potential negative environmental impacts of reducing storage

within Philbrook reservoir, we conclude that this minimum instream flow is not warranted.

We also do not recommend FWS's recommendation that when the inflow into Philbrook reservoir is less than 1 cfs, a minimum instream flow of at least 1 cfs would be discharged into Philbrook Creek, or Forest Service condition no. 18 which specifies that if instantaneous inflows into Philbrook reservoir are less than 0.5 cfs, the mean daily minimum instream flows released to Philbrook Creek shall be 1 cfs. As discussed in section 3.3.2.3, *Aquatic Resources*, currently there are self-sustaining populations of rainbow trout in this reach. Therefore, we conclude that increasing minimum instream flows beyond those currently required in this reach would provide little additional benefit to resident rainbow trout populations and that the minimal benefits that would result are not worth potentially jeopardizing Philbrook reservoir storage and increased water temperatures later in the year. Because releases from Philbrook dam can be used for downstream generation, this increase in minimum instream flows would not reduce project generation. Therefore, we conclude there is no cost associated with providing this increased flow; however, based upon the potential negative environmental impacts of reducing storage within Philbrook reservoir, we conclude that this minimum instream flow is not warranted.

West Branch Feather River-Downstream of Hendricks Diversion dam

As discussed in section 3.3.2.3, *Aquatic Resources*, minimum instream flows downstream of Hendricks diversion dam directly affect not only aquatic habitat and water temperatures in the lower West Branch Feather River, but also habitat conditions and water temperatures in lower Butte Creek, which support populations of federally-listed spring-run Chinook salmon and steelhead. The more water released from Hendricks diversion dam, the less water is available for diversion into Hendricks canal and subsequent generation. Our recommended minimum instream flows described below would provide a balance among generation, increased rainbow trout habitat, and cooler water temperatures downstream of the Hendricks diversion dam, while also ensuring water temperature increases in lower Butte Creek are minimized.

We recommend, consistent with PG&E's proposal and recommendations from the Conservation Groups, the minimum instream flows specified in table 3-16 (in bold) to be released from Hendricks diversion dam in normal water years. Our recommendation is also consistent with Forest Service condition no. 18, and recommendations from FWS and Cal Fish & Game, except from June 1 through August 31 when these agencies specify or recommend a minimum instream flow of 30 cfs, compared to PG&E's proposed, and our recommended 20 cfs. In dry water years we recommend the minimum instream flows specified in table 3-16 (in bold), which are consistent with PG&E's proposal, Forest Service condition no. 18, and recommendations from FWS, Cal Fish & Game, and the Conservation Groups, except from June 1 through August 31 when the

Forest Service specifies a minimum instream flow of 15 cfs from June 1 through February 28/29, and the Conservation Groups recommend a minimum instream flow of 15 cfs from June 1 through October 31, compared to PG&E's proposed, and our recommended 7 cfs. We conclude that the environmental benefits justify these minimum instream flows.

Overall, our recommended minimum instream flows of 7 and 20 cfs in dry and normal water years, respectively, would provide additional habitat for resident rainbow trout in the lower West Branch Feather River compared to existing conditions. We conclude that although the Forest Service specified and agency recommended minimum instream flows would further increase habitat for resident rainbow trout downstream of Hendricks diversion dam, current populations are viable and would be enhanced by our recommended minimum instream flows. Further, removing an additional 10 cfs during normal water years and 8 cfs during dry water years from the Hendricks canal during the June through August period would increase water temperatures in lower Butte Creek and have only slightly greater cooling effects on water temperatures within the lower West Branch Feather River compared to our recommended minimum instream flows. Compared to our recommended minimum instream flows, we estimate that implementing the Forest Service specified, and agency recommended minimum instream flows in the lower West Branch Feather River would reduce average annual project generation by 2,865 MWh, and would reduce the annual net benefit by $250,000. Therefore, we conclude that these minimum instream flows are not warranted due to these negative impacts and higher costs.

We do not recommend the Conservation Groups recommendation to construct and operate a DeSabla forebay temperature reduction facility, with an 80 percent reduction in thermal loading, as discussed below. We conclude that our recommended minimum instream flows at Hendricks diversion dam would only increase the weekly mean of the daily maximum temperature downstream of Centerville powerhouse, during the hottest week of the summer, by 0.12°C in normal years. Whereas the Forest Service specified and agency recommended minimum instream flows would increase water temperatures by 0.38°C.

Additionally, because we are not supporting the agency minimum instream flows at the Hendricks diversion dam, which would result in the higher water temperatures downstream of the Centerville powerhouse, we so no reason to delay the implementation of our recommended minimum instream flows until after the installation of a DeSabla forebay temperature reduction device, discussed below.

Further, the Forest Service and Cal Fish & Game recommend that flows made available as minimum instream flows downstream from the Hendricks diversion dam should be maintained within the West Branch Feather River downstream along the natural stream course to its discharge at the high-water line of Lake Oroville. The

Miocene diversion dam, located approximately 14 miles downstream of the Hendricks diversion dam, is a non-project structure located outside the project boundary, which extends to, but does not include, the Miocene diversion dam. Because this facility is not subject to the terms and conditions of the license, this recommendation is unenforceable and as a result we do not support it.

Upper Butte Creek-Downstream of Butte Creek Diversion dam

We recommend that the minimum instream flows specified in table 3-18 (in bold) be released downstream of the Butte Creek diversion dam in normal and dry water years. Our recommendation is consistent with recommendations from the Forest Service, FWS, and Cal Fish & Game, except in dry water years when these agencies recommend a minimum instream flow of 10 cfs be released from June 1 through February 28/29.

Currently, rainbow trout populations in this reach of upper Butte Creek are viable and self-sustaining under existing minimum instream flow requirements. Because our recommended minimum instream flows would be consistent with existing flows in this reach, except for during March 1 through May 31, as discussed below, we expect that these minimum instream flows would continue to support viable rainbow trout populations. Additionally, our recommendation to increase minimum instream flows from March 1 to May 31 by 14 cfs in normal water years and by 13 cfs in dry water years would further enhance existing habitat conditions for rainbow trout. We conclude that the environmental benefits justify providing these minimum instream flows.

We do not support recommendations from the Forest Service, FWS, and Cal Fish & Game to increase minimum instream flows in this reach by 3 cfs in dry water years from June 1 to February 28/29 to 10 cfs. We find that although this recommendation would further increase rainbow trout habitat in this reach compared to our recommendation and existing conditions, it would have a minimal effect on reducing downstream water temperatures for rainbow trout and only decrease water temperatures for approximately 4 miles downstream of the dam. Further, PG&E's temperature modeling indicates that temperatures in the upper Butte Creek reach under our recommended minimum instream flows would continue to remain within rainbow trout preferred temperatures (13 to 20ºC). Also, any reduction in the quantity of flows diverted into Butte canal would result in greater thermal loading within the canal, potentially increasing water temperatures within DeSabla forebay and putting spring-run Chinook salmon located downstream of Lower Centerville diversion dam at risk. Compared to our recommended minimum instream flows, we estimate that implementing the agency recommended minimum instream flow in upper Butte Creek from June 1 to February 28/29 in dry years would reduce average annual project generation by 353 MWh and would reduce the annual net benefit by $31,000. Therefore, we conclude that this minimum instream flow is not warranted due to the minimal additional environmental benefits and higher costs.

Lower Butte Creek-Downstream of Lower Centerville Diversion dam

As further discussed in section 3.3.2.3, *Aquatic Resources*, water at the Lower Centerville diversion dam can be either discharged downstream into lower Butte Creek as minimum instream flows, or diverted via into the Lower Centerville canal, which flows to Centerville powerhouse, and discharged back into lower Butte Creek, 6.4 miles downstream of the dam. Currently, the majority of ESA-listed spring-run Chinook salmon holding habitat is upstream of the Centerville powerhouse in lower Butte Creek, with the majority of spawning habitat located downstream of the Centerville powerhouse. Studies have shown that salmon holding in the reach upstream of Centerville powerhouse have saturated the available spawning habitat, creating conditions in which redd superimposition occurs, thus increasing fry mortality.

The Project operates such that cooler water is diverted from the West Branch Feather River basin into lower Butte Creek, which creates a net benefit to spring-run Chinook salmon in lower Butte Creek by decreasing instream water temperatures in the summer months. Without current Project operations providing this cold water benefit, natural water temperatures within lower Butte Creek would likely exceed those needed to support the number of salmon which now return to Butte Creek. Project operations have resulted in returns in excess of historical numbers and have therefore resulted in a lack of suitable spawning habitat due to the large number of salmon returns. However, increasing minimum instream flows downstream of the Lower Centerville diversion from mid-September through February would likely provide additional spawning habitat for these salmon.

To increase the amount of spawning habitat, we recommend that in normal and dry water years, that PG&E release the minimum instream flows specified in table 3-20 (in bold) from Lower Centerville diversion dam. We conclude that, in the reach above Centerville powerhouse, a minimum instream flow of 75 cfs in normal years provide approximately 63 percent of the WUA for spring-run Chinook salmon spawning compared to the 23 percent that currently exists, and that in dry years a minimum instream flow of 60 cfs would provide 70 percent of the WUA for spring-run Chinook salmon, compared to the 39 percent that currently exists. Therefore, we conclude that our recommended flows would provide additional spawning habitat for ESA-listed spring-run Chinook salmon below Lower Centerville diversion dam, help to alleviate redd-superimposition in this reach, and would also provide additional spawning habitat for ESA-listed steelhead. We conclude that the environmental benefits justify providing these minimum instream flows.

We do not recommend the recommendations from the Forest Service, FWS, NMFS, and Cal Fish & Game to increase minimum instream flows in this reach to 100 cfs during normal water years, and 75 cfs during dry water years. Compared to our

recommended minimum instream flows, these recommendations would only result in an additional 7 to 9 percent WUA for spring-run Chinook spawning habitat based on a normal and dry year, respectively. Compared to our recommended minimum instream flows, we estimate the total annual cost of implementing the agency recommended minimum instream flows in lower Butte Creek would reduce average annual project generation by 2,256 MWh and would reduce the annual net benefit by approximately $197,000. Therefore, we conclude that the minor additional increase in spring-run Chinook salmon spawning habitat does not justify these additional costs.

Inskip, Clear, Kelsey, Long Ravine, Cunningham, and Little West Fork Creeks

As discussed in section 3.3.2.3, *Aquatic Resources*, current trout populations both above and below these feeder creek diversion dams are self-sustaining and existing minimum instream flows are providing good water quality conditions to support resident aquatic organisms. Therefore, we recommend PG&E's proposed minimum instream flows for each of these feeder creeks. Our recommended minimum instream flows for these feeder creeks would be consistent with existing license requirements, which are shown in table 3-3.

Overall, flows specified by the Forest Service condition no. 18 and recommended by FWS, Cal Fish & Game for these feeder creeks are increased compared to PG&E's proposed, and our recommended minimum instream flows. Although these increased minimum instream flows would likely provide additional habitat for aquatic organisms compared to existing conditions, as previously stated, the available habitat downstream of these diversions is currently supporting self-sustaining populations of aquatic organisms. We estimate the added annual cost of increasing the minimum instream flows as specified and recommended by the Forest Service and FWS to cost $133,000 more than our recommended minimum instream flows and would result in 716 MWh of lost generation. We estimate Cal Fish & Game's recommended minimum instream flows to cost $62,000 more than our recommended minimum instream flows and would result in 358 MWh of lost generation. Therefore, we conclude that the minor additional benefits these flows would provide do no justify this additional cost.

Helltown Ravine

Although Upper Centerville canal has not been used for Project operations for many years, PG&E discharges approximately 3 cfs into this canal for local water users. As discussed in section 3.3.2.3, *Aquatic Resources*, any unused water from Upper Centerville canal travels down Helltown Ravine until it is intercepted by the Helltown diversion dam and flows into Lower Centerville canal where it is picked up for generation at Centerville powerhouse. As a result, there is the potential that the bypass reach downstream of the diversion dam could go dry, reducing aquatic habitat for resident trout, foothill yellow-legged frogs, and other aquatic organisms. Therefore, we

recommend, consistent with recommendations from the Forest Service and FWS, that PG&E release a minimum instream flow of 1 cfs, or inflow, during normal water years, and a minimum instream flow of 0.5 cfs, or inflow, during dry water years. This minimum instream flow would likely provide additional habitat for resident aquatic organisms compared to existing conditions when all flow in Helltown Ravine can potentially be diverted into lower Centerville canal. We estimate that providing this minimum instream flow to Helltown Ravine would reduce the average annual project generation by 217 MWh and that the total annual cost of implementing this minimum instream flow would be approximately, $20,800. We conclude that the environmental benefits justify this cost.

The Conservation Groups recommend that PG&E provide a minimum bypass flow of 1 cfs in Helltown Ravine downstream of the diversion dam. Although we support the Conservation Groups recommended minimum instream flow of 1 cfs during normal water years, as discussed above, we do not recommend providing a minimum instream flow of 1 cfs during dry water years. It is likely the Conservation Groups recommended minimum instream flow during dry water years would provide additional habitat for aquatic resources in this reach, compared to our recommendation. However, we estimate that the cost of providing this additional 0.5 cfs during dry years would cost approximately, $10,000 less in that year and providing the 0.5 cfs minimum flow in dry years would more closely mimic the natural hydrograph. Therefore, we conclude that the environmental benefits of providing a 1 cfs minimum instream flow to Helltown Ravine in dry years doe not justify the additional cost of $10,000.

Removal of Feeder diversion dams

PG&E proposes and the agencies support the removal of five feeder diversions because they have been discontinued for more than 10 years and are no longer serving a project purpose. Although no specific fish surveys were conducted in these feeder tributaries, the habitat was surveyed as part of Study 6.3.3-11, *Canal Feeder Stream Study Plan.* As a result of the habitat surveys conducted we find that each of these tributaries is likely to support fish populations above and below the diversion structures and that removing the five feeder diversion as proposed, would reestablish the habitat connectivity within the tributary streams and with Butte Creek. Because these facilities are no longer used, coupled with the environmental benefits, we find removing these feeder diversions is warranted and that the estimated annualized cost of $44,500 is justified. We therefore recommend that PG&E file a plan that provides a schedule for the removal of the diversions and provides detailed measures necessary for protection of environmental resources that would be implemented during the diversion removals. We further recommend, consistent with recommendations from the Forest Service and FWS, that PG&E develop the plan in consultation with the resource agencies.

As described in section 3.3.2.2, *Aquatic Resources*, the Forest Service and FWS have recommended minimum instream flows downstream of the Little Butte Creek diversion dam and therefore are not recommending this diversion be included in their recommended Feeder Creek Diversion Facility Removal Plan. Because this diversion dam, like the others discussed above, has not been in use for many years, PG&E is proposing that it be removed. Therefore, we recommend that the Little Butte Creek diversion dam also be included in the Feeder Creek Diversion Facility Removal Plan.

Lower Centerville diversion dam Removal

Removal of the Lower Centerville diversion dam, as recommended by the Conservation Groups and the CSSA, would essentially decommission the Centerville development and eliminate the need for PG&E's proposed Project Canal Fish Rescue Plan or a fish screen at the entrance to the Lower Centerville canal. Removing this structure would open up a small amount of fish habitat below a large 35 foot high natural barrier to upstream fish migration, that exist just 0.58-mile upstream of the diversion dam. However, it would also prevent the delivery of cold water to lower Butte Creek below the Centerville powerhouse, as discussed above and in section 3.3.2 *Aquatic Resources.*

As discussed above, if all the flow from DeSabla powerhouse remained in the channel, as would occur if the Lower Centerville diversion dam were to be removed or the Centerville powerhouse were decommissioned, the mean temperatures in the stream reach between the diversion dam and the Centerville powerhouse would be cooler. However, water temperatures in the stream reach downstream of the Centerville powerhouse, would increase by 0.67 ºC in a normal year and 1ºC in a dry year. This warmer water below Centerville powerhouse would place the spring-run Chinook, holding downstream of the Centerville powerhouse, at greater risk of temperature induced stress and mortality and it is likely that these fish would move upstream above Centerville powerhouse in search of the colder water, exacerbating the already crowded conditions.[59] As a result, limited environmental benefit of decommissioning of the Centerville development does not justify the annualized cost of $136,900.

Ramping Rates

The Forest Service specifies in condition no. 18 and FWS recommends that information gathered from their recommended foothill yellow-legged frog monitoring, as

[59] Cal Fish & Game studies conducted between 2001 and 2007 found that the population of adult spring-run Chinook in the Upper Centerville Reach exceeded the available spawning habitat, while during this same period, spawning habitat downstream of Centerville Powerhouse was underutilized (Source: PG&E's reply comments filed with the Commission on August 18, 2008.

discussed below, would be reviewed by PG&E, the Forest Service, and the resource agencies to assess if their ramping rate criteria is protective of foothill yellow-legged frog populations. The Forest Service also specifies in condition no. 18 and FWS recommends that ramping rates be developed to meet Forest Service and FWS targets for water velocity and stage changes to protect foothill yellow-legged frog egg masses, tadpoles, and juveniles. The Forest Service and FWS developed these targets based on empirical data presented in Kupferberg et al. (2008) and Lind and Yarnell (2008). These targets would limit water velocities downstream of the Hendricks diversion dam in the West Branch Feather River during: (1) down-ramping at egg mass sites to no greater than 0.2 feet per second per hour with water levels dropping to the extent that not more than 20 percent of egg masses are de-watered: (2) up-ramping so that velocity would not change more than 0.2 feet per second per hour and would not exceed 0.8 feet per second at the most sensitive egg mass site; and (3) up- and down-ramping to no more than 0.4 feet per second per hour and no more than 1.0 feet per second at the site when tadpoles or juveniles are present. The Forest Service further specifies and FWS further recommends that if foothill yellow-legged frog monitoring identifies the need for modifications to the ramping rate criteria above, PG&E would consult with the Forest Service and the resource agencies to establish more appropriate ramping rates. The Forest Service and FWS also recommend this methodology be applied to ramping rates in upper Butte Creek, downstream of the Butte Creek diversion dam, and in lower Butte Creek, downstream of Lower Centerville diversion dam, which would also be consistent with the ramping rates recommended by NMFS.

PG&E filed an alternative condition to address ramping rates downstream of the Hendricks diversion dam, which includes scheduling outages as early in the year as possible to avoid the foothill yellow-legged frog breeding and rearing season and avoiding changes in releases at the diversion dam during critical times in the life history of foothill yellow-legged frog . This alternative condition also recommends that: (1) while taking the canal on- or off-line, up- and down-ramping will occur slowly in order to avoid the potential for dislodging foothill yellow-legged frog egg masses, or flushing or stranding tadpoles, as well as the potential for other ecological impacts; (2) should an unscheduled emergency outage occur during foothill yellow-legged frog tadpole rearing, down-ramping, bringing the canal back online, will occur slowly in order to allow tadpoles the opportunity to move with the waterline and avoid stranding; and (3) up-ramping and down-ramping rates under the above conditions shall be limited to 0.1 foot per hour from April through October, and 0.2 foot per hour from November through March to protect the sensitive life-stages of this species.

Our recommended minimum instream flows, as previously discussed, are designed to improve resident trout and spring-run Chinook salmon habitat, while concurrently reducing water temperatures for spring-run Chinook salmon during the summer months. Generally, the flows proposed by PG&E, and supported by staff, are not as high as the Forest Service specified, and agency recommended flows and therefore would have less

potential to disrupt foothill yellow-legged frog habitat and breeding patterns. However, proposed flow increases would alter the existing hydrograph in stream channels downstream from the Project facilities. Low flows reduce available habitat and can increase mortality of egg masses and tadpoles stranded in dry areas, while high flows and rapid changes in flow can wash egg masses, tadpoles, and adults downstream to unsuitable habitat.

We support PG&E's proposal to schedule canal outages as early in the year as possible to avoid the foothill yellow-legged frog breeding and rearing season and to avoid changes in releases at the diversion during critical times in the life history of foothill yellow-legged frog . This would reduce the potential displacement of egg masses, tadpoles, and adults to unsuitable habitat. However, we further recommend that these measures also be applied to the Butte and the Lower Centerville canals to protect foothill yellow-legged frog and aquatic resources downstream of these diversion dams in Butte Creek.

Controlling the rate of flow and stage changes during critical time periods would limit the potential for mortality of early life stages of foothill yellow-legged frog s. As discussed in section 3.3.2.3, *Aquatic Resources*, we conclude that the Forest Service specified and FWS recommended ramping rates would be more protective of foothill yellow-legged frog populations compared to PG&E's alternative condition and would allow for more of an adaptive management approach. This approach would allow for refining ramping rates, if needed, to better protect foothill yellow-legged frog populations and other aquatic organisms. Also, consistent with recommendations from the Forest Service, FWS, and NFMS, we also recommend these ramping rates and this methodology be applied downstream of Butte and Lower Centerville diversion dams.

We further recommend that PG&E develop in consultation with the Forest Service, Cal Fish & Game, NMFS, and FWS, develop for Commission approval a Ramping Rate Plan. This plan should address methodologies for determining the relationship between Project operations at the diversion dams and how downstream water velocities at the specified locations are affected, and how compliance of these ramping rates will be achieved. We estimate the annualized cost of developing this plan to be $8,000, and conclude that the environmental benefits justify this cost.

