OROVILLE FACILITIES RELICENSING
FERC PROJECT NO. 2100

DRAFT
ENVIRONMENTAL IMPACT REPORT

State of California
The Resources Agency
Department of Water Resources

May 2007

STATE OF CALIFORNIA

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Notice of Completion and Availability of the Draft Environmental Impact Report and Notice of Public Meeting for Relicensing of the Oroville Facilities, FERC Project No. 2100

California Department of Water Resources

To Responsible Agencies and Interested Parties:

The California Department of Water Resources (DWR) is in the process of seeking a new 50 year hydroelectric license from the Federal Energy Regulatory Commission (FERC) to operate the existing Oroville Facilities. DWR has made available for public review and comment the Draft Environmental Impact Report (Draft EIR) for the Oroville Facilities Relicensing, FERC Project No. 2100. The State Clearinghouse Number for this EIR is: SCH 2001102011.

Project Location

The Oroville Facilities are located on the Feather River in the Sierra Nevada foothills 5 miles east of the City of Oroville and about 130 miles northeast of San Francisco. The Oroville Facilities were constructed in the 1960's as part of the State Water Project (SWP), a water storage and delivery system of reservoirs, aqueducts, power plants, and pumping plants designed to store and distribute water to supplement the needs of urban and agricultural water users and to meet recreational needs.

Project Description

The Oroville Facilities, as part of the SWP, are also operated for flood management, power generation, water quality improvement in the Sacramento–San Joaquin Delta, recreation, and fish and wildlife enhancement. The objective of the Proposed Project is the continued operation and maintenance of the Oroville Facilities for electric power generation, along with implementation of any terms and conditions to be considered for inclusion in a new FERC hydroelectric license. The initial FERC license for the Oroville Facilities, issued on February 11, 1957, expired on January 31, 2007. The Oroville Facilities are currently operating under an annual license issued by FERC effective February 1, 2007.

The Proposed Project is the *Settlement Agreement for Licensing of the Oroville Facilities Project No. 2100* signed March 21, 2006 (Settlement Agreement). Accordingly, the Draft EIR evaluates the potential environmental impacts that may be associated with implementation of the Settlement Agreement as the basis for new license conditions that may be issued by FERC.

The following describes the Settlement Agreement Plans and Programs related to relicensing the Oroville Facilities for continued hydroelectric power generation:

- Continued operation of the Oroville Facilities under a new FERC License;
- Lower Feather River Habitat Improvement Plan;
- Gravel Supplementation and Improvement Program;

- Channel Improvement Program;
- Structural Habitat Supplementation and Improvement Program;
- Fish Weir Program;
- Riparian and Floodplain Improvement Program;
- Feather River Hatchery Management Program;
- Lake Oroville Warmwater Fishery Habitat Improvement Program;
- Lake Oroville Coldwater Fishery Improvement Program;
- Water Quality Monitoring Program;
- Oroville Wildlife Area Management Plan;
- Invasive Plant Management Plan;
- Project Supplemental Benefits Fund;
- Recreation Management Plan;
- Feather River Whitewater Boating Opportunity Feasibility Study;
- Analysis of a Non-Motorized Water Trail Shoreline Access;
- Fuel Load Management Plan;
- Additional river stage and/or precipitation gaging;
- Feather River Fish Hatchery Funding;
- Revision of Speed Limit Regulation for Thermalito Afterbay;
- Flow/Temperature Modifications to Support Anadromous Fish;
- United States Forest Service Conditions; and a
- Draft Habitat Expansion Agreement for Anadromous Fish.

Significant Environmental Impacts

Potentially significant environmental impacts are identified from the DEIR analysis in the following categories: geology, paleontological resources, aquatic and terrestrial resources, noise, air quality, and public health/safety. Proposed mitigation measures described in the DEIR would reduce all potential impacts to less than significant. Other resource categories for which impacts were found to be less than significant include: soils, water quality, water quantity, recreation, cultural, visual, and agricultural resources, housing/population/public services, traffic and transportation.

Listed Toxic Sites

Based on information known to date, the project area is not listed as a toxic site.

Document Availability

Copies of the Draft EIR are available for public inspection and review at the following locations:

City	Location	Address
Oroville	Oroville Public Library	1820 Mitchell Avenue, Oroville CA 95965
Oroville	DWR, Oroville Field Division	460 Glen Drive, Oroville, CA 95966
Red Bluff	DWR, Northern District	2440 Main Street, Red Bluff, CA 96080
Sacramento	DWR Headquarters	1416 9th Street, Room 338, Sacramento, CA 95814

The DEIR is also available on the following DWR website: www.orovillerelicensing.water.ca.gov. A CD containing the Draft EIR may be requested by contacting Ann Lundberg at the California Department of Water Resources at (916) 653-6700.

Public Comment Period

The comment period for this document begins on May 21, 2007, and closes on July 20, 2007. Only written comments, and oral or written comments presented at the public meeting (see below), on the DEIR will be accepted. Written comments may be mailed to Henry M. Ramirez, Manager, Oroville Facilities Relicensing Program, California Department of Water Resources, 1416 Ninth Street, Room 1155, Sacramento, California, 95814.

Public Meeting

A public meeting is also scheduled so that DWR can accept oral or written comments regarding the project's environmental effects. The specifics of this meeting are:

City	Date	Time	Location
Oroville	June 21, 2007	4:00 pm	Garner Pavilion at Kelly Ridge, 5131 Royal Oaks Drive, Oroville, CA 95966 (Kelly Ridge)

Henry M. Ramirez, Manager
Oroville Facilities Relicensing Program

Henry M. Ramirez
Signature

May 14, 2007
Date

Barbara McDonnell, Chief
Division of Environmental Services

Barbara J. McDonnell
Signature

May 16, 2007
Date

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APPENDICES[1]

[1] These appendices are found on the CD located on the back inside cover of this document.

ACRONYMS AND ABBREVIATIONS

4WD	four-wheel drive
1983 Agreement	Agreement Concerning the Operations of the Oroville Division of the State Water Project for Management of Fish and Wildlife
2003 AQAP	2003 Air Quality Attainment Plan
AADT	average annual daily traffic
ACC	Area Control Center
ACHP	Advisory Council on Historic Preservation
ADA	Americans with Disabilities Act
af	acre-feet
AFRP	Anadromous Fish Restoration Program
afy	acre-feet per year
ALP	Alternative Licensing Procedure
APEA	Applicant Prepared Environmental Assessment
ARB	California Air Resources Board
ARP	Amended Recreation Plan
ARPA	Archaeological Resources Protection Act
BA	biological assessment
BACT	best available control technology for toxics
Basin Plan	water quality control plan
Basin Plan	The Water Quality Control Plan for the Sacramento River and San Joaquin River Basins
Bay-Delta	San Francisco Bay/Sacramento–San Joaquin Delta

Bay-Delta Estuary	San Francisco Bay/Sacramento–San Joaquin Delta Estuary
Bay-Delta Estuary Plan	San Francisco Bay/San Joaquin Delta Estuary Basin Plan
Bay-Delta Plan	1995 Water Quality Control Plan for the San Francisco Bay/Sacramento–San Joaquin Delta Estuary
BCAG	Butte County Association of Governments
BCAQMD	Butte County Air Quality Management District
BIC	Boat-in Campground
BLM	U.S. Bureau of Land Management
BMP	Best Management Practice
BO	biological opinion
BP	Before Present
BR	Boat Ramp
Business Plan Act	California Hazardous Materials Release Response Plans and Inventory Law of 1985
°C	degrees Celsius
CAA	federal Clean Air Act
CAAQS	California ambient air quality standards
CALFED	CALFED Bay-Delta Program
Cal IPC	California Invasive Plant Council
Cal-OSHA	California Occupational Safety and Health Administration
Caltrans	California Department of Transportation
CAT	Climate Action Team
CCAA	California Clean Air Act
CCR	California Code of Regulations

CD	compact disc
CDF	California Department of Forestry and Fire Protection
CDF Fire	California Department of Forestry and Fire Protection
CEC	California Energy Commission
CEII	Critical Energy Infrastructure Information
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CFC & WCD	County Flood Control and Water Conservation District
CFR	Code of Federal Regulations
cfs	cubic feet per second
CGS	California Geological Survey
CH_4	methane
CHP	California Highway Patrol
City	City of Oroville government
cm	centimeter(s)
CMP	Congestion Management Plan
CNDDB	California Natural Diversity Database
CNEL	community noise equivalent level
CNPPA	California Native Plant Protection Act
CNPS	California Native Plant Society
CO	carbon monoxide
CO_2	carbon dioxide
COA	Coordinated Operations Agreement
CORP	California Outdoor Recreation Plan

County	Butte County government
CRCG	Cultural Resources Consultation Group
CRHR	California Register of Historical Resources
CTC	California Transportation Commission
CTR	California Toxics Rule
CVHJV	Central Valley Habitat Joint Venture
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
CWA	Clean Water Act
CWHR	California Wildlife Habitat Relationships (database)
D-893	Decision 893 (State Water Resources Control Board)
D-1641	Decision 1641 (State Water Resources Control Board)
dB	decibel(s)
dBA	A-weighted decibel(s)
DBW	California Department of Boating and Waterways
DDT	dichlorodiphenyltrichloroethane
DEIR	draft environmental impact report
DEIS	draft environmental impact statement
Delta	Sacramento–San Joaquin Delta
DFA	California Department of Food and Agriculture
DFG	California Department of Fish and Game
DHS	California Department of Health Services
diesel PM	diesel particulate matter
DO	dissolved oxygen

DPR	California Department of Parks and Recreation
DTSC	California Department of Toxic Substances Control
DUA	Day Use Area
DWR	California Department of Water Resources
EC	Ecological Committee
EC	electrical conductivity
EDL	elevated data level
EIR	environmental impact report
EO	Executive Order
ER-L	Effects Range–Low
ER-M	Effects Range–Median
ERP	Ecosystem Restoration Program
ERPP	Ecosystem Restoration Program Plan
ESA	Endangered Species Act (Federal)
ESU	evolutionarily significant unit
EWA	Environmental Water Account
°F	degrees Fahrenheit
FBA	Fisheries Biological Assessment
FEIR	final environmental impact report
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FESA	federal Endangered Species Act
FIP	Federal Implementation Plan

FL	fork length
FMMP	Farmland Mapping and Monitoring Plan
FPA	Federal Power Act
FR	Federal Register
FRRPD	Feather River Recreation and Park District
FRSA	Feather River Service Area
ft	feet
FTIP	Federal Transportation Improvement Program
ft/sec	feet per second
FY	fiscal year
GHG	greenhouse gas
GIS	Geographic Information System
GP	General Plan
HAP	hazardous air pollutant
HCP	Habitat Conservation Plan
HEA	Habitat Expansion Agreement
HFC	High Flow Channel
HGMP	Hatchery Genetic Management Plan
HPMP	Historic Properties Management Plan
HPP	Historic Preservation Plan for California
HSC	habitat suitability criteria
Hz	hertz

I-	Interstate route
I&E	Interpretation and Education
IFIM	Instream Flow Incremental Methodology
IHN	infectious hematopoetic necrosis
ISO	Independent System Operator
JWDB	Joint Water Districts Boad
kg	kilogram(s)
KOP	key observation point
kV	kilovolt(s)
kWh	kilowatt-hour(s)
LCU	License Coordination Unit
L_{dn}	day-night noise level
L_{eq}	equivalent noise level
LFC	Low Flow Channel
LIM	Land Inventory and Monitoring
L_{max}	maximum noise level
L_{min}	minimum noise level
LOD	Level of Development
LOS	level of service
LOSRA	Lake Oroville State Recreation Area
LRMP	Land and Resource Management Plan
LWD	large woody debris

L_X	statistical descriptor (noise level exceeded x percent of a specific period of time)
µg/L	micrograms per liter
µg/m^3	micrograms per cubic meter
µin/sec	microinches per second
µmhos/cm	micro-mhos per centimeter
µS/cm	microsiemens per centimeter
m	meter(s)
M&I	municipal and industrial
MACT	maximum available control technology for toxics
maf	million acre-feet
maf/yr	million acre-feet per year
MBTA	Migratory Bird Treaty Act
MCL	maximum contaminant level
MFFR	Middle Fork Feather River
mg/L	milligrams per liter
mL	milliliter(s)
MLD	most likely descendant
mm	millimeter(s)
MOA	Memorandum of Agreement
mph	miles per hour
MSCS	Multi-Species Conservation Strategy
msl	mean sea level
MTBE	methyl tertiary butyl ether
MTRL	maximum tissue residue level

MW	megawatt(s)
MWD	Metropolitan Water District of Southern California
MWh	megawatt-hour(s)
N_2O	nitrous oxide
NAAQS	national ambient air quality standards
NAHC	Native American Heritage Commission
NAWQC	National Ambient Water Quality Criteria
NCCP	Natural Community Conservation Plan
NEHRP	National Earthquake Hazards Reduction Program
NEHRPA	National Earthquake Hazards Reduction Program Act
NEPA	National Environmental Policy Act
NFS	National Forest System
NGO	non-governmental organization
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOA	naturally occurring asbestos
NOAA	National Oceanic and Atmospheric Administration
NO_X	oxides of nitrogen
NO_2	nitrogen dioxide
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NSVAB	Northern Sacramento Valley Air Basin

O&M	operations and maintenance
OCAP	Operations Criteria and Plan
OCO	Operations Control Office
OEHHA	Office of Environmental Health Hazard Assessment
OES	Governor's Office of Emergency Services
OHP	California Office of Historic Preservation
OHV	off-highway vehicle
ORAC	Oroville Recreation Advisory Committee
Oroville Facilities	Oroville Facilities FERC Project No. 2100
OSHA	U.S. Department of Labor, Occupational Safety and Health Administration
OTMI	Oroville Temperature Management Index
OWA	Oroville Wildlife Area
P-2100	FERC Project No. 2100
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCL	Planning and Conservation League
PCT	Pacific Crest Trail
PCWA	Placer County Water Agency
PDEA	preliminary draft environmental assessment
PFMC	Pacific Fishery Management Council
PG&E	Pacific Gas and Electric Company
PHABSIM	physical habitat simulation
PL	Public Law

PM	particulate matter
PM&E	protection, mitigation, and enhancement
$PM_{2.5}$	fine particulate matter 2.5 micrometers or less in diameter
PM_{10}	respirable particulate matter 10 micrometers or less in diameter
PNF	Plumas National Forest
Porter-Cologne Act	Porter-Cologne Water Quality Control Act
ppm	part(s) per million
PRC	Public Resources Code
PRG	preliminary remediation goal
PWC	personal watercraft
RAC	Recreation Advisory Committee
RCRA	Resource Conservation and Recovery Act
RD	recreation day
REA	Ready for Environmental Analysis
RM	river mile
RMP	Recreation Management Plan
RMS	root mean square
ROD	Record of Decision
ROG	reactive organic gases
RPS	Renewables Portfolio Standard
RRMP	Redding Resource Management Plan
RSI	relative suitability index
RTIP	Regional Transportation Improvement Program
RTP	Regional Transportation Plan

RV	recreational vehicle
RWQCB	Regional Water Quality Control Board
SA	Settlement Agreement for Licensing of the Oroville Facilities FERC Project No. 2100, March 2006
SBF	State Board of Forestry
SBF	Supplemental Benefits Fund
SCE	Southern California Edison Company
SCOR	Sewerage Commission—Oroville Region
SD1	Scoping Document 1
SD2	Scoping Document 2 and Amended Notice of Preparation
SEL	single-event (impulsive) noise level
SFWP	South Feather Water and Power
S-H	“Scenic Highway” zoning designation
SHPO	State Historic Preservation Officer
SHSI	Structural Habitat Supplementation and Improvement Program
SIP	State Implementation Plan
SNFPA	Sierra Nevada Forest Plan Amendment
SO_2	sulfur dioxide
SP-	Study Plan
sq ft	square feet
SR	State Route
SVRA	State Vehicular Recreation Area
SWC	State Water Contractors
SWP	State Water Project
SWPPP	storm water pollution prevention plan

SWRCB	State Water Resources Control Board
TAC	toxic air contaminant
taf	thousand acre-feet
TCA	temperature control action
TCR	Transportation Concept Report
TDS	total dissolved solids
Team	Interagency Hazardous Materials Team
TIE	toxicity identification evaluation
TMDL	total maximum daily load
TOC	total organic carbon
Trinity ROD	Trinity River Record of Decision
TSS	total suspended solids
USACE	U.S. Army Corps of Engineers
USBR	U.S. Bureau of Reclamation
USC	United States Code
USDA	U.S. Department of Agriculture
USDOE	U.S. Department of Energy
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UV	ultraviolet

VAMP	Vernalis Adaptive Management Plan
VELB	valley elderberry longhorn beetle
VMS	Visual Management System
VQO	Visual Quality Objective
VRM	Visual Resource Management
Water Plan	California Water Plan
WCB	Wildlife Conservation Board
WSR	Wild and Scenic River
WUA	Weighted Usable Area
WY	Water Year

EXECUTIVE SUMMARY

ES.1 INTRODUCTION

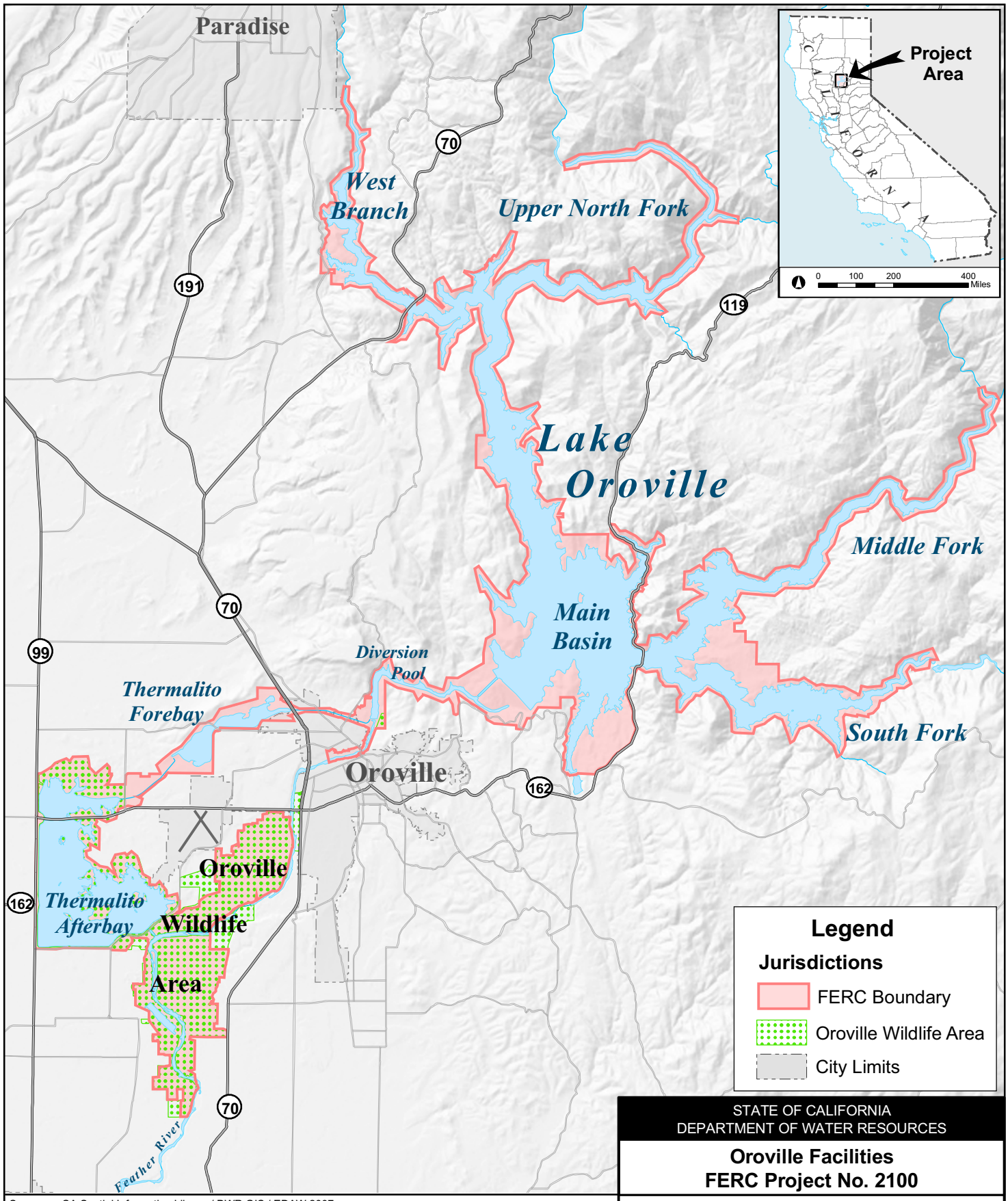
This Draft Environmental Impact Report (DEIR) evaluates the potential environmental impacts that may be associated with the *Settlement Agreement for Licensing of the Oroville Facilities Project No. 2100* signed March 21, 2006 (SA). The Oroville Facilities Federal Energy Regulatory Commission (FERC) Project No. 2100 (Oroville Facilities)—previously known as the Feather River Project or the Oroville Division, State Water Facilities—is located on the Feather River in the Sierra Nevada foothills in Butte County, California. Oroville Dam is located 5 miles east of the City of Oroville and about 130 miles northeast of San Francisco. The Oroville Facilities were developed as part of the State Water Project (SWP), a water storage and delivery system of reservoirs, aqueducts, power plants, and pumping plants designed to store and distribute water to supplement the needs of urban and agricultural water users in both northern and southern California, the San Francisco Bay area, the San Joaquin Valley, and the central coast region of the State. As part of the SWP, the Oroville Facilities are also operated for flood management, power generation, water quality improvement in the Sacramento–San Joaquin Delta, recreation, and fish and wildlife enhancement. Figure ES-1 shows the location and components comprising the Oroville Facilities.

The Oroville Facilities are operated in part pursuant to a license issued by FERC. The existing license for the Oroville Facilities, issued on February 11, 1957, expired on January 31, 2007. The Oroville Facilities are currently operating under an annual license issued by FERC effective February 1, 2007. If a new license is not issued on or before January 31, 2008, this annual license will be renewed automatically. The California Department of Water Resources (DWR) is seeking a new federal license from FERC to continue generating hydroelectric power while continuing to meet existing commitments and complying with regulations pertaining to water supply, flood control, the environment, and recreational opportunities.

ES.2 OBJECTIVES OF THE PROPOSED PROJECT

The Proposed Project is the SA that was submitted to FERC on March 24, 2006, as supplemental information to support the license application that DWR filed in January 2005 for consideration as future license conditions for the Oroville Facilities for the next 50 years.

The objective of the Proposed Project is the continued operation and maintenance of the Oroville Facilities for electric power generation, including implementation of any terms and conditions to be considered for inclusion in a new FERC hydroelectric license. The continued operation of the Oroville Facilities for electric power generation alleviates the need for new power resources that would otherwise be required to replace the 762 megawatts (MW) of capacity and roughly 2.4 million megawatt-hours (MWh) per year of energy generated by the three Oroville Facilities power plants.



Source: CA Spatial Information Library / DWR GIS / EDAW 2007

Original Scale 1 : 190,080
1" = 3 miles

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Oroville Facilities
FERC Project No. 2100

DRAFT ENVIRONMENTAL IMPACT REPORT

FIGURE ES-1
Oroville Facilities
FERC Project Area

Prepared by: PJ -- EDAW, Inc.
Date 3/20/07
P:\2000\0s016.gis\arcmap\proj_area_8x11.mxd

As an integral part of the SWP, water stored in Lake Oroville is released from the Oroville Facilities to meet a variety of statutory, contractual water supply, flood management, and environmental commitments. These contractual, flood management, fishery, water quality, and other environmental obligations are defined in numerous operating agreements that specify timing, flow limits, storage amounts, and/or constraints on water releases. The Proposed Project is consistent with these existing commitments and no changes to the contractual obligations or to the general pattern of these releases are anticipated.

The Oroville Facilities are also important components of the Sacramento River Flood Control Project, the flood management system for areas along the Feather and Sacramento rivers downstream of Oroville Dam. The Oroville Facilities provide flood protection benefits to Oroville, other portions of Butte County, Marysville, Yuba City, other portions of Yuba and Sutter counties, and many smaller communities downstream to Sacramento. The Oroville Facilities also provide protection to 283,000 acres of developed agricultural lands and a variety of transportation and other public utility infrastructure. Pursuant to Section 204 of the Flood Control Act of 1958, flood control operations at Oroville are governed by the rules and regulations prescribed by the Secretary of the Army. The Proposed Project is consistent with existing U.S. Army Corps of Engineers (USACE) flood management objectives.

ES.3 PURPOSE OF THE DRAFT ENVIRONMENTAL IMPACT REPORT

DWR has determined that preparation and certification of an environmental impact report (EIR) to satisfy the California Environmental Quality Act (CEQA) (Public Resources Code Section 21000 et seq.) is required before implementation of the Proposed Project (that is, the SA). DWR, as lead agency under CEQA, has prepared this DEIR to evaluate the potential effects of implementing the SA as new license terms and conditions for the continued operation of the hydroelectric component of the Oroville Facilities. In compliance with CEQA (Section 21002.1(a)), the DEIR publicly discloses potential significant environmental impacts that may result from approval of the Proposed Project, recommends mitigation measures related to the implementation of actions included in the SA, and evaluates alternatives to the Proposed Project. This DEIR also provides the information needed by the California Department of Fish and Game (DFG) to support compliance with the California Endangered Species Act (CESA).

Before FERC can issue a new license to DWR, the State Water Resources Control Board (SWRCB) must first issue a water quality certificate pursuant to Section 401 of the Clean Water Act and the Porter-Cologne Act, Water Code Section 13160 et seq. In issuing its water quality certification, the SWRCB certifies that the Proposed Project will comply with specified provisions of the Clean Water Act, including water quality standards that are developed pursuant to state law and in satisfaction of Clean Water Act Section 303 (33 U.S. Code 1313). Preparation and certification of an EIR under the terms of CEQA is required before the SWRCB can take action. This DEIR is intended to fulfill that purpose, and considers three alternatives: the No-Project Alternative, the

Proposed Project (SA), and the FERC Staff Alternative described in the FERC Draft Environmental Impact Statement (DEIS) released for public review on September 29, 2006.

ES.4 SCOPING, DEVELOPMENT, AND SUPPORT FOR THE PROPOSED PROJECT (SETTLEMENT AGREEMENT)

Since its commencement in 2001, the process for relicensing the Oroville Facilities has been broad-based, collaborative, and representative of a wide array of stakeholder interests, including affected federal and State agencies, local governmental entities, tribal interests, non-governmental organizations, and local residents. The relicensing process was conducted under FERC's Alternative Licensing Procedure (ALP), and it involved the substitution of the Environmental Report normally required as Exhibit E with a Preliminary Draft Environmental Assessment (PDEA). As a result, the participants in the collaborative relicensing process were extensively involved in scoping issues, submitting study requests, formulating study scopes, reviewing study results, and commenting on the draft license application and draft PDEA. DWR previously released its Scoping Document 1—Notice of Preparation on September 20, 2002, and Scoping Document 2—Amended Notice of Preparation on February 25, 2003. During the ALP and public scoping process under CEQA, a number of substantive comments were received stating concerns about various issues, including recreational opportunities, fisheries, and public services.

After DWR submitted its draft license application and draft PDEA, the stakeholders continued to negotiate and ultimately developed the SA, which was signed by 52 parties and adopted by DWR as the Proposed Project and submitted to FERC on March 24, 2006. The SA is the result of the broad-based relicensing effort and represents the culmination of substantial efforts on the part of each Settling Party[1] to craft a settlement that would garner support among the wide array of interests represented in the collaborative. With near-unanimous endorsement from federal and State resource

[1] The other Settling Parties include Alameda County Flood Control & Water Conservation District, Zone 7, Alameda County Water District, American Rivers, American Whitewater, Antelope Valley–East Kern Water Agency, Berry Creek Citizens Association, California Department of Boating and Waterways, California Department of Fish and Game, California Department of Parks and Recreation, California State Horsemen's Association, California State Horsemen's Association Region II, Castaic Lake Water Agency, Central Coast Water Agency, Chico Paddleheads, Citizens for Fair and Equitable Recreation, City of Oroville, Coachella Valley Water District, County of Kings, Crestline–Lake Arrowhead Water Agency, DC Jones, Desert Water Agency, Empire West Side Irrigation District, Feather River Low Flow Alliance, Feather River Recreation and Parks District, International Mountain Bicycling Association, Kern County Water Agency, Kon Kow Valley Band of Maidu, Lake Oroville Bicyclist Organization, Littlerock Creek Irrigation District, Metropolitan Water District of Southern California, Mojave Water Agency, Napa County Flood Control and Water Conservation District, National Marine Fisheries Service, Oak Flat Water District, Oroville Area Chamber of Commerce, Oroville Downtown Business Association, Oroville Economic Development Corporation, Oroville Parks Commission, Oroville Recreation Advisory Committee, Oroville Redevelopment Agency, Oroville Rotary Club, Palmdale Water District, San Bernardino Valley Municipal Water District, San Gabriel Valley Municipal Water District, San Gorgonio Pass Water Agency, Santa Clara Valley Water District, Solano County Water Agency, State Water Contractors, Inc., Town of Paradise, Tulare Lake Basin Water Storage District, and United States Department of the Interior on behalf of its component bureaus.

agencies, local governments, and environmental organizations, the SA is a comprehensive settlement package that by its terms resolves all relicensing issues among the Settling Parties associated with DWR's pending Application for New FERC License for continued operation of the Oroville Facilities, FERC Project No. 2100. DWR and the Settling Parties believe that the SA appropriately balances all interests and resources related to relicensing the Oroville Facilities.

The SA includes Appendix A, which incorporates all of the protection, mitigation, and enhancement (PM&E) measures that the Settling Parties believe to be under FERC's jurisdiction in Proposed License Articles, and Appendix B, which includes all of the PM&E measures and other agreements that the Settling Parties believe to be outside of FERC's jurisdiction or that are commitments made by parties other than DWR. In its DEIS for the Project, FERC evaluated only Appendix A of the SA as DWR's new preferred alternative in lieu of the preferred alternative identified in DWR's January 2005 Application. This DEIR analyzes the potential impacts of implementing the SA, including all its appendices, as DWR's Proposed Project.

ES.5 OTHER APPROVALS

As lead agency, DWR must consult with and seek comments on its DEIR from "state, federal, and local agencies which exercise authority over resources which may be affected by the project." (Public Resources Code Section 21104.) Likewise, FERC regulations require that applicants consult with appropriate resource agencies and other entities before filing an application for license. These consultations represent the first step in complying with the Fish and Wildlife Coordination Act, the federal Endangered Species Act (FESA), the National Historic Preservation Act (NHPA), and California Endangered Species Act (CESA).

In separate letters, both dated October 24, 2006, FERC requested formal consultation with the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) under FESA. The letters direct the agencies to review information contained in the FERC DEIS and DWR's Draft Biological Assessment (BA) filed with FERC on July 27, 2006, and requests that the federal agencies provide their biological opinions (BO) on FERC's findings no later than 135 days from receipt of the requests. On April 9, 2007, USFWS issued a Final Terrestrial BO for the project.

DWR has contacted DFG regarding compliance with CESA, and it is anticipated that DFG will issue a consistency determination pursuant to Section 2080.1(c) of the Fish and Game Code.

The draft Historic Properties Management Plan (HPMP) described in Section 5.8 of the DEIR was developed in compliance with the requirements of Section 106 of the NHPA and in consultation with Native American Tribes, the U.S. Bureau of Land Management (BLM), the U.S. Forest Service (USFS), and other applicable agencies and communities.

ES.6 EXISTING FACILITIES AND OPERATIONS

The Project encompasses 41,200 acres and includes Oroville Dam and Reservoir, Hyatt Pumping-Generating Plant, Thermalito Diversion Dam Power Plant, and the Thermalito Pumping-Generating Plant with combined licensed generating capacity of approximately 762 MW. Oroville Dam, along with 2 small saddle dams, impounds Lake Oroville, a 3.5-million-acre-foot (maf) capacity storage reservoir with a surface area of 15,810 acres at its normal maximum operating level. Other project features include Thermalito Diversion Dam, the Feather River Fish Hatchery, the Fish Barrier Dam, Thermalito Forebay, Thermalito Afterbay, the Oroville Wildlife Area (OWA), and numerous recreation facilities.

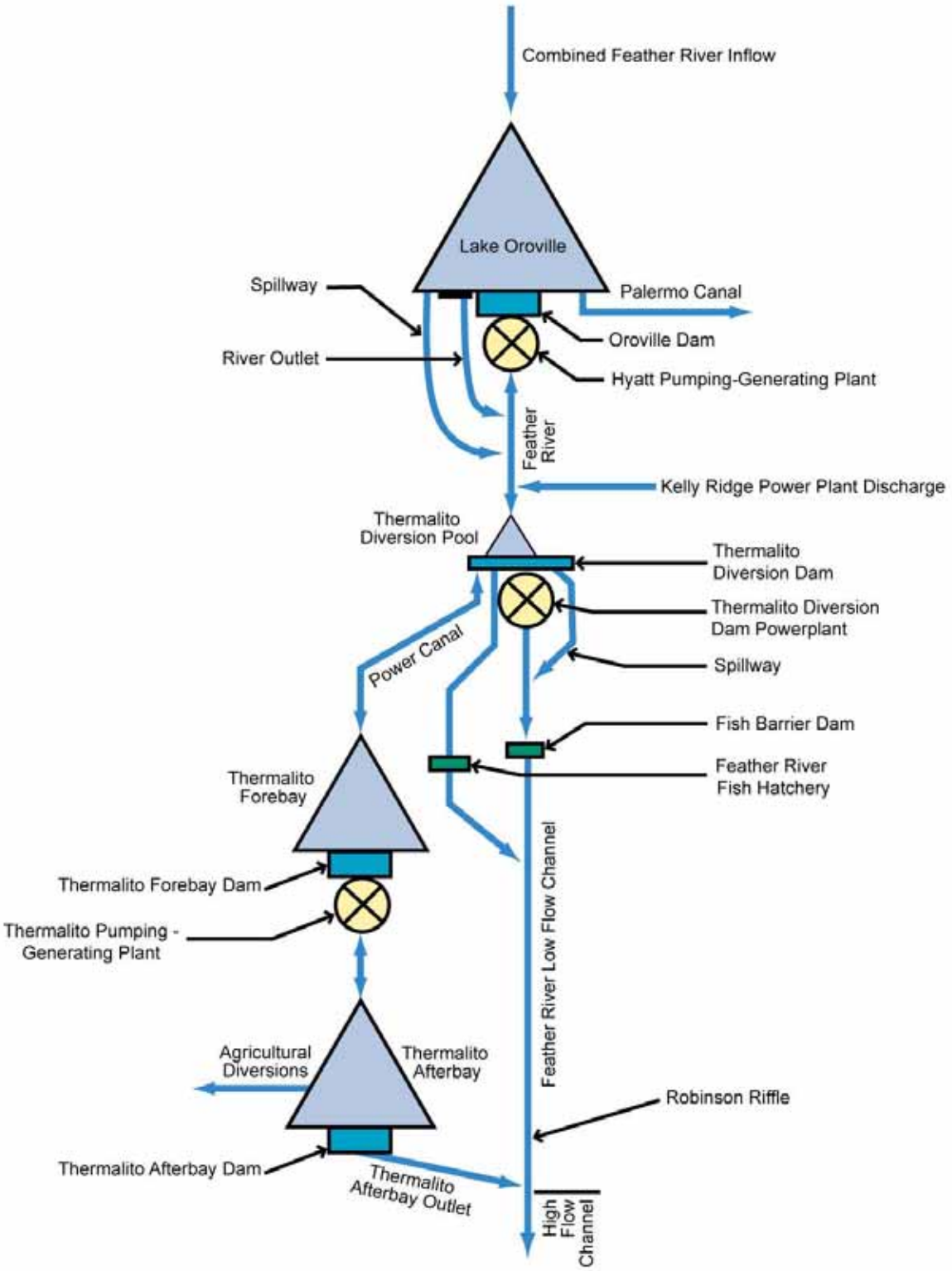
ES.6.1 Releases and Power Operations

Lake Oroville stores and releases water that flows into the reservoir from upstream reservoir releases and winter and spring runoff within the watershed. Water is released from the Oroville Facilities as part of a coordinated effort to meet water supply, flood protection, water quality improvement, and fish and wildlife enhancement requirements. Typically, power is generated when water is released from Lake Oroville through the Oroville Facilities for these purposes. Power is also generated through pump-back operations within the constraints established by the annual water operations plan. The annual water operations plan, developed through coordination with other federal, State, and local agencies, considers forecasted water supply, projected operations of the Central Valley Project, and regulatory and contractual obligations. The annual water operations plan is updated and reissued each month through April to reflect changes in hydrology and downstream operations. Figure ES-2 contains a flow diagram that illustrates the overall Oroville Facilities configuration and primary water storage and release points.

Storage in Thermalito Forebay and Thermalito Afterbay is used to generate power and maintain uniform flows in the Feather River downstream of the Oroville Facilities. Thermalito Afterbay also provides storage for pump-back operations. The pump-back operations are designed to use water that is in excess of what is required for downstream flow requirements for pumping back into Thermalito Forebay and then into Lake Oroville during off-peak hours. This water is then released again during on-peak hours when power values increase. A detailed description of Oroville Facilities power operations and releases made for various purposes, including entitlements, water quality, and in-stream flow for the Feather River, can be found in Chapter 3.0 of the DEIR.

ES.6.2 Environmental Facilities and Operations

The Oroville Facilities include facilities and operations to help protect and enhance fish and wildlife species and their habitat. Many of the environmental programs implemented within the FERC Project boundary are cooperatively managed or are based on agreements with other agencies such as DFG and USFWS. This includes operation and maintenance of facilities such as the Feather River Fish Hatchery and the



Source: MWH

Figure ES-2. Oroville Facilities flow diagram.

OWA and implementation of measures developed in consultation to protect species that are listed under FESA and/or CESA.

The Feather River Fish Hatchery is an anadromous fish hatchery built to compensate for the loss of spawning grounds and rearing areas for returning salmon and steelhead that resulted from the original construction of Oroville Dam. The hatchery complex consists of the Fish Barrier Dam and fish ladder, water supply lines and aeration tower, collection and holding tanks, enclosed spawning and early incubation facilities, grow-out ponds, and fish transport vehicles. The Feather River Fish Hatchery artificially spawns thousands of returning salmon and steelhead each year. DFG operates the hatchery under contract to DWR, and DWR pays for most hatchery-associated expenses. Water is released from the Oroville Facilities storage reservoirs to support fish hatchery operations. Each year, approximately 9,000–18,000 salmon and 2,000 steelhead are artificially spawned, a process that produces 18–20 million eggs. Salmon and steelhead are raised at the hatchery, then transported in oxygenated, temperature-controlled tanks for release in the Feather and Sacramento rivers, in Lake Oroville and other California reservoirs, and in San Pablo Bay near San Francisco Bay.

The OWA comprises approximately 11,000 acres west of Oroville that are managed for wildlife habitat and recreational activities. It includes Thermalito Afterbay and surrounding lands (approximately 6,000 acres) along with 5,000 acres adjoining the Feather River. The 5,000-acre area straddles 12 miles of the Feather River and includes willow and cottonwood-bordered ponds, islands, and channels. As a result of interagency agreements negotiated between DWR and DFG, DFG manages portions of Thermalito Afterbay and other OWA locations and is responsible for providing staff to manage and operate the OWA and setting and enforcing guidelines for public use of this area. DFG allows public use from 1 hour before sunrise to 1 hour after sunset. In addition, a designated area for overnight camping allows for a maximum stay of 14 nights in any calendar year. DWR, DFG, the California Waterfowl Association, and other stakeholders have worked cooperatively to reduce waterfowl losses and increase production in the OWA through programs that have included brood pond construction/maintenance in Thermalito Afterbay and planting/maintenance of upland forage and cover crops in the OWA to provide winter waterfowl forage and nesting cover.

DWR also manages a coldwater and warmwater sport fishery in Lake Oroville. DWR funds a full-time fishery biologist and a salmonid stocking program. Habitat improvements for warmwater game fish include brush shelter construction, planting of willows and/or buttonbush slips and annual grasses, irrigation systems, and channel catfish spawning structure construction.

ES.6.3 Recreational Facilities and Operations

The Oroville Facilities support a wide variety of recreational opportunities, including boating (several types), fishing (several types), fully developed and primitive camping (including boat-in and floating sites), picnicking, swimming, horseback riding, hiking, off-road bicycling, wildlife viewing, and hunting. There are also visitor information sites with

cultural and informational displays about the developed facilities and the natural environment. The majority of recreation facilities in the project area are within the Lake Oroville State Recreation Area (LOSRA), which has numerous facilities and sites offering diverse recreational opportunities. The LOSRA, managed by the California Department of Parks and Recreation (DPR), includes Lake Oroville and the surrounding lands and facilities within the Project area as well as the land and waters in and around the Diversion Pool and Thermalito Forebay, downstream of Oroville Dam. Additional recreational facilities and opportunities exist within the Project area but outside the LOSRA, specifically the OWA including Thermalito Afterbay, and the Feather River Fish Hatchery. Some facilities cross over from outside to inside the LOSRA, such as the extensive and popular trail system.

DWR also provides funding to the Butte County Sheriff's Department for boat and vehicular patrol services and security, to DPR for law enforcement and recreation management within the FERC Project boundary, to DFG for law enforcement and environmental and land management, and to Butte County for mosquito abatement efforts. In addition, DWR partners with the Oroville Chamber of Commerce to promote use of Lake Oroville through support of various festivals, aquatic camps, fishing tournaments and equestrian events. In addition, the California Highway Patrol fulfills an overarching law enforcement role for all of the Oroville Facilities. DWR also has a contract for private security services, which provides trained guards at various locations within the Project area.

A complete description of the recreation opportunities provided by the Oroville Facilities can be found in Chapter 3.0 of the DEIR.

ES.7 THE PROPOSED PROJECT AND ALTERNATIVES

State CEQA Guidelines Section 15126.6(a) requires that an EIR include a comparative evaluation of the Proposed Project with alternatives that are capable of attaining most of the project's basic objectives. The three alternatives evaluated in the DEIR are briefly described below. A full description of these alternatives can be found in Chapter 3.0 of the DEIR.

ES.7.1 The No-Project Alternative

CEQA requires the evaluation of the No-Project Alternative, against which the effects of the action alternatives can be compared. The purpose of describing and analyzing a No-Project Alternative for the Oroville Facilities is to allow decision-makers to better understand the environmental consequences of continuing to operate the project under the terms and conditions of its existing FERC license. Such consequences can then be compared to those associated with alternatives proposed for the project.

Under the No-Project Alternative, the Oroville Facilities would continue to be operated as it is now under the terms and conditions in the existing FERC license, and no new PM&E measures would be implemented, other than those arising from existing legal

obligations and agreements. In addition, DWR would continue existing operations and maintenance practices needed to maintain the Oroville Facilities.

The No-Project Alternative includes all existing facilities and operations, conditions of the existing FERC license, environmental commitments such as those associated with DWR's water rights, recreation programs, and other agreements that affect current Oroville Facilities operations. In addition, the No-Project Alternative includes changes that occurred during the ALP collaborative effort. This includes interim measures implemented by DWR primarily for recreational purposes, including restroom upgrades, equestrian campground enhancements, numerous day-use facilities improvements, and over $5 million toward design, permitting, and construction of Riverbend Park along the eastern bank of the Feather River adjacent to the City of Oroville.

DWR entered into early and informal consultation with USFWS to identify and resolve issues related to terrestrial listed species prior to the initiation of formal consultation and FERC license application filing. USFWS recommended four measures for early implementation (under the existing FERC license) to minimize or avoid take of federally listed species related to ongoing project activities. These measures include the identification of a listed-species coordinator within DWR, measures pertaining to the giant garter snake, measures pertaining to the bald eagle, and measures pertaining to the vernal pool-related species. These measures are described in a draft BA (see Appendix E of the PDEA), covering terrestrial resources, and are included in the No-Project Alternative.

ES.7.2 The Proposed Project

The Proposed Project is the continued operation of the Oroville Facilities under a new FERC License pursuant to the terms of the SA. The measures included within the SA are divided into two categories: Appendix A contains PM&E measures recommended to be included in the new Project License; Appendix B contains those measures agreed to among the parties to the SA but not to be included in the new Project License. Appendix C describes the Ecological Committee in detail, while Appendix D describes the SWRCB's participation in the SA negotiation. The Proposed Project also includes USFS Final Section 4(e) Conditions, and a multi-party Draft Habitat Expansion Agreement, which are included in the SA as Appendix E and Appendix F, respectively. A subset of the SA Settling Parties including NMFS, USFWS and DFG and Pacific Gas and Electric Company separately negotiated a Habitat Expansion Agreement (HEA) to address blockage of upstream passage by anadromous fish caused by several dams on the Feather River, including Oroville Dam. The SA Settling Parties have completed negotiations of the HEA, which includes the development of spawning habitat for 2,000–3,000 spring-run Chinook salmon. NMFS and USFWS have reserved their authority to prescribe fishways, pursuant to Section 18 of the Federal Power Act and consistent with the HEA, during the term of the new FERC license.

The planning and execution of Proposed Project SA articles that involve site preparation and construction activities to be undertaken by DWR would include the adoption of numerous Best Management Practices (BMPs) designed to avoid or mitigate short-term

effects typically associated with such activities. The BMPs to be adopted as part of the Proposed Project are presented in Appendix D of this DEIR.

The Proposed Project considered in this DEIR includes actions described in the SA designed for immediate implementation as well as future actions to develop numerous plans and programs. While implementation of these yet-to-be-detailed plans and programs will likely lead to future actions that will require additional environmental analysis, the preparation of many of these plans do not result yet in a physical change to the environment and therefore cannot be evaluated on a project-specific level. As noted in Chapter 5.0 of this DEIR, these programs and plans have been assessed at a program level of detail. Individual actions that are well described in the SA and are ready for analysis have been analyzed in the DEIR at a project level of detail. Additional CEQA review of these plans and programs will be necessary prior to implementation of specific activities not addressed at a project level of detail in this DEIR.

ES.7.2.1 SA Appendix A

In general, SA Appendix A includes a commitment by DWR to develop, in consultation with stakeholders, numerous environmental plans and programs. These environmental plans and programs would improve fish spawning and rearing habitat to complement FESA anadromous fish species recovery programs, support the Feather River Fish Hatchery, provide additional habitat for waterfowl, provide protection for terrestrial FESA species, monitor water quality in project waters, improve habitat for warmwater fish species and improve the coldwater fishery in Lake Oroville, and provide new management direction for the OWA. Plans and programs to be developed and implemented during the life of the new license include:

- Lower Feather River Habitat Improvement Plan—overall management strategy to coordinate the various habitat improvements of the Oroville facilities to enhance the benefits to fish and wildlife species;

- Gravel Supplementation and Improvement Program—to supplement gravel in the lower Feather River suitable for spring-run and fall-run Chinook salmon or steelhead;

- Channel Improvement Program—to increase the quality and complexity of salmonid spawning and rearing habitat in two existing side channels and to increase quantity of spawning and rearing habitat through the construction of five additional side channel riffle/glide complexes;

- Structural Habitat Supplementation and Improvement Program—to support restoration and improvement of salmonid rearing habitat in the lower Feather River below Oroville Dam by providing in-stream cover, edge and channel complexity through the addition of structural habitat including large woody debris (LWD), boulders, and other native objects;

- Fish Weir Program—to initially provide a counting weir to determine abundance of early returning (phenotypic spring-run) Chinook salmon and steelhead and later a barrier weir to spatially separate spring-run and fall-run in the Low Flow Channel to create a dedicated spawning preserve to protect the spring-run Chinook salmon;

- Riparian and Floodplain Improvement Program—to improve riparian habitat and habitat for associated terrestrial and aquatic species and connect portions of the Feather River to its floodplain within the OWA;

- Feather River Hatchery Management Program—overall management strategy to ensure the continued operation of the Hatchery in cooperation with DFG for the production of anadromous salmonids;

- Lake Oroville Warmwater Fishery Habitat Improvement Program—to build on the existing program by increasing and/or improving the structural complexity of the Lake Oroville fluctuation zone to benefit warmwater fish spawning and rearing;

- Lake Oroville Coldwater Fishery Improvement Program—to build on the existing program and stock coldwater fish in Lake Oroville to improve the coldwater sport fishery;

- Water Quality Monitoring Program—an expansion of the existing water quality monitoring plan to document water quality conditions in Project-affected waters including contributions from upstream sources, pathogen levels at recreation sites, effects of Project operations on thermal regimes, and long-term trends through the life of the license;

- OWA Management Plan—overall management plan for the OWA to include conservation measures required by final federal Biological Opinions, strategies to minimize current wildlife/recreation conflicts, resolution of access issues, and agency management and funding responsibilities; and

- Invasive Plant Management Plan—to manage and reduce native and non-native invasive plant species populations within the FERC Project boundary.

The plans and programs would be developed in coordination with an Ecological Committee (EC) established by DWR to advise on ecological issues related to the implementation of the new License. As described in the SA, the EC will be comprised of Settling Parties who represent relevant federal and State regulatory agencies, local governmental entities and Native American tribes, and other interested parties to the SA.

The SA includes a commitment by DWR to increase minimum instream flow releases in the Low Flow Channel (LFC) to benefit anadromous species. The SA also requires that DWR complete a Feasibility Study and Implementation Plan to evaluate possible facilities modifications that could be implemented to improve water temperature conditions for salmonids downstream. For purposes of analysis in this DEIR, the period

of time before facilities modification is referred to as the interim operating period of the Proposed Project, while the post-facilities modification period is referred to as post-facility modification. The first phase, or initial new license period, would include operational modifications such as increased minimum in-stream flows, use of the river valves to augment flow releases (to meet hatchery temperature objectives), shutter manipulation, and curtailment of pump-back operations to improve temperature conditions for anadromous fish until facilities modifications to provide colder water for coldwater fisheries benefits to the LFC and High Flow Channel (HFC) are constructed. The second phase, or post-facility modification, could include construction of one or more physical modifications described below.

SA Appendix A includes two separate documents as proposed license articles developed through the collaborative relicensing process: the SA Recreation Management Plan (RMP), which provides a long-term plan to enhance recreational resources; and the draft HPMP, which provides a framework to protect sensitive cultural and historical resources in the project area.

In general, the Proposed Project would result in recreation facility changes that would improve accessibility; provide additional and improved day use facilities, trails and trail facilities, parking areas, group day use shelters, picnic tables, and sanitation facilities, and provide for campground expansion and/or improvements at Bidwell Canyon, Loafer Creek, the Thermalito Afterbay Outlet, and the floating campsites. The Proposed Project would also enhance boating facilities (including increased access during times of low reservoir levels) and develop two Americans with Disabilities Act (ADA) accessible bank-fishing piers (South Thermalito Forebay and the Diversion Pool). The SA RMP contains various specific triggers to address increased recreation demand. The SA includes formation and support of a Recreation Advisory Committee (RAC), to include local governments, local interest groups, relevant State agencies, and DWR, among others. The RAC would periodically review recreational use data for project facilities and would recommend modifications to the RMP over time throughout the term of the new FERC license. The RAC would replace the Oroville Recreation Advisory Committee (ORAC), established during the existing FERC license. As such, coordination and cooperation with these participants would continue as defined in the RMP and in large part through the formation and continued activities of the RAC.

Under the Proposed Project, measures for the protection of or compensation for the ongoing project effects on cultural resources are proposed within the draft HPMP. The draft HPMP defines the area of potential effects and includes measures to address ongoing effects, including those on or affecting BLM and National Forest System lands; protocols for proposed future actions, including inadvertent discoveries and emergency situations; programs for future inventory and resource evaluation; a public education and information program; roles, responsibilities, and reporting requirements; and procedures for review and update of the draft HPMP.

ES.7.2.2 SA Appendix B

In addition to the measures in the SA that are incorporated into the Proposed License Articles in Appendix A to be included in the New Project License, DWR has agreed under the SA to undertake several measures that are beyond the scope of the FERC license. While these measures were essential for acceptance of the SA and will ultimately benefit recreation, socioeconomics, and environmental resources in the Project region, the SA Settling Parties believe that they should not be incorporated into any new license issued by FERC for the continued operation of the Project. Nonetheless, these measures are evaluated for potential environmental impacts as appropriate in the DEIR. These additional measures are set forth in Appendix B to the SA and are summarized briefly below.

- Project Supplemental Benefits Fund—designed to allow the benefits of the Project to be extended into the local communities in the vicinity of the FERC Project boundary and to create additional benefits by funding local projects as determined by a locally controlled steering committee.

- Feather River Whitewater Boating Opportunity Feasibility Study—to guide future whitewater recreation decisions and activities.

- Analysis of a Non-Motorized Water Trail Shoreline Access—to conduct an analysis of non-motorized trail shoreline access opportunities along the Feather River within and in the vicinity of the FERC Project boundary.

- Fuel Load Management Plan—to develop a plan to manage fuels within the Project area and improve interagency planning, management, and coordination.

- Additional gaging—to improve flood forecasting and monitoring.

- Feather River Fish Hatchery Funding—to provide all necessary funding to DFG to implement the Feather River Fish Hatchery Program.

- Gravel Supplementation—to initiate early efforts to obtain all necessary permits for supplementation of spawning gravels suitable for spring-run and fall-run Chinook salmon and steelhead as described in Appendix A of the SA.

- Oroville Wildlife Management Plan—agreement by DFG to use its best efforts to obtain adequate funding to share the cost to develop an OWA Management Plan as described in Appendix A of the SA.

- Revision of Speed Limit Regulation for Thermalito Afterbay—agreement by DFG to make a recommendation to the California Fish and Game Commission to rescind the speed limit for that portion of Thermalito Afterbay south of State Route 162.

- Flow/Temperature to Support Anadromous Fish—agreement by DWR to begin necessary studies for the refurbishment or replacement of the river valves once

the SA is executed and filed with FERC. In addition, DWR agreed to develop a Reconnaissance Study of Facilities Modifications to address temperature habitat needs for anadromous fisheries in the LFC and the HFC.

In addition to the SA, the Proposed Project includes existing measures described in the No-Project Alternative unless otherwise indicated.

ES.7.3 FERC Staff Alternative

After evaluating DWR's SA, including mandatory conditions filed pursuant to Section 4(e) and Section 18 of the Federal Power Act (FPA), and other recommendations from resource agencies and interested entities under Sections 10(a) and 10(j) of the FPA, FERC staff identified additional measures that FERC considers necessary or appropriate for continued operation of the Oroville facilities (FERC 2006). The measures are, for the most part, revisions to articles contained within the SA. However, sufficient differences between DWR's Proposed Project and the FERC Staff Alternative warrant an evaluation as a separate alternative in this DEIR. The FERC Staff Alternative does not include measures described in Appendix B of the SA with the exception of the Fuel Load Management Plan, nor does it include the HEA.

Under the FERC Staff Alternative, DWR would obtain Commission approval prior to implementing any modification to the minimum in-stream flow regime or water temperature objectives described in the SA. The FERC Staff Alternative also revises monitoring associated with the Gravel Supplementation and Improvement Program to include a provision to monitor 10 riffles every 5 years or after a high-flow event, assess the adequacy of the volume of gravel used, and replace gravel as necessary. If monitoring of 10 sites, as proposed, reveals that objectives are not being met, the FERC Staff Alternative would expand the monitoring effort to include all 15 sites and replace gravel as necessary.

The FERC Staff Alternative revises the implementation schedule for the Riparian and Floodplain Improvement Program to include a provision to implement 50 percent of the selected measures within 10 years and the remaining measures within 12 years of the issuance of any new license for the Oroville facilities.

The FERC Staff Alternative revises the RMP to include a requirement to establish standards for Project area trails and to conduct baseline inventory of trail conditions using these established standards developed for Project area trails prior to proposing any changes to trail use designation. Trail conditions would be monitored and reported on through the term of any new license issued. The recreation monitoring program would be expanded to include non-trail users to detect latent demand and unmet user needs related to trails. The non-motorized trails program would be revised based on the trail condition inventory, analysis of the survey and trail use data, and results of the feasibility studies for new trails. Recommendations, if appropriate, for changing trail use designations and a proposed implementation schedule would be included.

Under the FERC Staff Alternative, the Foreman Creek boat launch on Lake Oroville would be closed to recreational use while DWR develops a plan for protecting cultural resources that considers a spectrum of possible actions, including installing recreational facilities to redirect recreational use away from cultural resources (as described in SA Article A129) and discontinuing recreational use at the site. DWR would prepare a plan within 6 months of license issuance in consultation with local Native American tribes.

The FERC Staff Alternative also revises the RMP to include a provision to develop site plans and reconstruct the boat-in campgrounds at Bloomer, Goat Ranch, and Craig Saddle within the first 10 years after license issuance.

The Fuel Load Management Plan would become an Appendix A, FERC jurisdictional action under the FERC Staff Alternative and DWR would be required to prepare a biological evaluation of the effects of any Proposed Project construction activities on USFS special-status species or their habitat on FS lands.

Under the FERC Staff Alternative, the one-time interim project that seeded the downstream face of Oroville Dam with a wildflower mixture dominated by poppies would be continued as necessary. The FERC Staff Alternative would not require DWR funding associated with the July 4th fireworks displays at Lake Oroville due to the lack of project nexus.

The FERC Staff Alternative would require DWR to revise and resubmit the draft HPMP to provide rationale for proposing to evaluate only 20 percent of the sites and to provide for evaluating all sites within the fluctuation zone.

ES.8 RESULTS OF THE IMPACT ASSESSMENT

Chapter 5.0 of this document provides an analysis of the environmental consequences or “impacts” of the Proposed Project. In accordance with Section 15123 of the State CEQA Guidelines (California Code of Regulations Title 14), a summary of the impacts of the Proposed Project is provided in Section 5.16 of the DEIR. Table 5.16-1 includes mitigation measures that are recommended to bring potential impacts of the Proposed Project within identified thresholds of significance. Finally, the table indicates that implementation of the recommended mitigation measures would reduce impacts to less-than-significant levels.

The results of the impact assessment indicate that either action alternative would result in an increase in quantity and/or quality of aquatic and terrestrial habitat and recreational opportunities when compared to the No-Project Alternative. Construction-related activities would result in short-term impacts on soils, aquatic and terrestrial habitat, cultural resources, traffic, air quality, water quality, noise, and visual resources. The potentially significant environmental impacts identified during the DEIR analysis would be mitigated to less-than-significant levels. No unavoidable significant impacts under CEQA have been identified. The DEIR Table 5.16-1 shows those impacts that

are potentially significant and the mitigation that reduces the level to less than significant.

ES.9 AREAS OF CONTROVERSY AND ISSUES TO BE RESOLVED

During public scoping and the ALP process, a number of substantive comments were received stating concerns about various issues, most of which have been resolved. Areas of remaining controversy are: protection and management of cultural resources, water temperature for agricultural diversions, trail use designations, socioeconomics, road maintenance, public safety, and public health. These issues were considered during the ALP development of the SA Articles and Sections that are incorporated in the Proposed Project.

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CHAPTER 1.0

INTRODUCTION

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1.0 INTRODUCTION

This Draft Environmental Impact Report (DEIR) has been prepared by the California Department of Water Resources (DWR) for the relicensing of the hydroelectric component of Oroville Facilities Federal Energy Regulatory Commission (FERC) Project No. 2100 (Oroville Facilities). In compliance with the California Environmental Quality Act (CEQA) (Public Resources Code Section 21000 et seq.), this DEIR discloses environmental impacts and recommends mitigation measures related to the Oroville Facilities relicensing. This chapter describes the purpose and structure of the DEIR and explains how it will be used in the decision making process. Chapter 1 also includes information regarding public participation and document availability.

The Oroville Facilities—previously known as the Feather River Project or the Oroville Division, State Water Facilities—are located on the Feather River in the Sierra Nevada foothills in Butte County, California. Oroville Dam is located 5 miles east of the City of Oroville and about 130 miles northeast of San Francisco. The Oroville Facilities were developed as part of the State Water Project (SWP), a water storage and delivery system of reservoirs, aqueducts, power plants, and pumping plants designed to store and distribute water to supplement the needs of urban and agricultural water users in both northern and southern California, the San Francisco Bay Area, the San Joaquin Valley, and the central coast region of the state. As part of the SWP, the Oroville Facilities are also operated for flood management, power generation, water quality improvement in the Sacramento–San Joaquin Delta, recreation, and fish and wildlife enhancement.

1.1 CEQA, NEPA, AND THE PDEA PROCESS

The Oroville Facilities are operated in part pursuant to a license issued by FERC. The original license for the Oroville Facilities, issued on February 11, 1957, expired on January 31, 2007. DWR, through the Alternative Licensing Procedure (ALP), is seeking a new federal license from FERC to continue generating hydroelectric power while continuing to meet existing commitments and comply with laws and regulations pertaining to water supply, flood control, the environment, and recreational opportunities. The Oroville Facilities are currently operating under an annual license issued by FERC effective February 1, 2007. If a new license is not issued on or before January 31, 2008, this annual license will be renewed automatically.

Under the National Environmental Policy Act (NEPA) and the Council on Environmental Quality's (CEQ's) NEPA regulations (Title 40 of the Code of Federal Regulations (CFR), Section 1500 et seq. (i.e., 40 CFR 1500 et seq.)), federal agencies are required to evaluate the environmental effects of an action, including feasible alternatives, and identify mitigation measures to minimize adverse effects when they propose to carry out, approve, or fund a project that may have a significant effect on the environment. FERC, as the federal lead agency, must comply with NEPA and released a draft environmental impact statement (DEIS) for the Oroville Facilities on September 29, 2006. Other federal agencies may rely on FERC's prepared DEIS for approval of individual projects.

As part of the ALP, DWR developed a number of study plans, completed the studies described in the plans, and prepared a Preliminary Draft Environmental Assessment (PDEA) based on study results to determine the environmental effects of the project and alternatives for consideration in the new license. The PDEA provided FERC with the analysis required under NEPA in support of the relicensing. FERC used the information provided in the PDEA to compile its DEIS, released for public review on September 29, 2006. The PDEA also provided analysis appropriate for inclusion in this DEIR.

The PDEA for the Oroville Facilities presented the analysis and conclusions reached during the evaluation of three alternatives—the No-Action Alternative, the Proposed Action, and Alternative 2—along with supplemental information on relevant studies, data, and methodology included as appendices. The DEIS produced by FERC analyzed three alternatives: the No-Action Alternative, DWR's Proposal (the ALP Settlement Agreement (SA) with the exception of Appendix B sections), and a FERC Staff Alternative (modifications to DWR's proposal).

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

This DEIR considers three alternatives: the No-Project Alternative, the Proposed Project, and the FERC Staff Alternative described in the DEIS. Pursuant to Section 15125(a) of the CEQA Guidelines, this DEIR considers the physical presence of the Oroville Facilities and the functional interactions of the facilities and operations as of February 25th, 2003 as the baseline for analyzing the environmental impacts of the Proposed Project and FERC Staff alternative. This document satisfies the CEQA requirements to disclose potential environmental impacts and recommend mitigation measures related to the Proposed Project.

1.1.1 Type of EIR

This document is structured as a Programmatic EIR, consistent with California Public Resources Code Sections 21093 and 21094 and 14 California Code of Regulations (CCR) Sections 15152 and 15168. The program-level analysis considers the broad

environmental effects of the overall Proposed Project, which is the SA, and based on this program-level analysis, this DEIR identifies performance standards (e.g., Best Management Practices (BMPs), measures to protect biological and visual resources, and mitigation measures that would apply to all subsequent, future actions under the Proposed Project. These performance standards would be incorporated into the mitigation monitoring and reporting plan to avoid or reduce impacts to the degree feasible. In addition, the program-level analysis addresses the cumulative impacts of implementation of the Proposed Project and analyzes a reasonable range of alternatives. A No-Project Alternative is also analyzed as required by CEQA.

The Proposed Project considered in this DEIR includes the development and implementation of numerous plans and programs over the next several decades in addition to actions designed for immediate implementation. While some individual actions are well described in the Proposed Project and ripe for analysis, specific details of the numerous plans and programs described in the Proposed Project are unknown at this time. DWR anticipates that additional CEQA documents will be necessary in the future when these plans and programs are finalized. The Programmatic EIR provides the opportunity to examine the entire project generally, with project-specific information included as available.

In addition to the programmatic analysis described above, the DEIR also includes a more detailed project-level analysis of those actions fully described in the SA, primarily within the Recreation Management Plan (RMP). As more fully described in Chapter 3.0, many actions contained within the RMP are sufficiently detailed to allow this DEIR to provide the full and complete environmental review required under CEQA; therefore, no further environmental review will be required for these actions. For the remainder of the actions contained within the SA, DWR anticipates that additional CEQA review will be needed.

1.2 PURPOSE OF THIS DRAFT ENVIRONMENTAL IMPACT REPORT

The primary purpose of a DEIR is to identify and publicly disclose any potential significant environmental impacts that may result from implementation of a proposed project and to identify feasible alternatives, mitigation measures, and modifications to the project that would reduce those impacts. DWR, as lead agency under CEQA, has determined that preparation and certification of an EIR is required before approval of the Proposed Project, which is implementation of the *Settlement Agreement for Licensing of the Oroville Facilities* (SA) signed March 21, 2006. The information in this DEIR will also be used for the purposes described below.

1.2.1 State Water Quality Certification

DWR is required to obtain water quality certification for the Proposed Project from the State Water Resources Control Board (SWRCB) under Section 401 of the Clean Water Act. The Section 401 certification process is subject to CEQA compliance; therefore, the SWRCB can use the information in this DEIR, and subsequent final environmental impact report (FEIR), to prepare terms and conditions to be included in their future

Water Quality Certificate when issued. State water quality certification is one of the necessary prerequisites before FERC can issue a new license for the Oroville Facilities. In issuing its water quality certification, the SWRCB certifies that the Proposed Project will comply with specified provisions of the Clean Water Act, including water quality standards that are developed pursuant to state law and in satisfaction of Clean Water Act Section 303 (33 U.S. Code 1313).

Pursuant to Section 303, the Central Valley Regional Water Quality Control Board has adopted and the SWRCB has approved *The Water Quality Control Plan for the Sacramento and San Joaquin River Basins* (Basin Plan) (Central Valley RWQCB 2004). The Basin Plan designates or establishes beneficial uses within specified waters to be protected, establishes water quality objectives to reasonably protect those uses, and sets forth a program of implementation needed for achieving the objectives.

1.2.1.1 Beneficial Uses Identified in the Basin Plan for the Project Area

The Basin Plan identifies the waters of the Oroville Facilities as Lake Oroville, the Diversion Pool, Thermalito Forebay, Thermalito Afterbay, and the Fish Barrier Pool. The Basin Plan beneficial uses for any specifically identified water body generally apply to its tributary streams as well. The beneficial uses for the Oroville Facilities are municipal and domestic supply, irrigation, power, water contact recreation, non-contact water recreation, warm water and cold water habitat, warm water and cold water spawning habitat, and wildlife habitat. The beneficial uses for the Feather River from the Fish Barrier Dam to the Sacramento River are municipal and domestic supply, irrigation, contact recreation, canoeing and rafting, non-contact recreation, warm freshwater and cold freshwater habitat, warm water and cold water migration, warm water and cold water spawning, and wildlife habitat (Table II-1 of the Basin Plan).

Beneficial Uses at the Oroville Facilities

The Basin Plan identifies the following beneficial uses of project waters:

- **Municipal and Domestic Supply—**Uses of water for community, military, or individual water supply systems, including, but not limited to, drinking water supply.
- **Agricultural Supply—**Uses of water for farming, horticulture, or ranching including, but not limited to, irrigation, stock watering, or support of vegetation for range grazing.
- **Hydropower Generation—**Use of water for hydropower generation.
- **Water Contact Recreation—**Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, white water activities, fishing, or use of natural hot springs.

- **Non-contact Water Recreation—**Uses of water for recreational activities involving proximity to water, but where there is generally no body contact with water, nor any likelihood of ingestion of water. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, hunting, sightseeing, and aesthetic enjoyment in conjunction with the above activities.

- **Warm Freshwater Habitat—**Uses of water that support warm water ecosystems including, but not limited to, preservation and enhancements of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.

- **Cold Freshwater Habitat—**Uses of water that support cold water ecosystems, including, but not limited to, preservation or enhancements of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.

- **Spawning, Reproduction, and/or Early Development (Warm and Cold)—** Uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish.

- **Wildlife Habitat—**Uses of water that support terrestrial or wetland ecosystems including, but not limited to, preservation and enhancement of terrestrial habitats or wetlands, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food resources.

Beneficial Uses from the Fish Barrier Dam to the Sacramento River

The Basin Plan identifies the following beneficial uses for the Feather River from the Fish Barrier Dam to the Sacramento River:

- **Municipal and Domestic Supply—**Uses of water for community, military, or individual water supply systems, including, but not limited to, drinking water supply.

- **Agricultural Supply—**Uses of water for farming, horticulture, or ranching including, but not limited to, irrigation, stock watering, or support of vegetation for range grazing.

- **Water Contact Recreation—**Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, white water activities, canoeing, rafting, fishing, or use of natural hot springs).

- **Non-contact Water Recreation—**Uses of water for recreational activities involving proximity to water, but where there is generally no body contact with water, nor any likelihood of ingestion of water. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating,

hunting, sightseeing, and aesthetic enjoyment in conjunction with the above activities.

- **Warm Freshwater Habitat—**Uses of water that support warm water ecosystems including, but not limited to, preservation and enhancements of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.

- **Cold Freshwater Habitat—**Uses of water that support cold water ecosystems, including, but not limited to, preservation or enhancements of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.

- **Migration of Aquatic Organisms (Warm and Cold)—**Uses of water that support habitats necessary for migration or other temporary activities by aquatic organisms, such as anadromous fish.

- **Spawning, Reproduction, and/or Early Development (Warm and Cold)—** Uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish.

- **Wildlife Habitat—**Uses of water that support terrestrial or wetland ecosystems including, but not limited to, preservation and enhancement of terrestrial habitats or wetlands, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food resources.

1.2.1.2 Basin Plan Water Quality Objectives

The Porter-Cologne Water Quality Control Act (Porter-Cologne Act) defines water quality objectives as “the limits or levels of water quality constituents or characteristics which are established for the reasonable protection of beneficial uses of water or the prevention of nuisance within a specific area” (California Water Code Section 13050(h)). It also requires the Regional Water Quality Control Board to establish water quality objectives, while acknowledging that it is possible for water quality to be changed to some degree without reasonably affecting beneficial uses. In establishing water quality objectives, the Regional Water Quality Control Board must consider, among other things, past, present, and probable future beneficial uses, environmental characteristics of the hydrographic unit, water quality conditions that could reasonably be achieved through the coordinated control of all factors that affect water quality in the area, and economic considerations. California water quality standards consist of both beneficial uses and the water quality objectives based on those uses (Central Valley RWQCB 2004).

Water quality objectives for surface waters listed in the Basin Plan include standards for bacteria, chemical constituents, color, dissolved oxygen, floating material, methylmercury, oil and grease, pH, pesticides, radioactivity, salinity, sediment, settleable material, suspended material, tastes and odors, temperature, toxicity, and turbidity.

1.2.2 Compliance with the California Endangered Species Act

In addition to providing information for Section 401 water quality certification, this DEIR also provides the needed information for the California Department of Fish and Game (DFG) to support compliance with the California Endangered Species Act (CESA).

1.3 PROJECT DECISION MAKING

The SA, which was signed by many stakeholders representing local interests and agencies, non-governmental organizations (NGO), and State and federal agencies who participated in the Oroville Facilities (P-2100) relicensing collaborative, is reflected in the Proposed Project. The SA is the product of 6 years of collaborative development and review. The public and agency review of the DEIR could result in comments that may result in refining the Proposed Project prior to certifying an FEIR. As the CEQA Lead Agency, DWR has the authority to certify the FEIR. DWR will use the FEIR and any supplemental CEQA documents to make all necessary decisions for acceptance and implementation of the new FERC Project License and implementation of the SA.

The DEIR and FEIR will be forwarded to the stakeholders who entered into the SA for their consideration in connection with their responsibilities. State Responsible and Trustee Agencies, as defined by State CEQA Guidelines Section 15386, will also receive a DEIR and FEIR. SWRCB and California Department of Boating and Waterways are considered State Responsible Agencies; DFG and the California Department of Parks and Recreation (DPR) are Trustee Agencies. The State Clearinghouse will post notice regarding the availability of the DEIR and FEIR. After FEIR certification and acquisition of a 401 Water Quality Certification from the SWRCB, it is expected that FERC will issue a new license to operate the Oroville Facilities.

1.4 ORGANIZATION OF THIS DRAFT ENVIRONMENTAL IMPACT REPORT

This DEIR is organized as follows:

Chapter 1.0, Introduction, describes the purpose and structure of the document, explains how it will be used in the decision making process, and includes information regarding public participation and document availability.

Chapter 2.0, Objectives, Scoping, and Support for the Proposed Project, describes the needs and commitments related to power, water supply, flood management, recreation, and environmental benefits. This chapter also describes the ALP process including scoping, post-application efforts, and support for the SA.

Chapter 3.0, Description of Existing Facilities and Operations, the Proposed Project, and Alternatives, provides an overview of the existing Oroville Facilities as well as current operations, environmental commitments, and programs that would continue under the No-Project Alternative. This chapter also describes the Proposed Project (SA), the FERC Staff Alternative, and alternatives considered but eliminated from further evaluation.

Chapter 4.0, Environmental Setting, describes the affected environment under Existing Conditions.

Chapter 5.0, Environmental Impacts, describes the impacts on geology, soils, and paleontological resources; surface and groundwater quantity and quality; aquatic resources; terrestrial resources; land use; recreational resources; cultural resources; population, housing, and public services; environmental justice; aesthetic resources (visual resources and noise); air quality; agricultural resources; transportation and traffic; and public health and safety.

Chapter 6.0, Other Statutory Requirements, describes growth inducement, cumulative impacts, irreversible and/or unavoidable effects, the relationship between short-term uses of the environment and maintenance, and enhancement of long-term productivity.

Chapter 7.0, Regulatory Permits, Approvals, and Authorities Related to Relicensing the Oroville Facilities, lists and describes the regulations and constraints affecting the Proposed Project.

Chapter 8.0, Contributors and Reviewers, lists the contributors to this document, including those who wrote and reviewed sections and those who composed graphics.

Chapter 9.0, Distribution List, lists those stakeholders, NGOs, federal agencies, State agencies, and private citizens who have received a copy of this document.

Chapter 10.0, Consultation and Coordination with Applicable Agencies, lists consultation and coordination with applicable agencies.

Chapter 11.0, Literature Cited, provides a list of literature cited in this document, including printed references and websites, as well as personal communications with knowledgeable sources who provided information included in the DEIR.

Appendices (provided on CD)

- Appendix A—*Settlement Agreement for Licensing of the Oroville Facilities*—FERC Project No. 2100, March 2006
- Appendix B—Settlement Agreement Recreation Management Plan, March 2006
- Appendix C—Aquatic Resources Impact Analysis
- Appendix D—Best Management Practices
- Appendix E—Modeling Comparisons

1.5 COMMENTS REQUESTED

The public review period for the DEIR will be 60 days commencing on May 21, 2007, and terminating on July 20, 2007. Please send your written comments to:

Henry "Rick" Ramirez
Program Manager, Oroville Facilities Relicensing
California Department of Water Resources
P.O. Box 942836
Sacramento, CA 94236-0001

When a person or organization who has been consulted with regard to a DEIR fails to comment within the time limits provided by the Lead Agency, the Lead Agency may assume that the person or agency has no comment. Although a lead agency need not respond to late comments, it may choose to do so (State CEQA Guidelines Section 15207).

1.6 PUBLIC HEARING

While CEQA does not require a formal public hearing on a DEIR (State CEQA Guidelines Section 15087(i), DWR intends to hold a hearing in Oroville on June 21, 2007 at 4:00 PM at Kelly Ridge. This type of hearing is typically held to allow the Lead Agency to receive public comments on the DEIR. FERC held a public meeting on the DEIR on November 8, 2006, as required by statute and in accordance with the CEQ NEPA Regulations (40 CFR 1506.6(c)).

1.7 AVAILABILITY OF DEIR AND TECHNICAL STUDY REPORTS; INCORPORATION BY REFERENCE

This DEIR can be viewed at DWR's Oroville Relicensing website at http://orovillerelicensing.water.ca.gov or in the Sacramento or Oroville Public Reference Files at the following locations:

California Department of Water Resources
1416 Ninth Street, Room 338
Sacramento, CA 95814

Oroville Branch of the Butte County Library
1820 Mitchell Avenue
Oroville, CA 95966

The website and public file locations also include the ALP protocols, meeting logistics, summaries of all Plenary Group and work group meetings, the FERC License Application, which includes the PDEA and technical study reports, and the FERC DEIS.

This DEIR relies in part on information collected during Oroville Facilities relicensing studies, which were developed in coordination with stakeholders, including regulatory

agencies. The technical study reports listed below are incorporated by reference as though set forth in full as part of the text of the DEIR.

The Archaeological and Historical Site Inventory at Lake Oroville, Butte County—A Report for the Public—no date

This booklet describes the archaeological resources inventory of the Oroville Facilities area. It presents the background of the area, the methods used, and some of the inventory's results.

Konkow Maidu Tribal Presence in the Lake Oroville Area: An Ethnographic and Ethnohistoric Inventory—no date

This report contains an ethnographic and ethnohistoric inventory of Konkow Maidu cultural resources within the Project area.

Oroville Facilities Relicensing Project Cultural Resources Inventory—Interim Report—January 31, 2003

This report contains a field inventory of cultural resources within the Project area.

Historical Properties Management Plan—Draft 2007

The draft HPMP includes measures to address ongoing effects, protocols for proposed future actions, programs for future archaeological inventory and evaluation, and procedures for inadvertent discoveries and emergency situations.

L-1 Land Use Report (Final Report)—July 2004

This study presents the results of a comprehensive evaluation of existing and planned land uses in the Project area, as well as a brief overview of historical land use that formed the context of current land use planning in the Oroville area.

L-2 Land Management (Final Report)—August 2004

This report identifies the public agencies responsible for managing lands within the Project area, describes the management direction of these lands according to land use and resource management plans, and provides a discussion of the existing management practices of each responsible agency.

L-3 Comprehensive Plans Evaluation (Final Report)—May 2004

This report contains a comprehensive review of land use and resource management plans within the Project area and an analysis of whether the Project is consistent with those plans.

L-4 Aesthetic/Visual Resources Report (Final Report)—July 2004

This report inventories and characterizes the aesthetic/visual environment of the Project area and includes an assessment of the compatibility of Project facilities and operations with the Project's aesthetic/visual environment.

L-5 Fuel Load Management Evaluation (Final Report)—May 2004

This report summarizes existing data on the current fuel load conditions in the Project area, presents information on relevant fuel load reduction and management techniques, and summarizes the programs and policies of other local agencies' land management reports.

W-1 Project Effects on Water Quality Designated Beneficial Uses for Surface Waters (Final Report)—September 2004

This study evaluates the physical, chemical, and biological integrity of water within the Oroville Facilities and other Project-affected surface waters.

W-2, Phase 1 Contaminant Accumulation in Fish, Sediments, and the Aquatic Food Chain (Draft Report)—January 2004

This report presents the results of Phase 1 of the study that measured the significance of contamination in fish, crayfish, and sediments in project waters, and evaluated the effect on prey species and humans.

W-3 Recreational Facilities and Operations Effects on Water Quality; Year 1 Progress Report—August 2004

This report presents the progress of monitoring programs that were designed to target specific recreational facilities and activities with the potential to introduce contaminants into Project waters.

W-3 Recreational Facilities and Operations Effects on Water Quality, Task 1: Effects of Current Recreation Facilities and Operations; Task 1A Identification of Potential Effects to Water Quality (Interim Report)—October 10, 2002

This report identifies the potential effects to water quality from recreational facilities and their associated activities.

W-5, Task 1 Project Effects on Groundwater (Draft Report)—March 2004

This report analyzes the potential effects of Thermalito Forebay and Thermalito Afterbay upon local groundwater level and quality.

W-5 Project Effects on Groundwater; Task 1, Phase 1 Inventory Existing Wells and Assessment of Existing Groundwater Data and Current Groundwater Monitoring Activities (Draft Report)—May 14, 2003

This report presents an inventory of existing wells in the vicinity of Thermalito Afterbay, and includes an assessment of existing groundwater data and current groundwater monitoring activities.

W-5, Task 2 Project Effects on Groundwater (Draft Report)—November 2004

This study analyzes the hyporheic connectivity between the Feather River and ponds within the Oroville Wildlife Area (OWA).

W-6 Project Effects on Temperature Regime (Draft Final Report)—July 2004

This study evaluates the effects of Project facilities and operations on the temperature regime of Project waters and waters affected by the Project, and the ability of the Project to meet the temperature requirements for protection of beneficial uses, including agriculture, fish, and other aquatic resources.

W-7 Land and Watershed Management Effects on Water Quality (Progress Report)—January 2003

This report reviews the potential effects of land and watershed management activities on project waters.

W-7 Land and Watershed Management Effects on Water Quality Task 1: Effects to Water Quality from Ongoing Land Uses and Management; Task 1B: Evaluation of Potential Effects to Water Quality—August 2004

This report evaluates the effects on water quality from ongoing land uses and management activities.

W-9 Project Effects on Natural Protective Processes—June 2004

This report assesses the effectiveness of natural protective processes on water quality within the Project area.

T-1 Effects on Project Operations and Features on Wildlife and Wildlife Habitat (Final Report)—April 2004

This report identifies and evaluates potentially significant impacts on wildlife populations and habitat related to current and future project operations and maintenance. The report identifies opportunities to enhance, minimize, avoid, or mitigate potentially significant impacts.

T-2 Project Effects on Special Status Wildlife Species (Final Report)—January 2004

This study provides the information necessary to evaluate the potential impacts of the Project on special status wildlife species within the biological and environmental assessment processes.

T-2 Project Effects on Special Status Plant Species (Final Report)—March 2004

This report analyzes the Project's effects on special status plant species within the Project boundary. The scope of study for each species focused on areas of suitable habitat within the study area that may be affected by Project activities. Habitat for federally listed or State listed species was completely surveyed.

T-3/5 Project Effects on Riparian Resources, Wetlands, and Associated Floodplains (Draft Final)—July 2004

This report analyzes the effects of the Project on riparian resources, wetlands, and associated floodplains within the project area.

T-4 Biodiversity, Vegetation Communities, and Wildlife Habitat Mapping (Final Report)—December 2003

This report contains maps delineating vegetative cover/land use and habitat data. Suitable habitat and presence/absence data for special status plant and animal species are included in this report.

T-6 Interagency Wildlife Management Coordination and Wildlife Management Plan Development (Interim Report)—January 2004

This report analyzes opportunities for improved interagency wildlife coordination among the principal land management and wildlife regulatory agencies with responsibilities within the Project area.

T-7 Project Effects on Noxious Terrestrial and Aquatic Plant Species (Final Report)—June 2004

This report reviews and maps existing non-native invasive plant species which can adversely impact native plant species and communities and wildlife habitat through competition as well as impact downstream natural and agricultural resources.

T-8 Project Effects on Non-Native Wildlife (Final Report)—September 2003

This report provides information concerning potential management practices for population control of non-native species as appropriate to meet an agency's land and wildlife management goals.

T-9 Recreation and Wildlife (Final Report)—June 2004

This report evaluates the potential impacts associated with recreation on wildlife within the Project vicinity.

T-10 Effects of Project Features, Operations, and Maintenance on Upland Plant Communities (Final Report)—August 2004

This report analyzes current and potential future operations of the Oroville Facilities that may impact upland plant communities, including rare or unique community types.

T-11 Effects of Fuel Load Management and Fire Prevention on Wildlife and Plant Communities (Final Report)—October 2003

This study analyzes the potential benefits and impacts that possible fuel load management actions would have on wildlife and plant communities.

G-1 Effects of Project Operations on Geomorphic Processes Upstream of Oroville Dam (Final Report)—April 2004

This report assesses the channel resources above Lake Oroville and within the Fluctuation Zone, and includes a calculation of the total sediment in storage within Lake Oroville.

G-2 Effects of Project Operations on Geomorphic Processes Downstream of Oroville Dam; Task 1.1 Resources and References—June 2004

This report is one of eight reports that fulfill the scope of work for SP-G2.

G-2 Effects of Project Operations on Geomorphic Processes Downstream of Oroville Dam; Task 1.2 Physiographic Setting and Mesohabitat—April 2004

This report presents the sub-tasks, methodology, and results completed to date. It presents the physiographic “framework” for the overall study. In effect it is the foundation on which the other study plan tasks and corresponding reports are based.

G-2 Effects of Project Operations on Geomorphic Processes Downstream of Oroville Dam; Task 2 Spawning Riffle Characteristics—August 2004

This report includes the methodology, results, and conclusions of a Chinook salmon spawning riffle quality evaluation.

G-2 Effects of Project Operations on Geomorphic Processes Downstream of Oroville Dam; Task 3—Channel Cross-Sections and Photography; Task 4—Monitoring—September 2004

This report identifies the hydraulic, geomorphic, and sediment transport changes that have occurred as a result of Oroville Dam. The report also considers the effect of these

changes on salmonid spawning riffles, flooding, riparian vegetation, riparian habitat, and river habitat.

G-2 Effects of Project Operations on Geomorphic Processes Downstream of Oroville Dam; Task 5—Dam Effects on Channel Hydraulics and Geomorphology

This report includes flow exceedance calculations, flood frequency calculations, and Indicators of Hydraulic Alternation analysis on three Feather River gauges.

G-2 Effects of Project Operations on Geomorphic Processes Downstream of Oroville Dam Task 8—Summary and Conclusions—July 2004

This report presents the sub-tasks, methodology, and results. It presents the hydraulic, geomorphic, and sediment transport changes that have occurred as a result of human activities and the Oroville Facilities.

G-2 Effects of Project Operations on Geomorphic Processes Downstream of Oroville Dam; Task 6—Channel Meanders and Bank Erosion Monitoring—July 2004

This report presents the sub-tasks, methodology, and results completed to date concerning the monitoring of channel meanders and bank erosion.

G-2 Effects of Project Operations on Geomorphic Processes Downstream of Oroville Dam; Task 7—Hydraulic and Sediment Transport Modeling with Fluvial-12 (Draft Report)—March 2004

This report identifies and evaluates the ongoing and future effects of the construction of Oroville Dam on channel morphology and sediment transport in the Lower Feather River.

Paleontologic Resources in the Vicinity of FERC Project 2100 (Oroville Reservoir and Lower Feather River): Literature-Based Inventory and Significance Assessment—January 2005

This study provides baseline data on known fossil localities within the Project area.

Fluvial Modeling Study of Feather River Responses to Oroville Dam and Related Issues—February 2004

This report presents a modeling study of the effects on the Feather River by Oroville Dam.

F-1 Tasks 1 and 2 Evaluation of Project Effects on Non-Fish Aquatic Resources (Final Report)—August 2004

This report documents the status of existing aquatic macroinvertebrate and plankton communities based on field study results, and provides a description of potential environmental effects on these resources based on a review of the existing literature

(Task 1). The report also presents an evaluation of the current and potential future operational effects of the Oroville Facilities on aquatic macroinvertebrates, phytoplankton, and zooplankton residing in the Project reservoirs and river habitats within the study area (Task 2).

F-2 Evaluation of Project Effects on Fish Disease—June 10, 2004

This report presents an evaluation of the effects of ongoing and future Project operations on the establishment, transmission, extent and control of infectious hematopoetic necrosis, bacterial kidney disease, and other significant fish diseases in the Feather River basin.

F-2, Task 1 and 2 Evaluation of Project Effects on Fish Disease (Draft)—March 20, 2003

This report reviews existing information and evaluates the Project's effects on the establishment, transmission, and control of fish diseases in Project waters. The report also evaluates the potential for significant fish diseases to move downstream of the Project waters.

F-3.1, Task 1A Assessment of Potential Fish Passage Impediments Above Lake Oroville's High Water Mark (Final Report)—May 2004

This report identifies and characterizes potential fish passage barriers for inland salmonids, anadromous salmonids, and sturgeon upstream of Lake Oroville. The report provides information regarding the ability of the fish occurring within Lake Oroville to access habitat upstream of Lake Oroville and to interact with the fish communities in the tributaries upstream of Lake Oroville.

F-3.1, Task 1B Fish Species Composition in Lake Oroville's Upstream Tributaries (Final Report)—December 2004

This report provides information regarding fish species composition in the tributaries upstream of Lake Oroville and the effects of project operations on species composition.

F-3.1, Task 1C; F-3.2 Task 4A; GIS Fish Habitat Components—June 2003

This report contains Geographic Information System (GIS) maps showing fish habitat components.

F-3.1, Task 2A, 3A Fish Species Composition: Lake Oroville, Thermalito Diversion Pool, Thermalito Forebay—June 30, 2003

This report identifies the fish species composition in Lake Oroville, the Thermalito Diversion Pool, and Thermalito Forebay, and represents Tasks 2A and 3A of the SP-3.1 study entitled SP-3.1 Evaluation of the Project Effects on Fish and Their Habitat within Lake Oroville, its Upstream Tributaries, and Thermalito Complex, and the OWA.

F-3.1, Task 2B Evaluation of the Ability of Lake Oroville's Coldwater Pool to Support Salmonid Stocking Recommendations (Final Report)—March 2003

This report evaluates whether there is sufficient cold water in Lake Oroville to support current annual salmonid stocking goals of 170,000 yearling equivalent salmon.

F-3.1, Task 2C Evaluation of Lake Oroville Water Surface Elevation Reductions on Bass (Micropterus spp) Spawning Success (Final Report)—December 6, 2002

This report evaluates the effects of water surface elevation fluctuations on spawning of bass in Lake Oroville.

F-3.1, Task 2D Management Practices and Monitoring Studies for White Sturgeon (Final Report)—December 2002

This report summarizes information regarding management practices from reservoirs that are actively managed for sturgeon.

F-3.1 Task 3B, 3C Project Operations Influencing Fish habitat and Water Quality in the Thermalito Diversion Pool and the Thermalito Forebay (Final Report)—May 2004

This report looks at the influence of Project operations on fish habitat and water quality in the Thermalito Diversion Pool and the Thermalito Forebay.

F-3.1 Task 4A Fish Species Composition and Juvenile Bass Recruitment in the Thermalito Afterbay (Final Report)—December 2004

This report describes the fish species composition and evaluates juvenile bass recruitment in Thermalito Afterbay.

F-3.1, Task 4B Characterization of Cold Water Pool Availability in the Thermalito Afterbay (Final Report)—December 2003

This report evaluates whether sufficient cold water exists in Thermalito Afterbay to support a year-round cold water fishery.

F-3.1, Task 4C Evaluation of Water Surface Fluctuations on Bass Nest Dewatering and Characterizations of Inundated Littoral Habitat in the Thermalito Afterbay (Final Report)—August 2004

This report estimates the percentage of bass nests subject to dewatering in Thermalito Afterbay. Additionally, the report assesses the availability of inundated littoral habitat for black bass juvenile rearing in Thermalito Afterbay.

*F-3.1 Task 5A One-Mile Pond Fish Species Compos*ition—November 2003

This study identifies the fish species composition in the OWA and represents task 5A of the SP-F3.1 study entitled SP-F3.1 Evaluation of Project Effects on Fish and Their

Habitat within Lake Oroville, its Upstream Tributaries, the Thermalito Complex, and the OWA. A listing of the fish species is presented along with a general perspective as to the relative abundance of these species, and the relationship of these fish species compositions to existing fishery management programs is also discussed.

F-3.1 Task 5B Characterization of Fish Habitat in One-Mile Pond (Interim Report)—January 2004

This report analyzes the availability of warm water fish habitat in One-Mile Pond.

F-3.2 Task 1, F-21 Task 2 Fish Distribution in the Feather River Below the Thermalito Diversion Dam to the Confluence with the Sacramento River (Draft Report)—January 2003

This report establishes an informational baseline describing the current knowledge of fish distribution in the Feather River.

F-3.2, Task 1,4,5 Comparison of Fish Distribution to Fish Habitat in the Lower Feather River (Final)—August 2004

This report documents the distribution of non-salmonid fish species in the lower Feather River from the Thermalito Diversion Dam to the confluence of the Sacramento and Feather Rivers (Task 1), identifies fish habitat in the lower Feather River as it pertains to species-specific habitat requirements (Task 4), evaluates potential project effects on non-salmonid fish species, and integrates fish species distribution information and habitat requirements (Task 5).

F-3.2 Task 2, F-21 Task 1 Literature Review of Life History and Habitat Requirements for Feather River Fish Species (Interim Report)—January 2003

This report provides an information database regarding lifestage characteristics and habitat requirements of fish species in the Feather River.

F-3.2 Task 3A Final Assessment of Potential Sturgeon Passage Impediments—September 2003

This report provides the final assessment of potential sturgeon passage impediments in the Feather River.

F-3.2 Task 3A Identify Green Sturgeon Distribution and Habitat Use Patterns—December 2002

This repot describes Task 3A, which involved divers searching for sturgeon downstream of potential migration barriers in the Feather River, as well as surveys for sturgeon eggs at four stations in the Low Flow Channel.

F-3.2 Task 3A Final Assessment of Sturgeon Distribution and Habitat Use—December 15, 2003

This report assesses the distribution, spawning locations and timing, habitat usage, residence time, and outmigration patterns of sturgeon in the lower Feather River.

F-3.2, Task 3B Assessment of Potential Project Effects on Splittail Habitat (Final Report)—July 2004

This report assesses potential Project effects on splittail habitat availability during the splittail spawning, egg incubation, and initial rearing period.

F-5/7 Evaluation of Potential Effects of Fisheries Management Activities on ESA-Listed Fish Species (Final Report)—May 2004

This report analyzes the potential effects of fisheries management activities on fish species listed under the Endangered Species Act and listed by DFG as fish Species of Special Concern downstream of the project in the Feather River.

F-5/7 Task 2 Achievement of Current Stocking Goals—September 2004

This report evaluates whether the current stocking goals for Lake Oroville and Thermalito Forebay had been achieved as of September 2004.

F-5/7 Task 3 Evaluation of Interactions Between the Lake Oroville Fishery and Upstream Tributary Fisheries (Final Report)—December 2003

This report evaluates potential interactions between the Lake Oroville fishery and fisheries in the tributaries upstream of Lake Oroville.

F-8 Transfer of Energy and Nutrients By Anadromous Fish Migrations (Final Report)—August 1, 2003

This report investigates the potential impact of the elimination of anadromous salmonid spawning runs on ecosystem productivity of the historical Feather River tributaries upstream of Lake Oroville.

F-9 The Effects of the Feather River Hatchery on Naturally Spawning Salmonids (Draft Report)—November 2004

This report describes the physical, institutional, biological, and fisheries context in which the Feather River Fish Hatchery has operated, and will operate. The report examines some of its potential impacts on Central Valley Chinook salmon and steelhead.

F-9, Phase 1 Evaluation of Project Effects on Natural Salmonid Populations—Interim Literature Review—March 24, 2003

This report examines the available literature regarding the effects of the Feather River Fish Hatchery on naturally spawning salmonids.

F-10 Task 1C Evaluation of Flow-Related Physical Impediments in the Feather River Below the Fish Barrier Dam (Final Report)—January 2003

This report evaluates potential relationships between flow and flow-related physical passage impediments to adult salmonid immigration in the Feather River.

F-10, Tasks 1D and 1E Evaluation of Oroville Facilities Operations on Water Temperature Related Effects on Pre-Spawning Adult Chinook Salmon and Characteristics of Holding Habitat (Final Report)—June 2004

This report identifies and characterizes adult early up-migrant (spring-run) Chinook salmon (*Oncorhynchus tshawytscha*) holding habitat and use patterns in the lower Feather River below the Thermalito Diversion Dam (Task 1E). The report also evaluates the effects of Oroville Facilities operations on water temperature–related effects on pre-spawning salmonid adult production (Task 1D).

F-10 Task 1E Pre-spawning Chinook Salmon Migration Patterns and Holding Characteristics (Interim Report)—March 22, 2004

This report evaluates water temperatures, depth, and migration patterns of pre-spawning adult Chinook salmon in the Feather River below the Fish Barrier Dam.

F-10 Task 1E Identification and Characterization of Early Up-Migrant Chinook Salmon Holding Habitat and Habitat Use Patterns (Interim Report)—April 2003

This report includes a literature review to determine suitable water temperature, dissolved oxygen concentration, depth, substrate, and water velocity for adult spring - run Chinook salmon holding habitat. The report also includes an analysis that was conducted to determine the existence, location, and distribution of suitable holding habitat in the Feather River below Oroville Dam.

F-10 Task 2A Evaluation of Spawning and Incubation Substrate Suitability for Salmonids in the Lower Feather River (Final Report)—June 2004

This report evaluates spawning and incubation substrate suitability for salmonids in the lower Feather River.

*F-10 Task 2B 2003 Lower Feather River Steelhead (*Onchorhynchus mykiss*) Redd Survey*—July 10, 2003

This report includes thirteen weekly redd surveys performed between January 6 and April 3, 2003.

F-10 Task 2B Steelhead Spawning Methods (Interim Report)—May 2003

This report includes a literature review and evaluation to identify opportunities for improvement in the methods to quantify steelhead spawning in the Feather River.

F-10, Task 2B Evaluation of Potential Effects of Oroville Facilities Operations on Spawning Chinook Salmon (Final)—March 2004

This report evaluates the effects of the Oroville Facilities operational procedures on spawning Chinook salmon in the lower Feather River.

F-10, Task 2C Evaluation of the Timing, Magnitude, and Frequency of Water Temperatures and Their Effects on Chinook Salmon Egg and Alevin Survival (Final Report)—July 2004

This report evaluates the effects of Oroville Facilities operations on Chinook salmon egg and alevin survival in the lower Feather River.

F-10 Task 2D Evaluation of Flow Fluctuation Effects on Chinook Salmon Redd Dewatering in the Lower Feather River (Final Report)—July 2004

This report evaluates the effects of flow fluctuation in the lower Feather River on salmonid redd de-watering.

F-10 Task 3A Distribution and Habitat Use of Juvenile Steelhead and other Fishes of the Lower Feather River (Final Report)—April 2004

This report determines the characteristics of the wild steelhead population and identifies factors potentially limiting steelhead success in the lower Feather River.

F-10 Task 3A Distribution and Habitat Use of Steelhead and Other Fishes in the Lower Feather River, 1999–2001 (Interim Report)—January 22, 2003

This report determines the characteristics of the wild steelhead population and identifies factors potentially limiting steelhead success in the lower Feather River.

F-10 Task 3B Growth Investigations of Wild and Hatchery Steelhead in the Lower Feather River—February 2004

This report describes the results of an enclosure and mark recapture study in the Feather River LFC to assess growth, survival, and movement of juvenile steelhead.

*F-10 Task 3B Growth Investigations of Wild Juvenile Steelhead (*Onchorhynchus mykiss*) in the Feather River Using Mark and Recapture Techniques (Interim Report)*—June 17, 2003

This report investigates site fidelity and growth of wild rearing juvenile steelhead (*Oncorhynchus mykiss*) through mark-and-recapture sampling.

F-10 Task 3B Steelhead Rearing Temperatures (Interim Report)—July 2003

This report includes a literature review and evaluation to identify temperature ranges that are suitable for steelhead fry and juvenile rearing in the lower Feather River.

F-10 Task 3C Redd Dewatering and Juvenile Steelhead and Chinook Salmon Stranding in the Lower Feather River 2002–2003 (Interim)—June 17, 2003

This report determines the number of redds de-watered by reductions in flow; identifies potential ponding areas; determines the relative abundance of stranded salmonids; and determines the biological significance of stranding/redd dewatering losses to the existing population of salmonids in the river. The report summarizes activities from the 2002–2003 sampling season.

F-10 Task 3C Juvenile Steelhead and Chinook Salmon Stranding in the Lower Feather River 2001–2003 (Final Report)—August 2004

This report identifies potential ponding areas; determines the relative abundance of stranded salmonids; and determines the biological significance of stranding losses to the existing population of salmonids in the lower Feather River.

F-10 Task 4A Literature Review of Devices used for Enumeration of Juvenile Steelhead (Review Draft)—January 2003

This report includes a literature review of devices used to enumerate outmigrating juvenile steelhead, and includes a brief description of each device, a list of advantages and disadvantages associated with each device, a summary of several case studies involving use of the devices, and conclusions regarding the applicability of the devices for use in enumerating outmigrant juvenile steelhead in the Feather River.

F-10 Task 4A River Flow Effects on Emigrating Juvenile Salmonids in the Lower Feather River—December 2003

This report includes a literature review and an analysis of empirical data collected on the lower Feather River to determine the timing of emigration and the potential effects of river flow on emigrating juvenile salmonids.

F-10 Task 4B Timing, Thermal Tolerance Ranges, and Potential Water Temperature Effects on Emigrating Juvenile Salmonids in the Lower Feather River—October 2003

This report includes a literature review to determine the timing of emigration, the thermal tolerance ranges, and the potential effects of water temperatures on emigrating juvenile salmonids in the lower Feather River.

F-15, Task 2; F-3.1, Task 1C Inventory of Potentially Available Habitat and Distribution of Juvenile and Adult Fish Upstream from Lake Oroville (Final)—June 2004

This joint report inventories and assesses the suitability of available habitat upstream of Lake Oroville for adult and juvenile anadromous salmonids, and describes the distribution of species currently present.

F-15, Task 3 Evaluation of Methods and Devices Used in the Capture, Sorting, Holding, Transport, and Release of Fish (Final)—June 2004

This report evaluates the feasibility of moving anadromous salmonids and other targeted migratory fish species, specifically green sturgeon, past the Oroville Facilities.

F-15, Task 4 Fish Passage Model (Final)—January 2004

This report provides a fish passage assessment model to evaluate various combinations of alternative fish passage program elements and goals for the Oroville Facilities Relicensing environmental documentation.

F-16 Phase 1 Evaluation of Project Effects on Instream Flows and Fish Habitat (Phase 1 Report)—July 17, 2002

This report presents an evaluation of Phase 1 of the study of Project effects on instream flows and fish habitat. DWR and other participating agencies have been collecting physical and biological data on the Feather River downstream of Oroville Dam for many years. One aspect of these studies is the application of the Instream Flow Incremental Methodology and its associated PHABSIM (physical habitat simulation) computer models, which create indices describing the physical habitat suitability of alternative instream flow releases. Information gathered from this evaluation included instream flow study plans, data compilations, hydraulic data files, draft results, aerial photographs, fish spawning and rearing observations, and related materials.

F-16 Phase 2 Evaluation of Project Effects on Instream Flows and Fish Habitat (Phase 2 Report)—February 2004

This report presents an evaluation of Phase 2 of the study of Project effects on instream flows and fish habitat. The Oroville Facilities substantially control flow in the Feather River from the Fish Barrier Dam near Oroville to the confluence with the Sacramento River. Minimum flow releases were established by a 1983 agreement between DWR and DFG. DWR and DFG jointly conducted an instream flow study utilizing PHABSIM. Principal activities of Phase 2 included placing supplemental PHABSIM cross-section transects, measuring patterns of depth, velocity, substrate, and cover along the transects; merging old and new data; calibrating revised PHABSIM computer models; and computing updated habitat indexes relating suitable spawning habitat to discharge in the two reaches.

F-21 Task 3 Project Effects on Predation of Feather River Juvenile Anandromous Salmonids (Final Report)—May 2004

This report summarizes existing literature on predation of juvenile anadromous salmonids associated with artificial structures and hydropower project operations in river systems other than the Feather River, and determines the Project's effects on predation of juvenile anadromous salmonids in the Feather River.

F-21 Task 4 Predation PM&E Literature Review (Final Report)—February 2003

This report includes a literature review to summarize predation management and monitoring studies in order to determine their effectiveness and their potential applicability to the Oroville Facilities.

Development of the Feather River Flow-Stage Model—March 14, 2003

This report concerns the study that developed and calibrated a flow-stage model for the Feather River. . The model used the river geometry data from the U.S. Army Corps of Engineers Comprehensive Study and other available source information to develop a model of the Feather River comprising the reach from Oroville Dam to the confluence with Sacramento River, including all the hydraulic structures on the river.

E-3 Report on Evaluation of Potential Generation Improvements (Draft)—May 2004—Executive Summary only

This report on Evaluation of Potential Generation Improvements explores the potential for developing additional generation capacity through hydropower improvements or construction additions to the Oroville Facilities.

E-4 Flood Management Study (Final Report)—November 2004

This report is a compilation and summary of known flood control studies involving the Feather River. It contains 15 sections, various embedded tables and figures, and 2 appendices.

E-7A Oroville Reservoir Coldwater Pool Availability Analysis—May 1, 2003

This report evaluates the amount and availability of the cold water pool in Oroville Reservoir.

R-1 Vehicular Access Study (Final)—September 2003

This report examines vehicular access opportunities and constraints to Project area land and water resources.

R-2 Recreation Safety Assessment (Final)—January 2004

This report presents the results of the Recreation Safety Assessment. The study presents a quantitative and qualitative assessment of public safety as it relates to existing recreation activities within the study area, and develops proposed recommendations by the study plan authors to be considered during the relicensing process.

R-3 Assessment of the Relationship of Project Operations and Recreation (Final)—May 2004

This report determines the impacts of current Project operations and any proposed changes to operation of the Oroville Facilities on recreational use and recreational experiences of visitors engaged in various activities.

R-4 Relationship Assessment of Fish/Wildlife Management and Recreation (Final)—May 2004

This report identifies the effects of fish and wildlife management on providing recreational opportunities within the study area. The report describes the range of fish- and wildlife-related recreational opportunities available in the study area, mainly focusing on the 11,870-acre OWA and the 28,000-acre Lake Oroville State Recreation Area, and summarizes agency roles.

R-5 Assessment of Recreation Areas Management (Final)—June 2004

This report identifies the recreational opportunities provided in the Project area and summarizes the jurisdiction of agencies that are responsible for recreation management. It identifies the recreation management actions needed to maintain or enhance these recreational opportunities, as well as the potential funding mechanisms that could accomplish those actions.

R-6 ADA Accessibility Assessment (Final)—September 2003

This report assesses the degree of adequacy and future accessibility needs for persons with disabilities who may use public recreation facilities within the study area.

R-7 Reservoir Boating (Final)—March 2004

This report is an analysis of reservoir boating within the Project area.

R-8 Recreation Carrying Capacity (Final)—June 2004

This report assesses the types and levels of recreational use in the Project area to determine if use levels are compatible with the capacity of the Project area.

R-9 Existing Recreation Use (Final)—February 2004

This report estimates existing Project-related recreation use, both day and overnight use, at recreation facilities and dispersed recreation use areas within the Project area.

R-10 Recreation Facility Inventory and Condition Report (Final)—September 2003

This report consists of an initial inventory and description of the condition of existing recreation facilities within the Project area boundary. Additionally, a brief examination is provided regarding recreation areas affected by reservoir level. There is a brief discussion about planned facility development in the Project area.

R-11 Recreation and Public Use Impact Assessment (Final)—January 2004

This report includes a qualitative assessment of ecological impacts attributed to recreation and public use at recreation sites and areas in the Project area. The report summarizes the recreation and public use impacts on vegetation, soils, and water quality at Project recreation facilities.

R-12 Projected Recreation Use (Final)—May 2004

This report forecasts the amount of recreation use in the Project area for various intervals throughout the anticipated license period of the Oroville Facilities.

R-13 Recreation Surveys (Final)—December 2004

This report determines Project area recreationists' background characteristics; user preferences for facility and area development; perceptions of crowding; levels of satisfaction; reasons for visiting the area; and reasons for not visiting the area.

R-14 Assessment of Regional Recreation and Barriers to Recreation (Final)—February 2004

This report evaluates regional recreational opportunities in Northern California (and adjacent Nevada) and identifies potential barriers, if any, to increasing existing and future recreational uses within the Project area.

R-15 Recreation Suitability Analysis (Final)—February 2004

This report determines areas suitable for potential new recreation facility development, if needed, consistent with the resource opportunities and constraints of the Project area.

R-16 Whitewater and River Boating Report (Final)—January 2004

This report describes whitewater and river boating activities on the Feather River within the Project area, examines effects of Project operations on boating activities, evaluates solutions to any identified whitewater and river boating issues, and, ultimately, provides

useful information for planning recreational experiences for appropriate water-related activities.

R-17 Recreation Needs Analysis (Final)—June 2004

This report includes a comprehensive list of both overall and site-specific public recreation-related needs in the Oroville Facilities study area. The Recreation Needs Analysis contributes to the development of a new recreation plan for the Oroville Facilities area, or Oroville Facilities RMP. This report synthesizes the major results of the other technical resource recreation studies completed during the relicensing process.

R-18 Recreation Activity, Spending, and Associated Economic Impacts (Final)—May 2004

This report estimates the effects of spending activity generated by current and projected recreation use and operations and maintenance (O&M) of the Oroville Facilities on local business sales, employment, and personal income. The report also provides a better understanding of the relationship between the Oroville Facilities and economic development and growth within the region, particularly focused on the greater Oroville area.

R-19 Fiscal Impacts (Final)—May 2004

This report estimates the effects of economic activity generated by current and projected recreation use and by the O&M of the Oroville Facilities on sales tax revenues, lodging tax revenues, and other tax revenues of local governments, and on local public service costs related to Project-related recreation activity and O&M of the Oroville Facilities. The report also provides a better understanding of the relationship between the level of recreation activity at the Oroville Facilities and resulting levels of public revenues and costs generated for local agencies.

R-18, R-19 Phase 1 Background Report Economic and Fiscal Conditions (Final)—May 2003

This report includes socioeconomic and fiscal data pertaining to the local economy affected by the Oroville Facilities that are useful for (1) developing the community-based models for assessing economic and fiscal effects of the Project; and (2) evaluating the potential effectiveness of alternative enhancement measures to contribute to local economic development.

Phase 2 Background Report Economic and Fiscal Conditions – Recreation and Tourism Economy in Oroville—January 2004

This report analyzes commercial activity in the City of Oroville.

Phase 2 Background Report Economic and Fiscal Conditions—Property Value Analysis Using a Hedonic Property Pricing Model—January 2004

This report evaluates the relationship between the Oroville Facilities and local property values.

Oroville Facilities Relicensing Recreation and Socioeconomics Study Reports Addenda and Errata—January 2005

This document serves as an accompaniment to the 19 Recreation and Socioeconomic Study Reports prepared for the Oroville Facilities Relicensing Collaborative. It addresses factual and significant typographical errors found in the 19 reports since the date each report was published.

CHAPTER 2.0

OBJECTIVES, SCOPING AND SUPPORT FOR THE PROPOSED PROJECT

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2.0 OBJECTIVES, SCOPING, AND SUPPORT FOR THE PROPOSED PROJECT

2.1 OBJECTIVES OF THE PROPOSED PROJECT

The objective of the Proposed Project is continued operation and maintenance of the Oroville Facilities for hydroelectric power generation, including implementation of any terms and conditions to be considered for inclusion in a new FERC hydroelectric license. The original license for the Oroville Facilities was issued by FERC on February 11, 1957 and expired on January 31, 2007. DWR is seeking a new federal license; therefore, the objective of the Proposed Project is to continue generating electric power while continuing to meet existing commitments and comply with regulations pertaining to water supply, flood management, the environment, and recreational opportunities.

The Oroville Facilities are currently operating under an annual license issued by FERC and effective February 1, 2007. If issuance of a new license does not take place on or before January 31, 2008, this annual license will be renewed automatically.

It is critical that any new license terms and conditions allow DWR to meet all of its commitments related to the Oroville Facilities. Power production, water supply, and flood management are discussed below. Environmental commitments and recreational provisions are identified in Chapter 3.

2.1.1 Power

The continued operation of the Oroville Facilities for hydroelectric power generation alleviates the need for new power resources that would otherwise be required to replace the 762 megawatts (MW) of capacity and roughly 2.4 million megawatt-hours (MWh) per year of energy generated by the three power plants. This power capacity and generation is vital to the State of California in that it provides a large portion of the electricity needed to pump water through the SWP at a lower cost than if the same capacity and energy had to be supplied by replacement power sources.

Not only would replacement power sources be more expensive and thus lead to higher costs for SWP users, but also there is much uncertainty surrounding the future availability of such power sources. The California Energy Commission (CEC), in its *2003 Integrated Energy Policy Report* (CEC 2003), indicated that currently (figures cited are from 2002) the state uses 265,000 gigawatt-hours of electricity per year, and consumption is growing 2 percent annually. Peak demand is growing at about 2.4 percent per year. It was determined that California only had adequate power supplies and planned transmission upgrades to meet projected demands through the year 2009, assuming that adverse scenarios do not occur. If adverse circumstances such as earlier-than-expected retirement of older generation plants or more frequent dry water years occur in the near term, predictions were that California's power plant reserve margins could reach unacceptable levels as early as 2006 (CEC 2003). The CEC studies showed that with a 2002 peak summer demand of 52,863 MW, the equivalent of

three new 500-MW power plants would need to be constructed in California each year to keep up with growing demands over the next decade. As stated in the *2003 Integrated Energy Policy Report,* "the state needs to ensure that its electrical generation system, including reserves, is sufficient to meet all current and future needs, and that this reliable and high quality electricity needs to come without over-reliance on a single fuel source and at reasonable prices" (CEC 2003).

Existing Oroville Facilities power generation is achieved very reliably and at a reasonable price. Continued operation of the Oroville Facilities for electric power generation is critical to the State of California, and is key to DWR achieving its mission of providing a reliable and affordable supply of water throughout the State.

Notwithstanding the importance of this vital energy resource, it should be noted that the power operation aspects of the Oroville Facilities are heavily constrained by SWP-related agreements and other commitments. Continued operation and maintenance of the power features of the Oroville Facilities must be consistent with the operational criteria dictated by the operation of the entire SWP.

Oroville Facilities operations are planned and scheduled in concert with other SWP and U.S. Bureau of Reclamation (USBR) Central Valley Project (CVP) water storage, pumping, and conveyance facilities. The primary operating function of the Oroville Facilities power plants is to provide electricity to SWP pumps that move water through the SWP system. Overall, the SWP uses more energy than it produces. Thus, any decrease in power generation at the Oroville Facilities would need to be offset by increased purchases of energy from other resources and/or by construction of new power generating facilities. In 2005, the SWP required 8,282,000 MWh of generation to meet pumping requirements and station service usage. In the same year, the Oroville Facilities generated roughly 1,833,000 MWh of that total, which amounts to nearly one-fourth of the system's total requirements.

By generating hydroelectric power, the Oroville Facilities help reduce the amount of generation that is needed from fossil fuel power plants, thereby avoiding the emission of such pollutants as hydrocarbons, nitrogen oxides, carbon monoxide, and particulate matter. Hydroelectric generation at the project's facilities possibly avoids the construction of new power plant facilities, thus avoiding other adverse environmental effects. Power from the Oroville Facilities contributes to a diversified generation mix and helps meet power needs within and beyond the region. Regional power benefits from the Oroville Facilities include those often referred to as ancillary system benefits, including spinning reserves, non-spinning reserves, regulation, peaking capacity, and grid stability.

In 2006, the California legislature passed Assembly Bill 32, establishing a State goal for reducing greenhouse gas (GHG) emissions to 1990 levels by 2020. Hydropower generation is extremely clean, producing very little GHG emissions when compared to other power generation. The limited data available suggests that GHG emissions from reservoirs in the western United States are lower than those from reservoirs in eastern and western Canada and South/Central America. Based on this limited information on

GHG emissions at Oroville (which may not reflect a number of factors, including temporal and area variation), the Oroville Facilities could produce about 19,170 tons of CO_2 emissions annually. Based on approximately 2,500,000 MWh of annual generation, this would equate to 0.0077 tons of CO_2 emitted per MWh generated or 15 lbs of CO_2/MWh. By way of comparison, according to the USDOE, coal-fired generating plants produce an average of 2,117 lbs of CO_2 emissions per MWh generated. Similarly, natural gas and other petroleum-fired electrical generation ranges from 1,315-1,915 lbs of CO_2 emissions per MWh (USDOE, July 2000, Carbon Dioxide Emissions from the Generation of Electrical Power in the United States). Therefore, the Oroville Facilities are generating extremely clean electricity that reduces potential CO_2 GHG emissions by more than a ton (99.3% reduction) for every MWh produced compared to coal-fired electric generation which is the single largest source of electrical generation, or about 50% of all generation, in the U.S. today.

2.1.2 Water Supply

2.1.2.1 Overview of the State Water Project

The SWP is a water storage and delivery system composed of reservoirs, aqueducts, power plants, and pumping plants. The main purpose of the SWP is to provide a reliable and affordable supplemental water supply to urban and agricultural water users throughout California. SWP deliveries ranged from 1.8 million acre-feet (maf) to 3.6 maf between 2001 and 2006. About 23 million of California's estimated 34 million residents directly benefit from SWP water. These supplies also irrigate nearly 600,000 acres of farmland, mainly in the San Joaquin Valley (DWR Bulletin 132, Water Contracts and Delivery Chapter).

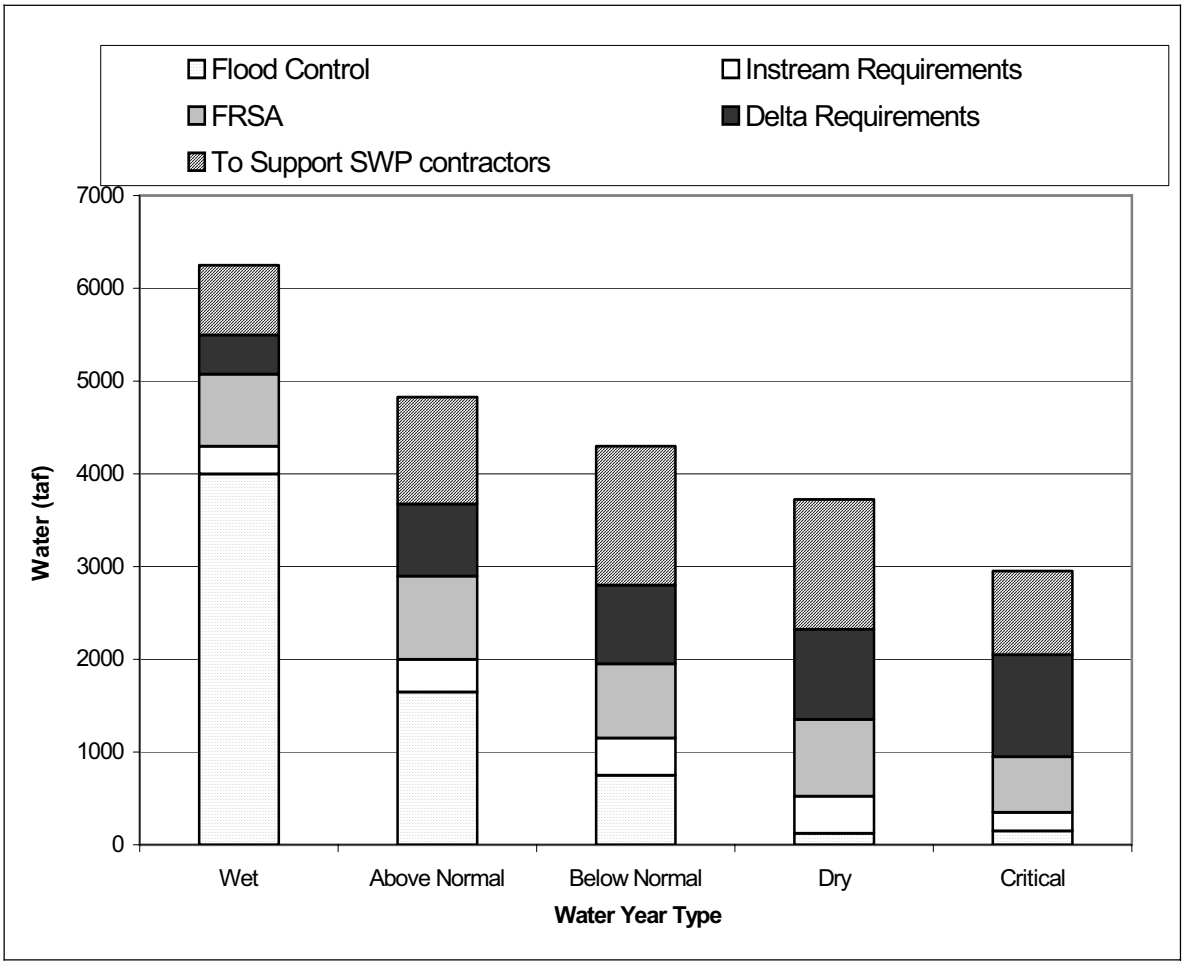
2.1.2.2 Role of the Oroville Facilities within the State Water Project

The Oroville Facilities were developed as a major part of the SWP. The Oroville Facilities are located at the foot of the Sierra Nevada in Northern California on the Feather River near Oroville. The Oroville Facilities have the capacity to store more than 3.5 maf of water, and account for a large portion of the SWP's water capture and storage each year. Water released from the Oroville Facilities into the Feather River flows downstream into the Sacramento River.

2.1.2.3 Lake Oroville Water Releases

As shown in Figure 2.1-1, water stored in Lake Oroville is released to meet a variety of contractual, flood management, and environmental commitments; the major commitments are highlighted below:

- Operate the project to meet flood control criteria outlined by USACE;



taf = thousand acre-feet

Source: Data provided by DWR

Figure 2.1-1. Primary purposes of releases from Lake Oroville.

- Ensure water supply of up to 936,000 acre-feet (af) per year to senior water right holders[1] along the Feather River from Lake Oroville to the confluence with the Sacramento River including the Feather River Service Area[2] (FRSA);

[1] The senior water right holders are the the Thermalito Irrigation District; the South Feather Water and Power Agency (formerly Oroville-Wyandotte Irrigation District); the Western Canal Water District; the Joint Water District Board (comprising the Richvale Irrigation District, the Biggs-West Gridley Water District, the Butte Water District, and the Sutter Extension Water District); the Tudor Mutual Water Company; the Oswald Water District; the Garden Highway Water Company; and the Plumas Mutual Water Company. The settlement of water rights for these entities is typically expressed in terms of acre-feet of annual entitlement, although some settlement agreements also stipulate specific rates of flow in cubic feet per second.

[2] The FRSA agencies are the Western Canal Water District and the Joint Water District Board (comprising the Richvale Irrigation District, the Biggs-West Gridley Water District, the Butte Water District, and the Sutter Extension Water District).

- Satisfy conditions in the 1983 agreement between DFG and DWR concerning the operation of the Oroville Facilities for management of fish and wildlife;

- Satisfy the conditions in the 1986 Coordinated Operations Agreement for CVP operation;

- Satisfy conditions in DWR's water right permits that were last amended in SWRCB Water Right Decision 1641 (D-1641). D-1641 requires the operations of the SWP and the CVP, owned and operated by USBR, to meet the water quality standards outlined in the *1995 Water Quality Control Plan for the San Francisco Bay/Sacramento–San Joaquin Delta Estuary* (Bay-Delta Plan);

- Satisfy conditions in the biological opinions for the CVP and SWP long-term Operations Criteria and Plan issued by the National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS) in 2004 and 2005, respectively; and

- Allocate annual water supply of up to 4.1 maf to SWP water contractors.

Releases for these purposes vary significantly from year to year depending on hydrologic conditions. Figure 2.1-1 shows typical water release volumes for various water year types. As indicated, in wet years significant releases are made in compliance with USACE flood management directives. Conversely, in dry or critical water years there are minimal releases made for flood management. Both instream flow releases and FRSA releases are relatively consistent regardless of water year type, except for critical years. Water available for export to the SWP water contractors is dependent upon the amount of releases for all other purposes, and as indicated by the data plotted on the graph, can vary widely depending on hydrologic conditions.

The flood management, contractual, fishery, water quality, and other environmental obligations are defined in numerous operating agreements that specify timing, flow limits, storage amounts, and/or constraints on water releases. Contractual obligations are met through scheduled releases of water from various points within the Oroville Facilities, including:

- Lake Oroville (through the Hyatt Pumping-Generating Plant, River Valves, Spillway, and Palermo Outlet);

- Thermalito Diversion Dam (through the Thermalito Canal Headworks, the Feather River Fish Hatchery inlet, the River Release Outlet, the Spillway, and Thermalito Diversion Dam Power Plant);

- The Fish Barrier Dam through the Spillway;

- The Feather River Fish Hatchery (through the Feather River Fish Hatchery fish ladder and Feather River Fish Hatchery Outlet); and

- Thermalito Afterbay (through the Irrigation Outlet Structures and the Thermalito Afterbay Outlet).

The scheduling of water releases to meet all of these delivery obligations requires a tremendous amount of planning, forecasting, and interagency coordination between DWR and other agencies.

2.1.3 Flood Management

Oroville Dam provided downstream flood protection even before it was completed. In 1964, while the dam was under construction, it prevented millions of dollars of property damage and saved lives by impounding floodwaters. Today, with flood storage space in Lake Oroville that varies from 375,000 to 750,000 af, flood management remains one of the major benefits of this dam. The Oroville Facilities are an integral component of the Sacramento River Flood Control Project, the flood management system for areas along the Feather and Sacramento Rivers downstream of Oroville Dam. They supply flood protection benefits to Oroville, Marysville, Yuba City, many smaller communities, and areas as far downstream as the Sacramento metropolitan area. The Oroville Facilities also protect about 283,000 acres of developed agricultural lands and a variety of transportation and other public utility infrastructure. The total value of structures and contents in the areas along the Feather River downstream of Oroville Dam is nearly $3 billion (USACE 1999).

It also has been estimated that during the 30 years before the construction of the Oroville Facilities, property affected by flooding along the Feather and Sacramento Rivers experienced more than $400 million in actual flood damages. Flood damages avoided during the 1997 single flood event were estimated to be more than $1 billion (United States Society on Dams 2004). Project flood management operations, which are further described in Section 4.2 of this DEIR, also are critical to maintaining the structural integrity of the many levees found along the Feather River below Oroville Dam and along the Sacramento River below the confluence with the Feather River. USACE helped fund the construction of Oroville Dam and has jurisdiction over flood management operations. Under the terms of the existing FERC license, DWR collaborated with USACE in formulating the current program of operation for the project in the interest of flood management.

2.2 THE SCOPING PROCESS

2.2.1 The License Application Scoping Process

A summary of the scoping history of the collaborative process is provided in Table A-2 of Appendix A, Consultation and Compliance, of the PDEA for the Oroville Facilities.

The ALP initiated Collaborative Work Groups, Task Forces, and a Plenary Group including representatives from federal, State, and local governments; resource agencies; federally and non-federally recognized Indian Tribes; nongovernmental organizations; local special interest groups; and local residents. The five Collaborative Work Groups (Cultural; Environmental; Recreation and Socioeconomics; Engineering

and Operations; and Land Use, Land Management, and Aesthetics) spent the first half of 2001 identifying and refining issue statements for study plan development and inclusion in Scoping Document 1 (Draft SD1). In September 2001, DWR distributed Draft SD1 to interested parties, which initiated formal scoping for the relicensing process. SD1 supported the development of either two separate environmental documents or a single, joint NEPA/CEQA document. It also provided the CEQA notice of preparation.

On October 29 and 30, 2001, public scoping meetings were held in the cities of Oroville and Sacramento, respectively. The purpose of the meetings was to receive input from any parties interested in the Oroville Facilities Relicensing and to gather information and identify issues regarding specific aspects of the relicensing process. More than 100 people signed in at the meetings, and 21 individuals representing a variety of interested parties provided public statements in person. A court reporter recorded all comments and statements made at the scoping meetings; transcripts of the meetings are available on the relicensing website and have been made a part of the FERC public record for the project. Any person who was unable to attend a public scoping meeting or desired to provide further comment was encouraged to submit written comments and information to DWR by November 26, 2001. The entities listed in Table 2.2-1 provided written comments on Draft SD1 as well as in response to the scoping meetings.

Throughout 2001 and 2002, the Work Groups further developed issue sheets, identifying both available and needed information to inform the decision makers regarding potential effects of the Oroville Facilities. The issue sheets formed the basis for the development of study plans. Eventually, 71 study plans were developed and approved through the Collaborative process.

DWR issued Scoping Document 2 and CEQA Amended Notice of Preparation (SD2) on September 20, 2002. SD2 addressed comments received on SD1 and reflected the progress made since September 2001 in working collaboratively with resource agencies, non-governmental organizations (NGOs), and other interested parties in identifying issues and initiating study programs. SD2 also fulfilled requirements allowing DWR to prepare a PDEA that both complies with NEPA and is adequate in supporting the FERC decision-making process. These documents are available at the DWR Oroville Facilities Relicensing public website (http://orovillerelicensing.water.ca.gov).

2.2.2 License Application Development

2.2.2.1 Development and Completion of Technical Studies

The five ALP Collaborative Work Groups used the resource issues, concerns, and comments gathered during the scoping process and issue statements they developed to cooperatively develop 71 study plans to provide supporting data and analysis for the relicensing effort. The results of these studies address issues identified during the formal scoping process and public meetings, and fulfill regulatory requirements

Table 2.2-1. Commenters during scoping for the Oroville Facilities relicensing process.

Commenting Entities
Feather River Diverters (Joint Water Districts and Western Canal Water Districts)
National Marine Fisheries Service
California Chamber of Commerce
Oroville Foundation of Flight
Southern California Water Committee
State of California Electricity Oversight Board
Association of California Water Agencies
Kern County Water Agency
Alameda County Flood Control & Water Conservation District
Castaic Lake Water Agency
Plumas National Forest
National Parks Service, California Hydro Program
Civil Engineering Services, F. D. Pursell
State Water Resources Control Board
California Department of Fish and Game
California Independent System Operator
Paleo Resource Consultants, F&F Geo Resources Associates, Inc.
Metropolitan Water District of Southern California
Santa Clara County Water District
State Water Contractors, Inc.
California Business Properties Association
Pacific Cherokee Tribal Council
Ron Davis
Catherine H. Hodges
Northern California Water Association
Butte County
County of Sutter, Board of Supervisors
California Department of Forestry and Fire Protection
U.S. Fish and Wildlife Service
The Baiocchi Family

associated with relicensing. In some cases, the study plans were designed to also address issues outside the FERC's authority that were anticipated to be considered in a settlement agreement. The studies addressed issues related to five broad resource areas:

- Environmental (i.e., water quality, fisheries, terrestrial, geomorphology);
- Engineering and operations;
- Land use, land management, and aesthetics;
- Recreation and socioeconomics; and
- Cultural resources.

2.2.2.2 Development of Recommended PM&E Measures

Proposed protection, mitigation, and enhancement (PM&E) measures were developed primarily through the ALP. Throughout 2002, the Work Groups and associated Task Forces worked cooperatively to review and refine many issues. This refinement included the identification of issues and questions, clarification of related resource interests, identification of existing and needed information to answer questions, agreement on the appropriate level of analysis required, regulatory standards, and other related issues. The stakeholders developed a common template to describe a proposed resource action, provide basic information considered necessary to begin analysis of potential resource actions related to the relicensing process, and identify the specific issue a potential action was designed to address.

Proposed resource actions were submitted by stakeholders to Work Groups or directly to DWR for distribution to the appropriate Work Group. In some cases, proposed actions were developed and refined by participants within the Work Groups themselves. Some proposed resource actions were transferred between Work Groups as stakeholders considered the most appropriate venue for discussion and further refinement.

The Work Groups spent many months developing and reviewing proposed actions, identifying and eliminating redundancies, and consolidating similar or synergistic actions as appropriate. Initial results from the numerous studies under way were used to inform the Work Groups and further refine proposed actions. Each Work Group then identified those proposed actions that could reasonably be expected to produce beneficial results and agreed by consensus to recommend the list of proposed resource actions for further analysis as potential PM&E measures for inclusion in an alternative. Supporting information for all PM&E measures that were received by DWR from the Work Groups and stakeholders and their disposition is described in the PDEA (DWR, 2005).

2.2.2.3 Evaluation of Proposed PM&E Measures for the PDEA

DWR evaluated the recommended PM&E measures as part of the alternatives development process for the PDEA. As part of this process, each PM&E measure was evaluated for expected reliability and effectiveness. The evaluation process also analyzed whether the proposed PM&E measure would directly or indirectly conflict with other potential PM&E measures, cause direct or indirect effects on other environmental resources, or conflict with existing plans and policies. Recommended PM&E measures were also evaluated to determine potential effects on developmental aspects of the Oroville Facilities, including water supply, flood management, and power generation. Most PM&E measures could have either direct or indirect effects on other resources, could affect water supply and result in power generation losses, or could involve other costs to implement.

2.2.2.4 Approach to Constructing the Alternatives for the PDEA

A broad array of potential PM&E measures was evaluated to determine project nexus and whether the PM&E measure would help achieve resource interests. PM&E measures that passed the initial level of analysis were carried forward into a more detailed definition and evaluation phase. Some PM&E measures were adjusted based on study results, and some PM&E measures were created as necessary to address a project effect. At the same time, operational modeling, including "sensitivity analyses," was conducted by DWR to help determine the feasibility of PM&E measures that would affect project operations. Technical study reports generated from the collaboratively developed study plans were used in the evaluation of potential PM&E measures and assisted in the development of the alternatives for the PDEA.

In addition to power and other developmental purposes derived from the continued operation of the Oroville Facilities, FERC must give equal consideration in any license issued to the purposes of energy conservation; the protection, mitigation of damage to, and enhancement of fish and wildlife (including related spawning grounds and habitat); the protection, mitigation, and enhancement of recreational opportunities; protection of important cultural resources; and the preservation of other aspects of environmental quality. The resulting three alternatives were developed for the PDEA with an awareness of these considerations, and included a "No-Action Alternative," a "Proposed Action," and an "Alternative 2."

2.2.2.5 Comments on the Draft License Application

The Draft License Application, including the PDEA Progress Summary, was circulated for public review and comment on April 30, 2004. Table 2.2-2 lists the entities commenting on the Draft License Application.

Table 2.2-2. Commenters on the Oroville Facilities Draft License Application.

Commenting Agencies and other Entities
Friends of the River
Ronald Rogers
Randy Kennedy
Yuba-Feather Work Group
State Water Contractors, Inc.
California Department of Fish and Game
U.S. Department of the Interior
County of Sutter
The Baiocchi Family
Dennis Carty
Alex Henes
Gordon Banks

Comment letters received on the Draft License Application and PDEA Progress Summary can be viewed on DWR's Oroville Facilities Relicensing website, http://orovillerelicensing.water.ca.gov.

2.2.2.6 License Application and PDEA

By letter dated January 19, 2005, and pursuant to FERC's regulations for a Major Project-Existing Dam, Title 18 of the Code of Federal Regulations (CFR), Section(s) 4.51 and 16.9, the Department of Water Resources of the State of California submitted an Application for New License for its Oroville Facilities (FERC Project No. 2100). DWR requested timely issuance of a new 50-year license to replace the 50-year license issued to DWR in 1957. In accordance with Section 4.32 of these regulations, DWR also submitted compact disc (CD) copies of the License Application to the entities marked on the Distribution List attached to the transmittal letter. These marked entities were the resource agencies, Indian Tribes, and members of the public that participated in the collaborative process under FERC's ALP. The remaining entities on the Distribution List were those entities that at one time may have expressed an interest in Project No. 2100 or were adjoining landowners to the FERC Project boundary, but were not otherwise active participants in the ALP. DWR sent a letter to these remaining entities informing them of the filing and availability of the License Application. Also pursuant to these regulations, a public notice was published in local newspapers, and the public portions of the License Application were made available at DWR's public reference file locations.

Included within this submittal were one original, two paper copies, and six CD copies of the License Application. Also enclosed with the License Application was a draft tendering notice for future publication by FERC in the Federal Register. Pursuant to new FERC regulations adopted on July 23, 2003, amending Title 18 CFR Part 4.41(h), the CD containing the FERC Project boundary (Exhibit G) also contained the required geo-referenced electronic format and a metadata file. For FERC's convenience, DWR forwarded under separate cover both paper and electronic copies of all study plan reports; these are located on DWR's Oroville Facilities relicensing public website (http://orovillerelicensing.water.ca.gov).

The License Application was developed pursuant to FERC's ALP, which provides for an Applicant Prepared Environmental Assessment (APEA). DWR's request to use the ALP and prepare an APEA was approved by FERC on January 11, 2001. Consequently, Exhibit E of the License Application was replaced by a PDEA that was structured to facilitate meeting the requirements of NEPA.

The License Application consisted of seven volumes:

- Volume I contained the Initial Statement and Exhibits A, B, C, D and H;
- Volume II contained Exhibits F and G (Critical Energy Infrastructure Information (CEII)—for FERC only); and
- Volumes III through VII contained the PDEA and its appendices.

Volume I and Volumes III through VII are public documents. Volume II, which contained diagrams and maps, warranted special treatment as CEII, and DWR requested that

FERC designate it as such. Volume II included Exhibits F and G, and the Exhibit F Design Report which, pursuant to Order Nos. 630 and 630-A, and FERC's regulations at Title 18 CFR Part 388, qualify for special treatment as CEII.

2.2.3 Post-application Process

2.2.3.1 Comments on the License Application and NEPA EIS Scoping

A summary of the post-application collaborative process and the FERC NEPA EIS scoping process is provided in Table 2.2-3 below.

Table 2.2-3. Summary of post-application scoping process.

Date/Time Frame	Oroville Facilities Relicensing—Post-Filing Activity
January 19, 2005	In accordance with Title 18 CFR Section 4.32, DWR provided interested parties with a CD copy of the public portions of its Application for New License. The public portions were also available for viewing at the public reference files located at DWR's Headquarters offices and the Oroville Branch of the Butte County Library.
January 25, 2005	Potentially interested parties were informed that DWR had submitted to FERC its Application for New License, and that the public portions were available for viewing at the public reference files located at DWR's Headquarters offices, the Oroville Branch of the Butte County Library, and on the relicensing website.
January 26, 2005	DWR submitted to FERC its Application for New License, Applicant-Prepared Preliminary Draft Environmental Assessment, and Draft terrestrial Biological Assessment.
February 3, 2005	FERC issued its "Notice of Application and Applicant Prepared Environmental Assessment Tendered for Filing with the Commission, and Establishing Procedural Schedule for Relicensing and Deadline for Submission of Final Amendments." The notice also included a schedule of FERC's milestones.
February 2 and 8, 2005	A legal notice was placed in the *Chico-Enterprise Record* and the *Oroville Mercury Register* providing public notification that DWR had filed its Application for New License with FERC.
May 17, 2005	FERC issued a letter informing DWR its Application for New License failed to conform to the requirements of the Commission's regulations. The letter contained a list of deficiencies, clarification questions, and additional information requests.
May 26, 2005	FERC's "Notice of Site Visit" was issued informing interested parties that on June 29–30, 2005, FERC and DWR staff would be visiting the Oroville Facilities, and that the visit was open to the public and resource agencies. A tentative schedule for the site visit was included in the notice.
June 29-30, 2005	Individuals from FERC, DWR, resource agencies, and the public participated in FERC's NEPA site visit. In coordination with FERC staff, DWR provided a number of tour bus/vans for traveling to the various locations. The list of attendees was provided by FERC staff.
August 12, 2005	DWR submitted to FERC its response to deficiencies, clarifications, and additional information requests. DWR also submitted several updates to selected exhibits of its Application for New License.

Table 2.2-3. Summary of post-application scoping process.

Date/Time Frame	Oroville Facilities Relicensing—Post-Filing Activity
August 31, 2005	DWR submitted a letter to FERC requesting the Commission defer issuance of its public notice asking for agency terms and conditions until at least December 1, 2005, in order to allow DWR to attempt to achieve settlement on outstanding environmental issues.
September 9, 2005	FERC issued a letter to DWR granting its request to extend the time available to resource agencies to submit their final terms and conditions to January 30, 2006. The letter also included FERC's remaining milestones.
September 12, 2005	FERC issued its "Notice of Application and Applicant-Prepared EA Accepted for Filing, Soliciting Motions to Intervene and Protest, and Soliciting Comments, and Final Recommendations, Terms and Conditions, and Prescriptions." The deadline for filing motions to intervene and protests, comments, and final recommendations, terms and conditions, and prescriptions was January 30, 2006, and for reply comments was March 16, 2006.
October 4, 2005	DWR distributed copies of its revised draft Historic Properties Management Plan (HPMP), dated September 2005, to the federally recognized Indian tribes (Berry Creek Rancheria, Enterprise Rancheria, and Mooretown Rancheria) as well as to the Mechoopda Indian Tribe of Chico Rancheria for their review and comment.
October 26, 2005	DWR, by letter dated October 18, 2005, to the SWRCB, requested the water quality certification or waiver pursuant to Section 401(a)(1) of the Federal Clean Water Act. DWR's letter, received by SWRCB on October 26, 2005, initiated a 1-year time clock for the SWRCB to act on the request.
November 3, 2005	DWR submitted to FERC a date-stamped copy of its request for water quality certification with the SWRCB.
November 23, 2005	SWRCB replied to DWR's October 18, 2005, letter in which DWR requested water quality certification or waiver pursuant to Section 401(a)(1) of the Federal Clean Water Act.
January 5, 2006	DWR submitted a letter to FERC informing the Commission that an agreement in principle had been reached among DWR, DFG, the U.S Department of the Interior (including USFWS), NMFS, State Water Contractors, and American Rivers on environmental measures. DWR also requested a second extension of the deadline for comments, interventions, and resource agency terms and conditions.
January 13, 2006	FERC issued a letter approving DWR's request to extend the time available to the resources agencies to submit their final terms and conditions to March 31, 2006. FERC also provided their remaining relicensing milestones.
January 13, 2006	FERC issued a letter extending the filing date for comments and motions to intervene to March 31, 2006.
March 24, 2006	DWR submitted to FERC its Settlement Agreement for Licensing of the Oroville Facilities, replacing the PDEA Proposed Action.
March 28, 2006	DWR submitted to FERC its Settlement Agreement Recreation Management Plan.
April 28, 2006	DWR submitted to FERC a request for extension of deadlines to file reply comments on the Settlement Agreement and the Application for New License.

Table 2.2-3. Summary of post-application scoping process.

Date/Time Frame	Oroville Facilities Relicensing—Post-Filing Activity
April 28, 2006	FERC issued letter granting DWR's request for an extension of time to file reply comments on the Application for New License and reply comments on the Settlement Agreement. The deadline for filing reply comments was extended to May 26, 2006.
May 3, 2006	DWR submitted to FERC its draft HPMP dated April 24, 2006, along with DWR's Record of Consultation.
May 12, 2006	DWR submitted to FERC supplemental reference documents in support of the Application for New License. The two "Phase 2 Background" reports are entitled *Recreation and Tourism Economy in Oroville* and *Property Value Analysis Using a Hedonic Property-Pricing Model*.
May 26, 2006	DWR submitted to FERC its response to recommendations, terms and conditions, prescriptions, and settlement comments.
July 27, 2006	DWR submitted to FERC its Draft Biological Assessment for Federally Listed Species (anadromous fish) under Project 2100.
September 29, 2006	FERC issued a notice of availability of a DEIS for DWR's Oroville Facilities and intention to hold public meetings under P-2100.
October 11, 2006	FERC issued a Notice of Intent to hold a public meeting to discuss the DEIS for DWR's Oroville Facilities under P-2100.
October 12, 2006	FERC issued a letter informing interested parties of FERC's updated schedule for the remainder of the relicensing process for the Oroville Facilities under P-2100.
October 16, 2006	DWR filed its withdrawal and resubmittal of the Water Quality Certification Application for relicensing of the Oroville Facilities.
October 24, 2006	FERC issued a letter to the National Oceanic and Atmospheric Administration (NOAA) requesting formal consultation under the Endangered Species Act regarding DWR's Oroville Facilities under P-2100.
October 24, 2006	FERC issued a letter to the Sacramento Fish and Wildlife Office requesting formal consultation under the Endangered Species Act regarding DWR's Oroville Facilities under P-2100.
November 2, 2006	Motion issued by Butte County, California, for Additional Time to File Comments on the DEIS to the Oroville Facilities Project in P-2100.
November 15, 2006	FERC issued a letter order granting Butte County, California's requests for 3 additional weeks until December 19, 2006, to file comments on the DEIS for the Oroville Facilities under P-2100.
November 15, 2006	FERC issued a letter informing interested parties of FERC's updated schedule for the remainder of the relicensing process for the Oroville Facilities and reflecting an extension of time of 3 weeks to file comments on the DEIS, P-2100.
November 17, 2006	SWRCB issued response to DWR's request for water quality certification for the relicensing of the Oroville Facilities under P-2100.
November 8, 2006	FERC held a public meeting to discuss the DEIS for DWR's Oroville Facilities under P-2100.
December 19, 2006	DWR submitted comments on the DEIS under P-2100.
December 19, 2006	NOAA Southwest Region issued Letter of Insufficiency with DEIS comments (12-19-06), and comments on Draft Reconnaissance Study (11-29-06) under P-2100.
January 29, 2007	USFWS responded to FERC's October 24, 2006, letter requesting formal consultation on the proposed Oroville Facilities Relicensing under P-2100.
January 30, 2007	DWR submitted its report entitled SP-W3, *Recreational Facilities and Operations Effects on Water Quality—Recreational Trails, Year 2 Progress Report,* July 2006 for P-2100.

Table 2.2-3. Summary of post-application scoping process.

Date/Time Frame	Oroville Facilities Relicensing—Post-Filing Activity
January 31, 2007	U.S. Forest Service Pacific Southwest Region submitted to FERC its Final Section 4(e) conditions under P-2100.
February 1, 2007	FERC issued Notice of Authorization for Continued Project Operation, effective until a new license is issued.
February 15, 2007	NMFS submitted to FERC comments, terms, and conditions and modified Fishway Prescriptions under 10(a), 10(j), and Section 18 of the FPA.
April 9, 2007	USFWS issues Final Terrestrial Biological Opinion under P-2100.

Source: DWR, State Water Project Analysis Office

2.2.3.2 Scoping for the CEQA EIR and Definition of Alternatives

As indicated in previous sections, the relicensing process was conducted under FERC's ALP, and involved the substitution of an applicant-prepared environmental assessment (referred to as the PDEA) in place of Exhibit E. As a result, all of the participants in the collaborative relicensing process were extensively involved in the scoping of issues, submitting study requests, formulating study scopes, reviewing study results, and commenting on the license application and subsequent FERC DEIS.

After DWR's filing of the License Application on January 26, 2005, the settling parties continued to invest considerable time and resources in finalizing the SA. DWR filed the final SA with FERC on March 24, 2006. The SA is a comprehensive settlement package that DWR believes addresses all issues associated with DWR's Application for New License, and continued operation of the Oroville Facilities. The SA modified the previously identified proposed action outlined in the PDEA to include additional PM&E measures beyond those proposed in the License Application. DWR believes that the agreed-upon PM&E measures set forth in the SA surpass all public interest requirements of the Federal Power Act (FPA) and other statutory and regulatory requirements pertaining to the relicensing of the project, but has nonetheless agreed to these measures as a means of compromise and of settling the proceeding.

The SA proposes numerous project improvements and, except as specified in the SA, settling parties believe that the measures satisfy their statutory, regulatory, or other legal requirements for the protection, mitigation, and enhancement of natural resources, water quality, recreation, and cultural and historic resources affected by the Project. The SA, moreover, is fully supported by the record in this proceeding, which includes numerous relicensing studies and the PDEA. Therefore, DWR is proposing the SA as its "Proposed Project" under CEQA. The other alternatives evaluated in comparison to the Proposed Project include the "No-Project Alternative" and the "FERC Staff Alternative" described in FERC's DEIS.

2.3 SUPPORT FOR THE PROPOSED PROJECT

The Proposed Project is the *Settlement Agreement for Licensing of the Oroville Facilities, FERC Project No. 2100* (SA) (filed with FERC March 24, 2006). The Proposed Project has near-unanimous endorsement from federal and State resource agencies, local governments, water agencies and districts, environmental organizations, other stakeholder organizations, and individual members of the public. The consensus reached among the settling parties and settlement supporters occurred only through the tremendous efforts exerted by all in diligently studying project impacts, assessing and analyzing study results, attending ALP meetings, understanding and working through differences, and ultimately negotiating the comprehensive and complex settlement. DWR believes that the Proposed Project is supported by the vast record compiled in this proceeding; that the regulatory review process conducted was more than sufficient to satisfy and exceed FERC's requirements under the FPA and attendant statutory and regulatory obligations; and that the Proposed Project will accommodate public interest considerations applicable to the Oroville Facilities during the expected 50-year new license term.

2.3.1 Federal and State Resource Agencies

In addition to DWR, the following State and federal agencies are parties to the SA:

- California Department of Boating and Waterways;
- DFG;
- DPR;
- NMFS; and
- U.S. Department of the Interior, on behalf of its component bureaus.

These and other agencies filed comments in support of, or consistent with, the SA:

- NMFS's *Motion to Intervene, Comments, Recommended Terms and Conditions, and Preliminary Fishway Prescriptions, Project No. 2100-052* (filed March 29, 2006 and final terms submitted to FERC on January 15, 2007);
- *Notice of Intervention of California Department of Fish and Game, Project No. 2100-052* (filed March 29, 2006);
- *Notice of Intervention and Forest Service Preliminary 4(e) Conditions and 10(a) Recommendations, Project No. 2100-052* (filed March 29, 2006);
- *Department of the Interior Comments, Recommendations, and Prescriptions in Response to Commission's September 12, 2005, Notice,* and *March 27, 2006, Notice of Settlement Agreement and Soliciting Comments, Project No. 2100-052* (filed March 31, 2006); and

- *Department of the Interior Notice of Intervention, Project No. 2100-052* (filed April 3, 2006).

2.3.2 Native Americans

The Konkow Valley Band of Maidu is a party to the SA and filed comments in support thereof. See *Motion to Intervene of Konkow Valley Band of Maidu, Project No. 2100-052* (filed March 31, 2006).

2.3.3 Local Governments

The following local governmental entities are parties to the SA:

- City of Oroville;
- Feather River Recreation and Parks District;
- Oroville Parks Commission;
- Oroville Redevelopment Agency; and
- Town of Paradise.

These and other local governmental entities filed comments in support of the SA, including:

- *Motion to Intervene of the City of Oroville, Project No. 2100-052* (filed April 20, 2006);
- *Comments of the Town of Paradise, California, Project No. 2100-000* (filed April 25, 2006); and
- *Motion to Intervene Out-of-Time and Comments of the Feather River Recreation and Park District, Project No. 2100-052* (filed May 10, 2006).

2.3.4 Water Agencies and Districts

The following water agencies and districts are parties to the SA:

- Alameda County Flood Control & Water Conservation District, Zone 7;
- Alameda County Water District;
- Antelope Valley–East Kern Water Agency;
- Castaic Lake Water Agency;
- Central Coast Water Authority;

- Coachella Valley Water District;
- County of Kings;
- Crestline–Lake Arrowhead Water Agency;
- Desert Water Agency;
- Empire West Side Irrigation District;
- Kern County Water Agency;
- Littlerock Creek Irrigation District;
- Metropolitan Water District of Southern California;
- Mojave Water Agency;
- Napa County Flood Control and Water Conservation District;
- Oak Flat Water District;
- Palmdale Water District;
- San Bernardino Valley Municipal Water District;
- San Gabriel Valley Municipal Water District;
- San Gorgonio Pass Water Agency;
- Santa Clara Valley Water District;
- Solano County Water Agency;
- State Water Contractors, Inc.; and
- Tulare Lake Basin Water Storage District.

Many of these organizations also filed comments in support of the SA, including:

- *Motion to Intervene and Comments in Support of the Settlement Agreement for Licensing of the Oroville Facilities of the Metropolitan Water District of Southern California, Project No. 2100-052* (filed March 28, 2006);
- *Motion to Intervene and Comments of the Alameda County Flood Control and Water Conservation District et al., Project No. 2100-052* (filed March 31, 2006);
- *Motion to Intervene and Comments of the United Water Conservation District and the City of San Buenaventura, Project No. 2100-052* (filed March 31, 2006); and

- *Comments of the State Water Contractors in Support of Settlement, Project No. 2100-052* (filed April 26, 2006).

2.3.5 Other Stakeholder Organizations

The following stakeholder organizations are parties to the SA:

- American Rivers;
- American Whitewater;
- Berry Creek Citizens Association;
- California State Horsemen's Association;
- California State Horsemen's Association Region II;
- Chico Paddleheads;
- Citizens for Fair and Equitable Recreation;
- Feather River Low Flow Alliance;
- International Mountain Bicycling Association;
- Lake Oroville Bicyclist Organization;
- Oroville Area Chamber of Commerce;
- Oroville Downtown Business Association;
- Oroville Economic Development Corporation;
- Oroville Recreation Advisory Committee; and
- Oroville Rotary Club.

These and other stakeholder organizations filed comments in support of the SA, including:

- *Comments of Folsom-Auburn Trail Riders Action Coalition, Project No. 2100-000* (filed February 9, 2006);
- *Comments of WTB, Project No. 2100-000* (filed March 28, 2006);
- *Comments of Lake Oroville Trail Users Coalition, Project No. 2100-000* (filed March 30, 2006) (consisting of the California State Horsemen's Association Region 2, High Mt. Riders, Desperado Horse Club, International Mountain

Bicycling Association, Lake Oroville Bicyclist Organization, Chico Mountain Bikers, Bicyclist of Nevada County, Redding Mountain Bikers, Trail Walkers Organization, Lake Oroville Tri Club, and Folsom-Auburn Trail Riders Action Coalition);

- *Motion to Intervene of International Mountain Bicycling Association, Project No. 2100-052* (filed March 31, 2006);
- *Motion to Intervene of California State Horsemen's Association, Region II, Project No. 2100-052* (filed March 31, 2006);
- *Motion to Intervene of California State Horsemen's Association, Project No. 2100-052* (filed March 31, 2006);
- *Motion to Intervene of Lake Oroville Bicyclist Organization, Project No. 2100-052* (filed March 31, 2006);
- *Comments of Northern California Mountain Bicycling Association, Project No. 2100-000* (filed April 1, 2006);
- *Comments of Oroville Economic Development Corp., Project No. 2100-000* (filed April 12, 2006); and
- *Motion to Intervene of American Rivers, American Whitewater, and the Chico Paddleheads, Project No. 2100-052* (filed March 31, 2006).

2.3.6 Individual Members of the Public

Arthur G. Baggett Jr. and D. C. Jones executed the SA. Of these, D. C. Jones filed comments in support of the Settlement; see *Comments of DC Jones, Project No. 2100-000* (filed April 26, 2006). Scores of non-settling individuals filed comments in support of the Application, SA, Recreation Management Plan, and/or the Comprehensive Non-Motorized Trails Management Program, including:

- *Comments of Buck & Nancy Jackson, Project No. 2100-000* (filed February 7, 2006);
- *Comments of Ted Stroll, Project No. 2100-000 (filed February 7, 2006);*
- *Comments of Arin Murphy, Project No. 2100-000* (filed February 7, 2006);
- *Comments of Fay Verle, Project No. 2100-000* (filed February 8, 2006);
- *Comments of Don Jones, Project No. 2100-000* (filed February 9, 2006);
- *Comments of Craig Stradley, Project No. 2100-000* (filed March 27, 2006);
- *Comments of Julie Small, Project No. 2100-000* (filed March 28, 2006);

- *Comments of Aaron D. Thies, Project No. 2100-000* (filed March 28, 2006);
- *Comments of Steven J. Callaway, Project No. 2100-000* (filed March 28, 2006);
- *Comments of Sara Taddo, Project No. 2100-000* (filed March 28, 2006);
- *Comments of David Emery, Project No. 2100-000* (filed March 28, 2006);
- *Comments of Susan Hughes, Project No. 2100-000* (filed March 28, 2006);
- *Comments of Douglass G. Perska, Project No. 2100-000* (filed March 28, 2006);
- *Comments of John Touchette, Project No. 2100-000* (filed March 28, 2006);
- *Comments of John Shoun, Project No. 2100-000* (filed March 28, 2006); and
- *Comments of Doug Baker, Project No. 2100-000* (filed March 29, 2006).

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CHAPTER 3.0

DESCRIPTION OF EXISTING FACILITIES AND OPERATIONS,
THE PROPOSED PROJECT, AND ALTERNATIVES

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3.0 DESCRIPTION OF EXISTING FACILITIES AND OPERATIONS, THE PROPOSED PROJECT, AND ALTERNATIVES

3.1 GENERAL LOCALE

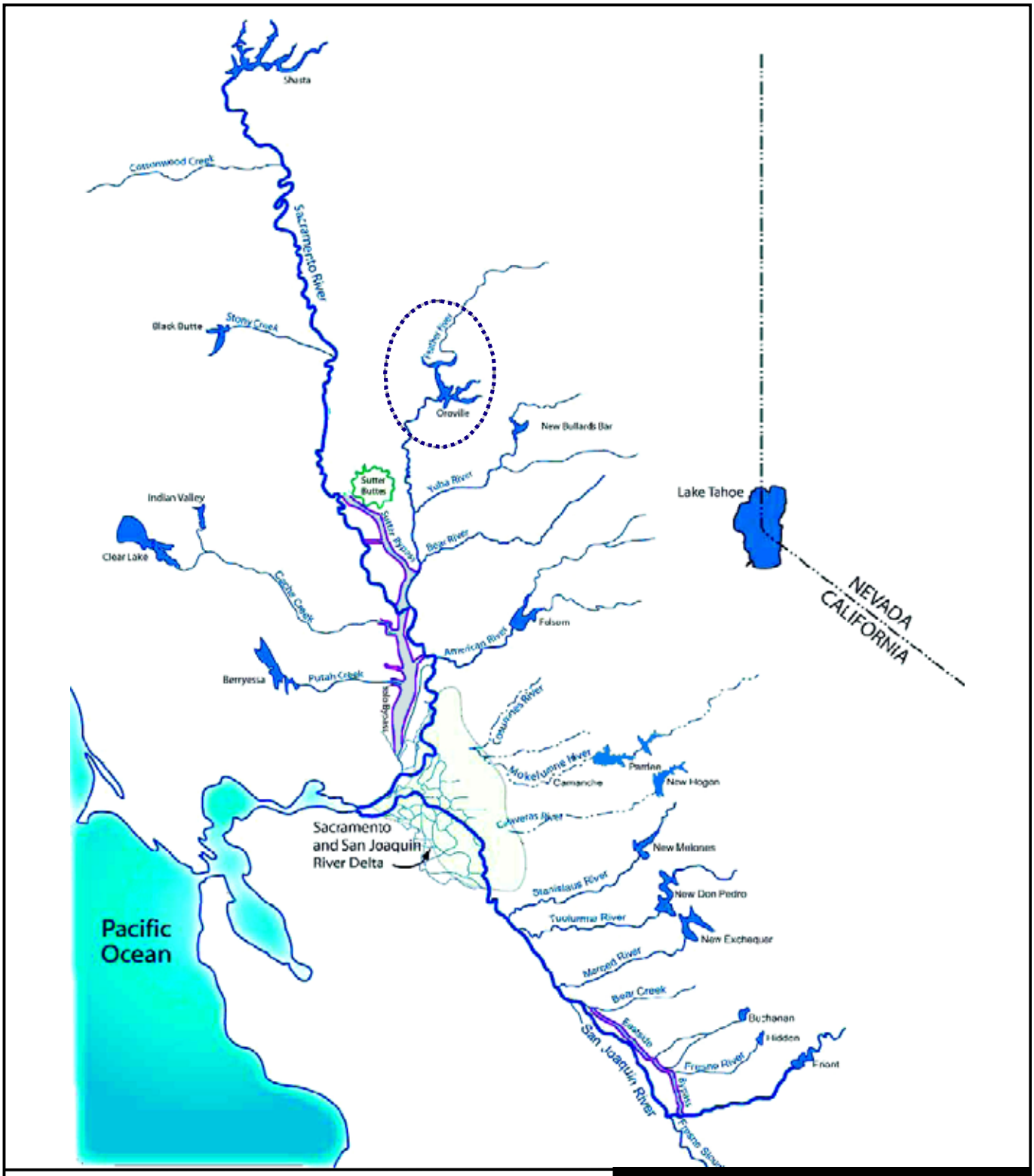
The Oroville Facilities are located in California's Central Valley. This valley is drained by two major river basins, the Sacramento River to the north and the San Joaquin River to the south, which converge in the Sacramento–San Joaquin Delta (Delta). From the Delta, water flows to San Francisco Bay and then to the Pacific Ocean. The Sacramento River contributes approximately 85 percent of the Delta water inflow in most years while the San Joaquin River contributes approximately 10–15 percent of inflow to the Delta (Figure 3.1-1).

The Sacramento River basin is composed of three major subbasins: the American River subbasin, the Feather River subbasin, and the Sacramento River subbasin. The Feather River subbasin is composed primarily of the Bear River, Yuba River, and Feather River. The Feather River is considered a major tributary to the Sacramento River, providing about 25 percent of the flow in the Sacramento River as measured at Oroville Dam.

Climate in the region follows a Mediterranean pattern, with cool wet winters and hot dry summers. Temperatures range from below zero to above 100 degrees Fahrenheit (ºF). Approximately 95 percent of the annual precipitation occurs during the winter months. Precipitation ranges from 33 inches at the City of Oroville, to more than 90 inches at the orographic (i.e., mountain) crest near Bucks Lake, to less than 20 inches in the eastern headwaters. Precipitation above 5,000 feet occurs primarily as snow, which regularly accumulates in excess of 5–10 feet in winter. There are infrequent summer thunderstorms, predominantly in the eastern third of the watershed. These storms can produce significant rainfall of short duration over a relatively small area.

Principal land use activities in the region include recreation, agriculture, timber production, hydropower generation, and livestock grazing. About 4 percent (roughly 70 square miles) of all land in Butte County is devoted to urban uses.

The Oroville Facilities project area and the surrounding region are described in further detail in Section 4.0.1 in Chapter 4.0, Environmental Setting.



Source: DWR

20 0 20 40 60 Miles

Original Scale 1 : 2,217,600
1" = 35 miles
(approximate)

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Oroville Facilities
FERC Project No. 2100

FIGURE 3.1-1

California Central Valley
and
San Francisco Bay-Delta Area

Prepared by: PJ -- EDAW, Inc. Date 4/10/07

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3.2 EXISTING OROVILLE FACILITIES AND OPERATIONS

The Oroville Facilities were developed as part of the SWP, a water storage and delivery system of reservoirs, aqueducts, power plants, and pumping plants. The SWP stores and distributes water to supplement the needs of urban and agricultural water users in Northern California, the San Francisco Bay Area, the San Joaquin Valley, Central Coast, and Southern California. As part of the SWP, the Oroville Facilities are also operated for flood management, power generation, water quality improvement in the Delta, recreation, and fish and wildlife enhancement. The Oroville Facilities generate electricity pursuant to a federal license issued by FERC (FERC Project No. 2100) on February 11, 1957. The FERC Project boundary encompasses 41,100 acres and includes both power and non-power facilities. The Oroville Facilities and FERC Project boundary are shown in Figure 3.2-1. Further detailed description of the Oroville Facilities is provided in Appendix B of the PDEA.

3.2.1 Impoundment and Power Facilities

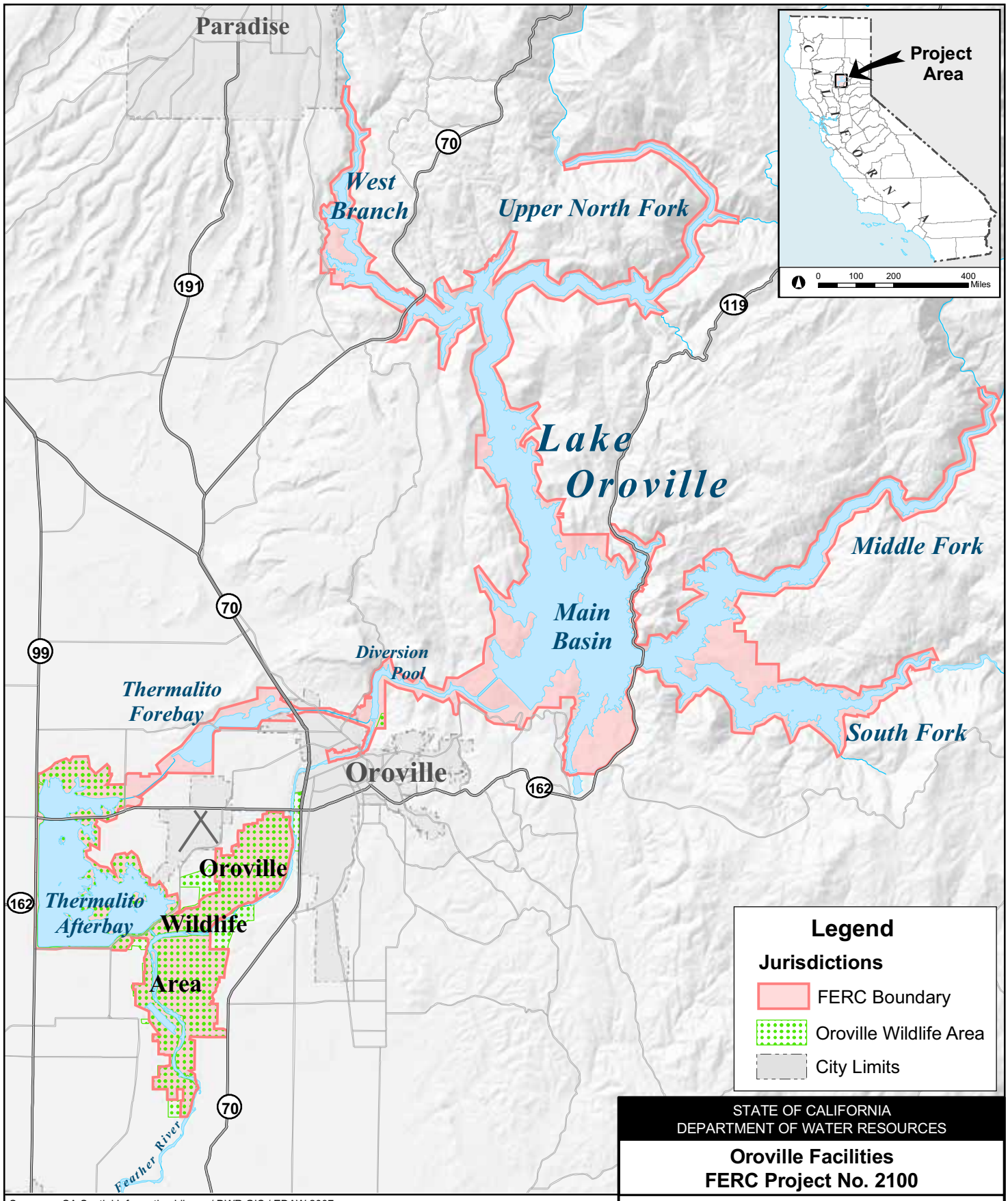
Oroville Dam, along with two small saddle dams, impounds Lake Oroville, a 3.5-million-acre-foot (maf) capacity storage reservoir with a surface area of 15,810 acres at its normal maximum operating level. The Oroville Facilities also include three power plants (two with pumpback capabilities) with combined licensed generating capacity of approximately 762 megawatts (MW).

The Hyatt Pumping-Generating Plant is the largest of the three power plants within the Oroville Facilities, with a capacity of 645 MW. Water from the six-unit underground power plant (three conventional generating and three pumping-generating units) is discharged through two tunnels into the Feather River just downstream of Oroville Dam. The plant has a generating and pumping flow capacity of 16,950 cubic feet per second (cfs) and 5,610 cfs, respectively.

The 114-MW Thermalito Pumping-Generating Plant is designed to operate in tandem with the Hyatt Pumping-Generating Plant and has generating and pumpback flow capacities of 17,400 cfs and 9,120 cfs, respectively. Smallest of the three power plants is the 3-MW Thermalito Diversion Dam Powerplant, located on the left abutment of Thermalito Diversion Dam. The power plant releases a maximum of 615 cfs of water into the Low Flow Channel (LFC) of the Feather River.

Thermalito Diversion Dam, 4 miles downstream of Oroville Dam, creates a tailwater pool for the Hyatt Pumping-Generating Plant and is used to divert water to the Thermalito Power Canal. The Thermalito Power Canal is a 10,000-foot (ft)-long channel designed to convey generating flows up to 16,900 cfs to Thermalito Forebay and pumpback flows to the Hyatt Pumping-Generating Plant. Thermalito Forebay is an off-stream regulating reservoir for the Thermalito Pumping-Generating Plant.

When in generating mode, the Thermalito Pumping-Generating Plant discharges into Thermalito Afterbay, which is contained by a 42,000-ft-long earthfill dam. Thermalito



Source: CA Spatial Information Library / DWR GIS / EDAW 2007

Original Scale 1 : 190,080
1" = 3 miles

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Oroville Facilities
FERC Project No. 2100

DRAFT ENVIRONMENTAL IMPACT REPORT

FIGURE 3.2-1

Oroville Facilities
FERC Project Area

Prepared by:	Date	
PJ -- EDAW, Inc.	3/20/07	P:\2000\0s016.gis\arcmap\proj_area_8x11.mxd

Afterbay is used to release water into the Feather River downstream of the Oroville Facilities. Thermalito Afterbay also helps regulate the power system, provides storage for pumpback operations, and provides recreational opportunities. Several local irrigation districts receive water released from Thermalito Afterbay.

3.2.2 Coordinated Operations

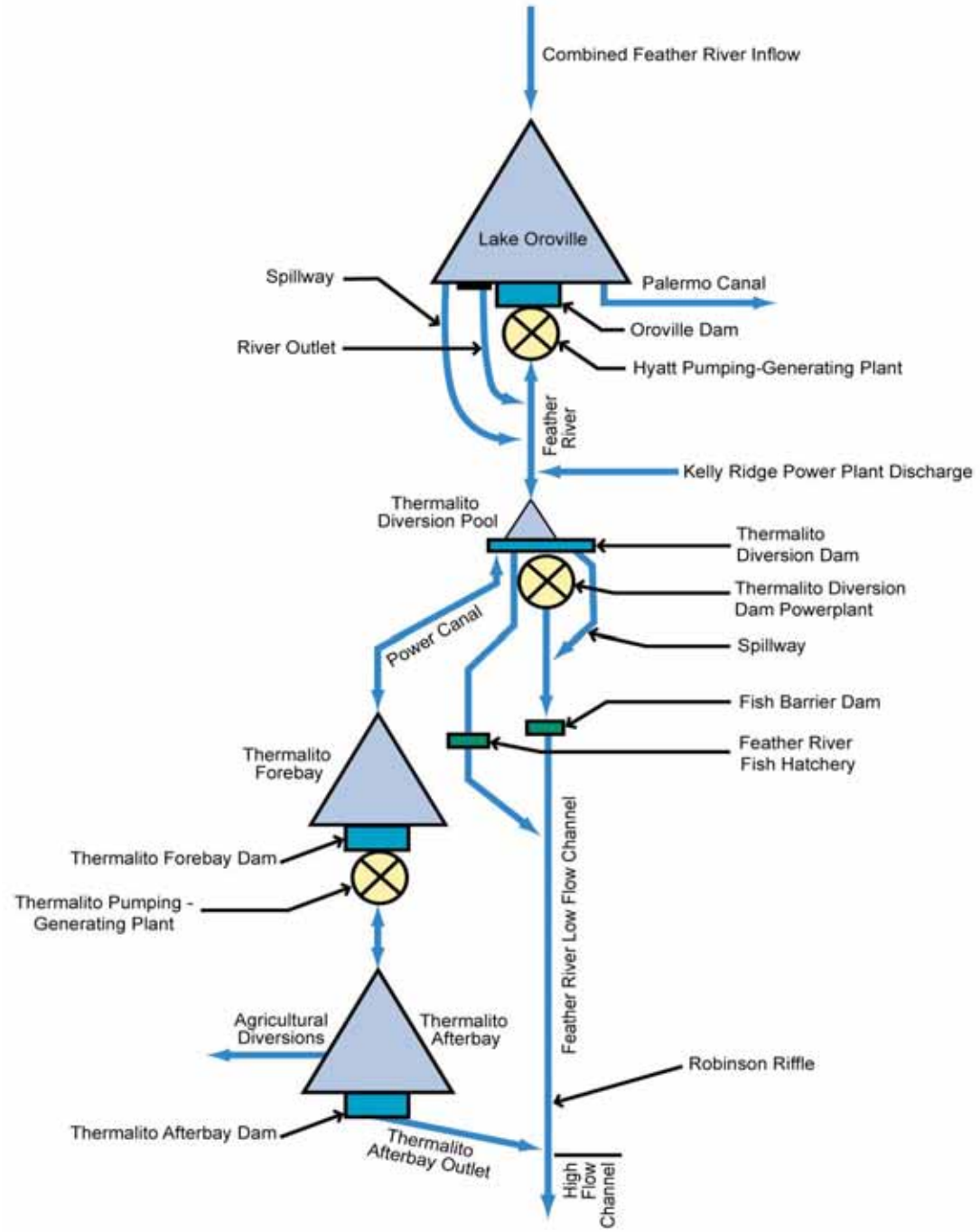
Lake Oroville stores and releases water that flows into the reservoir from upstream reservoir releases and runoff within the watershed. Water is released from the Oroville Facilities as part of a coordinated effort to meet water supply, flood protection, water quality improvement, and fish and wildlife enhancement requirements. Typically, power is generated when water is released from Lake Oroville through the Oroville Facilities for these purposes. Power is also generated through pumpback operations. Figure 3.2-2 contains a flow diagram that illustrates the overall Oroville Facilities configuration and primary water storage and release points.

Planning and implementing SWP operations is highly dependent on constraints placed upon the Oroville Facilities. The Oroville Facilities' operational planning is performed by the Operations Control Office (OCO).

The day-to-day operation of the Oroville Facilities is done through the Oroville Field Division. Decision-making for SWP operations begins with an overall long-range plan for the year. This long-range plan is used to establish general operational objectives and to assess the likelihood of achieving the operational objectives. Operations plans are developed on a weekly basis to meet the overall annual operational objectives. Daily schedules are subsequently developed to meet the weekly operational objectives and are adjusted in real-time as needed to respond to changes in conditions.

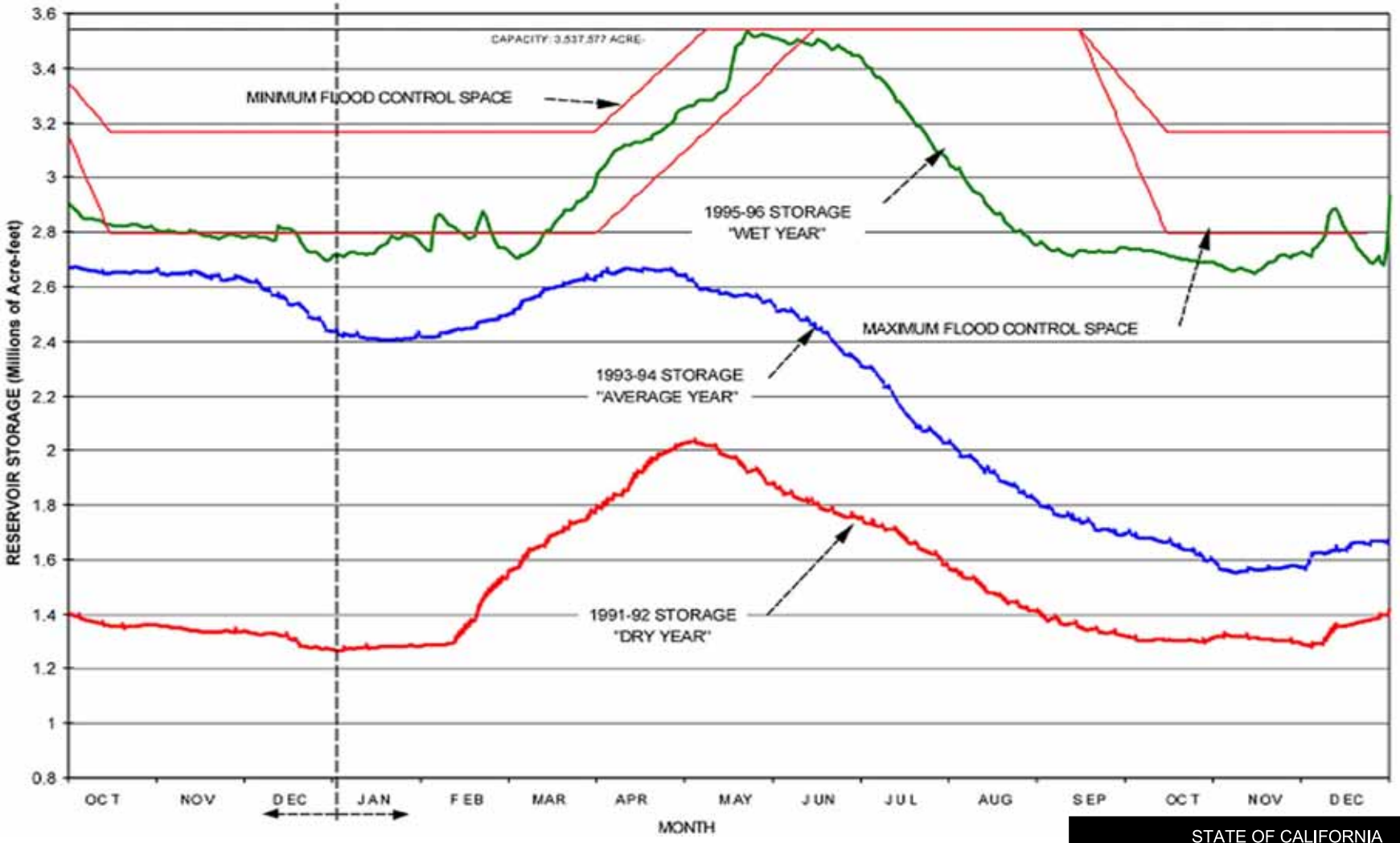
3.2.2.1 General Reservoir Operation

DWR stores winter and spring runoff in Lake Oroville for release to the Feather River, as necessary, to meet downstream demands. Annual operations planning is conducted for multi-year carryover, in which half the Lake Oroville storage above the minimum pool is assumed available for subsequent years. The U.S. Army Corps of Engineers (USACE) requires Lake Oroville to be operated to maintain up to 750,000 acre-feet (af) of storage space to capture significant inflows for flood management. The operations plan is updated regularly to reflect changes in hydrology and downstream operations. Lake Oroville is targeted to fill to near a maximum annual level of 900 ft above mean sea level (msl). Typically maximum storage, which in drier years may be below 900 ft msl, is achieved in June. After the maximum storage is achieved in June, Lake Oroville will then be lowered as necessary to meet downstream requirements, to its minimum level in December or January. During and following dry years, the reservoir may be drawn down more and may not fill to desired levels the following spring. During 1991, 1992, and 1993 (1991 and 1992 were dry years), the minimum elevations were 651 ft, 702 ft, and 723 ft, respectively. Historically, the maximum flood flow released from



Source: MWH

Figure 3.2-2. Oroville Facilities flow diagram.



COMBINATION WATER / CALENDAR YEAR

Source: DWR -- Operations Control Office

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Oroville Facilities
FERC Project No. 2100

Figure 3.2-3

Lake Oroville Water Levels
for Dry, Average and Wet Water Years

Prepared by:	Date	
PJ -- EDAW, Inc.	4/2/07	P:\2000\0s016.gis\arcview\pdea_non-gis.apr

Lake Oroville was about 160,000 cfs in 1997. Figure 3.2-3 shows Lake Oroville elevations under various water year type conditions.

3.2.2.2 Annual Water Operations Planning

Operations planning requires coordination with other federal, State, and local agencies, and must consider a number of factors. The OCO develops an annual water operations plan that considers forecasted water supply, projected operations of the CVP, and regulatory (flood management, instream requirements, and water quality) and contractual obligations. This first official plan for the next year is completed in early December as part of the allocation process and is a significant component in determining the amount of forecasted deliveries by the SWP. This monthly time-step plan includes projected release to the Feather River, forecasts of Oroville inflow, Lake Oroville end-of-month storage levels, and local demands. The water operations plan is updated and reissued each month through April to reflect changes in hydrology and downstream operations. The Oroville Facilities power generation plants operate within the constraints established by the water operations plan.

3.2.2.3 Weekly Water Operations Planning

Each week, the OCO develops a general plan for reservoir releases. This plan considers how much water will be needed downstream for local water supply demands, Delta water quality and quantity requirements, instream flow and temperature requirements, SWP pumping requirements in the Delta, and minimum flood management storage space. The weekly plan is revised as needed to meet changing operational conditions both upstream and downstream.

3.2.2.4 Daily Water Operations Scheduling

Hourly water releases through the power plants are scheduled daily. The hourly operation of the power plants is planned to maximize the amount of energy that may be produced during periods when electrical demand is highest. Additionally, ancillary services are bid into the California Independent System Operator (ISO) market on a day-ahead and an hour-ahead basis. These ancillary services include regulation up and down, spinning reserves, non-spinning reserves, and supplemental energy. Oroville Facilities operations are scheduled to maximize power benefits as long as the operations fit within the constraints of the overall daily Feather River release objective downstream of Thermalito Afterbay.

3.2.2.5 Power Transactions

Overall, the SWP uses more energy than it produces. When generation from the Oroville Facilities exceeds SWP load requirements, DWR sells the excess power on the market. Currently, DWR contracts with utilities and marketers for short-term purchase, sale, or exchange of power. In addition to selling firm power, DWR may sell power on a day-to-day or hour-to-hour basis according to the terms of its interchange agreements and the Western System Power Pool agreement. These agreements provide the basis

for making energy transactions, short-term capacity and energy sales or exchanges, unit commitments, and transmission service purchases.

To balance SWP loads with available resources, DWR relies on a suite of options that includes purchases from the day-ahead and hour-ahead markets; capacity exchanges; and energy contracts (both short and long-term). Two such contracts with Southern California Edison Company (SCE) have allowed DWR to exchange on-peak capacity and energy for off-peak energy that may be used elsewhere within the SWP system. Specifically, under the terms of the 1979 Power Contract and the 1981 Capacity Exchange Agreement, DWR provided SCE with up to 350 MW of capacity and approximately 40 percent of the energy from the Oroville Facilities. In return, DWR received off-peak energy from SCE equal to the amount of energy provided to SCE from the Oroville Facilities, plus an additional amount of energy as payment for the on-peak capacity. The amount of additional energy was determined annually based on the Capacity-Energy Exchange Formula defined in the 1979 Power Contract.

Several power purchases and sales agreements, the largest of which are the SCE power and capacity exchange contracts, expired on December 31, 2004; consequently, DWR developed the Post 2004 Program to establish new power and transmission contracts to replace these expired contracts. Through this program DWR is actively involved in solicitation and confidential negotiations with a number of utilities and power marketers. In any event, all new power contracts abide by applicable environmental and regulatory conditions. Implementation of these contracts does not alter the environmental analysis presented herein.

DWR controls the timing of SWP pumping load through an extensive computerized network. This control system allows DWR to minimize the cost of power it purchases by maximizing pumping during off-peak periods when power costs are lower—usually at night—and by selling power to other utilities during on-peak periods when power values are high. By taking advantage of this flexibility in scheduling SWP pumping load and generation, DWR reduces the net cost for SWP water deliveries.

3.2.2.6 Releases

Releases from Lake Oroville and Thermalito Afterbay are scheduled on a weekly basis to accommodate water supply requests and contracts, water quality requirements in the Delta; instream flow requirements in the Feather River; and minimum flood management space requirements. Weekly operational plans are updated as needed to respond to changing conditions. The Diversion Pool, Thermalito Forebay, and Thermalito Afterbay are too small for seasonal storage, so they are used only in weekly and daily operations planning. Releases through the Hyatt and Thermalito Pumping-Generating Plants are scheduled on an hourly basis to maximize the amount of energy produced when power values are highest. Because the downstream water supply is not dependent on hourly releases, and pumping of SWP water can be scheduled at off-peak times, hourly operational decisions are affected by the following considerations:

- Electrical energy prices and ancillary service requirements such as spinning reserve;
- Supplemental energy market activities; and
- Voltage regulation requirements.

Storage in Thermalito Forebay and Thermalito Afterbay is used to generate power and maintain uniform flows in the Feather River downstream of the Oroville Facilities. Thermalito Afterbay also provides storage for pumpback operations. The pumpback operations are designed to use water that is in excess of what is required for downstream flow requirements for pumping back into Thermalito Forebay and then into Lake Oroville during off-peak hours. This water is then released again during on-peak hours when power values increase. Generation provided by this pumpback activity contributes on average only about 6 or 7 percent to the total annual Oroville Facilities generation. Because the two main power plants are operated to take advantage of weekday generation when power values are highest, there is usually higher storage in Thermalito Afterbay by the end of the week. During the weekend, water from the afterbay continues to be released to the Feather River, generation at the Hyatt and Thermalito Pumping-Generating Plants is decreased, and pumpback operations into Lake Oroville may occur. By the end of the weekend, the elevation of Thermalito Afterbay is lowered to prepare for a similar operation the following week.

Feather River Service Area Water Supply Deliveries

DWR has contractual obligations to eight local agencies[1] along the Feather River from Lake Oroville to the confluence with the Sacramento River. They receive water according to the terms of settlement in various agreements stemming from the original construction of the Oroville Facilities. These settlements recognized the senior water rights of those agencies and determined that DWR would provide them certain quantities of water from storage in Lake Oroville in accordance with those senior water rights. Four of these agencies are allowed to divert up to 936,000 af during the irrigation season (April 1 through October 31), subject to provisions for reduction in supply under certain specific low-inflow conditions.[2] The agreements with these agencies also indicate that an unspecified amount may be diverted for beneficial use outside of the contract irrigation season (November 1 through March 31). The remaining four agencies are allowed to divert up to 45,055 af annually, also subject to provisions for reduction in supply under certain specific low-inflow conditions. Therefore, the actual amount diverted varies from year to year. These diversions are

[1] The agencies are the Thermalito Irrigation District; the South Feather Water and Power Agency (formerly Oroville-Wyandotte Irrigation District); the Western Canal Water District; the Joint Water District Board (comprising the Richvale Irrigation District, the Biggs-West Gridley Water District, the Butte Water District, and the Sutter Extension Water District); the Tudor Mutual Water Company; the Oswald Water District; the Garden Highway Water Company; and the Plumas Mutual Water Company. The settlement of water rights for these entities is typically expressed in terms of af of annual entitlement, although some settlement agreements also stipulate specific rates of flow in cfs.

[2] Individual contracts with these agencies determine the terms of flow reduction. Of the total entitlement, 187,245 af is not subject to reduction.

made at one location in Lake Oroville, one location in the Thermalito Power Canal, four locations in Thermalito Afterbay, and five locations on the Feather River below Thermalito Afterbay. The agencies[3] that divert directly from the Thermalito Afterbay are collectively referred to as the Feather River Service Area (FRSA) water users and are responsible for most of the local diversions.

DWR has also executed a number of small contracts with riparian landowners along the Feather River downstream of Oroville Dam. Riparian owners are entitled to divert unimpaired flow for use on riparian land, but are not entitled to augmented flow made available as a result of project storage. Although the quantities of water are relatively small and do not ordinarily influence SWP operations, in certain years riparian diversions can affect Oroville releases.

Water Supply Requirements of the State Water Project Water Contractors

As a component of the SWP, the Oroville Facilities are operated to provide downstream water supply for municipal, industrial, and irrigation purposes, and water is exported to meet the requests of the SWP water contractors. To illustrate how water releases from the Oroville Facilities are distributed for multiple downstream uses, Table 3.2-1 shows DWR records from 2005 and 2006 indicating actual releases for various uses. As a practical matter, water supply exports are met with whatever water is available after Delta requirements are met. Some of the water released for instream and Delta requirements in the table below may be available for export by the SWP once the Delta standards have been met.

Table 3.2-1. Primary Reason for Lake Oroville Releases (2005 and 2006)

Downstream Use	2005		2006	
	Amount Used (taf)	Percentage of Release	Amount Used (taf)	Percentage of Release
Feather River Service Area	1,035	29	1,057	15
Support of Exports	88	3	67	1
Instream and Delta Requirements	995	28	1,003	14
Flood Management	1,406	40	5,025	70
Total	3,524	100	7,152	100

Note: taf = thousand acre-feet
Source: DWR SWP Operations Control Office

Releases for Water Quality in the Delta

Flows through the Delta are maintained to meet Bay-Delta water quality standards arising from DWR's water rights permits and the 1995 Delta Water Quality Control Plan. These standards are designed to meet several water quality objectives such as salinity,

[3] The FRSA agencies are the Western Canal Water District and the Joint Water District Board (comprising the Richvale Irrigation District, the Biggs-West Gridley Water District, the Butte Water District, and the Sutter Extension Water District).

Delta outflow, and river flows, and to meet export limits. The purpose of these objectives is to attain the highest water quality, which is reasonable, considering all demands being made on Bay-Delta waters. In particular, they protect a wide range of fish and wildlife including Chinook salmon, delta smelt, striped bass, and the habitat of estuarine-dependent species.

Instream Flow Requirements in the Feather River

An August 1983 agreement between DWR and DFG entitled *Agreement Concerning the Operation of the Oroville Division of the State Water Project for Management of Fish and Wildlife* (1983 Agreement) sets criteria and objectives for flow and temperatures in the LFC and the reach of the Feather River between Thermalito Afterbay and Verona. This agreement: (1) establishes minimum flows between the Thermalito Afterbay Outlet and Verona that vary by water year type; (2) requires flow changes under 2,500 cfs to be reduced by no more than 200 cfs during any 24-hour period (ramping rate), except for flood management, failures, etc.; (3) requires flow stability during the peak of the fall-run Chinook spawning season; and (4) sets an objective of suitable temperature conditions during the fall months for salmon and during the later spring/summer for shad and striped bass.

The 1983 Agreement specifies that the Oroville Facilities release a minimum of 600 cfs into the Feather River from the Thermalito Diversion Dam for fisheries purposes. This is the total volume of flows from the Thermalito Diversion Dam Powerplant and the Feather River Fish Hatchery pipeline. Generally, the instream flow requirements below Thermalito Afterbay are 1,700 cfs from October through March, and 1,000 cfs from April through September. However, if runoff for the previous April-through-July period is less than 1,942,000 af (i.e., the 1911–1960 mean unimpaired runoff near Oroville), the minimum flow can be reduced to 1,200 cfs from October to February and 1,000 cfs for March. A maximum flow of 2,500 cfs is maintained from October 15 through November 30 to prevent spawning in overbank areas that might become dewatered.

The Thermalito Afterbay Outlet is operated to meet minimum instream flow requirements as well as to meet needs for SWP delivery and Delta environmental protection. Flow releases through the Thermalito Afterbay Outlet do not normally vary on an hourly or even daily basis, but instead are scheduled on a weekly basis.

Flood Management

The Oroville Facilities are an integral component of the Sacramento River Flood Control Project, the flood management system for the areas along the Feather and Sacramento Rivers downstream of Oroville Dam. From September to June, the Oroville Facilities are operated under flood control requirements specified by USACE. Under these requirements, Lake Oroville is operated to maintain up to 750,000 af of storage space to allow for the capture of significant inflows. Flood control releases are based on the release schedule in the flood control diagram or the emergency spillway release diagram prepared by USACE, whichever requires the greater release. Decisions regarding such releases are made in consultation with USACE.

The flood control requirements are consistent with multipurpose use of reservoir storage. During times when flood management space is not required to accomplish flood management objectives, the reservoir space can be used for storing water. From October through March, the maximum allowable storage limit (point at which specific flood release would have to be made to ensure adequate space in Lake Oroville to handle floodflows) varies from about 2.8 to 3.2 maf. Actual flood storage requirements are partially based on a wetness index, computed from accumulated basin precipitation. This allows higher levels in the reservoir when the prevailing hydrology is dry while maintaining adequate flood protection. When the wetness index is high in the basin (i.e., high potential runoff from the watershed above Lake Oroville), the flood management space required is at its greatest amount to provide the necessary flood protection. From April through June, the maximum allowable storage limit is increased as the flooding potential decreases, which allows capture of the higher spring flows for use later in the year. During September, the maximum allowable storage decreases again to prepare for the next flood season. During flood events, and in consultation with USACE, actual storage may encroach into the flood reservation zone to prevent or minimize downstream flooding along the Feather River.

3.2.3 Environmental Facilities and Operations

The Oroville Facilities include facilities and operations to help protect and enhance fish and wildlife species and their habitat. Many of the environmental programs implemented within the FERC Project boundary are cooperatively managed or are based on agreements with other agencies such as DFG and USFWS. This includes operation and maintenance of facilities such as the Feather River Fish Hatchery and the Oroville Wildlife Area (OWA) and implementation of measures developed in consultation to protect Endangered Species Act (ESA)–listed terrestrial species within the FERC Project boundary.

3.2.3.1 Draft Biological Assessment Measures

In 2004, DWR entered into informal consultation with USFWS to resolve issues related to terrestrial listed species prior to the initiation of formal consultation and FERC license application filing. Several of the measures were identified for early implementation (under the existing FERC license) to minimize or avoid take of federally listed species related to ongoing project activities. These measures include the identification of a listed-species coordinator within DWR, measures pertaining to the giant garter snake, measures pertaining to the bald eagle, and measures pertaining to the vernal pool-related species. These measures are described in a draft BA (see Appendix E of the PDEA), covering terrestrial resources, and have been implemented.

3.2.3.2 Feather River Fish Hatchery Facilities

The Feather River Fish Hatchery is an anadromous fish hatchery built to compensate for the loss of spawning grounds and rearing areas for returning salmon and steelhead that resulted from construction of Oroville Dam. The hatchery complex consists of the

Fish Barrier Dam and fish ladder, water supply lines and aeration tower, collection and holding tanks, enclosed spawning and early incubation facilities, grow-out ponds, and fish transport vehicles. The maximum intake for the Feather River Fish Hatchery is 115 cfs. The Thermalito Fish Hatchery Annex, a fish rearing facility on State Route (SR) 99 near Thermalito Afterbay, is used as a grow-out facility for some salmon and steelhead hatched at the Feather River Fish Hatchery and other DFG purposes.

The Fish Barrier Dam is downstream of the Thermalito Diversion Dam and immediately upstream of the Feather River Fish Hatchery. Flow over the dam maintains fish habitat in the LFC of the Feather River between the Fish Barrier Dam and the Thermalito Afterbay Outlet and provides attraction flow for the hatchery. The dam diverts fish into a fish ladder that leads to the hatchery. The Fish Barrier Pool formed behind the Fish Barrier Dam has a storage capacity of 560 af and covers 50 acres.

3.2.3.3 Feather River Fish Hatchery Operations

The Feather River Fish Hatchery artificially spawns thousands of returning salmon and steelhead each year. DFG operates the hatchery under contract to DWR, and DWR pays for most hatchery-associated expenses. Water is released from the Oroville Facilities storage reservoirs to support fish hatchery operations downstream of the Fish Barrier Dam. Existing fish hatchery temperature objectives are listed in Table 3.2-2. The design of the Oroville Facilities provides for flexibility to enable water temperature control.

Table 3.2-2. Feather River Fish Hatchery water temperature objectives.

Period	Temperature (+/- 4°F)
April 1–May 15	51°
May 16–May 31	55°
June 1–June 15	56°
June 16–August 15	60°
August 16–August 31	58°
September 1–September 30	52°
October 1–November 30	51°
December 1–March 31	no greater than 55°

Source: Initial Information Package (DWR 2001)

The Fish Barrier Dam diverts fish into a ladder leading to the hatchery. All fish are stopped at the dam. Fish ladder operations to allow entry of adult spring-run Chinook salmon have changed in recent years. When the gates are open, upstream migrating fish can move into the 0.5-mile-long ladder leading to the hatchery. Before 2003, the fish ladder gates were generally opened on or about September 1 to allow adult spring-run Chinook salmon to enter the hatchery. The early entries were ready for spawning in October. Fish entering the hatchery in the latter portion of September (the exact cut-off date has varied somewhat from year to year) were considered fall-run Chinook salmon. Since 2003, however, the fish ladder has opened during May and June to allow early

entry of spring-run Chinook salmon. These early-arriving spring-run Chinook salmon are counted, tagged, and released back into the river. When these tagged salmon re-enter the hatchery in the fall, they can be distinguished and spawned separately from fall-run Chinook salmon.

All salmon adults entering the hatchery are retained for egg taking or fertilization. The entire process of egg/milt collection, fertilization, incubation, rearing, and holding of fry, fingerlings, and yearlings is conducted within the facilities. As fish reach the end of the ladder, they swim into the gathering tank, and a mechanical sweep moves the fish into the spawning building. Salmon and steelhead that are not ready to be artificially spawned are moved to one of four circular holding tanks. The main hatchery building houses the spawning operation and incubators.

Unlike Chinook salmon, not all adult steelhead die after spawning; therefore, adult steelhead that have spawned at the hatchery are released. The fish ladder gate is open continuously through the fall and winter, as long as fish with viable eggs ascend the hatchery ladder. Hatchery steelhead are reared to the yearling stage and released in the Feather River. All steelhead fish produced in the Feather River Fish Hatchery are marked with an adipose fin clip. The external fin clip allows anglers to determine quickly whether the fish is of hatchery origin and can be kept. The hatchery also marks a percentage (currently about 10 percent) of its steelhead and spring- and fall-run Chinook salmon using coded wire tags. Each year, approximately 9,000–18,000 salmon and 2,000 steelhead are artificially spawned, a process that produces 18–20 million eggs. Salmon and steelhead are raised at the hatchery then transported in oxygenated, temperature-controlled tanks for release in the Feather and Sacramento Rivers, in Lake Oroville and other California reservoirs, and in San Pablo Bay near San Francisco Bay.

A variety of cold water fish have been stocked in Lake Oroville since its creation in 1968, including various strains of rainbow and brown trout, kokanee salmon, coho salmon, Chinook salmon, lake trout, and brook trout. DWR became involved with Lake Oroville fish stocking in 1993, and expanded the Feather River Hatchery in 1998 to enhance these activities. Since 2000, numerous problems have occurred with coldwater fish diseases, necessitating extensive disease management efforts. These include a cessation of stocking Chinook salmon, and the current practice of using domesticated strains of coho salmon from the Pacific Northwest.

3.2.3.4 Water Releases in Support of Environmental Resources

The 1983 Agreement between DWR and DFG sets criteria and objectives for flow and temperatures in the LFC and the reach of the Feather River between Thermalito Afterbay and Verona. The 1983 Agreement:

- Establishes minimum flows between the Thermalito Afterbay Outlet and Verona, which vary by water year type;

- Requires flow changes under 2,500 cfs to be reduced by no more than 200 cfs during any 24-hour period, except for flood management operations;
- Requires flow stability during the peak of the fall-run Chinook spawning season;
- Sets an objective of suitable temperature conditions during the fall months for salmon and during the later spring/summer for shad and striped bass; and
- Establishes a process whereby DFG could recommend each year, by June 1, a spawning gravel maintenance program to be implemented during that calendar year.

Additionally, a 1984 FERC Order states that upon completion of construction of the Thermalito Diversion Dam Powerplant, DWR shall operate the Oroville Facilities in such a manner as to maintain a minimum flow of 600 cfs within the Feather River downstream of Thermalito Diversion Dam. Downstream of the Thermalito Afterbay Outlet, the license requires a minimum release so that flows in the Feather River are 1,000 cfs from April through September, and 1,700 cfs from October through March when the April–July unimpaired runoff in the Feather River is greater than 55 percent of normal. When the April–July unimpaired runoff is less than 55 percent of normal, the license requires minimum flows of 1,000 cfs from March to September and 1,200 cfs from October to February. This requirement is to protect any spawning that could occur in overbank areas during the higher flow rate by maintaining flow levels high enough to keep the overbank areas submerged. In practice, flows are maintained below 2,500 cfs from October 15 to November 30 to prevent spawning in the overbank areas. According to the 1983 Agreement, if, during the period of October 15 to November 30, the average highest 1-hour flow of combined releases exceeds 2,500 cfs, except for flood management, accidents, or maintenance, then the minimum flow shall not be less than 500 cfs less than that flow. The 1983 Agreement also states that if the April 1 runoff forecast in a given year indicates that the reservoir level will be drawn to 733 ft, water releases for fish may be reduced, but not by more than 25 percent.