Drought Conditions

Drought conditions in the Project area have the potential to put reservoir storage at risk, which in turn could affect Project operations and flow releases from Round Valley and Philbrook reservoirs. Therefore, to adequately manage water in these two Project reservoirs during drought conditions, we recommend, consistent with Forest Service condition no. 18, and recommendations from FWS, NMFS, and Cal Fish & Game, that PG&E provide notification to the resource agencies and the Commission of potential

drought conditions as soon as possible. We further recommend, consistent with Forest Service condition, and recommendations from FWS, NMFS, and Cal Fish & Game, that upon notification, PG&E consult with these agencies to evaluate potential changes to Project operations that may be necessary to protect aquatic resources prior to prolonged drought conditions and the onset of extreme summer temperatures. Such consultation would likely involve discussing how best to manage reduced water quantities in the Project reservoirs and flow releases from these reservoirs as they pertain to protecting aquatic resources in the project area, including spring-run Chinook salmon in lower Butte Creek. Any proposals for modified Project operations would need to be filed with the Commission for approval, prior to implementation. We estimate the total annual cost of this notification and drought consultation would be $500 and conclude that the environmental benefits justify this cost.

For the reasons described above, we also recommend PG&E's proposal in its alternative condition to notify the Forest Service and other interested agencies of drought concerns by March 15 of the second or subsequent dry water year and that consultation, as described above, should occur by May 15 of the same year. Providing notification and consulting by May 15 would ensure the California Department of Water Resource's (Water Resources) Bulletin 120 April through July forecasts are available since PG&E states that they are not typically available until about the 8th day of March and May.

We believe PG&E alternative condition is consistent with the intent of the Forest Service's condition. However, PG&E's alternative would also provide for better compliance monitoring with this measure. Additionally, PG&E's alternative would also allow consultation in May to include the results of Water Resources' final April through July Forecast for the year. Therefore, we do not recommend the agencies' recommended time frame for conducting this consultation.

Stream Flow Monitoring

As discussed in section 3.3.2.1, *Aquatic Resources*, cool water is released from Philbrook reservoir as high temperatures occur during the summer months for the benefit of ESA-listed species in lower Butte Creek. The storage and release of water from Philbrook reservoir is vital to manipulating water temperatures in lower Butte Creek. Non-spill releases are made from the main dam on Philbrook reservoir via a low-level outlet directly to Philbrook Creek. In addition, flows from two spillways on Philbrook reservoir join Philbrook Creek approximately 1000 feet downstream of the main dam. Currently, PG&E's stream flow gage on Philbrook Creek only measures flow releases from the low-level outlet and does not capture any flow over the spillways. In addition, there is no record of the duration and magnitude of spill events at Philbrook reservoir.

While PG&E does not support the installation of a real-time flow gage in Philbrook Creek downstream of the confluence of both the low level release and the spill

channel, this gage would allow for all flows and river stage in Philbrook Creek to be monitored. Accurately monitoring flows in this reach would better allow for assessing how project operations and flows in Philbrook Creek affect overall water temperatures in lower Butte Creek and the West Branch Feather River. Therefore, we recommend, consistent with Forest Service condition no. 18, and recommendations from NMFS and FWS, that PG&E consult with USGS on the installation of a new gaging station that has real-time capability of reading river stage and minimum stream flow, downstream of the confluence of the low level release and the spill channel in Philbrook Creek. We estimate the total annual cost of constructing, installing, and maintaining this gage in Philbrook Creek would be $17,000 and conclude that the environmental benefits justify this cost.

We also recommend, consistent with Forest Service condition no. 18, and recommendations from FWS and NMFS, that PG&E, in consultation with the USGS, operate and maintain the existing gaging stations on the West Branch Feather River downstream of Round Valley reservoir and downstream of the Hendricks diversion dam. Like Philbrook reservoir, water storage and subsequent release from Round Valley reservoir plays an important role in project operations and minimizing the negative effects of high water temperatures on spring-run Chinook salmon in lower Butte Creek. Accurate monitoring of stream flows in the upper West Branch Feather River would better allow for determining how releases from Round Valley reservoir affect overall stream temperatures and Project operations in both the West Branch Feather River and lower Butte Creek. Also, accurately monitoring flows downstream of the Hendricks diversion dam would allow for the Commission to document compliance with any required minimum instream flows in the lower West Branch Feather River. We estimate the total annual cost of operating and maintaining these gages in the West Branch Feather River would be $6,600 and conclude that the environmental benefits justify this cost.

Feeder Creek Stream Flow Monitoring

Currently, the only Project feeder creek that contains a stream flow gage is Long Ravine Creek, which records minimum instream flows along with any spill over the diversion dam. FWS and NMFS recommend that new gaging stations be installed downstream of eight feeder creeks (Inskip, Kelsey, Clear, Helltown Ravine, Long Ravine, Cunningham Ravine, Little West Fork, and Little Butte creeks), and the Forest Service specifies in condition 18 that PG&E devise a measurement procedure in consultation with the Forest Service and other resource agencies to ensure compliance with minimum instream flows requirements at Long Ravine, Cunningham and Little West Fork creeks downstream of these diversion dams. The Forest Service also recommends that new gaging stations be installed downstream of Inskip, Kelsey, Clear, Helltown Ravine, and Little Butte creeks.

Currently, minimum instream flows are made from the project feeder diversions via 3- to 4-inch-in-diameter pipes at the base of the diversion dams with roving operators

used to monitor and maintain these diversions on a weekly basis. As discussed in section 3.3.2.1, *Aquatic Resources*, the Project feeder creeks are in high gradient areas, which we find can make the installation of stream gages difficult. Further, calibrating stream gages in such environments would also be difficult given the rough channel characteristics and topography, which may result in large amounts of uncertainty, possibly making accurate stream flow estimates unlikely. Additionally, as discussed above, PG&E proposes to remove the diversion dam on Little Butte Creek since it has not been in use for many years.

As a result, we do not recommend Forest Service condition no. 18 and Forest Service, NMFS, and FWS recommendations, to install stream gaging stations on Inskip, Kelsey, Helltown Ravine, Clear, Long Ravine, Cunningham Ravine, Little West Fork, or Little Butte creeks. We estimate the total annual cost of constructing, installing, and maintaining these eight stream flow gages would be $94,860 and conclude that the environmental benefits do not justify this cost. In lieu of installing stream gages, we recommend that PG&E continue to utilize roving operators to monitor and maintain these feeder diversions on a weekly basis. This would ensure any required minimum instream flow releases would continue to be made and that the pipelines supplying minimum instream flows do not become blocked with debris. We estimate the total annual cost of utilizing a roving operator to maintain these facilities would be $20,000 and conclude that the environmental benefits do justify this cost.

Reservoir Levels

As part of NMFS recommended Long-term Operations Plan, as further discussed below, NMFS recommends that PG&E install real-time water temperature, reservoir elevation and flow gages in Round Valley and Philbrook reservoirs. Currently, reservoir elevation data recorded for Round Valley and Philbrook reservoirs is synoptic and collected at weekly intervals when weather conditions allow access to these reservoirs. As discussed in section 3.3.2.2, *Aquatic Resources*, Round Valley reservoir is completely drained in typically one month's time once releases are begun from the dam in late-spring to early-summer. Releases from the dam are begun as soon as space is available in the Hendricks canal and the low level gate at Round Valley dam which supplies these flows is left fully open until the following spring. Because this reservoir is dry for much of the year and there is little to no Project-related reservoir level management once releases begin, we do not recommend installing a real-time water temperature, reservoir elevation or flow gage within this reservoir. We estimate that total annual cost of this equipment in Round Valley reservoir would be $17,000 and conclude that the benefits do not justify this cost.

Similarly, NMFS also recommends that PG&E install real-time water temperature, reservoir elevation and flow gages in Philbrook reservoir. Water releases and storage within Philbrook reservoir are monitored and adaptively managed to a greater extent by

PG&E, compared to Round Valley reservoir. As discussed in section 3.3.2.2, *Aquatic Resources*, flows from Philbrook reservoir are increased and decreased as temperatures in the Project area dictate, for the benefit of ESA-listed species in lower Butte Creek. Monitoring water temperatures within Philbrook reservoir, and reservoir levels on a real-time basis would provide additional data compared to what is currently collected on a weekly basis, and would likely assist in determining any potential modifications to Project operations that would further benefit downstream aquatic resources. However, with our recommended real-time stream flow gage in Philbrook Creek, as previously discussed, we conclude an additional flow gage as recommended by NMFS for within Philbrook reservoir is unnecessary. Therefore, we recommend that PG&E consult with USGS on the construction, operation, and maintenance of a real-time temperature and reservoir elevation gage within Philbrook reservoir. PG&E shall also consult with the Forest Service, NMFS, FWS, and Cal Fish & Game on the specific locations of these gages. We estimate that total cost of this temperature and reservoir level gage would be $17,000 and conclude that the benefits do justify this cost.

We do not support NMFS recommendation for PG&E to install remote operating equipment at the Round Valley or Philbrook reservoirs. Installation of real-time water temperature and reservoir level gages in Philbrook reservoir, as well as modifying, constructing and operating additional stream flow gages in important Project bypass reaches, as previously describe, would better enable the Project to operate based on changes in environmental conditions for the benefit of aquatic resources compared to existing conditions. This improved monitoring would allow for changes in Project operations to occur more quickly, if needed; however, there is little evidence to support the need for remote operation of these two Project reservoirs. We estimate that total cost of installing this remote operating equipment would be $20,500 and conclude that the benefits do not justify this cost.

DeSabla Forebay Water Temperature Improvement Plan

As discussed in section 3.3.2, *Aquatic Resources*, DeSabla forebay plays an integral role in how water temperatures downstream of DeSabla powerhouse in lower Butte Creek are affected as a result of thermal loading that occurs within the forebay. PG&E's relicensing studies indicate that under existing Project operations water temperatures increase 0.7 to 2°C as water moves through DeSabla forebay, depending upon residence time, and that during the warmest months (July through August) water temperatures increase by approximately 1.1°C while passing through the DeSabla forebay.

Because water temperatures are critical to the health and survival of aquatic species downstream in lower Butte Creek, including ESA-listed spring-run Chinook salmon and steelhead, we recommend PG&E's proposal to develop and implement a DeSabla Forebay Water Temperature Improvement Plan, consistent with

recommendations from FWS, NMFS, Forest Service, Cal Fish & Game, and the Conservation Groups. PG&E should consult with the aforementioned agencies and the Water Board in the development of this plan. At a minimum this plan should include a preliminary design of the proposed structure that will more quickly deliver water from the Butte canal to the DeSabla powerhouse intake, reducing the waters residence time and therefore thermal loading effect of the DeSabla forebay. The plan should include a schedule for final design, permitting, and construction of the new facility. This plan shall also ensure that the objective of this temperature reduction facility is to reduce thermal loading by 50 percent, as measured by the change in temperature between Butte canal at its discharge point into DeSabla forebay and DeSabla powerhouse.

Further, consistent with Cal Fish & Game's recommendation, we recommend that this plan include a provision for temperature monitoring in Butte Creek at the following locations: Butte Creek upstream of DeSabla powerhouse, Butte Creek at Lower Centerville diversion dam, Butte Creek at Pool 4, Butte Creek upstream of CVPH, and Butte Creek downstream of CVPH, for a period of five years, to document the effectiveness of this temperature reduction device on downstream water temperatures. A report on the results of this temperature monitoring should be submitted on an annual basis to FWS, NMFS, Forest Service, Cal Fish & Game, the Water Board, the Conservation Groups, and the Commission. This plan should be submitted to the Commission for approval. We estimate the total annual cost of developing and implementing this plan would be $412,300 and conclude that the environmental benefits justify the cost.

We do not support recommendations by FWS, NMFS, Forest Service, Cal Fish & Game, and the Conservation Groups that this plan address reducing thermal loading within DeSabla forebay by 80 percent or greater. Without taking into account minimum instream flows in the lower West Branch Feather River, during normal and dry water years, reducing thermal loading within DeSabla forebay by 80 percent would further decrease the weekly mean of the daily maximum temperature during the hottest week of the summer by approximately 0.23°C and 0.19°C, respectively, in lower Butte Creek. We estimate that the construction of such a facility would cost approximately $201,100 more annually than a facility which reduces thermal loading by 50 percent. Therefore, we conclude that these additional costs do not justify the limited additional temperature reductions that would result in lower Butte Creek by reducing thermal loading by 80 percent.

Fish Entrainment and Passage

Relicensing studies found that fish are entrained in to project canals as a result of project operations. As a result we do not recommend that PG&E conduct an additional entrainment study within the Hendricks canal, as provided for by the Forest Service's recommendation 21. We estimate the annualized cost of conducting this study to be $16,200, and find that implementing the study will not result in new or pertinent information necessary to inform license measures.

Installing fish screens at the Hendricks Head dam, lower Centerville diversion, and Butte Creek dam as recommended by the parties identified in table 3-28, would have an annualized cost of approximately 2.9 million dollars. We find it likely that providing these fish screens will largely prevent fish from becoming entrained into the project's canal system and project intakes, and reduce the project's affects of trout populations in affected stream reaches. However, as discussed in section 3.3.2, the trout populations above and below these project facilities are viable and generally healthy. Therefore, we find that the environmental benefits of providing fish screens at these facilities do not warrant the cost. Alternatively, PG&E's proposal to conduct fish rescues from project canals would adequately limit the projects effects on the fish populations at a reasonable annualized cost of approximately $42,900 and that the benefits to the fishery resources warrants this cost.

The installation of a fish ladder on the Hendricks Head dam would have an annualized cost of approximately $287,400, allow for the natural behavioral movements of the native trout population for foraging, rearing and spawning between the downstream Miocene diversion (non-project facility) and the headwaters of the West Brach Feather River. However, because resident trout populations do not rely on spawning migrations to fulfill their life histories and the trout populations both above and below Hendricks Head dam is viable and generally healthy. We find that the environmental benefits of this measure do not justify the cost. As a result, we do not recommend the installation of a fish ladder at this facility as suggested by the Cal Fish & Game, FWS, Conservation Groups, and the Forest Service. Additionally, because it is clear that dams and diversions structures block the natural upstream movements of most fish, we do not find that the Forest Service's recommendation 23 to conduct a fish migration study is necessary to confirm this and the annualized cost of $23,200 is not warranted.

Resident Fish Monitoring

We do not support the Forest Service's condition 19 or PG&E's alternative condition to conduct trout population monitoring in the vicinity of the Hendricks Head dam to determine if fish populations above and below the structure are meeting the Forest Service's population goal of 830 fish per acre. As previously mentioned, we find that resident trout populations within project affected stream reaches, both above and below the project diversions are viable and generally healthy and that the estimated annual cost

of $26,200 as required by the Forest Service or $28,000 for PG&E's alternative, to conduct this monitoring is not warranted.

However, recognizing that we are recommending alteration in minimum instream flows below many of the project's diversions, as discussed above, we do recommend that PG&E monitor fish species composition and relative abundance in those project affected stream reaches. We find that PG&E should utilize the same sampling methods and location used during the relicensing surveys. This monitoring effort would help to determine the resident fish population's response to changes in project operations, specifically, alteration in minimum flows provided to project bypass reaches, as discussed in section 3.3.2, *Aquatic Resources*. Our recommendation is largely consistent with the FWS's, Cal Fish & Game's and NMFS's recommendations and the Forest Service's condition 20.

However, the FWS's, Cal Fish & Game's and NMFS's recommendations and the Forest Service's condition 20, would require the development and implementation of a plan to monitor of resident fish populations in project affected stream reaches within Butte Creek, and the West Branch Feather River that would occur for the duration of the license term. The Forest Service condition 20 for resident fish monitoring specifies that surveys would be conducted in two successive years, beginning in the fifth full year after implementation of the minimum instream flows required by its condition 18 and be conducted in years 5, 6, 11, 12, 17, 18, 23, 24, 29, and every five years thereafter for the life of the license after the condition 18 stream flows have been implemented.[60]

Conducting the resident fish monitoring within the first five years of license issuance would capture the resident fish population's response to changes in minimum flows while in a state of flux and would serve little value. Therefore, we do not support the FWS's recommendation to begin the resident fish population monitoring the first year of license issuance. We do, however, recommend that monitoring be conducted on the frequency prescribed by the Forest Service, which will begin monitoring in the fifth year after the changes in project operations have been made, providing the fishery an opportunity to respond to those changes.

Given our finding above, we do not recommend that the monitoring plan be developed within 6 months of license issuance as recommended by the Cal Fish & Game and find that 1 year from license issuance as recommended by the Forest Service is appropriate.

Additionally, while agree with the necessity for monitoring project affected stream reaches, and support the Forest Service's specified monitoring frequency, we find that

[60] Pursuant to the Forest Service's condition, scheduled sampling would not occur during a wet water year and would be postponed until the following normal or dry water year type.

monitoring the resident fish populations for the duration of the license term as specified by the resource agencies is excessive. As stated above, any response the fishery may exhibit as a result of a change in project operations should be captured during the next monitoring cycle, 5 years following the change in operations. Therefore, recognizing the adaptive management approach to project operations, as discussed below, we recommend that the monitoring of the resident fish population be discontinued following the next monitoring cycle, 5 years following the last change in minimum instream flows. For example if changes to minimum instream flows continue to be modified for the duration of the license, monitoring the fisheries response would also continue for that duration; however, if data from the first monitoring cycle in years 5 and 6, do not support a change to the minimum instream flows, then no further monitoring would be necessary.

Regarding the deletion of site 43.6 by PG&E in its alternative condition, we find that because Round Valley reservoir is typically drained each year, and the watershed upstream of the reservoir typically goes dry during the summer and typically is not flowing during the specified time of the survey,[61] surveying the fishery at this location would serve no purpose, unless changes in project operation (as a result of the adaptive management approach) would result in a minimum instream flow being provided to this reach during the monitoring period. Therefore, we recommend that site 43.6 be removed from the resident fish monitoring plan.

Table 5-2. PG&E's Alternative monitoring sites to Forest Service 4(e) condition 20 fish monitoring sites.

Fish Monitoring Sites	
Site No.	Site Description
F-2	~~West Branch Feather River~~ *Philbrook Creek* Downstream of Philbrook Reservoir
15.1	West Branch Feather River ~~Downstream~~ *Upstream* of Rattlesnake Creek
21.2	West Branch Feather River Downstream of Fall Creek
35.6	West Branch Feather River (8 Amphibian sampling site)
41.1	West Branch Feather River Downstream of Coon Hollow Creek
~~43.6~~	~~West Branch Feather River Downstream of Round Valley Reservoir~~

DeSabla Forebay and Philbrook Reservoir are stocked by the Cal Fish & Game and managed as put-and-take fisheries; Round Valley reservoir is typically emptied by late summer. In its reply comments, PG&E contends that monitoring the fishery in these project impoundments, as recommended by the FWS in its 10(j) recommendation 6 and the Forest Service's 10(a) recommendation 6 would not result in added beneficial information.

[61] *See* Study Report 6.3.3-4, *Characterization of Fish Population in Project Reservoirs and Project-Affected Stream Reaches.*

We agree with PG&E, monitoring of the put-and-take fisheries within DeSabla Forebay and Philbrook Reservoir would serve little purpose and any population data gathered would be largely reflective of the put-and-take fishery (e.g. numbers of fish stocked and angling pressure). Therefore, we do not recommend that PG&E monitor the fish populations in Philbrook reservoir or DeSabla Forebay. Additionally, because Round Valley reservoir is typically drained each year, surveying Round Valley reservoir for fish would serve no purpose.

However, we also recognize that alterations to the DeSabla forebay resulting from the installation of a water temperature reduction facility, as discussed above, could affect the recreational fishery there. As a result, and as discussed below, in lieu of direct fish population monitoring, we recommend that PG&E conduct creel surveys at the DeSabla Forebay to monitor the effects of the water temperature reduction facility on the put-and-take recreational fishery within DeSabla Forebay. We recommend that the information gathered be utilized during the development and/or amendments to our recommended fish stocking plan, as discussed below.

Anadromous Fish Monitoring

We find that developing and implementing a plan to annually monitor federally-listed anadromous Chinook salmon and steelhead trout and their habitats in Butte Creek as recommended by the NMFS and the FWS in their 10(j) recommendation 5(A) and 6(A) respectively, the Forest Service in its 10(a) recommendation 6(A), and the Cal Fish & Game, and proposed by PG&E is warranted. Monitoring efforts would include annual snorkel surveys to monitor adult distribution and abundance, pre-spawn mortality surveys, and carcass surveys. The plan would also provide for the consideration of juvenile emergence and outmigration monitoring in extreme dry years. The plan would also consider modifications to facility operations and maintenance necessary to avoid, minimize or improve project related impacts to Chinook salmon and steelhead and would be used to inform the decision making processes to be laid out by the long-term operations plan discussed below. Implementation of this annual monitoring at an estimated annual cost of $139,700, would provide information to identify any changes in that would necessitate changes in project structures or operations necessary for continued protection of federally listed Chinook salmon and steelhead. Given the federally listed status of these species, we find that the environmental benefits of this measure warrant the cost.

Cal Fish & Game's 10(j) recommendation 6 would also include annual monitoring of movement patterns of adult Chinook salmon in response to any flow changes, and the monitoring of Chinook holding habitat and spawning gravels. PG&E does not commit to monitoring these additional measures, stating that they need further clarification on these monitoring recommendations. We find that monitoring the response of adult Chinook

and steelhead, and their habitats as a result of a change in project operation is prudent. Alteration in project flows may change the value and/or location of holding and spawning habitats and tracking these changes is warranted. However, we do not find that this monitoring needs to be done on an annual basis. Alternatively, this monitoring should be restricted to the first two years following a change in project operations that may influence the anadromous reach of Butte Creek. Two years should provide an adequate time for the habitat to respond, particularly the redistribution of spawning gravels, and to evaluate a change in behavioral patterns of returning adult Chinook salmon and steelhead. Given the federally listed status of these species, we find that the environmental benefits of this measure warrant the estimated annualized cost of $3,400.