Operations to Achieve Temperature Targets for Anadromous Species Protection

There are several temperature objectives for the Feather River downstream of the Thermalito Afterbay Outlet. During the fall months, after September 15, the temperatures must be suitable for fall-run Chinook. From May through August, they must be suitable for shad, striped bass, and other warm water fish. The National Oceanic and Atmospheric Administration (NOAA) has established an explicit criterion for steelhead trout and spring-run Chinook salmon, memorialized in a Biological Opinion (BO) on the effects of the CVP and SWP on Central Valley spring-run Chinook and steelhead as a reasonable and prudent measure. DWR is required to control water temperature at Feather River mile 61.6 (Robinson Riffle in the LFC) from June 1 through September 30 unless DWR consults with the Feather River Technical Team and receives approval from NMFS to deviate from the BO temperature requirement. This measure requires water temperatures less than or equal to 65ºF on a daily average. The requirement is not intended to preclude pumpback operations at the

Oroville Facilities needed to assist the State of California with supplying energy during periods when the California ISO anticipates a Stage 2 or higher alert.

The hatchery and river water temperature requirements contained within the BO sometimes conflict with temperatures desired by agricultural diverters. Under existing agreements, DWR provides water for the FRSA water users. The FRSA water users desire warmer water during spring and summer for rice germination and growth. To the extent practical, DWR uses its operational flexibility to accommodate the FRSA water users' temperature goals.

3.2.3.5 Sport Fishery Operations

DWR manages a cold and warmwater sport fishery in Lake Oroville. DWR funds a full-time fishery biologist and a salmonid stocking program and prepares 90-day and quarterly reports to FERC. Habitat improvements for warmwater game fish include brush shelter construction, planting of willows and/or buttonbush slips and annual grasses, and installation and operations and maintenance (O&M) for irrigation systems and channel catfish spawning structures.

3.2.3.6 Oroville Wildlife Area Facilities

The OWA comprises approximately 11,000 acres west of Oroville that are managed for wildlife habitat and recreational activities. It includes Thermalito Afterbay and surrounding lands (approximately 6,000 acres) along with 5,000 acres adjoining the Feather River. The 5,000-acre area straddles 12 miles of the Feather River, which includes willow and cottonwood-bordered ponds, islands, and channels. Limited gravel extraction also occurs within the OWA.

DWR, DFG, the California Waterfowl Association, and other stakeholders have worked cooperatively to reduce waterfowl losses and increase production in the OWA through programs that have included brood pond construction in Thermalito Afterbay. These ponds or impoundments, created by extending small earthen dams across inlets of the Afterbay, maintain relatively stable water surface elevation, which allows the establishment of emergent vegetation and submerged aquatic habitat while providing open water and terrestrial cover habitats for a variety of terrestrial and aquatic species including special status species.

DFG maintains wood duck/wildlife nest boxes each year with the help of public volunteers in the OWA. Although these nest boxes are intended for wood ducks, many other types of wildlife also use them. The work associated with the nest box program includes cleaning as well as replacing those that are in disrepair.

DWR also maintains fishing platforms and fish cleaning stations at various locations within the OWA.

3.2.3.7 Oroville Wildlife Area Operations

As a result of interagency agreements negotiated between DWR and DFG, DFG manages Thermalito Afterbay and other OWA locations. The first significant management agreement was executed in 1968, when DWR transferred to DFG "control and possession" of the borrow area used during Oroville Facilities construction and adjacent property along the Feather River. This agreement set forth DFG responsibility for establishing, operating, and maintaining a public fish and wildlife management area and providing for recreation on that property. In addition, DFG agreed to be responsible for all costs associated with operation and maintenance. The California Fish and Game Commission formally established this State Wildlife Area in coordination with that agreement.

The second significant management agreement was negotiated between DWR and DFG in 1986. This agreement transferred an easement to DFG for management of the Thermalito Afterbay water surface and adjoining lands for use as a State Wildlife Area and associated recreation. DWR did not transfer possession of the property but established an easement to allow DFG access to fulfill management responsibilities. DFG became responsible for all costs associated with operation and maintenance of this property as a subunit of the OWA, although some Thermalito Afterbay recreation facilities have subsequently been constructed and are maintained by DWR. Thermalito Afterbay has a 5 mph boating speed limit however it is rarely enforced.

DFG is responsible for providing staff to manage and operate the OWA and sets guidelines for public use of this area. This area had full-time staff assigned until March 1, 2004, when DFG management reassigned the staff to other State Wildlife Areas in response to State budget cuts. DFG allows public use from 1 hour before sunrise to 1 hour after sunset; a designated area for overnight camping allows for a maximum stay of 14 nights in any calendar year. Enforcement of these hours or stay limits has been difficult. DFG periodically conducts controlled burning to reduce fuel loading in various locations, primarily around Thermalito Afterbay and DFG and DWR have constructed and maintain fuel breaks in several locations to reduce the potential for spread of wildfire.

DFG has planted and maintained upland forage and cover crops in the OWA to provide winter waterfowl forage and nesting cover per land management guidelines of the Central Valley Habitat Joint Venture (CVHJV). Both DWR and DFG, among others, are signatories to this waterfowl management plan. In addition to this planting, DFG's habitat enhancement program in the OWA includes thinning and/or removal of vegetation around the Thermalito Afterbay brood ponds, scattered dredging ponds, and rock piles within the OWA to provide improved access for waterfowl and improved recreational access to the various habitats. DFG has drained a brood pond on at least one occasion to eliminate non-native fish species. Brood pond recharge is accomplished through either typical Afterbay water level fluctuations or through pumping.

Approximately 200 acres of land are tilled and planted each year and remain as suitable nesting/foraging habitat for approximately 5 years before beginning to revert to the existing grasses. In addition, DFG thins and removes vegetation in and around scattered ponds.

DFG does not directly conduct mosquito abatement programs within the OWA. However, the annual operating budget includes up to $40,000 per year (including up to $20,000 that is contributed by DWR) that is paid to the local mosquito abatement district. This program consists of spraying pesticides in amounts and locations determined appropriate by abatement program staff.

DWR utilizes Best Management Practices (BMPs) to prevent damage to fish and wildlife resulting from construction or operation of the Oroville Facilities by taking special precautions to prevent discharge of silt, petroleum products, and other harmful substances or debris into the Feather River.

3.2.3.8 Water Quality Monitoring

SWP water quality monitoring by DWR's Division of Operation and Maintenance for various inorganic, organic, and biological parameters has occurred regularly since 1968. Nutrients are monitored twice a year, in April and November, at Oroville Dam. Aluminum, barium, cadmium, mercury, silver, chlorinated organics, organo-phosphorus pesticides, herbicides, carbamates, and other pesticides are monitored quarterly at Thermalito Forebay. At Thermalito Afterbay, nutrients are monitored twice a year while aluminum, barium, cadmium, mercury, and silver are monitored monthly and bromide and suspended solids are monitored quarterly. This information is located on DWR's website (www.water.ca.gov) or by requesting it directly from DWR.

3.2.4 Recreation Facilities and Operations

3.2.4.1 Recreation Facilities

The Oroville Facilities support a wide variety of recreational opportunities, including: boating (several types), fishing (several types), fully developed and primitive camping (including boat-in and floating sites), picnicking, swimming, horseback riding, hiking, off-road bicycle riding, wildlife watching, and hunting. There are also visitor information sites with cultural and informational displays about the developed facilities and the natural environment. The majority of recreation facilities in the project area are within the Lake Oroville State Recreation Area (LOSRA), which has numerous facilities and sites offering diverse recreational opportunities. The LOSRA, managed by DPR, includes Lake Oroville and the surrounding lands and facilities within the project area as well as the land and waters in and around the Diversion Pool and Thermalito Forebay, downstream of Oroville Dam. Additional recreational facilities and opportunities exist within the project area but outside the LOSRA, specifically the OWA including Thermalito Afterbay, and the Feather River Fish Hatchery. Some facilities cross over from outside to inside LOSRA, such as the extensive and popular trail system.

Equestrian, Bicycle, and Hiking Trails

The Oroville Facilities include miles of trails offering diverse user groups with opportunities to walk, hike, bicycle, or horseback ride. Figure 3.2-4 is a map showing the existing trails within the project boundary. The Dan Beebe Trail and the Brad Freeman Trail are two of the more popular trails in the project area.

The Dan Beebe Trail is a 14.3-mile trail that is for equestrian and hiking use. The trail is commonly used by joggers and hikers and provides both difficult and easy terrain as it winds past the Diversion Pool and Lake Oroville. Restroom facilities and trailheads are dispersed along the route.

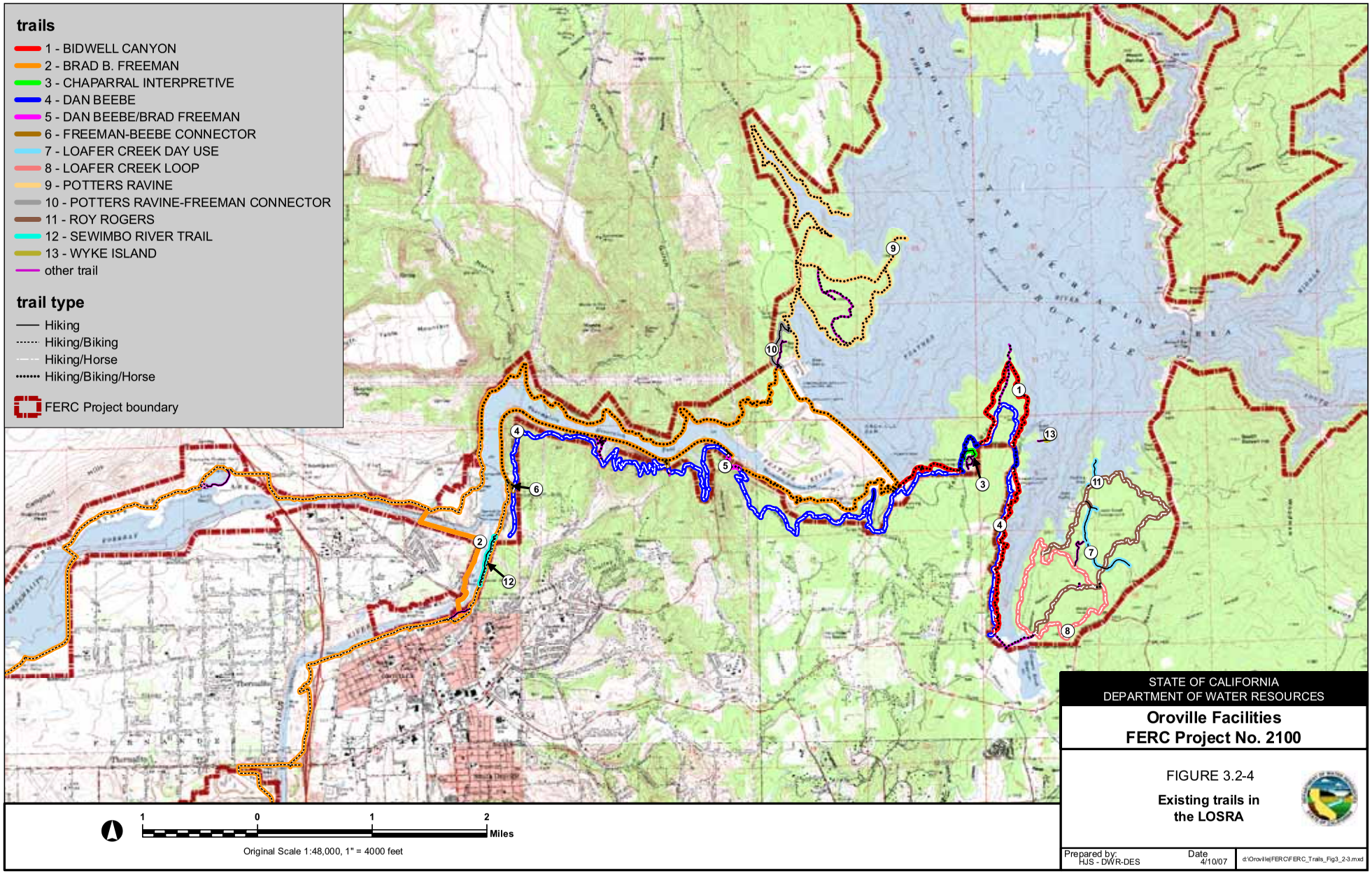
The 41-mile Brad Freeman Trail encircles Thermalito Forebay, Thermalito Afterbay, and the Diversion Pool, and crosses the crest of Oroville Dam. It was constructed in the mid-1990s as a mountain bicycle trail but became popular with equestrians and now has portions considered multi-purpose. There are about a dozen popular or marked access points, many at other popular project recreation sites, from which trail users can stage. The mostly unpaved trail provides scenic off-road recreation, while some short sections are along paved roads and can be used by less-specialized bicycles. More than 30 miles of the trail are flat but include some rolling terrain; steep grades can be found on either side of Oroville Dam. The Brad Freeman Trail has been used for downhill and cross-country mountain-bicycle races.

Most of the hiking trails at Lake Oroville are located in the Bidwell Canyon and Loafer Creek areas; however, there is also a trail in the Spillway area. Informal trails offering shoreline access are found at Thermalito Afterbay, the Craig Saddle area, and the Foreman Creek Car-top Boat Ramp (BR) area. Hiking trail locations and access points in the project area include Bidwell Canyon, Kelly Ridge, Loafer Creek, Potter's Ravine, Wyk Island, the Saddle Dam, Powerhouse Road, Lakeland Boulevard, East Hamilton Road, Toland Road, Tres Vias Road, and the Visitors Center Chaparral Interpretive Trail. DWR recently completed a group staging area at Thompson Flat that includes signage, a graveled driveway to Cherokee Road, graded parking, and a spur trail from the staging area to an existing trail.

The Sewim Bo River Trail was also recently developed along the southeast bank of the Feather River starting at the Feather River Nature Center and extending north to the Thermalito Diversion Dam. Amenities include picnic tables, shade ramadas, restrooms, and interpretive signage.

Recreation Facilities by Location

Lake Oroville, with more than 15,000 surface acres at full pool, is one of the largest reservoirs in California. Major recreation facilities are located around the reservoir at Bidwell Canyon, Loafer Creek, the Spillway, and Lime Saddle. An overview of these and other existing recreation facilities that are maintained and operated under the existing FERC license and included in the No-Project Alternative is presented below. Figure 4.7-1 in Section 4.7, Recreation Resources, is a map showing the location of


trails
1 - BIDWELL CANYON
2 - BRAD B. FREEMAN
3 - CHAPARRAL INTERPRETIVE
4 - DAN BEEBE
5 - DAN BEEBE/BRAD FREEMAN
6 - FREEMAN-BEEBE CONNECTOR
7 - LOAFER CREEK DAY USE
8 - LOAFER CREEK LOOP
9 - POTTERS RAVINE
10 - POTTERS RAVINE-FREEMAN CONNECTOR
11 - ROY ROGERS
12 - SEWIMBO RIVER TRAIL
13 - WYKE ISLAND
other trail
trail type
Hiking
Hiking/Biking
Hiking/Horse
Hiking/Biking/Horse
FERC Project boundary
1 0 1 2
Miles
Original Scale 1:48,000, 1" = 4000 feet
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Facilities
FERC Project No. 2100
FIGURE 3.2-4
Existing trails in the LOSRA
Prepared by:
HJS - DWR-DES
Date
4/10/07
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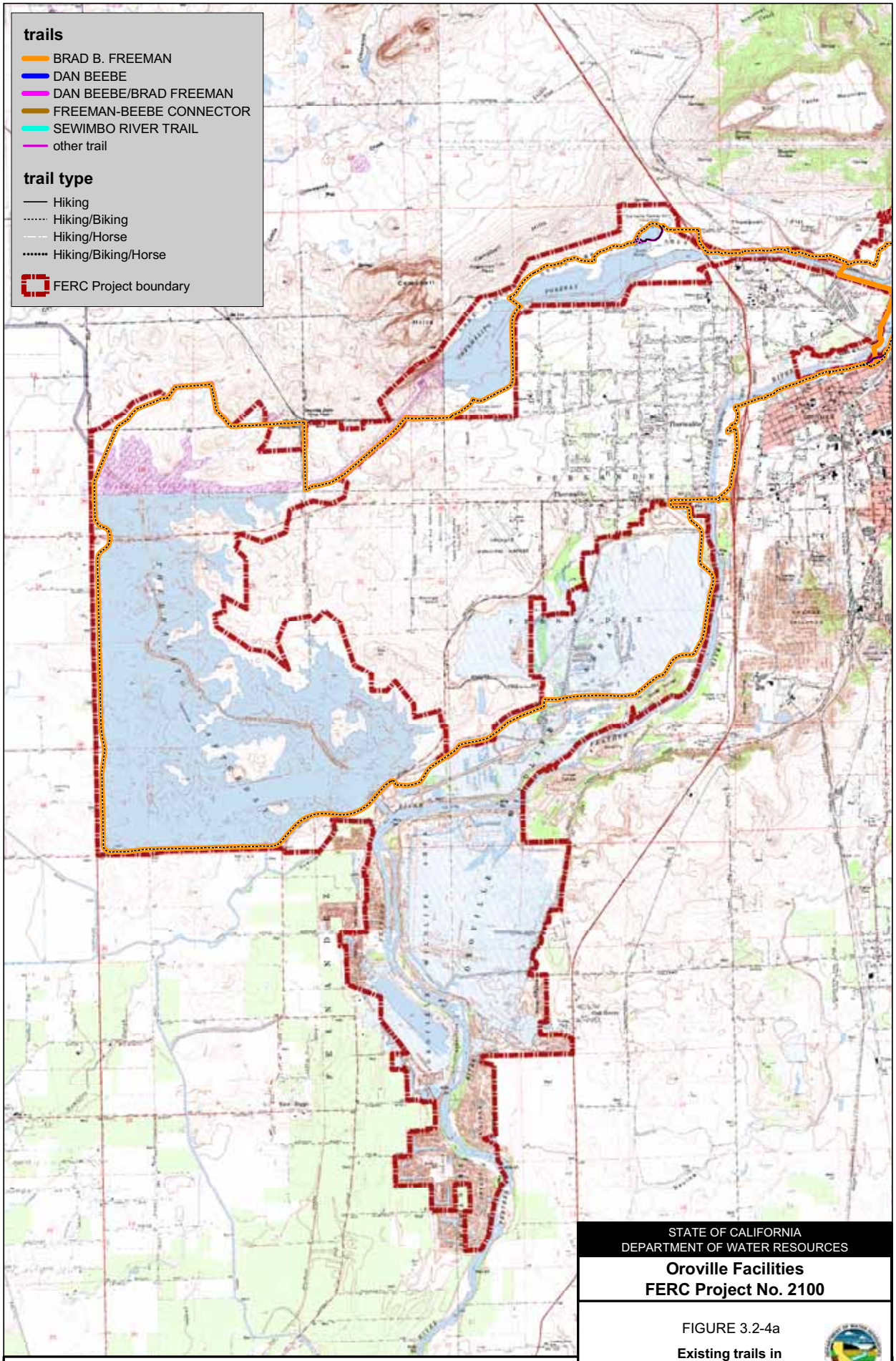

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Oroville Facilities
FERC Project No. 2100

FIGURE 3.2-4a

Existing trails in the LOSRA

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these facilities. More detailed information is provided in the SA Recreation Management Plan, Appendix B.

Bidwell Canyon Campground, Boat Ramp, Day Use Area, and Marina

Bidwell Canyon Campground is located along the southern shore of Lake Oroville, east of Oroville Dam. This facility provides campsites for tents or recreational vehicles (RVs), the latter with full hookups. This site has flush toilets, piped water, showers, gray water sumps, and a picnic area with fire grills.

The Bidwell Canyon Marina area, approximately 1 mile east of Oroville Dam on the southern shore of the reservoir, includes a fuel dock, pumping station for boat holding tanks, boat docks and storage, trailer facilities with RV hookups, a multi-lane boat launch ramp, and an exhibit describing the history of the Bidwell Bar Bridge.

Loafer Creek Campground, Boat Ramp, Day Use Area, and Equestrian Campground

Loafer Creek Campground is the largest campground within the FERC Project boundary and is located on the southern shore of Lake Oroville east of Oroville Dam. This facility has campsites for tents, RVs, and large groups. The multi-lane Loafer Creek boat ramp is located nearby. The campground is equipped with restrooms, showers, piped water, gray water sumps, picnic tables, and fire grills.

The Loafer Creek Equestrian Campground is equipped with shower stalls and feed troughs for horses. Restroom facilities and trailheads are located nearby. Recently, a paved access road, new feeder boxes, pipe corrals, and a 50-ft round pen were added at this location to provide enhanced equestrian recreational opportunities.

Lime Saddle Campground, Day Use Area, and Marina

Lime Saddle Campground is located on the western shoreline of the West Branch of the North Fork arm of Lake Oroville. This facility provides campsites for tents, RVs (some with hookups), and groups. The campground has restrooms, showers, and potable water; each site has a picnic table and fire grill.

Lime Saddle Marina includes boat docks and storage, fishing and boating supplies, gas, and oil. The marina is located on the West Branch of the Feather River near Lime Saddle Road. Close to the marina are the multi-lane Lime Saddle Boat Ramp and picnic facilities at the Day Use Area.

Spillway Recreation Area at Oroville Dam

The Spillway Recreation Area at Oroville Dam has the largest boat launching facility on Lake Oroville. A 12-lane ramp with more than 800 parking spaces, renovated in 2002, is used during periods of high lake level; an 8-lane second-stage ramp is used during

low-water periods. This site also provides limited day use activities, en-route camping, and opportunities for picnicking and bicycle riding.

Enterprise Boat Ramp and Day Use Area

The Enterprise Boat Ramp and Day Use Area, located on the South Fork arm of Lake Oroville, provides boat launching and shoreline access. This site has a multi-lane boat ramp used during periods of high lake level.

Car-Top Boat Ramps

The following locations provide access to boaters launching canoes, small sailboats, and other small watercraft.

Nelson Bar. Nelson Bar Car-top BR is located on the West Branch of the North Fork arm of Lake Oroville. The lower section of the boat ramp below the improved paved ramp is available for hand launching only. The site has a gravel parking lot, available at all but the highest water levels, and one vault toilet.

Vinton Gulch. Vinton Gulch Car-top BR is located on the West Branch of the North Fork arm of Lake Oroville. The single-lane boat ramp is used during periods of high lake level. This site has no designated parking area and one vault toilet.

Dark Canyon. Dark Canyon Car-top BR is located on the West Branch of the North Fork arm of Lake Oroville. This single-lane boat ramp is available at most water levels. There is a paved parking lot but no restroom.

Foreman Creek. Foreman Creek Car-top BR is located on the north side of the main body of Lake Oroville. This multi-lane boat ramp provides access at most water levels but has no formally designated parking area and no restroom.

Stringtown. Stringtown Car-top BR is located on the South Fork arm of Lake Oroville. The boat ramp is available at most water levels. This site has a small parking area and one vault toilet.

Lake Oroville Visitors Center

Located east of Oroville Dam on Kelly Ridge, the 10,000-square-foot (sq ft) center features exhibits on the engineering and construction of the Oroville Facilities. Additionally, there are interpretive displays on the Native American culture and the natural resources of the area. The center has observation decks with picnic tables and an observation tower. Visitors to the Lake Oroville Visitors Center can also obtain specific information about recreational opportunities and activities in the area.

Boat-in Campgrounds

In addition to traditional campgrounds, Lake Oroville provides boat-in campgrounds (BICs) around the reservoir. These camps are accessible only by boat and service

vehicles and are popular during periods of high lake level. There are a total of 84 individual/family boat-in campsites in the project area.

Bloomer Area. Bloomer Area BICs are located on the North Fork arm of Lake Oroville. Bloomer Area has four separate camp areas: Bloomer Cove, Bloomer Knoll, Bloomer Point, and Bloomer Group. Each has campsites equipped with tables and fire rings with cooking grills. The Bloomer Group is the only BIC in the Bloomer Area that offers a group site (one 75-person group site).

Goat Ranch. Goat Ranch BIC is located on the North Fork arm of Lake Oroville between the Bloomer campgrounds and where the West Branch splits from the North Fork arm. The campsites are equipped with tables and fire rings with cooking grills.

Foreman Creek. Foreman Creek BIC is located at the north side of Lake Oroville. This campground is equipped with potable water, gray water sump, tables, and fire rings with cooking grills.

Craig Saddle. Craig Saddle BIC is located between the Middle and South Fork arms of Lake Oroville. This area has 18 sites, each equipped with tables, potable water, and fire rings with cooking grills.

Floating Campsites and Restrooms

Lake Oroville has ten floating campsites that are anchored in different areas of the reservoir. Each is a 2-story structure that provides a unique on-water camping experience and can accommodate up to 15 people, with living space and amenities such as cooking grill, table, sink, restroom, and sleeping area.

There are seven floating restrooms on Lake Oroville designed to protect water quality and provide convenience for boaters. They are stationed around the reservoir, and each has two individual restrooms with vaults that are periodically pumped out.

Saddle Dam Day Use Area

This primarily equestrian-use trailhead is located in the southeastern portion of the project area.

Diversion Pool Day Use Area

The Diversion Pool Day Use Area is open for day use activities such as hiking, biking, trail access, and picnicking. Only non-motorized and electric boats are allowed on the Diversion Pool. The Diversion Pool Day Use Area has one vault toilet but few other amenities.

North Thermalito Forebay Recreation Area

The North Thermalito Forebay area offers picnicking, swimming, and en-route camping. Boating is restricted to non-motorized boats such as sailboats and canoes. The boat launch area has two multi-lane boat launch ramps. There are numerous picnic tables, group facilities and shade ramadas, and a popular sand beach.

South Thermalito Forebay Recreation Area

The South Thermalito Forebay Recreation Area provides outdoor recreational activities such as boating, picnicking, fishing, and swimming. The site has a multi-lane boat ramp with power boating limited to 330 acres of the 630-acre Thermalito Forebay. The site has several picnic tables with fire grills.

Thermalito Afterbay Boat Ramps

Several boat ramps are available on Thermalito Afterbay at the following locations:

Wilbur Road. The Wilbur Road boat launch area consists of a multi-lane paved boat ramp and a parking lot with 14 car/trailer combination spaces.

Larkin Road. The Larkin Road boat launch area has a graded and graveled car-top boat ramp. This site has a paved lot approximately 50 yards by 50 yards with a single-vault, handicap-accessible toilet.

Monument Hill. The boat ramp consists of a multi-lane paved boat launch ramp with a floating dock and is located on the eastern shoreline of Thermalito Afterbay. The paved and unpaved parking lots can accommodate about 75 car/trailer combinations.

Monument Hill Day Use Area

Monument Hill Day Use Area provides recreational activities such as boating, swimming, fishing, picnicking, and limited hunting. This site has several picnic tables, four flush toilets, a multi-lane boat launching ramp, and a fish cleaning station.

Dispersed Recreation Sites in the OWA

Other recreation areas in the OWA include dispersed recreation (hunting, fishing, and bird watching), model aircraft grounds, a boat launch on the Feather River, and a designated primitive camping area with minimal amenities for users.

3.2.4.2 Recreation Operations and Maintenance

The LOSRA, managed by DPR, includes Lake Oroville and the surrounding lands and facilities within the project area, as well as the land and waters in and around the Diversion Pool and Thermalito Forebay, downstream of Oroville Dam. Additional recreational facilities and opportunities exist within the project area but outside the LOSRA, specifically at Thermalito Afterbay, the OWA, and the Feather River Fish Hatchery. Each of these areas is managed by DFG.

3.3 DESCRIPTION OF ALTERNATIVES UNDER CONSIDERATION

3.3.1 No-Project Alternative

CEQA requires the evaluation of the No-Project Alternative, against which the effects of the alternatives can be compared. The purpose of describing and analyzing a No-Project Alternative for the Oroville Facilities is to allow decision-makers to better understand the environmental consequences of continuing to operate the project under the terms and conditions of its existing FERC license. Such consequences can then be compared to those associated with alternatives proposed for the project.

Under the No-Project Alternative, the Oroville Facilities would continue to be operated as it is now under the terms and conditions in the existing FERC license, and no new protection, mitigation, and enhancement measures would be implemented, other than those arising from existing legal obligations and agreements. In addition, DWR would continue existing maintenance practices needed to maintain the Oroville Facilities.

The No-Project Alternative includes all existing facilities and operations as described in Section 3.2, key conditions of the existing FERC license, environmental commitments such as those associated with DWR's water rights, recreation programs, and other agreements that affect current Oroville Facilities operations. This includes interim measures implemented by DWR during the ALP collaborative effort and further described in Section 3.3.1.1 below. These conditions and measures would continue to affect operations in the future under the No-Project Alternative.

During development of the FERC license application, the assessment of effects for the No-Project Alternative used the CALSIM II, HYDROPS™, WQRRS, and other modeling and technical studies completed for the "benchmark" modeling scenarios to simulate existing and future hydrologic conditions. These scenarios and related modeling results were completed with input provided by stakeholders at several hydrology modeling workshops and are described in the PDEA provided to FERC as part of the license application. Appendix C of the PDEA includes technical information on the operations modeling tools used for the assessment of effects and additional detail on existing project operations based on the models. Additional modeling discussion is included in Chapter 5 of this DEIR and Appendix E.

3.3.1.1 Interim Recreation Projects Included in the No-Project Alternative

Early in the ALP, DWR agreed to consider implementing some actions prior to receiving a new license provided no license amendment was needed, environmental review requirements were limited, and there was agreement to include the actions in the new license application when filed. A task force was initiated through the Recreation and Socioeconomics Work Group to evaluate potential actions that could be taken in advance of license renewal. The task force eventually recommended two dozen actions for consideration. DWR identified those actions that were feasible to accomplish before

license renewal and began implementation. The completed interim recreation projects included as part of the No-Project Alternative are listed and described below:

- Riverbend Park—DWR provided over $5 million toward funding the design, permitting, and construction of the expansion of the existing Riverbend Park along the eastern bank of the Feather River LFC adjacent to the City of Oroville. Phase one of the park includes trails, picnic facilities, a boat launch, playgrounds, a Frisbee golf course, and paved parking.

- Restroom Upgrades—Vault type, handicap accessible restrooms were installed at Wilbur Road Boat Ramp, Model Aircraft Flying Facility at Thermalito Afterbay, Enterprise Boat Ramp, South Thermalito Forebay, and Saddle Dam.

- Loafer Creek Equestrian Campground Improvements—A paved access road, new feeder boxes, pipe corrals, and a 50-ft round pen were added near Loafer Creek Campground to enhance equestrian recreational opportunities.

- Group Staging Area—DWR secured the Thompson Flat property, graded parking, installed signage, graveled the drive from Cherokee Road, and developed a spur trail from the staging area to an existing bicycle trail.

- Bidwell Exhibit—DWR coordinated with DPR to develop an exhibit of the history of Bidwell Bar Bridge.

- Saddle Dam Improvements—The existing Saddle Dam equestrian parking area was improved by re-grading and adding gravel to the parking area, and by adding picnic tables, hitching posts for horses, and plans to add native shade trees.

- Lake Oroville Overlook Improvements—The Lake Oroville overlook located off the Oro-Quincy Highway (SR 162) was improved by removing the existing cyclone fencing, installing a new California Department of Transportation (Caltrans) specification fence and automobile safety barrier, and adding interpretive signs.

- Seed the face of Oroville Dam—DWR seeded the downstream face of Oroville Dam with a wildflower mixture dominated by California poppies.

- Model Aircraft Flying Facility Improvements—At the Model Aircraft Flying Facility, DWR paved the crossing runways, graded and graveled the parking lot, installed aircraft staging tables, constructed picnic facilities with shade ramadas, installed a restroom, and added fencing.

- Promote Existing Recreation Facilities—DWR provided funding to the Oroville Chamber of Commerce for billboards along SR 99 and Pentz Road to direct people to LOSRA facilities.

- Boating Safety Training—DWR continues to work cooperatively with DPR, the Butte Sailing Club, and the Feather River Recreation and Parks District to fund improved boat storage facilities, boating safety equipment, and instructional programs. The latter includes a recurring "Aquatic Adventure Camp" that targets local disadvantaged youth.

- Sewim Bo Path—A walking trail was developed along the southeastern bank of the Feather River starting at the Old Bath House (now the Nature Center and Native Plant Garden) and extending north to the Thermalito Diversion Dam. Improvements along the river trail include picnic tables, shade ramadas, native trees and shrubs, a restroom, interpretive signs, and parking, including Americans with Disabilities Act (ADA) access.

- Feather River Fish Hatchery Landscaping Improvements—DWR planted new shade trees and assorted native plants and grasses on the Feather River Fish Hatchery grounds.

3.3.1.2 Actions Taken to Comply with Draft Biological Assessment

DWR entered into informal consultation with USFWS to resolve terrestrial listed species issues prior to the initiation of formal consultation to be conducted after license application filing. USFWS recommended four measures for early implementation (under the existing FERC license) to minimize or avoid take of federally listed species related to ongoing project activities. These measures include the identification of a listed-species coordinator within DWR, measures pertaining to the giant garter snake, measures pertaining to the bald eagle, and measures pertaining to the vernal pool-related species. These measures are described in a draft BA (see Appendix E of the PDEA), covering terrestrial resources, and are included in the No-Project Alternative.

The report for Relicensing Study Plan T-1 (SP-T1) identified a potential impact on nesting bank swallow, a State-listed Threatened species, related to July Feather River flows. DWR in consultation with DFG cooperatively agreed to mitigation in the form of habitat protection. Final site selection is subject to DFG approval. This measure is included in the No-Project Alternative.

3.3.2 Proposed Project

This section describes how the existing Oroville Facilities and project operations described in Section 3.3.1 would be modified under the Proposed Project. The Proposed Project is the SA signed March 21, 2006, and submitted to FERC. In the submittal, DWR requested that the SA become the preferred alternative, replacing the preferred alternative proposed and analyzed in the PDEA that was part of the license application in January 2005 for consideration as future license conditions for the Oroville Facilities for the next 50 years. The Proposed Project includes existing measures described in the No-Project Alternative, including interim recreation projects as well as

SA Appendix B sections not considered by FERC in their DEIS, unless otherwise indicated.

The SA includes a commitment by DWR to develop, in consultation with stakeholders, a number of plans and programs to enhance, protect, mitigate, restore, and/or create habitat within the FERC Project boundary. It also requires that DWR complete a number of studies and conduct monitoring to guide future decisions and activities. While these plans, programs, studies and monitoring activities will likely lead to future actions that would be subject to CEQA environmental review prior to implementation, the preparation of plans, development of programs, and completion of studies themselves do not result in a physical change to the environment and thus are not ready for project-specific CEQA analysis at this time. Articles and actions included in the Proposed Project that do not result in a physical change to the environment and are thus not analyzed in this document are identified on Table 5.0-1 in Chapter 5.0, Environmental Impacts. In some cases, during the ALP process DWR and the stakeholders evaluated potential options associated with actions included and generally described in SA articles. The level of detail necessary to analyze these actions on a project-specific level is not available at this time. Therefore, this document includes an analysis of these actions on a programmatic level, and in some cases provides options that would likely be considered based on collaborative discussions during the ALP. Table 5.0-1 identifies SA articles and sections not analyzed at a project level in this DEIR. Please review the SA for the complete description of the plans and programs DWR has committed to develop.

The SA also includes two separate documents developed through the collaborative relicensing process as proposed license articles: SA A127, the SA Recreation Management Plan (RMP), which provides a long-term plan to enhance recreational resources; and SA A128, the draft Historic Properties Management Plan (HPMP), which provides guidance to protect sensitive cultural and historical resources in the project area. These documents are incorporated in the SA, and thus in the Proposed Project and the FERC Staff Alternative, by reference.

In addition to specific actions, plans, and programs described in the SA articles, the Proposed Project also includes a multi-party Draft Habitat Expansion Agreement (HEA), which is described in Appendix F of the SA.

The SA originally included as Appendix E, the U.S. Forest Service (USFS) Draft Section 4(e) conditions that would be included in the development of plans, programs, and studies involving USFS lands. Since the SA was signed, the USFS has filed Final Section 4(e) conditions for the project. As provided for in the SA, these final conditions are incorporated into the SA and are included in Appendix A1 of this DEIR.

The planning and execution of Proposed Project SA articles that involve site preparation and construction activities to be undertaken by DWR would include the adoption of numerous Best Management Practices (BMPs) designed to avoid or mitigate short-term effects typically associated with such activities. The BMPs to be adopted as part of the Proposed Project are presented in Appendix D of this DEIR.

3.3.2.1 Impoundments and Power Facilities

Power Facilities

No new facilities designed to increase or enhance power production are planned under the Proposed Project. Existing operations and maintenance activities would continue unless noted below.

Oroville Dam and River Outlet Structure

The Howell-Bunger river outlet valves located at the base of Oroville Dam are sometimes used to release water into the Feather River to meet temperature objectives for the hatchery downstream. Section B108 of the SA states that DWR will evaluate the river valves and determine if they should be refurbished or replaced. DWR initiated studies necessary to evaluate river valve refurbishment or replacement after it filed the SA with FERC.

Interim Operations Prior to Facilities Modifications

As part of the SA, DWR is evaluating a number of facilities modifications that could be constructed to improve water temperature conditions downstream. Structural modifications, if any, to improve downstream water temperatures would be constructed after Year 10 of the new FERC license. For purposes of analysis in this EIR, the period of time before facilities modification is referred to as the "initial new license period" to distinguish it from the post-facilities modification period. The initial new license period would include non-facilities modifications such as augmentation of minimum flow releases (up to 1,500 cfs or the total releases into the High Flow Channel (HFC), whichever is less), shutter manipulation, or adjustments to pumpback operations to meet temperature targets in the LFC until facilities modifications to provide colder water for coldwater fisheries protection to the LFC and HFC, if any, are constructed. In addition, the river valves may be used to meet hatchery temperature targets. Potential future facilities modifications could include one or more of the actions described below.

Feasibility of Improving Temperature Conditions through Facilities Modifications

Under the terms of the SA, a feasibility study will be prepared within 3 years following license issuance to consider potential future facilities modifications to improve water temperature conditions in the LFC and the HFC to protect anadromous fish over the term of the new FERC license in the least costly manner. The SA calls for preparation of a reconnaissance study in advance of the feasibility study. In January 2007 DWR filed a final reconnaissance study with FERC. The intent of the reconnaissance study was to identify measures that could be combined into alternatives that might be expected to achieve the desired water temperature targets. These alternatives would be evaluated in more depth including additional project-specific modeling in the subsequent feasibility study.

The reconnaissance study includes potential actions within the LFC and actions associated with Thermalito Afterbay. Measures described in the reconnaissance study and briefly described below require further evaluation and development into feasible alternatives before specific environmental effects can be analyzed. Upon completion of the feasibility study, a project-specific CEQA analysis would be required for any alternative before construction. Future project-specific analysis, including operations modeling of potential future facility modifications, would tier from this programmatic DEIR.

Palermo Canal Improvements

The Palermo Canal currently draws water from Lake Oroville at approximately 549 feet msl and delivers approximately 50 cfs to the South Feather Power and Water Agency. Improvements would include increasing the volume of water passed through the Palermo Outlet Works to deliver the 50 cfs to the canal and to provide, via a pipeline, approximately 500 cfs to cool Feather River water temperatures at one or more points within the FERC Project boundary. These points could be the Feather River Fish Hatchery, the LFC downstream of Thermalito Diversion Dam, and the HFC near Thermalito Afterbay Outlet.

Hyatt Intake Extension

Currently, the lowest elevation for Hyatt Pumping-Generating Plant intake from Lake Oroville is at 613 feet msl. An extension at the intake structure to approximately 500 feet msl would allow access to an increased volume of cold water for release through the Hyatt Pumping-Generating Plant and downstream into the LFC. The extension would connect to the existing intake structure and existing shutters could continue to be used to mix flow from the deeper intake with flows from the upper water column.

River Valve Improvements

The existing river valves have been used as a low-level outlet works in the event reservoir storage is too low for release through Hyatt Pumping-Generating Plant. While the valves are exercised annually, they are not designed for frequent use as a temperature control device, and they are also limited to 1,500 cfs release for safety considerations. Potential improvements to the river valves could allow for more frequent usage and potentially higher flow release to benefit the Feather River Fish Hatchery and downstream water temperature control.

Canal Around Thermalito Afterbay

A canal would be constructed to route water from the Thermalito Pumping-Generating Plant tailrace directly to the LFC upstream of Thermalito Afterbay Outlet. This reduces residence time for Oroville water releases within Thermalito Afterbay. Reducing residence time in Thermalito Afterbay could reduce water temperatures released into the HFC.

Canal Through Thermalito Afterbay

A system of dikes, channels, and gated structures would be constructed within Thermalito Afterbay to route water more directly from the Thermalito Pumping-Generating Plant tailrace to the existing Thermalito Afterbay Outlet. This reduces the travel time for flows from the Thermalito Pumping-Generating Plant through Thermalito Afterbay to the Feather River, resulting in decreased water temperature releases to the HFC.

Alternate Afterbay Outlet and Channel

An alternate outlet and channel would be constructed to deliver water 4–8 miles downstream of the existing Thermalito Afterbay Outlet. It would work in concert with the existing outlet to provide additional temperature benefits for that portion of the HFC between the existing outlet and the alternate outlet. Minimum flow requirements for the HFC would be maintained through releases from the existing Thermalito Afterbay Outlet, while the remaining flows returning to the Feather River (up to 4,000 cfs) would be redirected for release at the new outlet. Releases in excess of 4,000 cfs would continue to be made through the existing Thermalito Afterbay Outlet.

Thermalito Afterbay Temperature Curtain

This measure would employ a temperature curtain installed within Thermalito Afterbay near the western and southern embankment. The intent of this option is to cause water released for irrigation to travel through the entire length of Thermalito Afterbay, by redirecting the flows, thereby increasing residence time and thus likely increasing water temperatures, before release through the irrigation diversion outlets.

3.3.2.2 Coordinated Operations

The Proposed Project does not include any changes to the general reservoir operations, scheduling, or power transactions. No changes are proposed to water supply deliveries or contracts and, as the keystone storage component of the larger SWP, the Proposed Project would not affect future water deliveries to the SWP water contractors.

Flood Management (SA Article A130, A131 and Section B103)

The Proposed Project provides for the continued operation of the Oroville Facilities in accordance with the rules and regulations prescribed by the Secretary of the Army pursuant to Section 204 of the Flood Control Act of 1958 and other applicable law (SA Article A130).

Under the Proposed Project, within 1 year of license issuance DWR would develop and file for FERC approval an Early Warning Plan, describing how DWR would communicate and coordinate project operations with USACE, the U.S. Bureau of Reclamation, the California Office of Emergency Services, and the Butte County Office of Emergency Services before and during flood emergency events (SA Article A131).

DWR would also evaluate and potentially implement additional stage and/or precipitation gaging locations to improve flood forecasting and monitoring (SA Section B103).

3.3.2.3 Environmental Facilities and Operations

Environmental measures included in the Proposed Project are designed to address ongoing effects of project operations over the term of the new FERC license. The Proposed Project includes measures contained within the draft BAs (terrestrial and fishery) and Final Terrestrial BO prepared in consultation with USFWS and NMFS, respectively, as well as final terms and conditions provided by USFS in accordance with Section 4(e) and recommendations in accordance with Section 10(a) of the Federal Power Act. In general, the Proposed Project includes the development and implementation of numerous environmental plans and programs to improve fish spawning and rearing habitat to complement federal Endangered Species Act (FESA) anadromous fish species recovery programs, support the Feather River Fish Hatchery, provide additional habitat for waterfowl, provide protection for terrestrial FESA and California Endangered Species Act (CESA) species, monitor water quality in project waters, improve habitat for warmwater fish species and improve the coldwater fishery in Lake Oroville, and provide various improvements in management direction for the OWA.

The environmental programs, plans, and specific actions included in the Proposed Project are described below. Additional specific information related to each of the proposed programs and plans is included in the SA, provided as Appendix A.

Ecological Committee (SA Article A100)

Under the Proposed Project and within 3 months of FERC license issuance, DWR would establish and convene an Ecological Committee (EC) to advise it on ecological issues related to the implementation of specific elements of the new project license. Membership would be composed of signatories to the SA who represent relevant federal and State regulatory agencies (such as NMFS, USFWS, BLM, DFG, and DPR), local governmental entities, Native American tribes, and other interested signatories to the SA (such as SWC and American Rivers). The SWRCB and the Central Valley Regional Water Quality Control Board (RWQCB) are also included in the membership even though they are not signatories to the SA. Specific information related to EC membership, organization, and scope of the EC is included as Appendix C of the SA.

Feather River Fish Hatchery Improvement Program (SA Article A107)

A proposed Feather River Fish Hatchery Improvement Program would include a Feather River Fish Hatchery Production Program, measures related to meeting Feather River Fish Hatchery temperature requirements, a Feather River Fish Hatchery Management Program, provisions for a hatchery disinfectant system, and approaches to facility assessment for operations and maintenance.

Feather River Fish Hatchery Production Program

Under the Proposed Project, DWR would ensure the continued operation of the Feather River Fish Hatchery, in cooperation with DFG, for the production of anadromous salmonids.

Feather River Fish Hatchery Temperature

The Proposed Project requires that DWR operate to meet new temperature targets at the Feather River Fish Hatchery. The new targets will become requirements upon facilities modifications outlined in SA Article A108, but no later than Year 10 after new FERC License acceptance.

Feather River Fish Hatchery Management Program

Under the Proposed Project, DWR would prepare a comprehensive Feather River Fish Hatchery Management Plan within 2 years of license issuance. The plan would include production goals for the Feather River Fish Hatchery and the protocols that would be utilized to meet these goals. Hatchery and Genetics Management plans would be included for each anadromous fish species managed by the hatchery to identify the effects of the hatchery program on FESA–listed salmonids, and to identify methods to reduce negative impacts on FESA-listed salmonids. A full description of the hatchery operations and issues would be provided including egg taking, hatching, rearing, tagging, straying, and release methods and locations. Diseases of concern at the Feather River Fish Hatchery would be identified and disease management procedures and activities employed at the hatchery would be described. The plan would include a methodology to study Feather River Fish Hatchery management effects on salmonids, and the interaction between in-river and hatchery-produced salmonids. The plan would also include a procedure for coordinating the Feather River Fish Hatchery operations with those of other Central Valley salmonid hatcheries. Annual summary reports would be prepared, and a comprehensive report of the Feather River Fish Hatchery Management Program would be prepared every 5 years for public and EC review.

Feather River Fish Hatchery Water Disinfection System

In the event that anadromous salmonids are passed upstream of the Feather River Fish Hatchery, the Proposed Project would also include the installation of a water disinfection system for the Feather River Fish Hatchery water supply before such passage.

Feather River Fish Hatchery Annual Operations and Maintenance

The Proposed Project requires DWR to provide the operational and maintenance funding to support the Feather River Fish Hatchery programs described above. This would include a comprehensive inspection of the Feather River Fish Hatchery facilities at least once every 5 years to identify maintenance and repair needs, as well as possible facility improvements. The inspection reports would be a component of the Lower Feather River Habitat Improvement Plan.

Habitat Expansion Agreement and A109 Reservation of Section 18 Authority

A subset of the SA parties, including NMFS, USFWS, and DFG, and Pacific Gas and Electric Company (PG&E) separately negotiated a draft HEA to address blockage of upstream passage by anadromous fish caused by several dams on the Feather River, including Oroville Dam. These SA parties and PG&E have reached an agreement in principle on habitat expansion, which may include off-site habitat enhancement. A draft of the agreement is attached to the SA as Appendix F. NMFS and USFWS have reserved their authority to prescribe fishways pursuant to Section 18 of the Federal Power Act, during the term of the new FERC license. As provided in the HEA, NMFS and USFWS may include in their reservation of authority the ability to modify that reservation, before or after FERC license issuance, and may submit fishway prescriptions, in the event that the HEA and the underlying agreement between DWR and PG&E are not executed or DWR and PG&E fail to perform.

The specific goal of the agreement is to expand habitat sufficiently to accommodate an estimated net increase of 2,000 to 3,000 spring-run Chinook salmon for spawning (habitat expansion threshold).

Within 2 years of signing the HEA, DWR and PG&E would, in consultation with NMFS, USFWS, the State Water Resources Control Board (SWRCB), USFS, and DFG, complete identification, evaluation, and selection of habitat expansion action(s) using the Evaluation Criteria and Selection Criteria listed in the agreement. Potential habitat actions would occur in the Sacramento River basin and may include, but are not limited to dam removal, dam re-operation, flow and water temperature improvements, fish passage, and physical habitat improvements.

Instream Flow and Temperature Improvement for Anadromous Fish (SA Article A108)

The Proposed Project establishes a new minimum flow of 700 cfs in the LFC during most of the year, increasing to a minimum flow of 800 cfs during the Chinook salmon spawning season from September 9 through March 31 unless NMFS, USFWS, DFG, and SWRCB provide a written notice that a lower flow (between 700 and 800 cfs) substantially meets the needs of anadromous fish. The volume of increased flows was determined from results of negotiations based on instream flow investigations (SP-F16, Phase 2) and spawning habitat utilization studies (SP-F10, Tasks 2B and 2C) conducted by DWR during the ALP. During the initial new license period the Proposed Project would operate the Oroville Facilities to achieve new water temperature objectives for the LFC as measured at Robinson Riffle (River Mile 61.6) as indicated on Table 1 of SA Article A108. The proposed water temperature objectives in Table 2 of SA Article A108, measured at the southern FERC Project boundary (River Mile 53.9), would be evaluated and new temperature targets would be established after potential future project modifications to improve water temperatures in both the LFC and the HFC have been constructed and tested.

HFC minimum flows would remain the same as the existing license and consistent with the 1983 DWR and DFG Operating Agreement. Oroville Facilities ramping rates would also remain consistent with the 1983 DWR and DFG Operating Agreement.

As described earlier in Section 3.3.2.1, DWR would study options for potential future facilities modifications to achieve temperatures consistent with the SA. Under the Proposed Project, DWR would complete a Feasibility Study and Implementation Plan to protect and improve temperature conditions for spawning, egg incubation, rearing, and holding habitat for anadromous fish in the LFC and the HFC. The plan would recommend a specific alternative for implementation and would be prepared in consultation with the resource agencies. The SA describes a 5-year test of facilities modifications after construction to determine resulting downstream water temperature improvements and to establish the final HFC temperature targets.

The SA also describes specific actions that would be taken to manage the coldwater pool to minimize exceedances of Table 1 temperature targets, consistent with water supply and other legal obligations, during conference years. A Conference Year is defined as any year in which the Oroville Temperature Management Index (OTMI) is equal or less than 1.35 million acre-feet. An explanation of how the OTMI is calculated and how Conference Year flows would be addressed under the Proposed Project is included in SA Article A108.6.

Additional details on flow and temperature measures in support of anadromous fish are included in SA Article A108.

Lower Feather River Habitat Improvement Plan (SA Article A101)

The Lower Feather River Habitat Improvement Plan consists of nine components that would improve the lower Feather River habitat for Chinook salmon and steelhead. The overall strategy is to coordinate various habitat improvement activities to maximize benefits to fish and wildlife species and to assess and correct potential predation problems created or exacerbated by any DWR-sponsored or implemented project modifications. For the first 5 years, DWR would annually report monitoring results and activities to the EC; after the fifth year of the new FERC license, DWR would consolidate the reports into a single, comprehensive monitoring and adaptive management summary report to be prepared every 5 years for the remainder of the FERC license term. The summary report would include the results of each of the various components of the Lower Feather River Habitat Improvement Plan and would provide a summary of actions taken, management decisions, and proposed modifications to the various program components.

Gravel Supplementation and Improvement Program (SA Article A102 and B105)

The Gravel Supplementation and Improvement Program is designed to address the current spawning habitat in the lower Feather River due to the blockage by Oroville Dam of suitable spawning gravel movement from upstream sources into the LFC.

Because sediments, including gravels, will continue to be trapped behind Oroville Dam, DWR would develop a Gravel Supplementation and Improvement Program to mitigate the cumulative impacts of the project on the quantity and quality of spawning gravels available for Chinook salmon and steelhead.

DWR would immediately initiate the planning, development, and implementation of a program to supplement up to 15 locations in the lower Feather River with at least 8,300 cubic yards of spawning gravels suitable for spring-run Chinook salmon and steelhead. This initial gravel supplementation would be completed within 5 years following FERC license issuance.

Gravel Management Plan

Within 2 years of license issuance, DWR would also develop a Gravel Management Plan to address ongoing and future gravel management for the lower Feather River. The Gravel Management Plan would provide for:

- A physical assessment of the spawning riffles from River Mile 54.2 (downstream FERC Project Boundary) to River Mile 67.2 of the Feather River (Fish Barrier Dam);
- A gravel budget for the LFC and, if necessary, portions of the HFC within the FERC Project boundary;
- A strategy to augment existing gravel recruitment in the LFC and HFC with gravel injections, placements, or other methods developed through site-specific investigations;
- Plans to monitor and evaluate the effectiveness of gravel augmentation and biological response of fish species;
- Annual summary of activities;
- Definition of high-flow events; and
- Coordination with other components of the Lower Feather River Habitat Improvement Program.

Specific measures, criteria, and timelines are included in SA Article A102.

Channel Improvement Program (SA Article A103)

The Channel Improvement Program includes habitat improvement measures to increase the quality and complexity of salmonid spawning and rearing habitat in two existing side channels (Moe's Ditch and Hatchery Ditch). Additionally, the Proposed Project includes development of 5 additional side channel riffle/glide complexes over a 5-year period, which would provide a minimum of 2,460 feet in length of new spawning and rearing habitat for Chinook salmon and steelhead. The EC and agencies would be

instrumental in recommending the locations and habitat components of the five additional projects. All side channels created would be adjacent to existing riffle complexes and would, as feasible, approximate historic habitat with respect to base flow ranges and other environmental conditions. Side channel flows would probably range between 10 and 75 cfs and should be designed to provide appropriate depth, velocity, substrate, and in-stream and riparian cover. The Channel Improvement Program would include monitoring of use by target species and annual reports describing the monitoring and implementation of Program activities would be submitted to the EC for review.

Structural Habitat Supplementation and Improvement Program (SA Article A104)

The Oroville Facilities currently block the upstream contribution of large woody debris (LWD) in the lower Feather River, contributing to the reduction in structural habitat and habitat complexity. The Structural Habitat Supplementation and Improvement Program is designed to address the need to provide habitat complexity in the lower Feather River, particularly in the LFC. The primary target for these actions would be steelhead and spring-run Chinook salmon juveniles. The Proposed Project would create additional cover, edge, and channel complexity through the addition of LWD, boulders, and other native objects. LWD includes multi-branched trees at least 12 inches in diameter at chest height and a minimum of 10 feet in length with approximately 50 percent of the structures containing intact root wads. Placement would be within the Feather River to maximize the instream benefit at lowest minimum flow. Safety issues will be addressed to minimize risk to human safety.

Structural Habitat Supplementation and Improvement Plan

The Proposed Project includes development of a Structural Habitat Supplementation and Improvement Program Plan in consultation with the EC. The Plan would include an analysis of safety issues to avoid unreasonable risk to safety of river users. Annual summary reports describing monitoring and implementation of Plan activities would be prepared by DWR for EC review and would be part of the 5-year Lower Feather River Habitat Improvement Plan Report.

Fish Weir Program (SA Article A105)

The presence of Oroville Dam and other upper Feather River dams and associated facilities block passage of migratory fishes and cause spring-run and fall-run Chinook salmon to share spawning habitat in the lower Feather River. The reduced amount of spawning habitat available in the lower river results in an increased rate of redd superimposition (subsequent spawning on top of an existing redd) that causes increased rates of egg and alevin mortality. The Proposed Project includes a Fish Weir Program whereby two fish barrier weirs would be installed in phases; the first-phase weir would be used to determine the abundance of phenotypic spring-run and steelhead in the LFC, after which a second weir would be installed that would spatially separate

spring-run and fall-run in the LFC to create a dedicated spawning area to protect the spring-run Chinook salmon.

Phase 1 of the Fish Weir Program includes monitoring and data collection over a period of time sufficient to allow for the collection of adequate baseline information on the migration timing and abundance of Chinook salmon and steelhead adults in the LFC necessary to develop the Phase 2 segregation weir plan. The location selected for the implementation of the second-phase fish segregation weir would be designed to isolate and dedicate an amount of spawning habitat adequate to meet the spring-run Chinook salmon population quantified in Phase 1. Phase 2 would also evaluate the installation of an egg-taking station, if appropriate, to collect fall-run Chinook salmon eggs for transport to the Feather River Fish Hatchery. DWR would compile annual reports into the 5-year Lower Feather River Habitat Improvement Plan Report.

Riparian and Floodplain Improvement Program (SA Article A106)

Under the Proposed Project, DWR would investigate and implement projects to improve riparian habitat and habitat for associated terrestrial and aquatic species and connect portions of the Feather River to its floodplain within the OWA. The Riparian and Floodplain Improvement Program would be implemented in four phases by DWR in consultation with the EC and resource agencies. Phase 1 consists of a screening level analysis of potential projects and identification of the recommended alternative. In the screening level analysis, higher priority would be given to those projects that maximize benefits for all species and habitats, including restoring riparian vegetation and the riparian corridor, restoring habitat for terrestrial species, reconnecting the river to its floodplain, and restoring and enhancing riparian and channel habitat for fish and other aquatic species. Phase 2 consists of implementing the Phase 1 recommended alternative. Phase 3 would reevaluate other potential feasible projects including those considered under Phase 1 and identify a Phase 3 alternative. Phase 4 consists of implementing the Phase 3 alternative. The full scope of the recommended alternative as well as design, project level environmental documentation for any physical changes proposed, permitting, and construction, is dependent on the gravel value and potential extraction processes that will define the timing and magnitude of the Program.

Lake Oroville Warm Water Fishery Habitat Improvement Program (SA Article A110)

Under the Proposed Project, DWR would develop a Lake Oroville Warm Water Fishery Habitat Improvement Program. This program would be similar to the existing program designed to improve the warmwater fish habitat in Lake Oroville that supports warmwater game fish such as black bass and channel catfish. The Lake Oroville Warm Water Fishery Habitat Improvement Program would increase and/or improve the structural complexity of the Lake Oroville fluctuation zone, which provides benefits to warmwater fish that use these areas for spawning and rearing, by constructing habitat with materials such as boulders, weighted pipes, riprap, vegetation and woody material, and artificial structures designed for fish habitat.

The program would be implemented over the license term in 7-year intervals. Within each 7-year interval, DWR would construct, on average, at least 15 "habitat units" during each of the 7 years. A "habitat unit" refers to a quantifiable measure of fish habitat and may include placement of brush shelters, flood-tolerant trees and annual grasses, and channel catfish spawning structures. An evaluation of site-specific conditions such as slope, soil type, exposure, access, and other factors would determine the specific placement and type of structure.

Brush shelters are common black bass spawning areas and would typically be constructed using various materials including discarded Christmas trees, trees/brush cut from the upland areas near Lake Oroville, and artificial habitat structures made of plastic. These materials would be anchored to the lakebed using steel fence posts, concrete blocks, or other suitable materials and would be typically installed in clusters in the back of coves with shallow sloping banks.

Flood-tolerant trees such as willow and buttonbush would be planted in the fluctuation zone in the 850- to 890-foot msl elevation range. These trees can survive periodic inundation as well as dry conditions found in the fluctuation zone, and once established, would provide large amounts of structural complexity over a long period of time. Annual grasses that germinate in the fall and grow during the winter could also be planted to provide microcover for juvenile fish.

Channel catfish spawning structures would primarily involve the placement of 3- to 4-foot sections of 9- to 18-inch diameter concrete and PVC pipe. Rock rubble and other materials that create similar cavities may also be used and would be placed in the same areas identified for brush shelters.

Within the first year of each 7-year interval, DWR would prepare a plan for the habitat improvement projects to be completed during that interval and present it to the EC for comments and recommendations. Success of these projects would be evaluated through monitoring and fish utilization assessments. Habitat units would be assessed for their durability, longevity, cost-effectiveness, and fish use monitored through snorkel surveys, electrofishing, creel surveys, or other suitable methods. Informational reports of the monitoring results would be provided to FERC every 2 years summarizing the habitat units completed over that time period, except during the final year of each 7-year period when a summary report for the entire 7-year period would be submitted to FERC. These reports would be provided to the EC for review and comment before submission to FERC.

Lake Oroville Cold Water Fishery Improvement Program (SA Article A111)

Under the Proposed Project, DWR would develop and implement a Lake Oroville Cold Water Fishery Improvement Program, similar to the existing fish stocking program designed to support a coldwater sport fishery at a level that is desirable to Lake Oroville anglers. Through the Lake Oroville Cold Water Fishery Improvement Program, DWR

would stock coldwater fish in Lake Oroville to improve the sport fishery, which should increase recreational opportunities and tourism at the reservoir.

Coldwater Fisheries Management Plan for Lake Oroville

Within 1 year of license issuance, DWR would develop a Coldwater Fisheries Management Plan for Lake Oroville in consultation with the EC. The plan would provide for the stocking, management, and monitoring of salmonids at approximately the same level of stocking as under the existing FERC license, which is 170,000 (+/- 10 percent) yearlings (or their equivalent) per year. The plan would focus on the first 10 years of coldwater fish stocking, and would be revised every 10 years thereafter. DWR would submit a monitoring report to the EC for review and recommendations every 2 years, before filing the report with FERC.

Oroville Wildlife Area Operations (SA Articles A115, A116, and Sections B106 and B107)

The OWA is currently managed pursuant to the Oroville Wildlife Area Management Plan prepared in 1978. Under the Proposed Project, within 2 years of license issuance, DWR in coordination with DFG, DPR, and USFWS, and in consultation with the EC, would develop and submit to FERC for approval an Oroville Wildlife Area Management Plan, including Thermalito Afterbay.

Oroville Wildlife Area Management Plan (SA Article A115)

The Oroville Wildlife Area Management Plan would include 11 components designed to comply with conservation measures contained within the Draft Terrestrial BA, minimize current and future conflicts between wildlife and recreation, meet wildlife management goals and objectives, identify agency management and funding responsibilities, manage invasive plants, and utilize best management practices including fuel load management to reduce fire risk to surrounding areas.

The Oroville Wildlife Area Management Plan would be reviewed every 5 years after initial implementation. The Recreation Advisory Committee would have an opportunity to provide input, consistent with recreation measures within the OWA outlined in the Recreation Management Plan.

As part of the SA, DFG agreed to use its best efforts to obtain adequate funding to develop the Oroville Wildlife Management Plan as described (SA Section B106). Additionally, there is currently a speed limit regulation of 5 mph on all of Thermalito Afterbay, but this regulation is rarely enforced. DFG agreed to make a recommendation to the California Fish and Game Commission to rescind the speed limit for that portion of Thermalito Afterbay south of SR 162 (SA Section B107).

Oroville Wildlife Area Access (SA Article A116). The Proposed Project includes reasonable access for hunting and fishing in the OWA, except where such access poses safety, security, operational risks, or adverse environmental impacts, and subject

to applicable State and federal hunting and fishing regulations and other reasonable conditions.

Draft Terrestrial Biological Assessment Actions (SA Articles A117–A121)

Protection of Vernal Pools (SA Article A117)

As part of the Proposed Project, DWR would continue conservation measures required by USFWS contained within the Draft BA to protect vernal pool invertebrate habitat within the FERC Project boundary. DWR implemented the following actions after informal consultation with USFWS and studies conducted during the ALP identified off-road vehicle damage to vernal pool habitats capable of supporting federally listed invertebrates and plants. DWR's responsibilities in the Final BO issued by USFWS would include continuation of the following actions:

- The installation and maintenance of signage in coordination with DPR and DFG;
- Inspection and prompt maintenance of vehicular barriers (primarily existing fences) in coordination with DPR and DFG; and
- Continuation of existing patrol and enforcement of vehicular closures in coordination with DPR and DFG.

If the conservation measures implemented are deemed to be unsuccessful in protection of the species within the FERC Project boundary, DWR would coordinate with USFWS to develop and possibly implement additional or alternative conservation measures to protect the species.

Minimization of Disturbances to Nesting Bald Eagles (SA Article A118)

As part of the Proposed Project, DWR would continue conservation measures required by USFWS contained within the Draft BA for any bald eagle management plans, which would be filed with FERC for approval. Several bald eagle nest territories exist within the FERC Project boundary and nest territory management plans would be developed through the informal consultation process to minimize or avoid recreational impacts on nesting bald eagles. These plans are site-specific and would evaluate factors related to type, frequency, location, timing, duration, and magnitude of potential recreation disturbance. Site-specific conservation measures would be developed that identify allowable activities within primary and secondary zones. These conservation measures would be designed to minimize or avoid recreational disturbance displacement and may include seasonal closure of existing facilities, relocation of recreational facilities, shoreline closures, and habitat protection measures.

Protection of Giant Garter Snake (SA Article A119)

As part of the Proposed Project, DWR would continue conservation measures required by USFWS contained within the Draft BA to protect giant garter snakes within the FERC

Project boundary. DWR's responsibilities in the Final BO issued by USFWS would include:

- Notification and consultation with USFWS before initiating any activities in certain areas of the OWA that would significantly affect the quality or extent of the high-value giant garter snake habitat;
- Minimization of activities that disturb, destroy, fragment, or otherwise modify habitat within 200 feet of giant garter snake wetland habitat;
- Avoidance of certain rodent control activities in designated giant garter snake wetlands habitat;
- Restriction on methodologies for nonnative or noxious weed removal;
- Development and implementation of a public education program; and
- Restriction of dog-training field exercises in the Thermalito Afterbay area.

If the conservation measures implemented were deemed to be unsuccessful in protection of the species within the FERC Project boundary, DWR would coordinate with USFWS to develop and possibly implement additional or alternative conservation measures to protect the species.

Protection of Valley Elderberry Longhorn Beetle (SA Article A120)

As part of the Proposed Project, DWR would implement conservation measures contained in the Draft BA to protect the valley elderberry longhorn beetle within the FERC Project boundary. It is anticipated that DWR's responsibilities in the Final BO issued by USFWS would include such measures as maintaining the same amount and quality of beetle habitat that now exists within the FERC Project boundary, based on DWR's 2004 habitat mapping, and BMPs and other protective measures to ensure that elderberry plants are not inadvertently treated with herbicides or otherwise harmed during nonnative and noxious plant control activities. If the conservation measures implemented were deemed to be unsuccessful in protection of the species within the FERC Project boundary, DWR would coordinate with USFWS to develop and possibly implement additional or alternative conservation measures to protect the species.

Protection of Red-Legged Frog (SA Article A121)

As part of the Proposed Project, DWR would implement conservation measures contained in the Draft BA to protect the red-legged frog within the FERC Project boundary. DWR, in coordination with USFWS, would annually evaluate and report on the effectiveness of the conservation measures to FERC for information purposes. If the conservation measures implemented were deemed to be unsuccessful in protection of the species within the FERC Project boundary, DWR would coordinate with USFWS to develop and possibly implement additional or alternative conservation measures to protect the species.

Construction and Recharge of Brood Ponds (SA Article A122)

The Proposed Project includes the construction of four waterfowl brood ponds within Thermalito Afterbay. DWR would develop a plan in conjunction with DFG and in consultation with the EC to be submitted to FERC for approval. The plan would include the construction of 4 waterfowl brood ponds within the first 20 years following license acceptance. The ponds would be constructed by creating a small earthen berm across an inlet in Thermalito Afterbay. As part of the plan, DWR would maintain adequate water surface elevations within the existing and future brood ponds by sufficiently filling the ponds no later than April 15 of each year and by ensuring that once filled, the water surface level of the ponds does not fluctuate more than 1 foot throughout the waterfowl brooding season of April 15 through July 31. DWR would recharge waterfowl brood ponds every 3 weeks during this time period. DWR would recharge the brood ponds at least monthly for the giant garter snake between April 1 and October 31 each year.

Provision of Upland Food for Nesting Waterfowl (SA Article A123)

The Proposed Project includes a total of 60–70 acres of upland/cover/forage crops to be prepared and planted on an annual basis to support upland game birds and wintering waterfowl within the Thermalito Afterbay portion of the OWA on a rotational basis. The DFG habitat improvement practice of planting and fertilizing wildlife forage crops in upland areas around Thermalito Afterbay for upland game species, migratory and resident waterfowl would be continued. DWR would continue the DFG practice of dry land farming rather than irrigated farming to produce forage crops.

Provision of Nest Cover for Upland Waterfowl (SA Article A124)

As part of the Proposed Project, DWR would actively manage 240 acres of waterfowl nest cover, including preparing and planting 60 acres and fertilizing an additional 180 acres annually within the Thermalito Afterbay portion of the OWA on a rotational basis. DWR would continue the DFG practice of dry land farming rather than irrigated farming to produce cover crops.

Installation of Wildlife Nesting Boxes (SA Article A125)

The Proposed Project includes the installation and maintenance of 100 wildlife-nesting boxes in suitable habitat within the project area to improve wood duck production.

Comprehensive Water Quality Monitoring Program (SA Article A112)

The Proposed Project includes development of a Comprehensive Water Quality Monitoring Program intended to expand the existing program for data collection to document water quality conditions in project-affected waters, including contributions from upstream sources, limnologic changes occurring within the project impoundments, pathogen levels at recreation sites, effects of project operations on the Feather River thermal regime, and long-term effects of the project on water quality from present and future operations.

Within 6 months following FERC license issuance, DWR, in consultation with the EC, SWRCB, Central Valley RWQCB, and Butte County Health Department, would begin preparation of a draft initial Water Quality Monitoring Program designed to track potential changes to water quality associated with the project, and to collect data necessary to develop a water quality trend assessment through the life of the new FERC license. The draft initial Water Quality Monitoring Program would focus on the identification of those organic and inorganic constituent and physical parameter levels that may affect beneficial uses for surface waters. Following the consultation and within 9 months of FERC license issuance, DWR would submit the draft initial Water Quality Monitoring Program to the SWRCB for review and approval. Upon approval from the Chief of the Division of Water Rights, SWRCB, DWR would file the program with FERC for approval. Upon FERC approval, DWR would implement the initial Water Quality Monitoring Program, including any changes required by FERC. In each of the first 5 years of the initial program, DWR would collect, analyze, and compile the water quality data into annual reports that would be provided to the EC and Butte County Health Department.

Following completion of all data collected for year 5, DWR would compile a summary report of the initial program, which would be provided to FERC, the EC, Butte County Health Department, and any other entity upon request. A 45-day notice would accompany the report, inviting all recipients to attend a water quality meeting scheduled by DWR to discuss the findings of the 5-year data set. After consultation, DWR would submit recommendations for a final Comprehensive Water Quality Monitoring Program to the SWRCB for review and approval. Upon approval from the Chief of the Division of Water Rights, SWRCB, DWR would file the final Comprehensive Water Quality Monitoring Program with FERC for approval. Upon FERC approval, DWR would implement the final Comprehensive Water Quality Monitoring Program, including any changes required by FERC.

Water Chemistry Monitoring Plan

Within 6 months of FERC approval of the final Comprehensive Water Quality Monitoring Program, DWR would begin implementation of the Water Chemistry Monitoring Plan component of the program including monitoring at 15–20 locations 4 times (seasonally) each year for in-situ physical parameters such as water temperature, dissolved oxygen, pH, specific conductivity, and turbidity. Monitoring at 15–20 sites twice per year would evaluate nutrients, such as nitrate plus nitrite, ammonia, organic nitrogen, dissolved orthophosphate, and total phosphorus, as well as minerals including calcium, sodium, potassium, magnesium, sulfate, chloride, boron, and alkalinity. DWR would monitor 18–22 locations 4 times (seasonally) each year for metals including aluminum, arsenic, cadmium, chromium, copper, iron, lead, manganese, nickel, selenium, silver, zinc, and mercury. Locations for metal sampling would include developed marinas and other sites within Lake Oroville, the Diversion Pool, Thermalito Forebay, Thermalito Afterbay, the LFC, Mile Long Pond, and the Feather River at the southern FERC Project boundary. DWR would also monitor two locations two times a year for phytoplankton and zooplankton as part of the water quality assessment in Lake Oroville and Thermalito Afterbay.

Fish Tissue Bioaccumulation Monitoring Plan

Within 3 years of FERC approval of the final Comprehensive Water Quality Monitoring Program, DWR would begin implementation of the Fish Tissue Bioaccumulation Monitoring Plan. DWR would collect resident fish species from 7 locations within project waters once every 5 years and analyze tissue for metals and organic compounds. The sampling strategy for target species, sampling locations, and analytical methods would be consistent with SWRCB's Surface Water Ambient Monitoring Program needs and would be determined through consultation with SWRCB, the Office of Environmental Health Hazard Assessment (OEHHA), Central Valley RWQCB, USFWS, NMFS, DFG, and the EC before each sampling year. Constituents to be analyzed include metals and organic compounds.

Recreation Site Water Quality Monitoring Plan

Within 6 months of FERC approval of the final Comprehensive Water Quality Monitoring Program, DWR would begin implementation of the Recreation Site Water Quality Monitoring Plan. DWR would conduct bacteriological monitoring at 12–16 locations within project waters each summer season consistent with the Basin Plan objectives for protection of beneficial uses. Potential sampling locations include developed beach areas, marinas, boat launch locations, and high-use dispersed beach and shoreline locations in all waters affected by project operations. The list of bacteriological sampling locations would always include North Forebay Cove and South Forebay Swim Area, in addition to sampling at 10–14 annually rotating stations. Additionally, at the North Forebay Beach area, individual screening samples would be collected four times (seasonally) throughout the year. Analysis for pathogens would include total coliform, fecal coliform, E. coli, and enterococcus, or other representative bacterial species consistent with any future amendment to the Basin Plan objectives.

DWR would also monitor six locations—Bidwell Marina, Lime Saddle Marina, Foreman Creek Boat-in Campground, Spillway BR/DUA, Oroville Dam, and Monument Hill—for petroleum products in project waters. Monitoring would occur once each month from June through September and once after the first three significant storm events. Field sampling methods would include collection of both surface and bottom samples at each location and would be analyzed for total petroleum hydrocarbons, methyl tertiary butyl ether (MTBE), and benzene.

The Proposed Project includes an annual inspection by DWR of trails between May 1 and May 15 and following summer recreation season to identify soil erosion and potential subsidence into reservoirs or flowing waterways associated with the project.

Water Temperature Monitoring Plan

Within 3 months of FERC approval of the final Comprehensive Water Quality Monitoring Program, DWR would begin implementation of the Water Temperature Monitoring Plan to provide information that demonstrates compliance with the Feather River Fish

Hatchery water temperature requirements, the Operations Criteria and Plan Biological Opinion and Basin Plan water quality standards. DWR would install four permanent continuous temperature-monitoring devices at the following locations:

- Feather River Fish Hatchery aeration tower;
- Robinson Riffle;
- Thermalito Afterbay Outlet; and
- The Feather River adjacent to the southernmost FERC Project boundary.

These monitoring devices would be capable of providing real-time temperature data to the Feather River Fish Hatchery operators and to the public via an Internet-based medium and would remain operational throughout the life of the license.

The Water Temperature Monitoring Plan would be reviewed after 5 years to determine whether modifications to the Comprehensive Water Quality Monitoring Program are necessary for consistency with measures that may be implemented following decisions on water temperature management in the LFC and the HFC. DWR would also install and collect temperature data from temporary continuous recording devices at appropriate locations to provide additional data necessary for modeling or study associated with potential facility modifications under consideration during the Flow/Temperature Reconnaissance Study and subsequent Feasibility Study.

Water Quality Bioassay Monitoring Plan

Within 3 months of FERC approval of the final Comprehensive Water Quality Monitoring Program, DWR would begin implementation of the Water Quality Bioassay Monitoring Plan. DWR would collect water column samples from 2 locations in the LFC 4 times (seasonally) in a single year, every 5 years to conduct bioassay tests on aquatic organisms. Field sampling and laboratory analysis would be consistent with methods recognized by the SWRCB's Ambient Monitoring Program and would include the aquatic organisms Ceriodaphnia and Fathead minnow.

Aquatic Macroinvertebrate Monitoring Plan

Within 1 year of FERC approval of the final Comprehensive Water Quality Monitoring Program, DWR would begin implementation of the Aquatic Macroinvertebrate Monitoring Plan. DWR would collect benthic macroinvertebrate samples from a minimum of 7 stream locations during the fall index period one time every 3 years. Field sampling, laboratory identification, and statistical analysis would be consistent with the California Stream Bioassessment Procedures used by DFG or subsequent methodologies acceptable to the SWRCB's Ambient Monitoring Program and DFG. A minimum of four sites would be located in the LFC and one site would be located in the HFC at the southernmost FERC Project boundary. After construction of side channel habitat as part of the Lower Feather River Habitat Improvement Program, sampling

sites representative of each channel would be added to the Aquatic Macroinvertebrate Monitoring Plan.

Monitoring of Bacteria Levels and Public Education (SA Article A113)

Under the Proposed Project, DWR in coordination with other agencies would perform monitoring for fecal coliform, enterococcus bacteria, and other bacterial indicators as required by the Basin Plan from June 1 through September 30 at developed and popular undeveloped swim areas within the FERC Project boundary and, upon input from appropriate agencies, place notices notifying the public if unsafe levels of bacteria are present in the water. Locations to be included in the monitoring are the North Thermalito Forebay recreation area, South Thermalito Forebay recreation area, Loafer Creek recreation area, Monument Hill recreation area, Lime Saddle recreation area, Foreman Creek boat launch area, Stringtown boat launch area, and Mile Long Pond. Monitoring would be performed as required in the applicable Basin Plan and monitoring information would be shared with the Recreation Advisory Committee (RAC). DWR would promptly provide monitoring information to appropriate public agencies and confer with them on additional measures that may be necessary to inform and educate the public about bacteria levels in project waters. In addition, DWR, in consultation with the relevant public health agencies and the SWRCB and Central Valley RWQCB, would determine if a public education program designed to inform the public about potential sources of bacteria in the water is necessary.

Public Education Regarding Risks of Fish Consumption (SA Article A114)

Under the Proposed Project, DWR, in consultation with OEHHA, the SWRCB, and the Central Valley RWQCB, would post notices at all boat ramps and other locations within the FERC Project boundary notifying the public about health issues associated with consuming fish taken from within project waters. DWR would also provide funding to OEHHA to facilitate the publishing of written materials notifying the public about health issues associated with consuming fish taken from within project waters.

Invasive Plant Management (SA Article A126)

As part of the Proposed Project, within 1 year of license issuance DWR would develop a plan to manage and reduce target noxious nonnative and native plant species populations within the FERC Project boundary and on or affecting National Forest System (NFS) lands that would be submitted to FERC for approval. The management plan would be developed in conjunction with USFS, BLM, DFG, and DPR. Before submittal to FERC, DWR would submit the portion of the plan pertaining to NFS lands to USFS for approval; submit the portion of the plan pertaining to BLM lands to BLM for approval; submit the portion of the plan pertaining to DFG lands to DFG for approval; and submit the portion of the plan pertaining to DPR lands to DPR for approval. The EC would have the opportunity to provide input and comment on the plan. The plan would identify specific species, areas, acreages, and treatment methods and would include a monitoring program that would include surveys to inventory and map target weed

species and assess the effectiveness of control methods. The plan would specifically address but not be limited to the following species:

- Purple loosestrife (*Lythrum salicaria*)
- Giant reed (*Arundo donax*)
- Tree of heaven (*Ailanthus altissima*)
- Scarlet wisteria (*Sesbania punicea*)
- Parrot feather (*Myriopyllum aquaticum*)
- Himalayan blackberry (*Rubus discolor*)
- Aquatic primrose (*Ludwigia peploides*)
- Yellow starthistle (*Centaurea solstitialis*)
- Spanish broom (*Spartium junceum*)
- French broom (*Genista monspessulana*)
- Scotch broom (*Cytisus scoparius*)
- Skeleton weed (*Chondrilla juncea*)

The plan would be reevaluated as necessary.

Forest Service Section 4(e) Conditions (Appendix E of the SA)

USFS provided Final Section 4(e) Terms and Conditions in accordance with 18 Code of Federal Regulations 4.34(b)(1)(i) and Recommendations as allowed under Section 10(j) of the Federal Power Act. These Terms, Conditions, and Recommendations are included in the SA as Appendix E and are provided in Appendix A1 of this DEIR. The Terms and Conditions are based on the Land and Resource Management Plan for the Plumas National Forest and portions of the Lassen National Forest administered by the Plumas, as approved by the Regional Forester of the Pacific Southwest Region. All Terms, Conditions, and Recommendations included in the Final 4(e) conditions to be incorporated during development of Plans, Programs, and other relevant actions described in the SA involving Forest System lands, are further described below.

Pesticide Use Restrictions on National Forest System Lands

In accordance with USFS Final Section 4(e) conditions, pesticides would not be used on NFS lands or in areas affecting NFS lands to control undesirable woody and herbaceous vegetation, aquatic plants, insects, rodents, undesirable fish, or other pests without prior written approval of USFS. If pesticide use were proposed on NFS lands, DWR would submit a request for approval of planned uses. The request would cover

annual planned use and be updated as required by USFS. Only materials registered by the U.S. Environmental Protection Agency for the specific use planned would be used. As an alternative, DWR could provide an Integrated Pest Management Plan that would describe planned pesticide use on NFS lands on a regular basis.

Protection of USFS Special-Status Species

As part of the Proposed Project, before taking actions to construct new project features on NFS lands that may affect USFS special-status species or their critical habitat, DWR would prepare a biological evaluation, assessing the potential impact of the action on the species or its habitat, and submit it to USFS for approval. The evaluation would include procedures to minimize adverse effects on special-status species; ensure that project-related activities would meet restrictions included in site management plans for special-status species; and develop implementation and effectiveness monitoring of measures taken or employed to reduce effects on special-status species.

Invasive Weed Management

Under the Proposed Project, within 1 year of license issuance DWR would develop and file for FERC approval a plan to manage and reduce native and non-native invasive plant species populations on or affecting NFS lands. This plan is intended to be consistent with the Invasive Plant Management Plan described above. FERC approval to use pesticides for noxious weed control constitutes the approval required by USFS.

Fire Prevention, Response, and Investigation

Under the Proposed Project, within 1 year of license issuance DWR would develop and file for FERC approval a Fire Prevention and Response Plan for NFS lands. This plan would identify DWR's responsibility for the prevention, reporting, control, and extinguishing of fires in the vicinity of the Project resulting from project operations. Fire prevention needs would also be analyzed.

Heritage Resources

Under the Proposed Project, within 1 year of license issuance DWR would develop and file for FERC approval an HPMP to protect and interpret heritage resources located on NFS lands. The HPMP would include consultation with appropriate entities and would define the areas of potential effects. The HPMP would also identify measures to mitigate potential impacts, including a monitoring program, and management protocols to protect archaeological properties.

Recreation Facilities and Operations (SA Recreation Management Plan, SA Article A127)

Recreation Facilities—General

The Proposed Project includes measures recommended through the collaborative relicensing process after reviewing results of the Recreation Needs Analysis (DWR 2004a) and through the subsequent development of the RMP (DWR 2006) included as a part of the SA and provided in Appendix B of this document. Under the Proposed Project, recreation facilities in the project area would be upgraded and modernized over the term of the new license to address current needs identified in the Recreation Needs Analysis and to address future needs based on monitoring as described in the RMP. Actions contained within the RMP focus on water- and reservoir-based recreation resources within the FERC Project boundary that are under authority of DWR as the licensee of the Oroville Facilities.

In general, the Proposed Project would result in recreation facility changes that would improve accessibility; provide additional and improved day use facilities, trails and trail facilities, parking areas, group day use shelters, picnic tables, sanitation facilities, and provide for campground expansion and/or improvements at Bidwell Canyon, Loafer Creek, the Thermalito Afterbay Outlet, and the floating campsites. The Proposed Project would also enhance boating facilities (including increased access during times of low reservoir level) and develop two ADA accessible bank-fishing piers (South Thermalito Forebay and Diversion Pool). Programmatic elements of the RMP are described below, followed by descriptions of site-specific actions arranged by geographic location within the project area.

Programmatic Elements of the RMP

The Recreation Advisory Committee

The RMP does not make management or resource commitments for other entities such as federal and State agencies, Tribes, or other stakeholders. However, the continued active involvement of these other recreation participants in the project area is important in helping to meet the overall recreation needs of visitors and area residents during the term of the new license. The RMP includes formation and support of an RAC, to be formed within 6 months of license issuance. Membership on the RAC would include local governments, two at-large public representatives, relevant State agencies, and DWR, among others. The RAC would periodically review recreational usage monitoring data for project facilities and would recommend modifications to the RMP over time throughout the term of the new FERC license. Recreational use data, reports, and recommendations made by the RAC would be provided to FERC every 2 years. Specific information related to the organization, membership, and scope of the RAC is included in Section 4.4 of the RMP. The RAC would replace the Oroville Recreation Advisory Committee (ORAC), established during the previous FERC license. As such, coordination and cooperation with these participants would continue as defined in the RMP and in large part through the formation and continued activities of the RAC.

The License Coordination Unit

Meetings of the RAC would be one of the activities coordinated through the newly formed DWR License Coordination Unit (LCU) to be located in Oroville at the Oroville Field Division. Initially DWR, through the LCU, would also facilitate community workshops twice per year in the City of Oroville or in the Oroville area to inform the community on progress of projects associated with FERC license requirements, reservoir conditions, operations, and other issues related to implementation of the RMP. The LCU would also be responsible for maintaining a web-based bulletin board, updated monthly or as needed with project status reports, milestones, community events, license events, community workshop notes, and RAC summaries.

Coordinated Roles and Responsibilities

Through the RMP, the Proposed Project clarifies the role of DPR, DFG, the California Department of Boating and Waterways (DBW), and other entities to carry out DWR's responsibility for managing, maintaining, and developing recreational resources within the FERC Project boundary. The Proposed Project would resolve existing conflicts between wildlife management objectives and recreational activities in the OWA in coordination with DPR, DFG, and other appropriate agencies by developing a comprehensive description of recreation and wildlife management priorities and responsibilities, including specific recommendations contained within the RMP.

Law Enforcement

The RMP clarifies the roles of the various entities with enforcement responsibilities for facilities within the FERC Project boundary and clearly defines the enforcement responsibilities to ensure the safety of recreation users and protection of environmental resources in the FERC Project boundary.

Recreation Implementation Plan

Within 1 year of license issuance, DWR will file a Recreation Implementation Plan with FERC. The plan will include a schedule for recreation development and implementation of the SA RMP for the first 12 years of the new license term, as well as results of consultation with the RAC.

Recreation Facility Development Program

The Recreation Facility Development Program focuses on upgrading existing recreation facilities and constructing new recreation facilities, when appropriate, based on documented needs and associated monitoring results. This program defines construction-related responsibilities of DWR, identifies proposed development projects and their estimated costs, provides conceptual site diagrams, and defines facility development standards and design criteria through seven program elements covering facility development and upgrades, development locations, design guidelines and approvals, ADA compliance, NEPA/CEQA compliance and environmental project

review/permitting, agency and public review, and construction coordination, scheduling, and phasing.

Resource Integration and Coordination Program

This program is a formalized process whereby DWR would make coordinated, timely, and informed decisions related to implementation of the SA RMP and other project-related resource management plans. The program includes elements designed to encourage and enhance ongoing communication and coordination among agencies and stakeholders with DWR such as regularly scheduled community workshops, a web-based bulletin board, and a dispute resolution process.

Recreation Monitoring Program

Monitoring activities are described in a Recreation Monitoring Program included in the RMP that details data collection process methodology, indicators, and standards that trigger when proposed capital measures and O&M-related measures would be implemented over the course of the license. Additional measures that may be considered in the future should use triggers be met are outlined in the RMP and include additional campsites, parking facilities, and various improvements at day use areas.

Plan Review and Revision Program

The Plan Review and Revision Program is designed to address changes in recreation or resource conditions that are expected over time as recreational needs, visitor preferences and attitudes, new recreation technologies, and other resource issues arise over the course of the new license term. DWR will determine the frequency of RMP updates, which are expected to occur no more than once about every 12 years.

Interpretation and Education Program

The Proposed Project includes development of a project-wide Interpretation and Education (I&E) Program as described in the RMP to include measures such as the installation of additional interpretive and educational signage at various locations within the FERC Project boundary and the provision of timely information to boaters regarding changing access and reservoir conditions and alternative boating facility availability. Educational signage at the Feather River Fish Hatchery would be considered under the RMP I&E Program. The Proposed Project also includes development of interpretive and informative signage at various locations within the FERC Project boundary consistent with the program described within the HPMP.

Another element of the proposed I&E Program is the installation of new directional signs at various locations within the FERC Project boundary to help the public locate recreation sites. DWR would use the website to promote the recreation facilities consistent with other SWP facilities.

Operations and Maintenance Activities

The RMP includes measures to address continued O&M and monitoring at existing and new recreation sites, periodic recreation monitoring through the term of the new license, the identification of additional measures to be undertaken should use triggers be met or as concessionaire contracts are renegotiated, and compliance with ADA requirements and other applicable regulations. Project-wide operations and maintenance activities described in the Proposed Project include increased debris removal at boat ramps and adjacent recreation facilities, more frequent adjustment of floating docks, and the commitment to provide information to boaters about substitute boating facilities and reservoir conditions. In addition, the LCU located at the Oroville Field Division would facilitate license compliance activities.

Project Supplemental Benefits Fund (SA Section B100)

As a non-license commitment under the SA, the Proposed Project includes establishment of a Project Supplemental Benefits Fund (SBF) intended to allow the benefits of the project to be extended into the local communities in the vicinity of the FERC Project boundary. The SBF would be used solely to support projects outside of the FERC Project boundary and selected subject to provisions contained in Section B100 of the SA. The SBF would be administrated by a Fund Administrator and would include a Steering Committee to provide direction regarding proposed projects to be funded through the SBF. The SBF would receive up to $61,270,000 in unescalated funds through a combination of initial and annual payments as described in the SA. Grant funds would be solicited by the Steering Committee in cooperation with the SWC and local interests and any CEQA documents required for future projects would be completed by a local lead agency.

Recreation Facilities—Equestrian, Bicycle, and Hiking Trails

The Proposed Project identifies a number of trail segment enhancements and additional short shoreline access trails to be constructed throughout the Project area. Figure 3.2-3 in Section 3.2 shows the existing and proposed trail system at the Oroville Facilities. In addition to the actions described below, the Proposed Project includes minor grading improvement to an old construction road at the Lake Oroville scenic overlook on SR 162 and enhancements to trailhead facilities such as horse-watering troughs and hand-washing sinks at Saddle Dam and Lakeland Boulevard locations.

Trails in the Lake Oroville and Oroville Dam Area

The Proposed Project includes several trail improvements or additions within the Lake Oroville area including the construction of short shoreline access trails in the Saddle Dam area, realignment of a portion of the existing Brad Freeman Trail near the Hyatt Pumping-Generating Plant to address security/safety concerns, opening of the Dan Beebe Trail and an existing access road south of the Loafer Creek Equestrian Campground to bicycle use, opening the Bidwell Canyon Trail to equestrian use,

construction of a North Fork shoreline trail extension in Potter's Ravine, and construction of a new hiking and biking trail from the Lime Saddle Campground to the Lime Saddle Marina boat ramp.

Trails in the Low Flow Channel/Feather River Area

The Proposed Project includes a feasibility investigation for constructing a new 2- to 4-mile trail designed primarily for bicycling that would run east/west from Lakeland Boulevard, connecting with a multiple-use segment of the Dan Beebe Trail and/or Brad Freeman Trail near the Diversion Pool. A paved trail from the Fish Hatchery downstream to the FERC Project boundary could also be constructed, provided that another recreation agency constructs a paved trail on the north side of the Feather River from Riverbend Park north to the FERC Project boundary. The Proposed Project would open the Dan Beebe Trail to bicycle use (except the Sycamore Hill trail segment) and would open Burma Road and adjacent portions of the Brad Freeman Trail to equestrian use. The Proposed Project would also consider new non-motorized trail opportunities in Thermalito Forebay (North and South) as a component of the proposed trails program included in the RMP.

Analysis of a Non-motorized Water Trail Shoreline Access

Under the Proposed Project, within 1 year of license issuance DWR would complete an analysis of non-motorized water trail shoreline access opportunities along the Feather River within and in the vicinity of the FERC Project boundary. Suitable sites would be identified and ranked in consultation with the signatories to the SA. DWR would fund and/or construct or improve a total of 2–3 river access sites within 5 years after license issuance. DWR would also work cooperatively with DBW and other appropriate State or local agencies to expand the boating trail opportunities downstream along the Feather River to the Sacramento River confluence or beyond where practical.

Recreation Facilities—Specific Actions at Lake Oroville

Bidwell Canyon Campground, DUA, Boat Ramp, and Marina

The Proposed Project includes measures at Bidwell Canyon designed to expand parking opportunities, maximize boat-launching capacity, and enhance ADA accessibility to the marina. Measures include the expansion of existing parking capacity to include approximately 215 additional parking spaces at Bidwell Marina, of which a minimum of 90 parking spaces would be constructed at the existing location of the Big Pine Campground Loop. Other new parking spaces would be provided at Ramp #2 and at Ramp #3. Expansion of Bidwell Marina parking facilities would necessitate the construction of 30–38 new campsites adjacent to the remaining "Gold Flat" loop to compensate for the loss of campground space displaced for additional parking. If insufficient space were available to replace the 38 campsites currently at the site, up to 15 sites would be added at Loafer Creek Campground.

The Proposed Project includes construction of a new, low-water-access boat ramp at Bidwell Canyon by extending 3 lanes starting at about elevation 750 msl and extending

to elevation 640 msl (reservoir conditions allowing), providing for continued use of Lake Oroville by boaters even during low-water conditions. Bidwell Canyon presents the most feasible location on Lake Oroville for construction of a low-water ramp due to topography, security, and access issues. An additional boating dock planned for Bidwell Marina would improve boat launching/retrieval efficiency. The Proposed Project also would provide one additional boarding dock at the top of the boat ramp to maximize boat-launching capabilities. Changes to the existing concessionaire contract may include a concessionaire-operated campground activity center and store/snack bar in the underutilized group meeting facility and/or provision of additional dry boat storage. The Proposed Project also includes ADA-related upgrades at the marina to improve accessibility between site amenities.

Loafer Creek Campground, DUA, BR, and Equestrian Campground

The Proposed Project includes measures to improve boat launch capacity at Loafer Creek through the addition of a new floating boarding dock. The Proposed Project also includes the construction of a new camp loop for the two new group RV campsites, and enhancement of ADA accessibility at the Loafer Creek Group and Equestrian Campgrounds, the replacement of a restroom, and improved ADA accessibility for picnic areas and swimming beach/cove. A new fish cleaning station connected to existing infrastructure is also included. Up to 15 new RV campsites near or adjacent to the existing Loafer Creek Campground could be constructed here if, after the parking expansion project is completed within the Bidwell Canyon Complex, all 38 RV campsites cannot be reasonably relocated at that location.

The swim beach constructed as part of the original facilities is often inaccessible during a significant portion of the high-use summer season as water levels drop below the beach elevation. A feasibility study would be conducted to evaluate the possibility of providing improved swimming opportunities at either Loafer Creek or Lime Saddle during the primary 4-month recreation season, and if a feasible and cost-effective option were identified from that study, that option would be implemented under the Proposed Project. The Loafer Creek location would receive priority over other locations within the FERC Project boundary, given the existing swim facility at this location. In conjunction with the feasibility study, an evaluation would consider a concessionaire-operated campground activity center and store/snack bar.

The Proposed Project would replace and restore the vandalized portable toilet at nearby Brooks Orchard with a new single-vault toilet building. DWR proposes to widen, grade, and gravel the existing dirt service road at the Loafer Creek DUA to approximately 750 feet msl elevation. The gated service road would then be open to the public when the Loafer Creek Boat Ramp becomes dewatered to allow car-top boat launching within the Loafer Creek Complex.

Lime Saddle Campground, DUA, BR, and Marina

Under the Proposed Project, the existing marina, boat ramp, and day use picnic sites would be updated for enhanced ADA accessibility. DWR would provide one additional boarding dock to supplement the existing marina gangway and dock system. The Proposed Project also proposes to include the Lime Saddle location in the feasibility study to provide new swimming opportunities in the future within the FERC Project boundary during the primary 4-month recreation season.

Under the Proposed Project, 13 older existing picnic tables and pole stoves and 7 existing shade ramadas in the DUA would be upgraded or replaced, and would include ADA accessibility improvements. Ten additional RV campsites and 1 new 6-unit group RV campsite would be constructed, and approximately 60 additional new boat ramp/marina parking spaces would be constructed near the existing parking lot where feasible. DWR may seek transfer of the adjacent PG&E parcel to DWR or DPR for site expansion purposes.

Oroville Dam Overlook DUA

The Proposed Project would provide approximately 100 additional new parking spaces in the Oroville Dam Overlook DUA with ADA-compliant access routes/stairs, 4–5 additional picnic tables with shade ramadas, and interpretive panels.

Spillway BR and DUA

No additional measures are included at this location in the Proposed Project. En-route RV camping at this location would continue, subject to periodic FERC Project security reviews.

Enterprise BR

The Proposed Project includes the development of a low-water boat ramp and boarding dock at Enterprise to meet user demand during a wider range of water level conditions. The existing ramp would be extended to approximately 750 feet msl elevation to provide for boat launching during low-water conditions and a new boarding dock and cable system would be installed. DWR would also construct ten family picnic sites at this location and provide ten gravel parking spaces where feasible. Exact alignment of the ramp and additional facilities would depend on results from cultural resource surveys and engineering studies.

Nelson Bar Car-top BR

No additional facilities are included in the Proposed Project for this location; however, a sign, barrier, and/or gate at the terminus of the boat ramp during lowered reservoir elevations would be installed for safety purposes.

Vinton Gulch Car-top BR

The Proposed Project includes periodic updates to interpretive materials at this site.

Dark Canyon Car-top BR

The Proposed Project includes replacement of the defunct toilet building at this location. Improved directional signage to assist users in locating this site is also included.

Stringtown Car-top BR

This boat ramp uses a remnant of a pre-project road that is now largely inundated by Lake Oroville. Under the Proposed Project, a sign, barrier, or gate would be installed for safety purposes at the unmaintained, abandoned road in the inundation zone. Improved directional signage from the main access road is included in the Proposed Project.

Foreman Creek Area

Due to the large number of archaeological sites in the Foreman Creek area, the HPMP developed for the project area would assist in both redirecting and improving recreational usage to specific areas of Foreman Creek to prevent future damage to historic properties and culturally sensitive areas. The Proposed Project includes redirection of recreational use as recommended in the HPMP and installation of a vault toilet, trash receptacle, and five to ten picnic tables with shade ramadas. Educational measures designed to provide information regarding the protection and preservation of cultural and other sensitive resources at Foreman Creek and other areas within the FERC Project boundary are included in the Proposed Project.

The SA also allows for DWR to seek removal of a small amount of acreage from the Foreman Creek Unit of the LOSRA from the FERC Project boundary for the purpose of making land available to Native American tribes for the purpose of reburial of repatriated human remains.

Lake Oroville Visitors Center

The Proposed Project includes existing visitors center facility enhancements and consideration of potential future facility functions, activities, and uses within the I&E Program as defined in the RMP.

Saddle Dam Trailhead Access

The Proposed Project includes the development of a short trail to provide shoreline access, ten new picnic tables, and a new horse-watering trough and hand-washing sink at this site.

Boat-in Campgrounds

The Proposed Project includes periodic updates of the interpretive materials at these locations. The Foreman Creek boat-in campground may see increased informal day use and overnight walk-in camping during low-water conditions due to proposed modifications to the Foreman Creek Car-top BR and day use facility. Boat-in campgrounds may include periodic closures to boat traffic due to low-water conditions that result in the exposure of cultural resources within the fluctuation zone.

Lake Oroville Scenic Overlook (SR 162 at bridge)

The Proposed Project includes minor trail enhancements along the old construction road and placement of a new trash receptacle and trash pick-up service coordinated with the Berry Creek Citizens Association.

Floating Campsites

The Proposed Project would deploy two new floating campsites in the Lime Saddle area and one new floating campsite in the West or North Fork areas of Lake Oroville. The existing floating campsites would remain at or near their current locations.

Recreation Facilities—Specific Actions at the Diversion Pool

Diversion Pool DUA (Northwest Side of Diversion Pool)

The Proposed Project would provide additional day use facilities, including ten new picnic sites with pole grills along the Diversion Pool. The Proposed Project also includes construction of an ADA-accessible fishing pier or platform at a suitable Diversion Pool location and enhancement of the existing gravel car-top boat access along Burma Road.

Lakeland Boulevard Trailhead Access (Southeast Side of Diversion Pool)

Vehicle access, day use facilities, and parking would be added near the trailhead at Lakeland Boulevard. This includes a gravel car-top boat ramp that would create new access on the south side of the Diversion Pool. Limited day use facilities would include gravel parking area, restroom, ten picnic tables, pole stoves, a non-potable stock-watering trough, and trail access to the water for hikers. Fencing would be installed as appropriate to separate the new access road and proposed day use facilities from the railroad tracks.

Recreation Facilities—Specific Actions at the Low Flow Channel/Feather River

Feather River Fish Hatchery

The Proposed Project includes consideration of a fish-viewing platform in the I&E Program. Additional interpretive signs and/or kiosks and additional interpretive paths would be added consistent with the I&E Program.

Feather River Whitewater Boating Opportunity Feasibility Study (SA Section B101)

As a non-license commitment under the SA, the Proposed Project includes a Whitewater Boating Opportunity and Recreation Feasibility Study to be conducted by DWR to assist the Project Supplemental Benefits Fund Steering Committee in determining whether to fund the construction and operation of such a project or cost share such a project somewhere in the region, pursuant to their funding criteria. The Feasibility Study was designed to build from the results of SP-R16, Whitewater and River Boating Report (DWR 2004b), and includes a scoping process, a review of potential whitewater opportunities within the area including park and non-park options locally and regionally, and constraints including physical, operational, environmental, costs, and permitting. Whitewater demand trends, market feasibility, ownership and management options, and potential direct and indirect economic activity potentially generated by such a facility would also be examined.

Recreation Facilities—Specific Actions at Thermalito Forebay

North Thermalito Forebay Boat Ramp, DUA, Aquatic Center, and "En Route" RV Campground

Under the Proposed Project, DWR would conduct a feasibility study to evaluate warmer water swimming options at this site and at other locations within the FERC Project boundary. It would also consider new non-motorized trail opportunities in Thermalito Forebay as a component of the proposed trails program included in the RMP. The Proposed Project would provide additional limited shoreline access consistent with FESA and CESA species protection and would include installation of a fish cleaning station.

South Thermalito Forebay BR and DUA

The Proposed Project includes the installation of an ADA-accessible fishing pier and additional day use and swimming facilities, a sandy swim beach, additional landscaping and shade trees, and five to ten additional picnic tables with pole grills. The Proposed Project also includes the provision of new trail opportunities in the area as recommended in the RMP.

Recreation Facilities—Specific Actions at Thermalito Afterbay

Wilbur Road BR

Improved directional signage at this location is included in the Proposed Project as a component of the proposed I&E Program.

Larkin Road Car-top BR

The Proposed Project includes installation of 5–10 new picnic tables with pole stoves and shade structures, and a swim beach area with a new swimming buoy line located

approximately 100–200 feet from the shoreline. Directional signs would be posted at key locations along the route to Larkin Road Car-top BR as a component of the proposed I&E Program.

Monument Hill BR and DUA

No additional measures are included in the Proposed Project at this location.

Model Aircraft Flying Facility

No additional measures are included in the Proposed Project at this location.

Recreation Facilities—Specific Actions Within the Oroville Wildlife Area

OWA—Afterbay Outlet BR, DUA, and Campground

The Proposed Project includes construction of an organized designated primitive RV/tent camping facility at the Thermalito Afterbay Outlet within approximately 40 acres adjacent to existing parking and day use areas near the outlet to discourage unauthorized, dispersed camping. Day use facilities, including five to ten picnic tables, vault toilet buildings, and gravel spurs with vehicle barriers would be added near the river but at some distance from the camping facilities. The existing gravel boat ramp would be upgraded to concrete, with paved parking provided. Existing access roads would be regraveled and disturbed areas would be revegetated with native arid landscaping for shade and aesthetics, consistent with wildlife habitat goals. Increased visitor management and enforcement would be implemented to enforce fishing regulations and other use restrictions within the OWA related to project operations. A Wildland Fire Evacuation Plan would be developed and implemented for the OWA.

Directional signs would also be posted at key locations along the route to the Afterbay Outlet BR and campground as a component of the proposed I&E Program. Appropriate boat ramp use restrictions that are necessary for boater safety due to flow conditions at this location would be posted and enforced through access gate closures.

OWA Dispersed River and Pond Access Sites

To improve the aesthetic appearance of the area, the Proposed Project would provide additional trash receptacles and trash pick-up at locations where trash accumulation is an issue within the OWA. Regulatory and educational signage detailing illegal fishing and consequences would be posted at Feather River locations within the OWA. These measures would be coupled with increased enforcement of regulations within the OWA and would include the use of vehicle barriers to further limit illegal access to selected areas within the OWA. The dispersed sites would be monitored for use and effects consistent with the RMP. DWR would coordinate with DFG to maintain and enhance existing access opportunities for traditional uses (hunting, fishing) within the OWA.

Two ADA-accessible Watchable Wildlife sites would be constructed and operated within the OWA to increase wildlife viewing opportunities.

Dispersed Use Sites Outside the OWA

The Proposed Project would include periodic monitoring for new dispersed use sites within the project area but outside of the OWA. New sites would be identified with the goal of managing the sites before degradation or damage occurs.

Operations for the Protection of Cultural Resources

Historic Properties Management Plan (SA Article A128)

Under the Proposed Project, measures for the protection of or mitigation for the ongoing project effects on cultural resources are proposed within the draft HPMP. The draft HPMP was developed in compliance with the requirements of Section 106 of the National Historic Preservation Act (NHPA) and in consultation with Native American Tribes, USFS, BLM, and other applicable agencies and communities. The draft HPMP defines the area of potential effects (including effects of implementing USFS Section 4[e] conditions), includes measures to address ongoing effects including those on or affecting NFS lands, protocols for proposed future actions including inadvertent discoveries and emergency situations, programs for future inventory and resource evaluation, a public education and information program, roles, responsibilities, and reporting requirements, and procedures for review and update of the draft HPMP. In accordance with FERC practices, the Final HPMP would be adopted as an attachment to a Programmatic Agreement under Section 106 of the NHPA. FERC, the California State Historic Preservation Officer (SHPO), the Advisory Council on Historic Preservation (ACHP), and other applicable parties are expected to sign the Programmatic Agreement for compliance with Section 106 consultation requirements prior to issuance of a new license.

The draft HPMP also includes the consideration of opportunities within the project area to set aside, enhance, or develop areas suitable for the collection of traditionally used plant materials. Ethnobotanical studies are under way to identify the types and locations for these activities within the project area; areas set aside for these purposes would be managed in a manner equivalent to NRHP-eligible cultural resources.

The draft HPMP provides specific actions to be taken to address ongoing impacts at McCabe Creek, and notes that Foreman Creek, Enterprise, and the Boat-in Campgrounds are also of high priority. These locations are identified as high-priority areas in need of specific activities to address ongoing project-related effects from reservoir water level fluctuations, recreational use by the public, and operational uses associated with the project. DWR would conduct resource evaluations to assess NRHP eligibility of involved resources, institute available management measures at these locations to avoid or reduce ongoing impacts, and coordinate with the signatory and concurring parties to the Programmatic Agreement, federally recognized and unrecognized local Maidu Tribes, DPR, and federal land management agencies as appropriate on the development of site-specific treatment plans to address unavoidable adverse effects on historic properties at these locations.

Cultural Resources Administrator/Coordinator. Under the Proposed Project, DWR would establish a Cultural Resources Administrator position and a Cultural Resources Coordinator position to work in coordination with the LCU at the Oroville Field Division to implement the draft HPMP and provide specialized as-needed expertise and critical support staff on technical issues.

Data Recovery Program. A Data Recovery Program would be implemented at McCabe Creek and public access may be restricted at certain times to protect this site.

Fluctuation Zone Vehicle Restriction. Motorized vehicles would be prohibited from using the reservoir fluctuation zone, on-site monitors would be employed, and signs informing the public of sensitive resource values and warnings of criminal penalties associated with State law violations would be posted.

Cultural Resources Consultation Group. The Cultural Resources Consultation Group (CRCG) is intended to meet DWR's goal for continued coordination with parties responsible for cultural resources management in the project area. It will provide enhanced opportunities for participation in resource stewardship and provide a mechanism for conducting an annual review of proposed future actions and other HPMP activities. The CRCG will meet annually for the first 10 years after license issuance and on an as-needed basis after that.

Plan to Improve and Redirect Recreation Usage at Foreman Creek Boat Ramp (SA Article A129)

The Proposed Project includes development of a plan within 1 year of license issuance to redirect recreation usage at Foreman Creek to protect cultural resources during the development of planned recreation enhancements at this location.

Land Use, Management, and Aesthetics Operations

Screening of Material Storage Area (SA Article A132)

In addition to the continuation of measures described in the No-Project Alternative, the Proposed Project includes a measure to improve the aesthetic appearance of the area by planting appropriate vegetation to screen the material storage/staging area located northwest of the Oroville Dam emergency spillway from view from Oroville Dam Boulevard. To the extent feasible, native plants would be used.

Project Boundary Modifications (SA Article A133)

Under the Proposed Project, within 2 years following license issuance DWR would file with FERC a revised License Application Exhibit G and narrative statement as an application to amend its license for purposes of re-defining the FERC Project boundary. The revised Exhibit G would include all project works, including environmental and recreation measures, access roads, transmission lines, and any other lands necessary for project purposes in the FERC Project boundary. The narrative statement would explain any changes to the proposed FERC Project boundary, the amount of federal

land occupied by the project, and how the proposed FERC Project boundary includes those lands necessary for project purposes.

Area Access

The Proposed Project acknowledges the USFS right to use any road over which DWR has control of within the project area for purposes deemed necessary and desirable in connection with the protection, administration, management and utilization of NFS lands and resources. USFS would control such use so as not to unreasonably interfere with safety or security uses or cause DWR to bear a share of the costs of maintenance disproportionate to DWR's use in comparison to the use of the road extended by USFS to others.

Fuel Load Management Plan (SA Section B102)

As a non-license SA commitment, under the Proposed Project, within 1 year of license issuance DWR would develop a Fuel Load Management Plan for project lands. The proposed measure is not mutually exclusive of the USFS Final 4(e) conditions and will include USFS lands consistent with USFS Final 4(e) conditions. The plan would be developed in coordination with USFS, BLM, the California Department of Forestry and Fire Protection, DPR, DFG, the Paradise Fire Department, the Butte County Fire Safe Council, the Butte County Resource Conservation District, the SWC, Native American Tribes, and other appropriate agencies and associated public processes. The plan would be prepared to be consistent with the plans adopted by the above entities for non-project lands, to the extent permitted by the FERC license and operational constraints of the project. The Plan would also be prepared to be consistent with the Oroville Wildlife Area Management Plan. The Fuel Load Management Plan would identify fuel management issues, prioritization, and recommended actions to address them.

Public Health and Safety

Risks and Hazards

The Proposed Project acknowledges the responsibility of DWR to identify and report all known or observed hazardous conditions on or affecting NFS lands that would affect the improvements, resources, or pose a risk of injury to individuals. Any non-emergency actions to abate such hazards on NFS lands would be performed after consultation with USFS. In emergency situations, DWR would notify USFS of its actions as soon as possible, but not more than 48 hours after such actions have been taken.

Operations and Maintenance Programs

Under the Proposed Project, DWR would continue routine operations and maintenance activities currently performed under the existing FERC license. Existing maintenance programs would be expanded to include any new features and facilities constructed as part of the Proposed Project as appropriate.

3.3.3 FERC Staff Alternative

After evaluating DWR's Proposed Action (the SA), including mandatory conditions filed pursuant to Section 4(e) and 18 of the Federal Power Act (FPA), and other recommendations from resource agencies and interested entities under Sections 10(a) and 10(j) of the FPA, FERC staff identified additional measures FERC considers necessary or appropriate for continued operation of the project (FERC 2006). The measures are, for the most part, revisions to articles contained within the SA. However, sufficient differences between DWR's Proposed Project and the FERC Staff Alternative warrant an evaluation as a separate alternative in this DEIR.

The FERC Staff Alternative includes nearly all of the measures described in the Proposed Project, including the SA RMP and the draft HPMP. However, the FERC Staff Alternative does not include the Appendix B actions because they are considered outside of FERC jurisdiction and/or suggest actions with no nexus to the Project. The FERC Staff Alternative does not include the HEA, nor does the FERC DEIS analyze this agreement as part of the Proposed Project. The FERC Staff Alternative does not recommend that DWR provide funding associated with the July 4th fireworks displays at Lake Oroville as described in the RMP because the measure does not appear to have a clear project nexus. In addition, the FERC Staff Alternative does not analyze the proposed 50-year license term. Additional measures proposed by FERC staff are described below. Unless noted, the FERC Staff Alternative is otherwise the same as the Proposed Project.

3.3.3.1 Impoundments and Power Facilities

No new facilities designed to increase or enhance power production are planned under the FERC Staff Alternative.

3.3.3.2 Coordinated Operations

No changes to general reservoir operations, scheduling, or power transactions are proposed under the FERC Staff Alternative. No changes to water supply entitlements or contracts, or changes to the role the Oroville Facilities plays in the SWP, are proposed under this alternative.

3.3.3.3 Environmental Facilities and Operations

Instream Flow and Temperature Improvement for Anadromous Fish (SA Article A108)

Under the FERC Staff Alternative, DWR would obtain Commission approval prior to implementing any modification to the minimum instream flow regime or water temperature objectives under SA Article A108.

Gravel Supplementation and Improvement Program (SA Article A102)

The FERC Staff Alternative would revise SA Article A102 to include a provision to monitor 10 riffles every 5 years or after a high-flow event, assess the adequacy of the volume of gravel used, and replace gravel as necessary. If monitoring of 10 sites, as proposed, reveals that objectives are not being met, the monitoring effort would be expanded to include all 15 sites and replace gravel as necessary.

Riparian and Floodplain Improvement Program (SA Article 106)

The FERC Staff Alternative would revise SA Article A106 to include a provision to implement 50 percent of the selected measures within 10 years and the remaining measures within 12 years of the issuance of any license for the project.

3.3.3.4 Recreation Facilities and Operations

Recreation Management Plan (SA Article A127)—Programmatic Elements

The FERC Staff Alternative would revise the RMP to include the establishment of standards for maintaining developed recreation facilities, including trails, and incorporate these into the RMP.

Recreation Facilities—Equestrian, Bicycle, and Hiking Trails

The FERC Staff Alternative would revise SA Article A127 to include a provision to conduct baseline inventory of trail conditions using established standards developed for project trails prior to proposing any changes to trail use designation. Trail conditions would be monitored and reported on through the term of any license issued. The recreation monitoring program would be expanded to include non-trail users to detect latent demand and unmet user needs related to trails. The non-motorized trails program would be revised based on the trail condition inventory, analysis of the survey and trail use data, and results of the feasibility studies for new trails. Recommendations, if appropriate, for changing trail use designations and a proposed implementation schedule would be included.

Recreation Facilities—Specific Actions at Lake Oroville

Foreman Creek Area

Under the FERC Staff Alternative, the Foreman Creek boat launch would be closed to recreational use while DWR develops a plan for protecting cultural resources that considers a spectrum of possible actions, including installing recreational facilities to redirect recreational use away from cultural resources (as described in SA Article A129) and discontinuing recreational use at the site. Within 6 months of license issuance, DWR would prepare a plan, in consultation with local Native American Tribes, for protecting cultural resources at Foreman Creek.

The FERC Staff Alternative also revises SA Article A127 to include the development of a plan to install a vault restroom, 5 to 10 picnic tables with shade ramadas, and interpretive signs, and possibly install pole stoves at the Foreman Creek boat launch.

Boat-in Campgrounds

The FERC Staff Alternative revises SA Article A127 to include a provision to develop site plans and reconstruct the boat-in campgrounds at Bloomer, Goat Ranch, and Craig Saddle within the first 10 years after license issuance.

3.3.3.5 Operations for the Protection of Cultural Resources

Under the FERC Staff Alternative, DWR would revise and resubmit the draft HPMP for Commission approval. The revision would provide rationale for proposing to evaluate only 20 percent of the sites and provide for evaluating all sites within the fluctuation zone.

3.3.3.6 Land Use, Land Management, and Aesthetics Operations

Fuel Load Management Plan (SA Section B102)

The Fuel Load Management Plan described under Section B102 of the SA would become an Appendix A, FERC jurisdictional action under the FERC Staff Alternative.

Aesthetics

Under the FERC Staff Alternative, the Interim Recreation Project that seeded the downstream face of Oroville Dam with a wildflower mixture dominated by poppies would be continued, as necessary.

3.4 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM FURTHER STUDY

The following identifies several alternatives that are not evaluated in detail within the DEIR. With the exception of the alternatives analyzed in the PDEA, in one form or another, these alternatives involve either transferring the operations and maintenance of the Oroville Facilities to another governmental entity or discontinuing power generation. None of these potential scenarios is considered reasonable or even remotely likely. Briefly discussed below are PDEA alternatives, non-power license, decommissioning, Oroville Dam removal and decommissioning, and federal takeover.

3.4.1 Alternatives Considered in the PDEA but Eliminated from Further Analysis in the DEIR

DWR filed a license application with FERC in January 2005 for consideration as future license conditions for the Oroville Facilities for the next 50 years. Contained within that application was a PDEA, which presented the analysis and conclusions reached during the evaluation of two action alternatives with supplemental information on relevant studies, data, and methodology included in the appendices.

3.4.1.1 PDEA Proposed Action and Alternative 2

The PDEA Proposed Action included protection, mitigation, and enhancement measures designed to address ongoing effects of project operations. These measures included those developed by the ALP Collaborative, measures recommended by the results of Study Plan R-17 (SP-R17), Recreation Needs Analysis (DWR 2004), and by USFWS during informal consultation. PDEA Alternative 2 included all measures described in the PDEA Proposed Action as well as a number of measures not preferred by the Licensee because they could adversely affect operational flexibility, do not have an apparent project nexus, would not represent the best balance of project resources, and in many cases are not well supported by the study results. Some of these measures were suggested in the Collaborative by resource agencies; other recreational enhancement measures were supported by some local stakeholder groups to meet their interpretation of what represented an appropriate level of recreation development. While the Proposed Project analyzed in this DEIR contains many of the measures included in the Proposed Action and Alternative 2 analyzed in the PDEA, some measures agreed to in the final SA were not included in the PDEA. Thus, neither alternative from the PDEA is evaluated in detail as a “stand-alone” alternative in this DEIR.

3.4.1.2 Federal Takeover

A federal department or agency may file a recommendation that the United States exercise its right to take over a hydroelectric power project with a license that is subject to Sections 14 and 15 of the FPA. The recommendation must be filed no earlier than 5 years before the license expires and no later than the end of the comment period specified by FERC. Federal takeover and operation of the Oroville Facilities would

require Congressional approval as provided under Section 14 of the FPA. Furthermore, should a takeover occur, DWR must follow procedures relating to takeover and relicensing as outlined in 18 Code of Federal Regulations (CFR) Part 16.

Although these facts alone would not preclude further consideration of this alternative, there is no evidence showing that a federal takeover should be recommended to Congress. No party has suggested that federal takeover would be appropriate, and no federal agency has expressed interest in operating the Oroville Facilities. Therefore, federal takeover of the Oroville Facilities is not considered further in this DEIR.

3.4.1.3 Non-power License

The alternative in which FERC would issue a non-power license is not evaluated in detail in the DEIR for several reasons. A non-power license is a temporary license that FERC would terminate whenever it determines that another governmental agency will assume regulatory authority over and supervision of the lands and facilities covered by the non-power license. FERC, under the authority of the FPA, allows licensees to apply for non-power licenses, which permit the licensees to cease operation of their power generation facilities. When a licensee proposes to cease operation of these facilities, FERC regulations require that the licensee prepare an environmental assessment or environmental impact statement in accordance with NEPA, Council on Environmental Quality guidelines, and other applicable laws.

Furthermore, the licensee must provide information required under 18 CFR 16.11 including but not limited to: (1) a proposal that shows the manner in which the licensee plans to remove or otherwise dispose of the project's power facilities; (2) a proposal to repair or rehabilitate any non-power facilities; and (3) a statement of the costs associated with removing the project's power facilities and with any necessary restoration and rehabilitation work.

Under this alternative, the non-power license would continue to cover and address all of the Oroville Facilities, which include Lake Oroville, Oroville Dam, the Hyatt Pumping-Generating Plant, Thermalito Diversion Dam Power Plant, Thermalito Forebay, Thermalito Pumping-Generating Plant, Thermalito Afterbay, and associated recreational and fish and wildlife preservation and enhancement facilities. DWR could be required to maintain the recreational facilities, Feather River Fish Hatchery, and the OWA.

Under a non-power license, the three Oroville power plants (Hyatt Pumping-Generating Plant, Thermalito Diversion Dam Power Plant, and Thermalito Pumping-Generating Plant) would remain in place, continue to operate for a limited amount of time, and eventually become inoperable. The dams and the powerhouse intakes would remain operable. The facilities could no longer be used to generate power, but they would retain their role in flood management, recreation, environmental purposes (fisheries and wildlife habitat enhancement), and water delivery (irrigation, salinity control, conditions in the Delta, etc.).

A termination of facility operations, temporary or otherwise, would have significant effect on power supply for the State's power grid by eliminating 762 MW, or roughly 2 percent, of the State's peak supply. Additionally, ancillary system benefits, including spinning reserves, non-spinning reserves, peaking capacity, and grid stability, would be lost, and the cost of developing replacement power would be considerable.

At this point, no agency has suggested a willingness or ability to assume regulatory authority and supervision over the lands and facilities covered by the non-power license. No party has sought a non-power license, and there is no basis for concluding that the Oroville Facilities should no longer be used to produce power. Additionally, a non-power license would not support the purpose and needs of the Oroville Facilities that relate to producing electric power to provide pumping energy needed for the SWP. Given this and the other factors outlined above, a non-power license for the Oroville Facilities is not considered further in this DEIR.

3.4.1.4 Decommissioning

Project retirement could result from:

- DWR notifying FERC that it sought to surrender its license; or
- An order of termination issued by FERC based on an implied surrender.

Neither of the foregoing conditions is reasonably foreseeable; nonetheless, to fulfill the intent of the ALP, the DEIR includes the following discussion of project retirement.

The regulations pertaining to non-power licenses under FERC, the FPA, NEPA, and the Code of Federal Regulations as outlined above would also apply to retirement or decommissioning without dam removal. Under the alternative of decommissioning without dam removal, the three Oroville power plants would be removed, the equipment would be salvaged or disposed of, and the powerhouse sites would be graded and/or restored as appropriate. The dams and powerhouse intakes would remain operable. Similar to the arrangement under the non-power alternative, the facilities could no longer be used to generate power, but they would retain their role in water supply, flood management, recreation, and environmental purposes such as releases for water quality enhancements. This alternative differs from the non-power alternative described above in that the generation plants would be removed or become permanently inoperable.

Under 18 CFR 6.2, the licensee may surrender its license if it has satisfied all conditions imposed by FERC to protect the public interest, including those related to disposition of constructed facilities. The licensee would also be required to file a schedule for the submittal of a surrender of license; file a surrender application according to the approved schedule; and provide for disposition of all project facilities. Where project facilities have been constructed on federal lands, the licensee must restore the project lands to a satisfactory condition and continue paying annual charges until the effective date of the order accepting surrender. Once decommissioning has been completed and

the area has been restored to a satisfactory condition, FERC would no longer be involved with the Oroville Facilities.

The purpose of this action would be to decommission while maintaining the impoundment and the critical non-power related roles performed by the Oroville Facilities. If the dams were not removed, they would have to be maintained to prevent dam failures and the attendant threat to public safety. Additionally, the dams would need to be maintained to allow the Oroville Facilities to continue their role in flood management, recreation, environmental purposes, and water delivery.

Decommissioning would have a significant, long-term effect on power supply to the State's power grid (see Chapter 2.0). Additionally, decommissioning would not support the primary purpose and needs of the Oroville Facilities that relate to providing electric power. Therefore, decommissioning of the Oroville Facilities has been eliminated from further consideration.

3.4.1.5 Oroville Dam Removal and Decommissioning

Under the dam removal and decommissioning alternative, Oroville Dam would be removed and the Hyatt Pumping-Generating Plant would be decommissioned. The Thermalito Diversion Dam Power Plant and Thermalito Pumping-Generating Plant could be removed or remain in place for power generation with unregulated flows from the Feather River. Because Lake Oroville would no longer exist in its current configuration to provide adequate water storage and release, the remaining generating plants, if left in place, could operate similar to run-of-river plants, losing much of their capability to provide reliable energy and ancillary services such as spinning reserves, peaking capacity, and grid stability. Thermalito Diversion Dam would likely remain in place, continuing to divert water to Thermalito Forebay and Thermalito Afterbay, allowing these facilities to continue their role in recreation, environmental resource enhancements, and water delivery for local irrigation. These roles would also continue for the Fish Barrier Dam and the Thermalito Afterbay Dam, which would remain in place.

The primary purpose of this action would be to restore much of the Lake Oroville area to its original natural habitat. This alternative, however, would have significant negative effects. The facilities could still play vital roles in recreation, environmental purposes, and water supply; however, these functions would be diminished significantly with the removal of Oroville Dam and the loss of its capability to store and release 3.5 maf of storage capacity currently available at Lake Oroville. Few, if any, water supply benefits would remain, and flood protection would virtually disappear. Because roughly 85 percent of the power generation would be decommissioned, and pumped-storage peaking operations would be eliminated, this action would have a significant, long-term effect on power supply for the State's power grid.

Dam removal activities would result in short-term increases in downstream turbidity and sedimentation and in short-term increases in noise, dust, exhaust emissions, and traffic in the vicinity of the Oroville Facilities. There could be significant effects on recreation

and property values around the existing Lake Oroville. A lower reservoir level would be established, potentially destroying existing shoreline wetlands and other habitat. A lower reservoir level would expose currently inundated archeological sites to damage from vandalism and illicit collecting. Restoration activities such as revegetation and slope stabilization may be necessary to restore the land previously inundated by approximately 16,000 surface acres of water, comprising Lake Oroville. DWR would also need to decommission the water-related recreation facilities at Lake Oroville, which include boat launches and floating and boat-in camps. Reduced recreational use of these facilities would lead to reduced economic benefits from recreational activities and project spending. Recreation facilities (campgrounds, picnic areas, boat launches, beaches, etc.) would no longer be maintained at Loafer Creek, Bidwell Canyon, the Spillway, and Lime Saddle; however, the Lake Oroville Visitors Center, Thermalito Forebay, Thermalito Afterbay, and the OWA would remain.

Removal of the dam could increase riverine habitat for several dozen miles, benefiting fish, wildlife, and riparian habitats. Recreational opportunities associated with riverine conditions (rafting, kayaking, and fishing) could increase, with related economic benefits to local communities. Fish passage would not be improved, as the Fish Barrier Dam and Thermalito Diversion Dam would remain in place. The Feather River Fish Hatchery would likely continue operations to compensate for fisheries effects. Short-term adverse visual effects during removal activities would give way over the long term to visual benefits from removal of project structures.

The cost to remove the dam and power plants would be significant. Additionally, this alternative would not support the primary purpose and needs of the Oroville Facilities that relate to electric power, water supply, flood management, recreation, and environmental purposes. Removal of all dams associated with the Oroville Facilities would not meet the project purpose and needs, and would generate effects similar to those described for removal of the main dam. Given these considerations, decommissioning facilities and removal of the dams included in the Oroville Facilities is not evaluated further in this DEIR.

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CHAPTER 4.0

ENVIRONMENTAL SETTING

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4.0 ENVIRONMENTAL SETTING

4.0.1 Overview of the Project Vicinity and Project Area

4.0.1.1 Feather River Basin

The Feather River watershed is located at the north end of the Sierra Nevada. The watershed is bounded by the volcanic Cascade Range to the north, the Great Basin on the east, the Sacramento Valley on the west, and higher elevation portions of the Sierra Nevada on the south. The Feather River watershed upstream of Oroville Dam is approximately 3,600 square miles and comprises approximately 68 percent of the Feather River basin. Downstream of Oroville Dam, the basin extends south and includes the drainage of the Yuba and Bear Rivers (see Figure 3.1-1 in Chapter 3 of this DEIR). The Yuba River joins the Feather River near the City of Marysville, 39 river miles downstream of the City of Oroville, and the confluence of the Bear River and the Feather River is 55 river miles downstream of the City of Oroville. Approximately 67 miles downstream of the City of Oroville, the Feather River flows into the Sacramento River, near the town of Verona, about 21 river miles upstream of Sacramento. The Feather River watershed, upstream of the confluence of the Sacramento and Feather Rivers, has an area of about 5,900 square miles.

The upper watershed (upstream of the Oroville Facilities) includes the West Branch, Upper North Fork, Lower North Fork, South Fork, and Middle Fork Feather River and ten smaller tributary creeks that drain directly into Lake Oroville. This watershed drains an area of 3,611 square miles. The North Fork and Middle Fork watersheds comprise 3,222 square miles of this area, including portions of the foothill and mountain regions of the northern Sierra Nevada and southern Cascade Range. The South Fork and West Branch watersheds contain the additional 389 square miles. The upper watershed is ruggedly mountainous, bisected by deep canyons in the western third of the watershed. The central third of the watershed is a transition zone consisting of broad alluvial valleys surrounded and separated by high, steep peaks and ridges. The headwater areas of the eastern third consist of long, broad meadow systems separated by relatively low ridges. Elevations range from 922 feet at the crest of Oroville Dam to more than 10,400 feet at Mount Lassen. The major tributaries as well as the major forks of the Feather River (including the South Fork, East Branch North Fork, North Fork, and Middle Fork) generally flow from east to west.

The upper watershed of the Feather River is owned and managed by a variety of federal, State, and local entities, including USFS, BLM, DPR, DFG, Butte County, and the City of Oroville. The North Fork Feather River canyon serves as a major east-west transportation arterial (Union Pacific Railroad and State Route [SR] 70) and has extensive hydropower generation development, producing more than 1,750 megawatts of electricity. The Middle Fork Feather River upstream of Lake Oroville is federally designated as a Wild and Scenic River.

4.0.1.2 Project Area

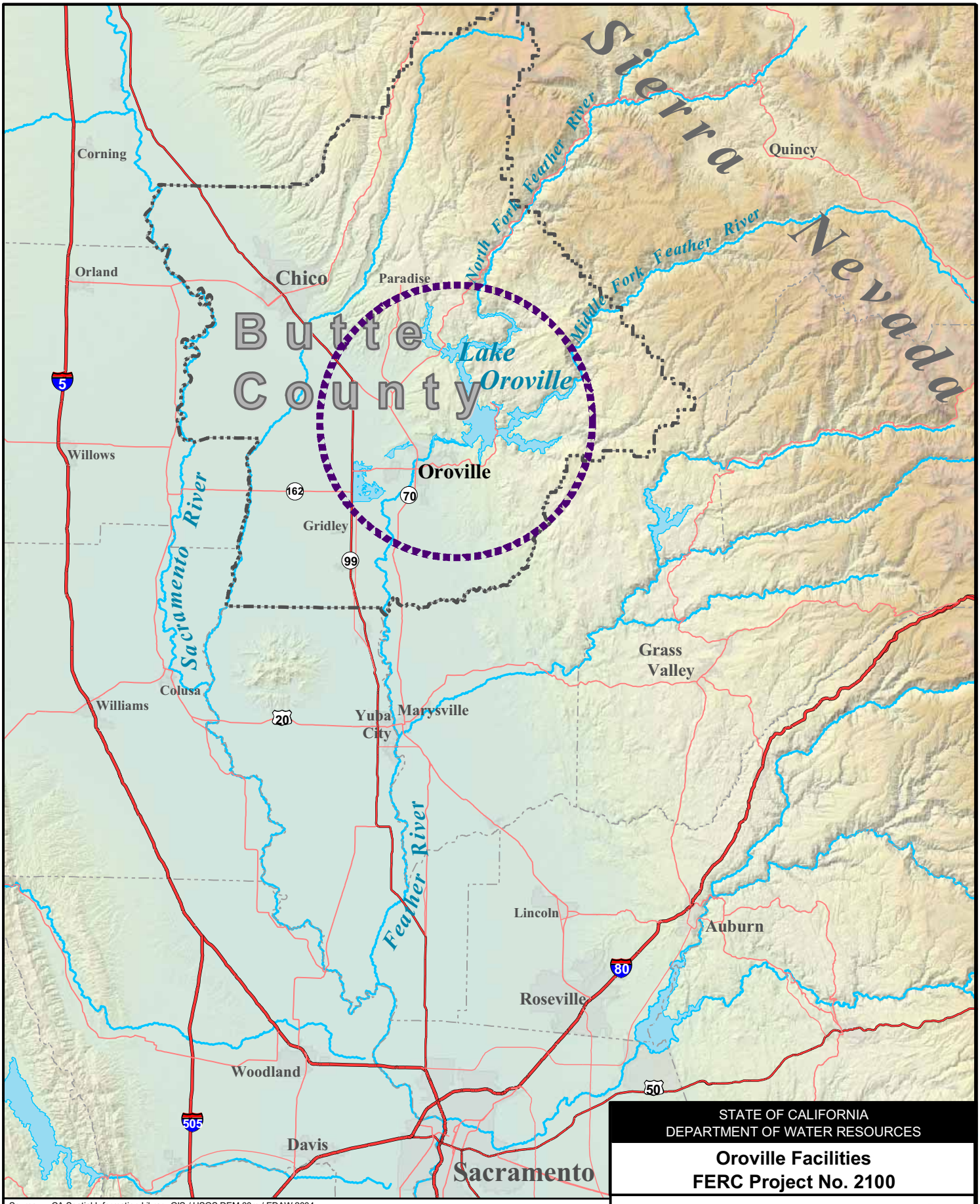
The Oroville Facilities are located on the Feather River in the foothills of the Sierra Nevada in Butte County (Figure 4.0-1). Oroville Dam is located 5 miles east of the City of Oroville and about 130 miles northeast of San Francisco.

The West Branch, North Fork, South Fork, and Middle Fork Feather River are the primary rivers that form the reservoir at Lake Oroville. Prior to construction of Oroville Dam, the Middle and South Forks joined 5.4 river miles above the Oroville Dam site, and were then joined by the North Fork 3 river miles below their confluence. Their confluence is now Lake Oroville, a 3.54-million-acre-foot (maf) reservoir that is one component of the Oroville Facilities. About half of the flow into Lake Oroville comes from the North Fork Feather River. The average annual inflow, dependent on annual precipitation, into Lake Oroville is approximately 4 maf. Outflow from the Oroville Facilities typically varies from spring seasonal highs that average about 8,000 cubic feet per second (cfs) to about 3,500 cfs in November.

Downstream of Oroville Dam, the Feather River flows can be diverted into the Thermalito Complex and the Feather River Fish Hatchery, and used to maintain instream flows in the Low Flow Channel (LFC) of the Feather River. Some of the water diverted to the Thermalito Complex is returned to the Feather River approximately 6 miles downstream of Oroville Dam. The Feather River, downstream of the Thermalito Afterbay Outlet and the confluence of the LFC, is generally known as the lower Feather River. The lower Feather River flows through a variety of habitat types, agriculture, and urban areas until its confluence with the Sacramento River. The flows in the lower Feather River are maintained relatively constant through regulation of the Thermalito Afterbay Outlet.

The mean annual discharge of the Oroville Facilities into the Feather River is in excess of 3.0 maf. In addition, mean annual releases to the Feather River Service Area (FRSA) from the Oroville Facilities total just under 1.0 maf. Hence the total mean annual discharge from the Oroville Facilities is approximately 4.0 maf. These waters are used for a variety of beneficial uses including recreation, coldwater aquatic habitat, hydropower generation, irrigation, and domestic and municipal water supply. The Oroville Facilities are a critical part of the SWP, providing much of the system's water collection and storage, flood management, and power production capacity.

At full pool (elevation 900 feet above mean sea level [msl]), Lake Oroville has a perimeter of approximately 167 miles and a surface area of approximately 15,400 acres.



Source: CA Spatial Information Library GIS / USGS DEM 30m / EDAW 2004

10 5 0 10 20 Miles

Original Scale 1 : 760,320
1" = 12 miles

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Oroville Facilities
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FIGURE 4.0-1

Project Vicinity

Prepared by:	Date	
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When the reservoir elevation is minimum pool elevation, 640 feet, the shoreline perimeter decreases to approximately 107 miles and the reservoir surface area is approximately 5,796 acres. The areal extent between the shoreline at full pool level and the shoreline at minimum pool level at 640 feet (i.e., areal extent of the fluctuation zone) is approximately 9,550 acres.

4.0.2 Contents of This Chapter

The rest of this chapter summarizes the project area's affected environment. A brief description of the affected environment is provided for each resource area. These sections use the best data available to define existing conditions for each of the following resource areas:

- Geology, Soils, and Paleontological Resources;
- Surface Water Quantity and Quality;
- Groundwater Quantity and Quality;
- Aquatic Resources;
- Terrestrial Resources (wildlife resources and botanical resources, including federally and State listed species);
- Land Use;
- Recreational Resources;
- Cultural Resources;
- Population, Housing, and Public Services;
- Environmental Justice;
- Aesthetic Resources (visual resources and noise);
- Air Quality;
- Agricultural Resources;
- Traffic and Road Maintenance; and
- Public Health and Safety.

To help define existing project operations, complex modeling was undertaken for the January 2005 PDEA for the Oroville Facilities (DWR 2005) with input from members of the ALP Collaborative. CALSIM II, HYDROPS™, WQRRS, and PHABSIM modeling was conducted to simulate project operations and related hydrology effects and is

described further in Appendix C of the PDEA (DWR 2005). This modeling helped the Collaborative better understand Oroville Facilities and SWP operations under numerous scenarios.

Supporting information for this chapter can be found in the PDEA (DWR 2005) and in the study plan reports that document the results of the various technical studies conducted as part of the collaborative process. The study plan reports can be found at DWR's Oroville Facilities Relicensing public website, http://orovillerelicensing.water.ca.gov.

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4.1 GEOLOGY, SOILS, AND PALEONTOLOGICAL RESOURCES

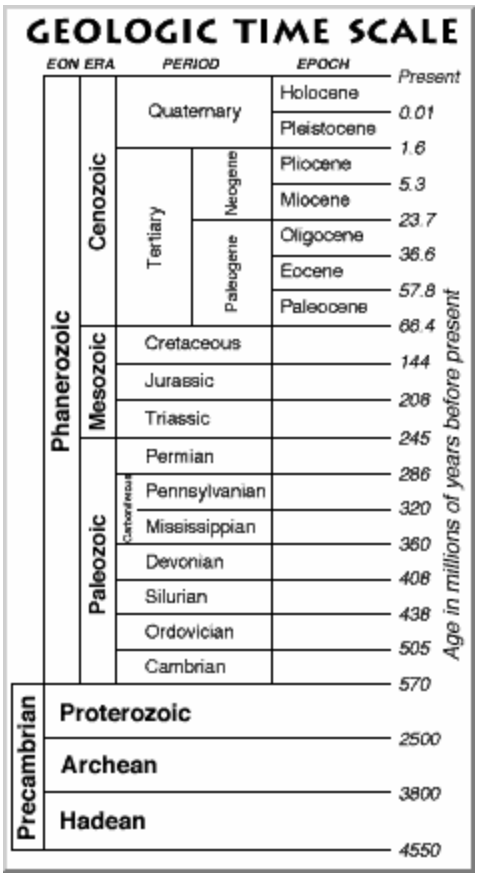
4.1.1 Regional Geology

4.1.1.1 Geologic Conditions

Approximately 85 percent of the upstream project area—the Feather River watershed above Thermalito Diversion Dam—is located within the metamorphic belt of the Sierra Nevada Geomorphic Province. The remaining 15 percent is located within the Cascade Range Geomorphic Province. The area downstream of Thermalito Diversion Dam is within the Sacramento Valley portion of the Great Valley Geomorphic Province. The Sierra Nevada Geomorphic Province consists of granitic intrusions, andesitic flows and breccia, basalt, metamorphic rocks, ultramafic rocks, and unconsolidated sedimentary deposits. The mountainous western slope of the Sierra Nevada ramps upward relatively gently from the Great Valley Geomorphic Province and is incised by southwest trending, steep-sloped river canyons, such as the Feather River Canyon, that are more than 3,000 feet deep. Highly weathered or decomposed granite, which is erodible and prone to landslides, is found in the eastern watershed and along portions of the North Fork Feather River canyon.

The Cascade Range Geomorphic Province extends about 500 miles from southern British Columbia to south of Lassen Peak and includes 495 square miles of the Feather River watershed, from Lassen Peak to Lake Almanor. Rocks of this province include Pliocene to Holocene age tuff, breccia, volcanic ash, lava flows, and basaltic to rhyolitic lahars. (See Figure 4.1-1 for the time frames associated with each eon, era, period, and epoch in the geologic time scale.)

The Great Valley Geomorphic Province is a narrow, elongated, asymmetrical, north-northwest trending basin that extends for about 450 miles between the Sierra Nevada and Coast Ranges Geomorphic Provinces. The northern portion is known as the Sacramento Valley (Norris and Webb 1990). The valley floor is an alluvial plain of unconsolidated Holocene deposits that overlie more consolidated alluvial and lacustrine deposits of Quaternary to Jurassic age. Below these sedimentary deposits are shales and sandstones of the Cretaceous Great Valley Sequence and upper Jurassic bedrock of metamorphic and igneous rocks associated in the east with the Sierra Nevada and in the west with the Coast Ranges (Norris and Webb 1990).



Source: NPS Website

Figure 4.1-1. The geologic time scale.

4.1.1.2 Regional Faulting and Seismicity

The project area is located in northeastern California, an area that has historically experienced relatively low seismic activity. Overall, the Sierra Nevada and Central Valley move collectively as an independent block, the eastern margin of which is formed by faults of the Sierra Nevada Fault Zone. Two fault types offset rocks in the watershed: high-angle reverse faults in the Sierra Nevada Geomorphic Province and normal faults in the Sierra Nevada and Cascade Range Geomorphic Provinces.

The dominant structure of the Sierra Nevada metamorphic belt and the project area is the Foothills Fault System. This series of north-northwest trending, east-dipping reverse (compressional) faults was formed during the late Jurassic era when subduction along the western continental margin resulting in the Nevadan orogeny (mountain-building event). The Foothills Fault System, though considered relatively quiet seismically, is important given the system's influence on the geologic structure of the project region. Seismicity on these faults has been reactivated in the late Cenozoic era (Wong 1992).

4.1.1.3 Volcanic Activity

Lassen Peak, considered to be one of the few active volcanoes in the continental United States, is located about 98 miles north of the City of Oroville. The last series of volcanic eruptions at Lassen Peak, between 1914 and 1917, deposited volcanic ash over a fairly wide area surrounding the cone. Localized mudflows were also deposited in stream valleys around the volcanic cone. There is no record of any significant ash or mud deposit reaching Butte County within historic time.

Although geologic hazards do exist in the area of Lassen Volcanic National Park, a review of historical and geological data suggests that the possibility of mudflows, flowing avalanches, or volcanic activity endangering the people of Butte County is very remote. Lassen Peak is being studied and monitored by the U.S. Geological Survey for seismic and volcanic activity. According to Professor E. H. Williams of the University of California, Berkeley, the monitoring system in place could provide an early warning of a potential volcanic eruption.

4.1.2 Project Geology

4.1.2.1 Upstream of Oroville Dam

As mentioned previously, the western metamorphic belt of the Sierra Nevada Geomorphic Province underlies a significant portion of the project watershed. These rocks range in age from Ordovician to Cretaceous (see Figure 4.1-1), and extend from Lake Almanor in the north to about Mariposa in the south (Norris and Webb 1990). This metamorphic belt is defined largely by a collective system of faults, the Foothills Fault System, which formed initially during the tectonic evolution of the region (Carlson 1990).

Most of the lower watershed consists of rocks of the western metamorphic belt, including metamorphosed gabbroic, diabase, and granitic rocks, that are exposed south and east of Lake Oroville. These assemblages are derived primarily from a volcanic island arc that became attached to the continental margin during the Jurassic Period (approximately 200 million years ago) and are identified locally as the Smartville Ophiolite Complex. Most of the Smartville Ophiolite Complex consists of basaltic to andesitic volcanic and volcaniclastic rocks, shown on geologic maps of the area as "mv" and "Jv" (Figures 4.1-2 and 4.1-2a). These rocks include the Foothill Melange-Ophiolite belt (Carlson 1990), with an almost continuous, 3-mile-wide band of ultramafic Mesozoic rocks crossing the watershed from northwest to southeast. These rocks consist largely of serpentinite, but also include peridotite, pyroxenite, and talc schist. Serpentinite is a moderately soft, green alteration product of ultramafic igneous rock prominent in the central portion of the watershed. It is generally associated with fault zones and may contain asbestos. These rocks are structurally weak and prone to landslides.

Geologic Legend

Qls — landslide

Qal — recent deposits (undifferentiated) -- alluvium, colluvium, terrace and fan deposits, dredge tailings and fill.

Cg — gravels -- bedded and flat-lying conglomerate, sand and silt. The conglomerate is weakly cemented, matrix is reddish-brown, clasts are mostly locally derived metamorphic, intrusive and volcanic rocks. The sand and silt is often cross-bedded and lensoid.

Tt — Tuscan Formation - gently dipping basaltic to andesitic flows, mudflow breccia, tuff, volcanic sandstone and conglomerate.

Tl — Lovejoy Formation -- gently dipping, dark, fine-grained olivine basalt.

Mi — intrusive rocks -- medium to coarse grained diorite, granodiorite and trondhjemite in plutons, dikes and plugs.

Ti / Tag / Tot — lone Formation -- bedded and gently dipping, buff to reddish, quartz-rich sandstone, claystone and siltstone, plus minor conglomerate, shale and lignite. Tag: "Auriferous Gravel" member -- white quartz and chert-rich pebble conglomerate, quartz-rich sandstone, siltstone and relect ash. Tot: "Oroville Tuff" member -- bedded, white to buff, andesitic mudflow, tuff, volcanic sandstone and minor conglomerate.

Kc — Chico Formation -- well bedded, brown to buff, fossiliferous arkose with minor pebble conglomerate.

Jm — Monte de Oro Formation -- well bedded, steeply dipping, dark buff to gray, foliated, slightly metamorphosed, fossiliferous graywacke and minor conglomerate.

Js — Smartville ophiolite -- dark gray to green gray, steeply-dipping, strongly foliated, metamorphosed, basaltic to diabasic volcaniclastic sediment, pillow lava, breccia, dikes and sills; gabbroic to felsic screen rocks occur within sheeted dikes; gabbroic plugs are rare.

Ja — arc complex rocks -- Ja : dark to light blue green, poorly foliated, metamorphosed, andesitic to basaltic agglomerate, tuff breccia and tuff. Ja : dark, well foliated, metamorphosed argillite and graywacke.

m / ma / ls / ms / mv — melange -- m: undifferentiated. m : metavolcanic rock, dark, fine-grained, basaltic flows (?) m : metavolcanic rock (arc derived) dark to light blue green, slightly metamorphosed andesitic agglomerate and tuff breccia. m : metasedimentary rock, dark to light colored, strongly foliated slate, phyllite, graywacke, conglomerate, plus minor chert and marble. ls: limestone.

sp — serpentine -- dark to light green, highly sheared, commonly associated with faults; includes minor metagabbro.

contact - dashed where approximately located, dotted where concealed.

fault - dashed where approximately located, dotted where concealed.

fault - questioned

Cenozoic faults shown in red.

thrust fault - dashed where approximately located, teeth on upper plate.

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Geologic Legend
Figure 4.1-2
Geologic Map of
Lake Oroville Area

Prepared by: AMG DWR Northern District
Date 2/08/03
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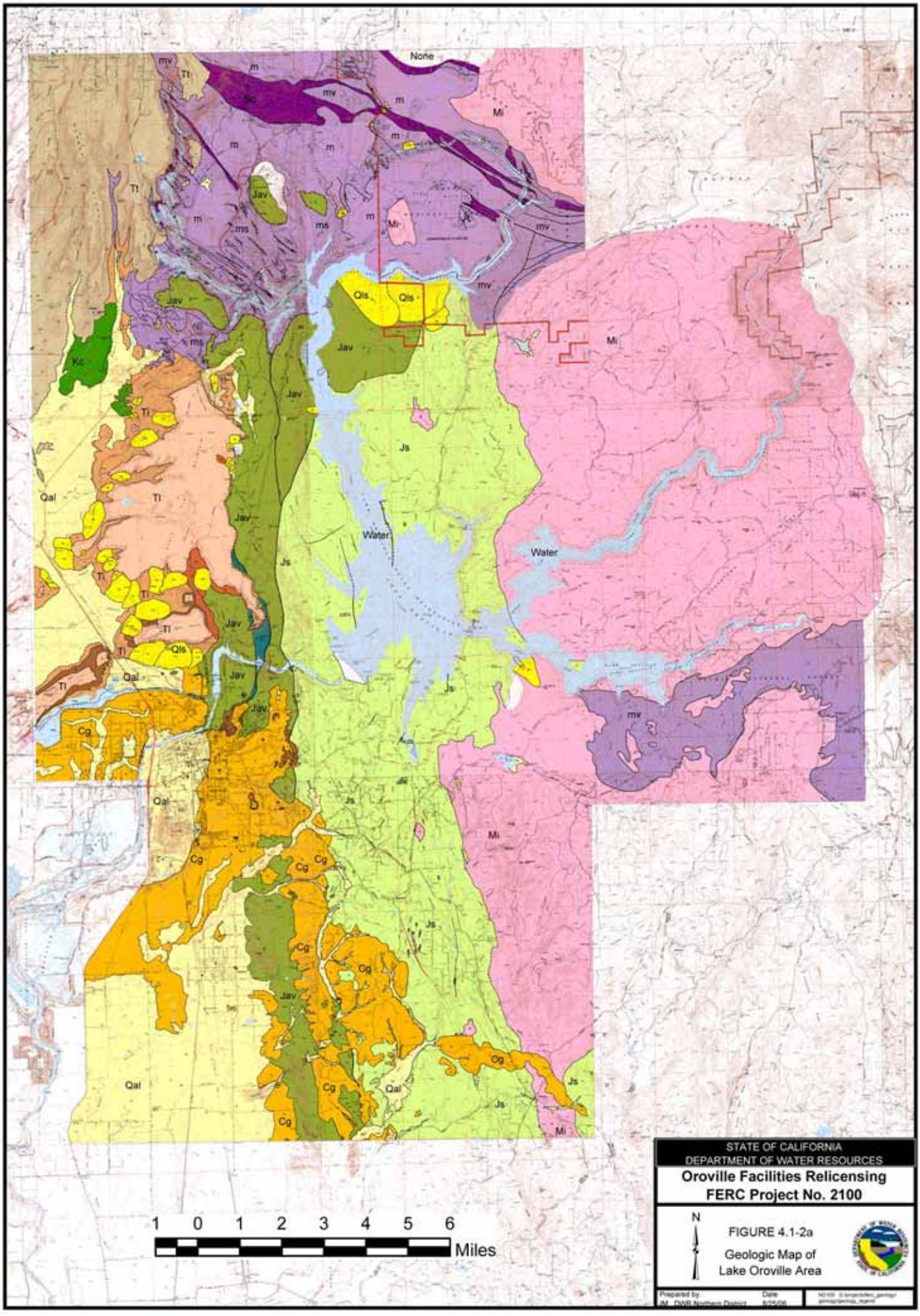
None
mv
Tt
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Water
1 0 1 2 3 4 5 6
Miles
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FERC Project No. 2100
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FIGURE 4.1-2a
Geologic Map of
Lake Oroville Area
Prepared by:
Date
8/25/06

Gabbroic (“gb”) and diabase (“db”) rocks south and east of Lake Oroville may represent the basement upon which this Jurassic volcanic arc was formed. Within the last 100 million years, Cretaceous dikes, sills, and plutons of the Nevadan mountain-building period (i.e., the Merrimac, Bald Rock, and Swedes Flat plutons) intruded these older rock units.

4.1.2.2 Downstream of Oroville Dam

Scattered sedimentary and volcanic deposits (superjacent series) blanket the older bedrock units (subjacent series) of the region, mostly along the boundary between the Sierra Nevada and Cascade Range Geomorphic Provinces and the Great Valley Geomorphic Province west of Lake Oroville. From oldest to youngest, these superjacent units include the marine Chico formation from the upper Cretaceous, the fluviatile Ione formation (“Ei”) and auriferous gravels (“Tag”) of the Eocene Epoch, the extrusive volcanic Lovejoy basalt (“Mlb”) of the late Oligocene to early Miocene, and volcanic flows (“Pv”) and volcaniclastic rocks of the Tuscan formation (“Ptu”) of the late Pliocene. Late Tertiary and Quaternary units include alluvial terrace and fan deposits of the Plio-Pliestocene Laguna formation (“Pl”), the Riverbank (“Qr”) and Modesto (“Qm”) formations of the Pleistocene, riverbed sediments (“Q”) of the Holocene, and historic dredge and mine tailings (“t”) from 20th century mining activities. The geologic units that outcrop along the Feather River downstream of the Fish Barrier Dam are described below.

The Plio-Pleistocene Laguna formation consists of interbedded, semiconsolidated, reddish-yellow to tan-green alluvial gravel, sand, and silt. It is about 150 feet thick and has been correlated with the Tehama formation of the northern Sacramento Valley. The ancestral west-flowing Feather, Yuba, Bear, and American Rivers deposited the formation. The Laguna formation is exposed in a number of riverbanks, but it can be seen only during low flows in the lower bank. Laguna deposits are believed to comprise resistant outcrops that form the ledge and rapids along the Feather River at Shanghai Bend. The presence of the Laguna formation in the lower riverbank is believed to be the primary reason that banks mapped as the Modesto and Riverbank formations are so erosion resistant.

The Pleistocene Riverbank formation, believed to range between 130,000 and 450,000 years old, has been divided into lower and upper members. Both members consist of weathered reddish gravel, sand, and silt and form planar terraces on both sides of the river. The lower member is somewhat more consolidated and erosion resistant. Both members are typically deposited on benches underlain by Laguna, Ione, and older deposits. In places, the Riverbank formation forms the edge of the Feather River meander belt, but it has not been identified in any eroding banks.

The Pleistocene Modesto formation, estimated to range between about 12,000 and 42,000 years old, is a set of terrace deposits that is younger than the Riverbank formation but also composed of lower and upper members. These terrace deposits consist of tan to light gray gravelly silt, sand, and clay and lie topographically above the Holocene river deposits. The lower member is distinguished by a clay-rich horizon

formed from a soil layer. The upper and lower members constrain the meander belt on both sides of the Feather River for most of its valley length. The Modesto formation is exposed in a number of riverbanks as far south as the Sutter Bypass. In places, the Laguna formation underlies the Modesto and may be partially responsible for the greater erosion resistance of these banks.

Alluvium is a general description of undifferentiated Holocene river sediments and may include floodplain, point bar, channel, and other deposits found in the Feather River meander belt. Stream channel deposits occur in active channels of the Feather, Bear, and Yuba rivers and tributary streams and are transported by present-day hydraulic conditions. These deposits contain clay, silt, sand, gravel, cobbles, and boulders in various layers and mixtures that reflect conditions at the time of deposition. Between 1855 and the early 20th century, upstream hydraulic mining caused a large increase in riverbed sedimentation; as a result, the lower Feather River became covered in a thick deposit of fine clay-rich, light yellow-brown slickens (i.e., pulverized matter from a quartz mill, or the lighter soil of hydraulic mines). These slickens have been buried by more recent floodplain deposits but are evident in eroding banks along most of the river.

Dredge tailings are large piles of gravels and cobbles generated by commercial gold mining activities that are found adjacent to the Feather River between the cities of Oroville and Gridley. Large floating dredges were once employed to process riverbed material, extract the gold, and deposit the remaining gravels in long piles along the riverbank. A large amount of the dredge tailings in the Oroville Wildlife Area was used to construct Oroville Dam.

4.1.2.3 Regional Faulting and Seismic Setting

The Oroville Facilities Project area has historically experienced relatively low seismic activity. The only known active fault (movement within the last 35,000 years) near the project area is the Cleveland Hill fault. This approximately 5.5-mile-long fault is located about 3 miles south of Oroville Dam. The Cleveland Hill fault ruptured on August 1, 1975, causing a 5.7 Richter magnitude earthquake felt in the City of Oroville. Other historic seismic events in the project area include a magnitude 4.6 earthquake that occurred near Chico on May 24, 1966, and a magnitude 5.7 earthquake located about 20 miles east of Chico that occurred on February 8, 1940. With the exception of these seismic events, most of the significant Quaternary and historic regional seismic activity is concentrated on faults located more than 60 miles to the north, east, and southeast of the project area.

Conditionally active faults (movement within the last 35,000–1.6 million years) include the Oregon Gulch fault, which passes through Lake Oroville, and the Paynes Peak and Prairie Creek fault zones, located to the south of Lake Oroville. Investigations into the Oregon Gulch fault have shown no evidence of Quaternary displacement. Evidence of small-scale, Cenozoic-era fault movements on the Paynes Peak and Prairie Creek fault zones has been identified.

According to the California Geological Survey (CGS), faults that have displaced soils within Holocene time (younger than 11,000 years) are classified as active. Faults that have produced earthquakes within Quaternary time (the last 2–3 million years) are classified as potentially active. The following faults within a 62-mile radius of Oroville Dam are considered by CGS to be active:

- Cleveland Hill Fault—See description above.
- Indian Valley Fault—This fault is approximately 7 miles long and is located about 48 miles northeast of Oroville Dam.
- Dunnigan Hills Fault—This fault is about 12 miles long and is located approximately 53 miles southwest of Oroville Dam. No historical earthquakes of magnitude 5.0 or greater have occurred on the Dunnigan Hills fault.

Faults in the project area are shown in Figure 4.1-3. Investigation performed by DWR following the 1975 Oroville earthquake indicated that the Cleveland Hill fault could be traced to within 1.4 miles of the Bidwell Canyon Saddle Dam. From this point, the Swain Ravine fault zone, which shows evidence of displacement during the last 10,000–100,000 years, appears to extend northward into Bidwell Canyon. Field investigations indicated that the fault zone apparently terminates in Lake Oroville.

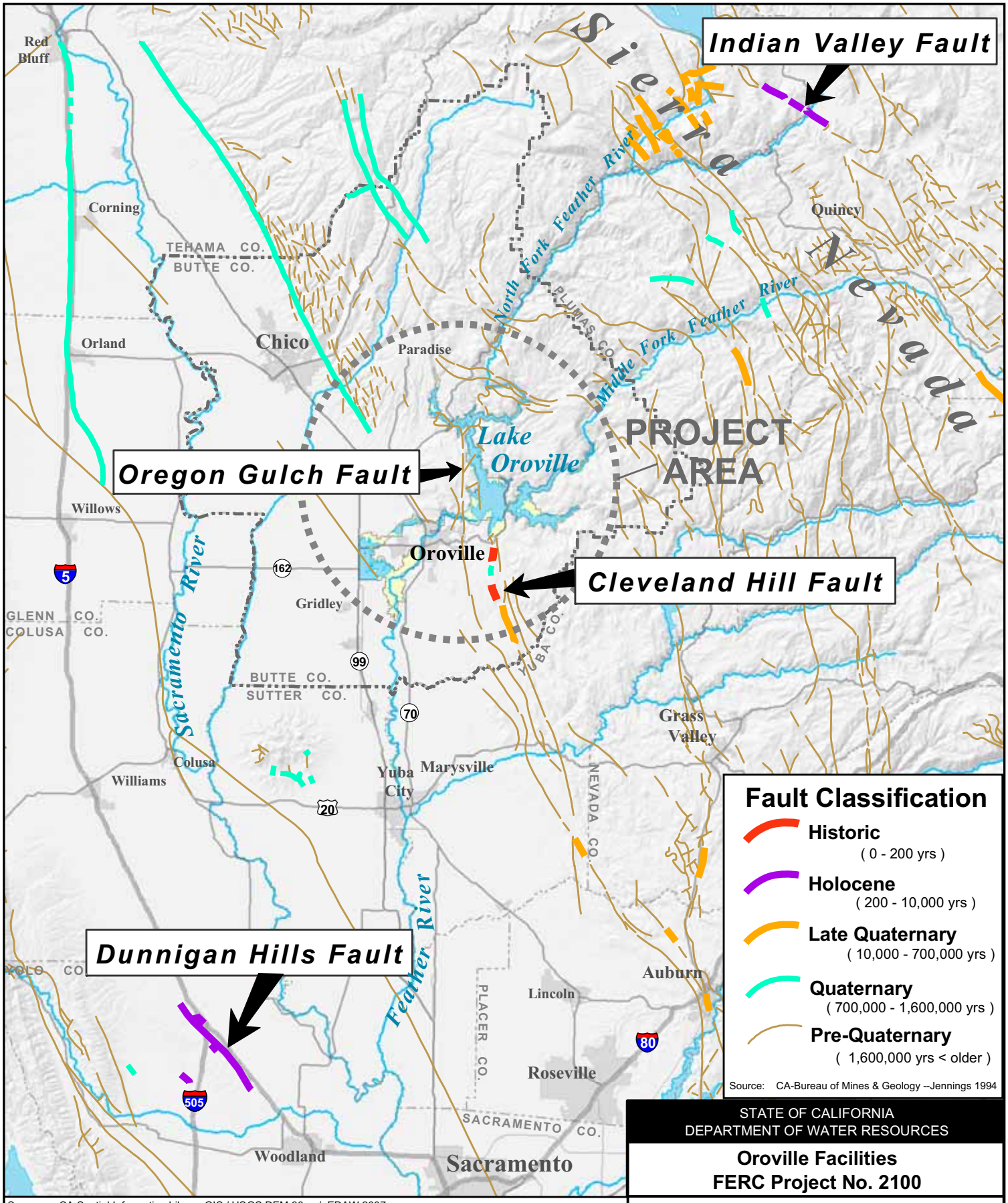
The Oregon Gulch fault trends north to south through the project area, extending from southward from the West Fork Feather River to a point south of Lake Oroville where it is obscured by late Cenozoic surficial deposits. Investigations of the Oregon Gulch fault showed no evidence of Quaternary displacement.

4.1.2.4 River Geomorphology

Conditions Upstream of Oroville Dam

In the lower two-thirds of the Feather River watershed, both the Middle and North Forks of the Feather River flow in deeply incised canyons with little or no floodplain. In the upper one-third of the watershed, streams historically flowed in shallow meandering channels with broad floodplains covered with riparian vegetation. Floodwaters would quickly overtop the banks and deposit sediment on the valley floor. Under present conditions, however, land use changes have caused many of the headwater streams to lose their meander patterns, instead forming sharp V-shaped channels devoid of vegetation with tall, easily eroded banks.

The upper Feather River watershed (outside the Oroville Facilities FERC Project boundary) is producing high yields of sediment because of accelerated erosion. A U.S. Soil Conservation Service report, *East Branch North Fork Feather River Erosion*



Source: CA Spatial Information Library GIS / USGS DEM 30m / EDAW 2007

Original Scale 1 : 760,320
1" = 12 miles

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DRAFT ENVIRONMENTAL IMPACT REPORT

FIGURE 4.1-3

Faults in the Project Area

Prepared by:	Date	
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Inventory Report (USSCS 1989), estimated that 90 percent of the erosion in the report's 1,209-square-mile study area was accelerated erosion. Accelerated erosion is a soil loss rate greater than natural geologic rates and is caused by human activities such as road building, timber harvesting, overgrazing livestock, and agriculture. High sediment yield can reduce reservoir capacity, degrade water quality, and harm fish and wildlife. High sediment yields are captured by several reservoirs on the North Fork Feather River, upstream of Lake Oroville (DWR 1994).

A large amount of this sediment is captured by reservoirs upstream of Lake Oroville. Lake Oroville captures nearly all of the remaining sediment moving down the Feather River watershed. This in turn results in a sediment-starved river system below the dam. It is estimated that the trap efficiency of the reservoir is greater than 97 percent (USGS 1978). A portion of silt and clay is discharged to the Feather River below the dam, but no pebbles, gravel, or cobbles are transported by the river past Oroville Dam.

Past investigations of watershed instability, erosion, and sedimentation have focused largely on tributaries of the North Fork with little attention to the Middle Fork watershed. This focus on the North Fork and its tributaries reflects concern about excessive sedimentation and increased maintenance, which have been effectively reducing the operating efficiency and life span of reservoirs and power plants. In addition, landslides cause increased sedimentation and downstream cumulative effects. Erosion and downcutting of streams lowers groundwater levels and dewaters meadows. Reduced streamflow in the late summer and fall from dewatered meadows reduces hydropower generation capability. The dewatering of meadows high in the Feather River watershed has also resulted in their transformation from perennial grasses to dry-land vegetation such as sagebrush.

Based on the geomorphological assessment and habitat typing of the West Branch and the Middle Fork tributaries above the full pool level (i.e., 900 feet) of Lake Oroville completed as part of Oroville Facilities Relicensing Study Plan (SP) G-1, Effects of Project Operations on Geomorphic Processes Upstream of Oroville Dam, impacts of project operations were not observed. Fluctuating water levels discourage substantial delta and sediment deposits above the 900-foot level. At the time of the field investigation for SP-G1, upper portions of the fluctuation zone were exposed to fluvial (as opposed to lentic) conditions. Based on the geomorphological assessment and habitat typing of the four main tributaries within the fluctuation zone, the following preliminary conclusions were presented in SP-G1:

- The West Branch has instream gravel strata in the upper portion of the fluctuation zone, but silt accumulation on the downstream portions causes a degradation in gravel quality.

- Gravel deposition in the North Fork is affected by daily fluctuating flows from upstream hydroelectric facilities.

- The Middle Fork has abundant gravel sources from remnant sediment wedge lag deposits.

- The South Fork is gravel-starved above Sucker Run Creek and is subject to flow variations because of Ponderosa Dam. Gravel quality improves downstream of Sucker Run Creek but gradually becomes sandier from remnant sediment wedge deposits.

Based on calculations derived from cross section and bathymetry surveys, the total volume of sediment in storage is about 28,300 acre-feet (af). Of this amount, about 11,400 af was estimated to be derived from shoreline bank erosion, and the remaining 16,900 af was identified as incoming sediment from the upstream watersheds. Based on a 36-year time period since the initial filling of Lake Oroville, annual sediment yield is about 470 af. If this rate of sediment field were to remain constant, sediment would completely fill the reservoir in about 7,400 years.

Conditions Downstream of Oroville Dam

Below Lake Oroville, the Feather River emerges from the Sierra Nevada and enters the Sacramento Valley. Here the stream gradient is less and the topography is mostly flat, with the exception of overflow channels, multiple channel areas, and both artificial and natural levees occurring along the river course. Honcut Creek, the Yuba River, and the Bear River join the Feather River before it enters the Sacramento River at Verona. The elevation of the valley floor varies from about 150 feet above mean sea level (msl) at Oroville to about 25 feet msl at Verona.

The Feather River below Thermalito Diversion Dam to Verona is mostly an alluvial stream flowing across its own sedimentary deposits of clay, silt, sand, and gravel. The river shape, form, gradient, bed material, etc., are constantly changing in response to changes in sediment and streamflow. A typical normal, mature alluvial stream would meander across its floodplain, eroding the outside of river bends and depositing sand and gravel on the inside curve of the bends. Then, during flood events, the river would overtop its banks and silt and sand would be deposited across the floodplain. On the Feather River, a variety of human-induced changes have affected this balance between erosion and deposition.

By far, historic hydraulic mining of Eocene gold-bearing gravel deposits caused the largest impact on the Feather River channel. Massive amounts of erosional debris, including cobbles, gravel, sand, silt, and clay, were washed into the river. Mining debris still profoundly affects the present-day Feather River. Both the human-modified cobble banks and clay rich slickens have increased bank stability. Between the cities of Oroville and Gridley, cobbles and coarse gravel dredge tailings constitute most of the banks, slowing the bank erosion process. Between Honcut Creek and the mouth of the Feather River, the meandering process has slowed, and the river is wide and shallow, with low sinuosity and a sand bed. Most of the reach is mapped as glides or long pools, with low mesohabitat variability.

The lower Feather River meander belt consists of Recent alluvium (Qa) and stream channel deposits (Qsc). Of the two, the alluvium is older, but both consist of river deposits, including floodplain deposits, point bar deposits, channel fill, oxbow lake

deposits, tributary delta deposits, and hydraulic mining debris. The deposits range in size from clay, silt, and sand to gravel, cobbles, and boulders. Coarse deposits predominate near the City of Oroville and fine deposits predominate from Gridley downstream to the mouth of the Feather River.

Older alluvial deposits not directly linked to the present Feather River form terraces on both sides of the active stream channel. These deposits are typically higher in elevation, more resistant to erosion and define the boundaries of the active meander belt.

4.1.3 Soils

4.1.3.1 Upstream Project Area

Soil Conditions

Soils in the tributary areas upstream of Oroville Dam are derived from weathering of the parent rock material in each area: Mesozoic and Paleozoic metasedimentary and volcanic rocks, Mesozoic intrusive plutonic rocks, and Cenozoic volcanic and sedimentary rocks. Soil profiles in the metamorphic and igneous rocks underlying the central and western portions of Lake Oroville tend to be thick, while thin soil profiles developed on the intrusive igneous rocks underlying the eastern portion. Along the lower portions of the Middle Fork and South Fork Feather River, intrusive rocks that are exposed tend to decompose readily into their basic mineral assemblages. These rocks do not generally form deep soil profiles, but can be readily eroded by wave/wind action.

Slope Stability/Landsliding

Landslides are numerous along the banks of Lake Oroville and common along the North Fork and Middle Fork Feather River. The landslides occur in granitic and metamorphic rocks that form the hills and valleys of the westernmost portion of the Sierra Nevada. Many of the landslides continue into the depths of the reservoir.

The majority of the active landslides around Lake Oroville are the result of reactivation of inactive or ancient landslides. There are also a substantial number of small active landslides, particularly on the Middle Fork Feather River, that are likely caused by repeated wave action undercutting unstable areas, resulting in bank/toe failure.

The amount of material derived from active landslide activity is considered minimal when compared to the amount of incoming watershed sediment and material derived from shoreline erosion. Nonetheless, it should be noted that significant reactivation of inactive or ancient slide masses could introduce large volumes of material into the reservoir and could block portions of the upper arms of Lake Oroville. There is evidence that a large prehistoric landslide, the Bloomer Hill Landslide, temporarily blocked the North Fork Feather River (DWR 2004).

The total area of confirmed landslides mapped in the Lake Oroville area is approximately 4,154 acres. Of this total, 328 acres (8 percent) are considered active,

579 acres (14 percent) are considered inactive, and the remaining 3,246 acres (78 percent) are ancient landslides. Approximately 15 shoreline miles are mapped as landslide material, representing less than 9 percent of the 167 miles of total shoreline length.

4.1.3.2 Downstream Project Area

The soils in the project area downstream of Oroville Dam are found on relatively level floodplain, with most slopes ranging from 0 to 2 percent. The steepest slope, with the exception of riverbank and road cuts, is 5 percent. The most common parent material for the soils is river alluvium, with some soils derived from mining debris deposited during the hydraulic mining period.

The predominant soil types or textures in the 100-year floodplain are characterized as fine sandy loam, loamy sand, and loam to silt loam. Minor soil types are clay, clay loam, sandy clay loam, sandy loam, silt loam, silty clay, sand and gravel, and river wash. Many of the soils are further divided by occurrence of flooding, such as occasionally flooded to frequently flooded. The soils range from shallow to very deep, with most being moderately deep to very deep. Floodplain soils are conducive to agriculture and many areas of riparian floodplain and fluvial terraces have been converted to irrigated crops and orchards.

Soils formed on the upper member of the Modesto formation are designated as Wyman series soils and are brown loam or silt loam with strong brown colors, and a strong blocky structure. Soils formed on the lower Modesto member are diverse and difficult to map. Soils formed on distributary channels of the lower member are designated as Ryer coarse variants, and are weakly developed on the coarse, somewhat excessively drained materials. The finer soils of the Ryer series are moderately to strongly developed with horizons ranging from about 10 percent to 13 percent clay.

Soils formed on the surface of the Riverbank formation are locally referred to as “red clays,” and are deeper, redder, and more strongly developed than those found on Holocene alluvium and the Modesto formation. The Yokohl, San Joaquin, Kimball, Kimball deep variants, and Ramona series soils are all associated with the Riverbank formation.

The great age and complex depositional and erosional history of the Laguna formation produced a large array of soils on various parts of the formation. The soils found on little eroded parts of the uppermost gravel bed of the upper member are of the Redding or Red Bluff series, a yellowish-red, very gravelly loam and a red, gravelly clay. Around the Oroville Airport and the Thermalito Afterbay area the soils are Corning series. Other soils of the upper Laguna formation have been mapped as the Cometa series, the Agate variant, the Altamont, and the Burris series. The lower member of the Laguna has a variety of associated soils, commonly strong variants of the Redding and Corning series.

4.1.4 Paleontological Resources

The known fossil-bearing formations within the Oroville Facilities Project area are the Calaveras Limestone, the Monte del Oro formation, and the Laguna formation. These are ranked as C1 formations, according to BLM criteria, because they are known to contain noteworthy examples of invertebrate or plant fossils (Monte del Oro and Calaveras) or vertebrate fossils (Laguna). Also occurring within the project area are portions of the Ione and Tuscan formations. These are ranked as "C2" formations because they have the potential to contain vertebrate fossils or noteworthy examples of invertebrate or plant fossils. Other rock formations exposed within the project area are not expected to contain fossils because of their igneous or metamorphic nature.

Calaveras Limestone is exposed in scattered blocks within the Foothill Melange-Ophiolite Belt and contains invertebrate fossils in exposures near Lime Saddle. The Monte del Oro formation is exposed north of Oroville and contains plant and leaf impressions in the shale units. This formation is equivalent to the Mariposa formation, which is exposed along the length of the western Sierra Nevada and contains many fossil localities. Excavations into the Laguna formation have revealed Plio-Pleistocene vertebrate fauna in places.

4.2 SURFACE WATER QUANTITY AND QUALITY

This section describes surface water quantity and quality within the Project area shown in Figure 4.2-1 and includes a description of the regional setting, water use, flood management, surface water hydrology, and surface water quality. This section also describes the SWRCB Basin Plan Objectives as they apply to Project waters and the role of the Oroville Facilities in protecting these objectives. Oroville Facilities compliance with other regulatory requirements related to water quantity and quality is also included. This information is intended to provide a basis for comparison between the existing surface water quantity and quality conditions relative to the potential effects on these resources from the Project alternatives.

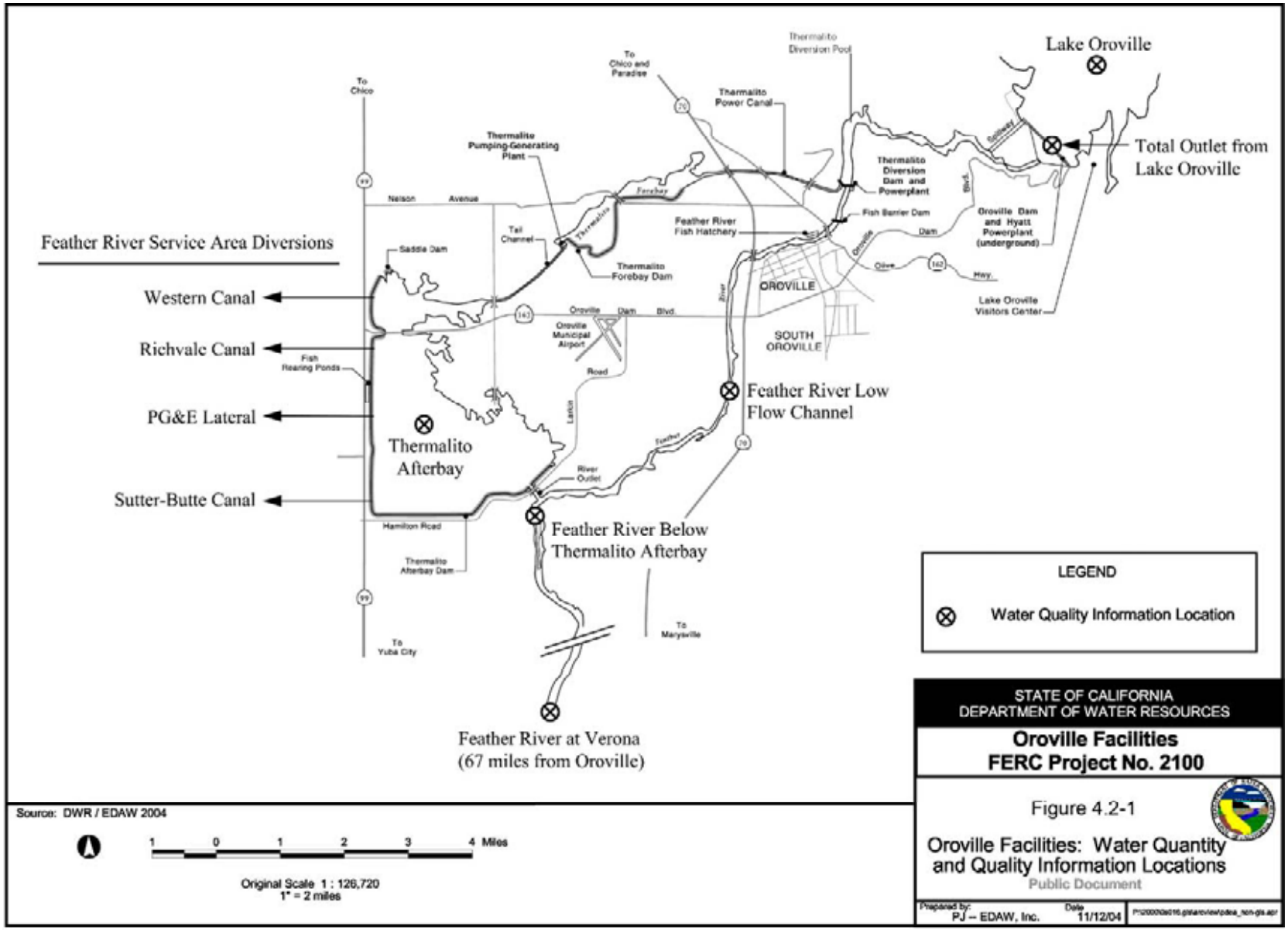
The Oroville Facilities allow DWR to meet a number of existing water supply and environmental commitments. These include the provision of entitlements for local irrigation diversions and SWP contract supply deliveries. Oroville Facilities operations for flood management, water supply, and environmental purposes affect downstream Feather River hydrology by altering flow magnitude, timing, and duration. These ongoing environmental requirements include minimum flow releases to benefit aquatic species downstream. The Oroville Facilities provide flood management and damage reduction benefits to many downstream communities (including Oroville, Yuba City, Marysville, and Sacramento), as well as to highly developed and productive agricultural areas along the Feather River and Sacramento River downstream of Oroville Dam.

4.2.1 Surface Water Quantity

4.2.1.1 Regional Overview

The Oroville Facilities were developed as part of the SWP and provide water storage, flood management, power generation, water quality improvement, and recreation, fish, and wildlife enhancement. The physical arrangement of the Oroville Facilities is illustrated in Figure 4.2-1.

The Oroville Facilities alter the streamflow in the Feather River through flow regulation that includes diversions for water supply, flood management, water quality requirements of the Sacramento–San Joaquin Delta (Delta), and instream flow requirements. Hydroelectric power operations do not further alter the streamflow in the Feather River downstream of the Thermalito Afterbay Outlet; hydroelectric power is generated from water released from Lake Oroville, and all of that water is essentially re-regulated in Thermalito Afterbay before it is released downstream. However, streamflow alterations in the lower Feather River do vary based on different hydrologic water year types. Water year types are determined according to the Sacramento Valley water year type definitions developed by the SWRCB as part of the regulatory activities for the San Francisco Bay/Sacramento–San Joaquin Delta (Bay-Delta). Water year type classifications include Critical, Dry, Below Normal, Above Normal, and Wet. Critical water years are sometimes referred to as Critically Dry water years.


Lake Oroville
Total Outlet from Lake Oroville
Feather River Service Area Diversions
Western Canal
Richvale Canal
PG&E Lateral
Sutter-Butte Canal
Thermalito Afterbay
Feather River Low Flow Channel
Feather River Below Thermalito Afterbay
Feather River at Verona
(67 miles from Oroville)
Thermalito Diversion Pool
Thermalito Power Canal
Thermalito Pumping-Generating Plant
Thermalito Diversion Dam and Powerplant
Thermalito Forebay Dam
Feather River Fish Hatchery
Fish Barrier Dam
Oroville Dam and Hyatt Powerplant (underground)
Lake Oroville Visitors Center
OROVILLE
SOUTH OROVILLE
Oroville Municipal Airport
Thermalito Afterbay Dam
Saddle Dam
Fish Rearing Ponds
To Chico
To Chico and Paradise
To Yuba City
To Marysville
LEGEND
Water Quality Information Location
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Facilities
FERC Project No. 2100
Figure 4.2-1
Oroville Facilities: Water Quantity and Quality Information Locations
Public Document
Source: DWR / EDAW 2004
1 0 1 2 3 4 Miles
Original Scale 1 : 126,720
1" = 2 miles
Prepared by: PJ -- EDAW, Inc.
Date 11/12/04

Extensive computer simulation modeling of Oroville Facilities operations was performed to support the relicensing environmental study programs during the past 5 years or more. A complete description of the various modeling tools used, and results of the model runs are contained in Appendix C of the PDEA (DWR 2005). Model runs depicting Existing Conditions based on a year-2001 level of development were used to help define baseline conditions to support environmental impact assessments and comparisons between alternatives in the PDEA. Those same model runs are used to help define Existing Conditions for the purposes of this DEIR.

4.2.1.2 Water Use

The Oroville Facilities divert water for senior water rights holders in the Feather River Service Area (FRSA) and supply water to the SWP Water Contractors. Monthly irrigation diversions of up to 150,000 acre-feet (af) are made from the Thermalito Afterbay Complex to the FRSA during the May-through-August primary irrigation season. Average annual FRSA diversions are slightly less than 1 million acre-feet (maf).

Water diversions to meet FRSA entitlements occur primarily during the irrigation months, April–October. Under Existing Conditions (2001 Level of Development), the average annual diversion of water to meet FRSA entitlements is about 994 thousand acre-feet (taf). The minimum and maximum annual diversions over the modeling period (1922–1993) are 613 taf and 1,057 taf, respectively.

Water is required in all months of the year to meet SWP Water Contractors' requests, with the highest requests typically in June through August and the lowest in January. Water available for delivery varies depending on hydrologic conditions and operating requirements. The model information for Existing Conditions, indicates that the average annual delivery to meet SWP contractor requests is about 3,051 taf. The maximum and minimum annual deliveries over the modeling period were 3,914 taf and 761 taf, respectively.

Discharges into the lower Feather River continue into the Sacramento River and into the Delta. At the north end of the Delta, some of this water may be pumped into the North Bay Aqueduct. In the south Delta, water is diverted into Clifton Court Forebay, where the water is stored until it is pumped into the California Aqueduct. Additionally, flows through the Delta are maintained to meet Bay-Delta water quality standards.

More detailed information regarding water supply, including a monthly breakdown of deliveries, is included in PDEA Appendix C (DWR 2005).

4.2.1.3 Flood Management

Flood management is one of the major benefits of the Oroville Facilities. The facilities are an integral component of the flood management system for areas along the Feather and Sacramento Rivers downstream of Oroville Dam. During the wintertime, the Oroville Facilities are operated under flood control requirements specified by the U.S.

Army Corps of Engineers (USACE). Flood management releases are based on the release schedule in the flood control diagram or the emergency spillway release diagram prepared by USACE, whichever requires the greater release (see Figure 3.2-3, Lake Oroville Water Levels for Dry, Average, and Wet Water Years, for a depiction of the flood control space required by USACE). During flood events, Lake Oroville and Oroville Dam are operated to attenuate the peak inflow of the natural flood hydrograph, substantially reducing both the magnitude and the frequency of flooding for Oroville, Marysville, Yuba City, and many smaller communities near the Feather River.

Flood control space requirements are based primarily on USACE's goal to protect urban and agricultural areas along the Feather River below Lake Oroville. These requirements are established to be compatible with multiple uses of the available reservoir space. When flood control space is not required to accomplish flood management objectives, the reservoir space can be used to store water for other purposes. From October through March, the maximum allowable storage limit (the point at which specific flood release would have to be made) varies from about 2.8 to 3.2 maf to ensure adequate space in Lake Oroville to handle flood inflows. This allows higher reservoir levels when the prevailing hydrology is dry while maintaining adequate flood protection under USACE requirements. The actual encroachment demarcation is based on a wetness index, computed from accumulated basin precipitation. Flood control space requirements, determined through planning studies, vary from a minimum of 375 taf to a maximum of 750 taf of storage, depending on hydrologic conditions.

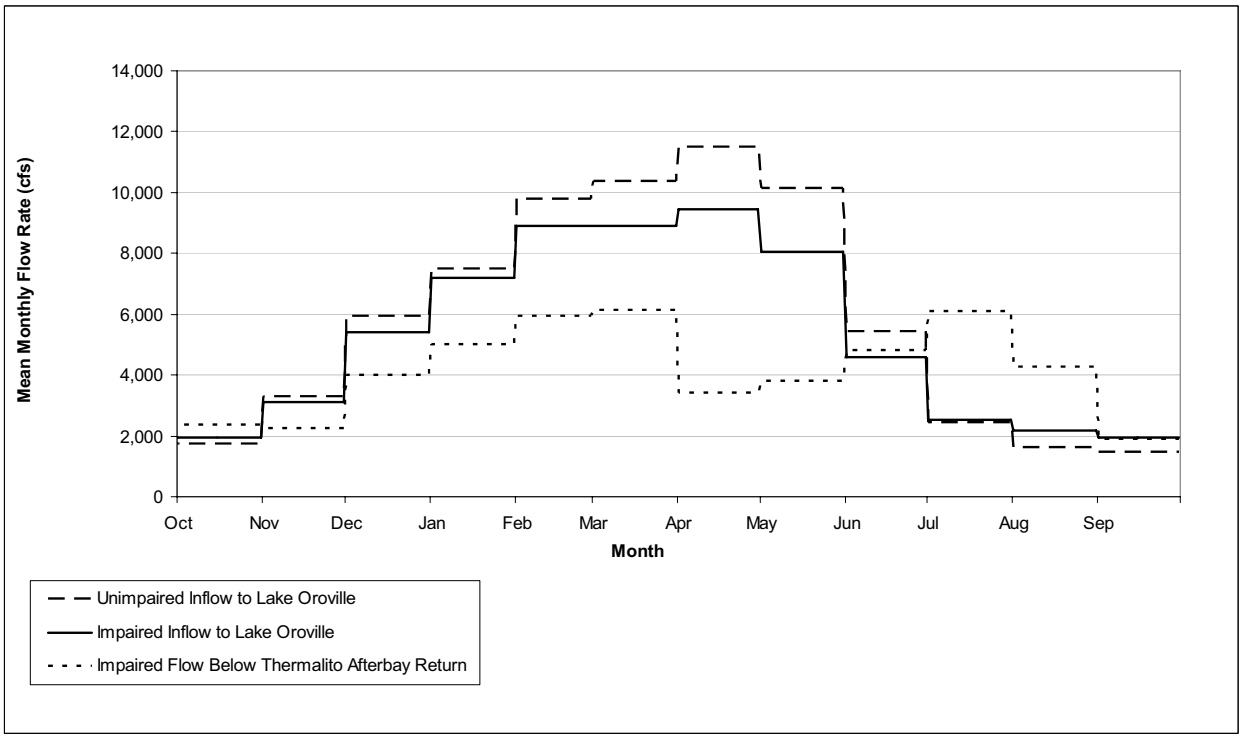
Decisions regarding flood releases are made in consultation with USACE. To fully utilize downstream channel capacities and storage space under various flood conditions, a maximum release capacity of 150,000 cubic feet per second (cfs) throughout the range of flood control space is desirable. However, since some reduction in this capacity in the lower range of the flood control space would not seriously reduce flood control accomplishments but would reduce cost appreciably, it was mutually agreed between the State of California and the United States that a smaller release capacity at the lower levels would be acceptable (Department of the Army 1970). The full 150,000-cfs release capacity must be provided when storage is within the upper half of the flood control space, and sufficient capacity exists in the lower levels to enable control of the standard project flood using the routing criteria found on the flood control diagram. A release capacity of 85,000 cfs occurs when the reservoir water surface elevation is at 848.5 feet (ft) (bottom of the flood control storage space), and the 150,000-cfs release capacity when the reservoir water surface elevation is at 863.5 ft.

4.2.1.4 Surface Water Hydrology

Flow in the Feather River is altered by other hydroelectric, water storage, and diversion projects upstream of the Oroville Facilities, Lake Oroville operation, and by diversions from Thermalito Afterbay to meet FRSA entitlements. Upstream projects alter Feather River flow through operation of storage facilities and by diversions from the river and its tributaries.

The average annual yield of the upstream Feather River basin at Oroville is about 4.2 maf. Much of the runoff occurs between January and June. Summer inflows into the reservoir are sustained at about 1,000 cfs by snowmelt and accretions from springs and groundwater in the upper watershed. Due to several diversions upstream, actual annual inflow into Lake Oroville is about 4.0 maf. Annual flows are variable and depend upon precipitation. From 1979 to 1999, annual inflows ranged from a minimum of 1.7 maf to as high as 10 maf.

Operation of Lake Oroville alters flow in the Feather River by storing inflows and making releases later in the year, or in subsequent years to meet downstream requirements. Mean monthly outflow from the project typically varies from 2,000 cfs to about 9,000 cfs. Mean monthly Feather River unimpaired and regulated (impaired) inflows to Lake Oroville, and flows below the Thermalito Afterbay Outlet are shown in Figure 4.2-2. In general, regulated inflows to Lake Oroville are reduced from unimpaired conditions during the months of November–June, primarily due to upstream diversions and storage operation. Conversely, regulated inflows to Lake Oroville tend to be slightly higher than under unimpaired conditions in the months of August–October due to releases from upstream projects during those months.



Source: DWR, California Data Exchange Center

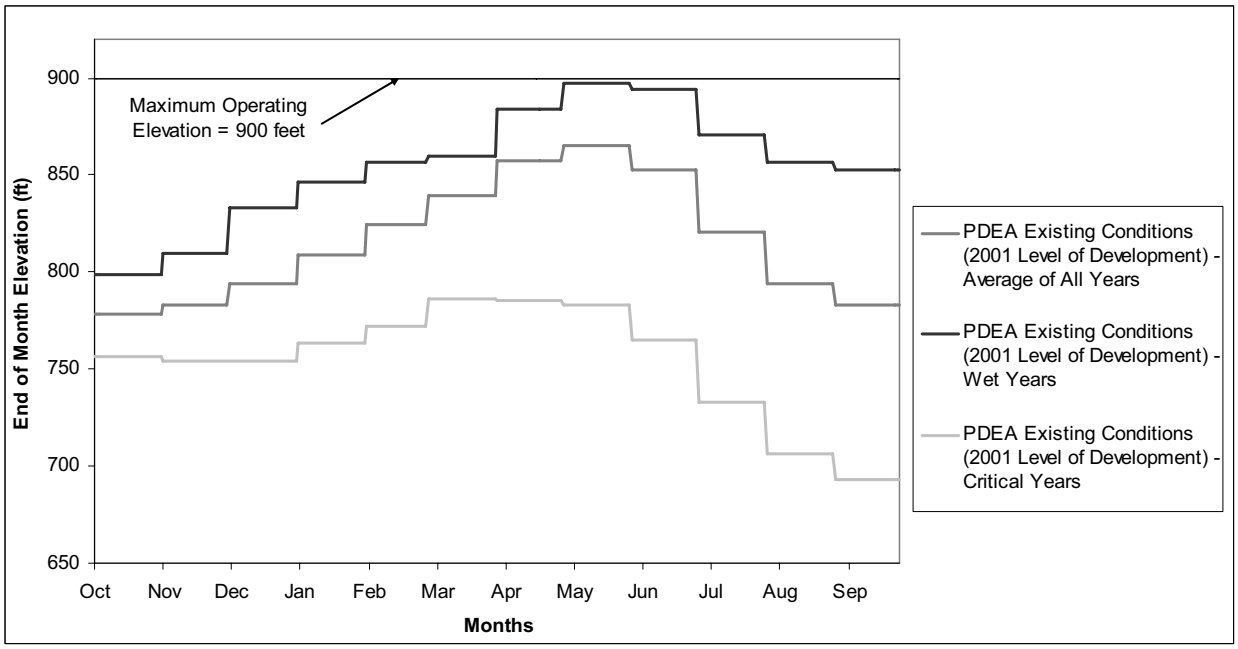
Figure 4.2-2. Mean monthly impaired and unimpaired inflow into Lake Oroville and flow below the Thermalito Afterbay Outlet under Existing Conditions.

The following sections provide a brief summary of existing (2001 Level of Development) surface-water hydrology conditions and related operating parameters.

Lake Oroville

Lake Oroville is generally operated to store water during the winter, (when most of the watershed's rainfall occurs) and the spring snowmelt period and make releases in the summer and fall to meet downstream requirements. Lake Oroville end-of-month reservoir water surface elevations were simulated during development of the PDEA using CALSIM II modeling and were used to describe reservoir operation under Existing Conditions.

Lake Oroville end-of-month elevations for Average, Wet, and Critically Dry year types are shown in Figure 4.2-3 for Existing Conditions. During the wetter years, Lake Oroville typically fills to capacity, or near capacity, in May or June. In drier years, the reservoir reaches its maximum elevation as early as March and does not fill to capacity, reducing DWR's ability to meet downstream requirements and fulfill SWP contractor requests. Reservoir storage typically reaches its minimum between September and January.

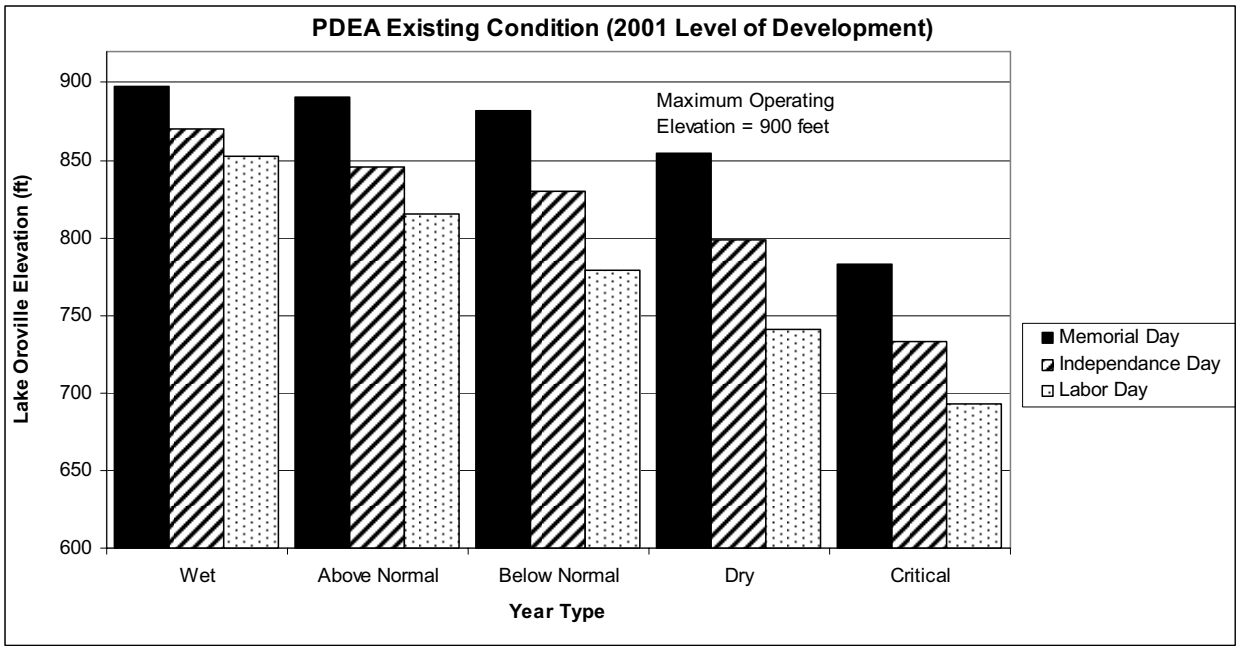


Source: DWR, 2004 OCAP Study 3 CALSIM II Modeling Results

Figure 4.2-3. Simulated Lake Oroville average end-of-month water surface elevation for All years, Wet years, Critical years.

Average Lake Oroville water surface elevations on Memorial Day, Independence Day, and Labor Day under different water year types for Existing Conditions are shown in Figure 4.2-4. On Memorial Day, in Wet years, Lake Oroville is typically at or near its maximum normal operating elevation of 900 ft above mean sea level (msl). In drier hydrologic years, the elevation of Lake Oroville is lower because the inflow to the reservoir is less. On Memorial Day, in Critical years, the surface elevation of Lake Oroville averages about 774 ft, representing a drawdown of about 126 ft from the

maximum normal operating elevation of 900 ft. The surface elevation of Lake Oroville is reduced through the summer season as releases from storage are required to meet downstream requirements, including instream flow, environmental requirements, in-basin uses, and FRSA and State Water Contractors (SWC) water supply requests. Under the Coordinated Operating Agreement (COA), the SWP and the federal CVP operate jointly to meet Delta water quality requirements and other water demands within the Sacramento River basin. These requirements are referred to as "in-basin" demands. On Labor Day Lake Oroville average elevation is about 707 ft in Critical years and 859 ft in Wet years, representing drawdowns of about 193 ft and 41 ft, respectively.

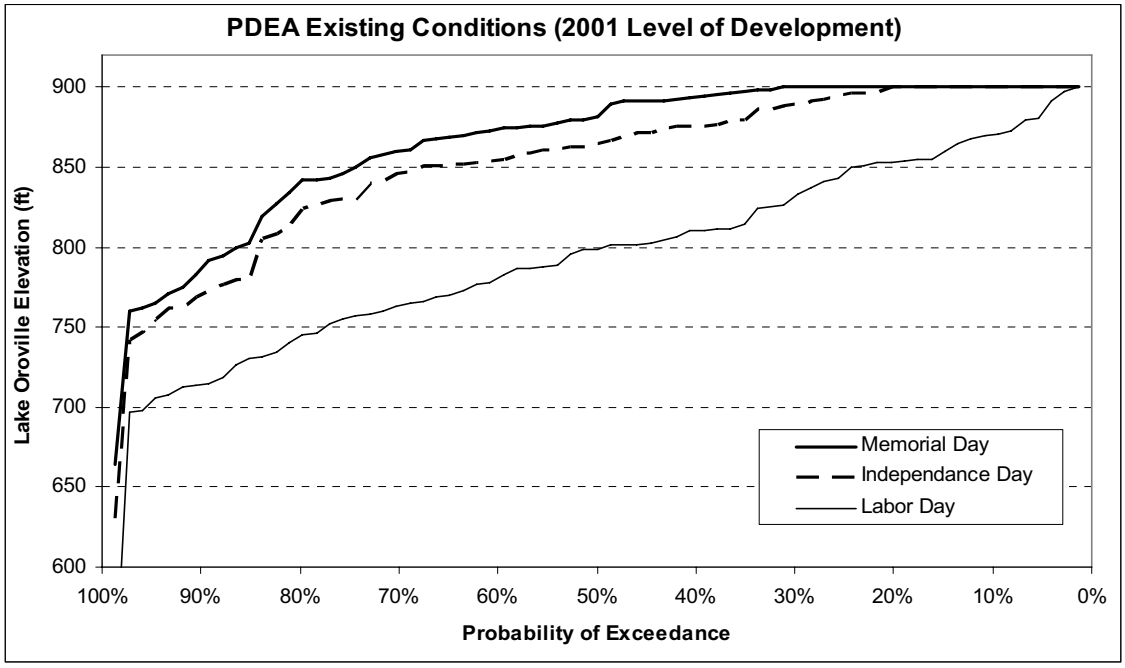


Source: DWR, 2004 OCAP Study 3 CALSIM II Modeling Results

Figure 4.2-4. Simulated average Lake Oroville water surface elevations, for specific days, by water year type, under Existing Conditions.