The Conservation Groups recommend installation of a removable weir to limit upstream migration of Chinook salmon to enable PG&E's monitoring of Chinook salmon migration, holding, and spawning, and that the monitoring would then be used to set a default protocol for the weir's installation and removal, for the better management of Chinook salmon habitat and spawning. To address concern for the effects of the PG&E DeSabla-Centerville project on the survival Chinook salmon, Cal Fish & Game constructed a removable fish barrier dam above the Centerville powerhouse to confine all Chinook salmon to the reach below the powerhouse. This action reduced the quantity of holding and spawning habitat for the salmon, but limited their exposure to low flow conditions and high water temperatures. The barrier dam was removed in the 1980s. Since then anadromous fish returns to Butte Creek exceed the historical returns when the barrier dam was in place. As a result, we do not find any reason to install a removable weir or a need to set a protocol for its installation and removal as recommended by the Conservation Groups' 10(a) recommendation 1(c).

Benthic Macroinvertebrate Monitoring

Forest Service condition 20 and NMFS and FWS's 10(j) recommendation 6 and 8, respectively, provide for the development and implementation of a benthic macroinvertebrate monitoring plan. The monitoring plan would include provisions for monitoring species composition and relative abundance to determine trends in the macroinvertebrate community structure. The plan would provide that sampling to be conducted within project bypass reaches in years 1 through 4, and in years 8, 12, 16, 20, 24, and every five years thereafter for the remainder of the license term. PG&E in its reply comments and alternative condition stipulates that surveys should be conducted in years 1, 3, 5, 11, 17, 23, 29 and every five years thereafter through the term of the license in coordination with its alternative condition 20 for the fish population monitoring.

Additionally, PG&E's alternative condition would adopt the bioassessment sampling methodology outlined in the California Statewide Ambient Monitoring Program, which replaced the California Stream Biomass Procedures as California's standard methodology for collecting aquatic macroinvertebrates for bioassessment.

Implementation of the benthic macroinvertebrate monitoring would assist with determining the effectiveness of measures implemented in the new license for enhancing trout populations, and for assessing whether any modifications or additional measures are needed. Sampling benthic macroinvertebrates in the same years as fish population monitoring would help to identify relationships between fish populations and the abundance of the aquatic macroinvertebrate prey base, improving the understanding of the relationship between environmental measures and aquatic productivity.

However, we find that monitoring the benthic macroinvertebrate populations for the duration of the license term as specified by the resource agencies, and PG&E's alternative condition, to be excessive. Therefore, we for the reasons discussed above, we recommend that the benthic macroinvertebrate population monitoring be coordinated with our recommended resident fish monitoring efforts. Additionally, because benthic macroinvertebrates populations should respond to alterations in stream flow more rapidly than the fish populations, we recommend that sampling also be conducted in years 1, 2, 3, and 4, but for a maximum of 2 years per water year type (normal and dry). Follow-up sampling would also occur during the first of the two consecutive years of our recommended resident fish population monitoring, for example in year 5, and then again in year 11 (if an alteration to the minimum instream flow has occurred) and would be coordinated with our recommended resident fish monitoring efforts.

Based on our analysis, we recommend implementation of benthic invertebrate monitoring plan but at our recommended sampling frequency. We find that conducting the benthic macroinvertebrate monitoring in years that the resident fish population monitoring is being conducted will allow for the better correlation of the resulting data for each of the monitoring efforts and would result in better decision making processes. Finally, we recommend that PG&E consult with the agencies in the development of the benthic macroinvertebrate monitoring plan to determine the most appropriate sampling methodology.

Water Temperature Monitoring

Water temperatures in the Project area are of critical importance to a variety of aquatic species in Project-affected stream reaches. Currently, PG&E operates the Project based upon an annual Project Operations and Maintenance Plan that is developed each spring in consultation with resource agencies with the goal of operating the Project such that water temperatures are reduced in lower Butte Creek during the hottest periods of the year for the benefit of ESA-listed spring-run Chinook salmon. Implementing new minimum instream flows in Project-affected stream reaches and by reducing water temperatures in DeSabla forebay through a temperature improvement plan, as discussed below, could separately and cumulatively reduce instream water temperatures in the Project area. Because water temperatures throughout the Project area will likely be

reduced upon implementing staff recommended measures, monitoring water temperatures would better allow for the extent of water temperature reductions to be documented and allow for an understanding of how these new environmental measures and altered project operations will affect instream water temperatures throughout the Butte Creek and West Branch Feather River water basins. Such monitoring could also lead to potential proposed changes in Project operations to better manage the available water supply in the Project reservoirs for the benefit of aquatic species such as spring-run Chinook salmon in lower Butte Creek. Therefore, we recommend that PG&E develop in consultation with the Forest Service, Cal Fish & Game, FWS, NMFS, and the Water Board, and implement, a Water Temperature Monitoring Plan as part of a Long-term Project Operations Plan, as discussed above, consistent with the Forest Service 4(e) condition no. 20 and recommendations by FWS and NMFS.

Also consistent with Forest Service 4(e) condition no. 20, and recommendations from FWS and NMFS, we recommend that this Water Temperature Monitoring Plan provide details for monitoring thalweg water temperature in the Project-affected stream reaches and that this monitoring be based on the previous year's Project Operations Plan's water temperature monitoring sites, methods, and reporting. We also recommend that the results of this monitoring be submitted to the Forest Service, FWS, NFMS, Cal Fish & Game, the Water Board, and the Commission in a technical report for review prior to the annual consultation meeting and that the report include a comparison of the results with those of the previous years and a discussion of the implications of the water temperature effects of diversion to Butte Creek through the Hendricks canal diversion. The plan shall be submitted to the Commission for approval as part of the Long-term Operations Plan. We estimate the total annual cost of this water temperature monitoring plan would be $32,500 and conclude that the environmental benefits justify the cost.

Water Quality Monitoring in Receiving Streams

As discussed in section 3.3.2.3, *Aquatic Resources*, Project canal outages can result in short-term turbidity increases in receiving streams downstream of canal discharge. Increases in turbidity within Project-affected stream reaches could potentially lead to a variety of negative effects on aquatic organisms, including siltation of spawning and rearing habitat for various aquatic species, including ESA-listed spring-run Chinook salmon, steelhead, and foothill yellow-legged frogs. Additionally, PG&E occasionally utilizes herbicides to control vegetation along Project canals, which also has the potential to negatively affect water quality and aquatic resources.

We recommend PG&E's proposal to conduct water quality monitoring in receiving streams prior to, during, and after returning Project canals to service. Consistent with PG&E's proposal, this sampling should occur within 24 hours of taking the canal out of service, once in the middle of the canal outage, and within 24 hours of placing the canal back into service, and include water quality sampling in the receiving

stream at one site upstream and downstream of the location the canal discharges water into the stream. Monitoring parameters should include water temperature, dissolved oxygen, and turbidity sampled at regular intervals. We also recommend PG&E's proposal to sample water quality for herbicides in receiving streams in the event they are utilized to control vegetation, following the monitoring methods described above. This water quality monitoring would allow for water quality exceedances of turbidity or herbicides to be identified and for changes in Project operations or in the application of herbicides to be considered if necessary to protect aquatic resources. Lastly, we also recommend PG&E's proposal to provide a summary of cleaning and maintenance activities as well as the monitoring results to the Water Board, and to file a summary report with the Commission within 30 days of completing the monitoring and any associated laboratory analysis. We estimate the total annual cost of conducting this water quality monitoring would be $22,000 and conclude that the environmental benefits justify the cost.

We do not recommend the Conservation Groups recommendation for PG&E to install turbidity sensors at four locations on Butte Creek between DeSabla powerhouse and immediately downstream of Centerville powerhouse. We conclude that our recommendation for PG&E to conduct turbidity monitoring in receiving streams prior to, during, and after canal outages, as described above, would allow for any increases in turbidity related to Project operations to be identified. Installing sensors in Butte Creek would allow for more turbidity data to be collected; however, it may be difficult to differentiate between increases in turbidity levels associated with natural conditions (i.e., rainfall) or Project-related increases. Also, we estimate the total annual cost of installing and maintaining these turbidity sensors would be $8,420 and conclude that the environmental benefits do not justify the additional cost.

Annual Consultation, Long-Term Operations, and Adaptive Management

Annual Consultation Meeting

The Forest Service's 4(e) condition 1 requires PG&E to annually meet with the Forest Service to consult on measures needed to ensure protection and utilization of the National Forest resources affected by the project. As required by the Forest Service, consultation would include but not be limited to:

- A status report regarding implementation of license conditions;
- Results of any monitoring studies performed over the previous year in formats agreed to by the Forest Service and South Feather during development of study plans;
- Review of any non-routine maintenance;
- Discussion of any foreseeable changes to project facilities or features;
- Discussion of any necessary revisions or modifications to plans approved

- as part of this license;
- Discussion of needed protection measures for species newly listed as
- threatened, endangered, or sensitive or, changes to existing management
- plans that may no longer be warranted due to delisting of species or, to
- incorporate new knowledge about a species requiring protection; and
- Discussion of elements of current year maintenance plans, such as for road maintenance.
- PG&E would keep a record of the meeting, which would include any recommendations made by the Forest Service for the protection of National Forest lands and resources. PG&E would file the meeting record, if requested, with the Commission no later than 60 days following the meeting. A copy of the certified record for the previous water year regarding instream flow, monitoring reports, and other pertinent records would be provided to the Forest Service at least 10 days prior to the meeting date, unless otherwise agreed. Copies of other reports related to project safety and non-compliance would be submitted to the Forest Service concurrently with submittal to the Commission. These would include, but are not limited to: any non-compliance report filed by PG&E, geologic or seismic reports, and structural safety reports for facilities located on or affecting Forest Service lands. Subject to any restrictions contained in any agreement with PG&E, the Forest Service reserves the right, after notice and opportunity for comment, to require changes in the project and its operation through revision of the Section 4(e) conditions to accomplish protection and utilization of National Forest lands and resources.

Long-term Operations Plan

PG&E proposes to develop in consultation with NMFS, Cal Fish & Game, and FWS, and implement upon Commission approval, a Long-term Operations Plan. PG&E proposes the plan would be implemented for the duration of any new license issued with the primary goal of seeking to provide cold water for holding, spawning, and rearing spring-run Chinook salmon and steelhead in Butte Creek upstream and downstream from the Centerville powerhouse. PG&E proposes the plan would consider the feasibility of increasing spawning habitat availability by increasing flows between the lower Centerville diversion dam and the Centerville powerhouse during the spawning and egg incubation period (late-September to February), while balancing power production. PG&E also proposes the plan would consider modifications to facility operations and maintenance necessary to avoid, minimize, or improve Project-related impacts to spring-run Chinook salmon.

PG&E's proposed Long-term Operations Plan is consistent with Forest Service 4(e) condition no. 24, Forest Service 10(a) recommendation no. 15, Cal Fish & Game 10(j) recommendation no. 4, FWS 10(j) recommendation no. 13 and NMFS 10(j)

recommendation no. 8. However, FWS, Cal Fish & Game, and NMFS further recommend that PG&E consult with the Water Board and the Commission and that this plan specify how other Project facilities are to operate in both Butte Creek and the West Branch Feather River, how and when water is diverted, and likely times for maintenance activity of Project facilities. These agencies further recommend the plan would be filed with the resource agencies. The Forest Service also requires in 4(e) condition no. 24 that when developing this plan, they also should be included in the consultation.

The Forest Service in 10(a) recommendation no. 15, FWS in 10(j) recommendation no. 13, and NMFS in 10(j) recommendation no. 4 further recommend that the Long-term Operations Plan would contain a water temperature monitoring plan that would be developed in consultation with NMFS, FWS, Cal Fish & Game, Water Board, and the Commission. This plan would be consistent with the water temperature monitoring as recommended by these agencies and as discussed below in Water Temperature Monitoring, and would be based on the previous year's Project operations plan's water temperature monitoring sites, methods, and reporting. We discuss agency recommendations pertaining to water temperature monitoring below under Water Temperature Monitoring.

NMFS further recommends in their 10(j) recommendation no. 8 that this long-term operations plan would contain provisions for the installation of remote operating capability as well as addition real-time water temperature and reservoir elevation and flow gages in Round Valley and Philbrook reservoirs. NMFS recommends the location of these gages would be agreed upon by Cal Fish & Game and NMFS. Because this measure addressed reservoir and stream gages, it is discussed above under Instream Flow and Reservoir Level Monitoring.

NMFS further recommends in their 10(j) recommendation no. 8 that this plan contain: (1) modifications to project facilities and operations necessary to release project flows from various locations from Centerville canal into the diverted reach below Centerville diversion dam; (2) gravel enhancement and pool development to increase physical habitat; and (3) develop operational alternatives in the event that Centerville powerhouse is shut down during the spawning period.

Comprehensive Monitoring Report

Cal Fish & Game's 10(j) recommendation 5 provides that, during the sixth year of license issuance, PG&E would develop, in consultation with the agencies, and submit a comprehensive monitoring and adaptive management summary report. Cal Fish & Game states that PG&E shall implement any adaptive management measures specified in the report upon Commission approval.

Our Findings

Conducting an annual meeting to review the results of monitoring reports and to consider any need to modify project operation or environmental measures would help to ensure that National Forest System Lands and other important environmental resources are protected. Opening the meeting to other resource agencies would assist with interpretation of monitoring results and ensure that the full range of effects of any proposed changes in operation or measures are fully considered. As a result, we recommend that this consultation meeting be inclusive of all project operations and facilities, not just those located on National Forest System Lands.

Since 1999, PG&E has operated the Project based upon an annual Project Operations and Maintenance Plan that was developed in consultation with Cal Fish & Game, NMFS, and FWS. This plan outlines the procedures and practices followed by PG&E in the operation and maintenance of the Project facilities with the goal of protecting and enhancing habitat for spring-run Chinook salmon in lower Butte Creek.

PG&E's proposal to develop and implement a long-term operations plan, consistent with Forest Service condition no. 24 and their recommendation no. 15, Cal Fish & Game recommendation no. 4, FWS's recommendation no. 13 and NMFS's recommendation no. 8, is similar in intent with the current annual Project Operations and Maintenance Plan. This Long-term Operation Plan would utilize information from previous year's operating plans and results collected through recent relicensing studies, and the results of future monitoring efforts to define long-term procedures and practices in an attempt to provide habitat conditions that support healthy populations of spring-run Chinook salmon and steelhead in lower Butte Creek, as wells as other aquatic species in all of the project affected reaches of Butte Creek and the West Branch Feather River.

Because water temperatures in the Project area are manipulated and controlled to some extent by project operations, including our recommended water temperature monitoring in a Long-term Operations Plan, as provided for by the Forest Service's recommendation no. 15, FWS's recommendation no. 13, and the NMFS recommendation no. 4, would allow for this information to be compiled together and used to inform proposals to manage and provide better habitat conditions, through alterations to project operations or facilities, for aquatic resources. Further, it would be prudent to consider all monitoring information gathered as a result of new license conditions, not just temperature, when evaluating modifications to project operations or facilities. Using all monitoring data collected during any new license term in the decision making process, would support better decisions on how to modify project operations to best serve the affected resources on an as-needed basis. A Commission approved Long-term Operations Plan could provide the flexibility for the jurisdictional agencies[62] and PG&E

[62] We define the Jurisdictional agencies as they pertain to the Long-term Operations Plan and the Operations Group to be: the National Marine Fisheries Service, Cal Fish &

(the Operations Group) to actively modify project operations (within the realm of the approved plan) to address aquatic resource needs on a day-to-day basis. However, by necessity we are binding the plans operational flexibility as it pertains to providing minimum instream flows to those that have already been analyzed and considered in this EA (current conditions to agency recommended). We find that providing the flexibility to actively manage project operations for the federally listed Chinook salmon, steelhead trout and other aquatic resources justifies our estimated $16,900 annualized cumulative cost of the annual consultation and the development and implementation of the Lon-term operations Plan measures.

We note that the Conservation group in its comments and recommendations requested that they be included as a member of the Operations Group. While we find that consultation on project operations and the Long-term operations plan should involve all interested stakeholders, the ultimate decision making process should be limited to the jurisdictional agencies and PG&E.

Regarding Cal Fish & Game's recommendation to incorporate adaptive management in to a new license and provisions for a summary report with adaptive management provisions, we find that said provisions would support more long-term changes to project operations and/or facilities, if deemed appropriate as a result of our recommended monitoring program. However, with the flexibility that our recommended Long-term Operations Plan would provide we questions the need for Cal Fish & Game's adaptive management approach and as a result we conclude that the potential environmental benefits of implementing the adaptive management approach do not warrant our estimated annualized cost of $3,400.

Terrestrial Resources

Invasive Weed and Vegetation Management

Invasive weeds occur throughout the project area. Project operations, maintenance, and recreation can act as a method of seed dispersal and create disturbed areas favorable to the spread of invasive weeds. PG&E's Invasive Weed Management and Vegetation Management Plans would ensure that invasive weed species are appropriately controlled and that vegetation management activities are carried out in a way to minimize effects on natural resources.

Modifications to the plan specified by Forest Service (Condition 3
1) include provisions that would require PG&E to develop a source of local native plant materials for revegetation projects so that a sufficient source would be available

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Game, the U.S. Fish and Wildlife Service, the Forest Service, and the California Water Resources Control Board.

throughout the life of the project and specifies when use of persistent non-native, non-invasive plant material is permitted. We conclude that these measures are reasonable and would have negligible costs.

California Fish & Game and Forest Service also specifies that PG&E prepare an aquatic invasive/noxious plant management plan that outlines best management practices for the prevention of invasive aquatic species. PG&E includes an adaptive management element in their plan to implement methods for the prevention of aquatic invasive species, as necessary. PG&E's should ensure that its proposed aquatic plant management plan incorporates best management practices to prevent the spread of invasive aquatic species. This would not increase the cost of the plan.

The Invasive Weed Management and Vegetation Management Plans only cover Forest Service lands, excluding PG&E and private lands located within the project boundary. Invasive weed populations are known to occur outside the National Forest, such as the highly disturbed areas in the vicinity of the DeSabla forebay and adjoining day-use area. We recommend that PG&E expand these plans to include all lands within the project boundary to the extent that access is allowed.

The estimated annualized cost for the recommended Invasive Weed Management and Vegetation Management Plans is about $20,000 per year. Expanding the plan to accessible project lands outside the National Forest would increase the cost of the plan to about $30,000 per year. This would be a moderate cost to the project but would provide adequate protection to native plant species within the project boundary.

Special-status Species

A number of state listed and state species of concern, federally listed, and Forest Service sensitive species occur within the project area or have the potential to occur. The annual review of the current list of federally-listed species, Forest Service sensitive species, and the Lassen and Plumas National Forest Watch List and development of protective measures, as needed, proposed by PG&E, would provide a mechanism for the evaluation of effects of project operation and maintenance on newly listed species and development of appropriate protective measures. This measure, however, would only cover Forest Service lands. This measure should be implemented for the continued protection of special status species throughout the project area. We also conclude, however, that the annual review and potential study plans should be done for all lands within the project boundary. Expanding the surveys to include all lands within the project boundary would provide the same level of monitoring and protection for special status species throughout the project area on lands under Commission jurisdiction. We recommend that the review be expanded to include Bureau sensitive/watch list species and federal and state rare, threatened, or endangered species and all accessible project lands, as recommended by FWS. This would provide additional protection to special

status species throughout the term of the license. We believe that the $2,500 annual cost for the review of special status species would be worth the cost.

Forest Service 4(e) condition 27 specifies that before future construction, PG&E provide a biological evaluation of potential effects on special status species.

Foothill Yellow-legged Frog Monitoring

As discussed in the *Aquatic and Terrestrial Resource* sections (section 3.2 and 3.3), increases in minimum flows and continuing flow fluctuations could affect habitat for the foothill yellow-legged frog resulting from reduced habitat suitability, increased water temperatures, and changes in aquatic and riparian vegetation and channel morphology. Monitoring could detect any changes in foothill yellow-legged frog populations and identify the need for changes in project operation.

The Forest Service specifies PG&E monitor the numbers of foothill yellow-legged frog egg masses, tadpoles, and adults on the West Branch Feather River within the National Forest on an annual basis for the first 10 years of the license and every 5 years thereafter for the term of the license. FWS recommends annual monitoring of populations on both the West Branch Feather River and Butte Creek and that monitoring occur every 3 years after the initial 10-year monitoring period. PG&E filed an alternative condition that provides for monitoring the West Branch Feather River for 3 consecutive years after the issuance of the license, then every 5 years thereafter. PG&E estimates that monitoring would cost about $55,000 per year for the West Branch Feather River. Total annualized monitoring costs for the West Branch Feather River would be $110,000 for the FWS recommendation, $47,600 for the Forest Service condition, and $20,200 for PG&E's alternative condition.

If the foothill yellow-legged frog populations are negatively affected by recommended changes in flows and ramping rates specified in a new license and subsequent temperature changes, then population monitoring could identify these factors and could provide a timely mechanism to implement project operational changes to benefit foothill yellow-legged frog . The health and range of the foothill yellow-legged frog , a Forest Service sensitive species and a California species of special concern, has substantially declined. Given the current status of the species in California and the potential effects of continued operation of the project, monitoring is necessary to prevent further declines.

As described above, there are numerous monitoring frequencies that have been identified by PG&E and the agencies. Based on the life history of the FLYF, a minimum three-year period of observation is needed to detect changes in populations based on environmental changes (Kupferberg et al., 2007). PG&E's monitoring schedule does include three consecutive years of monitoring as recommended by Kupferberg et al.

(2007) and additional monitoring every 5 years thereafter. This monitoring schedule would be sufficient to identify potential adverse effects.

PG&E should develop a monitoring plan to identify the effects of the changes in flow releases on foothill yellow-legged frog and any changes in population numbers to forma basis for the needs for changes in project operation or additional studies. Monitoring should include all foothill yellow-legged frog habitat potentially affected by changes in project operation on both Butte Creek and the West Branch Feather River according to PG&E schedule. We conclude that the annualized cost of $40,400 is worth the cost of protecting this special-status species.

The Forest Service and FWS would also , as described in more detail in section 3, have PG&E develop a population model linking various life stage data; relate egg mass counts quantitatively to adult population size or overall population growth rate; conduct a population viability analysis; determine the species-specific effects of temperature on development rates of embryos and larvae, growth rates of tadpoles, and size at metamorphosis; and develop an experimental methodology to determine the relationship between discharge and stage at egg mass and tadpole sites. PG&E estimates the costs would be at least $1.75 million, but that these costs might be underestimated based on the scope of the studies. The studies specified by the Forest Service and recommended by FWS could enhance conservation efforts for the foothill yellow-legged frog, but is in excess of what is needed to monitor changes in project operations. Population monitoring, as discussed above, would be sufficient to determine trends in numbers of egg masses, foothill yellow-legged frog distribution, suitability of breeding and rearing habitat, and level of recruitment. Therefore, the cost of these additional studies does not justify the benefits.

The Forest Service specifies and FWS recommends that PG&E monitor water temperatures to assess effects on eggs and tadpoles. Although modeling of increased flows do not show significant effects on mainstem water temperatures, temperatures at the river edge, which were not measured, may substantially differ. Measuring water temperature in foothill yellow-legged frog habitat would provide insight into the relationship between water temperature and the initiation of breeding and time to metamorphosis. Therefore, we recommend the monitoring plan include measurements of water temperature in the vicinity of egg masses and tadpoles. We believe that additional water temperature measurements during the annual monitoring would not add much to the cost.

The Forest Service specifies and FWS recommends that PG&E monitor the geomorphic and riparian vegetation response to the new flow regime and reassess streamflows if substantial changes in bar geomorphology and riparian vegetation encroachment result. Riparian habitat could be affected by proposed and recommended increases in minimum flow releases and associated effects on water levels within existing

riparian habitats and by potential scouring of habitat from water level fluctuations. Recording information on variable such as substrate, site morphology, channel shape and slope, water velocities, canopy, water temperature, riparian and aquatic vegetation, and the location of oviposition sites during the recommended monitoring would provide insight into the effects of flow increases on aquatic and riparian habitats and channel morphology. Therefore, PG&E should incorporate measurements of channel shape and slope and riparian and aquatic vegetation into the foothill yellow-legged frog monitoring plan. The additional measurements during the annual monitoring would have a modest effect on the total cost.

Bald Eagles

Bald eagle populations in California are rebounding and there are many eagles nesting in the Feather River Basin. The incidental taking of bald eagles is prohibited by the Bald and Golden Eagle Protection Act. The identification of future nesting is important in determining whether additional protection measures may be needed to protect the nesting eagles from project-related activities such as maintenance or recreation. Therefore, we recommend that PG&E develop a bald eagle monitoring plan to include development of protective measures in the event nesting is identified as a result of monitoring or through incidental observations. The plan should be consistent with the National Bald Eagle Management Guidelines (U.S. Fish and Wildlife Service 2008).

Forest Service specifies and FWS recommends that surveys occur at least once per year or at a frequency to be determined in the monitoring plan, while PG&E believes that a breeding and wintering survey every 3 years would be adequate.

Given the limited current use of the project area by eagles and the limited potential of impacts from recreation use or maintenance activities, monitoring every 3 years, along with incidental observations, would be sufficient to detect changes in eagle use of the project area and would be more cost-effective (annualized cost of 1,800 for staff recommendation compared to $5,000 for the agency recommendation). The plan however, should provide for more frequent surveys if observations of eagles become more common.

The cost of the recommended surveys would be worth the benefits to future nesting bald eagles. Although it is unclear how many surveys or the frequency of surveys that would be required under the agency monitoring plan, it would be more expensive with limited additional benefits to eagles.

Deer Protection at Canals

PG&E's current deer protection measures have lead to a significant decrease in deer mortality over the last 30 years are sufficient to keep deer mortality at low levels

(average of less than 3 deer per year). PG&E's proposal to monitor the status of the deer protection facilities (bridges, escape structures, etc.) and replace them as necessary would help ensure that mortality remains at current levels. PG&E would continue to record wildlife mortalities but does not address how it would deal with the possibility of increases in mortality over the term of the license based on changes circumstances, such as reduced effectiveness of the facilities or increases in deer numbers. The cost of monitoring the protection would be negligible since it would likely be part of the existing facilities maintenance plan. The cost of replacing facilities would be dependent on the number and types of facilities that might have to be replaced during the license term. We estimate that this measure would have an annualized cost of $9,600 and would be justified by the benefits to the local deer herd.

We recommend that PG&E prepare a summary mortality report every 5 years, as recommended by California Fish & Game, and implement additional measures if an increasing trend in animal mortalities is noted, as specified by Forest Service and recommended by California Fish & Game. Developing the mortality reports would have a minimal cost (annualize cost of $120) but would reveal the need for additional protection measures.

Threatened and Endangered Species

Valley Elderberry Longhorn Beetle

The project would result in the loss of elderberry shrubs that provide potential habitat for the VELB, a species listed as threatened, during the life of the project as a result of the need to clear vegetation that may threaten project facilities. PG&E has in a place a system-wide Valley Elderberry Longhorn Beetle Conservation Program, including the project area. The program provides for pre-construction surveys, educational training, implementation of minimization, avoidance, and protective measures, and monitoring.

Continued implementation of the program at the project would ensure that impacts to elderberry habitat would be avoided or minimized, and if impacts do occur, appropriate mitigation would be implemented. Therefore, we recommend that PG&E implement the program in relation to continued operation and maintenance of the project. The annualized cost of $1,900 for implementing the program would be worth the benefits to the VELB, a federally- listed threatened species.

Actions to identify newly listed species and appropriate protection measures are discussed above under *Special-status Species*.

Central Valley Chinook Salmon and Central Valley Steelhead

Our recommendation and analysis thereof for Chinook salmon and steelhead can be found above, in this section under *Aquatic Resources*.

Recreation Resources

Recreation Rehabilitation and Enhancements

PG&E proposes to develop and implement a Recreation Facility Rehabilitation and American with Disabilities Act (ADA) Upgrade Plan for the existing recreation facilities at Philbrook reservoir and DeSabla forebay within one year of license issuance. PG&E proposes to upgrade existing recreation facilities and improve accessibility over the term of the license, as discussed in section 3.3.5, *Recreation Resources*. PG&E's proposal would provide enhanced accessibility to recreation opportunities at the project and would ensure the proposed recreation accessibility measures and upgrades would be implemented over the term of a new license. Based on the specificity of the measures described in PG&E's proposed plan, we recommend PG&E implement the measures outlined in the Recreation Facility Rehabilitation and ADA Upgrade Plan in consultation with the Forest Service within 5 years and file a report upon completion of each of the measures.

We estimate the annualized cost associated with implementing the Recreation Facility Rehabilitation and ADA Upgrade Plan, the rehabilitation measures, and the minor maintenance measures at $19,200. Given the benefits identified above, we conclude that these benefits are worth the costs.

The Forest Service specifies several additional capital improvement measures, including extending the concrete boat launch on Philbrook reservoir. Currently the boat launch is operational during the primary recreation season, however, it is not adequate as it does not extend to the low water line and on occasion, boaters are forced to launch from compacted soil below the boat launch. Our analysis indicates that there is a demand for adequate recreational boating access and Forest Service's specified improvement would further improve the existing facility. We recommend PG&E extend the concrete boat launch on Philbrook reservoir within one year of license issuance and file a report upon completion of this measure. We find the addition of this improvement would have an annualized cost of $500, and we conclude that the benefits exceed the cost.

The Forest Service also specifies measures to upgrade and maintain an existing user-created trail and parking along Toadtown canal and construct and maintain a public recreation trail and parking from a new Forest Service access road to the southeast shoreline of Philbrook reservoir. Upgrading and maintaining an already existing user-created trail and parking would provide enhanced accessibility to recreation opportunities at the project in the vicinity of the Toadtown canal. We recommend PG&E upgrade the existing user-created trail and parking along Toadtown canal within one year of license

issuance and file a report upon completion of this measure. We estimate the annualized cost of this measure would be $2,500, and we conclude that the benefits exceed the costs.

Although providing trail access to the southeast shoreline of Philbrook reservoir would improve access, sufficient shoreline access is already provided on the north end of the reservoir at each of the existing project facilities. Moreover, this area of the reservoir is occupied by privately owned cabins located outside the project boundary. Accordingly, PG&E would not be responsible for providing recreation access to non-project facilities. Therefore, we do not recommend this additional trail measure specified by the Forest Service.

In addition to the rehabilitation measures, Forest Service specifies PG&E provide the Forest Service with 15-20% of the camping fees collected from National Forest Service Lands at Philbrook Campground and consider placing a portion of the campground under a reservation system. PG&E is ultimately responsible for the recreation facilities within the project boundary, and therefore, the use of camping fees collected at Philbrook Campground would be under the discretion of PG&E for costs associated with the operation and maintenance of the campground. Therefore, we do not recommend PG&E provide the Forest Service with 15-20% of camping fees, however, we do find it reasonable for PG&E to consider placing a portion of Philbrook Campground under a reservation system to make it easier for visitors to reserve a camp site.

FWS recommends that PG&E develop rehabilitation measures to improve recreation at Forest of Butte Creek campgrounds, the Ponderosa Bridge Parking area, and the Butte Creek trail. These facilities are located outside the project boundary and are not needed for project purposes. PG&E is currently meeting camping needs and provides public access to project lands and waters through both the Phibrook and DeSabla Recreation Areas. Therefore, we do not recommend these additional enhancement measures recommended by FWS.

California Salmon and Steelhead Association recommends that PG&E construct a public day use area with ADA accessible facilities Round Valley Reservoir (Snag Lake), and stock the reservoir with trout during the spring season. Under current project operations, there are no fish stocked at this reservoir and the reservoir itself is completely drained within one month during the summer season, resulting in little to no recreation use. For the reasons stated above, we do not recommend PG&E stock trout in Round Valley Reservoir or construct a day use area.

Dispersed Camping and OHV Use

PG&E's proposal to work with the Forest Service to discourage dispersed camping, trash dumping, and OHV use at the Project would ensure a high quality

recreational experience and enhance public safety. Further, measures to block vehicle access and discourage dispersed camping and OHV use would also provide protections to environmental resources within the project. PG&E is ultimately responsible for the operation and maintenance of the project's recreation facilities located within the project boundary and needed for project purposes. The Willows Dispersed Area, the West Branch Feather River Bridge crossing, and the former West Branch Campground site are all located outside the project boundary, but due to their close proximity to the reservoir, it is likely visitors to the project are utilizing these areas and these one-time measures would be appropriate. We estimate the annualized cost for these measures to be $6,000, and conclude that the benefits outweigh the costs.

Fish Stocking

PG&E proposes to continue to fund California Fish & Game up to $10,000 annually in years in which California Fish & Game stocks rainbow trout in DeSabla Forebay. This would amount to about 3,311 lbs of trout. California Fish & Game contends that under a 1983 agreement with PG&E, the applicant agreed to annually reimburse California Fish & Game for the stocking of 14,435 trout, or approximately 7,200 lbs. This would amount to roughly $22,000 by today's standards. California Fish & Game recommends PG&E annually reimburse California Fish & Game for the stocking of 8,000 lbs, approximately $24,160, of catchable trout, not limited to the DeSabla forebay, and they maintain that any decision made about where, when, and how many trout to stock should be at the discretion of the state. Angling is a primary recreational activity at the project and the DeSabla forebay is popular fishing spot with local residents. Although recreation use at the Project is estimated to increase approximately 2 percent over the next 50 years, this is not enough evidence to support increasing the poundage of fish stocked as recommended by California Fish & Game's. While PG&E is ultimately responsible for stocking the reservoirs and reaches associated with the Project, we recognize California Fish & Game's expertise in this area. Therefore, we recommend PG&E develop a fish stocking plan, after consultation with California Fish & Game, to include the amount and location of fish to be stocked at DeSabla forebay, Philbrook reservoir, and other affected stream reaches at the project. Creels surveys conducted through recreation monitoring, as discussed in the *Recreation Monitoring* section below, will be used to evaluate this plan every five years. We estimate the annualized cost for this measure to be $22,000, and conclude that the benefits outweigh the costs.

Recreation Monitoring

Both the Forest Service and Bureau specified PG&E develop recreation use monitoring, reporting and use triggers in consultation with both agencies to periodically monitor changes in recreation use patterns at the Project every five years. Additionally, Forest Service specifies PG&E develop an annual boat monitoring protocol on Philbrook

reservoir to support reservoir-based recreation. The FERC Form 80 already requires facility capacity and demand be reported every 6 years; however, the additional recreation report would provide more specific information such as change in use patterns and whether or not resource damage is occurring. Conducting the recreation monitoring every five years would allow for enhanced assessment of the adequacy of public recreation facilities and access at the project. While monitoring boat use may help identify excessive use and potential conflicts, it would be appropriate to include this protocol as a part of the monitoring efforts every five years rather than on an annual basis. Therefore, we are recommending PG&E develop recreation use monitoring, reporting, and use triggers, with the inclusion of the boat monitoring protocol, every five years. We estimate the annualized cost for this monitoring to be $75,000 (every five years), and conclude that the benefits outweigh the costs.

Law Enforcement

Both the Forest Service and Bureau specify PG&E provide patrol or funding for a law enforcement position at the Project. Both Butte County and the Conservation groups recommend the same. Although more visible patrol or law enforcement may help reduce conflicts between recreation users and improve visitor safety, the state and county are responsible for law enforcement activities at public recreation sites, including within the project area. Further, funding a law enforcement position provides no guarantee that the officer would be used exclusively within the project area. There would be no indication that existing recreation conflicts would be reduced through the proposed measure, therefore we do not recommend PG&E provide patrol or funding for a law enforcement position.

Land Use and Aesthetic Resources

Transportation System Management Plan

PG&E proposes to implement a Transportation System Management Plan to ensure that responsibilities and schedule for coordination and maintenance of project roads is clearly defined. In addition, Forest Service specifies PG&E include an inventory of roads necessary for the project, implement temporary traffic controls during construction, and develop a traffic monitoring plan to help determine project-associated use on roads within the project area as well as assist in the development of road share costs. Many project roads pass through land managed by the Forest Service, and therefore we consider it important to delineate PG&E and the Forest Service's responsibilities to ensure that these roads are well maintained to ensure appropriate, safe access to project facilities for inspection, operation, and maintenance purposes as well as appropriate public access to project lands and waters. We note, however, that it is the Commission's practice to require ongoing maintenance for only those roads used primarily for project purposes. At this time, we see no need to gather additional

information through a traffic monitoring plan to determine project-associated use or cost sharing responsibilities on roads located outside the project boundary. Therefore, based on the detailed measures provided by PG&E, we recommend PG&E implement the proposed measures in the Transportation System Management Plan with the addition of the road inventory and traffic controls specified by the Forest Service. These measures should be implemented after consultation with the Forest Service and other appropriate federal and state agencies within two years of license issuance and a report should be filed after each measure is completed. We estimate the annualized cost for this plan to be $23,000, and conclude that the benefits outweigh the costs.

Road Maintenance

Bureau specifies PG&E annually repair and maintain a portion of Ditch Creek Road from Bureau entrance gate to the point where the Project's 9/1 Spillway crosses Ditch Creek Road. Additionally, Butte County recommends PG&E update guardrails on county-maintained roads where project flumes and canals cross as well as pave back the apron to the County right-of-way at the project powerhouse road, just south of DeSabla reservoir. PG&E is responsible for any access road within the project boundary requiring maintenance; however, these roads are not project roads. Roads located outside the project boundary are not subject to Commission jurisdiction or the terms and conditions of the license, therefore we do not recommend these road maintenance measures.

Land Management Plans

The development of a fire management, hazardous substance plan, and visual management plan would provide the means for coordinating emergency response preparedness and prevention for both fires and hazardous substances at the project. In addition, visual management measures would reduce the visual effects on aesthetic resources at the project and help to restore natural habitat at the project. We estimate developing a fire management plan and a hazardous substance plan would have an annualized cost of $2,000, and the development of a visual management plan would have an annualized cost of $1,500. Given the benefits of improved public safety and reduced potential damage to property and natural resources, we conclude that the benefits of these measures are worth the costs.

Cultural Resources

National Register of Historic Places Eligibility

As part of the required cultural resources surveys, PG&E surveyed all accessible project lands within in the APE for cultural resources and conducted evaluations to determine which, if any of them within the APE were eligible for inclusion in the National Register. Informal evaluations were conducted for prehistoric sites and PG&E

found that, of the 29 sites, 10 sites may be eligible, two are eligible as contributing elements, and the rest were considered ineligible. As part of this historic sites and structures inventory, PG&E evaluated the DeSabla-Centerville Hydroelectric project facilities. The system contained several features that were found to be eligible for inclusion on the National Register as contributing elements to a historic district. Based upon the information provided by PG&E, we concur with PG&E's finding of eligibility and conclude that the resources indentified in that report warrant consideration regarding their eligibility for inclusion on the National Register of Historic Places.

Historic Properties Management

PG&E developed a Historic Properties Management Plan (HPMP) to manage historic properties within the APE of the project. In the HPMP, PG&E proposes to conduct monitoring of sites within the project area that are eligible for listing on the National Register of Historic Places (National Register). In addition, the HPMP includes additional mitigation and management measures for historic properties affected by the project, as well as proposals for continuous cultural resource consultation with the Bureau, the Forest Service, the Mechoopda Tribe, and Greenville Rancheria throughout the term of the license. The HPMP also includes a proposal for annual monitoring reports and consultation meetings, and meetings to review and revise the HPMP after five years and then again every 10 years, thereafter. The Forest Service condition 35 also would require finalization and implementation of an HPMP.

The Bureau, Greenville Rancheria, Mechoopda Tribe, and the Forest Service commented on the HPMP, but PG&E filed the HPMP prior to incorporating the comments. Bureau, Mechoopda Tribe, and the Forest Service provided recommendations to improve the HPMP, including additional contextual information, consulting requirements, and requests for more specific information and treatment measures. While the commentors and PG&E label the HPMP as a draft document, most of the requests for additional information can be addressed through the consultation protocols already set forth in the HPMP. As discussed in section 3.3.6.2, however, some of the comments address issues not originally included in the HPMP that would benefit the protection and enhancement of cultural resources.

As such, we recommend implementation of PG&E's HPMP with the following additions: 1) update the HPMP with the additional historic context information provided by Bureau, the Forest Service, and the Mechoopda Tribe; 2) develop a collection policy for discovery, curation, and disposition of artifacts; 3) develop a detailed HPMP section addressing identification, restoration, accessibility, and stewardship collaborations for traditional plant gathering/tending in wetlands and riparian habitat communities culturally important to participating tribes; 4) identify specific management measures to be undertaken and include them within PG&E's best practices or procedural manuals;

and 5) include mitigation measures for Round Valley reservoir site CA-BUT-1225/H and the Philbrook Lake Tenders Cabin.

PG&E also states that the National Register-eligible Centerville powerhouse most likely will need to rebuilt or refurbished within the next 10 years. The HPMP states that all maintenance, repair, alteration, replacement, and new construction that may be necessary at the project would be preformed in accordance with the *Secretary of FWS's Standards for the Treatment of Historic Properties* and in consultation with the California State Historic Preservation Officer (SHPO). While routine modifications and repairs at Centerville powerhouse normally would be covered under these management measures, no specific plans for rebuilding or refurbishing the powerhouse have been filed and therefore are not addressed in the HPMP.

In addition to the protections provided by the HPMP, Commission staff would issue a Programmatic Agreement (PA) among the Commission and California SHPO, pursuant to our responsibilities under section 106 of the National Historic Preservation Act. With the execution of a PA and implementation of a final HPMP, all anticipated effects to any historic properties within the APE would be resolved. We estimate that revision and finalization of the draft HPMP would have a one-time cost of $30,000 and an annualized cost of $25,100. We conclude that the expected benefits of implementing the HPMP with the recommended modifications are worth the cost.

5.3 Unavoidable Adverse Impacts

The continued operation of the project would continue to divert water from the West Branch Feather River thereby limiting flows downstream of the Hendricks diversion dam. Additionally, large mammal will continue to be entrained in project canals, and some minor unavoidable adverse effects on geologic, soils, and geomorphic resources would continue to occur. These could include some continued erosion associated with project operations, renovation of recreation facilities, and removal of five feeder diversions.

We have identified no other unavoidable adverse effects on resources influenced by the project.

5.4 Summary of Section 10(j) Recommendations and 4(e) Conditions

5.4.1 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, or 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 shall attempt to resolve any such inconsistency, giving due weight to the recommendations, expertise, and statutory responsibilities of such agency. In response to our REA notice, the following fish and wildlife agencies submitted recommendations for the project: FWS (on June 27, 2008), and NMFS and the Cal Fish & Game (each on June 30, 2008). Table 5.2 lists the federal and state recommendations filed subject to section 10(j), and whether the recommendations are adopted under the staff alternative. Environmental recommendations that we consider outside the scope of section 10(j) have been considered under section 10(a) of the FPA and are addressed in the specific resource sections of this document and the previous section.