Elevation-frequency plots of Lake Oroville water surface elevation for Memorial Day, Independence Day, and Labor Day for Existing Conditions are shown in Figure 4.2-5. On Memorial Day, Lake Oroville has a 90 percent probability of being at elevation 787 ft or higher and a 50 percent probability of being at elevation 885 ft. These elevations represent drawdowns of about 137 ft and 15 ft from the maximum normal operating elevation of 900 ft.

Similarly, on Labor Day, water surface elevations at Lake Oroville have a 90 percent probability of being at elevation 725 ft and a 50 percent probability of being at elevation 791 ft. These elevations represent reservoir drawdowns of about 175 ft and 109 ft from the maximum normal operating elevation of 900 ft.



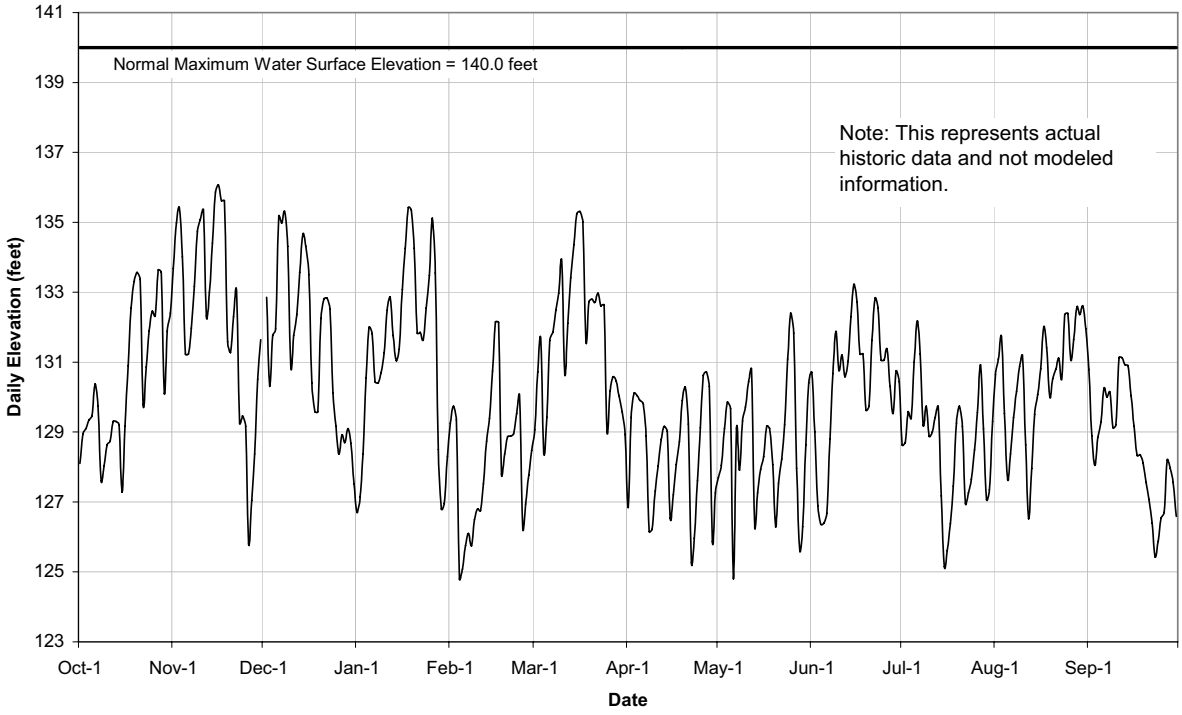
Source: DWR, 2004 OCAP Study 3 CALSIM II Modeling Results

Figure 4.2-5. Simulated monthly Lake Oroville water surface elevations, for specific days, under Existing Conditions.

Thermalito Afterbay

Thermalito Afterbay is operated to meet multiple requirements including regulation of inflow from the Thermalito Pumping-Generating Plant, provision of water for withdrawal during pump-back operation, and to make releases through the Thermalito Afterbay Outlet to the Feather River. Thermalito Afterbay is also the source of diversions for FRSA irrigation entitlements. A high degree of operational flexibility is required at Thermalito Afterbay to comply with all the existing flow release requirements for water supply, water quality, and instream flow needs, and to periodically recharge brood ponds to support nesting waterfowl. As a result, the elevation of Thermalito Afterbay fluctuates over short periods of time. Historical water levels for water year 2001 are shown in Figure 4.2-6. While actual fluctuations vary significantly from month to month and year to year, the 2001 water year provides an indication of the upper and lower bounds for an annual operating cycle.

Thermalito Afterbay operation is not affected by natural hydrologic conditions; it is primarily affected by operational requirements. Generally, there are no seasonal differences in the operation of Thermalito Afterbay and the water surface elevation varies from about 124 to 136 ft (msl) throughout the year. When peaking and/or pump-back power operations occur, Thermalito Afterbay tends to operate on a weekly cycle, and water surface elevations vary by approximately 3 feet during the Monday-through-Friday period. On Saturday and Sunday, the elevation is typically reduced by about 3 feet, with a majority of the elevation change occurring on Sunday.



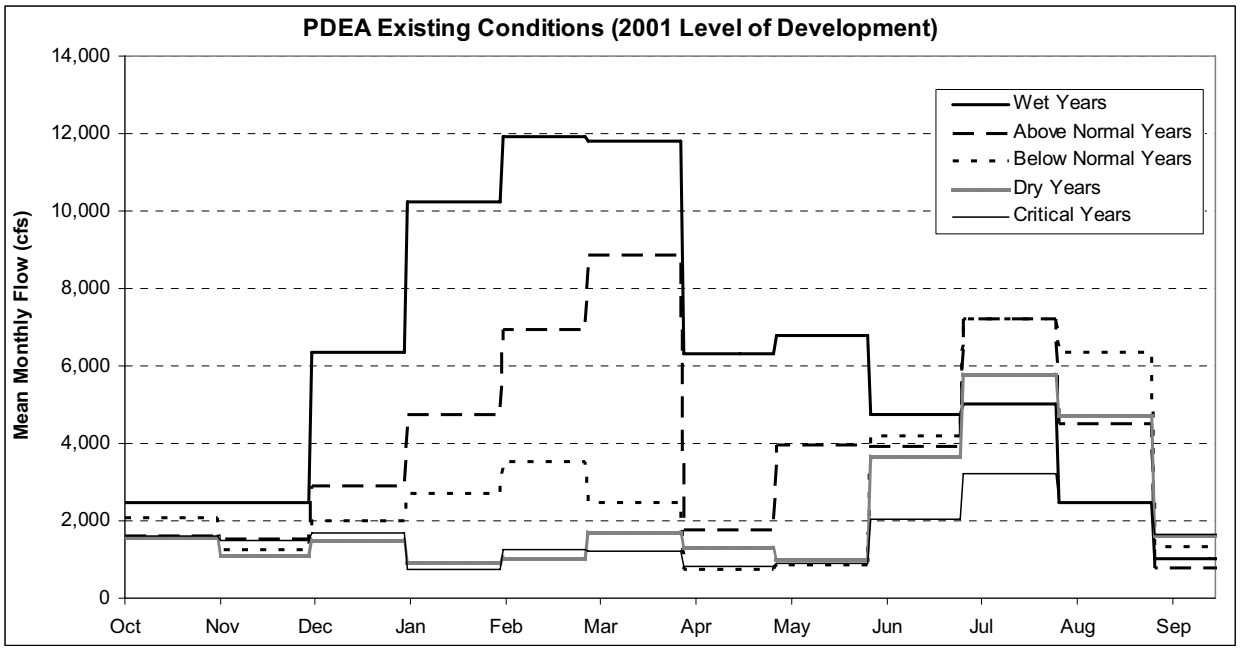
Source: California Data Exchange Center

Figure 4.2-6. Historic daily reservoir water surface elevations for the Thermalito Afterbay in water year 2001.

Feather River

Releases from Lake Oroville are made into the Diversion Pool below Oroville Dam, where water can be released through the Thermalito Diversion Dam Power Plant (or the Thermalito Diversion Dam spillway during flood release periods) to the Low Flow Channel (LFC) of the Feather River or diverted through the Thermalito Power Canal, through the Thermalito Pumping-Generating Plant and into Thermalito Afterbay. Flows can be diverted from Thermalito Afterbay to meet local FRSA requirements or released through the Thermalito Afterbay Outlet back into the Feather River, where they combine with flows passing through the LFC.

In Above-Normal and Wet years, the maximum total release from Lake Oroville typically occurs in February and March, due primarily to the requirement for large releases to meet flood control criteria and maintain adequate flood reservation storage volume in the reservoir (see Section 4.2.1.3, Flood Management, above). In Below-Normal, Dry, and Critically Dry years, the highest releases from Lake Oroville typically occur in July. Simulated average monthly releases from Lake Oroville under Existing Conditions are shown in Figure 4.2-7. A summary of simulated Feather River flows for Existing Conditions is presented in Table 4.2-1.



Source: DWR, 2004 OCAP Study 3 CALSIM II Modeling Results

Figure 4.2-7. Simulated monthly average total releases from Lake Oroville, by year type, under Existing Conditions.

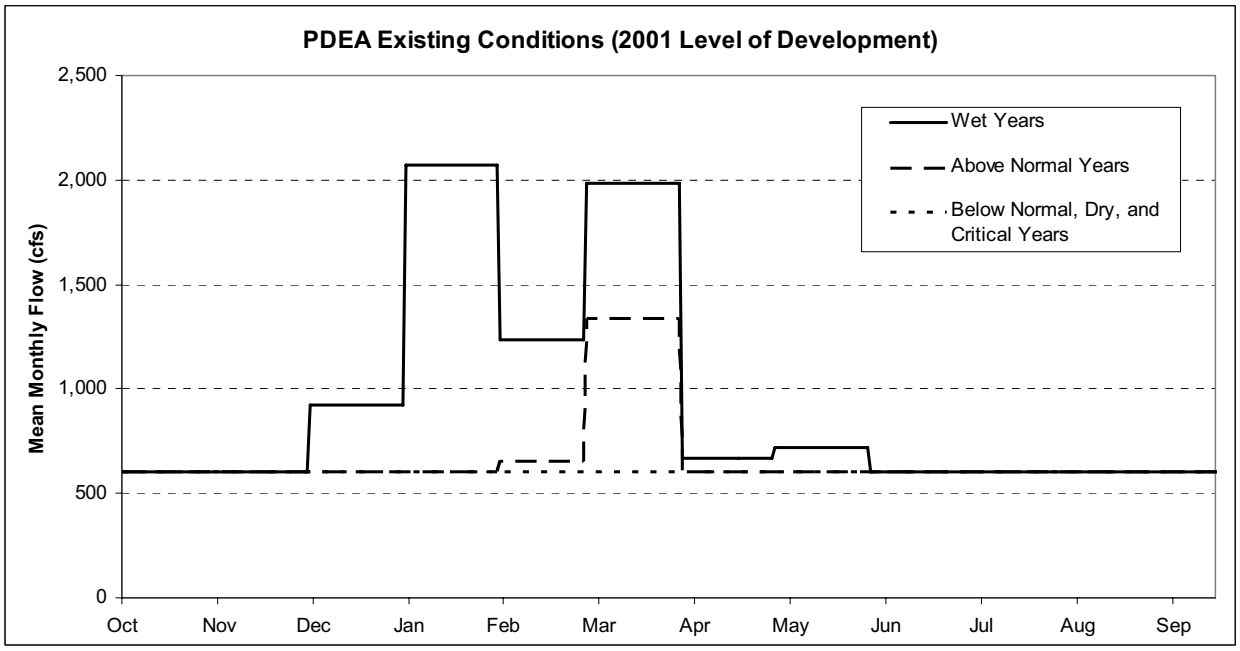
Table 4.2-1. Simulated average annual volumes of Feather River flow under Existing Conditions.

Total Release from Lake Oroville (taf)	
Mean	3,807
Max	8,648
Min	1,434
Low Flow Channel (taf)	
Mean	435
Max	436
Min	434
Feather River Below Thermalito Afterbay (taf)	
Mean	3,013
Max	7,898
Min	985
Feather River at Verona (taf)	
Mean	5,378
Max	14,216
Min	1,576

Note: taf = thousand acre-feet.

Sources: DWR, 2004 OCAP Study 3 CALSIM II Modeling Results

Flows in the LFC are currently required to be at least 600 cfs; however, this flow can be reduced if operating emergencies beyond the control of the Licensee necessitate lower flows. In some Above-Normal and Wet years, releases in excess of the power generating capacity of the Thermalito Pumping-Generating Plant, are occasionally required from Lake Oroville for flood management purposes. During these high-flow events, additional flows are released to the LFC. Typical mean monthly flows in the LFC under Existing Conditions are illustrated in Figure 4.2-8.

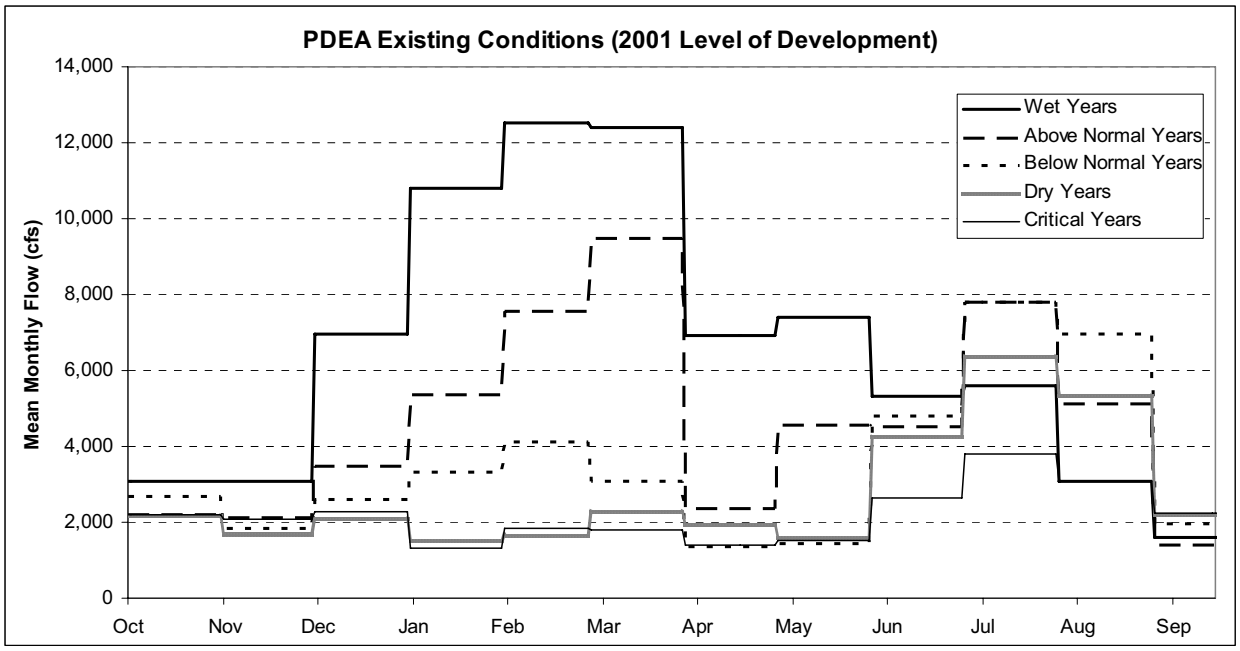


Source: DWR, 2004 OCAP Study 3 CALSIM II Modeling Results

Figure 4.2-8. Simulated monthly average flow in the LFC, by year-type, under Existing Conditions.

Flow in the Feather River below Thermalito Afterbay Outlet (the High Flow Channel (HFC)) varies with water released by the Oroville Facilities for the many commitments DWR has related to releases for downstream water quality control, flood management releases, SWP Water Contractor deliveries, and other purposes. The Feather River flow below Thermalito Afterbay for the simulated Existing Conditions is shown in Figure 4.2-9 for different water year types. As previously mentioned, a summary of simulated flows in the Feather River is shown in Table 4.2-1.

In Above-Normal and Wet years, maximum flows in the Feather River below Thermalito Afterbay typically occur in February or March due to high releases from Lake Oroville for flood management and to maintain adequate flood reservation storage volume in the reservoir. In Below-Normal, Dry, and Critical years, maximum flows in the Feather River below the Thermalito Afterbay Outlet typically occur during the month of July to meet downstream SWP Water Contractor demands. In these years, there are little or no releases made for flood management purposes. Minimum flows for all years typically occur in September.

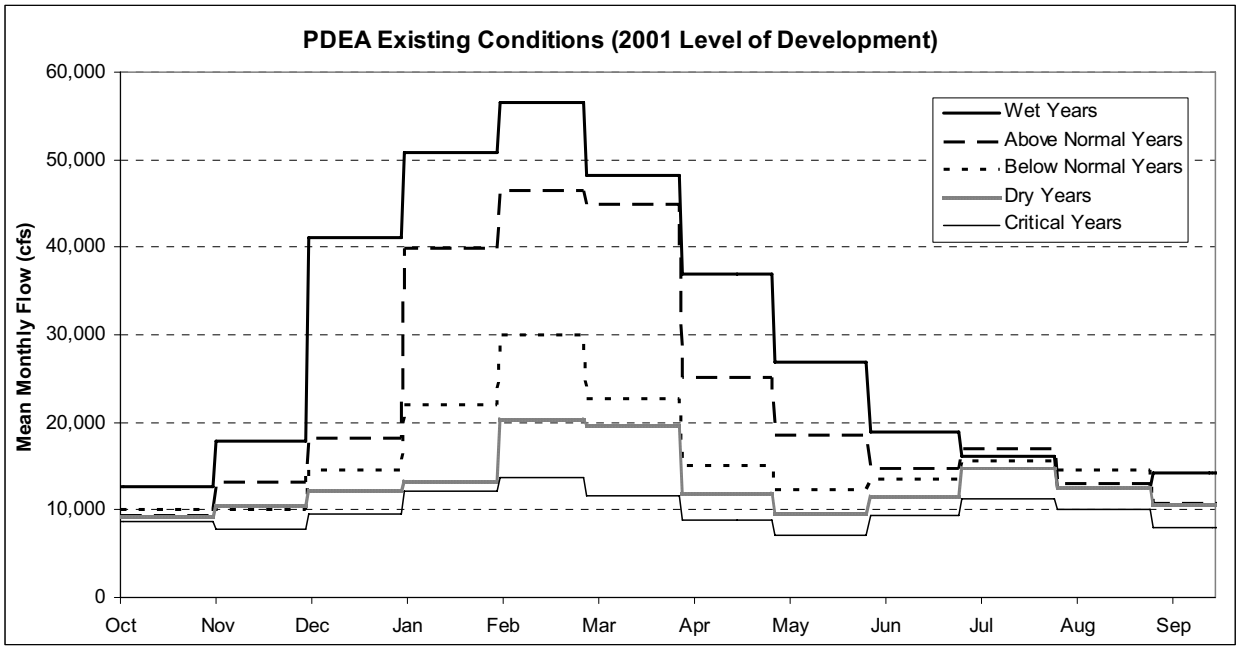


Source: DWR, 2004 OCAP Study 3 CALSIM II Modeling Results

Figure 4.2-9. Simulated monthly average Feather River flow below the Thermalito Afterbay, by year-type, under Existing Conditions.

Approximately 67 miles downstream of the Fish Barrier Dam, the Feather River flows into the Sacramento River near the town of Verona. Flow in the river at Verona is typically greater than the flow below Thermalito Afterbay, due to tributary accretions along the length of the river. The Feather River flow at Verona under the simulated Existing Conditions for different water year types are shown in Figure 4.2-10.

In most years, the maximum flow in the Feather River at Verona occurs during February or March due to the aforementioned reservoir releases from Lake Oroville for flood management purposes, and substantial flow accretions to the river downstream of the Oroville Facilities. Minimum flows for all year types typically occur between September and November.



Source: DWR, 2004 OCAP Study 3 CALSIM II Modeling Results

Figure 4.2-10. Simulated monthly average Feather River flow at Verona, by year type, under Existing Conditions.

4.2.2 Surface Water Quality

4.2.2.1 Regional Setting

DWR's Division of Operation and Maintenance, as part of the SWP, has conducted water quality monitoring for various inorganic, organic, and biological parameters regularly since 1968. Current water quality monitoring within project waters includes testing at Oroville Reservoir, Thermalito Forebay, and Thermalito Afterbay. Water quality monitoring is conducted on a regular schedule to confirm that the Oroville Facilities are reasonably protective of water quality objectives as described below.

Basin Plan—Beneficial Uses and Water Quality Objectives

Section 303 of the federal Clean Water Act requires states to adopt water quality standards that "consist of designated uses of the navigable waters involved and water quality criteria for such waters based upon such uses." The SWRCB carries out its water quality protection obligations and authority through the adoption of specific Basin Plans. The Basin Plans, developed by the regional water boards, establish water quality standards for particular water bodies by designating beneficial uses of those waters and water quality objectives to protect those uses. The Central Valley Regional Water Quality Control Board (RWQCB) provides additional protection of water quality within the Central Valley region by designating additional, water body–specific objectives in its Basin Plan, the *Water Quality Control Plan for the Sacramento and San Joaquin River Basins* (Central Valley RWQCB 2006; http://www.swrcb.ca.gov/quality.html). Guidelines in the Code of Federal Regulations state that beneficial uses, together with their corresponding water quality objectives, can be defined as water quality standards; therefore, Basin Plans encompass both federal and State requirements for water quality control.

Prior to issuance of a new license for the Oroville Facilities, federal law requires that the SWRCB issue a Section 401 water quality certification or a waiver of such certification. The certification requires a determination by the SWRCB that the project complies with appropriate requirements of the Central Valley RWQCB Basin Plan, which includes the water quality objectives for protection of designated beneficial uses.

The Central Valley RWQCB Basin Plan includes both numerical and narrative objectives. Numerical objectives have been established for some parameters that can be measured quantitatively (such as milligrams per liter [mg/L] of a chemical contaminant); narrative objectives have been established for parameters that may not be readily quantifiable (such as taste and odor) or have not been quantified in the Basin Plan (such as toxicity). Both numerical and narrative objectives are applicable when determining effects on beneficial uses. Demonstration of compliance with water quality standards and other appropriate requirements is needed in the application for water quality certification.

The beneficial uses specified by the Central Valley RWQCB Basin Plan for Lake Oroville are municipal and domestic supply, irrigation, power, contact recreation,

non-contact recreation, warmwater habitat, coldwater habitat, warmwater spawning habitat, coldwater spawning habitat, and wildlife habitat. The beneficial uses for the Feather River from the Fish Barrier Dam to the Sacramento River are municipal and domestic supply, irrigation, contact recreation, canoeing and rafting, non-contact recreation, warm freshwater habitat, cold freshwater habitat, warmwater migration, coldwater migration, warmwater spawning habitat, coldwater spawning habitat, and wildlife habitat (Table II-1 of the Basin Plan). The beneficial uses applicable to Lake Oroville and the Feather River from the Fish Barrier Dam to the Sacramento River are described below. Current operations of the Oroville Facilities supports and reasonably protects, or has no adverse effect on (as in the case of coldwater spawning in Lake Oroville), all beneficial uses specified in the Basin Plan for Project waters and are described below.

Lake Oroville

Municipal and Domestic Water Supply. (uses of water for community, military, or individual water supply systems, including drinking water). Lake Oroville is a key part of the SWP, providing supplemental water to two-thirds of California's population and over 750,000 acres of agricultural lands. Water is stored in and released from Lake Oroville to meet water supply, flood protection, water quality improvement, fish and wildlife enhancement, and recreation requirements.

Irrigation—Agriculture. (uses of water for farming, horticulture, or ranching). Water stored in Lake Oroville and rediverted in Thermalito Afterbay is used, in part, for irrigation. Monthly agricultural diversions of up to 190,000 af are made from Thermalito Afterbay and the Feather River during the May-through-August irrigation season. Total annual entitlement of the Butte and Sutter County agricultural users is approximately 1 maf.

Industry—Power. (use of water for hydropower generation). The Oroville Facilities have a combined license generating capacity of approximately 762 megawatts (MW). Hyatt Pumping-Generating Plant has a capacity of 645 MW, while Thermalito Pumping-Generating Plant has a capacity of 114 MW and Diversion Dam Powerplant has a capacity of 3 MW. Average historical generation of Hyatt and Thermalito Pumping-Generating plants in a median water year is about 2.2 billion kilowatt-hours (kWh) (DWR 1999). Thermalito Diversion Dam Powerplant adds another 24 million kWh a year.

Recreation—Contact. (uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible). Water-contact recreation opportunities are provided at Lake Oroville, Thermalito Forebay, and Thermalito Afterbay. The majority of recreation facilities associated with the Oroville Facilities are within the Lake Oroville State Recreation Area (LOSRA). The most popular water-contact recreation activities include bank fishing, boat fishing, swimming, water skiing and wakeboarding, and use of personal watercraft. Lake Oroville has one developed swim area at Loafer Creek, but much of the swimming activity in the lake is more informal in nature. During normal operations, reservoir drawdown can affect the beaches and their accessibility, particularly when the water surface level decreases to

the point where steep and muddy shorelines are exposed. Formal and informal swimming opportunities are also provided at Thermalito Forebay and Thermalito Afterbay.

Recreation—Other Non-contact. (uses of water for recreational activities involving proximity to water, but where there is generally no body contact with water, nor any ingestion of water [e.g., picnicking, sunbathing, hiking, beachcombing, horseback riding, camping, boating, hunting, sightseeing, and aesthetic enjoyment]). The LOSRA provides numerous non-contact recreation opportunities. The most popular non-contact recreation activities include motorboating, tent camping, houseboating, horseback riding, picnicking, recreational vehicle camping, and hiking.

Freshwater Habitat—Warm Water.[1] (uses of water that support warmwater ecosystems including but not limited to preservation and enhancements of aquatic habitats, vegetation, fish, or wildlife, including invertebrates). The Lake Oroville warmwater fishery is a regionally important self-sustaining recreational fishery and is the site of several annual bass fishing tournaments. Thermalito Afterbay is also a popular largemouth bass fishery.

Freshwater Habitat—Cold Water. (uses of water that support coldwater ecosystems, including but not limited to preservation or enhancements of aquatic habitats, vegetation, fish, or wildlife, including invertebrates). Lake Oroville's coldwater fishery is primarily composed of coho salmon, although rainbow trout, brown trout, and lake trout are caught periodically. The coho salmon fishery is sustained by a "put-and-grow" hatchery stocking program. Thermalito Forebay provides habitat primarily for coldwater fish; a "put-and-take" trout fishery is managed in Thermalito Forebay.

Spawning—Warm Water. (uses of water that support high-quality aquatic habitats suitable for reproduction and early development of fish). During normal operations, reservoir water level fluctuations (in particular decreasing water levels) in Lake Oroville can affect black bass nest survival; however, as noted under Freshwater Habitat above, the warmwater fishery in Lake Oroville is self-sustaining.

Spawning—Cold Water. The Lake Oroville coldwater fishery is not self-sustaining, possibly due to insufficient spawning and rearing habitat in the reservoir and accessible tributaries. Coldwater spawning is not known to occur within Lake Oroville. The Oroville Facilities do not affect the suitability of upstream spawning habitat. The Oroville Facilities do not affect this beneficial use designation.

Wildlife Habitat. The wildlife and wildlife habitats in the project area are influenced by the project's proximity to the Sierra Nevada, the Sacramento Valley, an abundance of water associated with the project, and the Feather River. The project area supports 24 habitat types, all of which have undergone varying degrees of disturbance from both natural and human-induced changes. Overall, the Oroville Facilities support wildlife habitat in the project area.

[1] As noted in the Basin Plan, segments with both warmwater and coldwater beneficial use designations are considered coldwater bodies for the application of water quality objectives.

Feather River from Fish Barrier Dam to Sacramento River

Municipal and Domestic Water Supply. As a component of the SWP, the Oroville Facilities are operated to provide downstream water supply for municipal, industrial, and irrigation purposes, and water is exported to meet the requests of the SWP water contractors. In 2005 and 2006, the FRSA received 1,035 and 1,057 taf of water, respectively.

Irrigation—Agriculture. The majority of the water diverted from this reach of the Feather River is used for agriculture.

Recreation—Contact. Recreation management of about 10 miles of the Feather River, including the LFC, overlaps with the Oroville Wildlife Area (OWA). Flows in the LFC are provided for coldwater species and could be considered too cold for some water-contact recreation such as swimming and water skiing. During the 2002 and 2003 relicensing study period, no swimming was observed in the Diversion Pool and little was observed in the Feather River. Other contact recreation uses in this area include bank and boat fishing. In fact, most of the visitors entering this reach of the river are wading anglers.

Recreation—Canoeing and Rafting. Although specified as a beneficial use on the lower Feather River, canoeing and rafting are not typical activities on this reach of river. Informal and formal access is available.

Recreation—Other Non-contact. The primary non-water contact recreation activities on the Feather River are boating, hunting, and wildlife viewing. Other recreational opportunities include hiking on trails and camping.

Freshwater Habitat—Warm Water. Warmwater fishes in the lower Feather River include black bass (downstream of the LFC), Sacramento pikeminnow, hardhead, Sacramento sucker, striped bass, bluegill, green sunfish, redear sunfish, and tule perch. The lower Feather River is not managed for warmwater fish habitat; however, from May through August, the Basin Plan specifies that temperatures must be suitable for warmwater fish.

Freshwater Habitat—Cold Water. Coldwater fish species of primary concern in the lower Feather River include spring-run Chinook salmon, fall-run Chinook salmon, Central Valley steelhead, rainbow trout, brown trout, brook trout, green sturgeon, white sturgeon, river lamprey, and American shad. The LFC is managed to protect these species. Under a 1983 operating agreement between DWR and DFG (1983 Agreement), flows are regulated at 600 cfs in the LFC, except during flood events, when flows have reached as high as 150,000 cfs (DWR 1983).

The1983 Agreement specifies a narrative objective for water temperatures downstream of the Thermalito Afterbay Outlet and a numerical objective for temperatures of water provided to the Feather River Fish Hatchery (Table 4.2-2). Below the Thermalito Afterbay Outlet, temperatures must be suitable for fall-run Chinook salmon during the fall months (after September 15). As previously noted, from May through August,

temperatures must be suitable for shad, striped bass, and other warmwater fish. The 2004 Operations Criteria and Plan (OCAP) Biological Opinion issued by NMFS requires 65-degree Fahrenheit (°F) water, to the extent possible, at River Mile 61.6 (Robinson Riffle) from June 1 through September 30 (Section 4.4).

Table 4.2-2. Feather River Fish Hatchery temperature objectives (±4°F between April 1 and November 30).

Period	Temperature (°F)
April–May 15	51
May 16–31	55
June 1–15	56
June 16–August 15	60
August 16–31	58
September	52
October–November	51
December–March	No greater than 55

Source: DWR 2001

Migration—Warm Water. The Oroville Facilities do not inhibit warmwater fish migration.

Migration—Cold Water. The discharge and flow requirements described above for Freshwater Habitat—Cold Water support the migration of salmon and steelhead.

Spawning—Warm Water. The upper section of the lower Feather River is managed for coldwater fish, which reduces the spawning habitat suitability for warmwater fish in this section of the lower Feather River. The rest of the downstream extent of the lower Feather River remains suitable for warmwater spawning.

Spawning—Cold Water. Provision of the flows and water temperatures described under Freshwater Habitat—Cold Water generally supports the spawning of Chinook salmon in the fall and steelhead in the early winter.

Wildlife Habitat. The 11,000-acre OWA is managed for wildlife habitat and recreational activities. The OWA includes 5,000 acres adjacent to and straddling 12 miles of the Feather River. Wildlife enhancements in the OWA have included wetland habitat enhancements (brood ponds), a wood duck/wildlife nest box program, and dryland farming for nesting cover and improved wildlife forage. The Oroville Facilities reasonably protect this beneficial use designation.

Water Quality Monitoring and Objectives

DWR's Division of Operation and Maintenance, as part of the SWP, conducts water quality monitoring within Project waters. Nutrients are monitored twice a year, in April and November, within the reservoir at Oroville Dam. Aluminum, barium, cadmium, mercury, silver, chlorinated organics, organophosphorus pesticides, herbicides, carbamates, and other pesticides are monitored quarterly at Thermalito Forebay. At Thermalito Afterbay, nutrients are monitored twice a year while aluminum, barium, cadmium, mercury, and silver are monitored monthly and bromide and suspended

solids are monitored quarterly. This monitoring program was augmented to collect additional specific data as part of the Oroville Facilities Relicensing process.

The Oroville Facilities Relicensing studies evaluated water quality parameters potentially affected by the Oroville Facilities and for which the Central Valley RWQCB has established water quality objectives in the Basin Plan. These parameters include but are not limited to water temperature, dissolved oxygen (DO) and pH, conductivity and minerals, sediment, turbidity, suspended material, settleable material, metals, pesticides and other organic contaminants, petroleum byproducts, nutrients, bacteria (pathogens), tastes and odors, color, floating material, radioactivity, and toxicity. In addition, the benthic macroinvertebrate community was studied according to protocols endorsed by the SWRCB.

Results of the water quality studies conducted for the Oroville Facilities were used to determine compliance of the project with Basin Plan objectives. The water quality measurements were compared to the numerical value of the objectives, and other applicable criteria or standards that are recognized as levels protective of beneficial uses. Other applicable criteria or standards used to augment the evaluation of water quality were obtained from the following sources:

- Criteria of the U.S. Environmental Protection Agency (USEPA) California Toxics Rule (USEPA 2000a);
- *Compilation of National Recommended Water Quality Criteria* (USEPA 1999);
- Criteria of the nutrient criteria guidance documents (USEPA 2000b, 2000c, 2000d, 2001);
- *Drinking Water Standards and Health Advisories* (USEPA 2000e);
- Drinking-water criteria (DHS 2004);
- *Water Quality for Agriculture* (Ayers and Westcot 1985);
- *Draft Guidance for Freshwater Beaches* (DHS 2006); and
- Methylmercury tissue contaminant action levels established by the California Office of Environmental Health Hazard Assessment (OEHHA) pursuant to USEPA recommended criteria (USEPA 2001).

Table 4.2-3 lists the objectives, standards, and criteria in the Basin Plan.

Table 4.2-3. Basin Plan water quality objectives, standards, and criteria[1].

Constituent	Concentration	Standard
Chemical constituents	Less than maximum contaminant levels (MCLs) for inorganics, fluoride, organics, secondary MCL consumer acceptance levels, and secondary MCLs—ranges	Title 22 of California Code of Regulations (CCR); see Tables 64431-A, 64431-B, 64444-A, 644449-A, and 644449-B
Arsenic	≤ 0.01 milligrams per liter (mg/L)	Basin Plan
Barium	≤ 0.1 mg/L	Basin Plan
Cadmium	≤ 0.00022 mg/L	Basin Plan
Copper	≤ 0.0056 mg/L	Basin Plan
Cyanide	≤ 0.01 mg/L	Basin Plan
Iron	≤ 0.3 mg/L	Basin Plan
Lead	≤ 0.015 mg/L	Basin Plan
Manganese	≤ 0.05 mg/L	Basin Plan
Silver	≤ 0.01 mg/L	Basin Plan
Zinc	≤ 0.016 mg/L	Basin Plan
Dissolved Oxygen	≥ 8 mg/L [9/1–5/31] ≥ 7 mg/L [6/1–8/31]	Basin Plan
Bacteria	≤ 200 fecal coliform conc/100 milliliters (mL); 10% samples ≤ 400/100 mL in any 30-day period	Basin Plan
Biostimulatory Substances	Cannot promulgate aquatic growth that adversely affects beneficial uses	Basin Plan
Color	Free of discoloration causing nuisance or adversely affecting beneficial uses	Basin Plan
Floating Material	Amount not causing nuisance or adversely affecting beneficial uses	Basin Plan
Oil and Greases	Amount not causing nuisance or adversely affecting beneficial uses and no visible film	Basin Plan
pH	6.5 to 8.5 with change ≤ 0.5	Basin Plan
Pesticides	No adverse affect on beneficial uses; total identifiable persistent chlorinated hydrocarbon < detectable; < allowable by applicable antidegradation policies	Basin Plan and U.S. Environmental Protection Agency (USEPA) 40 Code of Federal Regulations (CFR) Section 131.12
Thiobencarb	≤ 1 microgram per liter (µg/L)	Basin Plan
Radionuclides	< concentrations harmful to human, plant, animal and aquatic life	Title 22 CCR, Table 4 of Section 64443
Electrical Conductivity (at 25 degrees Celsius [^{0}C])	≤ 150 micro-mhos per centimeter (µmhos/cm) (90th percentile)	Basin Plan

Table 4.2-3. Basin Plan water quality objectives, standards, and criteria[1].

Constituent	Concentration	Standard
Sediment Load and Suspended Sediment	Not altered to cause nuisance or adversely affect beneficial uses	Basin Plan
Settleable Material	Not contain substances resulting in deposition causing nuisance or adversely affecting beneficial uses	Basin Plan
Suspended Material	Not cause nuisance or adversely affect beneficial uses	Basin Plan
Tastes and Odors	Not contain taste or odor producing substances importing undesirable tastes or odors to water supply, fish flesh, or other edible products	Basin Plan
Temperature	Not alter natural receiving water to extent that beneficial uses are adversely affected; not increase water temperature by more than 5 degrees Fahrenheit (°F)	Basin Plan
Toxicity	Free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal or aquatic life	Basin Plan
Turbidity	Free of changes that cause nuisance or adversely affect beneficial uses	Basin Plan

[1] "Where compliance with these narrative objectives is required (i.e., where the objectives are applicable to protect specified beneficial uses), the Regional Board will, on a case-by-case basis, adopt numerical limitations in orders which will implement the narrative objectives." Basin Plan Chapter 4, Implementation.

Source: Central Valley RWQCB 2006

The Basin Plan states that the natural receiving water temperature of intrastate waters shall not be altered unless it can be demonstrated to the satisfaction of the RWQCB that such alteration in temperature does not adversely affect beneficial uses. Further, at no time or place shall the temperature of cold or warm intrastate waters be increased more than 5°F above natural receiving water temperature (Section III of the Basin Plan).

The 1983 Agreement established a narrative water temperature objective for the Feather River downstream of the Thermalito Diversion Dam and Thermalito Afterbay Outlet. This narrative objective requires water temperatures that are suitable for fall-run Chinook salmon during the fall (after September 15) and suitable downstream of the Thermalito Afterbay Outlet for shad, striped bass, and other warmwater species from May through August. This objective has no direct effect on operations because it is not well defined, but it has encouraged operators to seek opportunities to provide colder water to the HFC (i.e., the portion of the Feather River downstream of the Thermalito Afterbay Outlet) during the fall months.

In May 1969, DWR entered into an agreement with the water districts that now comprise the Joint Water District Board to provide them with water based upon prior rights. The agreement discusses the diversion season and an amount of diversion, but it does not set numerical criteria for water temperature of agricultural diversions. A similar agreement between DWR and the Western Canal Water District discusses the diversion season and amount of diversion without setting any specific temperature requirement.

4.2.2.2 Water Quality Parameters

Water quality studies were developed and conducted during relicensing with Study Plan (SP) SP-W1, Project Effects on Water Quality Designated Beneficial Uses for Surface Waters (DWR 2004b), which specifically focused on the relationship of Oroville Facilities operations to beneficial uses as specified in the Basin Plan. The following discussions summarize the results of SP-W1.

Water Temperature

Operation of the Oroville Facilities influences Feather River temperatures, which generally comply with the numeric water quality criteria established for the Feather River Fish Hatchery and Robinson Riffle. When temperature exceedances do occur, they are minor. The following subsections describe the relationship between temperature and beneficial uses, summarize the results of related relicensing studies, and provide more information regarding project effects.

Relationship to Beneficial Uses

Water temperature has effects on many of the Basin Plan–designated beneficial uses for the Feather River. The beneficial uses identified in the Basin Plan that temperature can potentially affect are irrigation, contact and non-contact water recreation, warm and cold freshwater habitat, migration, and spawning. Although the Basin Plan does not have a numerical temperature criterion for irrigation, water temperatures associated with irrigation water can potentially affect agriculture because crop growth can be temperature dependent. The potential effects of water temperatures on rice production are discussed in Sections 4.13 and 5.13, Agricultural Resources. Water temperatures also affect recreation, particularly water contact recreation. The potential of water temperatures in the Feather River and the Oroville Facilities to affect warm freshwater habitat, cold freshwater habitat, spawning, and fish migration is discussed in Section 4.4, Aquatic Resources.

Results of Relicensing Studies

This section describes existing water temperature conditions associated with the Oroville Facilities, upper watershed streams, and the lower Feather River. Information in this section is based on continuous data obtained from thermographs installed in the streams and rivers and monthly depth profiles from the reservoirs associated with the Oroville Facilities. Temperatures were monitored beginning in spring 2002; monitoring continues to the current day. A discussion of the results collected from spring 2002

through spring 2004 is discussed here and is available in the report for SP-W6, Project Effects on Temperature Regime (DWR 2004a).

Thermal Regime of Tributaries to Lake Oroville

Water temperature data collected from the West Branch and North, Middle, and South Forks of the Feather River, including tributaries to these streams such as Concow Creek, Fall River, and Sucker Run Creek, are similar and follow seasonal patterns. Water temperatures begin to warm in May and June and reach maximum temperatures ranging from 70 to 80°F in late July and early August. The waters begin cooling in late September, with water temperatures ranging from 40 to 50°F in November through March. Mean summer water temperatures range from 68°F at Fall River, upstream of Feather Falls, to 75°F at West Branch near Paradise.

Lake Oroville

Water temperatures in Lake Oroville's North, Middle, and South Fork arms, the main body of the reservoir, and near Oroville Dam follow seasonal patterns. Surface (epilimnion) water temperatures at these areas begin to warm in the early spring, and reach maximum temperatures approaching the mid-80s ^{o}F during late July, and then gradually decline to winter minimums. The transition zone between the upper warmer and lower colder waters (metalimnion) ranges from about 30 to 50 feet below the surface during midsummer. The deeper water (hypolimnion) reaches a temperature of about 44°F near the reservoir bottom. Drawdown of reservoir water levels and gradual cooling of surface waters through the fall extends the depth of the epilimnion, and by late winter, relatively uniform temperatures exist throughout the water column in Lake Oroville.

Diversion Pool, Fish Barrier Pool, and Thermalito Forebay

The temperature of the water released from Lake Oroville generally affects water temperatures in the Diversion Pool, the Fish Barrier Pool, and Thermalito Forebay. The water warms a few degrees during hot weather, especially at the surface, as the water flows downstream in these facilities. At certain times of the year, Diversion Pool water temperatures can also be influenced by inflows from the South Feather Water & Power Agency's Kelly Ridge Power Plant.

Thermalito Afterbay

Water temperatures in Thermalito Afterbay increase during the spring through summer and decrease in the winter in response to the temperature of water delivered from South Thermalito Forebay and atmospheric conditions. Thermalito Afterbay can be described as North Thermalito Afterbay (north of State Route [SR] 162) and South Thermalito Afterbay (south of SR 162). Water temperatures in North Thermalito Afterbay are very similar to those in South Thermalito Forebay throughout the year. During spring, however, water temperatures increase more rapidly in South Thermalito Afterbay than in North Thermalito Afterbay. Measured temperature differences between North

Thermalito Afterbay and South Thermalito Afterbay ranged from essentially no change in April to about 9°F or more in September.

Water Released from Thermalito Afterbay

Water is released from Thermalito Afterbay to several irrigation canals and to the Feather River through the Thermalito Afterbay Outlet. Water temperatures can vary from the northern to the southern part of Thermalito Afterbay. The Western Canal and Sutter Butte Canal are two of the principal irrigation canals that receive water from Thermalito Afterbay; the Western Canal receives its water from North Thermalito Afterbay and the Sutter Butte Canal receives its water from southern portion of the Thermalito Afterbay. Water temperatures are usually warmer at the outlet to the Feather River than at either the Western Canal or Sutter Butte Canal outlets. Based on water temperature monitoring in 2002 and 2003, temperatures at the Thermalito Afterbay Outlet were as much as 11.3°F warmer than those at the Western Canal diversion, and up to 7.2°F warmer than those at the Sutter Butte Canal diversion.

Feather River Downstream of the Fish Barrier Dam

Water temperatures in the Feather River downstream of the Fish Barrier Dam vary seasonally. The river temperature patterns are best described separately for the LFC and the HFC. The LFC is considered the Feather River between the Fish Barrier Dam and the confluence with the Thermalito Afterbay Outlet. The HFC is the Feather River downstream of the confluence of the LFC and the Thermalito Afterbay Outlet.

Low Flow Channel

Water temperatures in the LFC begin to warm in March and maximum temperatures are reached in July and early August with a range from 61°F upstream of the Feather River Fish Hatchery to 69°F upstream of the Thermalito Afterbay Outlet. This reach of the river begins cooling in September, with water temperatures dropping to 45°F throughout the reach by February. Temperatures of water released from the Feather River Fish Hatchery vary little from temperatures of river water near the hatchery.

The release temperatures from Oroville Dam are designed to meet Feather River Fish Hatchery and Robinson Riffle temperature schedules included in the 1983 DFG Agreement and OCAP while also conserving the coldwater pool in Lake Oroville. Current operation indicates that water temperatures at Robinson Riffle are almost always met when the hatchery objectives are met. Due to temperature requirements of endangered fish species and the hatchery and overriding meteorologic conditions, the temperature requests for agriculture can be difficult to satisfy.

Water is withdrawn from Lake Oroville at depths that will provide sufficiently cold water to meet the Feather River Fish Hatchery and Robinson Riffle temperature targets. The reservoir depth from which water is released initially determines the river temperatures, but atmospheric conditions, which fluctuate from day to day, modify downstream river temperatures. Altering the reservoir release depth requires installation or removal of

shutters at the intake structures. Shutters are held at the minimum depth necessary to release water that meets the Feather River Fish Hatchery and Robinson Riffle criteria.

Water released from Lake Oroville and used for power generation may be pumped back into the reservoir for reuse later. While pump-back operations can draw water that has warmed in Thermalito Forebay or Thermalito Afterbay back into the Diversion Pool and Lake Oroville, these activities are monitored to identify potential adjustments necessary to operations to provide cooler water to help achieve downstream water temperatures described in the agreements for the lower Feather River.

High Flow Channel (Feather River Below the Thermalito Afterbay Outlet)

Water temperatures in the HFC begin to warm in March, reaching maximum temperatures during July and August that range from 71 to 77°F. River cooling begins in late August, with minimum temperatures of 44 to 45°F reached by January or February.

Releases from the Thermalito Afterbay Outlet as well as flow contributions from Honcut Creek, the Yuba River, and the Bear River influence HFC water temperatures from April through October. Except during periods of high flow through Thermalito Afterbay, which occur frequently in July and August, releases from Thermalito Afterbay during the warm season generally raise the water temperature of the river. Honcut Creek and Bear River inflows also tend to increase Feather River temperatures downstream of their confluences during this period. Flows contributed by the Yuba River tend to cool the Feather River during the warmer spring and summer months.

Existing Conditions at the Feather River Fish Hatchery

Generally, water temperatures for the Feather River Fish Hatchery are in compliance with the 1983 Agreement. Monitoring data from April 2002 to March 2004 indicate general compliance with the Feather River Fish Hatchery's temperature requirements 95 percent of the time. Temperatures were below the temperature requirements 13 days (less than 2 percent of the monitoring period), and exceeded requirements on 24 days (slightly more than 3 percent of the monitoring period). The 13 days in which temperatures were below the temperature requirement all occurred within the warmer summer months (June 15–August 31). Except for one day in spring 2002, temperature requirements were exceeded for 23 days during an extended warm period in the fall of 2002 (Table 4.2-4) when temperature requirements are at their lowest (51°F).

Existing Conditions in the Low Flow Channel

The 2004 OCAP Biological Opinion issued by NMFS requires daily mean temperature of 65-degree water, to the extent possible, at River Mile 61.6 (Robinson Riffle) from June 1 through September 30. The water temperatures slightly exceeded the 65°F maximum value in 2002 and 2003: on June 19, 2002, the mean temperature was 65.5°F, and during July 2003 the objective was exceeded on 5 occasions, with a maximum daily mean temperature of 66.0°F. These exceedances were most likely

caused by the response time and river heating from the Fish Barrier Dam to Robinson Riffle. In order to conserve the coldwater pool during dry years, DWR has strived to meet the Robinson Riffle temperatures by increasing releases to the LFC rather than releasing colder water.

Table 4.2-4. Compliance with 1983 DFG fish hatchery temperature requirements, April 2002–March 2004.

Dates	Days Below Minimum Objective	Days Above Maximum Objective	% of Days Below Minimum	% of Days Above Maximum
Year 2002–2003				
April–May 15	0	1	0	2
May 16–31	0	0	0	0
June 1–15	0	0	0	0
June 16–August 15	7	0	11.5	0
August 16–31	2	0	12.5	0
September	0	0	0	0
October–November	0	23	0	37.7
December–March	0	0	0	0
Year 2003–2004				
April–May 15	0	0	0	0
May 16–31	1	0	6.3	0
June 1–15	0	0	0	0
June 16–August 15	2	0	3.2	0
August 16–31	1	0	5.9	0
September	0	0	0	0
October–November	0	0	0	0
December–March	0	0	0	0

Source: DWR measurements

Existing Conditions at Agricultural Diversion Points

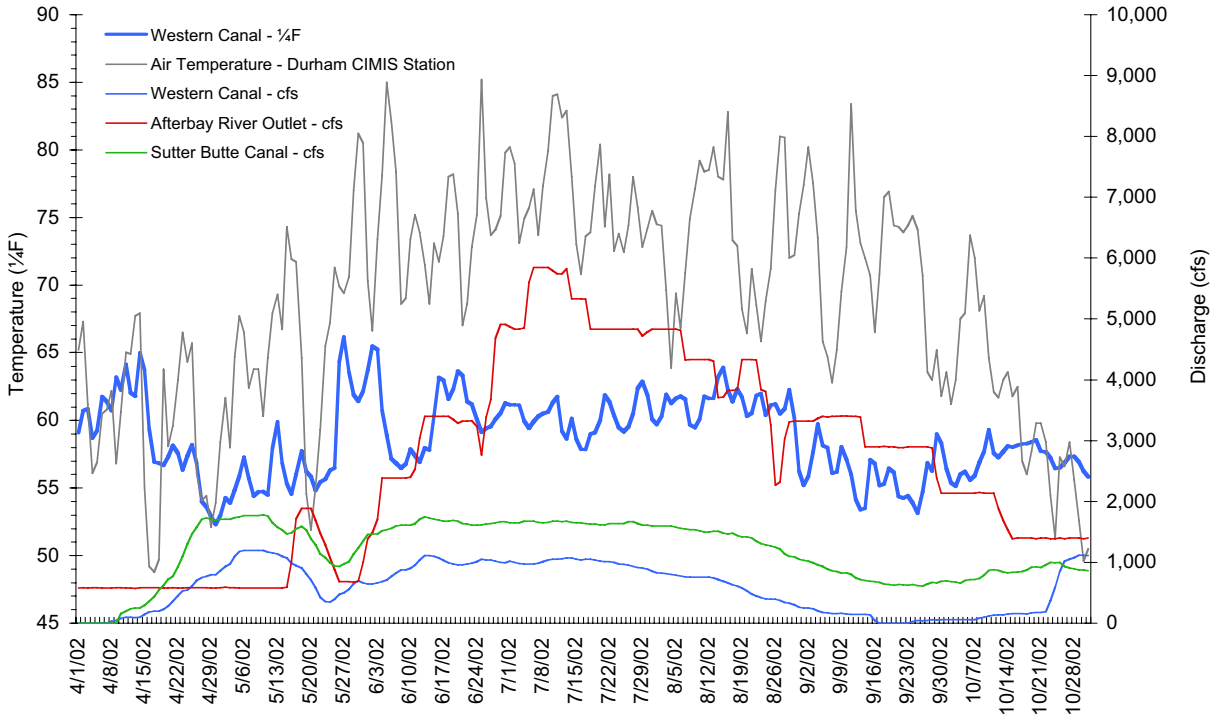
Agricultural water withdrawals are made directly from Thermalito Afterbay at several points. The project-related water temperature concern for agricultural users is the temperature of the water diverted from Thermalito Afterbay during the early part of the rice growing season, which generally begins in April or May. DWR has entered into a contractual agreement for the delivery of water to agricultural users and the concerns are discussed and resolved under the agreement. Water temperature, air temperature, the amount of water applied, and the varieties of rice planted are all factors that affect rice production. It should also be noted that agricultural users benefit from the late-season water reliability, which is greater during the latter part of the irrigation season than before the project was constructed.

Water temperatures at Thermalito Afterbay canal outlets can be influenced by several factors, including air temperatures, water temperatures of the Lake Oroville releases, meteorologic conditions, and operations that determine the residence time of water in Thermalito Afterbay. Residence time influences the amount of atmospheric warming that can occur in Thermalito Afterbay before the water reaches the agricultural

diversions. Oroville Facilities operations that determine the effective residence time of water in Thermalito Afterbay include:

- The volume of inflows compared to the total releases from Thermalito Afterbay, including the release to the river and agricultural diversions;
- The volume of water in Thermalito Afterbay; and
- The amount of peaking and pump-back operations.

As shown in Figure 4.2-11, when residence time is decreased due to increased diversions to the Western and Sutter Butte Canals and the Feather River, the temperature of water released from Thermalito Afterbay to the Western Canal also decreases.



Note: °F = Fahrenheit; cfs = cubic feet per second

Source: DWR Thermalito Afterbay ALP water temperature workshop (SP-W6, DWR, July 2004)

Figure 4.2-11. Effects of air temperatures and flows released from Thermalito Afterbay on Western Canal water temperatures during the 2002 growing season.

The location of an agricultural diversion in Thermalito Afterbay can affect travel and residence time for water in Thermalito Afterbay prior to reaching the diversion. The diversion locations for the Western Canal and the Richvale Canal are located opposite the Thermalito Afterbay inlet (i.e., the Thermalito Pumping-Generating Plant release point) in the northernmost portion of Thermalito Afterbay. This is an area with reduced circulation and exchange with the southern portions of Thermalito Afterbay. Water

entering Thermalito Afterbay from the Thermalito Pumping-Generating Plant tail canal flows directly toward these diversions, reducing residence time in Thermalito Afterbay. In contrast, the Sutter Butte Main Canal diversion is on the south side of Thermalito Afterbay, which allows water longer residence time in Thermalito Afterbay before it is diverted.

During Oroville Facilities pump-back operations, warmer water tends to be drawn from the southern, main body of Thermalito Afterbay into the more isolated northern portion, providing some warming of water at the Western Canal and Richvale diversion locations. Thermal imagery taken during pump-back operations shows a plume of warm water being drawn from the southern portion of Thermalito Afterbay through the constriction at the SR 162 bridge and into the northern portion of Thermalito Afterbay.

Effects of Pump-Back Operations

Data on recent pump-back operations were reviewed to evaluate effects of pump-back operations on Feather River Fish Hatchery temperatures and reservoir stratification. During pump-back operations, water is pumped from Thermalito Afterbay to Thermalito Forebay, then into the Thermalito Power Canal, to the Diversion Pool, and back into Lake Oroville. Pump-back operations have no effects on Lake Oroville water column temperatures but may affect the hatchery and LFC water temperatures. Pump-back operations are curtailed if hatchery temperatures would not otherwise be met.

Existing Water Temperature Conditions in the Feather River Downstream of the Thermalito Afterbay Outlet

Water temperatures in the Feather River downstream of Thermalito Afterbay Outlet are influenced by meteorological conditions, release rates and depths from Lake Oroville, and the relative volumes of flow either diverted to the Thermalito Complex or directed down the LFC. Water temperature increase in Thermalito Afterbay is related primarily to meteorological conditions (Figure 4.2-12) and residence time. Total releases from Thermalito Afterbay, including releases for agricultural diversions, determine the residence time of water in the Afterbay and, therefore, the opportunity for the water to warm under ambient climatic conditions. Based on relicensing workshop results reported in a series of documents (SP-E2), the volume of flow released from the Oroville Facilities potentially affects water temperatures downstream to the Honcut Creek confluence.

Dissolved Oxygen, pH

DO and pH levels within the project area were generally found to comply with the water quality objectives of the Basin Plan. When exceedances did occur, they were minor. The following subsections describe the relationship between DO and pH and beneficial uses, summarize the results of related relicensing studies, and provide information about potential existing project effects.

Relationship to Beneficial Uses

The beneficial uses identified in the Basin Plan that DO and pH can potentially affect are warm freshwater habitat and cold freshwater habitat.

Results of Relicensing Studies

The draft final report for SP-W1, Project Effects on Water Quality Designated Beneficial Uses for Surface Waters (DWR 2004b), provides seasonal information regarding DO and pH levels in the project area, including the upper watershed, Lake Oroville, the Thermalito Complex impoundments, and the lower Feather River. The Basin Plan objectives for DO and pH are provided in Table 4.2-3. The SP-W1 report also provides evaluations of the effects of decomposing salmon carcasses and discharges of non-Project related treated sewage on DO levels in the lower Feather River.

For upstream tributaries, within the FERC Project boundary, all DO concentrations met the Basin Plan objective for cold water (minimum of 7.0 mg/L). On the West Branch Feather River upstream of Lake Oroville and outside of the FERC Project boundary, a DO value of 4.9 mg/L was recorded. In upstream tributaries, all pH concentrations were within the range specified for the Basin Plan objective (i.e., 6.5–8.5).

In Lake Oroville, DO and pH levels at the monitoring stations generally met the Basin Plan objectives. Occasionally, when Lake Oroville thermally stratified during the summer, DO measured near the surface and bottom of the reservoir did not meet the objective. In February 2002, the pH at the Middle Fork area of Lake Oroville exceeded the objective.

DO and pH concentrations downstream of Oroville Dam are generally consistent with the Basin Plan objectives. The Basin Plan has a specific DO objective, 8.0 mg/L, for the Feather River from the Fish Barrier Dam to Honcut Creek from September through May. The DO concentrations in the lower Feather River dropped below this objective (to 5.4 mg/L) at the station downstream of the Feather River Fish Hatchery on October 27, 2003. This was during the salmon spawning period, when decomposing salmon carcasses were present. DO concentrations dropped slightly below the objective (with measurements of 6.5–7.6 mg/L) at 3 other stations during mid-December 2002. One pH value (6.3) obtained at Thermalito Afterbay Outlet was also slightly below the objective.

Conductivity and Minerals

Concentrations of dissolved inorganic minerals, and associated electrical conductivity, in the project area routinely comply with Basin Plan water quality objectives. However, use of salt at the Feather River Fish Hatchery was found to coincide with detectable changes in electrical conductivity in the LFC on one occasion. The following subsections describe the relationship between conductivity and minerals and beneficial uses, and summarize the results of related relicensing studies.

Relationship to Beneficial Uses

The beneficial uses identified in the Basin Plan that electrical conductivity and mineral contents can potentially affect are warm freshwater habitat and cold freshwater habitat.

Results of Relicensing Studies

The SP-W1 report (DWR 2004b) provides information regarding electrical conductivity and dissolved minerals in the study area, while the report for SP-W7, Land and Watershed Management Effects on Water Quality (DWR 2004c), provides more focused information regarding minerals in stormwater runoff. Results of both studies were used to determine compliance with water quality objectives or goals.

Electrical conductivity and minerals at most monitoring sites were routinely below objectives for the Feather River. On one date, in the LFC downstream of Feather River Fish Hatchery, the electrical conductivity was 151 micro-mhos per centimeter [µmhos/cm]), which is slightly higher than the Basin Plan objective of 150 µmhos/cm (see the SP-W1 report [DWR 2004b]).

Existing Conditions

The mineral and electrical conductivity values in the project area were routinely within Basin Plan water quality objectives.

Sedimentation, Turbidity, Suspended Solids, and Settleable Matter

Dams and reservoirs can affect the transport of sediment by trapping it and by reducing the size of the sediment that is released or spilled below the dam. The following subsections describe the relationship between related water quality parameters and beneficial uses, and summarize the results of related relicensing studies.

Relationship to Beneficial Uses

All of the beneficial uses identified in the Basin Plan can be affected when sedimentation, suspended solids, and settleable matter are excessive. The Basin Plan includes a narrative criterion for total suspended solids (TSS) designed to prevent impairment from nuisance conditions. The Basin Plan also contains numerical objectives for the allowable change in turbidity from background levels that may result from controllable factors.

Results of Relicensing Studies

The SP-W1 report (DWR 2004b) provides information regarding turbidity, TSS, and settleable matter in the project area based on monthly sampling. Results of the study were compared to the water quality objectives and criteria listed in Table 4.2-3 to determine compliance with the Basin Plan. Settleable matter concentrations were at trace or undetectable levels for the large majority of samples; therefore, they are not discussed further.

Results from SP-W1 indicate that the tributaries to Lake Oroville typically have very low levels of turbidity and TSS, except during storm events. Lake Oroville acts as a sediment trap, which results in low concentrations in Lake Oroville, the Feather River immediately downstream of Oroville Dam, and at the Thermalito Complex. Downstream of the Thermalito Afterbay Outlet, turbidity and TSS concentrations generally increase. This increase may be related to inputs from downstream tributaries to the lower Feather River. Approximately half of the samples from the Feather River at Shanghai Bend, the Feather River near Verona, and Honcut Creek failed to meet the Basin Plan turbidity objectives. The Bear River and Sacramento River stations each exceeded the turbidity objectives in all but one sample.

The U.S. Soil Conservation Service considers the upper Feather River watershed to be subject to accelerated erosion as a result of human-caused disturbances (United States Soil Conservation Service 1989). However, the numerous dams and reservoirs upstream of Lake Oroville are known to be effective traps of sediment, thereby reducing the quantity of sediment transported into Lake Oroville.

Wind and wave action within Lake Oroville can cause erosion along the shoreline, which in turn could contribute to minor sedimentation within the reservoir. Most shoreline erosion likely occurred during the first years following initial reservoir filling with scouring loss of the original topsoil.

Downstream of Oroville Dam, the release of “sediment-starved” water can cause scour and erosion of channel substrate and transport of additional suspended sediment. However, the reduction of larger channel-forming flows resulting from flood storage in Lake Oroville has had the opposite effect, reducing bank erosion and large channel meandering. In general, observations and modeling conducted for SP-G2, Effects of Project Operations on Geomorphic Processes Downstream of Oroville Dam, indicate that channel erosion downstream of Lake Oroville will slowly decrease over time.

Existing Conditions

The Oroville Facilities and project operations inhibit sediment transport and deposition. Due to the large size of Lake Oroville, most sediments that flow into the reservoir from the upper watershed are effectively retained, and only suspended material passes through to the lower Feather River basin. Wave and wind action causes some shoreline erosion.

Appropriate best management practices (BMPs) and other measures are typically implemented to avoid and minimize potential effects related to erosion from various ongoing operations and maintenance activities within the FERC Project boundary.

Sediment trapping behind Oroville Dam results in the release of relatively sediment-free water downstream of the reservoir. Fluvial modeling results for the lower Feather River indicate that channel erosion and scour will likely decrease over the long term as the supply of erodable sediment in the lower Feather River is depleted.

Metals

The Oroville Facilities are not a source of metals. However, they do affect metal loadings below Oroville Dam by trapping sediment from upstream historic mining sources behind the dam. Some fish tissue samples collected from fish in the project area exhibit accumulation of mercury above related public-health criteria. The following subsections describe the relationship between metals and beneficial uses, and summarize the results of related relicensing studies.

Relationship to Beneficial Uses

The beneficial uses identified in the Basin Plan that metals can potentially affect are contact water recreation (fishing), warm freshwater habitat, and cold freshwater habitat.

Results of Relicensing Studies

The SP-W1 report (DWR 2004b) provides information regarding metals concentrations in water in the project area. The report for SP-W2, Contaminant Accumulation in Fish, Sediments, and the Aquatic Food Chain (DWR 2004d), describes concentrations of metals in tissues collected from fish and crayfish in the project area. The report for SP-W3, Recreational Facilities and Operations Effects on Water Quality (DWR 2004e), gives information on levels of metals during the 2003 recreation season near developed recreational facilities and other locations in the project area with heavy recreation use. The SP-W7 report (DWR 2004c) examines concentrations of metals in stormwater drainage within and outside the FERC Project boundary.

The results from the studies were compared to the numerical limits used for Basin Plan objectives. The results from tissue sample analyses were compared to guidelines and criteria from various regulatory agencies and are contained in Appendix G-WQ2 of the PDEA.

Water Samples. The SP-W1 report (DWR 2004b) indicates that some water samples analyzed exceeded the Basin Plan objectives. Figure G-WQ2.5-1 in Appendix G-WQ2 of the PDEA depicts the location for each sampling station and the number of times any of the numerical limits were exceeded. The results also indicate that water samples that exceed objectives typically increased in frequency downstream of the FERC Project boundary.

The SP-W7 report (DWR 2004c) indicates that stormwater drainage samples from the city of Oroville and Kelly Ridge (a residential area outside the FERC Project boundary but near Oroville Dam) exceed the Basin Plan objectives for arsenic, aluminum, iron, manganese, and zinc. These results indicate that the Oroville Facilities are likely not a source of these constituents.

Tissue Samples. Analyses of metals contaminants in fish and crayfish tissues were conducted in two phases. In Phase 1, fish samples were collected from sites in Lake Oroville, the lower Feather River (the LFC and the HFC), the Thermalito Complex (Thermalito Forebay, Thermalito Afterbay, and Potters Pond), and two ponds in the

OWA. Crayfish tissue samples were obtained from the Diversion Pool, the Thermalito Complex, and the lower Feather River. Sediments were collected from sites where fish were collected. Phase 2 included supplementing fish tissue testing for mercury from additional sites from within the FERC Project boundary, upstream, and downstream from the project to broaden the scope of the study. Phase 2 also included the analyses of sediment samples collected during Phase 1.

The SP-W2 report (DWR 2004d) indicates that metal concentrations in tissue samples are generally below or occasionally above recommended levels included in the guidelines and criteria of various regulatory agencies. Phase 2 confirms that mercury consistently exceeds USEPA guidelines in most fish species and locations sampled for SP-W2. However, salmonids collected at the Feather River Fish Hatchery exhibited low levels of mercury in tissue.

In tributary waters upstream of the Project area, fish from some tributaries were insufficient in size or species to compare with Lake Oroville samples. Where tributary fish were collected, mercury levels in bass and trout were relatively low; however, several larger Sacramento pikeminnow collected in the North Fork Feather River near Poe Powerhouse contained mercury levels in excess of USEPA criteria.

Biomagnification apparently has resulted in elevated mercury levels in fish from all project waters. This is evidenced by the difference from coho Age-0 samples collected from the Feather River Fish Hatchery, when compared to Age-1 to 2 coho sample composites from Lake Oroville. Tissues from returning adult Chinook salmon and steelhead indicate that these fish do not bioaccumulate mercury during their life history away from the Project area to the same extent as do representative coho salmon in Lake Oroville. Mercury was detected in fish tissues from the lower Feather River at levels that exceeded criteria but at levels lower than in fish tissues sampled from areas of Lake Oroville.

Fish consumption advisories released by the California Environmental Protection Agency through its OEHHA are relatively common in the Sierra Nevada foothills, the Delta, and the Coastal Ranges of California where historic mercury ore mining and processing or gold mining activities occurred. There is a new Draft OEHHA consumption advisory for mercury in fish from the lower Feather River in Butte, Yuba, and Sutter Counties (OEHHA 2006). There is also a consumption advisory for the Bear and Yuba River watersheds (http://www.oehha.ca.gov), which are tributaries to the lower Feather River. However, OEHHA indicates that there have been no recorded incidences of mercury-related health effects from consumption of sport fish from California waters. The potential for health effects at the fish tissue mercury levels typically found in California is minimal unless a person is eating considerably greater quantities of fish than recommended (OEHHA 2003).

Analyses of sediment samples collected indicated that total mercury levels were below laboratory detection limits. However, methylmercury was found over the majority of sampling locations. Methylmercury concentration has a positive correlation with sediment total organic carbon (TOC) levels from sampled stations. Stations with

elevated TOC have higher methylmercury concentrations, signifying greater biomass availability and possibly leading to increased rates of mercury biotransformation.

Existing Conditions

Historical gold mining practices upstream of the Project area, as well as the development of municipal and industrial land uses in the upper watershed and along the lower Feather River, continue to be the primary sources for most of the metals found in the Project area. Because metals are usually associated with sediments, and Lake Oroville inhibits sediment transport, the Oroville Facilities act as a sink. Consequently, the Oroville Facilities likely affect the concentrations of metals in the project area both within Lake Oroville and downstream of Oroville Dam. The sources of excess metals in the watershed, particularly mercury, are unrelated to the Oroville Facilities.

Sediment from upstream sources is captured in Lake Oroville. A principal beneficial effect is to inhibit the transport of contaminated sediments to the lower Feather River and other water bodies. There is no evidence that operation of the Oroville Facilities has contributed to elevated concentrations of metals in fish tissues. However, the Oroville Facilities increase sportfishing opportunities in the project area. As discussed above, OEHHA has stated that there is a low potential health risk from consuming California sport fish from water bodies subject to fish advisories, unless the consumption rate is considerably higher than recommended.

Pesticides

The use of pesticides at the Oroville Facilities is minor. The Butte County Mosquito Abatement District is responsible for mosquito control within the OWA.

Relationship to Beneficial Uses

The beneficial uses identified in the Basin Plan that could potentially be affected by pesticide use are municipal and domestic water supply, warm freshwater habitat, cold freshwater habitat, and wildlife habitat. The California drinking-water standards are not applicable to ambient concentrations in source water supplies because the standards specifically apply to water after it has been treated.

Results of Relicensing Studies

The SP-W1 report (DWR 2004b) provides information regarding pesticide concentrations in water in the overall study area. The SP-W2 report (DWR 2004d) describes concentrations of pesticides in tissues collected from fish and crayfish in the project area, and the SP-W7 report (DWR 2004c) describes the results of sampling for pesticides following treatment for mosquito abatement in some OWA ponds.

The SP-W1 report indicates that the pesticide diuron was detected in one sample but that the concentration was well below USEPA criteria. The sample was collected upstream of the FERC Project boundary.

The SP-W2 report indicates that pesticides including chlordane, chlorpyrifos, dichlorodiphenyltrichloroethane (DDT) isomers, dieldrin, hexachlorobenzene, and polychlorinated biphenyls (PCBs) were detected in fish and crayfish tissue during Phase 1. The fish tissue guidelines used for this evaluation are provided in Appendix G-WQ2 of the PDEA.

None of the individual chlordane compounds exceeded the guidance values. However, the sum of the individual chlordane compounds (i.e., total chlordane) exceeded the maximum tissue residue level (MTRL) at each site where any chlordane compounds were detected.

Chlorpyrifos was detected only in fish from the Lower Pacific Heights Pond, and did not exceed any criteria. Dieldrin levels exceeded the MTRL in channel catfish in Lake Oroville, the North Fork Arm, and near the Spillway. Dieldrin levels exceeded the MTRL in carp collected from North Thermalito Forebay swim area, and from South Thermalito Afterbay, and bullhead sampled from Mile Long Pond also exceeded the MTRL.

While hexachlorobenzene was detected in catfish, Sacramento sucker, Sacramento pikeminnow, and carp sampled, it was not found in samples of bass or crayfish. No criteria were exceeded for hexachlorobenzene.

Some polynuclear aromatic hydrocarbons (PAHs) were detected in fish tissue composites obtained from the Feather River Fish Hatchery. Hatchery composite PAHs with associated USEPA screening value criteria, including benzo(a)pyrene, were below reporting limits. However, the DFG laboratory reporting limits were over three times higher than the screening value for benzo(a)pyrene. Therefore, no clear conclusions can be drawn for benzo(a)pyrene.

PCBs were detected in all fish and crayfish species from all water bodies that were sampled. Aroclors were detected in at least some fish in all water bodies (except Mile Long Pond) and in crayfish in the Feather River downstream from the SR 70 bridge. (Aroclor is a trade name under which Monsanto marketed a product line of insulating fluids beginning in the 1930s and continuing for several decades.) The elevated data level (EDL) for Aroclor 1254 was exceeded in Sacramento sucker collected from the Diversion Pool, pikeminnow and carp from North Thermalito Forebay swim area, carp from South Thermalito Afterbay, crayfish from the Feather River downstream of the SR 70 bridge, and channel catfish from the Lower Pacific Heights Pond. The EDL for Aroclor 1260 was exceeded in channel catfish from both South Fork Arm collection sites and the lower Middle Fork Arm of Lake Oroville, pikeminnow and carp from the North Thermalito Forebay swim area, and carp from the South Thermalito Afterbay.

Bass tissue samples contained PCBs at much lower levels than found in other fish species. However, spotted bass collected from both South Fork arms of Lake Oroville and largemouth bass collected from the Feather River both upstream and downstream from Thermalito Afterbay Outlet to the Feather River, contained total PCBs (as the sum of Aroclors) that exceeded the MTRL and screening values of the USEPA and OEHHA. Spotted bass from the lower Middle Fork Arm of Lake Oroville contained total PCBs that

exceeded the MTRL and were at the same concentration as the USEPA screening value. Total PCBs (as the sum of Aroclors) exceeded the MTRL and USEPA and OEHHA screening values in channel catfish from all sites where samples of this species was collected, which included all the Lake Oroville sampling sites and Lower Pacific Heights Pond. In addition, channel catfish sampled from the lower Middle Fork Arm of Lake Oroville exceeded the USFWS contaminant hazard recommendation for wildlife (USFWS 1986), while those sampled from both South Fork Arm collection sites also exceeded the EDL and USFWS contaminant hazard recommendation for wildlife. Both pikeminnow and carp collected from North Thermalito Forebay swim area exceeded the MTRL, EDL, USEPA, and OEHHA screening values and USFWS contaminant hazard recommendation for wildlife. Carp collected from both North Fork arms of Lake Oroville, South Thermalito Afterbay, and Potters Pond, as well as Sacramento sucker collected from the Diversion Pool and crayfish collected downstream of the SR 70 bridge exceeded the MTRL, USEPA, and OEHHA screening values for total PCBs as the sum of Aroclors. In addition, the EDL and USFWS contaminant hazard recommendations for wildlife were exceeded in carp collected from South Thermalito Afterbay.

Some of the detected PCBs found in post-spawn, adult Chinook salmon, and steelhead tissue composites were found to contain PCB levels, expressed as the sum of Aroclors, exceeding the MTRL for carcinogens in inland surface waters and the USEPA action level. Additionally, the larger size class steelhead composite also exceeded the OEHHA screening value. The coho composites collected from the Feather River Fish Hatchery and from Lake Oroville were found to have very low PCB levels that did not exceed any criteria or guideline. The hatchery coho composites were analyzed for pesticides in addition to PCBs. The coho composite collected from the Hatchery Annex rearing facility exceeded the MTRL for the pesticide dieldrin.

Although hatchery-raised fingerling Chinook salmon and steelhead were not analyzed for PCBs, hatchery-raised coho salmon of smolt size were analyzed. Based on PCB levels measured in these fish, as well as adult coho collected from the lake, it is clear that coho accumulate PCBs at an increased rate after removal from the Feather River Fish Hatchery for stocking into Lake Oroville, though still at levels below criteria. The PCB levels detected in adult coho collected from Lake Oroville serve as an indicator of bio-available PCB uptake in salmonids in Project waters, as the coho spend their entire life history in Feather River water. Conversely, PCB levels in the adult anadromous Chinook salmon and steelhead are much higher, indicating that uptake of these contaminants most likely occurred during their extended migrations through the Delta and Pacific Ocean.

Composite tissue samples of carp were found to contain the highest concentration of PCBs of all fish species sampled during Phase 2. Carp composites with the highest levels detected, were collected from the South Fork Arm of Lake Oroville, South Thermalito Afterbay, and Robinson Pond. Carp from these locations exceeded human health criteria, including the MTRL, EDL, OEHHA, and USEPA screening values, and wildlife protection criteria for total Aroclors. The Robinson Pond samples also exceeded wildlife protection criteria for total PCB congeners. PCB levels in individual channel and

white catfish sampled from Lake Oroville stations also exceeded human health criteria, but were below wildlife protection criteria.

Pikeminnow composite tissue samples were found to contain PCB levels exceeding human health criteria for total Aroclors from the North Fork Feather River near Poe Powerhouse, the Feather River near Gridley, and the South Fork Feather River upstream of Ponderosa Reservoir. The South Fork Feather River fish also exceeded the wildlife criteria for total PCB congeners. One composite sample of largemouth bass from Robinson Pond, as well as one composite of rainbow trout collected from the South Fork Feather River upstream of Ponderosa Reservoir, contained total Aroclors exceeding human health criteria. PCB uptake is most pronounced in minnows (carp, pikeminnow, and hardhead), followed by catfish. The only black bass composite to exceed criteria came from Robinson Pond, but this may be due to the larger size class of these bass sampled when compared to the other bass composites analyzed for this phase of the study. However, heavy industrial uses in this area may also contribute to PCB levels in fish; sediment PCB levels sampled nearby in the Feather River were at detectable levels.

Sediments collected during Phase 1, analyzed for organochlorine and organophosphorus pesticides during Phase 2, showed results below detection limits. Analyses for 52 different PCB congeners yielded detectable levels for only 8 congeners at 1 sampling station (Feather River upstream of Thermalito Afterbay Outlet). While fish samples contained PCB levels exceeding various criteria, sediments from Project waterbodies do not appear to be a major source of this contamination. The sediments with detectable levels of eight PCB congeners were collected from the downstream extent of the LFC, which has industrial activity adjacent to several miles of the river upstream of the sampling location.

The SP-W7 report indicates that methoprene and malathion and their breakdown byproducts were below detection levels. These pesticides are typically applied for mosquito control in the OWA. However, DWR was not informed that the Butte County Mosquito Abatement District used different pesticides during the year of monitoring.

Existing Conditions

The use of pesticides at the Oroville Facilities is minor. The Butte County Mosquito Abatement District applies pesticides for the control of mosquitoes to OWA ponds. Additionally, herbicides are applied for routine and ongoing maintenance of recreational and other facilities within the FERC Project boundary. However, application methods should be in accordance with Butte County Agriculture Commissioner Bulletins and pesticide label rates. Some pesticides were detected in fish tissue samples.

Petroleum Byproducts and Fuel Additives

Project-related boating and stormwater runoff from recreation use areas could contribute to infrequent and isolated detections of petroleum byproducts and fuel additives. The following subsections describe the relationship between these

parameters and beneficial uses, and summarize the results of related relicensing studies.

Relationship to Beneficial Uses

The beneficial uses identified in the Basin Plan that petroleum products can potentially affect are municipal and domestic water supply, warm freshwater habitat, cold freshwater habitat, and wildlife habitat. The California drinking-water standards are not applicable to ambient concentrations in source water supplies because the standards specifically apply to water after it has been treated.

Results of Relicensing Studies

The SP-W1 report (DWR 2004b) indicates that petroleum products were largely undetected in water samples. Similar results are reported in the SP-W7 report (DWR 2004c) for water samples collected in storm drains and the lower Feather River.

Existing Conditions

Project activities and facilities likely provide no direct source of detectable levels of petroleum byproducts and fuel additives.

Nutrients

Project-related recreation use and operation of the Feather River Fish Hatchery may contribute to increased nutrient loading in the project area. The following subsections describe the relationship between these nutrients and beneficial uses, and summarize the results of related relicensing studies.

Relationship to Beneficial Uses

The beneficial uses identified in the Basin Plan that nutrients can potentially affect are warm freshwater habitat and cold freshwater habitat.

Results of Relicensing Studies

The SP-W1 report (DWR 2004b) provides information on nitrogen and phosphorus concentrations in the project area, the SP-W3 report (DWR 2004e) provides information on nutrients near recreational facilities, and the SP-W7 report (DWR 2004c) provides information on nutrients in stormwater runoff. Results of all three studies were compared to the Central Valley RWQCB Basin Plan water quality objectives and criteria. Nutrient concentrations throughout the project area were consistently below most Basin Plan objectives for protection of beneficial uses.

The SP-W1 report also provides results of three focused investigations:

- Monitoring of periphyton (attached algae) density and dominant taxa to assess nutrient conditions;

- Nutrient additions from decomposition of spent salmon carcasses; and
- Nutrients from the Sewerage Commission Oroville Region (SCOR) treated sewage discharge downstream of Thermalito Afterbay Outlet. The SCOR facility is not operated by DWR.

Phosphorus and nitrate plus nitrite concentrations did not exceed Basin Plan criteria or objectives. Levels of total phosphorus in water samples from the tributaries upstream of Lake Oroville were frequently below 3 micrograms per liter (µg/L), and levels of total nitrogen (ammonia plus nitrate plus nitrite) were sometimes below 15 µg/L (see the SP-W1 report [DWR 2004b]). Water samples collected from the upper watershed frequently exceeded the USEPA-recommended criteria for phosphorus, and nitrate plus nitrite, which suggests that these streams often have an overabundant supply of nutrients.

Water samples were collected during the salmon spawning season to evaluate effects of decomposing salmon carcasses on water quality. Low levels of nutrients were detected in most of these samples. The study found no clear evidence of an effect of salmon carcasses on nutrient levels in the lower Feather River.

The periphyton (algae) monitoring program included stations in the tributaries upstream of Lake Oroville and in the lower Feather River. Water samples collected from the water column and from within gravel substrates at stations immediately upstream and downstream of the SCOR outlet showed no consistent differences in nutrient concentrations. However, the periphyton community at the station downstream of the SCOR outlet had characteristics indicative of a higher nutrient status than the communities at other stations. Green algae, which are considered indicative of higher nutrient levels than diatoms, were dominant in a sample downstream of the SCOR outlet collected in June.

On June 27, 2005, DWR staff investigated an algal bloom reported on the Middle Fork Arm of Lake Oroville. The water level at the Merrimac station was fairly low and the amount of attached algae in the water at the site appeared to be very high. Staff boated up the Middle Fork Arm and reported seeing algae against the shore near Nutmeg Creek, and farther upstream (the 90-degree bend at the north end of the arm) the entire waterway was covered with algae.

The algae were identified as *Anabaena flos-aquae*, blue-green algae that are actually a type of bacteria called cyanobacteria that grow in water and are photosynthetic. Blooms occur when algae that are normally present begin to reproduce rapidly, typically a result of warm water and slow-moving, nutrient-rich waters. Blue-green algae produce toxins that can affect human health.

DWR staff had previously sampled water at the Merrimac station in May 2005. The amounts of many chemical constituents in the Merrimac water sample were very high compared to previous data. For example, at this station in 3 years of sampling, the total iron levels had never exceeded 1,805 µg/L. The May 2005 sample contained 13,627

µg/L of iron. The highest total aluminum measured at FRMF-M was December 2004 at 1,472 µg/L and dissolved aluminum at 835 µg/L; in May 2005, total aluminum was 11,214 µg/L and dissolved aluminum was 2,230 µg/L. Manganese once measured 60.8 µg/L (total) in December 2002 and 15.1 µg/L (dissolved) in February 2004; in May 2005, manganese was measured at 696 µg/L (total) and 22.8 µg/L (dissolved). Phosphorus is usually reported at very low to non-detectable levels at this station, once reaching a maximum of 0.044 mg/L in December 2003. In May 2005, total phosphorus was measured at 0.6 mg/L, a significant increase. It is unclear what factors led to the bloom, but the relatively high level of phosphorus is presumed to be involved.

Existing Conditions

Nutrient concentrations throughout the project area were consistently below most Basin Plan objectives for protection of beneficial uses; the Oroville Facilities do not contribute to an adverse effect on beneficial uses resulting from nutrients. Nutrient levels are likely related to recreational activities and operation of the Feather River Fish Hatchery. Lake Oroville and the Thermalito Complex impoundments result in increased levels of recreation, which could potentially increase nutrient inputs; however, phosphorus and nitrate plus nitrite concentrations did not exceed Basin Plan criteria or objectives. Hence, the effects of these sources on nutrient concentrations in the future are likely to be minimal.

Pathogens (Bacteria)

Water samples from several locations in the project area where concentrated water contact recreational use occurs in conjunction with concentrated waterfowl use contain high bacterial counts on a seasonal basis when recreational activity and wildlife are present in the highest numbers. The following subsections describe the relationship between pathogens and beneficial uses, and summarize the results of related relicensing studies.

Relationship to Beneficial Uses

The beneficial uses identified in the Basin Plan that pathogens can potentially affect are water contact recreation and municipal and domestic water supply. The Basin Plan's numerical water quality objectives for fecal coliform bacteria concentrations in natural water bodies are designed to reduce human exposure to pathogens. The California Department of Health Services (DHS) also provides draft guidance for freshwater beaches (DHS 2006). The California drinking-water standards are not applicable to ambient concentrations in source water supplies because the standards specifically apply to water after it has been treated.

Results of Relicensing Studies

The SP-W1 report (DWR 2004b) provides information regarding indicator bacteria in the project area, the SP-W3 report (DWR 2004e) provides information about areas near recreational facilities, and the SP-W7 report (DWR 2004c) provides information on stormwater runoff.

The monthly monitoring study results generally indicate very low bacterial concentrations in the upper watershed tributaries to Lake Oroville and open-water sites within Lake Oroville. Elevated bacterial concentrations were detected periodically at many recreation sites within Lake Oroville and the Thermalito Complex based on weekly samples. The DHS-recommended level of bacteria contamination to trigger beach posting or closure was exceeded at least once at each recreation area monitored in 2003. Based on visual observations of large amounts of waterfowl present near recreation areas, it is apparent that the recreation facilities are also attractive to migratory waterfowl that also directly discharge fecal wastes to water or nearby drainage ways.

Existing Conditions

Occasionally there are elevated bacteria concentrations at certain areas within the Oroville Facilities. Recreation activities such as swimming and wading have the greatest potential for discharges of fecal wastes and exposure to human pathogens. Recreation facilities also attract wildlife (waterfowl and shorebirds) that also directly discharge fecal wastes to water. Bacterial contamination levels were elevated during seasonal peak periods of recreational activity and during non-recreation periods when many waterfowl are present, which indicates that bacteria is coming from both sources.

Aquatic Toxicity Tests

Aquatic toxicity was detected in some water samples collected in the project area; however, the data indicate that the Oroville Facilities are not likely a major contributor to these effects. The following subsections describe the relationship between toxicity and beneficial uses and summarize the results of related relicensing studies.

Relationship to Beneficial Uses

Toxicity tests are designed primarily to identify potential impairment for designated beneficial uses that pertain to aquatic organisms, such as warm freshwater habitat, cold freshwater habitat, and spawning, reproduction, and/or early development (warm and cold). The Basin Plan objective is narrative and states that “all waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses … in aquatic life” (Central Valley RWQCB 2006).

Results of Relicensing Studies

The SP-W1 report (DWR 2004b) provides aquatic toxicity information that was compiled using USEPA’s standardized tests for freshwater acute and chronic toxicity with fathead minnow (*Pimephales promelas*) and zooplankton (*Ceriodaphnia dubia*). Water samples from nine upper watershed tributary sites were collected bimonthly during the summer, following the first flush in the fall, following winter dormant spraying in February, and again during the high-runoff period in April or May. Water samples from eight lower Feather River monitoring sites (from the Fish Barrier Dam to Honcut Creek) were analyzed monthly. Water samples from three OWA ponds were also analyzed. Toxicity

identification evaluation (TIE) procedures were used for samples from sites with confirmed toxicity to evaluate whether particulate matter, metals, and/or polar organic compounds were associated with the toxicity.

SP-W7 also evaluated the toxicity of stormwater from the following locations: several City of Oroville drains; the Feather River Fish Hatchery settling ponds; and the Feather River at Oroville, downstream of the Feather River Fish Hatchery, and at SR 162.

In the upper-watershed tributaries, positive reproductive toxicity to *Ceriodaphnia* was present at all 9 regularly sampled sites; the frequency of toxicity per site ranged from 20 to 83 percent of the sampling dates. Survival toxicity to *Ceriodaphnia* was generally absent. Survival toxicity to fathead minnows in filtered samples occurred in all but 1 of the upper watershed sites, with frequency of toxicity per site ranging from 0 to 20 percent of sampling dates.

At the lower Feather River sites, reproductive toxicity to *Ceriodaphnia* was present on 21–58 percent of the sampling dates, which is similar to the range of frequencies at the upper-tributary sites. However, survival toxicity to *Ceriodaphnia* was detected more frequently at the lower Feather River sites than at the upper-watershed sites, ranging from 4 to 33 percent of the sampling dates. The Feather River Fish Hatchery settling pond and the Feather River downstream of the hatchery had the two highest reproductive-toxicity and survival toxicity rates. *Ceriodaphnia* reproductive toxicity was also present in the majority of storm event samples, and survival was reduced at several sites during one storm event.

Survival toxicity to fathead minnows was present at all 8 regularly sampled sites in the lower Feather River; the frequency in filtered samples ranged from about 4 to 18 percent of sampling dates. The sites with the highest fathead minnow toxicities were the city of Oroville, the Feather River Fish Hatchery settling pond, the Feather River downstream of the hatchery, and Thermalito Afterbay Outlet. Fathead minnow toxicity was generally absent in the storm event samples.

Detections of toxicities in the OWA ponds were relatively infrequent or absent both for *Ceriodaphnia* and for fathead minnows.

The TIE evaluation for several August 2003 sample sites confirmed that toxicity could be reduced when particulate matter, metals, and/or polar organic compounds were removed from the samples. However, the evaluation could not determine cause-and-effect relationships for specific contaminants or sample locations.

Existing Conditions

The Oroville Facilities are not a significant source of contaminants in the project area. The presence of aquatic toxicity in tests with *Ceriodaphnia* and fathead minnows in sites in the upper watershed and the lower Feather River indicates the presence of toxic constituents. The Project has no direct influence on water quality of the upper watershed sites and has no known direct discharges of toxic contaminants; hence, the Oroville Facilities likely have few effects on aquatic toxicity in the project area.

4.2.2.3 Water Quality Trends

Other than the change in water temperatures in the Feather River at Oroville (see Figure 4.2-12), review of historical water quality data did not reveal any upward or downward trends for the various water quality parameters. There are no reasonably foreseeable actions upstream of Oroville that would result in future changes in water quality other than water temperature.

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4.3 GROUNDWATER

4.3.1 Groundwater Quantity

Operation of the Oroville Facilities under Existing Conditions results in elevated groundwater levels near Thermalito Forebay and Thermalito Afterbay. Under Existing Conditions, groundwater levels have stabilized and there are no identified adverse effects associated with such elevated levels.

4.3.1.1 Groundwater Hydrology

Oroville Dam and Lake Oroville are underlain by relatively impermeable igneous and metamorphic bedrock that largely eliminates interaction between groundwater and Lake Oroville. However, Thermalito Forebay and Thermalito Afterbay are located on more permeable volcaniclastic and consolidated alluvial sediments where reservoir water and local groundwater interact. Thermalito Afterbay was constructed on an older, dissected upland consisting of coarse gravels cemented in a sandy clay matrix. The upland area is adjacent to the edge of the groundwater basin to the west, where younger alluvial materials overlap the older sediments. The younger sediments consist of alluvial fan, stream, and basin deposits. Existing lithology data from well driller reports indicate that there are at least two aquifers in the area, a confined zone and an unconfined zone, and there may be localized areas of semi-confined zones. Aquifer zones are not uniform in thickness, and there is not much uniformity in the depth at which different aquifer materials are encountered in area wells.

Groundwater flows in a south-southwest direction in the vicinity of Thermalito Forebay and Thermalito Afterbay. Localized seepage occurs from these reservoirs, and pumps have been installed to return the water to the reservoirs. Information developed as part of Study Plan W-5, *Project Effects on Groundwater*, indicates that the Oroville Facilities may have increased groundwater levels through recharge in the vicinity of Thermalito Forebay. Two wells potentially affected by Thermalito Forebay were monitored for water levels from 1959 to 1982. The monitoring results indicated that groundwater elevations increased by about 10 feet after project completion in 1969.

4.3.2 Groundwater Quality

Operations of the Oroville Facilities under Existing Conditions do not result in changes to groundwater quality. Under Existing Conditions, groundwater quality is stabilized and there are no identified adverse effects associated with such groundwater quality in the project area.

4.3.2.1 Relationship to Beneficial Uses

The Basin Plan (Central Valley RWQCB 2004) designates beneficial uses and water quality objectives for groundwater. The Basin Plan considers all groundwater in the Central Valley region suitable or potentially suitable, unless otherwise designated, for municipal and domestic, agricultural, industrial service, and industrial process supplies. Therefore, the water quality objectives for groundwater differ somewhat from those for surface waters. The Basin Plan lists the objectives, standards, and criteria used to evaluate project groundwater compliance with respect to the relevant water quality parameters. The Basin Plan objectives may be found in Section 4.2.2, Surface Water Quality. The California drinking-water standards do not apply to ambient concentrations in source water supplies because the standards specifically apply to water after it has been treated.

4.3.2.2 Results of Relicensing Studies

The results of Study Plan W-5, *Project Effects on Groundwater*, provide information on the water quality of groundwater around the Thermalito Forebay and Thermalito Afterbay Complex. Water quality was measured by sampling groundwater from 18 wells in the vicinity of these reservoirs (2 sampled wells were upgradient from the Thermalito Complex). Each well was sampled once in the late spring or early summer and once in the fall of 2003. Temperature, pH, and specific conductance were measured. The groundwater samples were analyzed for general mineral composition, aluminum, and mercury.

The groundwater quality results were compared to each other and to the surface-water quality results collected from two sites in Thermalito Afterbay and two sites in Thermalito Forebay. Two of the groundwater wells were located upgradient from the Thermalito Complex. The mineral content of the groundwater samples downgradient from the Thermalito Complex was consistently higher than that of the surface-water samples or upgradient wells. Specific conductance and total dissolved solids were consistently higher in the groundwater samples than in the surface-water samples. The metal content in groundwater was consistently lower than that in surface water (Table G-WQ2.5.3-1 in Appendix G-WQ2 of the PDEA).

4.3.2.3 Existing Conditions

The results of the groundwater survey indicate that the Oroville Facilities are not affecting local groundwater quality conditions. Mineral content was consistently much higher in the groundwater samples downgradient from the Thermalito Complex than in upgradient wells or surface-water samples. At the same time, concentrations of aluminum and mercury metal concentrations were generally similar or lower than upgradient wells and surface waters.

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4.4 AQUATIC RESOURCES

Operation of the Oroville Facilities influences environmental conditions within the lower Feather River, as well as within Lake Oroville and its upstream tributaries, the Diversion Pool, Thermalito Forebay, Thermalito Afterbay, the Feather River Fish Hatchery, the Fish Barrier Pool, and the Oroville Wildlife Area (OWA) ponds.

Evaluating potential effects on aquatic resources within the project study area requires an understanding of fish species' life histories and life stage–specific environmental requirements. General information is provided in Section 4.4.2, Fish Species Overview, regarding the species of primary management concern that occur within the Oroville Facilities project study area, as well as other species of local or regional importance. To reduce redundancy, discussions regarding some species with similar life histories, habitat requirements, and/or management strategies and objectives have been combined. Species-specific information for warmwater and coldwater species is provided separately in Section 4.4.2. More detailed information regarding fish species is provided in Appendix G-AQUA1, Affected Environment, of the PDEA for the Oroville Facilities, which summarizes the results of the aquatics study plan reports.

This section describes the affected environment related to fisheries and aquatic ecosystems in all water bodies that may be influenced by implementation of the alternatives. This includes the upper Feather River tributaries, Lake Oroville, the Diversion Pool, Thermalito Forebay, Thermalito Afterbay, the Fish Barrier Pool, the Feather River Fish Hatchery, OWA ponds, and the lower Feather River.

Fish species of primary management concern include:

- State and/or federally listed species within the project study area (spring-run Chinook salmon, green sturgeon, and Central Valley steelhead);
- Species that are recreationally or commercially important (fall-run Chinook salmon, American shad, coho salmon, striped bass, and four species of black bass);
- Candidate species for listing under the California Endangered Species Act (CESA) or federal Endangered Species Act (FESA); and
- State species of special concern (Sacramento splittail, river lamprey, and hardhead).

Special emphasis is placed on these fish species to facilitate compliance with applicable laws, particularly CESA and/or FESA, and to be consistent with State and federal restoration/recovery plans and federal biological opinions. This focus is consistent with:

- The CALFED Bay-Delta Program's (CALFED's) 2000 *Ecosystem Restoration Program Plan* (ERPP) and *Multi-Species Conservation Strategy* (MSCS);
- The programmatic determinations for the CALFED program, which include DFG's Natural Community Conservation Planning Act approval and the programmatic biological opinions (BOs) issued by NMFS and USFWS;

- The USFWS 2001 *Final Restoration Plan for the Anadromous Fish Restoration Program* (AFRP), which identifies specific actions to protect anadromous salmonids;
- The DFG 1996 *Steelhead Restoration and Management Plan for California*, which identifies specific actions to protect steelhead (DFG 1996); and
- DFG's *Restoring Central Valley Streams, A Plan for Action* (1993), which identifies specific actions to protect salmonids.

Improvement of habitat conditions for these species of primary management concern will likely protect or enhance conditions for other fish resources, including native resident species.

The overall fish species composition within the project study area is summarized in Table 4.4-1. Table 4.4-1 identifies those species that are considered species of primary management concern related to the Oroville Facilities and indicates whether each species is native or introduced, identifies the general geographic distribution of the species by water body, and summarizes both the regulatory and abundance/ management status of each species within the project study area.

Major issues related to fisheries identified during the scoping process included:

- Effects of project operations on aquatic resources, including populations and habitats of: (1) warmwater fish; (2) coldwater/anadromous fish; (3) special-status species; and (4) macroinvertebrates and other aquatic organisms;
- With respect to anadromous fish, project effects on populations, habitat quantity and quality, fish passage, and recruitment to ocean populations;
- Effects of fisheries management plans and activities on a balanced coldwater and warmwater fishery;
- Compliance of project operations with SWP Feather River flow constraints and adequacy of constraints to protect anadromous fish and other aquatic species; and
- The cumulative effect of existing and future project effects on regional fisheries, fish passage, and habitat quality and quantity within project-affected areas.

4.4.1 Regional Overview and Management Status

An overview of the Oroville Facilities and associated water bodies as they relate to aquatic resources is provided in Section 4.4.1.1, Facilities, Waterbodies, and Related Fisheries Resources. Applicable laws, ordinances, regulations, and standards related to fisheries resources are provided in Section 4.4.1.2.

4.4.1.1 Facilities, Waterbodies, and Related Fisheries Resources

Detailed physical descriptions of the Oroville Facilities and their operations are provided in Section 3.2, Oroville Facilities and Operations.

Table 4.4-1. List of fish species within the study area.

Common Name	Scientific Name	Regulatory Status [1]	Primary Mgmt. Concern Species [2]	CA Native or Introduced	Location Within Study Area [3]	Abundance/Mgmt Status [4]
Pacific lamprey	*Lampetra tridentata*	FSC	No	Native	LFR	Watch List
River lamprey	*Lampetra ayresi*	CSC, FSC	Yes	Native	LFR	Watch List
Green sturgeon	*Acipenser medirostris*	CSC; FT [5]	Yes	Native	LFR	Special concern
White sturgeon	*Acipenser transmontanus*	---	No	Native	LO, LFR	Stable or increasing
American shad	*Alosa sapidissima*	---	Yes	Introduced	LFR	Widespread and stable
Threadfin shad	*Dorosoma petenense*	---	No	Introduced	LO, TA, LFR	Widespread and expanding
Common carp	*Cyprinus carpio*	---	No	Introduced	UT, LO, TF, DP, TA, LFR, OWA	Widespread and expanding
Golden shiner	*Notemigonus crysoleucas*	---	No	Introduced	LO, DP, TF, TA, OWA	Widespread and expanding
Hardhead	*Mylopharodon conocephalus*	CSC	Yes	Native	LO, TF, DP, TA, LFR	Watch List
Hitch	*Lavinia exilicauda*	---	No	Native	TA, LFR	Watch List
Sacramento pikeminnow	*Ptychocheilus grandis*	---	No	Native	UT, LO, TF, DP, TA, LFR	Stable or increasing
Sacramento splittail	*Pogonichthys macrolepidotus*	CSC; [6] FSC	Yes	Native	LFR	Special Concern
Sacramento blackfish	*Orthodon microlepidotus*	---	No	Native	OWA	Stable or increasing
Goldfish	*Carassius auratus*	---	No	Introduced	LO	Widespread and stable
Sacramento sucker	*Catastomus occidentalis*	---	No	Native	UT, LO, TF, DP, TA, LFR, OWA	Stable or increasing
Black bullhead	*Ameiurus melas*	---	No	Introduced	LFR	Widespread and stable
Brown bullhead	*Ameiurus nebulosus*	---	No	Introduced	LFR, OWA	Widespread and stable
White catfish	*Ameiurus catus*	---	No	Introduced	LO, LFR, OWA	Widespread and stable

Table 4.4-1. List of fish species within the study area.

Common Name	Scientific Name	Regulatory Status [1]	Primary Mgmt. Concern Species [2]	CA Native or Introduced	Location Within Study Area [3]	Abundance/Mgmt Status [4]
Channel catfish	*Ictalurus punctatus*	---	No	Introduced	LO, LFR, OWA	Widespread and stable
Wakasagi	*Hypomesus nipponensis*	---	No	Introduced	LO, TF, DP, TA, LFR	Widespread and expanding
Fall-run Chinook salmon	*Oncorhynchus tshawytscha*	CSC, FSC [7]	Yes	Native	FRFH, LFR	Watch List
Spring-run Chinook salmon	*Oncorhynchus tshawytscha*	ST; FT	Yes	Native	FRFH, LFR	Threatened or Endangered
Coho salmon	*Oncorhynchus kisutch*	CSC; SE, FT [8]	No	Native	LO	Threatened or Endangered
Central Valley steelhead	*Oncorhynchus mykiss*	FT	Yes	Native	FRFH, LFR	Threatened or Endangered
Rainbow trout	*Oncorhynchus mykiss*	---	Yes	Native	UT, LO, TF, DP, TA, LFR	Widespread and stable
Brown trout	*Salmo trutta*	---	Yes	Introduced	UT, LO, LFR	Widespread and stable
Brook trout	*Salvelinus fontinalis*	---	Yes	Introduced	TF, DP, TA, LFR	Widespread and stable
Lake trout	*Salvelinus namaycush*	---	No	Introduced	LO	Localized
Western mosquitofish	*Gambusia affinis*	---	No	Introduced	OWA	Widespread and expanding
Threespine stickleback	*Gasterosteus aculeatus*	---	No	Native	LO	Stable or increasing
Prickly sculpin	*Cottus asper*	---	No	Native	UT, LO, TF, DP, TA, LFR, OWA	Stable or increasing
Riffle sculpin	*Cottus gulosus*	---	No	Native	UT, LO, TA, LFR, OWA	Watch List
Striped bass	*Morone saxatilis*	---	Yes	Introduced	LFR	Widespread and stable
Bluegill	*Lepomis macrochirus*	---	No	Introduced	LO, TF, DP, TA, LFR, OWA	Widespread and stable

Table 4.4-1. List of fish species within the study area.

Common Name	Scientific Name	Regulatory Status [1]	Primary Mgmt. Concern Species [2]	CA Native or Introduced	Location Within Study Area [3]	Abundance/Mgmt Status [4]
Green sunfish	*Lepomis cyanellus*	---	No	Introduced	LO, LFR, OWA	Widespread and stable or expanding
Redear sunfish	*Lepomis microlophus*	---	No	Introduced	LO, LFR, OWA	Widespread and stable
Warmouth	*Lepomis gulosus*	---	No	Introduced	LO, OWA	Localized
Black crappie	*Pomoxis nigromaculatus*	---	No	Introduced	LO, DP, TA, OWA, LFR	Widespread and stable
White crappie	*Pomoxis annularis*	---	No	Introduced	LO, TA, OWA, LFR	Widespread and stable
Largemouth bass	*Micropterus salmoides*	---	Yes	Introduced	LO, TF, DP, TA, LFR, OWA	Widespread and stable
Smallmouth bass	*Micropterus dolomieu*	---	Yes	Introduced	LO, DP, TA, LFR	Widespread and stable
Redeye bass	*Micropterus coosae*	---	Yes	Introduced	LO, LFR	Localized
Spotted bass	*Micropterus punctulatus*	---	Yes	Introduced	LO, TA, LFR	Widespread and expanding
Tule perch	*Hysterocarpus traski*	---	No	Native	DP, TF, TA, LFR	Stable or increasing

Table 4.4-1. List of fish species within the study area.

Common Name	Scientific Name	Regulatory Status [1]	Primary Mgmt. Concern Species [2]	CA Native or Introduced	Location Within Study Area [3]	Abundance/Mgmt Status [4]

[1] *FT = listed as Threatened under FESA; ST = listed as Threatened under CESA; FE = federal Endangered; SE = State Endangered; FC = candidate for listing under FESA; CC = candidate for listing under CESA; FSC = federal species of concern; CSC = California species of special concern.*

[2] *Species of primary management concern evaluated in this analysis include those that are recreationally or commercially important, State- and/or federally listed species within the project study area under FESA or CESA, candidate species for listing under FESA or CESA, and California species of special concern.*

[3] *Frequently or infrequently observed in the following: UT = upstream tributaries; LO = Lake Oroville; DP = Diversion Pool; TF = Thermalito Forebay; TA = Thermalito Afterbay; FBP = Fish Barrier Pool; FRFH = Feather River Fish Hatchery; OWA = Oroville Wildlife Area ponds; LFR = Lower Feather River.*

[4] *As defined in Moyle 2002.*

[5] *After reviewing the petition for listing green sturgeon, on January 29, 2003, NMFS determined that such listing was not warranted, although it was still considered a candidate species. On April 15, 2004, NMFS announced that the Northern and Southern Distinct Population Segments of Green Sturgeon would change in listing status from a candidate species to a species of concern (69 Federal Register [FR] 19977). However, litigation challenging NMFS' determination that green sturgeon do not warrant listing as an Endangered or Threatened species under FESA asserted that the agency was arbitrary and capricious in failing to examine whether habitat loss constituted a significant portion of the species' range. The court partially agreed with the Plaintiff's motion, and remanded the determination back to NMFS for further analysis and decision as to whether green sturgeon are endangered or threatened in a significant portion of its range. Hence, according to NMFS' April 15, 2004 interpretation of FESA provisions, green sturgeon were considered a candidate species as well as a species of concern, until this matter could be resolved. On April 7, 2006, a final rule was issued and adopted, and the southern distinct population segment was listed as Threatened. The final rule became effective June 6, 2006 (71 FR 17757 [2006]).*

[6] *USFWS removed Sacramento splittail from the list of Threatened species on September 22, 2003, and did not identify it as a candidate for listing under FESA. Sacramento splittail is identified as a California species of special concern and, informally, as a federal species of concern.*

[7] *Although late fall–run Chinook salmon does not occur within the project study area, the Central Valley fall-run/late fall–run Chinook salmon is identified as one Evolutionarily Significant Unit (ESU). In 1999, the Central Valley ESU underwent a status review after NMFS received a petition for listing. Pursuant to that review, NMFS found that the species did not warrant listing as Threatened or Endangered under FESA, but sufficient concerns remained to justify addition to the candidate species list. On April 15, 2004, NMFS published a notice in the Federal Register acknowledging establishment of a species of concern list, addition of species to the species of concern list, and revision of the candidate species list. In this notice, NMFS announced the Central Valley fall-run and late fall–run Chinook salmon ESU change in status from a candidate species to a species of concern. Therefore, according to NMFS' April 15, 2004 interpretation of FESA provisions, the Central Valley ESU now qualifies as a species of concern, rather than a candidate species (69 FR 19977).*

[8] *Populations south of San Francisco are listed by the State as endangered. Special-status species designations pertain only to coho salmon within their native habitats. Coho salmon occur within the project study area as a result of stocking programs and are managed for their recreational importance only.*

Sources: Initial Information Package (DWR 2001); Moyle 2002

Upstream Tributaries

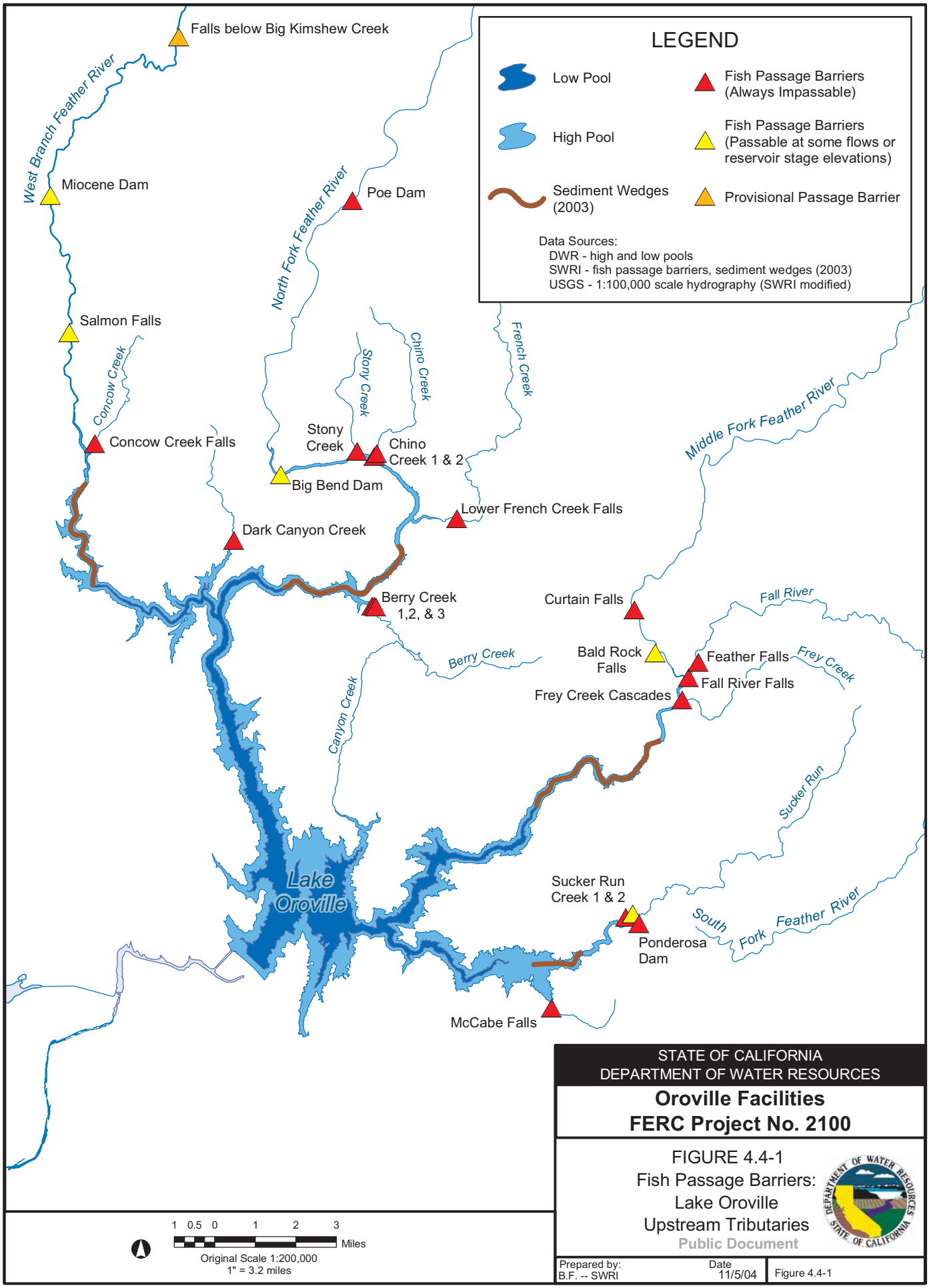
There are four major upstream tributaries to Lake Oroville: the North Fork Feather River, the West Branch of the North Fork Feather River, the Middle Fork Feather River, and the South Fork Feather River (see Figure 4.4-1). The Middle Fork Feather River is designated as a National Wild and Scenic River and a Heritage Trout Water by DFG (DFG Website 2003).

The coldwater fish species present in the upstream tributaries above Lake Oroville and below the first impassable fish barrier include rainbow trout and brown trout. The warmwater fish species in the upstream tributaries include bluegill, brown bullhead, carp, largemouth bass, redeye bass, roach, smallmouth bass, spotted bass, Sacramento pikeminnow, Sacramento sucker, and sculpin.

Project operations associated with the Oroville Facilities do not control flows and/or temperatures within the upstream tributaries. However, operations of the Oroville Facilities do potentially influence other aquatic resources in the upper Feather River tributaries up to the first impassable fish barriers (see Figure 4.4-1). The upstream tributaries' first impassable fish barriers were identified as the falls below Big Kimshew Creek (provisional impassable barrier) for the West Branch of the North Fork Feather River, Poe Dam on the North Fork Feather River, Curtain Falls for the Middle Fork Feather River, and Ponderosa Dam for the South Fork Feather River (additional information on upstream tributary migration barriers is included in Section G-AQUA1.3.1.1 in Appendix G-AQUA1 of the PDEA). There are several types of potential operational effects on fisheries resources in the upstream tributaries up to the first impassable fish barriers, including fish interactions, nutrient transfer, and sediment deposition in the tributary arms of Lake Oroville.

Fish within Lake Oroville can potentially interact with the upstream tributary fisheries through predation, competition for available food and habitat, disease transmission, and genetic introgression (additional information on potential fisheries interactions is included in Section G-AQUA1.5.1 in Appendix G-AQUA1 of the PDEA). Lake Oroville reservoir operations influence the accessibility of the upstream tributaries to fish species within Lake Oroville through the stage elevation of the reservoir. When Lake Oroville stage elevations are near full pool, Big Bend Dam becomes passable to fish; when reservoir stage elevations are reduced, sediment wedges in the tributary arms of the reservoir may be exposed and may inhibit or prohibit fish movement from the reservoir into the upstream tributaries. Increases or decreases in reservoir stage elevations also increase or decrease the distance from the reservoir to fish habitat in the upstream tributaries above the reservoir high-pool mark, which also may influence the amount and frequency of fish interactions between the reservoir fishery and the upstream tributary fishery.

The Oroville Facilities, including Oroville Dam, Thermalito Diversion Dam, and the Fish Barrier Dam, currently block the upstream movement of anadromous fish to that portion of historical spawning areas in the upstream tributaries of the Feather River below the


LEGEND
Low Pool
High Pool
Sediment Wedges (2003)
Fish Passage Barriers (Always Impassable)
Fish Passage Barriers (Passable at some flows or reservoir stage elevations)
Provisional Passage Barrier
Data Sources:
DWR - high and low pools
SWRI - fish passage barriers, sediment wedges (2003)
USGS - 1:100,000 scale hydrography (SWRI modified)
Falls below Big Kimshew Creek
West Branch Feather River
Miocene Dam
Salmon Falls
Concow Creek
Concow Creek Falls
North Fork Feather River
Poe Dam
Stony Creek
Chino Creek
Stony Creek
Chino Creek 1 & 2
Big Bend Dam
French Creek
Lower French Creek Falls
Middle Fork Feather River
Dark Canyon Creek
Berry Creek 1,2, & 3
Curtain Falls
Fall River
Berry Creek
Bald Rock Falls
Feather Falls
Frey Creek
Fall River Falls
Frey Creek Cascades
Canyon Creek
Sucker Run
Lake Oroville
Sucker Run Creek 1 & 2
South Fork Feather River
Ponderosa Dam
McCabe Falls
1 0.5 0 1 2 3
Miles
Original Scale 1:200,000
1" = 3.2 miles
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Facilities
FERC Project No. 2100
FIGURE 4.4-1
Fish Passage Barriers:
Lake Oroville
Upstream Tributaries
Public Document
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B.F. -- SWRI
Date
11/5/04
Figure 4.4-1

next impassable barrier (hydroelectric dams and facilities upstream that pre-date this project). Blockage of anadromous fish from upstream tributaries deprives these areas of fish-derived nutrients that could otherwise contribute to the productivity of both the aquatic and terrestrial ecosystems in and adjacent to the upstream tributaries. (Additional information on nutrient transfer is included in Section G-AQUA1.6 in Appendix G-AQUA1 of the PDEA.)

Lake Oroville

Lake Oroville is a warm, monomictic reservoir that thermally stratifies in the spring, destratifies in the fall, and remains destratified throughout the winter. Due to this stratification, Lake Oroville has been said to contain a "two-story" fishery, supporting both coldwater and warmwater fisheries that are thermally segregated for most of the year. The coldwater fish use the deeper, cooler, well-oxygenated hypolimnion, whereas the warmwater fish are found in the warmer, shallower, epilimnetic, and littoral zones. Once Lake Oroville destratifies in the fall, the two fishery components mix in their habitat utilization.

Lake Oroville's coldwater fishery is primarily composed of coho salmon, although rainbow trout, brown trout, and lake trout are periodically caught. The coldwater fishery for coho salmon is sustained by hatchery stocking. Lake Oroville's coldwater fishery is not self-sustaining, possibly due to insufficient spawning and rearing habitat in the reservoir and accessible tributaries, and natural and artificial barriers to migration into the upstream tributaries, where sufficient spawning and rearing habitat has historically existed (DWR 2001). A "put-and-grow" hatchery program is currently in use, where coho salmon are raised at the Feather River Fish Hatchery and stocked in the reservoir as juveniles, with the intent that these fish will grow in the reservoir before being caught by anglers (DWR 2001). Approximately 170,000 yearling sized coho salmon are stocked each fall. These fish are coded wire tagged and released following a final disease certification from DFG. Lake Oroville's warmwater and coldwater fish species are listed in Table 4.4-1 (additional information on Lake Oroville fish species composition is included in Section G-AQUA1.3.2.1 in Appendix G-AQUA1 of the PDEA).

The Lake Oroville warmwater fishery is a regionally important self-sustaining warmwater recreational fishery. The black bass fishery is significant both in terms of angler effort and economic effect on the area (additional information on black bass is included in Section G-AQUA1.3.2.3 in Appendix G-AQUA1 of the PDEA). Spotted bass are the most abundant bass species in Lake Oroville, followed by largemouth, redeye, and smallmouth bass. Catfish are the next most popular warmwater sport fish at Lake Oroville, with both channel and white catfish present. White and black crappie are also found in Lake Oroville, though populations fluctuate widely from year to year. Bluegill and green sunfish are the two primary sunfish species in Lake Oroville, though redear sunfish and warmouth are also present in very low numbers. Although common carp are considered by many to be a nuisance species, they are also abundant in Lake Oroville (DWR 2001). The primary forage fish in Lake Oroville are wakasagi and threadfin shad. Threadfin shad were intentionally introduced in 1967 to provide forage

for game fish, whereas the wakasagi migrated down from an upstream reservoir in the mid-1970s (DWR 2001).

Although the Lake Oroville warmwater fishery is self-sustaining, in the past, DWR has implemented programs for aquatic habitat improvements. For example, DWR implemented a habitat improvement program in 1995 that was completed in the spring of 2000 (DWR 2001). Components of the program included installing Christmas tree brush shelters, Manzanita brush shelters, and the planting of Button Brush and willow trees in riparian zones (DWR 1999). There have also been some experimental structures placed in the lake to improve channel catfish habitat. These structures utilize rocks or existing woody debris found along the shore of the lake. Most of these structures are approximately 30 inches long, 20 inches wide, and 10 inches deep (DWR 1997). Additional warmwater fish habitat enhancement projects have been conducted on an annual basis since 2000, utilizing these same techniques.

Water surface elevation fluctuations in Lake Oroville occur on a seasonal basis, resulting from seasonal variations in upstream tributary inflows into the reservoir, as well as seasonal variations in Oroville Facilities reservoir releases. Reservoir stage elevation reductions as well as the rate of reductions can reduce the amount of littoral fish habitat, invertebrate recruitment as a fisheries food base, coldwater pool volume, quantity of coldwater fishery habitat, and bass nest survival from dewatering (see Section 4.2.1, Surface Water Quantity, for more information on reservoir drawdown characteristics, and Section G-AQUA1.3.2.3 in Appendix G-AQUA1 of the PDEA for additional information on bass nest dewatering).

Oroville Facilities releases from selected water depth ranges from the reservoir affect the downstream water temperatures of the Thermalito Complex and the lower Feather River. Oroville Facilities water temperature releases directly affect the quantity, quality, and distribution of fish habitat in the Thermalito Complex and the lower Feather River (additional information on facility effects on fish habitat within the Thermalito Complex is included in Section G-AQUA1.3.3.2 in Appendix G-AQUA1 of the PDEA). The quantity and water temperature range selected for release from the reservoir also affect the coldwater pool volume and the quantity and quality of the coldwater fisheries habitat available in the reservoir (additional information regarding effects on coldwater pool volumes is included in Section 4.2.2, Surface Water Quality).

The elevations of the sediment wedges in the tributary arms of the reservoir (see Figure 4.4-1) are influenced by Oroville Facilities operations (additional information on upstream tributary sediment wedges is included in Section G-AQUA1.3.1.1 in Appendix G-AQUA1 of the PDEA). As sediment loads are suspended in the upstream tributary flows, a portion of the sediment load is deposited at the interface of the tributary and the reservoir (see Section 4.1, Geology, Soils, and Paleontological Resources, for additional information on sediment wedges). The stage elevation of the reservoir during these sediment deposition events determines the elevation of the resulting sediment wedge formation, which in turn determines the frequency and duration of sediment wedge exposure from reservoir operations as potential fish passage barriers. As sediment wedges are exposed by reductions in reservoir surface elevations, the

sediment is remobilized and redeposited at a lower stage elevation of the reservoir. The remobilization of the sediment can also potentially affect reservoir water quality suitability for aquatic life (additional information on water quality effects is included in Section 5.2.2, Surface Water Quality).

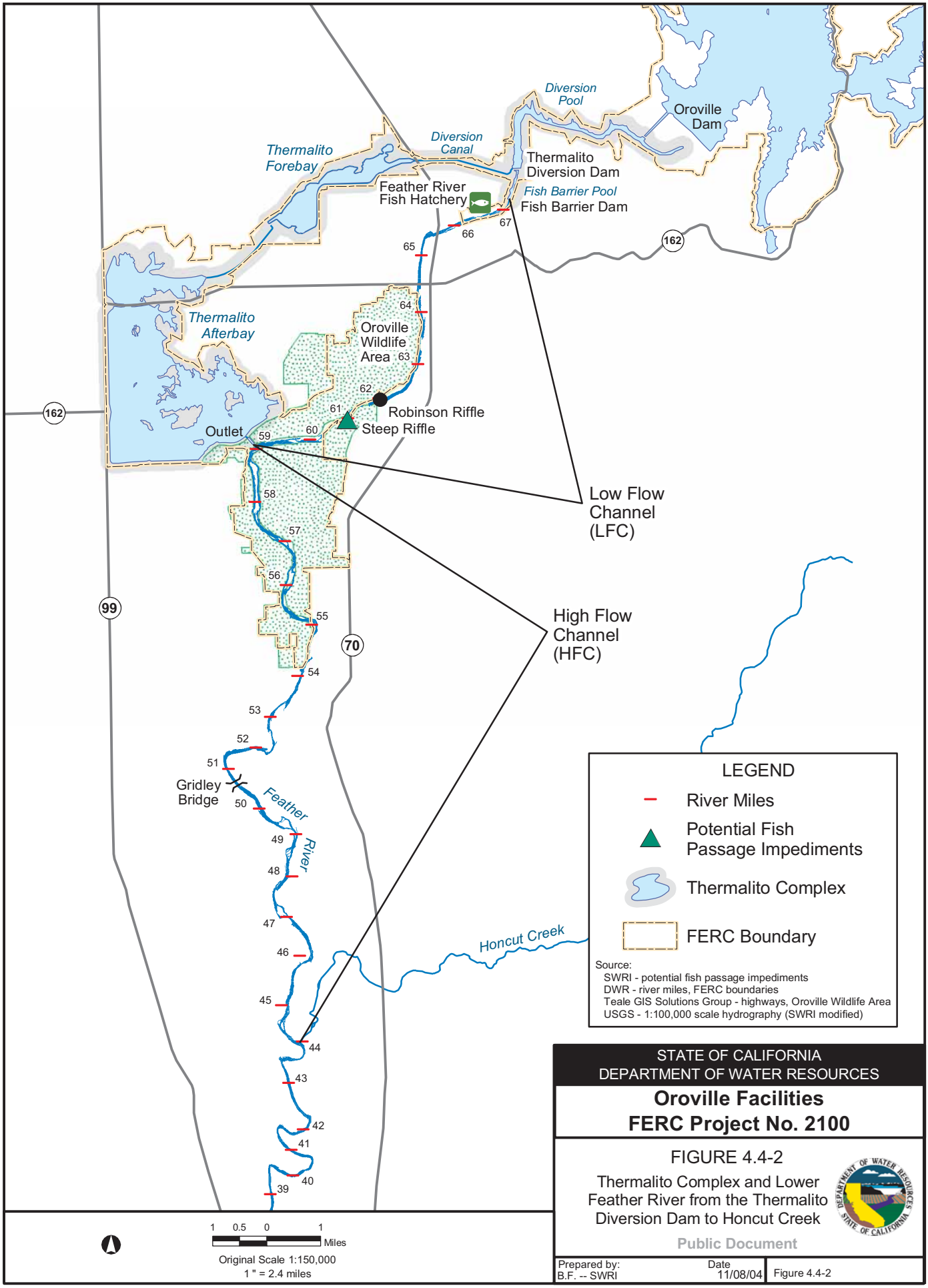
Lake Oroville traps upstream tributary contributions of gravel and sediment to the lower Feather River. Oroville Dam stops all of the gravel and most of the sand from being transported into the lower Feather River; generally, only fine sediment is discharged to the river below the dam (see Section 5.1, Geology, Soils, and Paleontological Resources, for additional information on reservoir effects on gravel and sediment transport). The gravel and sediment captured in the reservoir affect the fluvial geomorphologic functions of the lower Feather River and its contribution to the quality, quantity, and distribution of fish habitat in the lower Feather River (more information regarding Feather River fish habitat is included in Section G-AQUA1.8.1.4 in Appendix G-AQUA1 of the PDEA). The reservoir also traps large woody debris (LWD) contributions from the upstream tributaries and blocks the transport of these resources from contributing to the development and maintenance of fish habitat quality and diversity in the lower Feather River.

Diversion Pool

The Diversion Pool is located between Oroville Dam and Thermalito Diversion Dam (see Figure 4.4-2). The Diversion Pool is supplied with cold water from Lake Oroville's hypolimnion to meet water temperature requirements at the Feather River Fish Hatchery per the 1983 DWR Operating Agreement with DFG and at Robinson Riffle in the Low Flow Channel (LFC) of the lower Feather River per the 2004 NMFS Biological Opinion (see Section 4.2.2, Surface Water Quality, for additional information on water temperature requirements). The water intake for the Feather River Fish Hatchery is in the Diversion Pool at the Diversion Dam. Water temperatures in the Diversion Pool seldom exceed the high 50s (degrees Fahrenheit [°F]). Therefore, the Diversion Pool habitat is primarily suited for coldwater fish species; salmonids such as rainbow trout, brook trout, brown trout, and Chinook salmon have been sampled in the past (DWR 2001; DWR 2002). Although the Diversion Pool is not currently stocked, a lack of barriers between the Diversion Pool and Thermalito Forebay allows fish stocked in Thermalito Forebay to migrate freely into the Diversion Pool (DWR 2001; DWR 2002). Project peaking and pump-back operations, especially during the summer, potentially can increase water temperatures in the Diversion Pool, but the hatchery water temperature requirements limit the water temperature effects to ranges below salmonid water temperature requirements.

Thermalito Forebay

The Thermalito Forebay is an open, cold, shallow reservoir with a high surface area-to-volume ratio with few water surface elevation fluctuations (DWR 2001; DWR 2002) (see Figure 4.4-2). Thermalito Forebay remains cold throughout the year because it is supplied with water from the Diversion Pool, although pump-back operations from Thermalito Afterbay can increase water temperatures in the forebay somewhat (more


Diversion Pool
Oroville Dam
Diversion Canal
Thermalito Forebay
Thermalito Diversion Dam
Feather River Fish Hatchery
Fish Barrier Pool
Fish Barrier Dam
67
66
65
162
64
Thermalito Afterbay
Oroville Wildlife Area
63
62
Robinson Riffle
61
Steep Riffle
162
Outlet
59
60
58
57
56
Low Flow Channel (LFC)
99
55
High Flow Channel (HFC)
70
54
53
52
51
Gridley Bridge
50
Feather River
49
48
47
46
Honcut Creek
45
44
43
42
41
40
39
LEGEND
River Miles
Potential Fish Passage Impediments
Thermalito Complex
FERC Boundary
Source:
SWRI - potential fish passage impediments
DWR - river miles, FERC boundaries
Teale GIS Solutions Group - highways, Oroville Wildlife Area
USGS - 1:100,000 scale hydrography (SWRI modified)
1 0.5 0 1
Miles
Original Scale 1:150,000
1 " = 2.4 miles
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Facilities
FERC Project No. 2100
FIGURE 4.4-2
Thermalito Complex and Lower Feather River from the Thermalito Diversion Dam to Honcut Creek
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Prepared by: B.F. -- SWRI
Date 11/08/04
Figure 4.4-2

information regarding the influences of project operations on Thermalito Forebay is included in Section G-AQUA1.3.3.2 in Appendix G-AQUA1 of the PDEA). Because of the cool water temperatures, Thermalito Forebay provides habitat primarily for coldwater fish (DWR 2001; DWR 2002), although warmwater fish species in Lake Oroville are believed to exist in the forebay in low numbers as well (DWR 2001). DFG manages Thermalito Forebay as a put-and-take trout fishery, where rainbow trout of approximately 0.5 pound are stocked (DWR 2001; DWR 2002). The Thermalito Forebay is the second most popular reservoir sport fishery of the Oroville Facilities (DWR 2001; DWR 2002).

Thermalito Afterbay

Thermalito Afterbay constitutes the most hydrologically complex regime of all of the Oroville Facilities reservoirs (DWR 2001) (see Section 4.2.1, Surface Water Quantity, for more information on Thermalito Afterbay fluctuation characteristics). Thermalito Afterbay is a large, shallow, open reservoir with frequent water level fluctuations and a high surface-to-volume ratio (see Figure 4.4-2). Water temperatures can vary widely around the afterbay in the summer, with water in the low 60s near the tailrace channel that feeds the afterbay, and water in the mid 80s in the backwater areas that do not readily circulate (DWR 2001). Changes in flow rates, direction, and water surface elevations resulting from project operations affect water temperatures and the quality, quantity, and distribution of fish habitat in Thermalito Afterbay (additional information regarding Thermalito Afterbay habitat availability is included in Section G-AQUA1.3.4.2 in Appendix G-AQUA1 of the PDEA). Thermalito Afterbay provides habitat for both coldwater and warmwater fish.

In addition to a popular largemouth bass fishery, other warmwater species including smallmouth bass, spotted bass, various species of sunfish, bluegill, white crappie, black crappie, catfish, and common carp occur in Thermalito Afterbay (DWR 2001). Tule perch also has recently been confirmed in the Afterbay (pers. comm., See 2003). Although salmonids are not currently stocked, rainbow trout have been observed in Thermalito Afterbay. Most of the Lake Oroville sport fish species probably occur in the afterbay to some degree (DWR 2001).

Water surface elevations in Thermalito Afterbay change on a weekly and daily frequency, depending on power generation and pump-back operations. The shallow nature of Thermalito Afterbay results in obvious fluctuation effects with only a few feet of water surface elevation changes (DWR 2001). Mudflats can be exposed and a significant amount of the littoral zone can be dewatered, which affects the quantity of habitat available to fish species. Reductions in Thermalito Afterbay water surface elevations can dewater bass nests and potentially affect the sustainability of the centrarchid populations (further discussion of bass nest dewatering is included in Section G-AQUA1.3.2.3 in Appendix G-AQUA1 of the PDEA).

Oroville Facilities operations affect the water temperatures and their distribution in Thermalito Afterbay, which affects coldwater and warmwater fish habitat quantity, quality, and distribution in the afterbay as well as the water temperatures at the

agricultural diversions and the Thermalito Afterbay Outlet (see Section 5.2.2, Surface Water Quality, for additional information on water temperature effects in Thermalito Afterbay). Project operations that affect Thermalito Afterbay water temperatures include Oroville Dam release water temperatures and those operational variables that determine the effective residence time of water in the afterbay. Oroville Facilities operations that determine the effective residence time of water in the afterbay include the volume of inflows compared to the total releases from the afterbay (at both the Thermalito Afterbay Outlet and the agricultural diversions), afterbay stage elevations, and the amount of peaking and pump-back.

Fish Barrier Pool

The Fish Barrier Pool is located between the Thermalito Diversion Dam and the Fish Barrier Dam (see Figure 4.4-2). The Fish Barrier Dam diverts fish into a fish ladder that leads to the Feather River Fish Hatchery. The flow over the dam maintains fish habitat in the LFC of the Feather River between the dam and the Thermalito Afterbay Outlet, and provides attraction flow for the hatchery. Because of the relatively constant discharge of approximately 600 cubic feet per second (cfs) into the Fish Barrier Pool from the Thermalito Diversion Dam Power Plant, the Fish Barrier Pool remains at a stable pool elevation, except during periods of spill releases when flood flows are routed through the Fish Barrier Pool.

Feather River Fish Hatchery

The Feather River Fish Hatchery facilities include the Fish Barrier Dam below Oroville Dam, the fish ladder, holding tanks, hatchery buildings, and raceways (DWR 2002) (see Figure 4.4-2). DWR constructed the Feather River Fish Hatchery in 1967 to compensate for salmonid spawning habitat lost with construction of Oroville Dam. The facility is operated by DFG and maintained by DWR, and can accommodate 15,000–20,000 adult fish annually. The hatchery is one of five major Central Valley hatcheries producing and releasing fall-run Chinook salmon, one of three producing and releasing steelhead, and the only hatchery producing and releasing spring-run Chinook salmon (DWR 2002).

The hatchery complex uses water that is diverted from the Diversion Pool, which receives cold, hypolimnetic water (which rarely exceeds the mid to high 50s [°F]) from Lake Oroville. Water temperatures for the hatchery water intake are monitored for operational compliance with the hatchery water temperature requirements per the 1983 Oroville Operating Agreement between DWR and DFG.

Feather River Fish Hatchery practices of releasing hatchery production in San Pablo Bay have been suggested as contributing to the increase in straying rates of fish returning to non-natal tributaries for spawning. Hatchery operations may affect water quality conditions, such as temperature, dissolved oxygen, and pH, which in turn potentially may affect the rate or severity of fish disease occurrences both in the hatchery and in the lower Feather River (DWR 2002). Fish species, holding densities,

and the presence and amount of pathogens in the environment also may be related to the frequency or severity of occurrence and spread of fish diseases.

Hatchery practices also may potentially affect the genetic integrity of distinct runs of Chinook salmon, with the potential to commingle spring and fall Chinook salmon runs in the hatchery. Since 2004, DWR has been tagging adult spring-run Chinook salmon that enter the fish ladder starting as early as mid-May, after which the ladder is closed on June 30 or earlier if the permit limit is met and no more fish are tagged. The number of tagged fish varies from year to year. In 2006 there were 10,179 tagged (including reward tags) and an additional 7,197 were marked with a caudal fin-clip. The tagging/marking occurs every year between May 15 and June 30. This tagging/marking operation allows the Feather River Fish Hatchery staff to know which salmon are spring-run when it is time to spawn fish in the fall. Hatchery staff open the ladder for spawning in mid-September, and because the fish with tags are known to be the ones that came in during May and June, only these fish are spawned as "spring run." Hatchery-produced fish also have the potential to adversely affect naturally spawning salmonid runs in the Feather River and other Central Valley streams through competition with wild spawned salmonids for food and habitat, potential transmission of diseases, predation, and through genetic introgression.

Oroville Wildlife Area Ponds

The OWA contains over 75 warmwater ponds and sloughs, along with vast complexes of emergent marsh and flooded cottonwood, willow, and sycamore trees, totaling approximately 11,980 acres (see Figure 4.4-2). The OWA pond water levels are replenished, in part, by the Feather River, which seeps through the porous levees and substrates, or floods into the OWA during high-flow events. Because the stage of the Feather River is controlled by Oroville Facilities operations, fish and their habitat in the OWA may potentially be affected by Oroville Facilities releases. After the floods on the Feather River in 1997, DWR repaired a levee and left in place a culvert that was used during the repairs. Subsequently, beavers have constructed dams, backing up the water through the culvert, which has resulted in inundation of areas in the OWA. The inundated area increased the amount of potential fish and wildlife habitat in the OWA, but species of invasive aquatic plants are growing to densities that reduce the quality of or eliminate potential fish habitat (additional information on OWA ponds is included in Section G-AQUA1.3.5.1 in Appendix G-AQUA1 of the PDEA).

Largemouth bass, channel catfish, white catfish, bluegill, green sunfish, and carp are all highly abundant in the OWA ponds, along with populations of black and white crappie (further discussion of OWA fish species composition and management is included in Section G-AQUA1.3.5.1 in Appendix G-AQUA1 of the PDEA). The fish are replenished through natural reproduction in the ponds and from the Feather River, which floods into the OWA during Oroville Facilities high-flow release events.

Lower Feather River

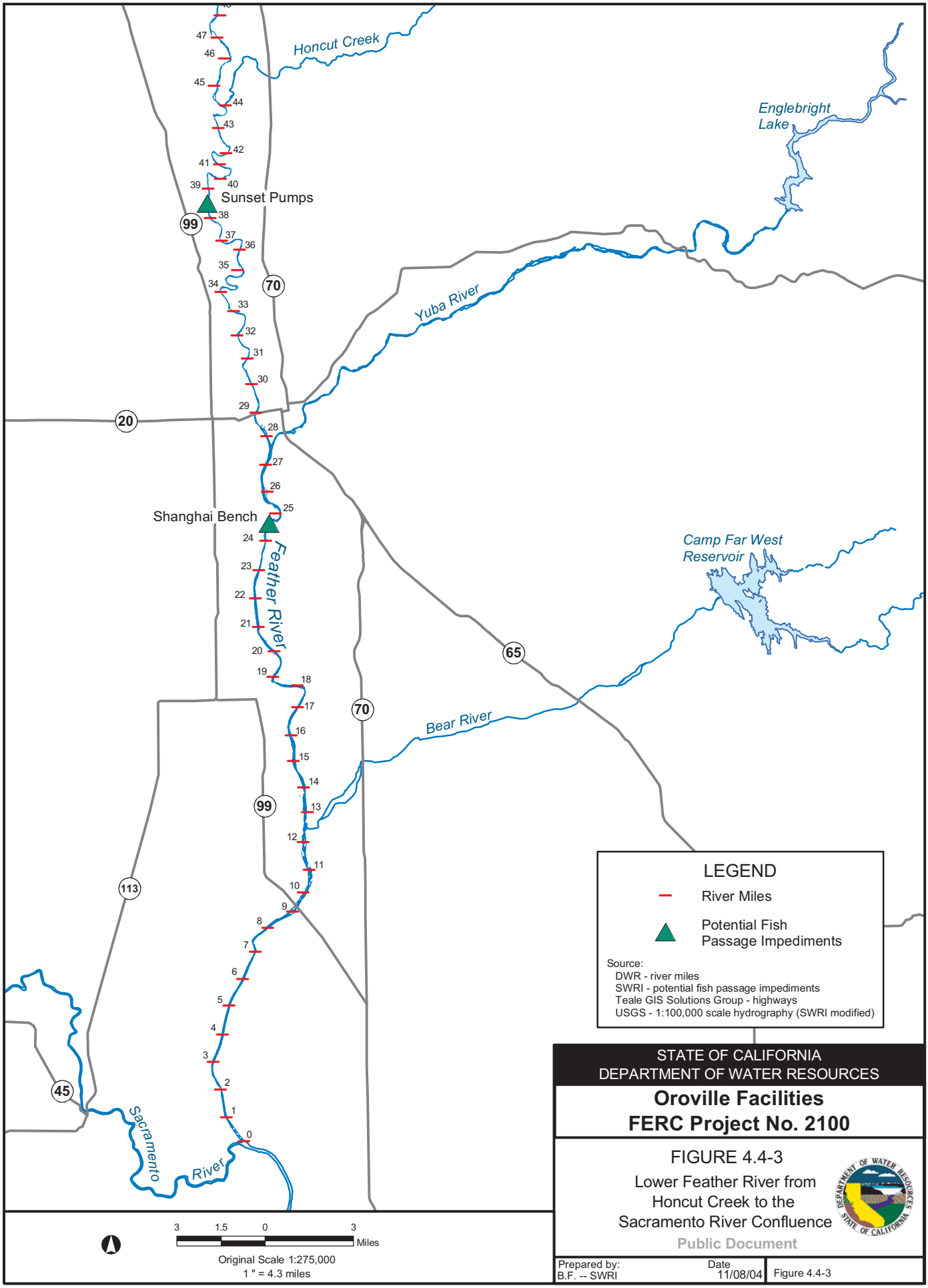
The lower Feather River extends from the Fish Barrier Dam (River Mile [RM] 67) to the confluence with the Sacramento River (RM 0). The LFC extends from the Fish Barrier Dam to the Thermalito Afterbay Outlet (RM 59) and the High Flow Channel (HFC) from the Thermalito Afterbay Outlet to the confluence with Honcut Creek (RM 44) (see Figure 4.4-2). The reaches of the lower Feather River are identified by the confluences with Honcut Creek to Yuba River (RM 27.5), Yuba River to Bear River (RM 12.5), and Bear River to the confluence with the Sacramento River (see Figure 4.4-3).

The lower Feather River supports a variety of anadromous and resident fish species. Fish species of primary management concern present in the lower Feather River include spring-run Chinook salmon, fall-run Chinook salmon, Central Valley steelhead, rainbow trout, brown trout, brook trout, green sturgeon, striped bass, river lamprey, American shad, hardhead, Sacramento splittail, largemouth bass, smallmouth bass, redeye bass, and spotted bass (more information on Feather River fish species is included in Section G-AQUA1.4.2 in Appendix G-AQUA1 of the PDEA).

Chinook salmon are the most numerous fish species in the lower Feather River; 30,000–170,000 Chinook salmon spawn in the lower Feather River annually. Approximately two-thirds of the natural Chinook salmon spawning occurs between the Fish Barrier Dam and the Thermalito Afterbay Outlet (RM 67–59), and one-third of the spawning occurs between the Thermalito Afterbay Outlet and Honcut Creek (RM 59–44). Chinook spawning typically occurs from September through December. Most juvenile Chinook salmon emigrate from the lower Feather River within a few days of emergence, and 95 percent of the juvenile Chinook have typically emigrated from the Oroville Facilities project area by the end of May. Adult Chinook salmon exhibiting the typical life history of the spring-run are found holding at the Thermalito Afterbay Outlet and the Fish Barrier Dam as early as April.

Most of the natural steelhead spawning in the Feather River occurs in the LFC, particularly in the upper reaches near Hatchery Ditch, a side channel located between RM 66 and RM 67 (additional information on steelhead spawning is included in Section G-AQUA1.8.2.2 in Appendix G-AQUA1 of the PDEA). Limited steelhead spawning also occurs below the Thermalito Afterbay Outlet. Soon after emerging from gravel, a moderate percentage of the fry appear to emigrate. The remainder of the population rears in the river for at least 6 months to 1 year. Studies have confirmed that juvenile rearing and probably adult spawning are associated with secondary channels within the LFC. The smaller substrate size and greater amount of cover (compared to the main river channel) likely make these side channels more suitable for juvenile steelhead rearing. Currently, this type of habitat comprises less than 1 percent of the available habitat in the LFC (DWR 2001).

The occasional capture of larval green sturgeon in outmigrant traps suggests that green sturgeon spawn in the Feather River (Moyle 2002); however, NMFS (NMFS 2002) reports that evidence of green sturgeon spawning in the Feather River is unsubstantiated. Significant efforts including scuba and snorkel surveys, hook and line


Honcut Creek
Englebright Lake
Sunset Pumps
Yuba River
Shanghai Bench
Feather River
Camp Far West Reservoir
Bear River
Sacramento River
99
70
20
65
113
45
LEGEND
River Miles
Potential Fish Passage Impediments
Source:
DWR - river miles
SWRI - potential fish passage impediments
Teale GIS Solutions Group - highways
USGS - 1:100,000 scale hydrography (SWRI modified)
3 1.5 0 3
Miles
Original Scale 1:275,000
1 " = 4.3 miles
STATE OF CALIFORNIA
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Oroville Facilities
FERC Project No. 2100
FIGURE 4.4-3
Lower Feather River from Honcut Creek to the Sacramento River Confluence
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Date 11/08/04
Figure 4.4-3

sampling, and larval traps during preparation of the Oroville Facilities studies were all unsuccessful in documenting the presence of green sturgeon in the lower Feather River. Sturgeon passage may be impeded at Shanghai Bench and Sunset Pumps on the lower Feather River at lower flow ranges, and sturgeon are reported as not typically entering the mouth of the Feather River at flows lower than approximately 5,000 cfs (more information regarding sturgeon passage impediments is included in Section G-AQUA1.4.3.1 in Appendix G-AQUA1 of the PDEA).

Sacramento splittail intermittently use the lower Feather River from February through May for spawning, egg incubation, and initial rearing. Splittail utilize shallow flooded vegetation for spawning and are infrequently observed in the lower Feather River from the confluence with the Sacramento River up to Honcut Creek. The majority of spawning activity in the lower Feather River is thought to occur below the Yuba River confluence, and occurs in greatest abundance in the Sutter Bypass during high-flow events (more information on splittail habitat use is included in Section G-AQUA1.4.3.3 in Appendix G-AQUA1 of the PDEA).

Oroville Facilities releases are regulated and subject to regulatory flow criteria. Under an agreement with DFG, flows in the LFC are regulated at 600 cfs, except during flood events when flows have reached as high as 150,000 cfs (DWR 1983). The instream flow requirements below Thermalito Afterbay are 1,700 cfs from October through March, and 1,000 cfs from April through September. In Critical years, however, the minimum flow can be reduced to 1,200 cfs from October to February, and to 1,000 cfs in March. Flows in the HFC are maintained at or below 2,500 cfs from October 15 through November 30 to prevent Chinook salmon redd dewatering.

The magnitude of Oroville Facilities releases can affect the quality, quantity, and distribution of fish habitat in the lower Feather River in several ways, including changes in water stage elevations, inundated area, water depth, water velocities, water quality, and water temperatures. Oroville Facilities releases determine the flows in the upstream reaches of the lower Feather River and contribute proportionately to total flows below the confluences with Honcut Creek, Yuba River, Bear River, and locations of other flow accretions or depletions. High Oroville Facilities releases contribute to the inundation of floodplain habitat utilized for salmonid juvenile rearing and emigration and splittail spawning, contribute to attraction flows for immigrating fish, and facilitate fish passage at potential fish passage impediments in the lower Feather River (more information regarding flow-related effects on fishes is included in Sections G-AQUA1.8.3.4, G-AQUA1.8.4.2, G-AQUA1.4.3.3, and G-AQUA1.3.1.1 in Appendix G-AQUA1 of the PDEA). The timing and magnitude of releases from the Oroville Facilities can affect the quantity, quality, and distribution of salmonid spawning and rearing habitat in the LFC and HFC and may affect predation rates on juvenile salmonids. Project structures associated with the release facilities may influence predation of juvenile salmonids by producing turbulence, eddies, and other in-river conditions that can be advantageous for predatory species (more information on predation of juvenile salmonids is included in Section G-AQUA1.11.4.1 in Appendix G-AQUA1 of the PDEA).

The frequency and magnitude of high-flow events drive many fluvial geomorphic processes that contribute to the development and maintenance of fish habitat quality, quantity, and distribution. Some of the fluvial geomorphic processes that affect fish habitat characteristic quality, quantity, and distribution include channel shaping, river meander, bank cutting, gravel and sediment recruitment, transport, and deposition, and LWD recruitment and retention (see Section 4.1, Geology, Soils, and Paleontological Resources, for additional information on fluvial geomorphic processes). Oroville Facilities releases moderate the flow regime in the lower Feather River. The relatively static flow regime in the LFC, with the exception of high volume releases associated with high-flow events, reduces fluvial geomorphic processes in this reach of the river and results in channel stabilization and reduces gravel and LWD recruitment, which reduces the diversity of instream habitat and affects fish and wildlife habitat quality.

Fluctuations in Oroville Facilities releases occur under flood management operations, scheduled operation-maintenance activities, storm events, or emergency shutdowns. The timing, location, and magnitude of flow fluctuations may result in redd dewatering or scouring and juvenile stranding, and may affect the timing of juvenile salmonid emigration (more information regarding flow fluctuation effects on salmonids is included in Sections G-AQUA1.8.2.6 and G-AQUA1.8.4.2 in Appendix G-AQUA1 of the PDEA).

Changes in flows and the resulting changes in water velocity may affect the distribution of suitable habitat for some fish species. In the case of extremely high flows, such as those occurring during a high-flow event, the resulting water velocities may make some areas of the lower Feather River unsuitable for some fish species for the duration of the high-flow event. High water velocities that occur during the higher ranges of Oroville Facilities releases can scour salmonid redds and mobilize substrate, which could potentially affect fish habitat substrate suitability, quality, and distribution.

Increases or decreases in flow releases from the Oroville Facilities result in increases or decreases in water depths in the lower Feather River. Increases in Oroville Facilities releases, such as those occurring during a high-flow event, could result in an increase in the amount of potentially suitable fish habitat for those fish species having minimum water depth requirements. Similarly, reductions in releases could potentially reduce the amount of potentially suitable fish habitat for those fish species with minimum water depth requirements. The greatest proportion of deep water and the greatest water depth diversity occur in the upstream-most reach of the lower Feather River, between the Fish Barrier Dam and the Thermalito Afterbay Outlet. Downstream of the Thermalito Afterbay Outlet, the river tends to become progressively shallower and less diverse in its depth distribution.

Oroville Facilities releases affect water temperatures in the upper portions of the lower Feather River. Oroville Facilities releases are currently managed to primarily benefit coldwater fisheries (DWR 2002). Water temperatures tend to be coldest in the uppermost portions of the lower Feather River near the Fish Barrier Dam and warm progressively moving downstream during the spring, summer, and fall. The LFC water temperatures have been managed to comply with the 2002 and 2004 supplemental NMFS BOs on the interim operations of the CVP and SWP on federally listed

Threatened Central Valley spring-run Chinook salmon and Central Valley steelhead (NMFS 2002). These BOs stipulated that from June 1 through September 30, DWR shall, to the extent possible and consistent with SWP requirements, control water temperatures to a daily average water temperature of less than or equal to 65°F at Robinson Riffle (see Figure 4.4-2). In October 2004, NMFS issued a BO on the effects of the long-term CVP and SWP Operations Criteria and Plan (OCAP), which superseded all previous BOs regarding the CVP and SWP OCAP (NMFS 2004). Water temperature objectives prescribed in the October 2004 OCAP BO at RM 61.6 near Robinson Riffle remained 65°F from June 1 through September 30 to protect over-summering steelhead.

Water temperatures in the lower Feather River below the Thermalito Afterbay Outlet in the spring, summer, and fall can be increased by releases from Thermalito Afterbay. The amount of water temperature increase in the lower Feather River below the Thermalito Afterbay Outlet is affected by ambient air temperatures, the proportion of flows released from the afterbay in comparison to flows in the LFC, and by the duration of reside time of water in the afterbay (see Section 4.2.2, Surface Water Quality, for additional information on Thermalito Afterbay and lower Feather River water temperatures).

The water temperature regime associated with the baseline operations of the Oroville Facilities may expose pre-spawning adult salmonids to elevated water temperatures that can adversely affect production (e.g., increased pre-spawning mortality, decreased fertilization, increased egg retention). Existing operations may also expose pre-spawning adult Chinook salmon to elevated water temperatures during the holding time period, which may adversely affect reproductive success. Water temperatures also can directly affect the spawning and incubation periods of salmonids, as well as the distribution of salmonid spawning and rates of egg and alevin survival (more information on water temperature effects on egg and alevin survival is included in Section G-AQUA1.8.2.5 in Appendix G-AQUA1 of the PDEA). Rearing juveniles exposed to high water temperatures may experience acute direct mortality or sublethal chronic thermal stress, which can be evidenced through indicators such as disease outbreaks, reduction in growth and food conversion efficiency, and hyperactivity or disorientation. (Additional information on water temperature effects on juvenile salmonids is included in Sections G-AQUA1.8.3.2 and G-AQUA1.8.3.3 in Appendix G-AQUA1 of the PDEA.) Elevated water temperatures also may affect the abundance and emigration pattern of Feather River juvenile salmonids. Warm water temperatures have the potential to create habitat conditions that are advantageous for some predatory fish species, which in turn may affect the juvenile rearing and emigration success of salmonids in the lower Feather River. (Additional information regarding predation of juvenile salmonids is included in Section G-AQUA1.11.3 in Appendix G-AQUA1 for of the PDEA.)

In the fall of 2005, DWR conducted an experimental release of cold water into the LFC by pulling stop logs in the Lake Oroville intake structure. The purpose of the experiment was to determine if there were any effects on spawning behavior and spawning success of spring-run and fall-run Chinook salmon. Analysis and results of this experimental

release have yet to be published. This additional release of cold water into the LFC does not reflect normal operations.

The Oroville Facilities physically block the upstream basin contributions of gravel, sediment, and LWD from the lower Feather River, and the upstream passage of anadromous salmonids to historical spawning areas.

Oroville Dam, Thermalito Diversion Dam, and the Fish Barrier Dam block gravel contribution from the upstream Feather River to the lower Feather River (see Section 4.1, Geology, Soils, and Paleontological Resources, for additional information on gravel recruitment and lower Feather River substrate conditions). High-flow releases from the Oroville Facilities mobilize smaller substrate particle sizes. The smaller substrate sizes are not replaced by upstream gravel, therefore resulting in a gradual relative coarsening of the particle size distribution of the substrate in the upper portions of the lower Feather River. Coarsening and armoring of the substrate size can affect fish spawning habitat suitability, quality, and distribution for salmonids and other fish species spawning in gravel substrates (more information regarding spawning substrate suitability is included in Section G-AQUA1.8.2.1 in Appendix G-AQUA1 of the PDEA). In general, the reach of river with the highest proportion of coarse substrate components is the upstream-most portion of the lower Feather River below the Fish Barrier Dam and above the Thermalito Afterbay Outlet.

More than 97 percent of the sediment from the upstream watershed is trapped in the upstream reservoirs, resulting in sediment starvation downstream (see Section 4.1, Geology, Soils, and Paleontological Resources, for additional information on sediment recruitment). Only very fine sediment is discharged from Lake Oroville to the river below. Depletion of the sediment load in the lower Feather River results in reduced formation of sediment benches, which affects riparian vegetation colonization and succession. The riparian vegetation provides overhanging cover for rearing fish, riparian shade, invertebrate contributions to the fish food base, and future LWD site contributions. Soft sediment substrates also contribute to the function of capture and retention of LWD.

The Oroville Facilities block the upstream contribution of LWD (see Section 4.1, Geology, Soils, and Paleontological Resources, for additional information on LWD recruitment and fluvial geomorphic functions). LWD creates zones of differential scour and deposit, creating gravel bars for use as spawning habitat by anadromous salmonids (Lassettre and Harris 2001). Logs, root wads, and undercut banks provide juvenile salmonid rearing cover from predators, velocity refuges, and increased concentrations of drifting food organisms. Debris-formed pools also provide adult salmonid holding habitat. LWD is an important functional component in the development and maintenance of habitat diversity and contributes to instream cover complexity (DWR 2002). The lowest proportion of instream cover complexity occurs in the upstream-most reach of the lower Feather River, from the Fish Barrier Dam to the Thermalito Afterbay Outlet. Downstream of the Thermalito Afterbay Outlet, the river increases in instream cover complexity. The farther downstream in the Feather River, the more the opportunity for lower Feather River LWD contribution to accumulate from the riparian

vegetation of the river, as well as from potential LWD contributions from lower Feather River tributaries.

The Oroville Facilities currently block the upstream migration of anadromous salmonids into historical spawning habitat in upstream tributaries. This blockage of upstream migration results in an overall reduction of total salmonid spawning habitat and a lack of access to historical upstream habitat, which may affect natural selection processes and eventually the genetic characteristics of the fish species. It also deprives these upstream tributary reaches up to the next impassable upstream barrier of the energy and nutrients that would otherwise be transferred there by the anadromous salmonid carcasses (more information regarding nutrient transfer is included in Section G-AQUA1.6 in Appendix G-AQUA1 of the PDEA).

Restricted access to historic spawning grounds causes spring-run Chinook salmon to spawn in the same lowland reaches that fall-run Chinook salmon utilize as spawning habitat. The overlap in spawning sites, combined with a slight overlap in spawning timing (Moyle 2002) with temporally adjacent runs, may be responsible for in-breeding between spring-run and fall-run Chinook salmon in the lower Feather River (Hedgecock et al. 2001). At present, the genetic distinctness of Feather River spring-run Chinook is still officially undetermined, although additional analysis has been conducted to determine the genetic distinction of spring-run and fall-run Chinook salmon (additional discussion is included in Section G-AQUA1.7 in Appendix G-AQUA1 of the PDEA).

The Fish Barrier Dam blocks upstream migration of anadromous salmonids and concentrates the intensity of habitat utilization to unnaturally high levels in the LFC. This increased concentration of intensity causes increased competition for spawning habitat and contributes to increased adult pre-spawning mortality levels and redd superimposition rates, which contributes to egg and alevin mortality (additional information on salmonid life stages and associated mortality estimates is included in Sections G-AQUA1.8.2.4, G-AQUA1.8.2.5, and G-AQUA1.8.2.6 in Appendix G-AQUA1 of the PDEA). Redd superimposition occurs when spawning Chinook salmon dig redds on top of existing redds dug by other Chinook salmon. The rate of superimposition is a function of spawning densities and typically occurs in systems where spawning habitat is limited (Fukushima et al. 1998). Redd superimposition may disproportionately affect early spawners, and therefore potentially affect Chinook salmon exhibiting spring-run life history characteristics.

As discussed in Section 4.2.2, six of the relicensing studies specifically address metals contamination in the project area. As part of these studies, water quality samples were collected at 17 locations within the lower Feather River. Samples exceeding aquatic life water quality criteria occurred for four constituents: total aluminum, iron, copper, and lead. In the reach of the Feather River extending from the Fish Barrier Dam downstream to the Thermalito Afterbay Outlet, 19 percent of the water quality samples exceeded aquatic life water quality criteria. Samples taken from the reach of the Feather River extending from the Thermalito Afterbay Outlet downstream to the confluence with the Sacramento River were variable, but all were higher than the upstream reach and 3 exceeded aquatic life water quality criteria 100 percent of the

time. Copper exceeded aquatic life water quality criteria in 5 of 276 samples; two of these occurrences were in the reach of the Feather River extending from the Fish Barrier Dam downstream to the Thermalito Afterbay Outlet. Iron only exceeded aquatic life water quality criteria at three sampling locations; all locations were downstream of the lower Feather River confluence with Honcut Creek. Lead exceeded aquatic life water criteria only once at several stations, but three or four times at the two most downstream stations on the Feather River.

4.4.2 Fish Species Overview

Detailed information regarding the life history and habitat requirements of each of the following fish species is provided in Section G-AQUA1.4 of Appendix G-AQUA1 of the PDEA for the Oroville Facilities, which summarizes the results of the aquatics study plan reports.

4.4.2.1 Warmwater Fish Species

Black Bass

Black bass species within the project area include spotted bass (*Micropterus punctulatus*), largemouth bass (*M. salmoides*), smallmouth bass (*M. dolomieu*), and redeye bass (*M. coosae*). None of these species of black bass are native to California; however, all are considered important recreational game fish.

Black bass spawn in the spring from March through June, with peak spawning activity in early May. All species prefer similar spawning habitat and are nest builders. Nest building begins at water temperatures around 54 degrees °F (12.2 degrees Celsius [°C]) and spawning continues until water temperatures exceed 75.2°F (24°C) (Aasen and Henry 1981; Baylis et al. 1993; Davis and Lock 1997; Graham and Orth 1986; Miller and Storck 1984; Wang 1986). Black bass spawning occurs in water 1–4 feet (ft) (0.3–1.2 meters [m]) deep near shore and has been observed as deep as 20 ft (6.1 m) in clear water (Davis and Lock 1997). In California, with changing reservoir levels, spawning has been observed at water depths up to 13.1–16.4 ft (4–5 m) (Moyle 2002).

Black bass species are found throughout the affected environment including tributaries upstream of Lake Oroville (DWR Unpublished Work), Lake Oroville (DWR 2003b), Thermalito Forebay (DWR 2003b), Thermalito Afterbay, and the lower Feather River from the mouth of the Thermalito Afterbay Outlet to the confluence with the Sacramento River (DWR 2003a). Black bass species are seldom observed in the LFC, probably due to colder water temperatures (DWR 2003a).

Catfish

Two species of catfish are found in the project area: channel catfish (*Ictalurus punctatus*) and white catfish (*I. catus*). Neither species is native to California; however, both are popular game fish. Adult channel catfish tend to be slightly larger than white catfish (13.8–17.7 inches vs. 11.8–15.7 inches [35–45 centimeters (cm) vs. 30–40 cm]) and, when in a river environment, are typically found in faster moving water, although

both species do well in large reservoirs (Moyle 2002). Both species of catfish are frequently observed in Lake Oroville (DWR 2003b).

In California, channel catfish generally spawn from April through June, while white catfish spawn slightly later during June through July (Moyle 2002). Spawning channel catfish require water temperatures ranging from 69.8 to 84.2°F (21–29°C), with 78.8 to 82.4°F (26–28°C) being the optimum water temperature range (Moyle 2002). Channel catfish typically construct nests in cave-like structures, and one reason for unsuccessful introductions has been suggested to be a lack of spawning habitat (Moyle 2002). Cavelike structures have been constructed in Lake Oroville to promote the channel catfish fishery (DWR 1997). In large impoundments, nests generally occur among rubble and boulders along protected shorelines at depths of 6.6–13.2 ft (2–4 m) (McMahon and Terrell 1982). White catfish construct nests in shallow depressions in sand or gravel near cover or utilize cave sites similar to channel catfish (Moyle 2002).

Crappie

Two species of crappie currently inhabit the project area: white crappie (*Pomoxis annularis*) and black crappie (*P. nigromaculatus*). Neither species is native to California; however, both are popular game fish. Sexually mature crappie are generally 4–8 inches (10–20 cm) in length and seem to prefer water temperatures ranging from 80.6 to 84.2°F (27–29°C) (Moyle 2002). Black crappie are more frequently observed in Lake Oroville, although both species are present (Moyle 2002).

Both species of crappie spawn in late spring and early summer, with white crappie tending to spawn a little earlier, although there is substantial overlap. Crappie spawn in water temperatures ranging from 62.6 to 68°F (17–20°C), at a depth of 3.3–23 ft (1–7 m) (Moyle 2002). Males of both species construct nests utilizing vegetation in shallow depressions in mud or gravel substrate (Moyle 2002).

Forage Fish

Two species of forage fish are found within the project area: threadfin shad (*Dorosoma petenense*) and wakasagi (*Hypomesis nipponensis*). Neither species is native to California, and both were introduced with the express purpose of serving as forage fish for game species in California lakes and reservoirs. Wakasagi were introduced to Lake Almanor in 1972 to serve as forage for salmonids (Moyle 2002). They have migrated downstream and are now found in Lake Oroville (Aasen et al. 1998; DWR 2003b) and are frequently observed in both Lake Oroville and Thermalito Forebay (DWR 2003b). Wakasagi spawn in the spring in small tributaries where eggs adhere to rocks or submerged vegetation (Aasen et al. 1998). Wakasagi normally spawn after their first year (Aasen et al. 1998), with a few surviving to spawn again in their second year. California wakasagi can tolerate a wide range of water temperatures, for both growth and reproduction (Moyle 2002).

Threadfin shad were first introduced in 1951 (Moyle 2002). Threadfin shad are broadcast spawners with fertilized eggs adhering to submerged logs or vegetation. In

California, threadfin shad spawning takes place during April through August and peaks in June and July when water temperatures exceed 68°F (20°C) (Moyle 2002; DWR 2003b; Wang 1986). Although originally introduced as a forage fish, the success of this program has been limited, and some authors suggest that the fish may actually compete for food resources with juvenile game fish (Moyle 2002). Threadfin shad have been infrequently observed in Lake Oroville (DWR 2003b).

Minnows

Four species of minnow are commonly found in the project area: Sacramento pikeminnow (*Ptychocheilus grandis*), hardhead (*Mylopharodon conocephalus*), hitch (*Lavinia exilicauda*), and Sacramento splittail (*Pogonichthys macrolepidotus*). All four species are native to the Sacramento River drainage (Moyle 2002).

Sacramento pikeminnow is ranked as the third most common species of native fish in the lower Feather River (Seesholtz et al. 2003). Pikeminnow are resident year-round and, therefore, all life stages are present. Spawning generally takes place from April through June (Moyle 2002), and the preferred water temperatures for spawning are in the range of 59 to 68°F (15–20°C). In reservoirs, pikeminnow have been observed spawning in very shallow water (a few inches in depth), as well as in water as deep as the thermocline (Patten and Rodman 1969). Pikeminnow are known predators of juvenile salmonids.

Hardhead was designated as a State species of special concern by DFG in 1995 and is listed as a Class 3 Watch List species, meaning that it occupies much of its native range, but was formerly more widespread or abundant within that range (Moyle 2002). Hardhead are fairly common in the Sacramento River and lower mainstems of the American and Feather Rivers. Hardhead are resident year round; therefore, all lifestages are present in the Feather River. Hardhead are frequently observed in the Feather River from the Fish Barrier Dam downstream to the confluence with the Sacramento River (Moyle 2002). Juvenile recruitment suggests that hardhead spawn from April through June in Central Valley streams, but the spawning may extend into August in the foothill streams of the Sacramento–San Joaquin drainage. Hardhead reportedly spawn in water temperature ranges from 55 to 75°F (12.8–23.9°F) (Moyle 2002; Wang 1986).

Hitch are a Class 3 Watch List species as designated by DFG (Moyle 2002). Females normally spawn between March and June (Wang 1986) and are broadcast spawners, selecting habitat and conditions similar to hardhead (Moyle 2002). Hitch are frequently observed in the Feather River from the Thermalito Afterbay Outlet to the confluence with the Sacramento River (USFWS 1999).

Sacramento splittail were designated as a Threatened species under FESA by USFWS on February 8, 1999 (64 *Federal Register* [FR] 5963 [1999]). Sacramento splittail were listed as Threatened throughout their entire range, which includes the Feather River (64 FR 5963 [1999]). On September 22, 2003, USFWS issued a Notice of Remanded Determination for the Sacramento Splittail (Seesholtz et al. 2003). This removed the

Sacramento splittail from the Endangered Species List; however, Sacramento splittail is still considered a species of special concern by DFG.

Other than incidental observations of Sacramento splittail in the Feather River (Seesholtz et al. 2003; USFWS 1995a), there have been no directed studies of abundance in this area. Because Sacramento splittail have been observed in the Feather River, it is assumed that some spawning takes place. Sacramento splittail spawning can occur anytime between late February and early July, but peak spawning occurs in March and April (Moyle 2002). Sacramento splittail spawn primarily in inundated floodplains (Moyle 2002; Wang 1986). The literature indicates that adult Sacramento splittail migrate into inundated areas during February (Moyle 2002), and that peak Sacramento splittail spawning occurs from March through April (Moyle 2002). Spawning reportedly is followed by 3–7 days of egg incubation (Moyle 2002), and the larvae remain in the vegetation for another 7–10 days, feeding on zooplankton. Approximately 10–14 days after Sacramento splittail eggs are fertilized, they reportedly develop into free-swimming larvae (Sommer et al. 1997). Juvenile rearing continues until juvenile Sacramento splittail have transformed into benthic-feeding juveniles. After floodplain waters begin to recede, juveniles leave the floodplain and begin to migrate downstream to brackish waters. Juvenile Sacramento splittail begin appearing at Sacramento–San Joaquin Delta (Delta) salvage pumps in April and peak during late April and May, suggesting that most juvenile out-migration from the Feather River has occurred by the end of May (Daniels and Moyle 1983; Sommer Unpublished Work).

Sacramento splittail spawning generally occurs in water with a depth of 3.0–6.6 ft (0.9–2.0 m) over submerged vegetation (Moyle 2002; Wang 1986). This same habitat is used for initial juvenile rearing. Sacramento splittail have a wide thermal tolerance during this time period, and water temperatures may range from 48 to 75°F (Moyle 2002; Sommer et al. 1997; Wang 1986).

Sacramento Sucker

The Sacramento sucker (*Catostomus occidentalis*) is common in the project area and is native to California (Wang 1986). The Sacramento sucker is described as one of the few native fish species that have thrived despite massive changes to historic habitat (Moyle 2002). Spawning occurs between late February and early June, with peak spawning during March and April (Moyle 2002). Sacramento suckers prefer water temperatures for spawning between 53.6 and 64.4°F (12–18°C), with water depths of 11.8 inches (30 cm) or more (Moyle 2002). The Sacramento sucker is infrequently observed in Lake Oroville and frequently observed in Thermalito Forebay (DWR 2003b). It is also common in the lower Feather River (Seesholtz et. al 2003).

Striped Bass

Striped bass (*Morone saxatilis*) is an introduced game fish that frequents the project area in April through June for spawning (Moyle 2002; Bell 1991; Hassler 1988; Hill et al. 1989). Striped bass have also been reported in Thermalito Forebay (DWR 2003b), which may indicate a small landlocked breeding population. The striped bass fishery is

one of the most valuable sport fisheries in California, both in terms of the recreation it provides and economic wealth it generates (Skinner 1962).

Female striped bass reach sexual maturity at age 4 to 6, while males reach sexual maturity at age 2 to 3 (Moyle 2002). The maximum age of striped bass is estimated at over 30 years; however, fish older than 10 years are uncommon (Moyle 2002). In California, striped bass have reportedly attained lengths of up to 49.2 inches (125 cm) and weights up to 90.4 pounds (41 kilograms [kg]) (Moyle 2002).

Striped bass are broadcast spawners, with peak spawning activity occurring from April through June (Wang 1986). Striped bass spawn in mainstem rivers and have shown little preference for substrate (Wang 1986). Based on various studies, the water temperature range in which spawning occurs is reported to be approximately between 59 and 68°F (20°C) (Moyle 2002; Bell 1991; Hassler 1988; Hill et al. 1989).

Sunfish

Three species of sunfish, bluegill (*Lepomis macrochirus*), green sunfish (*L. cyanellus*), and redear sunfish (*L. microlophus*), are common in the project area. None of these species is native to California, although all are popular recreational gamefish (Moyle 2002; Wang 1986).

All three sunfish species exhibit a similar life history, have a similar lifespan, and attain similar sizes; therefore, the traits of bluegill are discussed herein. Spawning normally occurs as water temperatures exceed 68°F (20°C) (Wang 1986). In California, spawning occurs throughout the summer, with peak spawning in June and July (Wang 1986). All three species generally inhabit small warm streams, ponds, and lake edges (Moyle 2002). All of the sunfishes are frequently observed in Lake Oroville, and a small population of bluegill may exist in Thermalito Forebay (DWR 2003b). Bluegill, green sunfish, and redear sunfish are also common in the OWA ponds (DWR 2003b) and in the lower Feather River (Seesholtz et. al 2003).

Tule Perch

The tule perch (*Hysterocarpus traski*) is native to California, including the Sacramento River system (Moyle 2002). As a species, the tule perch population is stable or increasing while the Sacramento River population of tule perch retains a Watch List status (Moyle 2002).

Tule perch prefer lotic water habitats with temperatures less than 71.6°F (22°C) and are reportedly not found in temperatures greater than 77°F (25°C) (Moyle 2002). Beds of surfacing aquatic plants, deep pools, and banks with complex cover, such as overhanging bushes, fallen trees, undercutting, and riprap, provide the preferred environment for tule perch (Moyle 2002). Tule perch are livebearers with females producing 25–60 young (Moyle 2002). Mating generally occurs in late summer, with females storing sperm from multiple males (Wang 1986). Actual fertilization takes place in January and birth occurs in May (Wang 1986). Young are released among tule

marshes and other types of vegetation (Wang 1986). A few tule perch have been observed in Thermalito Forebay (DWR 2003b) and they are common in the lower Feather River (Seesholtz et. al 2003).

4.4.2.2 Coldwater Fish Species

American Shad

The American shad (*Alosa sapidissima*) is an introduced species (Moyle 2002) that provides high recreational and economic value (Froese and D. Pauly Website 2002). American shad are present in the Feather River from May through mid-December, during the adult immigration, spawning, and emigration periods of their life cycle (Moyle 2002). American shad are an anadromous species, and the population in California is considered widespread and stable (Moyle 2002).

The Sacramento River supports large runs of American shad in late May and early June during their upstream spawning migration (Moyle 2002). American shad are broadcast spawners and normally spawn over sand or gravel substrate in main river channels (Moyle 2002). In the Sacramento River, American shad prefer water temperatures ranging from 62.6 to 75.2°F (17–24°C) for spawning (Moyle 2002) but elsewhere have been reported to spawn in water temperatures between 46 and 79°F (7.8–26.1°C) (Painter et al. 1979; Wang 1986). Emigration of juveniles from the spawning area takes place from July through December, generally peaking in August and September (Painter et al. 1979). Juveniles may spend up to 1 year in freshwater (Moyle 2002).

Chinook Salmon

Chinook salmon (*Oncorhynchus tshawytscha*) are native to California waters, including the Feather River. Chinook salmon have a varied life history. Within the Sacramento River system, three different Evolutionarily Significant Units (ESUs) of the species are recognized based on the time of year that upstream migrations begin. Spring-run Chinook salmon normally begin migration during March and continue through the beginning of September, holding in coldwater pools until ready to spawn. Fall-run Chinook salmon begin upstream migration in the summer and last until December. Although not located within the project area, a small winter-run population of Chinook salmon also exists within the Sacramento River system, with upstream migration beginning in December (Moyle 2002; DWR 1982; Sommer et al. 2001).

On September 19, 1999, the Central Valley spring-run Chinook salmon ESU was listed as Threatened under FESA by NMFS (NMFS 1999). The Central Valley spring-run Chinook salmon ESU includes all naturally spawned populations of spring-run Chinook salmon in the Sacramento River and its tributaries, including the naturally spawned spring-run Chinook salmon in the lower Feather River (NMFS 1999). The Feather River Fish Hatchery-spawned population of spring-run Chinook are also considered part of the ESU ((70 FR 37160) 2005). Additional discussion regarding spring-run Chinook salmon is provided in Section 4.4.2.4, Listed Fish Species.

In the same September 19, 1999 ruling, NMFS determined that naturally spawned Central Valley fall-run Chinook salmon were not warranted for listing under FESA (NMFS 1999), but were designated as a candidate for listing (NMFS 1999). On April 15, 2004, NMFS announced the Central Valley fall-run Chinook salmon change in status from a candidate species to a species of concern. The Central Valley fall-run Chinook salmon ESU includes all naturally spawned populations of fall-run Chinook salmon in the Sacramento and San Joaquin River basins and their tributaries, which includes naturally spawned fall-run Chinook salmon in the lower Feather River (NMFS 1999).

The timing of adult Chinook salmon spawning activity is strongly influenced by water temperature. When daily average water temperatures decrease to approximately 60°F (15.5°C), female Chinook salmon begin to construct nests (redds) into which their eggs (simultaneously fertilized by the male) are eventually released. Fertilized eggs are subsequently buried with streambed gravel. Spawning activity in the Feather River occurs from late August through December and generally peaks in mid to late November (Myers et al. 1998).

The intragravel residence period of incubating eggs and alevins (yolk-sac fry) is highly dependent upon water temperature. The intragravel egg and fry incubation life stage for Chinook salmon generally extends from about mid-October through March. Egg incubation survival rates are dependent on water temperature and intragravel water movement. Incubation temperatures of approximately 62 to 64°F (16.7–17.8°C) reportedly appear to be the physiological limit for embryo development resulting in 80 to 100 percent mortality prior to emergence (NMFS 1993). Egg incubation survival is highest at water temperatures at or below 56°F (13.3°C) (NMFS 1993; Vogel and Marine 1991).

Within the project area, fall-run Chinook salmon fry emergence generally occurs from late December through March. In the Sacramento River basin, fall-run Chinook salmon juvenile emigration occurs from January through July (Snider et al. 1997b; Vogel and Marine 1991). Emigration surveys conducted by DFG have shown no evidence that peak emigration of Chinook salmon is related to the onset of peak spring flows in the lower American River (Snider et al. 1997a). Temperatures required during emigration are believed to be about the same as those required for successful rearing. Water temperatures reported to be optimal for rearing of Chinook salmon fry and juveniles are between 45 and 65°F (7.2–18.3°C) (Raleigh et al. 1986b; Rich 1987). Raleigh et al. (Raleigh et al. 1986a) reviewed the available literature on Chinook salmon thermal requirements and suggested a suitable rearing temperature upper limit of 75°F (23.8°C) and a range of approximately 53.6 to 64.4°F (12–18°C). Juvenile fall-run Chinook salmon normally rear for 1–7 months in freshwater before migrating to the ocean (Moyle 2002). Chinook salmon from the Feather River normally spend 3–5 years in the ocean (Moyle 2002). Returning fall-run Chinook salmon average 35.4 inches (90 cm) in length (Moyle 2002).

Coho Salmon

Coho salmon (*O. kisutch*) are native to California waters and while no wild populations currently exist in the Feather River, they are stocked in Lake Oroville (DWR 2001). The Central California Coast ESU for coho salmon was listed as Threatened under FESA on December 2, 1996. Coho salmon also is designated as a State species of special concern, and populations south of San Francisco are listed by the State as endangered. These special-status species designations pertain only to coho salmon within their native habitats. Coho salmon occur within the project area as a result of stocking programs and are managed for their recreational importance only. Coho salmon supports valuable commercial and sport fisheries in the Pacific Southwest Region. According to the Pacific Fishery Management Council (PFMC), the sport fishery accounted for 58 percent of the total catch of coho salmon along the California coast in 1985 (Moyle 2002).

California coho salmon within their native habitat generally have a 3-year life cycle, with about half spent in freshwater and half spent in saltwater (Moyle 2002). Coho salmon die after spawning, with peak spawning migrations in California occurring from late December through January followed by immediate spawning (Weitkamp et al. 1995). Coho salmon spawn in riffles at water temperatures of 42.8 to 53.6°F (6–12°C) (Moyle 2002). Juveniles remain in freshwater for 12–15 months, then migrate to the ocean where they remain for 16–18 months before returning to spawn (Moyle 2002). Coho salmon have been introduced to the Great Lakes, and small reproducing populations have been observed in tributaries of Lake Superior (DWR 2003a); therefore, under certain conditions, the saltwater life cycle phase of coho salmon may not be a requirement for successful reproduction.

On August 19 and November 21, 2003, NMFS submitted comments to DWR regarding the Lake Oroville coho salmon stocking program. NMFS expressed concerns that the stocking of coho salmon in Lake Oroville may negatively affect threatened native populations of coastal coho salmon if stocked coho escape the reservoir and stray into a coastal coho stream. NMFS requested that DWR assess the risk of this occurring prior to the continuance of the coho stocking program (DWR 2004).

In 2004, DWR responded with a risk assessment that concluded:

- A low number of Lake Oroville stocked coho would successfully escape from the reservoir to the Pacific Ocean;
- High mortality in the ocean would further reduce the number of Lake Oroville stocked coho that would be available for return to freshwater;
- The probability that these fish would stray is low, and the probability that this straying would occur into a coastal coho stream is even lower; and
- Hatchery fish have inferior spawning performance when compared with wild fish.

Therefore, due to the reduction in probability that occurs each step of the way, DWR does not believe that stocking coho salmon in Lake Oroville poses a risk to coastal coho salmon populations (DWR 2004).

Coho salmon have been stocked in Lake Oroville since 2002. The current stocking goal is to plant approximately 170,000 juvenile coho per year. This goal was met in 2002 and 2003; however, in 2004 an outbreak of Bacterial Kidney Disease at the facility providing coho prevented any fish from being stocked in Lake Oroville in 2004. In 2005 approximately 59,000 yearling coho were stocked in Lake Oroville. During the fall of 2006, DWR stocked a total of 251,146 coho salmon in Lake Oroville. A total of 1,299 of these fish were 2-year-old adult coho salmon (approximately 20 inches long) and 249,847 were yearlings (approximately 8 inches long); these fish received a disease certification from DFG prior to stocking. At the request of NMFS, all of the yearlings were marked with a coded wire tag and an adipose fin clip (pers. comm., See 2007).

Lamprey

Two species of lamprey, river lamprey (*Lampetra ayresi*) and Pacific lamprey (*L. tridentata*), are found within the project area. Pacific lamprey are more frequently observed in the Feather River than river lamprey (DWR 2003a). Both species are native to California waters and are on the Watch List (Moyle 2002); however, river lamprey is designated as a State species of special concern by DFG. Both species spend 3–4 years in freshwater as ammocoetes (larval form of lamprey) before the metamorphosis to the adult form takes place, at which time they migrate to the ocean (Moyle 2002; Beamish 1980).

River lamprey congregate upstream of saltwater for 4 months as young adults, rapidly grow to 9.8–12.2 inches (25–31 cm), and enter the ocean in late spring (Moyle 2002). After approximately 3 months in the ocean, river lamprey return to freshwater to spawn in the fall (Moyle 2002). River lamprey hold in freshwater for up to 8 months until spawning from April through June (Beamish 1980). Lamprey construct gravel nests, and river lamprey are reported to spawn at water temperatures of 55.4 to 56.3°F (13–13.5°C) (Wang 1986).

Juvenile Pacific lamprey migrate to the ocean in the fall where they spend approximately 3.5 years in saltwater (Beamish 1980). Pacific lamprey enter freshwater in April through June. By September, upstream migration is complete, and adults over-winter and spawn in the spring of the following year (Bayer et al. 2001; Beamish 1980; Close et al. 2002). Crude nests are constructed in gravelly areas, and the water temperature range for Pacific lamprey spawning is 53.6 to 64.4°F (12–18°C) (Moyle 2002).

Steelhead/Rainbow Trout

Steelhead and rainbow trout are the same species (*O. mykiss*), with steelhead being the anadromous form. Steelhead are native to California waters. On March 19, 1998, naturally spawned Central Valley steelhead was listed as Threatened under FESA by

NMFS (53 FR 13347 [1998]). The Central Valley steelhead ESU includes all naturally spawned populations of steelhead (and their progeny) in the Sacramento and San Joaquin Rivers and their tributaries residing below naturally formed and artificial impassable barriers (e.g., waterfalls and dams), which includes the naturally spawned steelhead in the Feather River (53 FR 13347 [1998]). NMFS concluded that there are two artificial propagation programs considered to be part of the Central Valley ESU, i.e., the Coleman National Fish Hatchery on Battle Creek and the Feather River Fish Hatchery. Additional discussion regarding Central Valley steelhead is provided in Section 4.4.2.4, Listed Fish Species.

Rainbow trout are the most popular and widely distributed gamefish in California (Moyle 2002) and are currently stocked in Thermalito Forebay (DWR 2001). Naturally spawning populations of rainbow trout currently exist in the tributaries above Lake Oroville (Moyle 2002).

Most wild rainbow trout spawn in the spring between February and June (Moyle 2002). Rainbow trout normally spawn by constructing redds (nests) in coarse gravel substrate, 0.5–5.1 inches in diameter, in the tail of a pool or riffle (Moyle 2002). The number of eggs per female normally depends on the size of the fish at spawning but ranges from 200 to 12,000 eggs (Moyle 2002). Most spawning is observed when water temperatures are between 46 and 52°F (7.8–11.1°C) in water flowing at 0.2–3.6 ft per second (ft/sec) (Moyle 2002). Water temperatures above approximately 63°F (17.2°C) are reportedly lethal to developing rainbow trout embryos (Moyle 2002). Eggs normally hatch in 3–4 weeks, with alevins remaining in the gravel for another 2–3 weeks (Moyle 2002).

For the first year of life, juvenile rainbow trout normally inhabit cool, fast-flowing streams and rivers where riffles predominate over pools and there is cover from riparian vegetation and undercut banks (Moyle 2002). Older rainbow trout tend to move into deeper runs or pools (Moyle 2002). Rainbow trout are reportedly found where daytime water temperatures range from 32°F (0°C) in the winter to 80.6°F (27°F) in the summer, although 73.4°F (23°C) is reportedly lethal for unacclimated fish (Moyle 2002).

Rainbow trout are also stocked in Thermalito Forebay as part of a put-and-take fishery. These fish are generally stocked as 0.5 lb fish with the assumption that they will be caught by anglers. Rainbow trout stocked in the Thermalito Forebay are particularly sensitive to ceratomyxosis and die within about 3 months. Ceratomyxosis is caused by *Ceratomyxa Shasta*, an endemic myxozoan parasite that is lethal to many strains of rainbow trout. Salmonid populations that are native to rivers where *C. Shasta* naturally occurs (e.g., Feather River) appear to have developed varying degrees of resistance to infection (Noga 1996). The stocking of disease susceptible rainbow trout in Thermalito Forebay helps to ensure that those stocked rainbow trout that escape the fishery and migrate into the lower Feather River do not interact with the wild or stocked steelhead native to the Feather River watershed.

Sturgeon

Two species of sturgeon, white sturgeon (*Acipenser transmontanus*) and green sturgeon (*A. medirostris*), are found within the project area. White sturgeon are more commonly observed in the Feather River than green sturgeon (DWR 2003a), although both species are native to California waters. Green sturgeon are currently listed as Threatened under FESA and are discussed more thoroughly in Section 4.4.2.4, Listed Fish Species.

White sturgeon are known to spawn in the Feather River (Moyle 2002). The presence of larval green sturgeon in salmon outmigrant traps indicates that the Feather River may support a spawning green sturgeon population (NMFS 2002). However, NMFS (NMFS 2002) reports that evidence of green sturgeon spawning in the Feather River is unsubstantiated; substantial efforts (including scuba and snorkel surveys, hook-and-line sampling, and larval traps) during preparation of the Oroville Facilities Relicensing studies were all unsuccessful in documenting their presence in the lower Feather River. Both species begin an upstream spawning migration between February and June, with spawning occurring between April and June (Moyle 2002; Beamesderfer and Webb 2002). A few white sturgeon have been observed in Lake Oroville (DWR 2003b).

White sturgeon are broadcast spawners (Moyle 2002). Suitable water temperatures for white sturgeon spawning in California are 46.4 to 66.2°F (8–19°C); peak spawning occurs at water temperatures of approximately 57.2°F (14°C) (Moyle 2002). Juveniles remain in freshwater for 1–4 years before migrating to the ocean (Moyle 2002).

Trout

Brown trout (*Salmo trutta*), brook trout (*Salvelinus fontinalis*), and lake trout (*S. namaycush*) are found within the project area. None of these species are native to California waters, and all were introduced to provide a recreational sport fishery. All three species have been stocked in either Lake Oroville or Thermalito Forebay (DWR 2001). Brook trout and lake trout are not true trout but actually members of the char family.

Currently, only rainbow trout are stocked by DFG in the Thermalito Forebay. Lake trout were stocked in Lake Oroville during 1984 and 1985, and a few lake trout are still observed in Lake Oroville (DWR 2003b), suggesting the possibility of a small breeding population. Brown trout were stocked in Lake Oroville as recently as 2000 (DWR 2001).

Adult trout are largely bottom-oriented pool dwellers in streams and rivers (Moyle 2002). Overhanging and submerged vegetation, undercut banks, and instream objects such as debris piles, logs, and large rocks provide escape cover for adults and juveniles (Raleigh et al. 1986b). The water temperature tolerance range for trout is 32 to 80.6°F (0–27°C), although the preferred water temperatures for trout are reportedly 53.6 to 68°F (12–20°C) (Raleigh et al. 1986b).

All three species spawn in the fall or winter. In California, brook trout spawn from September through January, brown trout from November through December, and lake trout from September through November (Moyle 2002). Brook trout normally spawn in small tributaries but have been observed spawning on the gravel bottom shallows of some lakes (Moyle 2002). Brown trout spawn in small tributaries (Raleigh et al. 1986b). Lake trout are one of the few salmonids that do not construct redds; instead, they broadcast spawn in deep cold water of lakes (Moyle 2002).

4.4.2.3 Existing Conditions

Existing effects associated with the Oroville Facilities are discussed in detail in Section 4.4.1.1, Facilities, Waterbodies, and Related Fisheries Resources. In general, existing effects are associated with blocking sediment, gravel, and LWD contributions from the upstream tributaries to the lower Feather River, as well as blocking fish passage from the lower Feather River to the upstream tributaries. In addition to this physical blockage, the Oroville Facilities will continue to alter the flow regime and water temperatures in the lower Feather River, which affects fish habitat quality, quantity, and distribution, as well as the geomorphic processes that affect fish habitat complexity and diversity. More specifically, existing project effects include:

- Blockage of the upstream migration of anadromous salmonids to historic spawning grounds in tributaries of the Feather River upstream of Oroville Dam to the next upstream impassable barrier, resulting in redd superimposition and genetic introgression between fall-run and spring-run Chinook salmon populations, high spawning densities in the lower Feather River, and high juvenile rearing densities in the lower Feather River;
- Continued supplementation of Chinook salmon population levels due to Feather River Fish Hatchery production;
- Continued supplementation of steelhead population levels due to Feather River Fish Hatchery production;
- Blockage of gravel, sediment, and LWD contributions from the upstream tributaries to the lower Feather River by Oroville Dam, preventing these resources from contributing to the development and maintenance of fish habitat quality and diversity in the lower Feather River;
- Dewatering of bass nests during spawning season, although the effect is not great enough to change the self-sustaining nature of the bass fishery. Continued benefits to Lake Oroville warmwater fisheries with ongoing implementation of the Habitat Enhancement Program;
- Reduced habitat complexity and diversity in the lower Feather River due to regulated flows;
- Potential for disease transmission associated with the Feather River Fish Hatchery and Lake Oroville stocking programs;
- Increased rates of straying of adult Chinook salmon from the Feather River Fish Hatchery practices;

- High rates of pre-spawning mortality associated with a combination of stress related to water temperature, disease, spawning density, and recreational angling; and
- Fluctuations in Oroville Facilities releases resulting in redd dewatering and juvenile stranding.

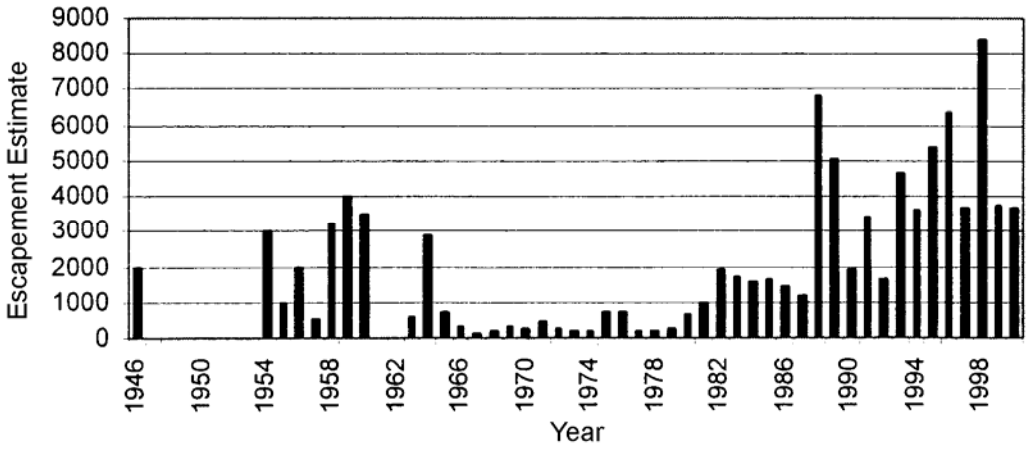
4.4.2.4 Listed Fish Species

A general discussion of fisheries and aquatic resources within the study area is provided in Section 4.4.1.1, Facilities, Waterbodies, and Related Fisheries Resources. Warmwater and coldwater fish species also are discussed in Sections 4.4.2.1 and 4.4.2.2, respectively. The following discussion specifically addresses those fish species within the study area that are federally and State listed, which includes spring-run Chinook salmon, Central Valley steelhead, and green sturgeon.

Of particular interest and importance is the distribution of Chinook salmon and steelhead spawning and rearing habitat in relation to the Oroville Facilities. Before construction of the major dams in the Central Valley, an estimated 6,000 miles of spawning and rearing habitat was accessible to Chinook salmon and steelhead. Currently, an estimated 95 percent of this habitat is blocked by dams or other obstructions (DWR 2002). The Oroville Facilities have the potential to directly affect spawning and rearing habitat for these species, as well as other species identified by State and/or federal resource agencies as species of special concern because of their declining numbers or limited distribution.

DWR constructed the Feather River Fish Hatchery in 1967 to compensate for salmonid spawning habitat lost with construction of Oroville Dam. Each year, approximately 9,000–18,000 salmon and 2,000 steelhead are artificially spawned at the hatchery. Salmon and steelhead raised at the hatchery are transported for release in the Feather and Sacramento rivers, in Lake Oroville and other California reservoirs, and in San Pablo Bay north of San Francisco Bay (DWR 2002).

Prior to construction of the Oroville Facilities, the Feather River spring-run Chinook salmon population was similar in magnitude to the size of the present hatchery run (Figure 4.4-4). Spring-run Chinook salmon ascended the very highest streams and headwaters of the Feather River watershed prior to the construction of hydroelectric power dams and diversions (DWR 2001). Before Oroville Dam (1946–1963), available population estimates ranged from 500 to 4,000 fish and averaged 2,200 per year (DFG 1998 in DWR and USBR 2001). However, Feather River spring-run Chinook salmon had probably been significantly affected by hydroelectric power facilities in the upper watershed well before completion of Oroville Dam. For instance, DFG found substantial overlap in the spawning distributions of fall-run and spring-run Chinook salmon upstream of the Oroville Dam site (DFG 1998 in DWR and USBR 2001).



Source: DWR and USBR 2001

Figure 4.4-4. Estimated adult spring-run Chinook salmon population abundance in Feather River, California.

As in several of the other spring-run streams, returns of spring-run Chinook salmon to the Feather River Fish Hatchery suggest that the population has been increasing slightly in the recent past (DWR 2001). This population trend could be caused by a large number of potentially contributing factors, some occurring within the project area and others unrelated to project operations (e.g., ocean cycle survival, decadal cycles), and are assessed further in the cumulative effects analysis provided in Section 6.2.

In September 2001, the U.S. District Court in Eugene, Oregon, in *Alsea Valley Alliance v. Evans* (161 F. Supp. 2d 1154, D. Oreg. 2001; *Alsea* decision) ruled that the ESA does not allow NMFS to list a subset of an ESU and that NMFS had improperly excluded stocks from the listing after it had decided that certain hatchery stocks were part of an ESU. Although the Court's ruling affected only the Oregon Coast coho salmon, it called into question nearly all of NMFS Pacific salmonid listing determinations. In its June 14, 2004, proposed listing determinations for 27 ESUs of West Coast salmonids, NMFS states that "for the proposed listing determinations … to be compliant with the Court's ruling in the *Alsea* case, all populations or stocks (natural, hatchery, resident, etc.) included in an ESU must be listed if it is determined that the ESU is threatened or endangered under the ESA."

Central Valley Spring-run Chinook Salmon

On September 19, 1999, the Central Valley spring-run Chinook salmon ESU was listed as Threatened under FESA by NMFS (NMFS 1999). The Central Valley spring-run Chinook salmon ESU includes all naturally spawned populations of spring-run Chinook salmon in the Sacramento River and its tributaries, which includes the naturally spawned spring-run Chinook salmon in the lower Feather River. In June 2005, NMFS published a final listing determination for Central Valley spring-run Chinook salmon that identifies the Feather River's nominal spring run as part of the Central Valley spring-run Chinook salmon ESU and is thus listed as Threatened. Spring-run Chinook salmon

produced at the Feather River Fish Hatchery are included in the ESU (70 FR 37160 [2005]).

On December 10, 2004, NMFS issued a proposed rule designating critical habitat for seven ESUs of Pacific salmon and steelhead in California. The final designation for critical habitat was published on September 2, 2005, and became effective on January 2, 2006. The critical habitat includes approximately 1,272 miles of occupied stream habitat and 427 square miles of estuarine habitat. A key area included in the newly designated critical habitat includes the lower Feather River (70 FR 52488 [2005]). The Central Valley spring-run Chinook salmon ESU also is listed as Threatened under CESA. A discussion of Chinook salmon in general is provided in Section 4.4.2.2, Coldwater Fish Species.

Adult spring-run Chinook salmon immigration into the Delta and lower Sacramento River occurs from mid-February through July, and peaks during April-May (Moyle 2002). Suitable water temperatures for adult upstream migration reportedly range between 51 and 67°F (10.5–19.4°C) (Bell 1991). Other authors suggest that varying degrees of adverse effects could potentially occur to migrating adult Chinook salmon at water temperatures of 60, 64, and 68°F (15.6, 17.8, and 20°C) (USEPA 2003a; USEPA 2003b; NMFS 1997; ODEQ 1995; USFWS 1995b). In addition to suitable water temperatures, adequate flows are required to provide migrating adults with olfactory and other cues needed to locate their spawning reaches (NMFS 1997).

The primary characteristic distinguishing spring-run Chinook salmon from the other runs of Chinook salmon is that adult spring-run Chinook salmon hold in areas downstream of spawning grounds during the summer months until their eggs fully develop and become ready for spawning. Maximum water temperatures for adult Chinook salmon holding while eggs are maturing are reported to be approximately 59 to 60°F (15–15.6°C) (NMFS 1997). However, variation among studies suggests that holding adult Chinook salmon exposed to water temperatures above 60, 64, and 68°F (15.6, 17.8, and 20°C) have varying degrees of effects on individuals (USEPA 2003a; USEPA 2003b; NMFS 1997; ODEQ 1995; USFWS 1995b). Spring-run Chinook salmon spawn in the upper Sacramento River upstream of Red Bluff Diversion Dam, the lower Yuba River, and the lower Feather River. Spawning has been reported to primarily occur during September and October, peaking in mid-September (Moyle 2002). Available literature suggests that water temperatures above 56, 58, 60, and 62°F (13.3, 14.4, 15.6, and 16.7°C) each have varying effects on spawning adult Chinook salmon and incubating embryos (Combs and Burrows 1957; Dauble and Watson 1997; Groves and Chandler 1999; Johnson and Brice 1953; NMFS 1993; NMFS 1997; NMFS 2002; USFWS 1995b). Although some portion of an annual year-class may emigrate as post-emergent fry (individuals less than 45 millimeters [mm] in length), most are believed to rear in the upper Sacramento River and tributaries during the winter and spring and emigrate as juveniles (individuals greater than 45 mm in length, but not having undergone smoltification) or smolts (silvery colored fingerlings having undergone the smoltification process in preparation for ocean entry). Juvenile spring-run Chinook salmon normally rear for 3–15 months before migrating to the ocean (Vogel and Marine 1991). The timing of juvenile emigration from the spawning and rearing grounds varies among the

tributaries of origin, and can occur during the period extending from October through April (Vogel and Marine 1991). In the Feather River, data on juvenile spring-run emigration timing and abundance have been collected sporadically since 1955 and suggest that November and December may be key months for spring-run emigration (Painter et al. 1977). Spring-run Chinook salmon from the Feather River normally spend 3 years in the ocean (Moyle 2002). Detailed discussion of the effects of exposure to elevated water temperatures on various life stages of spring-run Chinook salmon is provided in Section G-AQUA1.8 of Appendix G-AQUA1 of the PDEA.

Central Valley Steelhead

On March 19, 1998, naturally spawned Central Valley steelhead was listed as Threatened under FESA by NMFS (53 FR 13347 [1998]). When originally listed, the Central Valley steelhead ESU included all naturally spawned populations of steelhead (and their progeny) in the Sacramento and San Joaquin Rivers and their tributaries residing below naturally formed and artificial impassable barriers (e.g., waterfalls and dams), which includes the naturally spawned steelhead in the Feather River (53 FR 13347 [1998]). The listing was further clarified in January 2006, redefining the protected fish as Central Valley steelhead (71 FR 834 [2006]). On June 14, 2004, NMFS proposed that Central Valley steelhead remain listed as Threatened under FESA. In their proposed rule (113 FR 33102 [2004]), NMFS concluded that there are two artificial propagation programs considered to be part of the Central Valley steelhead ESU (i.e., the Coleman National Fish Hatchery on Battle Creek and the Feather River Fish Hatchery), although both programs are intended to support recreational fisheries for steelhead rather than to supplement naturally spawning populations. In addition, NMFS proposed that resident steelhead occurring with anadromous populations below impassable barriers also be included in the ESU. The Feather River Fish Hatchery largely sustains steelhead runs in the Feather River (McEwan 2001).

On December 10, 2004, NMFS issued a proposed rule designating critical habitat for seven ESUs of Pacific salmon and steelhead in California. The lower Feather River below Oroville Dam is identified as critical habitat for Central Valley steelhead.

Steelhead are known to live up to 9 years in the Central Valley (Moyle 2002). Adult steelhead immigration into Central Valley streams typically begins in December and continues into March. Steelhead may reenter fresh water anytime between July and May, but immigration generally peaks during January and February (Moyle 2002). Optimal immigration temperatures have been reported to range from 46 to 52°F (7.8–11.1°C) (NMFS 2000). However, other authors suggest that varying biological effects could occur to adult steelhead after exposure to water temperatures above 52, 56, and 70°F (11.1, 13.3, and 21.1°C) during immigration and holding (Leitritz and Lewis 1980; McCullough et al. 2001; NMFS 2000; USBR 1997a). Spawning occurs between January and March (McEwan 2001). Optimal spawning temperatures have been reported to range from 39 to 52°F (3.8–11.1°C) (NMFS 2000). However, other authors suggest that varying biological effects could occur to adult steelhead after exposure to water temperatures above 52, 54, 57, and 60°F (11.1, 12.2, 13.8, 15.6°C) during steelhead spawning and embryo incubation (Busby et al. 1996; USEPA 2001;

Humpesch 1985; Kwain 1975; McCullough et al. 2001; NMFS 2000; NMFS 2002; USBR 1997b; Redding and Schreck 1979; Rombough 1988; Timoshina 1972; USFWS 1995b) Unlike Chinook salmon, many steelhead do not die after spawning. Those that survive return to the ocean and may spawn again in future years. Most steelhead in California spawn twice (Busby et al. 1996).

Optimal egg incubation temperatures have been reported to range from 48 to 52°F (8.8–11.1°C) (NMFS 2000). However, other authors suggest that varying biological effects could occur to adult steelhead after exposure to water temperatures above 52, 54, 57, and 60°F (11.1, 12.2, 13.8, and 15.6°C) during steelhead spawning and embryo incubation (Busby et al. 1996; USEPA 2001; Humpesch 1985; Kwain 1975; McCullough et al. 2001; NMFS 2000; NMFS 2002; USBR 1997b; Redding and Schreck 1979; Rombough 1988; Timoshina 1972; USFWS 1995b) Preferred water temperatures for fry and juvenile steelhead rearing are reported to range from 45 to 65°F (7.2–18.3°C) (NMFS 2000) Each degree increase between 65°F (18.3°C) and the upper lethal limit of 75°F (23.9°C) reportedly becomes increasingly less suitable and thermally more stressful for the fish (Bovee 1978). Juveniles spend 1–2 years in freshwater before migrating to the ocean. The primary period of steelhead emigration occurs from March through June (Castleberry et al. 1991). Most steelhead in the Central Valley return to spawn after 1 year in the ocean while a smaller number may spend 2 years (Busby et al. 1996). Detailed discussions of the effects of exposure to elevated water temperatures on various life stages of steelhead are provided in Section G-AQUA1.8 in Appendix G-AQUA1 of the PDEA.

Green Sturgeon

On April 15, 2004, NMFS announced that the Northern and Southern Distinct Population Segments of Green Sturgeon would change in listing status from a candidate species to a species of concern (69 FR 19977). However, litigation challenging the NMFS determination that green sturgeon do not warrant listing as an Endangered or Threatened species under FESA asserted that the agency was arbitrary and capricious in failing to examine whether habitat loss constituted a significant portion of the species' range. The court partially agreed with the Plaintiff's motion, and remanded the determination back to NMFS for further analysis and decision as to whether green sturgeon are endangered or threatened in a significant portion of its range. Hence, according to NMFS April 15, 2004, interpretations of FESA provisions, green sturgeon were considered a candidate species as well as a species of concern, until this matter could be resolved. On April 7, 2006, a final rule was issued and adopted, and the southern distinct population segment was listed as Threatened. The final rule became effective June 6, 2006 (71 FR 17757 [2006]). Green sturgeon also are designated as a species of special concern in California (Moyle et al. 1995).

Green sturgeon may reach an age of 20 years before spawning and then spawn every 4 to 11 years (DFG Website 2002). Green sturgeon spawning migrations occur between February and July (DFG Website 2002), with peak spawning activity between April and June (Beamesderfer and Webb 2002). Green sturgeon also are broadcast spawners (Beamesderfer and Webb 2002). Green sturgeon can spawn in water temperatures

ranging from 46.4 to 68°F (8–20°C) (Moyle 2002; Beamesderfer and Webb 2002; DFG Website 2002). Juveniles remain in freshwater for up to 4 years before beginning a seaward migration (Beamesderfer and Webb 2002; DWR 2001).

4.5 TERRESTRIAL RESOURCES

The Oroville Facilities are located within the Sacramento Valley and Sierra Nevada Foothills subregions of the California Floristic Province (Hickman 1993). Broad vegetation patterns in this area correspond with changes in elevation from the valley floor to the upper elevations of the Sierra Nevada. The vegetation ranges from valley grasslands to foothill woodlands (characterized by blue-oak/foothill pine woodlands with varying amounts of chaparral), to mixed conifer forests in the higher elevations. These patterns vary and are influenced not only by elevation but also by precipitation, temperature, soils, aspect, slope, and disturbance history (SNEP 1996). This area is characterized by hot, dry summers and moderately cold, wet winters. Temperatures range from below zero to more than 100 degrees Fahrenheit (°F). Approximately 95 percent of the annual precipitation occurs during the winter. Precipitation ranges from less than 33 inches per year at Oroville to 5–10 feet per year at the upper elevations of the watershed.

4.5.1 Wildlife

4.5.1.1 Wildlife Resources

Overview

This section of the DEIR describes the affected environment as it relates to wildlife resources. It includes descriptions of wildlife habitats, richness of wildlife species, non-native species, commercially or recreationally important wildlife species in the project area, and current wildlife management activities. Special-status wildlife species that may occur in the project area are addressed in Section 4.5.1.2 of this DEIR.

Wildlife and wildlife habitats in the project area are greatly influenced by the proximity of the Oroville Facilities to the Sierra Nevada, the habitats generally found in the Sacramento Valley, the abundance of surface water associated with the Oroville Facilities and the Feather River, and adjacent land uses. The diversity of wildlife habitats within and adjacent to the project area also reflects variability in slope, aspect, precipitation, elevation, hydrology, land use, and localized edaphic (soil-related) conditions. Habitats in the project area support a variety of wildlife species, including numerous recreationally and commercially important species as well as special-status species.

Several land management agencies—USFS, BLM, DPR, DFG, and DWR—manage wildlife habitats in the project area. Lands in the project area are managed under the following federal, State, and local land resource management plans:

- *Proposed Amended Recreation Plan for Lake Oroville State Recreation Area* (DWR 2003a);
- *Plumas National Forest Land and Resource Management Plan* (USFS 1988) as amended by the *Sierra Nevada Forest Management Plan* (USFS 2001), including

provisions of the Herger-Feinstein Quincy Library Group Forest Recovery Act of 1998;

- *Proposed Redding Resource Management Plan* (BLM 1993);
- *Resource Management Plan and General Development, Lake Oroville State Recreation Area* (DPR 1973);
- *Oroville Wildlife Area Management Plan* (DFG 1978);
- *Management Plan for the Thermalito Afterbay Unit of the Oroville Wildlife Area* (DFG no date); and
- *Land Management Plan for the Protection of the Potential Habitats of Special Status Species of Fairy and Tadpole Shrimp* (DWR 2004a).

Project lands are also managed under five Bald Eagle Nest Territory Management plans.

In addition to CEQA, under which this document has been prepared, the principal statutes that form the basis for land management activities as they relate to wildlife resource management are:

- Federal Power Act of 1920, as amended;
- Endangered Species Act of 1973 (FESA), as amended;
- Fish and Wildlife Coordination Act;
- Migratory Bird Treaty Act of 1972;
- Bald Eagle Protection Act of 1940, as amended;
- NEPA; and
- California Endangered Species Act (CESA).

All of these statutes were considered in development and implementation of the Oroville Facilities relicensing studies. The BLM and USFS guidelines for management of sensitive species, and various DFG code sections, including Section 3500, were also considered. Descriptions of the acts are provided in Section 5.5.1.1 in Chapter 5.0, Environmental Consequences.

Detailed field investigations were completed in the project area in 2002, 2003, and 2004. These investigations focused on addressing management issues identified during scoping. Field investigations included surveys of wildlife habitats and species, special-status wildlife species, non-native species, and recreationally/commercially important species. Results of the investigations are reported in the reports for the following relicensing study plans:

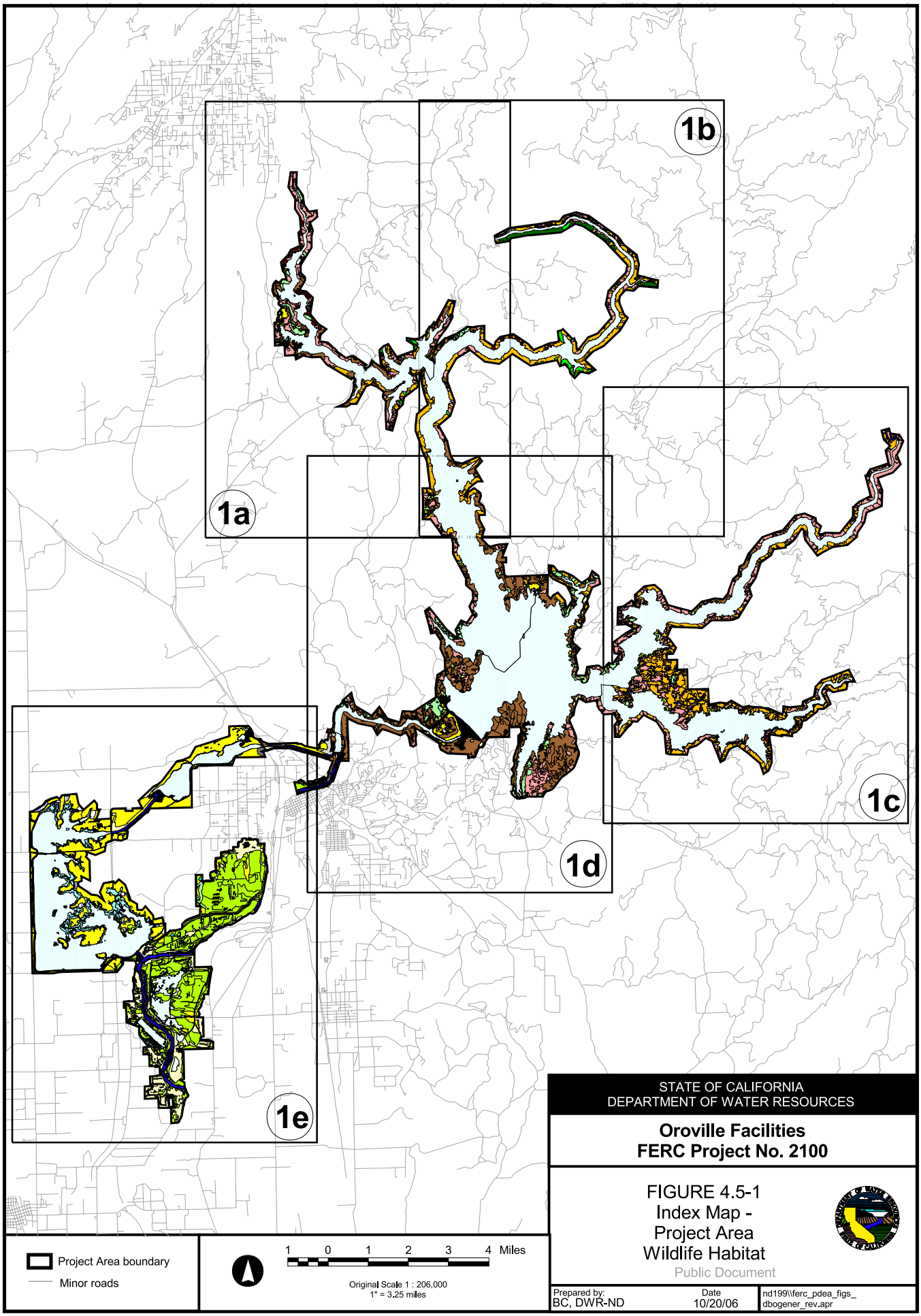
- Study Plan T-1 (SP-T1), Effects of Project Operations and Features on Wildlife and Wildlife Habitat (DWR 2004b);
- SP-T2, Project Effects on Special Status Wildlife Species (DWR 2004c);
- SP-T4, Biodiversity, Vegetation Communities and Wildlife Habitat Mapping (DWR 2003b);
- SP-T6, Interim Interagency Wildlife Management Coordination and Wildlife Management Plan Development (DWR 2004d);
- SP-T8, Project Effects on Non-Native Wildlife (DWR 2003c);
- SP-T9, Recreation and Wildlife (DWR 2004e); and
- SP-T11, Effects of Fuel Load Management and Fire Prevention on Wildlife and Plant Communities (DWR 2003d).

The studies were conducted in the same study area described for botanical resources (Section 4.5.2). Detailed descriptions of the study area, methods, and results are contained in the individual relicensing study plan reports.

Wildlife Habitats

The California Wildlife Habitat Relationships [CWHR] classification system was used to determine the wildlife habitat types that occur within the project area. As listed in Table 4.5-1 and described in the SP-T4 report, 24 habitat types occur within the project area. The distribution of these habitats is shown in Figures 4.5-1 and 4.5-1a through 4.5-1e. The principal wildlife habitat types are:

- Lacustrine (open water);
- Montane hardwood;
- Blue oak/foothill pine;
- Valley/foothill riparian;
- Montane hardwood/conifer;
- Annual grassland;
- Barren;
- Freshwater emergent wetland;
- Urban; and
- Blue oak woodland.



STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Oroville Facilities
FERC Project No. 2100

FIGURE 4.5-1
Index Map -
Project Area
Wildlife Habitat

Public Document

Prepared by:	Date	
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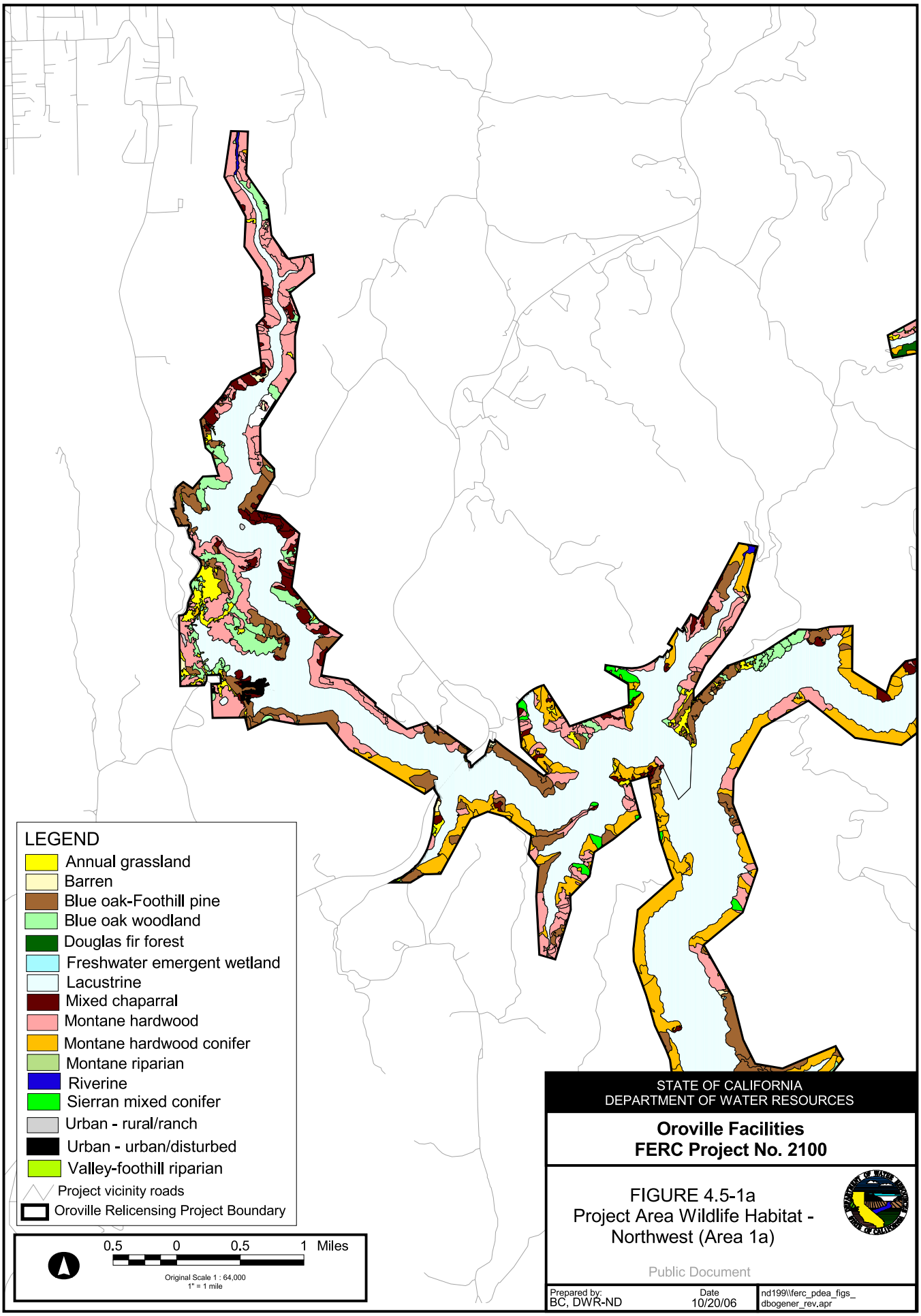
LEGEND
Annual grassland
Barren
Blue oak-Foothill pine
Blue oak woodland
Douglas fir forest
Freshwater emergent wetland
Lacustrine
Mixed chaparral
Montane hardwood
Montane hardwood conifer
Montane riparian
Riverine
Sierran mixed conifer
Urban - rural/ranch
Urban - urban/disturbed
Valley-foothill riparian
Project vicinity roads
Oroville Relicensing Project Boundary
0.5 0 0.5 1 Miles
Original Scale 1 : 64,000
1" = 1 mile
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Facilities
FERC Project No. 2100
FIGURE 4.5-1a
Project Area Wildlife Habitat -
Northwest (Area 1a)
Public Document
Prepared by:
BC, DWR-ND
Date
10/20/06
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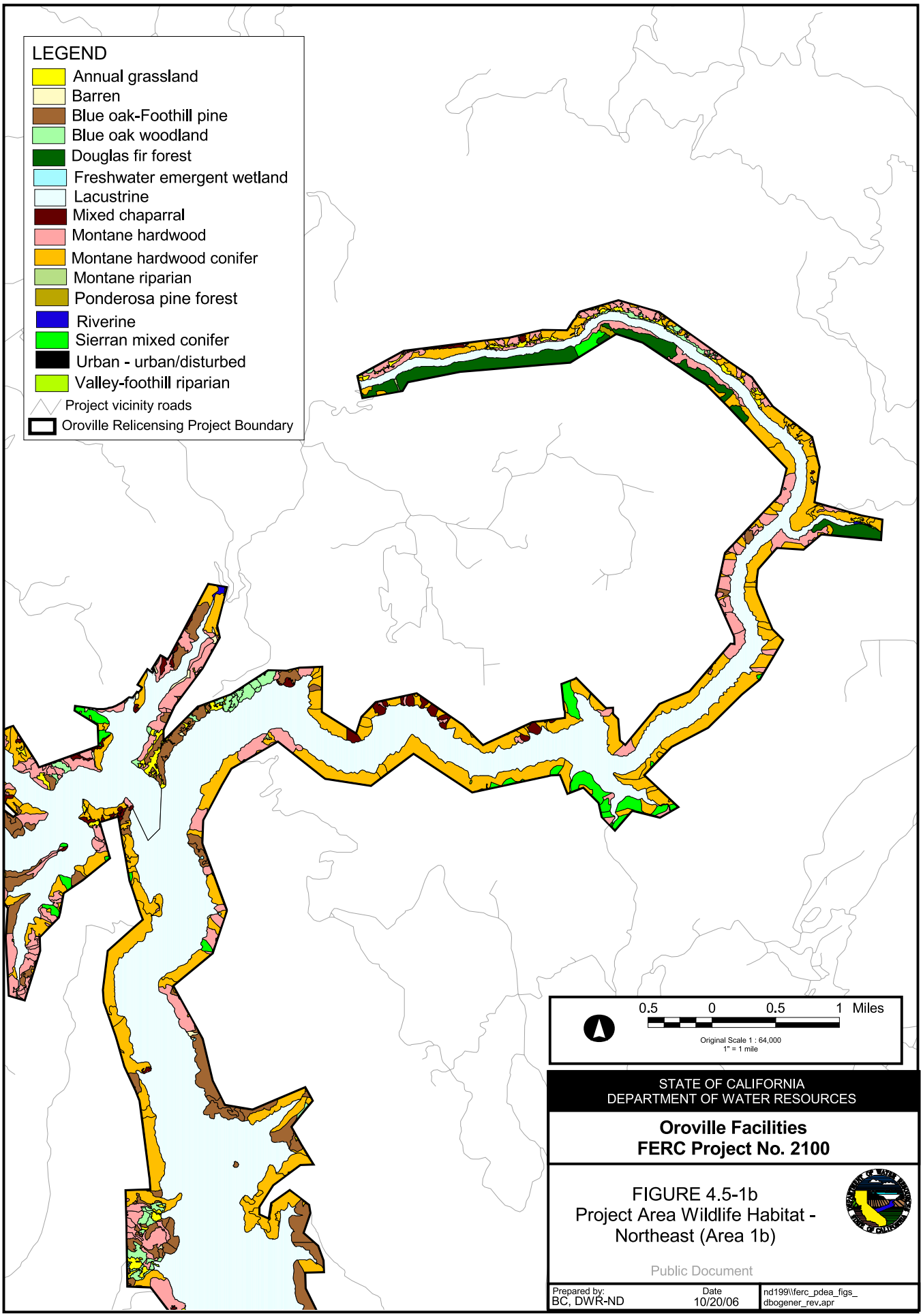
LEGEND
Annual grassland
Barren
Blue oak-Foothill pine
Blue oak woodland
Douglas fir forest
Freshwater emergent wetland
Lacustrine
Mixed chaparral
Montane hardwood
Montane hardwood conifer
Montane riparian
Ponderosa pine forest
Riverine
Sierran mixed conifer
Urban - urban/disturbed
Valley-foothill riparian
Project vicinity roads
Oroville Relicensing Project Boundary
0.5 0 0.5 1 Miles
Original Scale 1 : 64,000
1" = 1 mile
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Facilities
FERC Project No. 2100
FIGURE 4.5-1b
Project Area Wildlife Habitat -
Northeast (Area 1b)
Public Document
Prepared by:
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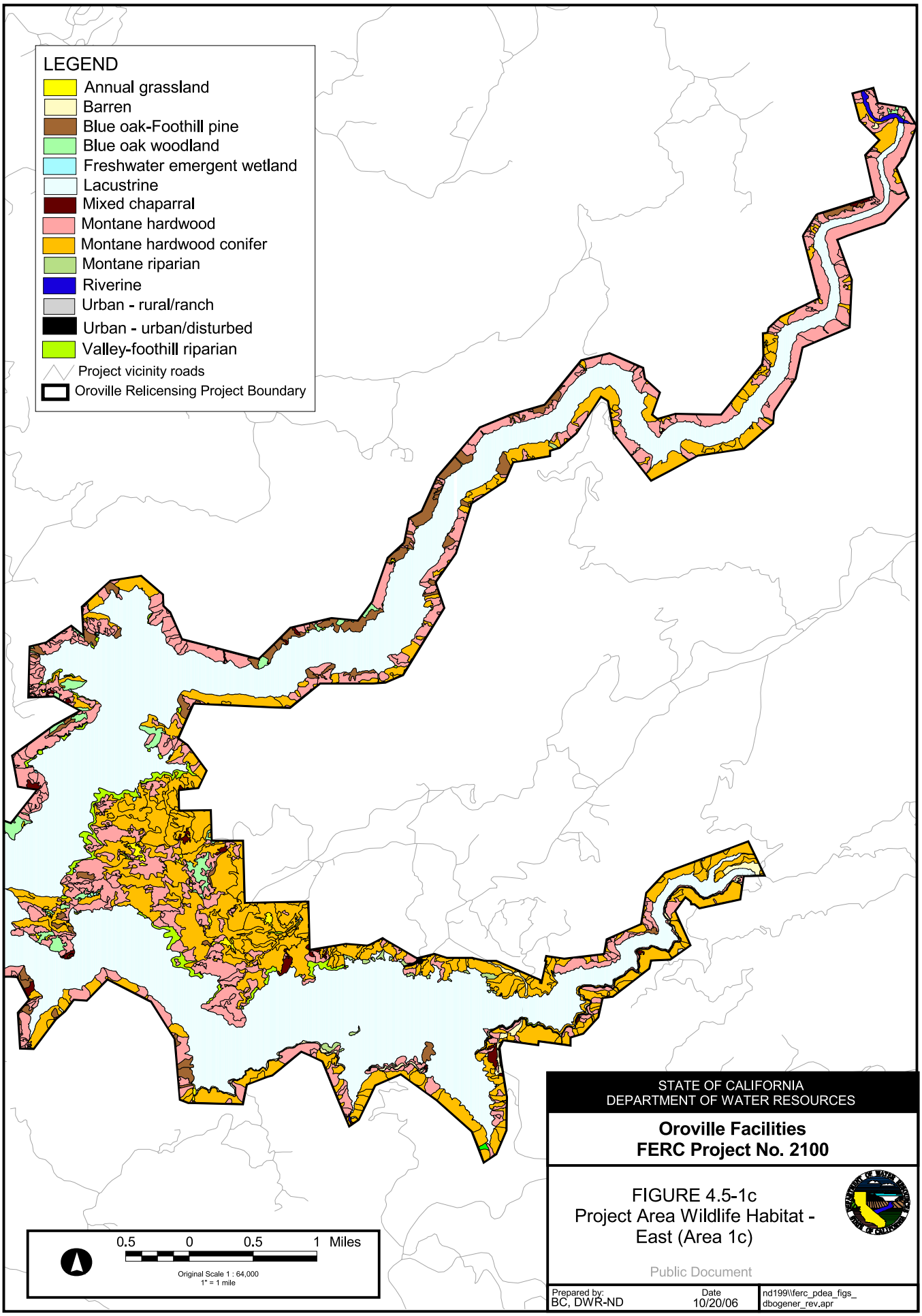
LEGEND
Annual grassland
Barren
Blue oak-Foothill pine
Blue oak woodland
Freshwater emergent wetland
Lacustrine
Mixed chaparral
Montane hardwood
Montane hardwood conifer
Montane riparian
Riverine
Urban - rural/ranch
Urban - urban/disturbed
Valley-foothill riparian
Project vicinity roads
Oroville Relicensing Project Boundary
0.5 0 0.5 1 Miles
Original Scale 1 : 64,000
1" = 1 mile
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Facilities
FERC Project No. 2100
FIGURE 4.5-1c
Project Area Wildlife Habitat -
East (Area 1c)
Public Document
Prepared by:
BC, DWR-ND
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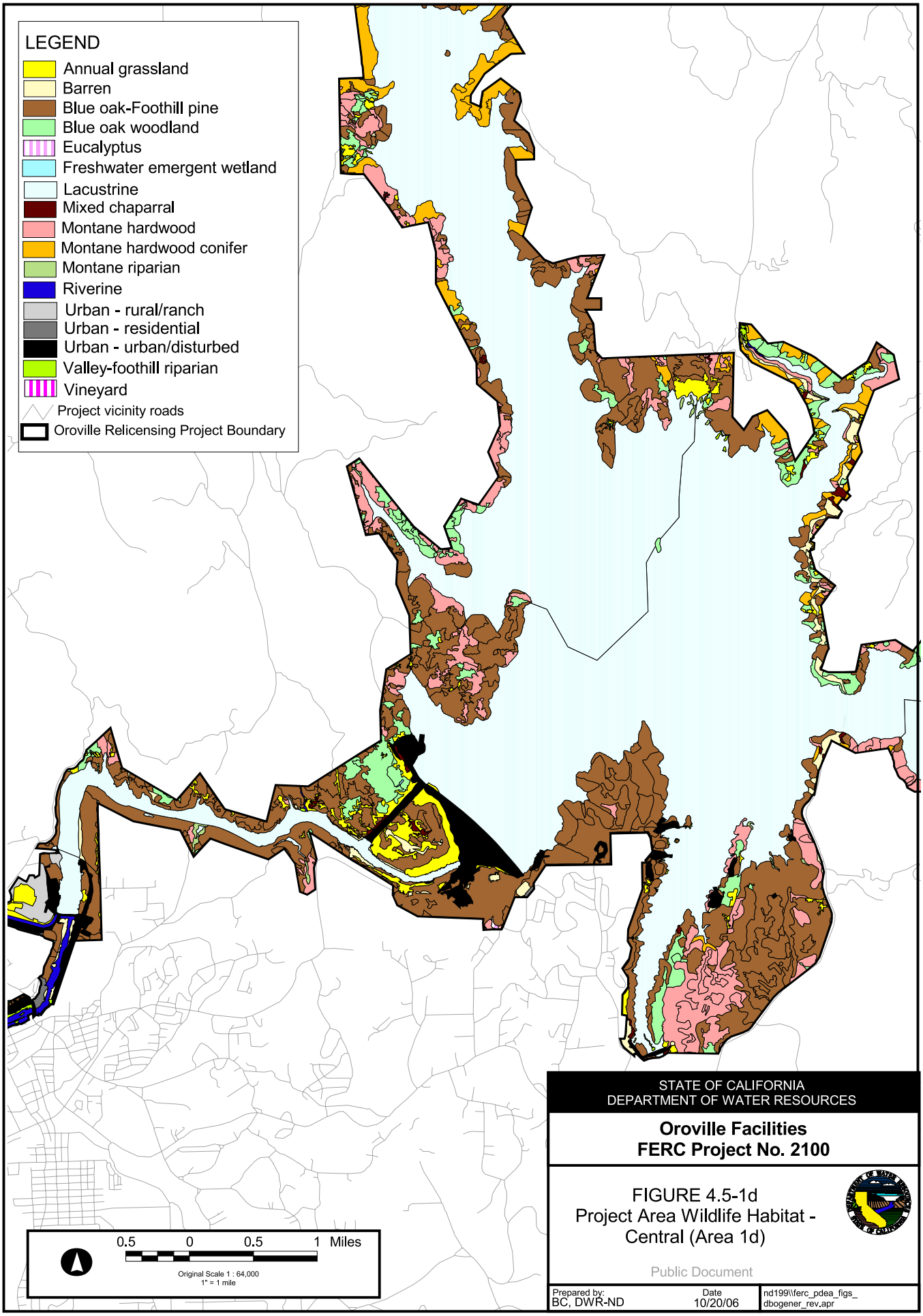

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Oroville Facilities
FERC Project No. 2100

FIGURE 4.5-1d
Project Area Wildlife Habitat - Central (Area 1d)

Public Document

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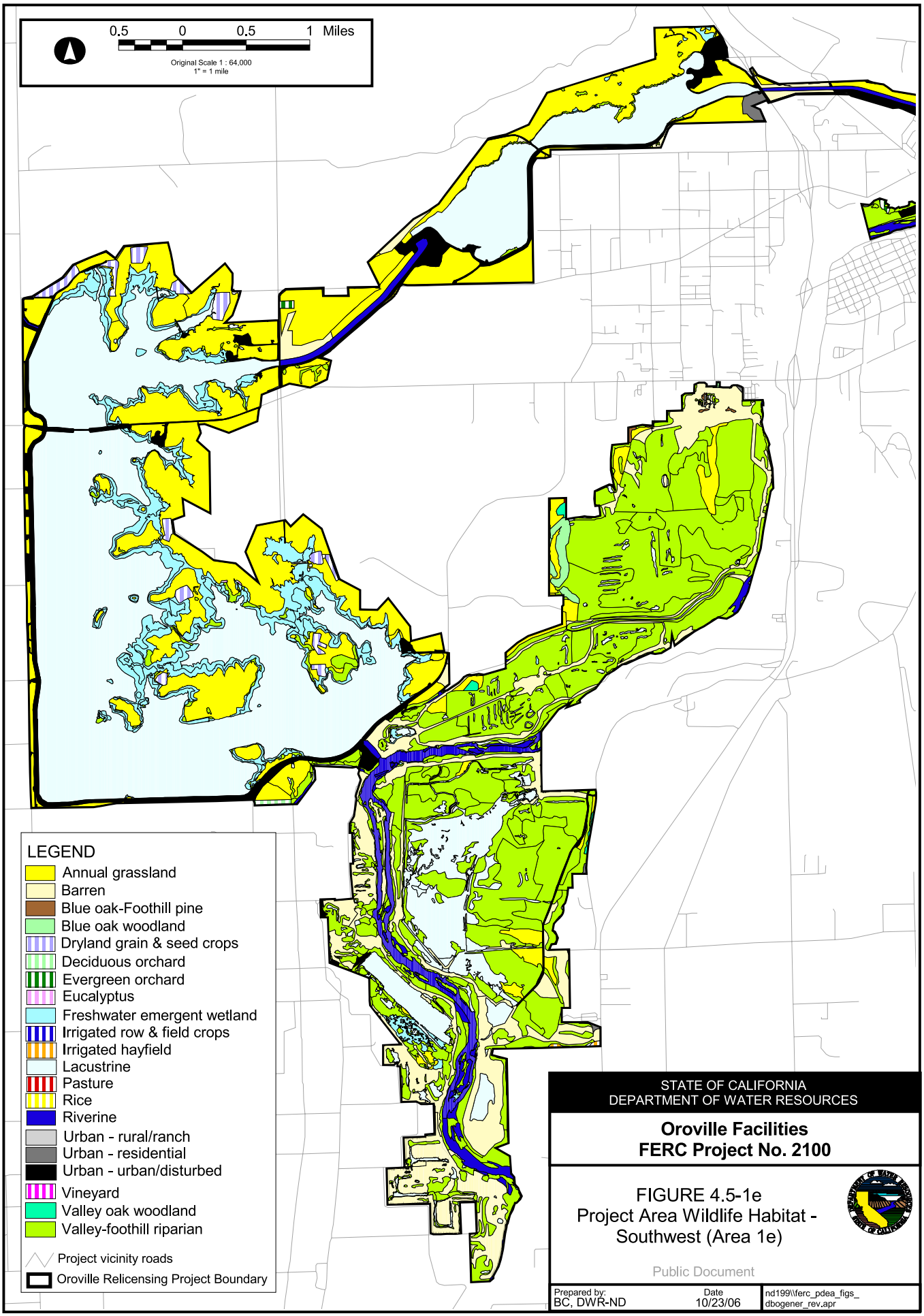

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Oroville Facilities
FERC Project No. 2100

FIGURE 4.5-1e
Project Area Wildlife Habitat -
Southwest (Area 1e)

Public Document

Prepared by:	Date	
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The dominant habitat type, lacustrine, covers 19,851 acres (about 48 percent) of the project area. Tree-dominated habitats cover about 36 percent of the project area. Riparian woodlands along the Feather River, dominated by cottonwoods and willows, represent about 8 percent of the total wildlife habitat. The 12 least common habitat types (Douglas-fir, Sierra mixed conifer, dryland grain, montane riparian, deciduous orchard, valley oak woodland, evergreen orchard, irrigated hayfield, ponderosa pine, eucalyptus, pasture, and vineyard) occur on less than 1 percent of the project area. However, three of these uncommon habitat types (eucalyptus, montane riparian, and valley oak woodland) exhibit high species richness values (DWR 2003b).

Table 4.5-1. Summary of wildlife habitat acreages within the project area.

CWHR Habitat Type	Total Acres Within Project Area	Percentage of Project Area
Lacustrine	19,851.9	48.2
Blue oak/foothill pine	3,518.8	8.6
Valley foothill riparian	3,398.1	8.3
Montane hardwood	3,295.0	8.0
Montane hardwood/conifer	3,179.8	7.7
Annual grassland	2,751.5	6.6
Barren	1,394.4	3.4
Freshwater emergent wetland	911.6	2.2
Urban	868.2	2.1
Blue oak woodland	793.3	1.9
Riverine	452.9	1.1
Mixed chaparral	234.3	0.6
Douglas-fir	169.6	0.4
Sierra mixed conifer	112.5	0.3
Dryland grain	98.3	0.2
Montane riparian	54.3	0.13
Deciduous orchard	11.0	<0.1
Valley oak woodland	9.8	<0.1
Evergreen orchard	8.1	<0.1
Irrigated hayfield	3.3	<0.1
Ponderosa pine	3.2	<0.1
Eucalyptus	2.6	<0.1
Pasture	0.7	<0.1
Vineyard	0.2	<0.1

CWHR = California Wildlife Habitat Relationships database
Source: DWR 2003b

Habitat types in the project area have undergone varying degrees of disturbance from both natural and human-induced changes. Pre-project disturbances related to land management practices (fire/logging) may be responsible for the preponderance of small to medium sized classes of tree habitat types, and the lack of decadent sized classes of chaparral stands indicate recent disturbance. Valley foothill riparian habitat along the Feather River has been disturbed since the 1800s, when hydraulic gold mining occurred in the area.

A brief description of the predominant habitat types within the project area is presented below.

Lacustrine Habitat

This habitat type includes lakes, reservoirs, and ponds greater than 5 acres in size that contain standing water (Mayer and Laudenslayer 1988). Lacustrine habitat is subdivided into the limnetic zone (deep open water), littoral zone (shallow-water areas where light penetrates to the bottom), and shore (water border with less than 2 percent vegetative cover). Lacustrine habitat provides all of the life history requirements (reproduction, food, water, and cover) for 150 wildlife species in California (Mayer and Laudenslayer 1988). Waterfowl use open-water areas for resting and feeding. Osprey, cormorants, bald eagle, mergansers, and gulls forage in open-water habitats. Grebes, herons, and diving ducks forage in the littoral zone. Swallows, bats, and swifts forage over lacustrine habitat. Banks associated with lacustrine habitat can provide cover or reproductive habitat for western pond turtle, river otter, and beaver. Lacustrine habitat is present in the project area at Lake Oroville, the Diversion Pool, Thermalito Forebay, and Thermalito Afterbay, and in ponded habitat along the Feather River.

Montane Hardwood Habitat

This habitat type is dominated by a pronounced hardwood layer with an infrequent and poorly developed shrub understory. Representative wildlife species include California newt, Nashville warbler, yellow-rumped warbler, mountain quail, black-headed grosbeak, and black bear. Discontinuous patches of montane hardwood habitat exist within the project area; habitat can be found on steep and rocky substrates in the upper elevations of the project area and is most common on north-facing slopes on the upper arms of Lake Oroville. This habitat type becomes increasingly common at higher elevations upslope from the project area.

Blue Oak/Foothill Pine Habitat

This habitat type exhibits high structural and plant species diversity because of the presence of multilayered tree canopies, shrub understory, and herbaceous ground cover. Approximately 130 wildlife species are known to use this habitat type for reproduction in the western Sierra Nevada (Mayer and Laudenslayer 1988). Common wildlife species include western fence lizard, western rattlesnake, acorn woodpecker, plain titmouse, western bluebird, black-tailed deer, Cooper's hawk, wild turkey, and lark sparrow. Blue oak/foothill pine habitat is the most common habitat type in the project area above 900 feet elevation.

Mature Valley/Foothill Riparian Habitat

This habitat type is structurally composed of a dominant deciduous overstory (California sycamore, valley oak, and cottonwood); an understory tree layer (white alder, Oregon ash); and a shrub layer (willows, poison oak, elderberries). Riparian habitat provides food, water, cover, and reproduction areas for a wide variety of California wildlife species—50 reptiles and amphibians, 55 mammals, and 147 birds (Mayer and

Laudenslayer 1988). Riparian habitat also provides migration and dispersal corridors and thermal cover for many species. The extensive riparian habitat present within the Oroville Wildlife Area (OWA) is the largest remaining block of riparian habitat along the Feather River and provides breeding habitat for a variety of neotropical migrants. These habitats also serve as nursery areas for many wildlife species, including two large mixed heron/egret rookeries. Numerous wildlife species are largely dependent on valley/foothill riparian habitat, among them red-shouldered hawk, western yellow-billed cuckoo, ringtail, yellow-breasted chat, and mink. Extensive stands of mature valley/foothill riparian habitat occur within the project area along the Feather River downstream of the City of Oroville. Narrow strips of riparian habitat also exist in association with the tributaries to Lake Oroville.

Annual Grassland Habitat

This habitat type is composed primarily of annual grasses and forbs and exists in areas that receive less than 40 inches of precipitation per year. Moist areas within annual grasslands can support perennial species like purple needlegrass and Idaho fescue. Vernal pools can occur in annual grassland habitat where depressions are underlain by impervious clay or hardpan soils. Common wildlife species include black-tailed jackrabbit, California ground squirrel, gopher snake, western fence lizard, California vole, badger, western kingbird, burrowing owl, horned lark, western meadowlark, Brewer's blackbird, American kestrel, turkey vulture, and northern harrier. Annual grassland habitat occurs around Thermalito Forebay, Thermalito Afterbay, and the Power Canal, in upland locations along the Feather River, and in isolated patches within the blue oak/foothill pine habitat around Lake Oroville.

Barren Habitats

These habitat areas are defined as areas with less than 2 percent herbaceous cover and less than 10 percent tree cover. Barren areas within the project area are mainly dredger tailings along the Feather River and in the OWA, unvegetated gravel bars, reservoir drawdown zones, and rock outcrops. Common wildlife species include killdeer, gulls, terns, western fence lizard, and western rattlesnake.

Emergent Wetland Habitats

These habitat areas are dominated by short, erect, rooted hydrophytes (cattail, tule, bulrush) and occur in waters less than 6 feet deep. Stands tend to be dense and structurally simple. Seasonal flooding restricts species diversity to those species adapted to anaerobic soil conditions. Emergent wetlands are a successional community that develops from open water to upland habitat over time. Erosion rates control the rate of successional change. Freshwater emergent wetlands can provide habitat for more than 160 species of birds in California as well as key habitat for numerous species of reptiles, amphibians, and mammals (Mayer and Laudenslayer 1988). Characteristic species include red-winged blackbird, giant garter snake, mallard, muskrat, short-eared owl, and bullfrog. Strips of emergent wetland habitat are found around Thermalito Afterbay and Thermalito Forebay, within dredger ponds in the OWA,

and in backwater areas along the Feather River. Emergent wetlands are generally absent within the drawdown zone of Lake Oroville or within the steeper drainages upslope from the reservoir.

Urban/Disturbed Habitat

This habitat type is structurally divided into five classes: tree grove, street strip, shade tree/lawn, lawn, and shrub cover (Mayer and Laudenslayer 1988). Urban habitats frequently exhibit high structural diversity, high diversity of plant species, and extensive edge areas. Both native and non-native plant species exist, but non-native annual and perennial species frequently dominate. Maintenance normally precludes community succession in urban/residential habitat. Common wildlife species associated with urban/residential habitat include European starling, house sparrow, rock dove, northern mockingbird, house finch, gopher snake, western fence lizard, striped skunk, and opossum. Urban/disturbed habitat exists within the project area. Furthermore, conversion of annual grassland, blue oak/foothill pine woodland, and valley/foothill riparian habitat to urban/disturbed habitat continues to occur around the perimeter of the project area.

Riverine Habitat

The structure of riverine habitat (i.e., stream and river habitat) consists of open water (greater than 2 feet in depth), submerged nearshore areas, and banks with less than 10 percent canopy cover (Mayer and Laudenslayer 1988). Waterfowl use open-water areas for resting. Osprey, cormorants, and gulls forage in open-water habitats. Shorebirds, including herons, egrets, and sandpipers, forage along the submerged nearshore areas. Insectivorous species, including swallows and phoebes, forage over riverine habitat. Banks associated with riverine habitat can provide cover or nesting substrate for bank swallow, belted kingfisher, muskrat, and beaver. Riverine habitat occurs throughout the project area along the Feather River and its tributaries.

The 11,000-acre OWA, west of the City of Oroville, is managed by DWR and DFG for wildlife habitat and recreational activities. Lacustrine, riverine, freshwater emergent, and valley foothill riparian habitats, as well as annual grassland and dryland grain/seed crops occur within the OWA. This area includes 6,000 acres in and around Thermalito Afterbay and the 5,000 acres adjacent to and straddling 12 miles of the Feather River. Past programs for enhancing wildlife habitat have included wetland habitat enhancements, a wood duck/wildlife nest box program, and dryland farming for nesting cover and improved wildlife forage. The quality of habitat in this area is adversely affected by historic dredger tailings within the Feather River floodplain.

Wildlife Nursery Habitats

Several locations within the project area support important wildlife nest colonies or nursery areas where high wildlife production occurs within a small geographic area. Examples include mixed Clark’s and western grebe nesting colonies on Thermalito

Afterbay and mixed heron/egret rookeries along the Feather River and near Lime Saddle.

Wildlife Species

The CWHR database was used to predict the occurrence of wildlife species within project area habitats. Observations of species were also noted during relicensing studies. CWHR modeling results included in the SP-T4 report (DWR 2003) indicate that 334 wildlife species may occur within the size and density classes of habitat types present within the project area: 13 amphibians, 22 reptiles, 235 birds, and 64 mammals (including 14 non-native species), and 55 recreationally and/or commercially important species.

Non-native Wildlife Species

Fourteen non-native vertebrate wildlife species—six birds, seven mammals, and one amphibian—may occur within the project area (Table 4.5-2). Several of these species were introduced by DFG as harvest species, or are currently managed as harvest species.

Relicensing studies summarized in the SP-T8 report (DWR 2003c) indicate that bullfrog and wild turkey exist in the project area at population levels that may adversely affect native species or that conflict with DPR management goals. Bullfrogs can be found in high densities within the dredger ponds of the OWA. These population levels may be a factor in the low occurrence or absence of native ranids. Extensive experimentation in California and elsewhere has not yielded viable methods of controlling bullfrog. DPR considers the relatively high population of non-native wild turkey in the Loafer Creek area as inappropriate in a State Park setting.

Table 4.5-2. Non-native vertebrate wildlife species that may occur in the project area.

Common Name	Scientific Name	Status
Black rat	*Rattus rattus*	—
Bobwhite quail	*Colinus virginianus*	DFG Harvest
Bullfrog	*Rana catesbeiana*	DFG Harvest
European starling	*Sturnus vulgaris*	—
Feral pig	*Sus scrofa*	DFG Harvest
House mouse	*Mus musculus*	—
House sparrow	*Passer domesticus*	—
Muskrat	*Ondatra zibethicus*	DFG Harvest
Norway rat	*Rattus norvegicus*	—
Red fox	*Vulpes vulpes*	—
Ring-necked pheasant	*Phasianus colchicus*	DFG Harvest
Rock dove	*Columba livia*	—
Virginia opossum	*Didelphis virginiana*	DFG Harvest
Wild turkey	*Meleagris gallopavo*	DFG Harvest

Source: DWR 2003c

Commercially and Recreationally Important Species

The project area provides seasonal or year-round habitat for a variety of commercially or recreationally important wildlife species. Fifty-five species classified as harvest species by DFG may occur within the project area (Table 4.5-3). Black-tailed deer are an important big-game species in eastern Butte County. The project area contains a portion of the winter range of two migratory deer herds (Bucks Mountain and Mooretown herds) as well as a small resident population.

Table 4.5-3. Commercially or recreationally important wildlife species that may occur in the project vicinity.

Common Name	Scientific Name	Habitat
MAMMALS		
American badger	*Taxidea taxus*	AG, BO/FP
Beaver	*Castor canadensis*	VFR, R, L
Black bear	*Urus americanus*	PP, MC, MH/C
Black-tailed deer	*Odocoileus hemionus*	VFR, PP, BO/FP, MC, MH/C
Black-tailed hare	*Lepus californicus*	AG
Bobcat	*Felis rufus*	All terrestrial
Brush rabbit	*Sylvilagus bachmani*	MC, VFR
Coyote	*Canis latrans*	All terrestrial
Desert cottontail	*Sylvilagus audubonii*	AG, BO/FP
Douglas tree squirrel	*Tamiasciurus douglasii*	PP, MH/C
Ermine	*Mustela erminea*	PP, MH/C
Feral pig	*Sus scrofa*	AG, BO/FP, VFR
Gray fox	*Unocyon cinereoargenteus*	VFR, MC, BO/FP, PP, MH/C
Long-tailed weasel	*Mustela frenata*	PP, BP/FP, MC, VFR, MH/C
Mink	*Mustela vison*	R, VFR
Raccoon	*Procyon lotor*	All terrestrial
Striped skunk	*Mephitis mephitis*	All terrestrial
Virginia opossum	*Didelphis virginina*	AG, FEW,VFR
Western gray squirrel	*Sciurus griseus*	BO/FP, PP, VFR, MH/C
Western spotted skunk	*Spilogale gracilis*	MC, VFR, BO/FP, MH/C
AMPHIBIANS		
Bullfrog	*Rana catesbeiana*	FEW, R, L
BIRDS		
American coot	*Fulica americana*	AG, FEW
American crow	*Corvus brachyrhynchos*	AG, CR, U, O/V
American wigeon	*Anas americana*	FEW, R, L, AG
Band-tailed pigeon	*Columba fasciata*	MH/C
Barrow's goldeneye	*Bucephala islandica*	FEW, R, L
Blue-winged teal	*Anas discors*	FEW, AG, L, R
Bufflehead	*Bucephala albeola*	FEW, L, R
California quail	*Callipepla californica*	VFR, MH/C, AG, BO/FP, U, MC
Canada goose	*Branta canadensis*	R, FEW, AG, L, C
Canvasback	*Aythya affinis*	FEW, L
Cinnamon teal	*Anas cyanoptera*	FEW, L
Common goldeneye	*Bucephala merganser*	R
Common merganser	*Mergus merganser*	R, L, FEW
Common snipe	*Gallingo gallingo*	FEW, C

Table 4.5-3. Commercially or recreationally important wildlife species that may occur in the project vicinity.

Common Name	Scientific Name	Habitat
Eurasian wigeon	*Anas americana*	FEW, L, R, AG
Gadwall	*Anas strepera*	FEW, L, R
Greater white-fronted goose	*Anser albifrons*	FEW, AG, C
Green-winged teal	*Anas crecca*	FEW, L, R
Hooded merganser	*Lophodytes cucullatus*	FEW, L, R
Lesser scaup	*Aythya affinis*	FEW, L
Mallard	*Anas platyrhynchos*	FEW, R, L, C
Mountain quail	*Oreortyx pictus*	VFR, MC, MH/C
Mourning dove	*Zenaida macroura*	AG, VFR, BO/FP, R, C, U
Northern pintail	*Anas acuta*	FEW, L
Northern shoveler	*Anas clypeata*	FEW, AG, L, C
Redhead	*Aythya americana*	FEW, L
Ring-necked duck	*Aythya collaris*	L, R
Ring-necked pheasant	*Phasianus colchicus*	FEW, AG, C
Ross' goose	*Chen rossii*	FEW, AG, C
Ruddy duck	*Oxyura jamaicensis*	FEW, L, R
Snow goose	*Chen caerulescens*	FEW, C
Tundra swan	*Cygnus columbianus*	L, AG
Wild turkey	*Melaegris gallopavo*	BO/FP, MH/C, PP, VFR
Wood duck	*Aix sponsa*	L,R

HABITAT KEY

AG = annual grassland	MH/C = montane hardwood/conifer
BO/FP = blue oak/foothill pine	O/V = orchard/vineyard
C = cropland	PP = ponderosa pine
FEW = freshwater emergent wetland	R = riverine
L = lacustrine	U = urban/disturbed
MC = mixed chaparral	VFR = valley/foothill riparian

Sources: CWHR modeling results for Butte County; DWR 2004d

Waterfowl are the most important group of wildlife (both commercially and recreationally) in the lower elevation areas of Butte County. Lands managed for commercial grain production or natural wetlands support high wintering densities of ducks, geese, swans, and shorebirds. These lands also provide nesting and brooding habitat for waterfowl. Waterfowl hunting access fees provide landowners with financial incentives to manage for waterfowl. Portions of the OWA within the FERC Project boundary are managed by DFG to provide habitat for nesting and wintering waterfowl. Approximately 3 percent of the recreational use of the OWA is related to hunting (DWR 2004e). The Thermalito Complex provides resting and foraging habitat for open-water and diving waterfowl species (ruddy duck, bufflehead, scaup, ring-necked duck, common goldeneye, and common merganser), which is generally lacking in surrounding agricultural areas.

Upland game species—mourning dove, wild turkey, ring-necked pheasant, and several species of quail—can be found in the project area and provide hunting opportunities on adjacent private lands as well as on some public lands, including the OWA.

Numerous furbearers—badger, mink, beaver, raccoon, gray fox, weasels, muskrat, bobcat, and opossum—may occur in the project area. However, current commercial harvest of these species within the project area is believed to be negligible. Use of steel leg-hold traps is currently prohibited in California.

Annual non-consumptive use (birdwatching, sightseeing, or nature study) within the project area is estimated to be greater than all wildlife-related consumptive uses combined (DWR 2004e). Students from local colleges, high schools, and elementary schools use the project area for nature/biological education and study.

Terrestrial Resources Existing Project Conditions

Several current project operations, land management practices, and project-related recreational activities affect wildlife and habitat in the project area, either directly or indirectly. Short- and long-term effects result in changes to the dynamics and stability of existing wildlife communities, including changes in species diversity and wildlife distribution, and may affect reproductive success. Direct and indirect effects may result from the following:

- *Lake Oroville Water Level Fluctuations.* Water levels in Lake Oroville fluctuate in response to needs for flood management, water quality and temperature needs, environmental commitments, and as a result of water withdrawals for irrigation or municipal water use. Daily and seasonal fluctuations in water levels generally favor the establishment of upland plant communities along the shoreline instead of riparian vegetation more typically associated with natural lakes. The zone exposed in late summer, fall, and winter by reservoir drawdown usually does not support any vegetation and may be subject to erosion. Areas exposed by a spring/early summer drawdown may support some vegetation if conditions are favorable, but plant biomass and diversity within this habitat are usually low and can be dominated by non-native, weedy species that provide limited, poor quality wildlife habitat (DWR 2004c). In addition, the creation of barren zones by reservoir drawdown can affect the ability of wildlife species to access water, which in turn causes them to be more vulnerable to predation.

- *Thermalito Complex Water Level Fluctuations.* Relatively minor water level fluctuations occur at the Diversion Pool and Thermalito Forebay, and within dredger ponds associated with the OWA. However, Thermalito Afterbay water level fluctuations are more extreme and can adversely affect critical life stages of certain wildlife species, including nesting and brooding waterfowl and nesting grebes (DWR 2004c). Exposed mudflats that occur during some Thermalito Afterbay fluctuations provide habitat for a variety of wildlife species, but they can also increase predation and loss of individuals that attempt to traverse them to reach either cover or open water.

- *Feather River Flow Fluctuations.* Dams and hydroelectric project operations affect downstream hydrology by altering flow magnitude, timing, and duration. Fisheries operations and other procedures to accommodate the needs of specific

species may also affect the timing and quantity of flows. These flow variations often affect streambank habitat, including bank swallow nesting habitat, by altering erosion and sediment deposition processes and by affecting recruitment and survival of riparian plant species. July project releases can increase river stage by more than 3 feet, potentially inundating portions of bank swallow nest colonies outside the FERC Project boundary when small numbers of prefledged young are present (DWR 2004c). In addition, hydroelectric project operations can affect wetlands that may be hydrologically connected to the river. Changes to riparian and wetland areas can affect the amount, quality, and connectivity of habitat available to wildlife; the greatest effects are on obligate species that depend on these habitats for food and cover. Further, spring/summer flow fluctuations can result in direct mortality of bank nesting species.

- *Ground/Soil Disturbance and Habitat Degradation from Operations and Maintenance Activities.* Project maintenance and/or operations may affect wildlife habitat by disturbing surfaces, resulting in direct elimination of habitat, degradation of habitat quality, and/or displacement of wildlife (DWR 2004c). Effects on habitat may be direct, through removal and development, or indirect, through disturbance or nonselective application of herbicides and pesticides that allow establishment of noxious weeds and other non-native wildlife species.

- *Disturbance from Project-Related Recreation.* Wildlife and wildlife habitat may be directly and indirectly affected by project-related recreation (DWR 2004e). Development and use of recreational facilities causes direct loss of habitat as vegetation is removed or altered and soil is disturbed. Project-related recreation also promotes the establishment of non-native plant species, which alter habitat structure and composition. Recreational activity often results in accumulation of trash and garbage, attracting non-native wildlife species, which may then displace resident wildlife. The availability of additional food can also change the composition and population dynamics of native species, increasing the abundance of raccoons, rodents, gulls, and crows. Additionally, recreational developments typically include nocturnal lighting and structures, which may cause resident wildlife to avoid the area. Increased human presence can also cause avoidance by some resident wildlife.

4.5.1.2 Special-Status Wildlife Species

Overview

This section identifies special-status wildlife species and their habitats that may occur in the project area. Special-status wildlife species include species listed under FESA and CESA, candidate species proposed for listing under FESA, federal and State species of concern, federal land management agencies' sensitive species, and State fully protected species.

Listed Wildlife Species

Seventy-one special-status wildlife species may occur within the project vicinity during some period of the year (Table 4.5-4). A discussion of federally listed species is presented below, followed by a discussion of State-listed species.

Table 4.5-4. Special-status species with the potential to occur in the project vicinity.

Special-Status Species	Status
American badger (*Taxidea taxus*)	CSC
American white pelican (*Pelecanus erythrorhynos*)	CSC
Bald eagle (*Haliaeetus leucocephalus)*	FT, SE, FP
Bank swallow (*Riparia riparia*)	ST
Barrow's goldeneye (*Bucephala islandica*)	CSC
Bell's sage sparrow (*Amphispiza belli belli*)	FSC, CSC
Black-crowned night heron (*Nycitcorax nycticorax*)	BLM
Black swift (*Cypseloides niger*)	FSC, CSC
Black tern (*Chilidonas niger*)	CSC
Burrowing owl *(Athene cunicularia)*	CSC, FSC, BLM
California gull (*Larus californicus*)	CSC
California horned lark (*Eremophila alpestris actia*)	CSC
California red-legged frog (*Rana aurora draytonii*)	FT, CSC
California spotted owl (*Strix occidentalis caurina*)	FSC, CSC, FS, BLM
California tiger salamander *(Ambystoma californiense)*	FT, CSC
Caspian tern *(Sterna caspia)*	FSC
Coast horned lizard (*Phrynosoma coronatum*)	CSC, FS
Common loon (*Gavia immer*)	CSC
Conservancy fairy shrimp (*Branchinecta conservatio*)	FE
Cooper's hawk (*Accipiter cooperi*)	CSC
Double-crested cormorant (*Phalacrocorax auritus*)	CSC
Ferruginous hawk (*Buteo regalis*)	FSC, CSC, BLM
Foothill yellow-legged frog (*Rana boylii*)	CSC, BLM, FS
Fringed myotis (*Myotis thysanodes*)	BLM
Giant garter snake *(Thamnophis couchi gigas)*	FT , ST
Golden eagle (*Aquila chrysaetos*)	CSC, FSC, BLM. FP
Greater sandhill crane (*Grus canadensis tabida*)	ST, FS, FP
Lawrence's goldfinch (*Carduelis lawrencei*)	FSC
Lewis's woodpecker (*Melanerpes lewis*)	FSC
Loggerhead shrike (*Lanius ludovicianus*)	FSC, CSC
Long-billed curlew (*Numenius americanus*)	FSC, CSC
Long-eared myotis (*Myotis evotis*)	BLM
Long-eared owl (*Asio otus*)	CSC
Marysville kangaroo rat (*Dipodomys californicus eximus*)	CSC, BLM
Merlin (*Falco columbarius*)	CSC
Mountain yellow-legged frog *(Rana muscosa)*	FC, CSC
Northern goshawk (*Accipiter gentilis*)	CSC, FS
Northern harrier (*Circus cyaneus*)	CSC
Northwestern pond turtle (*Clemmys marmorata marmorata*)	CSC, FS
Occult little brown bat (*Myotis occultus*)	CSC
Olive-sided flycatcher *(Contopus cooperi)*	FSC
Osprey (*Pandion haliaetus*)	CSC
Pale big-eared bat (*Corynorhinus townsendii pallescens*)	FSC, CSC, BLM, FS

Table 4.5-4. Special-status species with the potential to occur in the project vicinity.

Special-Status Species	Status
Pallid bat (*Antrozous pallidus*)	CSC, FS, BLM
Peregrine falcon (*Falco peregrinus anatum*)	SE, FSC, FS, FP
Prairie falcon (*Falco mexicanus*)	FSC, CSC
Purple martin (*Progne subis*)	CSC
Rufous hummingbird (*Selasphorus rufus*)	FSC
San Joaquin pocket mouse (*Perognathus inornatus inornatus*)	BLM
Sharp-shinned hawk (*Accipiter striatus*)	CSC
Short-eared owl (*Asio flammeus*)	CSC
Small-footed myotis (*Myotis ciliolabrum*)	BLM
Spotted bat (*Euderma maculatum*)	CSC, BLM
Swainson's hawk (*Buteo swainsoni*)	ST, FSC, FS
Townsend's big-eared bat (*Corynorhinus townsendii townsendii*)	CSC, FS, BLM
Tricolored blackbird (*Agelaius tricolor*)	FSC, CSC, BLM
Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*)	FT
Vaux's swift (*Chaetura vauxi*)	CSC
Vernal pool fairy shrimp (*Branchinecta lynchi*)	FT
Vernal pool tadpole shrimp *(lepidurus packardi)*	FE
Western burrowing owl (*Athene cunicularia*)	FSC, CSC, BLM
Western least bittern (*Ixobrychius exilis*)	CSC
Western mastiff bat (*Eumops perotis*)	CSC, BLM
Western red bat (*Lasiurus blossevillii*)	FS
Western spadefoot (*Scaphiopus hammondii*)	CSC, BLM
Western yellow-billed cuckoo *(Coccyzus americanus)*	SE, FC, FSC, FS
White-faced ibis (*Plegadis chihi*)	CSC
White-tailed kite (*Elanus leucurus*)	FP
Yellow-breasted chat (*Icteria virens*)	CSC
Yellow warbler (*Dendroica petechia brewsteri*)	CSC
Yuma myotis (*Myotis yumanensis*)	BLM

STATUS KEY

Federal Listing Categories:
BLM = U.S. Bureau of Land Management Sensitive Species
FC = Federal Candidate
FE = federally listed as Endangered
FS = U.S. Forest Service Sensitive Species
FSC = Federal Species of Concern
FT = federally listed as Threatened

California Listing Categories:
CSC = California Species of Special Concern
FP = State Fully Protected Species
SE = State listed as Endangered
ST = State listed as Threatened

Source: California Natural Diversity Database 2006

Federally Listed Species

USFWS issued a letter on January 28, 2004 (Appendix A of the Biological Assessment [BA] found in Appendix E of the PDEA for the Oroville Facilities [DWR 2005]), that listed the species that may occur in the project area. Ten wildlife species protected under FESA may occur within the project vicinity (Table 4.5-4). No designated or proposed critical habitat for these federally listed species exists within the project area.

Informal consultation with USFWS occurred throughout the collaborative ALP for the Oroville Facilities, including Plenary and Work Group meetings, beginning November 12, 2000. The *Draft Programmatic Biological Assessment for Terrestrial and Non-Anadromous Species* (DWR 2004f) was submitted to USFWS on May 19, 2004.

Relicensing studies indicate the presence or occurrence of potentially suitable habitat within the project area for eight species currently listed or proposed for listing under FESA: bald eagle, California red-legged frog, giant garter snake, valley elderberry longhorn beetle, vernal pool tadpole shrimp, Conservancy fairy shrimp, western yellow-billed cuckoo, and vernal pool fairy shrimp (DWR 2004c). Both the California tiger salamander and the mountain yellow-legged frog were determined not to have potentially suitable habitat within the project area.

Habitats were delineated by converting vegetation mapping for the project area to the CWHR habitat classification system. Surveys of suitable habitats for threatened and endangered species as well as visual surveys for the occurrence of the species were conducted in accordance with applicable USFWS or DFG protocols in 2002 (valley elderberry longhorn beetle, California red-legged frog, giant garter snake, bald eagle), 2003 (bald eagle, vernal pools) and 2004 (bald eagle, vernal pools).

Information about suitable habitats and species occurrence in the project area and within a 1-mile radius, along with species life histories, was compiled from the CWHR database and the California Natural Diversity Database (CNDDB). Other national, State, and county biological survey records and databases, as well as websites, printed articles, and discussions with local wildlife agencies were also consulted.

Detailed descriptions and analysis are included in the report for SP-T2, Project Effects on Special Status Wildlife Species (DWR 2004c), and in the *Draft Programmatic Biological Assessment for Terrestrial and Non-Anadromous Species* in Appendix E of the PDEA (DWR 2005).

Bald Eagle. USFWS listed the southern bald eagle as an Endangered species under FESA in March 1967. In 1995, after a federal status review, this species' status was downlisted to Threatened. Bald eagle is currently proposed for federal delisting (USFWS 1999). This species is currently State listed as Endangered.

Bald eagles historically nested throughout California near sea coasts, major rivers, and lakes. More than 160 pairs currently nest in California (up from 28 pairs in 1978); hundreds of additional bald eagles migrate into California during the winter.

Nesting habitat is described as old-growth trees and snags in remote mixed stands near water (Zeiner et al. 1990a). In a 1979 survey of 95 bald eagle nest sites in Northern California, 87 percent were in dominant or codominant ponderosa pine or sugar pine (Lehman 1979). Associated stands were generally open (less than 40 percent canopy cover), and within 1 mile of a water body. Approximately one-third of the nest sites were within 0.1 mile of a water body, and 85 percent of the nests had an unobstructed view of the water body. Seventy percent of the nests were associated with reservoirs.

Four active bald eagle nest territories currently exist within the FERC Project boundary, with one additional active nest territory present on the North Fork Feather River upstream of the project area (DWR 2004c). Two of the active nests are on Lake Oroville, one nest is on the Diversion Pool, and one nest is located on the Feather River

near the downstream FERC Project boundary. Population monitoring (2002–2006) indicates that reproduction meets or exceeds the goals of the USFWS *Pacific Bald Eagle Recovery Plan* (USFWS 1986).

Extensive use of Lake Oroville by bald eagles wintering in the area has been documented. Regular wintering use has also been observed at other project water bodies including the Feather River, the Diversion Pool, Thermalito Afterbay, Thermalito Forebay, and OWA dredger ponds. One communal winter roost location has been identified on the North Fork Arm of Lake Oroville.

Giant Garter Snake. USFWS listed the giant garter snake as a Threatened species under FESA in October 1993. This species has also been listed as Threatened under CESA since 1971.

The giant garter snake is endemic to the wetlands of California's Central Valley. Its historic range is believed to include valley floor wetlands from the vicinity of Butte County south to near Bakersfield. Historically, giant garter snakes were found in natural wetlands associated with flood basins.

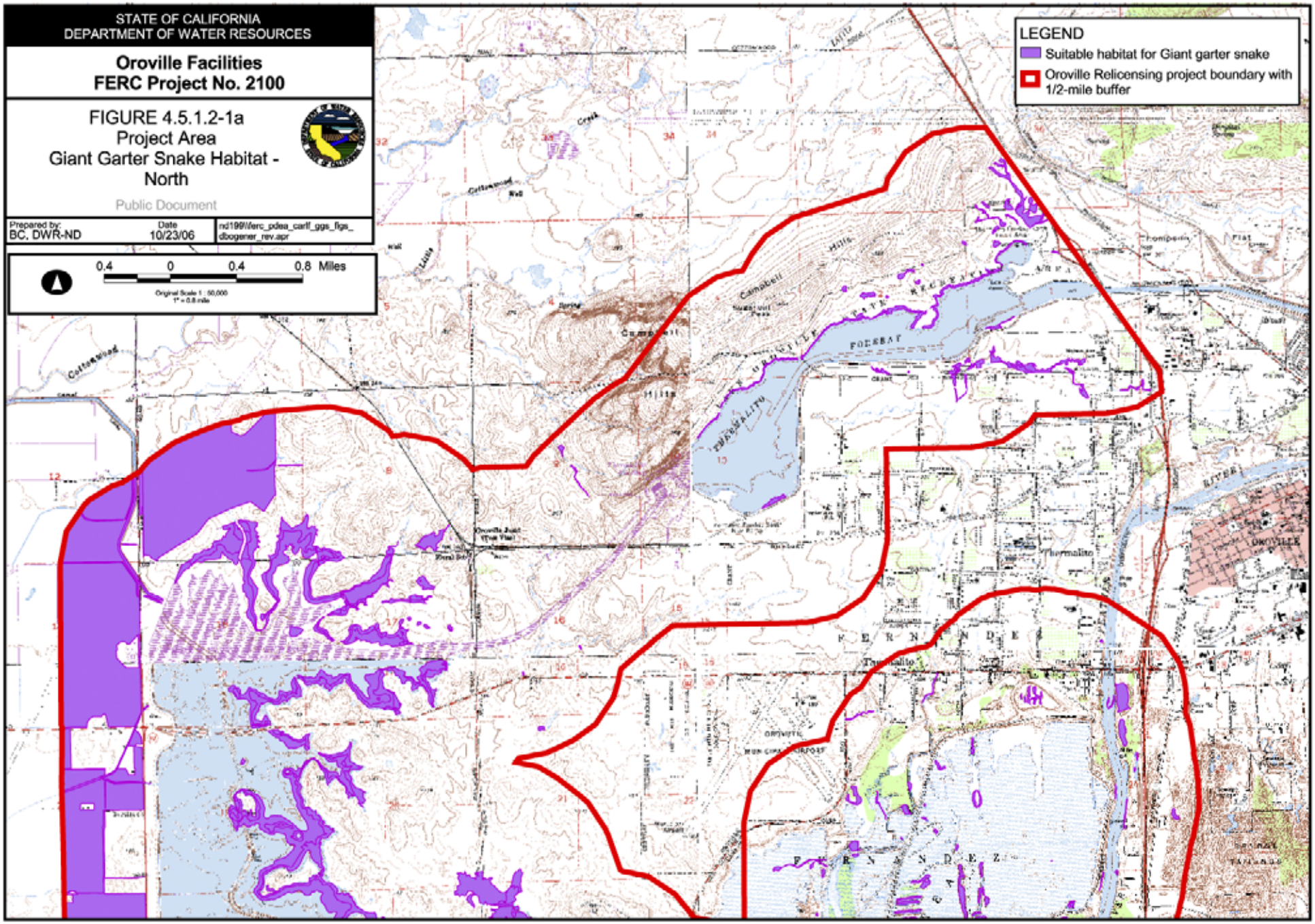
Thirteen sub-populations of giant garter snake have been identified; however, population information is generally lacking. The northern extent of the current range of this species is described as Sacramento and Contra Costa counties (Fox 1951), to near Gridley (Hansen and Brode 1980), to the vicinity of Chico (Rossman and Stewart 1987). In addition to natural wetlands, giant garter snakes are now found in agricultural wetlands (rice), managed wetlands (duck clubs and federal and State refuges), agricultural drains, ponds, and other artificial waterways.

The *Draft Recovery Plan for the Giant Garter Snake* (Miller and Hornaday 1999) describes the essential habitat components for this aquatic reptile as:

- Adequate water during the snakes' active season (early spring through mid-fall) to support dense populations of prey;
- Presence of emergent herbaceous cover (cattails and tules) for escape cover and foraging habitat;
- Grassy upland habitat adjacent to waterways for basking; and
- Higher elevation upland habitat for floodflow refuge.

This species is absent from larger rivers, riparian woodlands, and wetlands with sand, rock, or gravel substrates (Miller and Hornaday 1999).

Suitable giant garter snake habitat was identified within portions of Thermalito Forebay, Thermalito Afterbay, the OWA, and lands subject to rice agriculture adjacent to Thermalito Afterbay but outside the FERC Project boundary (Figures 4.5.1.2-1a through 4.5.1.2-1c). About 4,280 acres of suitable habitat have been identified within the project area (DWR 2004c). No giant garter snakes were observed during the course of the


STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Facilities
FERC Project No. 2100
FIGURE 4.5.1.2-1a
Project Area
Giant Garter Snake Habitat -
North
Public Document
Prepared by:
BC, DWR-ND
Date
10/23/06
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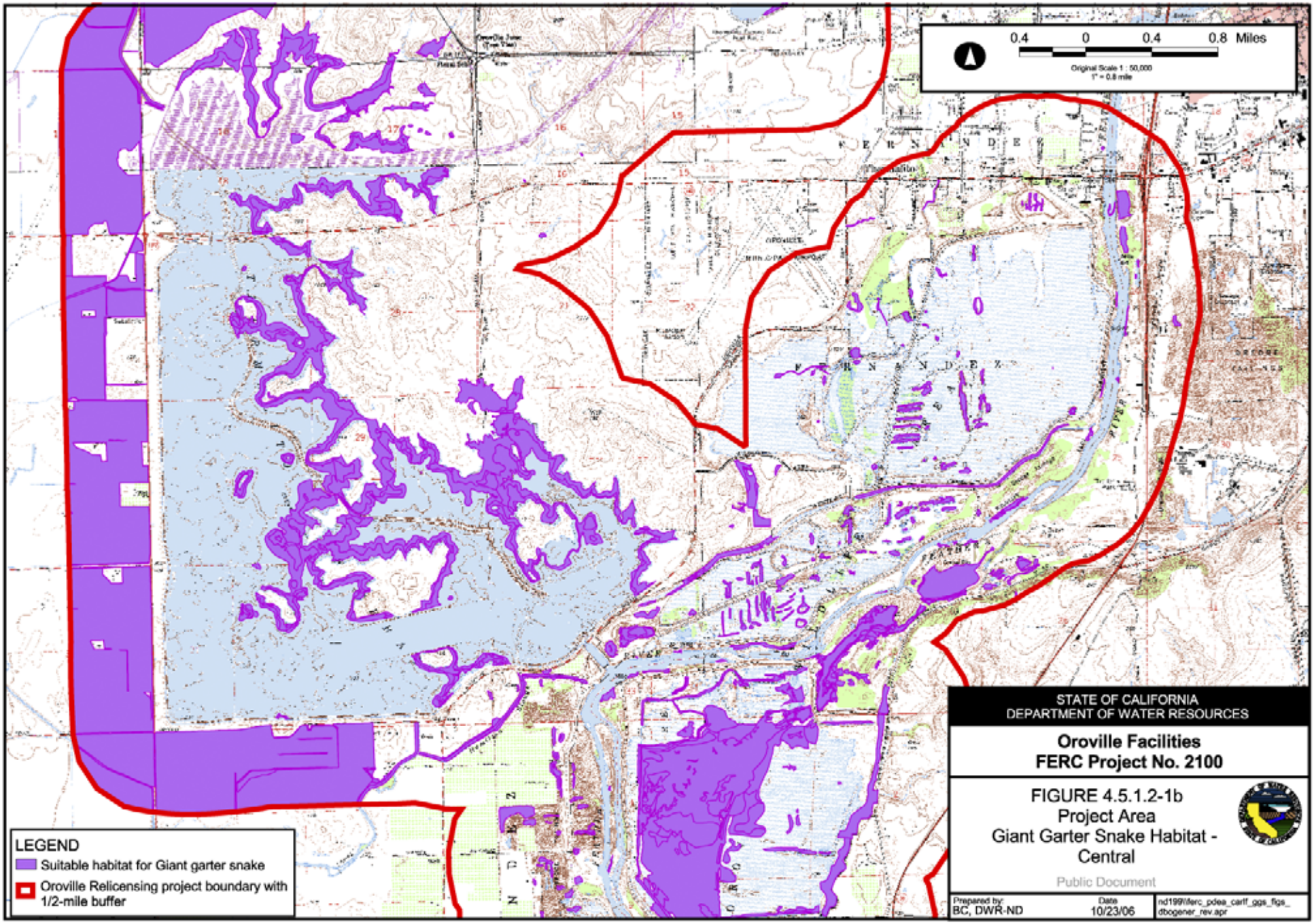
LEGEND
Suitable habitat for Giant garter snake
Oroville Relicensing project boundary with
1/2-mile buffer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1" = 0.8 mile
LEGEND
Suitable habitat for Giant garter snake
Oroville Relicensing project boundary with 1/2-mile buffer
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Facilities
FERC Project No. 2100
FIGURE 4.5.1.2-1b
Project Area
Giant Garter Snake Habitat - Central
Public Document
Prepared by: BC, DWR-ND
Date 10/23/06
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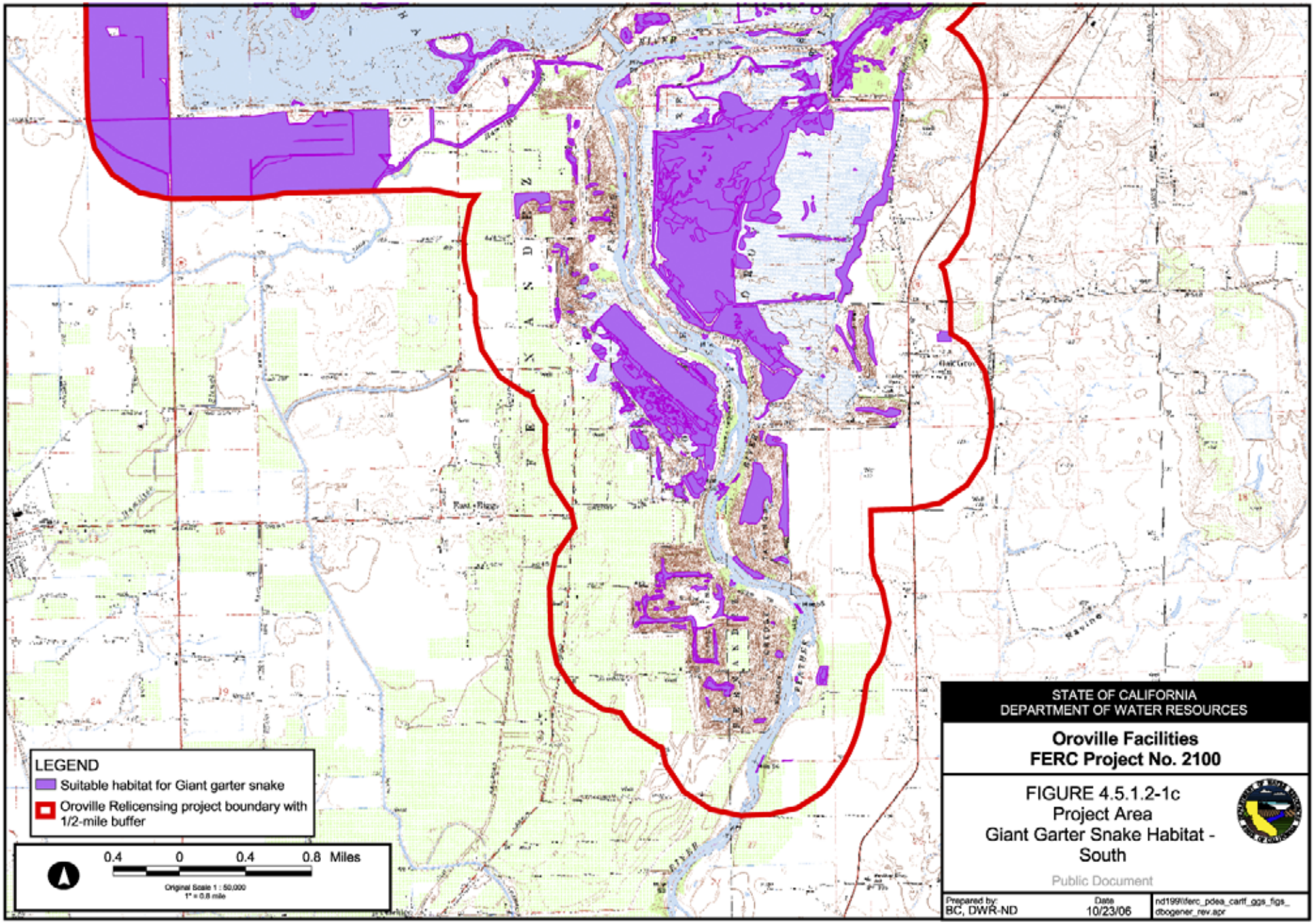
LEGEND
Suitable habitat for Giant garter snake
Oroville Relicensing project boundary with 1/2-mile buffer
0.4 0 0.4 0.8 Miles
Original Scale 1 : 50,000
1" = 0.8 mile
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Facilities
FERC Project No. 2100
FIGURE 4.5.1.2-1c
Project Area
Giant Garter Snake Habitat - South
Public Document
Prepared by:
BC, DWR-ND
Date
10/23/06
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relicensing studies. However, unconfirmed sightings of this species have been received historically from biologists working near Robinson Borrow Pond (adjacent to the FERC Project boundary) and Cherokee Canal (2 miles west of Thermalito Afterbay), and within Thermalito Afterbay. No suitable habitat exists at Lake Oroville. Several small, isolated patches of backwater habitats along the Feather River provide suitable habitat. The rice fields and canals along the western border of Thermalito Afterbay have suitable habitat for giant garter snake. These canals are primarily on private property outside of the FERC Project boundary. Rice fields and agricultural ditches provide habitat for most of the current populations of the giant garter snake (USFWS 1997), and these areas are expected to have populations of giant garter snake. Furthermore, these canals offer dispersal channels for giant garter snake to eventually move into the OWA waters that have potentially suitable habitat. However, State Route 99 serves as at least a partial barrier to this dispersal habitat.

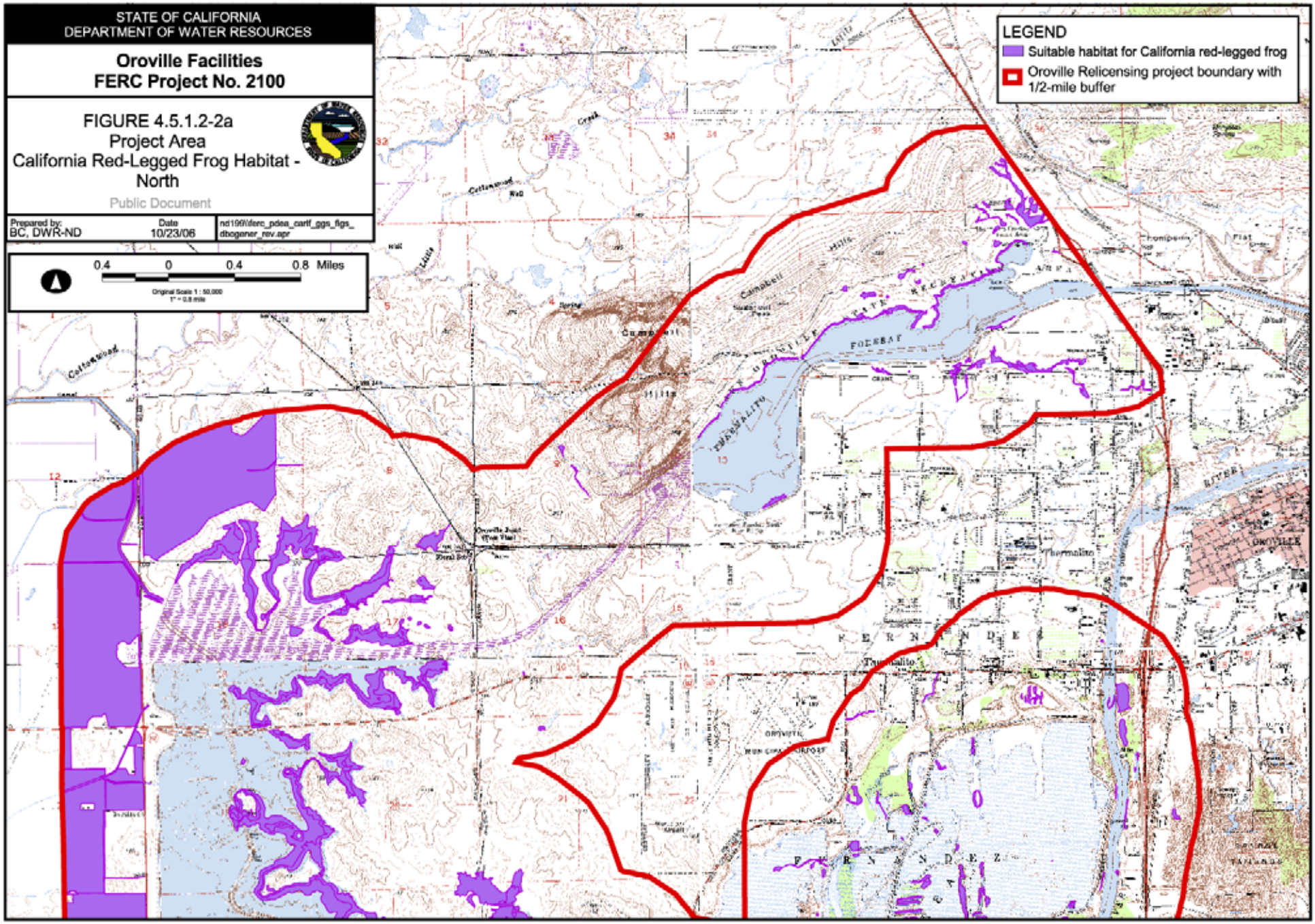
California Red-Legged Frog. USFWS listed the California red-legged frog as a Threatened species under FESA in June 1996. This species is considered a Species of Special Concern by the State. The California red-legged frog has been extirpated from approximately 70 percent of its former range, with only 2 known populations remaining east of the Coast Range.

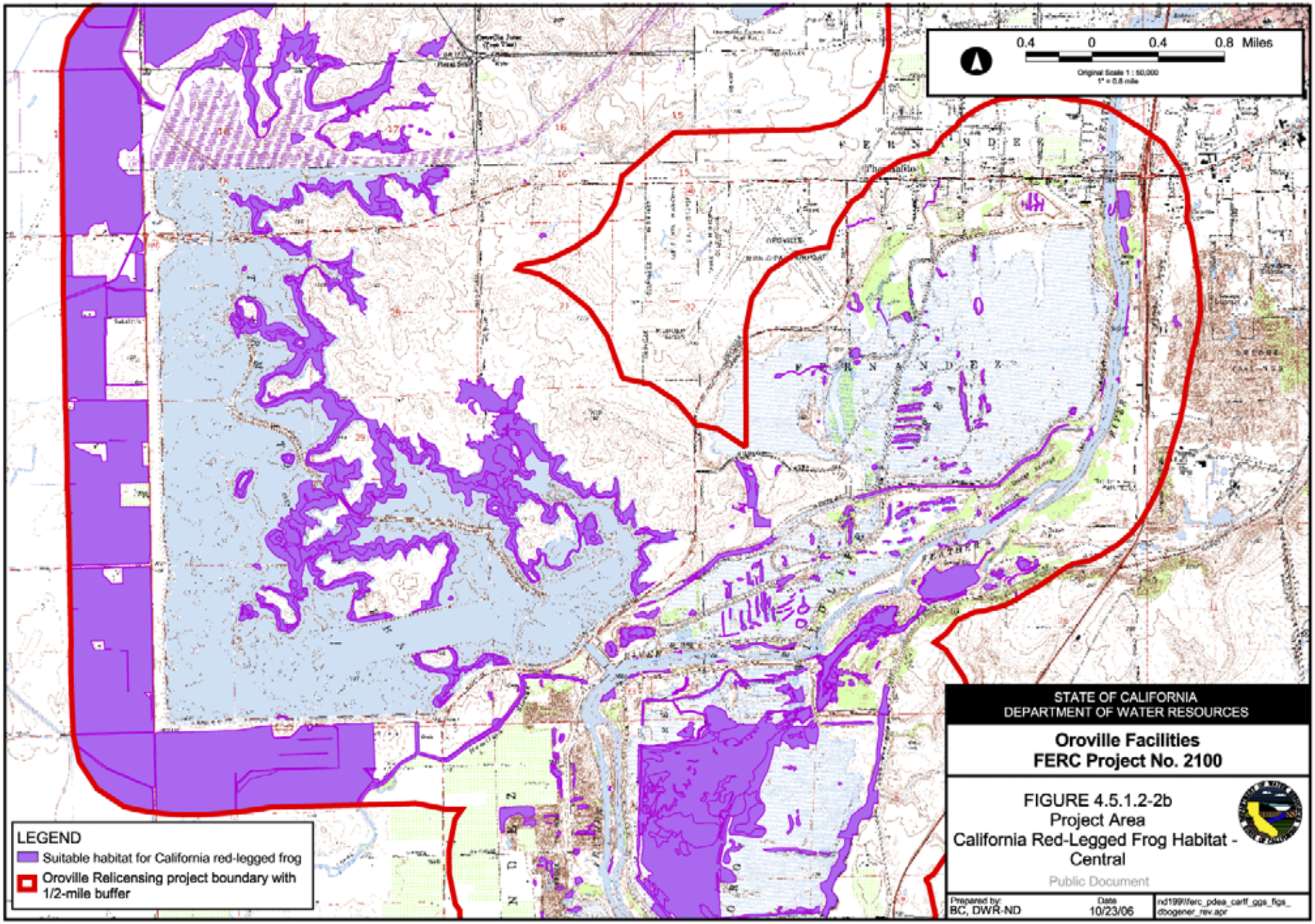
The California red-legged frog can occur from sea level up to approximately 5,000 feet elevation; most known populations exist below 3,500 feet. This species uses a variety of aquatic habitats for reproduction—streams, deep pools, backwaters, ponds, marshes, sag ponds, dune ponds, and lagoons (USFWS 2000). Breeding adults are generally associated with deep (greater than 2 feet), slow-moving water bordered by dense, low riparian or emergent vegetation (USFWS 2000). Upland areas near breeding locations can also be used extensively during the summer (USFWS 2000). Several reasons for the population decline have been identified: habitat loss (alteration, degradation, and fragmentation); urbanization; agricultural practices; water management activities; mining; livestock practices; recreational effects; timber harvest practices; exploitation (as food); disease; introduced species (e.g., bullfrog, mosquitofish, and largemouth bass); drought; and contaminants (USFWS 2000).

California red-legged frogs are not currently known to exist within the FERC Project boundary. However, the largest remaining population within the Sierra Nevada is within 1 mile of the FERC Project boundary in the North Fork Feather River drainage (USFWS 2000). Suitable red-legged frog habitat was identified within portions of Thermalito Forebay, Thermalito Afterbay, and the OWA (Figures 4.5.1.2-2a through 4.5.1.2-2c). Neither Lake Oroville nor the portion of the reservoir's tributaries within the project area contain suitable habitat.

Vernal Pool Invertebrates. The project area is known to be within the range of three federally listed eubranchiopod species: the vernal pool tadpole shrimp, the Conservancy fairy shrimp, and the vernal pool fairy shrimp.

The vernal pool tadpole shrimp is federally listed as an Endangered species. This tadpole shrimp species is found in vernal pools throughout the Sacramento Valley and


STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Facilities
FERC Project No. 2100
FIGURE 4.5.1.2-2a
Project Area
California Red-Legged Frog Habitat - North
Public Document
Prepared by: BC, DWR-ND
Date 10/23/06
nd199\derc_pdea_cartf_ggs_figs_dbogener_rev.apr
0.4 0 0.4 0.8 Miles
LEGEND
Suitable habitat for California red-legged frog
Oroville Relicensing project boundary with 1/2-mile buffer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Original Scale 1 : 50,000
1" = 0.8 mile
LEGEND
Suitable habitat for California red-legged frog
Oroville Relicensing project boundary with 1/2-mile buffer
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Facilities
FERC Project No. 2100
FIGURE 4.5.1.2-2b
Project Area
California Red-Legged Frog Habitat - Central
Public Document
Prepared by:
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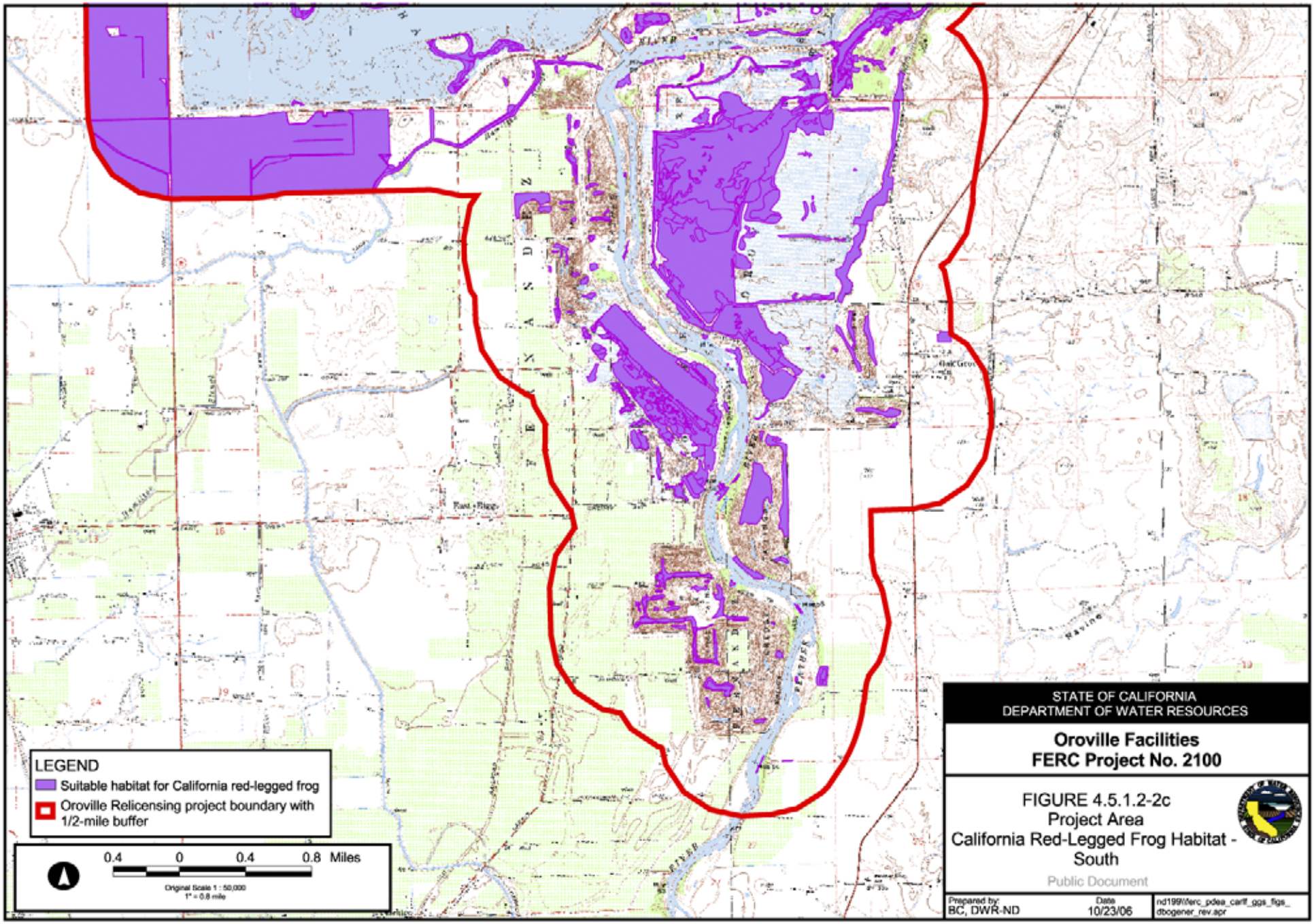
LEGEND
Suitable habitat for California red-legged frog
Oroville Relicensing project boundary with 1/2-mile buffer
0.4 0 0.4 0.8 Miles
Original Scale 1 : 50,000
1" = 0.8 mile
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Facilities
FERC Project No. 2100
FIGURE 4.5.1.2-2c
Project Area
California Red-Legged Frog Habitat - South
Public Document
Prepared by:
BC, DWR-ND
Date
10/23/06
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is reported to occur in Butte County. The tadpole shrimp is omnivorous and generally forages on the bottoms of pools in dense vegetation. Tadpole shrimp tend to be slow growing and are usually collected after the vernal pool has been ponded for 30 days.

The Conservancy fairy shrimp is federally listed as an Endangered species. This species is reported from large (>1.2 acres) and deep (>6 inches) turbid alkaline pools. This species of fairy shrimp has an extremely disjunct distribution. It is known from Tehama and Butte counties, in the northern part of the Sacramento Valley; Solano County, at the Jepson Prairie; Merced County, in the San Joaquin Valley near Haystack Mountain; and an isolated occurrence from northeastern Ventura County (Eriksen and Belk 1999).

The vernal pool fairy shrimp is federally listed as a Threatened species. This shrimp species is found in vernal pools throughout the Central Valley and western Riverside County in California, and near Medford, Oregon (Eriksen and Belk 1999). This fairy shrimp species occurs in neutral to slightly alkaline vernal pools throughout California's Central Valley, and in rock outcrop pools along the interior coast ranges, south of the Sacramento–San Joaquin Delta.

Typical habitat for fairy shrimp and tadpole shrimp in California includes vernal pools, ponded areas within vernal swales, rock outcrop ephemeral pools, playas, alkali flats, and salt lakes (Eng et al. 1990). Pool volume is important in determining potential shrimp habitat because deeper pools with a large surface area can more easily maintain their levels of dissolved oxygen. Similarly, deep pools will pond long enough to allow the shrimp to complete their life cycle.

None of these three invertebrate species is known to occur within the project area. However, vernal pool fairy shrimp are documented as occurring at two locations immediately adjacent to the FERC Project boundary (DFG 2004). Recent Relicensing studies indicate that 46.3 acres of suitable vernal pool invertebrate habitat exist within the project area, all occurring in the grasslands around Thermalito Forebay and Thermalito Afterbay (see Figures 5.7-4 and 5.7-4a through 5.7-4c in the SP-T2 report [DWR 2004c]).

Valley Elderberry Longhorn Beetle. USFWS listed the valley elderberry longhorn beetle as a Threatened species under FESA in August 1980. Since this initial listing, the known distribution of this species has increased greatly as a result of additional survey efforts. USFWS now identifies the species' range as throughout the Central Valley, up to 3,000 feet elevation on the eastern edge of the valley, and to the Coast Range watershed divide along the western side of the valley (USFWS 1984).

The beetle is restricted primarily to riparian habitat and adjacent uplands. The valley elderberry longhorn beetle is dependent upon its host plant, the elderberry (*Sambucus* sp.), throughout its life cycle. The valley elderberry longhorn beetle spends most of its 2-year life cycle boring within the stem in a larval stage. From March through June, the beetles emerge from the stem as adults to lay eggs, completing the life cycle (Barr 1991).

Elderberry bushes are one of the most common shrub species in high-terrace habitats within the portion of the OWA that borders the Feather River (Figures 4.5.1.2-3 and 4.5-1.2-3a through 4.5.1.2-3h). More than 90 acres of elderberry shrubs have been mapped on project levees in this area. Elderberry shrubs are rare at Lake Oroville, Thermalito Forebay, and Thermalito Afterbay. Several small patches of elderberry shrubs exist within the project area between Oroville Dam and Table Mountain Boulevard.

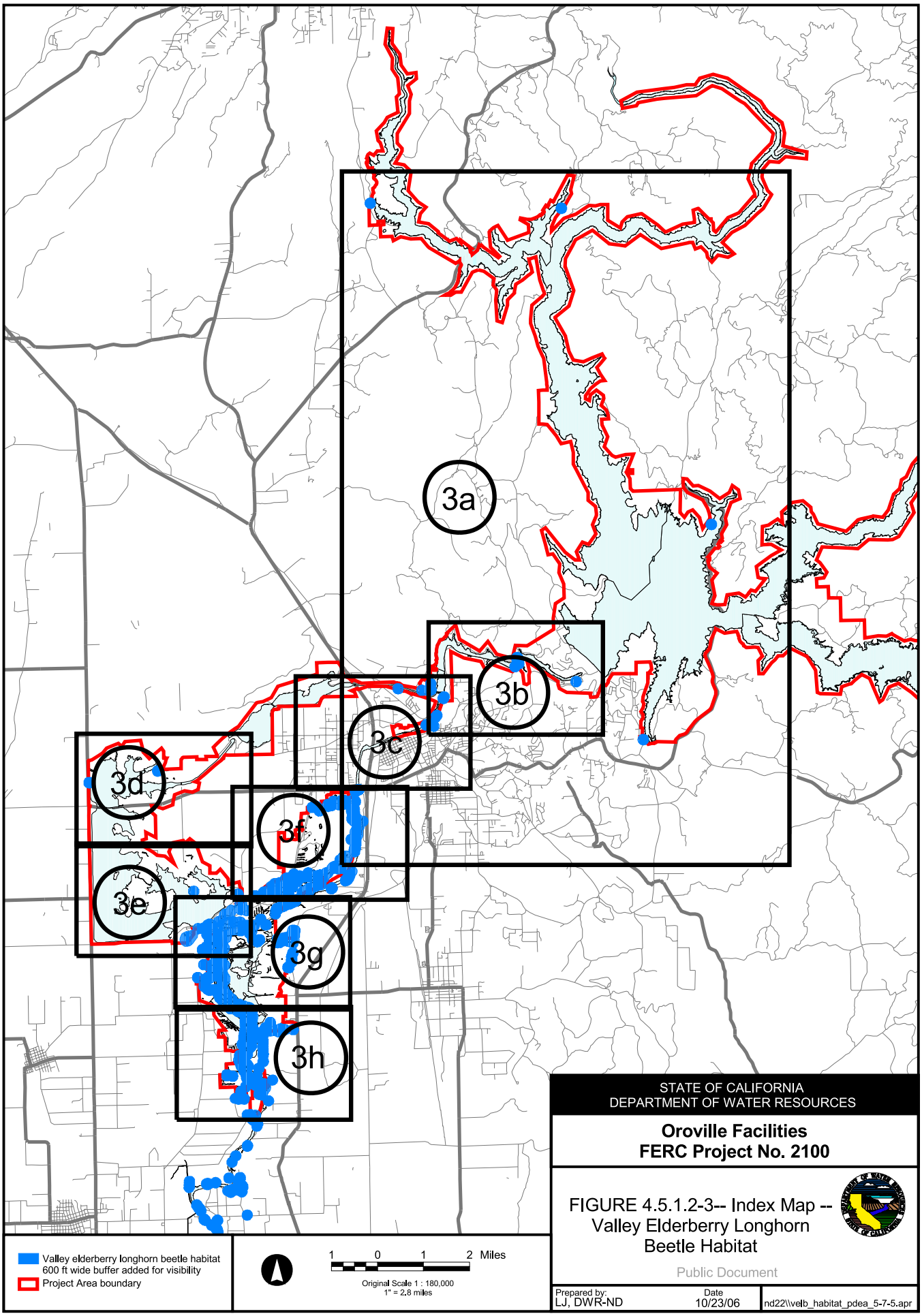
Other Federally Listed Species. Other species likely occurred in the project area historically but no longer occur in the area because of large-scale habitat modifications. Mountain yellow-legged frog, a federal Candidate species, is restricted to elevations ranging from 4,500 feet to more than 12,000 feet, but it occurs primarily above 5,900 feet (Zeiner et al. 1990b). This species is not found within the project area. Likewise, the project area is outside the range of California tiger salamander. There are no records for the species occurring within the FERC Project boundary (DWR 2004c). The only record of occurrence in Butte County was a 29-year-old record at Gray Lodge Wildlife Management Area, approximately 40 miles south of the project area. Subsequent surveys at Gray Lodge since 1965 have not recorded the presence of this species.

Western yellow-billed cuckoo is a federal Candidate species that requires deciduous riparian thickets or forests with dense, low understory near slow-moving waterways (Zeiner et al. 1990a). Potential cuckoo habitat within the project area and adjacent lands is restricted to riparian habitat within the OWA (Figure 4.5.1.2-4). Very few blocks of suitable habitat (dense low understory) greater than 25 acres and 300 feet in width exist within this area. Most of the areas within the OWA dominated by riparian vegetation are historic dredger tailings. No cuckoos were identified during surveys of potentially suitable nesting habitat within the project area during either 2002 or 2003 (DWR 2004c). Only one breeding pair was identified on the Feather River during the 1988 survey, and it was well downstream of the project area (Laymon and Halterman 1988). The lack of suitable habitat and of recent recorded sightings indicates that this species is not found within the FERC Project boundary.

State-Listed Species

Seven wildlife species listed under CESA may occur within the project vicinity (Table 4.5-4). Three of these species (bald eagle, giant garter snake, and yellow-billed cuckoo), which are protected under both FESA and CESA, have already been discussed in this section.

Swainson's Hawk. DFG listed the Swainson's hawk as a Threatened species under CESA in 1983. This species is not federally listed. The statewide population of Swainson's hawk was estimated at 375 pairs in 1980 (Bloom 1980). By 1993, it was estimated that the population of this migratory species in California had declined by 91 percent (DFG 1993).



STATE OF CALIFORNIA
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Oroville Facilities
FERC Project No. 2100

FIGURE 4.5.1.2-3-- Index Map -- Valley Elderberry Longhorn Beetle Habitat

Public Document

Prepared by:	Date	
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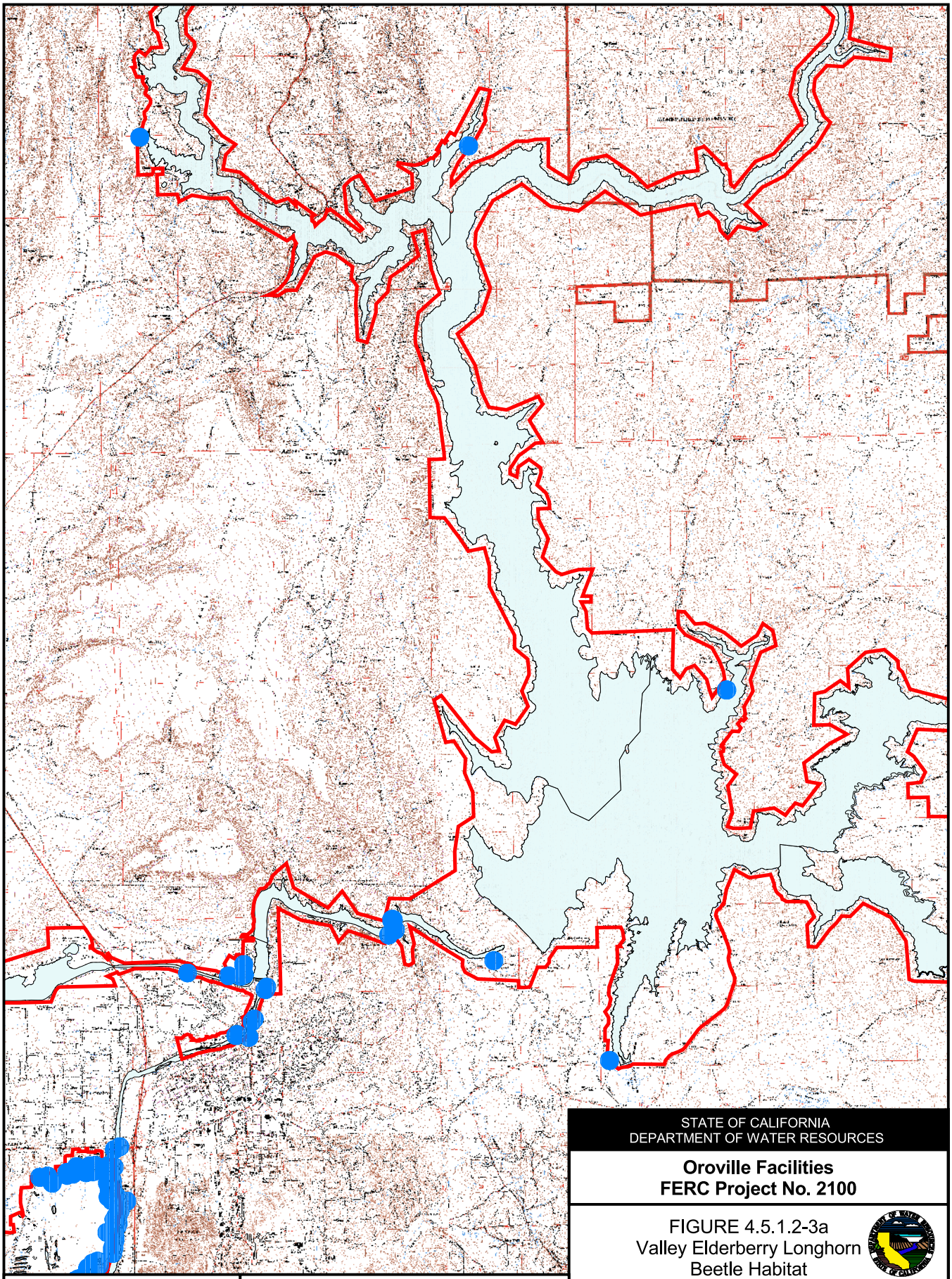

Valley elderberry longhorn beetle habitat
600 ft wide buffer added for visibility
Only habitat above Oroville Dam shown
Project Area boundary

0.5 0 0.5 1 1.5 Miles

Original Scale 1 : 108,000
1" = 1.7 miles

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FIGURE 4.5.1.2-3a
Valley Elderberry Longhorn Beetle Habitat
Lake Oroville (Area 3a)

Public Document

Prepared by:	Date	
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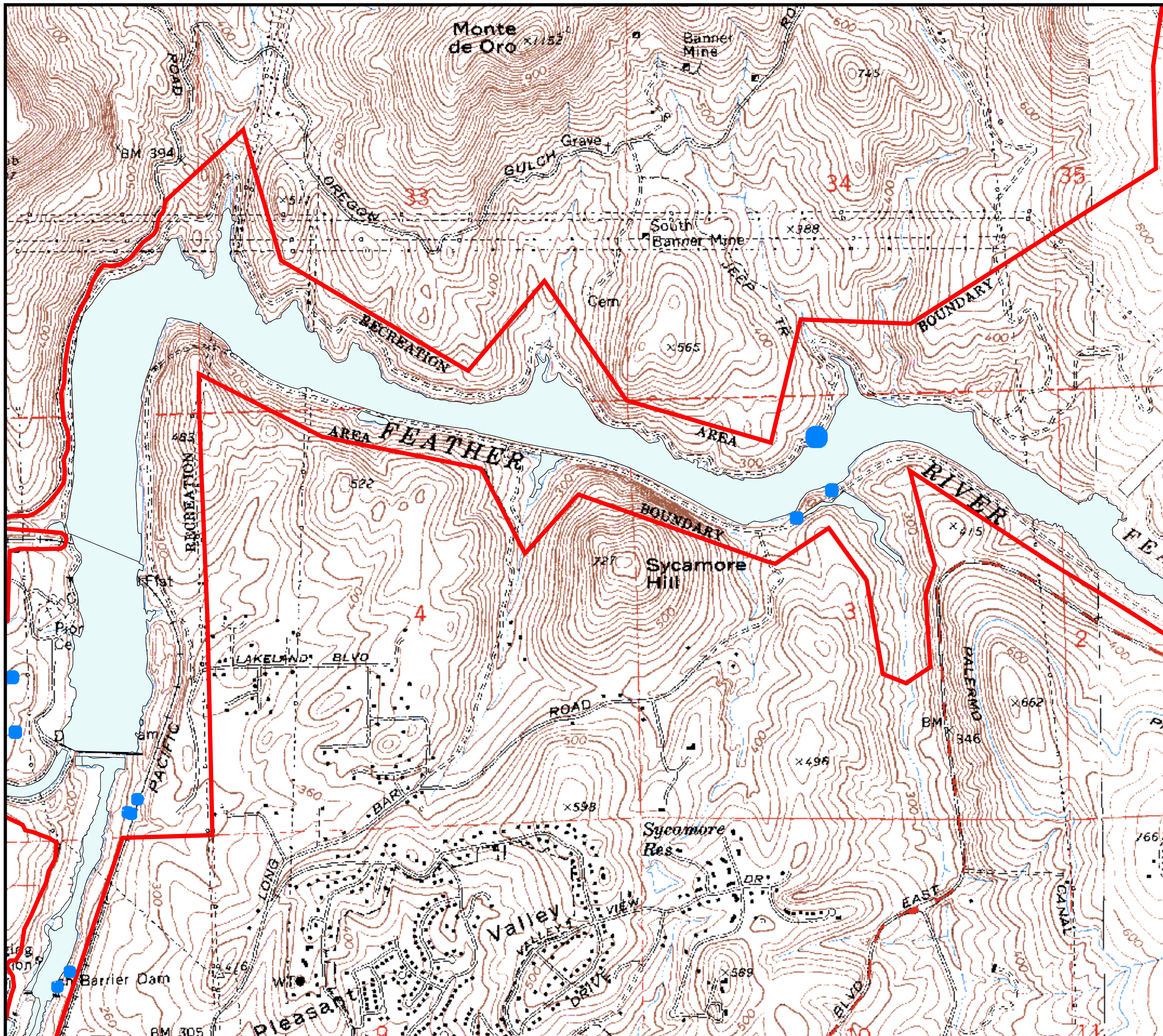

Valley elderberry longhorn beetle habitat 50 ft wide buffer added for visibility

Project Area boundary

0.1 0 0.1 0.2 0.3 Miles

Original Scale 1 : 24,000
1" = 0.4 miles

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FIGURE 4.5.1.2-3b
Valley Elderberry Longhorn Beetle Habitat
Diversion Pool (Area 3b)

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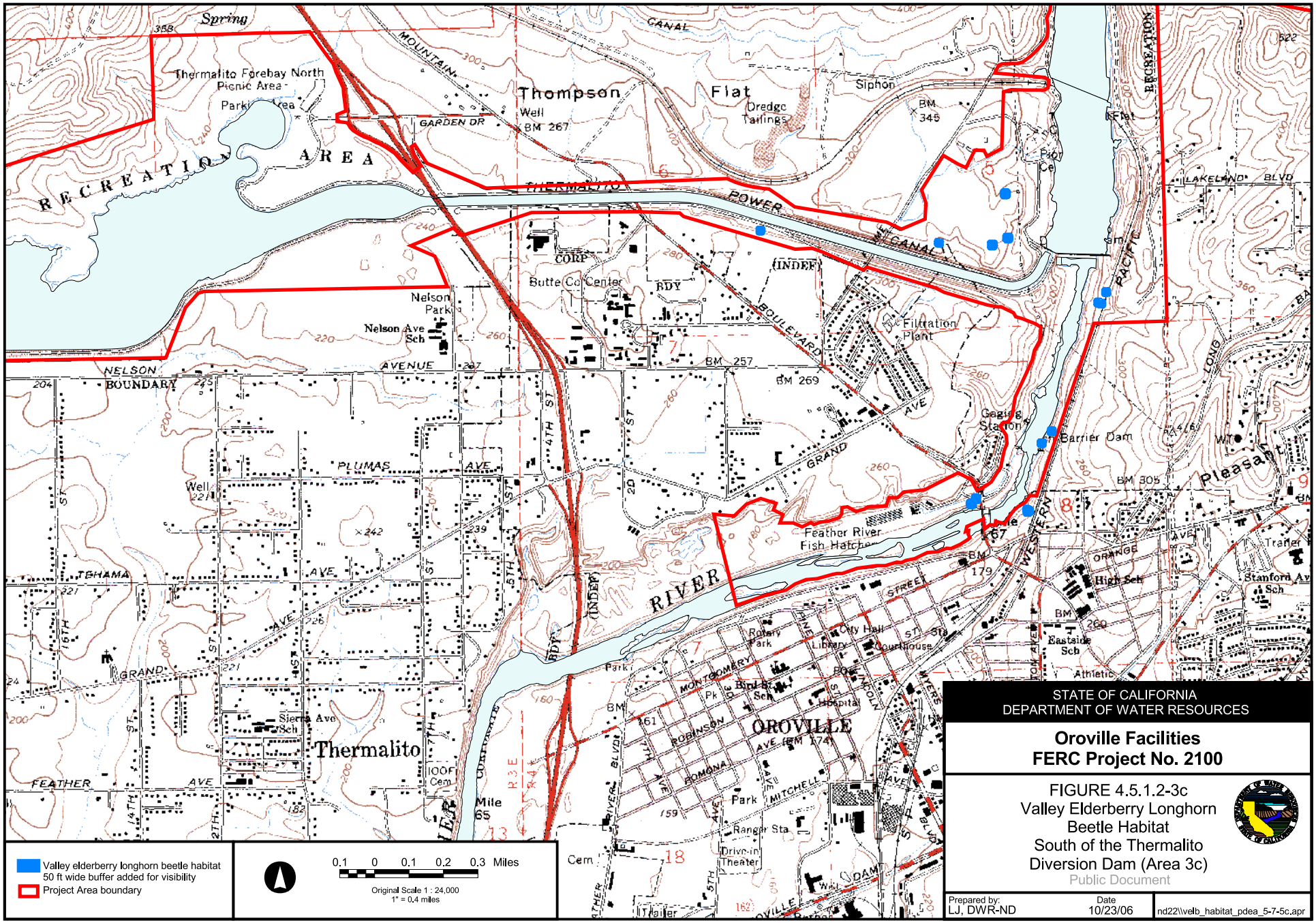
Date 10/23/06

nd22\\velb_habitat_pdea_5-7-5b.apr



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FERC Project No. 2100

FIGURE 4.5.1.2-3c
Valley Elderberry Longhorn Beetle Habitat
South of the Thermalito Diversion Dam (Area 3c)
Public Document

Prepared by:	Date	
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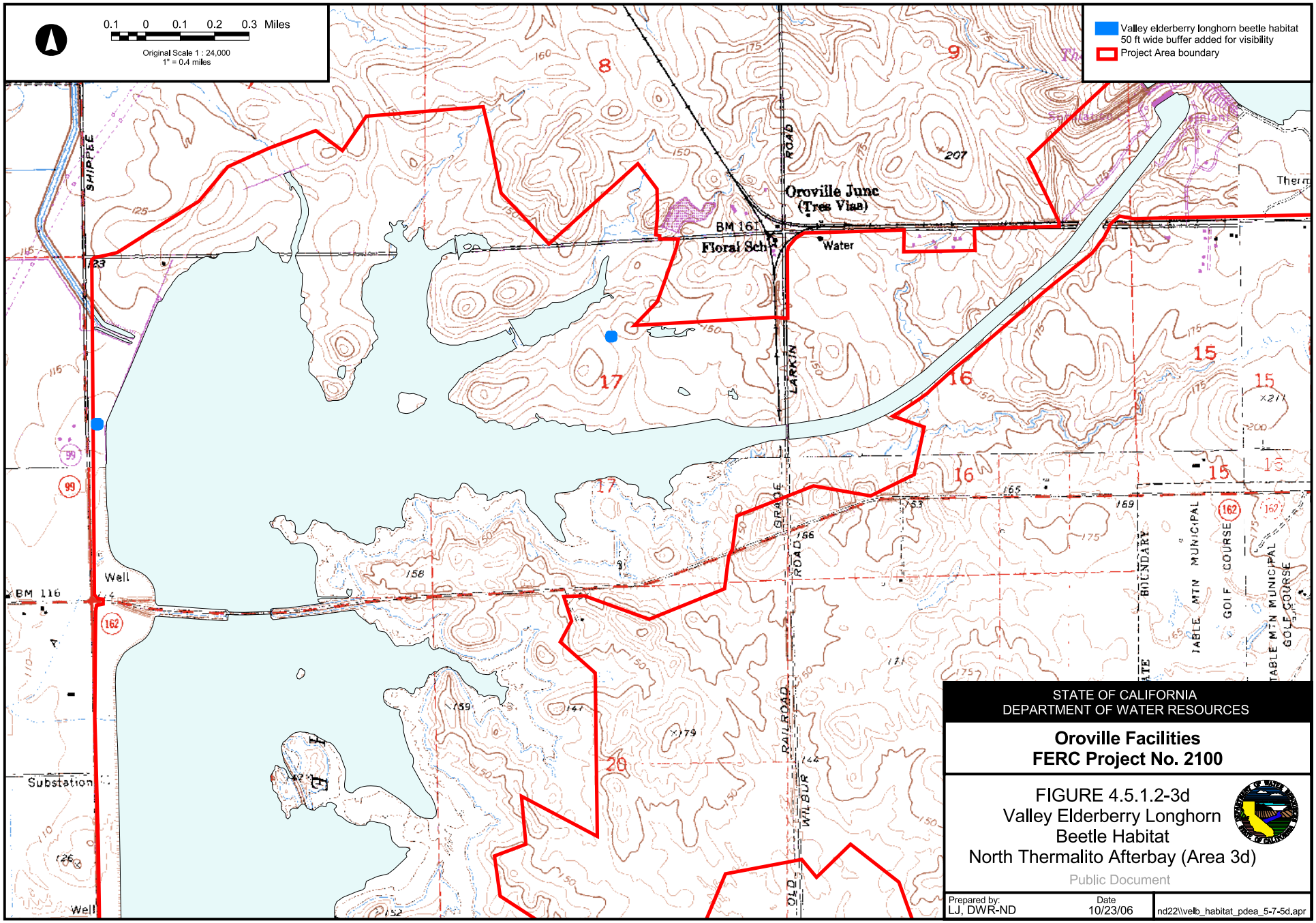
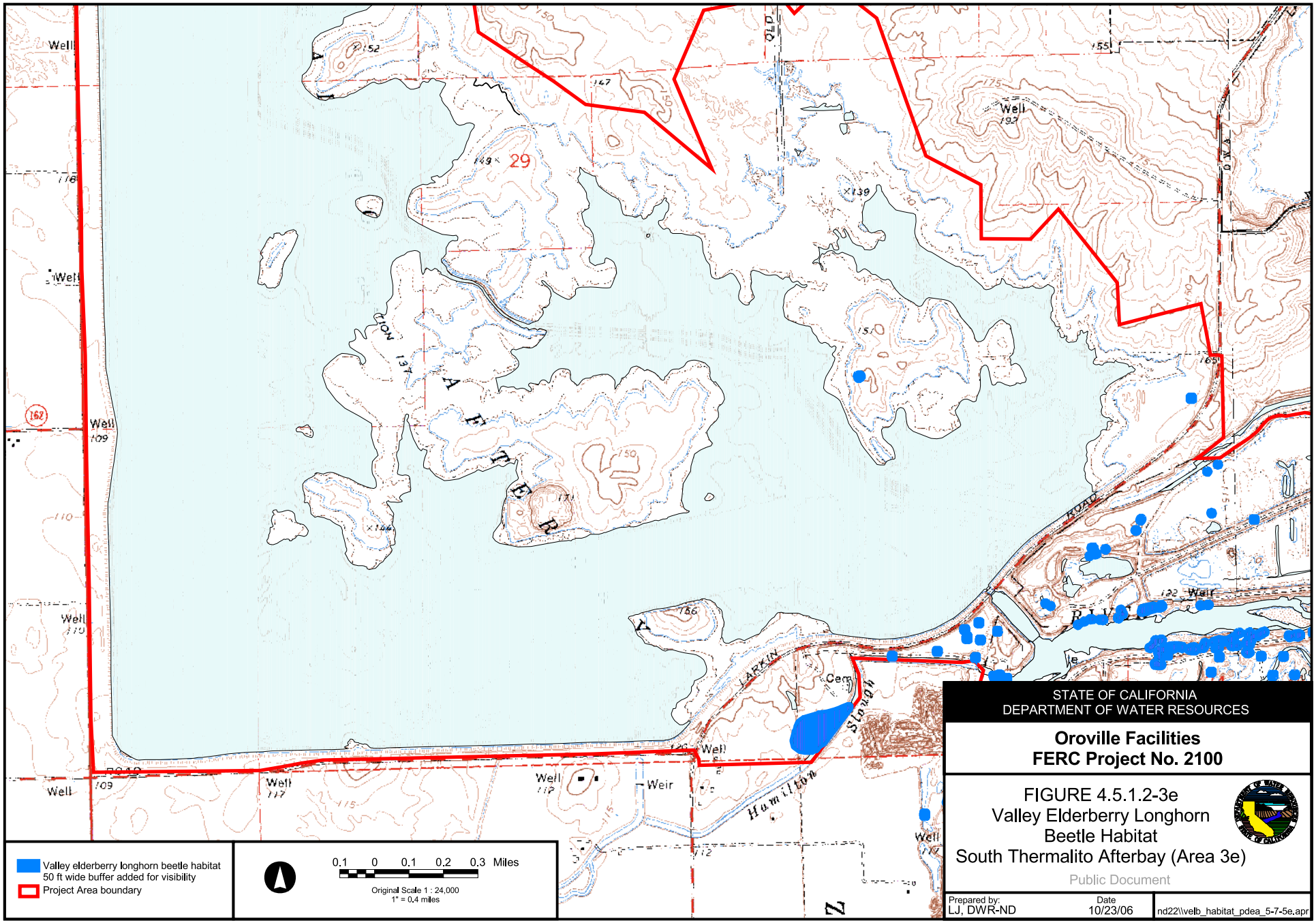

0.1 0 0.1 0.2 0.3 Miles
Original Scale 1 : 24,000
1" = 0.4 miles
Valley elderberry longhorn beetle habitat
50 ft wide buffer added for visibility
Project Area boundary
Oroville Junc
(Tres Vias)
BM 161
Floral Sch
Water
SHIPPEE
LARKIN ROAD
GRAVE ROAD
RAILROAD
WILBUR
OLD
BOUNDARY
TABLE MTN MUNICIPAL GOLF COURSE
Well
BM 116
Substation
Well
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Facilities
FERC Project No. 2100
FIGURE 4.5.1.2-3d
Valley Elderberry Longhorn
Beetle Habitat
North Thermalito Afterbay (Area 3d)
Public Document
Prepared by:
LJ, DWR-ND
Date
10/23/06
nd22\\velb_habitat_pdea_5-7-5d.apr


Valley elderberry longhorn beetle habitat
50 ft wide buffer added for visibility
Project Area boundary
0.1 0 0.1 0.2 0.3 Miles
Original Scale 1 : 24,000
1" = 0.4 miles
N
STATE OF CALIFORNIA
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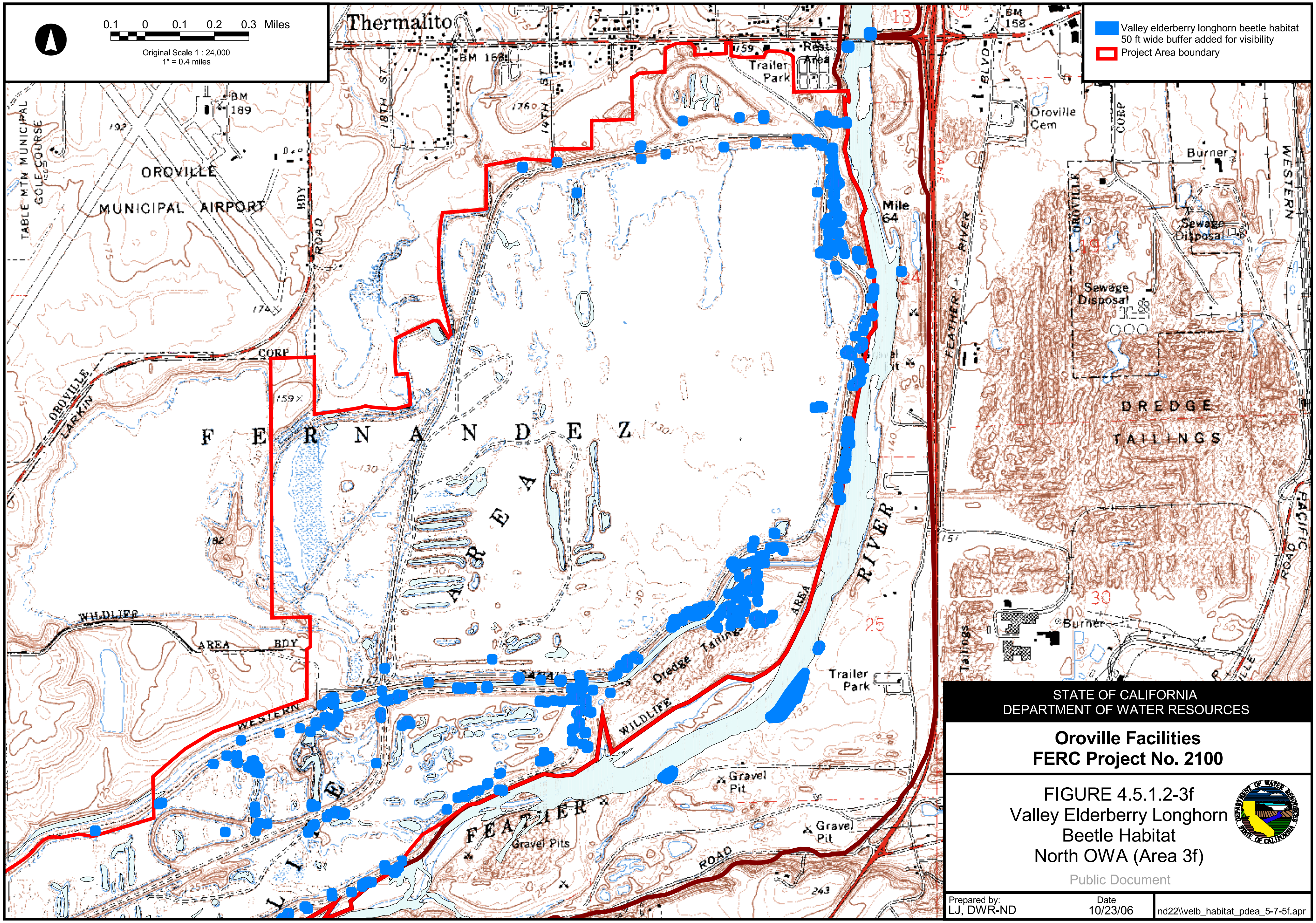
Oroville Facilities
FERC Project No. 2100
FIGURE 4.5.1.2-3e
Valley Elderberry Longhorn
Beetle Habitat
South Thermalito Afterbay (Area 3e)
Public Document
Prepared by:
LJ, DWR-ND
Date
10/23/06
nd22\\velb_habitat_pdea_5-7-5e.apr



0.1 0 0.1 0.2 0.3 Miles
Original Scale 1 : 24,000
1" = 0.4 miles
Valley elderberry longhorn beetle habitat
50 ft wide buffer added for visibility
Project Area boundary
Thermalito
OROVILLE
MUNICIPAL AIRPORT
TABLE MTN MUNICIPAL GOLF COURSE
F E R N A N D E Z
A R E A
FEATHER
RIVER
DREDGE
TAILINGS
Dredge Tailings
Trailer Park
Rest Area
Mile 64
Gravel Pit
Gravel Pits
Sewage Disposal
Burner
Oroville Cem
Tailings
WESTERN
PACIFIC
ROAD
WILDLIFE AREA BDY

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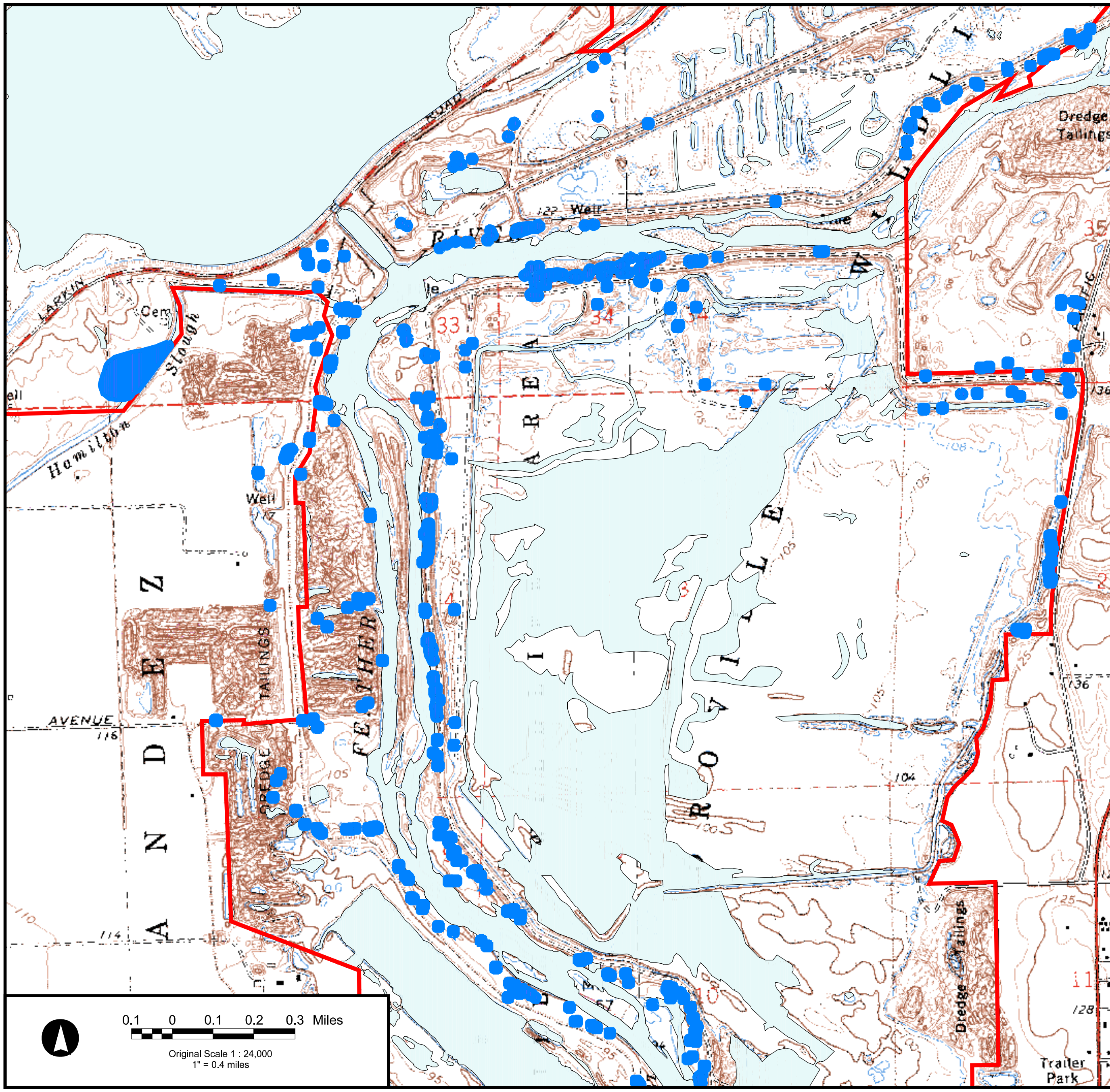
FIGURE 4.5.1.2-3f
Valley Elderberry Longhorn Beetle Habitat
North OWA (Area 3f)

Public Document

Prepared by: LJ, DWR-ND | Date 10/23/06 | nd22\\velb_habitat_pdea_5-7-5f.apr



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FERC Project No. 2100

FIGURE 4.5.1.2-3g
Valley Elderberry Longhorn Beetle Habitat
Central OWA (Area 3g)

Public Document

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Date 10/23/06

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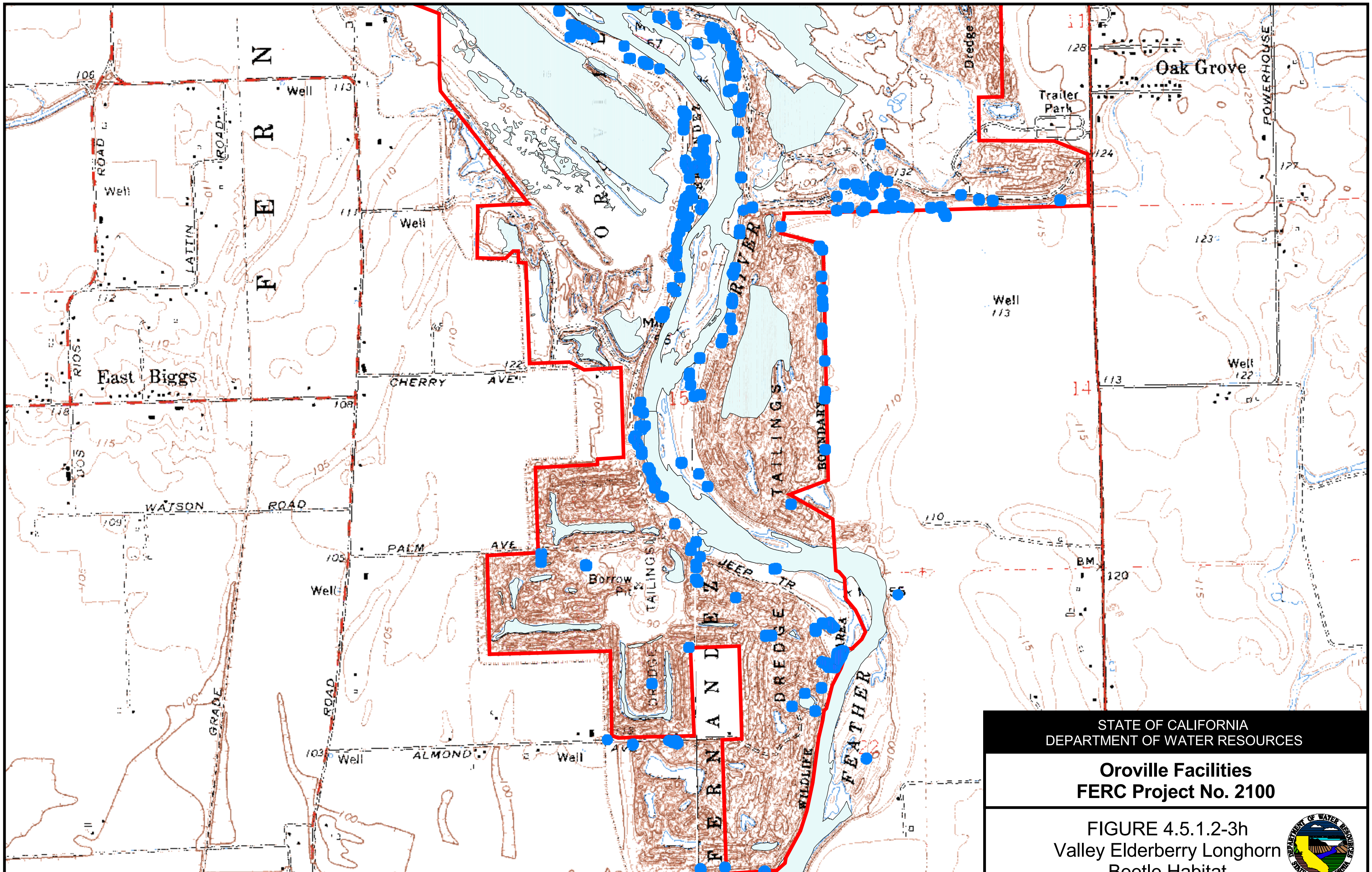

Valley elderberry longhorn beetle habitat 50 ft wide buffer added for visibility

Project Area boundary

0.1 0 0.1 0.2 0.3 Miles

Original Scale 1 : 24,000
1" = 0.4 miles

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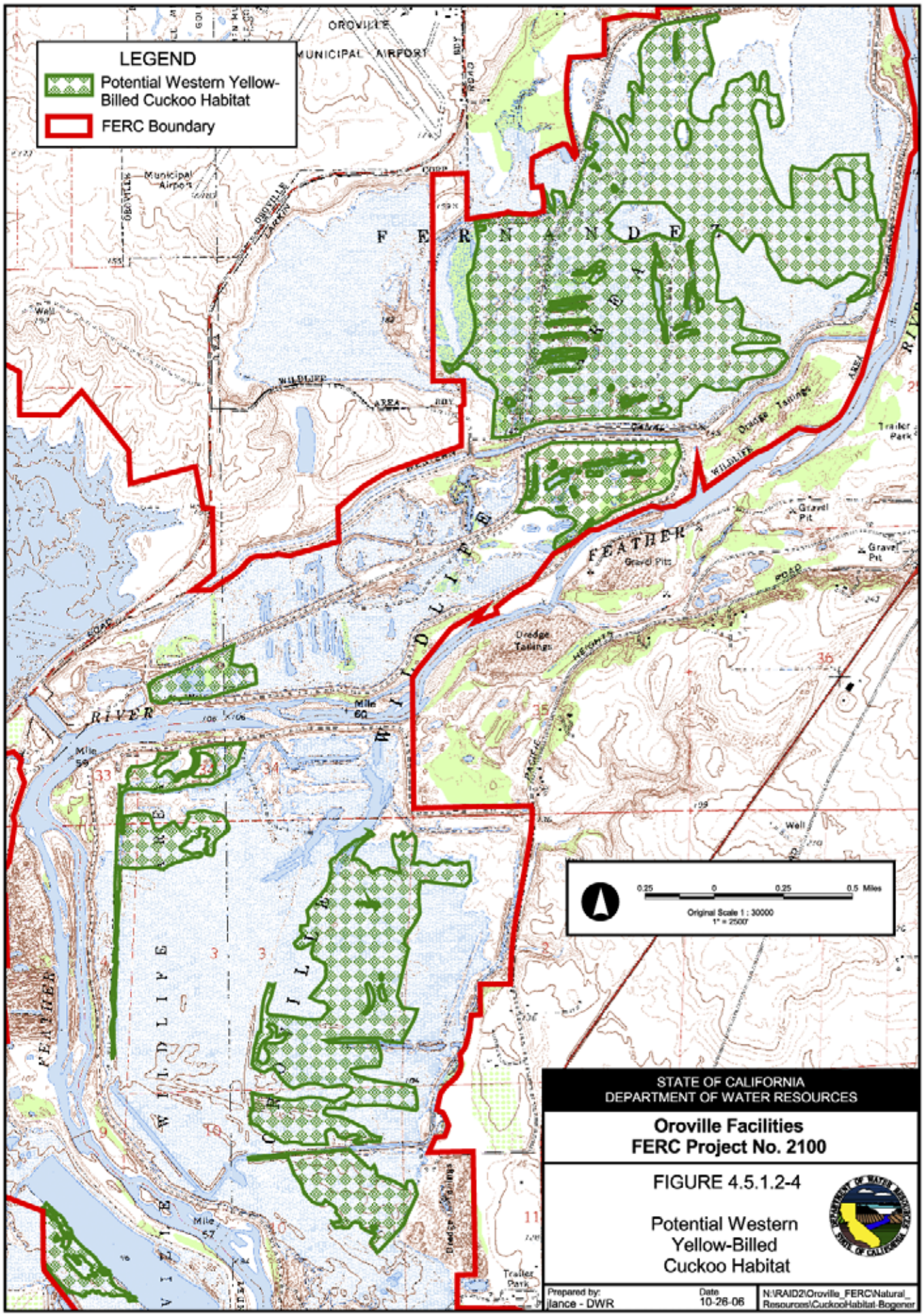
FIGURE 4.5.1.2-3h
Valley Elderberry Longhorn Beetle Habitat
South OWA (Area 3h)

Public Document

Prepared by: LJ, DWR-ND

Date 10/23/06

nd22\\velb_habitat_pdea_5-7-5h.apr


LEGEND
Potential Western Yellow-Billed Cuckoo Habitat
FERC Boundary
OROVILLE MUNICIPAL AIRPORT
Municipal Airport
F E R N A N D E Z
Dredge Tailings
Trailer Park
Gravel Pit
FEATHER
Gravel Pits
Dredge Tailings
RIVER
Mile 60
Mile 59
Mile 57
Well
0.25 0 0.25 0.5 Miles
Original Scale 1 : 30000
1" = 2500'
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Facilities
FERC Project No. 2100
FIGURE 4.5.1.2-4
Potential Western Yellow-Billed Cuckoo Habitat
Prepared by:
jlance - DWR
Date
10-26-06
N:\RAID2\Oroville_FERC\Natural_Resources\CuckooHabitat-Bogener

Swainson's hawks were historically found throughout most of lowland California (Grinnell and Miller 1944). Swainson's hawks use a variety of agricultural crops for foraging: alfalfa, fallow fields, beet, tomato, irrigated pasture, rice (non-flooded), and cereal grains. The current distribution of the species is limited to northeast California (primarily Modoc, Siskiyou, and Lassen counties) and the Central Valley. The species' decline is believed to be related to agricultural and urban land conversions (Estep 1989).

A nesting pair of Swainson's hawks was discovered during the course of the relicensing studies (DWR 2004c). This pair nested annually from 2002 through 2006 in a thin strip of mature riparian habitat within the OWA adjacent to the Feather River. This nest produced at least one young during each breeding season. Foraging activity occurred primarily in a young walnut orchard adjacent to the FERC Project boundary. No other sightings of adult Swainson's hawks were made at any other location within the FERC Project boundary.

Greater Sandhill Crane. Both the lesser and greater subspecies of sandhill crane winter in the Central Valley of California and may be found within the project area. The greater sandhill crane subspecies is State listed as Threatened and is considered a Sensitive species by Region 5 of USFS.

Wintering crane habitat consists of an open expanse of shallow water for communal roosting, rice or corn fields for foraging, and irrigated pasture for loafing (DFG 1992). No nesting sandhill cranes are found within the study area. Survey data indicate that a limited amount of marginally suitable sandhill crane wintering habitat is present within the FERC Project boundary around Thermalito Afterbay. Furthermore, survey results indicate that greater sandhill crane use of the habitat within the FERC Project boundary and adjacent agricultural habitats is at best uncommon (DWR 2004c).

Bank Swallow. DFG listed the bank swallow as a Threatened species in March 1989. Bank swallows are found in riverine habitat and require a sandy or silty vertical bluff or riverbank for nesting (Zeiner et al. 1990a). Floods or very high flows are required to create and maintain the eroded banks favored by this migratory, colonial species.

No bank swallow nest colonies were identified within the project area. However, surveys conducted on the Feather River downstream of the project area in 2002 and 2003 identified 8 and 15 active colonies, respectively (DWR 2004g). The total number of burrows in active colonies was 2,274 in 2002 and 3,594 in 2003 (DWR 2004c).

American Peregrine Falcon. UFSWS listed the American peregrine falcon as an Endangered species under FESA in 1970; DFG subsequently listed the species as Endangered under CESA. USFWS recently de-listed peregrine falcons, but they remain State listed. The breeding population of peregrine falcons in California has increased from 2 known active nest locations in 1970 to more than 250 nesting pairs in 2006.

Three active peregrine nest locations were identified within the study area during the 2002, 2003, 2004, 2005, and 2006 breeding seasons. Two of these locations had been

used historically. Between 2002 and 2005, the same two nest territories were occupied and fledged a collective minimum of three young per year. Pre-fledglings were salvaged by DFG after they fell or flew from one of the nest sites in 2003 and again in 2004. These chicks later fledged at another location and are not included in the production data. The newly documented nest territory was the only territory where incubation behavior was not observed. This production of 1.0 young per active nest and 1.5 young per occupied nest compare favorably with statewide production data collected between 1975 and 1988, which averaged 0.83 young per active nest and 1.04 young per occupied nest (Jurek 1989). However, the goal of 1.5 young per pair included in the *Pacific Coast Recovery Plan for the American Peregrine Falcon* (USFWS 1982) was not met during 2002, 2003, 2004, or 2005.

Other Special-Status Species

This section includes a brief overview of other special-status wildlife species, including State Species of Concern, State Fully Protected Species, Federal Species of Concern, and USFS and BLM Sensitive Species (see Table 4.5-4). Of the 57 remaining species presented in Table 4.5-4, the majority of the species are California Species of Special Concern. These numbers reflect species status as of February 2006.

Per stakeholder direction during the study plan report development process, no specific surveys were conducted for these species on a project-wide basis. However, all sightings of these species during the course of other relicensing wildlife studies were recorded and entered into a Geographic Information System (GIS) database. Further, more intensive surveys of all federal lands in the project area were completed for USFS and BLM Sensitive Species. The project area is outside of the elevational range of California spotted owl, mountain yellow-legged frog, and northern goshawk. Of the 54 special-status species included on Table 4.5.4 with the potential to occur within the project vicinity, 25 species were observed within or adjacent to the project area (Table 4.5-5).

American white pelican, double-crested cormorant, and osprey observations were most common with 180–597 individual records. Least frequently observed species include Barrow's goldeneye, western burrowing owl, and short-eared owl. Additional information on special-status species locations and observed habitat use is included in Chapter 14 of the SP-T2 report (DWR 2004c). Many of the special-status species observed in the project area are believed to breed within the project vicinity (Table 4.5-5).

Table 4.5-5. Special-status species observed within or adjacent to the project area.

Species	Believed to Breed within the Project Area?
American white pelican	Yes
Barrow's goldeneye	No
Black tern	No
Black-crowned night heron	Yes
California gull	No
Caspian tern	No
Common loon	No
Cooper's hawk	Yes
Double-crested cormorant	No
Foothill yellow-legged frog	Yes
Golden eagle	Yes
Lewis's woodpecker	Yes
Loggerhead shrike	Yes
Long-billed curlew	No
Northern harrier	Yes
Northwestern pond turtle	Yes
Osprey	Yes
Prairie falcon	Yes
Sharp-shinned hawk	Yes
Short-eared owl	Yes
Tricolored blackbird	Yes
Western burrowing owl	Yes
White-faced ibis	Yes
Yellow-breasted chat	Yes
Yellow warbler	No

Source: DWR 2004c

Existing Project Conditions

Existing project operations could cause direct and indirect effects on special-status wildlife species and habitats within the project area. Short- and long-term effects may result in changes to the dynamics and stability of existing wildlife communities, including changes in species diversity and wildlife distribution, and may affect reproductive success. Direct and indirect effects may result from the following:

- *Lake Oroville Water Level Fluctuations.* Water levels in Lake Oroville fluctuate in response to needs for flood management, water quality and temperature needs, environmental commitments, and as a result of water withdrawals for irrigation or municipal water use. Long-term population monitoring of nesting bald eagles on Shasta Lake indicates a positive correlation between bald eagle productivity (number of young produced per occupied nest) and the average water surface elevation between April and June (U.S. Bureau of Reclamation 1992). A similar relationship may occur on Lake Oroville. However, the limited information available about bald eagle reproduction on Lake Oroville does not allow meaningful evaluation.

- *Thermalito Afterbay Water Level Fluctuations.* Relatively minor water level fluctuations occur at the Diversion Pool and Thermalito Forebay, and within dredger ponds associated with the OWA. However, Thermalito Afterbay water level fluctuations are more extreme and can adversely affect the habitat of the highly aquatic giant garter snake. Mudflats that are exposed during some Thermalito Afterbay fluctuations may increase predation and loss of individual giant garter snakes that attempt to traverse these areas to reach either shoreline cover or aquatic foraging areas.

- *Ground/Soil Disturbance and Habitat Degradation from Operations and Maintenance Activities.* Project maintenance and/or operations may affect habitats of species listed under FESA and/or CESA by disturbing surfaces, resulting in direct elimination of habitat, degradation of habitat quality, and/or displacement of wildlife. Federally listed vernal pool tadpole and fairy shrimp are sensitive to sedimentation, drainage control, and herbicides associated with road and levee maintenance activities (see Appendix E of the PDEA [DWR 2005]). Valley elderberry longhorn beetles and their habitats are sensitive to facilities maintenance activities including grading, pruning, herbicide use, and pesticide use (Appendix E of the PDEA [DWR 2005]).

- *Disturbance from Project-Related Recreation.* Wildlife and wildlife habitat may be directly and indirectly affected by project-related recreation. Development and use of recreational facilities causes direct loss of habitat as vegetation is removed or altered and soil is disturbed as described in the report for SP-T9, Recreation and Wildlife (DWR 2004h). Bald eagles can be intolerant of human activity during the breeding season. However, tolerance to human activity varies from pair to pair. Human activity can result in nest abandonment and subsequent loss of production (Bogener 1980; Detrich 1980; Lehman 1983).

  In some cases, breeding bald eagles have relocated their nests in response to human activity (Thelander 1973). Recreational off-highway vehicle use can damage vernal pools by disrupting overland flow patterns and directly destroying habitat (DWR 2004c). The weight of a vehicle can crush or displace fairy and tadpole shrimp present during the wet season or destroy their cysts in the summer. The compacted soils in the resulting tire ruts are unsuitable for sustainability of the vernal pool ecology, affecting the growth of aquatic plants and algae.

4.5.2 Botanical

4.5.2.1 Botanical Resources

Overview

This section describes the affected environment as it relates to botanical resources, including vegetation communities, invasive non-native plant species, and special-status plants, and analyzes the baseline effects on these resources.

Botanical resources in the project area are influenced by a variety of factors. Vegetation patterns correspond with elevational changes and are dependent on precipitation, temperature, soils, aspect, slope, and disturbance history. Unique geologic and geomorphic conditions exist within the project area and affect plant habitats and species. The primary parent rock types around Lake Oroville are granitic, volcanic, metamorphic, and sedimentary. Unique formations include serpentine outcrops located within the West Branch and Big Bend area of the North Fork arm of the reservoir and gabbro-derived soils located along the South Fork arm. Vernal pools and swale complexes are a common part of the valley grassland habitats below Lake Oroville. These pools are of the Northern Hardpan type that occurs in areas of hummocky ground on terrace-alluvial derived Redding soils (DFG 1998). These formations tend to support a number of endemic and rare plant species.

Operation of the Oroville Facilities influences environmental conditions within and around Lake Oroville, its upstream tributaries, areas in and around the Thermalito Complex, and the OWA, as well as the Feather River floodplain below the project area. In general, the environmental effects on botanical resources of the Oroville Facilities may occur from (1) reservoir operations and water releases; (2) timing, magnitude, frequency, and duration of water level fluctuations; (3) facility maintenance or development; (4) vegetation and/or wildlife habitat management; (5) noxious weed management; (6) road maintenance and development; and (7) recreational use or development and/or maintenance associated with recreation areas. These are the principal actions that were used to analyze potential effects on botanical resources.

Botanical field investigations included surveys for vegetation mapping, invasive weeds, special-status plant species, and riparian and wetland resources. Surveys were conducted during 2002, 2003, and 2004. Please refer to each study plan report for more detailed information.

Vegetation Associations/Communities within the Project Area—Existing Conditions

The study area for the vegetation community/land use mapping included the FERC Project boundary, a 1-mile area beyond the FERC Project boundary, and the Feather River floodplain (within the Federal Emergency Management Area [FEMA] 100-year floodplain) downstream of the FERC Project boundary. Vegetation community/land use types and acreages are identified in Table 4.5-6. Maps depicting the vegetation

communities may be found in Figures 4.5.2-1 and 4.5.2-1a through 4.5.2-1j. A comprehensive vegetative communities/land use map was developed based on field surveys and aerial photography.

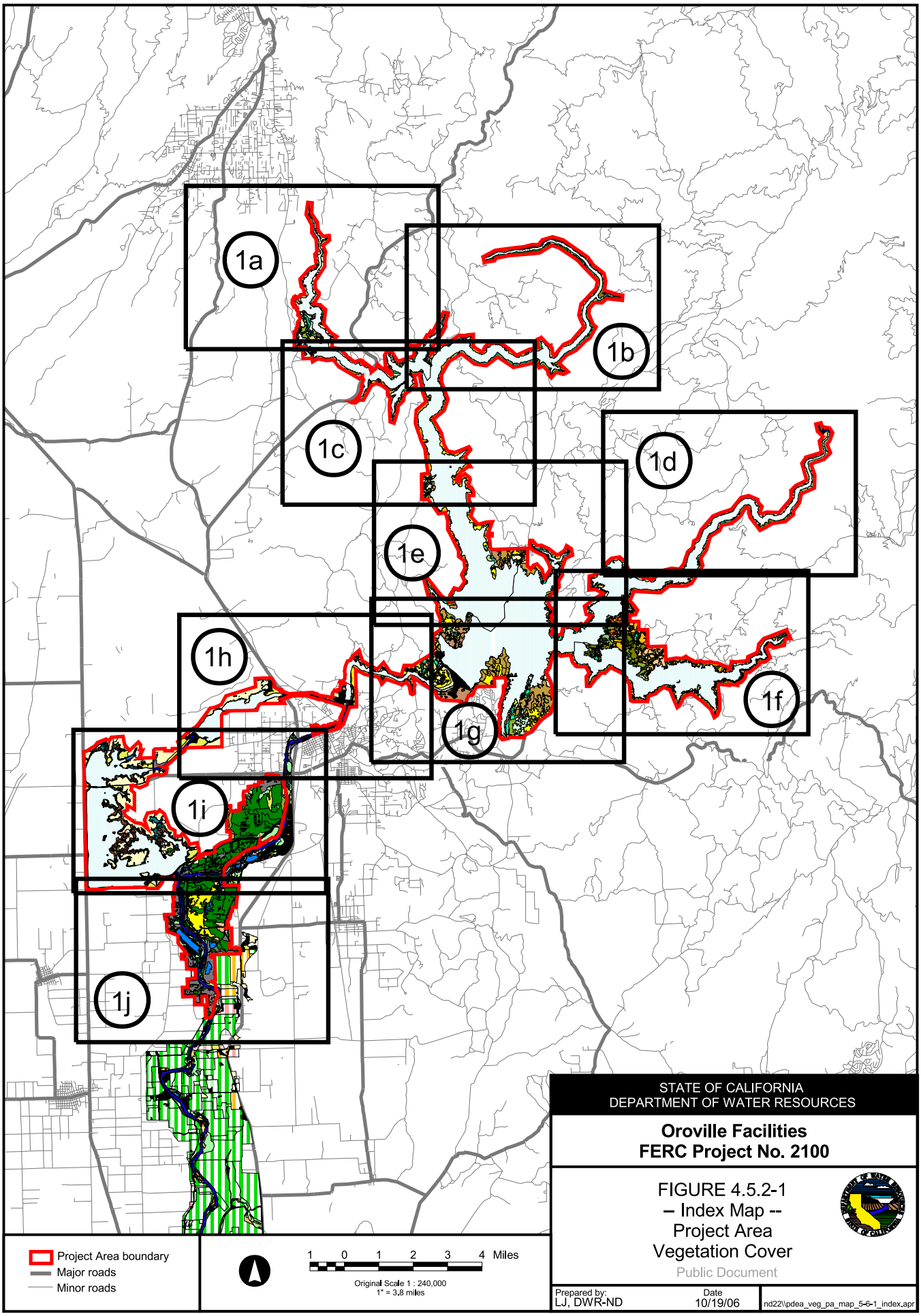
Table 4.5-6. Vegetation/land use within the study area.

Community Type	FERC Project Boundary		1 Mile Outside FERC Project Boundary		Feather River Floodplain	
	Acres	%	Acres	%	Acres	%
Upland Forest/Woodland	11,101	27	62,145	62	64	<1
Upland Herbaceous	2,752	7	12,218	12	2,661	8
Upland Shrub/Scrub	232	<1	2,289	2	0	0
Agriculture	126	<1	10,063	10	16,174	51
Disturbed/Urban/Bare	2,328	5	10,333	10	3,084	8
Riparian Forest/Woodland	3,238	8	1,043	1	4,269	13
Riparian Shrub/Scrub	215	<1	286	<1	2,175	7
Wetland	912	2	348	<1	210	<1
Open Water	19,796	48	767	<1	3,151	10
Aquatic/Submerged	443	1	33	<1	90	<1
TOTALS	**41,143**	**98**	**99,525**	**97**	**31,878**	**97**

Source: SP-T4

Vegetation communities are broad categories that represent an assemblage of similar vegetation association types. Vegetation associations are typically defined by dominant or co-dominant species and are based in part on the classification systems of Sawyer and Keeler-Wolf (1995) and Holland (1986). In total, seven natural vegetative community types were identified in the study area: upland forest/woodland, upland herbaceous, upland shrub/scrub, riparian forest/woodland, riparian shrub/scrub, wetlands, and aquatic/submerged vegetation. Other areas were mapped based on land uses such as disturbed, agriculture, urban or as rock outcrop, or open water (SP-T4). Nearly half (20,000 acres) of the 41,000 acres within the FERC Project boundary are surface waters. Discussion of these waters is not addressed here; however, plants that do inhabit backwaters and edges of these waters were mapped and are discussed under aquatic/submerged.

The majority of vegetation around Lake Oroville and the Diversion Pool consists of a variety of native vegetation associations including mixed oak woodlands, foothill pine/mixed oak woodlands, and oak/pine woodlands with a mosaic of chaparral. Open areas within the woodlands consist of annual grassland species. Below Oroville Dam and the Diversion Pool, vegetation around open waters of the Thermalito Complex consists of emergent wetland types with annual grasslands on the surrounding slopes. Open cottonwood riparian forests occur throughout much of the OWA, with mixed riparian and willow scrub near the Feather River.



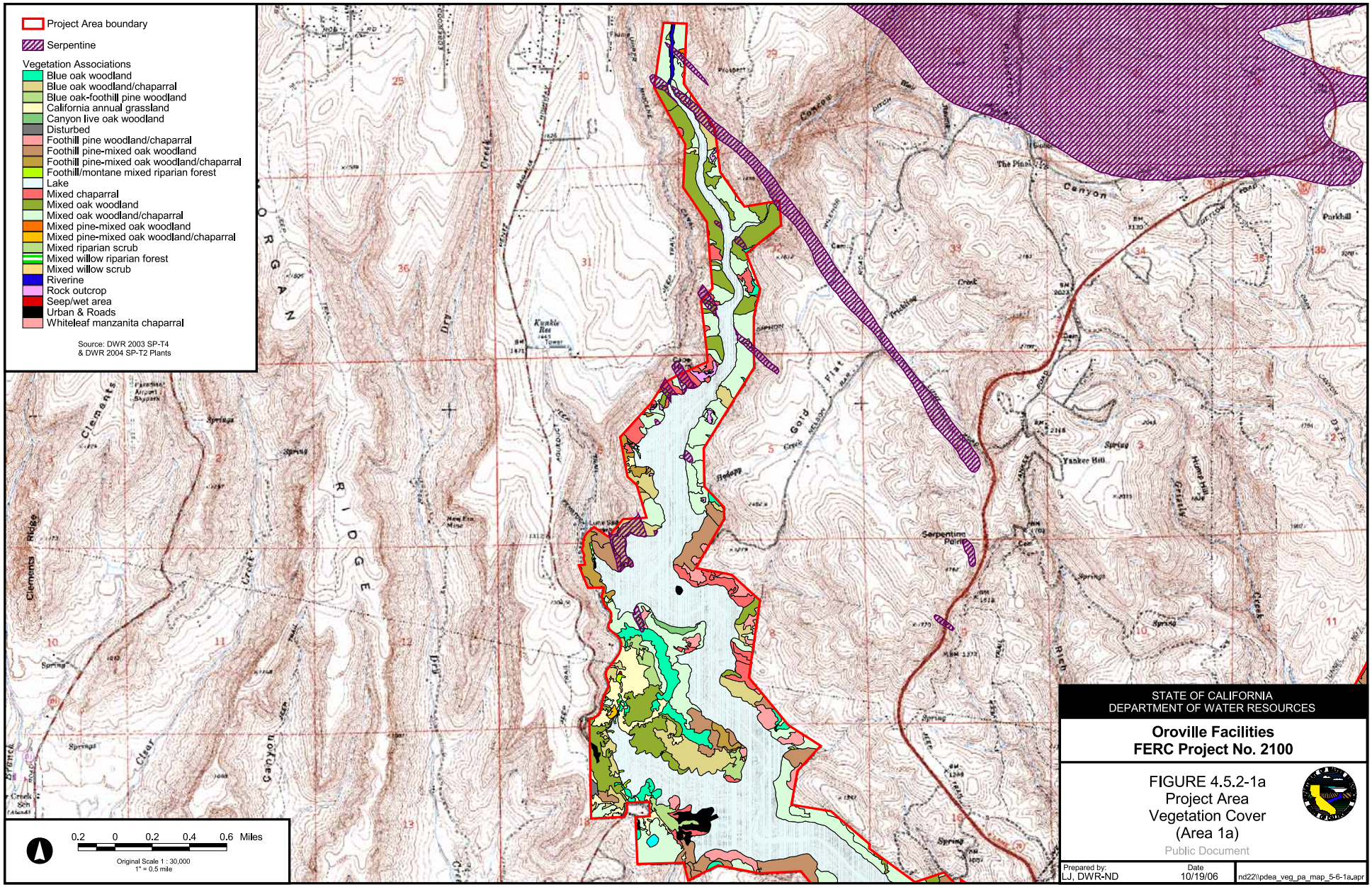
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Oroville Facilities
FERC Project No. 2100

FIGURE 4.5.2-1
– Index Map --
Project Area
Vegetation Cover

Public Document

Prepared by:	Date	
LJ, DWR-ND	10/19/06	nd22\\pdea_veg_pa_map_5-6-1_index.apr


Project Area boundary
Serpentine
Vegetation Associations
Blue oak woodland
Blue oak woodland/chaparral
Blue oak-foothill pine woodland
California annual grassland
Canyon live oak woodland
Disturbed
Foothill pine woodland/chaparral
Foothill pine-mixed oak woodland
Foothill pine-mixed oak woodland/chaparral
Foothill/montane mixed riparian forest
Lake
Mixed chaparral
Mixed oak woodland
Mixed oak woodland/chaparral
Mixed pine-mixed oak woodland
Mixed pine-mixed oak woodland/chaparral
Mixed riparian scrub
Mixed willow riparian forest
Mixed willow scrub
Riverine
Rock outcrop
Seep/wet area
Urban & Roads
Whiteleaf manzanita chaparral
Source: DWR 2003 SP-T4
& DWR 2004 SP-T2 Plants
0.2 0 0.2 0.4 0.6 Miles
Original Scale 1 : 30,000
1" = 0.5 mile
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Facilities
FERC Project No. 2100
FIGURE 4.5.2-1a
Project Area
Vegetation Cover
(Area 1a)
Public Document
Prepared by:
LJ, DWR-ND
Date
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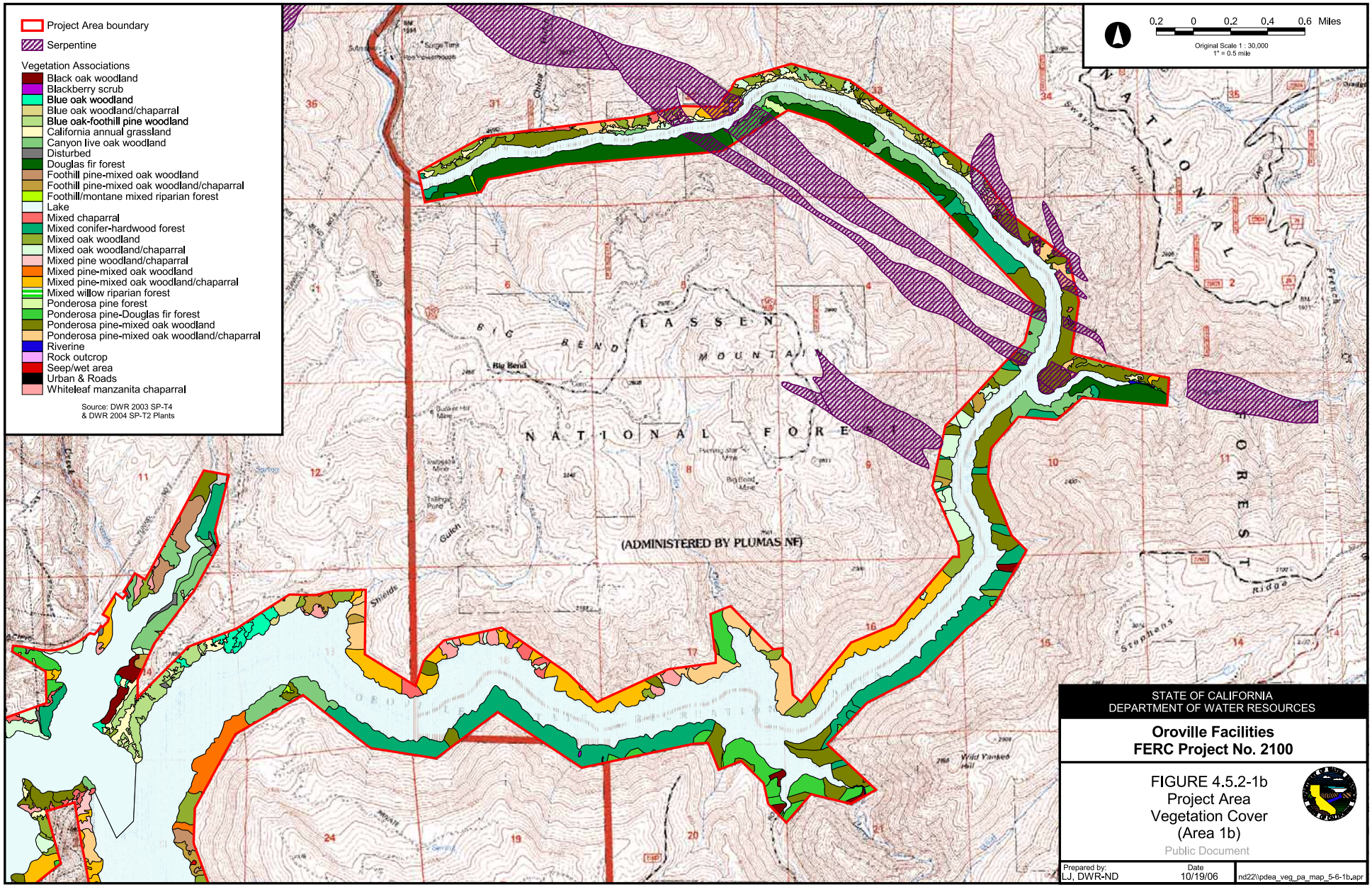
nd22\\pdea_veg_pa_map_5-6-1a.apr


Project Area boundary
Serpentine
Vegetation Associations
Black oak woodland
Blackberry scrub
Blue oak woodland
Blue oak woodland/chaparral
Blue oak-foothill pine woodland
California annual grassland
Canyon live oak woodland
Disturbed
Douglas fir forest
Foothill pine-mixed oak woodland
Foothill pine-mixed oak woodland/chaparral
Foothill/montane mixed riparian forest
Lake
Mixed chaparral
Mixed conifer-hardwood forest
Mixed oak woodland
Mixed oak woodland/chaparral
Mixed pine woodland/chaparral
Mixed pine-mixed oak woodland
Mixed pine-mixed oak woodland/chaparral
Mixed willow riparian forest
Ponderosa pine forest
Ponderosa pine-Douglas fir forest
Ponderosa pine-mixed oak woodland
Ponderosa pine-mixed oak woodland/chaparral
Riverine
Rock outcrop
Seep/wet area
Urban & Roads
Whiteleaf manzanita chaparral
Source: DWR 2003 SP-T4
& DWR 2004 SP-T2 Plants
0,2 0 0,2 0,4 0,6 Miles
Original Scale 1 : 30,000
1" = 0.5 mile
BIG BEND MOUNTAIN
LASSEN
NATIONAL FOREST
(ADMINISTERED BY PLUMAS NF)
Big Bend
Shields
Gulch
Ridge
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Facilities
FERC Project No. 2100
FIGURE 4.5.2-1b
Project Area
Vegetation Cover
(Area 1b)
Public Document
Prepared by:
LJ, DWR-ND
Date
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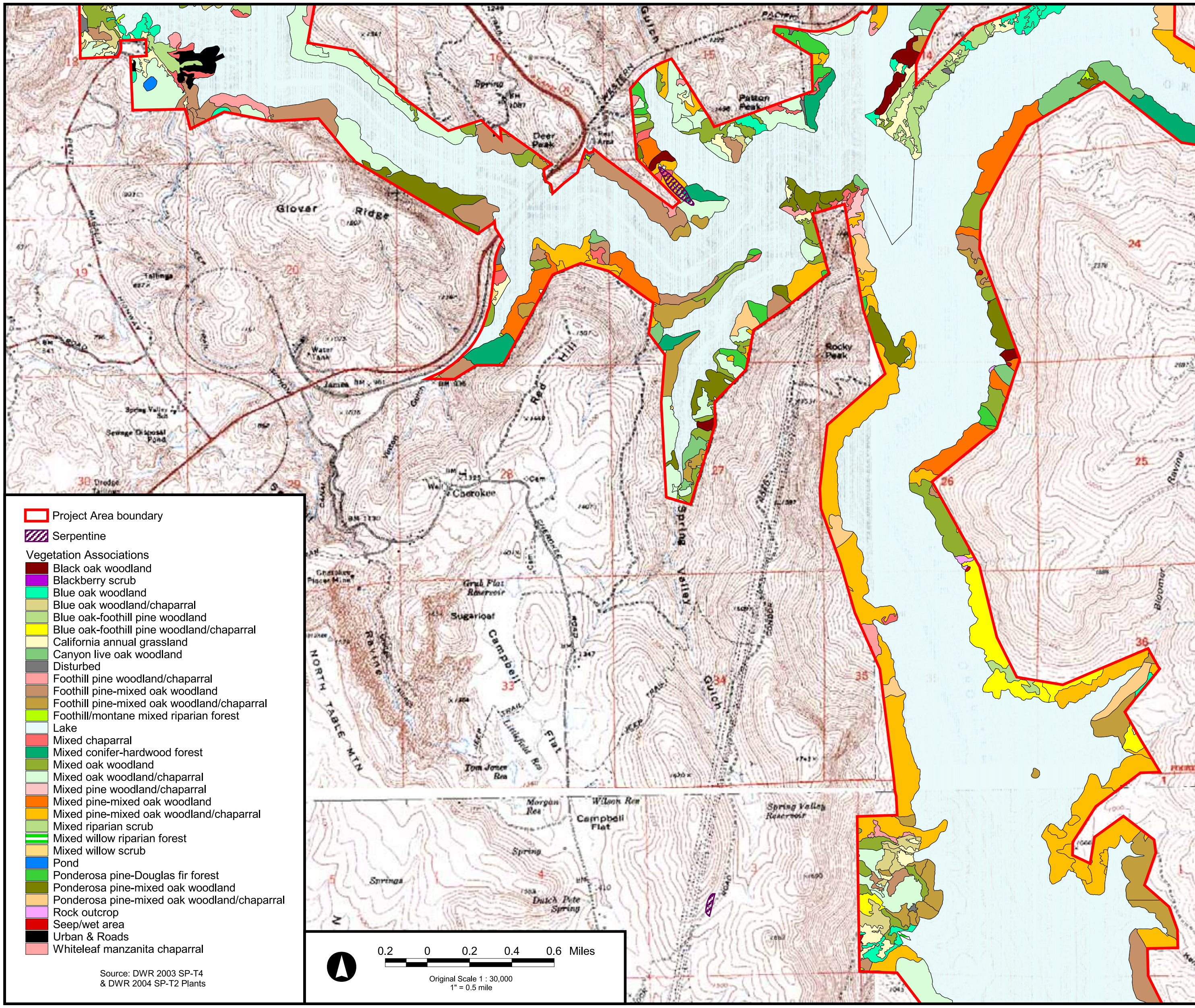
nd22\\pdea_veg_pa_map_5-6-1b.apr



Project Area boundary
Serpentine
Vegetation Associations
Black oak woodland
Blackberry scrub
Blue oak woodland
Blue oak woodland/chaparral
Blue oak-foothill pine woodland
Blue oak-foothill pine woodland/chaparral
California annual grassland
Canyon live oak woodland
Disturbed
Foothill pine woodland/chaparral
Foothill pine-mixed oak woodland
Foothill pine-mixed oak woodland/chaparral
Foothill/montane mixed riparian forest
Lake
Mixed chaparral
Mixed conifer-hardwood forest
Mixed oak woodland
Mixed oak woodland/chaparral
Mixed pine woodland/chaparral
Mixed pine-mixed oak woodland
Mixed pine-mixed oak woodland/chaparral
Mixed riparian scrub
Mixed willow riparian forest
Mixed willow scrub
Pond
Ponderosa pine-Douglas fir forest
Ponderosa pine-mixed oak woodland
Ponderosa pine-mixed oak woodland/chaparral
Rock outcrop
Seep/wet area
Urban & Roads
Whiteleaf manzanita chaparral
Source: DWR 2003 SP-T4
& DWR 2004 SP-T2 Plants
0.2 0 0.2 0.4 0.6 Miles
Original Scale 1 : 30,000
1" = 0.5 mile
Glover Ridge
Red Hill
Spring Valley
Gulch
Cherokee
Campbell Flat
Rocky Peak
Patton Peak
Deer Peak
Bloomer Hill
Bloomer Ravine
PLUMAS NAT FOR
NORTH TABLE MTN
Sugarloaf
Morgan Res
Wilson Res
Spring Valley Reservoir
Dutch Pete Spring
Tom Jones Res
Littlefield Res

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Oroville Facilities
FERC Project No. 2100

FIGURE 4.5.2-1c
Project Area
Vegetation Cover
(Area 1c)

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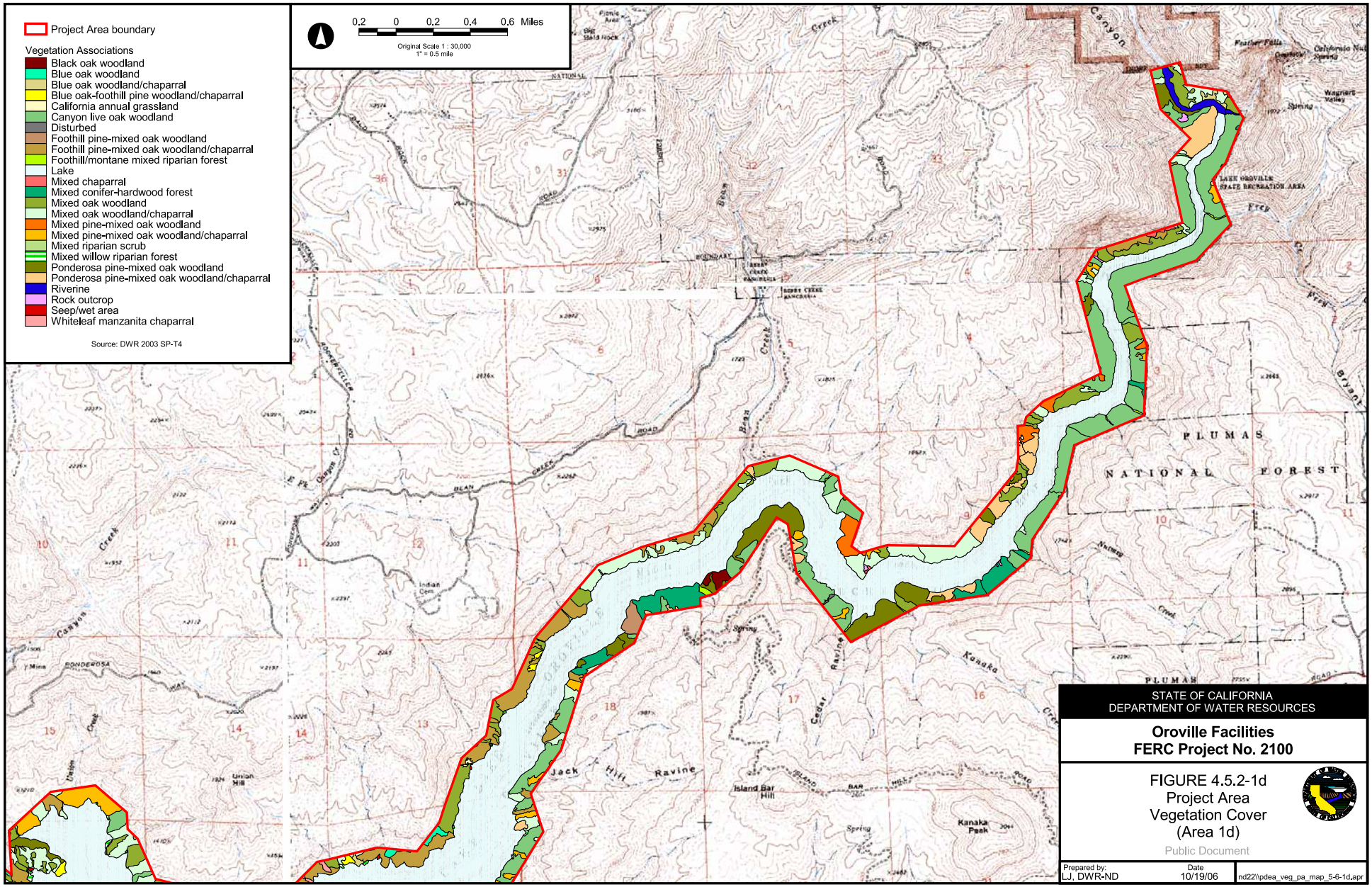
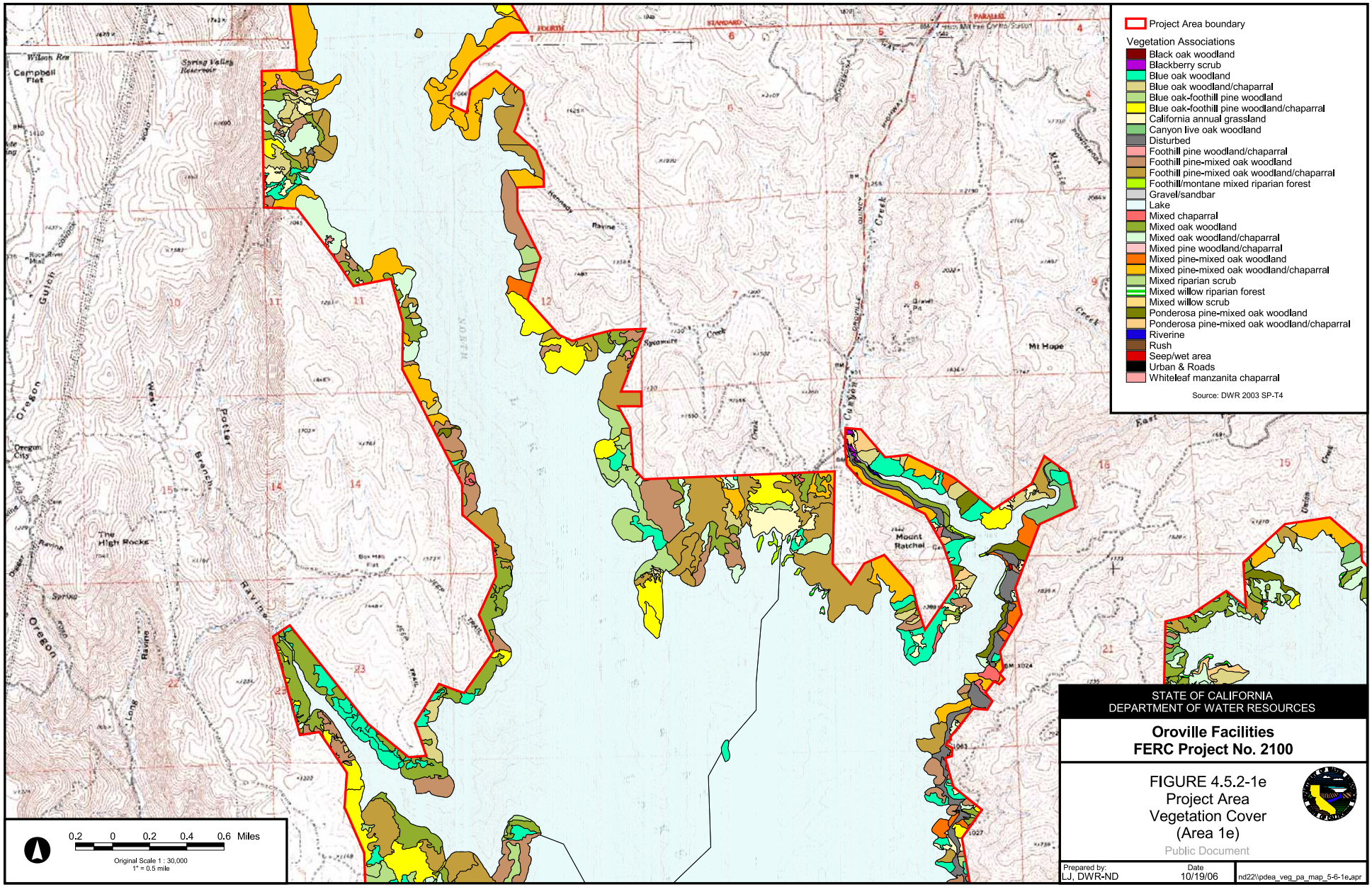
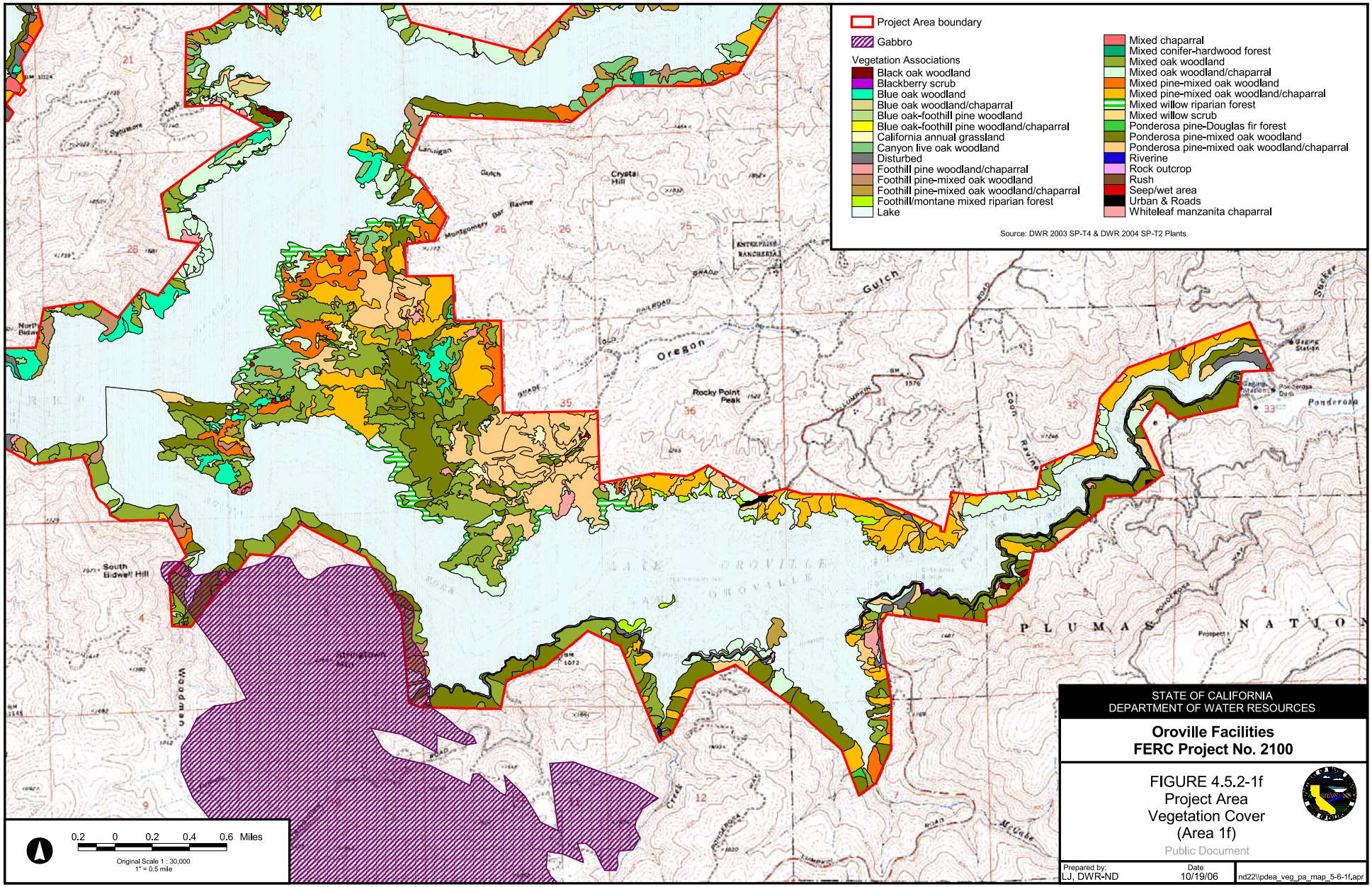

Project Area boundary
Vegetation Associations
Black oak woodland
Blue oak woodland
Blue oak woodland/chaparral
Blue oak-foothill pine woodland/chaparral
California annual grassland
Canyon live oak woodland
Disturbed
Foothill pine-mixed oak woodland
Foothill pine-mixed oak woodland/chaparral
Foothill/montane mixed riparian forest
Lake
Mixed chaparral
Mixed conifer-hardwood forest
Mixed oak woodland
Mixed oak woodland/chaparral
Mixed pine-mixed oak woodland
Mixed pine-mixed oak woodland/chaparral
Mixed riparian scrub
Mixed willow riparian forest
Ponderosa pine-mixed oak woodland
Ponderosa pine-mixed oak woodland/chaparral
Riverine
Rock outcrop
Seep/wet area
Whiteleaf manzanita chaparral
Source: DWR 2003 SP-T4
0,2 0 0,2 0,4 0,6 Miles
Original Scale 1 : 30,000
1" = 0.5 mile
PLUMAS NATIONAL FOREST
LAKE OROVILLE STATE RECREATION AREA
Jack Hill Ravine
Island Bar Hill
Kanaka Peak
Indian Cem.
Union Hill
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Facilities
FERC Project No. 2100
FIGURE 4.5.2-1d
Project Area
Vegetation Cover
(Area 1d)
Public Document
Prepared by:
LJ, DWR-ND
Date
10/19/06
nd22\\pdea_veg_pa_map_5-6-1d.apr


Project Area boundary
Vegetation Associations
Black oak woodland
Blackberry scrub
Blue oak woodland
Blue oak woodland/chaparral
Blue oak-foothill pine woodland
Blue oak-foothill pine woodland/chaparral
California annual grassland
Canyon live oak woodland
Disturbed
Foothill pine woodland/chaparral
Foothill pine-mixed oak woodland
Foothill pine-mixed oak woodland/chaparral
Foothill/montane mixed riparian forest
Gravel/sandbar
Lake
Mixed chaparral
Mixed oak woodland
Mixed oak woodland/chaparral
Mixed pine woodland/chaparral
Mixed pine-mixed oak woodland
Mixed pine-mixed oak woodland/chaparral
Mixed riparian scrub
Mixed willow riparian forest
Mixed willow scrub
Ponderosa pine-mixed oak woodland
Ponderosa pine-mixed oak woodland/chaparral
Riverine
Rush
Seep/wet area
Urban & Roads
Whiteleaf manzanita chaparral
Source: DWR 2003 SP-T4
0.2 0 0.2 0.4 0.6 Miles
Original Scale 1 : 30,000
1" = 0.5 mile
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Facilities
FERC Project No. 2100
FIGURE 4.5.2-1e
Project Area
Vegetation Cover
(Area 1e)
Public Document
Prepared by:
LJ, DWR-ND
Date
10/19/06
nd22\\pdea_veg_pa_map_5-6-1e.apr



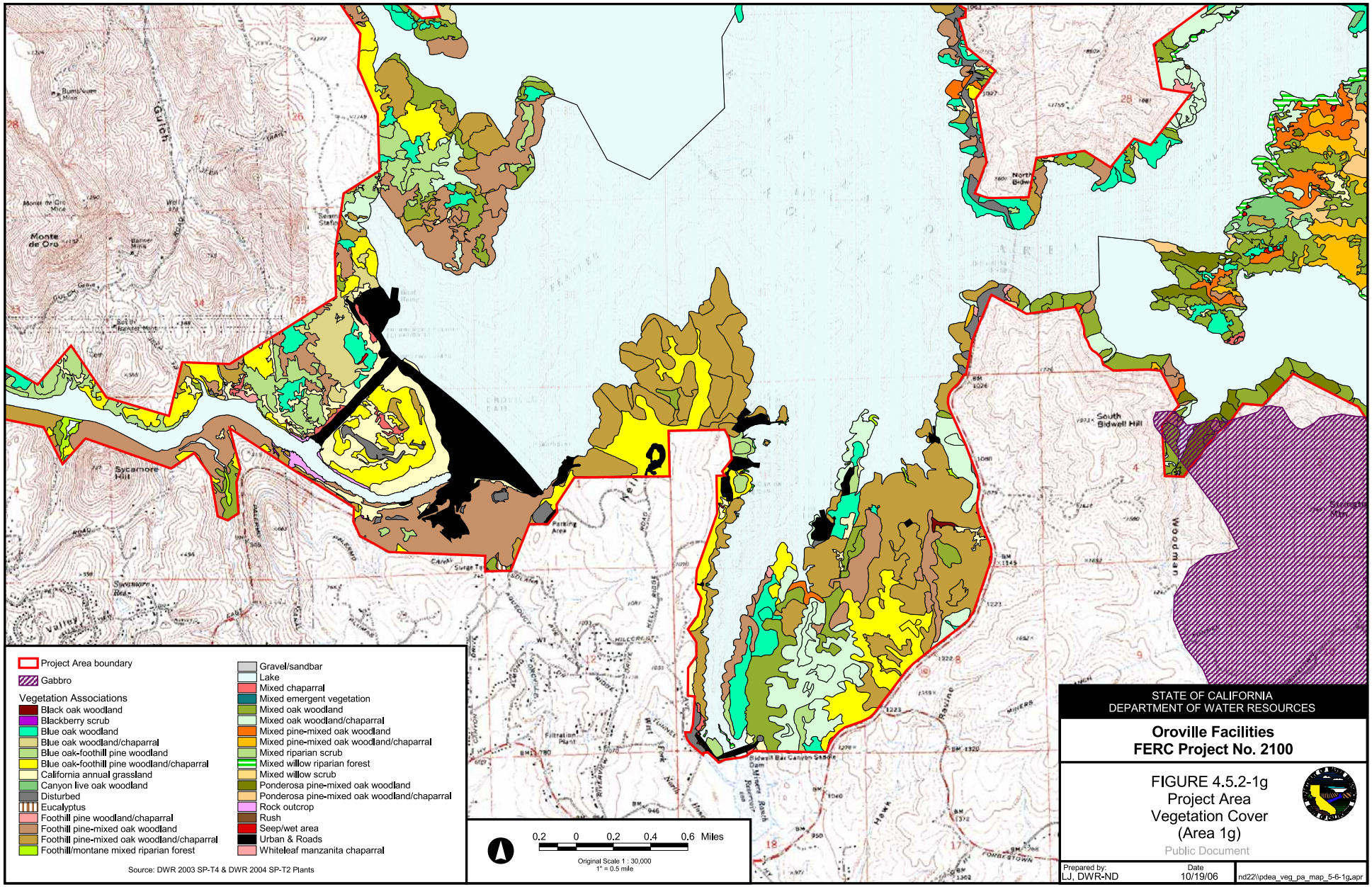
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

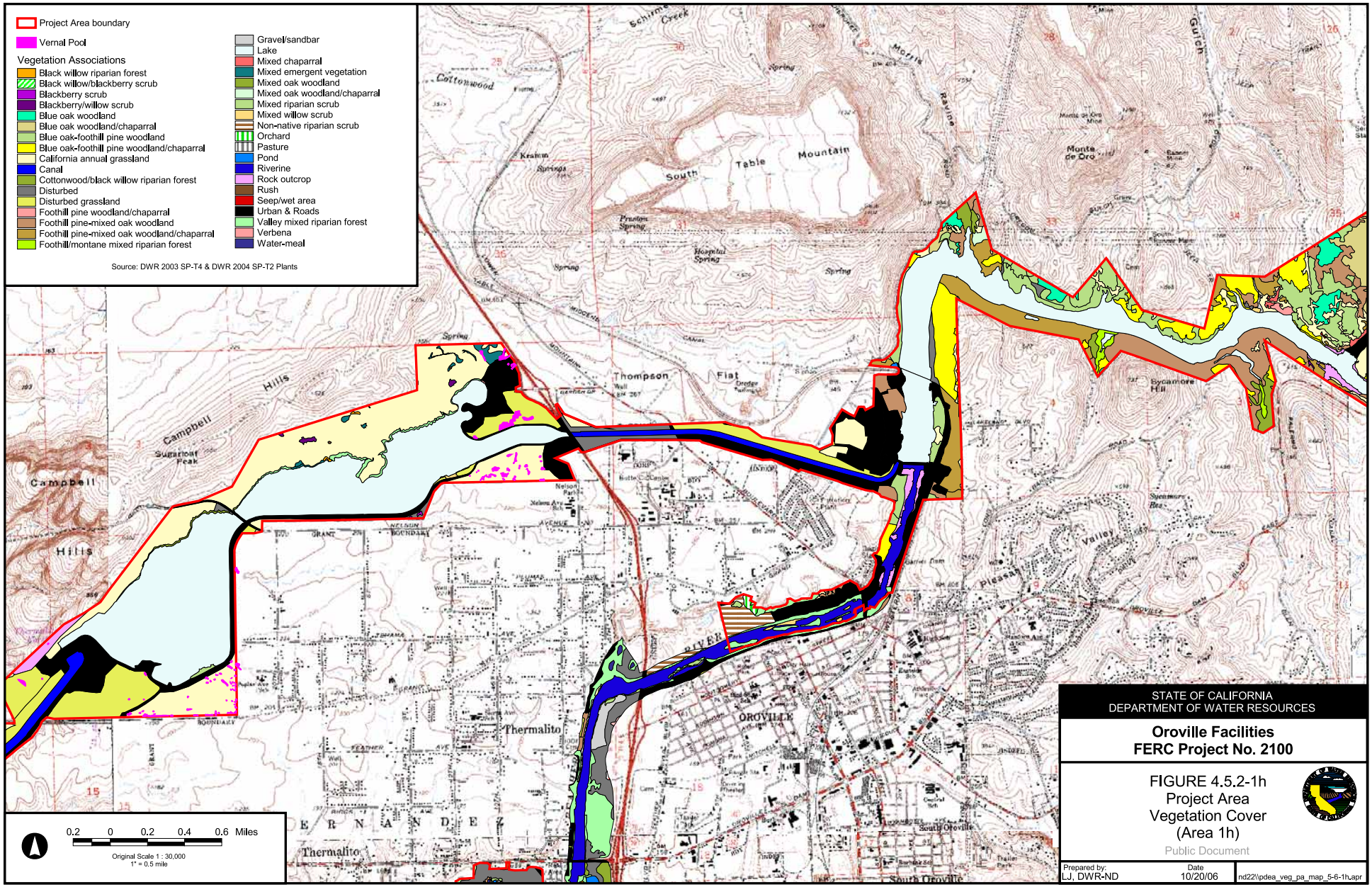
Oroville Facilities
FERC Project No. 2100

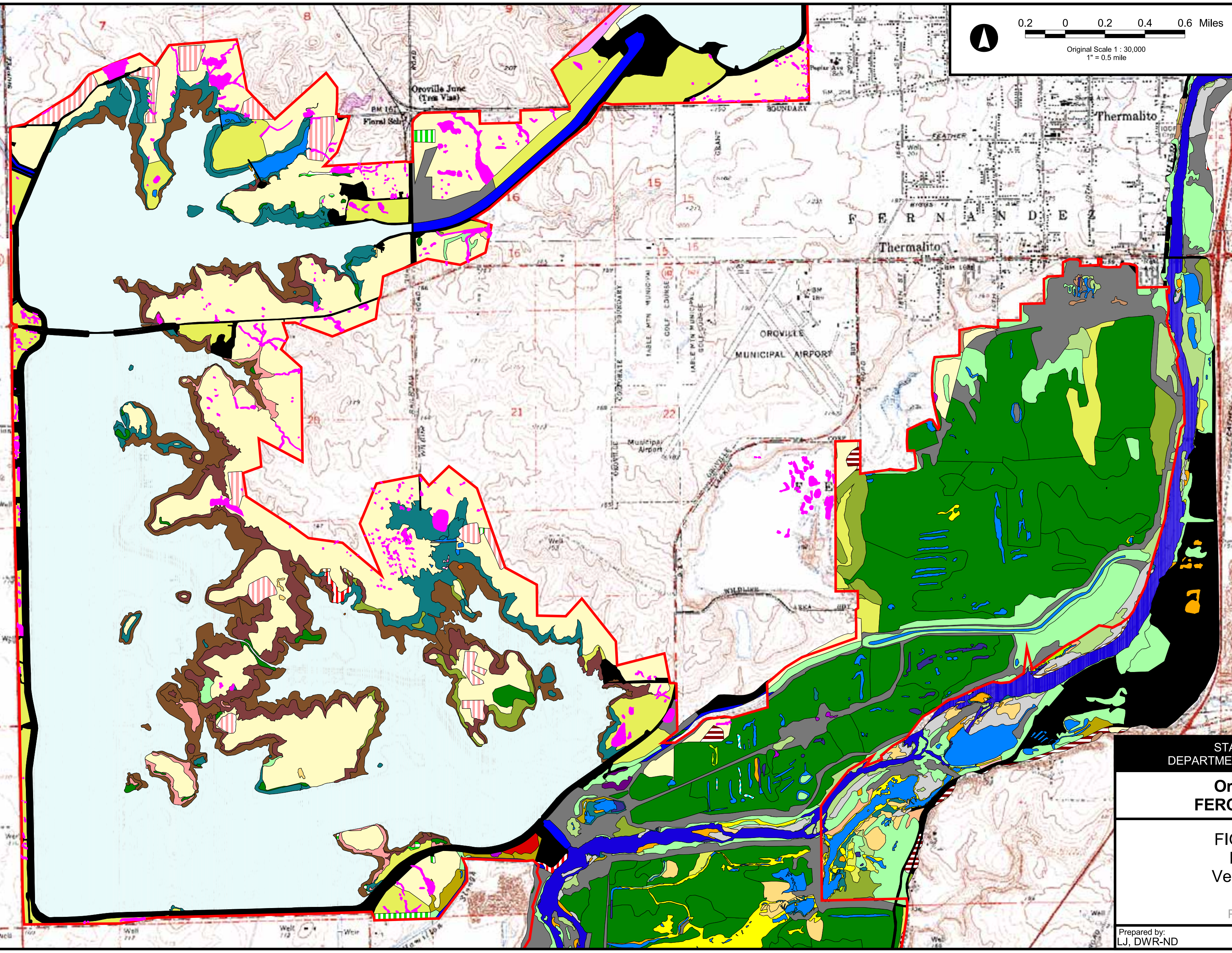
FIGURE 4.5.2-1f
Project Area
Vegetation Cover
(Area 1f)

Public Document

Prepared by:	Date	
LJ, DWR-ND	10/19/06	nd22\\pdea_veg_pa_map_5-6-1f.apr


Project Area boundary
Gabbro
Vegetation Associations
Black oak woodland
Blackberry scrub
Blue oak woodland
Blue oak woodland/chaparral
Blue oak-foothill pine woodland
Blue oak-foothill pine woodland/chaparral
California annual grassland
Canyon live oak woodland
Disturbed
Eucalyptus
Foothill pine woodland/chaparral
Foothill pine-mixed oak woodland
Foothill pine-mixed oak woodland/chaparral
Foothill/montane mixed riparian forest
Gravel/sandbar
Lake
Mixed chaparral
Mixed emergent vegetation
Mixed oak woodland
Mixed oak woodland/chaparral
Mixed pine-mixed oak woodland
Mixed pine-mixed oak woodland/chaparral
Mixed riparian scrub
Mixed riparian forest
Mixed willow scrub
Ponderosa pine-mixed oak woodland
Ponderosa pine-mixed oak woodland/chaparral
Rock outcrop
Rush
Seep/wet area
Urban & Roads
Whiteleaf manzanita chaparral
Source: DWR 2003 SP-T4 & DWR 2004 SP-T2 Plants
0.2 0 0.2 0.4 0.6 Miles
Original Scale 1 : 30,000
1" = 0.5 mile
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Facilities
FERC Project No. 2100
FIGURE 4.5.2-1g
Project Area
Vegetation Cover
(Area 1g)
Public Document
Prepared by:
LJ, DWR-ND
Date
10/19/06
nd22\\pdea_veg_pa_map_5-6-1g.apr


Project Area boundary
Vernal Pool
Vegetation Associations
Black willow riparian forest
Black willow/blackberry scrub
Blackberry scrub
Blackberry/willow scrub
Blue oak woodland
Blue oak woodland/chaparral
Blue oak-foothill pine woodland
Blue oak-foothill pine woodland/chaparral
California annual grassland
Canal
Cottonwood/black willow riparian forest
Disturbed
Disturbed grassland
Foothill pine woodland/chaparral
Foothill pine-mixed oak woodland
Foothill pine-mixed oak woodland/chaparral
Foothill/montane mixed riparian forest
Gravel/sandbar
Lake
Mixed chaparral
Mixed emergent vegetation
Mixed oak woodland
Mixed oak woodland/chaparral
Mixed riparian scrub
Mixed willow scrub
Non-native riparian scrub
Orchard
Pasture
Pond
Riverine
Rock outcrop
Rush
Seep/wet area
Urban & Roads
Valley mixed riparian forest
Verbena
Water-meal
Source: DWR 2003 SP-T4 & DWR 2004 SP-T2 Plants
0.2 0 0.2 0.4 0.6 Miles
Original Scale 1 : 30,000
1" = 0.5 mile
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Facilities
FERC Project No. 2100
FIGURE 4.5.2-1h
Project Area
Vegetation Cover
(Area 1h)
Public Document
Prepared by:
LJ, DWR-ND
Date
10/20/06
nd22\\pdea_veg_pa_map_5-6-1h.apr



- Project Area boundary
- Vernal Pool

Vegetation Associations

- Algae
- Black willow riparian forest
- Black willow/white alder riparian forest
- Blackberry scrub
- Blackberry/willow scrub
- Bulrush
- California annual grassland
- Canal
- Cattail
- Cottonwood/black willow riparian forest
- Disturbed
- Disturbed grassland
- Elderberry riparian scrub
- Eucalyptus
- Foothill pine-mixed oak woodland
- Fremont cottonwood riparian forest
- Gravel tailings
- Gravel/sandbar
- Lake
- Mixed aquatic
- Mixed emergent vegetation
- Mixed oak woodland
- Mixed riparian scrub
- Mixed willow riparian forest
- Mixed willow scrub
- Mosquito fern
- Narrowleaf willow scrub
- Non-native riparian forest
- Non-native riparian scrub
- Orchard
- Pasture
- Pond
- Rice
- Riverine
- Rock outcrop
- Row crops
- Rush
- Rush/Verbena
- Urban & Roads
- Valley mixed riparian forest
- Valley oak riparian forest
- Valley oak woodland
- Verbena
- Water primrose
- Water-meal

Source: DWR 2003 SP-T4
& DWR 2004 SP-T2 Plants

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Oroville Facilities
FERC Project No. 2100

FIGURE 4.5.2-1i
Project Area
Vegetation Cover
(Area 1i)

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Prepared by:	Date	
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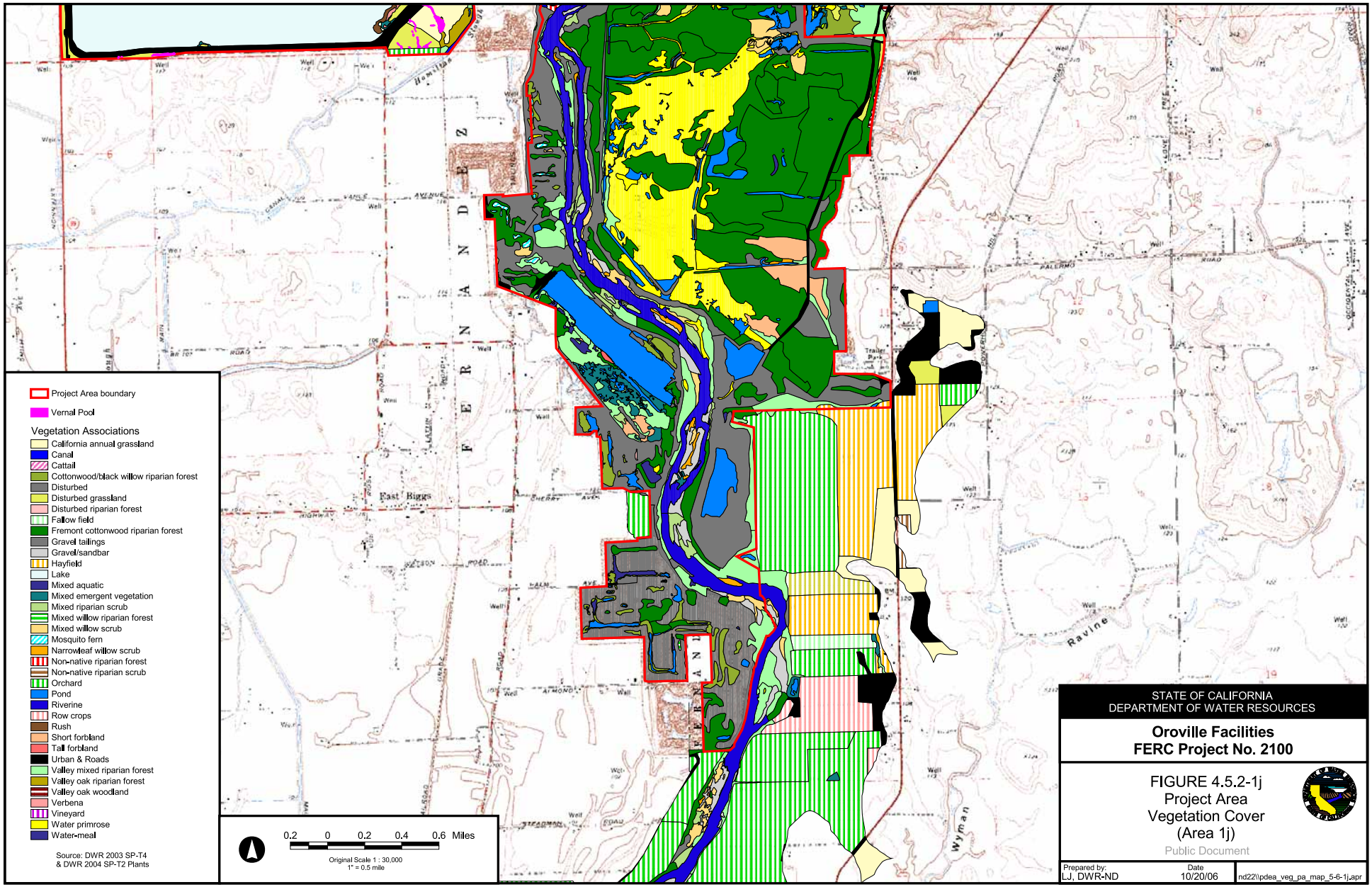

Project Area boundary
Vernal Pool
Vegetation Associations
California annual grassland
Canal
Cattail
Cottonwood/black willow riparian forest
Disturbed
Disturbed grassland
Disturbed riparian forest
Fallow field
Fremont cottonwood riparian forest
Gravel tailings
Gravel/sandbar
Hayfield
Lake
Mixed aquatic
Mixed emergent vegetation
Mixed riparian scrub
Mixed willow riparian forest
Mixed willow scrub
Mosquito fern
Narrowleaf willow scrub
Non-native riparian forest
Non-native riparian scrub
Orchard
Pond
Riverine
Row crops
Rush
Short forbland
Tall forbland
Urban & Roads
Valley mixed riparian forest
Valley oak riparian forest
Valley oak woodland
Verbena
Vineyard
Water primrose
Water-meal
Source: DWR 2003 SP-T4
& DWR 2004 SP-T2 Plants
0.2 0 0.2 0.4 0.6 Miles
Original Scale 1 : 30,000
1" = 0.5 mile
East Biggs
Ravine
Wyman
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Facilities
FERC Project No. 2100
FIGURE 4.5.2-1j
Project Area
Vegetation Cover
(Area 1j)
Public Document
Prepared by:
LJ, DWR-ND
Date
10/20/06
nd22\\pdea_veg_pa_map_5-6-1j.apr

Two types of special-status species habitat are found within the project area. Vernal pools and serpentine/gabbro soils (SP-T2) were mapped during special-status species surveys. However, these habitats were not included in the vegetation communities/land use mapping project. These unique communities were mapped using a combination of aerial photos, soils and geologic maps, and field surveys.