Of the 40 recommendations we find to be within the scope of section 10(j), we wholly include 22, include 13 in part, and do not include 5. We discuss the reasons for not including those recommendations in section 5.2 *Comprehensive Development and Recommended Alternative*. Table 5-3 indicates the basis for our preliminary determination concerning the measures that we consider inconsistent with section 10(j).

Table 5-3. Fish and wildlife agency recommendations for the DeSabla-Centerville Project (Source: Staff).

Recommendation	**Agency**	**Within scope of section 10(j)?**	**Annualized cost**	**Adopted? and Basis for Preliminary Determination of Inconsistency**
Project canal maintenance and inspection plan	FWS	No. Not a specific measure to protect, mitigate, or enhance fish and wildlife resources.	$152,570	Yes
Maintenance of canal wildlife protection facilities and monitor wildlife loss in project canals	FWS, Cal Fish & Game	Yes	$9,600	Yes
Summary report of wildlife mortalities in canals	Cal Fish & Game	No. Not a specific measure to protect, mitigate, or	$120	Yes

		enhance fish and wildlife resources.		
foothill yellow-legged frog monitoring plan	FWS	Yes	$110,000	Yes, as modified by staff (see section 5.2).
federally listed species protection and management	FWS	No. Measure dependent on future undefined actions	Unknown	Yes
federally listed species annual consultation	FWS	No. Not a specific measure to protect, mitigate, or enhance fish and wildlife resources.	2,500	Yes
Bald eagle management plan	FWS	Yes	$5,000	Yes, as modified by staff (see section 5.2).
Valley elderberry longhorn beetle management plan	FWS	Yes	$1,900	Yes
Invasive/noxious weed and vegetation management plan	FWS	No. . Not a specific measure to protect, mitigate, or enhance fish and wildlife resources.	$30,000	Yes
Fish Screening of Lower Centerville diversion	NMFS, Cal Fish & Game, FWS	Yes	$1,334,200	Not adopted[a] (see section 5.2).
Fish rescue plan and annual implementation	NMFS, FWS, Cal Fish & Game	Yes	$42,900	Yes
Fish Screening at Hendricks Head dam	FWS, Cal Fish & Game	Yes	$589,800	Not Adopted[a] (see section 5.2).
Fish Ladder at Hendricks Head dam	FWS, Cal Fish & Game	Yes	$940,600	Not Adopted[a] (see section 5.2).
Maintain a	FWS	Yes	$1000	Yes

minimum pool at Philbrook Reservoir of 250 acre-feet				
Resident fish monitoring in all project affected stream reaches and reservoirs. Monitoring in years 1, 2, 5, 6, 10, 11, 15, 16, 20, 21, 25, and 26	FWS	Yes	$88,700	Yes, as modified by staff (see section 5.2).
Resident fish monitoring in Butte Creek. Monitoring in years 1, 2, 5, 6, 10, 11, 15, 16, 20, 21, 25, and 26	NMFS	Yes	$32,500	Yes, as modified by staff (see section 5.2).
Annually monitor the ESA listed spring-run Chinook salmon and the Central Valley steelhead in Butte Creek, including	NMFS, FWS, Cal Fish & Game	Yes	$139,700	Yes
Monitor movement patterns of adult Chinook salmon in response to changes in project flows, and the monitoring of Chinook holding habitat.	Cal Fish & Game	Yes	$3,400	Yes.
Benthic macroinvertebrate monitoring in project affected bypass reaches in years in years 1 through 4, and 8, 12, 16, 20, 24, and 29.	NMFS, FWS, Cal Fish & Game	Yes	$55,300	Yes, as modified by staff (see section 5.2).
Long-Term Operations Plan	FWS, NMFS, Cal Fish & Game	Yes	$6,900	Yes
Install remote	NMFS	Yes	$54,500	Yes; as modified

operating capability as well as additional real-time water temperature and reservoir elevation and flow gages in Round Valley and Philbrook reservoirs				by staff (see section 5.2).
Comprehensive Monitoring Report with adaptive management summary	Cal Fish & Game	No. . Not a specific measure to protect, mitigate, or enhance fish and wildlife resources.	$3,400	No
Annually stock 8,000 pounds of trout for put-and-take fishery	Cal Fish & Game	Yes	$24,000	Yes, as modified by staff (see section 5.2).
Measure minimum instream flows as the 24-hour average and as instantaneous flow, as required by the USGS	FWS, NMFS, Cal Fish & Game	Yes	$0	Yes
The minimum instantaneous 15-minute stream flow shall be at least 80% of the prescribed mean daily flow for stream flows less than or equal to 10 cfs and at least 90% for minimum instream flows required to be greater than 10 cfs	FWS, NMFS	No. Not a specific measure to protect, mitigate, or enhance fish and wildlife resources.	$0	Yes
If mean daily flows are less than the required mean daily	FWS, NMFS	Yes	$0	Yes

flow, but more than the instantaneous flow, begin releasing the equivalent under-released volume of water within 7 days of discovery				
Instantaneous flows may deviate below the specified minimum instream flow releases by up to 10 percent, or 3 cfs, whichever is less	FWS, NMFS	No. Not a specific measure to protect, mitigate, or enhance fish and wildlife resources.	$0	Yes
Promptly resume performance of flow requirements after an emergency and notify the resource agencies within 48 hours, and provide notice to the Commission as soon as possible, but no later than 10 days after each incident with an explanation	FWS, NMFS, Cal Fish & Game	Yes	$0	Yes
Complete facility modifications needed for the releases of minimum instream flows as soon as possible, but no longer than three years after license issuance	FWS, NMFS, Cal Fish & Game	Yes	$0	Yes
By March 10 of the second or subsequent dry year, notify the resource agencies and by May 1	FWS, NMFS, Cal Fish & Game	No. Not a specific measure to protect, mitigate, or enhance fish	$500	Yes

consult with the resource agencies		and wildlife resources.		
Implement a revised drought operational plan, if agreed upon by the resource agencies, and if agreement is not reached file the plan with the Commission for approval	FWS, NMFS, Cal Fish & Game	Yes	$0	Yes, as modified by staff (see section 5.2).
Determine water year types based upon the California Department of Water Resources Bulletin 120	FWS, NMFS, Cal Fish & Game	Yes	$0	Yes
Provide notice to the resource agencies and the Commission within 30 days of making the final water year type determination	FWS, NMFS	No. Not a specific measure to protect, mitigate, or enhance fish and wildlife resources.	$0	Yes
Implement ramping rates based on water velocity and stage in foothill yellow-legged frog breeding areas	FWS	Yes	$8,000	Yes
During up-ramping downstream of Lower Centerville Diversion dam, velocity shall not change more than 0.2 feet per second per hour	NMFS	Yes	$0	Yes
In consultation with the resource agencies, review information from fish and foothill yellow-legged frog	FWS, NMFS	Yes	$1,000	Yes

monitoring to determine the need to adjust ramping rates, and file with the Commission any proposed adjustments				
Implement agency recommended minimum instream flows in lower Butte Creek, upper Butte, lower West Branch Feather River, and Philbrook Creek	FWS, NMFS,[b] Cal Fish & Game	Yes	$280,300[d]	Not adopted[a] (see section 5.2).
Implement agency recommended minimum instream flows downstream of Round Valley Reservoir	FWS, Cal Fish & Game	Yes	$0	Yes
Implement agency recommended minimum instream flows in Inskip, Kelsey, Clear, Helltown Ravine, Long Ravine, Cunningham Ravine, Little West Fork, and Little Butte creeks	FWS, Cal Fish & Game[c]	Yes	$133,200	Partially adopted[a] we recommend a minimum instream flow for Helltown Ravine (see section 5.2).
Flows discharged downstream of Hendricks Diversion dam shall be maintained within the West Branch Feather River to the high water line of Lake Oroville	Cal Fish & Game	Yes	$0	Not Enforceable (see section 5.2).
Make a good faith effort to ensure minimum instream	Cal Fish & Game	Yes	$0	Yes

flows downstream of Hendricks Diversion dam are not diverted from the West Branch Feather River through methods under the control of PG&E				
Consult with the resource agencies to identify water rights associated with diversion of water from the West Branch Feather River	Cal Fish & Game	No. Not a specific measure to protect, mitigate, or enhance fish and wildlife resources.	$500	Not adopted (see section 5.2).
Develop and Implement a Feeder Diversion Facility Removal Plan	FWS	Yes	$44,500	Yes
Remove the feeder diversions on Oro Fina Ravine, Emma Ravine, Coal Claim Ravine, Stevens, and Little Butte creeks	Cal Fish & Game	Yes	$42,800	Yes
Develop and Implement a DeSabla Forebay Water Temperature Improvement Plan to reduce thermal loading by 80 % within the forebay	FWS, NMFS, Cal Fish & Game	Yes	$613,400	Yes; however, we recommend thermal loading within the forebay be reduced by 50 % (see section 5.2).
Develop and implement a Water Temperature Monitoring Plan	FWS, NMFS	Yes	$32,500	Yes
Install and maintain a flow data logger downstream of Hendricks Diversion dam, a real-time flow	FWS, Cal Fish & Game	Yes	$37,400	Yes

gaging station upstream of Butte Diversion dam, and modify the existing stream gage near Lower Centerville dam for real-time access				
Operate and maintain the existing stream flow gages downstream of Round Valley Reservoir and Hendricks Diversion dam	FWS	Yes	$6,600	Yes
Install and maintain a new stream gage with real-time capability downstream of the confluence of the low level release and the spill channel in Philbrook Creek	FWS	Yes	$17,000	Yes
Install and maintain new stream flow gages downstream of the eight feeder creek diversions	FWS	Yes	$94,860	Not adopted[a] (see section 5.2).
Install and maintain up to 3 additional stream flow gages, if deemed necessary as a result of annual consultation with the resource agencies	Cal Fish & Game	Yes	$51,100	Not adopted[a] (see section 5.2)
Measure and document all minimum instream flow releases in publicly available and readily	FWS, Cal Fish & Game	No. Not a specific measure to protect, mitigate, or enhance fish	$2,500	Yes

accessible formats and provide flow data to the USGS in an annual report		and wildlife resources.		

[a]Preliminary finding that the recommendations found to be within the scope of 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.
[b] We note that NMFS 10(J) recommendation does not apply to the West Branch Feather River and Philbrook Creek.
[c] We note that Cal Fish & Game only recommends minimum instream flows on Long Ravine, Little West Fork and Cunningham Creeks, at an estimated annualized cost of $62,000.
[d]The $280,300 annualized cost for this measure is in addition to the cost of providing PG&E's proposed minimum instream flows.

5.4.2 Land Management Agencies' Section 4(e) Conditions

In section 2.2.5, Modifications to Applicant's Proposal—Mandatory Conditions, we list the preliminary 4(e) conditions submitted by the Forest Service, and note that section 4(e) of the FPA provides that any license issued by the Commission "for a project within a federal reservation shall be subject to and contain such conditions as the Secretary of the responsible federal land management agency deems necessary for the adequate protection and use of the reservation." Thus, any 4(e) condition that meets the requirements of the law must be included in any license issued by the Commission, regardless of whether we include the condition in our Staff Alternative.

Of the Forest Service's 36 preliminary conditions, we consider 18 of the conditions (conditions 1 through 17 and 27) to be administrative or legal in nature and not specific environmental measures. We therefore, do not analyze these conditions in this EA. Of the BLM's 22 revised preliminary conditions, we consider 18 of the conditions (conditions 1 through 17 and 22) to be administrative or legal in nature and not specific environmental measures. We therefore, do not analyze these conditions in this EA.

Table 5-4 summarizes our conclusions with respect to the each of the agencies preliminary 4(e) conditions that we consider to be environmental measures. We include in the Staff Alternative 15 conditions as specified by the agencies, 12 from the Forest Service and 3 from the Bureau, modify four of the Forest Service conditions adjust the scope of the measure, and did not recommend three conditions, two from the Forest Service and one from the Bureau; the measures we modify or do not adopt in total are discussed in more detail in section 5.2, *Comprehensive Development and Recommended Alternative*.

Table 5-4. Preliminary section 4(e) conditions filed by the Forest Service and the U.S. Bureau of Land Management for the DeSabla-Centerville Project (Source: Staff).

Forest Service Preliminary 4(e) Conditions		
Condition	**Annualized Cost**	**Adopted?**
No. 18: Streamflow	$311,600[a]	No. We adopt PG&E's proposed minimum instream flows as discussed in section 5.2; however, we do adopt the FS required flows for downstream of Round Valley reservoir dam.
No. 18: Water Year Type	$0	Yes
No. 18: Multiple Dry Water Years	$500	Yes
No. 18: Streamflow Measurement	$26,100	Yes; however, as discussed in section 5.2 we do not recommend that PG&E devise a measurement procedure for determining streamflow in Long Ravine, Cunningham Ravine, and Little West Fork creeks.
No. 18: Ramping Rates	$8,000	Yes
No 19: West Branch Feather River Rainbow Trout Monitoring	$26,200	No.
No. 20: Resident Fish Monitoring Plan for the West Branch Feather River	$19,400	Yes. However, we recommend an alternative to the duration of the monitoring and support PG&E's alternative 4(e) to remove site 43.6 from the sampling effort.
No. 20: Amphibian Monitoring	$37,600	Yes. However, we believe that PG&E's monitoring schedule (annually for first 3 years and every 5 years thereafter) would be sufficient.
No. 20: Benthic Macroinvertebrate Monitoring	$55, 300	Yes. However, we recommend an alternative to the duration and frequency of the monitoring
No. 21: Stabilize the Round Valley Spillway Channel	$480,000	Yes

No. 22: Stabilize the Philbrook Spillway Channel	$480,000	Yes
No. 23: Project Canal Maintenance and Inspection	$15,000	Yes
No. 24: Long-Term Operations Plan	$6,900	Yes
No. 25: Maintain Minimum Pool in Philbrook Reservoir	$1,000	Yes
No. 26: Special Status Species	$1,250	Yes
No. 28: Canal Wildlife Crossing or Escape Facilities	$9,600	Yes
No. 29: Monitor Animal Losses in Project Canals	$100	Yes
No. 30: Valley Elderberry Longhorn Beetle Protection	$1,900	Yes
No. 31: Vegetation and Invasive Weed Management	$20,000	Yes
No. 32: resolution of PG&E Encumbrances	Unknown	No. Unenforceable
No. 33: Recreation Facilities on or affecting National Forest Service Land	$126,050	Yes. However, we recommend an alternative to the amount of facility upgrades and the duration and frequency of the monitoring
No. 34: Land Resource Plans	$4,800	Yes.
No. 35: Heritage Properties Management Plan	$30,000	Yes
No. 36: Project Transportation System Management Plan	$20,300	Yes. However, we recommend an alternative to the duration and frequency of the monitoring.
U.S. Bureau of Land Management Revised Preliminary 4(e) Conditions		
No. 18: Recreation Use and Reporting	$15,000	Yes.
No. 19: Funding to Address Patrol and Maintenance	$30,000	No.
No. 20: Maintenance of Portion of Ditch Creek Road	$1,000	Yes.
No. 21: Control of Erosion	$15,000	Yes

[a] The $311,600 annualized cost for this measure is in addition to the cost of providing PG&E's Minimum instream flows below Hendricks Diversion dam, and the Long Ravine, Cunningham Creek, and Little West Fork feeder diversions.

5.5 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 14 comprehensive plans that are applicable to the DeSabla-Centerville Hydroelectric Project. No inconsistencies were found.

California

California Advisory Committee on Salmon and Steelhead Trout. 1988. Restoring the balance: 1988 annual report. Sausalito, California. 84 pp.

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. 10 pp. and exhibit.

California Department of Fish and Game. 1990. Central Valley salmon and steelhead restoration and enhancement plan. Sacramento, California. April 1990. 115 pp.

California Department of Fish and Game. 1993. Restoring Central Valley streams: A plan for action. Sacramento, California. November 1993. 129 pp.

California Department of Fish and Game. 1996. Steelhead restoration and management plan for California. February 1996. 234 pp.

California Department of Parks and Recreation. 2003. Public opinions and attitudes on outdoor recreation in California 2002, An Element of the California Outdoor Recreation Planning Program. California State Parks. Sacramento, California.

California Department of Parks and Recreation. 2002. California outdoor recreation plan-2002. Sacramento, California. 154 pp. and appendices.

California Department of Water Resources. 1994. California water plan update. Bulletin 160-93. Sacramento, California. October 1994. Two volumes and executive summary.

California Department of Water Resources. 2000. Final programmatic environmental impact statement/environmental impact report for the CALFED Bay-Delta Program. Sacramento, California. July 2000. Three volumes and CD Rom.

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California State Water Resources Control Board. 1975. Water quality control plan report. Sacramento, California. Nine volumes.

California - The Resources Agency. 1989. Upper Sacramento River Fisheries and Riparian Habitat Management Plan. Sacramento, California. January 1989. 158 pp.

United States

Forest Service. 1992. Lassen National Forest land and resource management plan, including Record of Decision. Department of Agriculture, Susanville, California. Appendices and maps.

State Water Resources Control Board. 1999. Water Quality Control Plans and Policies Adopted as Part of the State Comprehensive Plan. April 1999. Three enclosures.

U.S. Fish and Wildlife Service. California Department of Fish and Game. California Waterfowl Association. Ducks Unlimited. 1990. Central Valley habitat joint venture implementation plan: a component of the North American waterfowl management plan. Department of the FWS, Portland, Oregon. February 1990. 102 pp.

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6.0 FINDING OF NO SIGNIFICANT IMPACT

Continuing to operate the DeSabla-Centerville Project, with our recommended measures, involves minimal land-disturbing or land-clearing activities. Our recommended measures would protect water quality, provide cold water to support the federally listed Chinook salmon and steelhead trout, increase minimum stream flows to project effected stream reaches, provide recreational opportunities at project reservoirs. Project operation and the associated fish and deer entrainment into project canals would result in some minor, long-term effects on resident fish from Butte Creek and the West Branch Feather River. Providing the canal fish rescues would help minimize the affects on the fishery. Deer and other mammals will continue to be entrained into and have their habitat segmented by the project's canals. Maintaining the canal bridge crossings and escapement facilities will help limit these effects.

On the basis of our independent analysis, we find that the issuance of a license for the DeSabla-Centerville Project, with our recommended environmental measures, would not constitute a major federal action significantly affecting the quality of the human environment.

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7.0 LITERATURE CITED

Ashton, D.T., Lind, A.J. and K.E. Schlick. 1998. foothill yellow-legged frog (Rana boylii) natural history. USDA Forest Service, Pacific Southwest Research Station, Arcata, California. 18 pages.

Butte County. http://www.buttecounty.net/dds/Planning/seismic.htm. October 8, 2008.

Butte Creek Watershed Conservancy (BCWC). 2000. Butte Creek Watershed – Watershed Management Strategy. Prepared by the California State University, Chico Research Foundation. 29 pp.

California Department of Fish and Game (Cal Fish & Game). 2008. Notice of Intervention and Submission of Recommendations of the California Department of Fish and Game, DeSabla Centerville Hydroelectric Project, FERC No. 803; Letter from Ann S. Malcom, General Counsel, to Ms. Kimberly Bose, Secretary, Federal Energy Regulatory Commission, dated June 30, 2008.

California Department of Health Service. (CDHS). 2006. California Code of Regulations, Title 22, Division 4, Chapter 15, Domestic Water Quality and Monitoring.

California Energy Commission. 2007. California Energy Demand 2008-2018, Staff Draft Report, CEC-200-2007-015SD . July.

California Sportfishing Protection Alliance, Friends of Butte Creek, American Whitewater, and Friends of the River (Conservation Groups). 2008. Submittal of Alternative Conditions to the Preliminary Section 4(e) Conditions for DeSabla-Centerville Hydroelectric Project, FERC No. 803; Letter from Chris Shutes, FERC Projects Director for California Sportfishing Protection Alliance, to Kimberly Bose, Secretary, Federal Energy Regulatory Commission, dated July 29, 2008.

California Toxics Rule (CTR). 2000. Water Quality Criteria for Priority Toxic Pollutants for California Inland Surface Waters, Enclosed Bays and Estuaries. United States Environmental Protection Agency. Federal Register: Vol. 65(97).

Central Valley Regional Water Quality Control Board (CVRWQCB). 2006. Water Quality Control Plan (Basin Plan) for the Central Valley Region-Fourth Edition (Revised August 2006) Sacramento River and San Joaquin River Basins. Published by the California Regional Water Quality Control Board, Central Valley Region and the State Water Resources Control Board, Sacramento, CA.

Department of Water Resources (DWR), Northern District. 2000. Draft Butte County Groundwater Inventory Analysis. Department of Planning and Local Assistance.

DWR. 2004. Data transfer water quality and water temperature data from agency archives.

Federal Energy Regulatory Commission. 2005. Final environmental assessment, Poe Hydroelectric Project, Project No. 2107-016, California. March 2007.

Hill, K.A., and J.D. Webber. 1999. Butte Creek Spring-run Chinook Salmon,

Onchorhynchus tshawytscha, Juvenile Outmigration and Life History (1995 to 1998). State of California; The Resources Agency-Department of Fish and Game. 1999.

Jackman, R.E., and J. M..Jenkins. 2004. Protocol for evaluating bald eagle habitat and populations in California. Prepared for U.S. Fish and Wildlife Service. June 2004.

Kupferberg, S.J. 1996. Hydrologic and geomorphic factors affecting conservation of river-breeding frog (*Rana boylii*). Ecological Applications, 6(4): 1332-1344.

Kupferberg, S.J. 2006. Final letter report regarding *Rana boylii* in the Upper American River Project. Letter to J.O. Williams, Fisheries Biologist, Eldorado National Forest, Placerville, Califronia. October 5, 2006.

Kupferberg, S.J., A. Lind, J. Mount, and S. Yarnell. 2007. Pulsed flow effects on the foothill yellow-legged frog (*Rana boylii*): Integration of empirical, environmental and hydrodynamic modeling approached. Fianl report. California Energy Comission, PIER.

Lind, A.J., Hartwell H. Welsh, Jr., and Randolph A. Wilson. 1996. The effects of a dam on breeding habitat and egg survival of the foothill yellow-legged frog (*Rana boylii*) in Northwestern California. Herpetological Review 27(2): 62-67.

Lind, A.J, and L. Yarnell. 2008. Habitat suitability criteria for the foothill yellow-legged frog (*Rana boylii*) in the northern Sierra Nevada and coast ranges of California--final report. foothill yellow-legged frog Habitat Suitability Criteria Technical Workgroup. January 11, 2008.

National Oceanic and Atmospheric Administration-National Marine Fisheries Service (NMFS). 2008. Motion to Intervene, Comments, Recommended Terms and Conditions, Preliminary Prescription, and Index to Administrative Record for the DeSabla Centerville Hydroelectric Project, FERC No. 803; Letter from Rodney R. McInnis, Regional Administrator, to Ms. Kimberly Bose, Secretary, Federal Energy Regulatory Commission, dated June 30, 2008.

Pacific Gas and Electric Company (PG&E). 1985. Application for Amendment of License-DeSabla Centerville Hydroelectric Project FERC No. 803.

PG&E. 1994. DeSabla-Centerville Hydroelectric Project FERC No. 803, Two-Year Water temperature and Stream Flow Monitoring Study.

PG&E. 2004. DeSabla-Centerville Hydroelectric Project FERC No. 803, Pre-Application Document (PAD). Vol 1: Public Information. October 4, 2004.

PG&E. 2005. DeSabla-Centerville Hydroelectric Project FERC No. 803, Revised Study Plan. Public Information. July 16, 2005.

PG&E. 2006. Additional information request: animal loss records and canal structures that promote wildlife movement on project canals. December 2006.

PG&E. 2007a. DeSabla-Centerville Hydroelectric Project FERC Project No. 803, License Application. October 2007.

PG&E. 2007b. DeSabla-Centerville Hydroelectric Project FERC Project No. 803, Updated Study Results and License Application Sections. Filed on December 31, 2007.

PG&E. 2007c. Response to October 31, 2007 additional information request. November 20, 2007.

PG&E. 2008. DeSabla-Centerville Hydroelectric Project FERC Project No. 803, Reply Comments-Licensee Reply to Recommendations, Preliminary Terms and Conditions, and Preliminary Fishway Prescriptions. Filed August 14, 2008.

PG&E. 2008a. Pacific Gas and Electric Co's Updated Study Results and License Application Sections for the DeSabla-Centerville Hydroelectric Project under P-803. Filed February 19, 2008.

PG&E. 2008b. Pacific Gas and Electric Co's Errata Notice Regarding Application for New License for the DeSabla-Centerville Hydroelectric Project under P-803. Filed September 4, 2008.

PG&E. 2008c. Pacific Gas and Electric Co's Submittal of Alternative Conditions for Certain Preliminary 4(e) Conditions Submitted by the United States Forest Service to FERC for the DeSabla-Centerville Project, FERC Project No. 803. Filed July 30, 2008.

PG&E and U.S. Fish and Wildlife Service. 2003. Valley Elderberry Longhorn Beetle Conservation Program. March 2003.

Slade, R.C. and Associates, LLC. 2000. Hydrogeologic evaluation and well siting feasibility study, Paradise Irrigation District, Butte County, California. Unpublished draft report.

Stumm, W. and J.J. Morgan. 1970. Aquatic chemistry: an introduction emphasizing chemical equilibria in natural waters. Wiley Interscience, New York.

the Water Board (State Water Resources Control Board). 2004b. Recommended Numerical Limits to Translate Water Quality Objectives. May 19 2004.

U.S. Department of the FWS (FWS). 2008. Comments, Recommendations, Terms and Conditions, and Prescriptions, DeSabla Centerville Hydroelectric Project, FERC No. 803; Letter from Patricia Sanderson Port, Regional Environmental Officer, to Ms. Kimberly Bose, Secretary, Federal Energy Regulatory Commission, dated June 26, 2008.

USEPA. 2000a. Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California, 40 CFR 131. May 18.

USEPA. 2001. Water Quality Criterion for the Protection of Human Health: Methylmercury. Office of Water Report No. EPA-823-R-01-001. January.

U.S. Fish and Wildlife Service. 2003. Formal endangered species consultation on the Pacific Gas and Electric Company Transmission Separation Project, located in the Plumas, Sequoia, and Sierra National Forests within Butte, Plumas, Madera and Fresno Counties; in the Redding, Folsom, and Bakersfield Districts within Madera, Fresno, Amador, Calaveras, Tuolumne, Nevada, Placer, Butte, Yuba, Shasta and Tehama Counties; and various other jurisdictions, California. June 23, 2003.

U.S. Fish and Wildlife Service. 2005. Formal endangered species consultation on Federal Energy Regulatory Commission’s proposed license for Pacific Gas and

Electric Company's Upper North Fork Feather River Hydroelectric Project, FERC No.2105, Plumas County, California. January 25, 2005.

U.S. Fish and Wildlife Service. 2007. Biological opinion for the Oroville Facilities Relicensing Project (FERC File Number 2100), Butte County, California. April 9, 2007.

U.S. Fish and Wildlife Service. 2008. Final national bald eagle management guidelines.

U.S. Forest Service (Forest Service). 1998. Geophysical background reports for vegetation management and fire. Report prepared by Stephen L. Young, Lassen National Forest.

U.S. Forest Service. 2008. Preliminary Section 4(e) Terms and Conditions and Section 10(a) Recommendations, DeSabla Centerville Hydroelectric Project, FERC No. 803; dated June 26, 2008.

Western Electricity Coordinating Council. 2006. 10-Year Coordinated Plan Summary, Planning and Operation for Electric System Reliability. July.

Wetzel, R.G. 2001. Limnology: lake and river ecosystems. 3rd edition. Associated Press. San Diego, CA.

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8.0 LIST OF PREPARERS

Kenneth Hogan – EA Coordinator, Aquatic Resources, and Threatened and Endangered Species (Fishery Biologist; B.T., Fisheries Management and Aquaculture).

Aaron Liberty – Aquatic Resources, and Threatened and Endangered Species (Fishery Boilogist; M.S., Fisheries and Wildlife Sciences).

John Mudre - Aquatic Resources (Ecologist; Ph.D., Fisheries Science)

Emily Carter – Cultural Resources (Environmental Biologist; B.A., Environmental Studies)

Carolyn Templeton – Geology and Soils. (Environmental Biologist; M.S., GeoEnvironmental Studies; B.S., Biology)

Alan Mitchnick – Terrestrial Resources and Threatened and Endangered Species (Environmental Biologist; M.S., Wildlife and Fisheries Science).

Shana Murray – Recreation, Land Use, and Aesthetic Resources (Outdoor Recreation Planner; M.S. Recreation, Park, and Tourism Management)

Timothy Looney – Need for Power and Developmental Analysis (Civil Engineer; B.S. Engineering)

James Fargo – Developmental Analysis (Civil Engineer, M.S., Civil Engineering).

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Appendix A - Existing water rights on Butte Creek and West Branch Feather River

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Appendix A-Existing water rights on Butte Creek and West Branch Feather River with potential to affect or be affected by the DeSabla-Centerville Project. (Source: PG&E, 2004)

App. No.	Permit No.	License No.	App. Date	Source Stream	Trib. Stream	Max Storage	Max Direct Diversion
A000476	271		9/21/1916	Little Butte Creek	Butte Creek	9,500	0
A000476	271		9/21/1916	Little Butte Creek	Butte Creek	9,500	0
A002755	2006	988	2/9/1922	Philbrook Creek	West Branch Feather River	5,060	0
A002909	2027	1029	6/27/1922	Butte Creek	Butte Slough	0	20 CFS
A004989	2706	837	4/7/1926	West Branch Butte Creek	Butte Creek	0	2.53 CFS
A005109	3210	2614	7/17/1926	Butte Creek	Butte Slough	0	20 CFS
A005110	3211	2615	7/17/1926	Butte Creek	Butte Slough	0	20 CFS
A006723	3634	2560	7/8/1930	Empire Creek	West Branch Feather River	0	3 CFS
A008187	4699	2616	12/1/1934	Butte Creek	Butte Slough	0	100 CFS
A008188	4700	2617	12/1/1934	Butte Creek	Butte Slough	0	100 CFS
A008422	4644	2423	8/21/1935	Ogden Creek	West Branch Feather River	0	16000 GPD
A008422	4644	2423	8/21/1935	Ogden Creek	West Branch Feather River	0	16000 GPD
A008559	4743		2/19/1936	Big Butte Creek	Butte Slough	0	50 CFS

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A008565	4744		2/27/1936	Big Butte Creek	Butte Slough	0	50 CFS
A009735	5847		2/22/1939	Big Butte Creek	Butte Slough	0	50 CFS
A009736	5848		9/22/1939	Big Butte Creek	Butte Slough	0	50 CFS
A015866	10390	9267	5/10/1954	Butte Creek	Sacramento River	0	5.9 CFS
A015867	10391	9268	5/10/1954	Butte Creek	Butte Slough	0	5.9 CFS
A018780 A	12104	6940A	6/9/1959	UNSP	Little Butte Creek	0	960 GPD
A018780 B	12104	6940B	6/9/1959	UNSP	Little Butte Creek	0	960 GPD
A018780 C	12104	6940C	6/9/1959	UNSP	Little Butte Creek	0	960 GPD
A020429	13430	8025	10/6/1961	UNSP	UNST	0	7200 GPD
A022061	16040		2/25/1965	Little Butte Creek	Butte Creek	8,800	0
A022534	16022	10432	7/27/1966	Butte Creek	Butte Slough	0	8 CFS
A022564	16029	10433	8/29/1966	Butte Creek	Butte Slough	0	2.33 CFS
A022864	15752	10214	7/28/1967	UNSP (2)	Little Butte Creek	0	0.075 CFS
A023298	15950	10194	6/17/1969	Little Butte Creek	Butte Creek	45	0
A023298	15950	10194	6/17/1969	Little Butte Creek	Butte Creek	45	0
A023875	16631	10806	9/24/1971	Dix Butte Mine	UNST	0	900 GPD
A025967	18068		4/9/1979	Little Butte Creek	Butte Creek	0	10 CFS
A027815	20227		7/28/1983	Butte Creek	Butte Slough	0	250 CFS
A028567	20052	13249	10/2/1985	UNSP	UNST	0	600 GPD
A028663	20458	13250	12/18/1985	UNSP	UNST	0	0.09 CFS
A029251	20457	13251	5/25/1988	UNSP	UNST	0	0.223 CFS
A029580	20498		10/2/1989	UNSP	UNST	100	0.05 CFS
A029619	20949		11/24/1989	UNSP	UNST	0	0.09 CFS

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A029619	20949		11/24/1989	UNSP	Butte Creek	0	0.09 CFS
A029913			3/7/1991	Butte Creek	Butte Slough	52	0
A031413			4/15/2003	Butte Creek	Sacramento River	0	25 CFS
F003379S			1/1/1967	UNSP	Philbrook Creek	0	100 GPD
F005181S			1/1/1970	UNSP	West Branch Feather River	0	0
S000888			6/17/1967	West Branch Feather River	Feather River	1196	0
S000889			6/17/1967	West Branch Feather River	Feather River	0	125 CFS
S000890			6/17/1967	Butte Creek	Sacramento River	0	95 CFS
S000891			6/17/1967	Butte Creek	Sacramento River	0	180 CFS
S000892			6/12/1967	West Branch Feather River	Feather River	0	75 CFS
S000893			6/12/1967	Inskip Creek	Butte Creek	0	5 CFS
S000897			6/12/1967	Kelsey Creek	Butte Creek	0	2 CFS
S000901			6/12/1967	Clear Creek	Butte Creek	0	40 CFS
S000911			1/12/1967	Long Ravine	West Branch Feather River	0	130 CFS
S000912			6/12/1967	Little West Branch	West Branch Feather River	0	5 CFS
S000913			6/12/1967	Cunningham Ravine	West Branch Feather	0	5 CFS

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					River		
S000916			6/12/1967	UNST	West Branch Feather River	0	3 CFS
S000917			6/12/1967	Helltown Ravine	Butte Creek	0	180 CFS
S001251			6/23/1967	West Branch Feather River	Feather River	9.3	12.25 CFS
S001252			6/23/1967	Little Butte Creek	Butte Creek	0	0.5 CFS
S001252			6/23/1967	Little Butte Creek	Butte Creek	0	0.5 CFS
S001253			6/23/1967	Griffin Gulch	West Branch Feather River	0	1000 GPD
S001254			6/23/1967	Empire Creek	West Branch Feather River	0	1000 GPD
S001258			6/23/1967	Fall Creek	West Branch Feather River	0	1000 GPD
S001259			6/23/1967	Fall Creek	West Branch Feather River	0	1000 GPD
S001260			6/23/1967	Fall Creek	West Branch Feather River	0	1000 GPD
S001268			6/23/1967	West Branch Feather River	Feather River	0	1000 GPD
S001276			6/23/1967	Kanaka Creek	Clear Creek	0	1000 GPD
S001278			6/23/1967	Cold Creek	West Branch	0	1000 GPD

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					Feather River		
S001287			6/23/1967	Fish Creek	West Branch Feather River	0	1000 GPD
S001288			6/23/1967	High Rock Ravine	Last Chance Creek	0	1000 GPD
S001290			6/23/1967	Discovery Creek	Last Chance Creek	0	1000 GPD
S001293			6/23/1967	West Branch Butte Creek	Butte Creek	0	1000 GPD
S001294			6/23/1967	Haw Creek	Butte Creek	0	1000 GPD
S001297			6/23/1967	Inskip Creek	Butte Creek	0	1000 GPD
S001298			6/23/1967	West Branch Feather River	Feather River	0	1000 GPD
S001299			6/23/1967	Secret Creek	Bull Creek	0	1000 GPD
S001303			6/23/1967	Bull Creek	Butte Creek	0	1000 GPD
S001304			6/23/1967	Coon Creek	Bull Creek	0	1000 GPD
S001305			6/23/19667	Butte Creek	Sacramento River	0	1000 GPD
S008006			6/1/1972	Nesbet Ravine	Butte Creek	0	14400 GPD
S008079			1/1/1973	UNXX	UNST	0	16.5 GPD
S008304			1/1/1974	UNSP	Little Butte Creek	0	15120 GPD
S008459			1/1/1975	Little Butte Creek	Butte Creek	2,640	50 CFS
S009901			6/4/1979	Ogden Creek	West Branch Feather River	0	320 GPD
S009970			9/14/1979	Ogden Creek	West Branch	0	60 GPD

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					Feather River		
S012328			2/14/1986	Griffin Gulch	West Branch Feather River	0	5000 GPD
S012333			2/14/1986	West Branch Butte Creek	Butte Creek	0	5000 GPD
S012335			2/14/1986	Discovery Creek	Last Chance Creek	0	5000 GPD
S012336			2/14/1986	Fish Creek	West Branch Feather River	0	5000 GPD
S012337			2/14/1986	Clear Creek	Butte Creek	0	5000 GPD
S012338			2/14/1986	Clear Creek	Butte Creek	0	5000 GPD
S012340			2/14/1986	Long Ravine	Little W. Fork Feather River	0	5000 GPD
S012341			2/14/1986	UNST	West Branch Feather River	0	5000 GPD
S012343			2/14/1986	Cold Creek	West Branch Feather River	0	5000 GPD
S012344			2/14/1986	Long Ravine	Little W. Fork Feather River	0	5000 GPD
S012345			2/14/1986	Little W. Fork Feather River	West Branch Feather River	0	5000 GPD
S012346			2/14/1986	Long Ravine	Little W.	0	5000 GPD

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					Fork Feather River		
S012355			2/14/1986	Cedar Creek	West Branch Butte Creek	0	5000 GPD
S012357			2/14/1986	Last Chance Creek	West Branch Feather River	0	5000 GPD
S012370			2/14/1986	UNST	Butte Creek	0	5000 GPD
S012371			2/14/1986	West Branch Feather River	Feather River	0	5000 GPD
S013196			9/15/1988	UNSP	Butte Creek	0	0.401 CFS
S013427			5/4/1990	Little Butte Creek	Butte Creek	70	4 CFS
S013619			3/25/1991	Concow Creek	Concow Reservoir	0	0.044 CFS
S013623			3/25/1991	Lockerman Creek	Camp Creek	0	0.445 CFS
S013624			3/25/1991	UNST	Lockerman Creek	0	0.178 CFS
S013625			3/25/1991	Camp Creek	Lockerman Creek	0	0.178 CFS
S013634			3/25/1991	Long Ravine	Little West Fork	0	0.445 CFS
S013635			3/25/1991	Big Kimshew Creek	West Branch Feather River	0	0.445 CFS
S013637			3/25/1991	Little Kimshew Creek	Big Kimshew Creek	0	0.445 CFS
S013638			3/25/1991	Keyser Creek	Big Kimshew Creek	0	0.445 CFS

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S013639			3/25/1991	UNST	Breakneck Canyon	0	0.044 CFS
S013646			3/25/1991	West Branch Butte Creek	Butte Creek	0	0.445 CFS
S013647			3/25/1991	Platt Ravine	Butte CreekFeather River	0	0.178 CFS
S013649			3/25/1991	UNST	Gallager Ravine	0	0.445 CFS
S013651			3/25/1991	Little Kimshew Creek	Big Kimshew Creek	0	0.445 CFS
S013652			3/25/1991	UNST	Little Kinshew Creek	0	0.0445 CFS
S013653			3/25/1991	Keyser Creek	Kimshew Creek	0	0.445 CFS
S013654			3/25/1991	Keyser Creek	Kimshew Creek	0	0.178 CFS
S013660			3/25/1991	UNSP	UNST	0	0.044 CFS
S013661			3/25/1991	Web Hollow	Big Chico Creek	0	0.044 CFS
S013662			3/25/1991	West Branch Butte Creek	Butte Creek	0	0.044 CFS
S013663			3/25/1991	Clear Creek	Butte Creek	0	0.178 CFS
S013668			3/25/1991	Last Chance Creek	West Branch Feather River	0	0.445 CFS
S013669			3/25/1991	UNST	Inskip Creek	0	0.044 CFS
S013670			3/25/1991	Inskip Creek	Butte Creek	0	0.445 CFS
S013673			3/25/1991	Fish Creek / West Branch	Fish Creek	0	0.178 CFS
S013674			3/25/1991	Big Kimshew Creek	West Branch Feather River	0	0.044 CFS

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S013675			3/25/1991	Brown Ravine	Last Chance Creek	0	0.178 CFS
S013676			3/25/1991	Secret Creek	Bull Creek	0	0.178 CFS
S013677			3/25/1991	UNST	Bull Creek	0	0.044 CFS
S013678			3/25/1991	UNST	Bull Creek	0	0.178 CFS
S013681			3/25/1991	UNST	West Branch Feather River	0	0.178 CFS
S013683			3/25/1991	Alder Creek	Butte Creek	0	0.178 CFS
S013686			3/25/1991	Bull Creek	Butte Creek	0	0.178 CFS
S013687			3/25/1991	West Branch Feather River	Oroville Reservoir	0	0.178 CFS
S013688			3/25/1991	Grizzly (UNST)	Butte Creek	0	0.178 CFS
S013692			3/25/1991	Malloy Creek (UNST)	Butte Creek	0	0.044 CFS
S013693			3/25/1991	Big Chico Creek	Sacramento River	0	0.455 CFS
S013698			6/6/1991	Butte Creek	Sacramento River	0	0.066 CFS
S014232			9/29/1994	UNST	Little Butte Creek	0	0.022 CFS

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Appendix B - W2 Model Simulation Results

Appendix B; table 1: W2 Simulation Results: Difference between base case and simulation from Julian day 170 (6/19) to Julian day 220 (8/08) using the 2005 calibrated model (above normal hydrology, hot meteorology). WMMT = Weekly Mean of the daily Maximum Temperatures during the hottest week of the summer. (PG&E, 2008b)