Upland Communities

Upland Forest/Woodland Community. The upland forest/woodland community is the largest community in the project area, occupying over 11,100 acres. Lands around Lake Oroville and the Diversion Pool are mostly composed of open to dense woodland, forest, and chaparral communities. Although there is some degree of disturbance (dirt roads, natural land slides, etc.) in these vegetation types, the majority of this area is in a mostly natural state.

Upland woodland/forests in the vicinity of the project area are composed of a variety of mixed oak woodlands, foothill pine/mixed oak woodlands, and oak/pine woodlands with a mosaic of chaparral. Twenty-one associations of upland woodland/forest types were identified in the project area. Typical dominant species include interior and canyon live oaks (*Quercus wislizenii, Q. chrysolepis*), blue oak (*Q. douglasii*), and foothill pine (*Pinus sabiniana*). Blue oak woodland dominates the lower elevations but drops out fairly quickly as the dominant woodland type with distance upstream from the dam and is replaced by live oaks and foothill pine. Farther up the arms of the reservoir, live oaks and foothill pine are replaced by mixed hardwood/conifer types, composed of ponderosa pine (*Pinus ponderosa*), Douglas-fir (*Pseudotsuga menziesii*), black oak (*Quercus kelloggii*), madrone (*Arbutus menziesii*), and canyon live oak.

Upland Herbaceous Communities. Approximately 392 acres of annual grasslands occur above the dam, usually as small openings among woodland, forest, and chaparral vegetation. Around Thermalito Forebay and Thermalito Afterbay, annual grasslands are the major upland vegetation type, occupying over 2,300 acres. Annual grasslands are composed mostly of non-native annual grasses such as soft chess (*Bromus hordeaceus*), red brome (*B. madritensis* ssp. *rubens*), and wild oats (*Avena* spp.); however, native forbs such as lupine (*Lupinus* spp.), clarkia (*Clarkia* spp.), and popcorn flower (*Plagiobothrys* spp.) and perennial bulbs such as brodiaea (*Brodiaea* ssp.) and Mariposa lily (*Calochortus luteus)* are interspersed with the grasses. Some grassland areas are heavily infested with the noxious weeds yellow starthistle (*Centaurea solstitialis*) and medusahead grass (*Taeniatherum caput-medusae*).

Vernal pools and vernal pool/swale complexes are a common part of the valley grassland habitats in this area and are discussed in further detail under special-status plant habitats.

Upland Shrub/Scrub Communities. Approximately 232 acres of upland shrub/scrub communities (chaparral) occur within the FERC Project boundary around Lake Oroville and the Diversion Pool. Shrub/scrub vegetation in the project vicinity consists mostly of chaparral vegetation, which is characterized by evergreen, tough waxy leaves.

Common chaparral species include whiteleaf manzanita (*Arctostaphylos viscida*), buckbrush (*Ceanothus cuneatus*), toyon (*Heteromeles arbutifolia*), and scrub oak (*Quercus berberidifolia*). Chaparral is typically found on soils that are rocky or gravelly, and nutrient poor. Wildfire is a fundamental component of chaparral ecosystems, and most species have adaptations that encourage regrowth after fire. Stands of chaparral that undergo many years without fire are extremely flammable due to accumulated standing dead vegetation, leaf litter, and resinous foliage.

Agricultural and Disturbed Lands

Agriculture. A small number of areas (126 acres) within the FERC Project boundary are currently developed for agricultural uses. Approximately 100 acres within the grasslands surrounding Thermalito Afterbay have been converted to dryland cereal crop production for the benefit of waterfowl. Other agricultural types within the FERC Project boundary include eucalyptus groves, deciduous and evergreen orchards, vineyards, and rice fields.

Disturbed/Urban/Bare. Approximately 2,300 acres of disturbed areas were mapped within the FERC Project boundary, which include lands mostly barren of vegetation. These may be lands that have a high degree of human disturbance such as urban (developed) areas, levees, roads, gravel tailings from historic mining activities, gravel bars that result from natural processes, and natural rock outcrops.

Riparian Communities

The project area and the Feather River have a history of land uses that have affected natural river processes within the floodplain, including hydraulic mining, gravel mining, gold dredging, timber harvesting, construction of levees and dams, water diversion, agricultural encroachment, and urbanization. Historically, river systems in the project area were flanked by extensive floodplains that supported riparian forests and associated wetlands (Katibah 1984).

Riparian zones typically consist of a mosaic of vegetation types of various ages and species. Cottonwoods (*Populus fremontii*) and willows (*Salix* spp.) are usually the first species to colonize bare streambanks and bars. As vegetation from one cohort matures, it traps sediment and provides habitat for later successional species. Riparian shrub/scrub vegetation typically occurs along the margins of rivers and streams that are continually disturbed by point-bar deposition during higher flows.

A comprehensive vegetative/cover map was developed for riparian and wetland resources within the FERC Project boundary and the Feather River FEMA 100-year floodplain downstream of Oroville Dam. A riparian and wetland resource study including riparian recruitment downstream of the dam was conducted under SP-T3/5 and may be found in Figures 4.5.2-2 and 4.5.2-2a through 4.5.2-2g.

Riparian Forest/Woodlands. Approximately 3,238 acres of riparian forest/woodland occur within the FERC Project boundary. Over 2,450 acres of Fremont cottonwood forest occur within the project area; most of this acreage occurs in the OWA. Other

riparian forest types in the OWA include valley mixed riparian (490 acres), mixed willow riparian (99 acres), and cottonwood/black willow riparian (117 acres). Eighteen acres of riparian vegetation dominated by valley oaks occur in and around the OWA.

A very small percentage of these habitat acreages occur upstream of the dam. Around Lake Oroville, native riparian habitats are restricted to narrow strips along drainages, consisting mostly of alders, willows, and occasional cottonwoods and sycamores. A small amount of riparian vegetation occurs around the Thermalito Complex. The north shore of Thermalito Forebay is lined with a thin strip of mixed riparian species (mostly willows) with an understory of emergent wetland vegetation. Cottonwoods and willows occur in scattered areas around the high water elevation of Thermalito Afterbay.

Riparian Shrub/Scrub. During relicensing studies, 215 acres of riparian shrub habitat were mapped within the project area. These shrub associations occur almost entirely along the Feather River directly upstream and downstream of the Thermalito Afterbay Outlet. They are a mix of species but are predominately Arroyo willow (*Salix lasiolepis*) and sandbar willow (*S. exigua*). Non-native species such as giant reed (*Arundo donax*) and scarlet wisteria (*Sesbania punicea*) are prominent in the riparian shrub community along the Feather River above the outlet in the Low Flow Channel (LFC).

Wetland/Aquatic Communities

Wetlands. Wetlands are areas that are inundated or saturated by surface water or groundwater at a frequency or duration to support a prevalence of hydrophytic vegetation (plants that are specially adapted to inundated or saturated soils). Wetlands generally include marshes, ponds, bogs, and vernal pools.

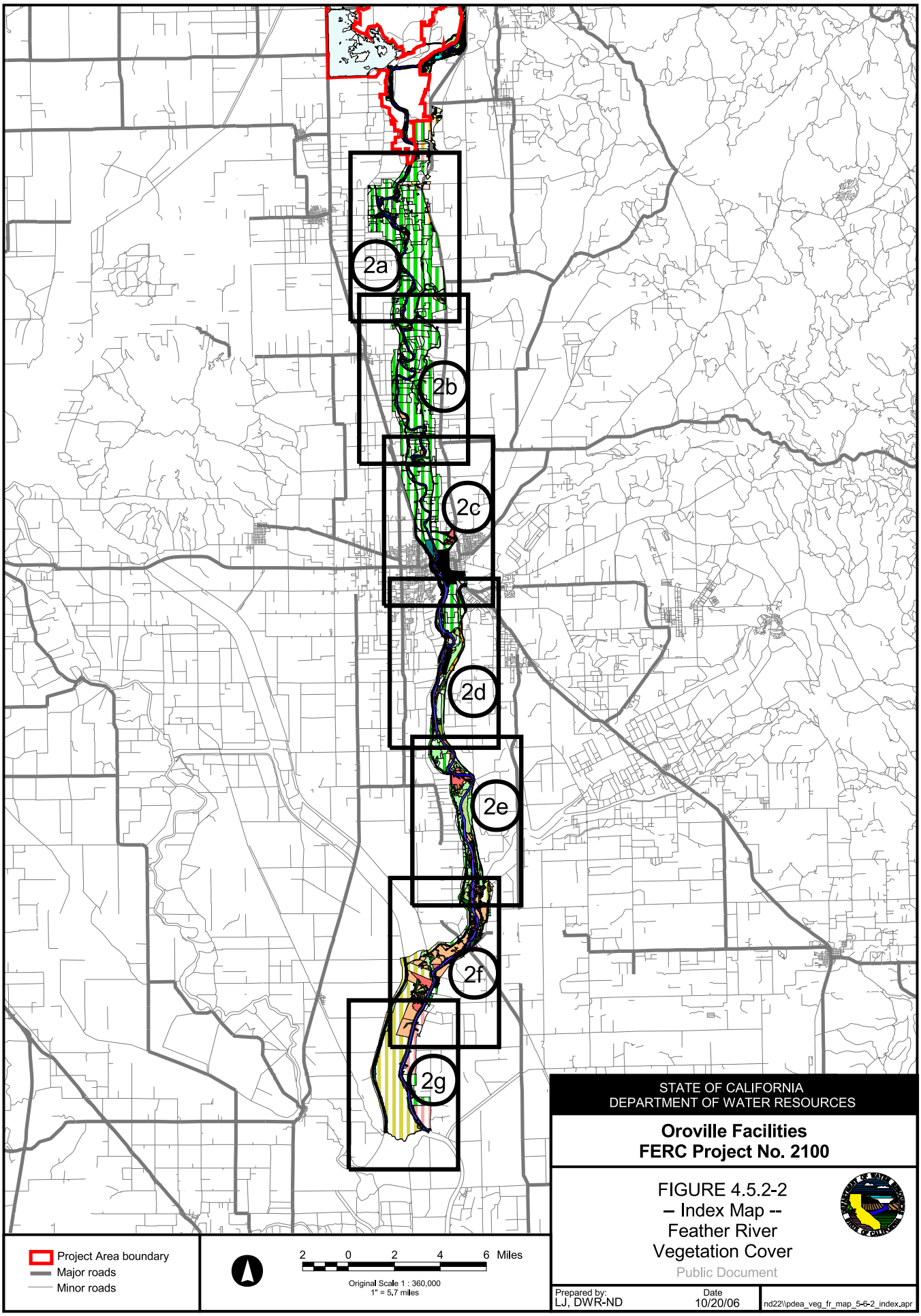
A total of 912 acres of wetland vegetation were mapped in the project area (Table 4.5-7), most of which occurs around Thermalito Afterbay. Less than 7 acres of wetland vegetation occurs around Lake Oroville and the Diversion Pool, mostly associated with seeps and springs that are a natural part of the landscape above the high-water line.

Approximately 42 acres of emergent wetland vegetation occur along the edges of ponds in the OWA.

Table 4.5-7. Acreages of wetland vegetation types for major project features.

	Thermalito Afterbay	Thermalito Forebay	Diversion Pool	Lake Oroville	OWA
Bulrush	<1	0	0	0	0
Cattail	<1	0	0	0	<1
Mixed emergent	234	10	0	<1	42
Rush	381	<1	0	<1	0
Rush/verbena	201	0	0	0	0
Verbena	36	<1	0	0	0
Seep/wet area	0	0	<1	6	0
Totals	**852**	**11**	**<1**	**6**	**42**

Source: SP-T3/5



STATE OF CALIFORNIA
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Oroville Facilities
FERC Project No. 2100

FIGURE 4.5.2-2
– Index Map --
Feather River
Vegetation Cover

Public Document

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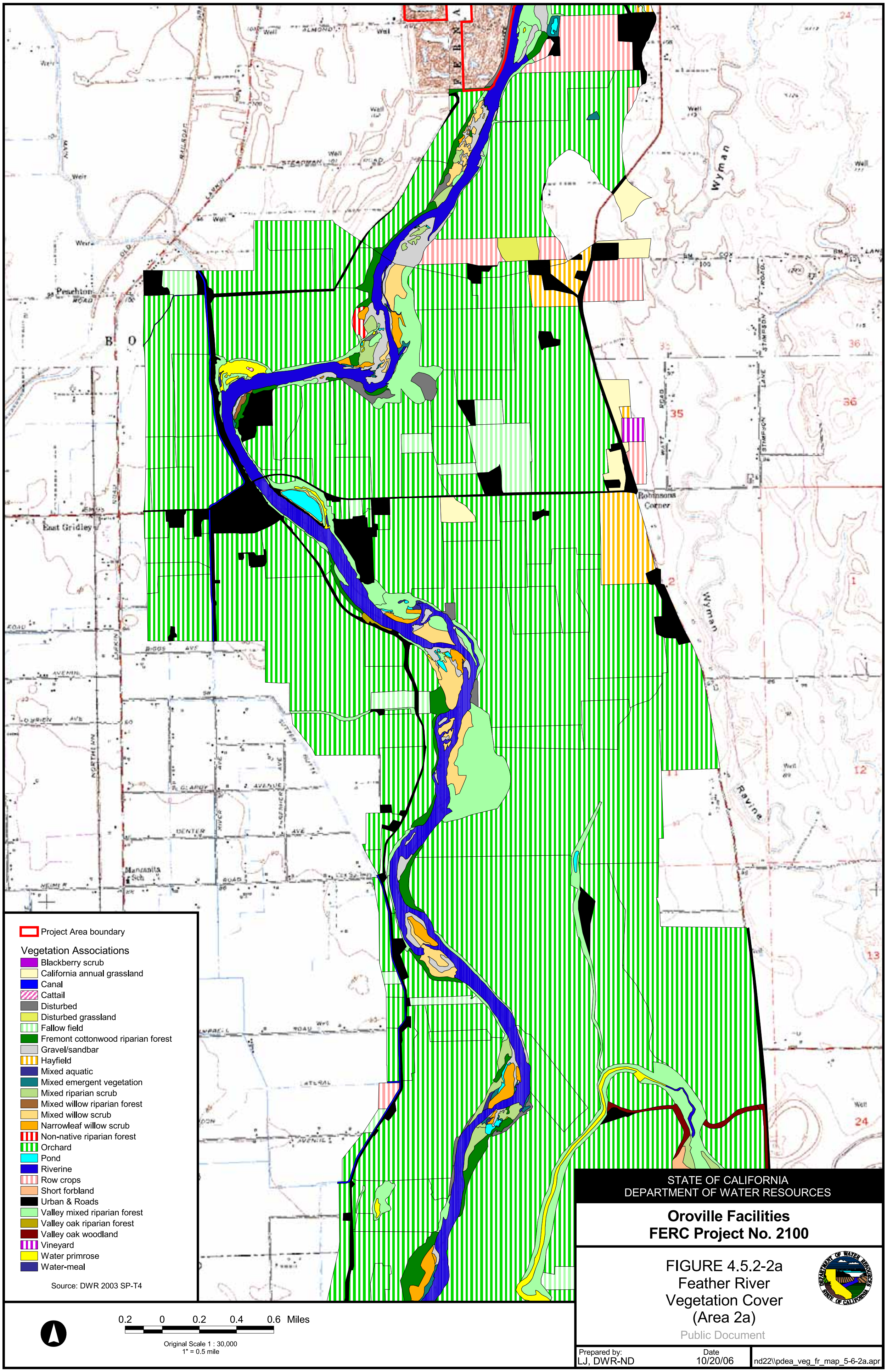
LJ, DWR-ND	10/20/06	nd22\\pdea_veg_fr_map_5-6-2_index.apr


Project Area boundary
Vegetation Associations
Blackberry scrub
California annual grassland
Canal
Cattail
Disturbed
Disturbed grassland
Fallow field
Fremont cottonwood riparian forest
Gravel/sandbar
Hayfield
Mixed aquatic
Mixed emergent vegetation
Mixed riparian scrub
Mixed willow riparian forest
Mixed willow scrub
Narrowleaf willow scrub
Non-native riparian forest
Orchard
Pond
Riverine
Row crops
Short forbland
Urban & Roads
Valley mixed riparian forest
Valley oak riparian forest
Valley oak woodland
Vineyard
Water primrose
Water-meal
Source: DWR 2003 SP-T4
0.2 0 0.2 0.4 0.6 Miles
Original Scale 1 : 30,000
1" = 0.5 mile
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Facilities
FERC Project No. 2100
FIGURE 4.5.2-2a
Feather River
Vegetation Cover
(Area 2a)
Public Document
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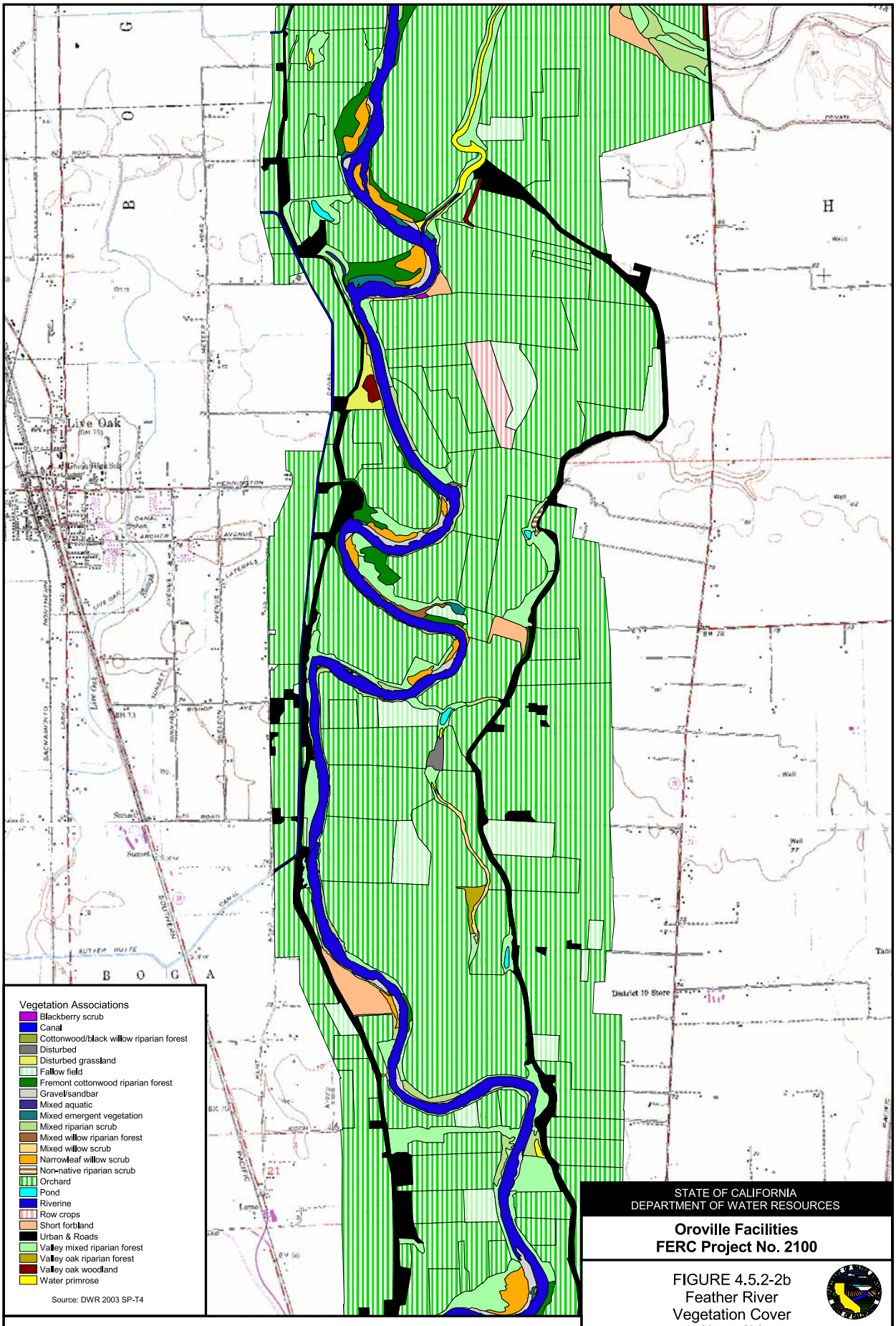
Live Oak
Sutter Butte
Vegetation Associations
Blackberry scrub
Canal
Cottonwood/black willow riparian forest
Disturbed
Disturbed grassland
Fallow field
Fremont cottonwood riparian forest
Gravel/sandbar
Mixed aquatic
Mixed emergent vegetation
Mixed riparian scrub
Mixed willow riparian forest
Mixed willow scrub
Narrowleaf willow scrub
Non-native riparian scrub
Orchard
Pond
Riverine
Row crops
Short forbland
Urban & Roads
Valley mixed riparian forest
Valley oak riparian forest
Valley oak woodland
Water primrose
Source: DWR 2003 SP-T4
0.2 0 0.2 0.4 0.6 Miles
Original Scale 1 : 30,000
1" = 0.5 mile
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Facilities
FERC Project No. 2100
FIGURE 4.5.2-2b
Feather River
Vegetation Cover
(Area 2b)
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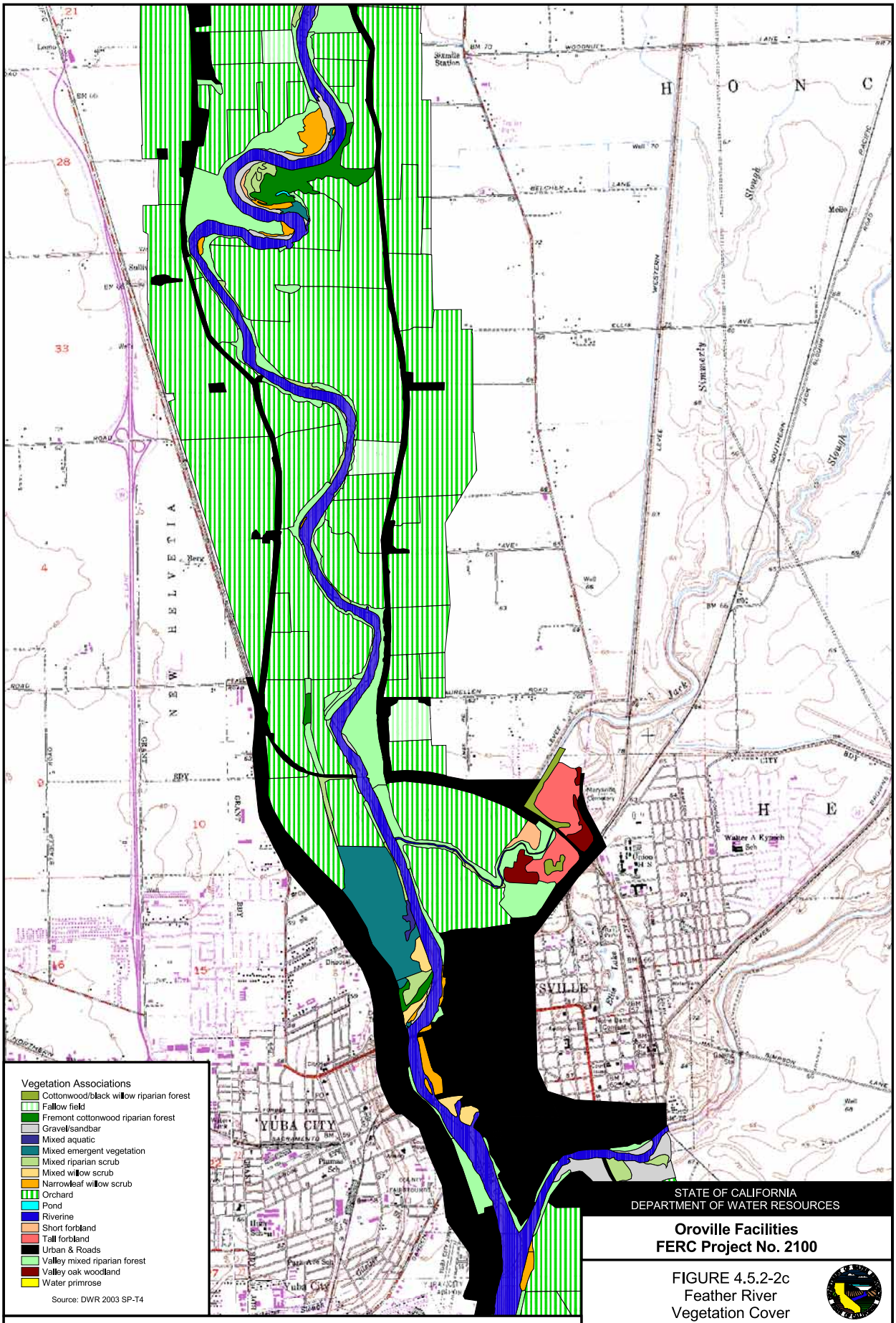
Vegetation Associations
Cottonwood/black willow riparian forest
Fallow field
Fremont cottonwood riparian forest
Gravel/sandbar
Mixed aquatic
Mixed emergent vegetation
Mixed riparian scrub
Mixed willow scrub
Narrowleaf willow scrub
Orchard
Pond
Riverine
Short forbland
Tall forbland
Urban & Roads
Valley mixed riparian forest
Valley oak woodland
Water primrose
Source: DWR 2003 SP-T4
0.2 0 0.2 0.4 0.6 Miles
Original Scale 1 : 30,000
1" = 0.5 mile
YUBA CITY
HONCUT
HELVETIA
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Facilities
FERC Project No. 2100
FIGURE 4.5.2-2c
Feather River
Vegetation Cover
(Area 2c)
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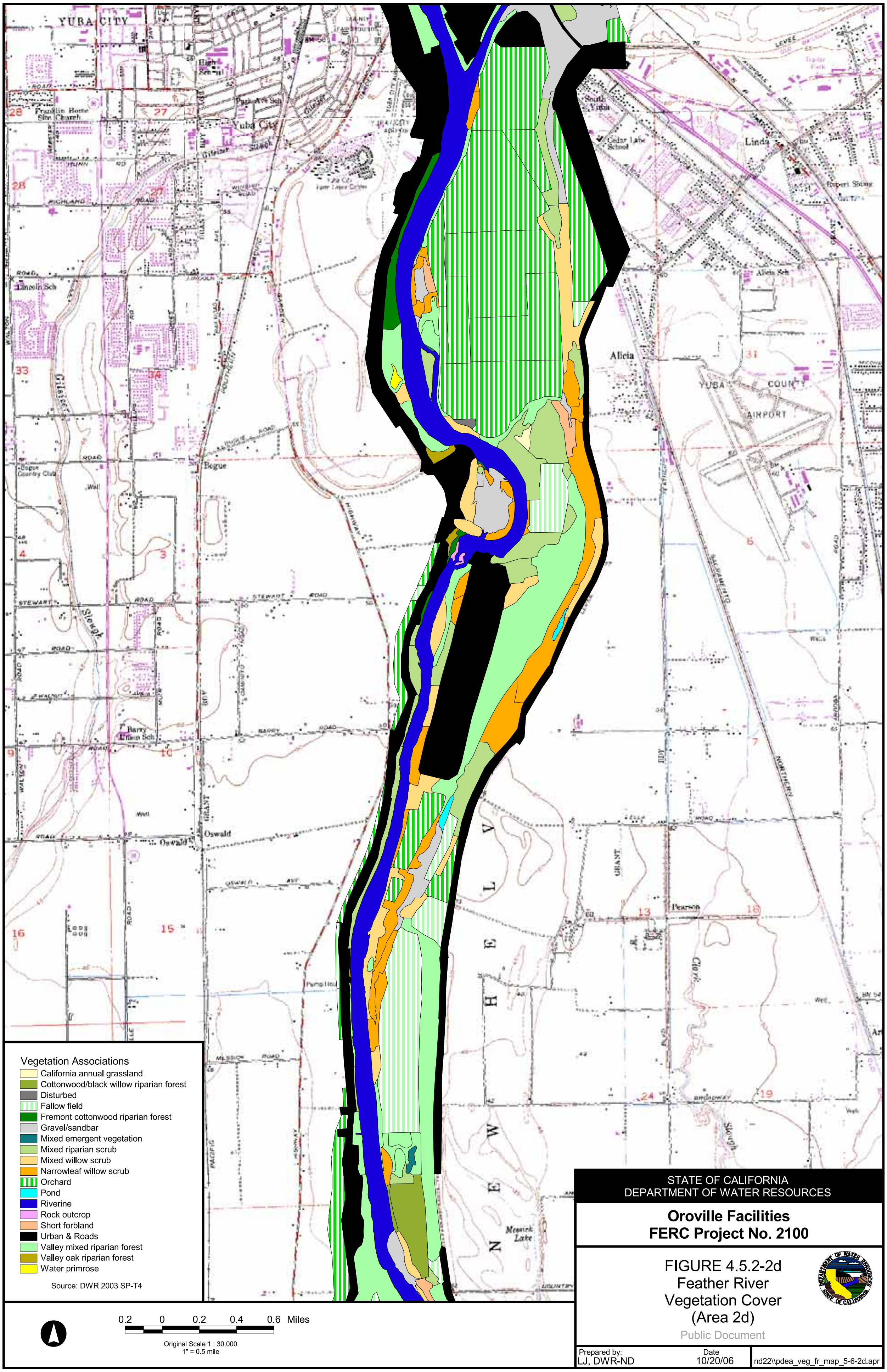

Vegetation Associations
California annual grassland
Cottonwood/black willow riparian forest
Disturbed
Fallow field
Fremont cottonwood riparian forest
Gravel/sandbar
Mixed emergent vegetation
Mixed riparian scrub
Mixed willow scrub
Narrowleaf willow scrub
Orchard
Pond
Riverine
Rock outcrop
Short forbland
Urban & Roads
Valley mixed riparian forest
Valley oak riparian forest
Water primrose
Source: DWR 2003 SP-T4
0.2 0 0.2 0.4 0.6 Miles
Original Scale 1 : 30,000
1" = 0.5 mile
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Facilities
FERC Project No. 2100
FIGURE 4.5.2-2d
Feather River
Vegetation Cover
(Area 2d)
Public Document
Prepared by:
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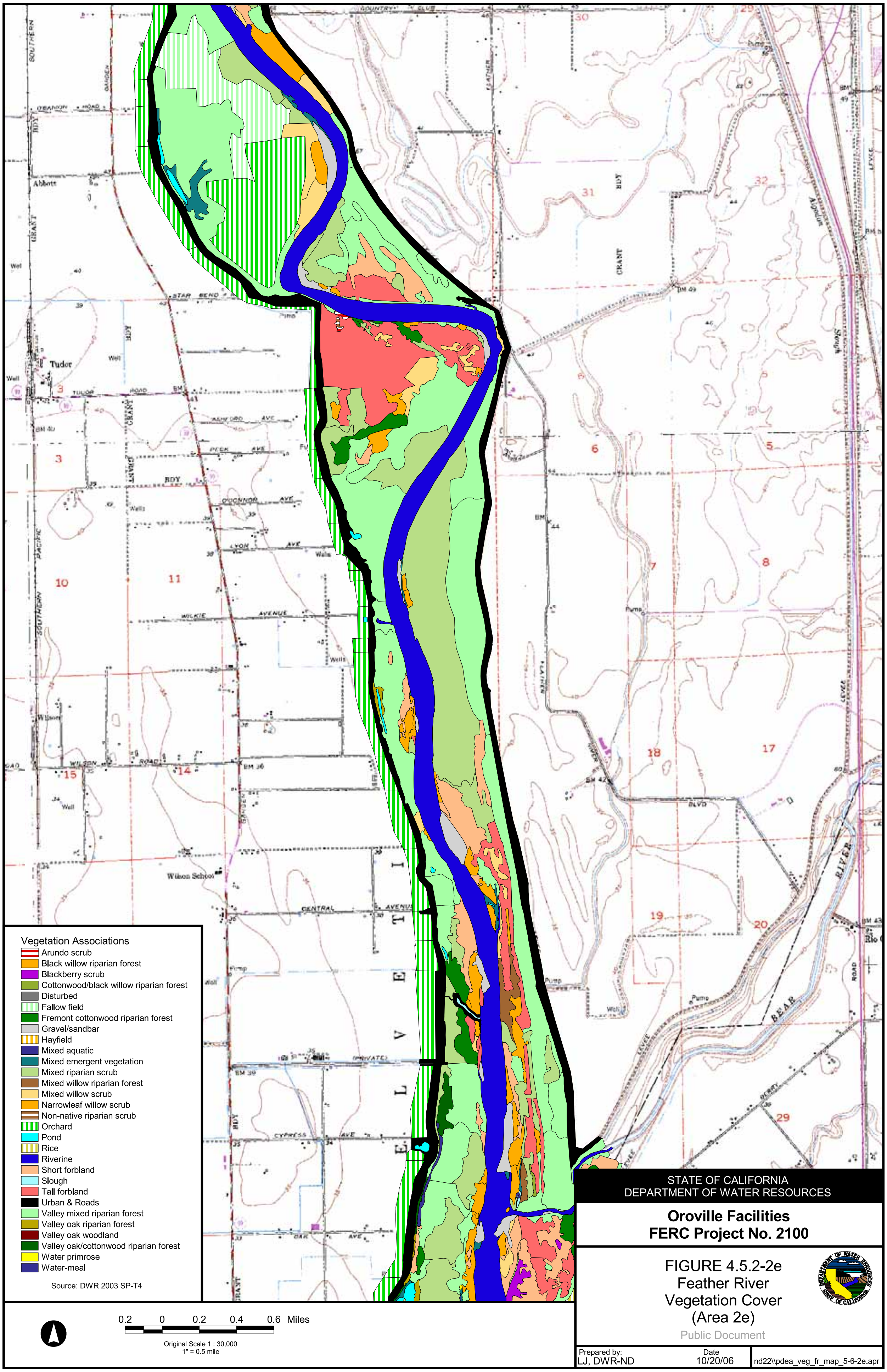
Vegetation Associations
Arundo scrub
Black willow riparian forest
Blackberry scrub
Cottonwood/black willow riparian forest
Disturbed
Fallow field
Fremont cottonwood riparian forest
Gravel/sandbar
Hayfield
Mixed aquatic
Mixed emergent vegetation
Mixed riparian scrub
Mixed willow riparian forest
Mixed willow scrub
Narrowleaf willow scrub
Non-native riparian scrub
Orchard
Pond
Rice
Riverine
Short forbland
Slough
Tall forbland
Urban & Roads
Valley mixed riparian forest
Valley oak riparian forest
Valley oak woodland
Valley oak/cottonwood riparian forest
Water primrose
Water-meal
Source: DWR 2003 SP-T4
0.2 0 0.2 0.4 0.6 Miles
Original Scale 1 : 30,000
1" = 0.5 mile
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Facilities
FERC Project No. 2100
FIGURE 4.5.2-2e
Feather River
Vegetation Cover
(Area 2e)
Public Document
Prepared by:
LJ, DWR-ND
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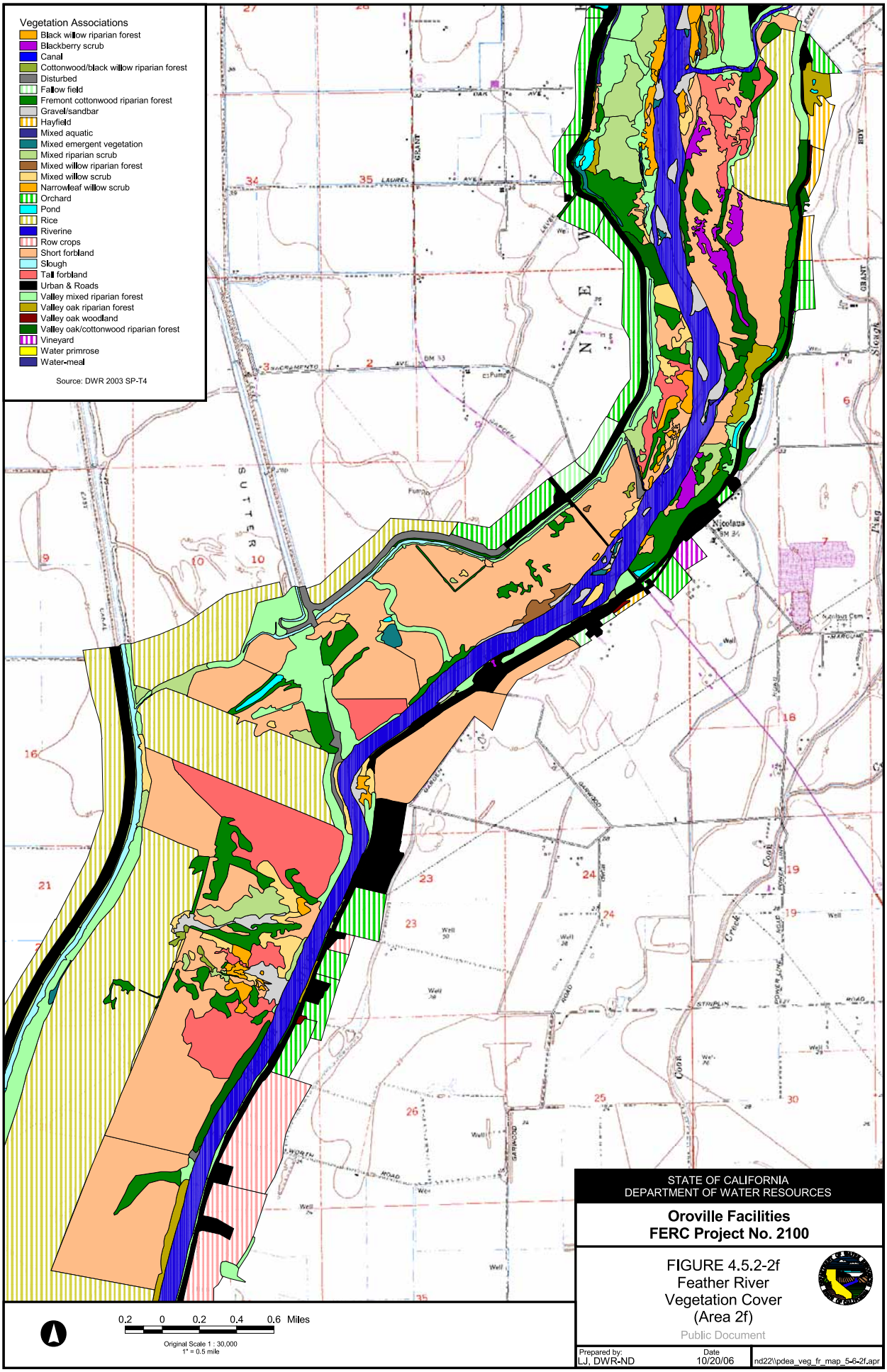
Vegetation Associations
Black willow riparian forest
Blackberry scrub
Canal
Cottonwood/black willow riparian forest
Disturbed
Fallow field
Fremont cottonwood riparian forest
Gravel/sandbar
Hayfield
Mixed aquatic
Mixed emergent vegetation
Mixed riparian scrub
Mixed willow riparian forest
Mixed willow scrub
Narrowleaf willow scrub
Orchard
Pond
Rice
Riverine
Row crops
Short forbland
Slough
Tall forbland
Urban & Roads
Valley mixed riparian forest
Valley oak riparian forest
Valley oak woodland
Valley oak/cottonwood riparian forest
Vineyard
Water primrose
Water-meal
Source: DWR 2003 SP-T4
0.2 0 0.2 0.4 0.6 Miles
Original Scale 1 : 30,000
1" = 0.5 mile
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Facilities
FERC Project No. 2100
FIGURE 4.5.2-2f
Feather River
Vegetation Cover
(Area 2f)
Public Document
Prepared by:
LJ, DWR-ND
Date
10/20/06
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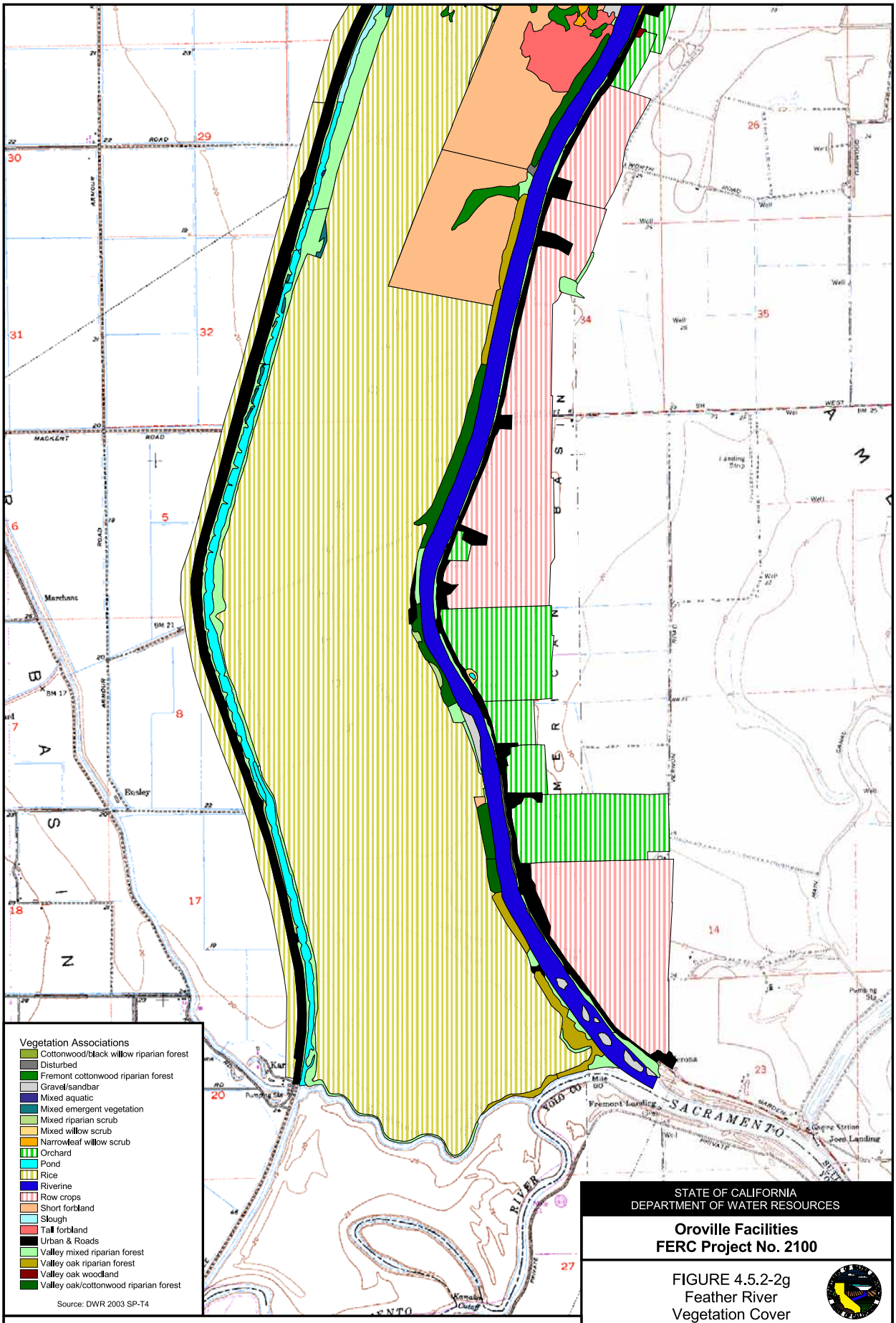
Vegetation Associations
Cottonwood/black willow riparian forest
Disturbed
Fremont cottonwood riparian forest
Gravel/sandbar
Mixed aquatic
Mixed emergent vegetation
Mixed riparian scrub
Mixed willow scrub
Narrowleaf willow scrub
Orchard
Pond
Rice
Riverine
Row crops
Short forbland
Slough
Tall forbland
Urban & Roads
Valley mixed riparian forest
Valley oak riparian forest
Valley oak woodland
Valley oak/cottonwood riparian forest
Source: DWR 2003 SP-T4
0.2 0 0.2 0.4 0.6 Miles
Original Scale 1 : 30,000
1" = 0.5 mile
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Facilities
FERC Project No. 2100
FIGURE 4.5.2-2g
Feather River
Vegetation Cover
(Area 2g)
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Ninety-four percent of the wetland vegetation occurs around Thermalito Afterbay. The frequent and steady fluctuations of water levels support a lower band of mixed emergent species. Waterfowl brood ponds constructed in inlets of Thermalito Afterbay support emergent vegetation along much of their shores. More detail for wetlands may be found in the report for SP-T3/5, Riparian Resources, Wetlands, and Associated Floodplains.

Aquatic/Submerged. Aquatic/submerged vegetation refers to both the free-floating plant species that occur on small ponds and slow-moving or sheltered riverine backwaters and the submerged rooted vegetation common in the deeper ponds of the OWA.

A total of 443 acres of aquatic/submerged vegetation was mapped in the project area, approximately 400 acres of which is water primrose (*Ludwigia peploides*). Water primrose occurs along the margins of ponds, waterways, and backwaters of the Feather River. Free-floating plants include mosquito fern (*Azolla* spp.), duckweed (*Lemna* spp.), and watermeal (*Wolffia* spp.), which occur primarily in the smaller ponds or canals in the OWA.

Special-Status Plant Habitats

Vernal Pools

Vernal pools are seasonally flooded depressions that are underlain by a substrate that limits drainage. They result from a combination of soil conditions, summer-dry Mediterranean climate, topography, and hydrology and support specialized plants and animals, including a large number of threatened and endangered species (SP-T2).

Approximately 49 acres of vernal pools and ephemeral swales were mapped within the project area (Figures 4.5.2-1h through 4.5.2-1j). These pools range in size from very small (less than 3 feet [ft] in diameter) to larger pools covering nearly an acre. Multiple-pool complexes range in size from 0.5 to 5 acres. The majority of pools are fairly shallow, although large deep pools also exist.

A total of 60 plant species were identified as occurring in vernal pools in the project area. Eleven of these species (18 percent) are non-native species. In comparison, 39 percent of the species found in the project area, excluding vernal pools and swales, are non-native species.

Serpentine and Gabbro

Vegetation types that occur on soils derived from serpentinitic and gabbroic rock types include sparse grassland, chaparral, and woodlands. Serpentine-derived soils tend to have low levels of nitrogen, phosphorus, and calcium, combined with high levels of magnesium and potentially toxic elements such as nickel, chromium, and cobalt. Gabbro-derived soils tend to be mildly acidic and are rich in iron and magnesium and often contain other heavy metals such as chromium. These soil types support unique

assemblages of plant species with many endemic species, including a high number of special-status plant species and support a high level of plant diversity. Serpentine and gabbro soils in the project area are potential and suitable habitat for the federally listed Layne's ragwort (*Senecio layneae*).

Approximately 172 acres of serpentinite and serpentine-derived soils occur in the project area (Figures 4.5.2-1a and 4.5.2-1b). Numerous northwest to southeast trending bands of serpentine occur in the North Fork and West Branch arms of Lake Oroville. Vegetation typically consists of sparse foothill pines and scattered chaparral shrubs. These outcrops harbor many endemic species including two special-status plant species: cut-leaved ragwort (*Senecio eurycephalus* var*. lewisrose*i) and Butte County calycadenia (*Calycadenia oppositifolia*).

Approximately 64 acres of gabbro and gabbro-derived soils occur in the project area along the South Fork arm of Lake Oroville (Figure 4.5.2-1f). Plant species composition is similar to surrounding vegetation, typically a mix of moderate to dense foothill or ponderosa pine and mixed oak woodland. One special-status species, Brandegee's clarkia (*Clarkia brandegeae*), was observed on gabbro soils.

Feather River Floodplain

The Feather River extends for approximately 55 miles below the FERC Project boundary before the confluence with the Sacramento River. Approximately 32,000 acres occur within the Feather River FEMA 100-year floodplain outside the FERC Project boundary and downstream of Lake Oroville.

Although the Feather River is tightly restricted by levees in some areas, much of the river has large setback levees, forming a wide floodplain. Over half of the floodplain has been converted to agriculture.

Invasive Non-native Plant Species

Nearly all plant communities within the project vicinity have invasive and/or noxious weed species as a component. A noxious weed as defined by the California Department of Food and Agriculture (DFA) means any "species of plant that is, or is liable to be, troublesome, aggressive, intrusive, detrimental, or destructive to agriculture, silviculture, or important native species, and difficult to control or eradicate" (DFA Website). An invasive species is defined by the National Invasive Species Council under Executive Order 13112 as "a species that is (1) non-native (or alien) to the ecosystem under consideration, and (2) whose introduction causes or is likely to cause economic or environmental harm or harm to human health" (Center for Invasive Plant Management Website).

Lists of noxious/invasive plant species with potential to occur in the project area were developed from DFA, the California Invasive Plant Council (Cal IPC), the U.S. Department of Agriculture (USDA), and the Plumas National Forest (PNF). During relicensing studies, all non-native species were identified and all species that were

listed at that time were mapped and recorded. Overall, 219 species of non-native plants were identified in the project area.

The weed/pest rating inventory lists developed by DFA and Cal IPC have been updated since the relicensing studies. DFA updated its list in 2004 and Cal IPC updated its list in 2006. Seventy-five species of noxious or invasive plant species that are currently listed by DFA, Cal IPC, USDA, and PNF were identified in the project area. Twenty-two of these species are identified as highly invasive wildland pests by DFA and/or Cal IPC (Table 4.5-8).

The numbers of weed species and infestations are substantially greater in lower elevation riparian and wetland areas than in upland communities, especially where some disturbance has occurred. Nineteen of the species in Table 4.5-8 were found below Oroville Dam in the OWA and in and around the Thermalito Complex. Eleven of these species were found around Lake Oroville. Species of greatest concern near the Thermalito Complex include purple loosestrife (*Lythrum salicaria*), giant reed, tree of heaven (*Ailanthus altissima*), yellow starthistle, and scarlet wisteria. Within the surrounding grasslands, yellow starthistle and medusahead are most widespread and have most likely affected native plant species to the greatest extent. Approximately 85 of the ~900 acres of wetland/riparian margin of Thermalito Afterbay contain varying densities of purple loosestrife. Please refer to the report for SP-T7, Project Effects on Noxious Terrestrial and Aquatic Plant Species, for maps and more detailed discussions. This species affects both native vegetation and wintering waterfowl nesting habitat.

Noxious weed species in the project area are most prolific in the OWA. The species of greatest concern to native riparian and wetland plant communities and wildlife habitat in this area include giant reed, tree of heaven, scarlet wisteria, parrots feather (*Myriophyllum aquaticum*), and Himalayan blackberry (*Rubus discolor*). Tree of heaven is intermingled with the valley elderberry (*Sambucus mexicanus*), habitat for the federally threatened valley elderberry longhorn beetle, in approximately 250 acres of the OWA.

Water primrose (*Ludwigia peploides*) is an aquatic plant species that occurs along the margins of ponds, waterways, and backwaters of the Feather River. Both the native (ssp. *peploides*) and non-native (ssp. *montevidensis*) subspecies occur in the area. This perennial species grows in dense mats and has been increasing in abundance since the mid-1990s. This increase has caused adverse ecological effects on several important fish species in the OWA. It has, however, increased habitat for the federally and State-listed giant garter snake.

Numerous noxious weed species occur around Lake Oroville, primarily in disturbed areas near roads, trails, and facilities, and in the immediate vicinity of the spillway and the associated power facilities. The species identified as those of greatest concern are skeleton weed (*Chondrilla juncea*); French, Spanish, and Scotch brooms (*Genista monspessulana, Spartium junceum, Cytisus scoparius*); Himalayan blackberry; and tree of heaven. Other species include edible fig (*Ficus carica*) and starthistle.

Table 4.5-8. Target weed species identified in the project area.

Genus species Common name	Cal-IPC List[1]	DFA List[2]	Around Lake Oroville	Below Oroville Dam
Aegilops triuncialis Barbed goatgrass	H	B		x
Ailanthus altissima Tree of heaven	M	-	X	x
Arundo donax Giant reed	H	-	-	x
Bromus madritenis ssp. *rubens* Foxtail chess	H	-	X	x
Centaurea solstitialis Yellow starthistle	H	C	X	x
Chondrilla juncea Skeleton weed	M	A	x	-
Cortaderia selloana Pampas grass	H	-	-	x
Cytisus scoparius Scotch broom	H	C	-	x
Ficus carica Edible fig	M	-	x	x
Foeniculum vulgare Fennel	H	-	x	x
Genista monspessulana French broom	H	C	x	x
Hedera helix English ivy	H			x
Ludwigia peploides ssp. Montevidensis Montevideo waterweed	H			x
Lythrum salicaria Purple loosestrife	H	B	-	x
Mentha pulegium Pennyroyal	M	-	-	x
Myriophyllum aquaticum Parrot feather	H	-	-	x
Myriophyllum spicatum Eurasian milfoil	H	-	-	x
Rubus discolor Himalayan blackberry	H	-	x	x
Sapium sebiferum Chinese tallow tree	M	-	x	-
Sesbania punicea Scarlet wisteria	H	-	-	x
Spartium junceum Spanish broom	H	-	x	-
Taeniatherum caput-medusae Medusahead	H	C	x	x

Table 4.5-8. Target weed species identified in the project area.

Genus species Common name	Cal-IPC List[1]	DFA List[2]	Around Lake Oroville	Below Oroville Dam

[1] *California Invasive Plant Council (2006) California Invasive Plant Inventory: H = High: invasive species with most severe wildland ecological impacts, widespread; M = Moderate: invasive species with substantial wildland impacts; local to widespread.*

[2] *California Department of Food and Agriculture List of Noxious Weeds: List A = Most invasive wildland pest plants - eradication, containment or other holding action at the State-County level; List B = Includes species less widespread and more difficult to contain—eradication, containment, control, or other holding action at the discretion of the Commissioner; List C = Weeds that are so widespread that the agency does not endorse State or County-funded eradication except in nurseries.*

Source: SP-T7

Botanical Resources Baseline Project Conditions

Baseline project operations, land management practices, and project-related recreation activities have the potential to affect botanical resources in the project area including vegetation communities, riparian resources, non-native invasive plant species, and special-status plant species. Direct and indirect as well as short and long-term effects may result in changes to the dynamics and stability of existing botanical resources, including changes in species diversity and distribution. Direct and indirect effects result from the following:

- *Lake Oroville Water Level Fluctuations.* Water levels in Lake Oroville fluctuate in response to power production and flood management, and as a result of water withdrawals for irrigation or municipal water use. The large daily and seasonal fluctuations in Lake Oroville's water levels, in addition to the reservoir's steep slopes and poor soils, adversely affect the establishment of hydrophytic plant species and the development of typical littoral and riparian communities along the shoreline. Few species can withstand inundation for periods of time that are typical within the drawdown zone of the reservoir as well as the dry harsh conditions of summer and fall. Areas exposed by a spring/early summer drawdown may support some vegetation where conditions are favorable, but plant diversity is often low and may be dominated by nonnative invasive species. Habitat improvements for warmwater game fish in Lake Oroville have included planting of willows (*Salix* sp.) and buttonbush (*Cephalanthus occidentalis*) within select areas along the reservoir shoreline. These have been moderately successful and have had a moderately beneficial effect on both riparian communities along the shoreline and warmwater fish habitat.

- *Thermalito Complex Water Level Fluctuations.* Water released for daily peak power generation and pump-back operations results in minimal water level fluctuations in the Diversion Pool, Thermalito Power Canal, and Thermalito Forebay. The relatively consistent water level in the forebay maintains a narrow wetland/riparian zone. One special-status species (four-angled spikerush) occurs in the wetland margin of Thermalito Forebay. The water levels in the forebay have a beneficial effect on both wetland vegetation and special-status

species habitat. Thermalito Afterbay, however, fluctuates on a daily/weekly cycle. Over 900 acres of wetland habitat occur along the north and east edges of the afterbay. The frequent water level fluctuations within this shallow reservoir adversely affect the structural and species diversity of the wetland vegetation and create optimal conditions for the nonnative invasive species, purple loosestrife (*Lythrum salicaria*). This species has replaced and affected native wetland plant species and occupies more than 85 acres of the ~900 acres of the wetland.

Two special-status species (four-angled spikerush and Sanford's arrowhead) occur within the wetland margins of the afterbay and associated brood ponds. These species cannot tolerate the periods of drawdown in the afterbay and are restricted to low areas within the wetland margin or in the brood pond margins where a more constant water source is maintained. The relatively consistent water levels in the brood ponds and low-lying areas around the afterbay have a beneficial effect and provide and maintain habitat for these species.

- *Discharge to the Feather River.* Riparian vegetation along the Feather River has been affected by a number of causes: historic hydraulic mining, historic and current land uses, flood management levees, flow regulation, and the presence of dams, including Oroville Dam. Historically, rivers in this area experienced high flows from December through March, with snowmelt keeping the water levels high through late spring. These types of flows provide sediment for floodplain deposition and scour fresh surfaces for germination of early successional riparian species.

  Under current operations, Lake Oroville is managed to capture winter and spring rains. Water is released from Lake Oroville to the Feather River as needed to meet water supply, flood management, power generation, water quality improvement, and fish and wildlife enhancement. The amount and timing of project-related flows downstream of Lake Oroville could adversely affect the extent, distribution, composition, and function of riparian vegetation along the Feather River.

  Low Flow Channel—Flows in the LFC (between Thermalito Diversion Dam and the Thermalito Afterbay Outlet) are maintained year round at a minimum flow of 600 cubic feet per second (cfs), except during large flood events. Levees severely restrict the floodplain in this reach, and piles of dredger tailings have replaced the natural floodplain soils, increasing the floodplain elevation along the river. The vegetation along this reach is characterized by a high percentage of non-native invasive species and a lack of well-developed woody riparian vegetation. During low flows, riparian vegetation such as alder and non-native species grow within the active channel along the edges of the Feather River. This vegetation gets scoured when flows are high, such as during releases for flood management. This flow management results in an adverse effect on riparian plant communities because the vegetation remains in an early successional stage of development and favors noxious/invasive weed species.

High Flow Channel—Flows below the Thermalito Afterbay Outlet typically are reduced dramatically after winter high-flow events, and remain low until irrigation demands increase flows in June through September. These flows dramatically drop after downstream irrigation demands decrease and before the winter rains begin. Levees outside the FERC Project boundary along the High Flow Channel (HFC) reduce the available floodplain along portions of the river. Although large setback levees occur along much of the river, the majority of this floodplain has been converted to agriculture. In addition, levees and banks have been artificially stabilized by other entities, resulting in additional impaired riparian recruitment. The riparian forests downstream of the project area are commonly fragmented and narrow, with little to no understory compared to historic riparian forests in the area. Although project flows have less effect in these areas than the effect of agriculture and urbanization, they do affect riparian recruitment. In areas where large meander bends occur, large patches of riparian habitat exist. These existing riparian plant communities are experiencing little or no recruitment of new riparian species. Riparian vegetation away from the active channel that would normally be maturing into a later successional stage is composed of large, older cottonwoods with relatively low structural and species diversity. These forests are not replacing themselves as the older trees die out. The general lack of riparian recruitment observed during riparian/recruitment studies (DWR 2003), as well as the low structural and species diversity, is an adverse effect associated with the current flow regime that affects the long-term health of the riparian communities downstream of the project area.

- *Ground/Soil Disturbance from Operations and Maintenance Activities.* Land management agencies in the FERC Project boundary area including DWR, DFG, and DPR conduct a wide variety of maintenance activities within the area. Some of these activities affect plant habitats. These activities include maintenance of roads and parking lots, levees, and transmission line rights-of-way. Road maintenance activities have the potential to adversely affect plant communities through direct removal or by disturbance activities that tend to promote the establishment of non-native invasive species. Wetlands can be affected by operations and maintenance activities that change drainage flows or patterns or that result in direct physical disturbance. Natural areas immediately adjacent to disturbed sites tend to have a high percentage of non-native species. The replacement of native vegetation with non-native invasive species is considered an adverse effect. Utility line corridors are cleared of trees and shrubs as they encroach into the corridor. This disturbance promotes establishment of invasive species along the edges of the corridor. These plants tend to move into the adjacent natural areas and adversely affect botanical resources. Invasive weeds are currently controlled within the project area along roadways and around project facilities.

- *Disturbance from Project-Related Recreation.* Botanical resources may be directly and indirectly affected by project-related recreation. Recreation within the project area includes recreational related disturbances within the project area could result from operations and maintenance, enhancement, and/or construction

of facilities and recreation activities including boating, fishing, camping, and hiking.

Facilities Maintenance—DWR, DPR, and DFG conduct maintenance activities associated with the various recreation areas. GIS data analysis identified approximately 90 acres of trails and a number of roads associated with recreation. Maintenance activities include surface repair and vegetation management by pruning, removal, and/or herbicide treatment. These activities can result in ground disturbance that can introduce invasive species into the adjacent natural areas and adversely affect botanical resources. A number of special-status plant populations occur in and/or near recreation areas. Improvement to roads, trails, and/or camping areas may have an adverse effect on these species.

Recreational Use—Recreational use impact studies indicate that there are some moderate adverse effects on vegetation at the Thermalito Afterbay Outlet and the Stringtown Car-top Boat Ramp. Adverse effects on upland vegetation types from dispersed recreation were highest from user-defined trails where vegetation was removed and/or trampled. Most were in steep areas leading to the water's edge of Lake Oroville, which in turn has created soil erosion problems. Direct damage to vegetation also occurs at a number of dispersed recreation sites. These activities also provide disturbance areas for invasion by noxious species.

- *Wildlife Habitat and Vegetation Management*. DFG conducts a habitat enhancement program in the OWA that includes the planting of upland nesting cover and foraging vegetation for waterfowl. Approximately 200 acres of land are tilled and planted each year. These plantings consist of a variety of non-native species that can invade into adjacent grasslands and vernal pool habitats, replacing native plant species and lowering native plant diversity. This action adversely affects both native plant communities and special-status species habitats by degradation and introduction of non-native invasive plant species.

  Fire suppression has resulted in adverse effects by limiting suitable habitat for some special-status plants that inhabit openings in woodland and chaparral communities. Lack of fire has resulted in unnatural monotypic, even-aged, dense stands of brush. Vegetation densities within the project area are relatively high, especially in upland habitats around Lake Oroville and the Diversion Pool. Continued fire suppression would result in the reduction of special-status plant habitat within these communities.

4.5.2.2 Listed Species

Special-Status Plant Species

This section addresses special-status plant species and their habitats that potentially occur within the Oroville Facilities project area. This includes species in the following categories:

- Species listed under FESA by USFWS as Threatened or Endangered;
- Species listed under CESA by DFG as Threatened, Endangered, or Rare;
- Plants on the PNF Sensitive and Special Interest Plant List (USFS 2003); and
- Plants on California Native Plant Society (CNPS) List 1B (plants considered by CNPS to be rare, threatened, or endangered in California and elsewhere) or List 2 (plants considered rare, threatened, or endangered in California but more common elsewhere).

A list of special-status plant species that have potential to occur in the project area was developed based on information compiled from USFWS (1999 and 2000 and updated in 2006); DFG (2002); the California Natural Diversity Database (CNDDB); the CNPS Inventory (2001); Plumas National Forest Sensitive and Special Interest Plant List (USFS 2003); DFG's Special Plants List (DFG 2001); and the USFS Pacific Southwest Region Sensitive Plant List (USFS 1998). Table 4.5-9 summarizes the list of special-status plant species that have potential to occur in the project area. It includes 7 species that are listed under FESA and/or CESA and an additional 43 species of concern that are listed by the PNF List and/or CNPS. A few species that were included on lists from USFWS, DFG, CNDDB, CNPS, and/or USFS are not included in Table 4.5-9. These species have very low potential for occurring in the project area due to particular soils, habitat, and/or elevational requirements.

Information on the listed species with the potential to occur in the project area were compiled from rare plant descriptions and distributions obtained from CNDDB records, a review of CNPS (2001), *Manual of the Vascular Plants of Butte County California* (Oswald 1994), *The Jepson Manual* (Hickman 1993), other State and/or Butte County biological survey records, web-based and printed articles, and discussions with local authorities. Nomenclature conforms to Hickman (1993) and Oswald (1994).

Botanical surveys were conducted for Oroville Facilities relicensing studies during 2002, 2003, and 2004 in accordance with standard guidelines issued by DFG (2000), USFWS (1996), and CNPS (2001). Field investigations were conducted in a manner that emphasized all potential habitats for the federally listed or State-listed species (i.e., vernal pools/valley grasslands and serpentine/gabbro soils). Local reference sites were visited where possible. Areas surveyed for federally listed or State-listed species included valley grasslands around Thermalito Afterbay and Thermalito Forebay, serpentine soils in the West Branch and North Fork area of Lake Oroville, and gabbro soils along the South Fork arm of Lake Oroville. Surveys for all other special-status plant species were focused in areas where project impacts are likely to occur and within 150 feet (ft) of all project facilities. Surveys were conducted during the time of year when the target species were identifiable. Surveys were floristic in nature in that all plant species encountered during these surveys were identified to the lowest taxonomic status possible. Detailed descriptions and analysis are included in the report for SP-T2, Project Effects on Special Status Species.

Table 4.5-9. Special-status plant species with potential to occur in the project area.

Scientific Name Common Name	Status USFWS[1]/DFG[2]/ CNPS[3]/PNF[4]	Habitat (elevation)	Found in Project Area
Federally Listed or State-Listed Species			
Chamaesyce hooveri Hoover's spurge	FT/--/1B/	Vernal pools (25–250 meters [m])	-
Limnanthes floccosa ssp. *californica* Butte County meadowfoam	FE/FCE/1B/	Valley and foothill grassland (mesic), vernal pools (50–90 m)	-
Orcuttia pilosa Hairy Orcutt grass	FE/FCE/1B/	Vernal pools (55–200 m)	-
Orcuttia tenuis Slender Orcutt grass	FT/CR/1B/	Vernal pools (35–1,760 m)	-
Pseudobahia bahiifolia Hartweg's golden sunburst	FE/CE/1B/	Cismontane woodland, valley and foothill grassland/clay (15–150 m)	-
Senecio layneae Layne's ragwort	FT/CR/1B/	Chaparral, cismontane woodland/ serpentinite or gabbroic (200–1,000 m)	-
Tuctoria greenei Greene's tuctoria	FE/CR/1B/	Vernal pools (30–1,070 m)	-
Other Special-Status Species			
Agrostis hendersonii Henderson's bent grass	SC/3/--	Valley and foothill grassland (mesic), vernal pools (70–305 m)	-
Allium jepsonii Jepson's onion	SC/1B/--	Cismontane woodland, lower montane conifer forest/serpentinite or volcanic (300–1,160 m)	-
Allium sanbornii var. *sanbornii* Sanborn's onion	--/4/SI-1	Chaparral, cismontane woodland, lower montane conifer forest/usually serpentinite, gravelly (260–1,410 m)	-
Arenaria "grandiflora" Large-flowered sandwort	--/4/SI-1	Granite sand on road banks and openings in woods (500–1,000 m)	-
Balsamorhiza macrolepis var. *macrolepis* Big-scale balsamroot	--/1B/SI-1	Chaparral, cismontane woodland, valley and foothill grassland/sometimes serpentinite (90–1,400 m)	-
Calycadenia oppositifolia Butte County calycadenia	--/1B/S	Chaparral, cismontane woodland, lower montane conifer forest, meadows and seeps, valley and foothill grassland/volcanic or serpentinite (215–945 m)	Yes
Calystegia atriplicifolia ssp. *buttensis* Butte County morning glory	SC/1B/--S	Lower montane conifer forest (600–1,200 m)	-
Cardamine pachystigma var. *dissectifolia* Dissected-leaved toothwort	--/3/SI-1	Chaparral, lower montane conifer forest/usually serpentinite, rocky (255–2,100 m)	Yes

Table 4.5-9. Special-status plant species with potential to occur in the project area.

Scientific Name Common Name	Status USFWS[1]/DFG[2]/ CNPS[3]/PNF[4]	Habitat (elevation)	Found in Project Area
Carex vulpinoidea Fox sedge	--/2/--	Marshes and swamps (freshwater), riparian woodland (30–1,200 m)	Yes
Castilleja rubicundula ssp. *rubicundula* Pink creamsacs	--/1B/--	Chaparral (openings), cismontane woodland, meadows and seeps, valley and foothill grassland/ serpentinite (20–900 m)	-
Clarkia biloba ssp. *brandegeae* Brandegee's clarkia	--/1B/S	Chaparral, cismontane woodland/ often roadcuts (295–885 m)	Yes
Clarkia gracilis ssp. *albicaulis* White-stemmed clarkia	--/1B/S	Chaparral, cismontane woodland/ sometimes serpentinite (245–1,085 m)	Yes
Clarkia mildrediae ssp. *lutescens* Golden-anthered clarkia	--/4/SI-1	Cismontane woodland, lower montane conifer forest (openings)/ often roadcuts (275–1,750 m)	-
Clarkia mildrediae ssp. *mildrediae* Mildred's clarkia	--/1B/SI-1	Cismontane woodland, lower montane conifer forest/ sandy, usually granitic (245–1,710 m)	-
Clarkia mosquinii Mosquin's clarkia	SC[5]/1B/S	Cismontane woodland, lower montane conifer forest/rocky, roadsides (185–1,170 m)	Yes
Cypripedium fasciculatum Clustered lady's slipper	SC/4/S	Lower montane conifer forest, north coast conifer forest/usually serpentinite seeps and stream beds (100–2,435 m)	-
Cypripedium fasciculatum Clustered lady's slipper	SC/4/S	Lower montane conifer forest, north coast conifer forest/usually serpentinite seeps and stream beds (100–2,435 m)	-
Cypripedium fasciculatum Clustered lady's slipper	SC/4/S	Lower montane conifer forest, north coast conifer forest/usually serpentinite seeps and stream beds (100–2,435 m)	-
Eleocharis quadrangulata Four-angled spikerush	--/--/2/--	Marshes and swamps (freshwater) (30–500 m)	Yes
Fritillaria pluriflora Adobe-lily	SC/1B/--	Chaparral, cismontane woodland, valley and foothill grassland/often adobe (60–705 m)	-
Hibiscus lasiocarpus Rose-mallow	--/2/--	Marshes and swamps (freshwater) (0–120 m)	-
Juncus leiospermus var. *ahartii* Ahart's dwarf rush	SC/1B/--	Valley and foothill grasslands (mesic) (30–100 m)	
Juncus leiospermus var. *leiospermus* Red Bluff dwarf rush	--/1B/--	Chaparral, cismontane woodland, meadows and seeps, valley and foothill grassland, vernal pools/ vernally mesic (35–1,020 m)	-

Table 4.5-9. Special-status plant species with potential to occur in the project area.

Scientific Name Common Name	Status USFWS[1]/DFG[2]/ CNPS[3]/PNF[4]	Habitat (elevation)	Found in Project Area
Lewisia cantelovii Cantelow's lewisia	--/1B/S	Broadleaved upland forest, chaparral, cismontane woodland, lower montane conifer forest/mesic, granitic, serpentinite seeps (385–1,370 m)	-
Lilium humboldtii ssp. *humboldtii* Humboldt lily	--/4/SI-1	Chaparral, lower conifer forest/ openings (30–1,800 m)	Yes
Lupinus dalesiae Quincy lupine	--/1B/S	Chaparral, cismontane woodland, lower/ upper montane conifer forest, openings, often in disturbed areas (855–2,500 m)	-
Monardella douglasii ssp. *venosa* Veiny monardella	SC/1B/--	Cismontane woodland, valley and foothill grassland (heavy clay) (60–410 m)	-
Myosurus minimus ssp. *apus* Little mousetail	SC/3/--	Valley and foothill woodland, vernal pools (alkaline) (20–640 m)	-
Paronychia ahartii Ahart's paronychia	SC/1B/--	Cismontane woodland, valley and foothill grassland, vernal pools (30–510 m)	Yes
Penstemon personatus Closed-throated beardtongue	SC/1B/S	Chaparral, lower/upper montane conifer forest, metavolcanic (1,065–2,120 m)	-
Perideridia bacigalupii Bacigalupi's yampah	--/4/SI-1	Chaparral, lower montane conifer forest/serpentinite (450–1,000 m)	-
Rhynchospora californica California beaked-rush	SC/1B/--	Bogs and fens, lower montane conifer forest, meadows and seeps, marshes and swamps (freshwater) (45–1,010 m)	-
Rhynchospora capitellata Brownish beaked-rush	--/2/SI-1	Lower/upper montane conifer forest, meadows and seeps, marshes and swamps, mesic (455–2,000 m)	-
Sagittaria sanfordii Sanford's arrowhead	SC/1B/--	Marshes and swamps (assorted shallow freshwater) (0–610 m)	Yes
Sedum albomarginatum Feather River stonecrop	--/1B/S	Chaparral, lower montane conifer forest/ serpentinite (260–1,785 m)	-
Senecio eurycephalus var. *lewisrosei* Cut-leaved ragwort	--/1B/S	Chaparral, cismontane woodland, lower montane conifer forest/ serpentinite (550–1,470 m)	Yes
Sidalcea robusta Butte County checkerbloom	SC/1B/--	Chaparral, cismontane woodland (90–1,600 m)	-
Silene occidentalis ssp. *longistipitata* Long-stiped catchfly	SC/1B/SI-1	Chaparral, lower/upper montane conifer forest (1,000–2,000 m)	-

Table 4.5-9. Special-status plant species with potential to occur in the project area.

Scientific Name Common Name	Status USFWS[1]/DFG[2]/ CNPS[3]/PNF[4]	Habitat (elevation)	Found in Project Area
Trifolium jokerstii Butte County golden clover	--/1B/SI-1	Valley and foothill grassland (mesic), vernal pools (50–385 m)	-
Wolffia brasiliensis Columbian watermeal	--/2/--	Marshes and swamps (assorted shallow freshwater) (30–100 m)	Yes
Bryophytes			
Bruchia bolanderi Bolander's bruchia moss	--/2/S	Lower/upper montane conifer forest, meadows and seeps, damp soil (600–1,700 m)	-
Mielichhoferia elongata Elongate copper moss	--/2/SI-1	Cismontane woodland (metamorphic rock, usually vernally mesic) (500–1,300 m)	-
Lichens			
Hydrothyria venosa Waterfan	--/--/S	Attached to rocks in cool mountain brooks and streams; submerged	-

[1] *USFWS: FT = federally Threatened; FE = federally Endangered; SC = federal species of concern (not a formal listing).*
[2] *DFG: CT = California Threatened; CE = California Endangered; CR = California rare.*
[3] *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; List 4 = plants of limited distribution.*
[4] *Plumas National Forest (PNF): S = Sensitive; SI-1 = Special Interest category 1 (Survey and recommend conservation measures).*
[5] *USFWS recognizes two subspecies of* Clarkia mosquinii*, ssp.* mosquinii *and ssp.* xerophila*, both as SC.*

Sources: USFS, DFG, CNDDB, CNPS, USFS

Federally and/or State Listed Plant Species and Habitats

Seven federally and/or State listed plant species have potential to occur within the project area. No designated or proposed critical habitat occurs within the project area for federally listed plant species. Potential habitats for listed species were initially delineated from aerial photographs, soils maps, preliminary field surveys, and vegetation maps (SP-T4, Biodiversity, Vegetation Communities, and Wildlife Habitat Mapping).

No federally listed or State-listed plant species were found within the project area during the 2002, 2003, and 2004 surveys; however, suitable habitat does exist for all 7 listed species. Approximately 49 acres of vernal pool and vernal swale habitat exists within the grasslands of the project area. Approximately 172 acres of serpentine-derived soils and 64 acres of gabbro-derived soils exist within the project area.

Vernal Pool Habitat

Vernal pool and swale complexes are a common part of the valley grassland habitats in the project area. These pools are of the Northern Hardpan type and occur in complexes in areas of hummocky ground on terrace-alluvial derived redding soils (DFG 1998). The

Northern Hardpan pools are most threatened by urban expansion, agriculture, and long-term intensive grazing.

Approximately 49 acres of vernal pools and ephemeral swales containing vernal pool plant species were identified within the FERC Project boundary, all of which occur in the grasslands around Thermalito Afterbay and Thermalito Forebay. These pools range in size from very small (less than 3 ft in diameter) to larger pools covering nearly an acre. The majority of pools are fairly shallow; however, large, deep pools that hold water longer also occur in the area. These pools and ephemeral drainages are suitable habitat for five federally listed plant species: Butte County meadowfoam (*Limnanthes floccosa* ssp. *californica*), hairy Orcutt grass (*Orcuttia pilosa*), slender Orcutt grass (*O. tenuis*), Greene's tuctoria (*Tuctoria greenei*), and Hoover's spurge (*Chamaesyce hooveri*).

A sixth species, Hartweg's golden sunburst (*Pseudobahia bahifolia*), typically inhabits upland sites associated with undulating mima mound topography within the valley grasslands. However, this species is now known only from Fresno, Madera, Merced and Stanislaus Counties. Although the type locality is along the Feather River in Yuba County, it has been extirpated in Northern California.

Serpentine and Gabbro Soil Habitats

Serpentine and gabbro soils in the project area are potential and suitable habitat for Layne's ragwort (*Senecio layneae*). Approximately 172 acres of serpentinite and serpentine-derived soils occur in the project area in the North Fork and West Branch arms of Lake Oroville. Approximately 64 acres of gabbro and gabbro-derived soils occur in the project area along the South Fork arm of the reservoir.

Special-Status Species

Butte County Meadowfoam (*Limnanthes floccosa* ssp. *californica*). Butte County meadowfoam is both a federally listed and State-listed Endangered species. This winter annual herb appears in late March to early May in ephemeral drainages, vernal pool depressions in ephemeral drainages, and occasionally around the edges of isolated vernal pools at elevations of 165–197 ft. It generally occurs on level to gently sloping terrain on poorly drained soils with shallow soil layers impermeable to water infiltration.

This species is restricted to a narrow 25-mile strip along the eastern flank of the Sacramento Valley from central Butte County to the northern portion of the City of Chico. Although the ranges of this species has not changed significantly from historical times, the number of populations, the area occupied, and the amount of available habitat within the range has declined significantly in the last 30 years. All remaining known populations are subject to urban development, airport maintenance activities, agricultural land conversion, and highway widening or realignment. There are 4 occurrence records for Butte County meadowfoam from approximately 5 miles north of Thermalito Afterbay in the vicinity of Shippee, California.

There were no occurrences of Butte County meadowfoam located in the project area during these surveys. Approximately 49 acres of vernal pools, ephemeral drainages, and pool/swale complexes occur in the project area in the grasslands around the Thermalito Complex. Many of the ephemeral drainages could potentially support Butte County meadowfoam. White meadowfoam (*Limnanthes alba* ssp. *alba*) is a common early inhabitant of ephemeral drainages and depressions within the project area. This species is closely related to the listed Butte County meadowfoam (*L. floccosa* ssp. *californica*) and occurs in similar habitat.

Hairy Orcutt Grass (*Orcuttia pilosa*). Hairy Orcutt grass is a federally listed and State-listed Endangered species. This annual grass species occurs in drying vernal pool habitat along the eastern margin of California's Central Valley at elevations ranging from 100 to 400 ft. This late season species grows in vernal pool bottoms and along edges of pools.

Of the 39 occurrences of hairy Orcutt grass listed by CNDDB (2006), 12 are thought to have been extirpated due to agricultural land conversion, urbanization, and intensive cattle grazing. Twenty-seven occurrences are presumed to be extant with the main area of concentration in the Vina Plains area in Tehama County. The one occurrence of hairy Orcutt grass in Butte County is found within 8 miles of the project area.

No occurrences of hairy Orcutt grass were found within the project area. Many of the larger, deeper pools were observed to be associated with clay soils that form a nearly impermeable pool bottom and are suitable habitat for this species.

Hartweg's Golden Sunburst (*Pseudobahia bahiafolia*). Hartweg's golden sunburst is a federally listed and State-listed Endangered species. This annual herb in the sunflower family is closely associated with mima mound topography in annual grasslands and blue oak woodlands.

The type locality for this species was historically known in Yuba County along the bank of the Feather River near the confluence with the Yuba River. This type locality has been extirpated. Currently, this species is known from two general areas in eastern San Joaquin County. Remaining populations are concentrated in the Friant region of Fresno and Madera counties and the La Grange region in Stanislaus County. The extirpated occurrence from Yuba County is more than 26 miles south of the Oroville Facilities FERC Project boundary.

No occurrences or potential habitat for Hartweg's golden sunburst were found downstream of the project area along the Feather River floodplain. The vernal pools in the grasslands around Thermalito Forebay and Thermalito Afterbay contain areas of hummocky ground that could be potential habitat for this species.

Greene's Tuctoria (*Tuctoria greenei*). Greene's tuctoria is a federally listed Endangered species and a California Rare species. This species occurs from May to July along the eastern margin of the California Central Valley. Greene's tuctoria occupies small or shallow vernal pools or the margins of deeper pools.

Forty-one occurrences have been documented from Fresno to Shasta Counties. However, 19 of these populations, from Fresno, Madera, Stanislaus, Tulare, and San Joaquin counties are thought to have been extirpated. The remaining populations occur in Butte, Glenn, Merced, Shasta, and Tehama Counties. All populations are on private lands except one population at the Sacramento National Wildlife Refuge. One occurrence of Greene's tuctoria is within 150 ft of the FERC Project boundary, one within 5 miles, and another within 10 miles of the project area.

No occurrences of Green's tuctoria were found in the project area. Potentially suitable habitat exists in the larger, deeper pools that are associated with impermeable clay soil bottoms.

Hoover's Spurge (*Chamaesyce hooveri*). Hoover's spurge is a federally listed Threatened species. This prostrate annual herb grows in the bottom of drying vernal pools on the eastern margin of California's Central Valley. This species typically inhabits larger, deeper pools in areas where competition from other species has been reduced by prolonged seasonal inundation or other factors.

According to current CNDDB records (2006), 4 of the 30 occurrences of Hoover's spurge have been extirpated. The 26 extant occurrences are distributed along remnant alluvial terraces and fans, mostly along the eastern edge of the Great Central Valley in Tulare, Merced, Stanislaus, Butte, Glenn, and Tehama Counties, where it occurs below 820 ft elevation. The majority of occurrences are located near the Butte-Tehama County line in the northern Sacramento Valley. The nearest occurrence of Hoover's spurge is approximately 8 miles north of the FERC Project boundary.

Although suitable habitat exists within the project area, no occurrences were found within the study area during relicensing surveys.

Slender Orcutt Grass (*Orcuttia tenuis*). Slender Orcutt grass is a federally listed Threatened species and a State-listed Endangered species. This annual grass species is found most often in the drying bottoms of large, deep vernal pools on remnant alluvial fans, high stream terraces, and recent basalt flows in valley grassland and blue oak woodland.

It is restricted to Northern California and occurs in disjunct populations from Siskiyou County to Sacramento County. The primary area of concentration is in the vicinity of Dales, Tehama County, with a second concentration on the Modoc Plateau Vernal Pool Region in Lassen, Plumas, Shasta, and Siskiyou counties. Two occurrences of slender Orcutt grass occur in Butte County within 1 mile of the project area.

Large, deep vernal pools with clay soils that form a nearly impermeable pool bottom occur in the project area. These deep pools are suitable habitat for this species. Slender Orcutt grass was not found in the project area during these surveys.

Layne's Ragwort (*Senecio layneae*). Layne's ragwort is a federally listed Threatened species and a State-listed Rare species. This perennial herb is found in open rocky

areas of serpentine and gabbroic derived soils within chaparral and chaparral/open pine or oak woodlands at elevations of 660–3,300 ft.

There are 43 extant occurrences of Layne's ragwort identified in the CNDDB from El Dorado, Tuolumne, and Yuba counties. Most known sites are scattered within a 40,000-acre area in western El Dorado County that includes the Pine Hill intrusion and adjacent serpentine. Two of the 43 records are in Yuba County, approximately 5 miles southeast of the South Fork arm of Lake Oroville on BLM land.

Approximately 172 acres of serpentine and serpentine-derived soils and 64 acres of gabbro and gabbro-derived soils occur in the project area around Lake Oroville. These serpentine- and gabbro-derived soils with sparse vegetation cover are potential habitat for Layne's ragwort. Layne's ragwort was not found in the project area during relicensing studies.

Other Special-Status Plant Species

Species identified here include rare plants that are not federally listed or State-listed species but are listed by USFS and/or BLM as Sensitive or Special Interest Species and taxa on CNPS Lists 1, 2, and 3.

A list of 51 special-status plant species with the potential to occur in the project area was developed based on information compiled from USFWS (1999 and 2002); DFG (2002), CNDDB records; the CNPS Inventory (2001); PNF Sensitive and Special Interest Plant list (USFS 2003); DFG's Special Plants List (DFG 2001); and the USFS Pacific Southwest Region Sensitive Plant list (USFS 1998). Botanical surveys were conducted in accordance with standard guidelines issued by DFG (2000), USFWS (1996), and CNPS (2001). Relicensing studies indicate the presence of suitable habitat within the project area for 40 vascular plant species, 2 bryophytes (mosses), and 1 lichen species (Table 4.5-9). Detailed descriptions and analysis are included in the SP-T2 report.

Fourteen special-status plant species were found within the project area during relicensing studies, as listed in Table 4.5-9. Five of these species were found within the OWA and Thermalito Complex. Four-angled spikerush and Sanford's arrowhead were found around the margins of Thermalito Afterbay. Four-angled spikerush was also found bordering Thermalito Forebay, small ponds in the OWA, and the larger One-Mile Pond in the OWA. Fox sedge was found bordering the Diversion Pool. Columbian watermeal was found in a number of ponds in the OWA. Ahart's paronychia was located along the margins of vernal pools south of Thermalito Forebay.

Nine special-status species were found in upland habitats around the Diversion Pool and/or lands around Lake Oroville. These include Butte County calycadenia, dissected-leaved toothwort, Brandegee's clarkia, white-stemmed clarkia, Mosquin's clarkia, Butte County fritillary, cut-leaved ragwort, Humboldt lily, and shield-bracted monkeyflower.

Butte County calycadenia (*Calycadenia oppositifolia*) is a slender annual herb in the sunflower family. This species is restricted to a 32-mile band along the Sierra Nevada and Cascade Range foothills and lower coniferous forest from northeast of Chico to southeast of Oroville at elevations of 295–3,100 ft. Butte County calycadenia grows on shallow soils in openings in blue oak woodlands, chaparral, mixed oak woodlands, and pine/mixed oak woodlands.

Brandegee's clarkia (*Clarkia biloba* ssp*. brandegeae*) is an annual herb in the evening primrose family. It occurs in the Sierra Nevada foothills from Butte, Yuba, Nevada, Placer, and El Dorado Counties at elevations of 970–2,900 ft. Brandegee's clarkia grows in openings and roadcuts in blue oak woodlands, chaparral, mixed oak woodlands, and pine/mixed oak woodlands.

White-stemmed clarkia (*Clarkia gracilis* ssp. *albicaulis*) is an annual herb in the evening primrose family. It is known only from Butte and Tehama Counties at elevations of 800–3,500 ft. White-stemmed clarkia grows in openings and roadcuts in chaparral, mixed oak woodlands, and pine/mixed oak woodlands.

Mosquin's clarkia (*Clarkia mosquinii*) is an annual herb in the evening primrose family. It is known only from Butte and Plumas Counties at elevations of 600–4,320 ft. Mosquin's clarkia grows in openings and roadcuts in chaparral, mixed oak woodlands, pine/mixed oak woodlands, and lower mixed conifer forest, mostly on southerly-facing slopes.

Ahart's paronychia (*Paronychia ahartii*) is an annual herb in the pink family. It is known from Butte, Shasta, and Tehama Counties at elevations of 180–1,750 ft. Ahart's paronychia is found in valley and foothill grasslands and vernal pools, and in grasslands within foothill woodlands.

Sanford's arrowhead (*Sagittaria sanfordii*) is a perennial herb in the water-plantain family. It is known from Del Norte, Shasta, Tehama, Butte, Sacramento, San Joaquin, Fresno, Merced, Kern, Ventura, and Orange Counties, although it is reported as extirpated from Ventura and Orange Counties. The elevation range of this species is 0–2,000 ft. Sanford's arrowhead is found in marshes and swamps, including the edges of shallow ponds.

Cut-leaved ragwort (*Senecio eurycephalus var. lewisrosei*) is a perennial herb in the sunflower family. It is known only from Butte and Plumas Counties at elevations of 940–4,960 ft. Cut-leaved ragwort is found on serpentine soils and outcrops, in chaparral, foothill woodlands, and lower coniferous forests.

Fox sedge (*Carex vulpinoidea*) is a perennial herb in the sedge family. In California, it is reported from a few widely scattered occurrences in Siskiyou, Trinity, Shasta, Tehama, and Butte Counties at elevations of 22–2,400 ft. Fox sedge grows on moist soils along streams, ditches, ponds, and reservoirs.

Four-angled spikerush (*Eleocharis quadrangulata*) is a perennial herb in the sedge family. It is known from Shasta, Tehama, Butte, and Merced counties at elevations of

77–612 ft. Four-angled spikerush grows in the shallow edges of freshwater marshes, swamps, and ponds.

Columbian watermeal (*Wolffia brasiliensis*) is a perennial aquatic herb in the duckweed family. In California, it is known from only 5 widely scattered occurrences in Butte, Glenn, and Yuba counties at elevations of 60–350 ft. Columbian watermeal grows floating on the surface of shallow freshwater sloughs and ponds.

Dissected-leaved toothwort (*Cardamine pachystigma var. dissectifolia*) is a perennial herb in the mustard family. It occurs in the coastal mountains of Mendocino, Sonoma, and Glenn counties and mid-elevations of the Sierra Nevada from Tehama to Placer counties. It occurs at elevations of 660–6,900 ft. In Butte County it grows in partial shade of Ponderosa pine and mixed conifer forest and associated chaparral.

Butte County fritillary (*Fritillaria eastwoodiae*) is a perennial herb in the lily family. It is known from Shasta, Tehama, Butte, Yuba, Nevada, and Placer counties at elevations of 164–4,920 ft. Butte County fritillary grows in partial shade in chaparral and foothill woodlands and in openings in the lower coniferous forest.

Baseline Project Conditions

The following baseline Oroville Facilities operations potentially could cause direct and indirect effects on special-status plant species and habitats within the project area:

- Fluctuations in Lake Oroville's water levels;
- Fluctuations in Thermalito Afterbay's water levels;
- Ground/soil disturbance and habitat degradation from operations and maintenance activities; and
- Disturbance from project-related recreation.

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4.6 LAND USE

This section provides an overview of land ownership, management, and land use patterns in the study area (which is defined as lands within 0.25 mile of the FERC Project boundary). The discussion includes spatial information related to ownership and land use patterns relative to five distinct study sub-areas: (1) Lake Oroville, (2) the Diversion Pool and Thermalito Forebay, (3) Thermalito Afterbay, (4) the Low Flow Channel (LFC) and the Oroville Wildlife Area (OWA), and (5) Feather River Service Area (FRSA).

4.6.1 Land Ownership, Management, and Use Patterns

Land ownership within the study area is characterized by substantial public land holdings. Figures 4.6-1a, 4.6-1b, and 4.6-1c depict land ownership in the study area and within the FERC Project boundary. Land ownership in the FRSA is made up of mostly private land holders for agricultural production land uses; see Appendix G-LU1 (Figure G-LU1-2) in the PDEA (DWR 2005) for a definition of the FRSA geographic area and agricultural land use types. Overall, approximately 69 percent (approximately 48,600 acres) of land within the approximately 70,500-acre study area is publicly owned. Of the publicly owned land in the study area, approximately 23 percent (approximately 11,000 acres out of 48,600) is owned by the federal government, 77 percent (approximately 37,200 acres) is owned by the State, and nearly 1 percent (approximately 400 acres) is owned by local jurisdictions (Butte County, the City of Oroville, and the Feather River Recreation and Park District [FRRPD]). Private entities own approximately 29 percent (approximately 20,700 acres) of land in the study area. The remaining approximately 2 percent of the study area (approximately 1,200 acres) is considered to be the “Other” ownership type, which primarily represents road rights-of-way that are often held in fee by the State (i.e., the California Department of Transportation) or Butte County.

All of the land within the FERC Project boundary is publicly owned. Approximately 15 percent (6,240 acres) of the land in the FERC Project boundary is owned by the federal government, and 85 percent (34,900 acres) is owned by the State (i.e., DWR, DFG).

DWR, on behalf of the State of California, “owns” or has fee-title to (i.e., is the controlling agency for) about 29,240 acres and DFG “owns” or has fee-title to approximately 5,660 acres of State-held lands within the FERC Project boundary. Figure 5.3-1, DWR Land Management Map, of the report for Study Plan L2 (SP-L2), Land Management, illustrates the locations of these lands and the facilities with which they are associated in the study area.

Table 4.6-1 summarizes the land ownership distribution of the study area and FERC Project boundary. More detailed ownership data are available in the report for SP-L1, Land Use Study.

Table 4.6-1. Land ownership inside the FERC Project boundary and in the study area.

Landowner	Inside the FERC Project Boundary[1]		Study Area[2]	
	Acres	Percent	Acres	Percent
Public				
Federal	6,240	15%	11,300	16%
State	34,900	85%	36,890	52%
Local Agencies	0	0%	440	1%
Subtotal: Public	**41,140**	**100%**	**48,630**	**69%**
Private	0	0%	20,700	29%
Other[3]	0	0%	1,200	2%
TOTAL	**41,140**	**100.0**	**70,530**	**100.0**

[1] *Includes lands within the FERC Project boundary.*
[2] *Includes lands within 0.25 mile of the FERC Project boundary.*
[3] *Represents road rights-of-way and public trust areas (e.g., river channel) without an official parcel number.*
Source: SP-L1, Table 5.2-1

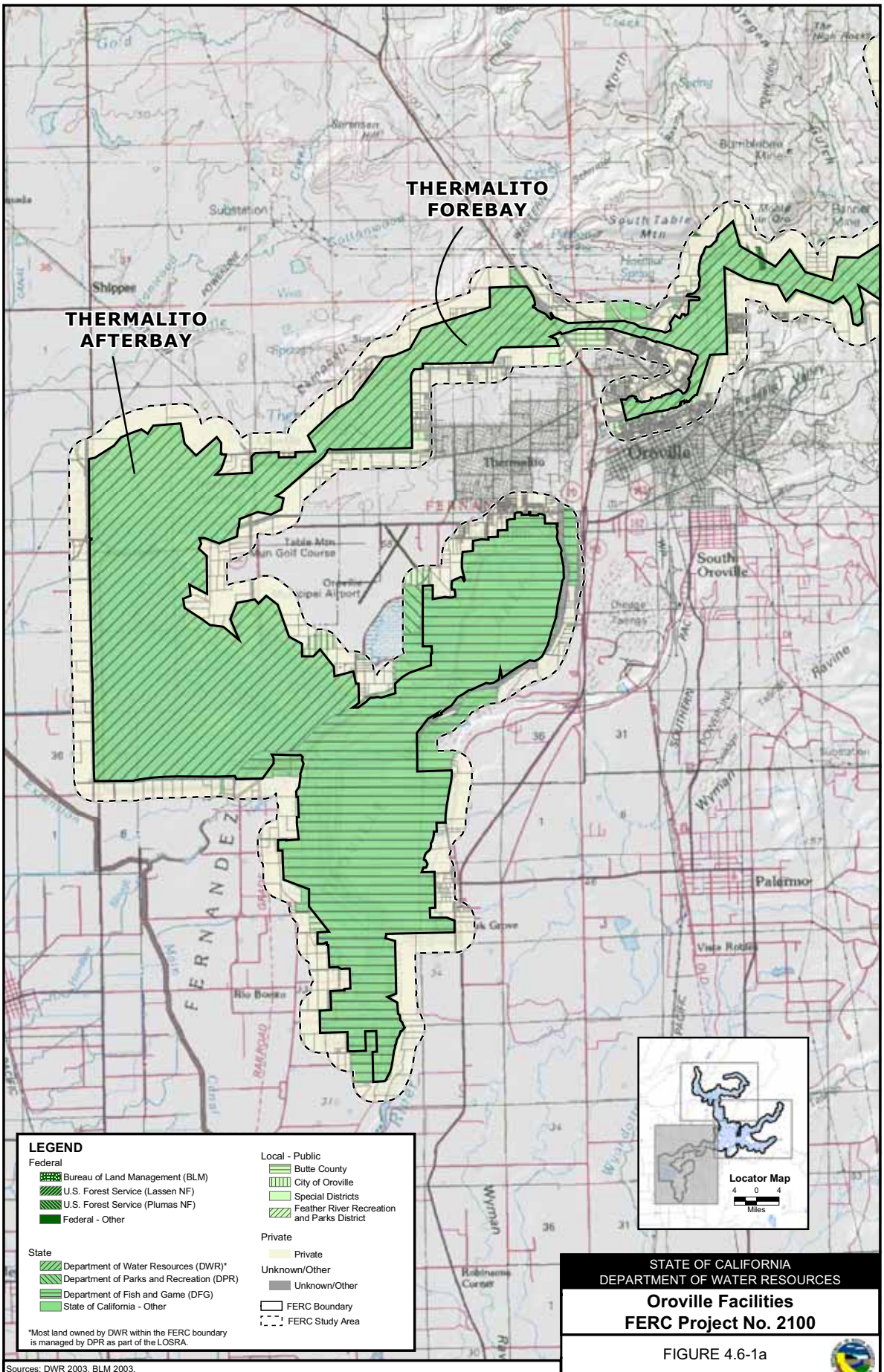
Land management in the study area is diverse, as illustrated by the multiple public land owners/managers described later in this section. In addition, there are substantial private property interests that are located inside the study area, but outside the FERC Project boundary. As illustrated in Figure 5.5-1, Land Management Direction from the report for SP-L2, Land Management Study, land management direction for most lands within the FERC Project boundary emphasizes recreation, wildlife conservation, and public facilities. Lands adjacent to the FERC Project boundary within the study area have different management directions, such as agricultural/rural residential development, timber preserve, conservation, recreation, and scenic lands.

Land use patterns within the study area are diverse. To categorize the variety of land uses, a land use classification system was developed for this document that utilizes eight major land use classifications: Reservoir/Open Water, Recreation, Conservation, Resource Extraction, Undeveloped, Urban, Rural, and Other. The report for SP-L1 describes the location patterns and how the eight classifications were developed.

The following discussion provides an overview of the land ownership, management, and use patterns for the four geographic sub-areas of the Oroville Facilities (i.e., Lake Oroville, the Diversion Pool and Thermalito Forebay, Thermalito Afterbay, and the LFC and OWA).

4.6.1.1 Lake Oroville

Ownership patterns in the Lake Oroville sub-area vary by location. Most of the land in the study area outside of the FERC Project boundary is privately owned, and most of the land within the FERC Project boundary is State-owned. Lands underlying and adjacent to the main body of Lake Oroville are primarily owned by DWR, but managed by DPR as part of the Lake Oroville State Recreation Area (LOSRA). There are scattered areas of federally owned lands both within the study area and within the FERC Project boundary (including underneath Lake Oroville). Federal lands are



Sources: DWR 2003, BLM 2003, CDFG 2002, EDAW 2004

6,000 3,000 0 6,000 Feet

Original Scale 1 : 72,000
1" = 6,000 feet

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Oroville Facilities
FERC Project No. 2100

FIGURE 4.6-1a

Existing Land Ownership
Feather River - Below Oroville Dam
Public Document

Prepared by:	Date	
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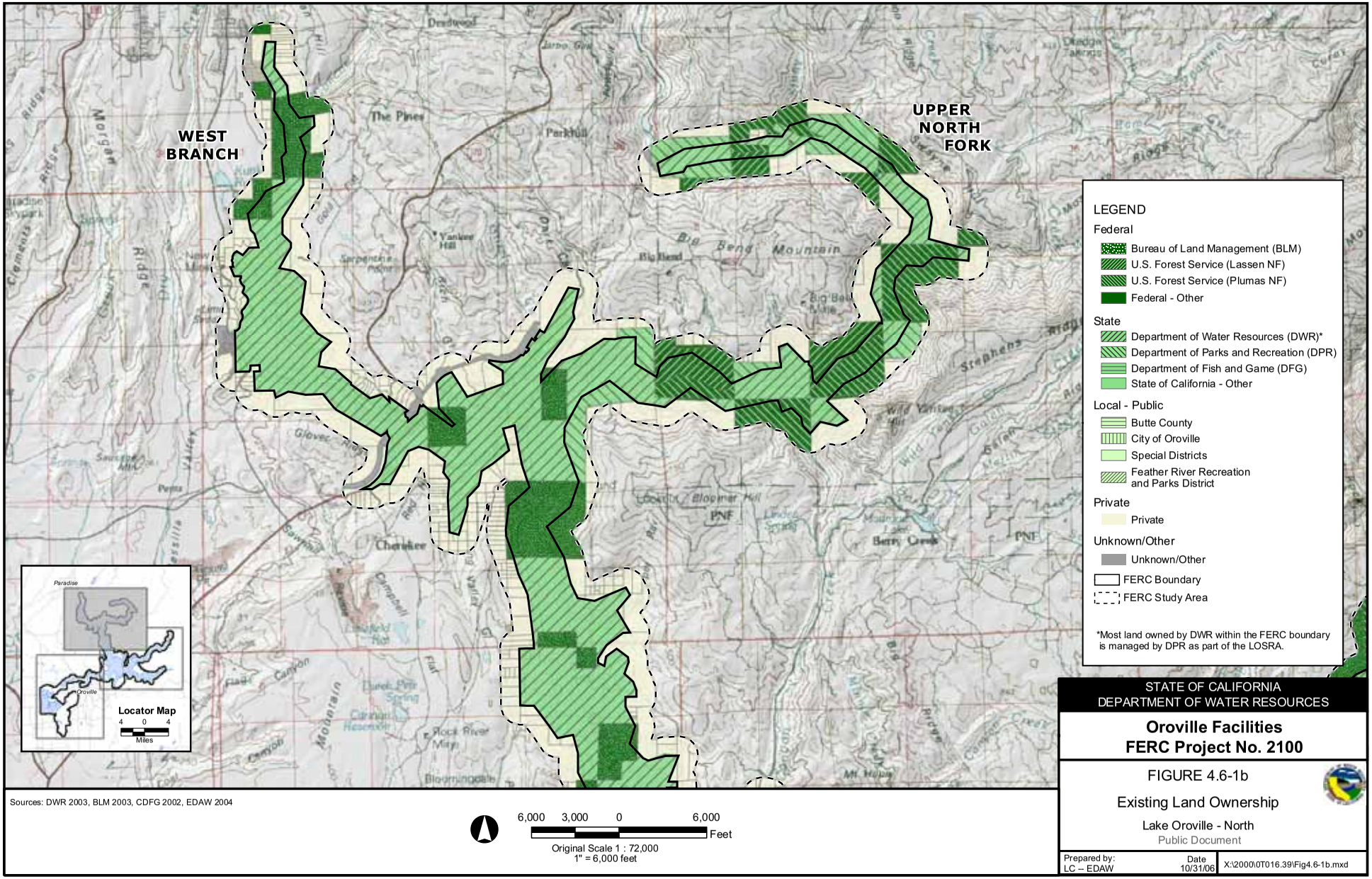
WEST BRANCH
UPPER NORTH FORK
LEGEND
Federal
Bureau of Land Management (BLM)
U.S. Forest Service (Lassen NF)
U.S. Forest Service (Plumas NF)
Federal - Other
State
Department of Water Resources (DWR)*
Department of Parks and Recreation (DPR)
Department of Fish and Game (DFG)
State of California - Other
Local - Public
Butte County
City of Oroville
Special Districts
Feather River Recreation and Parks District
Private
Private
Unknown/Other
Unknown/Other
FERC Boundary
FERC Study Area
*Most land owned by DWR within the FERC boundary is managed by DPR as part of the LOSRA.
Locator Map
4 0 4
Miles
Sources: DWR 2003, BLM 2003, CDFG 2002, EDAW 2004
6,000 3,000 0 6,000
Feet
Original Scale 1 : 72,000
1" = 6,000 feet
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Facilities
FERC Project No. 2100
FIGURE 4.6-1b
Existing Land Ownership
Lake Oroville - North
Public Document
Prepared by:
LC -- EDAW
Date
10/31/06
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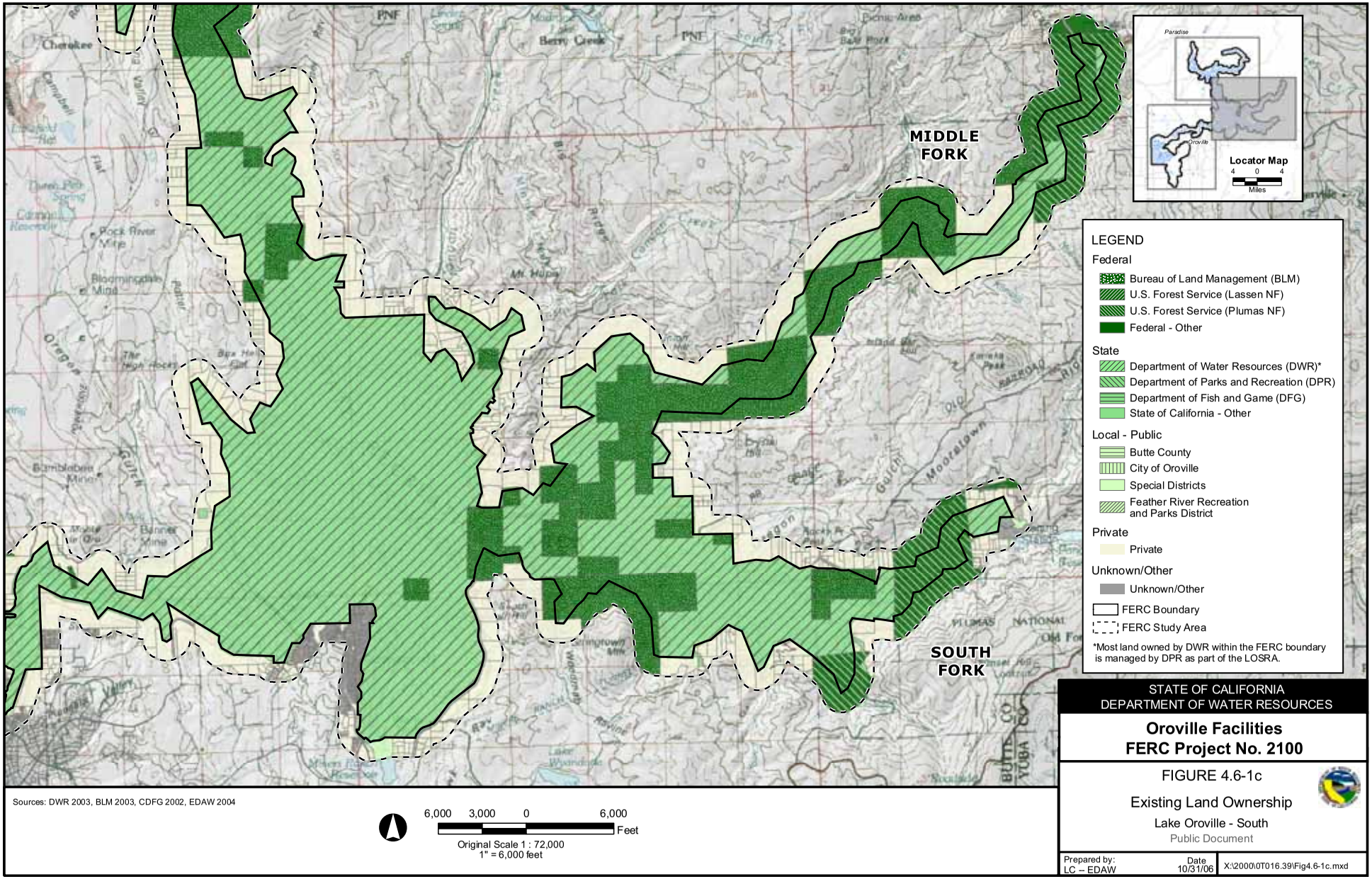

Sources: DWR 2003, BLM 2003, CDFG 2002, EDAW 2004

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Oroville Facilities
FERC Project No. 2100

FIGURE 4.6-1c

Existing Land Ownership

Lake Oroville - South

Public Document

Prepared by:	Date	
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generally located in the upper ends of the branches of Lake Oroville. The West Branch Feather River area is characterized by a relatively large amount of BLM land. The ownership pattern in the North Fork Feather River area is the most diverse in the study area, characterized by blocks of noncontiguous properties owned/managed by DWR, USFS (both Plumas and Lassen National Forest), DPR, and private interests. The Middle Fork and South Fork Feather River areas have similar ownership characteristics, containing a mix of DWR, BLM, USFS, and private land owners/managers. A small portion of the only Bureau of Indian Affairs–administered property (Enterprise Rancheria) is located along the Middle Fork Feather River tributary outside of the FERC Project boundary. Lands along the east, west, and south banks of the main body of Lake Oroville outside of the FERC Project boundary but within the study area are owned predominantly by private interests with limited public land holdings.

Lands underlying and adjacent to the main body of Lake Oroville, as well as surface waters of the LOSRA, are managed almost exclusively for recreational use. Small areas outside of the FERC Project boundary but within the study area in the Upper North, Middle, and South Forks are classified by USFS as unproductive forest lands (due to steep terrain and difficult access) that receive minimal management. Lands managed by BLM in these areas have been identified in the BLM's *Redding Resource Management Plan* (RRMP) for transfer to other entities.

The Middle Fork and South Fork Feather River areas have similar management characteristics, containing a mixture of lands managed by DPR, BLM, USFS, and private interests. Most of the lands along these two branches are currently managed for recreation and resource conservation, with limited areas for timber preserve. Butte County also has jurisdiction along these branches for private lands, although some are not provided with a zoning classification and continue to receive little to no management direction.

Lake Oroville covers approximately 15,400 surface acres when the reservoir level is at 900 feet above mean sea level (DWR 2001). Although Lake Oroville is classified as Reservoir/Open Water under the land use classifications used in this report, the reservoir's primary purpose is water supply serving the SWP; secondary uses include power generation, flood management, recreation, and fishery/wildlife habitat enhancement. For the most part, land immediately adjacent to the reservoir is contained within the LOSRA and is managed by DPR for recreational purposes and it has additional value as wildlife habitat. These lands include various developed facilities such as marinas, campgrounds, and boat launches, as well as undeveloped areas that are open to the public for dispersed recreational use. The only notable urban use in this sub-area is the Kelly Ridge residential development, located adjacent to the FERC Project boundary. Kelly Ridge is located on the south side of the reservoir, just east of Oroville Dam. On USFS lands in the upper portions of the North and South Fork Feather River branches are several areas classified as Resource Extraction. These areas would potentially allow timber harvest. The remainder of the Lake Oroville sub-area has been classified as Undeveloped and Conservation, with isolated rural areas.

4.6.1.2 Diversion Pool and Thermalito Forebay

The Diversion Pool and Thermalito Forebay study area contains landowners such as the federal government, the State, Butte County, the City of Oroville, FRRPD, and private interests. Public ownership in this segment tends to be at the State and local level, with several small BLM properties located west of Oroville Dam the only federal properties in the sub-area. All lands within the FERC Project boundary in this portion of the project are owned by the State. DWR is the primary landowner in this sub-area, administering land underlying the Diversion Pool and Thermalito Forebay, which is managed by DPR as part of the LOSRA. This sub-area also contains the majority of the City- and County-owned property in the study area. City properties are located along Montgomery Street within the city limits of Oroville; these properties are outside the FERC Project boundary. A cluster of County-owned properties is located just east of Thermalito Forebay, south of the FERC Project boundary. In this sub-area, private interests own the majority of the land outside the FERC Project boundary but within the study area.

The Diversion Pool and Thermalito Forebay area is particularly diverse in terms of land use. These lands contain a variety of management directions, including public facility management, commercial, recreation, agriculture, residential, and conservation. This sub-area is bisected by State Route (SR) 70, which separates the Diversion Pool area to the east and the Power Canal and Thermalito Forebay area to the west. Other transportation infrastructure includes the Union Pacific Railroad and numerous city/county roadways. The three water features, the Diversion Pool, Power Canal, and Thermalito Forebay, represent a significant land use and are classified as Reservoir/Open Water.

For the most part, the Recreation classification surrounds these water features, and includes the North and South Forebay recreation sites. Areas classified as Residential are located primarily west of the dam in the City of Oroville. Similarly, a range of Commercial/Industrial lands are found in the Oroville area along the LFC of the Feather River. The majority of the Oroville Facilities are located within the FERC Project boundary in this sub-area, including Oroville Dam, the Hyatt Pumping-Generating Plant, Palermo Canal Outlet Tunnel, Thermalito Diversion Dam, the Fish Barrier Dam, the Feather River Fish Hatchery, and the Thermalito Forebay Dam and Thermalito Pumping-Generating Plant. In terms of rural land uses, several pockets of land classified as Agriculture are found interspersed along with areas classified as Undeveloped.

4.6.1.3 Thermalito Afterbay

Ownership in the Thermalito Afterbay sub-area includes the State, Butte County, and the City of Oroville. Lands within the study area and outside of the FERC Project boundary are primarily owned by private interests, with the exception of small clusters of City- and State-owned properties within and around the OWA. All lands within the FERC Project boundary in this portion of the project are owned by the State.

Management in the Thermalito Afterbay area is somewhat complex. DFG is the primary land manager in this sub-area, which includes lands underlying Thermalito Afterbay as part of the OWA. However, DWR is responsible for recreation management at Thermalito Afterbay. DFG management direction for this area is primarily wildlife conservation and recreation. DWR has several third party leases and supports the active management of lands through these leases, which can improve land management accountability within the study area.

The Thermalito Afterbay sub-area is the most uniform in terms of land use. This area is characterized primarily by the Reservoir/Open Water and Conservation classifications within the FERC Project boundary, and Undeveloped and Agriculture classifications outside the FERC Project boundary (but within the study area). The Reservoir/Open Water classification reflects Thermalito Afterbay, and the Conservation classification represents the fact that this area is managed by DFG as part of the OWA. Outside the FERC Project boundary, Agriculture-based lands are concentrated west of SR 99 and south of Hamilton Road. Land use features located in this sub-area include several brood ponds, a shooting range, model airplane club, the Western Canal & Richvale Canal Outlet, Sutter Butte Canal Outlet and the Thermalito Afterbay Outlet, as well as several recreation sites, including the Monument Hill, Wilbur Road, and Larkin Road recreational facilities.

4.6.1.4 Low Flow Channel and OWA

Land within the study area that is outside of the FERC Project boundary is owned by an array of entities. Most of the land is owned by private interests, with other parcels owned by the State, Butte County, and the City of Oroville. Lands within the FERC Project boundary are owned by the State.

The OWA is the primary feature of the LFC and OWA sub-area. Those portions of the OWA within the FERC Project boundary are owned by the State and managed by DFG. Lands in this sub-area located outside the FERC Project boundary are managed by a mix of public and private interests, including DFG, Butte County, and the City of Oroville. Part of the LFC is within the FERC Project boundary and part is outside. DFG management direction for the OWA, which applies primarily to lands within the FERC Project boundary, is wildlife conservation and recreation. Management direction for some locations within this sub-area may be inconsistent at times.

The eastern part of the OWA is the major feature of the LFC and OWA sub-area and is located predominantly within the FERC Project boundary. Because of DFG management of the OWA, most land within the LFC and OWA sub-area has been classified Conservation. However, it is acknowledged that recreational use of the OWA (which includes the Rabe Road Shooting Area located outside of the FERC Project boundary) is considerable, with an emphasis on hunting and fishing activities. Other recreational uses in this area, but outside of the FERC Project boundary, include the Clay Pit State Vehicular Recreation Area (SVRA). In addition, there are currently gravel mining and rock removal leases to the west of SR 70 (within the OWA) that are held by private interests under lease agreements with the State. According to State lease

records, the area associated with gravel mining and rock removal operations within the OWA totals approximately 160 acres (DWR 2003). These lands are classified as Resource Extraction. Lands in this sub-area that are located outside the FERC Project boundary are diverse in terms of land use: Residential areas located north of the OWA along SR 162 and to the east of the OWA near Palermo Road, Commercial/Industrial areas located along Feather River Boulevard, Agriculture areas that surround the lower half of the OWA outside the FERC Project boundary, and Undeveloped areas interspersed within and around the OWA.

4.6.2 Land Management Entities

This section identifies the land management entities responsible for managing lands within the study area and FERC Project boundary, reviews the locations of lands managed by the various entities, and discusses the management direction of the entities. Figure 5.1-2, Primary Land Management Responsibility, of the report for SP-L2 depicts the entities responsible for managing lands in the study area.

4.6.2.1 Federal

Federal lands account for approximately 16 percent (11,300 acres) of the study area and 15 percent (6,240 acres) of land within the FERC Project boundary. Two federal agencies (USFS and BLM) manage the federal lands within the FERC Project boundary (Table 4.6-2).

U.S. Forest Service

USFS manages approximately 6 percent (4,370 acres) of lands in the study area and 4 percent (1,620 acres) of lands within the FERC Project boundary. Approximately 95 percent of the USFS lands are contained within the Plumas National Forest. The remaining 5 percent of USFS lands are located in the Upper North Fork and are part of the Lassen National Forest but are managed by the Plumas National Forest.

Management of USFS lands in the study area and FERC Project boundary is guided by several management plans and documents including the *Plumas National Forest Land and Resource Management Plan* (LRMP), *Herger Feinstein Quincy Library Group Forest Recover Act Environmental Impact Statement*, and the *Sierra Nevada Framework Record of Decision* (ROD). The Plumas National Forest LRMP management goals and policies direct the management of the Forest over 10–15 years (the “planning period”) and help meet long-term objectives over a 50-year period (the “planning horizon”). The LRMP is the document that guides most of the day-to-day management of the Forest. LRMP directives for the lands in the study area and FERC Project boundary primarily emphasize resource conservation, provision of high quality recreational opportunities, and protection of visual resources.

All USFS lands are managed through specific land use designation called Management Prescriptions. Each Management Prescription is composed of appropriate standards and guidelines that will meet some particular need (such as special habitat protection, recreation, recreation quality enhancement, or timber production) while allowing other

compatible activities. This direction supplements the *Forest-wide Standards and Guidelines,* which must always be applied (USFS 1998).

Table 4.6-2. Summary of public entity land management.

Public Entities	ACRES OF MANAGEMENT			
	Inside FERC Project Boundary	Percent Inside FERC Project Boundary	Study Area	Percent of Total Study Area
Federal				
USFS[1]	1,620	4%	4,400	6%
BLM	4,620	11%	6,600	9%
Other	0	0%	0	0%
Subtotal Federal	**6,240**	**15%**	**11,000**	**15%**
State				
DWR	2,000	5%	2,200	3%
DPR	22,100	54%	23,000	32%
DFG	11,200	27%	12,000	17%
Other	0	0%	0	0%
Subtotal State	**34,900**	**85%**	**37,200**	**52%**
Local Jurisdictions	**Private/Local Lands Subject to Local Land Management**			
Butte County	0	0%	21,300	31%
City of Oroville	0	0%	1,100	2%
Subtotal Local	**0**	**0%**	**22,400**	**33%**
TOTAL	**41,140**	**100%**	**70,500**	**100%**

[1] *Includes all management authority except for recreation and law enforcement, which was transferred to DPR.*

Sources: Butte County 2003 staff review of acreage totals from USFS, BLM, DWR, DPR, DFG, and City of Oroville; SP-L2, Table 5.1-1

Some USFS lands in the study area and FERC Project boundary (along the Upper North Fork and South Fork) have Management Prescriptions that would allow for varying degrees of timber harvest, and some are located in areas that might support timber harvest if not for steep terrain and difficult access. Many of these lands have been classified as unproductive or unsuitable for timber harvest. Due to resource protection concerns and difficult access, many of the USFS lands in the study area and FERC Project boundary have been managed in the past as de facto resource conservation lands. Under current USFS direction, these lands are being considered for fuel load management if they could be a threat to nearby urbanized areas.

USFS does not actively manage facilities or activities on most lands within the study area and FERC Project boundary. USFS and DPR have an agreement concerning management of USFS lands within the FERC Project boundary that are part of the LOSRA. The agreement, dated March 16, 1978, allows DPR to conduct law enforcement activities on USFS lands (USFS does, however, provide law enforcement to address illegal activities that take place on USFS lands such as illegal dumping of trash and hazardous materials, drug production lab debris, and vandalism of cultural resource sites). USFS retains all other authorities. In the agreement, USFS

"transferred interest" in USFS lands "within project boundaries shown in Exhibit K of the FERC license No. 2100 to permit the DPR to use, and protect said lands in a manner necessary to administer them for recreation purposes and, to the extent permissible, to enforce all applicable laws and regulations thereon." USFS is not interested in changing or terminating the agreement at this time but will reevaluate the agreement during the next Forest Plan revision (pers. comm., Taylor 2004). Currently, any development planned in conjunction with the Oroville Facilities on USFS lands, including construction of any facilities or infrastructure, within the National Forest must be approved by USFS prior to implementation (pers. comm., Humphreys 2003).

U.S. Bureau of Land Management

Federal lands managed by BLM are scattered throughout the region, primarily in the northern reaches of the West Branch Feather River, within the main body of the reservoir, and in the Middle and South Fork tributaries. In total, BLM manages approximately 9 percent (6,640 acres) of the land in the study area and 11 percent (4,620 acres) of lands within the FERC Project boundary. Most of these lands are noncontiguous, scattered parcels, some of which are submerged under Lake Oroville (see Figure 5.2-2 in the report for SP-L2).

BLM manages lands in the study area under the direction of the 1993 RRMP. Lands managed by BLM in and around the study area are designated as "undeveloped public lands." BLM has expressed a desire to surplus many properties in the study area and FERC Project boundary with public agencies. At an operational level, BLM has prioritized the following three management objectives for lands in and near the study area (pers. comm., Berg 2003):

1. Identify what lands are of specific interest to the State of California within the study area;

2. Design the mechanism(s) to effect transfer of surplus federal lands to the State of California; and

3. Complete transfer.

DWR and DPR have engaged in discussions with BLM regarding potential transfer of BLM lands to the State of California. In addition, DPR has submitted applications to BLM for land transfer sites within the study area in the vicinity of Stringtown Mountain along the South Fork of the Feather River. This area is of great cultural interest to the four recognized tribes in the Oroville area. Cultural issues are currently the major local management issues facing BLM (pers. comm., Matzat 2003).

Federal–Other

Due to the nature of the Geographic Information System (GIS) mapping process, certain lands in the study area are classified as Federal–Other (none of these lands are within the FERC Project boundary). These lands represent areas that are coded as federal lands in the Butte County parcel base. The parcel base does not track agency-level

ownership information, and these lands are not covered by the agency-specific data sources. These areas are a product of agency-specific data not completely matching the boundaries in the parcel data, thus resulting in small "sliver" polygons that cannot be attributed to a particular agency. These lands represent a minor percentage (less than 1 percent) of the study area total.

4.6.2.2 State of California

The State of California (DWR) owns and manages approximately 53 percent (37,200 acres) of land in the study area and 85 percent (34,900 acres) of land within the FERC Project boundary. DWR and DFG have fee title to all of the State-owned land within the FERC Project boundary and have a mandate to manage public recreation and fish and wildlife preservation and enhancement in connection with the SWP. At the Oroville Facilities, the management of various resources is shared among three agencies—DWR, DPR, and DFG. In 1961, DWR transferred recreational interests and management responsibility for 23,000 acres within the FERC Project boundary to DPR. These lands constitute the majority of the LOSRA. DPR is charged with designing, constructing, operating, and maintaining public recreational facilities on these lands. In 1961, DWR transferred approximately 12,000 acres of land within the FERC Project boundary to DFG. These lands constitute much of the OWA reserving any interests necessary to construct, operate, and maintain the SWP. DFG is charged with State-wide management of fish and wildlife habitats/associated recreational facilities.

The following sections discuss the State agencies with land and resource management responsibilities within the study area and FERC Project boundary.

California Department of Water Resources

As the owner, manager, and operator of the Oroville Facilities, which include all dams, powerhouses, and transmission facilities located within the FERC Project boundary, DWR has direct management responsibility for approximately 2,000 acres within the FERC Project boundary that are not managed by DPR as part of the LOSRA or DFG as part of the OWA. The lands that DWR has primary management responsibility for are generally related to operation of the project. DWR also has primary management responsibility for approximately 2,000 acres in the study area. Management of the Oroville Facilities is based on the terms of the existing FERC license. Day-to-day operations of the facilities are the responsibility of DWR. DWR has leased several parcels totaling approximately 700 acres to private groups or individuals in locations where DWR has primary management authority, as well as in locations within the OWA and LOSRA. These leases are generally located on scattered, noncontiguous parcels west of Oroville Dam and within the OWA and are summarized in Table 4.6-3. In addition, Table 5.3-1 of the report for SP-L2 provides more detailed information regarding known third-party lease arrangements with DWR.

Table 4.6-3. DWR third-party leases.

Purpose	Type	Acres	Lessee
Cattle grazing	Private	417	John Campbell
Community recreation	Local public	44	FRRPD
Cemetery	Private	23.7	Cemetery[1]
Site for flying model airplanes	Private	Not Known	Model Aircraft Flying Facility
Shooting range	Local public	9	Butte College
Rock removal	Local public	10	Joint Water Districts Board
Gravel extraction	Private	50	Mathews Ready Mix
Gravel extraction	Private	100	Granite Construction
Game bird raising	Private	77	K & L Quail Ranch[1]

[1] *Outside FERC Project boundary but within the 0.25-mile study area.*

Source: Maria Chin, DWR Division of Land and Rights-of-Way November 2003 (see SP-L2, Section 5.3-1)

California Department of Parks and Recreation

As mentioned previously, upon completion of the Oroville Facilities, the recreational interest for lands within what is now the LOSRA was transferred by DWR to DPR. The transfer was completed under the *Agreement for Transfer to Department of Parks and Recreation of Interest in Certain Real Property at Oroville Division of State Water Project*. DPR has the primary recreational management responsibility for most of the land underlying and surrounding Lake Oroville and its facilities, including lands that comprise the LOSRA. DPR coordinates management of the LOSRA with DWR, the California Department of Boating and Waterways (DBW), DFG, CDF, Butte County, the California Highway Patrol (CHP), USFS, volunteer organizations, and other groups and agencies. Although DPR manages the majority of LOSRA's recreational aspects, DWR bears the ultimate responsibility under the current FERC license for ensuring funding, development, and management of current and additional recreational facilities and FERC Project 2100. The Davis-Dolwig Act (Water Code Sections 11910–11925) requires DWR to plan for and acquire land for recreation in conjunction with all SWP facilities. In keeping with its responsibility, DWR works with DPR and DFG to provide for recreational opportunities and funding throughout the FERC Project boundary and LOSRA.

The LOSRA consists of major facilities at Loafer Creek, Bidwell Canyon, Spillway, Lime Saddle, the Lake Oroville Visitors Center, and North and South Thermalito Forebay and includes waters and lands in the West Branch, Upper North Fork, Lower North Fork, Middle Fork, South Fork, and the main basin. Figure 5.3-2 of the report for SP-L2, Land Management Study, depicts the locations of these facilities.

DPR has management responsibility for approximately 32 percent (23,000 acres) of land within the study area. Within the FERC Project boundary, DPR has management responsibility for approximately 54 percent (22,100 acres) of the land within the FERC Project boundary, all of which is located in the LOSRA. DPR's management responsibilities for the LOSRA include addressing a variety of issues such as safety, facilities maintenance, and overall visitor management for all recreational activities.

DPR coordinates these activities, when appropriate, with DWR, DBW, DFG, CDF, Butte County, CHP, volunteer organizations, and other groups and agencies.

The LOSRA is managed under the guidance of the LOSRA General Plan (GP), which was developed by the DPR in 1973 and is currently being updated. An amendment adopted in 1988 details additional development in the Lime Saddle area. The GP describes allowable recreational uses and intensities for various areas around the reservoir, such as Bidwell Canyon, Lime Saddle, Goat Ranch, and others. In compliance with the FERC Order of October 1, 1992, DWR prepared the Amended Recreation Plan (ARP) in 1993 as the recreation plan for the LOSRA. The ARP was adopted by the FERC Order of September 22, 1994 and superseded the 1966 Plan, Bulletin 117-6. DWR developed the ARP for the LOSRA to address public concerns associated with the recreation development associated with the project. The 1993 ARP describes a number of improvements and DWR commitments to construct specific facilities and take actions to address the fisheries and recreation needs at the project; additional improvements and actions deemed necessary by FERC were included in the September 22, 1994, Order. The 1993 ARP also detailed the timeframe for the completion of additional proposed recreational facilities. DWR acknowledges in the ARP that as the licensee, they are responsible for funding specific improvements. The ARP describes the fish and wildlife resources, facilities, local area, user patterns, operation of LOSRA and OWA facilities, economic considerations, recreation plan, and the fisheries management plan. The ARP puts forth recommendations for facility expansion and modification in light of these findings. These recommendations have since been implemented.

California Department of Fish and Game

DFG manages approximately 12,000 acres of land, or 17 percent of the total study area. Most of this area (11,200 acres) is located within the FERC Project boundary. DFG manages fish and wildlife habitat and associated recreational use for both surface water and dry lands within the OWA and the fish and wildlife habitat of the LOSRA. In addition, DFG manages and operates the Feather River Fish Hatchery. Figure 5.3-3 of the report for SP-L2, Land Management Study, illustrates the locations of DFG-managed lands, as well as facilities for which the agency is responsible within the study area. Most of the land area for which DFG provides day-to-day management is within the OWA and is located within the FERC Project boundary. The OWA includes Thermalito Afterbay and a wide swath of wildlife habitat straddling the Low Flow and High Flow Channel sections of the project south and west of the City of Oroville.

DFG manages the OWA, the wildlife and habitats of the LOSRA, and its other State-wide responsibilities under the California Fish and Game Code, Sections 1525–1530, and the California Fish and Game Commission's Hunting and Other Public Uses on State and Federal Lands California Regulations (DFG 2002). To ensure compatibility with the goals and uses of the Oroville Facilities within the LOSRA, DFG is also responsible for managing fish and wildlife resources and recreational activities pursuant to the Davis-Dolwig Act (Water Code Section 11917). Within the OWA, DFG strives to carry out management responsibilities as identified in the 1978 *Oroville Wildlife Area*

Management Plan (DFG 1978). DFG intends to revise the Management Plan in the near future.

Remote areas within the OWA that are accessible by road have been susceptible to illegal activities, such as dumping, fires, and lawless behavior. Consequently, some access restrictions have been implemented.

4.6.2.3 Local Entities

Butte County

All lands in the study area owned by Butte County are located outside the FERC Project boundary. County-owned properties generally reflect administrative uses for government services. In total, Butte County owns approximately 100 acres of land, which represents less than 1 percent of the study area and FERC Project boundary. Butte County has land management jurisdiction over approximately 21,300 acres of private lands within the study area, which represents approximately 31 percent of the entire study area. There are no private lands within the FERC Project boundary. All private development in Butte County is subject to the policies detailed in the Butte County GP and Zoning Ordinance.

The Butte County Zoning Ordinance is the regulatory mechanism that implements the County's land use designations listed in the Butte County GP. The zoning ordinance is a set of districts with different regulations on permitted uses, residential densities, lot sizes, signs, parking, and the intensity and placement of structures. The written text of the ordinance is accompanied by maps dividing the entire jurisdiction into zoning districts.

The majority of private lands under Butte County jurisdiction outside of and adjacent to the FERC Project boundary are designated Unclassified, consisting primarily of constrained areas that require minimal oversight. Butte County's land use designations are summarized in Table 5.4-1 of the report for SP-L2, Land Management Study. For each designation, this table describes both primary and secondary use and identifies the implementing zoning designations. The County's zoning designations, aggregated into categories, are illustrated in Figures 5.4-1a through 5.4-1c, Butte County Zoning, of the report for SP-L2, Land Management Study.

City of Oroville

The City of Oroville owns a limited number of properties in the study area, all of which are located outside of the FERC Project boundary. City-owned properties typically represent uses pertaining to government services and recreation. In total, the City owns roughly 150 acres of land in the study area.

Part of the study area is located within the boundary of the City of Oroville. These areas are located south of Lake Oroville and west of Saddle Dam and include the shoreline of Lake Oroville between the Saddle Dam and the northeastern edge of the Oroville Dam Spillway, the Diversion Pool, Thermalito Forebay, Thermalito Afterbay, the LFC of the

Feather River, and the OWA. In total, roughly 1,100 acres (or 2 percent of the total study area) are located within the City limits. No lands owned by the City of Oroville are located within the FERC Project boundary. Figure 5.4-2, City of Oroville Zoning, of the report for SP-L2, Land Management Study, illustrates the City of Oroville zoning within the City as it relates to the study area.

All development and activity within the City of Oroville is subject to the policies outlined in the City's GP and Zoning Ordinance. The objectives detailed in the GP pertaining to land use serve as a framework within which the City makes decisions relating to activities and developments within the study area that fall under its authority. The policies detailed in the plan represent the city's adopted commitments to actions that are intended to implement the community's broader objectives.

The Land Use Element of the Oroville GP designates areas near the project facilities as "Medium Density Residential" and "Parks." These land use designations are described in the report for SP-L2, Land Management Study.

Oroville GP policies that relate to the operation and management of Lake Oroville generally include enhancement of recreational and biological resources at Lake Oroville, as well as reducing potential flood and seismic hazards. Policies that specifically mention the Oroville Facilities are listed in Table 5.4-3 of the report for SP-L2, Land Management Study, organized by element of the Oroville GP.

Feather River Recreation and Park District

Another local entity that owns and administers lands in the study area is the FRRPD, which was established in 1953 and provides a variety of park and recreational services to residents of southeast Butte County. FRRPD holdings in the study area, which include Riverbend Park located west of SR 70 at Montgomery Street consisting of 50 owned and 100 DFG leased acres as well as roughly 18 owned acres and 34 acres leased from DWR for Nelson Avenue Park.

Other Local Districts/Agencies

There is also a set of public agencies, including local districts, that own property in the study area. Aside from the FRRPD described above, the following entities own land within the study area but outside the FERC Project boundary:

- Sacramento and San Joaquin Drainage District;
- County Board of Education;
- County Housing Authority;
- Thermalito Irrigation District;
- Richvale Irrigation District;

- Oroville Area Public Utility District;
- Oroville Elementary School District;
- Oroville Union High School District;
- Thermalito Elementary School District;
- Biggs-West Gridley Water District;
- Western Canal Water District; and
- South Feather Water and Power Agency.

In total, these entities own approximately 156 acres of land in the study area, representing less than 1 percent of the study area total.

4.6.2.4 Private

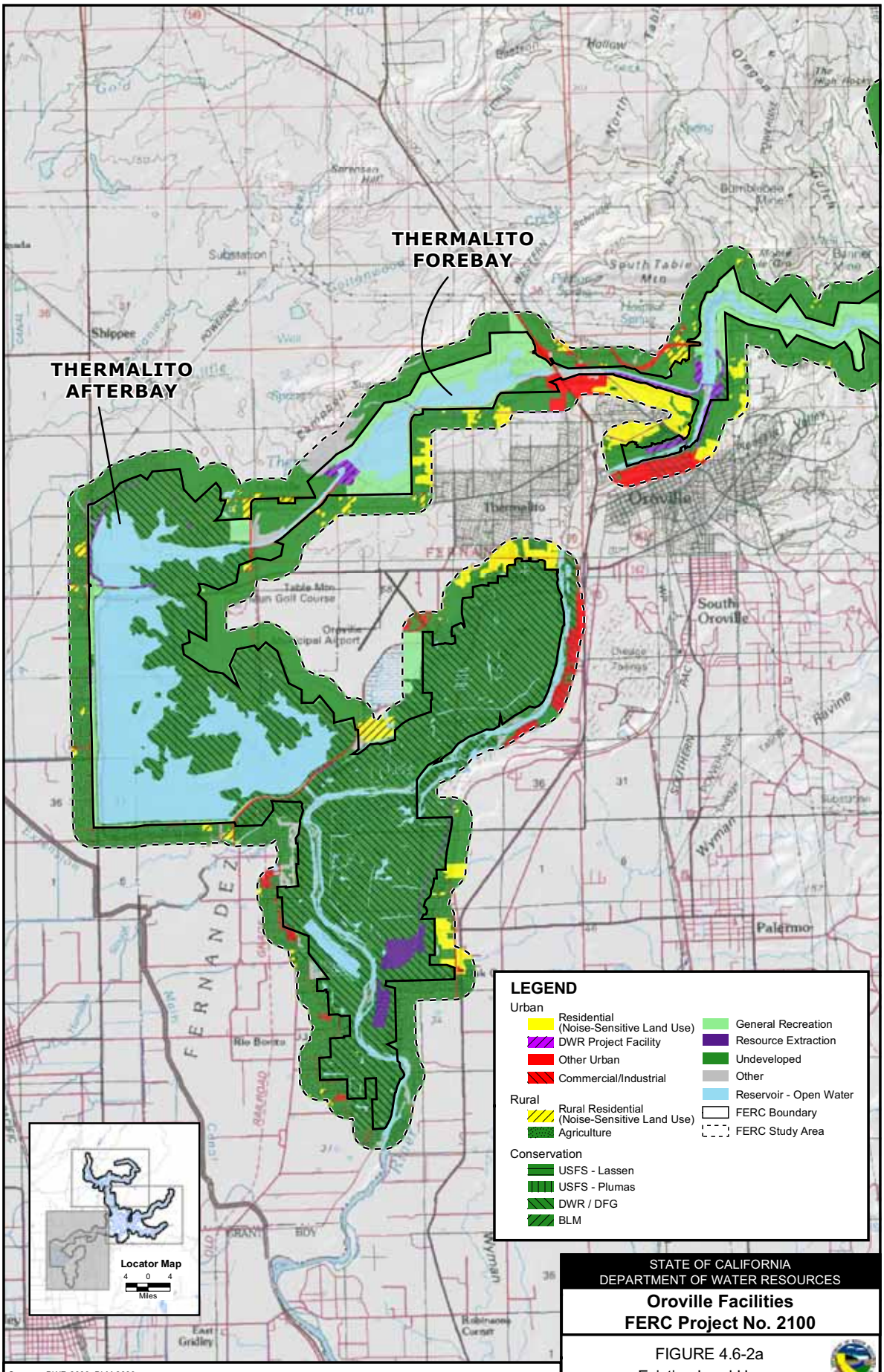
There are no private ownership interests within the FERC Project boundary; however, land in the study area (including land outside the FERC Project boundary) is predominantly owned by public agencies (approximately 69 percent) and private interests who own approximately 29 percent of lands in the study area. One of the larger private landowners in the study area is Pacific Gas and Electric Company (PG&E). This entity primarily uses lands in the study area for transmitting power. In general, management of private lands must comply with current land use planning guidelines (i.e., general plans) and regulations (i.e., zoning ordinances) of Butte County and the City of Oroville.

4.6.2.5 Other

The remaining lands in the study area are either State or County road rights-of-way or areas without an official parcel number, which are often attributed to public trust lands such as the river channel. Because these lands do not reflect meaningful ownership information, they have been classified as "Other." There are approximately 1,200 acres of other-owned land, representing nearly 2 percent of the study area total.

4.6.3 Existing Land Uses

The section is based on information in the report for SP-L1, Land Use Study, developed using available GIS data for the study area. Existing land uses in the study area have been organized into eight major land use classifications as shown in Table 5.8-4 of the report for SP-L1, which summarizes the respective major land use classifications within the FERC Project boundary and in the study area. Figures 4.6-2a, 4.6-2b, and 4.6-2c illustrate the existing land use patterns in the study area.



Sources: DWR 2003, BLM 2003, CDFG 2002, EDAW 2004

6,000 3,000 0 6,000 Feet

Original Scale 1 : 72,000
1" = 6,000 feet

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Oroville Facilities
FERC Project No. 2100

FIGURE 4.6-2a

Existing Land Uses, Including Noise-Sensitive Uses

Feather River - Below Oroville Dam

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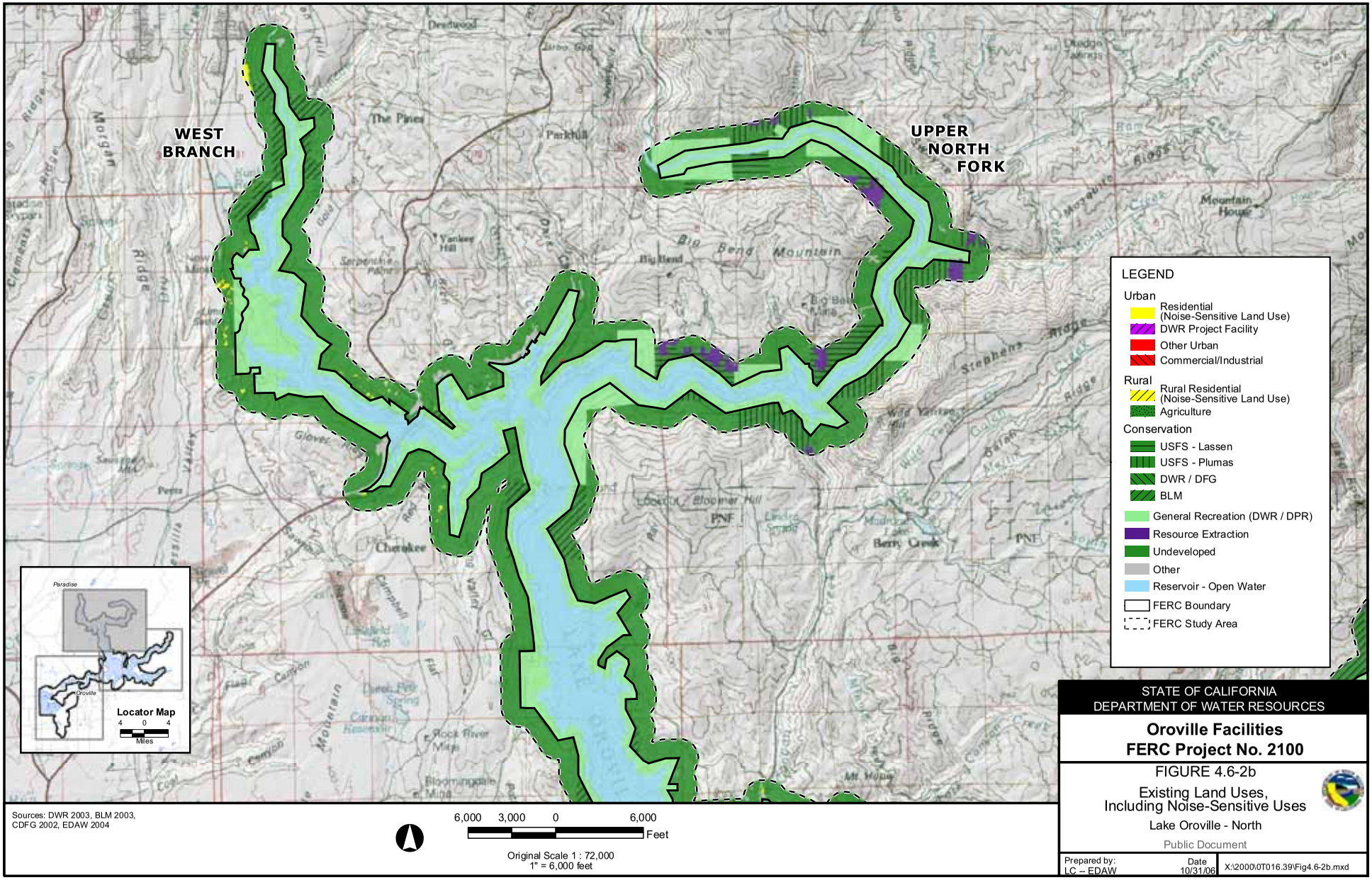
WEST BRANCH
UPPER NORTH FORK
LEGEND
Urban
Residential (Noise-Sensitive Land Use)
DWR Project Facility
Other Urban
Commercial/Industrial
Rural
Rural Residential (Noise-Sensitive Land Use)
Agriculture
Conservation
USFS - Lassen
USFS - Plumas
DWR / DFG
BLM
General Recreation (DWR / DPR)
Resource Extraction
Undeveloped
Other
Reservoir - Open Water
FERC Boundary
FERC Study Area
Locator Map
4 0 4
Miles
Sources: DWR 2003, BLM 2003, CDFG 2002, EDAW 2004
6,000 3,000 0 6,000
Feet
Original Scale 1 : 72,000
1" = 6,000 feet
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Facilities
FERC Project No. 2100
FIGURE 4.6-2b
Existing Land Uses, Including Noise-Sensitive Uses
Lake Oroville - North
Public Document
Prepared by: LC -- EDAW
Date 10/31/06
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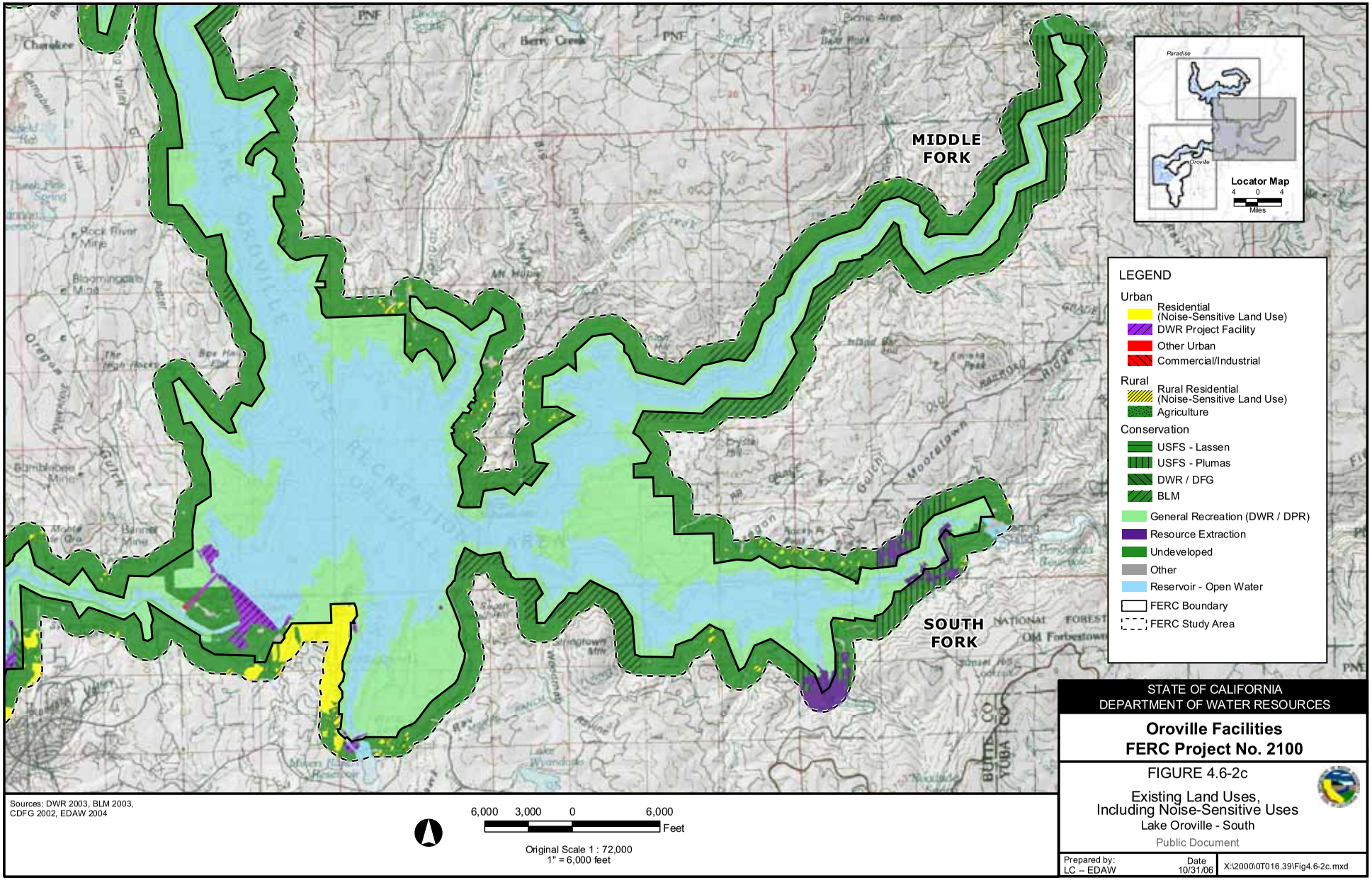
MIDDLE FORK
SOUTH FORK
Locator Map
4 0 4
Miles
LEGEND
Urban
Residential (Noise-Sensitive Land Use)
DWR Project Facility
Other Urban
Commercial/Industrial
Rural
Rural Residential (Noise-Sensitive Land Use)
Agriculture
Conservation
USFS - Lassen
USFS - Plumas
DWR / DFG
BLM
General Recreation (DWR / DPR)
Resource Extraction
Undeveloped
Other
Reservoir - Open Water
FERC Boundary
FERC Study Area
Sources: DWR 2003, BLM 2003, CDFG 2002, EDAW 2004
6,000 3,000 0 6,000
Feet
Original Scale 1 : 72,000
1" = 6,000 feet
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Facilities
FERC Project No. 2100
FIGURE 4.6-2c
Existing Land Uses, Including Noise-Sensitive Uses
Lake Oroville - South
Public Document
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4.6.3.1 Agricultural Resources

One of the sub-classifications shown in Table 4.6-4 is Agricultural, which refers to several, more specifically defined, agriculture-related land uses within the study area and FERC Project boundary. These uses include fallow fields, hayfields, orchards, pastures, rice, row crops, and vineyards. Further information regarding agricultural resources is provided in Section 4.13 of this DEIR and Appendix G-LU1, Agricultural Resources, in the PDEA (DWR 2005).

Table 4.6-4. Land uses in the study area.

Land Use	FERC Project Boundary		Study Area[1]	
	Acres[2] (approx.)	Percent	Acres[2] (approx.)	Percent
Urban				
Residential	0	0%	1,100	2%
Commercial/Industrial	0	0%	100	<1%
Project Facilities	400	<1%	700	1%
Other Urban	100	<1%	400	<1%
Subtotal: Urban	***500***	***1%***	***2,300***	***4%***
Rural				
Rural Residential	0	0.0%	400	1%
Agriculture	0	<1%	2,200	3%
Subtotal: Rural	***0***	***0%***	***2,600***	***4%***
Recreation	12,600	30%	13,900	20%
Conservation	7,300	18%	12,300	17%
Resource Extraction	200	<1%	700	1%
Undeveloped/Habitat	1,000	2%	18,700	26%
Other	200	<1%	700	1%
Reservoir/Open Water[3]	18,900	46%	19,300	27%
TOTAL[4]	**41,200**	**100.0%**	**70,500**	**100.0%**

[1] *Includes the FERC Project boundary and non-project lands adjacent to and within 0.25 mile of the FERC Project boundary.*
[2] *Acres are approximate and rounded to the nearest 100.*
[3] *Measure at full pool elevation (including all project water features).*
[4] *Numbers may not add up to 100 percent due to rounding.*
Source: Data compiled by EDAW in 2003.

4.6.4 Relevant Plans and Policies

FERC requires that relicensing applicants evaluate how compatible their project and project operations are with other comprehensive management plans. SP-L3, Comprehensive Plans Consistency Evaluation, was prepared by DWR to fulfill this requirement.

The study summarized the plans and policies that have been developed by federal, State, and local planning and resource agencies and other entities that are responsible for managing lands and resources within the study area. Some of these comprehensive plans were identified by FERC, some were relevant plans identified by staff, and others were plans identified by the Land Use, Land Management, and Aesthetics Work Group.

The agencies and jurisdictions responsible for implementing the plans were asked to review the descriptions of the plans for accuracy. Most of these agencies and entities responded and their suggested changes were incorporated in the report for SP-L3. The study area includes Lake Oroville, the lands and waters within the FERC Project boundary and one-quarter mile outside the boundary, adjacent lands, facilities, and areas with a clear Project nexus. A brief summary of agencies whose plans are relevant to the proposed project is shown below. A more detailed description of the plans is included in the report for SP-L3.

4.6.4.1 Federal Management Plans

The federal government does not have extensive land holdings in the study area. For a more detailed discussion related to the management of lands in the study area, refer to the report for SP-L2, Land Management Study. Federal lands that are in the project area are managed by USFS and BLM. USFS lands are part of the Plumas and Lassen National Forests and are managed under the Plumas National Forest LRMP. In addition, management of these lands is influenced by the more recent *Sierra Nevada Forest Plan Amendment*. BLM is responsible for scattered lands managed under the direction of the RRMP. All three plans are discussed below. In addition to the comprehensive plans developed by USFS and BLM that were reviewed, a plan for restoring anadromous fish (*Final Restoration Plan for Anadromous Fish Restoration Program*), written by USFWS, was reviewed. The ROD for the Title 34 Central Valley Project Improvement Act that was written by the U.S. Bureau of Reclamation and USFWS was reviewed, as was a plan developed by California and Federal Bay-Delta Program Agencies entitled *California's Water Future: A Framework for Action*.

4.6.4.2 State Management Plans

The State of California owns and manages a significant amount of land in the FERC Project area. Several agencies are responsible for the management of State land and have developed management plans for guidance. State agencies that have management responsibilities for State lands in the FERC Project area include DWR, DPR, and DFG. In addition to these three State agencies, the California Department of Forestry and Fire Protection (CDF) has developed management plans that influence land and resource management activities in the FERC Project area. The following section summarizes State agency plans and information that pertain to the FERC Project area.

4.6.4.3 Local Management Plans

There are three local entities in the FERC Project area that have land planning and/or management responsibilities. The Butte County Association of Governments (BCAG) is the Metropolitan Planning Organization and Regional Transportation Planning Agency and is responsible for the preparation of all federal and State transportation plans and programs for securing transportation funds. BCAG is an association of local governments formed by Butte County; the cities of Biggs, Chico, Gridley, and Oroville; and the Town of Paradise. In addition to BCAG, Butte County and the City of Oroville

also have comprehensive and/or management plans for lands in the FERC Project area.

Although the majority of land in the FERC Project area is managed by State agencies, there are considerable City and County lands that are within the study area.

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4.7 RECREATIONAL RESOURCES

This section presents combined results from recreation relicensing studies that summarize the components of the affected environment. The affected environment, including the surrounding regional area (Study Plan R-14 [SP-R14], Assessment of Regional Recreation and Barriers to Recreation), as well as recreation lands, sites, and activity types available at Lake Oroville are discussed (SP-R10, Recreation Facility Inventory and Condition Report) in this section. Recreation use levels for the various activities are also presented (results from SP-R9, Existing Recreation Use). The existing recreation management structure (results from SP-R5, Assessment of Recreation Areas Management) is also discussed for each of the geographical areas within the FERC Project boundary.

4.7.1 Regional and Project Recreational Setting

This section provides a description of the overall regional and Oroville Facilities' recreational setting, and a discussion of the recreational facilities' role in meeting regional and local recreation needs, to provide context to the subsequent description of the recreation opportunities and facilities provided within the project area.

4.7.1.1 Regional Setting

Reservoirs of various sizes are numerous in Northern California, offering recreationists many choices in destinations, settings, and activities. The 2 largest reservoirs (in terms of surface area) in the state are within a 2-hour drive of Oroville: Shasta Lake, with 29,500 acres, and Lake Almanor, with 27,064 acres. Both of these reservoirs are in attractive mountainous settings. Three reservoirs in the region are similar in size to Lake Oroville: Folsom Reservoir (12,000 acres), Lake Berryessa (21,000 acres), and Trinity Lake (16,535 acres). Smaller reservoirs (less than 5,000 acres) are more numerous and include Black Butte Lake, Bucks Lake, Bullards Bar Reservoir, Butt Valley Reservoir, East Park Reservoir, Englebright Lake, Indian Valley Reservoir, Lake Pillsbury, Lake Spaulding, Little Grass Valley Reservoir, Stony Gorge Reservoir, SWP Upper Feather River reservoirs (Antelope, Frenchman, Davis), and Whiskeytown Lake. These water bodies range in surface acreage from 698 acres (Lake Spaulding) to 4,700 acres (Bullards Bar). The region also offers 2 large and well known natural lakes: Lake Tahoe (122,200 acres) and Clear Lake (40,000 acres).

Many of these other lakes and reservoirs have facilities similar in type to Lake Oroville's and offer similar recreation experiences, activities, and opportunities. All of these regional water bodies have boat launching facilities and campgrounds. Lake Oroville is unique in offering floating campsites and equestrian trail-riding combined with equestrian camping.

4.7.1.2 Project Setting

The Oroville Facilities are located at the edge of the foothills of the Sierra Nevada and on the eastern margin of Sacramento River Valley. Lake Oroville sits above the city of

Oroville and is surrounded by steep slopes with mixed oak and conifer woodlands. Several hills and ridges rise from 1,000 to 2,000 feet (ft) or more above the reservoir. Aside from Oroville Dam and developed recreation areas, most of the surrounding lands are undeveloped and natural appearing. The reservoir has narrow and winding forks, and has a surface area of over 15,000 acres at the full pool elevation of 900 ft above mean sea level (msl), making it the fourth largest reservoir in California in surface acres after Shasta Lake, Lake Almanor, and Lake Berryessa.

Water from Lake Oroville is released from Oroville Dam to the Diversion Pool, which winds about 4.5 miles between steep wooded hillsides. Thermalito Diversion Dam diverts most of the water released to the Diversion Pool down a 10,000-foot-long canal to Thermalito Forebay, a 630-acre hourglass-shaped reservoir sitting at the base of low-lying grass-covered hills. Water passed to the Thermalito Forebay in turn flows through a powerhouse and canal to the 4,300-acre Thermalito Afterbay, a broad and shallow reservoir surrounded on two sides by a low earthfill dam and by flat to gently rolling grasslands. Water is discharged into canals at several Thermalito Afterbay locations for agricultural use. Water not diverted from Thermalito Afterbay is released back to the Feather River through the Thermalito Afterbay Outlet, near the southeast corner of the reservoir.

Water not routed through Thermalito Forebay and Thermalito Afterbay from the Diversion Pool passes through the Low Flow Channel (LFC) of the Feather River, the 9-mile-long section of the river upstream of the Thermalito Afterbay Outlet. The first half mile of the LFC is occupied by the Fish Barrier Pool, a small reservoir formed by the Fish Barrier Dam at the Feather River Fish Hatchery. The LFC flows between levees, passing near downtown Oroville and residential areas before entering the Oroville Wildlife Area (OWA). The main management unit of the OWA consists of over 5,000 acres of land on both sides of the Feather River and is dominated by gravel and cobble tailing piles interspersed with cottonwood and willow-lined ponds. Thermalito Afterbay and surrounding lands are managed as a part of the OWA. The FERC Project boundary terminates about 5 miles downstream of the Thermalito Afterbay Outlet, at the southern end of the OWA.

The climate in the project area follows a Mediterranean pattern, with hot dry summers and cool wet winters. Summer high temperatures are typically in the 90s (degrees Fahrenheit [°F]) and may exceed 100°F, while winter high temperatures average in the mid 50s. Nearly all of the precipitation in the project area occurs during the late fall, winter, and early spring months, with November-through-March precipitation averaging about 5–6 inches per month.

Importance of Recreational Opportunities/Facilities to the Public

The project area is a regional draw for recreationists, with Lake Oroville being one of the largest reservoirs in the state, and with the excellent fishing in Lake Oroville and the Feather River during annual salmon and steelhead runs. However, there is also heavy local use of Lake Oroville and other project facilities, including a significant amount of off-season use. The predominantly local use is attributable to the close proximity of the

city of Oroville and surrounding communities to the southern end of Lake Oroville and to the downstream areas. Many recreation areas are within a few minutes drive of these communities, and some residential areas are immediately adjacent to developed recreation facilities. Lake Oroville is also the closest reservoir for residents of other Butte County cities such as Paradise and Chico. Over one-half of those surveyed on-site for the Recreation Surveys (SP-R13) were from Butte County, demonstrating the importance of the project area to local residents. Some of the facilities do not currently have user fees, such as car-top boat ramps, the Lake Oroville Visitors Center, boat launching and day use facilities at Thermalito Afterbay, and all areas of the Diversion Pool and the OWA. Remaining developed areas typically have user fees that conform to those imposed at other State Recreation Areas.

4.7.2 Public Recreational Access and Facilities

The existing Oroville Facilities host a wide variety of recreation opportunities. The major components of the Oroville Facilities that host recreation are Lake Oroville, the Diversion Pool, Thermalito Forebay, Thermalito Afterbay, and the OWA. Most of a nearly 14-mile stretch of the Feather River downstream of the Diversion Pool is also within the FERC Project boundary. The upper 9 miles of this stretch is the LFC of the Feather River, from the Diversion Pool to the Thermalito Afterbay Outlet. Nearly 5 miles of the river below the outlet are also within the FERC Project boundary. A description of access to these project areas and a description of project facilities and recreational opportunities provided are included below. Table 4.7-1 summarizes the existing recreation facilities within the project area.

4.7.2.1 Formal and Informal Public Access to the Project Area

Most access to the project area is through formal roads; informal access is generally limited to residential areas. The access to Lake Oroville, as well as to the other geographic areas within the project area, is discussed below.

Access to Lake Oroville

Three major highways—State Routes (SR) 70, 99, and 162—provide road access to Lake Oroville. Two major interstate highways—Interstate 5 (I-5) and I-80—connect to these State highways. SR 70 is a two- to four-lane highway that runs north/south between Sacramento and the city of Oroville and turns northeast/southwest a few miles north of Oroville. SR 70 crosses the West Branch arm of Lake Oroville before continuing north to Quincy. SR 99 is a two- to four-lane highway that runs primarily north/south and roughly parallel to SR 70 and I-5, providing an additional route between the Sacramento area and Red Bluff. SR 99 northbound connects Chico to Red Bluff and southbound connects Chico to Sacramento. SR 162 is a two-lane highway that runs east/west between I-5 and the city of Oroville. The road continues east through the city of Oroville before crossing the reservoir at the mouth of the Middle Fork arm. The city of Oroville is 42 miles from I-5. Generally, the major recreation areas are easily accessible from these highways; however, the rugged terrain and limited public road network makes accessing remote forks of Lake Oroville more difficult.

Table 4.7-1. Recreation facilities within the Oroville project area.

Facility Type	Name	
Campgrounds	***Drive-In Campgrounds and Camping Areas*** • Bidwell Canyon Campground • Lime Saddle Campground • Lime Saddle Group Campground • Loafer Creek Campground • Loafer Creek Group Campground • Loafer Creek Horse Campground • North Thermalito Forebay "En Route" Recreational Vehicle Campground • OWA Primitive Camping areas	***Boat-in Campsites (BICs) and Floating Campsites*** • Goat Ranch BIC • Foreman Creek BIC • Craig Saddle BIC • Bloomer Cove BIC • Bloomer Knoll BIC • Bloomer Point BIC • Bloomer Group BIC • Floating Campsites (ten distributed in various Lake Oroville locations)
Day Use Areas (DUAs)	• Loafer Creek DUA • Oroville Dam Overlook DUA • Diversion Pool DUA	• Model Aircraft Flying Facility • OWA – Thermalito Afterbay Outlet
Boat Ramps (BRs)	***BRs with DUAS*** • Bidwell Canyon BR/DUA • Lime Saddle BR/DUA • Monument Hill BR/DUA • North Thermalito Forebay BR/DUA • South Thermalito Forebay BR/DUA • Spillway BR/DUA	***BRs without DUAs*** • Thermalito Afterbay Outlet BR • OWA unimproved BRs • Wilbur Road BR • Larkin Road Car-top BR • Enterprise BR • Foreman Creek Car-top BR • Stringtown Car-top BR • Dark Canyon Car-top BR • Nelson Bar Car-top BR • Vinton Gulch Car-top BR
Trails and Trailheads	***Trails*** • Bidwell Canyon Trail • Wyk Island Trail • Chaparral Interpretive Trail • Dan Beebe Trail • Brad Freeman Trail • Loafer Creek Loop Trail • Loafer Creek Day Use/Campground Trail • Roy Rogers Trail • Potter's Ravine Trail	***Trailheads*** • Saddle Dam Trailhead • Powerhouse Road Trailhead • Lakeland Boulevard Trailhead • East Hamilton Road Trailhead • Tres Vias Road Trailhead • Toland Road Trailhead
Special Use Facilities	• Feather River Fish Hatchery	• Lake Oroville Visitors Center

Source: EDAW 2004

Access to the Diversion Pool, Thermalito Forebay, Thermalito Afterbay, the Feather River, and the OWA

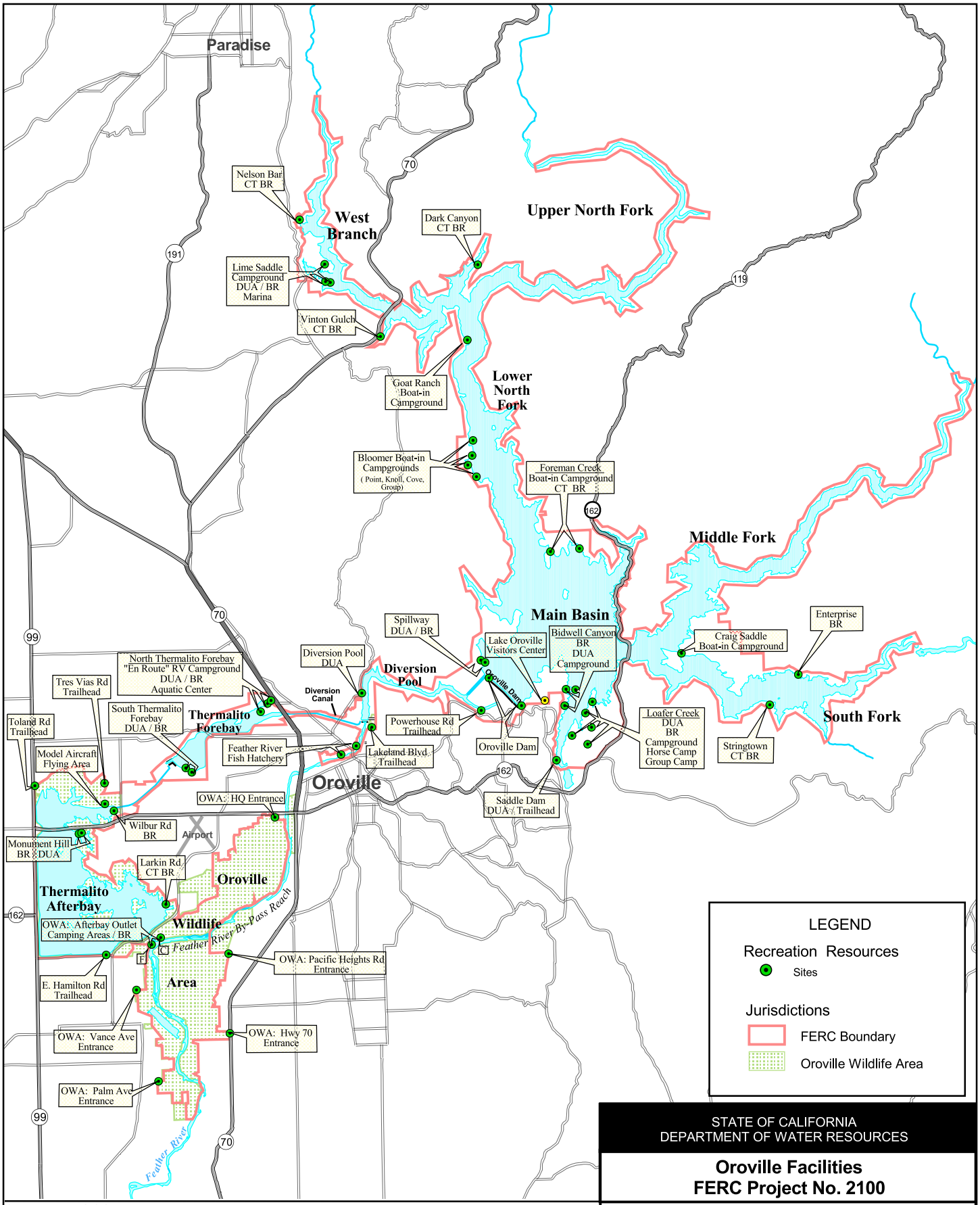
The Diversion Pool is accessible via Cherokee Road off of Table Mountain Boulevard and SR 70. A gravel road (known locally as Burma Road) runs alongside about 1 mile of the northwest shoreline and provides access to the pool for anglers and car-top boaters and trail access at the terminus of the road for hikers and bike riders. (During the recreation study period, this trail was designated for multiple use.) Thermalito Forebay is accessible via SR 70, with the North Forebay Boat Ramp (BR)/Day Use Area (DUA) located immediately adjacent to the highway. Local roads provide access to the two developed sites at the north and south ends of the Forebay. Thermalito Afterbay is accessible via both SR 99 and SR 162. SR 99 runs parallel to the western side of Thermalito Afterbay and SR 162 crosses Thermalito Afterbay and divides it into north and south parts. SR 162, along with Larkin Road along the east side of Thermalito Afterbay, provides immediate access to the three developed facilities on Thermalito Afterbay. The OWA is accessible via gravel roads off of SR 162 to the north, SR 70 and Pacific Heights Road to the east, and Larkin Road to the west. There are no paved roads that enter the OWA; all roads are gravel and generally run atop elevated levees and former railroad beds.

4.7.2.2 Facilities and Opportunities in the Project Area

The project area provides a wide range of facilities and accompanying recreational opportunities. A description of the facilities and opportunities at Lake Oroville, the Diversion Pool, Thermalito Forebay, Thermalito Afterbay, and the OWA is provided below (see Figure 4.7-1).

Lake Oroville

Lake Oroville is one of the largest reservoirs in California, with over 15,000 surface acres and 167 miles of shoreline at full pool. The reservoir elevation fluctuates more than 100 ft on average each year and can fluctuate 150 ft or more some years. The amount of fluctuation depends largely on the amount of winter precipitation in the watershed and resulting spring inflow into the reservoir. The reservoir and the lands and recreation facilities surrounding the reservoir are part of Lake Oroville State Recreation Area (LOSRA), managed by DPR. There are major recreation facilities at Lime Saddle, Spillway, Bidwell Canyon, and Loafer Creek. The Lime Saddle area is located on the western shoreline of the West Branch (of the North Fork Feather River) arm of the reservoir. The recently improved Spillway Recreation Area is adjacent to the Oroville Dam spillway, at the north end of the dam and at the southwest corner of the reservoir. Bidwell Canyon is located at the southern end of the reservoir. The Loafer Creek Recreation Area is the largest and most diverse recreation complex on the reservoir, located directly across Bidwell Cove from the Bidwell Canyon area.



Source: DWR GIS / EDAW 2003

1 0 1 2 3 4 5 6 7 Miles

Original Scale 1 : 190,080
1" = 3.0 miles

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Oroville Facilities
FERC Project No. 2100

Figure 4.7-1

Project Area and Associated Recreation Sites

Prepared by: PJ – EDAW, Inc.

Date 10/17/06

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Boating

Boating facilities at Lake Oroville include two full-service marinas and five boat ramps. The two concessionaire-operated marinas are located at Lime Saddle and Bidwell Canyon. They offer long- and short-term moorage and covered and open dock slips as well as boat rentals, gas, pump-out stations, and small stores with bait and tackle and convenience goods. There is also a restaurant/bar at the Bidwell Canyon Marina. The major launch ramps are located at Bidwell Canyon, Spillway, Lime Saddle, and Loafer Creek. The Bidwell Canyon ramp is a multi-lane boat ramp with parking for more than 200 vehicles and boat trailers. The Spillway area contains the largest boat launching facility on the reservoir, with ramps and parking areas at two levels to accommodate seasonal water level changes. The upper level ramp has 12 lanes with 3 floating docks and a parking area, providing space for 350 vehicles with boat trailers and more than 100 single vehicles. The lower level ramp provides 8 launch lanes and 3 floating docks, along with additional parking close to the ramp. The Lime Saddle ramp is a multi-lane boat ramp with parking for several hundred vehicles and boat trailers. The Loafer Creek ramp is a seasonal, multi-lane boat ramp with a floating dock and parking for nearly 200 vehicles and trailers. Each of the major ramps provides restrooms, and all but Loafer Creek provide fish cleaning stations for anglers.

In addition to these major ramps, the 2-lane Enterprise ramp provides seasonal launching with parking for 40 vehicles and trailers on the South Fork arm of the reservoir, primarily serving nearby rural residents. There is a new vault restroom at this site.

There are also five car-top boat ramps scattered around the reservoir that provide for small-boat access to the water and are also used for swimming, bank fishing, and picnicking. Most of these facilities are situated on more remote parts of the reservoir and provide a less-developed setting than the main boat ramps. Along with occasional hand launching of canoes and kayaks, the sites are used for a limited amount of trailer launching, mostly of small fishing boats, although this is not officially permitted at some sites. No boarding docks are provided, and parking is primarily undeveloped roadside parking. Most areas have pit toilets. Use levels are generally low to moderate. Most car-top ramps are improved (concrete) at their upper elevations, but lower reaches are simply abandoned roads that are not maintained.

Seven two-stall floating toilets anchored at various locations around the reservoir provide for the sanitary needs of boaters.

A limited amount of whitewater boating activity occurs on the Big Bend area of the North Fork Feather River when Lake Oroville reservoir pool levels are sufficiently low to expose several miles of river. (This area forms the Upper North Fork arm of the reservoir when water levels are higher.) Generally, a sufficient length of the run is exposed during the fall months (when the run is normally used) only during dry or critically dry water years. Even when several miles of the river are exposed, paddlers are faced with an equally long or longer flat water paddle after completing the run to

reach the takeout at the Dark Canyon Car-top BR. Paddlers who boat the Big Bend run put in just upstream of the project area boundary.

A few expert-level whitewater paddlers are reported to make the Class V Bald Rock Canyon run on the Middle Fork Feather River. The run begins outside the project area, several miles upstream of the Middle Fork arm of the reservoir, and terminates at the reservoir. Paddlers are required to make a several-hour-long flat-water paddle to take out at the Bidwell Bar Bridge or the Loafer Creek boat ramp.

On June 27, 2005, DWR staff investigated an algal bloom reported on the Middle Fork Arm of Lake Oroville. The water level at the Merrimac station was fairly low and the amount of attached algae in the water at the site appeared to be very high. Staff boated up the Middle Fork Arm and reported seeing algae pushed by the wind against the shore near Nutmeg Creek. This algal mass eventually expanded so that by the time they reached the 90-degree turn at the north end of the arm, the entire waterway was covered.

The algae were identified as the blue-green algae *Anabaena flos-aquae*. Blue-green algae are actually a type of bacteria called cyanobacteria that grow in water and are photosynthetic. Blooms occur when algae that are normally present begin to reproduce rapidly, typically a result of warm water and slow-moving waters that are rich in nutrients. The algal bloom did not affect recreation activities within the FERC Project boundary and it was unnecessary to place booms surrounding the algal bloom. Within a short amount of time, the algal bloom had dissipated.

Day Use

There are day use areas at Lime Saddle, Spillway, Loafer Creek, and Bidwell Canyon near the boat launch facilities, each providing picnic sites and restrooms (shared with the boat ramp). The Bidwell Canyon DUA is centered on a historic bridge and tollhouse that have been relocated to the site and includes a short loop trail. This site includes new interpretive exhibits in the tollhouse.

The largest DUA is at Loafer Creek, with 30 picnic tables and numerous barbeque grills set beneath mature oaks. Amenities include bathrooms and showers and a popular swimming access when the reservoir is above 850 ft. The day use facilities at Spillway overlook the boat ramp and the main basin of the reservoir and consist of several picnic table sites beneath shade structures and lawn areas. Potable water and flush toilets are provided. The day use sites at Lime Saddle also overlook the boat ramp, but are less developed.

Picnic tables are provided at each end of the crest of Oroville Dam, where visitors come to enjoy expansive views of the reservoir and the Sacramento Valley. The mile-long crest is popular with walkers, joggers, and bike riders. Parking and toilets are available at the entrance to the dam crest road. Several years ago, California poppy seeds were broadcast across the downstream face of the Oroville Dam.

The Lake Oroville overlook located off the Oro-Quincy Highway (SR 162) was improved and a new California Department of Transportation specification fence and automobile safety barrier were installed. In addition, a new interpretive panel features a project area map. Most other shoreline day use at Lake Oroville occurs at the car-top boat ramps described above, where non-boating visitors picnic, swim, and fish from the shoreline.

Camping

All the developed campgrounds in the project area are located at Lake Oroville: at Lime Saddle, Loafer Creek, and Bidwell Canyon. The campground at Lime Saddle, constructed on a peninsula across from the boat ramp and marina, has 45 family sites (15 are full-hookup recreational vehicle [RV] sites), restrooms, and showers. The Loafer Creek Campground has 137 tent/RV sites (no hookups), showers, and restrooms. The Bidwell Canyon Campground has 75 full hookup sites for both tent and RV camping, showers, and restrooms. There are group campgrounds at Lime Saddle (6 sites) and Loafer Creek (6 group sites) and an equestrian campground at Loafer Creek (15 sites).

The Loafer Creek equestrian campground is a specialized facility, with a horse washing station and horse tethering and feeding stations near each campsite. Recent improvements include paving the access road, adding new feeder boxes, installation of pipe corrals, and a 50-ft round exercise pen.

Self-contained RVs can use a portion of the Spillway's upper parking lot for overnight "en-route" stays. Unique to the Oroville Facilities are ten floating campsites anchored in several arms of the reservoir. Each is a two-story structure with tent/sleeping space, a gas grill, table, sink, restroom, and storage area. Camping boaters also have access to four primitive boat-in camp areas with dozens of designated tent sites, each with picnic tables and fire rings, and vault toilets.

Trails and Trailheads

There are several trails near Lake Oroville, primarily in the Bidwell Canyon and Loafer Creek areas, and a trail along the southwest shoreline of the reservoir with the trailhead at the Spillway BR/DUA. Two trails in the Loafer Creek area, the Roy Rogers Trail (4.0 miles) and Loafer Creek Loop Trail (3.2 miles), are limited to equestrian and hiking use only. Hikers and bike riders may use the Loafer Creek Day Use/Campground Trail (1.7 miles) and the service road linking the equestrian camp to Saddle Dam and the Bidwell Canyon area. The Bidwell Canyon area includes the Bidwell Canyon Trail (4.9 miles) for bike riders and hikers, and the roughly-parallel Dan Beebe Trail (14 miles) for equestrians and hikers. The Potters Ravine Trail (8.2 miles) starting at the Spillway BR parking lot is available to all user types. The Wyk Island Trail (0.2 mile) is associated with the Bidwell Canyon DUA and is for pedestrians only. The 0.2-mile Chaparral Trail is an interpretive trail next to the Lake Oroville Visitors Center.

The Saddle Dam Trailhead at the south end of Lake Oroville is primarily used by equestrians. It provides access to the Dan Beebe Trail in the Bidwell Canyon area and, by crossing the Saddle Dam, to the Loafer Creek Loop Trail and Roy Rogers Trail in the Loafer Creek area. Recent improvements at the site include regrading and adding gravel to the parking area, installation of picnic tables, installation of a vault toilet, a water trough, and hitching posts for horses, and planting native shade trees. This trailhead also allows hikers and bicyclists access to the Bidwell Canyon Trail.

Visitor Center

The Lake Oroville Visitors Center, situated atop Kelly Ridge between Oroville Dam and the Bidwell Canyon area, features exhibits on the engineering and construction of the hydroelectric power facilities, including the Oroville Dam, and explains how the Oroville Facilities distribute water and electrical power to their destinations. There are also interpretive displays on the native culture and the natural resources of the area. A 47-ft viewing tower provides a panoramic view of the reservoir and its surroundings. Shaded picnic areas and a short interpretive trail are provided nearby.

Diversion Pool

The Diversion Pool covers a 4.5-mile stretch of the Feather River from Oroville Dam to Thermalito Diversion Dam. The narrow pool covers 320 acres, winds between steep wooded hillsides, and provides opportunities for visitors to enjoy quiet, uncrowded conditions.

Day Use and Angling

This area is primarily used by shoreline picnickers, anglers, and walkers seeking a quiet undeveloped setting. The only facility provided is a vault toilet; no other day use or camping facilities are provided. A former DWR storage yard (known as Thompson Flat) has been recently upgraded. DWR graded the parking lot, installed signage, graveled the drive from Cherokee Road, and developed a spur trail from the staging area to an existing bicycle trail.

Boating

Only non-motorized and electric motor boats are allowed on the Diversion Pool. There is an undeveloped boat access point at the Diversion Pool DUA for hand launching of boats.

Trails and Trailheads

At the end of the Diversion Pool DUA access road (locally known as Burma Road) is a trailhead where hikers and bike riders can access the 41-mile Brad Freeman Trail, which follows Burma Road and the north shoreline of the Diversion Pool before climbing to Oroville Dam. A multiple-use segment of the Brad Freeman Trail also follows the opposite shore, running on a former railroad bed. The two sides are linked by the segment of trail that crosses Oroville Dam. (The majority of this trail makes a large loop

around Thermalito Forebay and Thermalito Afterbay, through the OWA, and along the Feather River LFC, as described below.)

The 14-mile Dan Beebe Trail is an equestrian trail (hikers are also permitted), winding through the hillsides above the south side of the Diversion Pool, that links to Kelly Ridge and continues to the Saddle Dam trailhead. The Lakeland Boulevard Trailhead sits above Thermalito Diversion Dam on the east side of the lower Diversion Pool and provides access to both trails. The large parking area serves as a day-use equestrian staging area with portable toilets and picnic tables. The Powerhouse Road Trailhead is near the upstream end of the Diversion Pool and provides access to the Brad Freeman Trail, but has no facilities.

Thermalito Forebay

Thermalito Forebay is a 630-acre hourglass-shaped reservoir that is divided into north and south portions at a point where the pool narrows at the Nelson Avenue bridge crossing.

Day Use

The 300-acre North Forebay DUA, the most popular day use site in the project area, features a large sandy beach and swim area on a shallow lagoon connected to the main body of the forebay. A large picnic area adjacent to the beach provides more than 100 picnic tables, many under shade structures, dispersed across a tree-shaded lawn. The picnic area is suitable for family or large group picnics, and has both flush toilet restrooms and vault toilets. A few picnic sites are also provided on the opposite side of the lagoon. The South Forebay DUA provides several shaded picnic sites and a sandy area for swimming. A vault restroom was recently added to the site. RV en-route camping is available at the North Forebay (RVs may park for the night).

Boating

Only non-motorized boats are permitted on the North Forebay, which is popular with users of small sailboats and paddle craft. The North Forebay DUA provides two boat ramps with floating docks and an Aquatic Center. The Aquatic Center is a 1,200-square-foot (sq ft) boat storage facility used by California State University, Chico, and others for boating instruction and events. The South Forebay is open for motorized boating, and the South Forebay DUA at the opposite end of the pool includes a boat ramp with floating dock.

Angling

The Thermalito Forebay is stocked regularly with trout and both the South and North Forebay DUAs are popular with local shore anglers. The South Forebay provides a fish cleaning station. Some boat angling also occurs on both portions of the Thermalito Forebay.

Trails and Trailheads

A paved trail encircles the swim lagoon at the North Forebay DUA. The Brad Freeman Trail also passes through the site and runs near the north shore of the North Forebay, crosses the pool at Nelson Avenue, and runs atop the earthfill dam along the east side of the South Forebay.

Thermalito Afterbay

Thermalito Afterbay is a shallow reservoir at the southwest corner of the project area covering 4,300 acres at maximum operating storage. Unlike Lake Oroville, the elevation of Thermalito Afterbay fluctuates during much of the year on a weekly cycle, with 4–6 ft of elevation change during a typical week. The typical daily elevation change is 1–2 ft. The pool is raised during the week and drawn down over the weekend, as dictated by hydroelectric power operations. Water temperatures can vary widely around Thermalito Afterbay in the summer, with water in the low 60s (°F) near the tailrace channel, in the mid-70s in the warmest, deeper water areas near the Thermalito Afterbay Outlet, and in the mid-80s in shallow backwater areas (DWR 2001a).

Boating

There are three boat launch facilities on the eastern shore of Thermalito Afterbay used by pleasure boaters, anglers, and hunters. The Wilbur Road BR near the north end of the pool provides two launch lanes, a floating dock, a recently installed vault toilet, and a paved parking area. The Monument Hill BR/DUA also provides two launch lanes and a floating dock. This area is popular with personal watercraft (PWC) riders, as well as water-skiers who frequently use the nearby water-ski slalom course. The Larkin Road Car-top BR is on the southern portion of Thermalito Afterbay and provides a vault toilet and a low-gradient paved ramp (old road bed) used to launch PWC and other small boats. Windsurfers commonly launch from several informal shoreline access points near the SR 162 bridge.

Day Use

The day use facilities on Thermalito Afterbay are at Monument Hill and include a small sand beach with picnic tables, additional shaded picnic sites on the hill above, and flush toilets. Informal swimming also occurs at Larkin Road Car-top BR.

Angling

The diverse temperature structure of Thermalito Afterbay provides suitable habitat for both coldwater and warmwater fish, including a popular largemouth bass fishery. Fishing in Thermalito Afterbay occurs both from the shore and from boats. A fish cleaning station is provided at Monument Hill DUA.

Trails and Trailheads

The Brad Freeman Trail runs around the north, west, and south sides of Thermalito Afterbay. Three trailheads are located in the area: one on the south side (East Hamilton Road) and two on the north side (Toland Road and Tres Vias Road). There are no facilities at any of these trailheads, which are primarily used by hunters.

Other Facilities and Opportunities

Additional facilities at Thermalito Afterbay include hunting blinds that have been installed at various points along the shoreline for the use of waterfowl hunters. A special youth pheasant hunt is held in the area each fall. A model aircraft flying facility is used by a local club near the north shoreline and has benefited from recent improvements. DWR paved the crossing runways, graded and graveled the parking lot, installed aircraft staging tables, constructed picnic facilities with shade ramadas, and added fencing.

Oroville Wildlife Area and Feather River

The OWA, not including the Thermalito Afterbay subunit described above, consists of about 5,700 acres of lands on both sides of the Feather River, most of which is within the FERC Project boundary. A large percentage of the OWA is covered with gravel and cobble spoil piles left behind by historic gold dredging in the river. There are numerous small willow and cottonwood-lined ponds in areas where this material has been removed. The OWA is adjacent to or straddles about 10 miles of the Feather River. The lower 1.25 miles of the LFC and the upper 1.5 miles of the LFC, upstream of the OWA, are within the FERC Project boundary.

Day Use

There is a vault toilet at the Thermalito Afterbay Outlet area. There also are designated primitive camping areas at the Thermalito Afterbay Outlet, but no developed camping facilities.

The Feather River Fish Hatchery is located at the upper end of the LFC of the Feather River, immediately below the Fish Barrier Dam and about one-half mile below the Thermalito Diversion Dam. The hatchery provides interpretive displays related to salmon and trout, and seasonally provides a unique opportunity for visitors to watch fish ascend the fish ladder to the hatchery through underwater windows. Tours of the hatchery itself are also offered to the public. Additional amenities at the hatchery include an overlook platform at the base of the Fish Barrier Dam, riverbank benches, and restrooms. Recent improvements include new shade trees and assorted native plants and grasses on the Feather River Fish Hatchery grounds.

Day use of the east side of the Fish Barrier Pool has recently been improved to include a pedestrian trail (Sewim Bo Trail), picnic tables, shade ramadas, native trees and

shrubs, restrooms, interpretive signs, and parking, including Americans with Disabilities Act (ADA) access.

Boating

A few motorized and non-motorized boaters use the 9-mile LFC, the upper 1.5 mile and lower mile of which are within the FERC Project boundary. Few developed boat access facilities are provided, particularly at the upstream end where non-motorized boaters would most desire to launch. Non-motorized boats are occasionally hand launched from the riverbank near the Feather River Fish Hatchery.

The only formal boating facility on the Feather River in the OWA is a gravel boat ramp at the Thermalito Afterbay Outlet. There are several other unpaved and informal boat launch sites along the west bank of the river. Some motorized boating activity (primarily by anglers) on the river in the OWA originates from a private campground boat ramp across the river from the OWA (outside the FERC Project boundary) and from access point downstream of the project area.

Angling

The Feather River draws most visitors to the OWA, in particular its steelhead and salmon fishery. The most visited site in the area is the well-known Thermalito Afterbay Outlet area, where Thermalito Afterbay releases water into the Feather River. During the peak of the steelhead and salmon seasons, the site is heavily used by both boat and bank anglers from throughout the region. Anglers also gain access to the riverbank and several riffles at several dispersed locations where levee roads provide close vehicle access. Fishing for warmwater species also occurs at some of the OWA ponds.

Trails and Trailheads

The Brad Freeman Trail runs through the northern portion of the OWA following the gravel levee-top road network and former railroad beds. Informal walking paths exist where visitors may access the Feather River from roadside parking areas. Paved (street) segments of the Brad Freeman Trail run near the east riverbank of the LFC from the OWA to the Diversion Dam, linking Riverbend Park and the Feather River Nature Center.

Hunting

The ponds in the OWA draw waterfowl hunters during the fall and winter hunting seasons. Dove and quail hunting also occurs during the fall, and a special lottery turkey hunt is held each spring. Deer hunting is permitted, but is limited to bows, shotguns, and handguns (no rifles allowed). Seasons and hunting opportunities are established by the California Fish and Game Commission and are subject to change.

4.7.2.3 Americans with Disabilities Act Accessibility at Project Area Facilities

Facilities required to be ADA accessible within the study area meet, or will soon be upgraded to meet, ADA technical standards. These include facilities such as parking spaces, restrooms, pathways between parking and restrooms, and campsites. Not all recreation facilities are required to be made accessible. Additionally, the managing agencies have met the required ADA standards by providing disabled recreationists access to the "programs" available in the area. Programmatic access is required by the *Americans with Disabilities Act Access Guidelines.* All indoor facilities are required to be made accessible while outdoor facilities are required to be made accessible by "program." The programs that are accessible include campgrounds, boating facilities, picnic areas, and beach/water access.

The ADA Accessibility Study (SP-R6) identified a few opportunities to go beyond programmatic compliance in addressing access deficiencies. For example, most of the paved walkways between the parking area and the picnic sites at the Loafer Creek DUA are too steep for disabled visitors to use. Also, the Recreation Needs Analysis (SP-R17) identified opportunities to expand special facilities such as ADA fishing piers (only one exists within the FERC Project boundary, at the North Forebay DUA).

4.7.3 Specially Designated Areas in the Project Area Vicinity

Though all located outside of the FERC Project boundary, there are several federally designated areas in the vicinity of Lake Oroville including one Scenic Area, one National Recreation Trail and one National Scenic Trail, a Scenic Byway, and a Wild and Scenic River. A description of each is given below.

4.7.3.1 Feather Falls Scenic Area and National Recreation Trail

The Feather Falls Scenic Area is a 15,000-acre area managed by Plumas National Forest. The scenic area is southwest of Bucks Lake and northeast of Lake Oroville, near the town of Feather Falls. The Feather Falls National Recreation Trail is a 9-mile loop trail that leads to Feather Falls. The trailhead is approximately 20 miles east of the city of Oroville. Feather Falls, at 640 ft, is the sixth highest waterfall in the contiguous United States and the fourth highest in California. The trail also provides excellent views across the canyon of the Middle Fork Feather River to Bald Rock Dome, a large barren granite dome that rises above the canyon and dominates the scenery for miles around.

4.7.3.2 Feather River National Scenic Byway

The byway, dedicated by USFS in 1998, follows SR 70 from the north end of Lake Oroville up through the gorge of the North Fork of the Feather River. Travelers enjoy spectacular views and many points of cultural, geologic, and historical interest along the 130-mile route.

4.7.3.3 Middle Fork Feather Wild and Scenic River

The Middle Fork Feather River (MFFR) was designated a National Wild and Scenic River (WSR) in 1968. The MFFR WSR is currently administered by Plumas National Forest and runs from near Beckwourth to Lake Oroville. It is located outside of the FERC Project boundary. The designated reach totals 77.6 miles, including 32.9 miles of Wild River area, 9.7 miles of Scenic River area, and 35 miles of Recreational River area designation. The lower part of the MFFR flows through a deep canyon with numerous large boulders, narrow steep canyon walls, and some impassable waterfalls. Rafting and kayaking opportunities are considered to be for experts only (Class V). The upper stretches of the river, however, are gentler with easy access, proving opportunities for rafting and canoeing.

4.7.3.4 Pacific Crest Trail

The Pacific Crest Trail (PCT) is 1 of 8 National Scenic Trails in the United States, this one spanning some 2,650 miles from Mexico to Canada through 3 western states. The route was first explored in the late 1930s by teams of young men from the YMCA. Once proven feasible, trail pioneers Clinton Clarke and Warren Rogers lobbied the federal government to secure a border-to-border trail corridor. Largely through the efforts of hikers and equestrians, the PCT was eventually designated one of the first scenic trails in the National Trails System by Congress in 1968 and was dedicated in 1993. The PCT generally runs in a north-south direction, east of the project area. The PCT crosses the Middle Fork Feather River and SR 70 near the town of Belden, approximately 40 miles northeast of the project area.

4.7.4 Recreational Opportunities/Facilities Outside the Project Area

A few sites offer recreational opportunities and facilities in the immediate vicinity of the project area. Although adjacent to the OWA, two facilities located in the Clay Pit (a borrow area used in the construction of Oroville Dam) are outside of the FERC Project boundary. Also in the vicinity of the project area but outside the FERC Project boundary are Riverbend Park and Bedrock Park.

The Clay Pit State Vehicular Recreation Area (SVRA), located 3 miles southwest of the city of Oroville, provides a riding area for off-highway vehicle (OHV) enthusiasts and is managed by DPR. The clay used to build Oroville Dam was taken from this area, resulting in a large shallow pit ringed with low hills, providing about 220 acres of riding area. The site has a gravel staging/parking area for loading and unloading vehicles. The site is accessed from Larkin Road.

The Rabe Road Shooting Range, managed by DFG, is an unstaffed public shooting area with unmarked backstops (undefined places to place paper targets), a graded and graveled parking area, seven picnic tables, and a vault toilet building. It is technically a rifle range, but pistol use commonly occurs there as well. The shooting range is directly adjacent to Clay Pit SVRA.

Riverbend Park and the adjacent Bedrock Park are located on the LFC of the Feather River on the west side of the City of Oroville, and are owned and managed by Feather River Recreation and Park District (FRRPD). Riverbend Park provides riverbank access and day use amenities such as a Frisbee golf course, a paved loop trail with exercise stations, benches, and picnic tables. Recent upgrades to the park include enlargement of the boat launch and construction of restrooms, play areas, parking, and picnic shelters. The adjacent Feather River Fish Ponds (recently improved and operated by FRRPD in a lease partnership with DFG as part of the West Park Riverbend Corridor) include parking and restrooms. At this location, visitors can fish from the pond banks and off of piers. The piers and restrooms are ADA accessible. Bedrock Park is a smaller facility that provides access to the river for anglers and swimmers, shaded picnic sites and an irrigated lawn area, and restrooms. Bedrock Park is separated from Riverbend Park by SR 70, but the two parks are connected by a paved bike and walking trail.

Plumas National Forest lands also offer access to a range of activity opportunities including camping, boating, hiking, and OHV use. One of the closest opportunities to the Oroville Facilities is the Feather Falls National Recreation Trail, described above. Boaters can also hike to the base of the falls from the upper reaches of the Middle Fork arm of Lake Oroville when the reservoir water level is high.

4.7.5 Recreational Use, User Characteristics, and Capacity

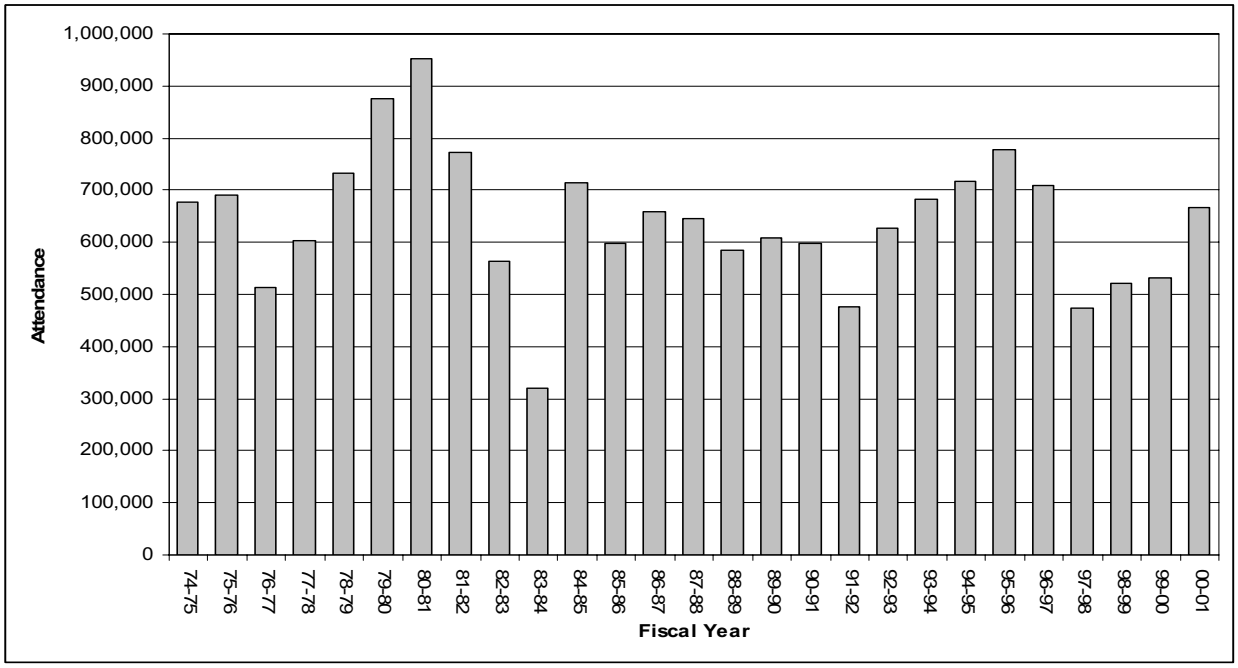
This subsection describes historic and current recreation use levels by activity and for various geographical areas within the FERC Project boundary. Recreation use levels are measured in recreation days (RDs). A single RD represents participation in recreation at a site during a single calendar day by one person for any length of time. This is followed by a discussion of issues related to the capacity of recreation areas and facilities to support current use.

4.7.5.1 Historic Use Levels

Official DPR estimates of attendance for LOSRA are available on a fiscal year (FY) basis (July through June) for the period 1974-75 to 2000-01. Figure 4.7-2 illustrates these data. The estimates represent a compilation of daily use data at various park units into monthly and FY totals, and so are comparable to RD estimates of current use. LOSRA comprises the majority of the project area, and includes all Lake Oroville, Diversion Pool, and Thermalito Forebay recreation sites and surrounding lands and waters. The data also include attendance at the Clay Pit SVRA since FY 1996-97. Historic attendance data are not available for Thermalito Afterbay and the OWA because these data were not regularly collected by the two managing agencies, DWR and DFG, until about 1995.

The annual average total attendance across the 27 years for which data are available was about 650,000 visits. Although considerable variation is seen in the data, for most years attendance was between 500,000 and 700,000 visits. Attendance peaked during FY 1980-81 at over 950,000 visits and was over 700,000 visits for several years around

that time. The lowest attendance was recorded for FY 1983-84 with just over 320,000 visits. However, investigation of the very low attendance estimate for FY 1983-84 for the purpose of relicensing studies yielded the conclusion that the estimate may not be accurate and is most likely a result of counting problems. The next lowest attendance estimate was about 472,000 visits for FY 1997-98, and attendance was only slightly higher for FY 1991-92 with about 477,000 visits. FY 1991-92 fell in the midst of a multi-year drought, which severely reduced the water levels in Lake Oroville. (Statistical modeling performed for the Projected Recreation Use Study [SP-R12] established that pool level in Lake Oroville was positively related to attendance at Lake Oroville recreation sites.) Attendance appears to be on an upward trend since the low in FY 1997-98.



Source: DWR 2003

Figure 4.7-2. Recreation visitor attendance at LOSRA recreation sites, fiscal years 1974-75 to 2000-01.

4.7.5.2 2002–2003 Estimated Annual Use

The Existing Recreation Use Study (SP-R9) estimated use within the project area by site and divided use at each site by activity. The following describes the total amount of use by each activity at each major geographic area within the project area according to the popularity of each activity. Estimates of use by activity were made based mainly on observational data; professional judgment and informal observations were used where necessary. Estimates of use are for the period from May 15, 2002, to May 14, 2003. Activities included in estimates were bank fishing, boating access, camping, sightseeing, hunting, picnicking, swimming, and trail use. The term “boating access” is used because boating activities do not literally occur at the site; the site provides access for boaters to the body of water where boating activities actually take place.

Sightseeing includes activities such as driving for pleasure, touring sites, or looking around. Picnicking also includes the activities of resting and relaxing.

Boating

Boating (reported as boating access in the Existing Recreation Use Study [SP-R9] because boating does not actually occur at sites) was the most popular activity in the project area. At Lake Oroville, 45 percent or about 411,011 RDs were accounted for by boating. Boating was also popular at Thermalito Afterbay, where 52,557 RDs or about 56 percent of use at Thermalito Afterbay was boating access. Boating was not as popular at Thermalito Forebay (10 percent of use/14,234 RDs), the river or ponds within the OWA (8 percent of use/25,021 RDs), or the Diversion Pool (4 percent of use/729 RDs) as it was at Lake Oroville or Thermalito Afterbay.

Angling

Angling by boat was included in the estimate for boating; however, the amount of bank angling was estimated separately. Bank fishing was the third most popular activity overall within the project area. Bank angling was extremely popular in the OWA compared to the rest of the geographic areas within the FERC Project boundary. About 67 percent of the use within the OWA was estimated to be bank angling, equivalent to 213,709 RDs. Almost one-quarter (24 percent) of use at Thermalito Forebay was estimated to be bank angling, about 32,110 RDs. About one-fifth of the use at Diversion Pool was estimated to be from bank angling with 4,371 RDs. Bank angling accounted for less than 10 percent of total use at Lake Oroville (5 percent/48,145 RDs) and at Thermalito Afterbay (4 percent/3,992 RDs).

Trail Use

Use of specific trail segments by number of people (using infrared trail counters) and trail use at trailheads were estimated, with results presented in the Existing Recreation Use Study (SP-R9). Generally, trail use is relatively low; it may even have been elevated during the study period because trails were designated multi-use and thus opened to more user groups. Trail use data show that the highest trail use occurred in October, with about 50–60 people using specific trails within the FERC Project boundary on peak days. This is an average of five people per hour, a relatively low level of use. The lowest trail use occurred from mid-December through mid-March, with no use recorded on many days and peak daily use of ten or fewer people on representative trail segments. As for use at trailhead sites, this accounted for only 1 percent of total use at Lake Oroville (4,690 RDs) and Thermalito Afterbay (891 RDs). However, at the Diversion Pool, one-half of use was estimated to be from trail use (10,403 RDs). Trail use accounted for about 1 percent of total RDs within the project area.

General Day Use

Three general day use activities were estimated in the Existing Recreation Use Study (SP-R9): picnicking, sightseeing, and swimming. Sightseeing was the second most popular activity within the project area, picnicking was fourth, and swimming was fifth. Combined, these activities were most popular at the Feather River Fish Hatchery where 100 percent of use was accounted for by general day use activities (160,395 RDs). General day use activities were also very popular at Thermalito Forebay, where 62 percent of total use or 85,034 RDs were accounted for these activities, owing in part to the very popular swimming lagoon at North Forebay BR/DUA. This lagoon is one of the only two formal swimming areas within the FERC Project boundary. Over one-third of use at Lake Oroville (36 percent/328,109 RDs) and Thermalito Afterbay (38 percent/35,928 RDs) was accounted for by picnicking, sightseeing, and swimming. One-quarter of total use at the Diversion Pool was accounted for by these 3 activities, or 5,100 RDs. At the OWA, 22 percent of total use was estimated to be from these general day use activities, equivalent to 70,866 RDs.

Camping and Other Overnight Use

Camping primarily occurs at Lake Oroville, where all of the developed campgrounds are located. About 7 percent of the total use at Lake Oroville was estimated to be from camping, about 62,300 RDs. There was also low use of the RV en-route camping at North Forebay BR/DUA (39 RDs) and Spillway BR/DUA (91 RDs, included in the Lake Oroville total). Overall, camping was the sixth most popular activity in the project area, with about 4 percent of total use.

Other Recreational Uses

There are four other main activities for which use estimates were generated: hunting, walking, target shooting, and OHV use. It should be noted that OHV use is prohibited by law on all lands within the FERC Project boundary.

Most of the hunting in the project area occurs in two geographic areas: the greater OWA and the Thermalito Afterbay portion of the OWA. Hunting access occurs at these areas at three main locations: the West and East Levee Roads in the south portion of the OWA, and trailheads near Thermalito Afterbay including South Wilbur Road Trailhead, Toland Road Trailhead, and Tres Vias Road Trailhead. Hunting accounted for 27 percent of total use at these trailheads, or 4,995 RDs. Within the OWA, hunting only accounted for 3 percent of total use or 8,866 RDs. (The percentage of total use is low in part because hunting is seasonal with most hunting occurring between October and January.) Hunting is also allowed in the more remote parts of LOSRA away from developed recreation areas, but the level of activity is believed to be low as virtually no such use was discerned during recreation surveys.

Walking use tends to be mostly at the Oroville Dam/Overlook DUA and the North Forebay BR/DUA. Due to its proximity to the Kelly Ridge residential area, its views of the reservoir and Sacramento Valley, and the mile-long crest with pedestrian walkway,

Oroville Dam is a popular place to walk, jog, or bicycle. There were an estimated 56,930 RDs associated with walking, jogging, and bicycling across the dam. At the North Forebay BR/DUA, walking generally occurs on the path around the swimming cove. North Forebay is located fairly close to residential areas and therefore receives many local visitors who enjoy walking there. There were an estimated 4,303 RDs from walkers at the North Forebay BR/DUA.

4.7.5.3 Project Area Visitor and Visit Characteristics

The following summary serves to describe in general terms the visitors to the project area and their use of the area for recreation based on survey results.

Most project area visitors are regular visitors to the area (three or more visits per year) and most visit during the spring and fall as well as summer. Over 60 percent of visitors surveyed were from Butte County or an adjacent county, and nearly all of the remaining visitors were from elsewhere in northern California.

Visitors to Lake Oroville, where most project area camping facilities are located, were fairly evenly divided between day and overnight users. In contrast, 60–90 percent of visitors to other parts of the project area were day users. Most overnight visitors stayed 2 or 3 days, and most stayed in campgrounds or with family/friends. Nearly 90 percent of visitors from Butte County and the adjacent counties were day users, while most visitors from more distant locations were overnight visitors. Day user visits averaged 4–6 hours in length. About one-quarter of visitors surveyed at Lake Oroville also planned to visit other portions of the project area, and about 30–45 percent of visitors to most downstream areas planned to visit Lake Oroville sites.

Group sizes at most areas average two to four people. Large groups were more common at Thermalito Forebay, where the median group size was seven people. Proximity to their homes and desirable natural resource features such as high water quality were the predominant reasons for visitors to come to most of the project area. Fishing opportunities was the predominant reason among OWA visitors. Project area visitors participated in a wide range of activities, but water-based recreation such as motorboating, water-skiing, swimming, and angling were the predominant activities in most areas. Other important activities, in particular at the Diversion Pool and the Feather River, were trail walking/hiking, biking, and horseback riding. Sightseeing, picnicking, and general relaxing are also important at many areas.

4.7.5.4 Existing Recreation Capacity

The existing capacity status and identified capacity issues of resource areas and facilities for boating, camping, day use, angling, and trail use are summarized here.

Boating

The Reservoir Boating Study (SP-R7) indicated that boat traffic is moderately dense on Lake Oroville during peak-season holidays, and many additional boats spend time

moored on or near shore, where there may be competition for mooring sites. The study also established that the typical length of time boaters wait to use the ramps is not excessive, although waits of 20–30 minutes may occasionally occur at peak-use times. Observation of peak holiday weekend launching at the Spillway boat ramp, the largest such facility on the reservoir, indicated that back-ups at the ramp were minimal and waits were short. Corresponding with these conditions, boaters' perceptions of crowding and conflict problems on the project reservoirs are low, and these problems appear to be short-term and localized where they do occur, typically only during holiday peak use conditions.

Facility capacity limits affect recreation access at Bidwell Canyon, where boaters frequently cannot gain access to the boat ramp during high-water summer weekends and holidays due to lack of parking. This is in part due to Bidwell Canyon Marina boaters parking their vehicles in vehicle/boat trailer spaces in the boat ramp parking lot, which is exacerbated by insufficient marina parking. This problem is particularly acute when reservoir pool levels are high; additional marina parking becomes available in the fluctuation zone as the pool level falls. The boat ramp and marina parking is commonly full to capacity by mid-morning on some weekends, causing arriving visitors to be turned away. Boaters wishing to launch a boat can instead drive 3 miles to the Spillway boat ramp, where ample parking is available. Marina boaters may park in the adjacent residential area and walk to the marina.

Parking capacity for boaters wanting to launch their boats at Lime Saddle is also an issue during some peak-use periods. The parking areas are shared by boat ramp users and marina boaters. As observed at Bidwell Canyon, vehicle/trailer spaces are often used by marina boaters due to an insufficient number of spaces for single vehicles. Additional parking is available at a gravel overflow lot outside the park entrance.

Camping

Average occupancy of campgrounds during summer recreation season weekends, the peak-use period, was generally not high during the relicensing study period, averaging about 50–60 percent at most sites. An exception was the Loafer Creek Group Campground, with an average occupancy rate of over 80 percent, and near 100 percent occupancy during July and August. The floating campsites also had high occupancy rates, ranging between 84 and 94 percent on both weekdays and weekends through the summer months. The Lime Saddle Group Campground and Loafer Creek Equestrian Campground had low occupancy rates during the summer recreation season, below 35 percent. Equestrian campground occupancy was higher during the spring and fall, when trail riding conditions were more favorable. Occupancy of all campgrounds may be higher during years with more consistent high reservoir pool levels than existed during the relicensing study period.

Day Use

Use of the developed day use facilities in the project area was generally moderate, and crowding problems were not found. However, use of the largest DUA on Lake Oroville,

the Loafer Creek DUA, was greatly reduced during the study period by low reservoir water levels. Use of the North Forebay DUA, the largest such facility in the project area, exceeded parking capacity only occasionally during peak holiday periods.

Angling

Boating activity on the project area reservoir is generally low during the off-season, which is the period when most angling occurs. Anglers on the project area reservoirs had few complaints about crowding; however, bank and boat anglers in the OWA and on the Feather River LFC expressed concern about crowding. The high concentration of both boat and bank anglers at the Thermalito Afterbay Outlet can sometimes cause conflicts between anglers (in particular between bank and boat anglers). The majority of anglers contacted in the OWA (including at the Thermalito Afterbay Outlet) considered the areas where they fished to be moderately to extremely crowded.

Trail Use

Use of most trails appears to be low or moderate, with the highest use occurring during the spring and fall. A high percentage of trail users (generally over 90 percent) expressed satisfaction with the condition of the trails (poor trail conditions are one indicator of overuse), and perceptions of crowding were very low.

4.7.5.5 Visitors' Experience, Perceptions, and Preferences

This subsection summarizes information obtained primarily by recreation visitor surveys conducted throughout the project area that outlines overall satisfaction, perceptions of key issues, and perceptions related to recreation facilities and management. Additional information was obtained through on-site observations. The summary is organized by management area and primary recreation activities in those areas.

Lake Oroville State Recreation Area

LOSRA visitors indicated they were satisfied with their overall recreation experience and relatively few felt crowded. From 70 percent to over 93 percent of visitors to these areas indicated they were satisfied, very satisfied, or extremely satisfied with their trip to the area. Regarding crowding at recreation sites, about 67 percent of Thermalito Forebay visitors, 70 percent of Lake Oroville visitors, and over 90 percent of Diversion Pool visitors rated their perception of crowding between "not at all crowded" to "slightly crowded."

Additional information is reported below that describes specific activity groups' level of satisfaction, and existing issues and problems identified at LOSRA through the completion of recreation technical studies.

Boating

In general, the Recreation Surveys (SP-R13) indicated that boaters enjoy a high level of satisfaction with their boating experiences, with about 74 percent stating they were

satisfied to extremely satisfied. Large majorities felt that the number of boat ramps, marinas, boat-in gas stations, and boat-in campsites were adequate. Relatively few boaters felt that the number of watercraft on the water or interactions/conflicts between boaters were more than a slight problem and large majorities felt that most of these issues were not a problem at all. Boaters' greatest concerns related to exposed land and shallow areas during low water levels, which are unavoidable effects of reservoir drawdown and which are most prevalent during the late summer and during drought periods.

Boaters' use of several of the boat ramps may be hampered by the lack of boarding docks for some of the launch lanes, and a majority of boaters felt that the number of docks or temporary moorage sites was too few. Also, excessive floating debris, mud and debris on the boat ramps, and partially grounded floating docks during low-water periods were observed at some locations. Some boaters expressed concern about the amount of floating woody debris that remains on the surface of Lake Oroville during the spring and early summer, in spite of DWR's and DPR's collection efforts.

Camping

Overall, LOSRA campers expressed high satisfaction with their experience at the campgrounds and 74 percent of campers said they were satisfied, very satisfied, or extremely satisfied with their trip. Large majorities of Lake Oroville visitors felt that the number of campgrounds, campsites with RV hookups, group campsites, and number of shower facilities were adequate. Nearly half of those visitors felt that the number of floating campsites was too few. The floating campsites are a unique and popular type of facility, but the limited number of suitable sites and high maintenance requirements are likely to limit further expansion.

A few campers at each campground made requests for a range of additional amenities, such as play areas for children, more convenient trail access to the shoreline, and more availability of food and convenience items.

Angling

About 76 percent of Lake Oroville anglers, 80 percent of Thermalito Forebay anglers, and 91 percent of Diversion Pool anglers stated that they were satisfied with their angling experience. Those who were not satisfied most often said their failure to catch fish was the reason, but most anglers reported catching fish and catch rates appear to be good. Anglers' perception of crowding in the areas where they fished was generally low with 74 percent at Thermalito Forebay, 76 percent at Lake Oroville, and 100 percent at Diversion Pool considering these areas to be not at all crowded to slightly crowded. With the exception of the Diversion Pool, large majorities of LOSRA visitors felt that the number of fish cleaning stations was adequate.

Trail Use

About 83 percent of visitors whose primary activity was trail use indicated that they were satisfied, very satisfied, or extremely satisfied with their trip. Also, a high percentage of

trail users (generally over 90 percent in each management area) expressed satisfaction with the condition of the trails. Large majorities of Lake Oroville, Diversion Pool, and Thermalito Forebay visitors considered the number of paved and unpaved bike trails, hiking trails, and equestrian trails to be adequate, while less than a majority, about 43 percent, of Diversion Pool trail users felt that the number of equestrian trails was too few. A similar percentage of Lake Oroville and Diversion Pool trail users felt that the number of signs indicating trail locations was too few.

In general, few LOSRA trail users (6–9 percent) reported encounters with other trail users that they felt put them at risk. The most common types of such encounters were reported by equestrians in reference to bike riders; other encounters involved walkers with dogs and illegal motorized trail use. A few equestrian trail users surveyed expressed dissatisfaction with multiple-use trails (shared with bikes) and expressed a desire for separate trails.

Swimming and Other Day Use

The primary issues surrounding swimming opportunities and other day use activities are related to project operations and are discussed below in Section 4.7.5.6, Existing Effects of Project Operations on Recreation Resources. Related to this is the finding that from one-half to two-thirds of Lake Oroville and Diversion Pool visitors felt that the number of swim areas and developed day use or picnic areas along shore was too few and about one-third of Lake Oroville visitors considered access to the shoreline to be a moderate or big problem. Reservoir drawdown is the primary constraint on these types of shoreline developments at Lake Oroville.

In regard to other types of day use facilities, large majorities of LOSRA visitors felt that the number of group picnic sites, equestrian facilities, and restrooms was adequate.

An additional issue related to swimming involved water quality at the popular swim beach at the North Forebay DUA. Water quality testing done for environmental technical studies indicated that bacteria levels were consistently high in the area during the summer, possibly due to the high number of geese present in the area.

Oroville Wildlife Area

In keeping with prior data analysis and technical study plan reports, data from the greater OWA and Thermalito Afterbay visitors are reported separately, although Thermalito Afterbay is managed as a part of the OWA.

Most OWA visitors indicated that they were satisfied with their overall recreation experience. About 64 percent of OWA visitors and 69 percent of afterbay visitors indicated that they were satisfied, very satisfied, or extremely satisfied with their trip to the area. Regarding crowding at recreation sites, about 67 percent of Thermalito Afterbay visitors rated their perception of crowding between not at all crowded and slightly crowded. However, perceptions of crowding at the OWA were higher, with about 50 percent rating crowding between moderately crowded and extremely crowded.

These responses are strongly associated with the Thermalito Afterbay Outlet site, described previously as one of the most popular salmon and trout angling locations in the region, particularly during the fall spawning run.

Additional information is reported below that describes specific activity groups' level of satisfaction, and existing issues and problems identified at the OWA through the completion of recreation technical studies that may reduce enjoyment and satisfaction for some visitors.

Areawide Issues

Three issues appear to be affecting recreation satisfaction and enjoyment in many areas of the OWA. First among these is safety and security. Although the majority of OWA visitors surveyed felt that overall safety and security as well as law enforcement presence was not a problem in that area, higher percentages (20 and 30 percent, respectively) than in any other area felt that these were moderate or big problems. Second is litter accumulation, which was noted at camping areas and DUAs as well as along parts of the riverbank and dispersed access areas used by anglers. Three-quarters of OWA visitors considered litter along the shoreline to be a moderate or big problem, and 58 percent held this perception of sanitation along the shoreline. Third, parts of the gravel levee-top roads that provide access to most of the OWA are rough and washboard with frequent potholes.

Camping

Large majorities of OWA and smaller majorities of Thermalito Afterbay visitors felt that the number of campgrounds, campsites with RV hookups, group campsites, and shower facilities was too few. However, as described above, the level of recreation development represented by developed campgrounds generally conflicts with the policies and goals of the DFG for management of State Wildlife Areas.

Some campers expressed dissatisfaction with the primitive camping facilities provided in the OWA. Litter, vegetation damage, and other ecological effects were noted in the primitive camping areas, as were camper concerns about personal safety and adequate law enforcement presence.

Angling

About 82 percent of OWA anglers and 72 percent of Thermalito Afterbay anglers stated that they were satisfied with their angling experience. As at LOSRA, those who were not satisfied most often said their failure to catch fish was the reason, but most anglers reported catching fish and catch rates appear to be good. Crowding and undesirable site conditions such as litter, overflowing garbage cans, and dirty (or the lack of) restrooms were also given as reasons. Anglers' perception of crowding in the areas where they fished were generally low at Thermalito Afterbay, with about 63 percent of afterbay anglers considering the area to be not at all crowded to slightly crowded. In contrast, only 31 percent of OWA anglers considered the areas where they fished to be

not at all to slightly crowded, while about 54 percent considered it moderately to extremely crowded.

Most afterbay visitors considered the number of fish cleaning stations to be adequate (one is provided at Monument Hill DUA), but about 90 percent considered the number provided at the OWA (none are provided) to be too few. It should be noted that DFG recommends that fish be cleaned in the Feather River, as the entrails provide nutrients to the system that would normally be provided by natural salmon mortality.

Other issues about which OWA anglers expressed concern included rude behavior by other anglers, illegal fishing practices, and the amount of litter on the riverbanks. The high concentration of anglers at the Thermalito Afterbay Outlet can sometimes cause conflicts between anglers (in particular between bank and boat anglers), and many anglers felt that additional law enforcement was needed.

Hunting and Other Open Space Activities

Three out of four hunters interviewed within the OWA were satisfied with their hunting experience, and most who were hunting for ducks (the most commonly hunted game in the area) were successful, as were most turkey hunters and over 40 percent of pheasant hunters. However, dissatisfied hunters felt that the habitat in the area needed improvement and several hunters felt that habitat had declined in recent years. Exotic weeds invading many of the ponds used for waterfowl hunting was seen as a major problem.

Wildlife viewing and nature study opportunities are prevalent in the OWA, with a large variety of species of birds, mammals, reptiles, and amphibians. However, as described previously, the lack of facilities along with trash accumulation, dumping, and rough roads may discourage organized nature study field trips by school groups or by individuals. Over one-half of afterbay visitors and nearly three-quarters of OWA visitors considered the number of interpretive programs and educational opportunities to be too few.

Boating on Thermalito Afterbay

Use of powerboats and PWC at speeds greater than 5 miles per hour (mph) is technically not allowed by DFG within State Wildlife Areas, in accordance with boating speed restrictions specified in Title 14 of the California Fish and Game Code. However, these speed limits have historically not been enforced on Thermalito Afterbay. To the contrary, boating access improvements used by all types of power boaters including water-skiers and PWC riders have been constructed in recent years and a water-ski slalom course was installed. Essentially, boating speeds are not enforced on Thermalito Afterbay due to conflicting management goals; in this case, DWR's goal is to provide recreational boating opportunities and DFG's goal is to limit activities inconsistent with wildlife management, enhancement, and protection (pers. comm., Atkinson 2003).

Feather River

In keeping with prior data analysis and technical study plan reports, discussion for the Feather River is for sites on the LFC portion of the river, upstream of the OWA. Other Feather River sites are included within the OWA, since all of the recreation access and sites are within the OWA. LFC survey sites included the Feather River Fish Hatchery (within the FERC Project boundary) and Riverbend Park (outside the FERC Project boundary).

Most Feather River visitors indicated that they were satisfied with their overall recreation experience. About 62 percent of visitors indicated that they were satisfied, very satisfied, or extremely satisfied with their trip to the area. About 77 percent of anglers said they were satisfied with their fishing experience. Regarding crowding at recreation sites, about 76 percent of visitors rated their perception of crowding "not at all crowded" and "slightly crowded."

Few issues and problems were identified at the Feather River Fish Hatchery or other Feather River areas through the completion of recreation technical studies. Large majorities considered most trail, camping, and boating facilities to be adequate in number. About 74 percent considered the number of fish cleaning stations to be too few (none are provided). Although not a majority, about 43 percent considered the number of restrooms to be too few. Few visitors considered any management issues, water condition issues, or user interaction issues to be a problem. The issue of litter along the shoreline may be considered an exception, with 41 percent considering this to be a moderate or big problem.

Projectwide

A few issues pertinent to recreation across the project area were identified through the completion of the recreation technical studies and other aspect of the relicensing program.

First, the collaborative relicensing process has included a discussion of a need for a comprehensive trails plan to resolve issues around multiple use of trials and trail safety, as well as issues surrounding needs for trail expansion, trail maintenance, development of more loop trails, and potential for specially designed single-track mountain bike trails. The Recreation Needs Analysis (SP-R17) recommends that a Comprehensive Non-Motorized Trails Program be developed to address all trail and trailhead management issues.

Second, the Recreation Needs Analysis suggests that a comprehensive Interpretation and Education (I&E) Program should be developed to plan and coordinate I&E efforts among the several agencies that provide access and facilities in the area. In addition, it was noted that few interpretive facilities exist downstream of Lake Oroville, with the exception of fisheries-related displays at the Feather River Fish Hatchery and standard informational bulletin boards at some sites.

Third, several stakeholder groups believe that non-local visits to the area, an important factor in economic growth, could be increased by additional facilities to support special events. DPR and FRRPD are responsible for permitting or organizing several special events each year. Special events that are currently being offered in the Lake Oroville area on an annual basis or more frequently include but are not limited to major fishing tournaments, equestrian trail rides, a competitive mountain bike ride, a triathlon, an Independence Day celebration, a salmon festival, and Butte Sailing Club events. Each of these events occurs in total or in part within the project area. Specific interest has been identified in new or enhanced facilities to support these events or other events such as water-skiing competitions, power boat races, and PWC races, some of which have been held in the project area in past years.

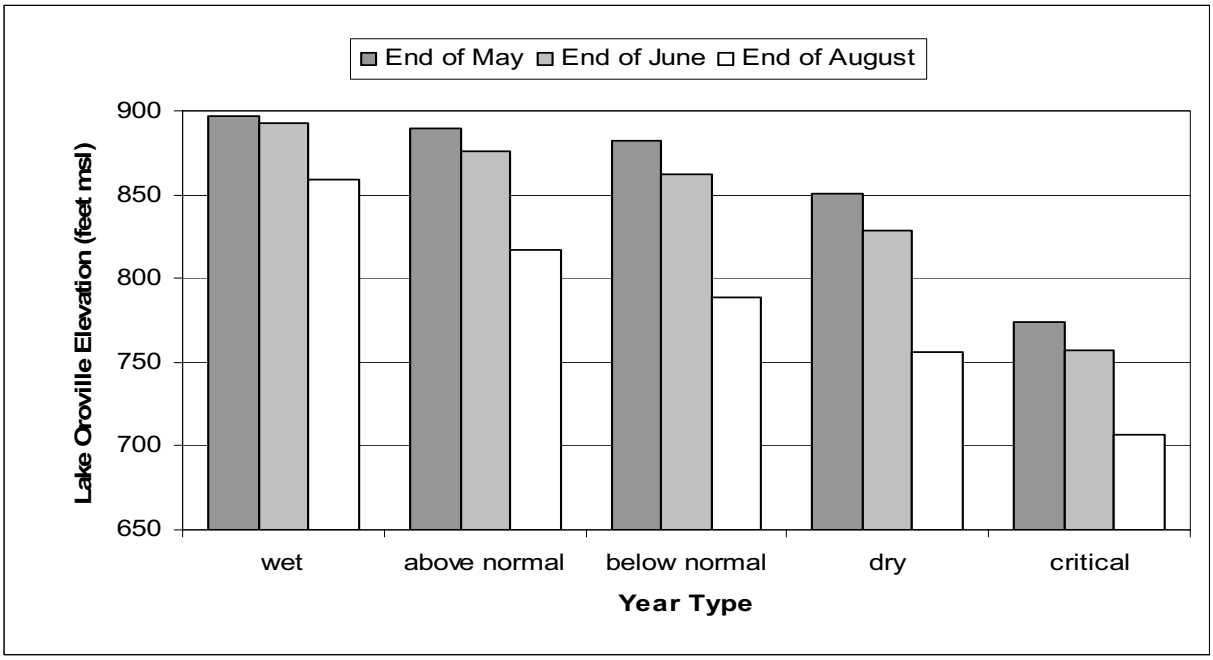
4.7.5.6 Existing Effects of Project Operations on Recreation Resources

Several important effects of project operations on recreation resources, identified within the recreation studies and quantified using hydrologic modeling conducted by the licensee, would continue into the future. Prominent among these are effects of the drawdown of Lake Oroville during the normal annual cycle of reservoir operations. Other effects include weekly fluctuations in water level at Thermalito Afterbay, cold water temperatures through the peak summer boating and swimming period in areas downstream of Lake Oroville (Diversion Pool, Thermalito Forebay and Thermalito Afterbay, and Feather River), and regulated flows in the LFC of the Feather River.

Lake Oroville Drawdown Effects

The annual drawdown of Lake Oroville affects boating, shoreline access and use (including swimming), and indirectly affects angling and camping. Effects are slight but negative in most cases (and positive in some cases) at pool levels within about 50 ft of full pool (850–900 ft msl). Effects are moderately negative in most cases at pool levels between 800 and 849 ft, but are more severe at certain types of facilities. Below 800 ft, effects become more substantial at several facilities, and 1 major boat ramp closes at a pool elevation of 775 ft. Access to the reservoir for both boaters and shoreline users is available down to pool levels below 700 ft, but the quantity and quality of access is progressively reduced as the pool level declines.

Hydrologic modeling based on historic hydrologic conditions for a 73-year period (1922–1994) has produced simulations of Lake Oroville elevations at several key end-of-month dates during the peak summer use season, for different water-year types (wet, above normal, below normal, dry, and critical) under existing operating conditions and levels of demand for water (see Figure 4.7-3). These results can be used to evaluate likely reservoir conditions at specific times of year and the associated effects on recreation. Results for the end of May represent conditions soon after the Memorial Day holiday weekend, the traditional start of the peak boating season. Results for the end of June represent conditions just before the Independence Day holiday, which often is the highest use period of the year. Results for the end of August represent conditions just prior to the Labor Day weekend, after which recreation activity typically declines sharply.



Source: DWR 2004

Figure 4.7-3. Modeled Lake Oroville elevation during peak recreation season under Existing Conditions, by water year type (average pool level).

Effects on Boating

Drawdown affects the number of boat ramps and launch lanes available to boaters and the ease of use of the facilities. Both the number of ramps and the number of launch lanes available decreases with decreasing pool levels, with the major developed launch ramps narrowing in stages and each closing due to low water at different elevations. Pool elevations below 800 ft result in the most substantial effects, with 1 ramp closed and at least 16 of the 33 total launch lanes reservoir-wide unavailable.

The results of the hydrologic modeling described above indicate that the average pool elevation at the end of May would be 775 ft during critical years. This means that two of the five developed boat ramps on the reservoir would be closed from the start of the season or soon after. The average pool elevation on that date in other (wetter) years would be about 850 ft or higher, and effects on boat ramps would be minor. Modeling results for the end of June are similar to the end of May, with substantial effects on boat ramps only in critical years. The modeling for the end of August, however, indicates that baseline operations effects would include average pool elevations below 800 ft in below normal years and much below 800 ft during dry and critical years. Average pool elevation in above normal years is expected to be just slightly above 800 ft at that date.

Regarding low-water access, the ramps at Lime Saddle, Bidwell Canyon, and Spillway each provide boaters access to the water down to pool elevations between 702 and 695 ft msl. This means that boaters will have access to the water at these sites during all but the lowest low-water periods, which may occur during the late fall and winter during

droughts. The reservoir pool elevation fell below 700 ft for several weeks in late 2002 but prior to that had not been below 700 ft since March 1991. Each of these ramps provides 2 or 3 launch lanes at their lowest usable elevations.

The ramp at Loafer Creek primarily serves boaters camping at the Loafer Creek Campground and becomes unusable at the substantially higher elevation of 775 ft msl. This means the ramp is likely to be unavailable by mid to late summer during drier-than-normal years. When the ramp is closed, boating campers in the Loafer Creek area, the primary users of the ramp, can instead drive several miles to the Bidwell Canyon or Spillway ramps.

The remaining developed ramp, the Enterprise boat ramp, is a two-lane facility that primarily serves rural residents on the east side of the reservoir. The ramp closes below pool elevations of about 835 ft msl, which means the ramp is likely to be unavailable during part of the summer boating season, even during above normal water years. The ramp may be closed for all or most of the summer boating season during drier than normal years. When the ramp is closed, the primary users from the local rural area are required to drive a considerable distance to a ramp at the south end of Lake Oroville in order to launch their boat.

In addition to launch ramp and lane closures, low pool levels make use of most of the boat ramps more difficult by requiring boaters to walk long distances up and down the steep ramps between the water and their vehicles parked above. In particular, boaters using the Lime Saddle and Bidwell Canyon ramps, where low-level parking is limited or non-existent, complain about the long and steep walk to and from their vehicles from their boats when the pool level is low. Two other ramp conditions related to reservoir drawdown have also been a problem at times: mud and debris on the ramps, and floating boarding docks being partially or completely grounded as the reservoir reaches low water levels.

The car-top boat ramps (essentially old roads within the inundation zone) vary in respect to when pool elevation limits their use. This feature depends on the slope of the land and the length and condition of the old roads that provide access to the shore and water. The three ramps on the West Branch arm of Lake Oroville have steep shorelines, making hand launching difficult at low water levels and limiting other shoreline use. The Vinton Gulch and Nelson Bar Car-top BRs provide trailer launching only at high or moderately high pool levels (above 840–850 ft msl). These sites continue to provide some opportunity for hand launching of boats until the pool elevation falls below about 825 ft. Steep and rocky shorelines preclude use by boaters below that elevation. At the Dark Canyon Car-top BR, the access road runs for some distance along the side of Dark Canyon cove, providing opportunities for hand and trailer launching until the reservoir is below about 765 ft msl.

The gently sloped shoreline of the Foreman Creek Car-top BR attracts shoreline use by both boaters and non-boaters and the road extends far into Lake Oroville, providing launching opportunities even at low pool levels. However, the road may be covered by mud and debris at low pool elevations, and use of the area was observed to be low at

those times. Similarly, the abandoned road at the Stringtown Car-top BR extends far enough into the reservoir to be used for launching at low pool levels. The County road leading to Stringtown Car-top BR, however, is long and winding, and relatively few boats are launched in the area. The dominant use is by fishermen using small boats, and who generally fish in nearby parts of the reservoir. (A sign stating that trailer launching is prohibited is posted at the turnoff to the Stringtown Car-top BR.)

In addition to the facility-related effects, drawdown can affect the recreational experience of boaters while out on the reservoir. Although crowding has generally not been found to be a problem on Lake Oroville, the surface area available for boaters to use decreases as the pool level falls. At 800 ft elevation, the reservoir has about 11,250 surface acres, nearly a 30 percent decrease from full pool. As the reservoir shrinks, coves favored by houseboaters and others for anchoring and mooring to the shoreline, and for water-skiing and similar sports, become gradually dewatered. This increases competition among boaters for these sites, which may become a greater concern only during years when severe drawdown occurs during the peak summer boating season. Declining water levels also increase the number of outcrops and other such obstructions at or near the surface, which limits boating activity in some areas. For safety, hazards in high-traffic areas are marked with buoys and a 5 mph boat speed limit is imposed within 200 ft of shore (reservoir-wide) year round.

Effects on Angling

Effects of project operations on reservoir boating, as discussed above, also apply to angling to a large degree in that most angling in the area (with the exception of angling on the Feather River) occurs from boats. Therefore, drawdown has effects on fishing at Lake Oroville to the extent that boater access is affected. However, angling activity at Lake Oroville, including major fishing tournaments, peak during the fall and spring and usually does not appear to be greatly affected by the typically low, off-season pool levels. The typically reduced number of launch lanes available during those seasons has generally not been a major impediment to these events, except during the most extreme low water conditions. (For example, a tournament was held November 23, 2002, at the Bidwell Canyon boat ramp when the reservoir pool elevation was below 700 ft msl.) Although conflicts may occur if few launch lanes are usable, relatively few pleasure boaters use the launch facilities during the non-summer months, reducing competition for use of the ramps and potential conflicts.

Effects of drawdown on bank fishing may be greater, in that low water levels make the shoreline less accessible in most areas. However, at a few locations on Lake Oroville, a moderate degree of drawdown leads to more exposed and accessible shoreline for bank fishing that at high water levels is not available or is difficult to reach.

Effects on Shoreline Use and Swimming

The Oroville Facilities are located in a region with hot summer temperatures, and often warm temperatures in the late spring and early fall, which helps make swimming an activity much in demand. Lake Oroville has one developed swim area at Loafer Creek,

but much of the swimming activity is more informal in nature. Swimming activity often occurs at the same locations and in conjunction with other shoreline-based day use activities such as picnicking, sunbathing or relaxing in the shade, and bank fishing.

The swim beach and associated facilities at the Loafer Creek DUA are used by both day users and campers staying at the nearby Loafer Creek camping facilities. The area receives heavy use during periods of high reservoir water levels; however, the beach becomes unusable as designed when the reservoir is more than about 50 ft below full pool. Historically, this has meant that the beach has not been usable at all during the summer some years and has been unusable a large part of the summer most years.

Several other small day use facilities without swim beaches exist at Lake Oroville, generally in association with boat ramps, and each with picnic tables, grills, and shade structures or trees. Lake Oroville visitors also use the car-top boat ramp areas as informal swimming and day use areas. Several of these become more usable by swimmers, picnickers, anglers, and others as reservoir level decreases, exposing more usable shoreline. Visitors have expressed demand for additional developed shoreline access sites, but reservoir drawdown combined with steep shoreline slopes is a severe constraint on such additions.

Shoreline use by swimmers, anglers, and others becomes more difficult and less enjoyable as the pool level decreases due to the primarily steep and muddy shorelines in most areas. A moderate level of drawdown has beneficial effects at Stringtown Car-top BR, because it provides areas of shoreline for parking and recreation use, whereas very little shoreline is accessible or useable at reservoir elevations near full pool.

Effects on Camping

With the exception of boat-in camping, most camping is not directly affected by reservoir drawdown. Only the Bidwell Canyon Campground provides sites close to the shoreline. Shoreline use in that area becomes difficult or undesirable due to steep and muddy conditions as the pool elevation falls more than about 50 ft below full pool. Campers at the Lime Saddle and Loafer Creek Campgrounds may hike to the shoreline near the campgrounds, and would also find the shoreline areas increasingly less favorable for use as the pool level falls.

Regarding boat-in camping, at moderate and low water levels the campsites can be a significant distance from the water. Routes from the shoreline to the campsites through the fluctuation zone become lengthy and steep, making these campsites less attractive. Therefore, boat-in campgrounds are generally more popular when the reservoir level is high and become generally unused as the reservoir level drops more than 50–70 ft below full pool (830–850 ft msl).

The aesthetic experience of floating campsite users can be negatively affected by drawdown because of the exposed shoreline that becomes a dominant aspect of the visual setting. Access to the floating campsites is not usually affected by drawdown during the majority of the recreation season. (Other aesthetic effects of reservoir

drawdown that may affect the enjoyment of visitors to Lake Oroville are discussed in Section 4.11.1, Visual Resources.)

Effects on Trails

Access to trails or trailheads is not generally affected by reservoir drawdown; however, some trail users would like to have more trails that provide access to the water, which currently is only provided by a few trails when the reservoir is at or near full pool. Additional access may be difficult or infeasible due to changing water levels. Additionally, the aesthetic effect of drawdown can affect the recreational setting for trail users using shoreline trails and therefore affect the recreational trails experience.

Lake Oroville Temperature Effects

As with most deep lakes and reservoirs in areas with temperate climates, Lake Oroville stratifies thermally each year, meaning that warmer waters are located near the surface and colder waters are located at depth. This two-layered system provides an opportunity for both a coldwater fishery (e.g., salmon and trout) and warmwater fishery (e.g., black bass, catfish) to flourish. The warmer waters at the surface, which are generally in the high 70s to mid 80s (°F) during the summer, provide good conditions for swimming and other water-contact recreation such as water-skiing, wake-boarding, and riding PWC.

Thermalito Afterbay Pool Fluctuation Effects

Overall, the surface elevation fluctuates much less at Thermalito Afterbay than at Lake Oroville. The pool elevation fluctuates as much as 4–6 ft on a weekly basis due to project operations, with a rapid drawdown and the lowest elevations typically occurring during weekends. The changes in elevation follow a weekly cycle dictated by hydroelectric power operations and can generally be characterized by a gradual increase in elevation from Monday through Friday followed by a more rapid decrease in elevation during the weekend. The typical 24-hour elevation gain is about 1 ft; the typical 24-hour elevation loss is about 2 ft. Most weeks, the range in elevation is about 3–4 ft. Fluctuations are similar during wetter-than-normal and drier-than-normal years, although weekly fluctuation during dry years may be slightly greater, in the range of 3–6 ft.

Effects on Boating

Stakeholder input indicates that the low pool levels can cause concerns for boaters using the Thermalito Afterbay boat ramps, particularly when the water level approaches the toe of the ramps. Low water levels also create a risk of grounding or stranding of boats in shallow areas.

Effects on Angling

Angling may be affected to some degree by daily or weekly changes in elevation or temperature changes that affect the fisheries or their reproduction in Thermalito Afterbay, which can in turn affect angling success rates.

Water Temperature Effects Downstream of Lake Oroville

The temperature of the water in the Feather River is regulated during much of the year by drawing of water from lower, colder strata of Lake Oroville. DWR is required to control water temperatures in the river to meet the needs of the Feather River Fish Hatchery and steelhead trout and spring-run Chinook salmon. At mile 61.6 of the LFC, the average daily water temperature is required to be less than or equal to 65°F during the months of June through September. A 1983 agreement between DWR and DFG specifies water temperature objectives for the Feather River Fish Hatchery ranging from 55°F to 60°F through the summer months. As a result of these requirements, water temperatures are cold year round in the reservoirs and in the Feather River downstream of Lake Oroville.

Water temperatures are generally uniformly cold in the Diversion Pool and most of Thermalito Forebay, rarely rising above 60°F during the summer. Surface water temperatures in the shallow swim cove where a beach is located can rise into the low 70s, although the water a meter or more below the surface remains at temperatures similar to the main pool of the forebay. Thermalito Afterbay water temperatures can vary widely. Summer water temperatures are in the low 60s near the tailrace channel where water enters the pool, in the 70s in areas near the outlet to the river, and in the mid 80s in the backwater areas that do not readily circulate (DWR 2001b).

Effects on Swimming

The cold water temperatures in the Diversion Pool and Feather River (generally from the upper 50s to mid 60s) can make swimming unattractive for most people. No swimming was observed in the Diversion Pool and little was observed in the Feather River during the study period. Prior to construction of the Oroville Dam, summer water temperatures in this area reached 70–75°F, and swimming was a popular activity. Currently, most of the visitors entering the river are wading anglers.

The cool water temperatures in most of Thermalito Forebay and Thermalito Afterbay reduce the desirability of the water for swimming but, as noted above, some warming of the water does occur in certain areas and several swim beach locations receive substantial use. The substantially warmer water at the North Forebay DUA swim beach, in particular, makes that area very popular with swimmers.

Swimming and water-skiing are popular summer activities at Thermalito Afterbay although water temperatures are less than ideal in some areas, with the warmest waters accessible to most pleasure boaters and skiers reaching the low 70s.

Effects on Angling

Changes in temperature that affect fish populations would also affect fishing success, and subsequently affect the fishing experience. The cold water temperatures of the downstream reservoir and the Feather River support well-utilized coldwater fisheries in all of these areas. The diverse temperature structure of Thermalito Afterbay provides suitable habitat for both warmwater and coldwater fish, including a popular largemouth bass fishery.

Low Flow Effects on the Feather River

The Feather River in the project area consists of two sections: the upper reach, also referred to as the LFC, from the Thermalito Diversion Dam to the Thermalito Afterbay Outlet, and the lower reach, downstream of the Thermalito Afterbay Outlet. The LFC generally has a flow rate of 600–700 cubic feet per second (cfs) (600 cfs is the required minimum for fisheries purposes) at most times, although flows may be much higher during the winter and spring of wetter-than-normal years, as water is released from Lake Oroville for flood control purposes. High volumes of water will also be carried in the LFC during actual flood events. Flows in the lower reach are more variable with the lowest flows (about 2,000–4,000 cfs) occurring during the fall and winter in most years and higher flows (5,000–8,000 cfs) occurring during the mid and late summer. Wetter-than-normal years will result in higher late winter and spring flows (6,000–12,000 cfs), while critical years will result in reduced flows (1,500–3,000 cfs) throughout the year.

Effects on Boating

Effects on boating occur but are not common on this portion of the Feather River. The low flows in the LFC reduce navigability, particularly for jet boats and other powered watercraft, because of shallows and riffles created by the low flows and growth of aquatic weeds. Conversely, low flows may make boating easier for novice paddlers and fishing boats wishing to anchor in the river. Paddlers who find shallows and riffles to be a barrier to navigation or who desire a more challenging paddle would have their enjoyment increased with greater flows. In the lower reach, the greater flows increase navigability. Very high flows may make boating more challenging; however, field observations suggest that anglers who boat on the river during the prime late-summer and fall fishing season are not deterred from using this very popular fishery resource during high flows.

Effects on Angling

The primary potential effect of low flows on recreation results from potential adverse effects on the coldwater fishery in the river, which is the major focus of most recreation activity there. However, wading by anglers in the river, which is a common angling technique, is made easier by the stable low flows. In the lower reach, the greater flows make wading more difficult in deeper areas. Wading anglers tend to adjust to the higher flows by staying in shallower water or by fishing from the bank or gravel bars.

4.8 CULTURAL RESOURCES

Cultural resources are those sites, objects, buildings, structures, and traditional areas associated with the prehistoric, ethnohistoric, and historic past. Information on the cultural resources of the project area is based on the results of three technical studies: a historical and archaeological inventory; an ethnographic and ethnohistoric inventory; and an inventory and evaluation of the buildings and other structural elements of the Oroville Facilities. A detailed description of the prehistoric and historic archaeological resources of the project area is provided in the *Final Archaeological and Historical Resources Inventory Report* (DWR 2005), which was prepared in accordance with Study Plan C-1 (SP-C1). The *Ethnographic and Ethnohistoric Inventory of Konkow Maidu Cultural Places* (DWR 2004a) provides a thorough description of the ethnographic and ethnohistoric cultural context and documented resources. The *Historic Properties Inventory and Evaluation: Oroville Facilities, Butte County, California* (DWR 2004b), prepared in accordance with SP-C1 and SP-C2, provides a description and evaluation of each of the buildings and major structural features (e.g., Oroville Dam) associated with the construction and operation of the Oroville Facilities. The discussion below summarizes those reports. Because these documents contain sensitive information on the location and nature of cultural resources, they are considered confidential and are exempt from Freedom of Information Act regulations.

4.8.1 Prehistory

The Feather River region has been occupied by Native American peoples for at least 3,000 years, and use continued up to and beyond the arrival of Euroamerican immigrants in the mid-1800s. The Feather River provided fresh water, abundant fish and other riverine resources, and a transportation corridor. The adjacent woodlands provided oaks, numerous other plants, and game such as deer. These resources, supplemented by trade with neighboring tribal groups, provided the Konkow-Maidu with the resources they needed for food, shelter, clothing, and the pursuit of a variety of ceremonial and sacred practices.

Archaeologists working in Northern California have been researching a number of major trends, themes, and issues characterizing the prehistory of the Feather River–Lake Oroville area. Prehistoric archaeology in this region has focused on defining archaeological contexts, examining past lifeways, and studying cultural processes. Important research topics include the paleoenvironment (e.g., conditions of the vegetative communities 3,000 years ago), site-formation processes, and cultural chronology. Issues related to determining past lifeways—including technology, subsistence-settlement, social organization, demography, and ideology/religion—have also been explored. Questions concerning cultural processes have dealt mainly with the nature of hunter-gatherer adaptations.

Prehistoric peoples of the Feather River region resided in an area containing a suite of habitats embedded within grassland, scrubland, deciduous woodland, and coniferous forest biomes. Over time, the people developed subsistence adaptations that were increasingly focused upon the gathering and use of fish (e.g., native slow-water species

and anadromous salmonids), large mammals (e.g., elk, deer, pronghorn), and acorns. These were supplemented by a host of other plants and animals. Various technological innovations were intimately tied to subsistence, including changes in weaponry (e.g., the introduction of the bow and arrow, fishing facilities), milling equipment (e.g., the shift from use of manos and metates to mortars and pestles), and textile arts (e.g., the development of basketry). Procuring additional resources was a primary goal of local and regional trade networks, which frequently transported goods over long distances (e.g., obsidian and marine-shell ornaments). Trade was one aspect of the increasing elaboration of social organization through time, and development of regional religions such as the Kuksu cult. Forces affecting cultural change through time have been proposed to include localized population growth, in-migration of foreign peoples, and environmental change.

The basic outline of prehistoric cultural chronology in the project area and environs was first developed by Olsen and Riddell (1963) and later expanded and elaborated by Ritter (1968, 1970) and Kowta (1988). The earliest securely dated archaeological complex in the Lake Oroville area is known as the Mesilla Complex, which has been dated between ca. 3,000 and 2,000 years Before Present (BP). This was followed by the Bidwell Complex (ca. 2,000–1,200 BP), the Sweetwater Complex (ca. 1,200–500 BP), and the Oroville Complex (ca. 500–150 BP). The Oroville Complex represents protohistoric Konkow-Maidu. The Kuksu religion was probably present in some form during this late period. Political organization was very similar to the pattern described in the ethnographic literature, consisting of autonomous tribelets. Population density is believed to have reached its highest levels at the time of Euroamerican contact.

4.8.1.1 Prehistoric Archaeological Sites

Archaeological resources consist of the material remains (artifacts, features, and alterations to the land) left behind by people who used the area in the past. Prehistoric archaeological sites may contain a small number of artifacts or features in a confined location, or may reflect long-term habitation and use in large, complex sites spanning many acres. Given thousands of years of use for a wide variety of activities, the FERC Project boundary contains a diverse array of prehistoric archaeological sites.

At the end of the 2003 archaeological field season, 325 archaeological sites containing materials from the prehistoric past—91 of which co-occur with historic-era resources—were known to occur within the FERC Project boundary. This total includes 93 sites that were previously recorded in areas that were inundated and could not be revisited. These prehistoric resources primarily include small bedrock milling sites used for processing plants, limited lithic scatters serving short-term or specialized purposes, and extensive open-air residential sites that may have been used as village locations for extended periods of time. Sites assigned to the latter category often contain several different types of tools and other artifacts, as well as evidence of semi-subterranean house features and/or midden deposits.

Other prehistoric site types known to occur in the Feather River region, such as quarries and lithic workshops, rock art, sites within caves and rock shelters, and cemetery areas

were found infrequently during the 2002–2003 inventory effort. Table 4.8-1 summarizes the approximate percentage of each of the main site categories. Additional information on these site categories is presented in the confidential *Final Archaeological and Historical Resources Inventory Report* (DWR 2005).

Table 4.8-1. Prehistoric archaeological site categories within the fluctuation zone.

Site Category	Percentage of Total Prehistoric Sites
Bedrock Milling	36 percent
Open-air Residential	33 percent
Limited Lithic Scatters	30 percent
Caves and Rock Shelter	Less than 1 percent
Rock Art	Less than 1 percent
Quarries and Workshops	Less than 1 percent
Cemetery Areas	Less than 1 percent

Source: DWR 2005

The percentages listed above may not accurately reflect the frequency of these site types within the broader project area. Because of the excellent visibility within the fluctuation zone, where vegetative cover was virtually nonexistent, most of the prehistoric-era resources were found within this area, which is generally closer to the major watercourses. Consequently, the open-air residential sites documented at this time are likely over-represented, while smaller lithic scatters, which are perhaps more common in the upland areas of the project area, are probably under-represented. More intensive archaeological investigations would be needed to clarify and refine the nature and relevance of site categories, and gather more specific data on the number, nature, age, and distribution of these diverse site types.

DWR, in consultation with the State Historic Preservation Officer (SHPO) and local Maidu tribes, has initiated the evaluation of some of the documented prehistoric resources in a manner consistent with SP-C2. This evaluation effort is intended to determine which sites are eligible for inclusion in the National Register of Historic Places (NRHP) and/or the California Register of Historical Resources (CRHR), and is focused on sites currently being affected by project operations. In addition, the current evaluation is being implemented at a sample of prehistoric sites within the fluctuation zone in an attempt to better characterize and understand these resources. The results of these evaluations are not yet finalized.

4.8.2 Ethnohistory

Native American residents of the study area spoke closely related dialects of the Konkow language, which extended throughout the Northwest Maidu or Konkow territory. Konkow is a sister language to Maidu (Northeastern or Mountain Maidu) and to Nisenan (Southern Maidu). Together, these three languages make up the Maiduan language family, classified as a member of the Penutian language stock (Shipley 1978).

The Konkow were organized in village communities in which a larger, major village provided the central ceremonial and political focus for several nearby affiliated villages. These communities incorporated three to five smaller villages, with a total population estimated at 200 people. Chiefs of these communities were known for their leadership ability, wealth, and generosity (Dixon 1905; Kroeber 1925). Several such village communities have been identified in the general Oroville region, with some locations occurring within the study area (Rathbun n.d.).

Subsistence was based on a mixture of gathering, fishing, and hunting that occurred on a seasonal basis during the course of the year. Salmon, deer, acorns, and pine nuts were among the most important food items. Trade with neighboring tribes was used to supplement the locally available resource base, and to foster intertribal relationships. Elaborate ceremonies, including the Kuksu cult, were practiced during the fall, winter, and spring. Traditional competitive games provided an important opportunity for social interactions with teams from neighboring communities.

The influx of Spanish and Euroamerican explorers, trappers, early settlers, and cattle ranchers in the early 1800s introduced diseases and disrupted both the environment and certain traditional Native American practices. With the onset of the Gold Rush in 1848, the Feather River was the site of intensive settlement and mining activities that severely affected the fishery and displaced Native American inhabitants. Some Native Americans began working for miners, ranchers, or settlers; many, however, were sent to the Nome Lackee reservation in Tehama County, only to return shortly thereafter because of poor conditions (Jewell 1987). A second relocation of local Native Americans was undertaken in fall 1863, when almost 500 Indians were forced to march 100 miles across the Sacramento Valley to the Round Valley reservation (Hill 1978). This was a devastating march for the Maidu during which there were heavy losses, particularly among the very young and older population. Ultimately, the Maidu experienced a loss of 80 to 90 percent of their population and virtually all of their lands as a result of Euroamerican colonization. Today, local traditions and festivals such as the Feather River First Salmon Ceremony are indications of the rejuvenation of traditional values, practices, and community involvement, including classes to renew the Konkow language and to teach basketry arts.

4.8.2.1 Ethnographic Resources

Ethnographic and ethnohistoric resources are locations that have special cultural significance or sensitivity for Native Americans or other ethnic groups. These resources may be related to sacred and/or traditional uses of both site-specific locations, such as an ethnographic village, and general areas such as a mountain that is a central element of Maidu myths or legends.

The investigation into ethnographic and ethnohistoric resources for this project was conducted in consultation and collaboration with the Maidu Advisory Council and members of local Maidu tribal groups. The inventory was based on two main informational sources: published and unpublished archival materials; and interviews with knowledgeable local Native Americans. Oral interviews for the ethnographic

inventory began in fall 2002, and continued into fall 2004. These interviews were held with numerous local tribal elders who were born and raised in the area, including members from the Berry Creek, Enterprise, and Mooretown rancherias, as well as the Konkow Valley Band of Maidu. Many of the elders participated in multiple interviews, and field visits were used regularly in combination with oral interviews to assist in the data-gathering process. A total of 88 oral interviews were conducted and documented in the inventory report (DWR 2004a).

The library and archival phase of work involved the review of extensive materials at local and regional repositories, including the Butte County Public Library; the Meriam Library at California State University, Chico; and the California State Archives. This literature was supplemented by the review of historic maps and federal census records, which provided critical information to help develop and understand the history of the Native American community in this area.

Formal evaluations of the ethnographic and ethnohistoric resources against the criteria for eligibility in the NRHP, as defined at 36 Code of Federal Regulations (CFR) 60.4, are in preparation. Resources determined to be eligible for inclusion in the NRHP are, by definition, also eligible for inclusion in the CRHR.

The ethnographic and ethnohistoric inventory led to the identification of 144 locations in or close to the project area. These locations of ethnographic and/or ethnohistoric importance have been organized into 14 site categories, based on the uses that were most commonly undertaken at these locations. The most common of these site categories, villages and fishing grounds, are reflective of the intensive settlement of the various forks of the Feather River in the project area, as well as the value of the fisheries that occurred in this area. More complete information on these resources is provided in the confidential report titled *Ethnographic and Ethnohistoric Inventory of Konkow Maidu Cultural Places* (DWR 2004a).

While many locations served multiple purposes for the local Native American community, each of the 144 documented sites has been placed into one of the 14 categories, as shown in Table 4.8-2.

4.8.3 History

On the far northeastern frontier of Spanish California, the Feather River area was first explored by the Spanish in the early 19th century and later exploited by fur trappers in the 1820s and 1830s. The latter incursion led to the introduction of diseases that severely disrupted the indigenous Native American society. The Mexican rancho period in northeastern California began in the 1840s, but it was soon interrupted, first by the American takeover of California and then by the Gold Rush.

Three months after gold was discovered at Sutter's Mill near the town of Coloma, John Bidwell found gold on the Feather River at what became known as Bidwell's Bar. The Feather River was a major gold-producing area, with all the social, economic, and

Table 4.8-2. Ethnographic and ethnohistoric site categories within the study area.

Site Category	Number of Locations
Village	30
Cemetery	3
Camp	3
Fishing Ground	29
Spawning Ground	13
Hunting Ground	2
Gathering Area	7
Swimming Hole/Picnic Area	7
Ceremonial Site	2
Mythological Site	12
Petroglyph	2
Historic Event/Battle Site	2
Trail	11
Place Name	21
Total	144

Source: DWR 2004a

environmental consequences found elsewhere in the mining West. By 1850, there were more than 3,000 miners in Butte County, with most of these men pursuing the relatively easily worked surface placer deposits. The miners quickly outnumbered the small Mexican population and much larger indigenous population inhabiting the area and began to reshape the landscape. As mining operations became more complex and costly, mining corporations began to dominate the local industry, with the construction of reservoirs, dams, and extensive ditches. Later hydraulic mining and dredging became the preferred means of extracting gold ore. This latter process continued well into the 20th century and is reflected in approximately 8,000 acres of dredger tailings in the Oroville Wildlife Area (OWA).

Following the influx of miners to the region, the foothills and valleys along the Feather River and between the Feather and Sacramento Rivers soon became a center for ranching and agriculture—first cattle, then wheat, and later fruit, rice, and other crops. Timber harvesting was initially conducted in the local area to support the mining industry, then on a more regional scale to provide lumber for residential and commercial use. The rise of agriculture to a preeminent position in the local economy was tied to the establishment of irrigation, including the adaptation of water-delivery systems from mining to agriculture, and the establishment of more robust and reliable transportation systems. In the 20th century, the area became an important source of hydroelectric power and a vital source of water for California.

4.8.3.1 Historic-Era Archaeological Sites

The archaeological inventory resulted in the recording of 553 historic-era archaeological sites within the FERC Project boundary. An additional 19 sites with historic-era components had previously been recorded within areas that were inundated and inaccessible during the recent inventory efforts. Ninety-three of the 572 resources

containing evidence of use during the historic period are found in conjunction with prehistoric-era components. As described in the *Final Archaeological and Historical Resources Inventory Report* (DWR 2005), the historic-era archaeological sites represent a variety of developmental themes. These themes include transportation, settlement, mining, water conveyance systems, industry and commerce (e.g., logging), and agricultural development. Some archaeological resources are representative of more than one of these major themes, such as a ditch that was constructed for mining purposes and later used for agricultural pursuits. Based on information obtained from the 553 resources documented, Table 4.8-3 indicates the approximate percentages of the dominant historical themes represented in the project area.

Table 4.8-3. Historic-era archaeological sites within the study area.

Primary Historic Theme	Percentage of Total Historic-era Sites
Transportation	32 percent
Settlement	28 percent
Mining	22 percent
Water Systems	13 percent
Industry and Commerce	2 percent
Agricultural Development	1 percent
Other	2 percent
Total	100 percent

Source: DWR 2005

4.8.3.2 Historical Structures

Historical structures associated with the Oroville Facilities that may be eligible for listing in the NRHP and/or CRHR include the dams, power plants, reservoirs, and canals associated with the hydroelectric facilities, along with the Lake Oroville Visitors Center, the Feather River Fish Hatchery, and the DWR Oroville Field Division facility on Glen Drive. While all of these structures are less than 50 years in age, the regulations implementing Section 106 of the National Historic Preservation Act (36 CFR 800) require the consideration of more recent properties that may have “exceptional” importance to the nation’s history (36 CFR 60.4[g]). Resources eligible for inclusion in the NRHP are, by definition, also eligible for inclusion in the CRHR.

The inventory and evaluation of the buildings, structures, and objects associated with the Oroville Facilities began with a field reconnaissance, followed by extensive research into DWR records, photographs, and historic maps to help ascertain specific dates of construction for each feature. Published literature and unpublished archival information was used to help develop the historical context for these resources. Each of the involved historical structures was then inspected in the field, photographed, and documented on standard DPR forms and included with the inventory and evaluation report.

These resources were also evaluated against the criteria for inclusion in the NRHP (36 CFR 60.4), both as individual resources and as part of a historic district. The

technical report entitled *Historic Properties Inventory and Evaluation: Oroville Facilities, Butte County, California* (DWR 2004b) contains detailed information on this investigation, including substantial background information on the development of the Oroville Facilities.

Elements of the built environment not directly associated with the hydroelectric facilities, such as campgrounds, marinas, roads, and trails, were not included in this investigation because these features were built following construction of the hydroelectric system, and are not considered to possess "exceptional" significance as defined at 36 CFR 60.4(g).

4.8.3.3 Documented Historical Structures

Table 4.8-4 identifies a total of 16 historical structures associated with the Oroville Facilities that were documented and evaluated against the NRHP criteria (36 CFR 60.4). Two of these resources, Oroville Dam and the Hyatt Pumping-Generating Plant, appear to be eligible for inclusion in the NRHP and CRHR as individual properties under the "exceptional importance" criterion (36 CFR 60.4[g]). These two structures, along with 12 additional facilities, are all considered contributing elements to the proposed Oroville Division Historic District under criteria A and C as defined in NRHP and criteria 1 and 2 as defined in CRHR at the State level of significance. This conclusion was reached because of the historical significance of the Oroville Facilities and the importance of many of these facilities within the field of engineering and design.

As defined in the guidelines published by the National Park Service (DOI 1991), a district "possesses a significant concentration, linkage, or continuity of sites, buildings, structures, or objects united historically or aesthetically by plan or physical development." As a significant component of the SWP, the proposed Oroville Field Division Historic District, with contributing elements listed in Table 4.8-4, appears to meet this definition, and is recommended as eligible to the NRHP under criteria A, C, and G and to the CRHR under criteria 1 and 2 (DWR 2004b).

Two resources, the Thermalito Fish Hatchery Annex and the Thermalito Diversion Dam Power Plant, were built in the 1980s and are not considered eligible either as individual resources or as elements of the proposed historic district.

Table 4.8-4. Historical structures within the study area.

Resource	Date Built	Individually Eligible	Contributing Element to the Historic District
Lake Oroville Visitors Center	1972–1974	No	Yes
Oroville Dam	1961–1968	Yes	Yes
Oroville Peripheral Dams: Parish Creek and Bidwell Bar Canyon	1966–1968	No	Yes
Hyatt Pumping-Generating Plant and Intake Structure	1963–1969	Yes	Yes
Oroville Area Control Center and Switchyard		No	Yes
DWR Field Division Facility	1968–1969	No	Yes
Fish Barrier Dam	1962–1964	No	Yes
Visitor Viewing Platform	1966–1968	No	Yes
Feather River Fish Hatchery	1966–1967	No	Yes
Thermalito Fish Hatchery Annex	1989	No	No
Thermalito Diversion Dam	1962–1968	No	Yes
Thermalito Diversion Dam Power Plant	1984–1989	No	No
Thermalito Power Canal	1965–1967	No	Yes
Thermalito Power Plant	1964–1969	No	Yes
Thermalito Forebay	1965–1968	No	Yes
Thermalito Afterbay	1965–1968	No	Yes

Source: DWR 2004b

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4.9 POPULATION, HOUSING, AND PUBLIC SERVICES

As the major storage facility of the SWP, Lake Oroville and other components of the Oroville Facilities play an instrumental role in allowing DWR to meet its commitment of supplying reliable and affordable water to its Feather River Service Area (FRSA) and SWP water customers throughout California. The provision of services to meet these commitments affects the local human environment. The following sections describe the affected environment in and near the project area for population, housing, and public services issues.

4.9.1 Population and Housing

The following section describes the affected environment conditions for population and housing. Data from the PDEA were used to describe these conditions. Data compiled for the PDEA came from several sources, including California Department of Finance estimates of existing population levels and housing characteristics for communities within Butte County, and Butte County Association of Governments population projections for Butte County.

4.9.1.1 Population

Butte County is one of ten counties located in California's largely agriculture-dependent Sacramento Valley region. Population trends in Butte County and its incorporated cities since the development of the Oroville Facilities are shown in Table 4.9-1. In 2000, Butte County had a population of just over 200,000 people, representing a doubling of population growth during the period since the construction of Oroville Dam. Between 1980 and 2000, Butte County's growth rate dropped behind California's rate, and the county's annual average growth rate of 2.1 percent was slower than the 2.8 percent growth rate across the ten-county Sacramento Valley region.

Butte County's population was an estimated 212,745 in January 2004, with 118,960 people residing in incorporated cities and 93,785 residents in the unincorporated areas of the county (California Department of Finance 2004). The racial composition of the population in Butte County is predominantly White, and the county also has a relatively high proportion of retirees. The county's largest city is Chico (population 71,317), followed by Paradise (26,725), Oroville (13,344), Gridley (5,769), and Biggs (1,805). The Chico and Paradise areas are the fastest growing areas of Butte County. Much of the historic population growth in the incorporated areas of Butte County has occurred in Chico, which owes a large part of its growth to annexation. Conversely, population growth in Oroville has been relatively slow, with the city's population growing at an average annual rate of 2.3 percent between 1970 and 2004, compared to rates of 7.8 percent in Chico and 3.2 percent countywide.

Table 4.9-1. Historic and current population levels in Butte County.

Jurisdiction	1970 [1]	1980 [1]	1990 [1]	2000 [1]	2004
Biggs	1,115	1,413	1,581	1,793	1,805
Chico	19,580	26,716	39,970	60,516	71,317
Gridley	3,534	3,982	4,631	5,382	5,769
Oroville	7,536	8,683	11,885	13,004	13,344
Paradise	-- [2]	22,571	25,401	26,408	26,725
Butte County (unincorporated)	70,204	80,486	98,652	96,068	93,785
Butte County (Total)	**101,969**	**143,851**	**182,120**	**203,171**	**212,745**

[1] *Represents census data.*

[2] *Paradise was not incorporated in 1970.*

Sources: California Department of Finance 2002, 2004

The population of Butte County is projected to increase to roughly 276,300 by the year 2020 and to 321,300 by 2030 (Table 4.9-2), corresponding to an average annual growth rate of 1.9 percent between 2000 and 2030. This is higher than the state's projected growth rate over the same time frame (1.4 percent). Projected growth rates in Butte County are lower than statewide projections for the 2000 to 2010 period but are higher for the two 10-year periods between 2010 and 2030.

Table 4.9-2. Population projections in Butte County and California through 2030.

Jurisdiction	Year			
	2000 [1]	2010 [2]	2020 [2]	2030 [2]
Butte County (Total)	203,171	232,080	276,280	321,320
State of California	34,043,198	39,246,770	43,851,740	48,110,670

Sources:

[1] *California Department of Finance 2004*

[2] *Butte County Association of Governments 2006*

Recreation visitation and operations and maintenance (O&M) activities associated with the Oroville Facilities currently support a portion of the local population base. Visitor-induced spending supports local and regional jobs, thereby sustaining population levels associated with these jobs. O&M activities directly support the local population base by providing employment opportunities and indirectly support the population base from the local spending of O&M worker earnings. Based on information developed for Study Plan R-19 (SP-R19), Fiscal Impacts, the local population base that is both directly and indirectly supported by the Oroville Facilities is estimated at about 2,360 persons.

4.9.1.2 Housing

Table 4.9-3 summarizes the characteristics of the existing (2004) housing stock in Butte County, which totaled 89,896 housing units in 2004. Of these, the majority (64 percent) were single units. The largest concentration of housing stock in the incorporated portions of Butte County was found in the city of Chico (29,001 units). Roughly 5,600

housing units were located in the city of Oroville, which had the highest vacancy rate in the county (9.9 percent) (compared to the countywide average of 6.8 percent). The population attributed to the Oroville Facilities, which is largely concentrated in the Oroville area, indirectly generates a demand on local housing resources. Based on existing vacancy rates, the Oroville Facilities do not appear to be contributing to a shortage in the regional housing stock.

Table 4.9-3. Housing stock in Butte County (2004).

Jurisdiction	Single Units	Multiple Units	Mobile Homes	Total Units	Vacancy Rate (percent)
Biggs	541	33	46	620	6.77
Chico	15,343	12,339	1,319	29,001	3.73
Gridley	1,765	278	75	2,118	6.19
Oroville	3,126	2,077	388	5,591	9.93
Paradise	9,055	1,060	2,469	12,584	6.33
Butte County (unincorporated)	28,049	1,848	10,085	39,982	8.74
Butte County (Total)	**57,879**	**17,635**	**14,382**	**89,896**	**6.79**

Source: California Department of Finance 2004

4.9.2 Public Services

This section addresses the provision of public services in the Oroville Facilities project area and in the surrounding area. For purposes of this section, the Oroville Facilities project area is defined as the area within the FERC Project boundary, hereafter referred to as the project area. Other areas discussed in this section include the Lake Oroville State Recreation Area (LOSRA) and the Greater Oroville Area. With the exception of areas around Thermalito Afterbay and within the Oroville Wildlife Area (OWA), which are inside the project area but outside of the LOSRA, the boundary of the LOSRA is similar to the boundary of the project area, and includes lands around Lake Oroville, the Feather River downstream of Oroville Dam to near the Thermalito Diversion Dam, and Thermalito Forebay. The Greater Oroville Area generally includes the city of Oroville and developed unincorporated areas immediately surrounding Oroville.

Recreation is an important activity in the project area, with local residents and out-of-county visitors using recreation sites and areas associated with the Oroville Facilities. As the Oroville Facilities receive increased recreation use, the resultant change in the demand for public services needs to be addressed along with other related issues.

Several federal, State, and local agencies have responsibilities for providing public services in and around the project area, as described below for the key public services required by visitors to the Oroville Facilities.

Data from the PDEA (DWR 2005) were used to describe the affected environment for public services. These data were compiled from interviews with local service providers and local agency budgets, and from information developed during the relicensing studies, particularly information included in SP-R19, Fiscal Impacts (DWR 2004a). In addition, data from information in documents submitted by Butte County to FERC related to DWR's Oroville Facilities relicensing application, from personal communications with staff at DPR and other agencies, and from publicly available documents were used to describe the affected environment for public services.

4.9.2.1 Law Enforcement and Criminal Justice Services

DPR is the primary provider of law enforcement services in the project area, focusing its services within the LOSRA. The Butte County Sheriff's Department and the City of Oroville Police Department provide primary backup law enforcement services within the project area, at times serving as the first responders to calls for law enforcement services, depending upon the location, type of call, and availability of other potential responders. The Butte County Sheriff's Department is the primary provider of law enforcement services in the unincorporated areas of Butte County outside of the LOSRA, including Thermalito Afterbay and the OWA. The Oroville Police Department has primary law enforcement responsibilities within the city of Oroville, including areas along the Feather River within the city limits.

Other law enforcement service providers in the area include the California Highway Patrol (CHP) on non-LOSRA State lands and local roadways; DFG at the OWA and

elsewhere within the area where its statutory Game Warden responsibilities extend; DWR (through private security patrols) at DWR facilities and land-based recreation facilities at Thermalito Afterbay; and federal agencies (USFS and BLM) on federal lands located within and outside of the project area. The law enforcement responsibilities of these and other agencies are discussed in more detail below.

When arrests are made in the project area, regardless of the arresting agency, arrestees are processed through the Butte County criminal justice system, potentially involving Butte County's jail and court system, including Butte County's district attorney's office, its public defender office, and its probation department. (Note: The Butte County Superior Court is funded entirely by the State of California; therefore, cases that are processed through the superior court do not directly affect the County's budget.) According to DPR staff (pers. comm., Feazel 2006), DPR arrested about 80 persons in the LOSRA requiring incarceration during fiscal year 2004-05. During that year, DPR rangers also issued more than 500 citations, with a significant portion of fines from these citations going to Butte County to help defray criminal justice and law enforcement costs associated with these actions.

As part of the FERC relicensing, recreation user surveys were conducted by DWR that included questions related to recreation safety both within the project area and at similar sites in Northern California. Results of these surveys provided useful information pertaining to recreation safety issues in the project area. In general, a small fraction of the respondents identified behavior that put them at risk while visiting the project area. Personal watercraft and boats operating too close to other boaters were mentioned as the most common at-risk behavior. About 7 percent of the respondents who identified themselves as trail users stated that they experienced an at-risk encounter while on a trail. Examples of illegal activities that take place in the project area include illegal dumping of trash and vandalism of cultural resource sites. There have been reported altercations at the Thermalito Afterbay Outlet fishing area. These issues are most serious during the salmon fishing season, and were identified by representatives from DFG, DWR, and the City of Oroville Police Department. Due to the large geographic extent of the Oroville Facilities area, law enforcement can be difficult in some locations.

California Department of Parks and Recreation

DPR is a major provider of recreation opportunities in California, managing about 270 park units in California, including historic and cultural sites as well as natural areas. DPR is the primary agency responsible for managing and patrolling recreation sites in the LOSRA, which includes Lake Oroville and Thermalito Forebay. DPR conducts boat patrols at Lake Oroville and Thermalito Forebay as well. Boat patrols take place on the weekends during peak and shoulder seasons, and sporadically during the weekdays during these time periods. Normally, there are 11 rangers and 2 supervising rangers at the LOSRA, though some positions are intermittently vacant as personnel turnover occurs. Based on LOSRA visitation in 2002, estimated at about 1,040,000 visitor days (including residents and non-residents of Butte County), LOSRA's average daily visitor population is 2,850, indicating an average DPR law enforcement service level of about 4.5 rangers per 1,000 visitors.

Because DPR provides law enforcement services in LOSRA, which includes areas adjacent to the city of Oroville and within unincorporated Butte County, law enforcement services in both the city of Oroville and Butte County benefit by this presence. For example, on occasion DPR is called by the Butte County Sheriff's Department or other agencies for backup on calls outside of the LOSRA (pers. comm., Feazel 2006).

California Department of Water Resources

DWR is responsible for managing water resources in California in cooperation with other federal, State, and local agencies. DWR has no law enforcement authority, but it has a contract with a private security company to provide security officers to patrol DWR facilities and buildings, as well as land-based recreation sites at Thermalito Afterbay. DWR also operates an Area Control Center (ACC) near Oroville Dam that coordinates operations and generation activities related to the project. The ACC operates 24 hours a day and coordinates patrols and security at the field level.

DWR currently spends approximately $1.4 million annually for security and public safety measures associated with the Oroville Facilities. These measures include the following.

- A contract for about $220,000 per year with the Butte County Sheriff's Department for the provision of Boat and Vehicular Patrol Services, which includes law and boating safety enforcement, at the Thermalito Afterbay facilities.

- A contract for $325,000 per year with a private security vendor to patrol the Oroville Facilities and to enhance facilities security and visitor safety.

- In addition to DPR's approximately $3.75 million annual budget to operate the LOSRA, DWR expends $900,000 per year to contribute to the funding of 11–13 full-time law enforcement peace officers that DPR employs for daily operations at the LOSRA within the project area.

An additional State contribution to law enforcement presence at the Oroville Facilities is provided by CHP pursuant to their lead enforcement role for State lands. State funding for law enforcement in the project area is a public service benefit to Butte County because FERC typically does not require project licensees to provide dedicated law enforcement at project facilities.

California Department of Fish and Game

DFG is the primary State agency responsible for the management of fish and wildlife in California. DFG is responsible for law enforcement within the OWA, which includes Thermalito Afterbay. The OWA consists of riparian habitat along the river, ponds and ditches with aquatic vegetation, sparsely vegetated areas, and dredge tailing ridges. DFG wardens patrol the OWA along the Feather River, while contracted Butte County Sheriff's Office deputies patrol Thermalito Afterbay. Currently, there are normally one or two DFG game wardens patrolling DFG-managed lands in Butte County.

The OWA presents law enforcement challenges. The OWA, which includes about 7 miles of Feather River frontage in addition to Thermalito Afterbay, is located within a few miles of commercial and residential areas, providing easily accessible secluded locations for the conduct of illegal activities within this part of the project area.

Butte County Sheriff's Department

Although DPR is the primary law enforcement service provider in the LOSRA, the Butte County Sheriff's Department assists DPR with calls within the LOSRA and at times provides first response. It also operates a recreational boating and waterways patrol program on Lake Oroville during the summer months, patrols the Thermalito Afterbay area under a contract with DWR, and responds to calls within the OWA.

According to Butte County's adopted fiscal year (FY) 2002-03 budget, the Butte County Sheriff-Coroner Department was staffed by 137 positions for administration, patrols, and operations. These activities, including equipment replacement, were supported by an adopted budget totaling $11.7 million. The Butte County Sheriff-Coroner Department does not employ a formal level of service standard tied to population, but does maintain general service level goals. In 2005, Butte County had a law enforcement service level of 1.18 sworn officers per 1,000 population (Butte County Office of the Chief Administrative Officer 2006). This ratio was apparently based on the number of sworn officers employed by Butte County in 2005 and the population of the county's unincorporated areas, which include lands owned by State and federal agencies. Butte County's service level does not account for other law enforcement personnel who patrol these and other portions of the unincorporated area, including those from CHP, DPR, and DFG. For example, as discussed previously, DPR normally employs 11–13 rangers for law enforcement in the LOSRA.

According to a report prepared by the Butte County Office of the Chief Administrative Officer (*Operational Impacts of the Oroville Facilities Project on Butte County*, February 2006), the Butte County Sheriff's Department currently responds to "hundreds of calls" for service within the project area each year from resident and non-resident visitors to the Oroville Facilities and from calls from outside agencies, including DPR, CHP, and DFG, requesting mutual aid. In this same report, however, it was stated that the Butte County Sheriff's Department responded between October 2004 and October 2005 to something more than 40 calls for back-up or other assistance in the project area, in addition to providing its regular patrols and responses to visitor calls in the project area. The report states that over the same period DPR personnel responded to 87 calls, suggesting that DPR refers about 50 percent of its requests for law enforcement services in the project area to the Butte County Sheriff's Department.

This service demand on the Butte County Sheriff's Department generated by project visitors is disputed by DPR. According to DPR, Butte County Sheriff's Department personnel rarely enter the LOSRA to respond to law enforcement calls and are rarely called to back up DPR calls. Additionally, the Sheriff's Department has the option to decline to respond to calls in the LOSRA, as it reportedly did when asked to respond to a 911 call in 2006. The major exception to these optional responsibilities is calls from

DPR to the Butte County Sheriff's Department for search and rescue assistance, which the sheriff's department is legally mandated to provide (pers. comm., Feazel 2006).

Oroville Police Department

The City of Oroville Police Department is responsible for public safety within the city limits of Oroville. As the primary provider of law enforcement services within the city of Oroville, the Oroville Police Department provides law enforcement services at a number of Oroville Facilities, including the Feather River Fish Hatchery, Thermalito Forebay, and the entrance to the OWA, and at non-project facilities such as recreation sites along the Feather River between the Thermalito Diversion Pool and OWA (i.e., Feather River Parkway and Riverbend Park). Additionally, most visitors to the LOSRA travel through the city limits of Oroville on their way to Lake Oroville, stopping to shop or to use local accommodations. Visitation to the Oroville Facilities affects the workload of the Oroville Police Department as congestion on local roads increases, resulting in increased accidents and traffic enforcement activities, increased patrols of motel and grocery store parking lots during peak-use months, periodic implementation of vehicle checkpoints, and increased patrolling and staffing to manage special events. These patrols often involve issuing citations for vehicle mechanical violations, problems with vehicle trailers, or alcohol use. The City of Oroville Police Department also provides additional support during incidents at project facilities.

According to the City of Oroville's (City's) adopted FY 2002-03 budget, the City of Oroville Police Department, supported by an adopted budget of $2.7 million, was staffed by a total of 38 positions during that year, including 25 full-time officers. The City of Oroville Police Department is guided by a population-based level of service standard of 2 officers per 1,000 population. Based on the current population in the city limits (about 13,000), the level-of-service standard is being met, although the City of Oroville Police Department also helps serve the City's sphere of influence that includes a population of about 55,000.

California Highway Patrol

Since 1995, CHP has had the duty and responsibility of providing protection to State property, including State-managed lands within the FERC project boundary (California Vehicle Code Section 2400[g]). Prior to 1995, this function was performed by the California State Police, which has since merged into CHP. The California Legislature has granted broad authority to CHP to promulgate rules and regulations and enforce such regulation for the protection of State employees, property, buildings and grounds and occupants of State property. Two State-managed highways, State Route (SR) 70 and SR 162, are proximate to the project area, and many recreational users in the area use these two highways to reach recreation facilities. CHP often responds to traffic incidents on roads within and adjacent to the project area.

CHP also assists local government during emergencies when requested and provides backup for other agencies responsible for public safety in the project area. The extent, nature, and coordination of the operations of local law enforcement relative to those of

CHP and the LOSRA State Park Rangers are a matter of intergovernmental administrative understanding and comity (50 Ops. Cal. Att'y Gen. 69).

California Department of Boating and Waterways

The California Department of Boating and Waterways (DBW) operates a number of watercraft-related programs, including boating and aquatic safety education and training programs, boat and yacht licensing programs, and programs that fund the development of public access boating facility projects. DBW does not have patrol responsibilities within the project area, but it is involved with boating safety throughout the state and contracts with the Butte County Sheriff's Department to patrol river reaches within Butte County (DWR 2004b). DBW is also responsible for maintaining statewide boating accident statistics.

U.S. Forest Service

USFS is a federal resource agency within the U.S. Department of Agriculture. USFS is responsible for managing 1,620 acres, or 4.0 percent, of the project area. USFS's Plumas National Forest manages parcels of land in the eastern portion of the project area. Plumas National Forest has no formalized patrols in the project area, but its personnel do respond to calls for mutual support. Additionally, USFS has an agreement with DPR (dating back to 1978) that permits DPR to the extent permissible to enforce applicable laws and regulations on National Forest lands within the project boundary.

U.S. Bureau of Land Management

BLM is a federal resource agency within the U.S. Department of the Interior and is responsible for managing 4,620 acres, or 11.2 percent, of the project area. BLM has lands within the project area administered by the Redding Field Office. BLM collaborates with State agencies (DPR, DWR) and allows them to patrol BLM-managed lands within the project area (DWR 2004b).

4.9.2.2 Fire Protection and Emergency Services

Potentially destructive wildfire is an issue that land managers in the California foothills frequently address. Relicensing stakeholders have expressed concern that historic land management and fire prevention activities within the project area have resulted in increased fuel load, which has led to an increased risk of wildfires.

The rapid population growth of the state's urban areas, accompanied by an increase in affluence and leisure time, has resulted in a dramatic increase in the number of people visiting and enjoying the recreation opportunities of Butte County. For much the same reason, Butte County's permanent population has also grown steadily. The problems of protecting life and property from fire hazards have increased significantly with the growing numbers of residents and visitors in the mountain and foothill areas. Pressures in Butte County that serve to push the urban boundary into rural areas and in doing so,

exacerbate wildland fire occurrence, are consistent with statewide trends in development.

Providing fire protection and emergency services within the project area is complicated by the rugged topography of the region. Primary responsibility for providing fire suppression and emergency medical services to the project area and in the Greater Oroville Area is divided among State, federal, and local agencies, as mandated by State and federal laws and cooperative agreements with local agencies. According to California Public Resources Code Sections 4125-4127, the State Board of Forestry and Fire Protection classifies all lands within California for the purpose of determining areas of State responsibility for preventing and suppressing fires. The following definitions apply to these areas.

- State Responsibility Areas are those areas designated, as defined by statute, by the State Board of Forestry and Fire Protection that are primarily the financial responsibility of the State for the prevention and suppression of forest, range, and watershed wildfires. This responsibility does not extend to protecting structures and improvements, nor does it extend to providing emergency medical services. These responsibilities rest with local agencies. Lands owned or controlled by the federal government and lands within the boundaries of cities are not included in State Responsibility Areas.

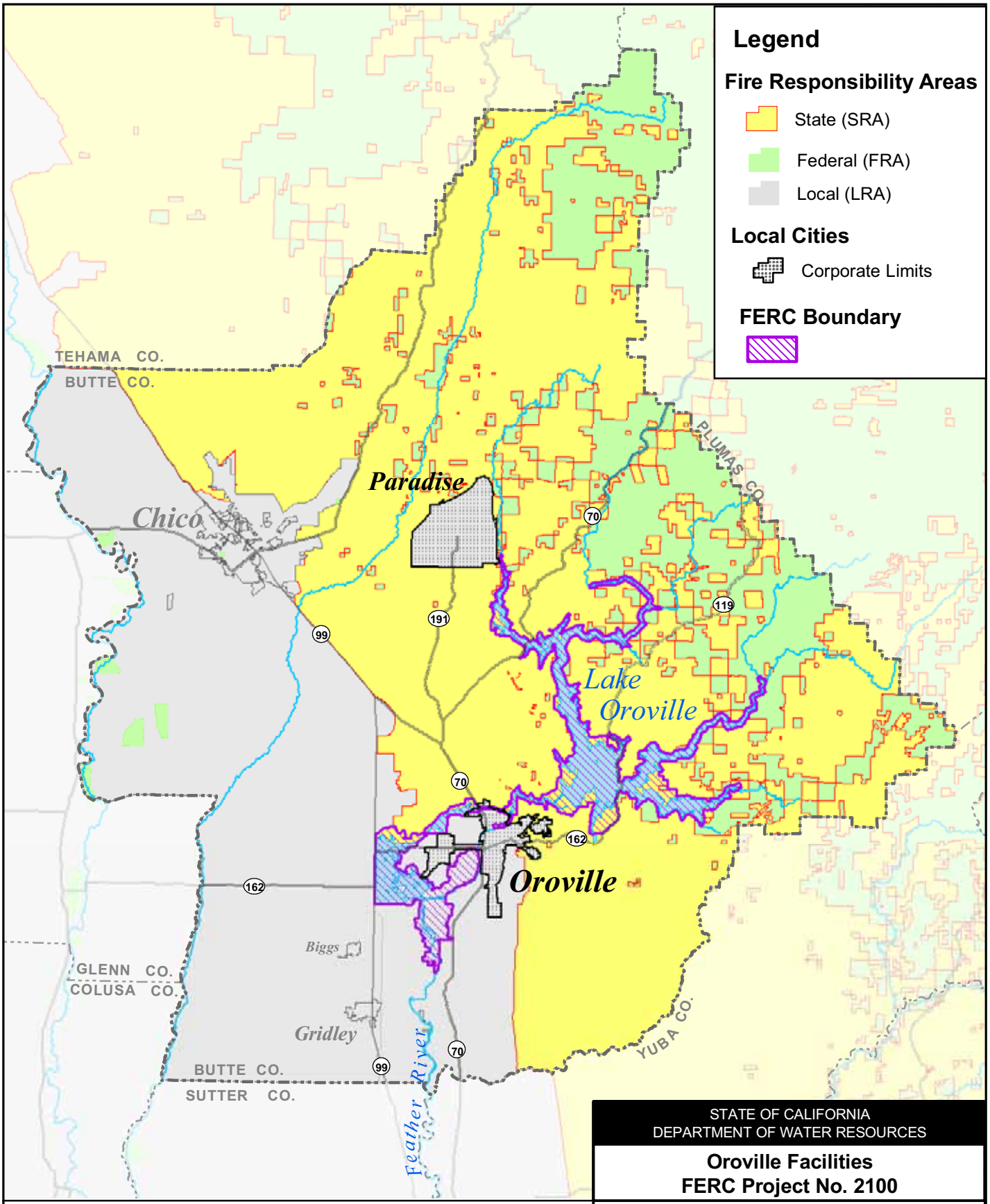
- Federal Responsibility Areas are those owned or controlled by the federal government, including Plumas National Forest and BLM lands in the project area.

- Local Responsibility Areas are those areas outside of State Responsibility Areas and Federal Responsibility Areas. The financial responsibility for fire protection and suppression in Local Responsibility Areas is primarily that of local government agencies, including Butte County and the City of Oroville.

Figure 4.9-1 shows the locations of these designated areas in and around the project area. As shown in the figure and comprising roughly 75 percent of the project area, lands surrounding Lake Oroville and along the Feather River downstream to roughly Thermalito Diversion Dam are contained in a State Responsibility Area, and are therefore the primary responsibility of the State through the California Department of Forestry and Fire Protection (CDF). Thermalito Forebay, Thermalito Afterbay, and the OWA are in Local Responsibility Areas, and are therefore the primary responsibility of the City of Oroville and Butte County, depending on the location of specific incidents.

Thus, primary fire protection and emergency services responsibilities in and around the project area are as follows:

- State Responsibility Areas (including Lake Oroville): The State is primarily financially responsible for wildland fire protection and suppression in State Responsibility Areas (Figure 4.9-1), including lands within LOSRA surrounding Lake Oroville and the Feather River. Butte County has financial responsibility for fire suppression involving structures and improvements in these areas. DPR is



Source: CA Spatial Information Library GIS / CA Dept of Forestry (CDF) FRAP 2006 / DWR GIS / EDAW 2007

10 5 0 10 Miles

Original Scale 1 : 475,200
1" = 7.5 miles

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Oroville Facilities
FERC Project No. 2100

DRAFT ENVIRONMENTAL IMPACT REPORT

FIGURE 4.9-1

Fire Responsibility Areas in Butte County

Prepared by: PJ -- EDAW, Inc.
Date: 4/5/07
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primarily responsible for emergency service calls within the LOSRA, with primary backup provided by BCFD. In State Responsibility Areas outside of LOSRA, Butte County has primary financial responsibility for responding to emergency service calls.

- Local Responsibility Areas (including Thermalito Forebay, Thermalito Afterbay, and the OWA): In the unincorporated part of the Local Responsibility Area (Figure 4.9-1), Butte County is primarily responsible for fire protection and suppression and emergency service calls, with Butte County bearing the primary financial responsibility. Within Oroville, the City of Oroville has primary fire protection and emergency services and financial responsibilities.

In practice, fire protection and emergency medical services to the project area and to the Greater Oroville Area are provided jointly by CDF, BCFD, DPR, and the Oroville Fire-Rescue Department. These agencies cooperatively respond to calls within the area based on the South County Interagency Fire Protection Agreement. Under this agreement, primary responsibility for fire protection and emergency service calls in the south County area is divided among these agencies depending on the location of the incident and the availability of fire units to respond to the call, regardless of primary jurisdictional responsibilities. Calls from the project area are most likely to be rescue-related, with DPR and CHP sometimes receiving the initial call, which may then be passed along to the most appropriate responder (Butte County Office of the Chief Administrative Officer, February 2006). Within the LOSRA, including Lake Oroville, DPR rangers who have EMT or equivalent certifications are the first responders for emergency calls (pers. comm., Feazel 2006). DPR has four to five vessels at their disposal at any given time for this purpose. DPR usually transports medical emergency victims on Lake Oroville to appropriate boat ramps or marina locations, where accident victims can then be picked up by local ambulance firms or Enloe Hospital resources, such as a helicopter. The accident victims or their medical insurers are financially responsible for the ambulance and hospital costs. Additionally, CDF/BCFD fire department personnel often respond to calls for emergency services in the LOSRA and are the primary responders to emergency services calls elsewhere in unincorporated Butte County.

Additional information on the operations and responsibilities of CDF, BCFD, and the Oroville Fire-Rescue Department are provided below.

California Department of Forestry and Fire Protection

CDF has a mission to protect the people of California from fires, respond to emergencies, and protect and enhance forest, range, and watershed values providing social, economic, and environmental benefits to rural and urban citizens. As discussed previously, CDF has major fire-related responsibilities within State Responsibility Areas in Butte County, including lands surrounding Lake Oroville. CDF also often serves as a first responder to accidents in the area and provides assistance and mutual aid on search-and-rescue operations. CDF provides funding for the Butte Emergency

Command Center, which serves the needs of CDF, BCFD, and certain cities within the county.

State law (Public Resources Code Sections 4142, 4144, and 4145) allows CDF to enter into cooperative agreements with local governments for the purpose of providing full-service fire protection services on any lands within a jurisdiction, including Local Responsibility Areas, as it does with 35 counties and 25 cities in California. As a full-service fire department, compensated for its services by a local agency, CDF can respond to wildland fires, structure fires, floods, hazardous material spills, swift-water rescues, civil disturbances, earthquakes, and medical emergencies of all kinds depending on terms of the cooperative agreement. Pursuant to this authorization, CDF has had longstanding cooperative agreements, reinstituted annually, with Butte County and with the Cities of Biggs and Gridley, as these small municipalities do not provide city-funded separate fire protection services.

The contract between CDF and Butte County, known as the Cooperative Agreement Program Schedule A Agreement for Local Services, stipulates, among other terms, that CDF is to maintain the necessary equipment, personnel, and facilities required to provide fire protection and emergency services in the County's Local Responsibility Area during the entire year. The agreement, in some ways, consolidates the wildland fire suppression operations of CDF and Butte County throughout the unincorporated county area, with Butte County paying the State for the services in the Local Responsibility Area covered by the cooperative agreement. The contractual arrangement is designed to meet the fire protection and suppression needs of Butte County.

As a major fire protection service provider statewide and in the region, CDF has prepared a Fire Management Plan (CDF 2002) for the Butte Unit, which documents the assessment of the fire situation within the unit. The plan includes stakeholder contributions and priorities, identifies strategic areas for pre-fire planning, and fuel treatment as defined by the people who live and work with the local fire problem. The fire plan assessment system has four components, which include level of service, assets at risk, hazardous fuels, and historic fire weather. CDF bases its level of service on initial attack success rates for lands of a similar type. Generally, the goal of CDF is to attain approximately 95–98 percent success rates across planning belts (i.e., grass, brush, interior-timber, woodland, and agricultural or urban). Success rates in the Butte Unit range from 89 percent (interior timber) to 100 percent (woodland), and are generally in the mid-to-upper 90th percentile; these success rates are considered to meet established service standards (pers. comm., Hawks 2004).

Butte County Fire-Rescue Department

As discussed previously, BCFD holds responsibility for responding to wildland fire incidents in the unincorporated areas of the County outside of State Responsibility Areas, and has primary financial responsibility for responding to structural fires and medical emergency calls in all unincorporated areas of Butte County, although DPR has primary responsibility for responding to emergency services calls in the LOSRA. As

described previously, Butte County contracts with CDF for full-service emergency and non-emergency response to incidents that include medical emergencies, rescues, structural fires, wildland fires, hazardous material spills, and other miscellaneous calls for service. Butte County pays CDF for staff services under the cooperative fire protection agreement, and BCFD receives supplemental staffing through a volunteer program.

In FY 2002-03, BCFD was staffed by approximately 200 career and seasonal CDF employees, 250 volunteers, and 100 staff assigned to the Butte Fire Center, according to Butte County's adopted budget. (CDF employees staff the Butte County Fire-Rescue Department through a contractual arrangement between Butte County and CDF.) Budgeted expenditures for Butte County's regular and volunteer fire protection programs, including equipment replacement, totaled $10.1 million in FY 2002-03.

According to Butte County (Butte County Office of the Chief Administrative Officer 2006), there are 22 fire stations, not including City of Oroville fire stations, with the ability to respond and provide services to a large part of Butte County that includes the project area. Butte County has stated that these fire stations have response areas that fall within the area most frequented by resident and non-resident visitors to the Oroville Facilities. This roughly 400,000-acre area, as defined by Butte County in its relicensing filings with FERC, was used by Butte County to calculate county project-related emergency response calls. This represents an area approximately ten times larger than the project area. Of these 22 stations, 9 are Butte County Volunteer Fire stations, 4 are CDF/BCFD 'Amador' stations, 8 are BCFD stations, and 1 is a CDF station.

This visitor-frequented area, which has not been verified by other service providers, is much larger than the FERC project boundary area and LOSRA, taking in areas that may be traversed by visitors on their way to Oroville Facilities recreation sites. Hence, project visitors may generate few service calls for some of these stations. These stations primarily serve Butte County residents in addition to potentially providing services to project visitors.

Butte County Volunteer Fire stations are owned and maintained by Butte County and are primarily staffed by trained volunteer staff who receive stipends. CDF/Butte County "Amador" stations are owned by the State of California. For these stations, CDF provides full staffing and operational funding for 5 months (the fire season) of the year, while for the remaining 7 months (the non-fire season), Butte County continues to pay the additional emergency response pay for CDF firefighters, who then respond to county emergencies. BCFD stations are owned and operated solely by Butte County. Firefighters assigned to BCFD stations are CDF employees paid by Butte County through the cooperative agreement contract between the County and CDF. CDF Stations are owned, operated, and funded solely by the State.

Within the project area, visitors to the Oroville Facilities generate calls primarily for emergency medical services. Other types of calls generated by visitors include water rescues on Lake Oroville, the Feather River, Thermalito Forebay, and Thermalito Afterbay. Although few fires have occurred in the LOSRA, there are occasional

responses to reports of illegal campfires. Outside of the LOSRA, visitors traveling to the Oroville Facilities generate emergency medical services calls related to traffic accidents and occasionally generate calls to respond to grass fires (pers. comm., Fowler 2003).

According to Butte County, BCFD responds to many calls for service in the project area, including emergency medical, fire, rescue, and hazardous materials calls (Butte County Office of the Chief Administrative Officer 2006). Although call data specific to the entire project area are not available, the department reportedly responded to more than 51 emergency services calls in 2004 and 47 calls in 2005 in the Lake Oroville portion of the project area (Butte County Office of the Chief Administrative Officer 2006). Countywide, BCFD responded to 10,588 incidents in 2003 and 10,368 incidents in 2004 (Butte County 2005), indicating that emergency services calls in the Lake Oroville portion of the project area accounted for less than 0.5 percent of BCFD's total calls in 2004.

DPR confirms that BCFD personnel (including contracted CDF personnel) respond to calls for emergency medical services within the LOSRA, with or without DPR's request for assistance. DPR, however, estimates that BCFD personnel respond to only 20–25 calls for service within the LOSRA each year, with most of those responses not requested by DPR (pers. comm., Feazel 2006).

Oroville Fire-Rescue Department

Within the Oroville Fire-Rescue Department's core service area (i.e., city limits of Oroville), the fire department responded to approximately 3,000 calls during FY 2001-02 (including false fire alarm responses). Emergency medical aid–related calls accounted for 1,651 calls, or about 60 percent of non–false alarm calls. Part of this workload is attributed to visitation to LOSRA and related recreational facilities as non-residents travel to and use recreation facilities. Visitation generates calls related primarily to traffic accidents, medical aid to recreationists, and swift-water rescues on the Feather River. The majority of visitor-related incidents requiring fire-rescue department response are for emergency medical services (pers. comm., Pittman 2003).

According to the City of Oroville's adopted FY 2002-03 budget, the Oroville Fire-Rescue Department's $1.5 million budget supported 18.4 positions during that year. The City of Oroville Fire Department is guided by Fire Department Standards of Cover Guidelines included in the Safety Element of the City of Oroville General Plan:

- 8.30h: Fire Department travel times should strive to place a first due unit at the scene within 5 minutes of travel time, for 90 percent of fire and medical incidents.

- 8.30i: Fire Department units should be located and staffed such that an effective response force of four units with eight personnel minimum should be available to all areas of the City of Oroville within a maximum of 10 minutes travel time, for 90 percent of all structure fires.

According to the Standard of Coverage Study conducted by the Oroville Fire-Rescue Department (2003), the City of Oroville Fire Department, through the South County Fire

and Rescue Management Agreement, meets these standards. Since that report, however, incident activity and new development has created the need for an additional staffed engine company serving the western portions of Oroville. Further, staffing has not increased since 1983 due to revenue deficiency, although there is roughly 3 times the emergency workload. Based on these considerations, there are concerns that multiple or simultaneous emergencies would exceed the City of Oroville Fire Department's ability to provide service (pers. comm., Pittman 2004).

4.9.2.3 Traffic and Road Maintenance

Traffic and road maintenance issues related to use of the Oroville Facilities area are discussed in Section 4.14, Traffic and Road Maintenance.

4.9.2.4 Utilities and Service Systems

Various utilities and service systems serve the area, and may be needed to serve proposed facility developments under the alternatives and indirect population growth generated by the project. These services include water, wastewater treatment, and solid waste disposal.

Water

Water service is provided to the Kelly Ridge portion of the project area by the South Feather Water and Power (SFWP), formerly known as the Oroville-Wyandotte Irrigation District. It primarily functions as a domestic water retailer and a hydropower generator, with the Feather River serving as its source of water. The SFWP's water rights and facilities are upstream and not part of the SWP.

The ditch system utilized for irrigation water by the SFWP today is a modification and expansion of the ditch network constructed by early miners who diverted water from the Feather River to their mining claims. In the late 19th century, as mining gave way to agriculture, the South Feather Land and Water Company acquired many of the miners' ditches.

The Del Oro Water Company was originally formed in 1965 to meet the water needs of the Paradise Pines area in Magalia, California. Since that time the company has grown throughout California. Nine hundred of its customers are located in the Lake Oroville area.

Wastewater Treatment

The 60-acre Sewerage Commission–Oroville Region (SCOR) wastewater treatment plant is designed to treat 6.5 million gallons of wastewater per day, and treats 1.2 billion gallons per year, serving 15,000 households and numerous industries in the Greater Oroville Area, including the City of Oroville and outlying rural areas. Eighty percent of the treatment plant's power is supplied by a 520-kilowatt solar panel array, which at the time of installation in 2002 was the fifth largest solar-powered system in the world, and the first predominantly solar-powered wastewater treatment plant in the country.

Public entities in the Greater Oroville Area own individual wastewater collection systems, while SCOR receives and treats collected wastewater for the region.

Solid Waste

Management of solid waste material in the area is performed by several privately owned transfer stations and one central sanitary landfill site that is owned by Butte County and leased to a private company (Waste Management) for operation and management. Solid waste produced in the area is transferred to the Neal Road Landfill, which is located in the City of Paradise and operated by the Neal Road Landfill Company, a subsidiary of Waste Management. The Neal Road Landfill provides service to all 212,800 residents of Butte County. Waste from outside Butte County is not accepted. The landfill's expected capacity would allow it to be used until 2034, with a total of 140 acres permitted for landfill.

Power

Pacific Gas and Electric Company is the primary provider of electricity and natural gas services to residents and businesses in the area. Scheduling of local and regional power generation and distribution is managed by the California Independent System Operator. Information regarding power generated by the Oroville Facilities is included in Chapter 3.0.

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4.10 ENVIRONMENTAL JUSTICE

Environmental justice refers to the fair and equitable treatment of individuals regardless of race, ethnicity, or income level in the development and implementation of environmental management policies and actions. Executive Order (EO) 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations," requires each federal agency to "make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low income populations" (Council on Environmental Quality 1997). Comparable policies and guidelines have been established by the State of California Resources Agency, which includes DWR, owner and operator of the Oroville Facilities.

4.10.1 Characteristics of Populations Affected by the Oroville Facilities

An important baseline effect of the Oroville Facilities is the provision of relatively affordable water to customers throughout the SWP service areas. The Oroville Facilities also provide recreation opportunities, including access to fee-based and free facilities, to visitors from throughout the State. A summary of the demographic characteristics of populations affected by the Oroville Facilities is provided in this section.

The racial characteristics of the population living in the SWP service areas vary by region of the state. Locally, the racial makeup of the population in the FRSA is more uniform than that of the state, with only American Indians/Alaska Natives representing a higher proportion of the overall population. The proportion of American Indians/Alaska Natives is even higher in the city of Oroville, which is nearly four times the state average. Based on survey data collected as part of Study Plan R-13 (SP-R13), Recreation Surveys, the ethnicity of visitors to the Oroville Facilities is predominantly White/Anglo/non-Hispanic, and Latinos/Hispanics are the second most populous ethnicity.

Income-related characteristics of persons living in the SWP service areas also varies considerably. The FRSA has the lowest median household income in the Oroville area with the city of Oroville (included in the FRSA) having the lowest income level. Median household income levels in both of these areas are lower than statewide figures. The highest poverty rates occur in the San Joaquin Valley, followed by the FRSA and Southern California, all of which are higher than the state average. Based on the survey data, the household income levels for Oroville recreationists are fairly evenly distributed. The majority of visitors had a total household income that was higher than median income level for Butte County in 2000.

The evaluation of environmental justice considerations focuses on the local, regional, and out-of-region effects of the Oroville Facilities on minority and low-income groups. Once the socioeconomic impacts of the Oroville Facilities are identified, along with the populations affected by those impacts, it is necessary to establish the extent to which

minority and low-income groups potentially are disproportionately affected by adverse impacts of the Proposed Project. The information and data presented below serve as the foundation for establishing the proportion of minority and low-income groups affected by the project. The information presented is organized into the following categories: (1) the core service area of the SWP, which includes regional (i.e., Butte County) and out-of-region populations, and (2) visitors to the Oroville Facilities, as derived from the recreation survey data collected as part of SP-R13, Recreation Surveys. Location-specific race and income data are considered in the context of statewide data to establish whether a particular area or group is more disposed to environmental justice impacts.

4.10.2 Minority Groups

The racial composition of population comprising the SWP service area, which includes Butte County and its local communities, is presented in Table 4.10-1. The six regions served by the SWP have different racial compositions. The Upper Feather River area is most uniform with 82.6 percent of the population being White, the next largest ethnic classification ("Other Race") representing less than 6 percent of the population, and Hispanics (of any race) comprising roughly 12 percent of the population; however, this area contains the largest proportion of American Indian/Alaska Native populations (1.9 percent) of the SWP service areas and in the State of California overall. The South Bay area has the lowest proportion of White residents (51.5 percent), and the largest proportion of Asian residents (23.2 percent). The largest proportion of Black/African Americans (11.6 percent) and people of two or more races (5.8 percent) occurs in the North Bay area. The San Joaquin Valley area has the largest Hispanic population at 39.5 percent.

The population of Butte County and its communities is predominantly White, ranging from 66.6 to 93.7 percent depending on the jurisdiction and 84.5 percent for the county overall. The population of the city of Oroville is diverse, with the highest percentage of other defined racial groups (i.e., Black or African American, American Indian or Alaska Native, Asian, and Native Hawaiian or Pacific Islander) in Butte County. The cities of Biggs and Gridley have relatively large populations of Hispanics, 27.6 percent and 38.6 percent, respectively, which is well above the 10.5 percent countywide average.

Table 4.10-2 identifies the racial composition of visitors to the Oroville Facilities.

4.10.3 Socioeconomic Indicators of Well-Being (Low-Income Groups)

Socioeconomic indicators are those factors that provide information on the social well-being of residents of a particular community or region. These indicators are commonly tied to economic factors, and therefore serve as proxies in identifying low-income groups for the purposes of evaluating environmental justice issues associated with the project.

Table 4.10-1. Racial composition (percent) of populations in the SWP service area.

Service Area/ Jurisdiction	White	Black or African American	American Indian or Alaska Native	Asian	Native Hawaiian or Pacific Islander	Other Race	Two or More Races	Hispanic or Latino (Any Race)
Upper Feather River	**82.6**	**1.5**	**1.9**	**3.9**	**0.1**	**5.9**	**3.9**	**12.1**
Yuba City	91.8	0.6	2.5	0.5	0.1	1.8	2.6	5.7
Plumas Co.	67.0	2.8	1.7	8.9	0.3	14.4	4.9	24.6
Butte Co.	84.5	1.4	1.9	3.3	0.1	4.8	3.9	10.5
Biggs	*74.5*	*0.4*	*1.8*	*0.8*	*0.0*	*18.5*	*3.8*	*27.6*
Chico	*82.4*	*2.0*	*1.3*	*4.2*	*0.2*	*5.7*	*4.3*	*12.3*
Gridley	*66.6*	*0.3*	*1.5*	*3.5*	*0.0*	*24.1*	*4.0*	*38.6*
Oroville	*77.2*	*4.0*	*3.9*	*6.3*	*0.3*	*2.8*	*5.4*	*8.3*
Paradise	*93.7*	*0.2*	*1.1*	*1.0*	*0.1*	*1.2*	*2.6*	*4.3*
North Bay Area	**62.1**	**11.6**	**0.8**	**10.4**	**0.7**	**8.7**	**5.8**	**19.1**
Napa Co.	80.0	1.3	0.8	3.0	0.2	10.9	3.7	23.7
Solano Co.	56.4	14.9	0.8	12.7	0.8	8.0	6.4	17.6
South Bay Area	**51.5**	**8.4**	**0.7**	**23.2**	**0.4**	**10.6**	**5.1**	**21.7**
Alameda Co.	48.8	14.9	0.6	20.4	0.6	8.9	5.6	19.0
Santa Clara Co.	53.8	2.8	0.7	25.6	0.3	12.1	4.7	24.0
San Joaquin Valley	**59.9**	**5.1**	**1.5**	**5.4**	**0.2**	**23.2**	**4.7**	**39.5**
Fresno Co.	54.3	5.3	1.6	8.1	0.1	25.9	4.7	44.0
Kern Co.	61.6	6.0	1.5	3.4	0.1	23.2	4.1	38.4
Kings Co.	53.7	8.3	1.7	3.1	0.2	28.3	4.8	43.6
Stanislaus Co.	69.3	2.6	1.3	4.2	0.3	16.8	5.4	31.7
Central Coast	**77.2**	**2.2**	**1.1**	**3.6**	**0.2**	**11.8**	**4.0**	**27.4**
San Luis Obispo Co.	84.6	2.0	0.9	2.7	0.1	6.2	3.4	16.3
Santa Barbara Co.	72.7	2.3	1.2	4.1	0.2	15.2	4.3	34.2
Southern California	**56.8**	**7.3**	**0.9**	**10.2**	**0.3**	**19.8**	**4.7**	**38.3**
Los Angeles Co.	48.7	9.8	0.8	11.9	0.3	23.5	4.9	44.6
Orange Co.	64.8	1.7	0.7	13.6	0.3	14.8	4.1	30.8

Table 4.10-1. Racial composition (percent) of populations in the SWP service area.

Service Area/ Jurisdiction	White	Black or African American	American Indian or Alaska Native	Asian	Native Hawaiian or Pacific Islander	Other Race	Two or More Races	Hispanic or Latino (Any Race)
Riverside Co.	65.6	6.2	1.2	3.7	0.3	18.7	4.4	36.2
San Bernardino Co.	58.9	9.1	1.2	4.7	0.3	20.8	5.0	39.2
San Diego Co.	66.5	5.7	0.9	8.9	0.5	12.8	4.7	26.7
Ventura Co.	69.9	1.9	0.9	5.3	0.2	17.7	3.9	33.4
STATE OF CALIFORNIA	**59.5**	**6.7**	**1.0**	**10.9**	**0.3**	**16.8**	**4.7**	**32.4**

[1] *Percentages for each area total to greater than 100 percent because persons of Hispanic/Latino heritage may be considered members of other racial classifications.*

Source: U.S. Census Bureau 2000

Table 4.10-2. Racial composition of visitors to the Oroville Facilities.

Ethnicity	Percent at Each Survey Site						
	Lake Oroville	Thermalito Diversion Pool	Low Flow Channel	Thermalito Forebay	Thermalito Afterbay	Oroville Wildlife Area	All Facilities
White/Anglo/Non-Hispanic	**84.8**	**86.2**	**76.1**	**72.8**	**80.4**	**74.8**	**81.0**
Latino/Hispanic	5.1	3.4	7.7	16.3	10.7	10.0	7.9
Asian	3.3	0.0	2.8	2.8	0.4	4.8	3.0
African American/Black	1.1	0.0	0.7	2.8	0.4	0.3	1.1
American Indian/Alaskan Native	2.3	8.6	7.0	2.8	4.4	4.5	3.3
Pacific Islander	1.0	0.0	1.4	1.1	0.7	2.8	1.2
Other	2.5	1.7	4.2	1.4	3.0	2.8	2.5

Source: DWR 2004c

As derivatives of total income, per-capita personal income and poverty rates are established indicators of social well-being (Table 4.10-3). In terms of SWP service areas, only the North Bay ($22,848) and South Bay ($29,971) areas have per-capita income levels that are higher than the statewide average ($22,711); all other service areas fall below the statewide average, with the lowest per-capita income level occurring in the San Joaquin Valley area ($15,915). Double-digit poverty rates occur in the Upper Feather River, San Joaquin Valley, and Southern California areas.

Average per-capita income of residents of Butte County is significantly below regional, state, and national averages. In 2000, average per-capita income in Butte County was $17,517, which was 77 percent of the per-capita income level for the State of California ($22,711) (U.S. Census Bureau 2000). Among the incorporated jurisdictions, per-capita income levels are relatively higher (compared to Butte County) in Paradise ($19,267) and Chico ($16,970) and relatively lower in Biggs ($12,386), Gridley ($12,267), and Oroville ($12,345). In addition, Oroville has the highest proportion (33.1 percent) of residents below the poverty level; this figure is substantially higher than the countywide average of 19.8 percent.

4.10.4 Identification of Minority and Low-Income Groups for Potentially Analyzing Environmental Justice Impacts

Users of the Oroville Facilities are a population group that could potentially experience environmental justice effects. Recreation fees are paid by users of certain Oroville Facilities, including fees for camping, boat and personal watercraft launching, and day-use areas. Information on the economic characteristics of recreation users of the Oroville Facilities was collected as part of SP-R13, Recreation Surveys, including household income levels. The distribution of respondents' income was fairly evenly distributed, with the highest number of responses in the $40,000-to-$59,999 range, which corresponds to the median household income for the state of California ($47,493). Further, approximately 33 percent of users of the Oroville Facilities had household incomes of less than $40,000, while roughly 37 percent of statewide residents had household income levels of less than $35,000 (note that survey data and census data used different income brackets). Based on these figures, household income levels of recreationists using the Oroville Facilities and the general (statewide) population are comparable, with users of the Oroville Facilities having slightly higher income levels compared to the state. Because there are no meaningful differences between these two populations, it can be concluded that the recreation user group is not a disproportionately low-income population.

The majority of users of the Oroville Facilities are Butte County residents, and therefore it is important to note the income levels and ethnicity of recreationists from Butte County compared to Butte County residents as a whole, as well as Butte County compared to the state averages.

Table 4.10-3. Personal income measures of social well-being in the SWP service area. [1]

Jurisdiction	Income		Percent Below Poverty Level	
	Median (Family)	Per-Capita	All Ages	Families
Upper Feather River	**$41,188**	**$17,443**	**19.0**	**12.3**
Plumas County	$39,381	$15,928	18.1	14.5
Yuba City	$46,119	$19,391	13.1	9.0
Butte County	$41,010	$17,517	19.8	12.2
Biggs	$39,063	$12,386	17.5	11.7
Chico	$43,077	$16,970	26.6	12.7
Gridley	$29,957	$12,267	23.3	19.5
Oroville	$27,666	$12,345	33.1	26.2
Paradise	$41,228	$19,267	12.4	9.7
North Bay Area	**$60,792**	**$22,848**	**8.3**	**6.0**
Napa County	$61,410	$26,395	8.3	5.6
Solano County	$60,597	$21,731	8.3	6.1
South Bay Area	**$74,393**	**$29,971**	**9.1**	**6.2**
Alameda County	$65,857	$26,680	11	7.7
Santa Clara County	$81,717	$32,795	7.5	4.9
San Joaquin Valley	**$40,112**	**$15,915**	**20.5**	**16.1**
Fresno County	$38,455	$15,495	22.9	17.6
Kern County	$39,403	$15,760	20.8	16.8
Kings County	$38,111	$15,848	19.5	15.8
Stanislaus County	$44,703	$16,913	16.0	12.3
Central Coast	**$53,433**	**$22,603**	**13.7**	**7.9**
San Luis Obispo County	$52,447	$21,864	12.8	6.8
Santa Barbara County	$54,042	$23,059	14.3	8.5
Southern California	**$51,078**	**$21,427**	**15.1**	**11.7**
Los Angeles County	$46,452	$20,683	17.9	14.4
Orange County	$64,611	$25,826	10.3	7.0
Riverside County	$48,409	$18,689	14.2	10.7
San Bernardino County	$46,574	$16,856	15.8	12.6
San Diego County	$53,438	$22,926	12.4	8.9
Ventura County	$65,285	$24,600	9.2	6.4
STATE OF CALIFORNIA	**$53,025**	**$22,711**	**14.2**	**10.6**

[1] *Represents 1999 data reported in the 2000 census.*

Source: U.S. Census Bureau 2000

Table 4.10-4. Total household income of visitors to the Oroville Facilities.

Income [1]	Percent at Each Survey Site						
	Lake Oroville	Thermalito Diversion Pool	Low Flow Channel	Thermalito Forebay	Thermalito Afterbay	Oroville Wildlife Area	All Facilities
Less than $20,000	8.3	10.7	20.3	26.7	14.8	12.5	12.7
$20,000-39,999	16.6	17.9	**29.3**	**36.4**	22.0	21.4	19.9
$40,000-59,999	**22.7**	25.0	24.8	23.1	**24.8**	**25.7**	**23.6**
$60,000-79,999	17.5	16.1	9.8	12.8	16.0	16.8	16.1
$80,000-100,000	15.6	3.6	9.0	6.6	10.8	8.9	12.4
Over $100,000	19.3	**26.8**	6.8	4.4	11.6	14.6	15.4

[1] *Total household income before taxes.*

Source: DWR 2004c

In general, income levels for recreationists from Butte County are comparable to income levels for Butte County residents as a whole. Household income for recreationists from Butte County generally fall between $20,000 and $60,000, with slightly more responses in the $20,000-to-$39,999 range, which corresponds to the median household income for Butte County ($31,924). Roughly 18 percent of Butte County recreationists had household incomes of less than $20,000, while roughly 22 percent of Butte County residents had household income levels of less than $15,000. Based on these figures, there is a slightly smaller low-income population in the Butte County user group compared to Butte County as a whole. Because there are no meaningful differences between these two populations, it can be concluded that recreation users of the Oroville Facilities from Butte County are not a disproportionately low-income population group.

Income levels in Butte County and the City of Oroville fall below statewide figures. Median household income in Butte County is $31,924 versus $47,493 for the state of California, a 49 percent difference. In Oroville, the median household income ($21,911) is less than half of that for the state. In terms of poverty rates, Butte County (12.2 percent) and the city of Oroville (26.2 percent) are also higher than the statewide average (10.6 percent). Based on these figures, it is reasonable to state that low-income families in the affected area are “meaningfully greater” than in the general population (i.e., state of California), and therefore a low-income population exists in the Oroville Facilities project area.

For ethnicity, the population of Butte County and the city of Oroville are predominantly White, 84.5 percent and 77.2 percent, respectively, which is higher than in the state of California (59.5 percent). As such, the proportion of minority groups is generally lower in the county and city than in the state as a whole. However, the proportion of American

Indians/Alaska Natives in Butte County (1.9 percent) and the city of Oroville (3.9 percent) is “meaningfully greater” than in the state (1.0 percent). As a result, the American Indian population is considered a minority population in the Oroville Facilities project area for the purposes of the environmental justice analysis.

4.11 AESTHETIC RESOURCES

The aesthetic environment encompasses visual resources, noise, and odor. The scoping process did not reveal any concerns with noise or odors associated with the Oroville Facilities, but did identify issues related to visual resources. Noise and odor issues were not discussed by the Collaborative, and they were not detected during field reconnaissance, but noise and odor are included in this DEIR to comply with CEQA. Hence, the description of the affected aesthetic environment focuses on visual resources.

4.11.1 Visual Resources

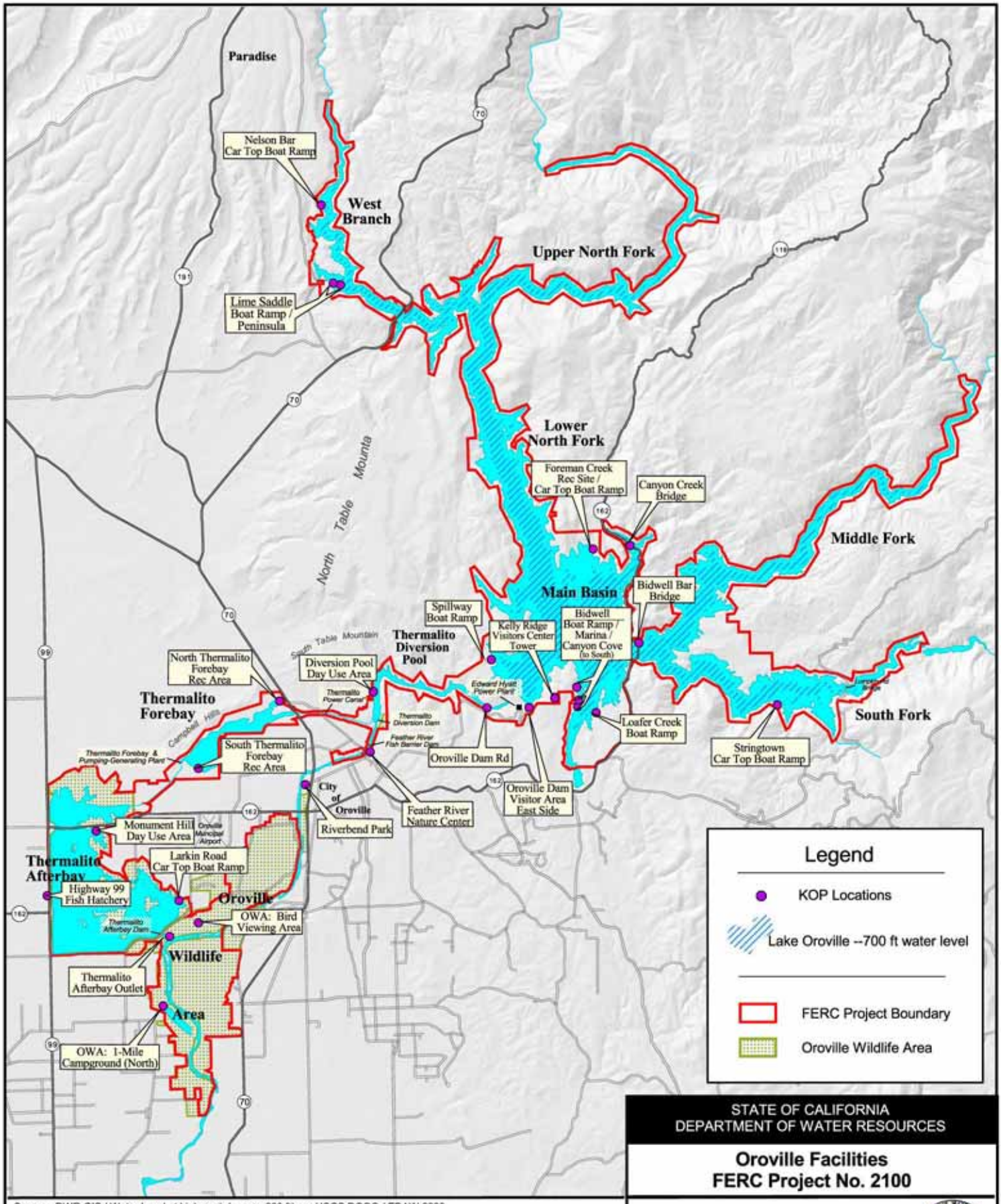
This section describes the existing aesthetic environment of the Oroville Facilities. The Oroville Facilities have been divided into five aesthetically distinct geographic areas (Lake Oroville, the Diversion Pool and Thermalito Forebay, the Thermalito Afterbay, the Low Flow Channel (LFC), and the Oroville Wildlife Area [OWA]). The review of each of the five areas includes a brief description of the area's location, topography, vegetation patterns, types of views available from within the area, land uses, major aesthetic features, and types of viewers. The description of each area also includes a brief discussion of the key observation points (KOPs) that were used in Study Plan L-4 (SP-L4), Aesthetics. KOPs are locations within and near the FERC Project boundary chosen to represent views of the aesthetic environment of the Oroville Facilities (see Figure 4.11-1). Descriptions of and photographs from each KOP are included in Appendix A of SP-L4.

Major issues related to aesthetic resources identified during the scoping process included:

- Effects of project operations, features, and land uses on the aesthetic quality of project lands; and
- Assessment of appropriate landscaping, restoration, and facilities management programs for aesthetic enhancement of project lands.

4.11.1.1 Regional Setting

The Oroville Facilities are located in Butte County. The western half of Butte County is situated along the eastern edge of the Central Valley. This part of the county is primarily flat, and land use is largely agricultural with scattered areas of development ranging in intensity from scattered rural residential, to suburban, to urban. The aesthetic environment of this part of the county is dominated and largely influenced by human development activities and generally has a rural character. The agricultural areas in this part of the county generally include irrigated row crops and orchards in the flatter areas and grazing in the foothills. Thermalito Forebay and Thermalito Afterbay are located in this area.



Source: DWR GIS / Water Level at high pool (approx 880 ft) per USGS DOQQ / EDAW 2003

1 0 1 2 3 4 5 Miles

Original Scale 1 : 190,080
1" = 3.0 miles

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Oroville Facilities
FERC Project No. 2100

Figure 4.11-1

Location of Key Observation Points (KOPs)

Prepared by: PJ -- EDAW, Inc. Date 11/16/04 P:\2000\0s016.gis\arcview\apr\kop.apr

The eastern half of the county begins near the foothills of the Sierra Nevada and continues east to the range's upper slopes. This part of the county is largely undeveloped and retains much of its natural character. Scattered rural residences and small communities are located throughout this area. Vegetative cover in the foothills area includes chaparral, oak woodland, and coniferous forest. Lake Oroville is located is this area.

4.11.1.2 Project Aesthetic Environment

Lake Oroville

Lake Oroville is impounded by Oroville Dam, an earthfill structure that rises 770 feet (ft) above the floor of the Feather River Canyon and is approximately 1.3 miles in length. Oroville Dam is a major visible feature in the Oroville area. Its scale, shape, texture, and color contrast with the surrounding landscape. The dam's ancillary facilities (substation, equipment yards, roads, etc.) are somewhat visible and have a moderate degree of contrast with the landscape.

Three 230-kilovolt (kV) overhead transmission lines extend approximately 9 miles from the Hyatt Pumping-Generating Plant switchyard to Pacific Gas and Electric Company's (PG&E's) Table Mountain Substation and in some locations introduce contrasting shape, form, and color into the viewed landscape (particularly where they are silhouetted against the sky). It must be noted that there are many other non-project transmission lines that are visible in the vicinity of the project.

Lake Oroville is a major regional aesthetic resource. At maximum operating storage capacity, the reservoir's surface area at full pool is approximately 15,800 acres in size with approximately 167 miles of shoreline. The straight-line distance between Oroville Dam and the farthest reaches of both the West Branch and the Middle Fork is approximately 12 miles. Lake Oroville is composed of five main "arms" or "branches" and the large, centrally located main basin. The five arms are known as the West Branch, the Upper North Fork Branch, the Lower North Fork Branch, the Middle Fork, and the South Fork. These arms range in width from as much as 1 mile in the lower portions of the Lower North Fork, to less than 100 ft in their upper reaches. The terrain adjacent to the arms is typically steep, and the arms become narrow and canyon-like toward their upper reaches. Views along the straight parts of the arms can be extensive (approximately 7 miles in the Lower North Fork), but are restricted in most areas by twisting terrain. In contrast, the main body of the reservoir affords wide open views of the surrounding landscape.

Due to steep topography and limited road access, much of Lake Oroville is not easily accessible to the public by land. The greatest number of people who view the reservoir up close are recreating on the reservoir or at its major recreational facilities. Another large group of people who view Lake Oroville are the motorists who observe it when they drive over the bridges on State Route (SR) 162 (the Bidwell Bar Bridge), SR 70, and Lumpkin Road. A third group of people who view the reservoir are the people who live near the Oroville Facilities. Most of these residents live near Kelly Ridge and have

views of the Loafer Creek area, the main body of the reservoir, and the Bidwell Bar Bridge area. Other areas with residential viewers are scattered along the South Fork (primarily near Enterprise), in the main basin near Canyon Creek, and along the west side of the upper reaches of the West Branch.

KOPs were selected to represent existing aesthetic conditions and the types of views available from around Lake Oroville. The KOPs represent a variety of locations around the reservoir and different types of viewing areas such as developed marinas, developed boat ramp facilities, less developed car-top boat ramps, and areas from which the project can be viewed, such as bridges and the Lake Oroville Visitors Center. The locations of the KOPs include the upper, narrow ends of branches, the wide open main basin of the reservoir, and areas outside of the FERC Project boundary. Table 4.11-1 includes a brief description of the KOPs at Lake Oroville.

Table 4.11-1. Lake Oroville Key Observation Points.

Location of KOP	Description
MR-1: Nelson Bar Car-top Boat Ramp (BR)	Represents the aesthetic conditions of the upper West Branch from the car-top BR at Nelson Bar.
MR-2: Lime Saddle BR	Represents the aesthetic conditions of the portion of the West Branch near Lime Saddle from one of the more used facilities at the project.
MR-3: Lime Saddle Peninsula	Represents the aesthetic conditions of the area south of the Lime Saddle Marina in the West Branch.
MR-4: Foreman Creek Car-top BR	Represents the aesthetic conditions of the main basin of the reservoir from a car-top BR located at the northernmost part of the main basin.
MR-5: Canyon Creek Bridge	Represents the aesthetic conditions of the Canyon Creek inlet from an area adjacent to SR 162.
MR-6: Bidwell Bar Bridge (SR 162)	Represents the aesthetic conditions of the portion of the main basin of the reservoir that can be seen from near the Bidwell Bar Bridge.
MR-7: Stringtown Car-top BR	Represents the aesthetic conditions of the middle portion of the South Branch from a car-top BR.
MR-8: Bidwell Canyon BR	Represents the aesthetic conditions of the southern part of the main basin from one of the more used boat ramp facilities at the project.
MR-9: Bidwell Canyon Marina	Represents the aesthetic conditions of the southern part of the main basin near the largest marina in the project.
MR-10: Bidwell Canyon Cove to South	Represents the aesthetic conditions of the cove south of the Bidwell Canyon Marina from an area located between the marina and the Loafer Creek BR.
MR-11: Loafer Creek BR	Represents the aesthetic conditions of the southern part of the main basin from a very popular boat ramp facility.
MR-12: Lake Oroville Visitors Center Tower	Represents the aesthetic conditions of the western part of the main basin from a popular facility on top of Kelly Ridge that is outside of the FERC Project boundary.
MR-13: Oroville Dam Visitors Area East Side	Represents the aesthetic conditions of the western part of the main basin and the area near the Oroville Dam from an established overview area and from Oroville Dam Road.
MR-14: Spillway BR	Represents the aesthetic condition of an inlet off of the main basin from a heavily used boat ramp facility.

Source: SP-L4

The water level elevation of Lake Oroville fluctuates throughout the year and influences the nearby aesthetic environment. As drawdown occurs during the course of the summer and fall, an increasingly broad ring of shoreline appears between the vegetated shoreline and the water of the reservoir. Reservoir drawdown has different effects on different locations at Lake Oroville. The upper ends of the arms or branches are the most affected by drawdowns. These shallower areas can have considerable amounts of vertical and horizontal shoreline exposed during drawdowns. The drawdowns also expose shoreline in the main basin of the reservoir, but to a lesser degree than in the upper arms or branches. In steep portions of the main basin, such as the area near the Bidwell Bar Bridge, drawdowns can expose a considerable amount of vertical shoreline. Unlike the upper arms or branches, however, steep areas of the main basin of Lake Oroville are deep, so they do not become dewatered.

SP-L4 examined and included photographs of three different elevations at Lake Oroville over a 2-year period to evaluate the influence of very different reservoir elevations on the aesthetic environment. The report also used exceedance data to determine the frequency that each elevation could be expected to be reached or exceeded, based on water year history for the years between 1922 and 1994, and based on actual Lake Oroville water usage data from 2001. For a detailed discussion describing exceedance data, please see Section 6.1.2.1 of the SP-L4 report.

The exceedance data in Table 4.11-2 indicate that the three elevations used for this assessment represented a range of reservoir elevations that vary in terms of likeliness to occur at various times of the year. Reservoir elevations that approach or reach full pool (900 ft) are not common events, whereas an elevation of 830 ft has a good chance of occurring or being exceeded during most water years (75–85 percent). The elevation 710 ft was selected to represent very low elevations. The likelihood of an elevation of 710 ft being met or exceeded throughout the year in any given year is very high, at 95 percent. Conversely, the likelihood of a water surface elevation lower than 710 ft in any given year is 5 percent. Even though this elevation occurs infrequently, it is important to include it in the analysis to have a “worst-case” scenario example to analyze. The following describes the effects of the three elevations on the aesthetic environment. See the figures in Section 6.1.2.1 of the SP-L4 report for photographs from around Lake Oroville at the three elevations.

Table 4.11-2. Lake Oroville exceedance data at three elevations.[1]

Month	Elevation 900 ft	Elevation 830 ft	Elevation 710 ft
April	0%	85%	95%
May	30%	80%	95%
June	25%	75%	95%
July	5%	45%	95%
August	5%	30%	95%
September	0%	30%	95%
October	0%	25%	95%

[1]Data indicate percentage or likelihood that the elevation is met or exceeded for a particular month. Another way to evaluate the data is to realize that if an elevation has a likelihood of being exceeded of, for example, 95 percent, the likelihood of Lake Oroville being at or below that elevation would be 5 percent.
Source: DWR 2004

Elevation 900 ft (Full Pool)—Full pool (elevation 900 ft) is not a common occurrence at Lake Oroville. The likelihood of an elevation of 900 ft being met or exceeded in May and June is 30 and 25 percent, respectively. The likelihood is lower in other months. At full pool, the water of the reservoir completely covers all of the shoreline of Lake Oroville up to the vegetation line and, in some areas, rises above it. Shoreline debris such as tree stumps, and exposed features such as rock outcroppings that are exposed at lower reservoir elevations, are submerged at this elevation. At full pool, trash and other floating debris that collects along exposed shorelines at lower pool elevations is carried with the rising pool and can be deposited along the high pool elevation shoreline in adjacent vegetation.

Elevation 830 ft—Lake Oroville reaches or exceeds this elevation with great regularity during the spring months. The likelihood of this elevation being met or exceeded in April, May, or June is approximately 85, 80, and 75 percent, respectively. During the summer months, the likelihood of this elevation being met or exceeded is less, approximately 45, 30, and 30 percent in July, August, and September, respectively. At elevation 830 ft, the exposed shoreline at many locations becomes a primary part of the scenery but does not dominate the scene. Some parts of the reservoir have less exposed shoreline and may have features (such as marinas) that receive viewer attention and thus lessen the adverse effect of exposed shorelines. Because of the exposed shoreline, most viewers would be expected to find Lake Oroville less attractive at this elevation than at full pool.

Elevation 710 ft—An elevation of 710 ft is almost 200 ft below full pool. Based on exceedance data, the chance of this elevation being reached or exceeded for any month between April and October is 95 percent, which conversely means that the likelihood of this elevation being even lower or met in any given month, below April and October, is approximately 5 percent. Reservoir elevations that are this low generally only occur during the fall of very dry water years. This elevation would likely be considered the least attractive of the three elevations by most viewers.

Diversion Pool and Thermalito Forebay

The approximately 4.5-mile-long Diversion Pool follows the river bed of the Feather River, beginning approximately 0.5 mile downstream from the Oroville Dam and extending to Thermalito Diversion Dam. The approximately 50- to 200-ft-wide Diversion Pool has a riverine character as it meanders through thickly vegetated hillsides. Views within the Diversion Pool are confined and directed by the adjacent steep hillsides. Major aesthetic features that can be observed in the vicinity of the Diversion Pool include the downstream face of Oroville Dam, electric transmission lines (both project and non-project), an unpaved access road that runs parallel to part of the right side of the Diversion Pool, railroad tracks that follow the left side of the Diversion Pool, the railroad bridge near the end of the reservoir, and the Diversion Dam. Most viewers in this area are recreationists involved in activities such as walking, canoeing (and other non-motorized boating), windsurfing, bicycle riding, horseback riding, and fishing.

Only the upstream face (approximately 15 feet) of the 1,300-ft-long Diversion Dam is visible from this area. The downstream face of the Diversion Dam rises 143 feet above the Feather River channel (in the LFC area).

The linear form of the Diversion Dam, along with its color and texture, contrasts with the nearby landscape, particularly when viewed from downstream. When viewed from upstream near the Diversion Pool, the dam is much less visible.

From Thermalito Diversion Dam, the 10,000-ft-long Thermalito Power Canal connects the Diversion Pool to Thermalito Forebay. The linear concrete-lined channel and adjacent chain-link fence pass through flat grasslands and are adjacent to some residential areas. The Thermalito Power Canal is one of the least visible major project features. It is primarily seen by the public where Cherokee Road, SR 70, and Table Mountain Boulevard cross over it. The Thermalito Power Canal contrasts highly with the landscape it passes.

Thermalito Forebay begins at the west end of the Thermalito Power Canal and extends approximately 3 miles southwest to Thermalito Forebay Dam. The forebay is an hourglass-shaped, 630-acre reservoir, just west of SR 70 in the transition zone between the flatlands of the Central Valley and the more steeply sloped terrain of the foothills. The northwest edge of Thermalito Forebay is located just southeast of the Campbell Hills, while the remainder of it is situated in flat valley land. The downstream edge of the reservoir is formed by a low earthfill dam (91 ft high at its highest point) that extends for more than 3 miles along Thermalito Forebay's southern edge. Thermalito Forebay Dam is one of the least visible major project features.

The hourglass shape of the reservoir results in two major segments, North Forebay and South Forebay. The majority of people who view Thermalito Forebay do so as recreationists from either of the two main recreation areas (the North and South Thermalito Forebay Recreation Areas), or as drivers from nearby transportation routes such as SR 70, Nelson Avenue, or Grand Avenue. Given the relatively flat, open, grass-covered terrain where Thermalito Forebay is located, most views from around Thermalito Forebay are expansive.

To represent existing aesthetic conditions and the types of views available from around the Diversion Pool and Thermalito Forebay, four KOPs were selected. The four KOPs are described in Table 4.11-3.

Because the Diversion Pool, Power Canal, and Thermalito Forebay are all designed to share the same operating water level and are essentially the same hydraulic system, the water levels in each of these facilities rise and subside in unison. The system does not fluctuate much on a daily basis. During the summer, it is generally cycled down 2–4 ft during the middle of the week and then refilled by the weekend. During the winter, it may fluctuate more for varying reasons. When the elevations of these facilities are 2–4 ft below full pool, there are varying amounts of exposed shoreline, which can offer visual contrast to the adjacent landscape. It can be assumed that elevations at the high end of

this range are considered more visually attractive to most viewers than elevations at the lower end of this range, which may be perceived by some viewers as unattractive.

Table 4.11-3. Diversion Pool and Thermalito Forebay Key Observation Points.

Location	Description
TD-1: Oroville Dam Road	Represents the aesthetic conditions of the view that people driving on Oroville Dam Road have of the spillway on the downstream face of Oroville Dam.
TD-2: Diversion Pool Day Use Area	Represents the aesthetic conditions of the southern part of the Diversion Pool from the adjacent access road.
TD-3: North Thermalito Forebay Recreation Area	Represents the aesthetic conditions of the east part of Thermalito Forebay from a very popular recreation area.
TD-4: South Thermalito Forebay Recreation Area	Represents the aesthetic conditions of the southern and western part of Thermalito Forebay from a primitive recreation area.

Source: SP-L4

However, because the Diversion Pool and Thermalito Forebay elevations change so little over much of the year and introduce two bodies of water into the landscape of the project area, operations do not have much of an influence on aesthetic environment of areas near the Diversion Pool and Thermalito Forebay.

Thermalito Afterbay

The approximately 4,300-acre Thermalito Afterbay is formed by a low “L”-shaped earthfill dam with a maximum height of 39 ft. The Thermalito Afterbay Dam extends for nearly 8 miles along the impoundment’s western and southern edges, and has a very flat, level, and linear appearance. The western edge of Thermalito Afterbay Dam runs parallel to SR 99. Thermalito Afterbay Dam is one of the most visible project features. Its linear form, shape, and uniform texture contrast highly with the surrounding landscape.

The north and east edges of Thermalito Afterbay (and several islands) are defined by the surrounding rolling terrain and have an undulating, natural appearance. Because the terrain that surrounds most of Thermalito Afterbay is either flat or rolling, and because Thermalito Afterbay is so large, views in this part of the project are open and extensive. On clear days, the Sierra Nevada foothills can be seen from many parts of Thermalito Afterbay. Other major aesthetic features in the vicinity of Thermalito Afterbay include the Feather River itself, which is visible from nearby areas in the southeast part of the project area; the SR 162 (Oroville Dam Boulevard) causeway and bridge that cross the north part of Thermalito Afterbay from west to east; SR 99 (which is located west of Thermalito Afterbay dam and next to the Thermalito Fish Hatchery Annex); several recreation areas (Monument Hill Recreation Site, Larkin Road Car-top Boat Ramp [BR], and the Wilbur Road Recreation Site); a few scattered residences; and parts of the undeveloped OWA (some of which are adjacent to Thermalito Afterbay and some of which can be viewed to the southeast from near the Thermalito Afterbay Outlet). Viewers of Thermalito Afterbay and surrounding landscape include people participating in activities such as boating, swimming, picnicking, fishing, and hunting; motorists; and people viewing Thermalito Afterbay from residences in the area.

To represent existing aesthetic conditions and the types of views available from around the Thermalito Afterbay, three KOPs were chosen (Table 4.11-4).

Table 4.11-4. Thermalito Afterbay Key Observation Points.

Location	Description
TA-1: Larkin Road	Represents the aesthetic conditions of the view that people using this primitive recreation area have of eastern portion of Thermalito Afterbay.
TA-2: Monument Hill Day Use Area	Represents the aesthetic conditions of the views that people using this developed recreation area have of the north part of Thermalito Afterbay.
TA-3: SR 99	Represents the aesthetic conditions of the views that people driving north on SR 99 have of the west side of the Thermalito Afterbay Dam (or levee).

Source: SP-L4

Thermalito Afterbay is a large, shallow, open body of water that has frequent water level fluctuations and a high surface-to-volume ratio. Thermalito Afterbay has several fluctuation cycles and daily, weekly, and occasional seasonal adjustments. Thermalito Afterbay generally fluctuates on a daily basis as a result of water releases from Lake Oroville (related to power generation) and releases into the Feather River. The amount of daily fluctuation varies depending on factors such as time of year, diversion rates, release rates, and type of water. Typical daily changes for most months for the years of 2001 (a dry year) and 2003 (a wet year) were between 1 and 2 ft, with changes more frequently in the 1-ft range.

Weekly fluctuations vary more than daily fluctuations as DWR attempts to adjust power generation into particular hours of the week. A common refill pattern is that Thermalito Afterbay is at its low point on Monday and builds storage capacity over the week to reach a maximum elevation on Saturday. After a maximum is reached on Saturday, Thermalito Afterbay is often decreased through the first part of Monday and the cycle frequently starts over. The weekly fluctuations usually range from 2 to 6 ft, although there are times during the year when the Thermalito Afterbay elevation is allowed to be higher or lower as a response to systemwide operations or energy prices. Fluctuations of approximately 9–11 ft sometimes occur during a several-week period and are most likely to occur in the winter. The general refill pattern of keeping Thermalito Afterbay highest on weekends and having fluctuations of between 2 and 6 ft results in a reservoir that generally looks “full,” although at the lower end of the range, shoreline and mudflats can be exposed in shallower areas. It can be assumed that elevations at the high end of this range are considered more visually attractive to most viewers than elevations at the lower end of this range. The lowest elevations that expose the greatest amount of shoreline and have the greatest adverse influence of Thermalito Afterbay occur infrequently and generally take place in the winter.

Low Flow Channel

The upper portion of the LFC below the Diversion Dam passes through the central part of the city of Oroville. Most of the area adjacent to this portion of the LFC is developed and includes project facilities, such as the Feather River Fish Hatchery (which includes

a 0.5-mile-long fish ladder, underwater fish viewing area, office, hatchery spawning building, rearing channels, lighted parking areas, and other facilities) and the 91-ft-high, 600-ft-long concrete fish barrier dam. The Feather River Fish Hatchery facilities contrast with the nearby landscape in terms of shape, color, and texture. The Fish Barrier Dam (and its waterfall) and the Fish Barrier Pool are generally visually compatible with their surroundings. Other non-project developments include the Feather River Nature Center, the Table Mountain Boulevard Bridge, scattered residences overlooking the LFC, and trails along the adjacent levee system. People who view the upper part of the LFC include passing motorists, recreationists, and visitors to the Feather River Fish Hatchery.

Lands adjacent to the LFC downstream of the SR 70 bridge are much less developed than those adjacent to the upper part, next to the central part of the city of Oroville. Much of the Feather River floodplain adjacent to the LFC, particularly along the lower portion, was drastically altered during hydraulic mining activities in the mid-1800s until the early 1900s. It is covered by coarse debris from the hydraulic mining era and mounded remains of dredge tailings, some of which were later used as material for the construction of Oroville Dam. The dredge tailings cover large areas and contain sinuous ridges of cobble, boulders, and gravel piles up to 40 ft in height. Various vegetation communities, such as riparian and oak woodlands, have become established throughout the area.

Views from within and near the LFC are variable due to adjacent topography, vegetation, and levels of development. Some areas have extensive open views of the LFC and other areas have restricted views. The majority of viewers see the upper portion of the LFC from areas near the city of Oroville. These areas include the levee and associated trail system, the Feather River Fish Hatchery complex, and the Feather River Nature Center. A number of people also have views of the LFC as they pass over it via bridges such as the Table Mountain Boulevard Bridge and the Table Mountain Bicycle Bridge. People who view the lower portion of the LFC do so from areas within the OWA, SR 70, or the Thermalito Afterbay Outlet, as well as other undeveloped access points.

To represent existing aesthetic conditions and the types of views available from the portion of the LFC situated near and within the FERC boundary, two KOPs were chosen. The two KOPS are briefly described in Table 4.11-5.

Table 4.11-5. Low Flow Channel Key Observation Points.

Location	Description
BR-1: Feather River Nature Center	Represents the aesthetic conditions of the views that people using the Nature Center have of the upper part of the LFC.
BR-2: Thermalito Afterbay Outlet	Represents the aesthetic conditions of the views that people recreating near this popular area in the lower part of the LFC have of the Thermalito Afterbay Outlet area and the Feather River.

Source: SP-L4

Oroville Wildlife Area

Although the OWA includes Thermalito Afterbay, this description focuses on the main portion of the OWA that is south and east of Thermalito Afterbay. The OWA consists of a series of ponds, levees, mining tailings, and flat and low-lying areas. Although the OWA is managed for wildlife, it supports recreation and contains limited camping, a one-lane boat ramp, several unimproved boat ramps, and a number of roads in varying conditions. Views within the OWA are varied; in some portions, sparse vegetation and flat terrain allow for expansive views, while in other areas, vegetation and dredge tailings limit views considerably. Views within the main part of the Clay Pit State Vehicular Recreation Area (SVRA) (which is not located within the FERC Project boundary) are more expansive due to the level topography of the area and the relative scarcity of shrubs and trees. Most use in the OWA and Clay Pit SVRA is dispersed, and views occur throughout the area.

To represent existing aesthetic conditions and the types of views available from the within the OWA, two KOPs were chosen and are described in Table 4.11-6.

Table 4.11-6. Oroville Wildlife Area Key Observation Points.

Location	Description
OWA-1: One-Mile Pond	Represents the aesthetic conditions of the views that people see from this area.
OWA-2: Bird Viewing Area	Represents the aesthetic conditions of the views that people see from this area.

Source: SP-L4

4.11.2 Noise

This section includes a summary of acoustic fundamentals and a description of existing ambient-noise conditions within the FERC Project area. Noise is generally defined as sound that is loud, disagreeable, or unexpected. Because of the ability of the human ear to detect a wide range of sound-pressure fluctuations, sound-pressure levels are expressed in logarithmic units called decibels (dB). The sound-pressure level in decibels is calculated by taking the log of the ratio between the actual sound pressure and the reference sound pressure squared. The reference sound pressure is considered the absolute hearing threshold (Caltrans 1998). A commonly used unit for frequency is Hertz (Hz). The human ear is sensitive to frequencies from 20 Hz to 20,000 Hz (the audible range) and can detect the vibration amplitudes that are comparable in size to a hydrogen atom (USEPA 1974). Typical indoor and outdoor noise levels are presented in Figure 4.11-2.

4.11.2.1 Acoustic Fundamentals

Sound and the Human Ear

With respect to how humans perceive increases in noise levels, an increase of 1 A-weighted decibel (dBA) is imperceptible, a 3-dBA increase is barely perceptible, a 6-dBA increase is clearly perceptible, and a 10-dBA increase is subjectively perceived as approximately twice as loud (Egan 1988). For this reason, an increase of 3 dBA or more is generally considered a degradation of the existing noise environment for this type of source.

Sound Propagation

As sound (noise) propagates from the source to the receptor, the attenuation, or manner of noise reduction in relation to distance, is dependent on surface characteristics, atmospheric conditions, and the presence of physical barriers. Atmospheric conditions such as wind speed, temperature, and humidity may affect noise levels.

Noise Descriptors

The selection of a proper noise descriptor for a specific source is dependent upon the spatial and temporal distribution, duration, and fluctuation of the noise. The noise descriptors most often encountered when dealing with traffic, community, and environmental noise are defined below (Caltrans 1998; Lipscomb and Taylor 1978).

- L_{max} (maximum noise level): The maximum noise level during a specific period of time. The L_{max} may also be referred to as the “highest (noise) level.”

- L_{min} (minimum noise level): The minimum noise level during a specific period of time.

- L_X (statistical descriptor): The noise level exceeded X percent of a specific period of time.

- L_{eq} (equivalent noise level): The energy mean (average) noise level. The instantaneous noise levels during a specific period of time in dBA are converted to relative energy values. From the sum of the relative energy values, an average energy value is calculated, which is then converted back to dBA to determine the L_{eq}.

- L_{dn} (day-night noise level): The 24-hour L_{eq} with a 10-dBA "penalty" for the noise-sensitive hours between 10 p.m. and 7 a.m. The L_{dn} attempts to account for the fact that noise during this specific period of time is a potential source of disturbance with respect to normal sleeping hours.

- CNEL (community noise equivalent level): A noise level similar to the L_{dn} described above, but with an additional 5-dBA "penalty" for the noise-sensitive hours between 7 p.m. and 10 p.m., which are typically reserved for relaxation, conversation, reading, and television. If the same 24-hour noise data are used, the CNEL is typically approximately 0.5 dBA higher than the L_{dn}.

- SEL (single-event [impulsive] noise level): A receiver's cumulative noise exposure from a single impulsive-noise event, which is defined as an acoustical event of short duration and which involves a change in sound pressure above some reference value.

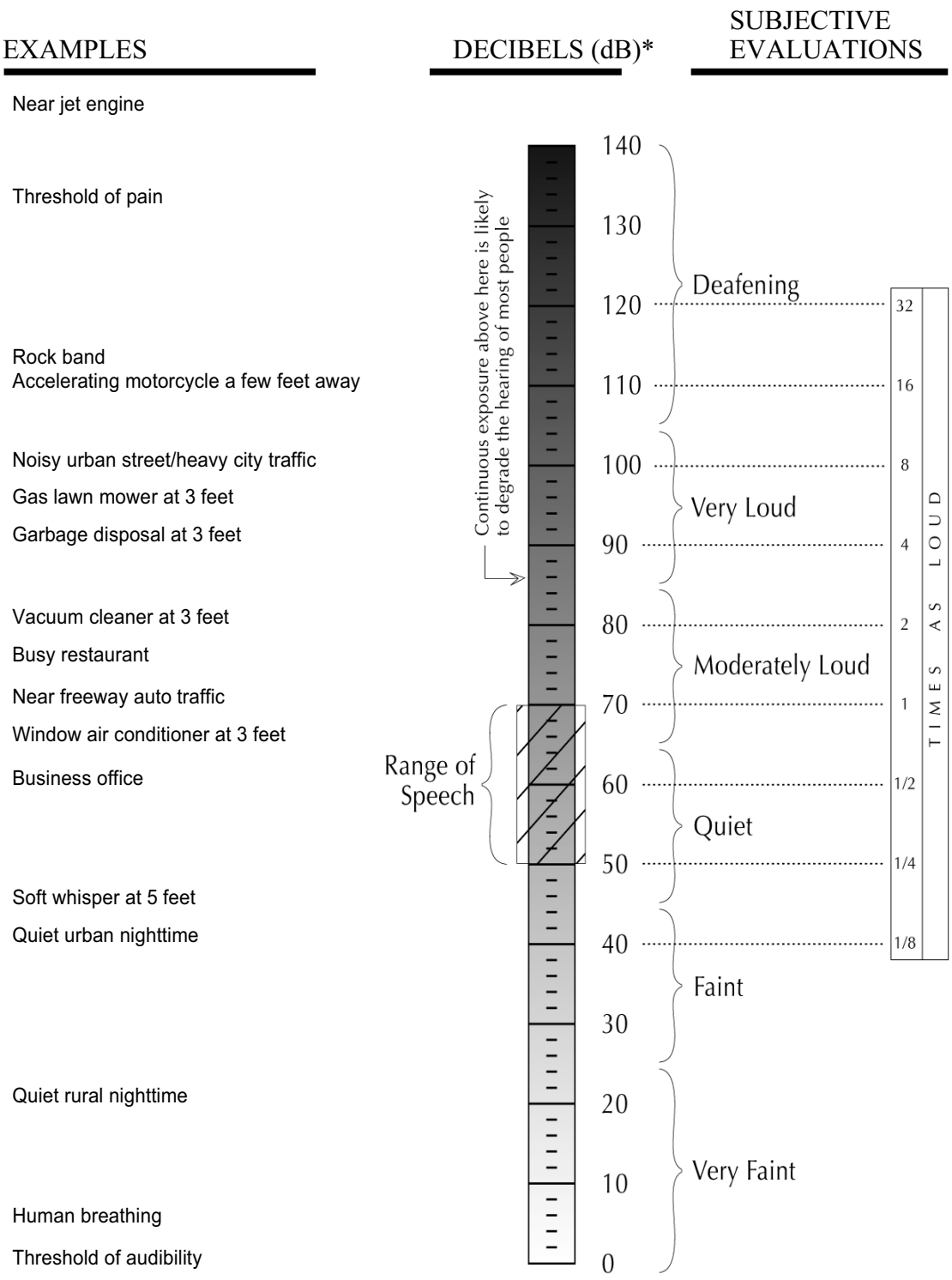
Typical outdoor sources of perceptible groundborne vibration are construction equipment, steel-wheeled trains, and traffic on rough roads. Construction vibrations can be transient, random, or continuous. Random vibration can result from jackhammers, pavement breakers, and heavy construction equipment. Table 4.11-7 describes the general human response to different levels of groundborne vibration-velocity levels.

Table 4.11-7. Human response to different levels of groundborne noise and vibration.

Vibration-Velocity Level	Human Reaction
65 VdB	Approximate threshold of perception.
75 VdB	Approximate dividing line between barely perceptible and distinctly perceptible. Many people find that transportation-related vibration at this level is unacceptable.
85 VdB	Vibration acceptable only if there are an infrequent number of events per day.

Note: VdB = vibration decibels referenced to 1 microinch per second (µin/sec) and based on the root mean square (RMS) velocity amplitude.

Source: FHWA 1995



* dB are "average" values as measured on the A-scale of a sound-level meter.
Source: From *Concepts in Architectural Acoustics* (Egan 1972) and *The Noise Guidebook* (HUD n.d.).

Figure 4.11-2. Typical noise levels.

4.11.2.2 Existing Sensitive Receptors

Noise- and vibration-sensitive land uses generally include those uses where exposure would result in adverse effects (e.g., annoyance and structural damage), as well as uses where quiet is an essential element of their intended purpose. Residential dwellings are of primary concern because of the potential for increased and prolonged exposure of individuals to both interior and exterior noise levels. Other sensitive land uses include hospitals, convalescent facilities, parks, hotels, churches, libraries, and other uses where low interior noise levels are essential, including any uses where people sleep at night. With respect to the FERC Project area, existing noise-sensitive receptors consist primarily of urban and rural residences. Refer to Figures 4.6-2a, 4.6-2b, and 4.6-2c in Section 4.6, Land Use, for the locations of these noise-sensitive land uses. Note that the urban and rural residential land uses depicted in these figures have been identified as the existing noise-sensitive receptors.

4.11.2.3 Existing Noise Sources

The existing noise environment in and surrounding the FERC Project area is influenced by transportation noise emanating from rail traffic on the Union Pacific line, which runs north of Oroville through the Feather River Canyon; vehicular traffic on area roadways (e.g., SRs 70, 99, and 162); air traffic from the Oroville Airport and the Lake Oroville Landing Area Seaplane Base; and boat traffic on Lake Oroville. Noise from surrounding operations (e.g., commercial and industrial uses) and from outdoor activity areas (e.g., people talking, dogs barking, operation of landscaping and agricultural equipment) also contribute, to a lesser extent, to the existing noise environment.

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4.12 AIR QUALITY

The FERC Project area is located in Butte County, California, which is within the Northern Sacramento Valley Air Basin (NSVAB) and under the local jurisdiction of the Butte County Air Quality Management District (BCAQMD). Ambient air pollutant concentrations are determined by the amount of emissions released by pollutant sources and the ability of the atmosphere to transport and dilute such emissions. Natural factors that affect transport and dilution include terrain, wind, atmospheric stability, and the presence of sunlight. Therefore, existing ambient air quality conditions in the area are determined by such natural factors as topography, meteorology, and climate, in addition to the amount of emissions released by existing air pollutant sources, as discussed separately below.

4.12.1 Topography, Meteorology, and Climate

The NSVAB is relatively flat and is bordered by the North Coast Ranges to the west and the northern Sierra Nevada to the east. Air flows into the NSVAB through the Carquinez Strait, the only breach in the western mountain barrier, and moves across the Sacramento–San Joaquin Delta (Delta) from the San Francisco Bay Area.

Most precipitation in the area results from air masses that move in from the Pacific Ocean, usually from the west or northwest, during the winter months. More than half the total annual precipitation falls during the winter rainy season (November through February). The prevailing winds are moderate in speed and vary from moisture laden breezes from the south to dry land flows from the north.

The mountains surrounding the NSVAB create a barrier to airflow, which leads to the entrapment of air pollutants when meteorological conditions are unfavorable for transport and dilution. Poor air movement is most common in the fall and winter, when high-pressure cells are present over the NSVAB.

4.12.2 Existing Air Quality—Criteria Air Pollutants

Concentrations of ozone, carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), respirable and fine particulate matter (PM_{10} and $PM_{2.5}$), and lead are used as indicators of ambient air quality conditions. These are the most prevalent air pollutants known to be deleterious to human health, and extensive health-effects criteria documents are available; therefore, these pollutants are commonly referred to as "criteria air pollutants." Table 4.12-1 describes attainment area standards, designations, and attainment for these criteria air pollutants.

Table 4.12-1. Ambient air quality standards and designations.

Pollutant	Averaging Time	California		National Standards [1]		
		Standards [2,3]	Attainment Status (Butte County) [4]	Primary [3,5]	Secondary [3,6]	Attainment Status (Butte County) [7]
Ozone	1-hour	0.09 ppm (180 µg/m^3)	N (Moderate)	– [9]	Same as Primary Standard	– [9]
	8-hour	0.070 ppm [8]	–	0.08 ppm (157 µg/m^3)		N
Carbon Monoxide (CO)	1-hour	20 ppm (23 mg/m^3)	A	35 ppm (40 mg/m^3)	–	U/A
	8-hour	9 ppm (10 mg/m^3)		9 ppm (10 mg/m^3)		
Nitrogen Dioxide (NO_2)	Annual Arithmetic Mean	–	–	0.053 ppm (100 µg/m^3)	Same as Primary Standard	U/A
	1-hour	0.25 ppm (470 µg/m^3)	A	–		–
Sulfur Dioxide (SO_2)	Annual Arithmetic Mean	–	–	0.030 ppm (80 µg/m^3)	–	U
	24-hour	0.04 ppm (105 µg/m^3)	A	0.14 ppm (365 µg/m^3)	–	
	3-hour	–	–	–	0.5 ppm (1300 µg/m^3)	
	1-hour	0.25 ppm (655 µg/m^3)	A	–	–	–
Respirable Particulate Matter (PM_{10})	Annual Arithmetic Mean	20 µg/m^3	N	50 µg/m^3 [11]	Same as Primary Standard	U/A
	24-hour	50 µg/m^3		150 µg/m^3		

Table 4.12-1. Ambient air quality standards and designations.

Pollutant	Averaging Time	California		National Standards [1]		
		Standards [2,3]	Attainment Status (Butte County) [4]	Primary [3,5]	Secondary [3,6]	Attainment Status (Butte County) [7]
Fine Particulate Matter ($PM_{2.5}$)	Annual Arithmetic Mean	12 µg/m^3	N	15 µg/m^3	Same as Primary Standard	U/A
	24-hour	–	–	35 µg/m^3 [12]		
Lead [10]	30-day Average	1.5 µg/m^3	A	–	–	–
	Calendar Quarter	–	–	1.5 µg/m^3	Same as Primary Standard	A
Sulfates	24-hour	25 µg/m^3	A	**No National Standards**		
Hydrogen Sulfide	1-hour	0.03 ppm (42 µg/m^3)	U			
Vinyl Chloride [10]	24-hour	0.01 ppm (26 µg/m^3)	U/A			
Visibility-Reducing Particle Matter	8-hour	Extinction coefficient of 0.23 per kilometer—visibility of 10 miles or more (0.07—30 miles or more for Lake Tahoe) because of particles when the relative humidity is less than 70 percent	U			

Notes: µg/m^3 = micrograms per cubic meter; ppm = parts per million

[1] *National standards (other than ozone, PM, and those based on annual averages or annual arithmetic means) are not to be exceeded more than once a year. The ozone standard is attained when the fourth highest 8-hour concentration in a year, averaged over 3 years, is equal to or less than the standard. The PM_{10} 24-hour standard is attained when 99 percent of the daily concentrations, averaged over 3 years, are equal to or less than the standard. The $PM_{2.5}$ 24-hour standard is attained when 98 percent of the daily concentrations, averaged over 3 years, are equal to or less than the standard. Contact the U.S. Environmental Protection Agency (USEPA) for further clarification and current federal policies.*

[2] *California standards for ozone, CO (except Lake Tahoe), SO_2 (1- and 24-hour), NO_2, PM, and visibility-reducing particles are values that are not to be exceeded. All others are not to be equaled or exceeded. CAAQS are listed in the Table of Standards in Title 17, Section 70200, of the California Code of Regulations.*

[3] *Concentration expressed first in units in which it was promulgated (i.e., parts per million [ppm] or micrograms per cubic meter [µg/m^3]). Equivalent units given in parentheses are based on a reference temperature of 25 degrees Celsius (C) and a reference pressure of 760 torr. Most measurements of air quality are to be corrected to a reference temperature of 25 degrees C and a reference pressure of 760 torr; ppm in this table refers to ppm by volume, or micromoles of pollutant per mole of gas.*

[4] *Unclassified (U): The data are incomplete and do not support a designation of attainment or nonattainment.*

Attainment (A): The state standard for that pollutant was not violated at any site in the area during a 3-year period.

Nonattainment (N): There was a least one violation of a state standard for that pollutant in the area.

Nonattainment/Transitional (NT): A subcategory of the nonattainment designation. The area is close to attaining the standard for that pollutant.

[5] *National Primary Standards: The levels of air quality necessary, with an adequate margin of safety, to protect the public health.*

[6] *National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.*

[7] *Nonattainment (N): Any area that does not meet (or that contributes to ambient air quality in a nearby area that does not meet) the national primary or secondary ambient air quality standard for the pollutant.*

Attainment (A): any area that meets the national primary or secondary ambient air quality standard for the pollutant.

Unclassifiable (U): any area that cannot be classified on the basis of available information as meeting or not meeting the national primary or secondary ambient air quality standard for the pollutant.

[8] *This concentration took effect on May 17, 2006.*

[9] *The 1-hour ozone NAAQS was revoked on June 15, 2005.*

[10] *ARB has identified lead and vinyl chloride as toxic air contaminants with no threshold of exposure for adverse health effects determined. These actions allow for the implementation of control measures at levels below the ambient concentrations specified for these pollutants.*

[11] *USEPA has revoked the annual standard for PM_{10}; the revocation went into effect on December 18, 2006.*

[12] *The 24-hour standard for $PM_{2.5}$ has been reduced from 65 µg/m3to 35 µg/m^3, effective December 18, 2006.*

Sources: ARB Website, USEPA Website, Federal Register 2006

4.12.2.1 Monitoring Station Data and Attainment Area Designations

Criteria air pollutant concentrations are measured at several monitoring stations in Butte County. The Chico and Paradise stations are the closest monitoring stations to the FERC Project area with recent data for ozone, CO, NO_2, PM_{10}, and $PM_{2.5}$. In general, the ambient air quality measurements from these stations are representative of the air quality in the vicinity of the project area. Table 4.12-2 summarizes the air quality data from the most recent 3 years for these two monitoring stations. With respect to ozone, Butte County is currently designated by the U.S. Environmental Protection Agency as a nonattainment area for the State 1-hour and national 8-hour ambient air quality standards, respectively. Butte County is also designated as a nonattainment area for the State PM_{10} and $PM_{2.5}$ standards.

Table 4.12-2. Summary of annual ambient-air-quality data (2003–2005).

	2003	2004	2005
OZONE			
Chico–Manzanita Avenue Monitoring Station			
Maximum concentration (1-hr/8-hr average, ppm)	0.092/0.076	0.088/0.073	0.083/0.077
Number of days State standard exceeded (1-hr)	0	0	0
Number of days national standard exceeded (1-hr/8-hr)	0/0	0/0	0/0
Paradise–4405 Airport Road			
Maximum concentration (1-hr/8-hr average, ppm)	0.101/0.091	0.103/0.094	0.092/0.085
Number of days State standard exceeded (1-hr)	5	2	0
Number of days national standard exceeded (1-hr/8-hr)	0/8	0/3	0/1
CARBON MONOXIDE (CO)			
Chico–Manzanita Avenue Monitoring Station			
Maximum concentration (1-hr/8-hr average, ppm)	3.9/2.54	3.6/2.86	3.3/2.74
Number of days State standard exceeded (8-hr)	0	0	0
Number of days national standard exceeded (1-hr/8-hr)	0/0	0/0	0/0
NITROGEN DIOXIDE (NO_2)			
Chico–Manzanita Avenue Monitoring Station			
Maximum concentration (1-hr average, ppm)	0.057	0.056	0.048
Number of days State standard exceeded	0	0	0
Annual Average (ppm)	0.011	0.011	0.009
FINE PARTICULATE MATTER ($PM_{2.5}$)			
Chico–Manzanita Avenue Monitoring Station			
Maximum concentration ($\mu g/m^3$)	56.1	76.3	82.7
Number of days national standard exceeded (measured [1])	0	0	0

Table 4.12-2. Summary of annual ambient-air-quality data (2003–2005).

	2003	2004	2005
RESPIRABLE PARTICULATE MATTER (PM_{10})			
Chico–Manzanita Avenue Monitoring Station			
Maximum concentration (μg/m^3)	54.0	115.0	60.0
Number of days State standard exceeded (measured/calculated [1])	1/5.8	5/30.2	3/–
Number of days national standard exceeded (measured/calculated [1])	0/0	0/0	0/0

Notes: 1-hr = 1-hour; 8-hr = 8-hour; μg/m^3 = micrograms per cubic meter; ppm = parts per million

[1] *Measured days are those days that an actual measurement was greater than the level of the State daily standard or the national daily standard. Measurements are typically collected every 6 days. Calculated days are the estimated number of days that a measurement would have been greater than the level of the standard had measurements been collected every day. The number of days above the standard is not necessarily the number of violations of the standard for the year.*

Sources: ARB Website 1, USEPA Website

4.12.3 Existing Air Quality—Toxic Air Contaminants

Concentrations of toxic air contaminants (TACs) are also used as indicators of ambient air quality conditions. TACs are usually present in minute quantities in the ambient air; however, their high toxicity or health risk may pose a threat to public health even at low concentrations.

According to the *California Almanac of Emissions and Air Quality* (ARB 2005), the majority of the estimated health risk from TACs can be attributed to relatively few compounds, the most important being PM from diesel-fueled engines (diesel PM). Although diesel PM is emitted by diesel-fueled internal combustion engines, the composition of the emissions varies depending on engine type, operating conditions, fuel composition, and lubricating oil, and whether an emission control system is present. In addition to diesel PM, benzene, 1,3-butadiene, acetaldehyde, carbon tetrachloride, hexavalent chromium, para-dichlorobenzene, formaldehyde, methylene chloride, and perchloroethylene are the TACs for which data are available that pose the greatest existing ambient risk in California.

According to the California Air Resources Board, three facilities in the vicinity of the project emit TACs: Sierra Pacific Industries, Pacific Oroville Power, and Granite Construction Company (ARB Website 2).

In addition, naturally occurring asbestos (NOA), which was identified as a TAC in 1986 by the California Air Resources Board, is located in many parts of California and is commonly associated with ultramafic rocks (Clinkenbeard et al. 2002). Asbestos is the common name for a group of naturally occurring fibrous silicate minerals that can separate into thin but strong and durable fibers. Ultramafic rocks form in high-temperature environments well below the surface of the earth. By the time they are

exposed at the surface by uplift and erosion, ultramafic rocks may be partially to completely altered to serpentinite, a type of metamorphic rock. Sometimes the metamorphic conditions are right for the formation of chrysotile asbestos or tremolite-actinolite asbestos in the bodies of these rocks or along their boundaries (Churchill and Hill 2000).

For individuals living in areas of NOA, there are many potential pathways for airborne exposure. Exposures to soil dust containing asbestos can occur under a variety of scenarios, including children playing in the dirt, dust raised from unpaved roads and driveways covered with crushed serpentine, uncontrolled quarry emissions, grading and construction associated with development of new housing, gardening, and other human activities. For homes built on asbestos outcroppings, asbestos can be tracked into the home and can also enter as fibers suspended in outdoor air. Once such fibers are indoors, they can be entrained into the air by normal household activities, such as vacuuming (as many fibers will simply pass through vacuum cleaner bags).

People exposed to low levels of asbestos may be at elevated risk (e.g., above background rates) of lung cancer and mesothelioma. The risk is proportional to the cumulative inhaled dose (number of fibers), and also increases with the time since first exposure. Although there are a number of factors that influence the disease-causing potency of any given asbestos, such as fiber length and width, fiber type, and fiber chemistry, all forms are carcinogens.

The U.S. Department of Conservation, California Geologic Survey (formerly the California Division of Mines and Geology) has prepared a General Location Guide for Ultramafic Rocks in California—Areas More Likely to Contain Naturally Occurring Asbestos (Churchill and Hill 2000). While geologic conditions are more likely for asbestos formation in or near these areas, the presence thereof is not certain. According to this guide, an area that is more likely to contain NOA is located within the northern Project boundary (Churchill and Hill 2000). Refer to Figure 4.12-1 for the locations of areas of serpentinite within the FERC Project boundary and project vicinity.

4.12.4 Existing Air Quality—Greenhouse Gases

Increasing awareness and study of the role that greenhouse gases (GHGs) have on climate change has resulted in the development of several methodologies for quantifying both natural releases and releases related to human activities of several GHG of interest, including carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and fluoronated gases. Human activities that result in the release of GHGs include but are not limited to motor vehicle use, wood and coal burning, feedlot and dairy practices, agricultural practices, flooding of vegetated surfaces for game refuges, and water storage/flood management facilities. Compared to emissions from thermal power projects, GHG emissions from hydropower projects are considerably more difficult to measure or estimate. Degassing fluxes from reservoirs vary seasonally and decrease over time. Emissions are dependent on complex biological and chemical cycles occurring in the reservoir that are driven by geography, climate, and types of flooded soils and vegetation. When a reservoir is first filled, a large quantity of biomass is

readily converted to CO_2 and CH_4, which is released through diffusion into the air at the reservoir surface, as well as through the migration of gas bubbles produced below the surface. Over time, the rate of GHG release from reservoirs decreases as the initial pulse of flooded biomass is consumed; however, GHGs continue to be fueled by whatever carbon enters the reservoir throughout its lifetime.

Few studies have been undertaken to quantify GHG emissions from reservoirs and hydropower projects, focusing primarily on facilities located in northern and tropical latitudes. However, the data to date suggests that GHG emissions from reservoirs in the western United States have lower CO_2 and CH_4 emissions than those in eastern and western Canada and Central/South America. This may be due to their age; their low amount of flooded organic matter; highly aerobic conditions, which lead to consumption of CH_4; and suspected greater role for photosynthesis in the withdrawal of CO_2. When the Oroville Facilities were constructed, most of the trees were cut and removed prior to inundation, lessening the amount of flooded organic matter. The Oroville Facilities are representative of this group of temperate reservoirs located in California that are generally older and located in regions where terrestrial vegetation is scarce with little or no peat accumulation, in valleys surrounded by hilly relief.

4.13 AGRICULTURAL RESOURCES

This section describes the agricultural resources within the project study area that could be affected by implementation of the No-Project Alternative, the Proposed Project, and the FERC Staff Alternative. The discussion focuses on agricultural land use issues associated with potential effects of the alternatives on water temperatures at Thermalito Afterbay and related agricultural diversion points, which could, in turn, potentially affect rice yields and production in the Feather River Service Area (FRSA). It should be noted that, although the focus of this evaluation is on potential water temperature effects on rice yields and production, water temperature is only one of the contributing factors potentially affecting agricultural resources.

Four irrigation and water districts currently divert water from Thermalito Afterbay: the Western Canal Water District, the Richvale Irrigation District, the Butte Water District, and the Biggs–West Gridley Water District. Water is delivered within the FRSA via four water diversion locations, namely the Sutter Butte Main Canal, Western Canal, Richvale Canal, and the Western Lateral Canal (see Figure 4.13-1). The geographic extent of the FRSA defines the geographic scope of the potential effects of the Oroville Facilities on agricultural resources.

Under existing environmental requirements, DWR operates the Oroville Facilities to meet water temperature requirements in the Feather River for the protection of listed fish species and to meet water quality standards in the Sacramento–San Joaquin Delta. In addition, the Oroville Facilities provide water for agricultural diversions to senior water rights holders in Butte and Sutter counties. Agricultural operations in these counties enjoy major benefits from the Oroville Facilities through improved water supply reliability for agricultural diversions and flood management that increases agricultural productivity and reliability. In addition to improving the reliability of water supply availability for agricultural resources, the Oroville Facilities also have the potential to affect agricultural resources by influencing water temperatures at the four agricultural diversions located in the Thermalito Afterbay (see Figure 4.13-1).

Several variables that impact or have the potential to impact agricultural resources, and specifically rice production, are not evaluated in this section because they are not adversely affected by Oroville Facilities operations, the Proposed Project, or the FERC Staff Alternative. Examples of these unaffected agricultural resource–related variables include changes in the groundwater table, changes to water quality constituents not including water temperature, conversion of farmland due to construction or erosion, and additional aquatic weeds or weed seeds in the agricultural irrigation distribution and conveyance system, growers' cultural practices, and water management.

Prior to construction of Oroville Dam, several water districts in the Feather River watershed diverted water from the Feather River. DWR entered into agreements with the Western Canal Water District and the Joint Water Districts Board (JWDB) to provide water based upon their pre-1914 water rights (DWR 1969). The agreement between the JWDB, which includes the Richvale Irrigation District, the Biggs–West Gridley Water District, the Butte Water District, and the Sutter Extension Water District, and DWR

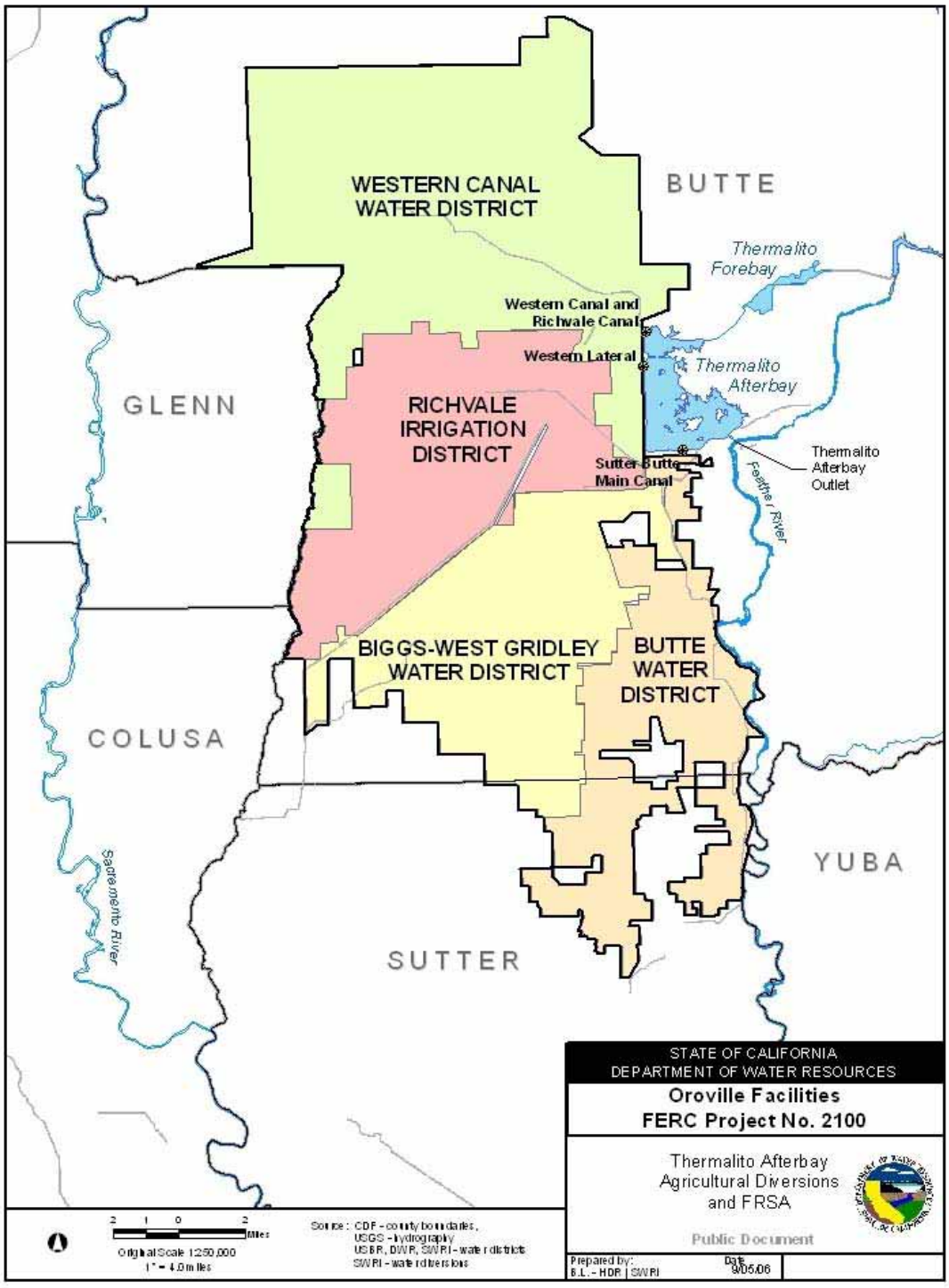


Figure 4.13-1. Thermalito Afterbay agricultural diversions and FRSA.

includes terms describing the amounts of water that the State shall make available to these districts. This agreement, signed May 1969, states that the "[d]istricts shall have the right to divert from the Feather River at the Thermalito Afterbay Diversion Structures each Irrigation Season, five hundred sixty thousand (560,000) acre-feet of water of the Feather River up to and including the year 1980 and five hundred fifty-five thousand (555,000) acre-feet each Irrigation Season thereafter" (DWR 1969). The May 1969 agreement between DWR and the Joint Water District does not contain specific water temperature or water quality goals or criteria. The agreement between DWR and the Western Canal Water District, signed during January 1986, superseded an agreement between DWR and Pacific Gas and Electric Company to provide water to the Western Canal for irrigation purposes. The January 1986 agreement specified that DWR would provide 295,000 acre-feet (af) of water from March 1 through October 31. Additionally, during the period from November 1 through March 1 DWR agreed to deliver additional water to the Western Canal Water District for additional beneficial uses. However, during drought years, some deliveries could be curtailed.

4.13.1 Current Agricultural-Related Water Diversions

The primary water use of FRSA-diverted water is for agricultural irrigation, although some water is allocated for habitat production (USBR et al. 2004). Agriculture-related land uses within the study area include fallow fields, hayfields, orchards, pastures, rice, row crops, and vineyards. The irrigation districts in the FRSA deliver water from the Oroville Facilities to approximately 172,568 acres of farmland in Butte and Sutter counties, of which approximately 114,000 acres is planted with rice. However, the actual acreage of rice planted varies from year to year depending on several variables including climatic conditions, economics, and crop rotations.

Currently, monthly irrigation diversions of up to 150,000 af are made from the Thermalito Afterbay during the May-through-August irrigation season. Annual diversions are slightly less than 1 million acre-feet (maf), leaving approximately 3 maf for flow in the Feather River downstream of the Oroville Facilities (DWR 2001).

Figure 4.2-12 in Section 4.2.2, Surface Water Quality, shows the relationship of the water temperatures at the diversions and the volume of water being diverted from Thermalito Afterbay when water is being used for rice production. Oroville Facilities operations affect the water temperatures and water temperature distribution in Thermalito Afterbay, which affect water temperatures at the agricultural diversions and the Thermalito Afterbay Outlet (see Section 5.2.2, Surface Water Quality, for additional information on project effects on water temperatures). Warmer water temperatures at the agricultural diversions would be beneficial to rice production, but potentially would conflict with coldwater fisheries management in the lower Feather River below the Thermalito Afterbay Outlet (see Section 5.4, Aquatic Resources, for additional information on effects of Thermalito Afterbay water temperatures on aquatic resources).

Oroville Facilities operations that affect Thermalito Afterbay water temperatures include Oroville Dam releases and those operational variables that determine the effective residence time of water in Thermalito Afterbay. Oroville Facilities operations that

determine the effective residence time of water in Thermalito Afterbay include: (1) the volume of inflows compared to the total releases from Thermalito Afterbay, including the Thermalito Afterbay Outlet and the agricultural diversions; (2) the Thermalito Afterbay stage elevation; and (3) power generation operations, including the frequency, magnitude, and duration of peaking and pump-back. The timing and magnitude of diversions from Thermalito Afterbay affect the residence time of water in the Thermalito Afterbay, which, in turn, influences the amount of warming that can occur in the Thermalito Afterbay prior to the agricultural diversion of the water. Specifically, increased volumes of agricultural diversions contribute to reduced water residence times during the irrigation season, which directly affects water temperatures at the agricultural diversions. Additionally, water warming can be further reduced during times when ambient air temperatures are cool, which limits warming in Thermalito Afterbay and in the agricultural conveyance canals. Agricultural diversion volumes and ambient air temperatures are independent of operation of the Oroville Facilities, which limits the opportunity to change operations to influence agricultural diversion water temperatures. (See Section 5.2, Surface Water, for more information on effects of the Oroville Facilities on Thermalito Afterbay water temperatures.)

Figure 4.2-12 in Section 4.2.2, Surface Water Quality, illustrates the water temperatures at the diversion locations during the early growing season, the pattern of water diversion volumes, and the relationship of diversion volume to the resulting water temperatures. Water temperatures for rice production are reported to be suitable above 60 degrees Fahrenheit (°F) to 65°F (Mutters et al. 2003a). Graphical representation of water temperatures shown in Section 4.2.2 indicates that the Western Canal diversion location remains below 65°F for the majority of the early growing season. Because of the relatively short residence time of water in the agricultural conveyance systems, especially during periods of high volumes of diversions and agricultural water deliveries, there is little opportunity for water to warm before it is delivered in the field at the point of use. After water is delivered to a rice field, it warms to an equilibrium with the ambient air temperature. Areas in the rice fields that are affected by delivery water temperatures are localized to the areas of the field immediately adjacent to the field water inlet. Later in the rice growing season, when ambient air temperatures are warmer and delivery volumes are lower, there is some warming of water within the conveyance systems, especially in the farthest reaches of the system at greater distances from the diversion location to the point of the water application.

The diversion locations for the Western Canal and Richvale Canal are located on the opposite side of the Thermalito Afterbay inlet in the northernmost portion of Thermalito Afterbay (Figure 4.13-1). The northern portion of Thermalito Afterbay has reduced circulation and mixing with the southern portion of the Thermalito Afterbay volume due to constriction from the SR 162 bridge structure.

Water entering the Thermalito Afterbay inlet from the power canal flows directly toward the northern diversions, which reduces the opportunity for the inflow to mix with warm water from the southern portion of the Thermalito Afterbay, and reduces inflow residence time. The physical proximity of the Thermalito Afterbay inlet water and the

Western Canal and Richvale diversion locations contribute to the reduced water temperatures at these locations in comparison to the Sutter Butte Main Canal diversion location shown in Figure 4.13-1. However, Oroville Facilities pump-back operations tend to draw warmer water from the main body of Thermalito Afterbay into the northern portion of the Thermalito Afterbay, providing some warming at the northern water diversion locations. The Sutter Butte Main Canal diversion is on the south side of Thermalito Afterbay, which allows water in the Thermalito Afterbay to warm by typically 4–6°F prior to diversion.

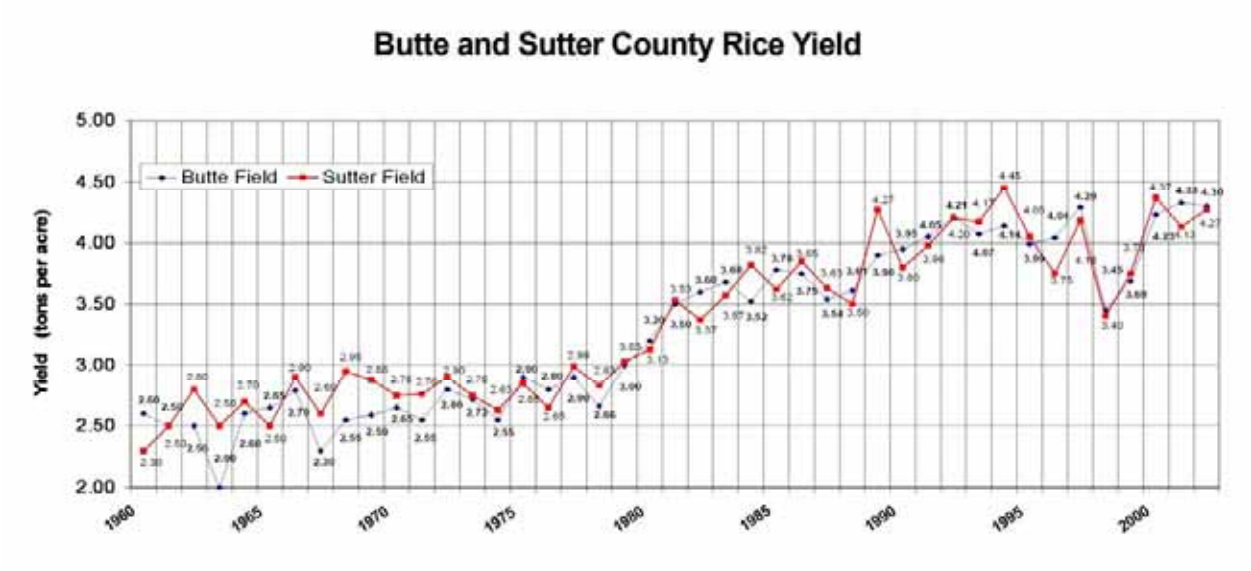
4.13.2 Agricultural Production

California is the number one agricultural producer in the United States, earning $27.6 billion in agricultural markets in 2001. The total land acreage dedicated to farming in California is 27.7 million acres, and 13 percent of the national gross cash receipts from farming can be attributed to California farming products (California Department of Food and Agriculture 2002). Rice ranks as the 32nd most valuable agricultural commodity produced in California. During 2001, rice production accounted for $209 million of the agricultural production value in California, or approximately 1 percent of California's total gross cash income from farming (California Department of Food and Agriculture 2002). The top 3 counties for rice production in California are Colusa (25.3 percent of the total value), Sutter (19.1 percent), and Butte (18.7 percent) (CASS Website).

Historically, Butte County's economy has been agriculturally based, and commercial agriculture continues to be the County's principal economic base (see Section 4.9.1, Population and Housing). The Feather River and groundwater are the largest sources used to meet the County's water demands. Butte County had approximately 381,532 acres of farmland in 2002 (NASS 2004), and farming accounted for 41.6 percent of the County's total inventoried land area of 917,909 acres (Farmland Mapping and Monitoring Program 2004a). The region supported approximately 256,519 acres of total cropland, of which 222,735 acres were irrigated land (NASS 2004). Rice is the highest total value crop grown in Butte County. Approximately 94,700 acres of rice were harvested in Butte County, which constituted approximately 18.7 percent ($101.2 million) of the value of California's rice production during 2002 (CASS Website). Other major crops in the County are almonds, walnuts, and plums.

Figure 4.13-2 shows rice yields over time for Butte and Sutter counties. The general trend in rice yield shows an increase over time. This increase in yields is attributable to a number of production factors, including rice variety genetics, fertilization practices, weed control, pest and disease management, increased acreage under production, and water supply reliability.