	Simulation	Location	Mean Temp. Difference, C	Largest Change in Daily Maximum Temp. (+/-), C	Julian Day of Largest Temp. Difference	WMMT* (JD195-201), C
8	60 cfs below LCDD and 80% reduction in DSF thermal loading	Butte Creek Below Centerville Powerhouse	-0.12	-0.63	170	-0.37
		Butte Creek Above Centerville Powerhouse	-0.27	-0.86	170	-0.46
		Butte Creek at Hellhorn	-0.14	-0.84	170	-0.72
9	60 cfs below LCDD and 80% reduction in DSF thermal loading	Butte Creek Below Centerville Powerhouse	0.22	1.02	170	0.19
		Butte Creek Above Centerville Powerhouse	-0.xx	-1.37	170	-0.44
		Butte Creek at Hellhorn	-0.15	-1.15	170	-0.12
		Butte Creek at Pool 4	-0.16	-1.26	212	-0.08
		Butte Creek at Quartz Bowl	-0.29	-1.14	215	-0.13
10	All DSFH flow in Butte Creek and 80% Reduction in DSF thermal loading	Butte Creek Below Centerville Powerhouse	0.03	-0.19	170	0.04
		Butte Creek Above Centerville Powerhouse	-1.37	-2.78	200	-2.56
		Butte Creek at Hellhorn	-1.09	-3.27	200	-2.89
11	All DSFH flow in Butte Creek and 80% Reduction in DSF thermal loading	Butte Creek Below Centerville Powerhouse	-0.1	-1.21	170	0.0
		Butte Creek Above Centerville Powerhouse	-1.47	-3.11	200	-2.80
		Butte Creek at Hellhorn	-1.21	-3.13	200	-2.56
		Butte Creek at Pool 4	1.01	3.12	200	2.60
		Butte Creek at Quartz Bowl	-0.40	-1.37	215	-0.60
12	20 cfs release into WBFR (Remove 5 cfs at HHD)and 80% Reduction in DSF thermal loading	Butte Creek Below Centerville Powerhouse	0.28	1.21	170	0.37
		Butte Creek Above Centerville Powerhouse	-0.23	-0.97	215	-0.44
		Butte Creek at Hellhorn	-0.25	-0.59	215	-0.47
13	20 cfs release into WBFR (Remove 5 cfs at HHD). 80% Reduction in DSF thermal loading and All DSFH flow in Butte Creek	Butte Creek Below Centerville Powerhouse	0.10	0.78	171	0.11
		Butte Creek Above Centerville Powerhouse	1.16	2.84	196	2.16
		Butte Creek at Hellhorn	1.20	2.71	200	2.19
14	30 cfs release into WBFR (Remove 15 cfs at HHD) and 80% Reduction in DSF thermal loading	Butte Creek Below Centerville Powerhouse	-0.14	-0.81	170	-0.13
		Butte Creek Above Centerville Powerhouse	0.20	0.67	170	0.39
		Butte Creek at Hellhorn	0.22	0.73	170	0.44

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	Simulation	Location	Mean Temp. Difference, C	Largest Change in Daily Maximum Temp. (+/-), C	Jday of Largest Temp. Difference	WMAT* (JD195-201), C
8	60 cfs below LCDD and 80% reduction in DSF thermal loading	Butte Creek Below Centerville Powerhouse	-0.12	-0.63	170	-0.27
		Butte Creek Above Centerville PowerHouse	-0.27	-0.96	170	-0.26
		Butte Creek at Helltown	-0.26	-0.94	170	-0.32
9	60 cfs below LCDD and 80% reduction in DSF thermal loading	Butte Creek Below Centerville Powerhouse	-0.22	-1.02	170	-0.49
		Butte Creek Above Centerville Powerhouse	-0.36	-1.37	170	-0.44
		Butte Creek at Helltown	0.35	1.35	170	0.52
		Butte Creek at Pool 4	-0.36	-1.26	213	-0.58
		Butte Creek at Quartz Bowl	0.32	1.14	213	0.53
10	All DSPH flow in Butte Creek and 80% Reduction in DSF thermal loading	Butte Creek Below Centerville Powerhouse	0.00	-0.79	170	0.24
		Butte Creek Above Centerville Powerhouse	-1.37	-2.73	200	-2.56
		Butte Creek at Helltown	-1.09	-2.72	200	-2.19
11	All DSPH flow in Butte Creek and 80% Reduction in DSF thermal loading	Butte Creek Below Centerville Powerhouse	-0.11	-1.21	170	0.00
		Butte Creek Above Centerville PowerHouse	-1.47	-3.11	212	-2.80
		Butte Creek at Helltown	-1.20	-3.13	200	-2.66
		Butte Creek at Pool 4	-1.01	-3.12	200	-2.60
		Butte Creek at Quartz Bowl	0.40	1.37	213	0.60
12	30 cfs release into WBFR (Remove 5 cfs @ HHD)and 80% Reduction in DSF thermal loading	Butte Creek Below Centerville Powerhouse	-0.26	-1.21	170	-0.37
		Butte Creek Above Centerville Powerhouse	-0.23	-0.67	213	-0.44
		Butte Creek at Helltown	-0.25	-0.69	213	-0.47
13	30 cfs release into WBFR (Remove 5 cfs @ HHD), 80% Reduction in DSF thermal loading and All DSPH flow in Butte Creek	Butte Creek Below Centerville Powerhouse	-0.10	-0.78	171	0.14
		Butte Creek Above Centerville PowerHouse	-1.46	-2.84	196	-2.66
		Butte Creek at Helltown	-1.20	-2.71	200	-2.49
14	30 cfs release into WBFR (Remove 15 cfs @ HHD) and 80% Reduction in DSF thermal loading	Butte Creek Below Centerville Powerhouse	-0.14	-0.61	170	-0.13
		Butte Creek Above Centerville PowerHouse	-0.20	-0.67	170	-0.39
		Butte Creek at Helltown	-0.22	-0.73	170	-0.44

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	Simulation	Location	Mean Temp. Difference, C	Largest Change in Daily Maximum Temp. (+/-), C	Jday of Largest Temp. Difference	WMMT* (JD195-201), C
15	30 cfs release into WBFR (Remove 15 cfs @ HHD). 2 cfs removed from Hendricks feeders, 2 cfs removed from the Butte Canal, and 80% Reduction in DSF thermal loading	Butte Creek Below Centerville Powerhouse	-0.09	-0.38	170	-0.04
		Butte Creek Above Centerville Powerhouse	-0.18	-0.56	213	-0.39
		Butte Creek at Helltown	-0.20	-0.57	213	-0.43
		Butte Creek at Pool 4	0.20	0.61	170	0.17
		Butte Creek at Quartz Road	-0.24	-0.55	190	-0.23

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Appendix B; table 2: W2 Simulation Results: Difference between base case and simulation from Julian day 170 (6/19) to Julian day 220 (8/08) using 2001 hydrology and 2005 meteorology (dry hydrology, hot meteorology). WMMT = Weekly Mean of the daily Maximum Temperatures during the hottest week of the summer. (PG&E, 2008b)

	Simulation	Location	Mean Temp. Difference, C	Largest Change in Daily Maximum Temp. (Δ), C	Jday of Largest Temp. Difference	WMMT (JD185-201), C
12	50 cfs below LCDD	Butte Creek Below Centerville Powerhouse	0.84	1.80	189	1.22
		Butte Creek Above Centerville Powerhouse	-0.57	-0.65	170	-0.25
		Butte Creek at Helltown	-0.46	-0.71	201	-0.42
17	80 cfs below LCDD	Butte Creek Below Centerville Powerhouse	0.24	1.15	189	1.07
		Butte Creek Above Centerville Powerhouse	-0.08	-1.34	219	-0.06
		Butte Creek at Helltown	0.71	1.05	201	0.81
18	All DSPH flow in Butte Creek	Butte Creek Below Centerville Powerhouse	0.20	1.19	202	1.00
		Butte Creek Above Centerville Powerhouse	-1.34	-2.01	202	-1.45
		Butte Creek at Helltown	1.06	1.99	201	1.32
19	15 cfs release into WEIR (Remove 5 cfs @ HED)	Butte Creek Below Centerville Powerhouse	0.07	0.21	198	0.18
		Butte Creek Above Centerville Powerhouse	0.01	0.12	202	0.02
		Butte Creek at Helltown	0.05	0.07	202	0.04
20	15 cfs release into WEIR (Remove 5 cfs @ HED)	Butte Creek Below Centerville Powerhouse	0.11	0.52	197	0.28
		Butte Creek Above Centerville Powerhouse	0.03	0.26	202	0.03
		Butte Creek at Helltown	0.04	0.25	202	0.04
21	X cfs release into WEIR (Remove 15 cfs @ HED)	Butte Creek Below Centerville Powerhouse	0.21	0.53	198	0.57
		Butte Creek Above Centerville Powerhouse	0.06	0.21	202	0.07
		Butte Creek at Helltown	0.07	0.21	202	0.07
22	50% Reduction in DSF thermal loading	Butte Creek Below Centerville Powerhouse	0.26	0.17	214	0.22
		Butte Creek Above Centerville Powerhouse	-0.18	-0.32	215	-0.24
		Butte Creek at Helltown	0.20	0.05	213	0.18

	Simulation	Location	Mean Temp. Difference, C	Largest Change in Daily Maximum Temp. (+/-), C	Day of Largest Temp. Difference	WMMT (JD195-201), C
23	80% Reduction in DSF thermal loading	Butte Creek Below Centerville Powerhouse	-0.41	-0.73	214	-0.36
		Butte Creek Above Centerville Powerhouse	0.29	0.83	213	0.33
		Butte Creek at Helltown	-0.39	-1.05	213	-1.07
		Butte Creek at Pool 4	0.33	1.07	214	0.69
		Butte Creek at Quartz Bowl	-0.44	-0.94	202	-1.18
24	60 cfs below LCDD and 50% reduction in DSF thermal loading	Butte Creek Below Centerville Powerhouse	-0.05	0.65	180	0.47
		Butte Creek Above Centerville Powerhouse	-0.78	-1.23	202	-0.77
		Butte Creek at Helltown	0.65	1.37	201	0.97
25	60 cfs below LCDD and 80% reduction in DSF Thermal Loading	Butte Creek Below Centerville Powerhouse	-0.21	0.62	180	0.22
		Butte Creek Above Centerville Powerhouse	-0.92	-1.59	202	-1.10
		Butte Creek at Helltown	0.81	1.79	201	1.31
		Butte Creek at Pool 4	-0.67	-1.94	201	-1.40
		Butte Creek at Quartz Bowl	0.56	1.14	202	0.22
26	All DSPH flow in Butte Creek and 50% Reduction in DSF thermal loading	Butte Creek Below Centerville Powerhouse	-0.05	0.90	170	0.25
		Butte Creek Above Centerville Powerhouse	-1.62	-1.73	202	-2.16
		Butte Creek at Helltown	-1.33	-2.56	202	-2.27
27	All DSPH flow in Butte Creek and 80% Reduction in DSF thermal loading	Butte Creek Below Centerville Powerhouse	-0.21	-0.84	201	-1.10
		Butte Creek Above Centerville Powerhouse	1.75	2.36	202	2.53
		Butte Creek at Helltown	-1.49	-2.86	202	-2.61
		Butte Creek at Pool 4	1.35	2.90	202	2.72
		Butte Creek at Quartz Bowl	-0.61	-1.25	202	-0.24
28	15 cfs release into WBFP (Remove 3 cfs @ HHD) and 80% Reduction in DSF thermal loading	Butte Creek Below Centerville Powerhouse	-0.32	-0.56	214	-0.15
		Butte Creek Above Centerville Powerhouse	[illegible]	-0.80	213	[illegible]
		Butte Creek at Helltown	0.30	1.02	213	0.72

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	Simulation	Location	Mean Temp. Difference, C	Largest Change in Daily Maximum Temp. (Hr), C	Jday of Largest Temp. Difference	WMMT* (JD195-201), C
29	15 cfs release into WBFR (Remove 8 cfs @ HHD), 80% Reduction in DSF thermal loading and All DCFH Flow in Butte Creek	Butte Creek Below Centerville Powerhouse	-0.17	0.76	[illegible]	[illegible]
		Butte Creek Above Centerville Powerhouse	-1.66	-2.91	202	-2.32
		Butte Creek at Helltown	-1.41	-1.58	202	-2.40
30	10 cfs release into WBFR (Remove 3 cfs @ HHD) and 80% Reduction in DSF thermal loading	Butte Creek Below Centerville Powerhouse	-2.58	-0.65	214	-0.29
		Butte Creek Above Centerville Powerhouse	2.28	0.81	213	0.37
		Butte Creek at Helltown	-0.31	-1.04	215	-0.75
31	15 cfs release into WBFR (Remove 7 cfs @ HHD, 2 cfs removed from Hendricks feeders, 4 cfs removed from the Butte Canal and 80% Reduction in DSF thermal loading	Butte Creek Below Centerville Powerhouse	-0.24	-0.39	214	0.11
		Butte Creek Above Centerville Powerhouse	-0.15	-0.77	213	-0.16
		Butte Creek at Helltown	-0.26	-1.30	215	-0.61
		Butte Creek at Pool 4	-2.30	-1.02	214	-0.74
		Butte Creek at Quartz Bowl	-0.43	-0.51	202	0.01

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Appendix C – Draft License Articles

Appendix C. Draft License Articles

I. Mandatory Conditions

Of the Forest Service's and the Bureau of Land Management's preliminary 4(e) conditions (described in section 2.2.4 of the EA) we include in the Staff Alternative 15 conditions as specified by the agencies, 12 from the Forest Service and 3 from the Bureau, modify four of the Forest Service conditions to adjust the scope of the measures, and did not recommend three conditions, two from the Forest Service and one from the Bureau; the measures we modify or do not adopt in total are discussed in more detail in section 5.2, *Comprehensive Development and Recommended Alternative*. However, we recognize that the Commission is required to include valid section 4(e) conditions in any license issued for the project.

Under the staff alternative with mandatory conditions, each of the measures that staff recommend's be modified or does not recommend at all would be added to the Staff Alternative. Incorporation of these mandatory conditions into a new license would cause us to modify or eliminate some of the environmental measures that we include in the Staff Alternative. Our recommendations for: water temperature and aquatic biota monitoring in the West Branch Feather River, minimum instream flows at Hendricks's diversion dam, and recreation facilities on National Forest System Lands would no longer be necessary given the Forest Service provides a counter part measure in their 4(e) conditions to our recommended measure.

As a result, the following provides the draft environmental license articles staff would recommend in addition to the mandatory conditions.

II. Additional License Articles Recommended by Commission Staff

We recommend including the following license articles for any license issued for the project:

Draft Article 4xx. *Minimum Instream Flows*. Within 90 days of license issuance, the licensee shall release the minimum instream flows downstream of Butte Creek diversion dam, Lower Centerville diversion dam, and Inskip, Kelsey, Clear, and Helltown Ravine creeks, as specified in the table below.

Point of Discharge	Minimum Instream Flow Requirement by Water Year	Time Period

	Normal	Dry	
Butte Creek diversion dam	30 16	20 7	March 1-May 31 June 1-February 28/29
Lower Centerville diversion dam	75 80 80 40	60 75 65 40	September 15-January 31 February 1-April 30 May 1-May 31 June 1-September 14
Inskip Creek	0.25	0.10	Year-round
Kelsey Creek	0.25	0.10	Year-round
Clear Creek	0.5	0.25	Year-round
Helltown Ravine Creek	1.0	0.5	Year-round

The interim minimum flow may be temporarily modified if required by operating emergencies beyond the control of the licensee, or for short periods upon agreement between the licensee, the California Department of Fish and Game (California Fish and Game), National Marine Fisheries Service (NMFS), and the Fish and Wildlife Service (FWS). If the required minimum flow is so modified, the licensee shall notify the Commission, California Fish and Game, NMFS, and the FWS as soon as possible, but not later than 10 days, after each such occurrence.

Draft Article 4xx. *Feeder Creek Diversion Removal Plan*. Within 1 year of license issuance, the licensee shall file with the Commission for approval a Feeder Creek Diversion Removal Plan. This plan shall include schedules, site plans, and mitigation measures for the removal of feeder diversion facilities on Stevens, Oro Fina, Emma Ravine, Coal Claim Ravine, and Little Butte creeks.

The licensee shall develop the plan after consultation with the FWS, California Fish and Game, Forest Service, and NMFS. The licensee shall include with the plan documentation of agency consultation, copies of comments and recommendations made in connection with the plan, and a description of how the plan accommodates the comments and recommendations of the agencies. The licensee shall allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing shall include the licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. The plan shall not be implemented until the licensee is notified that it has been approved by the Commission. Upon Commission approval, the licensee shall implement the plan, including any changes required by the Commission.

Draft Article 4xx. *Water Quality Monitoring*. The licensee shall conduct water quality monitoring in receiving streams prior to, during, and after returning Project canals to service. Sampling shall occur within 24 hours of taking the canal out of service, once in the middle of the canal outage, and within 24 hours of placing the canal back into service. Routine monitoring shall include sampling water quality in the receiving stream at one site upstream and downstream of the location the canal discharges water into the stream. Monitoring parameters will include water temperature, dissolved oxygen, and turbidity sampled at regular intervals. In the event that herbicides are used along Project canals, the licensee shall include herbicide sampling with the routine monitoring parameters listed above. Laboratory analysis shall include the herbicide's active ingredients and any degradation byproducts associated with aquatic toxicity in the herbicides used. Licensee shall provide a summary of cleaning and maintenance activities as well as the monitoring results to the SWRCB, and file the summary report with the Commission within 30 days of completing the monitoring and any associated laboratory analysis.

Draft Article 4xx. *Ramping Rate Plan*. To protect aquatic habitat downstream of the Butte Creek and Lower Centerville diversion dams when the Butte or Lower Centerville canals are brought on- or off-line, or in instances when the Project changes between required minimum instream flow releases, the licensee shall ramp controllable flows based upon the following criteria specified in Forest Service 4(e) condition no. 18(5) for downstream of the Hendricks diversion dam.

If sufficient water is not available to hold stream stage levels constant during periods when foothill yellow-legged frog egg masses are present, the flow releases shall be based on combined conditions of water velocity and stage in breeding areas, such that: (1) if eggs are laid at a high flow level, then during down-ramping (fall), stage changes shall not occur at a rate greater than 0.2 feet per second per hour at the egg mass site and water levels shall not drop to the extent that more than 20% of egg masses are de-watered; (2) during up-ramping (rise), velocity shall not change more than 0.2 feet per second per hour and shall not exceed 0.8 feet per second at the most sensitive egg mass site; and (3) when foothill yellow-legged frog tadpoles or juveniles are present, the up and down ramping rate shall be 0.4 feet per second per hour or less and shall not exceed 1.0 foot per second at the site.

Within 1 year of license issuance, the licensee shall file with the Commission for approval a Ramping Rate Monitoring Plan. This plan should include a methodology for determining how Project operations at each of these diversion dams affect downstream water velocities at specific monitoring locations, and a methodology for documenting compliance with the above

specified ramping rate criteria. This plan shall also provide for consultation with Forest Service, Cal Fish and Game, NMFS, and Interior to review foothill yellow-legged frog population monitoring results to determine if the ramping rate criteria specified above is protective of this species or if there is a need to potentially modify these ramping rates. Any revised ramping rates would need to be filed with the Commission for approval prior to implementation.

The licensee shall develop the plan after consultation with the Forest Service, FWS, California Fish and Game, and NMFS. The licensee shall include with the plan documentation of agency consultation, copies of comments and recommendations made in connection with the plan, and a description of how the plan accommodates the comments and recommendations of the agencies. The licensee shall allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing shall include the licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. The plan shall not be implemented until the licensee is notified that it has been approved by the Commission. Upon Commission approval, the licensee shall implement the plan, including any changes required by the Commission.

Draft Article 4xx. *DeSabla Forebay Water Temperature Improvement Plan*. Within two years of license issuance, the licensee shall file with the Commission for approval a DeSabla Forebay Water Temperature Improvement Plan based on the results of the feasibility study regarding the potential for reducing the thermal loading within DeSabla Forebay. At a minimum, the plan shall include a preliminary design of the proposed facility and a schedule for final design, permitting, and construction of the new facility. This plan shall also have a goal of reducing the thermal loading within the forebay by 50 percent at a minimum, as measured as the difference in heat gain between water temperature in the Toadtown canal above DeSabla forebay and at the DeSabla Powerhouse.

This plan shall also include a provision for monitoring water temperatures for a period of five years after construction of the physical modification is complete and in operation. Specific water temperature monitoring locations in Butte Creek should be selected in consultation with the Forest Service, FWS, California Fish and Game, and NMFS. After two years of monitoring, the licensee shall report the results of temperature monitoring to Cal Fish and Came, the Forest Service, FWS, NMFS, and the Commission.

The licensee shall develop the plan after consultation with the Forest Service, FWS, California Fish and Game, and NMFS. The licensee shall include

with the plan documentation of agency consultation, copies of comments and recommendations made in connection with the plan, and a description of how the plan accommodates the comments and recommendations of the agencies. The licensee shall allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing shall include the licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. The plan shall not be implemented until the licensee is notified that it has been approved by the Commission. Upon Commission approval, the licensee shall implement the plan, including any changes required by the Commission.

Draft Article 4xx. *Roving Operators*. Upon license issuance, the licensee shall provide a roving operator to inspect and monitor the feeder creek diversion facilities on Inskip, Clear, Kelsey, Long Ravine, Cunningham, and Little West Fork creeks. At a minimum, this roving operator shall inspect these diversions on a weekly basis, weather dependent, to ensure the required minimum instream flows are being released downstream of each respective diversion. The licensee shall notify the Commission, California Fish and Game, NMFS, and the FWS as soon as possible, but not later than 10 days, after any deviation from minimum instream flow requirements at these feeder diversions.

Draft Article 4xx. *Flow Monitoring and Recording*. Within one year of license issuance, the licensee shall construct, operate and maintain a real-time flow gaging station upstream of the Butte Creek diversion dam, and modify the existing stream gaging station near Lower Centerville diversion dam for real-time access. The licensee shall consult with the United States Geological Service to site, maintain and report information from these gages.

All data recorded by the above mentioned equipment all flows shall comply with United States Geological Survey standards and record flows at a frequency of no greater than 15-minute intervals.

The licensee shall measure and document all instream flow releases in publicly available and readily accessible formats. Flow data collected by the licensee from the stream gages will be made available to the USGS in annual hydrology summary reports. The flow values (generally 15-minute recordings) used to construct the 24-hour average flows will be available to the resource agencies from the licensee upon request.

Draft Article 4xx. *Reservoir Elevation Monitoring and Recording.* Within one year of license issuance, the licensee shall construct, operate and maintain a

real-time water temperature and reservoir elevation gage in Philbrook Reservoir. The licensee shall consult with the Forest Service, NMFS, FWS, and Cal Fish and Game on the location of these gages within the reservoir. The licensee shall also consult with the United States Geological Service to site, maintain and report information from these gages.

All data recorded by the above mentioned equipment all flows shall comply with United States Geological Survey standards and record flows at a frequency of no greater than 15-minute intervals.

Draft Article 4xx. *Fish Rescue Plan.* Within 180 days of license issuance, the licensee shall file with the Commission, for approval a plan for rescuing fish from project canals. The plan shall: (1) define activities that would trigger canal fish rescue efforts; (2) provide for the prior notification and coordination with the California Department of Fish and Game; and (3) identify methods to be implemented.

The licensee shall prepare the fish rescue plan, after consultation with the California Department of Fish and Game, the U.S. Fish and Wildlife Service, and the Forest Service. The licensee shall include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the comments are accommodated by the plan. The licensee shall allow a minimum of 30 days for comments and recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing shall include the licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Upon Commission approval, the licensee shall implement the plan, including any changes required by the Commission.

Draft Article 4xx. *Butte Creek Resident Fish Monitoring Plan.* Following a change to the minimum instream flows on Butte Creek, the licensee shall monitor the response of the fishery in the effected stream reach(s). Monitoring shall occur for two consecutive years, beginning the fifth year following the alteration of the minimum instream flow. Monitoring methods shall be consistent with those prescribed by the Forest Service in their 4(e) condition 20.

Within 180 days of completing the resident fish monitoring, the licensee shall file a report depicting the status of the monitored fishery, its response to the change in the minimum instream flows, and any recommended future alterations to project operations (e.g. minimum instream flows).

The licensee shall prepare the report, after consultation with the California Department of Fish and Game, the U.S. Fish and Wildlife Service, the National Marine Fisheries Service, the California State Water Resources Control Board, and the Forest Service. The licensee shall include with the final report documentation of consultation, copies of comments and recommendations submitted on a draft report after it has been prepared and provided to the agencies, and specific descriptions of how the comments are accommodated by the final report. The licensee shall allow a minimum of 30 days for comments and recommendations before filing the final report with the Commission. If the licensee does not adopt a recommendation, the filing shall include the licensee's reasons, based on project-specific information.

Any recommended alterations to project operations or facilities identified in the final report must first be approved by the Commission before they may be implemented.

Draft Article 4xx. *Federally Listed Anadromous Fish Monitoring Plan.* Within one year of license issuance, the licensee shall file with the Commission, for approval a plan for annually monitoring federally listed fish in lower Butte Creek. The plan shall at a minimum: (1) include annual snorkel surveys to monitor adult distribution and abundance, pre-spawn mortality surveys, and carcass surveys; and (2) provide for the consideration of juvenile emergence and outmigration monitoring in extreme dry years.

The licensee shall prepare the plan, after consultation with the National Marine Fisheries Service, the California Department of Fish and Game, the U.S. Fish and Wildlife Service, and the Forest Service. The licensee shall include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the comments are accommodated by the plan. The licensee shall allow a minimum of 30 days for comments and recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing shall include the licensee's reasons, based on project-specific information.

Draft Article 4xx. *Federally Listed Anadromous Fish Habitat Monitoring Plan.* Within one year of license issuance, the licensee shall file with the Commission, for approval a plan for monitoring federally listed fish habitat in lower Butte Creek. The plan shall include at a minimum provisions for monitoring and mapping the changes in behavioral responses of adult Chinook and steelhead, and alterations to their habitats (e.g. spawning gravel locations and quantity) as a result of a change in project operation (e.g. minimum instream flows) downstream of the Lower Centerville diversion dam.

The licensee shall prepare the plan, after consultation with the National Marine Fisheries Service, the California Department of Fish and Game, the U.S. Fish and Wildlife Service, and the Forest Service. The licensee shall include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the comments are accommodated by the plan. The licensee shall allow a minimum of 30 days for comments and recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing shall include the licensee's reasons, based on project-specific information.

Draft Article 4xx. *Benthic Macroinvertebrate Monitoring Plan.* Within 180 days of license issuance, the licensee shall file with the Commission, for approval a plan for monitoring benthic macroinvertebrates in project affected stream reaches within Butte Creek. The plans shall provide for monitoring during years 1, 2, 3, and 4, but for a maximum of 2 years per water year type (normal and dry), and include a report for each year monitoring is conducted. Follow-up monitoring shall be in conjunction with the Butte Creek resident fish population monitoring required by Article 4xx.

The licensee shall prepare the plan, after consultation with the California Department of Fish and Game, the National Marine Fisheries Service, the California State Water Resources Control Board, the U.S. Fish and Wildlife Service, and the Forest Service. The licensee shall include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the comments are accommodated by the plan. The licensee shall allow a minimum of 30 days for comments and recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing shall include the licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Upon Commission approval, the licensee shall implement the plan, including any changes required by the Commission.

Draft Article 4xx. *Long-term Operations Plan.* Within one year of license issuance, the licensee shall file with the Commission, for approval, a long-term operations plan. The plan shall have the primary goal of seeking to provide cold water for holding, spawning, and rearing Chinook salmon and steelhead in Butte Creek upstream and downstream of the Centerville Powerhouse. The plan shall include a protocol for how all project facilities will operate in both, the Butte

Creek and the West Branch Feather River watersheds, how and when water is to be diverted and its delivery location (e.g. Centerville powerhouse tailrace or the Lower Centerville diversion dam), and a preferred schedule for maintenance of project facilities. The plan shall also consider the feasibility of increasing spawning habitat availability by increasing flows in-between the Lower Centerville Diversion Dam and the Centerville Powerhouse during the spawning and egg incubation period (i.e., late-September to February), while balancing power production, and/or augmenting spawning gravels within that reach.

The plan shall provide for an oversight group, the Operations Group, to be made up of representatives from the licensee, National Marine Fisheries Service, the U.S. Fish and Wildlife Service, the California Department of Fish and Game, The California State Water Resources Control Board, and the Forest Service.

The licensee shall prepare the plan, after consultation with the Operations Group. The licensee shall include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the Operations Group, and specific descriptions of how the comments are accommodated by the plan. The licensee shall allow a minimum of 60 days for comments and recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing shall include the licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Upon Commission approval, the licensee shall implement the plan, including any changes required by the Commission.

Draft Article 4xx. *Annual Project Consultation*. Consistent with Forest Service 4(e) condition 1, the licensee shall also annually consult with: the California Department of Fish and Game; the California State Water Resources Control Board; the National Marine Fisheries Service, the U.S. Fish and Wildlife Service, and the U.S. Geological Survey.

Draft Article 4xx. *General Erosion and Sedimentation Improvements and Maintenance*. Within one year of license issuance, the licensee shall perform the following road improvements:

- Increased drainage controls (e.g., additional culverts or rolling dips on several roads to reduce production of fine sediments;
- Replace a number of damaged and/or temporary culverts;
- Install velocity dissipators at culvert outlets; and
- Improve management of side cast materials during annual road blading activities.

Within one year of license issuance, the licensee shall armor the Round Valley reservoir plunge pool with rip rap and place warning signs to keep visitors away from the steep plunge pool slopes as a means to reduce sediment input to the spillway.

In keeping with established Best Management Practices, the licensee shall perform regular aerial and ground patrols, perform periodic canal repairs and removal of hazard trees, and abandon the use of passively automatic siphonic spill equipment.

Draft Article 4xx. *Special Status Species Review and Protection*. The special status species review and protection measures required by Forest Service condition nos. 26 and 27 shall apply to all accessible project lands and shall also include Bureau of Land Management sensitive/watch list species and federal and state rare, candidate, threatened, and endangered species. The Commission reserves the right to require measures to protect special status species.

Draft Article 4xx. *Deer Protection Measures.* The deer protection measures outlined in Forest Service 4(e) condition nos. 28 and 29 shall apply to all project canals. The licensee shall file a summary wildlife mortality report every 5 years by December 31 outlining any trends in wildlife mortality at project canals. In the event of an increasing trend in wildlife mortalities, the licensee shall include in the report, for Commission approval, additional measures to minimize wildlife mortality, prepared after consultation with the Forest Service and California Department of Fish and Game. The Commission reserves the right to require changes to the deer protection measures.

Draft Article 4xx. *Vegetation and Invasive Weed Management Plans*. The Vegetation Management Plan and Invasive Weed Plan required by Forest Service 4(e) condition no. 31 shall also cover all project lands located outside National Forest System lands to the extent that access is allowed. The Commission reserves the right to require changes to the plans.

Draft Article 4xx. *Foothill Yellow-legged Frog Monitoring Plan.* The licensee, within one year from the date of issuance of this license, shall file with the Commission, for approval, a plan to monitor foothill yellow-legged frog populations affected by the project located outside of National Forest Service lands. The plan shall include a detailed description of visual encounter surveys, consistent with “A standardized approach for habitat assessments and visual encounter surveys for the foothill yellow-legged frog” PG&E, May 2002, to be conducted every year for the first 5 years and then every 5 years thereafter. Collection of information on substrate, channel morphology, channel shape and

slope, water velocities, canopy, water temperature, riparian and aquatic vegetation, and location of oviposition sites shall be included in the surveys.

The licensee shall prepare the plan after consultation with the U.S. Fish and Wildlife Service and the California Department of Fish and Game. The licensee shall include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments and recommendations are accommodated by the plan. The licensee shall allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing shall include the licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan shall not begin until the plan is approved by the Commission. Upon Commission approval, the licensee shall implement the plan, including any changes required by the Commission.

If the results of the monitoring confirm that foothill yellow-legged frogs are being adversely affected by the project, the licensee shall file as part of the monitoring report, for Commission approval, measures to protect the frog or proposals for additional studies. The Commission reserves the right to require changes to the yellow-legged frog protective measures or require additional measures or studies.

Draft Article 4xx. *Bald Eagle Monitoring Plan*. The licensee, within 6 months from the date of issuance of this license, shall file with the Commission, for approval, a plan to monitor bald eagle nesting at the project. The plan shall provide for one breeding and one wintering survey every 3 years along with documentation of any incidental bald eagle observations and schedule for providing monitoring reports to the Commission.

The licensee shall prepare the plan after consultation with the U.S. Fish and Wildlife Service, Forest Service, and the California Department of Fish and Game. The licensee shall include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments and recommendations are accommodated by the plan. The licensee shall allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing shall include the licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan shall not begin until the plan is approved by the Commission. Upon Commission approval, the licensee shall implement the plan, including any changes required by the Commission.

If the results of the monitoring confirm that eagles nest in the project area, the licensee shall file as part of the monitoring report, for Commission approval, a Bald Eagle Nest Management Plan consistent with the current U.S. Fish and Wildlife Service's National Bald Eagle Management Guidelines. The Commission reserves the right to require changes to the bald eagle protective measures or require additional measures.

Draft Article 4xx. *Philbrook Spillway Channel Stabilization.* In addition to the conditions included in the Forest Service's 4(e) Condition No. 22 (Implement the Philbrook Spillway Channel Stabilization Plan), the licensee shall include, in the plan) a schedule for filing status reports with the Commission on the ongoing monitoring associated with erosion below the Philbrook spillway channel.

Draft Article 4xx. *Recreation Resources Management Plan*. Within 5 years of license issuance, the licensee shall file a report documenting the construction and implementation of the proposed recreation measures outlined in the Recreation Facility Rehabilitation and American with Disabilities Act (ADA) Upgrade Plan dated October 2007 as it relates to the relicensing of the DeSabla-Centerville Project. The following existing facilities shall be operated and maintained for the term of the license: Philbrook reservoir, Philbrook Campground, Philbrook Picnic and Camping Overflow Area, Philbrook Angler Access, DeSabla forebay, DeSabla Group Picnic Area, and Round Valley reservoir.

Draft Article 4xx. *Fish Stocking Plan*. Within one year of license issuance, the licensee shall file with the Commission for approval, a plan to stock fish in reservoirs and affected stream reaches at the project. The plan shall be developed after consultation with Cal Fish and Game and include a description of the amount and location of fish to be stocked in DeSabla forebay, Philbrook reservoir, and other affected stream reaches at the project and an implementation schedule.

The licensee shall include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the entities above, and specific descriptions of how the entities' comments are accommodated by the plan. The licensee shall allow a minimum of 30 days for the entities to comment and to make recommendations before filing the plan with the Commission. If the licensee does not adopt a

recommendation, the filing shall include the licensee's reasons, based on project-specific reasons.

The Commission reserves the right to require changes to the plan. Upon Commission approval the licensee shall implement the plan, including any changes required by the Commission.

Draft Article 4xx. *Recreational Fishery Monitoring*. Within 5 years of license issuance, the licensee shall conduct recreational fishery surveys in addition to the recreation monitoring specified by the Forest Service in 4(e) condition 33. The Licensee shall interview anglers over set daily and weekly time periods beginning immediately after the fifth year of stocking and continuing into mid-September every five years throughout the term of the license. Information gathered shall include: (1) date; (2) time; (3) total time spent fishing; (4) species and sizes of fish retained; (5) species and sizes of fish released; and (6) index of satisfaction. Interviews shall occur in the morning and evening with weekdays and weekend days randomly being selected for each month, including holidays.

The licensee shall include this information in a draft report after consultation with Cal Fish and Game and other entities to be included in the final recreation monitoring report filed every five years. The report shall summarize the results of each survey, providing comparisons between these results and recommendations for stocking the following year. A final report would be filed with the Commission within a year of conducting the surveys.

The agencies shall have 30 days to provide comments and recommendations. The final report shall be submitted to the FERC and shall address recommendations from the agencies. Final recommendations by the Licensee shall include a description of the proposed stocking regime, responsible entities and additional annual costs, if any, of that proposal

Draft Article 4xx. *Programmatic Agreement and Historic Properties Management Plan.* The licensee shall implement the "Programmatic Agreement Between the Federal Energy Regulatory Commission and the California Historic Preservation Officer for Managing Historic Properties that May be Affected by Issuance of a License to PG&E for the Continued Operation of the DeSabla-Centerville Hydroelectric Project in Butte County, California (FERC No. 803)," executed on (future date), and including but not limited to the Historic Properties Management Plan (HPMP) for the project. Pursuant to the requirements of this Programmatic Agreement, the licensee shall implement the HPMP with the following modifications: 1) update the HPMP with the additional historic context information provided by BLM, the Forest Service, and the Mechoopda Tribe; 2) develop a collection policy for discovery, curation, and disposition of artifacts; 3)

develop a detailed HPMP section addressing identification, restoration, accessibility, and stewardship collaborations for traditional plant gathering/tending in wetlands and riparian habitat communities culturally important to participating tribes; 4) identify specific management measures to be undertaken and include them within PG&Es best practices or procedural manuals; and 5) include mitigation measures for Round Valley reservoir site CA-BUT-1225/H.

In the event that the Programmatic Agreement is terminated, the licensee shall continue to implement the provisions of its approved HPMP. The Commission reserves the authority to require changes to the HPMP at any time during the term of the license. If the Programmatic Agreement is terminated, the licensee shall obtain approvals from or make modifications of the Commission and the California State Historic Preservation Office where the HPMP calls upon the licensee to do so.

Draft Article 4xx. *Use and Occupancy*. (a) In accordance with the provisions of this article, the licensee shall have the authority to grant permission for certain types of use and occupancy of project lands and waters and to convey certain interests in project lands and waters for certain types of use and occupancy, without prior Commission approval. The licensee may exercise the authority only if the proposed use and occupancy is consistent with the purposes of protecting and enhancing the scenic, recreational, and other environmental values of the project. For those purposes, the licensee shall also have continuing responsibility to supervise and control the use and occupancies, for which it grants permission, and to monitor the use of, and ensure compliance with the covenants of the instrument of conveyance for, any interests that it has conveyed, under this article. If a permitted use and occupancy violates any condition of this article or any other condition imposed by the licensee for protection and enhancement of the project's scenic, recreational, or other environmental values, or if a covenant of a conveyance made under the authority of this article is violated, the licensee shall take any lawful action necessary to correct the violation. For a permitted use or occupancy, that action includes, if necessary, canceling the permission to use and occupy the project lands and waters and requiring the removal of any non-complying structures and facilities.

(b) The type of use and occupancy of project lands and waters for which the licensee may grant permission without prior Commission approval are: (1) landscape plantings; (2) non-commercial piers, landings, boat docks, or similar structures and facilities that can accommodate no more than 10 water craft at a time and where said facility is intended to serve single-family type dwellings; (3) embankments, bulkheads, retaining walls, or similar structures for erosion control to protect the existing shoreline; and (4) food plots and other wildlife enhancement. To the extent feasible and desirable to protect and enhance the

project's scenic, recreational, and other environmental values, the licensee shall require multiple use and occupancy of facilities for access to project lands or waters. The licensee shall also ensure, to the satisfaction of the Commission's authorized representative, that the use and occupancies for which it grants permission are maintained in good repair and comply with applicable state and local health and safety requirements. Before granting permission for construction of bulkheads or retaining walls, the licensee shall: (1) inspect the site of the proposed construction; (2) consider whether the planting of vegetation or the use of riprap would be adequate to control erosion at the site; and (3) determine that the proposed construction is needed and would not change the basic contour of the reservoir shoreline. To implement this paragraph (b), the licensee may, among other things, establish a program for issuing permits for the specified types of use and occupancy of project lands and waters, which may be subject to the payment of a reasonable fee to cover the licensee's costs of administering the permit program. The Commission reserves the right to require the licensee to file a description of its standards, guidelines, and procedures for implementing this paragraph (b) and to require modification of those standards, guidelines, or procedures.

(c) The licensee may convey easements or rights-of-way across, or leases of project lands for: (1) replacement, expansion, realignment, or maintenance of bridges or roads where all necessary state and federal approvals have been obtained; (2) storm drains and water mains; (3) sewers that do not discharge into project waters; (4) minor access roads; (5) telephone, gas, and electric utility distribution lines; (6) non-project overhead electric transmission lines that do not require erection of support structures within the project boundary; (7) submarine, overhead, or underground major telephone distribution cables or major electric distribution lines (69-kV or less); and (8) water intake or pumping facilities that do not extract more than one million gallons per day from a project reservoir. No later than January 31 of each year, the licensee shall file three copies of a report briefly describing for each conveyance made under this paragraph (c) during the prior calendar year, the type of interest conveyed, the location of the lands subject to the conveyance, and the nature of the use for which the interest was conveyed.

(d) The licensee may convey fee title to, easements or rights-of-way across, or leases of project lands for: (1) construction of new bridges or roads for which all necessary state and federal approvals have been obtained; (2) sewer or effluent lines that discharge into project waters, for which all necessary federal and state water quality certification or permits have been obtained; (3) other pipelines that cross project lands or waters but do not discharge into project waters; (4) non-project overhead electric transmission lines that require erection of support structures within the project boundary, for which all necessary federal and state approvals have been obtained; (5) private or public marinas that can

accommodate no more than 10 water craft at a time and are located at least one-half mile (measured over project waters) from any other private or public marina; (6) recreational development consistent with an approved Exhibit R or approved report on recreational resources of an Exhibit E; and (7) other uses, if: (i) the amount of land conveyed for a particular use is five acres or less; (ii) all of the land conveyed is located at least 75 feet, measured horizontally, from project waters at normal surface elevation; and (iii) no more than 50 total acres of project lands for each project development are conveyed under this clause (d)(7) in any calendar year. At least 60 days before conveying any interest in project lands under this paragraph (d), the licensee must submit a letter to the Director, Office of Energy Projects, stating its intent to convey the interest and briefly describing the type of interest and location of the lands to be conveyed (a marked Exhibit G map may be used), the nature of the proposed use, the identity of any federal or state agency official consulted, and any federal or state approvals required for the proposed use. Unless the Director, within 45 days from the filing date, requires the licensee to file an application for prior approval, the licensee may convey the intended interest at the end of that period.

(e) The following additional conditions apply to any intended conveyance under paragraph (c) or (d) of this article:

(1) Before conveying the interest, the licensee shall consult with federal and state fish and wildlife or recreation agencies, as appropriate, and the State Historic Preservation Officer.

(2) Before conveying the interest, the licensee shall determine that the proposed use of the lands to be conveyed is not inconsistent with any approved Exhibit R or approved report on recreational resources of an Exhibit E; or, if the project does not have an approved Exhibit R or approved report on recreational resources, that the lands to be conveyed do not have recreational value.

(3) The instrument of conveyance must include the following covenants running with the land: (i) the use of the lands conveyed shall not endanger health, create a nuisance, or otherwise be incompatible with overall project recreational use; (ii) the grantee shall take all reasonable precautions to ensure that the construction, operation, and maintenance of structures or facilities on the conveyed lands will occur in a manner that will protect the scenic, recreational, and environmental values of the project; and (iii) the grantee shall not unduly restrict public access to project waters.

(4) The Commission reserves the right to require the licensee to take reasonable remedial action to correct any violation of the terms and conditions of

this article, for the protection and enhancement of the project's scenic, recreational, and other environmental values.

(f) The conveyance of an interest in project lands under this article does not in itself change the project boundaries. The project boundaries may be changed to exclude land conveyed under this article only upon approval of revised Exhibit G drawings (project boundary maps) reflecting exclusion of that land. Lands conveyed under this article will be excluded from the project only upon a determination that the lands are not necessary for project purposes, such as operation and maintenance, flowage, recreation, public access, protection of environmental resources, and shoreline control, including shoreline aesthetic values. Absent extraordinary circumstances, proposals to exclude lands conveyed under this article from the project shall be consolidated for consideration when revised Exhibit G drawings would be filed for approval for other purposes.

(g) The authority granted to the licensee under this article shall not apply to any part of the public lands and reservations of the United States included within the project boundary.

Document Content(s)