Sutter County also has a highly agricultural economy. Sutter County's water supply includes surface water from the Feather and Sacramento rivers, other surface water, surface water reuse, and groundwater wells (USBR et al. 2004). During 2002, 1,391 farms occupied 371,964 acres (NASS 2004) of the 389,439 total acres inventoried in the County (Farmland Mapping and Monitoring Program 2004b). The main agricultural



Source: Annual reports from and personal communications with Butte County Agricultural Commissioner's Office and Sutter County Agricultural Commissioner's Office

Figure 4.13-2. Rice yields over time in Butte and Sutter Counties.

commodities within the County during 2002 were rice, dried plums, peaches, and walnuts. Sutter County accounted for 19.1 percent ($103.1 million) of California's total rice production value during 2002 with more than 96,000 acres of rice having been harvested (CASS Website).

Rice is cultivated in the majority of the area under agricultural production in the FRSA (see Figure 4.13-3). Heavy red and gray clay soils and their associated low water infiltration rate characteristics make much of the areas to the northwest, west, and southwest of the Oroville Facilities ideal for rice production. These soil types also limit crop selection alternatives and account for the general monoculture of rice production in these areas. (See Section 4.1, Geology, Soils, and Paleontological Resources, for additional information on soil types.) Crop types supported by water diverted from the

Thermalito Afterbay and downstream in the Feather River include field crops, pasture, deciduous fruit, and nuts. Other agricultural land uses that occur adjacent to the Oroville Facilities include dryland grain farming, grazing, truck crops, nurseries, ranchettes, and forestry upland of the Oroville Facilities.

4.13.3 Agricultural Land Designation

As part of the Land Inventory and Monitoring (LIM) system developed by the U.S. Department of Agriculture (USDA), definitions were established for designations of Prime Farmland, Farmland of Statewide Importance, Unique Farmland, and Farmland of Local Importance. Farmland maps are created by the Farmland Mapping and Monitoring Program (FMMP), under the direction of the USDA. The FRSA farmland designations are provided in Figure 4.13-4.

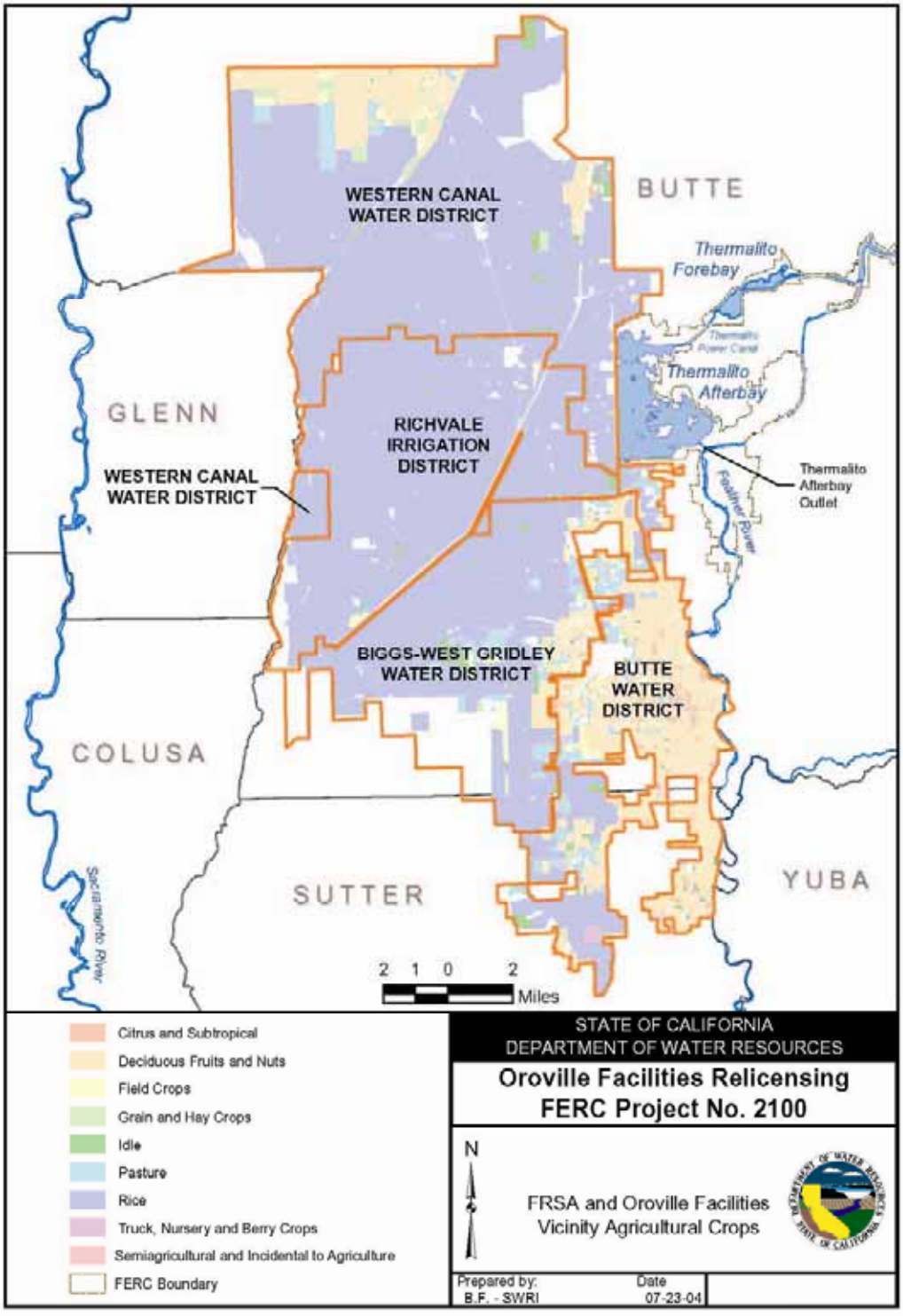


Figure 4.13-3. FRSA and Oroville Facilities vicinity agricultural crops.

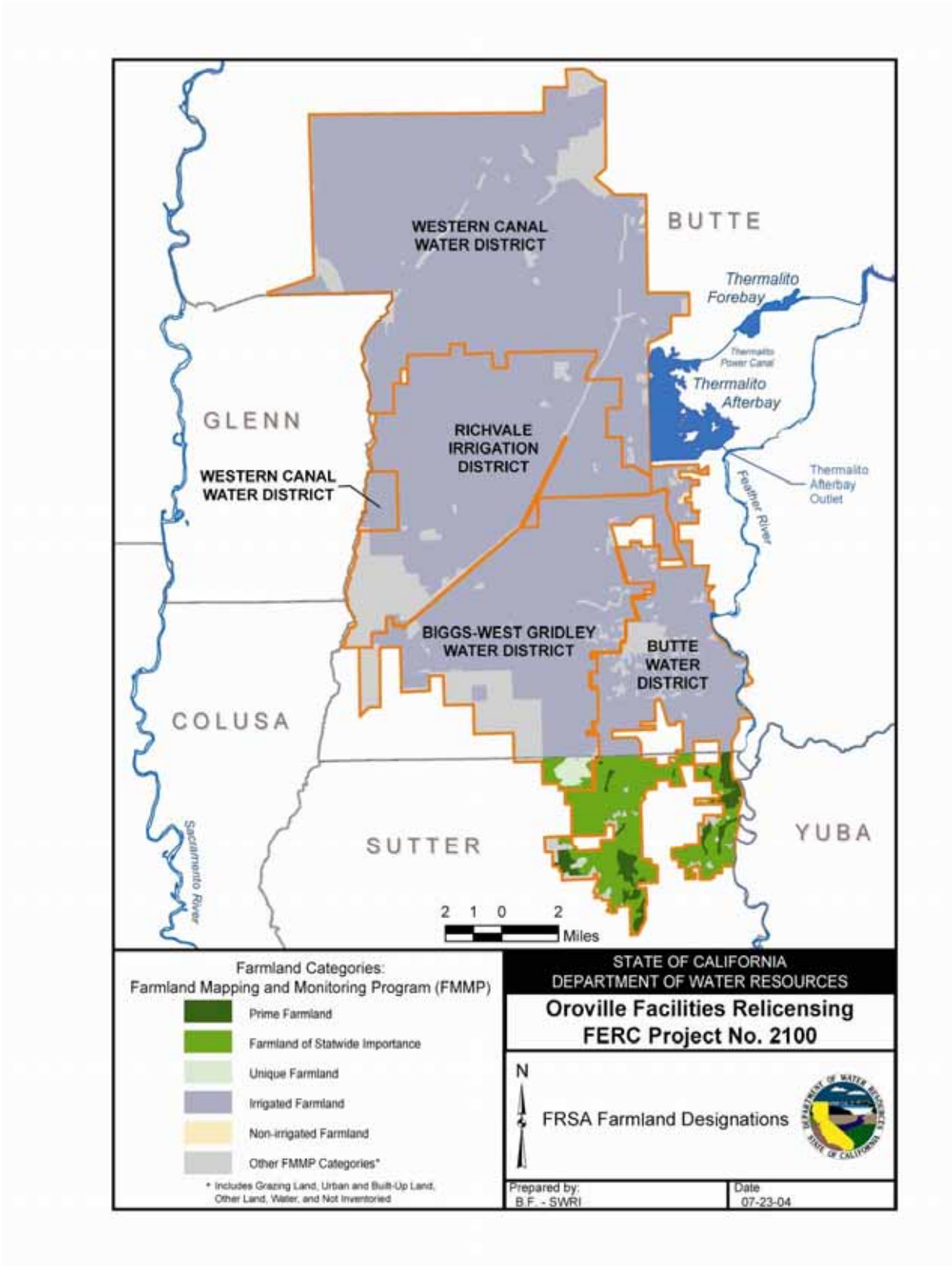


Figure 4.13-4. FRSA farmland designations.

Prime Farmland is land that has been deemed to encompass the best combination of physical and chemical characteristics for the production of crops. If treated and managed according to current farming methods, Prime Farmland has the soil quality, growing season, and moisture supply to produce sustained high crop yields. Ten categories, each with specific criteria, have been established for Prime Farmland. For farmland to meet the designation, it must meet criteria in all ten categories, which include water, soil temperature range, acid-alkali balance, water table, soil sodium content, flooding, erodibility, permeability, rock fragment content, and rooting depth.

Farmland of Statewide Importance includes lands not designated as Prime Farmland that have a good combination of physical and chemical characteristics for the production of crops. Eight of the above listed criteria for Prime Farmland must be met to allow for a designation of Farmland of Statewide Importance. Criteria for permeability and rooting depth are not required to be met for this categorization of farmland.

Unique Farmland cannot be either Prime Farmland or Farmland of Statewide Importance because it is land that does not meet the criteria for either land designation. However, Unique Farmland exhibits a particular combination of soil quality, location, growing season, and moisture supply such that the land produces a sustained high quality and/or high yield of a specific crop (e.g., oranges, avocados, rice) when managed according to current farming methods. Unique Farmland tends to be used for specific high-value crops, of which favorable conditions exist for the growth of the specific crop on the particular parcel of land. High-value crops are determined by the California Department of Food and Agriculture and are listed in its annual publication, *California Agriculture* (California Department of Food and Agriculture 2002).

The total acreage of each type of farmland designation in each water district, as determined by the FMMP, is provided in Tables 4.13-1 and 4.13-2. Approximately 6,300 acres of Prime Farmland within Sutter County are located in the FRSA. An interim mapping study has been conducted for Butte County. Where no farmland mapping study has been conducted, an interim mapping study typically is conducted, from which designations of land are made as either Irrigated Farmland or Non-irrigated Farmland. The interim designations collectively represent the four categories of farmland and are intended to be renamed after advanced soil surveys have been conducted. The total number of acres of farmland within the FRSA, as listed in Tables 4.13-1 and 4.13-2, represents the agricultural resource area potentially affected by Oroville Facilities operations.

Table 4.13-1. Farmland Mapping and Monitoring Program summary for Butte County by water district service area.

	Other		Irrigated Farmland[1]		Non-irrigated Farmland[1]		Unique Farmland		Farmland of Statewide Importance		Prime Farmland		Total	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
Western Canal WD	4,828	7	61,210	93	33	0	0	0	0	0	0	0	66,038	100
Richvale ID	5,079	14	32,287	86	0	0	0	0	0	0	0	0	37,366	100
Butte WD	2,215	12	15,617	88	60	0	0	0	0	0	0	0	17,832	100
Biggs–West Gridley WD	5,770	17	27,984	83	0	0	0	0	0	0	0	0	33,754	100

Notes: ID = Irrigation District; WD = Water District. Butte County contains only Interim Farmland map categories.

[1] *Two categories of Interim Farmland, Irrigated Farmland and Non-irrigated Farmland, are mapped in lieu of Prime Farmland, Farmland of Statewide Importance, Unique Farmland, and Farmland of Local Importance. No Farmland of Local Importance occurs within the water district service areas of concern in Butte County. The "Other" category represents Grazing Land, Urban and Built-up Land, Other Land, Water, and Areas Not Mapped.*

Source: Farmland Mapping and Monitoring Program 2004a

Table 4.13-2. Farmland Mapping and Monitoring Program summary for Sutter County by water district service area.

	Other		Irrigated Farmland[1]		Non-irrigated Farmland[1]		Unique Farmland		Farmland of Statewide Importance		Prime Farmland		Total	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
Butte WD	3,126	8	0	0	0	0	130	0	27,262	74	6,278	17	36,796	100
Biggs–West Gridley WD	283	7	0	0	0	0	1,817	45	1,892	47	26	1	4,018	100

Notes: WD = Water District. Sutter County utilizes an Important Farmland Mapping system compiled by the Farmland Mapping and Monitoring Program.

[1] *The categories "Irrigated Farmland" and "Non-irrigated Farmland" are only used for Interim Farmland Maps. Therefore, no lands within the water district service areas of concern in Sutter County are designated as either Irrigated Farmland or Non-irrigated Farmland. No Farmland of Local Importance occurs within the water district service areas of concern in Sutter County. The "Other" category represents Grazing Land, Urban and Built-up Land, Other Land, Water, and Areas Not Mapped.*

Source: Farmland Mapping and Monitoring Program 2004b

4.13.4 Cultural Practices and Rice Production

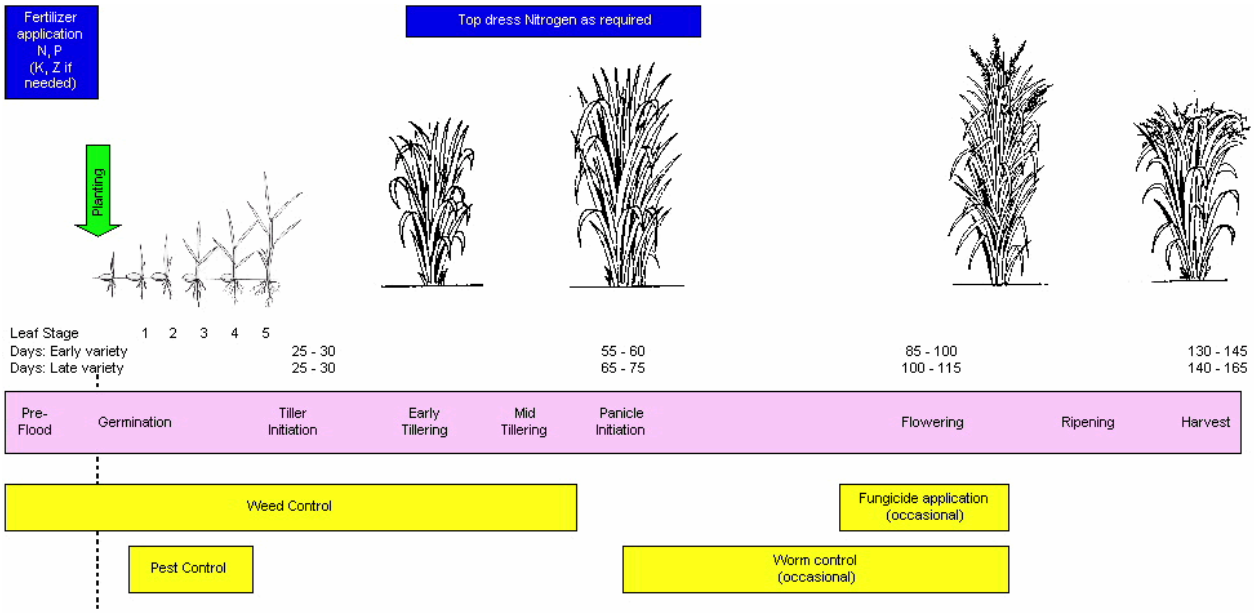
Irrigation water is an essential component of high-value agricultural crop production. Agricultural cropland is often irrigated before crop planting in the spring to leach accumulated salts out of the crop root zone and to recharge the moisture availability of the soil profile. Crops are irrigated at frequent intervals during the growing season; in the case of rice production, irrigation is nearly continuous, with the exception of some periods of water holding and recirculation for specific cultural practices related to herbicide and insecticide applications. For rice production, the field is often flooded after harvest to facilitate rice straw decomposition and provide waterfowl habitat. Because rice is the dominant crop type grown in the FRSA and is potentially affected by FRSA water temperatures, the remainder of this section focuses on rice production practices as they relate to the potential effects of water temperatures.

Rice production typically occurs on clays or other poorly drained soils with impervious layers. These soil types are fairly impermeable to water, which increases their water use efficiency for rice production. Rice is an aquatic crop requiring almost continuous flooding until the time of harvest. Fields intended for rice crop seeding typically are initially flooded during April or May, which accounts for the peak in agricultural water diversion volumes during this time period. Planting primarily occurs during April and May, with the majority of planting within the FRSA occurring during May.

Rice plants go through five growth stages: germination, tiller initiation, panicle initiation, flowering, and harvest (see Figure 4.13-5). Continually flowing water is needed for rice production. Water is reused through subsequent rice paddies several times before it is released back into the main water channel or agricultural drainage. Rice paddies are laser-leveled or contour-leveled so that there is a slight slope within the field to aid in the flow of water. Berms or checks are constructed to control the flow of water over the growing rice and to ensure that there is an equal water depth within each basin (UC Cooperative Extension Rice Project Website). Water depth management in rice production is important for weed control, rigorous rice crop growth, and management of potential plant diseases.

Pest management during rice cultivation often requires the use of pesticide applications. Under State regulations, treated waters are required to be held within fields to facilitate the breakdown of pesticides before draining. Holding water for the extended period of time required for decomposition of chemical pesticides can cause stress to rice if tailwater is not managed properly (UC Cooperative Extension Rice Project Website).

After the panicle initiation rice crop growth stage, the water level in the rice paddy often is raised to protect the reproductive organs of the plant from colder air temperatures at night. Sterility may occur if the panicle is exposed to air temperatures below 55°F 10–15 days before heading (UC Cooperative Extension Rice Project Website). Fields are not drained until the panicle is fully tipped and brown. Early drainage can result in low milling yields from breaking or cracking during harvesting if the kernels are not completely filled (UC Cooperative Extension Rice Project Website).



Source: California Rice Research Board Website 2004

Figure 4.13-5. Rice growth and cultural practice timeline.

Low water temperatures early during the growing season can cause delayed or failed germination, reduced growth rates, reduced or delayed tillering, panicle sterility, or seed head blanking (Williams and Wenning 2003). Yield reduction associated with cold water has been reported to be most pronounced when cold water exposure occurs early during the growing season (6–7 weeks after planting) (Mutters et al. 2003a, 2003b). However, reproduction, which occurs slightly later, also is reportedly affected by reduced water temperatures (Mutters 2003b).

Rice production requires warmer water during the spring and summer for germination and growth of rice (i.e., 65°F from approximately April through mid-May, and 59°F during the remainder of the growing season) (DWR 2001). Research indicates that a 100 percent yield loss can occur in locations exposed to water temperatures below 55°F in as little as 4 days (100 hours) of exposure, and about a 60 percent yield loss can occur in locations exposed to water temperatures below 60°F in as little as 8 days (200 hours) of exposure (Mutters et al. 2003a).

Effects of cold water on rice yield tend to be localized near the field irrigation inlet, although effects have been observed in adjacent checks where cold water has seeped though the dividing levee (Mutters et al. 2003b). Water applied to rice paddies is diverted from the main diversion canals via turnouts. The temperature of water entering the paddy tends to be the coldest water temperature in the field, such that losses to yield are most often observed in association with the turnouts, with decreasing expression of cold water–related effects in proportion to the distance from the turnout.

During 2005, DWR performed a study on six rice fields within the Western Canal Water District, Richvale Irrigation District, and Biggs–West Gridley Water District to determine the effects of water temperatures delivered from the Thermalito Afterbay on rice yields. The study was designed to confirm the cold water to rice yield relationship described in the literature (Mutters et al. 2003a, 2003b; Williams and Wenning 2003) and to determine the distribution of any potential impacts across each district and the FRSA. Preliminary results indicate that yield losses occur at approximately 260 hours of exposure to water temperatures below 65°F. The distribution of impacts across the FRSA is not currently available.

To avoid potential losses associated with cold water exposure, some growers use "warming checks," which are areas of the field at the turnout dedicated to warming field inflow water where either (1) there are no crop inputs or (2) increased yield losses associated with the cold water are expected. Warming checks can vary in size from approximately 1–5 acres depending on the inlet water temperatures and the volume of water flowing into the field, which is determined in part by the size of the field. In some locations, up to 10 percent of the field size can be reserved for the warming checks (pers. comm., Mutters 2004). The strategy of utilizing warming checks to obtain more suitable water temperatures may not be completely effective, particularly early in the season when temperatures are far below optimal (Cline 2002). Growers in the FRSA do not use dedicated warming checks as a common practice. Another strategy used for water temperature management in the field is the use of tailwater recirculation to blend warm water from the tail end of the field with the cooler water at the field inlet. Growers in the FRSA do not use field tailwater recirculation practices probably because of low water costs, increased pumping costs, and the amount of land required for the recirculation system conveyance.

4.14 TRANSPORTATION AND TRAFFIC

This section describes the current traffic and transportation systems in the project area that are affected by operation of the Oroville Facilities. It includes descriptions of local roads and State Highways in the vicinity of the project; provides current use data in terms of average annual daily traffic (AADT) and current and projected future levels of service (LOS); and provides current responsibilities for road maintenance.

Data on existing traffic conditions and Oroville Facilities access routes, obtained from study plan reports Study Plan R-1 (SP-R1), Vehicular Access Study (DWR 2003), and SP-9, Existing Recreational Use (DWR 2004a), as well as DWR visitor count data for the Oroville recreational area, Butte County Public Works traffic count data, Butte County Association of Governments (BCAG) traffic count data, and Butte County Regional Transportation Plan (BCAG 2004) were used to describe transportation and traffic conditions. Additionally, data from the PDEA were used to describe the environmental setting for traffic and roadway maintenance issues. These data were compiled from interviews with local service providers and from information developed during the relicensing studies, particularly information included in SP-R19, Fiscal Impacts (DWR 2004b).

4.14.1 Regional Setting

The project area is located in Butte County approximately 3 hours by car from the San Francisco Bay Area and 1.5 hours from the City of Sacramento. The county encompasses approximately 1,665 square miles in north central California. The western part of the county is located in the northern Sacramento Valley, while the eastern portion extends into the foothills of the Cascade Mountain Range.

Butte County has five incorporated cities that range from small farming communities to regional urban centers. The cities of Biggs and Gridley are located about 5 miles apart in the valley area in the southwest portion of the county, while the City of Chico is located farther north in the western valley area. The City of Oroville, the County seat, is located along the Feather River in the southern portion of the county, and the town of Paradise is on a ridge in the foothills of the Cascades near the center of the county. Numerous unincorporated communities also dot Butte County. Feather Falls, Berry Creek, and Brush Creek are in the Cascade foothills in the eastern portion of the county, while Paradise Pines, Magalia, Stirling City, Forest Ranch, Cohasset, and Butte Meadows are in the foothills in the north area. The western portion of the valley includes the communities of Dayton, Durham, Nelson, and Richvale, with Palermo, Honcut, Cherokee, and Forbestown farther to the east.

4.14.2 Transportation System

The project area is located in a generally rural area, and is served by a roadway network of State Routes and county and local roads. Three major highways, State Routes (SR) 70, 99, and 162, provide regional transportation access to the Oroville Facilities area. Two major interstate highways—Interstates (I) 5 and 80—connect to

these three State Routes. Figure 4.14-1 illustrates the primary regional roadways. The project area is also served by the Oroville Airport and the Lake Oroville Landing Area Seaplane Base.

4.14.2.1 State Route 70

SR 70 is a two-lane north-south highway that provides one of the main connections between Butte County and the rest of the state. SR 70 also continues east through the Feather River Canyon and includes some of the most scenic and historic vistas in the region. Figure 4.14-2 illustrates the location of State Route 70. Extending north from SR 99 in Sutter County, SR 70 travels along the east side of the Feather River through Oroville. The route then traverses the Feather River Canyon, through Quincy in Plumas County, finally terminating at SR 395 near the Nevada border. While along most of its length through Butte County SR 70 is a 2-lane rural highway, the route becomes a 4-lane freeway from just south of Oroville to SR 149.

4.14.2.2 State Route 99

SR 99 is a primary connection between Butte County and the surrounding region. As shown in Figure 4.14-3, the overall state route extends from I-5 south of Bakersfield to Red Bluff via numerous valley communities including Fresno, Modesto, Sacramento, and Yuba City. SR 99 bisects Butte County along the west side of the Feather River through Gridley and Chico. Although the route is primarily a 2-lane rural highway through Butte County, it is a 4-lane expressway/freeway from SR 149 to just north of Chico.

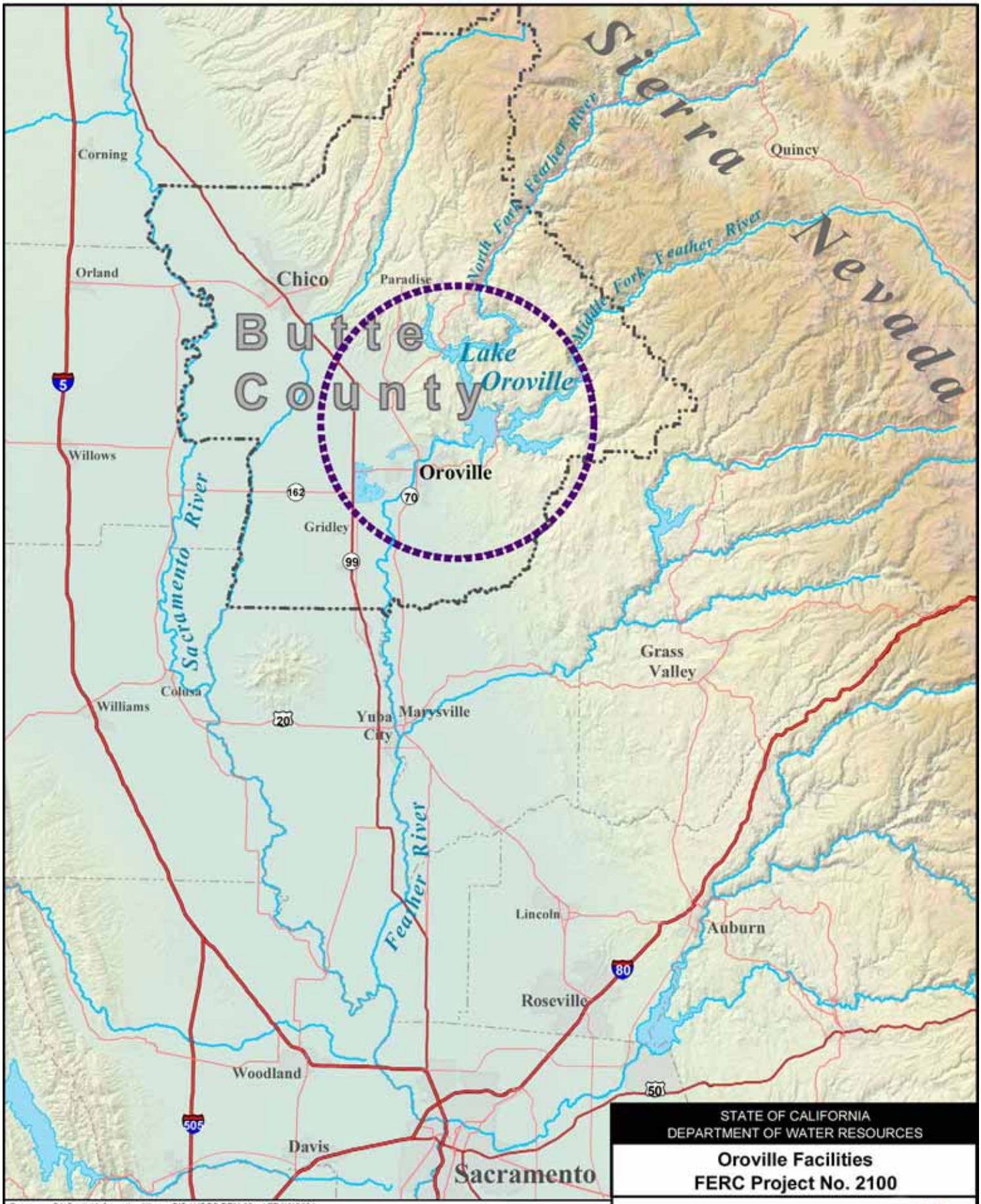
4.14.2.3 State Route 162

SR 162 provides an east-to-west connection for rural communities in the North Valley. The overall route starts at U.S. 101 north of Willits and the route temporarily ends upon entering the west side of the Coast Range mountains. As noted in Figure 4.14-4, SR 162 picks up again on the east side of the Coast Range mountains, extending through Elk Creek and Willows, and ending east of the City of Oroville near Berry Creek. This route is primarily a rural two-lane highway, but in the Oroville area the segment of SR 162 from SR 70 to Olive Highway is a 4-lane arterial road with a continuous left-turn lane. While the State Highway designation ends just past Lake Oroville, the road itself continues as Oroville-Quincy Highway to connect with Quincy via Berry Creek and Bucks Lake.

Several roadway operational projects are planned both within and to the east of the City of Oroville, from Oroville Dam Boulevard to Kelly Ridge Road.

4.14.2.4 Oroville Facilities Connecting Roads and On-Site Roads

The Oroville Facilities are accessed by various County roads and City of Oroville streets, and access to individual areas is provided by on site roads.



Source: CA Spatial Information Library GIS / USGS DEM 30m / EDAW 2004

10 5 0 10 20 Miles

Original Scale 1 : 760,320
1" = 12 miles

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Oroville Facilities
FERC Project No. 2100

Figure 4.14-1

Primary Regional Roadways

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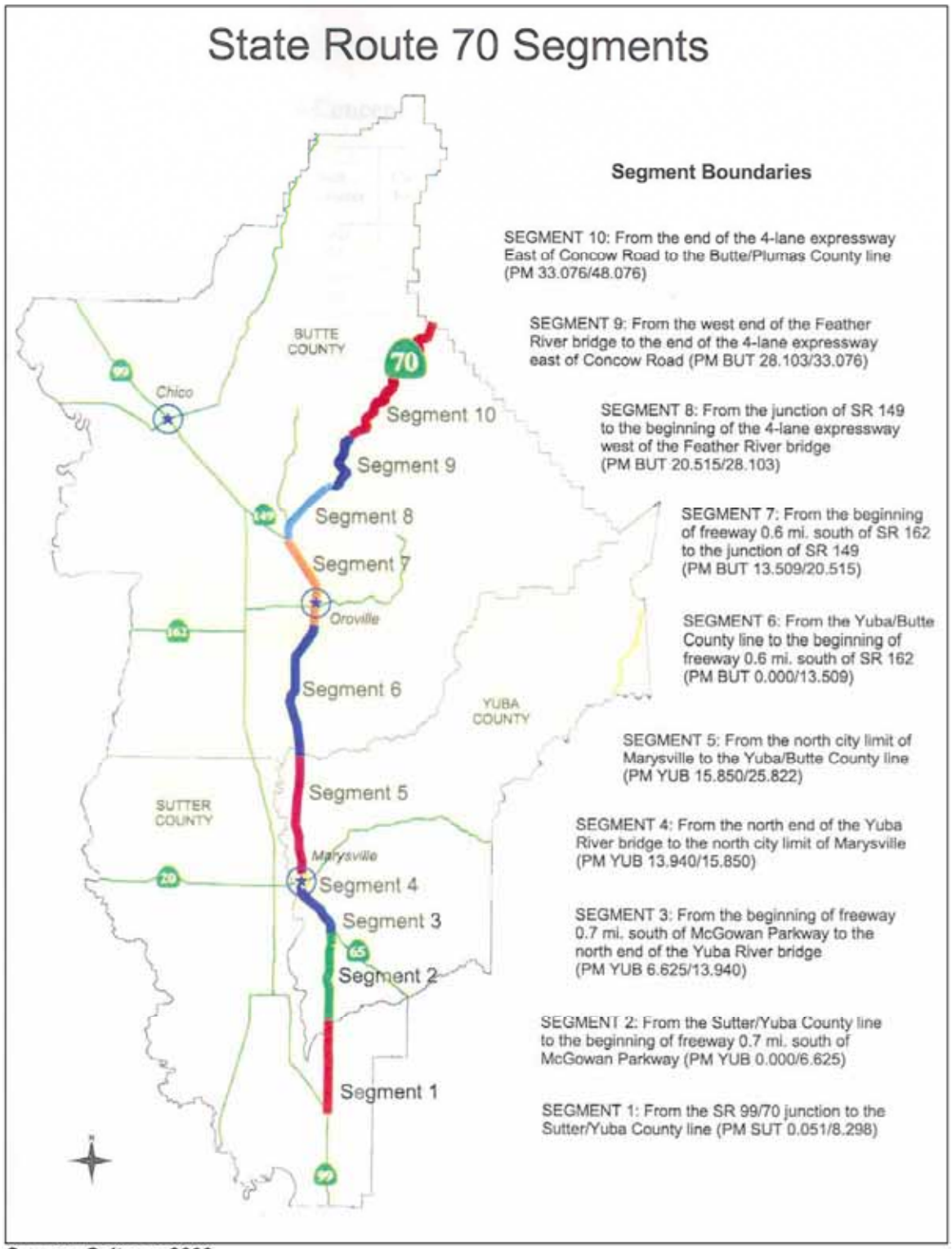
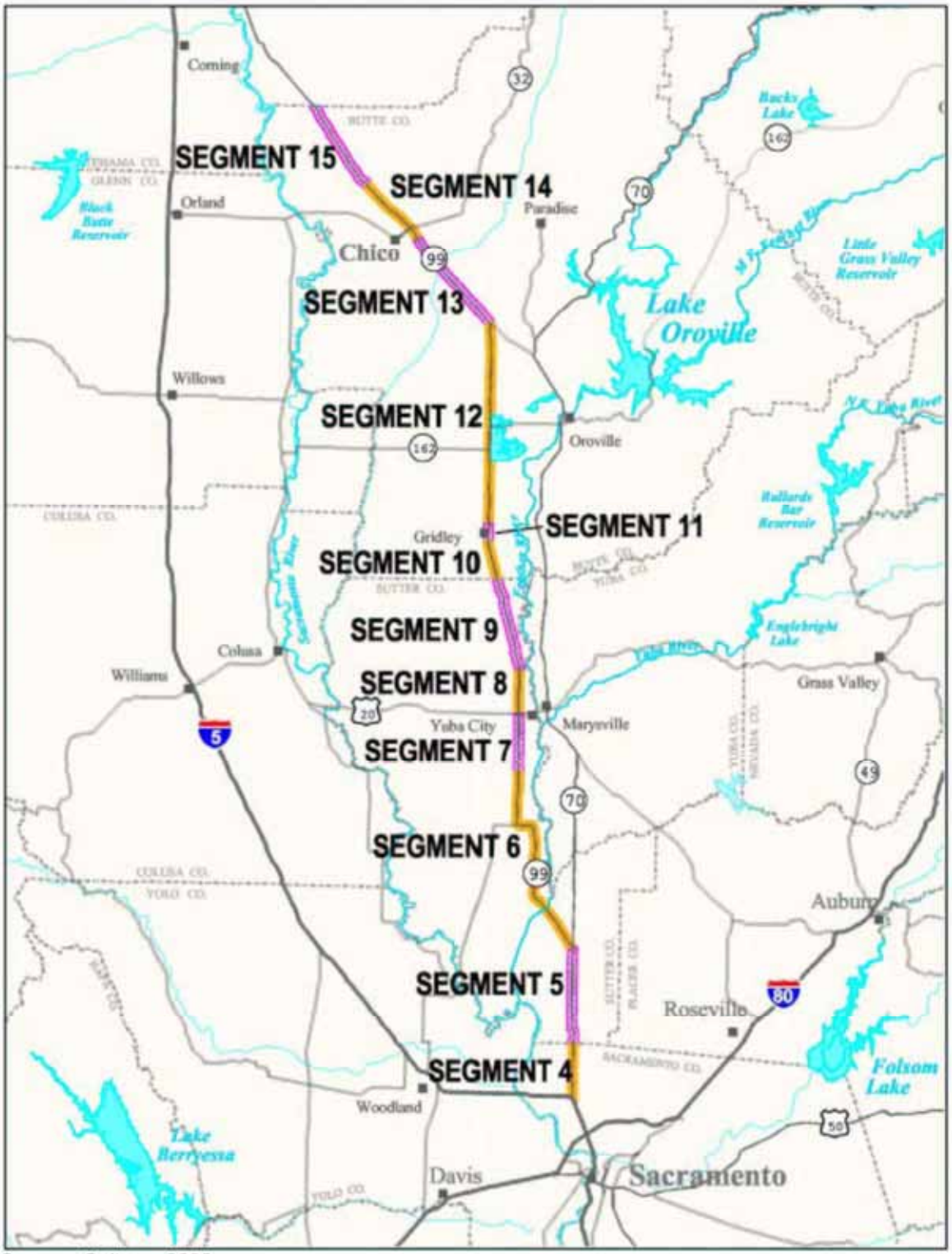


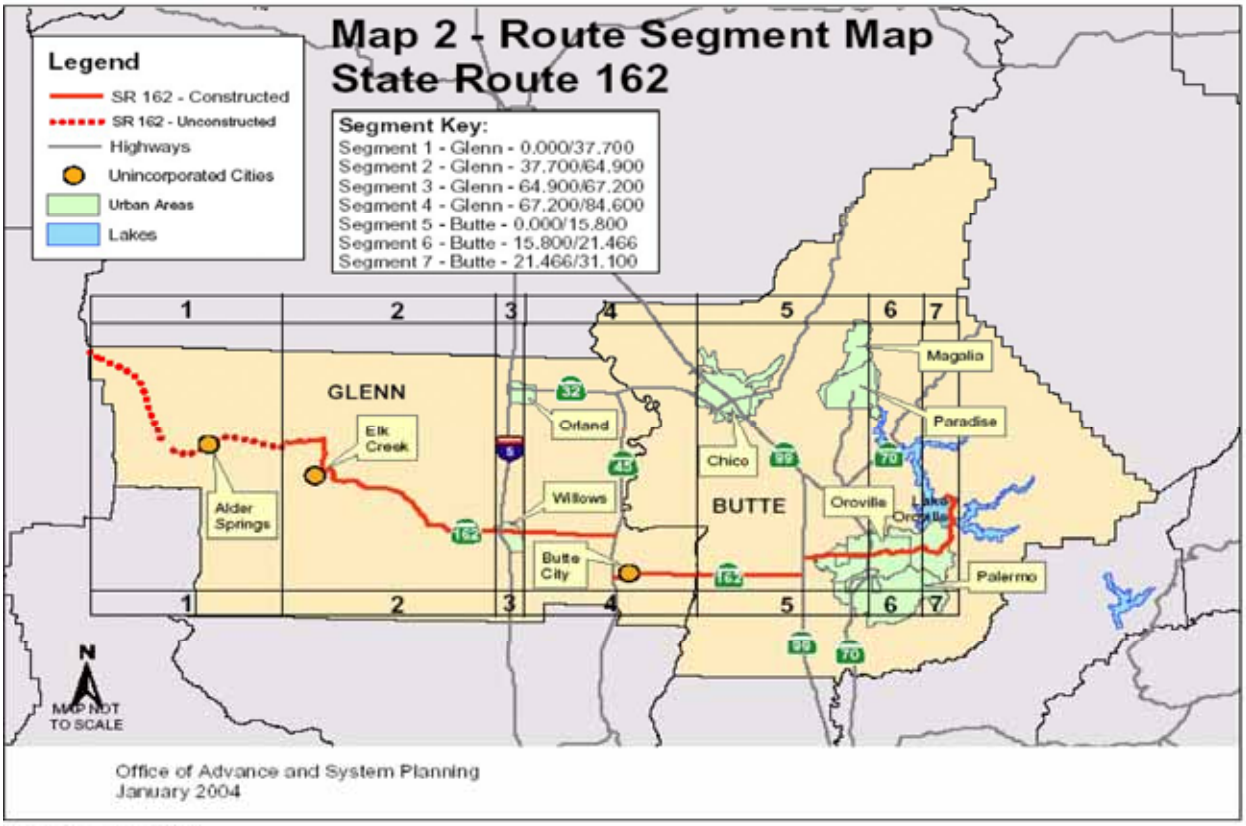
Source: Caltrans 2003

Figure 4.14-2. Road Segments on State Route 70.



Source: Caltrans 2003

Figure 4.14-3. Road segments on State Route 99.



Source: Caltrans 2004.

Figure 4.14-4. Road segments on State Route 162.

Oroville Dam Boulevard/Oroville Dam Boulevard East connects central Oroville with Oroville Dam. West of Olive Highway, this road is designated as SR 162. Canyon Drive provides access between SR 162 and Oroville Dam. Traffic on the road and highway network in and near the Oroville Facilities is normally free-flowing with little congestion, and roads are in generally good to adequate condition.

Recreation visitation at the Oroville Facilities results in traffic on local roadways. Traffic levels in the Oroville area are generally low; however, recreation use during peak holiday periods can result in short-term traffic congestion, particularly near the marinas and high-use recreation areas and parking lots.

The highest use areas include Bidwell Canyon, Lime Saddle, North Thermalito Forebay, Loafer Creek, Lake Oroville Visitors Center, and Spillway Day Use Area (DUA). The majority of heavy traffic is associated with recreational use of these areas. Many of the recreational visitors' cars and trucks tow boat trailers, which can affect traffic conditions, and many of the roads that lead to the high-use sites pass through residential neighborhoods and commercial areas in and around the City of Oroville.

A vehicular access study for the Oroville Facilities Relicensing (part of SP-R1, Vehicular Access Study (DWR 2003)) was prepared by DWR. That study provides detailed

information regarding recreational access to the project area, including number of visitors to particular areas of the project area, and road conditions.

4.14.2.5 Air Access

In addition to the regional roadways described above, the Oroville Airport is 3 miles southwest of the City of Oroville and is accessible from SR 162. The airport maintains two runways and air traffic averages approximately 99 arrivals/departures per day (AirNav Website).

The Lake Oroville Landing Area Seaplane Base is 5 miles northeast of the City of Oroville with a 9,000-foot-diameter circular landing zone in the center of the lake. Seaplane operations at the Lake Oroville Landing Area Seaplane Base average approximately 25 arrivals/departures per year (AirNav Website).

4.14.3 Existing Traffic Volumes/Levels of Service

4.14.3.1 State Highways

Table 4.14-1 lists ranges of AADT volumes reported by Caltrans for the state routes in Butte County, while LOS reported in the Transportation Concept Reports (TCR) for these routes is presented in Table 4.14-2.

Level of Service is a quantitative measure of the quality of traffic flow roads or through intersections. Levels of service are assigned letter designations, with LOS A representing the best operating conditions, smooth traffic flow, and LOS F the worst with traffic at a standstill. Two-lane highways can be rated lower, because they present problems for passing if congestion is present. Congestion can be created by just a few slow-moving vehicles when passing becomes difficult or dangerous on a two-lane highway.

AADT on SR 70 in Sutter, Yuba, and Butte Counties ranges between 1,500 and 31,500 (Table 4.14-1). Table 4.14-2 identifies recent and projected LOS for segments of SR 70 in these counties. LOS on SR 70 ranges between A and E, with LOS in Butte County rated from A to E.

AADT on SR 99 in Sacramento, Sutter, and Butte Counties ranges between 10,900 and 75,000 (Table 4.14-1). Table 4.14-2 identifies recent and projected LOS for each segment of SR 99. LOS on SR 99 is rated from B to E in these counties. In Butte County, LOS is rated from A to E.

AADT on SR 162 ranges between 1,050 and 32,000 (Table 4.14-1). The current and projected LOS for each segment are listed in Table 4.14-2. In Butte County, LOS is rated B and E.

Traffic on the road and highway network in and near the Oroville Facilities is normally free flowing with little congestion. Of the 24 segments of State Routes in the project area, 12 have LOS ratings of C or better. The main highway road segments

Table 4.14-1. Annual average daily traffic (AADT) on State Highways.

Route	From (postmile)	To (postmile)	2005 Annual Average Daily Traffic
SR 70	Yuba County line (0.00)	Beginning of Freeway south of Oroville (13.51)	12,100 to14,900
	Beginning of freeway South of Oroville	SR 162 (Oroville) (13.90)	14,900
	SR 162	Montgomery Street (Oroville) (14.61)	23,300
	Montgomery Street	Grand Avenue (Oroville) (15.43)	31,500
	Grand Avenue	Nelson Avenue (Oroville) (15.72)	23,600
	Nelson Avenue	End of Freeway (20.14)	21,600
	End Of Freeway	SR 149 (20.48)	21,600
	SR 149	SR 191 (21.87)	8,200
	SR 191	Plumas County line (48.08)	3,100 to 1,450
SR 99	Sutter County line (0.00)	Wilson Street (Gridley) (4.12)	16,400 to 19,200
	Wilson Street (Gridley)	Spruce Street (Gridley) (4.38)	23,100
	Spruce Street (Gridley)	SR 162 (east) (13.16)	15,100 to 10,900
	SR 162 (east)	SR 149 (21.81)	11,100
	SR 149	Begin Freeway (30.40)	25,500
	Begin Freeway	Skyway (Chico) (30.60)	34,000
	Skyway	East 20th St (Chico) (31.50)	52,000
	East 20th St	SR 32 (Chico) (32.45)	72,000
	SR 32	Cohassatt Hwy (Chico) (34.25)	75,000 to 61,000
	Cohassatt Hwy	East Avenue (Chico) (34.93)	42,500
	East Avenue	End of Freeway (37.32)	29,000 to 19,500
	End of Freeway	Tehama County Line (45.98)	19,500 to 11,900
SR 162	Glen County line (0.00)	SR 99 (Biggs) (9.73)	1,500 to 1,050
	SR 99 (9.73)	12th Street (Oroville) (14.96)	2,700 to 8,600
	12th Street	SR 70 (Oroville) (15.83)	13,200
	SR 70	Washington Ave (Oroville) (17.55)	32,000 to 30,500
	Washington Avenue	Lower Wyandotte Road (Oroville) (18.01)	29,000
	Lower Wyandotte Rd	Foothill Blvd (18.46)	20,900
	Foothill Blvd	Canyon Drive (21.26)	12,400 to 11,000
	Canyon Drive	Forbestown Road (24.19)	7,600 to 4,550
	Forbestown Road	Foreman Road (31.07)	1,850 to 1,500

Source: Caltrans Website 2006

Table 4.14-2. Level of service (LOS)[1] for road segments.

State Route 70					
Milepost	**County**	**Segment**	**2003 LOS**	**20 Year No-Build LOS**	**Concept LOS [2]**
0–0.3	Sutter	1	D	F	C
0–6.6	Yuba	2	D	F	C
6.6–13.9		3	C	F	D
13.9–15.9		4	C	F	D
15.9–25.8		5	D	F	D
0–13.5	Butte	6	E	F	D
13.5–20.5		7	A	B	B
20.5–28.1		8	D	D	C
28.1–33.1		9	A	A	C
33.1–18.1		10	D	D	E
State Route 99					
Milepost	**County**	**Segment**	**2000 LOS**	**20 Year No-Build LOS**	**Concept LOS**
32.1–36.9	Sacramento	4	C	F	E
0–8.9	Sutter	5	B	E	C
14.3–41.2		6	E	C	C
25.0–30.6		7	C	E	D
30.6–35.0		8	C	E	E
35.0–42.4		9	E	F	D
0–3.1	Butte	10	E	F	D
3.1–4.8		11	E	F	D
4.8–24.8		12	E	F	D
30.6–37.8		13	B	C	C
30.6–37.8		14	D	F	C
37.8–46.0		15	E	F	D
State Route 162					
Milepost	**County**	**Segment**	**Current LOS**	**20 Year No-Build LOS**	**Concept LOS**
37.7–64.9	Glenn	2	B	B	D
64.9–67.2		3	A	A	D
67.2–84.6		4	B	C	D
0–15.8	Butte	5	E	F	E
15.8–21.466		6	B	C	B

[1] *Level of Service ratings for two-lane highways: A = no delays, B = no delays, C = minimal delays, D = minimal delays, E = significant delays, F = considerable delays (Source: TRB 2000).*

[2] *Concept LOS is the goal that Caltrans has for various road segments. Implementation is based on prioritization of funding allocations and constraints.*

Sources: Caltrans Website 2003; pers. comm., Flournoy 2003

approaching Lake Oroville have impaired drivability. Caltrans plans to improve State Routes with regular congestion as budget allocations allow (pers. comm., Van Valen 2003). The *Interregional Transportation Strategic Plan* identifies the portion of SR 70 between its junction with SR 99 in Sutter County and SR 149 in Butte County (segments 1–7) as a "High-Emphasis Focus Route," which means it is one of Caltrans' highest priority routes for project planning and programming. The intent is to improve this portion of SR 70 to full freeway standard (Caltrans 2003).

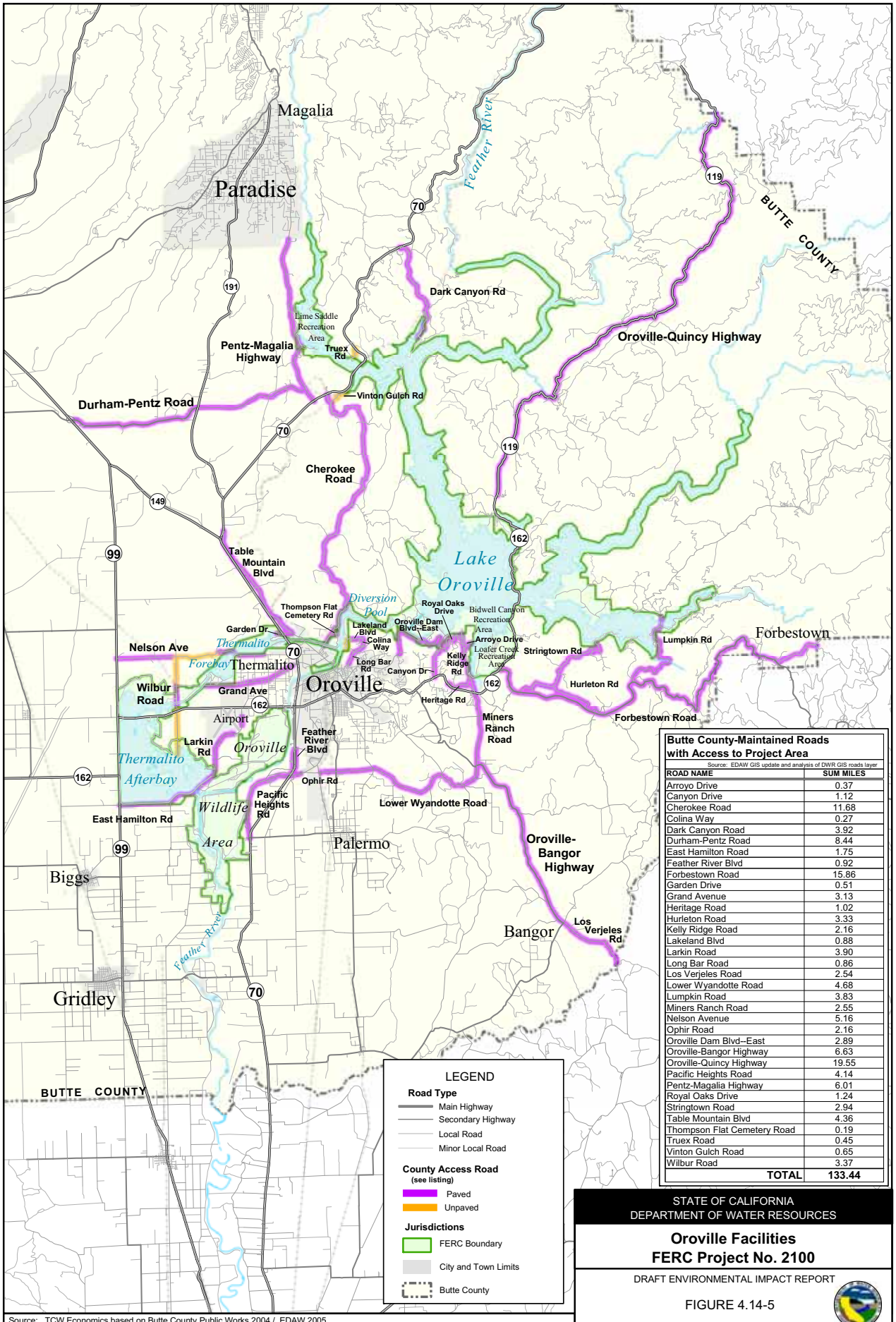
4.14.3.2 Butte County Roads

Butte County roads are used by visitors (i.e., non-residents of unincorporated Butte County) to access the Oroville Facilities. Although several of the roads heavily used by recreationists to reach popular recreation sites in the LOSRA are either State-maintained highways (e.g., SR 70, SR 162) or City of Oroville-maintained streets (e.g., Oroville Dam Boulevard, Montgomery Street), a number of County-maintained roads are also regularly or sometimes used to reach the Oroville Facilities. According to the Butte County Public Works Department (pers. comm., Crump 2003; Edell 2003), the roadway access shown in Figure 4.14-5 and summarized in Table 4.14-2 is used by visitors. Information relative to recreational access was provided in SP-R1, Vehicular Access Study (DWR 2003), for these roadway segments. More information related to these roads is provided in Section 4.14.4.1 below.

Table 4.14-3 identifies daily traffic volumes reported by local agencies for these roads. Data collected in 2006 is identified, along with volumes reported by Butte County for the year 2001, 2002, or 2003.

The Levels of Service occurring on Butte County Roads can be suggested based on generalized Level of Service thresholds contained in Regional Transportation Plan or the Butte County General Plan Circulation Element. Table CIR-8 of the General Plan suggests daily traffic volumes that can be accommodated on various roadways at specific Levels of Service. Two-lane surface streets are shown to accommodate up to 9,600 ADT at LOS A, 11,200 ADT at LOS B, and 12,800 ADT at LOS C. The Regional RTP categorizes Levels of Service based on peak hour traffic volume, but the peak hour methodology can be generally applied to daily volumes by conservatively assuming that 10% of the daily traffic occurs during the peak hour. RTP thresholds designate all traffic conditions as LOS C or better and do not make use of LOS A or B designations. The limit of the LOS C threshold is generally 9,000 ADT on two lane roads urban streets and 5,000 ADT on rural roads. In this DEIR, the RTP thresholds, which are lower, have been used to identify the current operating Level of Service on Butte County roads.

As noted in Table 4.14-3, all study area roads carry traffic volumes that are indicative of LOS C conditions.



Butte County-Maintained Roads with Access to Project Area

Source: EDAW GIS update and analysis of DWR GIS roads layer

ROAD NAME	SUM MILES
Arroyo Drive	0.37
Canyon Drive	1.12
Cherokee Road	11.68
Colina Way	0.27
Dark Canyon Road	3.92
Durham-Pentz Road	8.44
East Hamilton Road	1.75
Feather River Blvd	0.92
Forbestown Road	15.86
Garden Drive	0.51
Grand Avenue	3.13
Heritage Road	1.02
Hurleton Road	3.33
Kelly Ridge Road	2.16
Lakeland Blvd	0.88
Larkin Road	3.90
Long Bar Road	0.86
Los Verjeles Road	2.54
Lower Wyandotte Road	4.68
Lumpkin Road	3.83
Miners Ranch Road	2.55
Nelson Avenue	5.16
Ophir Road	2.16
Oroville Dam Blvd--East	2.89
Oroville-Bangor Highway	6.63
Oroville-Quincy Highway	19.55
Pacific Heights Road	4.14
Pentz-Magalia Highway	6.01
Royal Oaks Drive	1.24
Stringtown Road	2.94
Table Mountain Blvd	4.36
Thompson Flat Cemetery Road	0.19
Truex Road	0.45
Vinton Gulch Road	0.65
Wilbur Road	3.37
TOTAL	**133.44**

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Oroville Facilities
FERC Project No. 2100

DRAFT ENVIRONMENTAL IMPACT REPORT

FIGURE 4.14-5

County-Maintained Access Roads Serving Project Area

Prepared by: PJ -- EDAW, Inc.
Date 3/29/07
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Table 4.14-3. Traffic volumes on connecting roads.

Road	From	To	Daily Volume	Level of Service
Arroyo Drive			n.a.	-
Canyon Drive			3,199**	C
Cherokee Road	Oroville City limits	Burma Road	528**	C
Colina Way	Long Bar Road	Lakeland Blvd	n.a.	-
Dark Canyon Rd			n.a.	-
Durham Pentz Road			8,289 to 2,255*	C
Feather River Blvd	Outside of City limits		1,870**	C
Forbestown Road	Oroville Quincy Highway	Butte County line	2,978*	C
Garden Drive			1,484**	C
Grand Avenue	West of city limits		601**	C
East Hamilton Road			98**	C
Heritage Road			256*	C
Hurleton Road			426**	C
Kelly Ridge Road			2,187**	C
Lakeland Blvd			n.a.	-
Larkin Road	SR 162	East Hamilton Rd	2,828**	C
Lime Saddle Road			341**	C
Long Bar Road	City limits	Colina Way	930**	C
Los Verjeles Road	La Porte Road	Butte County line	996*	C
Lower Wyandotte Rd	Ophir Road	Oroville Bangor Highway	7,210*	C
Lumpkin Road	Forbestown Road	North shore of South Fork	649**	C
Miners Ranch Road			2,777*	C
Nelson Avenue	West of city limits		995**	C
Ophir Road	Beyond City limits		6,999*	C
Oroville Bangor Highway	Miners Ranch Road	La Porte Road	2,036*	C
Oroville Dam Blvd	East of Glen Drive		1,586**	C
Oroville Quincy Highway	East Fork Canyon Creek	County line	375*	C
Pacific Heights Road			1,101**	C
Pentz Magalia Road	Paradise limits	SR 70	1,653**	C
Royal Oaks Drive	Canyon Drive	Kelly Ridge Rd	1,211**	C
Table Mountain Blvd	Outside City of Oroville		n.a.	-
Thompson Flat Cemetery Road			n.a.	-
Truet Road			n.a.	-
Vinton Gulch Road			n.a.	-
Wibur Road			n.a.	-

*Sources: *BCAG 2006, **Butte County 2006*

LOS thresholds per 2004 Butte County Regional Transportation Plan (BCAG 2004).

4.14.4 Road Maintenance

Roads and highways in the vicinity of the project area are in generally good to adequate condition. Caltrans maintains State Routes and interstate highways in the area. Three major highways, SR 70, 99, and 162, provide transportation access to the Oroville Facilities area. Two major interstate highways—I-5 and I-80—connect to these three State Routes. Butte County and the City of Oroville maintain the majority of local roads used to reach the project area, including the area immediately surrounding the Lake Oroville State Recreation Area (LOSRA). DWR maintains the roads within the project area (i.e., the area within the project boundary) that are not encompassed within the LOSRA. DPR maintains roads within the LOSRA.

The following sections describe existing project-related road maintenance issues for local roadways, including those maintained by Butte County and the City of Oroville, based on information contained in SP-R19, Fiscal Impacts (DWR 2004b), prepared by DWR for the Oroville Facilities Relicensing.

4.14.4.1 Roads Maintained by Butte County

In 2003, the Butte County Public Works Department maintained about 1,355 miles of County roads within unincorporated areas of Butte County (pers. comm., Phillips 2003). The use of County roads by visitors (i.e., non-residents of unincorporated Butte County) to access the Oroville Facilities increases the County's need to regularly maintain these roads. Although several of the roads heavily used by recreationists to reach popular recreation sites in the LOSRA are either State-maintained highways (e.g., SR 70, SR 162) or City of Oroville-maintained streets (e.g., Oroville Dam Boulevard, Montgomery Street), a number of County-maintained roads are also regularly or sometimes used to reach the Oroville Facilities. According to the Butte County Public Works Department (pers. comm., Crump 2003; Edell 2003) and roadway access information provided by SP-R1, Vehicular Access (DWR 2003), the following roadway segments, shown in Figure 4.14-5, are used by visitors:

- Kelly Ridge Road;
- Oroville Dam Boulevard between Glen Drive and Powerhouse Road;
- Canyon Drive between Olive Highway and Oroville Dam Boulevard;
- Royal Oaks Drive between Canyon Drive and Kelly Ridge Road;
- Oroville Quincy Highway between East Fork Canyon Creek and the Butte County Line;
- Forbestown Road between Oroville Quincy Highway and the Butte County line;
- Lumpkin Road from Forbestown Road to the north shore of the South Fork Feather River arm of Lake Oroville;

- The portion of Ophir Road outside of the City of Oroville;
- Lower Wyandotte Road between Ophir Road and Oroville Bangor Highway;
- Miners Ranch Road;
- Oroville Bangor Highway between Miners Ranch Road and La Porte Road;
- Los Verjeles Road between La Port Road and the Butte County line;
- Pentz-Magalia Road south of the Paradise City Limits to SR 70;
- Durham Pentz Road;
- Vinton Gulch Road;
- Truet Road;
- Dark Canyon Road;
- Cherokee Road between the Oroville City Limits and Burma Road;
- Thompson Flat Cemetery Road;
- Long Bar Road between the Oroville City Limits and Colina Way;
- Colina Way between Long Bar Road and Lakeland Boulevard;
- Lakeland Boulevard;
- Nelson Avenue west of the Oroville City Limits;
- Wilbur Road;
- Grand Avenue west of the Oroville City Limits;
- Larkin Road between SR 162 and East Hamilton Road;
- East Hamilton Road;
- Pacific Heights Road;
- Arroyo Drive;
- Heritage Road;
- Garden Drive;
- The portion of Feather River Boulevard outside of the City of Oroville;
- Hurelton Road; and
- The portion of Table Mountain Boulevard outside of the City of Oroville.

These roadway segments total an estimated 133.4 miles (Figure 4.14-5). Additionally, according to Butte County's report, *Operational Impacts of the Oroville Facilities Project on Butte County* (Butte County Office of the Chief Administrative Officer 2006), 8 County-owned dirt and gravel roads totaling 30.3 miles are used exclusively by recreationists to access project facilities. However, FERC staff, as part of their analysis

of road maintenance effects in the FERC DEIS prepared for the Oroville Facilities Relicensing, concluded, based on their review of relevant information and a site visit, that only 1.5 miles of these roads are within the FERC Project boundary and that none of the roads are used exclusively by recreationists to access the Oroville Facilities.

In addition to roads listed above used by recreationists, Glenn Drive, is approximately a two-mile long road and connects Oroville Dam Boulevard to Oroville-Quincy Highway. Glenn Drive is regularly used by State employees and those conducting State business to reach DWR and DPR headquarter facilities. In addition to the State facilities, there are also numerous local residences either located on, or accessed from, Glenn Drive.

No data are available concerning the percentage of roadway use and wear that is associated with non-residents of unincorporated Butte County who visit the Oroville Facilities. (Recreationists who live in Butte County already use County roads, causing wear on roadways). Roadway use and wear, however, can be approximated based on consideration of roadway use by recreation visitors compared to use by the resident population of unincorporated Butte County. Based on recreation use estimates provided by SP-R9, Existing Recreation Use (DWR 2004a), non-residents of unincorporated Butte County (including residents of incorporated cities in the county) who visit the Oroville Facilities add, on average, an estimated 1,910 persons to the county's daily resident population, accounting for 0.9 percent of the countywide resident population and 2.0 percent of the unincorporated area's resident population. This increase in the area's population suggests that non-resident visitors account for about 0.9 to 2.0 percent of the maintenance needed for the roads used by non-resident recreationists. (Note that residents of incorporated cities in Butte County who recreate at the Oroville Facilities would likely travel into the unincorporated areas of Butte County and impact County roads even if they were not recreating at the Oroville Facilities; therefore, the inclusion of residents of the incorporated areas in the visitor estimates cited above likely overestimates the actual use of County roads attributable to visitation to the Oroville Facilities.)

4.14.4.2 Bridges and Roads Maintained by DWR or Other State Entity Partnering with DWR

DWR owns and maintains the structural portions of several bridges utilized by the public in Butte County, while Butte County or Caltrans maintains the decking portion (or roadway) of the bridges. Since 1995, DWR has expended $1.2 million on the following bridge structures:

- Recreation Access Road (Oroville Dam Spillway);
- SR 162 (Bidwell Bar Bridge);
- SR 162 (Canyon Creek Bridge);
- SR 162 (Thermalito Afterbay);
- SR 70 (Power Canal);
- SR 70 (West Branch Feather River);

- Lumpkin Road (Enterprise Bridge);
- Recreation Access Road;
- Cherokee Road;
- Table Mountain Boulevard;
- Nelson Avenue;
- Wilbur Road;
- Larkin Road; and
- Hamilton Road.

The following roads are maintained by DWR, DPR, or other State entity partnering with DWR at the Oroville Facilities:

- 1.8 miles of Oroville Dam Boulevard from Oroville Powerhouse Road to the upper Canyon Drive intersection with Oro Dam Boulevard;
- Canyon Drive between both upper and lower Royal Oaks Drive intersections;
- The roadway across the top of the Oroville Dam Crest Road;
- Roadways throughout the LOSRA;
- Car-top BR access roads at Vinton Gulch, Goat Ranch, and others;
- Paved boat ramp access roads at Monument Hill, Larkin Rd, and Thermalito Afterbay Outlet BR/DUA; and
- Thermalito Diversion Dam Access Road (south side of Feather River past Feather River Nature Center, access to Sewim Bo).

4.14.4.3 Roads Maintained by the City of Oroville

With the exception of SR 70 and SR 162, which are maintained by Caltrans, the Oroville Public Works Department maintains streets within Oroville's city limits. Maintenance activities include shoulder grading, pothole patching, crack sealing, chip sealing, and asphalt overlaying. Although Caltrans maintains SR 162, which includes a portion of Oroville Dam Boulevard and Olive Highway (two roadway segments heavily used by Lake Oroville recreationists), the City of Oroville maintains several other streets often used by recreationists and visitors to reach recreation sites, including the portion of Oroville Dam Boulevard between its intersections with Olive Highway and Glen Drive, Montgomery Street between SR 70 and Oroville Dam Boulevard, Nelson Avenue and Table Mountain Boulevard between SR 70 and Montgomery Street, Cherokee Road between Table Mountain Boulevard and the city limits, and the portion of Ophir Road within the city limits. Several other city streets, including 1st Avenue, 5th Avenue,

Feather River Boulevard, and Arlin Rhine Drive, are used to reach recreation sites along the Feather River (pers. comm., Boulant 2003; Gibbons 2003).

The Oroville Public Works Department maintained about 90 total miles of streets and roads during 2002 (Revenue & Cost Specialists 2002). The city-maintained streets and roads identified as being regularly used by recreationists total an estimated 9.8 miles. Visitors traveling to the Oroville Facilities account for an unknown portion of the use and wear on these streets and roads, but visitor use can be approximated based on the effect that out-of-town visitors have on the total population that regularly uses Oroville's streets. Based on Oroville Facilities recreation use estimates, non-resident visitors add an average of 1,900 persons to the city's resident population, accounting for an estimated 12.5 percent of the resident population of Oroville. Assuming that the average non-resident visitor generates the same amount of wear on roadways as an average resident, non-resident visitors to the Oroville Facilities account for about 12.5 percent of the maintenance required for the estimated 9.8 miles of city streets and roads used by visitors.

4.15 PUBLIC HEALTH AND SAFETY

This section addresses public safety issues in the Oroville Facilities Project area, including hazardous materials concerns that may be associated with operation of the Oroville Facilities.

4.15.1 Hazardous Materials

Hazardous materials are defined in Section 66260.10, Title 22, of the California Code of Regulations as:

> A substance or combination of substances which, because of its quantity, concentration, or physical, chemical, or infectious characteristics, may either (1) cause, or significantly contribute to, an increase in mortality or an increase in serious, irreversible, or incapacitating reversible, illness; or (2) pose a substantial present or potential hazard to human health or environment when improperly treated, stored, transported, or disposed of or otherwise managed.

Hazardous materials within the FERC Project boundary are managed through the coordination of federal, State, and Butte County laws, regulations, and programs. A thorough search of available environmental databases has indicated that there are 36 sites within the City of Oroville area. This search indicates where there is some type of hazardous materials information, whether it relates to existing underground storage tanks, aboveground storage tanks, hazardous materials handling, hazardous waste generation, or hazardous materials spill incidents. There appear to be no significant hazardous materials or waste issues within the FERC Project boundary. DWR conducts its hazardous materials and wastes management activities within the requirements of local, State, and federal laws and regulations.

4.15.2 Environmental Contamination

The Oroville Facilities support a wide variety of recreational opportunities. These opportunities include boating (several types), fishing (several types), fully developed and primitive camping (including boat-in and floating sites), picnicking, swimming, horseback riding, hiking, off-road bicycle riding, wildlife watching, and hunting. Contaminant accumulation in fish, sediment, and the aquatic food chain has been identified as an issue of concern. Contamination of fish from mercury and other metals and organic contaminants is a significant concern in many areas of California, including the Feather River watershed. Lake Oroville tributaries in the upper Feather River watershed experienced significant gold mining activity during the Gold Rush era and continue to experience recreational gold mining activity. Numerous large mercury mines were developed in the Coast Range to supply mercury as an amalgam for gold extraction in the Feather River and other areas. Mercury lost to the tributaries during gold mining operations is slowly being transported downstream with sediments. Although the Gold Rush era has long since passed, mercury still remains in the streams tributary to and in Lake Oroville.

Potentially occurring anoxic conditions beneath the sediment/water interface at the reservoir bottom create ideal conditions for biologically mediated liberation of methylmercury by sulfate-reducing bacteria. The redistribution of methylmercury in the water column during lake mixing in the fall and winter may facilitate bioaccumulation into the food web, including plankton, fish, and piscivorous birds and other animals, including humans. In addition, other industrial activities in the upper Feather River watershed have contributed metal and organic contaminants, including polychlorinated biphenyls (PCBs), which also have an affinity for sediments and bioaccumulate in the food web. Re-suspended sediments and recycled metals and organic contaminants in Lake Oroville can be transported downstream to other project waters, including the Diversion Pool, Thermalito Afterbay, Thermalito Forebay, Oroville Wildlife Area ponds, and the Feather River, where uptake and bioaccumulation in aquatic organisms can occur. Sediments trapped behind Oroville Dam potentially contain metals and organic contaminants, which may bioaccumulate in the food web.

In addition to the potential anoxic conditions, which create ideal conditions for the liberation of methylmercury, an algal bloom was reported on June 27, 2005. DWR staff investigated an algal bloom reported on Middle Fork Arm of Lake Oroville. The water level at the Merrimac station was fairly low and the amount of attached algae in the water at the site appeared to be very high. Staff boated up the Middle Fork Arm and reported seeing algae pushed by the wind against the shore near Nutmeg Creek. This algal mass eventually expanded so that by the time they reached the 90-degree turn at the north end of the arm, the entire waterway was covered.

The algae were identified as the blue-green algae (*Anabaena flos-aquae*). Blue-green algae are actually a type of bacteria called cyanobacteria that grow in water and are photosynthetic. Blooms occur when algae that are normally present begin to reproduce rapidly, typically a result of warm water and slow-moving waters that are rich in nutrients. Blue-green algae produce toxins that can affect the nervous system, liver, promote the development of tumors, or affect the gastrointestinal system. Upon evaluation, no booms were necessary to surround the algal bloom and the bloom dissipated within a few days.

Due to the potential risk to humans, associated with eating fish caught in the area and exposure to toxic blue-green algae, the presence of environmental contaminants in the FERC Project area could potentially be a public safety concern.

A discussion of the Proposed Project's effect on water quality is discussed in Section 4.2.2, Quality, in Section 4.2, Surface Water Quantity and Quality.

4.15.3 Oroville Facilities Hazards

FERC is the major federal regulatory agency responsible for regulating non-federal hydroelectric dams. As a part of relicensing, FERC requires that dam safety be addressed. Projects in operation are inspected to see that they are being properly maintained to assure the continued safety of the structures, that no unauthorized modifications have been made to the projects, and that the project is being operated

efficiently and safely. Furthermore, FERC oversees compliance with the terms of the license, including compliance with requirements related to environmental matters, public use, and safety. All constructed projects for which a license has been issued or an application is pending are subject to inspection. Each licensee has the responsibility to ensure that projects are operated and maintained in compliance with FERC regulations and the terms and conditions for any license, including conditions prescribed by resource agencies, and consistent with the requirements of Parts 8 and 12 of the FERC regulations. Normally, all high and significant-hazard-potential dams will be inspected once a year.

Also, the Division of Dam Safety and Inspections (a division of FERC) is responsible for making sure that licensed dams are constructed, operated, and maintained to protect life, health, and property.

DWR manages lands within the FERC Project boundary for the operation of the Oroville Facilities of the SWP, including the Oroville Dam, Lake Oroville, Hyatt Pumping-Generating Plant, Thermalito Pumping-Generating Plant, Thermalito Diversion Dam, Thermalito Diversion Dam Power Plant, Thermalito Forebay, Thermalito Afterbay, the Fish Barrier Dam, and the Thermalito Power Canal. DWR currently operates and manages the Oroville Facilities to maximize its benefit to the SWP, with the primary focus on water supply. The nature of operations at the Oroville Facilities necessitates the operation of a large amount of physical infrastructure that could present a safety hazard to visitors. DWR maintains infrastructure facilities in a manner designed to prevent injuries to persons who may encounter these facilities. The following features have been identified as potentially hazardous features, and all may have implications related to recreation safety:

- Spillways;
- Powerhouse intakes;
- Powerhouse tailrace areas;
- Spillway tailraces;
- Canals;
- Intake areas;
- Boat ramps;
- Natural channels;
- Substations and power lines;
- Bridges;
- Project structures;

- Natural and other hazards (submerged stumps, protruding rock structures, submerged structures); and

- Recreation areas.

4.15.4 Flood Management

Because of the region's proximity to several major watercourses, including the Feather River, flooding has historically been a major concern facing residents of the area. In response to concerns over flooding and the need for water supplies to serve increasing agricultural and population pressures, it was clear that a major water supply/flood control project was warranted in the Oroville area. In the 1950s the California Legislature approved development of the water resources of the Feather River watershed, including a dam near the City of Oroville.

The Oroville Facilities are an integral component of the flood management system for the Sacramento Valley. During the wintertime, the Oroville Facilities are operated under flood control requirements specified by the U.S. Army Corps of Engineers (USACE). Under these requirements, Lake Oroville is operated to maintain up to 750,000 acre-feet of storage space to allow for the capture of significant inflows. Flood control releases are based on the release schedule in the flood control diagram or the emergency spillway release diagram prepared by USACE, whichever requires the greater release. Decisions regarding such releases are made in consultation with USACE. The flood control requirements are an example of multiple use of reservoir space. When flood control space is not required to accomplish flood management objectives, the reservoir space can be used for storing water. From October through March, the maximum allowable storage limit (the point at which specific flood release would have to be made) varies from about 2.8 million acre-feet (maf) to 3.2 maf to ensure adequate space in Lake Oroville to handle flood flows. The actual encroachment demarcation is based on a wetness index, computed from accumulated basin precipitation. This allows higher levels in the reservoir when the prevailing hydrology is dry. When the wetness index is high in the basin (i.e., high potential runoff from the watershed above Lake Oroville), required flood control space is at its greatest to provide the necessary flood protection. From April through June, the maximum allowable storage limit is increased as the flooding potential decreases, which allows capture of the higher spring flows for use later in the year. During September, the maximum allowable storage decreases again to prepare for the next flood season. During flood events, actual storage may encroach temporarily into the flood reservation zone to prevent or minimize downstream flooding along the Feather River.

For more discussion of flood control issues, refer to Section 4.2.1.3, Flood Management, in Section 4.2, Surface Water Quantity and Quality.

4.15.5 Regional Health Facilities

Major health care providers in the area include Oroville Hospital in the City of Oroville and Enloe Hospital in Chico. Oroville Hospital has 130 physicians and a 24-hour

emergency room. It is the base hospital for all ambulance service in southern Butte County. Enloe Hospital in Chico is the largest hospital in the county and provides helicopter evacuation services for areas within 60 miles of Chico. The primary ambulance service is First Responder, and the response time is generally in the 15-minute range for the majority of the developed recreation sites. However, first response is often provided by a variety of agencies, including the Oroville Police Department, Butte County Sheriff's Office, Butte County Fire, DPR, the California Department of Forestry and Fire Protection, and the California Highway Patrol. Local helicopter evacuation (Enloe FlightCare) is provided through Enloe Hospital in Chico; once contacted, helicopter response time is about 10 minutes to the Oroville Facilities area.

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CHAPTER 5.0

ENVIRONMENTAL IMPACTS

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5.0 ENVIRONMENTAL IMPACTS

This chapter of the DEIR identifies potential environmental effects of the alternatives and the associated mitigation measures that avoid, reduce, or compensate for significant impacts. This introduction is intended to provide an overview of the impact methodology and terminology used in the following sections. Specific methodologies for identifying and describing impacts are included in the subsections for the following resource areas:

- Geology, Soils, and Paleontological Resources;
- Surface Water Quantity and Quality;
- Groundwater Quantity and Quality;
- Aquatic Resources;
- Terrestrial Resources (wildlife and botanical resources);
- Land Use;
- Recreational Resources;
- Cultural Resources;
- Population and Public Services (population and housing and public services);
- Environmental Justice;
- Aesthetic Resources (visual resources and noise);
- Air Quality;
- Agricultural Resources;
- Transportation and Traffic; and
- Public Health and Safety (hazardous waste, emergency response, wildland fire).

5.0.1 Program Level versus Project Level

This DEIR evaluates actions included in the Proposed Project and the FERC Staff Alternative at both a program level and project level of impact analysis. Program-level evaluations are conducted on actions that either are more “global” in scale and may occur areawide, or are those actions that were specified in the SA to be developed to a fuller level of detail through the new license implementation period and therefore lack sufficient detail regarding the location, method, or timing of action to support a project-level of analysis. The program-level analyses are intended to fully disclose and

evaluate what is currently known regarding the Proposed Project and FERC Staff Alternative for these actions. Program-level evaluated actions would also be subject to subsequent project-level environmental analysis prior to implementation or construction. As an example, although several potential future facilities modifications are identified and described in the SA, the SA specifies that these (and potentially other future identified alternative facilities modifications) would be further refined and developed in a future Feasibility Study. This DEIR evaluates the general characteristics of the potential future facilities modifications (as they are currently described in the SA) and their potential effects on environmental resources. Because the detailed design and operational characteristics of these (and potentially other) facilities are not yet defined, the analysis of these potential project actions were evaluated at a program level. Further, since the characteristics of these potential facilities modifications are not yet sufficient to support detailed modeling comparisons, scenarios that would include potential future facilities modifications are not included in the DEIR. Some limited modeling and comparisons of the initial new license operating period were conducted, but these alternatives comparisons were conducted at a program level of analysis (see Appendix E).

Many of the actions included in the SA (and therefore, in the Proposed Project and FERC Staff Alternative) would be further developed and refined in the course of the initial new license implementation period, in consultation with appropriate agencies and stakeholders. Most of these actions designed to further protect and enhance environmental resource conditions were evaluated in the DEIR at a program level unless details were included in the SA descriptions. Some of the articles included in the SA describe the development of plans and programs. Plan and program development do not, in and of themselves, typically result in environmental effects. Therefore, those plan and program development activities are not evaluated in this DEIR. See Table 5.0-1 for a list of SA articles and sections included in the Proposed Project and the FERC Staff Alternative that are not evaluated in the DEIR because they have no potential to affect on environmental resources.

5.0.2 Thresholds of Significance and Levels of Significance of Impacts

For each resource area, thresholds of significance are identified; these thresholds, based on the State CEQA Guidelines, are used to determine whether the alternatives would have a significant effect on that resource as compared to the Existing Conditions presented in Chapter 4.0.

Table 5.0-1. Settlement Agreement Articles and Sections included in the Proposed Project and/or the FERC Staff Alternative that are not evaluated in this Draft Environmental Impact Report.

SA Article or Section #	SA Article/Section Title
APPENDIX A	
A100	Ecological Committee
A101	Lower Feather River Habitat Improvement Plan
A109	Reservation of Section 18 Authority
A115	Oroville Wildlife Area Management Plan
A116	Oroville Wildlife Area Access
A130	Flood Control
A131	Early Warning System
A133	Project Boundary Modifications
A134	Expenditures
A135	Procedural Requirements
APPENDIX B	
B100	Project Supplemental Benefits Fund
B101	Feather River Whitewater Boating Opportunity Feasibility Study
B104	Feather River Fish Hatchery Funding
B105	Gravel Supplementation—Permitting related to A102
B106	Oroville Wildlife Management Plan
B108	Flow/Temperature to Support Anadromous Fish
B109	Riparian/Floodplain Screening Level Analysis
B110	Analysis of Non-Motorized Water Trail Shoreline Access
B111	Oroville Wildlife Area Funding
APPENDIX C	
Appendix C	Ecological Committee
APPENDIX D	
Appendix D	SWRCB Participation Statement
APPENDIX E	
Appendix E	Forest Service Draft 4(e) Conditions

Source: Settlement Agreement for Licensing of the Oroville Facilities FERC Project No. 2100, March 2006

In this DEIR, all impacts were evaluated based on the following categories:

- **No impact** indicates that the construction, operation, and maintenance of the project would not have any direct or indirect effects on the environment. It means no change from Existing Conditions. This impact level does not need mitigation.

- A **beneficial** effect is an impact that is considered to cause a positive change or improvement in the environment and for which no mitigation measures are required.

- A **less-than-significant impact** is an adverse impact that would not result in a substantial or potentially substantial adverse change in the physical environment. This impact level does not require mitigation, even if feasible, under CEQA.

- A **less-than-significant impact with mitigation** is a potentially significant adverse impact that would be reduced to less than significant levels with implementation of the identified mitigation measure.

- A **potentially significant impact** is an adverse impact that, if it were to occur, would be considered a significant impact as described above; however, the occurrence of the impact cannot be immediately determined with certainty. For CEQA purposes, a potentially significant impact is treated as if it were a significant impact.

- A **significant impact** is defined by State CEQA Guidelines Section 15382 as an adverse impact that would cause "a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project." Under CEQA, mitigation measures or alternatives to the proposed project must be provided, where feasible, to reduce the magnitude of significant impacts.

- A **significant and unavoidable impact** is an impact that would result in a substantial or potentially substantial adverse effect on the environment, and that could not be reduced to a less-than-significant level even with any feasible mitigation. Under CEQA, a project with significant and unavoidable impacts could proceed, but the lead agency would be required to prepare a "statement of overriding considerations" in accordance with State CEQA Guidelines Section 15093, explaining why the lead agency would proceed with the project in spite of the potential for significant impacts.

5.0.3 Mitigation

CEQA requires that feasible mitigation measures be discussed for all significant impacts to avoid or reduce significant adverse effects. Protection, mitigation, and enhancement (PM&E) measures are included in the SA as proposed license articles for FERC's consideration. As a result of the comprehensive scoping and stakeholder ALP

collaborative used for relicensing that included responsible agencies, the majority of SA articles are designed to address the environmental impacts of continued Oroville Facilities operations. The majority of identified impacts associated with implementation of the SA are short-term, construction related, and mitigated through the use of standard Best Management Practices described in Appendix D that are currently standard construction practices followed by DWR during routine operations and maintenance at the Oroville Facilities.

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5.1 GEOLOGY, SOILS, AND PALEONTOLOGICAL RESOURCES

5.1.1 Regulatory Setting

5.1.1.1 Federal Plans, Policies, Regulations, and Laws

Earthquake Hazards Reduction Act

In October 1977, the U.S. Congress passed the Earthquake Hazards Reduction Act to "reduce the risks to life and property from future earthquakes in the United States through the establishment and maintenance of an effective earthquake hazards and reduction program." To accomplish this, the Act established the National Earthquake Hazards Reduction Program (NEHRP). The National Earthquake Hazards Reduction Program Act (NEHRPA) significantly amended this program in November 1990 by refining the description of agency responsibilities, program goals, and objectives. The NEHRPA designates the Federal Emergency Management Agency as the lead agency of the program and assigns it several planning, coordinating, and reporting responsibilities. Other NEHRPA agencies include the National Institute of Standards and Technology, the National Science Foundation, and the U.S. Geological Survey (USGS).

Erosion and Water Quality

SWRCB and regional water quality control boards (RWQCBs) regulate discharges of waste to water through National Pollutant Discharge Elimination System (NPDES) permits, which are authorized under Section 402 of the federal Clean Water Act (CWA). The permits are issued for discharges to surface waters from such sources as stormwater runoff from general construction activities. The NPDES Construction Activities Storm Water General Permit applies to stormwater discharges associated with construction activity, including clearing, grading, excavation, and reconstruction of existing facilities that could disturb at least 1 acre of land. The NPDES permitting process and other regulatory requirements for the protection of water quality are described in Section 5.2.2.1, Surface Water Quality Regulatory Setting.

Erosion from construction activity would be regulated under the CWA.

Antiquities Act of 1906

Federal protection for significant paleontological resources would apply to the project if any construction or other related project impacts occurred on federally owned or managed lands. Federal legislative protection for paleontological resources stems from the Antiquities Act of 1906 (Public Law 59-209; 16 United States Code 431 et seq.; 34 Stat. 225), which calls for protection of historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest on federal land.

5.1.1.2 State Plans, Policies, Regulations, and Laws

California Seismic Hazards Mapping Act

The California Seismic Hazards Mapping Act of 1990 (Public Resources Code Sections 2690–2699.6) addresses seismic hazards other than surface rupture, such as liquefaction and induced landslides. The Seismic Hazards Mapping Act specifies that the lead agency for a project may withhold development permits until geologic or soils investigations are conducted for specific sites and mitigation measures are incorporated into plans to reduce hazards associated with seismicity and unstable soils.

Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act (Public Resources Code Section 2621 et seq.) was passed by the California Legislature to mitigate the hazard of surface faulting to structures. The act's main purpose is to prevent the construction of buildings used for human occupancy on the surface trace of active faults. The act addresses only the hazard of surface fault rupture and is not directed toward other earthquake hazards. Local agencies must regulate most development in fault zones established by the State Geologist. Before a project can be permitted in a designated Alquist-Priolo Earthquake Fault Zone, cities and counties must require a geologic investigation to demonstrate that proposed buildings would not be constructed across active faults.

California Public Resources Code—Archaeological, Paleontological, and Historical Sites

No State or local agency requires a paleontological collecting permit to allow for the recovery of fossil remains discovered as a result of construction-related earthmoving on State or private land in a project site. California Public Resources Code Chapter 1.7 (Archaeological, Paleontological, and Historical Sites), Section 5097.3, specifies that State agencies may undertake surveys, excavations, or other operations as necessary on State lands to preserve or record paleontological resources.

5.1.1.3 Local Plans, Policies, Regulations, and Laws

Butte County General Plan

The *Butte County General Plan* contains eleven separate documents or elements. Each element sets forth the County's adopted goals, objectives, policies and standards for various issues affecting Butte County. Together these elements make up the *Butte County General Plan.*

The Seismic Safety Element of the General Plan for Butte County carries with it the assumption that available data on seismic risk is described or referenced within the General Plan, and that new information will be added as it becomes known.

5.1.2 Impact Thresholds

The following thresholds are used to determine whether the alternatives would have a significant effect on geology, soils, or paleontological resources. There would be a significant impact if the alternatives would:

- 5.1-a: Result in substantial soil erosion or loss of topsoil, degradation of soils or farmland, or changes in the rate of siltation, deposition, or erosion that could modify channel morphology or habitat use;
- 5.1-b: Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving fault rupture, strong seismic ground shaking, seismic-related ground failure including liquefaction, or landslides related to a known earthquake fault as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist;
- 5.1-c: Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse;
- 5.1-d: Be located on expansive soil, as defined in the Uniform Building Code, creating substantial risks to life or property;
- 5.1-e: Result in the placement of septic tanks or alternative wastewater disposal systems on soils incapable of adequately supporting these systems where sewers are not available for the disposal of wastewater;
- 5.1-f: Result in the loss of a known mineral resource of value to the region and the residents of the State;
- 5.1-g: Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan; or
- 5.1-h: Directly or indirectly degrade a unique paleontological resource or site or compromise a significant paleontological site's scientific and educational values.

5.1.3 Method of Analysis

5.1.3.1 Geomorphic Processes Upstream of Oroville Dam

Potential impacts from the continued operation of the Oroville Facilities upstream of Oroville Dam were analyzed as part of the Environmental Work Group's Study Plan G-1 (SP-G1). The two primary tasks of SP-G1 were to assess channel resources (both above Lake Oroville and within the Fluctuation Zone) and determine the total sediment in storage by resurveying the existing reservoir cross sections and assessing other geomorphic conditions around the reservoir, such as slope stability, landslides, and bank erosion.

5.1.3.2 Geomorphic Processes Downstream of Oroville Dam

Effects of continued operations of the Oroville Facilities downstream of Oroville Dam were analyzed through the Environmental Work Group's SP-G2 reports.

The SP-G2 Task 2 report entitled Spawning Riffle Characteristics includes the methodology, results, and conclusions of a Chinook salmon spawning riffle quality evaluation. The riffle sampling and testing was performed by DWR Northern District Geology staff during the fall of 2002 and 2003. Riffle sampling data collected included surface and subsurface bed material, temperature, permeability, and dissolved oxygen. Riffles were sampled in the lower Feather River between Oroville and Honcut Creek.

Results from this study were used to identify ongoing channel changes and develop a comprehensive sediment management plan for the purposes of protection, mitigation, and enhancement measures to improve form and function in the Feather River. The study results were used by other studies to help assess the project's ongoing effects on downstream water quality, aquatic and riparian resources, and protection of private lands and public trust resources. (SP-G2 Task 3)

The first half of the SP-G2 Task 5 report focused on collecting existing survey, topographic, and photographic data. It also plotted channel locations for the years available on the atlas and the Geographic Information System (GIS). Changes in channel location, islands, multiple channel areas, levees, and riprap were delineated. The second half of the report focused on determining the effect of project operations on channel geomorphology. This was done by using geologic maps in conjunction with aerial photo interpretation to identify structural controls on river erosion and plan form. These aerial photos and old survey maps were used to establish the location of historic river channels and used to establish the extents of the meander belt. Available past cross-sectional data was also compared to those surveyed in Task 3 to determine changes in channel shape, form, and function caused by the dam. Finally, changes in depth, width, hydraulic radius, roughness, gradient, pool-riffle-run ratio, and other hydraulic parameters were determined. (SP-G2 Task 5)

The SP-G2 Task 6 geomorphic report compares historic and current conditions to help identify ongoing project effects to channel meander and bank erosion in the downstream reach defined in this study. This information was used by other studies to help assess the project's effects on plant, fish, animal, and riparian resources. This data, together with other study results, provided boundary conditions for assessing potential management actions.

Project-related structures and operations alter flow regimes, which can affect the occurrence of geomorphically significant flows. The Task 6 report addresses potential adverse effects from these flows, including changes in the rate of channel meander and bank erosion. (SP-G2 Task 6)

The SP-G2 Task 7 report contains information describing the modeling effort undertaken to determine ongoing and future changes in stream geomorphology and

sediment transport. Major items that required calibration included the roughness coefficient, sediment transport equation, and the bank erodibility factor. The model was run using a number of different sediment transport equations. The Engelund-Hansen equation was selected because the results most closely resembled sediment transport data measured by USGS (1978). The model was calibrated by comparing changes in surveyed cross sections between 1972 and 1997, and by comparing observed and calculated water-surface profiles. Hydrologic data from 1972 to 1997 were used for calibration. The model was then run to predict conditions 50 years in the future. Hydrologic data from 1997 to 2002, followed by 1967 to 2002, and 1967 to 1977, were used to model the 50-year changes. (SP-G2 Task 7)

5.1.3.3 Soils

The data for the Feather River soils within the 100-year floodplain, below Thermalito Diversion Dam, were gathered from various resources. Data for Yuba and Sutter Counties were collected form the Natural Resources Conservation Service, and the partial coverage of Butte County was supplied by the DWR Northern District wetlands survey project.

5.1.3.4 Paleontological Resources

Information presented in this section was derived primarily from *Paleontological Resources in the Vicinity of FERC Project 2100 [Oroville Reservoir and Lower Feather River]: Literature-based Inventory and Significance Assessment* (Hanson 2003). As the study title indicates, this is a primarily literature-based inventory prepared for the Oroville Facilities Relicensing. The presence of fossils and fossil-bearing geological formations within the study area was assessed in this study through professional examination of published and unpublished literature, examination of museum collections and associated records of fossil finds, and interviews with persons familiar with the geology and paleontology of the study area. Known fossil locations within the study area are documented in the study. The study also identifies geological formations that have produced fossils elsewhere, but for which there have not yet been any documented fossil finds within the project area.

General potential impacts were assessed on the basis of potential impact areas (identified on the basis of erosion modeling, areas with other sorts of project operational impacts, and plans for recreational development) and general sensitivity areas in terms of potentially important geological formations.

5.1.4 Impacts and Mitigation Measures

This DEIR analyzes the No-Project Alternative, the Proposed Project, and the FERC Staff Alternative including both programmatic and project-level analyses. Table 5.1-1 indicates the actions that could have an effect on geological resources, and whether these effects are expected to be beneficial, less-than-significant, or would be less-than-significant following implementation of recommended mitigation measures. Impacts on

Table 5.1-1. Environmental effects on geological resources.

Alternative(s)	Article # and Title	Level of CEQA Analysis	Nature of Potential Impact(s)	Effects
PRO, FERC	A102—Gravel Supplementation and Improvement Program (Also see B105)	Programmatic	Aid in geomorphic function; gravel recruitment	B
PRO, FERC	A104—Structural Habitat Supplementation and Improvement Program	Programmatic	Aid in geomorphic function; large woody debris recruitment	B
PRO, FERC	A106—Riparian and Floodplain Improvement Program	Programmatic	Aid in geomorphic function; floodplain connectivity	B
PRO, FERC	A122—Construction and Recharge of Brood Ponds	Project-Specific	Paleontology	LTSM
PRO, FERC	A127—Recreation Management Plan (trails, campgrounds, and facilities)	Project-Specific	Seismic hazards; paleontology	LTSM

Coding:

B = Action with potential to result in a beneficial effect; could involve short-term, less-than-significant, construction-related impacts that would be avoided or reduced through the use of best management practices (BMPs). See Appendix D.

LTS = Project that would result in less-than-significant impact on resource.

LTSM = Project that would result in less-than-significant impact on resource following mitigation.

geologic resources from implementing the FERC Staff Alternative are similar to those anticipated from implementation of the Proposed Project, unless noted. Potential impacts are identified as follows: NO (No-Project), PRO (Proposed Project), and FERC (FERC Staff Alternative).

The Proposed Project includes programs and agreements that would result in **beneficial** effects on the channel-forming geomorphic processes present in the dynamic Feather River system such as gravel supplementation and large woody debris (LWD) and boulder placement to increase channel complexity. The Habitat Expansion Agreement (SA Appendix F) could include restoration activities within river channels that could also help restore functionality.

DWR performed a reconnaissance study of potential future facility modifications as described in the Proposed Project (SA Section B108) designed to study ways to provide colder water to the lower Feather River for even greater protection and enhancement of beneficial uses. The reconnaissance study, conducted to address water temperature habitat needs for anadromous fisheries in the Low Flow Channel (LFC) and the High Flow Channel (HFC), was completed in December 2006 and identified a number of conceptual actions that would be further studied for feasibility, individually or in concert with one another. Any measures recommended for potential implementation as a result of the feasibility study would be subject to future CEQA analysis.

With the exception of the No-Project Alternative, alternatives analyzed would result in **less-than-significant** impacts on geologic resources with the implementation of best management practices (BMPs) included in both the Proposed Project and the FERC Staff Alternative and as described in Appendix D, to address short-term, construction-related impacts and no further mitigation would be required.

5.1.4.1 Program-Level Impacts and Mitigation Measures

With implementation of the No-Project Alternative, baseline conditions identified in Section 4.1.2, Environmental Setting, would continue into the future. In general, existing Oroville Facilities operations and maintenance activities would remain the same as under Existing Conditions. There would be, however, some effects on geologic, geomorphic, and soils-related resources within the study area due to continued existing operational activities. These include effects on flood damage reduction, channel morphology, and geomorphic function.

Several of the baseline incremental effects identified in the No-Project Alternative are addressed under the Proposed Project. These consist of various aspects of channel morphology and geomorphic function, including gravel recruitment, sediment transport, LWD recruitment, and channel complexity. The Proposed Project also addresses channel habitat abundance and diversity.

Impact 5.1-a: Result in substantial soil erosion or loss of topsoil, degradation of soils or farmland, or changes in the rate of siltation, deposition, or erosion that could modify channel morphology or habitat use.

NO

Regular intermediate flood flushing flows to maintain geomorphic function of the river and replenish fish and riparian habitats are generally rare. With implementation of the No-Project Alternative, there would continue to be an effect on the natural geomorphic processes (channel migration, floodplain renewal/interconnectivity, and point bar development) of the Feather River below Oroville Dam and this would be considered **potentially significant**.

Upstream gravel recruitment contribution continues to be blocked and results in continued changes to substrate quality and streambed armoring. This includes the incremental loss of sediment (particularly coarse sands and gravels) in the lower Feather River as a result of the continued blockage by the Oroville Facilities and other Upper Feather River hydroelectric projects, as indicated in the FLUVIAL-12 Sediment Transport Modeling (SP-G2, Task 7) and would be considered **potentially significant**.

Continued transport blockage to the lower Feather River of LWD contributed upstream of Oroville Dam results in continued incremental reduction in habitat quality and complexity in the lower Feather River described in Existing Conditions. LWD recruitment, which plays an important role in gravel retention and channel morphology, is limited in the LFC by the Oroville Facilities under the No-Project Alternative resulting in a **potentially significant** impact.

With the implementation of the No-Project Alternative, there would continue to be a **beneficial** effect because the reduction in natural, high-volume flow events (e.g., spring snowmelt runoff, winter flooding) has caused a significant reduction in channel erosion and property loss along the lower Feather River below Oroville Dam.

One of the primary functions of the Oroville Dam is to store winter and spring runoff, which has in turn altered the natural flow regime in the river below the dam. One of the results of a regulated flow regime is that there has been an increase in development and urbanization within the river's natural floodplain (both outside and inside levees). The attenuation of peak flood flows, which in the northern Sierra Nevada Geomorphic Province are typically associated with winter storms and spring snowmelt, has generally resulted in decreased rates of bank erosion and a reduction on the rate of channel migration. (SP-G2, Tasks 5 and 7) While there has continued to be incremental sediment loss in the lower

Feather River (discussed above), the results of the operation of the Oroville Facilities have reduced the average rates of erosion, and therefore reduced overall property losses along the river. This is a **beneficial** effect.

PRO, FERC

The Structural Habitat Supplementation and Improvement Program (SA Article A104) would provide some floodplain renewal/interconnectivity and placement of LWD and boulders.

With the Gravel Supplementation and Improvement Program (SA Article A102), placement of gravel within the Feather River system downstream of Oroville Dam would address loss of geomorphic function resulting from the ongoing presence of the Oroville Facilities and would be **beneficial**.

With implementation of the Proposed Project, there would be **beneficial** effects on the natural geomorphic processes on the Feather River below Oroville Dam. These include increased gravel recruitment and sediment transport with the implementation of the Gravel Supplementation and Improvement Program.

The Proposed Project would improve LFC complexity and provide long-term **beneficial** effects through the Structural Habitat Supplementation and Improvement Program and the Riparian and Floodplain Improvement Program (SA Articles A104 and A106).

With respect to soil erosion and property loss, the Proposed Project and FERC Staff alternative are the same as the No Project.

Impacts of the Proposed Project Relative to Existing Conditions

The Gravel Supplementation and Improvement Program (SA Article A102) is designed to mitigate the effects of sediment trapping and flow management caused by Oroville Dam. The program proposes to directly place appropriate-sized spawning gravel directly on riffles that have become coarsened and armored.

The riffles in the LFC from the Fish Barrier Dam to Thermalito Afterbay Outlet can be accessed from DWR-owned land except for Bedrock Park Riffle in downtown Oroville. Access would be from levees and roadways that remain from activities that occurred during construction of Oroville Dam. Any undisturbed areas remaining after the extensive previous construction disturbance can be avoided. Sensitive areas of riparian vegetation, including elderberry shrubs, would also be avoided to the extent feasible.

Instream gravel placement would occur only during the approved timing windows for performing instream work to minimize disturbance to anadromous fish. Instream work would be performed using rubber-tired equipment to minimize the amount of

disturbance. Gravel would be washed to reduce the occurrence of fines. BMPs would be used to reduce the potential occurrence of hydrocarbon leaks and spills. See Appendix D for descriptions of BMPs that are included in the Proposed Project.

5.1.4.2 Project-Level Impacts and Mitigation Measures

This section addresses those specific proposed projects that would have geologic impacts as defined by the thresholds of significance section as required by CEQA.

Impact 5.1-a: Result in substantial soil erosion or loss of topsoil, degradation of soils or farmland, or changes in the rate of siltation, deposition, or erosion that could modify channel morphology or habitat use.

PRO, FERC

Specific projects that involve earth-moving actions would be susceptible to increased erosion. Areas that could be particularly susceptible to increased erosion are the Middle Fork and South Fork arms of Lake Oroville where soils developed on the underlying granitic bedrock; however, few activities are planned in these areas. Since these soils can be highly erodible, BMPs as described in Appendix D and part of both the Proposed Project and the FERC Staff Alternative, would be implemented to prevent or reduce:

- Erosion, removal, disturbance, and compaction or shifting of gravels in the Feather River channel downstream of the Fish Barrier Dam, except as appropriate for protection or improvement of fish habitat;
- Discharge of silt, petroleum hydrocarbons, and other harmful substances or debris into the Feather River;
- Construction of new facilities on or near areas prone to landsliding or highly erodible soils; and
- Changes to Oroville Facilities borrow areas (e.g., historic, current, and/or future gravel mining areas) that cause them to become sources of silt or other fines during floods or to dissipate stream maintenance flows or trap anadromous fish.

With the BMPs identified as part of the both the Proposed Project and the FERC Staff Alternative, the impacts from increased erosion would be **less-than-significant**.

Impact 5.1-b: Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving fault rupture, strong seismic ground shaking, seismic-related ground failure including liquefaction, or landslides related to a

known earthquake fault as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist.

NO, PRO, FERC The 1975 Oroville Earthquake occurred on the Cleveland Hills Fault. The surface rupture on this fault extended to about 3 miles south of Lake Oroville and is mapped under the Alquist-Priolo Act on the Bangor 7.5' Quadrangle. The linement along which the rupture occurred is mapped to the south end of the cove containing the Bidwell Marina. Although this area did not experience surface rupture, existing facilities and any facilities proposed under the Proposed Project and the FERC Staff Alternative in this area could be subject to earthquake-generated rupture. This would be considered **potentially significant**.

Mitigation measure 5.1-b:

PRO, FERC Perform geologic investigation of any facilities proposed in the Bidwell Marina (SA Article A127) area to ensure adequate setback from possible lineaments associated with the active Cleveland Hills Fault. Implementation of Mitigation Measure 5.1-b would reduce the impact to **less-than-significant**.

Impact 5.1-c: Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse.

PRO, FERC The map of proposed facilities locations was superimposed with the landslide map prepared under the Environmental Work Group's SP-G1. None of the currently proposed facilities conflict with any known landslides. There should be **no impact** from landsliding.

Impact 5.1-d: Be located on expansive soil, as defined in the Uniform Building Code, creating substantial risks to life or property.

NO, PRO, FERC Expansive soils have not been identified in the project area.

Impact 5.1-e: Result in the placement of septic tanks or alternative wastewater disposal systems on soils incapable of adequately supporting these systems where sewers are not available for the disposal of wastewater.

NO,PRO, FERC No septic systems are proposed. There should be **no impact** from septic systems.

Impact 5.1-f: Result in the loss of a known mineral resource of value to the region and the residents of the State.

PRO, FERC The Gravel Supplementation and Improvement Program (SA Article A102) includes provisions for potential utilization of gravel/aggregate resources. There should be **no impact** on mineral resources statewide.

Impact 5.1-g: Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan.

PRO, FERC The Gravel Supplementation and Improvement Program (SA Article A102) includes provisions for potential utilization of gravel/aggregate resources. There should be **no impact** on the Mineral Resource Local Plan.

Impact 5.1-h: Directly or indirectly degrade a unique paleontological resource or site or compromise a significant paleontological site's scientific and educational values.

PRO, FERC There are three areas that could be sensitive to disturbance to paleontological resources. These are in the vicinity of Lime Saddle where the blocks of Calaveras Limestone in the mélange sequence are known to contain fossils; an area about halfway along the Diversion Pool that is crossed by an outcrop of the Monte del Oro Formation that is known to contain fossils; and the vicinity of Thermalito Forebay and Thermalito Afterbay that overlie the Laguna Formation that in other places is known to contain vertebrate fossils. Actions in the Proposed Project and the FERC Staff Alternative that are proposed for these areas (i.e. SA Article A122 and Article A127) could involve earth-moving activities with the potential to disturb paleontological resources and could result in a **potentially significant** impact.

Mitigation measure 5.1-h:

PRO, FERC Screen for the presence of fossils as plans are finalized for actions near known paleontological resources. If avoidance is not possible, have plans in place for the recovery/preservation of any fossils encountered. With screening and a recovery/preservation plan as described, any impacts would be reduced to **less-than-significant.**

5.2 SURFACE WATER

5.2.1 Surface Water Quantity

5.2.1.1 Regulatory Setting

As part of the relicensing process, DWR must comply with federal and State laws that are relevant to the relicensing of the Oroville Facilities. A summary of potentially relevant federal and State laws and regulations relating to surface water quantity is provided below.

Federal Plans, Policies, Regulations, and Laws

U.S. Army Corps of Engineers Flood Storage Requirements under the Flood Control Act of 1958 (Act of Congress, Public Law 85-500, 72 Stats. 297)

During fall, winter, and spring, the Oroville Facilities are operated under flood control requirements specified by the U.S. Army Corps of Engineers (USACE) in accordance with the provisions of the Flood Control Act of 1958. Under these requirements, Lake Oroville is operated to maintain up to 750,000 acre-feet (af) of flood storage space to allow for the capture of significant flood inflows.

Fish and Wildlife Coordination Act (16 United States Code 661 et seq.)

The purpose of this act is to recognize the contribution of fish and wildlife resources to the nation. The goal is to ensure that fish and wildlife conservation receives equal consideration and is coordinated with other features of water resources development programs. The statute provides that whenever the waters of any stream or other body of water are proposed to be impounded or diverted, or the channel deepened or otherwise controlled or modified, the responsible federal agency shall consult with USFWS and/or NMFS, as appropriate. DFG comments are also incorporated into the Fish and Wildlife Coordination Act report, which is then forwarded to the responsible agency.

Federal Power Act Section 10(j)

Under the provisions of Section 10(j) of the Federal Power Act (FPA), each hydroelectric license issued by FERC is required to include conditions for the protection, mitigation, and enhancement of fish and wildlife resources affected by the project as may be recommended by NMFS, USFWS, and DFG, to the extent that FERC determines that such recommendations are not inconsistent with the FPA. Compliance with the Fish and Wildlife Coordination Act is coordinated through the 10(j) recommendations.

Federal Endangered Species Act

Section 7 of the federal Endangered Species Act requires federal agencies to ensure that their actions are not likely to jeopardize the continued existence of endangered and threatened species or to cause destruction or adverse modification of the critical habitat of such species. FERC must consult with USFWS and NMFS under Section 7.

State Plans, Policies, Regulations, and Laws

California Fish and Game Code Section 1602 (Streambed Alteration)

Section 1602 of the California Fish and Game Code states that any entity proposing to substantially divert or obstruct the natural flow or alter streambed materials, channel, or bank in any river, stream, or lake must obtain a Lake and Streambed Alteration Agreement from DFG. The application requires a detailed description of the proposed project location and map, name and description of the river, stream, or lake affected by streamflow diversions, and copies of applicable local, State, or federal permits and/or other documents already issued.

California Fish and Game Code Section 5937 (Flows Below Dams)

Section 5937 of the California Fish and Game Code states that the owner of any dam must provide sufficient water at all times through a fishway, or in the absence of a fishway, allow sufficient water to pass over, around or through the dam, to keep any fish below the dam “in good condition.”

State Water Code

The Davis-Dolwig Act, California Water Code Section 11900, states that it is necessary for the general public health and welfare that preservation of fish and wildlife be provided for in connection with the construction of State water projects. It further declares that State facilities for the storage, conservation, or regulation of water must be constructed in a manner consistent with the full utilization of their potential for the enhancement of fish and wildlife and to meet recreational needs.

Water Code Section 1375 et seq. authorizes the SWRCB to issue water rights permits and licenses. The SWRCB has issued four water rights permits to DWR covering the operation of the Oroville Facilities: (a) Two permits, P-16477 and P-16480, allow the use of up to 11,000 cubic feet per second (cfs) of direct diversion and up to 3,880,000 acre-feet per year diversion to storage for power generation at the Oroville Facilities, including incidental recreation and fish and wildlife enhancement; and (b) two permits, P-16478 and P-16479, allow the use of the same quantities of water for consumptive use purposes.

State Water Project Statutes

Central Valley Project Act. In 1933, the California Legislature enacted, and the voters approved in a referendum, the State CVP Act (Water Code Section 11100 et seq.). The

State CVP Act provided for the implementation of a statewide water project in California's Central Valley. However, due to lack of funds available to the State during the Depression of the 1930s, the United States government built the federal CVP, which is operated by the U.S. Bureau of Reclamation. The State CVP Act, however, now governs the construction, operation, and administration of the subsequently constructed SWP, which gained its impetus from voter approval of the Burns-Porter Bond Act, discussed below.

Burns-Porter Bond Act. In the 1950s, the Legislature authorized construction of initial facilities of the SWP, commencing with construction of facilities in the Oroville area in 1957. However, it was the enactment by the Legislature and approval by the voters in 1960 of the Burns-Porter Bond Act (entitled the California Water Resources Development Bond Act, Water Code Sections 12930–12944) that provided major funding through the authorization of $1.75 million in general obligation bonds for construction of the initial features of the SWP. Since the late 1960s, DWR has also issued revenue bonds pursuant to authority contained in the State CVP Act to finance construction of additional SWP facilities. Both the Burns-Porter general obligation bonds and the CVP revenue bonds are repaid through SWP revenues.

5.2.1.2 Impact Thresholds

The following thresholds are used to determine whether the alternatives would have a significant effect on surface water quantity. There would be a significant impact if the alternatives would:

- 5.2.1-a: Substantially alter an existing drainage pattern of the site or area, including alteration of the course of a stream or river, or a substantial increase in the rate or amount of surface runoff in a manner that would result in flooding on- or off-site; or

- 5.2.1-b: Create or contribute to runoff water exceeding the capacity of existing or planned stormwater drainage systems or provision of substantial additional sources of polluted runoff.

5.2.1.3 Method of Analysis

During the course of the environmental studies for relicensing, extensive computer-based operations simulation modeling was performed. The models developed and methodologies used to simulate existing and future operations under a wide variety of assumed conditions are detailed in Volume III, Appendix C, of the PDEA. That appendix describes the analytical modeling tools and evaluation procedures that were used to support the PDEA and characterize project-related effects on reservoir and river hydrology, as well as other selected modeling tools that were used to assess environmental impacts. Since there would be no changes in net releases from the facilities or changes to future allocation patterns, the modeling results utilized in the PDEA are equally applicable to the No-Project, Proposed Project, and FERC Staff Alternatives; therefore, no additional comparison is necessary. The hydrologic results

also served as important information for the evaluation of power production, flood management, water quality, fisheries, recreation, and economic impacts.

The following operation, temperature, and sediment models were used to perform the environmental analysis of the various alternatives included in the PDEA:

CALSIM II: Modeled the SWP and CVP using a monthly time step. Allowed for assessment of water supply impacts and provides operational constraints for the other operations models.

Local Operations (HYDROPS^{TM}): Modeled Oroville Facilities operations at an hourly time step with the goal of maximizing hydroelectric power production given input constraints.

Reservoir–River Temperature (WQRRS): Modeled temperatures in the Oroville–Thermalito Complex and in the Feather River, from the base of Oroville Dam extending downstream to its confluence with the Sacramento River.

Flow-Stage (HEC-RAS): Modeled channel geometry and flow resistance to develop flow-stage relationships along the Feather River from the base of Oroville Dam extending downstream to its confluence with the Sacramento River.

FLUVIAL-12: Modeled sediment movement in the Feather River to provide input to the analysis of scour and erosion within the river.

5.2.1.4 Impacts and Mitigation Measures

As stated in Chapter 3.0 of the PDEA that accompanied the FERC License Application, no modifications to project operations related to surface water flow ramping rates, water supply, or flood management were proposed for any of the alternatives evaluated (DWR 2005). The SA includes provisions for future increases in minimum flows and potential greater increases in flows for water temperature management in the Low Flow Channel (LFC) to support anadromous fish and other beneficial uses; however, it would not increase net facility releases in the Proposed Project. The No-Project Alternative and FERC Staff Alternative are consistent with future water supply allocations. The only changes to net facility releases are in response to future changes in allocations or release timing. These changes apply equally to the No-Project, Proposed Project, and FERC Staff Alternatives evaluated in the DEIR.

In addition to the Proposed Project, this DEIR analyzes the No-Project Alternative and the FERC Staff Alternative. All alternatives analyzed result in **no impacts** on surface water quantity.

Impact 5.2.1-a: Substantially Alter an Existing Drainage Pattern of the Site or Area, Including Alteration of the Course of a Stream or River, or a Substantial Increase in the Rate or Amount of Surface Runoff in a Manner that Would Result in Flooding On- or Off-Site.

There are no measures that have the potential to substantially alter an existing drainage pattern of the site or area, including alteration of the course of a stream or river, or a substantial increase in the rate or amount of surface runoff in a manner that would result in flooding on- or off-site, with the exception of the possibility for planned flooding of previously disconnected floodplain during implementation of the Riparian and Floodplain Improvement Program. However, no specific actions or locations have been identified for consideration for inclusion in this program.

Impact 5.2.1-b: Create or Contribute to Runoff Water Exceeding the Capacity of Existing or Planned Stormwater Drainage Systems or Provision of Substantial Additional Sources of Polluted Runoff.

There are no measures that have the potential to create or contribute to runoff water exceeding the capacity of existing or planned stormwater drainage systems or provision of substantial additional sources of polluted runoff. Most construction activities would occur at previously developed locations with adequate stormwater runoff drainage systems in place and would include Best Management Practices (BMPs) to control and contain construction-related runoff. New facilities to be built in previously undisturbed locations would include stormwater drainage systems consistent with State building standards. Trails would be planned to consider drainage and include stormwater drainage systems as necessary to avoid exceeding drainage system capacities and prevent substantial additional polluted runoff.

5.2.2 Surface Water Quality

5.2.2.1 Regulatory Setting

The quality of surface water resources in California is protected under various federal and State laws, including the federal Clean Water Act (CWA) and the State Porter-Cologne Water Quality Control Act (Porter-Cologne Act). The U.S. Environmental Protection Agency (USEPA) has authorized the SWRCB and the nine associated regional water quality control boards (RWQCBs) to administer all surface water quality regulations in California. Both USEPA and the SWRCB provide oversight, while the RWQCBs have primary responsibility for implementation and enforcement. The Central Valley RWQCB is responsible for enforcing these regulations in Butte County.

Federal Plans, Policies, Regulations, and Laws

Clean Water Act Section 303(d) Total Maximum Daily Load

Section 303(d) of the CWA establishes requirements for states to identify and prioritize water bodies that do not meet water quality standards. For these water quality–limited water bodies, states must calculate the total maximum daily load for the contaminants of concern, set an allowable mass loading level to achieve water quality standards, and adopt a plan of implementation within the applicable water quality management plan (40 Code of Federal Regulations [CFR] Sections 130.2 and 130.7).

Clean Water Act Section 402 NPDES Permit Compliance

The National Pollutant Discharge Elimination System (NDPES) permit system under Section 402 of the CWA applies to discharges of wastes to surface waters of the United States. Under California's Porter-Cologne Act, the SWRCB and associated RWQCBs regulate discharges of wastes to all waters of the State and land to protect both surface and groundwater. The most applicable NPDES permit for the anticipated activities associated with the Oroville Facilities is the Statewide stormwater permit for general construction activity (SWRCB Order 99-08-DWQ, as amended) that applies to all construction projects that disturb greater than 1 acre of land.

Clean Water Act Section 404 Dredge and Fill

Section 404 of the CWA requires a permit from the U.S. Army Corps of Engineers (USACE) before any activity that involves any discharge of dredged or fill material into "waters of the United States," including wetlands. Waters of the United States include navigable waters, interstate waters, all other waters where the use or degradation or destruction of the waters could affect interstate or foreign commerce, tributaries to any of these waters, and wetlands that meet any of these criteria or that are adjacent to any of these waters or their tributaries.

State Plans, Policies, Regulations, and Laws

Water Quality Certification

California Water Code Section 13160 authorizes the SWRCB to act as the State water pollution control agency for purposes of compliance with Section 401 of the federal CWA. Section 401 requires an applicant for a federal license or permit for an activity that may result in any discharge into navigable waters to provide to the licensing or permitting agency a certification from the State in which the discharge originates that any such discharge will comply with state water quality standards and other appropriate requirements. The SWRCB administers the Section 401 program for the purpose of obtaining a FERC hydroelectric license. Section 401 requires the SWRCB to find that there is a reasonable assurance that an activity will be conducted in a manner that will not violate applicable water quality standards and other appropriate requirements. "Water quality standards and other appropriate requirements" means the applicable provisions of CWA and any other appropriate requirements of State law. Water quality standards consist primarily of designated beneficial uses and the narrative and numerical water quality objectives that are necessary for attainment of the beneficial uses. Certification may be conditioned with other limitations to assure compliance with various CWA provisions.

Water Quality Control Plan and Applicable Water Quality Criteria

Pursuant to the Porter-Cologne Act, each RWQCB prepares and updates a water quality control plan (Basin Plan) every 3 years that identifies water quality protection policies and procedures. The Basin Plan describes the officially designated beneficial uses for specific surface water and groundwater resources and the enforceable water quality objectives necessary to protect those beneficial uses. The Basin Plan includes numerical and narrative water quality objectives for physical and chemical water quality constituents. Numerical objectives are set for temperature; dissolved oxygen (DO); turbidity; pH (i.e., acidity); total dissolved solids (TDS); electrical conductivity (EC); bacterial content; and various specific ions, trace metals, and synthetic organic compounds. Narrative objectives are set for parameters such as suspended solids, biostimulatory substances (e.g., nitrogen and phosphorus), oils and grease, color, taste, odor, and aquatic toxicity.

In addition, the California Toxics Rule (CTR) is a separate regulatory instrument that prescribes criteria for trace metals and organic compounds for the protection of aquatic life and human health. Federal and state drinking-water quality standards regulate the quality of treated municipal drinking-water supplies delivered to users.

Basin Plan Objectives

In issuing its water quality certification, the SWRCB certifies that the project will comply with specified provisions of the CWA, including water quality standards that are developed pursuant to state law and in satisfaction of Section 303 of the Act (33 United States Code [USC] Section 1313). The Central Valley RWQCB has adopted, and the

SWRCB has approved, a Basin Plan for the Sacramento River and San Joaquin River Basins pursuant to State law and in satisfaction of Section 303 of the Clean Water Act (33 USC Section 1313), which requires the State to establish water quality standards (California Regional Water Quality Control Board, *Water Quality Control Plan for the Sacramento and San Joaquin River Basins*, Fourth Edition, September 1998, as amended). The Basin Plan consists of a designation or establishment for the waters within a specified area of beneficial uses to be protected, establishes water quality objectives to protect those uses, and sets forth an implementation program for achieving the objectives. The numeric and narrative water quality objectives are presented in Section 4.2.2, Table 4.2-3.

Operation of the Oroville Facilities also must reasonably comply with the *San Francisco Bay/Sacramento–San Joaquin Delta Estuary Basin Plan* (Bay-Delta Estuary Plan). The watershed of the San Francisco Bay/Sacramento–San Joaquin Delta (Bay-Delta) Estuary provides drinking water to two-thirds of California's population and water for a multitude of urban and other beneficial uses. Additionally, it supplies some of California's most productive agricultural areas, both inside and outside of the estuary. The Bay-Delta Estuary itself is one of the largest ecosystems for fish and wildlife habitat and production in the United States. However, historical and current human activities (e.g., water development, land use including Delta land reclamation for agriculture, wastewater discharges, introduced species, and harvesting), exacerbated by variations in natural conditions, have degraded the beneficial uses of the Bay-Delta Estuary, as evidenced by declines in populations of many biological resources of the estuary (Central Valley RWQCB 1998).

The Bay-Delta Estuary Plan provides one component of a comprehensive management package for the protection of the Estuary's beneficial uses that involves salinity (from saltwater intrusion and agricultural drainage) and water project operations (flows and diversions), as well as a dissolved oxygen objective. This plan supplements other water quality control plans adopted by the SWRCB and RWQCBs, and State policies for water quality control adopted by the SWRCB, relevant to the Bay-Delta Estuary watershed. These other plans and policies establish water quality standards and requirements for parameters such as toxic chemicals, bacterial contamination, and other factors with the potential to impair beneficial uses or cause nuisance.

State Water Resources Control Board Decision 1641

The Bay-Delta Estuary Plan contains the current water quality objectives for the Bay-Delta Estuary. SWRCB Decision 1641 (D-1641) outlines the current water right requirements to implement the Bay-Delta water quality objectives. In D-1641, the SWRCB assigned responsibilities to the Bureau of Reclamation and DWR for meeting these requirements on an interim basis. These responsibilities required that the CVP and SWP be operated to meet water quality objectives in the Delta, pending a water rights hearing to allocate the obligation to meet the water quality and flow-dependent objectives among all users of the Sacramento and San Joaquin River Basin waters with water rights assigned after 1914. *The San Joaquin River Agreement* and *Sacramento Valley Water Management Agreement* (Phase 8) are settlements between DWR and

the U.S. Bureau of Reclamation with water users upstream of the Delta in which the CVP and SWP will continue to meet the D-1641 water quality requirements. Therefore, the water rights hearing to allocate that responsibility was no longer needed and the hearing was dismissed.

Basin Plan Beneficial Uses

The beneficial uses included within the Basin Plan for the Sacramento and San Joaquin River Basins for Lake Oroville are municipal and domestic supply, irrigation, power, contact recreation, non-contact recreation, warmwater habitat, coldwater habitat[1], warmwater spawning habitat, coldwater spawning habitat, and wildlife habitat. The beneficial uses for the Feather River from the Fish Barrier Dam to the Sacramento River are municipal and domestic supply, irrigation, contact recreation, canoeing and rafting, non-contact recreation, warmwater habitat, coldwater habitat, warmwater migration, coldwater migration, warmwater spawning habitat, coldwater spawning habitat, and wildlife habitat. Descriptions of these beneficial uses are provided in Section 4.2.2.

The Basin Plan states that the natural receiving water temperature of intrastate waters shall not be altered unless it can be demonstrated to the satisfaction of the Regional Water Board that such alteration in temperature does not adversely affect beneficial uses. Further, at no time or place shall the temperature of cold or warm intrastate waters be increased more than 5^{o}F above natural receiving water temperature.

Regulatory Guidance for Quality of Aquatic Sediment

There are no regulatory criteria pertaining to ambient concentrations of chemical constituents in aquatic sediments. However, if a project results in the removal of sediment, the material is subject to federal and State hazardous waste regulations, the RWQCB-designated waste classification program (Central Valley Regional Water Quality Control Board 1989), and applicable waste classification regulations described in California Code of Regulations (CCR) Title 22. The California Department of Health Services (DHS) administers the hazardous waste regulations pursuant to CCR Title 22. Title 22 (Division 4, Chapter 30) describes classification protocols, including lists of known compounds and waste testing requirements based on numerical concentration criteria.

The RWQCB administers the reuse of contaminated “nonhazardous” sediment for creation, enhancement, and restoration of wetlands. The wetland reuse criteria were developed in part based on Effects Range–Low (ER-L) and Effects Range–Median (ER-M) criteria originally developed by the National Oceanic and Atmospheric Administration (NOAA) (DWR 1995). The ER-L and ER-M criteria reflect the concentrations below which adverse biological effects may be expected to occur less than 10 percent of the time and less than 50 percent of the time, respectively. The RWQCB also considers disposal options with respect to USEPA’s established preliminary remediation goals

[1] Segments with both warmwater and coldwater beneficial use designations are considered cold water bodies for the application of water quality objectives.

(PRGs). PRGs are concentration values that have been established based on the risks to human health of wastes in soil material, using specific assumptions about receptor exposure. PRGs are guidance values only for acceptable constituent concentrations at industrial and residential sites; they are not legally binding enforcement criteria.

The RWQCB criteria specify allowable uses based on two categories:

- Use for wetland non-cover where exposure to the aquatic environment would be limited; and

- Use for wetland cover or levee construction where sediments would be exposed to the water.

Local Plans, Policies, Regulations, and Laws

The *Butte County General Plan* (1971, as amended) states "In the future, the agencies charged with the responsibility of reviewing the development of the County should review proposals on the basis of their potential for water use and wastewater disposal. Those projects which do not conform to the standards set by the SWRCB should not be approved until assurance can be given that the development will not have a detrimental effect on the water quality of the County. The County should adopt local ordinances consistent with existing State and Federal regulations for water quality and which relate to local land use policies."

5.2.2.2 Impact Thresholds

The following thresholds are used to determine whether the alternatives would have a significant effect on surface water quality. There would be a significant impact if the alternatives would:

- 5.2.2-a: Violate any water quality standards or waste discharge requirements;

- 5.2.2-b: Substantially alter an existing drainage pattern of the site or area, including alteration of the course of a stream or river, in a manner that would result in substantial erosion, siltation on- or off-site; or

- 5.2.2-c: Otherwise substantially degrade water quality.

5.2.2.3 Method of Analysis

Potential impacts on water resources were assessed using both qualitative and quantitative methods. Baseline data for this assessment were collected during Oroville Facilities relicensing studies. These studies were developed in coordination with stakeholders, including the regulatory agencies. Detailed field investigations were conducted in accordance with standard methodologies recommended by the resource agencies, pertinent jurisdictions, or affiliations with oversight for the individual resource area. For detailed descriptions of Study Plan methodologies, please refer to each study

plan report. The following technical studies were conducted to address the specific water resource issues identified during relicensing scoping:

- Study Plan W1 (SP-W1), Project Effects on Water Quality Designated Beneficial Uses for Surface Waters;
- SP-W2, Contaminant Accumulation in Fish, Sediments, and the Aquatic Food Chain;
- SP-W3, Recreational Facilities and Operations Effects on Water Quality;
- SP-W5, Project Effects on Groundwater;
- SP-W6, Project Effects on Temperature Regime;
- SP-W7, Land and Watershed Management Effects on Water Quality; and
- SP-W9, Project Effects on Natural Protective Processes.

Extensive modeling of the Oroville Facilities operations was performed for the PDEA to evaluate effects on energy generation, Lake Oroville water levels, Feather River flows and water temperatures. The PDEA modeling analyses indicated that the PDEA Proposed Action would result in cooler water temperatures that would increase the protection and enhancement of beneficial aquatic uses over the Existing Conditions. The following analysis in Sections 5.2.2.6 and 5.2.2.7 demonstrates that the CEQA Proposed Project, when compared to the PDEA Proposed Action, is more protective and enhances water quality beneficial uses and aquatic resources. For a more in-depth discussion of the comparison between the PDEA Proposed Action, the CEQA Proposed Project, and the CEQA No-Project, see Appendix E.

As discussed in Section 4.2.2, Surface Water Quality Environmental Setting, current facility operations are reasonably protective of Basin Plan objectives. Section 5.2.2.5, Comparison of Alternatives to Basin Plan Beneficial Uses, provides a qualitative evaluation of the Proposed Project actions on each of the Basin Plan beneficial uses, both for the initial new license operating period and the post facilities modifications period.

DWR performed a reconnaissance study of potential future facility modifications as described in the Proposed Project (SA Section B108) designed to study ways to provide colder water to the lower Feather River for even greater protection and enhancement of beneficial uses. The reconnaissance study, conducted to address water temperature habitat needs for anadromous fisheries in the Low Flow Channel (LFC) and the High Flow Channel (HFC), was completed in December 2006 and identified a number of conceptual actions that would be further studied for feasibility, individually or in concert with one another. Any measures recommended for potential implementation as a result of the feasibility study would be subject to future CEQA analysis. Given the limitations of the specificity of the current descriptions of the potential facilities modifications in the SA and lack of design specifics or knowledge of the operational characteristics of any future

facilities modifications that would be required to support a modeling comparison, this EIR only evaluates what is currently known regarding these potential facilities modifications. The evaluation utilizes a qualitative approach to assess the general nature and relative magnitude of expected effects on surface water temperatures.

Because the FERC Staff Alternative has the same operating characteristics as the CEQA Proposed Project, the effects on water quality from the Proposed Project operations would be similar for the FERC Staff Alternative. The Proposed Project and FERC Staff Alternative were compared to the No-Project Alternative to determine the effect on water quality and beneficial uses.

The water quality analysis includes evaluation of the water quality impacts of implementing the programmatic and project-level provisions of the SA and compared the effects to the Existing Conditions. For each Proposed Project action, potential water quality impacts were identified. Impacts on surface water quality from implementing the FERC Staff Alternative are similar to those anticipated from implementation of the Proposed Project unless otherwise noted.

5.2.2.4 Overview of Operations Modeling

The following section provides an overview of the operations modeling conducted for analysis of environmental impacts. Technical details regarding modeling comparisons are documented in Appendix E. The PDEA analysis found that, in comparison to the Existing Conditions, the PDEA Proposed Action benefited coldwater beneficial uses and coldwater fisheries (see PDEA Chapter 5.4, Water Quality, and Chapter 5.5, Aquatic Resources). Since previous modeling analyses showed that the PDEA Proposed Action would result in increased beneficial effects over Existing Conditions, and the CEQA Proposed Project provides additional protection, no further quantitative analyses of modeling comparisons is necessary. The CEQA Proposed Project specifically protects and enhances beneficial uses of coldwater habitat; migration (cold and warmwater species); and spawning, identified as beneficial uses for Project waters in the Central Valley RWQCB Basin Plan objectives (see Section 4.2.2).

The CEQA Proposed Project water temperature targets at the Feather River Fish Hatchery (SA Article A107) and Robinson Riffle (SA Article A108) were developed to protect and enhance coldwater beneficial uses. They are either the same as or colder than those for the PDEA Proposed Action. The more protective water temperature targets at Robinson Riffle also would result in increased protection and enhancement of cold freshwater habitat conditions at the Project's lower Project Boundary relative to the Existing Conditions/No-Project Alternative as well as the Proposed Action from the PDEA. Construction and testing of the potential future facilities modifications may provide improved access to coldwater pool volume in Lake Oroville or improve "plumbing" of the Thermalito Complex to reduce water warming, thereby providing more protective water temperatures. After the future facilities modification testing period, Feather River Fish Hatchery water temperature requirements also may be revised to further protect coldwater resources. The potential effects of the selected facilities

modifications would be subject to detailed evaluation in a subsequent environmental document prior to construction.

Proposed Project Coldwater Pool Availability

The ability of the project to meet the initial new license period water temperature targets was analyzed by evaluating changes in two water temperature management factors. During those years when additional coldwater pool volume is accessible by the current facilities, the more protective water temperature targets of the Proposed Project during the initial new license period would result in additional coldwater fisheries benefits. During those years where no additional coldwater resources are available, the conditions achieved would still be enhanced compared to the Existing Conditions/No-Project Alternative due to the increased efficiency of use of the limited coldwater pool through improved coldwater pool conservation water temperature control actions (TCAs) included in the Proposed Project.

For the purposes of this analysis, the end of November concludes the water temperature management season because (1) water temperature exceedances have historically occurred in November but not December; (2) significant inflows resulting from precipitation events typically do not occur by the end of November; and (3) reservoir turnover typically occurs in December or later. Therefore, the month of November is most representative of the coldwater pool resource available to manage water temperatures downstream of Oroville Reservoir.

Qualitative evaluations of the nature of the potential surface water temperature effects of the alternatives are presented in Sections 5.2.2.6 and 5.2.2.7. Sections 5.4, Aquatic Resources, 5.5, Terrestrial Resources, 5.7, Recreational Resources, and 5.13, Agricultural Resources, utilize these qualitative evaluations of the nature of the effect of potential future facilities modifications on surface water temperatures in the LFC, HFC, and Thermalito Afterbay for their impact assessments.

5.2.2.5 Comparison of Alternatives to Existing Conditions and Basin Plan Beneficial Uses

Section 4.2.2.1 includes a description of Existing Conditions relative to designated Basin Plan beneficial uses. There would be no substantive difference between the Existing Conditions and the No-Project Alternative relative to Basin Plan beneficial uses.

The following section compares the Proposed Project with the designated Basin Plan beneficial uses for Lake Oroville and the downstream Feather River and describes how the Proposed Project would protect, enhance, or otherwise affect the beneficial uses. Impacts on Basin Plan beneficial uses resulting from implementation of the FERC Staff Alternative would be similar to those anticipated with implementation of the Proposed Project. This analysis assumes that the beneficial uses for the Diversion Pool, Thermalito Forebay and Thermalito Afterbay are consistent with those specified for “Lake Oroville” in the Basin Plan.

Lake Oroville, Diversion Pool, and Thermalito Forebay and Thermalito Afterbay

Municipal and Domestic Water Supply. One of the key provisions of the SA is to protect existing water supply uses. The SA was structured so as not to affect the SWP's ability to meet future water supply needs. That is, the Proposed Project would be capable of delivering (at the downstream FERC boundary) the same amount of water to the FRSA and the SWP that it can presently supply under its existing FERC License. Lake Oroville would continue to be used for the storage and release of water. Therefore the water supply beneficial use is protected by the Proposed Project.

Irrigation—Agriculture. The irrigation use of water stored in Lake Oroville and re-regulated in Thermalito Afterbay would continue to be protected through the Proposed Project. The Feasibility Study defined in the SA would consider the effects of implementing a potential future facility modification on the water temperatures in the LFC and HFC as well as Thermalito Afterbay. Potential effects on water temperature at the agricultural diversion points within Thermalito Afterbay would also be evaluated in this future study. These potential future facilities modifications would be subject to a subsequent environmental analysis and approval by FERC.

During the initial new license operating period and the post-facilities modification operating period, DWR would increase minimum instream flows below Thermalito Diversion Dam and make operational changes relative to Existing Conditions to manage water temperatures in the LFC to meet revised temperature targets at Robinson Riffle. Operational changes with the implementation of the new license actions affect water temperatures in the LFC and Thermalito Afterbay during the agricultural analysis period (May through July). Operational changes that would occur with the implementation of the initial new license operating actions that could affect water temperatures in the LFC and Thermalito Afterbay are (1) curtailing pumpback, (2) removing shutters at Hyatt, and (3) increasing flows in the LFC up to 1,500 cfs or the total flows into the HFC, whichever is less.

Based on SA Article A108, Table 1 water temperature targets, water temperature reductions of 2°F could occur at Robinson Riffle during portions of the agricultural analytical period (May through July). Specifically, Table 1 water temperature targets would be 2°F cooler than under Existing Conditions from June 1 through July 31. However, no water temperature targets exist under Existing Conditions for May. The Table 1 target under the Proposed Project for May 1 through May 15 increases from 56°F to 63°F, while the target for the remainder of May is the same as for June (i.e., 63°F). As such, it is likely that water temperatures at Robinson Riffle under the Proposed Project would be somewhat lower than under Existing Conditions during May. However, water temperature reductions at Robinson Riffle do not necessarily directly equate to water temperature changes of the same magnitude at the agricultural diversions within Thermalito Afterbay.

Under approximately 75 percent of conditions that occurred from May through July in 2001–2006, water temperatures at Robinson Riffle were more than 2°F cooler than the current water temperature requirements, as shown in Appendix E. These conditions

would also occur in the same proportions under the Proposed Project, with no water temperature changes needed to meet the Proposed Project water temperature objectives at Robinson Riffle relative to the Existing Conditions. Therefore, under these conditions no change in the source water temperatures for Thermalito Afterbay would occur. For almost all conditions, water temperatures under the Existing Condition at Robinson Riffle are somewhat cooler than the current water temperature requirements. These conditions would also occur in the Proposed Project with probable water temperature reductions of less than 2°F, resulting in less than a 2°F reduction in the source water temperatures for Thermalito Afterbay during May through July.

Increases in minimum flows in the LFC from 600 cubic feet per second (cfs) to 700 cfs during the rice water temperature analytical period with the implementation of the new license would increase the distance downstream that the same water temperatures are propagated as compared to the lower minimum flows under the Existing Condition. However, there would be no flow changes in the HFC under the new license period of the Proposed Project. To maintain the same net facilities releases in the HFC with increased flows in the LFC, Thermalito Afterbay release to the lower Feather River would be reduced accordingly. Therefore, the effective residence time of water in Thermalito Afterbay and the opportunity for water warming prior to diversion for agricultural uses would increase slightly from Existing Conditions, which would result in a contribution to increased water temperatures at the agricultural diversions. The increased minimum flows in the LFC also result in a reduction of the number and magnitude of TCAs required to meet Robinson Riffle Table 1 water temperature targets. Additionally, increased flows of up to 1,500 cfs or the total flows into the HFC, whichever is less, in the LFC for water temperature management are implemented with the initial new license operating period. Increasing LFC flows under the Proposed Project for Robinson Riffle water temperature management response, as opposed to the pulling of Hyatt intake stop logs as are utilized in the TCA sequence under the Existing Condition and No-Project, would lower the frequency and magnitude of source water temperature reductions for Thermalito Afterbay and subsequently Thermalito Afterbay agricultural diversions.

Reductions in water temperature targets of 2°F at Robinson Riffle would likely result in either no water temperature change or in the worst case scenario a less than 2°F reduction in water temperature at the agricultural diversions during the rice analytical period under the initial new license operating period as compared to the Existing Condition.

Operations associated with meeting the targets could differ between the initial new license period and after the completion of facilities modifications (see Section 3.3.2, Proposed Project, for a description of potential operational changes to meet water temperature objectives between the initial new license period and after potential future facilities modifications have been completed). Meeting new water temperature objectives at the Feather River Fish Hatchery or the southern FERC Project boundary (Table 2) could alter the temperature of water entering Thermalito Afterbay, the frequency, magnitude, and duration of water temperature changes would depend on which of the potential facility modification(s) (or potential combination of facilities) that

are selected for construction as well as the resulting water temperature objectives that are set after testing period of the potential new facilities. Any facilities modifications proposed for implementation would be subject to a subsequent environmental analysis and approval by FERC.

The exact nature of potential agricultural impacts associated with the future potential facilities modifications are currently unknown, but some potential impacts could be anticipated based upon the current descriptions of the potential facilities modifications. Following is a qualitative evaluation of the general characteristics of the potential facilities modifications as they are currently defined. This discussion of the potential future facilities modification as they are currently defined is intended to describe what is currently known about these potential future facility modifications included in the Proposed Project and provides a qualitative description of the general nature of the potential effects on agricultural beneficial uses. The details of the nature and interactions of these potential future facilities modifications would be evaluated and refined through the Feasibility study process described in SA Article A108 and would be subject to a subsequent environmental analysis. Each measure studied would have the potential to further enhance water temperatures in the LFC and/or HFC for coldwater fisheries management (i.e., reducing water temperatures during the spring and summer), which also could potentially affect water temperatures in Thermalito Afterbay and at the agricultural diversions during the rice analytical period (May through July).

Of the potential future facilities modifications described in Section 3.3, the Palermo Canal improvements, Hyatt Intake extension, and river valve replacement are designed to improve coldwater access. Under the Palermo Canal improvements, up to 500 cfs of deep, coldwater pool water would be released into the LFC. Because up to 500 cfs of colder water would be delivered directly to the LFC without significant mixing with the Hyatt releases, the water temperature of the Hyatt releases could remain the same or under some conditions even be increased while meeting the coldwater temperature objectives in the LFC and HFC. The releases from Hyatt would be the source water for Thermalito Afterbay and therefore, the implementation of a potential Palermo Canal facilities modification may result in either no change or potentially a beneficial change in water temperatures at Thermalito Afterbay agricultural diversions with respect to beneficial use water temperatures for agricultural irrigation for rice production.

The Hyatt Intake Extension and river valve replacement facilities modifications are also designed to allow more cold water to be released from Lake Oroville to meet downstream water temperature targets. Implementation of either of these potential future facilities modifications likely would result in cooler source water temperatures for Thermalito Afterbay and therefore, a reduction in the water temperatures at the agricultural diversions. However, for every 1°F reduction in Lake Oroville release water temperature, a less than 1°F change in Thermalito Afterbay water temperatures at the agricultural diversion would occur due to atmospheric warming and mixing within Thermalito Afterbay. As the difference between the water temperature and the ambient air temperature increases, the rate of heat gain in water temperature increases so, each incremental reduction in water temperature of 1°F, results in a less than 1°F reduction downstream.

Potential future Thermalito Afterbay modifications as defined in the SA include (1) constructing a bypass canal around the Thermalito Afterbay initiating downstream of the Thermalito Power Plant; (2) constructing a channel structure within the Thermalito Afterbay; (3) an alternate Thermalito Afterbay Channel and outlet; and (4) constructing a water temperature curtain structure to restrict inflow mixing until it nears Thermalito Afterbay Outlet. A complete description of each of the potential Thermalito Afterbay modifications and the conditions under which one of the modifications would be implemented is provided in Section 3.3.

Construction of a bypass canal would result in reduced volumes of water being released into Thermalito Afterbay under normal operating conditions. The only water released into Thermalito Afterbay would consist of peak flows above the bypass canal capacity or water required to meet the agricultural diversion demands. Construction of a bypass canal would result in an increase in the effective residence time of water within the Thermalito Afterbay, which would result in some increase in water temperatures in Thermalito Afterbay and at the agricultural diversions.

Construction of any channel structure within the Thermalito Afterbay Outlet or a water temperature curtain structure to limit inflow mixing until it nears the Afterbay Outlet would potentially increase the water temperatures at the agricultural diversions at the northern end of Thermalito Afterbay (i.e., Western Canal and Richvale Canal and Western Lateral) by channeling cold water from the power canal directly past these agricultural diversions. Thus, the northern agricultural diversions would be drawing water that had been residing in Thermalito Afterbay for substantially longer than water entering Thermalito Afterbay from the Thermalito Afterbay powerhouse tailrace. However, slightly colder water temperatures could occur at the agricultural diversion located in the southern portion of Thermalito Afterbay (i.e., Sutter Butte Main Canal) with construction of a channel structure in Thermalito Afterbay. A channel allowing water entering Thermalito Afterbay to move directly to the southern portion of Thermalito Afterbay would not allow as much warming opportunity prior to reaching the southern agricultural diversions, as with Existing Conditions or under the Proposed Project initial operating period.

Construction of an alternate Thermalito Afterbay Channel and Outlet would not affect the effective residence time of water within Thermalito Afterbay, and would therefore not affect water temperatures in Thermalito Afterbay or at the agricultural diversions.

Construction of a water temperature curtain structure or canal through Thermalito Afterbay could potentially increase water temperatures at the northern diversions under most conditions, but may decrease water temperatures at the southern diversions under some conditions and operations.

Regardless of which potential future facility modification involving Thermalito Afterbay is implemented by DWR in the future, these water temperature changes in Thermalito Afterbay could potentially improve water temperature conditions for the majority of rice acreage grown in the FRSA under most conditions. If the alternate Thermalito Afterbay

Outlet and channel is selected for implementation, it likely would not appreciably change water temperatures at the agricultural diversions in Thermalito Afterbay.

During the Proposed Project initial new license operating period, water temperature reductions of less than 2°F at the agricultural diversions in the worst case conditions (and no water temperature changes under other conditions) would not be expected to substantially decrease rice yield attributable to coldwater exposure, relative to Existing Conditions. The potential rice yield loss attributable to the reduction in water temperatures at Thermalito Afterbay agricultural diversions under the initial new license operating period would not be expected to result in any conversion of agricultural land. Additionally, the existing water supply reliability benefit to the FRSA, that would continue to accrue with implementation of the Proposed Project initial new license operating period, would have no adverse effect on agricultural beneficial uses or result in the conversion of farmland to other uses.

Implementation of the potential future facilities modifications under the Proposed Project may result in either beneficial or less-than-significant effects on agricultural—irrigation Basin Plan beneficial uses. These potential future facilities modifications would be subject to subsequent CEQA and NEPA environmental analysis to determine the relative benefits and impacts on agricultural resources and to develop appropriate mitigation measures prior to selection and approval by DWR and FERC.

Industry—Power. The Proposed Project would preserve most of the project's annual energy production. However, it would reduce the amount of energy historically produced by Thermalito Pumping-Generating Plant, and could reduce the amount produced at Hyatt Pumping-Generating Plant if cold water is released from Lake Oroville in a manner that bypasses Hyatt generating facilities.

In order to protect and improve coldwater habitat, coldwater migration, and coldwater spawning beneficial uses in the LFC and potentially farther downstream in the Feather River, DWR, under the Proposed Project, would release more water down the LFC relative to Existing Conditions. The increase in minimum LFC flows is more than can be used by the Diversion Dam Powerplant to generate power. The minimum flow increment above the Diversion Dam generation capacity represents a foregone power generation opportunity impact from the Proposed Project. Additionally, the incremental amount of water volume that can be passed through the Diversion Dam turbine has a smaller hydraulic drop than the Thermalito power plant, so there is an additional increment of power generation opportunity cost associated with the increase in minimum LFC flows from rerouting water that would have passed through the Thermalito power plant through the Diversion Dam power plant. The calculated power generation opportunity cost from the increased LFC minimum flows is approximately 11,000 megawatt-hours (MWh) per year on average. Potential future facilities modifications would be evaluated in a subsequent environmental document to determine the potential power generation effects prior to construction of any selected facilities modifications. Water released through the river valves represents a foregone power generation opportunity for the Hyatt power plant.

Recreation—Contact. The Proposed Project includes recreation facilities that would enhance water contact recreation opportunities at Lake Oroville, Thermalito Forebay, and Thermalito Afterbay. DWR would conduct a feasibility study of new swim facility options at the Loafer Creek Complex and other locations within the FERC Project boundary (e.g., Lime Saddle Complex, North Thermalito Forebay, see Table A-1 of SA Recreation Management Plan). The Loafer Creek site would receive priority, given existing swim opportunities at this location. If a feasible and cost-effective option is identified at this site by DWR, compared to other locations within the FERC Project boundary, it would be constructed and then operated during the swimming season. DWR would construct a new sandy beach and a new swimming buoy line at the Larkin Road car top boat ramp. DWR would operate and maintain project recreation features as specified in Section 7.2 of the SA Recreation Management Plan.

Under the Proposed Project, DWR would monitor water quality at key water contact recreation sites. SA Article A113 requires DWR to monitor fecal coliform, enterococcus bacteria, or other bacterial indicators as specified by the Basin Plan. Specific locations within the project boundary to be monitored include the North Thermalito Forebay recreation area, South Thermalito Forebay recreation area, Loafer Creek recreation area, Monument Hill recreation area, Lime Saddle recreation area, Foreman Creek boat launch area, Stringtown boat launch area, and Mile Long Pond. Should bacterial indicators as required by the Basin Plan exceed state standards for water contact recreation, DWR, in cooperation with State and local health officials would place notices informing the public that unsafe levels of bacteria are present in the water and educating the public on sanitary measures designed to prevent or minimize contamination of water. Should unsafe levels of bacteria persist, DWR, in coordination with California Department of Health Services and Butte County, would follow accepted practices for closure to protect the public.

As part of the Proposed Project, DWR in consultation with the Office of Environmental Health Hazard Assessment (OEHHA), SWRCB, Central Valley RWQCB, and Butte County Health Department would post notices at all boat ramps and any other location specified by OEHHA within the FERC Project boundary about health issues associated with consuming fish taken from within FERC Project waters (SA Article A114).

Also as part of the Proposed Project, DWR would implement a Comprehensive Water Quality Monitoring Program to monitor water quality parameters throughout the Project area including specific monitoring protocols for metals at 18–22 locations four times per year (SA Article 112).

Recreation—Other Non-contact. The Proposed Project would improve non-contact recreation opportunities at Lake Oroville through construction and operation of additional campgrounds, boat-in campgrounds and floating campsites, day use areas, boat ramps, and trails and trailheads. A complete description of the recreation improvements can be found in the SA RMP. The Proposed Project protects this beneficial use.

Freshwater Habitat—Warm Water.[2] The Proposed Project would continue to enhance aquatic habitats, riparian vegetation, and wildlife in and around Lake Oroville. SA Article A110 describes the Lake Oroville Warm Water Fishery Habitat Improvement Program. The Program is primarily directed at benefiting spawning and rearing of warmwater fishes in Lake Oroville.

Freshwater Habitat—Cold Water. The Proposed Project would enhance the coldwater fishery through expansion of existing habitat via construction of habitat structures and continued coldwater fish stocking. SA Article A111 describes the Lake Oroville Cold Water Fishery Improvement Program. DWR would provide for the stocking of 170,000 yearling salmon or equivalents per year, plus or minus 10 percent.

As discussed above under Irrigation—Agriculture, the SA identified potential future facility modifications. All of the potential future facilities modifications are designed to reduce water temperatures in the LFC and HFC of the lower Feather River and would benefit coldwater fisheries, particularly anadromous salmonids.

The Palermo Canal improvements, Hyatt Intake extension, and river valve improvement measures are each conceptualized to increase access to coldwater pool reserves in Lake Oroville. These measures for increased coldwater pool access are primarily designed to improve water temperatures at the Feather River Fish Hatchery and in the LFC from the Fish Barrier Dam downstream to Robinson Riffle. The volume of suitable cold water fisheries habitat that exists in the boundary layer between the epilimnion and the hypolimnion would not be expected to substantively change with increased utilization of cold water pool volume from the facility modifications. These measures also are intended to reduce water temperatures below Robinson Riffle in the LFC and to improve water temperature conditions in the HFC from the Thermalito Afterbay Outlet downstream to the lower Project Boundary. Both the river valve and the Hyatt intake extension measures would enable DWR to release cold water below the Oroville Dam into the Diversion Pool and reduce the water temperatures of the entire volume of water released from Lake Oroville. Cooling the entire volume of water released from Lake Oroville would reduce water temperatures in the Diversion Pool and Thermalito Forebay, benefiting those coldwater fisheries resources, and the Feather River Fish Hatchery water intake. The Palermo Canal improvements would release cold water at the intake for the Diversion Dam and minimize the mixing of the coldwater release with the water volume in the Diversion Pool prior to discharge to the lower Feather River. Therefore, the Palermo Canal improvements would not benefit the coldwater fisheries in the Diversion Pool or the Thermalito Forebay, but also would not reduce the quantity or quality of warmwater fisheries in the Thermalito Afterbay. The Feather River Fish Hatchery water supply intake would be provided by a portion of the Palermo Canal improvement facilities releases to blend with the Diversion Pool supplies to meet the hatchery water temperature requirements. The upper portion of the LFC would benefit from the release of cold water from the Palermo Canal as a result of improved water temperature suitability for coldwater fisheries. The remainder of the Palermo Canal

[2] Segments with both warmwater and coldwater beneficial use designations are considered cold water bodies for the application of water quality objectives.

improvement releases would be transported via pipeline for release at a location farther down the LFC to further enhance the quantity and quality of available coldwater fisheries habitat.

The Thermalito Afterbay measures included as potential future facility modifications are intended to complement the selected upstream coldwater pool access measure and primarily benefit water temperatures in the Feather River below the Thermalito Afterbay Outlet downstream to the lower Project Boundary, which is the Table 2 water temperature target location. The potential Thermalito Afterbay future facilities modifications would only affect the water temperature distribution of Thermalito Afterbay and not the other water bodies covered under the "Lake Oroville" designation of beneficial uses in the Basin Plan.

Of the potential Thermalito Afterbay future facilities modifications, the canal around the Thermalito Afterbay, canal through Thermalito Afterbay and Thermalito Afterbay water temperature curtain may result in warmer water temperatures in Thermalito Afterbay. The curtain measure would utilize a baffle (temperature curtain) to direct cold water through Thermalito Afterbay, thus allowing colder water to flow through the eastern portion of the Afterbay faster while increasing the residence time of warmer water utilized for agricultural diversions from the western side, which would result in some localized water temperature improvements in Thermalito Afterbay for coldwater fisheries. The alternative Thermalito Afterbay Outlet would not alter water temperatures directly in Thermalito Afterbay; therefore, implementation of this potential future facilities modification would not affect reservoir coldwater fisheries beneficial uses.

These potential future facilities modifications would be subject to subsequent CEQA environmental analyses, which would include a detailed analysis to determine the relative benefits and impacts on aquatic resources and to develop appropriate mitigation measures prior to selection and approval by DWR and FERC.

Spawning—Warm Water. The Proposed Project would enhance warmwater spawning and nursery area in Lake Oroville through the creation of habitat structures. The habitat structures are described in SA Article A110.

Of the potential Thermalito Afterbay future facilities modification measures, the canal around the Thermalito Afterbay, canal through the Thermalito Afterbay and the Thermalito Afterbay water temperature curtain may result in warmer water temperatures in Thermalito Afterbay. The canal in Thermalito Afterbay may reduce the water temperatures along the northern shore, depending on the specific facilities design, which would result in a water temperature reduction in the locations of the majority of the black bass spawning in Thermalito Afterbay which could potentially affect the sustainability of the Thermalito Afterbay warmwater fishery. These potential future facilities modifications would be subject to a subsequent environmental analysis and documentation, which would include a detailed analysis of potential effects on reservoir warmwater fisheries beneficial uses or prior to construction.

Spawning—Cold Water. Lake Oroville does not support salmonid spawning; therefore there would not likely be any change in coldwater fisheries spawning in Lake Oroville with the Proposed Project.

Wildlife Habitat. The Proposed Project would enhance wildlife habitat around Lake Oroville through a number of measures including an Invasive Plant Management Plan (SA Article A126) and actions such as SA Article A118, which would minimize disturbances to nesting bald eagles In the vicinity of Thermalito Afterbay and OWA, DWR would implement the following enhancements: Riparian and Floodplain Improvement Program (SA Article A106), Oroville Wildlife Area Management Plan (SA Article A115), Protection of Vernal Pools (SA Article A117), Construction of and Recharge of Brood Ponds (SA Article A122), Provision of Upland Food for Nesting Waterfowl (SA Article A123), Provision of Nest Cover for Upland Waterfowl (SA Article 124), and Installation of Wildlife Nesting Boxes (SA Article A125).

Feather River from Fish Barrier Dam to Sacramento River

Municipal and Domestic Water Supply. The Proposed Project would not result in any reduction in the protection of the municipal and domestic water supply beneficial uses in the Feather River between the Fish Barrier dam and the Sacramento River since there would be no changes to the volume of Feather River flows downstream of Thermalito Afterbay Outlet with the Proposed Project versus Existing Conditions.

Irrigation—Agriculture. Under the Proposed Project, water in the Feather River downstream of the Fish Barrier Dam would be colder than under Existing Conditions. Water temperatures in the lower Feather River warm progressively from Thermalito Afterbay Outlet downstream until the water temperature reaches a point of equilibrium with the ambient temperature conditions. The point of water temperature equilibrium moves upstream or downstream depending on the facility release water temperatures, flows, and the ambient temperature conditions. As a result of the water warming in the river and the distance from Thermalito Afterbay Outlet, very little water temperature change would be expected at Sunset Pumps even after implementation of any of the potential future facilities modifications. Therefore, little or no water temperature-related effects on agricultural irrigation beneficial uses for rice production would be expected to occur with the implementation of the Proposed Project initial new license operating period or after the potential future facilities modifications. These potential future facilities modifications would be subject to a subsequent environmental analysis to determine the relative benefits and impacts on agricultural resources and to develop appropriate mitigation measures prior to selection and approval by DWR and FERC.

Recreation—Contact. The Proposed Project would enhance contact recreation along the lower Feather River by providing additional facilities in this portion of the FERC Project Boundary. The SA RMP (SA Article A127) includes a fish-cleaning station at North Thermalito Forebay, new sandy beach at South Thermalito Forebay, swim buoys at Thermalito Afterbay, OWA improvements for overnight and day use, and Americans with Disabilities Act (ADA)-accessible fishing piers at the Diversion Pool and Thermalito Forebay, all of which are consistent with contact recreation Basin Plan objectives.

Recreation—Canoeing and Rafting. The Proposed Project would not affect flows downstream of Thermalito Afterbay Outlet. Therefore, rafting and canoeing opportunities would not be affected by the Proposed Project in the HFC. In the LFC, future monitoring and segregation weirs could affect canoeing and rafting; however, the design of the monitoring and segregation weirs is anticipated to minimize effects on canoeing and rafting. The higher flows in the LFC under SA Article A108 for temperature enhancements and during the Chinook spawning period may enhance canoeing and rafting during these periods.

Recreation—Other Non-contact. The Proposed Project would enhance non-contact recreation along the lower Feather River. DWR would provide funding to construct new non-motorized boater put-in/take-outs pending completion of an analysis of non-motorized water trail shoreline access (SA Section B110). Additionally, DWR would construct new developed tent and RV campsites within the OWA adjacent to the northern parking area and day use area.

Freshwater Habitat—Warm Water. The Proposed Project does not include improvements specific for warmwater species in the lower Feather River. However, elements of the Lower Feather River Habitat Improvement Program, as described in SA Article A103, would also benefit warmwater species (e.g. channel improvement, structural habitat supplementation and improvement, and riparian and floodplain improvement programs). Providing colder water in the LFC and downstream of the Thermalito Afterbay Outlet as described in SA Article A108 would likely have an adverse effect on the quality and quantity of suitable warmwater fisheries habitat. Even though it is anticipated that the Proposed Project water temperature improvements to benefit coldwater fish species would be expected to reduce the quantity and quality of warmwater fish species in the LFC and the upper portion of the HFC, the majority of the rest of the lower Feather River would continue to be suitable warmwater fisheries habitat. The reduction in warmwater fisheries habitat attributable to the implementation of the Proposed Project would not result in a substantial reduction in the overall amount of available and suitable habitat; therefore, the Proposed Project would continue to be reasonably protective of this beneficial use as designated by the Basin Plan.

Freshwater Habitat—Cold Water. The Proposed Project would have a substantial beneficial effect on coldwater habitat for Chinook salmon and steelhead in the lower Feather River. Coldwater habitat would be enhanced through increases in the minimum flow in the LFC from a current 600 cfs to a minimum flow of 800 cfs from September 9 through March 31 and 700 cfs during the remainder of the year. One of the key coldwater temperature enhancements would be to provide colder water in both the LFC and HFC. Per SA Article A108, DWR would implement TCAs to provide colder water in the LFC, such as curtailing pumpback operations, removing shutters on the Hyatt intake, and increasing flows in the LFC up to 1,500 cfs or the total flows into the HFC, whichever is less.

The potential future facilities modifications included in the Proposed Project are designed to reduce water temperatures even more in the LFC and HFC of the lower Feather River and will benefit coldwater fisheries, particularly anadromous salmonids.

The Palermo Canal improvements, Hyatt Intake extension, and river valve improvement measures are each conceptualized to increase access to coldwater pool reserves in Lake Oroville. These measures for increased coldwater pool access are primarily designed to improve water temperatures at the Feather River Fish Hatchery and in the LFC from the Fish Barrier Dam downstream to Robinson Riffle. These measures also are intended to reduce water temperatures below Robinson Riffle in the LFC and to improve water temperature conditions in the HFC from Thermalito Afterbay Outlet downstream to the FERC Project boundary. Both the river valve and the Hyatt intake extension measures would enable DWR to release cold water below Oroville Dam into the Diversion Pool and reduce the water temperatures of the entire volume of water released from Lake Oroville. Cooling the entire volume of water released from Lake Oroville would reduce water temperatures in the Diversion Pool, Thermalito Forebay, and the Feather River Fish Hatchery water intake, benefiting the coldwater fisheries resources in the lower Feather River downstream from the Fish Barrier Dam.

The Palermo Canal improvements would release cold water at the intake for the Diversion Dam and minimize the mixing of the coldwater release with the water volume in the Diversion Pool prior to discharge to the lower Feather River. The Feather River Fish Hatchery water supply intake would be fed by a blend of water released from the Palermo Canal improvement facilities and the Diversion Pool supplies to meet the hatchery water temperature requirements. The upper portion of the LFC would benefit from the Palermo Canal releases as a result of improved water temperature suitability for coldwater fisheries. The remainder of the Palermo Canal improvement releases would be transported via pipeline for release at a location farther down the LFC to further enhance the quantity and quality of available coldwater fisheries habitat. Palermo Canal release locations would be evaluated as part of future feasibility studies and subject to review and comment by the Ecological Committee. The increased biological benefits of these potential release locations are (1) increased spawning habitat suitability for the spawning areas at and immediately downstream of Robinson riffle, (2) the opportunity to utilize release water to create a side channel designed to benefit steelhead spawning and rearing (the most limited type of habitat in the lower Feather River), and (3) the ability to reduce localized high fishing pressure and poaching potential that could result from the creation of a coldwater refugium that could serve to prolong spring-run Chinook salmon holding. All of these improvements would result in power losses as water bypasses the turbines.

Of the potential Thermalito Afterbay facility modification measures, the canal around Thermalito Afterbay, canal through Thermalito Afterbay and the Thermalito Afterbay water temperature curtain may provide cooler water temperatures in the HFC during the spring and early summer but could under some conditions, occasionally result in warmer lower Feather River water temperatures in the late summer and fall. However, the Thermalito Afterbay Outlet extension releases water from Thermalito Afterbay downstream of the majority of coldwater fisheries spawning habitat in the HFC. By introducing the water from Thermalito Afterbay farther downstream, the water temperature reduction effect in the LFC would be allowed to continue further downstream before the Thermalito Afterbay discharge would be mixed with the cooler LFC water.

These potential future facilities modifications would be subject to a subsequent environmental analysis prior to implementation, which would include a subsequent analysis to determine the relative benefits and impacts on freshwater habitat resources and to develop appropriate mitigation measures prior to selection and approval by DWR and FERC.

Additional lower Feather River coldwater fisheries habitat improvements include a Gravel Supplementation and Improvement Program (SA Article A102), a Channel Improvement Program (SA Article A103), a Structural Habitat Supplementation and Improvement Program (SA Article A104), a Riparian and Floodplain Improvement Program (SA Article A106), and a Feather River Fish Hatchery Improvement Program (SA Article A107).

Migration—Warm Water.[3] The cooler waters in the upper portions of the lower Feather River could have some adverse impact on the migrations of warmwater species. Potential effects of the Proposed Project on "Freshwater Habitat—Warm Water" designated beneficial uses is discussed under "Migration—Warm Water" for the initial new license operating period. None of the Proposed Project potential future facilities modifications would be expected to result in the creation of a coldwater thermal barrier to warmwater fish species migration. The potential future facilities modifications would be subject to a subsequent environmental analysis prior to implementation, which would include a subsequent analysis to determine the relative benefits and impacts on warmwater migration and to develop appropriate mitigation measures prior to selection and approval by DWR and FERC.

Migration—Cold Water.[4] The water temperature management actions (see Freshwater Habitat—Cold Water above) under the Proposed Project would have a beneficial effect on the migration of steelhead and Chinook salmon. Steelhead immigrate and reside in the Feather River from September through about mid-April, with peak immigration occurring in October and November. Spring-run Chinook salmon immigrate and hold in the Feather River from March through October while fall-run Chinook salmon immigrate in the Feather River from about mid-July though September, with peak immigration occurring late October through early December. The Proposed Project would result in cooler lower Feather River water temperatures than under Existing Conditions during Chinook salmon immigration period and therefore provides greater enhancement and protection of Migration—Cold Water beneficial uses than the currently reasonably protective Existing Condition. Potential future structural modifications under SA Article A108 designed to further reduce water temperatures would likely further enhance the migration of Chinook salmon by enhancing the suitability of coldwater fisheries immigration water temperatures farther downstream in the lower Feather River. These potential future facilities modifications would be subject to a subsequent environmental analysis to determine the relative benefits and impacts on coldwater migration and to develop appropriate mitigation measures prior to selection and approval by DWR and FERC.

[3] Striped bass, sturgeon, and shad.
[4] Salmon and steelhead.

The Structural Habitat Supplementation and Improvement Program would enhance immigration and holding habitat quality for steelhead and Chinook salmon. The Structural Habitat Supplementation and Improvement Program and the Riparian Floodplain Improvement Program would both enhance habitat for emigrating juvenile steelhead and Chinook salmon.

Spawning—Warm Water. The cooler waters in the upper portions of the lower Feather River could have some adverse impact on the spawning of warmwater species. Discussion of potential effects of the Proposed Project on Freshwater Habitat—Warm Water beneficial uses encompasses the discussions for Spawning—Warm Water for the initial new license operating period. The potential future facilities modifications included in the Proposed Project would be subject to a subsequent environmental analysis to determine the relative benefits and impacts on warmwater spawning and to develop appropriate mitigation measures prior to selection and approval by DWR and FERC.

Spawning—Cold Water. Cooler waters in the lower Feather River that would result from the implementation of the Proposed Project would have beneficial effects on the spawning of coldwater fisheries species. The water temperature management actions and the increased flows during the spawning period of Chinook salmon and steelhead would improve spawning success for these species. Discussion of potential effects of the Proposed Project on Freshwater Habitat—Cold Water beneficial uses encompasses the discussions for Spawning—Cold Water for the initial new license operating period as well as for the potential future facilities modifications. The potential future facilities modifications included in the Proposed Project would be subject to a subsequent environmental analysis to determine the relative benefits and impacts on coldwater spawning and to develop appropriate mitigation measures prior to selection and approval by DWR and FERC.

The Gravel Supplementation and Improvement Program included in the Proposed Project would result in an enhancement of the quantity and quality of available suitable coldwater fisheries spawning habitat. Hence the Proposed Project would benefit salmon and steelhead spawning.

Wildlife Habitat. The Proposed Project is designed to benefit wildlife habitat along the Feather River. This would be accomplished through the Riparian and Floodplain Improvement Program (SA Article A106).

5.2.2.6 Program-Level Impacts and Mitigation Measures

The following section describes the beneficial effects and potentially adverse impacts of the Proposed Project, including both programmatic and project-level analyses. Table 5.2-1 indicates the SA articles or actions that could have an effect on surface water quality, and whether these effects are expected to be beneficial or less-than-significant following continued use of standard Best Management Practices (BMPs) as described in Appendix D.

Table 5.2-1. Environmental effects on surface water quality.

Alternative(s)	Article # and Title	Level of CEQA Analysis	Nature of Potential Impact(s)	Effect
PRO, FERC	A102—Gravel Supplementation and Improvement Program	Programmatic	Potential disturbance of stream bank and stream bottom with potential to adversely affect water quality during construction	B/LTS
PRO, FERC	A103—Channel Improvement Program	Programmatic with Project-specific actions	Potential disturbance of stream bank and stream bottom with potential to adversely affect water quality during construction	B/LTS
PRO, FERC	A104—Structural Habitat Supplementation and Improvement Program	Programmatic	Potential disturbance of stream bank and stream bottom with potential to adversely affect water quality during construction	B/LTS
PRO, FERC	A105—Fish Weir Program	Programmatic	Potential disturbance of stream bank and stream bottom with potential to adversely affect water quality during construction	B/LTS
PRO	A106—Riparian and Floodplain Improvement Program	Programmatic	Potential disturbance of floodplain and stream bank with potential to adversely affect water quality during construction	B/LTS
FERC	A106—Riparian and Floodplain Improvement Program (as revised by FERC Staff to accelerate schedule)	Programmatic	Potential disturbance of floodplain and stream bank with potential to adversely affect water quality during construction	B/LTS
PRO, FERC	A107—Feather River Fish Hatchery Improvement Program	Programmatic with Project-specific actions	Water temperature decreases in the LFC would enhance coldwater habitat beneficial uses, but could adversely affect warmwater habitat and recreational beneficial uses	B/LTS
PRO, FERC	A108—Flow/Temperature to Support Anadromous Fish	Programmatic with Project-specific actions	Increase in flow and water temperature decreases in the LFC would enhance coldwater habitat beneficial uses, but could adversely affect warmwater habitat, rice production, and recreational beneficial	B/LTS

Table 5.2-1. Environmental effects on surface water quality.

Alternative(s)	Article # and Title	Level of CEQA Analysis	Nature of Potential Impact(s)	Effect
			uses	
PRO, FERC	A110—Lake Oroville Warm Water Fishery Habitat Improvement Program	Programmatic	Potential disturbance of fluctuation zone sediments during construction	B/LTS
PRO	A122—Construction and Recharge of Brood Ponds	Project	Potential disturbance of fluctuation zone sediments during construction	LTS
PRO	A127—Recreation Management Plan -Trails -Equestrian facilities -DUA improvements -Docks, boat ramps -Campgrounds	Programmatic with some Project-specific actions	Actions included in the SA RMP have potential to increase sediment transport during the winter; increase turbidity levels; increase bacterial levels; increase oil and grease releases and other floating materials into project waters	LTS
FERC	A127—Modified Recreation Management Plan Same as A127 Recreation Management Plan with: Develop a plan to install facility upgrades at Foreman Creek; Reconstruct boat-in campgrounds.	Programmatic with some Project-specific actions	SA RMP have potential to increase sediment transport during the winter; increase turbidity levels; increase bacterial levels; increase oil and grease releases and other floating materials into project waters.	LTS
PRO	A129 – Improve and Redirect Recreation Usage to Specific Areas at Foreman Creek (Plan development)	Project	Implementation could result in short-term construction-related impacts to water quality	LTS

Table 5.2-1. Environmental effects on surface water quality.

Alternative(s)	Article # and Title	Level of CEQA Analysis	Nature of Potential Impact(s)	Effect
FERC	A129 (revised by FERC staff to include temporary closure) – Improve and Redirect Recreation Usage to Specific Areas at Foreman Creek (Plan development)	Project	Implementation could result in short-term construction-related impacts to water quality however, closure of Foreman Creek could result in less water-contact recreation and thus benefit water quality.	B/LTS

Coding:

B = Action with potential to result in a beneficial effect; could involve short-term, less-than-significant, construction related impacts that would be avoided or reduced through the use of Best Management Practices (BMPs). See Appendix D.

LTS = Action that would result in less-than-significant impact on resource.

In addition to the Proposed Project, this DEIR analyzes the No-Project Alternative and the FERC Staff Alternative. Impacts on surface water quality from implementation of the FERC Staff Alternative are similar to those anticipated with implementation of the Proposed Project, unless noted. Potential impacts are identified for each of the following alternatives: NO (No-Project), PRO (Proposed Project), and FERC (FERC Staff Alternative). All alternatives analyzed would result in less-than-significant impacts on surface water quality and quantity, with the continued use of standard BMPs as described in Appendix D to address short-term, construction-related impacts, and no further mitigation would be required.

All programs described in the Proposed Project would be implemented to continue and enhance the reasonable protection of the designated beneficial uses in the Central Valley RWQCB's Basin Plan and in accordance with the 401 water quality certification for the new FERC license and future permit conditions including any new DFG 1602 streambed alteration agreements and USACE CWA Section 404 permits.

The Proposed Project also includes a future feasibility study that would evaluate potential future facility modifications to address additional temperature enhancements for anadromous fish in the LFC and the HFC of the Feather River. Potential future facility modifications and resultant operational changes resulting from this study would be subject to additional CEQA and NEPA review and analysis.

Impact 5.2.2-a: Violate any water quality standards or waste discharge requirements; or **Impact 5.2.2-c:** Otherwise substantially degrade surface water quality.

NO — Under the No-Project Alternative, the Oroville Facilities would continue to be operated as they are now under the terms and conditions of the existing FERC license. Gravel supplementation would only occur if requested by DFG per the 1983 Agreement. Current facility operations are reasonably protective of Basin Plan objectives and include standard BMPs to protect water quality (see Appendix D for detailed descriptions of BMPs). Therefore, there would continue to be **less-than-significant** impacts on surface water quality from continuing operations.

PRO — Gravel Supplementation and Improvement Program (SA Article A102)**.** A Gravel Supplementation and Improvement Program would be developed and implemented to increase the quantity and improve the quality of spawning habitat for spring-run Chinook salmon and steelhead in the LFC, from the Fish Barrier Dam downstream to Thermalito Afterbay Outlet, and in the HFC within the Project Boundary. This program includes gravel supplementation at up to 15 locations in the lower Feather River with initial placement of at least 8,300 cubic yards of spawning gravel. The program would allow for development of a strategy to augment existing gravel recruitment beyond the initial 8,300 cubic yards. The actions would result in long-term **beneficial** effects on

beneficial uses. Construction-related impacts on surface water quality would be short-term and **less-than-significant** with use of standard BMPs described in Appendix D.

Channel Improvement Program (SA Article A103). This Program includes habitat improvement measures to increase the quality and complexity of salmonid spawning and rearing habitat in Moe's Ditch and Hatchery Ditch. The Proposed Project also includes the creation of 5 additional side channel riffle/glide complexes over a 5-year period, which would provide no less than a cumulative total of 2,460 additional feet of new spawning and rearing habitat for Chinook salmon and steelhead. Construction of the side channels would disturb the streambank and streambed and likely result in temporary elevated turbidity and sediment levels.

The actions would result in long-term **beneficial** effects on beneficial uses. Construction-related impacts on surface water quality would be short-term and **less-than-significant** with use of standard BMPs described in Appendix D.

Structural Habitat Supplementation and Improvement Program (SA Article A104)**.** This Program is designed to provide habitat complexity in the lower Feather River, particularly in the LFC. The Proposed Project would create additional cover, edge, and channel complexity through the addition of large woody debris, boulders, and other native objects. Placement of these materials would disturb the streambank and streambed and likely result in temporary elevated turbidity and sediment levels.

The actions would result in long-term **beneficial** effects on beneficial uses. Construction-related impacts on surface water quality would be short-term and **less-than-significant** with use of standard -BMPs described in Appendix D.

Fish Weir Program (SA Article A105). This Program includes the phased installation of two fish weirs and an egg taking station if necessary, in support of spring- and fall-run Chinook salmon segregation.

The actions would result in long-term **beneficial** effects on coldwater beneficial uses. Construction-related impacts on surface water quality would be short-term and **less-than-significant** with use of standard BMPs described in Appendix D.

Riparian and Floodplain Improvement Program (SA Article A106). This Program includes a phased, 25-year effort to identify, screen, and implement riparian/floodplain improvement projects.

The actions would result in long-term **beneficial** effects on beneficial uses. Construction-related impacts on surface water quality would be short-term and **less-than-significant** with use of standard BMPs described in Appendix D.

Feather River Fish Hatchery Improvement Program (SA Article A107). This Program includes the use of existing operational measures and potential increases to minimum instream flows in the LFC to meet water temperature targets set forth in SA Table 107A.

The long-term effects on coldwater beneficial uses with implementation of the Feather River Fish Hatchery Water Temperature element (SA Article A107.2) would be **beneficial**. Impacts on surface water quality from operational measures included in this program would be considered **less-than-significant** because the operational measures are within the range of current operations.

Flow/Temperature to Support Anadromous Fish (SA Article A108). This program is designed to meet Table 1 water temperature targets to benefit anadromous fish through the increase of minimum flow into the LFC during the initial new license operating period prior to potential facility modifications. During the initial new license operating period, if Table 1 water temperatures are not achieved through increased LFC minimum flows, DWR would singularly or in combination curtail pumpback operation, remove shutters on Hyatt intake, and increase flow releases in the LFC up to 1,500 cfs or the total flows into the HFC, which ever is less. After the initial new license operating period, additional measures may include potential future facility modifications as described in Section 5.2.2.5.

The long-term effects on coldwater beneficial uses with implementation of this article would be **beneficial**. Impacts on surface water quality from implementation of curtailing pumpback operation, removing shutters on Hyatt intake, and increasing flow releases in the LFC up to 1,500 cfs, cfs or the total flows into the HFC, which ever is less, would be **beneficial** to the Basin Plan objectives. Colder water may affect warmwater fish species, water temperatures for agriculture—irrigation beneficial uses, and some contact water recreational opportunities; however, this effect is considered **less-than-significant** due to warmwater habitat availability downstream and the minor magnitude of expected water temperature changes at the agricultural diversions and the availability of other recreational swimming opportunities. Any potential future facility modifications would be subject to project-

specific CEQA analysis prior to implementation of a selected alternative. Any alternative selected would be expected to further protect and enhance beneficial uses as described in the Basin Plan.

Lake Oroville Warm Water Fishery Habitat Improvement Program (SA Article A110). This program would be a continuation of the existing program designed to improve the warmwater fish habitat in Lake Oroville that supports warmwater game fish. The Program would increase and/or improve the structural complexity in the Lake Oroville fluctuation zone by constructing habitat with materials such as boulders, weighted pipes, riprap, and artificial structures designed to increase warmwater fish spawning habitat.

The actions would result in long-term **beneficial** effects on warmwater beneficial uses. Construction-related impacts on surface water quality would be short-term and **less-than-significant** with use of standard BMPs described in Appendix D.

FERC

Gravel Supplementation and Improvement Program (SA Article A102). This program is the same as the Proposed Project with the addition of a provision for DWR to monitor at least 10 riffles every 5 years or after a high flow event. If monitoring shows that criteria are not being met, DWR would assess all 15 sites and replace gravel as necessary. Construction-related impacts on surface water quality would be similar but more frequent than for the Proposed Project. Construction-related impacts on surface water quality would be **less-than-significant** with use of standard BMPs described in Appendix D.

Channel Improvement Program (SA Article A103); Structural Habitat Supplementation and Improvement Program (SA Article A104); Fish Weir Program (SA Article A105); Feather River Fish Hatchery Improvement Program (SA Article A107); Lake Oroville Warm Water Fishery Habitat Improvement Program (SA Article A110). All of these programs within the FERC Staff Alternative are the same as for the Proposed Project, and construction-related impacts on surface water quality would be **less-than-significant** with use of standard BMPs described in Appendix D.

Riparian and Floodplain Improvement Program (SA Article A106). This program is the same as the Proposed Project but with an accelerated schedule that calls for implementation of 50 percent of the selected alternatives within 10 years and the remainder within 12 years of license issuance. Acceleration may reduce program effectiveness by reducing long-term gravel extraction partnering opportunities and by creating the potential for less than optimal

floodplain connectivity. A shortened schedule also would result in the loss of the benefit of knowledge gained through monitoring the early years of the implementation program. Construction-related impacts on surface water quality would occur earlier in the license term than for the Proposed Project. However, construction-related impacts on surface water quality would be **less-than-significant** with use of standard BMPs described in Appendix D.

Flow/Temperature to Support Anadromous Fish (SA Article A108). This Article included in the FERC Staff Alternative is the same as the Proposed Project, with the addition of a notification requirement relative to changes in minimum in-stream flow rates. No additional effects to surface water quality would result from this addition when compared to the Proposed Project. The long-term effects of implementation of this article on coldwater beneficial uses would be beneficial. Surface water quality impacts from the initial new license operating period actions included in this article would be beneficial to Basin Plan objectives. Any post-license facility modifications would be subject to project-specific CEQA analysis prior to implementation of a selected alternative. Any alternative selected would be expected to further protect and enhance **beneficial** uses as described in the Basin Plan.

Mitigation measures 5.2.2-a and 5.2.2-c: No mitigation is required.

Impact 5.2.2-b: Substantially Alter an Existing Drainage Pattern of the Site or Area, Including Alteration of the Course of a Stream or River, in a Manner that Would Result in Substantial Erosion, Siltation On- or Off-Site, or Otherwise Substantially Degrade Water Quality.

NO — Under the No-Project Alternative, the Oroville Facilities would continue to be operated as they are now under the terms and conditions of the existing FERC license and a channel improvement program would not be implemented. Current facility operations are reasonably protective of Basin Plan objectives and include standard BMPs to protect water quality (see Appendix D for detailed descriptions of BMPs). Therefore, there would continue to be **less-than-significant** water quality impacts from continuing operations resulting from alteration of existing drainage patterns or stream courses in the project area.

PRO — Channel Improvement Program (SA Article A103). This Program includes the creation of 5 additional side channel riffle/glide complexes within the OWA over a 5-year period. Construction of the side channels would alter existing stream drainage patterns within the lower Feather River in the area where channels are developed. These channels would be located to avoid or minimize

impacts on surface water quality. Temporary disturbance of riparian and/or floodplain habitat and redirection of flow into newly created channels would likely result in short-term, temporary elevated turbidity and sediment levels. This action would result in long-term **beneficial** effects on beneficial uses. Construction-related impacts on surface water quality would be short-term and **less-than-significant** with use of standard BMPs described in Appendix D.

Riparian and Floodplain Improvement Program (SA Article A106). This Program includes a phased, 25-year effort to identify, screen, and implement riparian/floodplain improvement projects. While details on specific projects that may be included are unknown at this time, individual projects included in this program may alter existing stream drainage patterns within the lower Feather River where constructed. Riparian habitat and floodplain systems improve water quality by trapping sediments and providing nutrients to the system, thus providing **beneficial** effects on surface water quality. Nutrients, metals, and minerals deposited on riparian floodplains can be taken up by plants and sequestered, thus reducing the overall contaminant load in the water (SP-W9, DWR 2004). This action would result in long-term **beneficial** effects on beneficial uses. Construction-related impacts on surface water quality would be short-term and **less-than-significant** with use of standard BMPs described in Appendix D.

Flow/Temperature to Support Anadromous Fish (SA Article A108). This program could include future facility modifications that could alter surface drainage patterns around and through Thermalito Afterbay. Any post-license facility modifications would be subject to project-specific CEQA analysis prior to implementation of a selected alternative. Any alternative selected would be expected to further protect and enhance beneficial uses as described in the Basin Plan.

FERC

Channel Improvement Program (SA Article A103); Flow/Temperature to Support Anadromous Fish (SA Article A108); Riparian and Floodplain Improvement Program (SA Article A106). All of these programs within the FERC Staff Alternative are the same as for the Proposed Project and would result in long-term **beneficial** effects on beneficial uses. Construction-related impacts on surface water quality would be short-term and **less-than-significant** with use of standard BMPs described in Appendix D.

Mitigation measure 5.2.2-b: No mitigation is required.

5.2.2.7 Project-Level Impacts and Mitigation Measures

Table 5.2-1 identifies actions with the potential to adversely affect surface water quality or beneficial uses. The impact of each action is assessed and appropriate mitigation identified in this section. Assessments are combined for similar facility types (e.g., trails; equestrian trails; parking and picnicking facilities; boat docks, floating campsites, and boat ramps; campsites; fishing access; and swimming areas). All project-level actions described in the Proposed Project would be implemented to reasonably protect the designated beneficial uses in the Central Valley RWQCB's Basin Plan (including agricultural production) and in accordance with future permit conditions, including any new DFG 1602 streambed alteration agreement, USACE CWA Section 404 permit, and SWRCB CWA Section 401 water quality certification.

Impact 5.2.2-a: Violate Any Water Quality Standards or Waste Discharge Requirements or

Impact 5.2.2-c: Substantially Degrade Surface Water Quality

NO — No new PM&E measures would be implemented, other than those arising from existing legal obligations and agreements. DWR would continue existing maintenance practices needed to maintain the Oroville Facilities. Current facility operations are reasonably protective of Basin Plan objectives and include standard BMPs to protect water quality (see Appendix D for detailed descriptions of BMPs). Because DWR would implement activity-specific BMPs as appropriate, impacts would remain at **less-than-significant** levels.

PRO — Channel Improvement Program (SA Article A103). This Program includes habitat improvement measures to increase the quality and complexity of salmonid spawning and rearing habitat in Moe's Ditch and Hatchery Ditch. Construction within the existing ditches would disturb the streambank and streambed and likely result in temporary elevated turbidity and sediment levels. Construction-related impacts on surface water quality would be short-term and **less-than-significant** with use of standard BMPs described in Appendix D.

Construction and Recharge of Brood Ponds (SA Article A122). Brood ponds are designed to maintain a more stable water surface elevation than Thermalito Afterbay to provide waterfowl and giant garter snake cover adjacent to aquatic habitats. The Proposed Project includes construction and operation of four new brood ponds. DWR would construct a total of 4 new brood ponds over a 20-year period, with one new pond being built at least every 5 years.

The construction of the new brood ponds could temporarily affect turbidity of Thermalito Afterbay. Construction-related impacts on

surface water quality would be short-term and **less-than-significant** with use of standard BMPs described in Appendix D.

Recreation Management Plan (RMP) (SA Article A127). These actions includes construction of:

- Trails;
- Equestrian facilities;
- DUA improvements;
- Docks, boat ramps; and
- Campgrounds, including new floating campsites.

These construction activities have the potential to increase soil disturbance during construction, thereby increasing sediment transport. Construction-related impacts on surface water quality would be short-term and **less-than-significant** with use of standard BMPs described in Appendix D.

Storm events would likely transport the sediments to adjacent streams, wetland areas, and other bodies of water resulting in elevated levels of turbidity and suspended sediments. Sediment transport during storm events would be **less-than-significant** with use of standard BMPs described in Appendix D.

These facilities may increase recreational use, which may in turn increase bacterial levels (increased horse manure on trails, in parking lots, and equestrian campsites), oil and grease releases from increased boating and bicycling, and releases of other incidental floating materials into project waters. These impacts are considered **less-than-significant** due to the inclusion in the Proposed Project of Article A113, which would develop a monitoring and public education program related to bacteria, contact recreation, and public noticing of conditions.

Flow/Temperature to Support Anadromous Fish (SA Article A108). This project-specific action to be implemented upon issuance of the new FERC license is designed to meet Table 1 water temperature targets to benefit anadromous fish through the increase of minimum flow into the LFC and other operational changes, during a post-license issuance operating period prior to potential future facility modifications. During this period, if Table 1 water temperatures are not achieved through increased minimum releases, DWR would singularly or in combination curtail pumpback, remove shutters at Hyatt Intake, and increase flow releases in the LFC up to 1,500 cfs or the total flows into the HFC,

whichever is less.

The long-term effects on coldwater beneficial uses resulting from implementation of this flow/temperature aspect of SA Article A108 would be **beneficial**. Impacts on Basin Plan surface water quality objectives from post-license issuance operating period actions would be **beneficial**. While colder water may affect warmwater species and some contact water recreational opportunities, this affect is considered **less-than-significant** due to warmwater habitat availability downstream and the availability of other recreational swimming opportunities.

Improve and Redirect Recreation Usage at Foreman Creek (SA Article A129). This action would result in a plan that would restrict the usage of the existing car-top boat ramp and develop facility improvements to direct recreational use to designated areas, protecting cultural resources. Construction-related impacts on surface water quality would be short-term and **less-than-significant** with use of standard BMPs described in Appendix D.

FERC

The FERC Staff Alternative revises the SA RMP to include rehabilitation of the boat-in campgrounds. This activity could result in construction-related impacts similar to the Proposed Project. Construction-related impacts on surface water quality would be **less-than-significant** with use of standard BMPs described in Appendix D.

The FERC Staff Alternative alters SA Article A129 by closing the Foreman Creek boat launch to recreational use while DWR, in consultation with the Tribes, develops a plan for protecting cultural resources. Implementation could result in short-term, **less-than-significant** construction-related impacts to water quality. However, closure of Foreman Creek could result in less water-contact recreation and thus be **beneficial** to water quality.

Mitigation measures 5.2.2-a and 5.2.2-c: No mitigation is required.

Impact 5.2.2-b: Substantially Alter an Existing Drainage Pattern of the Site or Area, Including Alteration of the Course of a Stream or River, in a Manner that Would Result in Substantial Erosion, Siltation On- or Off-Site, or Otherwise Substantially Degrade Water Quality.

NO

Under the No-Project Alternative, the Oroville Facilities would continue to be operated as they are now and no new facilities would be constructed and no existing trails would be extended. Therefore, there would be **no impact** to surface water quality under the No-Project Alternative.

PRO, FERC

Construction and Recharge of Brood Ponds (SA Article A122). Brood ponds are designed to maintain a more stable water surface elevation than Thermalito Afterbay to provide waterfowl and giant garter snake cover adjacent to aquatic habitats. The Proposed Project includes construction and operation of four new brood ponds. DWR would construct a total of 4 new brood ponds over a 20-year period, with at least one new pond being built every 5 years.

The construction of the new brood ponds could temporarily affect turbidity of Thermalito Afterbay and would be potentially significant. Construction-related impacts on surface water quality would be short-term and **less-than-significant** with use of standard BMPs described in Appendix D.

Mitigation measure 5.2.2-b: No mitigation is required.

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5.3 GROUNDWATER QUALITY AND QUANTITY

5.3.1 Regulatory Setting

This subsection describes the current responsibilities of primarily one State agency, the SWRCB, acting under both its own mandate and as authorized to act by the U.S. Environmental Protection Agency (USEPA), as related to the regulation of groundwater quality and quantity. Groundwater resources in California are protected under the federal Clean Water Act (CWA) and the State Porter-Cologne Water Quality Control Act (Porter-Cologne Act). USEPA has generally authorized the SWRCB and the nine associated regional water quality control boards (RWQCBs) to administer all federal CWA water quality regulations in California. Both USEPA and the SWRCB generally provide oversight, while the RWQCBs have primary responsibility for implementation and enforcement. The Central Valley RWQCB is responsible for enforcing these regulations in the project area watershed.

The State does not have a comprehensive groundwater permit process to regulate groundwater withdrawal. Butte County has several chapters in the Butte County Code that pertain to groundwater resources, primarily regulating water extraction, which is not at issue in the Oroville Facilities Relicensing.

5.3.1.1 Federal Plans, Policies, Regulations, and Laws

CWA Section 401 requires an applicant for a federal license or permit for an activity that may result in any discharge into navigable waters to provide to the licensing or permitting agency a certification from the state in which the discharge originates that any such discharge will comply with state water quality standards and other appropriate requirements.

5.3.1.2 State Plans, Policies, Regulations, and Laws

Water Quality Certification

California Water Code Section 13160 authorizes the SWRCB to act as the State water pollution control agency for purposes of compliance with Section 401 of the federal CWA. The SWRCB administers the Section 401 program through a water quality certification process. Water quality certification is required prior to obtaining a FERC hydroelectric license. Section 401 requires the SWRCB to find that there is a reasonable assurance that an activity will be conducted in a manner that will not violate applicable water quality standards and other appropriate requirements. SWRCB certification may be conditioned with measures to assure compliance with various CWA and State water quality objectives.

Basin Plan and Applicable Water Quality Criteria

The Porter-Cologne Act defines water quality objectives as "...the limits or levels of water quality constituents or characteristics which are established for the reasonable

protection of beneficial uses of water or the prevention of nuisance within a specific area" (Water Code Section 1305(h)). The Porter-Cologne Act also requires the RWQCB to “establish water quality objectives, while acknowledging that it is possible for water quality to be changed to some degree without unreasonably affecting beneficial uses.”

Water quality standards, developed by the RWQCB pursuant to State law and in satisfaction of Section 303 of the CWA (33 United States Code (USC) Section 1313), consist primarily of designated beneficial uses for specific surface water and groundwater resources along with the narrative or numerical water quality objectives that are considered necessary for attainment of the designated beneficial uses. The water quality objectives collectively comprise the Basin Plan. Pursuant to the Porter-Cologne Act, each RWQCB prepares and updates the Basin Plan every 3 years.

The Central Valley Region Basin Plan includes numerical and narrative water quality objectives for groundwater: numerical objectives are set for bacteria, chemical constituents including toxicity, and radioactivity while narrative objectives are set for tastes and odors. Unless otherwise designated by the RWQCB, all groundwater in the Central Valley Region is considered as suitable or potentially suitable, at a minimum, for municipal and domestic water supply, agricultural supply, industrial service supply, and industrial process supply.

California Toxics Rule

In addition, the California Toxics Rule is a separate regulatory instrument that prescribes criteria for trace metals and organic compounds for the protection of aquatic life and human health. Federal and state drinking-water quality standards regulate the quality of treated municipal drinking-water supplies delivered to users.

5.3.1.3 Local Plans, Policies, Regulations, and Laws

Butte County has several chapters in the Butte County Code that pertain to groundwater and related resources and activities. Butte County Code Chapter 23B pertains to regulations on the installation of groundwater wells. Chapter 33, entitled “Groundwater Conservation,” establishes and regulates the mechanism by which water purveyors within Butte County can utilize groundwater as part of a water transfer agreement. The ordinance requires a permit for all groundwater extractions that are to be transferred outside the county, directly or indirectly, via groundwater substitution. Chapter 33 also mandates groundwater level and quality measurements be done by the County to assess the quantity and quality of the groundwater resources underlying the County. Chapter 33A defines the mechanism by which the Basin Management Objectives program within Butte County is to be established and maintained.

5.3.2 Impact Thresholds

The following thresholds were used to determine whether the alternatives would have a significant effect on groundwater quality or quantity. There would be a significant impact if the alternatives would:

- 5.3-a: Violate any groundwater quality standards for factors controllable by the Oroville Facilities as set forth in the Basin Plan;

- 5.3-b: Substantially degrade groundwater quality; or

- 5.3-c: Substantially deplete groundwater supplies or cause substantial interference with groundwater recharge, such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level.

5.3.3 Method of Analysis

Groundwater resources in the Project area were evaluated and reported in Oroville Facilities Relicensing Study Plan W-5 (SP-W5), Project Effects on Groundwater. This study plan consisted of two phases. During Phase 1, existing groundwater quality was evaluated. A review of this data indicated that there was insufficient information to provide an adequate evaluation of the project on area groundwater quality. Therefore, Phase 2 was initiated. During this phase additional groundwater quality data were collected in the vicinity of both Thermalito Forebay and Thermalito Afterbay.

The groundwater quality monitoring program included wells currently monitored semi-annually and monthly for groundwater levels and several additional wells to enhance areal coverage. Groundwater quality was measured during the spring and fall from the existing monitoring wells and additional wells included in the study. Groundwater samples were analyzed for general mineral composition, aluminum, mercury, and physical parameters, including pH, conductivity, and temperature, at the time of sampling. The general mineral and physical parameter analyses enabled the ionic composition and physical characteristics of the groundwater to be compared with those from the lower depths of Thermalito Forebay and Thermalito Afterbay collected in SP-W1, Project Effects on Water Quality Designated Beneficial Uses for Surface Waters, to provide an indication of connectivity. Analytical results from the lower depths of the project waters were used to compare to groundwater quality. This comparison was made because the water at the interface between the water and the soil at the bottom of the reservoirs is most likely to be influencing groundwater quality.

An inventory of wells was made utilizing records maintained at the DWR office in Red Bluff. Data for well location, surface elevation, depth, design, and use were entered into a Geographic Information System (GIS) database. After reviewing existing well log records, approximately 162 wells were identified as being within a 2-mile radius downgradient from the Thermalito Afterbay. This information, along with data obtained from existing DWR Northern District current and historical water level monitoring data, was used to evaluate potential project impacts.

5.3.4 Impacts and Mitigation Measures

In addition to the Proposed Project, this DEIR analyzes the No-Project Alternative and the FERC Staff Alternative. No impacts on groundwater resources (quality or quantity) result from the implementation of any of the alternatives evaluated. Beneficial uses

identified in the Central Valley Region Basin Plan related to groundwater (municipal and domestic water supply, irrigation–agricultural supply, and industrial service and process supply) are not affected by any of the alternatives. Potential effects resulting from short-term, construction-related impacts would be avoided through the use of Best Management Practices as described in Appendix D.

5.3.4.1 Program Level Impacts and Mitigation Measures

The program level actions contained within all alternatives analyzed against the thresholds of significant result in **no impacts** on groundwater quantity.

5.3.4.2 Project Level Impacts and Mitigation Measures

The project level actions contained within all alternatives analyzed result in **no impacts** on groundwater quantity.

Impact 5.3-a: Violate any Groundwater Quality Standards for Factors Controllable by the Oroville Facilities as Set Forth in the Basin Plan.

There are no actions in the Proposed Project or the FERC Staff Alternative that have the potential to violate any groundwater quality standards for factors controllable by the Oroville Facilities as set forth in the Basin Plan.

Impact 5.3-b: Substantially Degrade Groundwater Quality.

There are no actions in the Proposed Project or the FERC Staff Alternative that have the potential to substantially degrade groundwater quality.

Impact 5.3-c: Substantially Deplete Groundwater Supplies or Cause Substantial Interference with Groundwater Recharge, Such that There Would Be a Net Deficit in Aquifer Volume or a Lowering of the Local Groundwater Table Level.

There are no actions in the Proposed Project or the FERC Staff Alternative that have the potential to substantially deplete groundwater supplies or cause substantial interference with groundwater recharge, such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level.

5.4 AQUATIC RESOURCES

5.4.1 Regulatory Setting

Aquatic resources in the Oroville Facilities study area are managed by State and federal agencies. Only a few of the government agencies, however, have regulatory authority over topics related to aquatic resources. These agencies derive their respective mandates from an often diverse collection of statutes, legislative policies, executive branch directives, and regulations.

The Oroville Facilities are regulated through a federal license issued by FERC. FERC has broad authority over almost all aspects of non-federal hydroelectric projects. There are two other areas related to aquatic resources where the State of California has regulatory authority. The first is compliance with the water quality certification requirements of Section 401 of the federal Clean Water Act (CWA). The SWRCB implements this regulatory program pursuant to federal and State law. Second, the California Fish and Game Commission sets State angling regulations.

The California Fish and Game Commission adopts policies for the aquatic resources of lakes and streams on State lands, with implementation and enforcement responsibility through DFG. When federal lands are involved, the federal land management agency is responsible for habitat management and DFG is responsible for management of fish and wildlife populations and has enforcement authority (California Fish and Game Commission, Management and Utilization of Fish and Wildlife on Federal Lands 1999 in CPUC 2000a; CPUC 2000b).

Given this jurisdictional context, the following narrative summarizes the regulations, standards, agreements, policies, and programs with a direct bearing on the management of aquatic resources and their habitats at the Oroville Facilities. The agencies responsible for implementation are also identified.

5.4.1.1 Plans, Policies, and Management Objectives

The following plans and policies are pertinent to the management of fish and aquatic resources at the Oroville Facilities. Other applicable plans and policies are discussed in Chapter 7.0.

1978 Oroville Wildlife Area Management Plan

The *Oroville Wildlife Area Management Plan* provides policy direction and management guidance on OWA lands and serves as the official planning document for the OWA (Hodson 1978). The plan's purpose is to provide "for the preservation and enhancement of the fish and wildlife resources of the Oroville Wildlife Area and for reasonable use and enjoyment by the public." Recommendations for fisheries include maintaining the warmwater fishery resources and habitat and developing additional warmwater fisheries.

Key Fish and Game Commission Policies and Management Objectives Related to Fish and Aquatic Resources

The California Fish and Game Commission formally adopted the following policies related to aquatic resources (California Fish and Game Commission Website):

- Commission Designated Wild Trout Waters—It is the policy of the Fish and Game Commission to designate certain State waters to be managed exclusively for wild trout. The Fish and Game Commission established the California Wild Trout Program in 1971, with an objective of protecting and enhancing fisheries sustained by wild strains of trout. The waters managed by the Fish and Game Commission include lakes and streams, which are designated as either Catch-and-Release and/or Wild Trout. The Fish and Game Commission set forth a policy that states: "All necessary actions, consistent with State law, shall be taken to prevent adverse effect by land or water development projects affecting designated wild trout rivers." It is the responsibility of DFG, through the Wild Trout Program, to implement the Trout and Steelhead Conservation and Management Planning Act of 1979, which requires annual statewide inventories of trout streams and lakes, evaluations of catch-and-release regulations, and to recommend waters for catch-and-release angling regulations. The Middle Fork Feather River is one of the original streams included in the Wild Trout Program, and is designated as a Wild Trout River. Trout that are managed in the Middle Fork Feather River include rainbow and brown trout.

- Salmon Management Objectives—It is the policy of the Fish and Game Commission that salmon is managed to protect, restore, and maintain the populations and genetic integrity of all identifiable stocks. Salmon streams shall be inventoried for quantity and quality of habitat, including instream flow requirements. Restoration plans shall identify habitats for restoration and acquisition and opportunities to protect or guarantee future instream flows. Existing salmon habitat shall not be diminished further without offsetting the effects of the lost habitat. All available steps shall be taken to prevent loss of habitat, and DFG shall oppose any development or project that will result in irreplaceable loss of fish. Artificial production shall not be considered as appropriate mitigation for loss of wild fish or their habitat.

- Steelhead/Rainbow Trout Management Objectives—It is the policy of the Fish and Game Commission that steelhead be managed to protect and maintain the populations and genetic integrity of all identifiable stocks. The remainder of this policy is similar to the policy for salmon.

- Trout Management Objectives—It is the policy of the Fish and Game Commission that natural reproduction and rearing of trout will be encouraged to the greatest extent possible by protecting and improving habitat and by affording protection from disease, predators, and competing fish species. Artificial propagation and rearing of trout will be utilized only when necessary to augment natural production. Catchable-sized trout shall be stocked only in lakes,

reservoirs, and streams where natural reproduction and growth are inadequate to maintain populations capable of supporting fishing.

- Warmwater Game Fish Stocking—It is the policy of the Fish and Game Commission that maintenance stocking of warmwater game fish is not recommended because satisfactory populations are usually sustained by natural reproduction. The policy describes the circumstances under which stocking is permitted.

- Land Use Planning—This policy articulates the Fish and Game Commission's desire to have DFG coordinate closely with other State, federal, and local planning agencies in the formulation and implementation of any plans that may affect fish and wildlife resources.

- Management and Utilization of Fish and Wildlife on Federal Lands—It is the policy of the Fish and Game Commission that DFG will manage and protect all fish and wildlife and threatened or endangered native plants on lands administered by the federal government. This policy will not affect the right of the federal government to manage habitat and control access on its property. Management and protection of migratory fish and wildlife will be coordinated between DFG and the federal government on all lands under federal jurisdiction.

- Management and Utilization of Fish and Wildlife on Private Lands—It is the policy of the Fish and Game Commission that the owners or tenants of privately owned lands shall be actively encouraged to propagate, conserve, and promote the wise use of fish and wildlife populations on their lands, consistent with other reasonable uses. This policy describes the procedures for setting up Private Lands Wildlife Habitat Enhancement and Management Areas with DFG.

- Water—It is the policy of the Fish and Game Commission that the quantity and quality of the waters of California should be apportioned and maintained so as to produce and sustain the maximum numbers of fish and wildlife. DFG is directed to review and comment on proposed water development projects, on applications for licenses or permits for water use, water development, and on projects affecting aquatic habitat. It is also directed to recommend and seek the adoption of proposals necessary or appropriate for the protection and enhancement of fish and wildlife and their habitat, and to oppose the issuance of permits or licenses that have not prevented or adequately compensated for damage to fish and wildlife resources.

1996 DFG Steelhead Restoration and Management Plan for California

Goals for steelhead restoration and management are outlined in DFG's 1996 *Steelhead Restoration and Management Plan for California*. The two goals are: (1) to increase natural production, as mandated by *The Salmon, Steelhead Trout, and Anadromous Fisheries Program Act of 1988*, in an attempt to create self-sustaining steelhead

populations and maintain them in good condition; and (2) to enhance opportunities for angling and non-consumptive uses.

The plan focuses on the restoration of native and wild stocks, as these stocks have the greatest value insofar as maintaining genetic and biological diversity. Suggested strategies to accomplish these two goals include restoring degraded habitat; restoring access to historic habitat that is currently blocked; reviewing angling regulations to ensure that steelhead adults and juveniles are not over-harvested; maintaining and improving hatchery runs, where appropriate; and developing and facilitating research to address deficiencies in information on fresh water and ocean life history, behavior, habitat requirements, and other aspects of steelhead biology.

5.4.1.2 Regional Regulations and Policies

CALFED

The California Water Policy Council and the Federal Ecosystem Directorate united in June 1994 to form CALFED. In June 1995, CALFED issued its Bay-Delta Program to develop a long-term, comprehensive solution to environmental issues in the Sacramento–San Joaquin Delta (Delta) and San Francisco Bay. The CALFED Bay-Delta Program is a collaborative effort of 23 federal and State agencies focusing on restoring the ecological health of the Bay-Delta estuary while ensuring water quality improvements and water supply reliability to all users of the Bay-Delta water resources. The CALFED Bay-Delta Program includes a range of balanced actions that can be taken forward to a comprehensive, multi-agency approach to managing Bay-Delta resources. The Bay-Delta watershed includes the Sacramento and San Joaquin rivers and their tributaries, including the Feather River.

The Framework Agreement for CALFED states that the State and federal agencies will work together in three areas of Bay-Delta management:

- Water quality standards formulation;
- Coordination of SWP and CVP operations with regulatory requirements; and
- Long-term solutions to problems in the Bay-Delta Estuary.

In the August 28, 2000, CALFED Record of Decision (ROD), State and federal agencies committed to implementing a long-term plan to restore the Bay-Delta. This plan consists of many activities associated with eight separate elements: the Ecosystem Restoration Program, Water Quality Program, Levee System Integrity Program, Water Use Efficiency Program, Water Transfer Program, Watershed Program, Storage Program, and Conveyance Program.

CALFED Ecosystem Restoration Program

The CALFED Ecosystem Restoration Program (ERP) is an unprecedented collaboration among local partners and governmental agencies to improve ecosystem processes and

diverse habitats for species in the Bay-Delta watershed. The ERP is designed to maintain, improve, and increase aquatic and terrestrial habitats, and improve ecological functions in the Bay-Delta. The ERP works to support sustainable populations of diverse and valuable plant and animal species, and support recovery of at-risk species in the Bay-Delta watershed. The Feather River is included in the ERP and 26 potential programmatic restoration actions are identified. The actions include improving a variety of aquatic and terrestrial habitats for at-risk species, improving water quality conditions (e.g., flow and temperature regimes), maintaining or improving coarse sediment supply to the lower Feather River, and improving natural floodplain/river interactions and connectivity (CALFED 2000).

Central Valley Project Improvement Act (Public Law 102-575, Title 34)

The Central Valley Project Improvement Act (CVPIA) was signed into law on October 30, 1992, and is designated as Title 34 of the Reclamation Projects Authorization and Adjustment Act of 1992. Subsection 3406(a) of the CVPIA amends the authorization of the U.S. Department of the Interior's CVP to include fish and wildlife protection, restoration, and mitigation as project purposes having equal priority with irrigation and domestic water uses and power generation. Subsection 3406(e) of the CVPIA requires that not later than 5 years after the date of enactment of the Act, the Secretary of the Interior shall provide Congress with specifically identified supporting investigations related to the restoration and enhancement of anadromous fishes affected by the CVP. Most of these investigations have been completed and reports submitted. Successful implementation of the CVPIA in concert with the activities of CALFED requires the cooperation of DWR in fishery restoration efforts.

The CVPIA identifies several goals to meet the new fish and wildlife purposes. Significant among these is the broad goal of restoring populations of anadromous fish (Chinook salmon, steelhead, green and white sturgeon, American shad, and striped bass) in Central Valley rivers and streams and to double their recent average population levels (see discussion below regarding the Anadromous Fish Restoration Program (AFRP)).

Anadromous Fish Restoration Program

The AFRP was developed to comply with Section 3406(b)(1) of the CVPIA. The Secretary of the Interior was directed to:

> "…develop within three years of enactment and implement a program which makes all reasonable efforts to ensure that, by the year 2002, natural production of anadromous fish in Central Valley rivers and streams will be sustainable, on a long-term basis, at levels not less than twice the average levels attained during the period of 1967–1991 ..."

The responsibilities of implementing the CVPIA, and in particular Section 3406(b)(1), were jointly imparted to USFWS and the U.S. Bureau of Reclamation (USBR), although USFWS has assumed the lead role in development of the AFRP. The Final Restoration

Plan for the AFRP was adopted on January 9, 2001, and will be used to guide the long-term development of the AFRP.

Coordinated Operations Agreement

The CVP and SWP use the Sacramento River and the Delta as common conveyance facilities. Reservoir releases and Delta exports must be coordinated to ensure that the projects operate in accordance with water rights decisions, biological opinions, and agreed upon procedures.

The Coordinated Operations Agreement (COA) between the United States of America and DWR to operate the CVP and SWP was signed in November 1986. Under the COA, USBR and DWR agree to operate the CVP and SWP in a manner to meet Sacramento Valley and Delta needs while maintaining their respective annual water supplies as identified in the agreement. Implementing an accounting procedure based on the sharing principles outlined in the COA facilitates coordination between the two projects. Although the principles were intended to cover a broad range of conditions, changes introduced by past NMFS and USFWS biological opinions (BOs), by SWRCB Decision 1641 (D-1641), and by the CVPIA were not specifically addressed by the COA. However, these new requirements have been addressed by USBR and DWR through mutual informal agreements. When water must be withdrawn from storage to meet Sacramento Valley and Delta requirements, 75 percent of the responsibility is borne by the CVP and 25 percent by the SWP. The COA also provides that when unstored water is available for export, 55 percent of the sum of stored water and the unstored export water is allocated to the CVP and 45 percent is allocated to the SWP.

Basin Plans

The California Water Code (Section 13240) and the federal CWA requires the preparation and adoption of Basin Plans. Section 303 of the CWA requires states to adopt water quality standards, which "consist of the designated uses of the navigable waters involved and the water quality criteria for such waters based upon such uses." According to Section 13050 of the California Water Code, Basin Plans consist of a designation or establishment for the waters within a specified area of beneficial uses to be protected, water quality objectives to protect those uses, and a program of implementation needed for achieving the objectives.

The Oroville Facilities are located within the Basin Plan area for the Central Valley Regional Water Quality Control Board (RWQCB), which includes the Sacramento and San Joaquin River basins and involves an area bounded by the crests of the Sierra Nevada on the east and the Coast Range and Klamath Mountains on the west. The area covered in this Basin Plan extends some 400 miles, from the California–Oregon border southward to the headwaters of the San Joaquin River.

Operation of the Oroville Facilities also must reasonably comply with the *San Francisco Bay/Sacramento–San Joaquin Delta Estuary Basin Plan* (Bay-Delta Estuary Plan). The watershed of the Bay-Delta Estuary provides drinking water to two-thirds of California's

population and water for a multitude of urban and other beneficial uses. Additionally, it supplies some of California's most productive agricultural areas, both inside and outside of the estuary. The Bay-Delta Estuary itself is one of the largest ecosystems for fish and wildlife habitat and production in the United States. However, historical and current human activities (e.g., water development, land use including Delta land reclamation for agriculture, wastewater discharges, introduced species, and harvesting), exacerbated by variations in natural conditions, have degraded the beneficial uses of the Bay-Delta Estuary, as evidenced by declines in populations of many biological resources of the estuary (Central Valley RWQCB 1998).

The Bay-Delta Estuary Plan provides the component of a comprehensive management package for the protection of the estuary's beneficial uses that involves salinity (from saltwater intrusion and agricultural drainage) and water project operations (flows and diversions), as well as a dissolved oxygen objective. This plan supplements other water quality control plans adopted by the SWRCB and RWQCBs, and State policies for water quality control adopted by the SWRCB, relevant to the Bay-Delta Estuary watershed. These other plans and policies establish water quality standards and requirements for parameters such as toxic chemicals, bacterial contamination, and other factors with the potential to impair beneficial uses or cause nuisance.

State Water Resources Control Board Decision 1641

The Water Quality Control Plan for the Bay-Delta Estuary contains the current water quality objectives. SWRCB D-1641 contains the current water right requirements to implement the Bay-Delta water quality objectives. In D-1641, the SWRCB assigned responsibilities to USBR and DWR for meeting these requirements on an interim basis. These responsibilities require that the CVP and SWP be operated to meet water quality objectives in the Delta, pending a water rights hearing to allocate the obligation to meet the water quality and flow-dependent objectives among all users of the Sacramento and San Joaquin River Basin waters with water rights assigned after 1914. *The San Joaquin River Agreement* and *Sacramento Valley Water Management Agreement* (Phase 8) are settlements between DWR and USBR with water users upstream of the Delta in which the CVP and SWP will continue to meet the D-1641 water quality requirements. Therefore, the water rights hearing to allocate that responsibility was no longer needed and the hearing was dismissed.

5.4.1.3 Flow Standards and Agreements

1983 Oroville Operating Agreement Between DWR and DFG

Minimum flows in the lower Feather River were established by a 1983 agreement between DWR and DFG (DWR 1983). The agreement *Concerning the Operation of the Oroville Division of the State Water Project for Management of Fish and Wildlife* establishes criteria for flow and water temperature for the Low Flow Channel (LFC) and the reach of the Feather River below the Thermalito Afterbay Outlet to the confluence with the Sacramento River for preservation of salmon spawning and rearing habitat. The agreement specifies that DWR release a minimum of 600 cubic feet per second

(cfs) into the Feather River from Thermalito Diversion Dam for fisheries purposes. This is the total volume of flows from the Thermalito Diversion Dam outlet, the Thermalito Diversion Dam Power Plant, and the Feather River Fish Hatchery pipeline.

For a Lake Oroville surface elevation greater than 733 feet above mean sea level, the minimum instream flow requirements for the Feather River below the Thermalito Afterbay Outlet are listed in Table 5.4-1 (DWR 1983).

Table 5.4-1. Minimum instream flow requirements for the Feather River.

Percent of Normal[1] Runoff (%)	October–February (cfs)	March (cfs)	April–September (cfs)
> 55	1,700	1,700	1,000
< 55	1,200	1,000	1,000

[1] *Normal runoff is defined as 1,942,000 acre-feet, which is the mean (1911–1960) April-through-July unimpaired runoff near Oroville.*

Source: DWR 2001

The agreement includes a requirement that if during October 15 through November 30 the hourly flow is greater than 2,500 cfs, then the flow minus 500 cfs must be maintained until the following March unless the high flow was due to flood management operations or mechanical problems. This requirement is to protect any spawning that could occur in overbank areas during the higher flow rate by maintaining flow levels high enough to keep the overbank areas submerged. In practice, the flows are maintained below 2,500 cfs from October 15 to November 30 to prevent spawning in the overbank areas.

The agreement also specifies a narrative objective for water temperature below the Thermalito Afterbay Outlet and a numerical objective for temperatures of water provided to the Feather River Fish Hatchery. Below the Thermalito Afterbay Outlet, water temperatures must be suitable for fall-run salmon during fall months (after September 15). From May through August, water temperatures must be suitable for shad, striped bass, and other warmwater fish. Under the agreement, the water supply for the Feather River Fish Hatchery must adhere to the water temperature objectives (a deviation of plus or minus 4 degrees Fahrenheit (°F) is allowed between April 1 and November 30) listed in Table 5.4-2.

Table 5.4-2. Water temperature objectives.

Period	Temperature (+/- 4°F)
April 1–May 15	51°
May 16–May 31	55°
June 1–June 15	56°
June 16–August 15	60°
August 16–August 31	58°
September 1–September 30	52°
October 1–November 30	51°
December 1–March 31	no greater than 55°

Source: DWR 2001

Meeting the water temperature criteria is facilitated by a shutter-controlled intake gate system at Oroville Dam that selects water for release from various reservoir depths, depending on the desired water temperature.

1969 Agreement Between DWR and Joint Water Districts

In May 1969, DWR entered into agreements with several water districts to provide them with water based upon prior rights (DWR 1969). The agreement among Richvale Irrigation District, Biggs-West Gridley Water District, Butte Water District, Sutter Extension Water District (i.e., the Joint Water District), and DWR includes terms describing the amounts of water that the State is required to make available to the districts. The agreement with Western Canal Water District is similar. The agreements do not have specific requirements for water quality.

Water temperatures at the agricultural diversion points within the Thermalito Complex are influenced by Oroville Facilities operations. Water temperatures within Thermalito Afterbay are influenced by the temperature and quantity of water released from Oroville Dam. The amount of water released affects its residence time in the afterbay; the longer the residence time, the more opportunity the water has to warm. Other factors influencing water temperatures in the Thermalito Complex include stage elevations and pumpback operations within Thermalito Afterbay.

The Oroville Facilities are operated to meet water temperature objectives for the Feather River Fish Hatchery water supply and for the Feather River downstream of the Thermalito Afterbay Outlet. These water temperature objectives sometimes conflict with temperatures desired by agricultural diverters. DWR accommodates these agricultural diverters by releasing water that is as close as possible to the maximum temperature allowable under the DFG–DWR agreement (i.e., 4°F higher than the objectives stated above).

5.4.1.4 Biological Opinions

In 2002, NMFS issued a BO on the effects of interim operations of the CVP and SWP on federally listed threatened Central Valley spring-run Chinook salmon and Central Valley steelhead (NMFS 2002). This BO established quantitative water temperature criteria for the lower Feather River between the Fish Barrier Dam and River Mile (RM) 61.6 (near Robinson Riffle). The BO stipulates that from June 1 through September 30, DWR shall to the extent possible and consistent with SWP requirements control water temperatures to a daily average water temperature of less than or equal to 65°F to protect over-summering steelhead from thermal stress and from warmwater predator species. The requirement is not intended to preclude pumpback operations at the Oroville Facilities needed to assist the State of California with supplying energy during periods when the California Independent System Operator (ISO) anticipates a Stage 2 or higher alert.

In addition, the 2002 NMFS BO established ramping rates to minimize adverse effects of flow fluctuations associated with upstream reservoir operations on incubating eggs,

fry, and juvenile spring-run Chinook salmon and steelhead. The NMFS BO stipulates that during periods outside of flood management operations, and to the extent controllable during flood management operations, DWR shall ramp down releases to the LFC, as presented in Table 5.4-3.

Table 5.4-3. NMFS 2002 Biological Opinion required ramping rates.

Feather River Low Flow Channel Releases (cfs)	Rate of Decrease (cfs)
5,000 to 3,501	1,000 per 24 hours
3,500 to 2,501	500 per 24 hours
2,500 to 600	200 per 24 hours

Source: NMFS 2002

In February 2004, NMFS issued a supplemental BO to the 2002 BO on the interim operations of the CVP and SWP on federally listed threatened Central Valley spring-run Chinook salmon and Central Valley steelhead (NMFS 2004b). The supplemental BO was issued to assess the 2-year extension of the BO and to assess changes in operations of the Trinity Division of the CVP. No changes in operations of the Oroville Facilities were proposed during the time period analyzed by NMFS, and thus, the supplemental BO did not provide additional reasonable and prudent measures or additional terms and conditions for operation of the Oroville Facilities and did not change its opinion that the CVP and SWP, as proposed, were not likely to affect the continued existence of Central Valley spring-run Chinook salmon and Central Valley steelhead (NMFS 2004b). However, NMFS did require DWR to work with NMFS Fisheries engineers to assist the Feather Water District in the design of a fish screen for their diversion on the Feather River.

In October 2004, NMFS issued a BO on the effects of the long-term CVP and SWP Operations Criteria and Plan (OCAP) on federally listed endangered Sacramento River winter-run Chinook salmon, threatened Central Valley spring-run Chinook salmon, threatened Central Valley steelhead, threatened southern Oregon/northern California coast Coho salmon, and threatened central California coast steelhead and their habitat (NMFS 2004a). The October 2004 BO superseded all previous BOs regarding the CVP and SWP OCAP. Water temperature objectives prescribed in the October 2004 OCAP BO at RM 61.6 near Robinson Riffle remained 65°F from June 1 through September 30 to protect over-summering steelhead. However, ramping rates were altered slightly from the 2002 OCAP BO and are presented in Table 5.4-4.

In July 2004, USFWS issued a BO for the coordinated operations of the CVP and SWP and the OCAP on the federally threatened delta smelt (USBR 2004). Because delta smelt are not present in the Feather River and because the CVP and SWP OCAP is not likely to jeopardize the continued existence of delta smelt, no specific operational terms and conditions were provided by USFWS for the Oroville Facilities.

Table 5.4-4. NMFS 2004 Biological Opinion required ramping rates.

Feather River Low Flow Channel Releases (cfs)	Rate of Decrease (cfs)
5,000 to 3,501	1,000 per 24 hours
3,500 to 2,501	500 per 24 hours
2,500 to 600	300 per 24 hours

Source: NMFS 2004a

Pursuant to informal consultation with NMFS, DWR prepared a project-specific Fisheries Biological Assessment (FBA) that analyzed the effects of relicensing the Oroville Facilities on threatened and endangered species, their critical habitat, and Essential Fish Habitat. This FBA, along with FERC's DEIS dated September 2006, provides the basis for NMFS to issue a BO in accordance with the provisions of the Endangered Species Act. FERC formally requested NMFS's BO for this project by letter dated October 24, 2006 (FERC letter to Rodney McInnis, 2006).

5.4.1.5 Stocking and Habitat Enhancement Programs

Federal Energy Regulatory Commission Order 2100-054

On September 22, 1994, FERC approved the revised recreation plan, *Oroville Recreation Plan Oroville Reservoir, Thermalito Forebay, and Afterbay Recreation Report,* submitted by DWR. Included in this plan are requirements regarding recreation and fishery-related issues. FERC ordered DWR to formulate and implement a fisheries management plan that would "promote a multi-species warmwater and coldwater fishery with the general goal of benefiting a diverse angling community." DWR conducted fish stocking and habitat improvements programs at Lake Oroville in accordance with the FERC order and filed reports on an annual basis from 1994 until 1999 regarding: (1) Lake Oroville fish stocking and fish habitat improvements, (2) the DFG Chinook salmon recommendations, and (3) a discussion of DWR's role in fisheries management at Lake Oroville (FERC 2004).

Prior to 2000, Chinook salmon and brown trout were stocked in Lake Oroville. An infectious hematopoetic necrosis (IHN) outbreak in 2000 at the Feather River Fish Hatchery resulted in DFG issuing a moratorium on stocking salmonids in Lake Oroville until testing of the susceptibility of other salmonid stocks was completed. DFG concluded that Coho salmon were the only salmonid that could be stocked in Lake Oroville due to their resistance to IHN (FERC 2004). Beginning in 2002, Coho salmon were stocked in Lake Oroville. Current stocking goals for Coho salmon are outlined in the *2003–January 31, 2007 Salmonid Stocking Strategy*. The stocking plan is in effect through the end of the current FERC license.

Feather River Fish Hatchery Management

DWR constructed the Feather River Fish Hatchery to compensate for salmonid spawning habitat lost due to the construction and operation of the Oroville Facilities.

The hatchery has been operated by DFG since the late 1960s, releasing millions of spring- and fall-run Chinook salmon fry, fingerlings, smolts, and yearlings, and steelhead yearlings to fulfill DWR's existing Oroville FERC license conditions. Goals for the hatchery are defined in terms of numbers of eggs taken each year for rearing and the number of fish to be released as smolts or yearlings. DFG operates the hatchery under contract to DWR, and DWR pays for most hatchery-associated expenses. Hatchery operations are conducted as part of DWR and DFG obligations pursuant to provisions of the federal Endangered Species Act (DWR 2002).

5.4.2 Impact Thresholds

The following thresholds are used to determine whether the alternatives would have a significant effect on fisheries resources or on threatened or endangered aquatic species. There would be a significant impact on fisheries resources if the alternatives would:

- 5.4-a: Interfere substantially with the movement of native resident or migratory fish, substantially reduce the habitat of a fish species, or cause a fish population to drop below self-sustaining levels;
- 5.4-b: Cause a substantial decrease in the prey base for any species identified as a candidate, sensitive, or special-status species;
- 5.4-c: Result in substantial habitat degradation for fisheries or aquatic species identified by DFG, NMFS, or USFWS as a candidate, sensitive, or special-status species; or
- 5.4-d: Substantially conflict with any local policies, ordinances, adopted Habitat Conservation Plans, Natural Community Conservation Plan, or other approved plans protecting fishery resources within the FERC Project boundary.

5.4.3 Method of Analysis

Appendix G-AQUA1 in the PDEA (2005) for the Oroville Facilities relicensing provides a detailed discussion regarding the methods, processes, and basis used to evaluate the No-Action Alternative, the Proposed Action, and Alternative 2, and their potential effects on aquatic and fisheries resources. Implementation of any of the alternatives is anticipated to produce two distinct types of effects: (1) direct effects related to new development or construction activities or changes to existing Oroville Facilities operations; and (2) indirect effects related to changes in flow releases and/or water levels.

Both quantitative and qualitative assessments were completed to evaluate potential effects on aquatic resources (Appendix C). Qualitative analyses were conducted based on a combination of literature reviews, study plan report results, and the best professional judgment and experience of qualified individuals. These qualitative analyses examined potential effects associated with all of the following:

- Fish interactions (e.g., competition for food or habitat, genetic introgression, predation);
- Fisheries resources management (stocking programs and disease management); and
- Potential effects on Chinook salmon spawning segregation, upstream passage, macroinvertebrate populations, woody debris distribution, gravel recruitment, channel complexity, riparian and floodplain improvement program, and water quality criteria for aquatic life in relationship to aquatic resources and habitat quality.

5.4.4 Impacts and Mitigation Measures

The following section describes the beneficial effects and potentially adverse impacts of the Proposed Project, including both programmatic and project-level analyses. Table 5.4-5 indicates the SA articles or actions that could have an effect on aquatic resources, and whether these effects are expected to be beneficial, less-than-significant, or would be less-than-significant following implementation of recommended mitigation measures.

In addition to the Proposed Project, this DEIR analyzes the No-Project Alternative and the FERC Staff Alternative. Impacts on aquatic resources from implementing the FERC Staff Alternative are the same as those anticipated from implementation of the Proposed Project unless noted. Detailed analyses of potential impacts of the Oroville Facilities on habitat components, warmwater and coldwater reservoir fish species, and lower Feather River fish species under the No-Project, Proposed Project, and FERC

Table 5.4-5. Environmental effects on aquatic resources.

Alternative(s)	Article # and Title	Level of CEQA Analysis	Nature of Potential Impact(s)	Effect
PRO, FERC	A102—Gravel Supplementation Program	Programmatic	Increase salmonid spawning habitat quantity and quality/short-term construction related effects.	B/LTS
PRO, FERC	A103—Channel Improvement Program	Programmatic with some project-specific elements	Increase salmonid habitat quantity and quality/short-term construction related effects.	B/LTS
PRO, FERC	A104—Structural Habitat Supplementation and Improvement Program	Programmatic	Increase juvenile salmonid rearing habitat quantity and quality/short-term construction related effects.	B/LTS
PRO, FERC	A105—Fish Weir Program	Programmatic	Segregation of adult spring- and fall-run Chinook salmon spawning	B
PRO	A106— Riparian and Floodplain Improvement Program	Programmatic	Increase salmonid habitat quality and potential slight increase in quantity/short-term construction related effects.	B/LTS
FERC	A106— Riparian and Floodplain Improvement	Programmatic	Increase salmonid habitat quality and potential slight	B/LTS

Table 5.4-5. Environmental effects on aquatic resources.

Alternative(s)	Article # and Title	Level of CEQA Analysis	Nature of Potential Impact(s)	Effect
	Program		increase in quantity/short-term construction related effects.	
PRO, FERC	A107—Feather River Fish Hatchery Water Temperature and Feather River Fish Hatchery Adaptive Management Program	Programmatic	Increase salmonid habitat quality and potential slight increase in quantity	B
PRO, FERC	A108—Minimum Flow and other Measures	Project-specific (108.1); Programmatic (108.2 and 108.3)	Increase salmonid habitat quantity and quality Reduced habitat quality for warmwater species	B LTS
NO, PRO, FERC	A110—Lake Oroville Warm water Fishery Habitat Improvement Program	Programmatic	Increase habitat quantity and quality of warm water fish habitat in Lake Oroville	B
NO, PRO, FERC	A111—Lake Oroville Cold Water Fishery Habitat Improvement Program	Programmatic	Increase habitat quantity and quality of cold water fish habitat in Lake Oroville	B
PRO	Appendix F— Habitat Expansion Agreement	Programmatic	Fully mitigates for the loss of access to historic anadromous salmonid habitat due to the continued existence of the Oroville Facilities	B

Coding:

B = Action with potential to result in a beneficial effect; could involve short-term, less-than-significant, construction-related impacts that would be avoided or reduced through the use of Best Management Practices (BMPs). See Appendix D.

LTS = Action that would result in less-than-significant impact on resource.

Staff Alternative are provided in Appendices C2 (Existing Conditions vs. No-Project), C3 (Existing Conditions vs. Proposed Project), and C4 (No-Project vs. Proposed Project).

Potential impacts are identified as follows: NO (No-Project), PRO (Proposed Project), FERC (FERC Staff Alternative). All alternatives analyzed result in **beneficial** or **less-than-significant** impacts on aquatic resources.

5.4.4.1 Program-Level Impacts and Mitigation Measures

Continuation of Oroville Facilities operations, construction of new or improved facilities, and implementation of the Proposed Project would result in beneficial effects on aquatic resources. These include supplementing and improving gravel salmonid spawning substrate in the lower Feather River, improving existing and creating new side-channel fish habitat, supplementing and improving large woody debris (LWD) in the lower Feather River, installation of fish segregation weirs for the segregation of spring-run Chinook salmon spawning, implementation of a Hatchery Adaptive Management Program, implementation of Lake Oroville warm water and cold water fishery habitat

improvement programs, and implementation of a habitat expansion program for spring-run Chinook salmon (Proposed Project only). Additionally, under both the Proposed Project and the FERC Staff Alternative, after the potential facility modification(s) are in place and after the testing period is completed, a revised set of water temperature objectives may be developed for SA Article A108, Table 2.

Establishment of water temperature targets as noted above would result in modifications to minimum instream flows in the LFC, and other operational changes, that would all be beneficial to coldwater aquatic resources because they would result in lower water temperatures to improve aquatic habitat conditions. These improvements would be made immediately upon issuance of the new FERC license, and would be in place during the period referred to as the initial new license period. Potential impacts on aquatic resources as a result of these near-term actions are evaluated at a project-specific level of analysis in this EIR.

In addition to these flow/temperature actions, potential future facility modifications to further enhance water temperature management for coldwater fish species may be constructed post-licensing. Potential future facilities modifications that are being considered by DWR for water temperature management in the LFC include Palermo Canal improvements, a Hyatt Intake extension, and river valve improvements. Potential future modifications being considered to further improve temperature management for coldwater fish in the HFC include a canal around Thermalito Afterbay, a canal through Thermalito Afterbay, and an alternate Thermalito Afterbay outlet and channel. Potential impacts on aquatic resources as a result of any of the above long-term actions are evaluated at a program level of analysis because the actions currently do not have a sufficient level of detail regarding design, operational characteristics, location, implementation timing and phasing, or methods of implementation to adequately support a project level of analysis sufficient to satisfy permitting requirements. As such, prior to their implementation, any future action selected by DWR and approved by FERC would be subject to subsequent environmental analysis and documentation when additional specificity of the actions becomes available and after they have undergone the Ecological Committee (EC) review and comment process specified by the SA and described in Section 3.3.2.

Implementation of some of the actions in the Proposed Project may involve instream construction activities or construction activities within areas adjacent to waterbodies in the project area. Utilization of specific design elements, construction techniques, and aquatic conservation measures are incorporated in the proposed actions to minimize and avoid construction related effects on species of management concern within the immediate vicinity of and downstream from the construction area. Construction activities would be scheduled to avoid impacts during critical life stages when those life stages would be unable to volitionally avoid the construction area (e.g., during salmonid embryo incubation). Additionally, construction-related effects on aquatic resources would be reduced through the implementation of standard construction Best Management Practices (BMPs) as described in Appendix D, a Storm Water Pollution Prevention Plan (SWPPP), and, if necessary, Erosion and Sediment Control Plans.

Impact 5.4-a: Interfere substantially with the movement of native resident or migratory fish, substantially reduce the habitat of a fish species, or cause a fish population to drop below self-sustaining levels.

NO

Warm water fisheries - Continued dewatering of bass nests in Lake Oroville during spawning season would occur, although the impact is not great enough to change the self-sustaining nature of the bass fishery. Increased nesting success attributable to the Lake Oroville Warm Water Fishery Habitat Improvement Program instituted in 1994 would continue to occur under the No-Project Alternative. This impact is considered **less-than-significant**.

Cold water fisheries - Implementation of the stocking program begun in 1994 would continue. This is considered a **beneficial** effect.

American shad - **No impact** on the quality, quantity, or distribution of habitat relative to Existing Conditions would occur.

Black bass – Continuation of the black bass program would result in **beneficial** effects on the quality, quantity, or distribution of habitat relative to Existing Conditions.

Hardhead - **No impact** on the quality, quantity, or distribution of habitat as compared to Existing Conditions would occur.

River lamprey - Continued incremental degradation of spawning gravel would occur. This impact is considered **less-than-significant** when compared to Existing Conditions.

Sacramento splittail - **No impact** on the quality, quantity, or distribution of habitat as compared to Existing Conditions would occur.

Striped bass - **No impact** on the quality, quantity, or distribution of habitat as compared to Existing Conditions would occur.

PRO, FERC

Warmwater fisheries - This impact would be the same as under the No-Project Alternative in Lake Oroville with implementation of SA Article A110. Increased nesting success attributable to the Lake Oroville Warm Water Fishery Habitat Improvement Program instituted in 1994 would continue to occur under the both the Proposed Project and the FERC Staff Alternative and is considered **beneficial**.

Potential future facilities modifications (SA Article A108) may have an adverse impact on warmwater fisheries habitat quality in Thermalito Afterbay. This potential impact would be fully evaluated in subsequent project-specific CEQA analysis. This impact is considered **less-than-significant** based on the SA descriptions of future facilities modifications.

Construction-related impacts on warmwater fisheries would be short-term and **less-than-significant** with use of standard BMPs described in Appendix D.

Coldwater reservoir fisheries - The Lake Oroville Cold Water Fishery Improvement Program (SA Article A111) would continue the existing program with the addition of actions to identify alternative sources of fish, provide additional monitoring, address disease concerns, and analyze the feasibility of providing hatchery water disinfection. This impact would be similar to that under the No-Project Alternative in Lake Oroville; this effect is considered **beneficial**.

American shad **– No impact** on the quality, quantity, or distribution of habitat relative to Existing Conditions would occur.

Black Bass - This impact would be the same as under the No-Project Alternative in Lake Oroville with implementation of SA Article A110. Increased nesting success attributable to the Lake Oroville Warm Water Fishery Habitat Improvement Program instituted in 1994 would continue to occur under both the Proposed Project and the FERC Staff Alternative and is considered **beneficial**.

Potential future facilities modifications (SA Article A108) may have an adverse impact on black bass habitat quality in Thermalito Afterbay. This potential impact would be fully evaluated in subsequent project-specific CEQA analysis. This impact is considered **less-than-significant** based on the SA descriptions of future facilities modifications.

Construction-related impacts on aquatic resources for black bass would be short-term and **less-than-significant** with use of standard BMPs described in Appendix D.

Hardhead – **No impact** on the quality, quantity, or distribution of habitat as compared to Existing Conditions would occur.

River Lamprey - Implementation of the Gravel Supplementation Program and Channel Improvement Program would result in **beneficial** effects for river lamprey. Additionally, initial new license period operational modifications would result in **beneficial** effects on the habitat quantity and quality for river lamprey through water temperature enhancements in the lower Feather River.

Sacramento splittail **– No impact** on the quality, quantity, or distribution of habitat as compared to Existing Conditions would occur.

Striped bass – **No impact** on the quality, quantity, or distribution of habitat as compared to Existing Conditions would occur.

Mitigation measure 5.4-a: No mitigation is required.

Impact 5.4-b: Cause a substantial decrease in the prey base for any species identified as a candidate, sensitive, or special-status species.

NO — There would be no changes in macroinvertebrate conditions from Existing Conditions that would result in continued reduced productivity and species diversity. This impact is considered **less-than-significant**.

PRO, FERC — Implementation of the Large Woody Debris (SA Article A104), Riparian Habitat (SA Article A106), Gravel Supplementation (SA Article A102), and Channel Improvement (SA Article A103) programs would increase habitat quality and habitat diversity, resulting in **beneficial** impacts on macroinvertebrates.

Construction-related impacts on macroinvertebrates would be short-term and **less-than-significant** with use of standard BMPs described in Appendix D.

Mitigation measure 5.4-b: No mitigation is required.

Impact 5.4-c: Result in substantial habitat degradation for fisheries or aquatic species identified by DFG, NMFS, or USFWS as a candidate, sensitive, or special-status species.

NO — Continuation of Oroville Facilities operations could potentially result in impacts on large woody debris, gravel recruitment, channel complexity, and water quality for aquatic life. This impact is considered **less-than-significant**.

Woody Debris Recruitment (SA Article A104) - Continued deprivation of LWD upstream contribution and a small incremental reduction in habitat quality and complexity in the lower Feather River would occur. This impact is considered **less-than-significant**.

Gravel Recruitment (SA Article A102) - Continued blockage of upstream gravel recruitment contribution and ongoing incremental degradation of substrate quality and continued streambed armoring would occur when compared to Existing Conditions. This impact is considered **less-than-significant**.

Channel Complexity (SA Article A103) - Continued incremental decrease in channel complexity and habitat diversity downstream of Oroville Dam would occur when compared to Existing Conditions. This impact is considered **less-than-significant**.

Water Quality for Aquatic life - No changes in water quality criteria for aquatic life from Existing Conditions would occur. This impact

is considered **less-than-significant**.

Fall-run Chinook salmon - Continued incremental degradation of spawning gravel, LWD cover, and habitat complexity would occur as compared to Existing Conditions. This impact is considered **less-than-significant**.`

Green sturgeon - **No impact** on the quality, quantity, or distribution of habitat would occur.

Spring-run Chinook salmon - Incremental degradation of spawning substrate and habitat quality from continuing loss of LWD and redd superimposition when compared to Existing Conditions would occur. This impact is considered **less-than-significant**.

Steelhead - Incremental degradation of spawning substrate and habitat quality from continuing loss of LWD as compared to Existing Conditions would occur. This impact is considered **less-than-significant**.

PRO

Implementation of the gravel recruitment (SA Article A102), large woody debris (SA Article A104), riparian habitat, channel improvement (SA Article A103), water quality for aquatic life, spatial segregation of spring-run Chinook salmon (SA Article A105), and temperature improvement programs (SA Article A108) would result in **beneficial** impacts. Construction-related impacts on aquatic resources would be short-term and **less-than-significant** with use of standard BMPs described in Appendix D.

Gravel Recruitment (SA Article A102) - Lower Feather River gravel supplementation would address the blockage of upstream gravel contribution. Implementation of the Gravel Supplementation Program and Channel Improvement Program would result in **beneficial** effects.

Channel Complexity (SA Article A103) - Enhancement of existing and creation of new side channels (SA Article A103) and implementation of the Large Woody Debris (SA Article A104), Gravel Supplementation (SA Article A102), and Riparian Habitat (SA Article A106) programs would result in **beneficial** effects.

Water Quality for Aquatic life - No changes in water quality criteria for aquatic life from Existing Conditions would occur with either the Proposed Project or the FERC Staff Alternative and therefore either alternative would have a **less-than-significant** effect. See Section 5.2.2 for a discussion of surface water quality.

Implementation of the fish segregation weirs (SA Article A105) addresses genetic introgression between spring- and fall-run Chinook salmon caused by the continued existence of the Oroville Facilities and the resultant loss in spatial and temporal segregation

of the two runs due to the blocking of upstream adult migration. Thus, installation of fish segregation weirs and implementation of the Hatchery Adaptive Management Program and the Habitat Expansion Agreement (SA Appendix F) would result in **beneficial** effects on aquatic resources.

Fall-run Chinook salmon - Implementation of the Hatchery Adaptive Management Program (SA Article A107), Habitat Expansion Agreement (SA Appendix F), Fish Weir Program (SA Article A105), Large Woody Debris (A 104) and Gravel Supplementation (SA Article 102), Riparian and Floodplain Improvement Program (SA Article A106), and Channel Improvement Program (SA Article A103) would result in **beneficial** effects. Additionally, initial new license period operational modifications would result in beneficial effects on the habitat quantity and quality for Chinook salmon through water temperature enhancements in the lower Feather River.

Implementation of the fish segregation weirs would reduce the currently available spawning habitat for fall-run Chinook salmon; however, this impact would be more than offset by the Lower Feather River Habitat Improvement Plan through gravel supplementation and side channel creation.

Potential future facilities modifications (SA Article A108) by design would result in further **beneficial** effects on the habitat quantity and quality for Chinook salmon through additional enhancements to water temperatures in the lower Feather River.

Construction-related impacts on Chinook salmon would be short-term and **less-than-significant** with use of standard BMPs described in Appendix D.

Green sturgeon - Initial new license period operational modifications would result in **beneficial** effects on the habitat quantity and quality for green sturgeon through water temperature enhancements in the lower Feather River.

Potential future facilities modifications (SA Article A108) by design would result in further **beneficial** effects on the habitat quantity and quality for green sturgeon through additional enhancements to water temperatures in the lower Feather River.

Construction-related impacts on green sturgeon would be short-term and **less-than-significant** with use of standard BMPs described in Appendix D.

Spring-run Chinook salmon - Implementation of the Feather River Hatchery Improvement Program (SA Article A107), Habitat Expansion Agreement (SA Appendix F), Fish Weir Program (SA Article A105), Large Woody Debris (SA Article A104) and Gravel

Supplementation (SA Article A102), Riparian and Floodplain Improvement Program (SA Article A106), and Channel Improvement Program (SA Article A103) would result in **beneficial** effects.

Implementation of the fish segregation weirs (SA Article A105) would reduce the competition for currently available spawning habitat. Additionally, initial new license period operational modifications would result in **beneficial** effects on the habitat quantity and quality for spring-run Chinook salmon through water temperature enhancements in the lower Feather River.

Potential future facilities modifications (SA Article A108) by design would result in further **beneficial** effects on the habitat quantity and quality for spring-run Chinook salmon through additional enhancements to water temperatures in the lower Feather River.

Construction-related impacts on spring-run Chinook salmon would be short-term and **less-than-significant** with use of standard BMPs described in Appendix D.

Steelhead - Implementation of the Channel Improvement Program (SA Article A103), Feather River Fish Hatchery Improvement Program (SA Article A107), and Large Woody Debris (SA Article A104), Riparian Habitat (SA Article A106), and Gravel Supplementation and Improvement programs (SA Article A102) would result in **beneficial** effects. Additionally, the Habitat Expansion Agreement (SA Appendix F) mitigates for the loss of anadromous salmonid habitat upstream of the Oroville Facilities, resulting in a **beneficial** effect.

Potential future facilities modifications (SA Article A108) by design would result in further **beneficial** effects on the habitat quantity and quality for steelhead through additional enhancements to water temperatures in the lower Feather River.

Construction-related impacts on steelhead would be short-term and **less-than-significant** with use of standard BMPs described in Appendix D.

FERC

Same as Proposed Project with the exception of:

- gravel recruitment (SA Article A102) – additional monitoring
- riparian and floodplain (SA Article A106) – accelerated implementation

The FERC Staff Alternative does not include the Habitat Expansion Agreement. However, installation of fish segregation weirs (SA Article A105), enhancement of existing side channels (SA Article A103), and implementation of the Feather River Hatchery Improvement Program (SA Article A107), Large Woody

Debris (SA Article A104), Gravel Supplementation (SA Article A102), and Channel Improvement Programs (SA Article A103) would result in **beneficial** effects for aquatic resources.

Although the FERC Staff Alternative is modified from the Proposed Project, the construction-related impacts on aquatic resources would be short-term and **less-than-significant** with use of standard BMPs described in Appendix D.

Mitigation measure 5.4-c: No mitigation is required.

Impact 5.4-d: Substantially conflict with any local policies, ordinances, adopted Habitat Conservation Plans, Natural Community Conservation Plan, or other approved plans protecting fishery resources within the FERC Project boundary.

The Proposed Project did not identify any program that would conflict with local policies, ordinances, adopted Habitat Conservation Plans, Natural Community Conservation Plan, or other approved plans protecting fishery resources within the FERC Project boundary.

Mitigation measure 5.4-d: No mitigation is required.

5.4.4.2 Project-Level Impacts and Mitigation Measures

Continuation of Oroville Facilities operations, construction of new or improved facilities, and implementation of new projects would result in both ongoing beneficial effects as well as potential impacts on aquatic resources. A project-level action, under both the Proposed Project and the FERC Staff Alternative that could potentially affect aquatic resources is the increase in minimum flows in the LFC from 600 cfs year round to 700 cfs from April 1 through September 14 and to 800 cfs from September 15 through March 31. This change would be made immediately upon issuance and acceptance of the new FERC license. The potential impacts on aquatic resources from this action are evaluated at a project level of analysis because a sufficient level of detail exists regarding operational characteristics, location and implementation timing. A detailed analysis of flow effects associated with each of the alternatives studied for the DEIR is presented in Appendices C3 and C4.

Increased flows associated with implementation of the Proposed Project or FERC Staff Alternative would only occur in the LFC. However, because the LFC would be contributing a higher proportion of overall flow in the lower Feather River, the benefits associated with decreases in water temperature are anticipated to extend into the HFC, downstream of the Thermalito Afterbay Outlet.

Impact 5.4-a: Interfere substantially with the movement of native resident or migratory fish, substantially reduce the habitat of a fish species, or cause a fish population to drop below self-sustaining levels.

NO **No impact** on the quality, quantity, or distribution of habitat as compared to Existing Conditions would occur.

PRO, FERC — American shad – Following implementation of flow changes as a component of SA Article A108, water temperatures would be reduced, but these fish tolerate a broad range of water temperatures and therefore this impact would be similar to that of the No-Project Alternative.

Black bass - Following implementation of flow changes as a component of SA Article A108, water temperatures would be reduced and result in a small reduction in the quality and quantity of suitable black bass habitat. This impact is considered **less-than-significant** due to the availability of suitable habitat downstream.

Hardhead, River Lamprey, Striped bass, and Sacramento Splittail – **No impact** on the quality, quantity, or distribution of habitat for these species when compared to Existing Conditions would occur.

Mitigation measure 5.4-a: No mitigation is required.

Impact 5.4-b: Cause a substantial decrease in the prey base for any species identified as a candidate, sensitive, or special-status species.

NO — There would be no changes in macroinvertebrate conditions from Existing Conditions that would result in continued reduced productivity and species diversity. This impact is considered **less-than-significant**.

PRO, FERC — Construction-related impacts on macroinvertebrates would be short-term and **less-than-significant** with use of standard BMPs described in Appendix D.

Mitigation measure 5.4-b: No mitigation is required.

Impact 5.4-c: Result in substantial habitat degradation for fisheries or aquatic species identified by DFG, NMFS, or USFWS as a candidate, sensitive, or special-status species**.**

NO — **No impact** on the quality, quantity, or distribution of habitat as compared to Existing Conditions would occur.

PRO, FERC — Fall-run Chinook salmon Increased flows and resultant lowering of water temperatures in the LFC would result in increased quantity and quality of habitat. This effect would be **beneficial**.

Green sturgeon - Implementation of new minimum flow standards in the LFC would likely result in cooler water temperatures extending downstream from the Thermalito Afterbay Outlet and increase the quantity and quality of green sturgeon habitat

resulting in **beneficial** effects.

Spring-run Chinook salmon - Increases in minimum flows in the LFC would result in increased quantity and quality of habitat. This effect would be **beneficial**.

Steelhead - Increases in minimum flows in the LFC would result in increased quantity and quality of habitat. This effect would be **beneficial**.

Mitigation measure 5.4-c: No mitigation is required.

Impact 5.4-d: Substantially conflict with any local policies, ordinances, adopted Habitat Conservation Plans, Natural Community Conservation Plan, or other approved plans protecting fishery resources within the FERC Project boundary.

The Proposed Project did not identify any project that would conflict with local policies, ordinances, adopted Habitat Conservation Plans, Natural Community Conservation Plan, or other approved plans protecting fishery resources within the FERC Project boundary.

Mitigation measure 5.4-d: No mitigation is required.

5.5 TERRESTRIAL RESOURCES

The following section discusses the environmental impact analysis for botanical and wildlife terrestrial resources. The Regulatory Setting and Thresholds of Significance discussions are relevant to both botanical and wildlife terrestrial resources.

5.5.1 Regulatory Setting

5.5.1.1 Federal Plans, Policies, Regulations, and Laws

Federal Endangered Species Act

USFWS and NMFS oversee the federal Endangered Species Act (FESA). Sections 9 and 4(d) of FESA prohibit the "take" of any fish or wildlife species listed as endangered or threatened, including the destruction of habitat that could hinder species recovery. The Section 9 take prohibition of FESA applies only to wildlife and fish species. Section 9 prohibits the removal, possession, damage, or destruction of any endangered plant from federal land. Section 9 further prohibits acts to remove, cut, dig up, damage, or destroy an endangered plant species in nonfederal areas in knowing violation of any state law or in the course of criminal trespass. Candidate species and species that are proposed for listing receive no protection under FESA. USFWS has jurisdiction over plants, wildlife, and resident fish.

Section 7 of FESA mandates that all federal agencies consult with USFWS to ensure that federal agencies' actions do not jeopardize the continued existence of a listed species or adversely modify critical habitat for listed species.

Section 404 of the Clean Water Act

Section 404 of the Clean Water Act (CWA) establishes a requirement to obtain a permit from the U.S. Army Corps of Engineers (USACE) prior to any activity that involves any discharge of dredged or fill material into "waters of the United States," including wetlands. Waters of the United States include navigable waters of the United States, interstate waters, all other waters where the use or degradation or destruction of the waters could affect interstate or foreign commerce, tributaries to any of these waters, and wetlands that meet any of these criteria or that are adjacent to any of these waters or their tributaries. Wetlands are defined by USACE as those areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. The majority of jurisdictional wetlands meet three wetland delineation criteria: hydrophytic vegetation, hydric soil types, and wetland hydrology. Many surface waters and wetlands in California meet the criteria for waters of the United States, including intermittent streams and seasonal lakes and wetlands.

Executive Order 11990 (Protection of Wetlands)

Executive Order 11990 (1977) requires each agency having jurisdiction to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands. Further, the agencies are directed to avoid undertaking or providing assistance for any new construction located in wetlands unless the head of the agency finds that there is no practicable alternative to such construction and that the proposed action includes all practicable measures to minimize harm to the affected wetlands.

5.5.1.2 State Plans, Policies, Regulations, and Laws

California Endangered Species Act

The California Legislature enacted the California Endangered Species Act (CESA) (Fish and Game Code Sections 2050 et seq.) in 1984. Similar to FESA both in process and substance, CESA does not supersede FESA, but operates in conjunction with it. Species may be listed under both acts (both State and federal laws would apply) or under only one act. Section 2080 of the Fish and Game Code prohibits the take of any plant or animal listed or proposed as threatened, endangered, or rare (rare applies only to plants). DFG administers the Act and authorizes take through Section 2081 incidental take permits. CESA allows for take incidental to otherwise lawful development projects. CESA emphasizes early consultation to avoid potential impacts to rare, endangered, and threatened species and to develop appropriate mitigation planning to offset project caused losses of listed species populations and their essential habitats.

California Native Plant Protection Act

The California Native Plant Protection Act (CNPPA) of 1977 (Fish and Game Code Sections 1900-1913) directed the Department of Fish and Game (DFG) to carry out the Legislature's intent to "preserve, protect and enhance rare and endangered plants in this State." The CNPPA gave the California Fish and Game Commission the power to designate native plants as "endangered" or "rare" and protected endangered and rare plants from take. CESA expanded upon the original CNPPA and enhanced legal protection for plants, but the CNPPA remains part of the Fish and Game Code. To align with Federal regulations, CESA created the categories of "threatened" and "endangered" species. It converted all "rare" animals into the Act as threatened species, but did not do so for rare plants. Thus, there are three listing categories for plants in California: rare, threatened, and endangered. DFG requires a CESA Section 2081 (a) permit for take of candidate or listed threatened and endangered plants for scientific, educational, or management purposes, and a CESA Section 2081 (b) permit for incidental take of listed threatened and endangered plants from all activities, except those specifically authorized by the CNPPA.

California Fish and Game Code for Riparian Communities

The California Riparian Habitat Conservation Program, administered by the Wildlife Conservation Board (WCB), is to protect, preserve, and restore riparian habitats by

acquisition of interests and rights in real property and waters (Section 1387). Preservation and enhancement of riparian habitat shall be a primary concern of the WCB, DFG, and State agencies whose activities impact riparian habitat (Section 1389).

Oak Woodland Conservation Act

Section 21083.4 was recently added to the California Public Resources Code. This statute requires counties to review potential impacts on oak woodlands as part of their CEQA process and outlines specific options for mitigation should the project have potential significant impacts on oak woodlands. The statute exempts agricultural lands that "produce or process plant and animal products for commercial purposes".

California Native Plant Society Species Designations

CNPS is a statewide non-profit organization that seeks to increase understanding of California's native flora and to preserve this rich resource for future generations. CNPS has developed and maintains lists of vascular plants of special concern in California as described in Section 4.5.2.2, Listed Botanical Species. While CNPS-listed species have no formal legal protection, the values and importance of these lists are widely recognized. CNPS considers species included on List 1 and 2 as rare plants. This DEIR considers impacts on these plants.

5.5.1.3 Local Plans, Policies, Regulations, and Laws

The *Butte County General Plan* is broken into elements. Elements relevant to natural resources are discussed under Conservation Planning (Butte County 1971) and Open Space (Butte County 1976). Riparian habitat is acknowledged for its value as habitat and for its scenic quality, where the Feather River is described as having the greatest resource value to be protected. Soil resources are addressed in order to reduce erosion. The Open Space Element (Butte County 1976) addresses preservation of timberlands for their economic, wildlife, scenic, watershed protection, and other values.

5.5.2 Impact Thresholds

The following thresholds are used to determine whether the alternatives would have a significant effect on terrestrial wildlife resources, including listed species. There would be a significant impact on terrestrial wildlife resources if the alternatives would:

- 5.5.1-a: Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by DFG or USFWS;
- 5.5.1-b: Interfere substantially with the movement of any native resident or migratory wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites;

- 5.5.1-c: Directly disturb or create long-term effects on wildlife population dynamics and cause a substantial reduction in wildlife use of established habitats within the Project Area;

- 5.5.1-d: Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance;

- 5.5.1-e: Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations, or by the DFG or USFWS;

- 5.5.1-f: Substantial Habitat Degradation for Wildlife Species Identified by USFWS or DFG as Threatened or Endangered Species;

- 5.5.1-g: Result in a Substantial Impact on a Wildlife Species that is Listed by DFG or USFWS as a Candidate, Sensitive, or Special-Status Species, or on its Designated Habitat; or

- 5.5.1-h: Conflict with the provisions of an adopted Habitat Conservation Plan (HCP), Natural Community Conservation Plan (NCCP), or other approved local, regional, or State HCP.

The following thresholds are used to determine whether the alternatives would have a significant effect on botanical resources, including listed species. There would be a significant impact on botanical resources if the alternatives would:

- 5.5.2-a: Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by DFG or USFWS;

- 5.5.2-b: Effects on Natural Upland Plant Communities (Excluding Riparian/Wetlands and Sensitive Plant Habitats);

- 5.5.2-c: Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the CWA (including but not limited to marsh, vernal pool, coastal, etc.) through direct removal, filling, or hydrological interruptions, or other means;

- 5.5.2-d: Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations, or by the DFG or USFWS; or

- 5.5.2-e: Effects on Natural Communities, Wildlife Habitat, and Special-Status Species and Their Habitats from Invasive Plant Species.

5.5.3 Method of Analysis

Potential impacts on terrestrial resources were assessed by both qualitative and quantitative methods. Baseline data for this assessment were collected during Oroville Facilities relicensing studies. These studies were developed in coordination with stakeholders, including the regulatory agencies. Detailed field investigations were conducted in accordance with standard methodologies recommended by the resource agencies, pertinent jurisdictions, or affiliations with oversight for the individual resource area. Studies included vegetation mapping, invasive weed surveys, surveys for special-status species, and riparian and wetland resource studies. Surveys were conducted during 2002, 2003, and 2004. For detailed descriptions of Study Plan methodologies, please refer to each Study Plan Report. The following technical studies were conducted to address the specific terrestrial resource issues identified during relicensing scoping:

- Study Plan T-1 (SP-T1), Effects on Project Operations and Features on Wildlife and Wildlife Habitat;
- SP-T2 (two reports), Project Effects on Special Status Wildlife Species and Project Effects on Special Status Plant Species;
- SP-T3/5, Project Effects on Riparian Resources, Wetlands, and Associated Floodplains;
- SP-T4, Biodiversity, Vegetation Communities, and Wildlife Habitat Mapping;
- SP-T6, Interagency Wildlife Management Coordination and Wildlife Management Plan Development;
- SP-T7, Project Effects on Noxious Terrestrial and Aquatic Plant Species;
- SP-T8, Project Effects on Non-Native Wildlife;
- SP-T9, Recreation and Wildlife;
- SP-T10, Effects of Project Features, Operations, and Maintenance on Upland Plant Communities; and
- SP-T11, Effects of Fuel Load Management and Fire Prevention on Wildlife and Plant Communities.

5.5.4 Impacts and Mitigation Measures

5.5.4.1 Wildlife Impacts and Mitigation Measures

The following section describes the beneficial effects and potentially adverse impacts of the Proposed Project, including both programmatic and project-level analyses. Table 5.5-1 indicates the SA articles or actions that could have an effect on wildlife resources, and whether these effects are expected to be beneficial, less than significant, or would be less than significant following implementation of recommended mitigation measures.

In addition to the Proposed Project, this DEIR analyzes the No-Project Alternative and the FERC Staff Alternative. Impacts on wildlife resources from implementing the FERC Staff Alternative are similar to those anticipated from implementation of the Proposed Project unless noted. Potential impacts are identified as follows: NO (No-Project), PRO (Proposed Project), and FERC (FERC Staff Alternative). All alternatives analyzed result in beneficial or less-than-significant impacts on wildlife resources with implementation of mitigation.

Continuation of Oroville Facilities operations, construction of new or improved facilities, and implementation of new programs could result in impacts on wildlife resources. Potential impacts on wildlife resources as a result of these actions are evaluated at a program level of analysis whenever these actions currently do not have a sufficient level of detail to analyze the action on a project level. Information on specific design, operational characteristics, location, implementation timing and phasing, or methods of implementation are needed to adequately support a project level of analysis sufficient to satisfy permitting requirements. As such, prior to their implementation, these project actions will be subject to subsequent environmental analysis and documentation when additional specificity of the actions becomes available and after they have undergone the Ecological Committee (EC) review and comment process as described in the SA. Where adequate level of detail is available to reliably predict project impacts on wildlife resources, a project level of analysis is performed.

Actions associated with the No-Project Alternative are described in Chapter 3.0 and generally include interim recreation projects and Riverbend Park recreational improvements, and endangered species habitat conservation measures associated with informal consultation and identified for early implementation within the Terrestrial Biological Assessment (Terrestrial BA) (DWR 2003). Ongoing existing project operational effects on wildlife resources identified in Chapter 3.0 would continue under the No-Project Alternative.

Actions associated with the Proposed Project include those actions identified within the No-Project Alternative as well as all articles included within Appendix A and B of the SA that are described in Chapter 3.0. The Proposed Project also addresses ongoing operational effects identified under Existing Project Conditions.

Table 5.5-1. Environmental effects on wildlife resources.

Alternative(s)	Article # and Title	Level of CEQA Analysis	Nature of Potential Impact(s)	Effects
PRO	A106—Riparian and Floodplain Improvement Program	Programmatic	Long-term beneficial effect on wildlife resources. Potential for temporary minor impacts on wildlife habitats and special-status species from construction activities.	B
FERC	A106—Riparian and Floodplain Improvement Program as revised by FERC staff to accelerate monitoring and implementation plan	Programmatic	Long-term beneficial effect on wildlife resources. Potential for temporary minor impacts on wildlife habitats and special-status species from construction activities.	B
PRO, FERC	A110—Lake Oroville Warm Water Fishery Habitat Improvement Program	Programmatic	Beneficial effects by creating additional riparian habitat and concentrating prey species.	B
PRO, FERC	A111—Lake Oroville Cold Water Fishery Habitat Improvement Program	Programmatic	Beneficial effect by increasing density of prey species for fish-eating species.	B
PRO, FERC	A102—Gravel Supplementation and Improvement Programs	Programmatic	Potential for minor impacts on wildlife resources, including special-status species from construction activities.	LTS/ LTSM
PRO	B103—Additional Gaging	Programmatic	Potential for minor impacts on wildlife resources, including special-status species from construction activities.	LTS
PRO, FERC	A128—Historic Properties Management Plan	Programmatic	Short-term and minor impacts due to restoration of cultural sites.	LTS
PRO, FERC	A103—Channel Improvement Program. This action is programmatic; however, Moe's and Hatchery Ditch activities are project level	Programmatic with some Project elements	Potential for minor impacts on wildlife resources, including special-status species from construction activities.	LTS/ LTSM

Table 5.5-1. Environmental effects on wildlife resources.

Alternative(s)	Article # and Title	Level of CEQA Analysis	Nature of Potential Impact(s)	Effects
PRO, FERC	A104—Structural Habitat Supplementation and Improvement Program	Programmatic	Potential for minor impacts on wildlife resources, including special-status species from construction activities.	LTS/ LTSM
PRO, FERC	A105—Fish Weir Program	Programmatic	Potential for minor impacts on wildlife resources, including special-status species from construction activities.	LTS/ LTSM
PRO	A127—Recreation Management Plan Trails Equestrian facilities Day use area (DUA) improvements Docks, boat ramps Campgrounds	Programmatic with some Project elements	Potential for minor impacts on wildlife resources, including special-status species from construction activities.	LTSM
FERC	A127—SA Recreation Management Plan (RMP) (Revised by FERC staff to include modifications to trails development/implementation; reconstruction of boat-in campsites; delay of DUA at Foreman Creek)	Programmatic with some Project elements	Potential for minor impacts on wildlife resources, including special-status species from construction activities.	LTSM
NO, PRO, FERC	A117—Vernal Pools	Project	Provides protection for special-status wildlife species and associated habitats.	B
NO, PRO, FERC	A118—Minimization of Disturbances to Nesting Bald Eagles	Project	Provides protection for special-status wildlife species and associated habitats.	B
PRO, FERC	A119—Giant Garter Snake	Project	Provides protection for special-status wildlife species and associated habitats.	B
PRO, FERC	A120—Protection of Valley Elderberry Longhorn Beetle	Project	Provides protection for special-status wildlife species and associated habitats.	B
PRO, FERC	A121—Red-Legged Frog Protection	Project	Provides protection for special-status wildlife species and associated habitats.	B

Table 5.5-1. Environmental effects on wildlife resources.

Alternative(s)	Article # and Title	Level of CEQA Analysis	Nature of Potential Impact(s)	Effects
PRO, FERC	A123—Provision of Upland Food for Nesting Waterfowl	Project	Beneficial effect for wildlife species and wildlife habitats including special-status species.	B
PRO, FERC	A124—Provision of Nest Cover for Upland Waterfowl	Project	Beneficial effect for wildlife species and wildlife habitats including special-status species.	B
PRO, FERC	A125—Installation of Wildlife Nesting Boxes	Project	Beneficial effect for wildlife species and wildlife habitats including special-status species.	B
PRO	A129—Improve and Redirect Recreation Usage to Specific Areas at Foreman Creek (Plan development)	Project	Minor benefit due to reduced disturbance/displacement and reduced habitat degradation.	B
FERC	A129 (revised by FERC staff to include temporary closure)—Improve and Redirect Recreation Usage to Specific Areas at Foreman Creek (Plan development)	Project	Minor benefit due to reduced disturbance/displacement and reduced habitat degradation.	B
PRO, FERC	A122—Construction and Recharge of Brood Ponds	Project	Long-term beneficial effect on wildlife resources. Potential for temporary minor impacts on wildlife habitats and special-status species from construction activities.	B/LTS
PRO	B107—Revision of Speed Limit Regulation for Thermalito Afterbay	Project	Minor effect due to increased disturbance/displacement and increased habitat degradation.	LTS

Coding:

B = Action with potential to result in a beneficial effect; could involve short-term less-than-significant, construction-related impacts that would be avoided or reduced through the use of Best Management Practices (BMPs). See Appendix D.

LTS = Action that would result in less-than-significant impact on resource.

LTSM = Action that would result in less-than-significant impact on resource following mitigation.

Program-Level Impacts and Mitigation Measures

Impact 5.5.4.1-a: Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by DFG or USFWS**.**

NO

The Riverbend Park project, initiated by the Feather River Recreation and Park District (FRRPD) and partially funded by DWR as an Interim Project, was evaluated in a separate CEQA document (FRRPD 2003). No other interim recreation projects required CEQA documentation and were designed to avoid or minimize soil and vegetation disturbances and generally involved only minor modification of existing facilities within areas of previous disturbance. No significant wildlife habitat impacts occurred due to implementation of other interim recreation projects.

Potential ongoing project effects on nesting bank swallows were mitigated in consultation with DFG through habitat protection on the lower Feather River. DWR acquired a conservation easement that allows a geomorphically active portion of the river to continue to erode and provide high-quality bank swallow nesting habitat.

Endangered Species Act (ESA) conservation measures associated with informal consultation for the Terrestrial BA and that were implemented early were designed in consultation with USFWS to avoid and minimize selected ongoing impacts on nesting bald eagles and vernal pool habitats. None of the actions associated with these conservation measures would result in loss or degradation of wildlife habitat. Additionally, conservation measures designed to protect nesting bald eagle habitat would also protect valley/foothill riparian habitat, blue oak/foothill pine, and montane conifer habitats from habitat manipulation or recreational development impacts. Likewise, conservation measures designed to protect vernal pool habitats serve to protect annual grassland and wetland habitats from loss and degradation associated with off-highway vehicle (OHV) damage. The habitat impacts associated with implementation of these conservation measures are **beneficial**.

Several of the interim recreation projects involved actions adjacent to federally listed wildlife species habitats, including vernal pool invertebrate habitat and valley elderberry longhorn beetle habitat. USFWS-prescribed buffers were incorporated into the interim recreation projects design to avoid impacts, including a 100-foot buffer around elderberry shrubs and 200-foot buffer around vernal

pools.

PRO, FERC

The majority of the remaining programs included within the Proposed Project involve at least minor modification, degradation, or loss of existing wildlife habitat. Actions expected to result in less than 1 acre of direct habitat loss include activities described under SA Articles A104 and A105, and selected elements in Article A127. Individually, none of these projects represent a significant wildlife habitat loss; however, total loss of wildlife habitat from these programs associated with the combined implementation area of these actions could be a **potentially significant** impact on wildlife habitat.

No program-level actions included within the Proposed Project have the potential to affect greater sandhill crane, bank swallow, peregrine falcon, or yellow-billed cuckoo. However, staging areas and river access improvements required for The Gravel Supplementation and Improvement Program could have a **potentially significant** impact on Swainson's hawk and bald eagle nesting habitats as well as giant garter snake habitat.

Several programmatic actions included within this alternative are designed to protect State-listed species/habitats or will incidentally result in a **beneficial** effect on these species. These actions include activities described under SA Articles A110 and A111.

Programmatic actions that have at least some potential to adversely affect State-listed species or their habitats are SA Articles A102, A103, A104, A105, and A127. These programs have the potential to **significantly** impact bald eagles, Swainson's hawks, and giant garter snake habitat.

Programmatic actions that could occur within or adjacent to giant garter snake habitat with the potential to adversely affect this species include activities described under SA Articles A102, A103, A104, A105, A122, A123, A124, trails, ADA improvements, upgrades, or new day use areas (DUAs) (including watchable wildlife sites), upgrades to boat ramps, and installation of a new sandy beach. These actions could result in **potentially significant** impacts.

Implementation of SA Articles A102, A103, A104, and A105 may have the potential for minor impacts on wildlife resources, including special-status species, which may include nesting bald eagles, valley elderberry longhorn beetles, giant garter snakes, and California red-legged frogs, and their associated habitats from construction activities. However, early implementation of the Draft

Terrestrial BA and implementation of conditions contained in the Final Terrestrial BO would result in **less-than-significant** impacts on special-status species.

Staging areas and river access improvements required for the Gravel Supplementation and Improvement Program could impact valley elderberry longhorn beetle, giant garter snake habitat, and bald eagle nesting habitat. These projects would be designed or constructed to avoid significant habitat degradation for federally listed threatened or endangered wildlife species consistent with the Final Terrestrial BO and would result in **less-than-significant** impacts.

During implementation of Feather River fisheries enhancements, DWR would abide by USFWS BO terms and conditions designed to avoid impacts to listed species including bald eagle, valley elderberry longhorn beetle, and giant garter snake. These terms and conditions would reduce impacts to **less-than-significant**.

As described in the SA RMP, the Potter Ravine trail extends an existing trail an additional 2.2 miles and ends immediately outside the secondary protection zone for a bald eagle nest territory. The existing Potter's Ravine trail is subject to administrative closure from January 1 through August 31 during years that a nearby bald eagle nest territory is active. With continued seasonal closures, extension of the trail as described in SA Article A127 would result in **less-than-significant** impacts on nesting eagles. Termination of the trail before entering the protection zone would avoid impacts on nesting bald eagles in compliance with the Bald Eagle Nest Territory Management Plan and no mitigation would be required.

Wildlife habitat enhancements and recreational developments at the Thermalito Complex can be designed and implemented to avoid and buffer vernal pool invertebrate habitat, which would reduce any impacts to **less-than-significant**. No mitigation would be required.

Giant garter snake habitat losses may be associated with North Forebay fishing access improvements and the creation of a sandy beach at Larkin Road. These habitat losses can be minimized through project design and construction. These projects would be designed or constructed to avoid significant habitat degradation for federally listed threatened or endangered wildlife species consistent with the Final Terrestrial BO and would result in **less-than-significant** impacts.

Mitigation measure 5.5.4.1-a: Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by DFG or USFWS**.**

PRO, FERC — The following actions can be implemented to reduce the impact as a result of habitat losses under the Proposed Project.

Minimize direct habitat loss or disturbance through project design and construction timing. Retain screening vegetation to limit indirect habitat loss and wildlife disruption/displacement. Retain key wildlife habitat elements to the extent possible including snags, woody dead and down material, live trees containing cavities, and shrub cover. Retain mature trees and minimize use of non-native landscaping. Minimize recreational development in riparian or wetland habitats. Revegetate areas of disturbed soil. Implementation of these mitigation and avoidance measures would reduce direct habitat loss and reduce potential impacts to **less-than-significant.**

Spatial and/or temporal avoidance of species identified as a candidate, sensitive, or special-status species by DFG or USFWS would reduce the impact to a **less-than-significant** level.

Impact 5.5.4.1-b: Interfere substantially with the movement of any native resident or migratory wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites.

NO — None of the interim recreation projects or conservation measures associated with informal consultation for the Terrestrial BA, and that were implemented early prior to new license issuance, have the potential to create barriers to wildlife dispersal or movement. **No impact** is anticipated.

PRO, FERC — The Fish Weir Program (SA Article A105) has the potential to create a barrier to wildlife dispersal and movement. The Fish Weir Program may impede upstream movement of the highly aquatic western pond turtle, a State Species of Special Concern. This passage issue is a **potentially significant** impact.

Mitigation measure 5.5.4.1-b: Interfere substantially with the movement of any native resident or migratory wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites**.**

PRO, FERC — Modify weir design and operation to allow turtles passage without allowing salmon passage. Allow shoreline/shallow-water passage during periods of stable flow. Implementation of these mitigation

and avoidance measures would reduce direct habitat loss and reduce potential impacts to a **less-than-significant** level.

Impact 5.5.4.1-c: Directly Disturb or Create Long-Term Effects on Wildlife Population Dynamics and Cause a Substantial Reduction in Wildlife Use of Established Habitats Within the Project Area.

NO — None of the interim recreation projects or conservation measures associated with informal consultation for the Draft Terrestrial BA and that were implemented early, prior to new license issuance, have the potential to substantially reduce wildlife habitat use or negatively affect long-term wildlife population dynamics. **No significant** impact is anticipated.

PRO, FERC — Several programmatic actions within the Proposed Project are designed to benefit specific wildlife species or groups of species. These actions will benefit individual animals but are probably insignificant at the population level. Examples of these **beneficial** actions include activities described under SA Articles A110 (Lake Oroville Warm Water Fishery Habitat Improvement Program) and A111 (Lake Oroville Cold Water Fishery Habitat Improvement Program).

The Gravel Supplementation and Improvement Program (SA Article A102) could provide more productive wildlife habitats. If gravel is sourced from barren gravel tailings, then additional wildlife habitat values could be created at these sites. Installation of additional vehicular barriers within the Oroville Wildlife Area (OWA) could serve to reduce habitat degradation and vehicle-related mortality of sedentary wildlife and reduce wildlife disturbance or displacement. Restrictions on motorized wheeled vehicle use within the drawdown zone of Lake Oroville could serve to reduce disturbance or displacement of both lacustrine and terrestrial wildlife species. These actions would result in **less-than-significant** effects for wildlife therefore no mitigation is necessary.

Mitigation measure 5.5.4.1-c: No mitigation is required.

Impact 5.5.4.1-d: Substantially Conflict with Any Local Policies, Ordinances, Adopted HCPs, NCCPs, or Other Approved Plans Protecting Wildlife Resources Within the Project Boundary.

NO — None of the actions in the No-Project Alternative, including interim recreation projects or conservation measures associated with informal consultation for the Draft Terrestrial BA and that were implemented early, have the potential to substantially conflict with

any local policies, ordinances, adopted HCPs, NCCPs, or other approved plans protecting wildlife resources within the project boundary. **No impact** is anticipated.

PRO, FERC — None of the actions in the Proposed Project have the potential to substantially conflict with any local policies, ordinances, adopted HCPs, NCCPs, or other approved plans protecting wildlife resources within the project boundary. **No impact** therefore no mitigation is necessary.

Mitigation measure: 5.5.4.1-d: No mitigation is required.

Impact 5.5.4.1-e: Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations, or by the DFG or USFWS**.**

NO — None of the interim recreation projects or conservation measures associated with informal consultation for the Draft Terrestrial BA and that were implemented early has the potential to substantially impede the use of wildlife nursery areas.

PRO, FERC — Programmatic actions where specific project locations are not currently known have the potential to significantly affect wildlife nursery areas. The Gravel Supplementation and Improvement Program (SA Article A102) has the potential to result in short-term, **potentially significant** impacts on heron/egret rookeries through direct habitat loss and disturbance associated with construction access, staging, and in-water construction.

Over the long term, the Gravel Supplementation and Improvement Program (SA Article A102) and the Riparian and Floodplain Improvement Program (SA Article A106) could provide more productive wildlife habitats. If gravel is sourced from barren gravel tailings, then additional wildlife habitat values could be created at these sites. Installation of additional vehicular barriers within the OWA could serve to reduce vehicle-related mortality of sedentary wildlife and reduce wildlife disturbance or displacement. Restrictions on motorized wheeled vehicle use within the drawdown zone of Lake Oroville could serve to reduce disturbance or displacement of both lacustrine and terrestrial wildlife species. These actions would result in **less-than-significant** impacts.

Actions to enhance Feather River fisheries habitats through SA Articles A103, A104, and A105 would have a **less-than-significant** effect on rookeries with implementation of Best Management Practices (BMPs) implemented as part of either the Proposed Project or the FERC Staff Alternative.

Mitigation measure 5.5.4.1-e: Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations, or by the DFG or USFWS**.**

PRO, FERC — During construction activities, avoid wildlife nursery areas during critical nesting periods. Implementation of this mitigation measure would reduce the impact to **less-than-significant**.

Impact 5.5.4.1-f: Substantial Habitat Degradation for Wildlife Species Identified by USFWS as Threatened or Endangered Species.

NO — Several of the interim recreation projects involved actions adjacent to federally listed wildlife species habitats, including vernal pool invertebrate habitat and valley elderberry longhorn beetle habitat. USFWS-prescribed buffers were incorporated into the interim recreation projects design to avoid impacts, including a 100-foot buffer around elderberry shrubs and 200-foot buffer around vernal pools.

Conservation measures associated with informal consultation for the Draft Terrestrial BA and that were implemented early, prior to issuance of the new license, were designed in consultation with USFWS to avoid potential ongoing impacts on both nesting bald eagle habitat and vernal pool invertebrate habitat.

Riverbend Park improvements generally avoided impacts on federally listed wildlife species through facilities siting and project design (FRRPD 2003). Loss of any USFWS threatened or endangered species was addressed in a separate EIR (FRRPD 2003) and Biological Opinion (BO) (USACE, 2004).

PRO, FERC — Implementation of SA Articles A102, A103, A104, and A105 may have the potential for minor impacts on wildlife resources, including special-status species, which may include nesting bald eagles, valley elderberry longhorn beetles, giant garter snakes, and California red-legged frogs, and their associated habitats from construction activities. However, early implementation of the Draft Terrestrial BA and implementation of conditions contained in the Final Terrestrial BO would result in **less-than-significant** impacts on special-status species.

Staging areas and river access improvements required for the Gravel Supplementation and Improvement Program could impact valley elderberry longhorn beetle, giant garter snake habitat, and bald eagle nesting habitat. These projects would be designed or constructed to avoid significant habitat degradation for federally listed threatened or endangered wildlife species consistent with

the Final Terrestrial BO and would result in **less-than-significant** impacts. No mitigation would be required.

During implementation of Feather River fisheries enhancements, DWR would abide by USFWS BO terms and conditions designed to avoid impacts to listed species including bald eagle, valley elderberry longhorn beetle, and giant garter snake. These terms and conditions would reduce impacts to **less-than-significant**.

As described in the SA RMP, the Potter Ravine trail extends an existing trail an additional 2.2 miles and ends immediately outside the secondary protection zone for a bald eagle nest territory. The existing Potter's Ravine trail is subject to administrative closure from January 1 through August 31 during years that a nearby bald eagle nest territory is active. With continued seasonal closures, extension of the trail as described in SA Article A127 would result in **less-than-significant** impacts on nesting eagles. Termination of the trail before entering the protection zone would avoid impacts on nesting bald eagles in compliance with the Bald Eagle Nest Territory Management Plan and no mitigation would be required.

Wildlife habitat enhancements and recreational developments at the Thermalito Complex can be designed and implemented to avoid and buffer vernal pool invertebrate habitat, which would reduce any impacts to **less-than-significant**. No mitigation would be required.

Giant garter snake habitat losses may be associated with North Forebay fishing access improvements and the creation of a sandy beach at Larkin Road. These habitat losses can be minimized through project design and construction. These projects would be designed or constructed to avoid significant habitat degradation for federally listed threatened or endangered wildlife species consistent with the Final Terrestrial BO and would result in **less-than-significant** impacts.

Mitigation measure 5.5.4.1-f: No mitigation is required.

Impact 5.5.4.1-g: Result in a Substantial Impact on a Wildlife Species that is Listed by DFG or USFWS as a Candidate, Sensitive, or Special-Status Species, or on its Designated Habitat.

NO

The interim recreation projects or conservation measures associated with informal consultation for the Draft Terrestrial BA that were implemented early would have **no impact** on candidate, sensitive, or special-status species/habitat.

Potential impacts from the Riverbend Park recreational

development were addressed under a separate EIR (FRRPD 2003); these actions resulted in **less-than-significant** impacts.

PRO, FERC

Actions specifically designed in consultation with USFWS to protect and enhance federally listed species habitats will also provide benefits to a variety of special-status species. Wildlife and fisheries habitat enhancement actions such as brood pond construction/recharge, Lake Oroville warm and coldwater fisheries enhancements, and waterfowl nest cover and forage enhancements will also benefit special-status species. Special-status species that could potentially **benefit** from these actions include American bittern, American white pelican, Bell's sage sparrow, black tern, black-crowned night heron, California gull, California thrasher, Cooper's hawk, double-crested cormorant, long-eared owl, merlin, northern harrier, osprey, short-eared owl, tricolored blackbird, western burrowing owl, least bittern, yellow warbler, white-tailed kite, yellow-breasted chat, and western pond turtle.

However, some programs or actions have the potential to affect one or more special-status wildlife species. Feather River fisheries enhancement actions (activities described under SA Articles A102, A103, A104, and A105) would result in short-term habitat loss degradation to several special-status riverside species including river otter, pond turtle, double-crested cormorant, American white pelican, black tern, California gull, and osprey. No substantial long-term effects on these species are predicted and these actions would have **less-than-significant** impacts.

The Gravel Supplementation and Improvement Program has the potential to result in short-term adverse impacts on riparian and riverine habitats and species associated with these habitats through direct habitat loss and disturbance associated with construction access, staging, and in-water construction. These species could include American bittern, American white pelican, Barrow's goldeneye, black tern, California gull, California thrasher, Cooper's hawk, double-crested cormorant, osprey, yellow warbler, yellow-breasted chat, western pond turtle, and river otter. However, over the long term, and with implementation of included BMPs, these effects would be **less-than-significant** and no mitigation would be required.

The Fish Weir Program has the potential to result in a substantial impact on western pond turtle by impairing upstream movement as discussed in Section 5.5.4.1-b above. This could result in a **significant** impact.

Mitigation measure 5.5.4.1-g: Result in a Substantial Impact on a Wildlife Species that is Listed by DFG or USFWS as a Candidate, Sensitive, or Special-Status Species, or on its Designated Habitat.

PRO, FERC — Modify weir design to allow turtle passage. Allow shoreline/shallow water passage during periods of stable flow. Implementation of this mitigation measure would reduce the impact to turtle passage to **less-than-significant** levels.

Project-Level Impacts and Mitigation Measures

Impact 5.5.4.1-a: Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by DFG or USFWS**.**

NO — The Riverbend Park project, initiated as an interim recreation project, was evaluated in a separate CEQA document (FRRPD 2003). Other interim recreational improvements were screened to avoid the need for CEQA documentation and were designed to avoid or minimize soil and vegetation disturbances and generally involved only minor modification of existing facilities within areas of previous disturbance. No significant wildlife habitat impacts occurred due to implementation of other interim recreation projects.

ESA conservation measures associated with informal consultation for the Terrestrial BA, and which were implemented early, were designed in consultation with USFWS to avoid and minimize selected ongoing impacts on nesting bald eagles and vernal pool habitats. None of the actions associated with these conservation measures would result in loss or degradation of wildlife habitat. Additionally, conservation measures designed to protect nesting bald eagle habitat would also protect valley/foothill riparian habitat, blue oak/foothill pine, and montane conifer habitats from habitat manipulation or recreational development impacts. Likewise, conservation measures designed to protect vernal pool habitats serve to protect annual grassland and wetland habitats from loss and degradation associated with OHV damage. The habitat impacts associated with implementation of these conservation measures are beneficial and have a **less-than-significant** impact.

PRO, FERC — Several of the project-level actions included in the Proposed Project are designed to protect existing fish or wildlife habitats. These habitat protection actions described in the Terrestrial BA (DWR 2003) include 36 conservation measures developed in consultation with USFWS to protect/preserve habitat for species protected under ESA and generally reserve these lands from

development or disturbance. These protection measures include conservation measures related to nesting bald eagle, giant garter snake, California red-legged frog, valley elderberry longhorn beetle, and vernal pool tadpole and fairy shrimp. Descriptions of these conservation measures are included in the Terrestrial BA (DWR 2003). While these conservation measures are designed to protect ESA-listed species habitats, they also serve to protect co-occurring wildlife species dependent upon mature coniferous forest, blue oak/foothill pine, freshwater emergent wetlands, riparian, annual grassland, and vernal pool habitats. Actions designed to protect/enhance wildlife habitats include activities described under SA Articles A117, A118, A119, A120, A121, A123, A124, and A125. These actions are designed to have **beneficial** effects on wildlife habitat.

Actions within the Proposed Project described in the Recreation Management Plan (RMP), SA Article A127, are estimated to involve habitat losses of 1 acre or more and would be a **potentially significant** impact on wildlife habitat. These actions, as described in SA Article A127, may include building of campgrounds, replacements, upgrades and/or new day-use areas, trail improvements, or new parking areas. However, with implementation of BMPs included as part of both the Proposed Project and the FERC Staff Alternative the impacts would be **less-than-significant.**

Mitigation measure 5.5.4.1-a: No mitigation is required.

Impact 5.5.4.1-b: Interfere substantially with the movement of any native resident or migratory wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites.

NO

None of the interim recreation projects or conservation measures associated with informal consultation for the Terrestrial BA, and that were implemented early prior to new license issuance, have the potential to create barriers to wildlife dispersal or movement. **No significant** impact is anticipated.

None of the interim recreation projects or conservation measures associated with informal consultation for the Draft Terrestrial BA and that were implemented early have the potential to substantially impede the use of wildlife nursery areas. **No impact** is anticipated.

PRO, FERC

The Fish Weir Program (SA Article A105) has the potential to create a barrier to wildlife dispersal and movement. The fish weir program may impede upstream movement of the highly aquatic western pond turtle, a State Species of Special Concern. This passage issue is a **potentially significant** impact.

Projects such as new construction at Lime Saddle, additional campsites, and new marina parking as described in SA Article A127, could significantly affect a rookery located near the boat ramp access road. These actions could result in adverse impacts on wildlife however, with implementation of BMPs included as part of both the Proposed Project and the FERC Staff Alternative the impacts would be **less-than-significant**.

The Gravel Supplementation and Improvement Program has the potential to result in short-term impacts; however, these impacts are **less-than-significant** to heron/egret rookeries through direct habitat loss and disturbance associated with construction access, staging, and in-water construction and no mitigation is necessary.

Mitigation measure 5.5.4.1-b: Interfere substantially with the movement of any native resident or migratory wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites.

PRO, FERC

The weir would be designed to allow turtles passage without allowing salmon passage and allow shoreline/shallow water passage during periods of stable flow. Modification of operation and design of the fish weir would reduce this impact to **less-than-significant.**

Impact 5.5.4.1-c: Directly Disturb or Create Long-Term Effects on Wildlife Population Dynamics and Cause a Substantial Reduction in Wildlife Use of Established Habitats within the Project Area.

NO

None of the interim recreation projects or conservation measures associated with informal consultation for the Terrestrial BA and that were implemented early, prior to new license issuance, have the potential to substantially reduce wildlife habitat use or negatively affect long-term wildlife population dynamics. **No impact**.

PRO, FERC

SA Article A127 may affect wildlife species through the development of trails or major new recreational developments. Wildlife species may be adversely affected by indirect habitat loss associated with disturbance or displacement resulting from short-term construction-related activities or long-term increases in

recreational use. Actions with the potential to result in either short-term reduction in wildlife use due to increased human disturbance include construction-related activities. Long-term increases in wildlife disturbance/displacement are likely to be associated with those measures that serve to increase recreational use, extend the period of recreational use, or expand the area of recreational use. These potential indirect effects are **less-than-significant** impacts.

Several project-level actions within the Proposed Project are designed to benefit specific wildlife species or groups of species. These actions will benefit individual animals but are probably insignificant at the population level. Examples of these **beneficial** actions include activities described under SA Articles A117, A118, A119, A120, A121, A122, A123, A124, and A125.

Thirty-six conservation measures were developed in consultation with USFWS for the protection of federally listed species. Cumulatively, these measures place severe restrictions on future habitat disturbance on over 8,000 acres within the project area and preserve riparian, annual grassland (including vernal pools), freshwater emergent wetland, blue oak/foothill pine, and mature coniferous forest habitats. Wildlife habitat improvement measures (construction of waterfowl brood ponds, installation of wildlife boxes, recharge of waterfowl brood ponds, and waterfowl nest cover and forage enhancements) are designed to **benefit** selected wildlife species within portions of the project area. These species include waterfowl, small mammals, raptors, secondary cavity nesters, aquatic reptiles and amphibians, and ground nesting or seed/grain eating birds. Increased patrol and enforcement on project lands could reduce wildlife disturbance and losses associated with OHV use, illegal hunting, arson, illegal dumping of trash and hazardous materials, trespass, and violation of seasonal or area recreational closures. In addition to construction-related direct habitat loss, native wildlife species could be affected in other ways by implementation of the Proposed Project, including increased recreational or construction-related disturbance/displacement, improved habitat conditions for non-native competitors, and construction-related wildlife mortality as well as increases in traffic-related wildlife mortality during operations. These impacts are short-term and **less-than-significant.**

Modification of the Thermalito Afterbay speed limit (SA Section B107) to allow boat speeds greater than 5 mph would appear to result in increased disturbance displacement of wildlife, including migratory waterfowl, in the portion of the Afterbay south of State

Route 162. However, as a practical matter the 5-mph speed limit has never been enforced, so enforcement provided through actions under SA Section B111 may serve to reduce boating related wildlife disturbance and/or displacement in the future over historic levels; therefore, the effects of Section B111 are **less-than-significant**.

Mitigation measure 5.5.4.1-c: No mitigation is required.

Impact 5.5.4.1-f: Substantial Habitat Degradation for Wildlife Species Identified by DFG as Threatened or Endangered Species.

NO

None of the interim recreation projects or conservation measures associated with informal consultation for the Draft Terrestrial BA, and that were implemented early prior to issuance of the new license, involved actions within or adjacent to State-listed wildlife species habitats. Likewise, Riverbend Park improvements avoided impacts on State-listed species habitats. Potential ongoing project effects on nesting bank swallows are being mitigated in consultation with DFG through habitat protection on the lower Feather River. DWR is acquiring a conservation easement, which allows a geomorphically active portion of the river to continue to erode and provide high-quality bank swallow nesting habitat.

No take of any State Fully Protected Species would occur as defined in the Fish and Game Code.

PRO, FERC

No project-level actions included within the Proposed Project have the potential to affect greater sandhill crane, bank swallow, peregrine falcon, or yellow-billed cuckoo. However, staging areas and river access improvements required for the Gravel Supplementation and Improvement Program could have **potentially significant** impacts on Swainson's hawk and bald eagle nesting habitats as well as giant garter snake habitat. Projects in this program would be designed or constructed to avoid significant habitat degradation for State protected species and would result in **less-than-significant** impacts. In addition, implementation of BMPs included in both the Proposed Project and the FERC Staff Alternative would reduce these to **less-than-significant** levels and no additional mitigation is necessary.

No take of any State Fully Protected Species would occur as defined in the Fish and Game Code.

Several project actions included within these alternatives are designed to protect State-listed species/habitats or will incidentally result in a **beneficial** effect on these species. These actions include activities described under SA Articles A117, A118, A119,

A120, A121, A122, A123, and A124.

Mitigation measure 5.5.4.1-f: No mitigation is required.

Impact 5.5.4.1-f: Substantial Habitat Degradation for Wildlife Species Identified by USFWS as Threatened or Endangered Species.

NO

Several of the interim recreation projects involved actions adjacent to federally listed wildlife species habitats including vernal pool invertebrate habitat and valley elderberry longhorn beetle habitat. USFWS-prescribed buffers were incorporated into the interim recreation projects design to avoid impacts including a 100-foot buffer around elderberry shrubs and 200-foot buffer around vernal pools.

Conservation measures associated with informal consultation for the Draft Terrestrial BA and that were implemented early, prior to issuance of the new license, were designed in consultation with USFWS to avoid potential ongoing impacts on both nesting bald eagle habitat and vernal pool invertebrate habitat.

Riverbend Park improvements generally avoided impacts on federally listed wildlife species through facilities siting and project design (FRRPD 2003). Loss of any USFWS threatened or endangered species were addressed in a separate EIR and BO.

PRO, FERC

Several of the Proposed Project project-level actions included within this alternative were developed in consultation with USFWS specifically to protect or enhance habitats for federally listed wildlife species. These conservation measures include activities described under SA Articles A117, A118, A119, A120, A121, A122, A123, and A124. Implementation of these articles would result in a **beneficial** effect for wildlife species and wildlife habitats including special-status species.

Staging areas and river access improvements required for the Gravel Supplementation and Improvement Program could impact valley elderberry longhorn beetle, giant garter snake habitat, and bald eagle nesting habitat. These projects would be designed or constructed to avoid significant habitat degradation for federally listed threatened or endangered wildlife species consistent with the Final Terrestrial BO and would result in **less-than-significant** impacts. No additional mitigation would be necessary.

The existing Potter's Ravine trail is subject to administrative closure by DPR from January 1 through August 31 during years that the bald eagle nest territory is active. Extension of the trail as described in SA Article A127 would result in **less-than-significant**

impacts on nesting eagles if seasonal closures continue to be implemented and the trail terminates outside of the bald eagle nest territory protection zone.

Recreational developments, such as trails, at the Thermalito Complex would be designed and implemented to avoid and buffer vernal pool invertebrate habitat consistent with the Final terrestrial BO, which would reduce any impacts to **less-than-significant**. Potential impacts on valley elderberry longhorn beetle habitat would be minimized through the incorporation of avoidance into project design of recreational improvement projects consistent with the Final Terrestrial BO, which would reduce any impacts to **less-than-significant**.

Potential impacts on giant garter snake habitat would be minimized and reduced to **less-than-significant** through incorporation of avoidance measures consistent with the Final Terrestrial BO and BMPs described in Appendix D for recreational improvement projects.

Giant garter snake habitat losses may be associated with North Forebay fishing access improvements and the creation of a sandy beach at Larkin Road. These habitat losses can be minimized through project design and construction consistent with the Final Terrestrial BO to minimize the effects to **less-than-significant**.

Mitigation measure 5.5.4.1-f: No mitigation is required.

Impact 5.5.4.1-g: Result in a Substantial Impact on a Wildlife Species that is Listed by DFG or USFWS as a Candidate, Sensitive, or Special-Status Species, or on its Designated Habitat.

NO

The interim recreation projects or conservation measures associated with informal consultation for the Draft Terrestrial BA that were implemented early would have **no impacts** on candidate, sensitive, or special-status species/habitat.

Potential impacts from the Riverbend Park recreational development were addressed under a separate EIR; these actions resulted in **less-than-significant** impacts (FRRPD 2003).

PRO, FERC

Actions specifically designed in consultation with USFWS to protect and enhance federally listed species habitats will also provide benefits to a variety of special-status species. Wildlife and fisheries habitat enhancement actions such as brood pond construction/recharge, Lake Oroville warm and coldwater fisheries enhancements, and waterfowl nest cover and forage enhancements will also benefit special-status species. Special-status species that could potentially **benefit** from these actions include American bittern, American white pelican, Bell's sage sparrow, black tern, black-crowned night heron, California gull, California thrasher, Cooper's hawk, double-crested cormorant, long-eared owl, merlin, northern harrier, osprey, short-eared owl, tricolored blackbird, western burrowing owl, least bittern, yellow warbler, white-tailed kite, yellow-breasted chat, and western pond turtle.

The Gravel Supplementation and Improvement Program has the potential to result in short-term impacts on riparian and riverine habitats and species associated with these habitats through direct habitat loss and disturbance associated with construction access, staging, and in-water construction. These species could include American bittern, American white pelican, Barrow's goldeneye, black tern, California gull, California thrasher, Cooper's hawk, double-crested cormorant, osprey, yellow warbler, yellow-breasted chat, western pond turtle, and river otter. With implementation of the BMPs described in Appendix D, these effects are not expected to result in long-term impacts and would be **less-than-significant**.

Recreational developments including trail, road, campground, boat ramp, DUA, and parking lot construction would result in potential short-term impacts on forest and grassland special-status species through disturbance displacement. The effects are not expected to result in substantial long-term impacts on certain special-status wildlife species and would result in **less-than-significant** impacts on these species. No mitigation would be required.

Mitigation measure: 5.5.4.1-g: No mitigation is required.

Impact 5.5.4.1-h: Substantially Conflict with Any Local Policies, Ordinances, Adopted HCPs, NCCPs, or Other Approved Plans Protecting Wildlife Resources Within the Project Boundary.

NO, PRO, FERC

None of the actions in the No-Project, Proposed Project, or FERC Staff Alternative, including interim recreation projects or conservation measures associated with informal consultation for the Draft Terrestrial BA and that were implemented early, have the potential to substantially conflict with any local policies,

ordinances, adopted HCPs, NCCPs, or other approved plans protecting wildlife resources within the project boundary. **No impact** is anticipated and therefore, no mitigation is required.

Mitigation measure 5.5.4.1-h: No mitigation is required.

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5.5.4.2 Botanical Impacts and Mitigation Measures

This section describes the potential effects of the alternatives on terrestrial resources, including natural riparian habitat and other sensitive natural terrestrial communities, federally protected wetlands, special-status species and habitats, and non-native invasive species.

Under the No-Project Alternative, existing project operations, land management practices, and project-related recreation activities that may affect botanical resources include Lake Oroville water level fluctuations, Thermalito Complex operations, flow releases from Lake Oroville to both the Low Flow Channel (LFC) and High Flow Channel (HFC) of the Feather River, ground/soil disturbance from operations and maintenance activities, disturbance from project-related recreation including facilities maintenance and recreational use, and wildlife habitat and vegetation management. (See Section 4.5.2.1 for more detail on baseline effects on botanical resources.) The No-Project Alternative also includes a number of other actions that may affect botanical resources. These include Interim recreation projects that DWR agreed to implement prior to license issuance, including Riverbend Park recreational improvements and conservation measures that were developed in coordination with USFWS under the Section 7 ESA informal consultation process and discussed in detail in the draft Programmatic BA.

In addition to No-Project, this DEIR analyzes the Proposed Project and the FERC Staff Alternative. These alternatives include a number of plans and programs to enhance, protect, mitigate, restore, and/or create habitat within the project area as described in the SA. The SA proposes the development of two plans (Invasive Species Management Plan (Article A126) and Fuel Load Management Plan (Article B102)) that are expected to include measures that would be beneficial to terrestrial botanical resources. Development of these plans would not result in environmental effects on resources and therefore are not evaluated in this DEIR. Once developed, the plans would be subject to additional CEQA review. Potential impacts are identified as follows: NO (No-Project), PRO (Proposed Project), FERC (FERC Staff Alternative). All alternatives analyzed result in beneficial or less-than-significant impacts on botanical resources with implementation of mitigation.

Potential impacts on botanical resources are evaluated at a program level of analysis whenever the proposed actions do not have a sufficient level of detail regarding design, operational characteristics, location, implementation timing, or methods of implementation to adequately support a project level of analysis. As such, prior to their implementation, these actions would also be subject to subsequent environmental analysis and documentation when additional specificity of the actions becomes available and after they have undergone the Ecological Committee (EC) review and comment process as described in the SA. Where adequate level of detail is available to assess project impacts on botanical resources, project-level analyses were performed.

Table 5.5-2. Environmental effects on botanical resources.

Alternative(s)	Article # and Title	Level of CEQA Analysis	Nature of Potential Impact(s)	Effects
PRO, FERC	A102—Gravel Supplementation and Improvement Program	Programmatic	Potential for minor impacts on plant communities, wetlands, sensitive plant species habitats, and promotion of invasive species establishment from construction activities.	B/LTS/ LTSM
PRO, FERC	A103—Channel Improvement Program (This action is programmatic; however, Moe's and Hatchery Ditch activities are project-level)	Programmatic with some Project elements	Potential for minor impacts on plant communities, wetlands, sensitive plant species habitats, and promotion of invasive species establishment from construction activities.	B/LTS/ LTSM
PRO, FERC	A104—Structural Habitat Supplementation and Improvement Program	Programmatic	Potential for minor impacts on plant communities, wetlands, sensitive plant species habitats, and promotion of invasive species establishment from construction activities.	B/LTS/ LTSM
PRO, FERC	A105—Fish Weir Program	Programmatic	Potential for minor impacts on plant communities, wetlands, sensitive plant species/habitats, and promotion of invasive species establishment from construction activities.	B/LTS/ LTSM
PRO	A106—Riparian and Floodplain Improvement Program	Programmatic	Long-term beneficial effect on botanical resources. Potential for temporary minor impacts on plant communities, wetlands, and sensitive plant species habitats from construction activities.	B/LTSM

Table 5.5-2. Environmental effects on botanical resources.

Alternative(s)	Article # and Title	Level of CEQA Analysis	Nature of Potential Impact(s)	Effects
FERC	A106—Riparian and Floodplain Improvement Program as revised by FERC staff to accelerate monitoring and implementation plan	Programmatic	Long-term beneficial effect on botanical resources. Potential for temporary minor impacts on plant communities, wetlands, and sensitive plant species habitats from construction activities.	B/LTSM
PRO, FERC	A110—Lake Oroville Warm Water Fishery Habitat Improvement Program	Programmatic	Beneficial effects by creating additional riparian habitat.	B/LTS
PRO, FERC	A108—Flow/Temperature to Support Anadromous Fish	Project (A108.1 only); Programmatic (108.2 and 108.3 only)	Short-term minor impacts on riparian and wetland resources.	B/LTS
PRO, FERC	A132—Screening of Material Storage Area	Project	Restores native plants in project area.	B/LTS
PRO	A129—Improve and Redirect Recreation Usage to Specific Areas at Foreman Creek (Plan development)	Project	Protects plant communities, wetlands, and sensitive plant species and habitats.	B/LTS
FERC	A129 (revised by FERC staff to include temporary closure)—Improve and Redirect Recreation Usage to Specific Areas at Foreman Creek (Plan development)	Project	Protects plant communities, wetlands, and sensitive plant species and habitats.	B/LTS
PRO, FERC	A117—Protection of Vernal Pools	Project	A beneficial effect on botanical resources by reducing use and restricting development in areas within 200 feet of vernal pools.	B/LTS
PRO, FERC	A118—Minimization of Disturbances to Nesting Bald Eagles	Project	A beneficial effect on plant communities by reducing use and restricting development in areas closed during the nesting season.	B/LTS

Table 5.5-2. Environmental effects on botanical resources.

Alternative(s)	Article # and Title	Level of CEQA Analysis	Nature of Potential Impact(s)	Effects
PRO, FERC	A119—Giant Garter Snake	Project	A beneficial effect on botanical resources by reducing use and restricting development in areas within 200 feet of giant garter snake habitat.	B/NI/LTS
PRO, FERC	A120—Protection of Valley Elderberry Longhorn Beetle	Project	A beneficial effect on plant communities by reducing use and restricting development in areas within 100 feet of elderberry shrubs.	B/NI/LTS
PRO, FERC	A121—Protection of Red-legged Frog	Project	A beneficial effect on botanical resources by reducing use and restricting development in areas within 200 feet of California red-legged frog habitat.	B/NI/LTS
PRO, FERC	A112—Comprehensive Water Quality Monitoring Program	Project	Short-term minor impacts on riparian and wetland resources	NI/LTS
PRO, FERC	A122—Construction and Recharge of Brood Ponds	Project	Implementation could result in temporary construction-related impacts on botanical resources.	B/LTS
PRO, FERC	A123—Provision of Upland Food for Nesting Waterfowl	Project	Minor impacts on botanical resources through habitat modification and introduction of non-native plant species.	B/LTS
PRO, FERC	A124—Provision of Nest Cover for Upland Waterfowl	Project	Minor impacts on botanical resources through habitat modification and introduction of non-native plant species.	B/LTS
PRO	A127—Recreation Management Plan Trails Equestrian facilities DUA improvements Docks, boat ramps Campgrounds	Programmatic with some Project elements	Minor impacts on plant communities, wetlands, and sensitive plant species/habitats from increased recreational use and construction activities.	LTSM

Table 5.5-2. Environmental effects on botanical resources.

Alternative(s)	Article # and Title	Level of CEQA Analysis	Nature of Potential Impact(s)	Effects
FERC	A127—SA RMP (Revised by FERC Staff to include modifications to trails development/implementation; reconstruction of boat-in campsites; delay of DUA at Foreman Creek)	Programmatic with some Project elements	Minor impacts on plant communities, wetlands, and sensitive plant species/habitats from increased recreational use and construction activities.	LTSM

Coding:

B = Action with potential to result in a beneficial effect; could involve short-term less-than-significant, construction-related impacts that would be avoided or reduced through the use of Best Management Practices (BMPs). See Appendix D.

LTS = Action that would result in less-than-significant impact on resource.

LTSM = Action that would result in less-than-significant impact on resource following mitigation.

NI = Action that would result in no impact.

Program-Level Impacts and Mitigation Measures

Effects that would occur under each alternative are identified and summarized below as follows: NO (No-Project), PRO (Proposed Project), and FERC (FERC Staff Alternative). Implementation of SA Articles A102, A103, A104, A105, A106, and A108 under the Proposed Project would have a **beneficial** effect and **less-than-significant** adverse impacts on botanical resources. The Proposed Project also includes SA Article A127 that has the potential to adversely affect botanical resources; however, with implementation of appropriate mitigation, the impacts are reduced to **less-than-significant**.

Impact 5.5.4.2-a: Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations, or by the DFG or USFWS.

NO — Continuing operation and maintenance activities under the No-Project Alternative could result in disturbance and/or loss of sensitive habitats, including riparian habitat and sensitive plant habitat.

PRO — The Proposed Project includes a number of actions relating to environmental and recreational improvements that may affect riparian/wetland resources and special plant habitats.

Implementation of the Gravel Supplementation and Improvement Program (SA Article A102), the Channel Improvement Program (SA Article A103), the Structural Habitat Supplementation and Improvement Program (SA Article A104), the Fish Weir Program (SA Article A105), the Riparian and Floodplain Improvement Program (SA Article A106), Flow/Temperature To Support Anadromous Fisheries (SA Article A108.2), and the Lake Oroville Warm Water Fishery Habitat Improvement Program (SA Article A110) would disturb the streambed, stream bank, and adjacent riparian/wetland areas. These projects would have short-term **significant** impacts on sensitive riparian/wetland habitats. These short-term impacts would be considered significant due to direct loss of these resources; however, these impacts are designed to be self-mitigating since they would be ultimately designed to improve these resources through restoration, creation, rehabilitation, and enhancement. The long-term effects of these actions would be considered **beneficial** and no mitigation would be required.

Implementation of the SA RMP provides for future construction of recreational facilities. The SA RMP identifies that Loafer Creek would provide additional RV campsites if unable to accommodate the proposed RV campsites at Bidwell Campground. This action

has the potential to affect riparian or sensitive habitat by direct disturbance. This action could have a **significant** impact on riparian resources as well as sensitive plant habitats. With implementation of mitigation measure 5.5.4.2-a, these potential impacts would be reduced to **less-than-significant**.

Implement Best Management Practices (BMPs) such as fencing to prevent access/disturbance to adjacent wetland/sensitive areas from construction/maintenance vehicles. Use erosion control and stabilization devices to prevent sediment from entering wetland and riparian habitats. Wetland/sensitive areas that cannot be avoided, will be revegetated with appropriate native species. These measures would reduce the impacts to **less-than-significant**.

FERC — Impacts on riparian habitat under the FERC Staff Alternative would be similar to those under the Proposed Project. The FERC Staff Alternative includes more robust monitoring of the Gravel Supplementation and Improvement Program (SA Article A102) and earlier implementation of the Riparian and Floodplain Improvement Program (SA Article A106).

Implement Best Management Practices (BMPs) such as fencing to prevent access/disturbance to adjacent wetland/sensitive areas from construction/maintenance vehicles. Use erosion control and stabilization devices to prevent sediment from entering wetland and riparian habitats. Wetland/sensitive areas that cannot be avoided will be revegetated with appropriate native species. These measures would reduce the impacts to **less-than-significant**.

Mitigation measure 5.5.4.2-a: Minimize Loss and Impacts on Natural Resources.

PRO, FERC — Avoid ground-disturbing activities whenever possible, lessen areas of disturbance during project construction, and revegetate disturbed area with native species. Stockpile soil for reuse in areas of special resources to reinoculate the soils and seed bank. These actions would reduce the impacts to **less-than-significant.**

Impact 5.5.4.2-b: Effects on Natural Upland Plant Communities (Excluding Riparian/Wetlands and Sensitive Plant Habitats)**.**

NO — Continuing operation and maintenance activities under the No-Project Alternative may have minor adverse effects on plant communities through direct removal, herbicide usage, and/or by disturbance activities that tend to promote establishment of non-native plant species. These invasive species potentially impact

adjacent native communities. Minor temporary adverse effects could occur to these plant communities and are considered **less-than-significant**.

Recreational use and facilities maintenance activities may adversely affect plant communities by trampling, direct removal, and other forms of disturbance. These plant communities could experience minor adverse effects and are considered **less-than-significant**.

PRO

Implementation of the Gravel Supplementation and Improvement Program (SA Article A102), the Channel Improvement Program (SA Article A103), the Structural Habitat Supplementation and Improvement Program (SA Article A104), the Fish Weir Program (SA Article A105), and the Riparian and Floodplain Improvement Program (SA Article A106) have the potential for minor impacts on upland plant communities from disturbance associated with access and staging areas. These impacts would be considered **less-than-significant** and no mitigation would be required. Implementation of the Riparian and Floodplain Improvement Program (SA Article A106) results in a **beneficial** effect on upland plant communities.

Implementation of the SA RMP provides for future construction of recreational facilities. The SA RMP identifies that Loafer Creek would provide additional recreational vehicle (RV) campsites if unable to accommodate the proposed RV campsites at Bidwell Campground. This action has the potential to affect upland woodland and grassland communities by direct disturbance. However, because these plant communities are both locally and regionally abundant; and with implementation of Best Management Practices (BMPs) described in Appendix D, these impacts would be considered **less-than-significant** and no mitigation would be required.

FERC

Impacts on botanical resources under the FERC Staff Alternative would be similar to those under the Proposed Project. The FERC Staff Alternative includes more robust monitoring of the Gravel Supplementation and Improvement Program (SA Article A102) and earlier implementation of the Riparian and Floodplain Improvement Program (SA Article A106). As such, these impacts would be considered **beneficial** or **less-than-significant** and no mitigation would be required**.**

Mitigation measure 5.5.4.2-b: No mitigation is required.

Impact 5.5.4.2-c: Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the CWA (including but not limited to marsh, vernal pool, coastal, etc.) through direct removal, filling, or hydrological interruptions, or other means.

NO

Continuing operation and maintenance activities under the No-Project Alternative could result in disturbance and/or loss of jurisdictional wetlands. DWR implements mitigation measure 5.5.4.2-a; hence, work associated with these projects result in **less-than-significant** impacts.

PRO

The Proposed Project includes a number of actions relating to environmental and recreational improvements that may affect jurisdictional waters.

Implementation of the Gravel Supplementation and Improvement Program (SA Article A102), the Channel Improvement Program (SA Article A103), the Structural Habitat Supplementation and Improvement Program (SA Article A104), the Fish Weir Program (SA Article A105), the Riparian and Floodplain Improvement Program (SA Article A106), Flow/Temperature To Support Anadromous Fisheries (SA Article A108.2), and the Lake Oroville Warm Water Fishery Habitat Improvement Program (SA Article A110) would disturb the streambed, stream bank, and adjacent riparian/wetland areas. These projects would have short-term **significant** impacts on jurisdictional waters of the United States. These short-term impacts would be considered significant due to direct loss of these resources; however, these impacts are designed to be self-mitigating since they would be ultimately designed to improve these resources through restoration, creation, rehabilitation, and enhancement. The long-term effects of these actions would be considered **beneficial** and no mitigation would be required.

Implementation of the SA RMP provides for future construction of recreational facilities. The SA RMP identifies that Loafer Creek would provide additional RV campsites if unable to accommodate the proposed RV campsites at Bidwell Campground. This action has the potential to affect jurisdictional wetlands by direct disturbance. This action could have a **significant** impact on jurisdictional waters.

Implement Best Management Practices (BMPs) such as fencing to prevent access/disturbance to adjacent wetland areas from construction/maintenance vehicles. Use erosion control and stabilization devices to prevent sediment from entering wetland. Wetland areas that cannot be avoided will be revegetated with

appropriate native species. These measures would reduce the impacts to **less-than-significant**.

FERC — Impacts on wetlands under the FERC Staff Alternative would be similar to those under the Proposed Project. The FERC Staff Alternative includes more robust monitoring of the Gravel Supplementation and Improvement Program (SA Article A102) and earlier implementation of the Riparian and Floodplain Improvement Program (SA Article A106). As such, these impacts would be considered **beneficial.**

Mitigation measure 5.5.4.2-c: No mitigation is required.

Impact 5.5.4.2-d: Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by DFG or USFWS**.**

NO — Continuing operation and maintenance activities under the No-Project Alternative may have adverse effects on special-status plant species if they are present at the site.

PRO — The Proposed Project includes a number of actions relating to environmental and recreational improvements that may affect special plant species.

Implementation of the Gravel Supplementation and Improvement Program (SA Article A102), the Channel Improvement Program (SA Article A103), the Structural Habitat Supplementation and Improvement Program (SA Article A104), and the Fish Weir Program (SA Article A105) have the potential for minor impacts on special plant species from disturbance associated with access and staging areas. Implementation of Best Management Practices (BMPs) would reduce the short-term construction impacts to **less-than-significant**. The long-term effects of these actions would be considered **beneficial**.

Implementation of the SA RMP provides for future construction of recreational facilities. The SA RMP identifies that Loafer Creek would provide additional RV campsites if unable to accommodate the proposed RV campsites at Bidwell Campground. This action has the potential to affect special plant species by direct disturbance. Implementation of Best Management Practices (BMPs) would reduce the impacts to **less-than-significant**.

FERC — Impacts on special plant species under the FERC Staff Alternative would be similar to those under the Proposed Project. The FERC Staff Alternative includes more robust monitoring of the Gravel Supplementation and Improvement Program (SA Article A102)

and earlier implementation of the Riparian and Floodplain Improvement Program (SA Article A106). Implementation of Best Management Practices (BMPs) would reduce the short-term construction impacts to **less-than-significant**. The long-term effects of these actions would be considered **beneficial**.

Mitigation measure 5.5.4.2-d: No mitigation is required.

Impact 5.5.4.2-e: Effects on Natural Communities, Wildlife Habitat, and Special-Status Species and Their Habitats from Invasive Plant Species.

NO

Continuing operation and maintenance activities under the No-Project Alternative may have adverse effects on natural communities, wildlife habitat, and special-status species and their habitats from invasive plant species. DWR implements mitigation measure 5.5.4.2-e; hence, work associated with these projects result in **less-than-significant** impacts.

PRO

Project-level impacts identified under the No-Project Alternative would also occur under the Proposed Project. In addition, a number of articles relating to environmental and recreation improvements may promote the establishment of invasive plant species.

Implementation of the Gravel Supplementation and Improvement Program (SA Article A102), the Channel Improvement Program (SA Article A103), the Structural Habitat Supplementation and Improvement Program (SA Article A104), the Fish Weir Program (SA Article A105), and the Riparian and Floodplain Improvement Program (SA Article A106) would disturb the streambed, stream bank, and adjacent riparian/wetland areas and may potentially promote the establishment of invasive species by ground disturbance activities. With implementation of mitigation measure 5.5.4.2-e, these potential impacts would be reduced to **less-than-significant.** The long-term effects of these actions would be considered **beneficial.**

Implementation of the SA RMP provides for future construction of recreational facilities. The SA RMP identifies that Loafer Creek would provide additional RV campsites if unable to accommodate the proposed RV campsites at Bidwell Campground. Areas disturbed by construction activities and future recreational use have potential to facilitate the spread of invasive plant species. Implementation of mitigation measure 5.5.4.2-e would reduce impacts to **less-than-significant**.

FERC

Impacts on natural plant communities, wildlife habitat, and special-

status species and their habitats from invasive plant species under the FERC Staff Alternative would be similar to those under the Proposed Project. The FERC Staff Alternative includes more robust monitoring of the Gravel Supplementation and Improvement Program (SA Article A102) and earlier implementation of the Riparian and Floodplain Improvement Program (SA Article A106). With implementation of mitigation measure 5.5.4.2-e, potential impacts would be reduced to **less-than-significant.**

Mitigation measure 5.5.4.2-e: Minimize Loss and Impacts on Natural Resources from Invasive Plant Species.

PRO, FERC — Avoid ground-disturbing activities whenever possible, lessen areas of disturbance during project construction, and revegetate disturbed area with native species. Stockpile soil for reuse in areas of special resources to reinoculate the soils and seed bank. These actions would reduce the impacts to **less-than-significant.**

Project-Level Impacts and Mitigation Measures

Effects that would occur under each alternative are identified and summarized below as follows: NO (No-Project), PRO (Proposed Project), and FERC (FERC Staff Alternative). Implementation of SA Articles A103, A117, A118, A119, A120, A121, A122, A123, A124, A129, and A132 under the Proposed Project would have a **beneficial** effect and **less-than-significant** adverse impacts on botanical resources.

The Proposed Project also includes SA RMP (SA Article A127), which has the potential to adversely affect botanical resources; however, with implementation of appropriate mitigation, the impacts are reduced to **less-than-significant**.

Impact 5.5.4.2-a: Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by DFG or USFWS**.**

NO — Continuing operation and maintenance activities under the No-Project Alternative may have adverse effects on special-status plant species if they are present at the site.

Threatened and endangered species habitat conservation measures associated with informal consultation and identified for early implementation in the Terrestrial BA were designed in consultation with USFWS to avoid and minimize ongoing impacts on nesting bald eagles and vernal pool habitats. None of these measures would result in loss of or degradation of special plant habitats or natural plant communities. Measures associated with vernal pool invertebrates protect vernal pool habitats (SA Article A117) in the project area and have a **beneficial** effect by

protecting listed plant species habitats.

Interim recreation projects as described in Section 3.2 were designed to avoid or minimize soil and vegetation disturbances and generally involved only minor modification of existing facilities within areas of previous disturbance. No significant impacts on these resources occurred due to implementation of interim recreation projects.

In addition, the Riverbend Park Project EIR reduced significant impacts on botanical resources to **less-than-significant** with implementation of mitigation.

PRO

Project-level impacts identified under the No-Project Alternative would also occur under the Proposed Project. In addition, a number of Articles relating to environmental and recreation improvements may affect special plant species.

Implementation of actions for Protection of Giant Garter Snake (SA Article A119), Protection of Valley Elderberry Longhorn Beetle (SA Article A120), and Protection of Red-Legged Frog (SA Article A121) would provide **beneficial** effects for special-status plant species by protecting habitat for those species that occur along wetland margins.

Construction and Recharge Brood Ponds (SA Article A122) would convert open water habitats to emergent wetland habitats. This measure would have a **beneficial** effect on special-status plant species by creating additional wetlands for those species associated with wetland habitats.

Flow/Temperature to Support Anadromous Fish (SA Article A108.1) establishes a new minimum flow for the LFC. The new minimum flow in the LFC as described in the SA would have **no impact** on special-status plant species.

The Comprehensive Water Quality Monitoring Program (SA Article A112d–l) establishes a program that includes a number of elements relating to water quality and monitoring. It includes a comprehensive water quality monitoring program; fish tissue bioaccumulation, recreational site water quality, water temperature, water quality bioassay, aquatic macroinvertebrate, and bacterial monitoring. Additionally, a public education element relating to bacterial levels (SA Article A113) and risks associated with fish consumption (SA Article A114) would be implemented. Implementation of these programs would have **no impact** on special-status plant species.

The SA RMP (SA Article A127) includes a number of improvements that have the potential to affect wetlands/waters of the United States:

- Trails;
- Equestrian facilities;
- DUA improvements;
- Docks, boat ramps; and
- Campgrounds.

Some of the boat ramp extensions included in the SA RMP may involve significant fill material to be placed within water; however, this activity would be limited to areas that have been previously disturbed and inundated. The SA RMP actions could also cross drainages and, therefore, have potential to affect special-status plant species. Although when considered individually the acreage loss is small, the total loss could be **potentially significant**. Implementation of mitigation measure 5.5.4.2-a would reduce these impacts to **less-than-significant.**

Trail improvements—Some of the trail enhancements/additions proposed have the potential to affect drainages; therefore, they have the potential to affect special-status plant species. Implementation of mitigation measure 5.5.4.2-a would reduce these impacts to **less-than-significant.**

Lake Oroville Recreation Facilities: A number of new actions relating to facilities around Lake Oroville could result in impacts on special-status plant species. These impacts may be relatively small per site; however, the total loss could be **potentially significant**. These impacts would occur on a small scale and would be **less-than-significant** with implementation of mitigation measure 5.5.4.2-a.

Implementation of the SA RMP provides for future construction of recreational facilities. The SA RMP identifies that Loafer Creek would provide additional RV campsites if unable to accommodate the proposed RV campsites at Bidwell Campground. This action has the potential to affect special-status plant species by direct disturbance. These impacts would occur on a small scale and would be **less-than-significant** with implementation of mitigation measure 5.5.4.2-a.

Flow/Temperature to Support Anadromous Fish (SA Article A108.1) establishes a new minimum flow for the LFC. Implementation of this program in the LFC may affect special-status plant species when the minimum flow is increased. However, the flows identified in the SA would not increase water levels significantly and vegetation should reestablish naturally at the water's edge. This impact would be considered **less-than-significant**.

FERC — The FERC Staff Alternative generally incorporates the programs considered under the Proposed Project. The FERC Staff Alternative includes modifications to trails development and implementation; reconstruction of boat-in campsites; and temporary closure of Foreman Creek. Impacts on special-status plant species under the FERC Staff Alternative would be similar to those under the Proposed Project. As such, with implementation of mitigation measure 5.5.4.2-a, these potential impacts would be reduced to **less-than-significant**.

Mitigation measure 5.5.4.2-a: Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by DFG or USFWS**.**

PRO, FERC — To reduce impacts to **less-than-significant,** avoid ground disturbing activities in areas with known populations of special-status species. For new development, conduct surveys if not already completed. Avoid and/or minimize disturbance footprint. Implement invasive species management and revegetate with appropriate native species. Stockpile soil if avoidance is not possible.

Impact 5.5.4.2-b: Effects on Natural Upland Plant Communities (Excluding Riparian/Wetlands and Sensitive Plant Habitats).

NO — Continuing operation and maintenance activities under the No-Project Alternative may have minor adverse effects on natural plant communities through direct removal, herbicide usage, and/or by disturbance activities that tend to promote establishment of non-native plant species. These invasive species potentially impact adjacent native communities. Minor adverse effects could occur to these plant communities. However, these communities are locally and regionally abundant; thus, the impacts as a result of these activities would be considered **less-than-significant**.

Threatened and endangered species habitat conservation

measures associated with informal consultation and identified for early implementation in the Terrestrial BA were designed in consultation with USFWS to avoid and minimize ongoing impacts on nesting bald eagles and vernal pool habitats. None of these measures would result in loss of or degradation of natural plant communities. Measures relating to nesting bald eagles (SA Article A118) may have a **beneficial** effect on plant communities by reducing future development and recreational use in areas closed during the nesting season.

Interim projects as described in Section 3.2 were designed to avoid or minimize soil and vegetation disturbances and generally involved only minor modification of existing facilities within areas of previous disturbance. **No impacts** on native upland plant communities occurred due to implementation of any interim projects. In addition, an EIR for Riverbend Park, the largest of the Interim Projects, was prepared by FRRPD as lead agency. This site was mostly riparian/wetland vegetation, barren/cobble, or disturbed annual grassland. The Riverbend Park Project EIR reduced significant impacts on botanical resources to **less-than-significant** with implementation of mitigation (FRRPD 2003).

PRO

Project-level impacts identified under the No-Project Alternative would also occur under the Proposed Project. In addition, a number of programs and actions contained in the SA relating to environmental and recreational improvements may affect upland plant communities.

Implementation of actions for Protection of Giant Garter Snake (SA Article A119), Protection of Valley Elderberry Longhorn Beetle (SA Article A120), and Protection of Red-Legged Frog (SA Article A121) would provide beneficial effects on botanical resources and would result in **no impact** on upland native plant communities.

Construction and Recharge Brood Ponds (SA Article A122) would convert open water habitats to emergent wetland habitats. In addition, Provision of Upland Food for Nesting Waterfowl (SA Article A123) and Provision of Nest Cover for Upland Waterfowl (SA Article A124) have potential to introduce new invasive non-native plant species into the surrounding grasslands. While not analyzed at a project-specific level in this document, SA Article A126, Invasive Plant Management, is expected to provide direction to address this potential effect and would be evaluated once developed. Upland native plant communities are locally and regionally abundant; therefore, impacts would be considered **less-than-significant** and no mitigation would be required.

The Flow/Temperature to Support Anadromous Fish (SA Article A108.1) establishes a new minimum flow for the LFC. The new minimum flow in the LFC as described in the SA would have **no impact** on natural upland plant communities.

The Comprehensive Water Quality Monitoring Program (SA Article A112d–l) establishes a program that includes a number of elements relating to water quality and monitoring. It includes a comprehensive water quality monitoring program; fish tissue bioaccumulation, recreational site water quality, water temperature, water quality bioassay, aquatic macroinvertebrate, and bacterial monitoring. Additionally, a public education element relating to bacterial levels (SA Article A113) and risks associated with fish consumption (SA Article A114) would be implemented. Implementation of these programs would have **no impact** on natural upland plant communities.

Screening of Material Storage Area (SA Article A132) requires planting vegetation around the material storage area downstream of Lake Oroville. This article would have a **beneficial** effect on native plant communities.

The SA RMP (SA Article A127) includes a number of improvements that have the potential to affect upland plant communities:

- Trails;
- Equestrian facilities;
- DUA improvements;
- Docks, boat ramps; and
- Campgrounds.

The SA RMP actions would affect a variety of woodland plant communities through direct removal of vegetation and potential for invasive species to establish. Although individually, the acreage loss is small, the total loss could be **potentially significant**. Implementation of mitigation measure 5.5.4.2-b would reduce these impacts to **less-than-significant**.

Trail improvements—A number of trail enhancements/additions are proposed that have potential to affect upland plant communities around Lake Oroville, the Diversion Dam, and the Thermalito Forebay could have **significant** impacts on blue oak,

mixed oak, foothill pine, chaparral, and annual grassland communities. Impacts on these communities may result from disturbance from increased recreational use and removal of vegetation and disturbance during construction activities. Implementation of mitigation measure 5.5.4.2-b would reduce these impacts to **less-than-significant**.

Lake Oroville Recreation Facilities: A number of new actions relating to facilities around Lake Oroville may result in impacts on upland plant communities. Although most of these would result in minor amounts of plant community loss of less than 1 acre, enhancements at the Bidwell Canyon and Loafer Creek recreation areas could result in loss of >5 and >10 acres of woodland/grassland communities, respectively. A loss of more than 5 acres of oak woodland community may be **potentially significant.**

FERC — The FERC Staff Alternative generally incorporates the programs considered under the Proposed Project. The FERC Staff Alternative includes modifications to trails development and implementation; reconstruction of boat-in campsites; and temporary closure of Foreman Creek. Impacts on botanical resources under the FERC Staff Alternative would be similar to those under the Proposed Project. As such, with implementation of mitigation measure 5.5.4.2-b, these potential impacts would be reduced to **less-than-significant.**

Mitigation measure 5.5.4.2-b: Effects on Natural Upland Plant Communities (Excluding Riparian/Wetlands and Sensitive Plant Habitats).

PRO, FERC — To reduce impacts on woodland communities, design new recreational features and improvements to minimize loss of large trees and special resource areas within the woodland communities. Retain native vegetation where possible and use native species in landscaping. Revegetate areas of disturbed soil with native species. Implementation of these mitigation and avoidance measures would help reduce direct loss of mature trees and reduce potential effects to **less-than-significant**.

Avoid ground-disturbing activities whenever possible, lessen areas of disturbance during project construction, and revegetate disturbed area with native species. Stockpile soil for reuse in areas of special resources to reinoculate the soils and seed bank. Implementation of mitigation measure 5.5.4.2-b would reduce these impacts to **less-than-significant**.

Impact 5.5.4.2-c: Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the CWA (including but not limited to marsh, vernal pool, coastal, etc.) through direct removal, filling, or hydrological interruptions, or other means.

NO

Continuing operation and maintenance activities under the No-Project Alternative could result in loss of jurisdictional wetland habitat.

Threatened and endangered species habitat conservation measures associated with informal consultation and identified for early implementation in the Terrestrial BA were designed in consultation with USFWS to avoid and minimize ongoing impacts on nesting bald eagles and vernal pool habitats. None of these measures would result in loss of or degradation of jurisdictional wetlands. Measures associated with vernal pool invertebrates protect vernal pool habitats (SA Article A117) in the project area and have a **beneficial** effect by protecting listed plant species habitats and federally protected.

Interim recreation projects as described in Section 3.2 were designed to avoid or minimize soil and vegetation disturbances and generally involved only minor modification of existing facilities within areas of previous disturbance. **No impacts** on jurisdictional wetlands occurred due to implementation of any interim recreation projects.

In addition, an EIR for Riverbend Park, the largest of the interim recreation projects, was prepared by FRRPD as lead agency. This site was mostly riparian/wetland vegetation, barren/cobble, or disturbed annual grassland. The Riverbend Park Project EIR reduced significant impacts on botanical resources to **less-than-significant** with implementation of mitigation. It was determined that impacts on jurisdictional wetlands that could not be avoided would be significant. Although the Riverbend Park Project EIR identified some riparian vegetation would be removed, an additional 23 acres of riparian forest would be restored after removing invasive non-native species. The Riverbend Park Project EIR reduced significant impacts on riparian/wetland resources to **less-than-significant** with implementation of mitigation.

PRO

Project-level impacts identified under the No-Project Alternative would also occur under the Proposed Project. In addition, a number of programs and actions contained in the SA relating to environmental and recreational improvements may affect jurisdictional wetlands.

Implementation of the Gravel Supplementation and Improvement Program (SA Article A102), the Channel Improvement Program (SA Article A103), the Structural Habitat Supplementation and Improvement Program (SA Article A104), and the Fish Weir Program (SA Article A105) have the potential for minor impacts on jurisdictional wetlands from disturbance associated with access and staging areas. These impacts would be considered **less-than-significant**.

Implementation of actions for Protection of Giant Garter Snake (SA Article A119), Protection of Valley Elderberry Longhorn Beetle (SA Article A120), and Protection of Red-Legged Frog (SA Article A121) would provide **beneficial** effects on riparian resources through habitat protection.

Construction and Recharge Brood Ponds (SA Article A122) would convert open water habitats to emergent wetland habitats. This measure would have a **beneficial** effect on riparian resources by creating additional habitat.

Flow/Temperature to Support Anadromous Fish (SA Article A108.1) establishes a new minimum flow for the LFC. Implementation of this program in the LFC may affect riparian vegetation when the minimum flow is increased. However, the flows identified in the SA would not increase water levels significantly and vegetation should reestablish naturally at the water's edge. This impact would be considered **less-than-significant**.

Comprehensive Water Quality Monitoring Program (SA Article A112d–l). The proposed project includes a number of elements relating to water quality and monitoring. It includes a comprehensive water quality monitoring program; fish tissue bioaccumulation, recreational site water quality, water temperature, water quality bioassay, aquatic macroinvertebrate, and bacterial monitoring. The construction of permanent water temperature monitoring stations would occur on a small scale and would be **less-than-significant.**

The SA RMP (SA Article A127) includes a number of improvements that have the potential to affect riparian resources:

- Trails;
- Equestrian facilities;
- DUA improvements;

- Docks, boat ramps; and
- Campgrounds.

The SA RMP actions would affect a variety of riparian resources because they may cross drainages and have potential to affect wetland/waters of the United States. Although individually, the acreage loss is small, the total loss could be **potentially significant**. Implementation of mitigation measure 5.5.4.2-c would reduce these impacts to **less-than-significant**.

Trail improvements—Some of the trail enhancements/additions proposed have the potential to affect drainages; therefore, they have the potential to affect riparian resources. Implementation of mitigation measure 5.5.4.2-c would reduce these impacts to **less-than-significant.**

Lake Oroville Recreation Facilities: A number of new actions relating to facilities around Lake Oroville could result in impacts on wetland resources. These impacts may be relatively small per site; however, the total loss could be **potentially significant**. These impacts would occur on a small scale and would be **less-than-significant** with implementation of mitigation measure 5.5.4.2-c.

FERC — The FERC Staff Alternative generally incorporates the programs considered under the Proposed Project. The FERC Staff Alternative includes modifications to trails development and implementation; reconstruction of boat-in campsites; and temporary closure of Foreman Creek. Impacts on riparian resources under the FERC Staff Alternative would be similar to those under the Proposed Project. As such, with implementation of mitigation measure 5.5.4.2-c, these potential impacts would be reduced to **less-than-significant**.

Mitigation measure 5.5.4.2-c: Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the CWA (including but not limited to marsh, vernal pool, coastal, etc.) through direct removal, filling, or hydrological interruptions, or other means.

PRO, FERC — To reduce impacts to jurisdictional wetlands from recreational improvement, construction, and maintenance activities, features would be designed to avoid and minimize direct loss to these habitats to the extent possible. Implement protective actions such as fencing to prevent access/disturbance to adjacent sensitive areas from construction/maintenance vehicles. Use erosion control and stabilization devices to prevent sediment from entering wetland and riparian habitats. Sensitive areas that cannot be

avoided will be revegetated with appropriate native species. These measures would reduce the impacts to **less-than-significant**.

Impact 5.5.4.2-d: Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations, or by the DFG or USFWS.

NO

Continuing operation and maintenance activities under the No-Project Alternative could result in disturbance and/or loss of riparian habitat, and sensitive plant habitat.

Threatened and endangered species habitat conservation measures associated with informal consultation and identified for early implementation in the Terrestrial BA were designed in consultation with USFWS to avoid and minimize ongoing impacts on nesting bald eagles and vernal pool habitats. None of these measures would result in loss of or degradation of special plant habitats or natural plant communities. Measures associated with vernal pool invertebrates protect vernal pool habitats (SA Article A117) in the project area and have a **beneficial** effect by protecting listed plant species habitats and federally protected.

Interim recreation projects as described in Section 3.2 were designed to avoid or minimize soil and vegetation disturbances and generally involved only minor modification of existing facilities within areas of previous disturbance. **No impacts** on riparian resources and special plant habitats occurred due to implementation of any interim recreation projects.

In addition, an EIR for Riverbend Park, the largest of the interim recreation projects, was prepared by FRRPD as lead agency. This site was mostly riparian/wetland vegetation, barren/cobble, or disturbed annual grassland. The Riverbend Park Project EIR reduced significant impacts on botanical resources to **less-than-significant** with implementation of mitigation. It was determined that impacts on jurisdictional wetlands that could not be avoided would be significant. Although the Riverbend Park Project EIR identified some riparian vegetation would be removed, an additional 23 acres of riparian forest would be restored after removing invasive non-native species. The Riverbend Park Project EIR reduced significant impacts on riparian/wetland resources to **less-than-significant** with implementation of mitigation.

PRO

Project-level impacts identified under the No-Project Alternative would also occur under the Proposed Project. In addition, a

number of programs and actions contained in the SA relating to environmental and recreational improvements may affect riparian resources and special plant habitats.

Implementation of the Gravel Supplementation and Improvement Program (SA Article A102), the Channel Improvement Program (SA Article A103), the Structural Habitat Supplementation and Improvement Program (SA Article A104), and the Fish Weir Program (SA Article A105) have the potential for minor impacts on upland plant communities from disturbance associated with access and staging areas. These impacts would be considered **less-than-significant**. Implementation of the Riparian and Floodplain Improvement Program (SA Article A106) results in a **beneficial** effect on upland plant communities.

Implementation of the SA RMP provides for future construction of recreational facilities. The SA RMP identifies that Loafer Creek would provide additional RV campsites if unable to accommodate the proposed RV campsites at Bidwell Campground. This action has the potential to affect upland woodland and grassland communities by direct disturbance. However, these plant communities are both locally and regionally abundant, therefore, impacts would be considered **less-than-significant**.

Implementation of actions for Protection of Giant Garter Snake (SA Article A119), Protection of Valley Elderberry Longhorn Beetle (SA Article A120), and Protection of Red-Legged Frog (SA Article A121) would provide **beneficial** effects on riparian resources through habitat protection.

Construction and Recharge Brood Ponds (SA Article A122) would convert open water habitats to emergent wetland habitats. This measure would have a **beneficial** effect on riparian resources by creating additional habitat.

Flow/Temperature to Support Anadromous Fish (SA Article A108.1) establishes a new minimum flow for the LFC. Implementation of this program in the LFC may affect riparian vegetation when the minimum flow is increased. However, the flows identified in the SA would not increase water levels significantly and vegetation should reestablish naturally at the water's edge. This impact would be considered **less-than-significant**.

Comprehensive Water Quality Monitoring Program (SA Article A112d–l). The proposed project includes a number of elements relating to water quality and monitoring. It includes a comprehensive water quality monitoring program; fish tissue

bioaccumulation, recreational site water quality, water temperature, water quality bioassay, aquatic macroinvertebrate, and bacterial monitoring. The construction of permanent water temperature monitoring stations could create minor impacts on riparian resources or waters of the United States. These impacts would occur on a small scale and would be **less-than-significant**.

The SA RMP (SA Article A127) includes a number of improvements that have the potential to affect riparian resources:

- Trails;
- Equestrian facilities;
- DUA improvements;
- Docks, boat ramps; and
- Campgrounds.

The SA RMP actions would affect a variety of riparian resources because they may cross drainages and have potential to affect wetland/waters of the United States. Although individually, the acreage loss is small, the total loss could be **potentially significant**. Implementation of mitigation measure 5.5.4.2-d would reduce these impacts to **less-than-significant**.

Trail improvements—Some of the trail enhancements/additions proposed have the potential to affect drainages; therefore, they have the potential to affect riparian resources of the United States. Implementation of mitigation measure 5.5.4.2-d would reduce these impacts to **less-than-significant.**

Lake Oroville Recreation Facilities: A number of new actions relating to facilities around Lake Oroville could result in impacts on riparian/wetland resources. These impacts may be relatively small per site; however, the total loss could be **potentially significant**. These impacts would occur on a small scale and would be **less-than-significant**.

FERC

The FERC Staff Alternative generally incorporates the programs considered under the Proposed Project. The FERC Staff Alternative includes modifications to trails development and implementation; reconstruction of boat-in campsites; and temporary closure of Foreman Creek. Impacts on riparian resources under the FERC Staff Alternative would be similar to those under the Proposed Project. As such, with implementation of mitigation measure 5.5.4.2-d, these potential impacts would be reduced to **less-than-significant**.

Mitigation measure 5.5.4.2-d: Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations, or by the DFG or USFWS**.**

PRO, FERC

Use measures such as fencing to prevent access/disturbance into adjacent sensitive areas from construction/maintenance vehicles. Use erosion control and stabilization devices to prevent sediment from entering riparian habitats. Use appropriate native species when revegetating adjacent riparian areas. These measures would reduce the impacts to **less-than-significant.**

To reduce impacts to riparian and special plant habitats from recreational improvement, features would be designed to avoid and minimize direct loss to these habitats to the extent possible. Implement protective actions such as fencing to prevent access/disturbance to adjacent sensitive areas from construction/maintenance vehicles. Use erosion control and stabilization devices to prevent sediment from entering wetland and riparian habitats. Sensitive areas that cannot be avoided, will be revegetated with appropriate native species. These measures would reduce the impacts to **less-than-significant**.

Impact 5.5.4.2-e: Effects on Natural Communities, Wildlife Habitat, and Special-Status Species and Their Habitats from Invasive Plant Species.

NO

Continuing operation and maintenance activities under the No-Project Alternative may have adverse effects on natural communities, wildlife habitat, and special-status species and their habitats from invasive plant species.

Threatened and endangered species habitat conservation measures associated with informal consultation and identified for early implementation in the Terrestrial BA were designed in consultation with USFWS to avoid and minimize ongoing impacts on nesting bald eagles and vernal pool habitats. These measures would not promote the establishment of invasive plant species and would be **beneficial**.

Interim recreation projects as described in Section 3.2 were designed to avoid or minimize soil and vegetation disturbances and generally involved only minor modification of existing facilities within areas of previous disturbance. **No impacts** on these resources occurred due to implementation of interim recreation projects.

Invasive species removal and restoration with native riparian species is included as part of the Riverbend Park Project EIR.

Overall, this project would be **beneficial** to native plant and wildlife habitats.

PRO

Project-level impacts identified under the No-Project Alternative would also occur under the Proposed Project. In addition, a number of Articles relating to environmental and recreation improvements may promote the establishment of invasive plant species.

Implementation of actions for Protection of Giant Garter Snake (SA Article A119), Protection of Valley Elderberry Longhorn Beetle (SA Article A120), and Protection of Red-Legged Frog (SA Article A121 should have **no impact** on the establishment of invasive species wetland margins.

Construction and Recharge Brood Ponds (SA Article A122) would convert open water habitats to emergent wetland habitats. In addition, Provision of Upland Food for Nesting Waterfowl (SA Article A123) and Provision of Nest Cover for Upland Waterfowl (SA Article A124) have potential to introduce new invasive non-native plant species into the surrounding grasslands. With implementation of mitigation measure 5.5.4.2-e, the potential impacts would be reduced to **less-than-significant**.

The Comprehensive Water Quality Monitoring Program (SA Article A112d-l) would establish a program that includes a number of elements relating to water quality and monitoring. It includes a comprehensive water quality monitoring program; fish tissue bioaccumulation, recreational site water quality, water temperature, water quality bioassay, aquatic macroinvertebrate, and bacterial monitoring. Additionally, a public education element relating to bacterial levels (SA Article A113) and risks associated with fish consumption (SA Article A114) would be implemented. Implementation of these programs would have **no impact** on the spread of invasive species.

The SA RMP (SA Article A127) includes a number of improvements that have the potential to affect the spread of invasive species:

- Trails;
- Equestrian facilities;
- DUA improvements;
- Docks, boat ramps; and
- Campgrounds.

Trail improvements—Some of the trail enhancements/additions that are proposed could promote the establishment of invasive species through ground disturbance. Implementation of mitigation measure 5.5.4.2-e would reduce these impacts to **less-than-significant**. While not analyzed in this document, SA Article A126, Invasive Plant Management, is expected to provide direction to address this potential effect and would be evaluated once developed. These impacts would be relatively small per site; however, the total disturbance could be potentially significant. These impacts would occur on a small scale and would be **less-than-significant** with implementation of mitigation measure 5.5.4.2-e.

FERC — The FERC Staff Alternative generally incorporates the programs considered under the Proposed Project. The FERC Staff Alternative includes modifications to trails development and implementation; reconstruction of boat-in campsites; and temporary closure of Foreman Creek. Impacts related to invasive species under the FERC Staff Alternative would be similar to those under the Proposed Project. As such, with implementation of mitigation measure 5.5.4.2-e, these potential impacts would be reduced to **less-than-significant**.

Mitigation measure 5.5.4.2-e: Effects on Natural Communities, Wildlife Habitat, and Special-Status Species and Their Habitats from Invasive Plant Species.

PRO, FERC — Avoid ground-disturbing activities whenever possible, lessen areas of disturbance during project construction, and revegetate disturbed area with native species. Stockpile soil for reuse in areas of special resources to reinoculate the soils and seed bank. These actions would reduce the impacts to **less-than-significant.**

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5.6 LAND USE AND LAND MANAGEMENT PLANS

5.6.1 Regulatory Setting

Relevant comprehensive land use and resource management plans in the Oroville Facilities Project area are listed in Table 5.6-1. A more detailed description of the plans is included in Oroville Facilities Relicensing Study Plan SP-L-3 (SP-L3).

5.6.1.1 Federal Plans, Policies, Regulations, and Laws

The federal government does not have extensive land holdings in the FERC Project boundary. For a more detailed discussion related to the management of lands in the FERC Project boundary, refer to Oroville Facilities Relicensing SP-L2, Land Management Report. Federal lands that are in the FERC Project area are managed by USFS and BLM.

Federal Power Act Section 4(e)

Section 4(e) of the Federal Power Act (FPA) provides that any license issued by FERC for a project located 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. BLM and USFS have authority over some lands occupied by the Oroville Facilities. It has not been established at this time that the BLM lands are “reservation” lands subject to Section 4(e) and BLM has not filed any 4(e) conditions with FERC.

Federal Land Policy and Management Act of 1976

The Federal Land Policy and Management Act describes how federal lands shall be managed on the basis of multiple use and sustained yield unless otherwise specified by law. It requires that the public lands be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archaeological values and that where appropriate, certain public lands will be preserved and protected in their natural condition to provide food and habitat for fish, wildlife, and domestic animals, and also to provide for outdoor recreation and human occupancy and use.

Table 5.6-1. Relevant comprehensive land use and resource management plans in the Oroville Facilities area.

Agency	Document Title	Date	FERC Identified Plan
FEDERAL			
USFS	Plumas National Forest Land and Resource Management Plan (LRMP)	1988	No
USFS	Sierra Nevada Forest Plan Amendment (SNFPA)	2004	No
BLM	Redding Resource Management Plan and Record of Decision (ROD)	1993	No
USFWS	Final Restoration Plan for the Anadromous Fish Restoration Program	2001	No
CALFED	California's Water Future: A Framework for Action	2000	No
STATE			
DPR	California Outdoor Recreation Plan (CORP)	2002	Yes
DPR	Public Opinions and Attitudes on Outdoor Recreation in California	1997	Yes
DPR	Lake Oroville State Recreation Area Resource Management Plan and General Development Plan	1973	No
DPR	Lake Oroville State Recreation Area Resource Management Plan Amendment—Lime Saddle Area	1988	No
DPR	Office of Historic Preservation. Comprehensive Statewide Historic Preservation Plan for California, 2000–2005	2001	No
DWR	The California Water Plan Update, Bulletin 160 Series	1994	Yes
DWR	Lake Oroville Fisheries Habitat Improvement Plan	1995	No
DFG	Oroville Wildlife Area (OWA) Management Plan	1978	No
DFG	California Regulations on Hunting and Other Public Uses on State and Federal Areas	2002	No
California Department of Forestry and Fire Protection (CDF) and State Board of Forestry (SBF)	The California Fire Plan	1996	No
CDF	Butte Unit Fire Management Plan	2002	No
SWRCB	Basin Plan	2006	No
LOCAL			
Butte County	General Plan	1996	No
City of Oroville	General Plan	1995	No
City of Oroville	Bicycle Transportation Plan	1998	No
Butte County Association of Governments (BCAG)	Butte County 2001 Regional Transportation Plan (RTP)	2001	No
BCAG	Countywide Bikeway Master Plan	1998	No

Source: DWR 2004

Plumas National Forest Land and Resource Management Plan, 1988 (USFS)

The Plumas National Forest Land and Resource Management Plan (LRMP) was adopted in 1988 and directs the management of the 1,618,517 acres of Plumas National Forest and approximately 15,000 acres of Lassen National Forest. The Plumas National Forest includes lands adjacent to the FERC Project boundary in the North Fork, Middle Fork, and South Fork extremities of Lake Oroville. Lands in the Big Bend area are contained within Lassen National Forest, but are managed by the Plumas National Forest and fall under the management direction of the Plumas LRMP. The purpose of the LRMP is to help guide USFS in the efficient use and protection of National Forest resources, fulfill legislative requirements, and balance local, regional and national needs. The LRMP includes three Management Areas adjacent to the FERC Project area; Galen, French Creek, and Kellogg Management Areas. Standards and guidelines for these Management Areas are described in Tables 5.6-2, 5.6-3, and 5.6-4.

Table 5.6-2. Applicable Plumas National Forest standards and guidelines in the Galen Management Area.

General Direction	Standards and Guidelines
Recreation	
Efficiently manage recreation in the Lake Oroville State Recreation Area (LOSRA).	Continue cooperation allowing the DPR to manage the reservoir area, including Plumas National Forest lands.
Provide for semi-primitive recreation.	Maintain the character of the Bald Rock semi-primitive area. Restrict off-highway vehicle use.
Facilities	
Provide roads necessary to meet developed recreation and other demands.	Improve access to the Milsap Bar Campground on the North Fork Feather River.

Source: USFS 1988

Sierra Nevada Forest Plan Amendment, 2004 (USFS)

In January 2001, the Pacific Southwest Region adopted the Sierra Nevada Forest Plan Amendment (SNFPA) for managing 11 National Forests and 11.5 million acres of National Forest land. The SNFPA was adopted by all land and resource management plans for National forests in the Sierra Nevada and Modoc Plateau, including the two National forests located near the FERC Project boundary—the Plumas and Lassen National forests.

Redding Resource Management Plan, 1993 (BLM)

The primary purpose of the Redding Resource Management Plan is to update and integrate BLM land use planning for the Redding Resource Area into a single, comprehensive land use plan. The plan directs the management of public lands and Federal mineral estates that are administered by BLM within the Redding Resource Area of north-central California. The four main land use issues addressed in the

Table 5.6-3. Applicable Plumas National Forest standards and guidelines in the French Creek Management Area.

General Direction	Standards and Guidelines
Recreation	
Efficiently manage recreation in the Lake Oroville State Recreation Area (LOSRA).	Continue cooperation allowing DPR to manage the reservoir area, including Plumas National Forest lands.
Provide developed recreation facilities/programs to meet demand while reducing unit costs.	Maintain Rogers Cow Camp Campground, but operate as a self-service facility with no developed water supply. Close when major expenditure is required.
Visual Resources	
Maintain pleasing visual corridors.	Minimize the visual impact of transmission lines and hydroelectric facilities.
Wildlife	
Maintain species viability.	Provide suitable bald eagle foraging habitat along the North Fork upstream from Lake Oroville.
Water	
Protect and where necessary, improve water quality.	Maintain and construct additional erosion control works when needed to control excessive erosion and sedimentation from the French Creek basin.
Facilities	
Upgrade forest arterials and collectors.	Reconstruct the Oroville-Quincy Highway as part of the Forest Highway System. Reconstruct the Stanwood Saddle Road in cooperation with Butte County.

Source: USFS 1988

Redding Resource Management Plan are land tenure adjustment, recreation management, access, and forest management.

Final Restoration Plan for the Anadromous Fish Restoration Program, 2001 (USFWS)

The Final Restoration Plan for the Anadromous Fish Restoration Program (AFRP) was established by USFWS to increase the natural production of anadromous fish in the Central Valley of California under authority of the Central Valley Project Improvement Act. The restoration plan is a programmatic-level description of the AFRP in broad and general terms, and will be used to guide the long-term development of the AFRP. The AFRP coordinates restoration efforts with those used by other groups, such as DFG and the CALFED Bay-Delta Program.

Table 5.6-4. Applicable Plumas National Forest standards and guidelines in the Kellogg Management Area.

General Direction	Standards and Guidelines
Recreation	
Protect and enhance recreation use of the Middle Fork of the Feather River.	Manage Wildlife Scenic Zones consistent with the Wild and Scenic Rivers Act.
Provide for semi-primitive recreation.	Maintain the semi-primitive character of the Middle Fork and Bald Rock areas without roads.
Expand and improve the trail system.	Nominate Hartman Bar Trail as a National Recreation Trail when right-of-way is secured; improve facilities to meet planned uses.
Wildlife	
Protect and improve emphasis species habitat.	Coordinate projects affecting wild trout streams with DFG. Provide suitable peregrine falcon habitat in the Bald Rock Dome area.
Facilities	
Upgrade forest arterials and collectors.	Improve the Milsap Bar Campground access road as use studies show need to meet demand.
Special Areas	
Protect unique scenic values.	Continue special management of Feather Falls Scenic Area; recommend designation of Feather Falls as a National Natural Landmark.
Protect unique scenic and botanic values.	Preserve the champion ponderosa pine adjacent to the Hartman Bar Trail.

Source: USFS 1988

California's Water Future: A Framework for Action, 2000 (CALFED Bay-Delta Program Agencies)

In 1994, the State of California and the federal government signed a Framework Agreement pledging cooperation on a long-term plan to address chronic water supply and environmental problems in the Bay-Delta. The CALFED Bay-Delta Program is a collaborative effort among 23 State and federal agencies (CALFED Agencies) to improve water supplies in California and the health of the Bay-Delta watershed.

5.6.1.2 State Plans, Policies, Regulations, and Laws

The State of California owns and manages a significant amount of land in the Project area. Several agencies are responsible for the management of State land and have developed management plans for guidance. State agencies that have management responsibilities for State lands in the Project area include DWR, DPR, and DFG. In addition to these three State agencies, the California Department of Forestry and Fire Protection (CDF) has developed management plans that influence land and resource management activities in the Project area.

California Outdoor Recreation Plan, 2002 (DPR)

The California Outdoor Recreation Plan (CORP) was designed to meet the specific program responsibilities of the Federal Land and Water Conservation Fund Act, whose concerns are outdoor recreation, land acquisition, facility development, redevelopment, and rehabilitation. The primary objective of the CORP is to determine the outdoor recreation issues that are most critical in California, and to explore the most appropriate actions by which public agencies—State, federal, and local—might best address them. This plan is comprehensive in its scope, considering the full range of outdoor recreation issues throughout the entire State.

Lake Oroville State Recreation Area Resource Management Plan and General Development Plan, 1973 (DPR)

The current Lake Oroville State Recreation Area (LOSRA) General Development Plan, as amended, was developed by DPR in 1973. DPR released a public draft of a new General Plan in 2005, but it has not yet undergone the CEQA review process and has not been adopted by the Parks and Recreation Commission. The Development Plan describes allowable recreational uses and intensities for various areas around Lake Oroville. Recreational use intensities described in the Development Plan are primarily tied to slope and resource protection constraints.

Lake Oroville State Recreation Area General Development Plan Amendment—Lime Saddle Area, 1988 (DPR)

The LOSRA General Development Plan Amendment—Lime Saddle Area was approved by the State Park Commission in 1988. The Plan was intended to specifically address the changes needed at the Lime Saddle Marina.

Comprehensive Statewide Historic Preservation Plan for California, 2000–2005 (2001) (DPR Office of Historic Preservation)

The Comprehensive Statewide Historic Preservation Plan for California (HPP) was developed over the course of several years based upon input from both conservation professionals and the public. The HPP describes the vision for historic preservation and provides guidance on planning procedures for the identification, registration, protection, and preservation of important historical resources. Provisions for the periodic review and revision of the HPP every 5 years intend to ensure that changing needs and preservation priorities are being met.

The California Water Plan Update, Bulletin 160 Series (DWR)

The Bulletin 160 series assesses California's water needs and evaluates water supplies to quantify the gap between future water demands and water supplies. The series presents a statewide overview of current water management activities and provides water managers with a framework for making decisions. Bulletins 160-93, 160-98, and 160-05 are the latest in the series and evaluate water management options that could improve California's water supply reliability.

Lake Oroville Fisheries Habitat Improvement Plan, 1995 (DWR)

In response to the September 22, 1994, FERC Order, DWR adopted the Lake Oroville Fisheries Habitat Improvement Plan in 1995 to improve fish habitat and establish a schedule for implementation. A major plan objective includes increasing the productivity of fisheries within specific areas and the entire lake.

Oroville Wildlife Area Management Plan, 1978 (DFG)

In 1962, the Director of DWR declared that public interest and necessity required the acquisition of the Oroville Borrow Area (the clay source for the construction of the Lake Oroville Dam) for fish and wildlife enhancement and recreation. In total, 5,500 acres were transferred from DWR to DFG for creation of the Oroville Wildlife Area (OWA) on August 12, 1968. In 1978, DFG developed the Oroville Wildlife Area Management Plan. The purpose of the management plan was to provide for the preservation and enhancement of the OWA and for the reasonable use and enjoyment by the public.

California Regulations on Hunting and Other Public Uses on State and Federal Areas, 2002 (DFG)

The California Regulations on Hunting and Other Public Uses on State and Federal Areas is not a comprehensive plan per se, but it does govern hunting on State and federally owned lands and includes specific management direction for the OWA. Included in the regulations are hunting license provisions and requirements; application and fee information; a listing of all hunting areas throughout the state, including wildlife areas, recreation areas, and national forests; and detailed information regarding area locations and boundaries, hunting practices and regulations, permit requirements, and firearms and archery equipment regulations in each hunting area.

California Fire Plan: A Framework for Minimizing Costs and Losses From Wildland Fire, 1996 (CDF and State Board of Forestry)

In 1996, the State Board of Forestry (SBF) and CDF adopted the California Fire Plan, a comprehensive strategy for wildland fire protection in California. The fire plan is the State's management guidance for identifying and working to reduce the risk and devastation caused by wildfire. The fire plan, updated most recently in 1999, targets pre-fire management measures geared at reducing fire fighting costs and property losses, increasing firefighter safety, and contributing to ecosystem health. The fire plan is a cooperative effort between the SBF and CDF.

Fire Management Plan, 2002 (CDF Butte Unit)

The Butte Unit Fire Management Plan documents the assessment of fire management within the Butte Unit (Butte County and a portion of Plumas County) and identifies strategic areas for pre-fire planning and fuel treatment to reduce destruction and costs associated with wildfire. The plan systematically assesses the existing level of wildland fire protection service, identifies high-risk and high-value areas where potential exists

for costly and damaging wildfires, ranks these areas in terms of priority needs, and prescribes methods to reduce future costs and losses.

California Regional Water Quality Control Board, Central Valley Region, Water Quality Control Plan, Fourth Edition, 2006

The California Regional Water Quality Control Board, Central Valley Region, first adopted a Basin Plan in 1975 for the entire Sacramento and San Joaquin River Basins. Several editions have been adopted since then, with the current, fourth edition dated 2006. Basin Plan objectives relevant to the Oroville Facilities are described in Section 4.2.

5.6.1.3 Local Plans, Policies, Regulations, and Laws

There are three local entities in the Oroville Facilities Project area that have land planning and/or management responsibilities. The Butte County Association of Governments (BCAG) is the Metropolitan Planning Organization and Regional Transportation Planning Agency and is responsible for the preparation of all federal and State transportation plans and programs for securing transportation funds. BCAG is an association of local governments formed by Butte County and the cities of Biggs, Chico, Gridley, and Oroville and the Town of Paradise. In addition to BCAG, Butte County and the City of Oroville also have comprehensive and/or management plans for lands in the Project area.

Although the majority of land in the Project area is managed by State agencies, there are considerable city and county lands within the relicensing study area.

County Plans

Butte County General Plan, 1971, as amended (County of Butte)

Local governments have been directed by the State of California to prepare and adopt a general plan per Section 65302(a) of the California Government Code. In compliance with California Law, the *Butte County General Plan* was adopted in 1971 by the County of Butte and the BCAG. The purpose of this document is to provide a complete statement of the policies and intentions regarding future development of land over a planning horizon of 20 years, which extends to the year 2016. Table 5.6-5 describes the policies included within the *Butte County General Plan* that relate to the Oroville Facilities.

Butte County 2001 Regional Transportation Plan 2001

The Butte County Regional Transportation Plan (RTP) is a 20-year long-range plan that is intended to attain an efficient and environmentally sound multi-modal transportation system. Land use coordination policies in the RTP are intended to facilitate the development of the most efficient and effective transportation system possible through existing and future land development forms. The RTP makes reference to its support

for the general projects included in the Countywide Bikeway Master Plan, as well as support for the 41-mile bicycle trail loop around the Feather River, and trails located within the Lake Oroville State Recreation Area (LOSRA).

Table 5.6-5. Butte County General Plan policies related to the Oroville Facilities.

Element	Policy Statement
Land Use	Biological Habitat: Lake Oroville and Butte County's larger streams are highly valuable habitats for trout, salmon, bass, and other game fish. Several rare and/or endangered plant and animal species are found within the county. Policy 6.5.a. Regulate development in identified winter deer ranges to facilitate the survival of deer herds. Policy 6.5.b. Prevent development and site clearance other than river bank protection of marshes and significant riparian habitats. Policy 6.5.c. Limit development which would increase sediment loads in prime fishing waters. Policy 6.5.d. Regulate development to facilitate survival of identified rare or endangered plants and animals. Geologic Hazards: The risk of landslides is greatest in areas with steep slopes, weak rock, and high rainfall; some areas around Lake Oroville and its branches have very high risk. Erosion potential varies by the same factors but is greatest in granite areas. Findings and policies on these subjects and other geologic hazards are presented in the Safety Element adopted in 1977. Policy 7.4.a. Correlate allowable density of development to potential for landslides, erosion and other types of land instability.
Open Space	Open Space for Outdoor Recreation: The DPR manages the extensive recreation facilities around Lake Oroville and the Thermalito Bays. Policy L. Butte County should encourage the DPR to complete their development of recreational facilities in the LOSRA.
Scenic Highways	Eligible State Scenic Highways: Highway 70 north of Highway 149 is eligible as a State Scenic Highway, although not officially designated. Policy 1. Protect valuable scenic areas for enjoyment by residents and visitors. Policy 5. Locate and design utility structures to minimize visual impact, where economically feasible. Policy 6. Encourage compatible land use patterns in scenic corridors. Policy 8. Consider economic impacts on property affected by a scenic highway designation.
Recreation	Policy 5. Lake Oroville and Facilities: Proposed development (parking, camp, picnic, boat ramp, comfort station, trailer, food, gasoline, oil, water, observation points and other facilities to serve the recreation minded public) at the following facilities: Lime Saddle, Foreman Creek, Bloomer, Craig, Kelly Ridge, Forebay, Loafer Creek, Goat Ranch, Afterbay, Potter Ravine, Fish Hatchery, etc. Development Agencies: County, Recreation District and DPR.

Source: Butte County 2000

Countywide Bikeway Master Plan, 1998

The primary purpose of the Countywide Bikeway Master Plan is to designate a regional bikeway system for Butte County that focuses on areawide bikeway connections. The Bikeway Plan mentions the Oroville Facilities specifically, as one of its policies is to "emphasize connections to regional recreation centers, such as Lake Oroville and Bidwell Park…".

Municipal Plans

City of Oroville General Plan, 1995 (City of Oroville)

The *City of Oroville General Plan* is a statement of Oroville's vision of its long-term future, focusing on the physical components that comprise the City. The General Plan consists of eight sections: (1) land use; (2) design; (3) circulation; (4) open space, natural resources, and conservation; (5) public facilities and services; (6) safety; (7) noise; and (8) housing goals, objectives, policies, and designations. The objectives and goals outlined in the general plan are intended to be the framework within which the City will make future decisions related to the community. Table 5.6-6 describes the policies included within the general plan for the City of Oroville that relate to the Oroville Facilities.

Bicycle Transportation Plan, 1998 (City of Oroville)

The *City of Oroville Bicycle Transportation Plan*, adopted in December 1998, provides the most up-to-date policies for bicycle transportation in the City of Oroville. The City of Oroville plans all bikeways within its "Sphere of Influence," although they are ultimately outside of the city's jurisdiction. The planning and implementation of bikeways is not a mandated process, but one undertaken by communities at their discretion.

5.6.2 Impact Thresholds

The following thresholds are used to determine whether the alternatives would have a significant effect on land use. There would be a significant impact if the alternatives would:

- 5.6-a: Physically divide an established community;
- 5.6-b: Conflict with any applicable land use plan or regulation of an agency with jurisdiction over the project (including but not limited to the general plan, specific plan, and zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect; or
- 5.6-c: Conflict with any applicable Habitat Conservation Plan or Natural Community Conservation Plan.

Table 5.6-6. City of Oroville General Plan policies that mention the Oroville Facilities.

Element	Policy Statement
City Design	Policy 4x. Request the State to landscape and develop the Thermalito Afterbay as a destination water recreation park which defines the western boundary of the community in accordance with the State's original master plan of recreation development associated with the FERC permit.
	Policy 4y. Encourage the efforts of the Feather River Parks and Recreation Department in the North Forebay, Nelson Ballpark expansion, and development of River Bend Park.
Open Space, Natural Resources and Conservation	Policy 6.11s. Coordinate with the DFG to ensure the ongoing operation of the Feather River Fish Hatchery.
	Policy 6.11w. Work with the DFG to ensure the preservation and enhancement of species or resident and anadromous fish along the Feather River, in Lake Oroville, and throughout the Project area.
Safety	Policy 8.10e. Monitor studies related to induced seismicity; if further studies establish a conclusive relationship between reservoir drawdown, refilling, and seismic activity, encourage the DWR to manage the Oroville Dam water regime to reduce risk (evidence thus far suggests a relationship between reservoir drawdown, refill, and subsequent seismic activity. This was seen in the 1975 Cleveland Hills earthquake, thought to have occurred after unprecedented drawdown and refilling of Lake Oroville).
	Policy 8.20m. Identify critical facilities in flood hazard areas and within the Oroville Dam inundation area, and seek ways to improve their level of protection, if possible (critical facilities provide fire and emergency services, water, electricity, gas supply, sewage disposal, communications, and transportation).
	Policy 8.20o. In the event of dam failure on the Oroville Dam, implement emergency measures consistent with the city's Multi-hazard Functional Disaster Plan (Dam failure, while considered unlikely, is among the hazards mentioned in the City's Multi-hazard Functional Disaster Plan).

Source: City of Oroville 1995

5.6.3 Method of Analysis

The methodology used to evaluate potential land use effects considered baseline information provided in PDEA Section 5.8.1, Land Use Affected Environment, as summarized from SP-L1, Land Use Study, and SP-L2, Land Management.

In addition, the analysis included a review of the alternatives in the context of established local, State, or federal land use and management plans to determine if the alternatives are consistent with such plans. The plan consistency analysis in this section focused on land use and management–related plans only. The consistency of such plans is evaluated in detail in Chapter 9.0, Consistency with Comprehensive Plans. All plan consistency analyses are based on information acquired as part of SP-L3, Comprehensive Plan Consistency.

Other land use and management–related studies were also used, including SP-L4, Aesthetic/Visual Resources; SP-L5, Fuel Load Management Evaluation; and SP-R4,

Assess Relationship of Fish/Wildlife Management and Recreation, to help assess the effects of the alternatives on land use, land management, and planning.

5.6.4 Impacts and Mitigation Measures

In addition to the Proposed Project, this DEIR analyzes the No-Project Alternative and the FERC Staff Alternative. All alternatives analyzed result in **no impacts** to land use and therefore, no mitigation is required.

Impact 5.6-a: Physically Divide an Established Community.

There are no measures that have the potential to physically divide an established community.

Impact 5.6-b: Conflict with Any Applicable Land Use Plan or Regulation of an Agency with Jurisdiction over the Project (Including but Not Limited to the General Plan, Specific Plan, and Zoning Ordinance) Adopted for the Purpose of Avoiding or Mitigating an Environmental Effect.

There are no measures that have the potential to conflict with any applicable land use plan or regulation of an agency with jurisdiction over the project (including but not limited to the general plan, specific plan, and zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect.

Impact 5.6-c: Conflict with Any Applicable Habitat Conservation Plan or Natural Community Conservation Plan.

There are no measures that have the potential to conflict with any applicable Habitat Conservation Plan or Natural Community Conservation Plan.

5.7 RECREATIONAL RESOURCES

5.7.1 Regulatory Setting

This subsection describes the current responsibilities and activities of four primary State agencies, and other local and federal agencies, as related to recreation management.

In 1961, the California Legislature passed the Davis-Dolwig Act (California Water Code Sections 11900–11925), which defined responsibilities of four State agencies (DWR, DPR, DFG, and California Department of Boating and Waterways [DBW]) for providing recreational opportunities and fish and wildlife enhancements as part of the SWP, which includes the Oroville Facilities. DWR is charged with planning for public recreation and fish and wildlife preservation and enhancement in connection with the development of SWP facilities. This duty involves acquiring land and locating and constructing all works and project features so as to allow for fish and wildlife enhancement and recreational uses following construction of the project. DPR is authorized to design, construct, operate, and maintain public recreation facilities. DFG is responsible for managing fish and wildlife resources. DBW, in turn, is charged with planning, designing, and constructing boating-related facilities.

Lands, facilities, and recreational interests in the project area are also owned and managed by two federal land management agencies, BLM and USFS, and a local parks agency, the Feather River Recreation and Parks District (FRRPD). The properties and management responsibilities of each agency are detailed in a series of deeds, agreements, and transfers between the agencies involved.

Relevant agency ownership, management responsibilities, and current management practices throughout the project area are presented below by geographic area. Additional detail on organizational structure and budget are provided in the report for Relicensing Study Plan R-5 (SP-R5), Assessment of Recreation Areas Management. Under FERC regulations, DWR is ultimately responsible for public access, recreation opportunities, and associated development within the FERC Project boundary.

5.7.1.1 Management of Lake Oroville State Recreation Area

The Lake Oroville State Recreation Area (LOSRA) contains most of the recreation waters, land, and facilities within the FERC Project boundary, comprising approximately 28,000 of the approximately 41,100 acres within the FERC Project boundary.

California Department of Water Resources

DWR has transferred management responsibilities (“recreational interest”) for most lands, waters, and recreation facilities within the LOSRA to DPR. Although DWR does not manage the majority of the recreational opportunities and facilities in the LOSRA or the project area, it is responsible, under its existing FERC License, for implementing a variety of recreation-related projects and improvements, ensuring funding, operation, development, and management of current and additional recreation facilities within the

project area. Although in many cases DWR is not involved in the direct implementation of recreation improvements and programs at the field level, it is ultimately DWR's responsibility to ensure that all improvements, maintenance, and studies prescribed in the FERC License are properly carried out. Consistent with its responsibilities, DWR works with DPR, DBW, and DFG to provide for recreational opportunities and funding throughout the Oroville Facilities as required by FERC.

California Department of Parks and Recreation

As the manager of the LOSRA, DPR is the primary provider of recreation opportunities and facilities within the project area. DPR's Core Programs, linked directly to the agency's mission, include Resource Protection, Education and Interpretation, Facilities, Public Safety, and Recreation (DPR 2001). Routine tasks performed by DPR staff include collecting fees and monitoring attendance; cleaning and maintaining restrooms and toilet buildings; servicing trash receptacles; maintaining camping and day use areas including launch ramps, courtesy docks, and 47 miles of trails; monitoring and maintaining buoys and vessels; and maintaining recreation area grounds and landscaping. DPR and DWR maintain a floating debris removal program on Lake Oroville whereby boats are used to picked up debris and deliver it to collection points (cove areas with debris containment booms), where it is collected from the shore after the reservoir has receded.

DPR is also responsible for carrying out boat safety inspections and providing safety patrols at Lake Oroville, Thermalito Forebay, and the Diversion Pool. (Patrols are not regularly conducted in the Diversion Pool and Thermalito Forebay due to relatively low levels of boating activity.) Less frequent tasks include road maintenance for approximately 21 miles of road, maintenance of all park utilities (including electrical, water, and wastewater facilities), and capital improvement of all recreational facilities. Under the direction of DPR, two private concessionaires operate and maintain facilities at Bidwell Canyon and Lime Saddle Marinas, subject to DPR contracts and oversight (pers. comm., Feazel 2002).

Utility services in the recreation area are overseen by a water/sewer plant supervisor. In addition to LOSRA staff, DPR's other Northern Buttes District administrative staff provide additional aid to all units in the DPR District. DPR annually hires additional seasonal support staff in the summer to operate entrance stations and carry out basic facility maintenance tasks.

The Seventh Generation: The Strategic Vision of California State Parks (DPR 2001) outlines the strategies and management practices that DPR follows in managing parks throughout the State. DPR manages interpretive programs, most Lake Oroville Visitors Center activities, special events coordination, and general recreational opportunities with that guiding document in mind. More specific to the project area, DPR is currently updating the General Development Plan for LOSRA. The General Development Plan update establishes a long-range vision for the park and provides guidelines to protect and improve the park's natural, cultural, and recreational values.

Although DPR manages the majority of LOSRA's recreational aspects, as stated, DWR bears the ultimate responsibility under the current FERC License for ensuring funding, development, operation, and management of current and additional recreation facilities at the Oroville Facilities. In addition, the Davis-Dolwig Act requires DWR to plan for and acquire land for recreation in conjunction with all SWP development. Under the Davis-Dolwig Act, DPR has the authority to design, construct, operate, and maintain recreation facilities of the SWP. DPR has a budget that is controlled and appropriated annually by the California Legislature.

California Department of Boating and Waterways

DBW administers a number of programs, including boating and aquatic safety education and training programs, boat and yacht licensing programs, and programs that fund the development of public-access boating facility projects. DBW funds and constructs various projects at the LOSRA and the Oroville Wildlife Area (OWA) related to boating and boating-related facilities, including boat-in facilities, launch ramps and associated parking areas, floating restrooms, other restrooms at boat ramps, and general renovation of boating facilities. Projects pursued by DBW are typically proposed following suggestions from other agencies and from the public through DBW's public outreach programs. Following construction, the responsibility for operation and maintenance of facilities is turned over to the appropriate land managing agency—in this case it is DPR (LOSRA) or DWR (Thermalito Afterbay). DBW neither owns nor manages any recreational facilities or activities within the study area (pers. comm., DiGiorgio 2003).

DBW has spent $9.4 million since 1995 on constructing and maintaining boating facilities that support boating at LOSRA. When this amount is adjusted (normalized) to 2002 using the Consumer Price Index for California, DBW expenditures for recreation-related projects at the LOSRA total $18 million.

California Department of Fish and Game

DFG management in the LOSRA is limited to the enforcement of hunting and fishing regulations and the California Fish and Game Code, management of the fish stocking program, and participation in biological studies (pers. comm., Atkinson 2003). DFG also participates in some habitat improvement programs, the management of wildlife and special-status species habitat projects, and related issues falling under DFG jurisdiction.

U.S. Bureau of Land Management

BLM is responsible for scattered lands managed under the direction of the 1993 *Redding Resource Management Plan* discussed below. Within the FERC Project boundary, BLM manages approximately 3,852 acres of land in scattered, noncontiguous parcels along the West Branch and the North, Middle, and South Forks of Lake Oroville. BLM lands within the FERC Project boundary represent 9.4 percent of the total 41,142 acres of the Oroville Facilities. Of the total acres of BLM-administered public lands within the FERC Project boundary, approximately half are submerged under Lake

Oroville. Currently, BLM does not actively manage recreation on any lands within the FERC Project boundary (pers. comm., Williams 2003; pers. comm., Ritter 2002).

U.S. Forest Service

Within the LOSRA boundary, there are 1,811 acres of Plumas National Forest lands, which comprise several fragmented holdings distributed proportionately between the North, Middle, and South Forks of Lake Oroville. There are also 228 acres of Lassen National Forest lands within the LOSRA, located on the North Fork arm of the reservoir, which are administered by the Plumas National Forest (pers. comm., Graham 2004). All National Forest lands within the FERC Project boundary are part of the USFS French Creek, Galen, Kellogg, and Feather Falls Management Areas, where ownership is a checkerboard of private, State, and federally owned parcels (USFS 1988).

The French Creek, Galen, Kellogg, and Feather Falls Management Areas, including those areas that overlap with the area, are managed with a number of specific goals related to resource conservation, provision of high-quality recreational opportunities, and protection of visual resources. The *Plumas Land and Resource Management Plan* specifically calls for the promotion of efficient recreation management in both the French Creek and Galen Management Areas by allowing DPR to manage recreation on Plumas National Forest lands that fall within the LOSRA boundary, per a 1978 Memorandum of Agreement (MOA) between the two agencies (USFS 1988; USFS and DPR 1978).

5.7.1.2 Management of Oroville Wildlife Area

The OWA consists of 2 informal subunits: the 5,700-acre original management area adjoining the Feather River (including the area formerly known as the Oroville Borrow Area) owned by DFG, and the approximately 6,000 acres of Thermalito Afterbay and surrounding lands managed by DFG under an agreement with DWR. The non-Thermalito Afterbay portion of the OWA is managed primarily for dispersed types of recreation such as hunting, fishing, and bird watching with minimal developed facilities. Waterfowl and upland game hunting are permitted in the OWA, including in Thermalito Afterbay. The area is managed primarily for day use, but primitive camping areas are located near the Larkin Road access point (Thermalito Afterbay Outlet).[1] Limited gravel extraction also occurs in a few locations. The Thermalito Afterbay subunit is also managed for dispersed types of recreation and for day use only, but it also has three additional developed boat launching and day use facilities.

California Department of Fish and Game

DFG's goals in managing the lands and facilities at wildlife areas are to maximize the amount and quality of habitat available for fish and wildlife, while also providing for use and enjoyment of the area by the public (DFG 1978; pers. comm., Atkinson 2003; pers. comm., Rischbieter 2003). Ideally, DFG manages wildlife areas to protect and enhance

[1] Primitive camping was allowed at another interior OWA location, One-Mile Pond, until March 2004. The designation of this area for camping was terminated due to the conflicts it presented with adjacent areas of the OWA being closed to nighttime use.

fish and wildlife habitats and the populations that depend on them, while allowing compatible recreation in the areas used by the public only to the extent that such uses do not interfere with the primary goals of fish and wildlife management.

DFG manages the OWA under the 1978 *Oroville Wildlife Area Management Plan* (DFG 1978), the California Fish and Game Commission's *Hunting and Other Public Uses on State and Federal Lands California Regulations* (DFG 2002), and the California Fish and Game Code, Sections 1525–1530 (OLC 2003). DFG, with limited assistance from DWR, works to achieve the objectives laid out in these documents through its lands, facilities, and fish and wildlife management strategies and practices. Additionally, as the State agency responsible for enforcement of hunting and fishing regulations on all public and private lands, DFG coordinates with the other management agencies in the area to ensure that regulations are enforced.

DFG management responsibilities at the OWA include facilities management, maintenance (such as solid waste collection and removal), boundary posting, fencing and signage repairs, code enforcement, and patrolling for illegal uses such as dumping and unauthorized off-highway vehicle use. DFG management actions also include habitat enhancement and inventorying and monitoring of vegetation and wildlife, including the monitoring of habitat improvement areas (pers. comm., Atkinson 2003). DFG's habitat enhancement program includes a wood duck nest-box program and dry land farming for nesting cover and improved wildlife forage. Fish and wildlife-related facilities also include hunting blinds located within the OWA.[2]

A unique aspect of the OWA, compared with other State Wildlife Areas in California, is the ongoing gravel mining activity. Mining is not typically consistent with the California Fish and Game Code or with any of the management goals set forth by DFG for wildlife areas. Leases providing for gravel extraction from the OWA are allowed due to legal agreements (developed prior to the designation as a wildlife area) that provide for this use, though some are a result of a land exchange between DFG and commercial gravel interests.

California Department of Water Resources

As a result of the 1993 *Amended Recreation Plan*, new day use facilities were constructed at Thermalito Afterbay by DWR in coordination with DFG (DWR 1993). DWR continues to manage two paved boat ramps and one car-top boat ramp and associated day use facilities on Thermalito Afterbay. The new facilities have led to increased use levels that may not be fully compatible with a designated wildlife area (pers. comm., Atkinson 2003). DWR also funds a contract with the Butte County Sheriff's Department for boat patrol on the Thermalito Afterbay portion of the OWA.

In 1993, an MOA, *Development and Management of Thermalito Afterbay Brood Ponds and Surrounding Habitat*, was created between DWR, DFG, and the California

[2] DFG terminated day-to-day management activities and staffing at the OWA, effective March 1, 2004, owing to State budget shortfalls.

Waterfowl Association to implement a plan for the development, operation, and maintenance of brood ponds and surrounding habitat to enhance wildlife at Thermalito Afterbay as part of the Central Valley Joint Venture Implementation Plan. DWR constructed 3 brood ponds, 1 per year following the MOA dated August 17, 1993 (DWR 2003).

5.7.1.3 Management of Recreation on the Feather River

About 10 miles of the Feather River, including about 5 miles of the Low Flow Channel (LFC), flows adjacent to and through the OWA; thus, recreation management of the river overlaps to a large extent with the OWA management discussed above. However, about 3 miles of the LFC, about half of which is within the FERC Project boundary, is upstream of the OWA and provides additional recreation opportunities.

The first three-quarters of a mile of the LFC below the Thermalito Diversion Dam is occupied by the Fish Barrier Pool, which is accessible to the public by nearby trails but which receives very little use. The Fish Barrier Pool and approximately 1 mile of the river downstream from the Fish Barrier Dam are within the FERC Project boundary. The Feather River Fish Hatchery occupies much of the right riverbank immediately below the Fish Barrier Dam. The remaining 1.5 miles of the river and adjacent riverbanks are outside the FERC Project boundary and are owned or managed by the City of Oroville or FRRPD, or are in private ownership.

Fishing Regulations

The segment of the Feather River in the project area is one of the most popular seasonal fishing destinations in the region, hosting tens of thousands of anglers each year (DWR 2001), most of whom are drawn by the well-known salmon and steelhead fisheries. The most popular location for anglers to congregate is at the Thermalito Afterbay Outlet within the OWA, but anglers also boat, wade, and use the riverbanks in the upstream section. DFG holds primary responsibility for fish and wildlife management within the State and therefore has jurisdiction to enforce DFG laws on all lands within the project area, including all of the Feather River. Most of the Feather River is open to fishing during certain periods each year. Fishing along the Feather River from the Fish Barrier Dam downstream to the Table Mountain bicycle bridge is prohibited year-round. Fishing from the Table Mountain Bridge to the State Route (SR) 70 bridge is permitted from January 1 to July 15 (barbless hooks only). Fishing is permitted throughout the year on the remainder of the river within the project area, but catch limits for trout and salmon vary by season.

5.7.1.4 Feather River Fish Hatchery (California Department of Water Resources and California Department of Fish and Game)

The Feather River Fish Hatchery was built in 1967 to compensate for the loss of salmon and steelhead trout spawning grounds due to the construction of Oroville Dam. The hatchery was designed as a relatively compact facility where a large number of adult salmon and steelhead could be held and artificially spawned.

The Feather River Fish Hatchery is funded by DWR and managed by DFG. DWR has assisted DFG with fish rearing and stocking, and with developing management protocols at the hatchery. The Fish Barrier Dam, located immediately upstream of the hatchery, prevents fish from traveling farther upstream. The flow over the Fish Barrier Dam maintains fish habitat in the LFC of the Feather River between the dam and the Thermalito Afterbay Outlet while providing attraction flow for the hatchery. Salmon and trout follow a fish ladder from the base of the Fish Barrier Dam up to the hatchery, where they are artificially spawned. Underwater viewing windows allow visitors to watch the fish as they swim and leap up the ladder. Hatchery facilities have an annual production capacity of 10 million fall-run salmon, 2 million spring-run salmon, and 450,000 steelhead (pers. comm., Kastner 2003).

Feather River Recreation and Park District

FRRPD, established by Butte County in 1952 to provide recreation and park services to the residents of the City of Oroville and surrounding communities, is a special assessment district encompassing 700 square miles of southeastern Butte County (City of Oroville 1995; FRRPD 2002). FRRPD provides a variety of recreation programs to the community and owns or leases several parks and sports facilities, several of which lie near or adjacent to the FERC Project boundary (City of Oroville 1995; FRRPD 2003). Riverbend Park and the adjacent Bedrock Park on the Feather River are important community assets and are linked to the Diversion Pool and the OWA recreation sites within the area by a paved segment of trail (part of the 41-mile Brad Freeman Trail).

5.7.2 Impact Thresholds

The following thresholds are used to determine whether the alternatives would result in significant effects on recreational resources. There would be a significant impact if the alternatives would:

- 5.7-a: Cause a direct or indirect substantial physical degradation of either public recreation uses or public recreational facilities;
- 5.7-b: Conflict with local, State, or federal agency recreation management plans; or
- 5.7-c: Substantially diminish values for which a stream segment is considered eligible for Wild and Scenic River System inclusion.

5.7.3 Method of Analysis

Potential impacts on recreation resources were assessed by qualitative methods. Baseline data for this assessment were collected during Oroville Facilities Relicensing studies. The Recreation and Socioeconomics Work Group developed 17 study plans to guide 17 separate but interrelated recreation studies (2 additional studies investigated socioeconomic issues and related recreation spending). The 17 recreation studies provided a comprehensive source of information to define the affected environment and

also supported assessment of the effects of the No-Project Alternative, the Proposed Project, and the FERC Staff Alternative on recreation resources, as described in Section 5.7.4 below. The 17 studies include the following:

- SP-R1, Vehicular Access Study;
- SP-R2, Recreation Safety Assessment;
- SP-R3, Assessment of the Relationship of Project Operations and Recreation;
- SP-R4, Relationship Assessment of Fish/Wildlife Management and Recreation;
- SP-R5, Assessment of Recreation Areas Management;
- SP-R6, ADA Accessibility Assessment;
- SP-R7, Reservoir Boating;
- SP-R8, Recreation Carrying Capacity;
- SP-R9, Existing Recreation Use Study;
- SP-R10, Recreation Facility Inventory and Condition Report;
- SP-R11, Recreation and Public Use Impact Assessment;
- SP-R12, Projected Recreation Use;
- SP-R13, Recreation Surveys;
- SP-R14, Assessment of Regional Recreation and Barriers to Recreation;
- SP-R15, Recreation Suitability;
- SP-R16, Whitewater and River Boating; and
- SP-R17, Recreation Needs Analysis.

These relicensing studies provide information on existing and historical recreation conditions. Professional judgment based on thorough familiarity with the recreation resources and issues of the project gained over the course of the collaborative relicensing effort is also an important element in assessing effects on recreation quality or quantity. For detailed descriptions of study plan methodologies, please refer to each study plan report, which can be found at http://orovillerelicensing.water.ca.gov/.

5.7.4 Impacts and Mitigation Measures

The following section describes the beneficial effects and potentially adverse impacts of the Proposed Project, including both programmatic and project-level analyses. Table 5.7-1 indicates the SA articles or actions that could have an effect on recreation resources, and whether these effects are expected to be beneficial, less-than-significant, or would be less-than-significant following implementation of recommended mitigation measures.

In addition to the Proposed Project, this DEIR analyzes the No-Project Alternative and the FERC Staff Alternative. Impacts on recreation from implementing the FERC Staff Alternative are similar to those anticipated from implementation of the Proposed Project unless noted. Alternatives are identified as follows: NO (No-Project), PRO (Proposed Project), and FERC (FERC Staff Alternative). Effects are identified as follows: B (beneficial), LTS (less than significant), LTSM (less than significant with mitigation) and SU (significant and unavoidable). All alternatives analyzed result in **less-than-significant** impacts to recreation with the implementation of best management practices (BMPs), as described in Appendix D and included in both the Proposed Project and the FERC Staff Alternative, to address short-term, construction-related impacts, and no further mitigation would be required.

Table 5.7-1. Environmental effects on recreational resources.

Alternative(s)	Article # and Title	Level of CEQA Analysis	Nature of Potential Impact(s)	Effects
PRO, FERC	A102—Gravel Supplementation and Improvement Program (Also see B105)	Programmatic	Aquatic habitat improvements could lead to enhanced fish vigor and number, thereby enhancing the quality of the angling experience within the project area due to increased catch rates or catching larger fish.	B
PRO, FERC	A103—Channel Improvement Program (This action is programmatic; however, Moe's and Hatchery Ditch activities are project-level)	Programmatic with some Project elements	Aquatic habitat improvements could lead to enhanced fish vigor and number, thereby enhancing the quality of the angling experience within the project area due to increased catch rates or catching larger fish. Construction of several measures could cause short-term disruptions to recreation use and activities.	B/LTS
PRO, FERC	A104—Structural Habitat Supplementation and Improvement Program (SHSI)	Programmatic	Aquatic habitat improvements could lead to enhanced fish vigor and number, thereby enhancing the quality of the angling experience within the project area due to increased catch rates or catching larger fish. Placement of habitat structures could require the closure of areas to recreation. Large woody debris could be a hazard to boaters and swimmers.	B/LTS
PRO, FERC	A106—Riparian and Floodplain Improvement Program	Programmatic	Aquatic habitat improvements could lead to enhanced fish vigor and number, thereby enhancing the quality of the angling experience within the project area due to increased catch rates or catching larger fish. Construction of several measures could cause short-term disruptions to recreation use and activities.	B/LTS
PRO, FERC	A110—Lake Oroville Warm Water Fishery	Programmatic	Aquatic habitat improvements could	B/LTS

Table 5.7-1. Environmental effects on recreational resources.

Alternative(s)	Article # and Title	Level of CEQA Analysis	Nature of Potential Impact(s)	Effects
	Habitat Improvement Program		lead to enhanced fish vigor and number, thereby enhancing the quality of the angling experience within the project area due to increased catch rates or catching larger fish. Habitat structures could provide obstacles to boating, may affect shore access, and may affect the recreation setting.	
PRO, FERC	A105—Fish Weir Program	Programmatic	Construction of weirs could impact recreation. Weirs could be impediments to boating and would decrease amount of area for fishing due to creation of "No Fishing Zones" around the weirs.	LTS
PRO, FERC	A128—Draft Historic Properties Management Plan: Potentially Restrict Access in the Inundation Zone to Specific Boat-in Campgrounds (BICs) as Appropriate During Periods of Low Reservoir, and Eliminate Wheeled Motorized Vehicle Use within the Lake Oroville Fluctuation Zone	Programmatic	Closure of boat-in campsites could affect recreation use. Eliminating unauthorized vehicular access could reduce vehicle use at some shoreline areas.	LTS
PRO, FERC	A112—Comprehensive Water Monitoring Program	Project (all of A112 except A112[a–c])	Water quality monitoring could increase safety and enhance the recreation experience.	B
PRO, FERC	A113—Monitoring of Bacteria Levels and Public Education	Project	Water quality monitoring and education could increase safety and enhance the recreation experience.	B
PRO, FERC	A114—Public Education Regarding Risks of Fish Consumption	Project	Education could increase safety and enhance the recreation experience.	B
PRO, FERC	A123—Provision of Upland Food for Nesting Waterfowl	Project	Terrestrial habitat improvements for wildlife could improve wildlife watching opportunities and provide additional wildlife for hunting.	B

Table 5.7-1. Environmental effects on recreational resources.

Alternative(s)	Article # and Title	Level of CEQA Analysis	Nature of Potential Impact(s)	Effects
PRO, FERC	A124—Provision of Nest Cover for Upland Waterfowl	Project	Terrestrial habitat improvements for wildlife could improve wildlife watching opportunities and provide additional wildlife for hunting.	B
PRO, FERC	A125—Installation of Wildlife Nesting Boxes	Project	Terrestrial habitat improvements for wildlife could improve wildlife watching opportunities and provide additional wildlife for hunting.	B
PRO, FERC	A108—Flow/Temperature to Support Anadromous Fish	Project (A108.1 only); Programmatic (108.2 and 108.3 only)	Flow and temperature changes could lead to enhanced fish vigor and number, thereby enhancing the quality of the angling experience within the project area due to increased catch rates or catching larger fish. Water temperature changes would likely be unnoticeable to anglers and boaters. Potential measures to address temperature goals could result in additional safety risks, barriers or impediments to recreation, and could benefit fishing. Fishing could be benefited by increased spawning; however, some anglers may find wading more difficult at higher water levels. Use by small motorized fishing boats may slightly increase at higher flows.	B/LTS
PRO, FERC	A122—Construction and Recharge of Brood Ponds	Project	Terrestrial habitat improvements for wildlife could improve wildlife watching opportunities and provide additional wildlife for hunting. Thermalito Afterbay water level drawdown during construction could impact Afterbay water surface access and recreational angling at existing brood ponds.	B/LTS

Table 5.7-1. Environmental effects on recreational resources.

Alternative(s)	Article # and Title	Level of CEQA Analysis	Nature of Potential Impact(s)	Effects
PRO	A127—Recreation Management Plan: Construction of Recreation Facilities, Provide Additional Allowable Uses on Some Trails, and Deploy Two New Floating Campsites in the Lime Saddle Area and Deploy One New Floating Campsite in the West or North Fork Areas of the Reservoir	Programmatic/ Project	Provision of new recreation facilities such as new trails, parking areas, restrooms, fish cleaning stations, beach, swimming areas, signage, improved vehicular access and provision of boating, day use, camping, the Americans with Disabilities Act, and equestrian and wildlife-watching facilities could increase recreation use and enhance the recreation experience by offering improved recreation opportunities, new recreation opportunities at some sites, and support use of the project area by creating a wider range of users. Construction of several measures could cause short-term disruptions to recreation use and activities. Changing allowable uses may displace some users, but would also provide additional trail opportunities. Additional floating campsites may slightly decrease acreage available for high speed boat cruising.	B/LTS
PRO, FERC	A107—Feather River Fish Hatchery water temperature	Project (107.2)	Water temperature changes would likely be unnoticeable to anglers and boaters within the Feather River.	LTS
PRO, FERC	A117—Protection of Vernal Pools	Project	Vernal pool protection may influence location of recreation site expansion at South Forebay Boat Ramp/Day Use Area. Revegetation of roads could affect recreation access.	LTS
PRO, FERC	A118—Minimization of Disturbances to Nesting Bald Eagles	Project	Trails near the active nest sites may disturb nesting bald eagles.	LTS

Table 5.7-1. Environmental effects on recreational resources.

Alternative(s)	Article # and Title	Level of CEQA Analysis	Nature of Potential Impact(s)	Effects
PRO, FERC	A119—Protection of Giant Garter Snake	Project	Protection of giant garter snake habitat may affect recreation activities at the Thermalito Afterbay complex.	LTS
PRO, FERC	A120—Protection of Valley Elderberry Longhorn Beetle	Project	Protection of beetle habitat may influence the location of proposed recreation facilities at the Thermalito Afterbay Outlet.	LTS
PRO, FERC	A121—Protection of Red-Legged Frog	Project	Protection of red-legged frog habitat may affect recreation activities at the Thermalito Afterbay complex.	LTS
FERC	A127—Modified Recreation Management Plan Same as A127 Recreation Management Plan with: Additional trail studies required prior to changing trail use designations	Programmatic	Conducting additional studies would delay expansion of trail opportunities for both equestrians and bike riders for several years.	LTS
FERC	A127—Modified Recreation Management Plan Same as A127 Recreation Management Plan with: Reconstruction of Boat-in Camps at Bloomer, Goat Ranch, and Craig Saddle	Project	Reconstruction would result in temporary loss of use of these facilities by campers.	B/LTS
FERC	A129 (revised by FERC staff to include temporary closure)—Improve and Redirect Recreation Usage to Specific Areas at Foreman Creek (Plan development) Boat Ramp while Plan is Developed to Protect Cultural Resources	Project	Temporary closure during plan development would decrease lake access and recreation opportunities for local residents.	LTS

Coding:

B = Action with potential to result in a beneficial effect; could involve short-term, less-than-significant, construction related impacts that would be avoided or reduced through the use of Best Management Practices (BMPs). See Appendix D.

LTS = Action that would result in less-than-significant impact on resource.

Program-Level Impacts and Mitigation Measures

The Proposed Project would provide many **beneficial** impacts to recreation. Aquatic habitat improvements as well as flow and temperature changes could lead to enhanced fish vigor and number, thereby enhancing the quality of the angling experience within the project area due to increased catch rates or catching larger fish (Please refer to Table 5.7-1 for description of beneficial effects). Provision of new recreation facilities such as new trails, parking areas, restrooms, fish cleaning stations, beach, swimming areas, signage, improved vehicular access and the provision of boating, day use, camping, the Americans with Disabilities Act (ADA), and equestrian and wildlife-watching facilities could increase recreation use and enhance the recreation experience by offering improved recreation opportunities, new recreation opportunities at some sites, and support use of the project area by creating a wider range of users.

Impact 5.7-a: Cause a direct or indirect substantial physical degradation of either public recreation uses or public recreational facilities**.**

NO

Under the No-Project Alternative, routine operations and maintenance activities would continue. Therefore, substantial physical degradation of public recreation uses and facilities would not occur, and there would be a **less-than-significant** impact as compared to existing conditions. The existing conditions of the No-Project Alternative are discussed in the Affected Environment section (Section 4.7.1).

PRO

Aquatic

Structural Habitat Supplementation and Improvement Program and Instream Structural Placement Plan (SA Article A104). This measure would include placement of large woody debris (LWD) and boulders in the Feather River to improve habitat for fish. During placement of LWD and boulders, areas would be closed to recreation, creating a short-term **less-than-significant** impact as long as boaters could still travel down the Feather River. Once placed, LWD could be a hazard to boats (hulls, anchor lines, and propellers) and could be a drowning hazard to swimmers and waders. Within the Structural Habitat Program, safety issues would be addressed to minimize risk to human safety. The Instream Structural Placement Plan would include an analysis of safety issues to avoid unreasonable risk to the safety of river users. Implementation of specific measures designed to avoid such risk would reduce impacts to **less-than-significant** levels.

Fish Weir Program (SA Article A105). This measure includes the installation of two fish barrier weirs within the Feather River in two phases. Construction of the two weirs would likely cause short-term impacts on recreation; however, the level of impact cannot be

identified without further details on weir construction. The weirs would have provisions for manually passing boats over the weirs, and therefore the weirs would not prevent boating, although they would be impediments, the severity of which would be based on final location and design. Most boat anglers focus on the Thermalito Afterbay Outlet, but some boaters travel the Feather River from Riverbend Park south toward the Thermalito Afterbay Outlet. Use of this section of the river may also increase due to the enhanced and now publicly accessible boat ramp at Riverbend Park. A boating compatibility analysis is also part of this measure and would identify impacts and ways to minimize impacts on boating from the two weirs. Installation of two fish weirs would also lead to a "No Fishing Zone" immediately above and below the weirs, which would decrease available fishing area. However, this would be a small decrease compared to the amount of area available for fishing along the Feather River both within and outside of the FERC Project boundary. Therefore, this measure is expected to have a **less-than-significant** impact on boating and fishing.

Lake Oroville Warm Water Fishery Habitat Improvement Program (SA Article A110). This measure would create additional habitat for fish, primarily within the fluctuation zone of Lake Oroville. Construction of new habitat could provide obstacles to boating (boulders, weighted pipes, etc.) and may affect shore access from the water, depending on where enhancements are located around the reservoir. Some conflict with informal shoreline swimming locations may occur, given that areas of gradually sloping shoreline are favorable for both swimming and habitat enhancement. Riprap and other materials placed in the fluctuation zone may also affect the recreation setting, as the reservoir draws down and habitat enhancements become visible within the fluctuation zone. However, enhanced warm water fish habitat would benefit recreational angling opportunities in Lake Oroville, and the percentage of the fluctuation zone affected would be small. Thus, overall, impacts on recreation from this measure are expected to be **less-than-significant**.

Temperature, Flows, Operations

Flow/Temperature to Support Anadromous Fish (SA Article A108). Proposed water temperature targets would likely be unnoticeable to anglers and boaters within the Feather River. The river is not commonly used for body water contact recreation, but is mainly used by boaters and shoreline anglers wearing waders. Water temperatures are already cold and a change of a few degrees colder would likely not be noticeable to most recreationists.

Therefore, this measure would have a **less-than-significant** impact on recreation.

The Proposed Project also includes future studies that would evaluate different ways to address temperature habitat needs for anadromous fish in the LFC and the High Flow Channel of the Feather River. Potential future facility modifications and operational changes resulting from this study would be subject to additional CEQA review and analysis.

General

Recreation Management Plan (SA Article A127), Channel Improvement Program (SA Article A103), and Riparian and Floodplain Improvement Program (SA Article A106). Construction of many proposed recreation facilities and habitat improvements could cause short-term disruptions to recreation use and activities. Disruptions would likely only last during construction/implementation and would not continue once construction/implementation was completed (except for programs and specifics mentioned above and in the project-level impact section). Therefore, construction/implementation would have **less-than-significant** impacts on recreation.

Draft HPMP (SA Article A128)

Potentially Restrict Access in the Inundation Zone to Specific Boat-in Campgrounds (BICs) as Appropriate during Periods of Low Reservoir Levels.

This measure, which is among potential actions to be proposed in the draft HPMP, could include periodic closure of BICs such as Bloomer BIC (four BICs) and Goat Ranch BIC at low pool levels when cultural resources are exposed; however, restrictions could be limited to signage. This measure would have a **less-than-significant** impact on recreation because signage would not directly affect use of the campsites (only of the inundation zone) and any closures would occur during low water periods when the boat-in campgrounds receive very little use.

Eliminate Wheeled Motorized Vehicle Use within the Lake Oroville Fluctuation Zone.

This measure would eliminate all motorized vehicle access in the fluctuation zone, with the exception of designated areas mostly at developed and car-top boat ramps. The purpose of this action is to prevent damage to cultural resources in the inundation zone.

Most motorized use outside designated areas (beyond access roads, ramps, and parking areas) is illegal, although such use occurs near some car-top ramps where this prohibition is not posted. These actions would have **less-than-significant** impacts on recreation by eliminating unauthorized vehicular access to some shoreline areas.

FERC

The following describes a measure under the FERC Staff Alternative that may have effects on recreation in addition to those associated with the Proposed Project:

Revision of Recreation Management Plan to require additional inventory of trail conditions, expanded monitoring, and measurement of trail demand and user needs, prior to development of recommendations and a schedule for changing trail use designations.

This measure would likely delay by several years the implementation of the non-motorized trails program contained in the SA Recreation Management Plan (RMP) (Appendix B). The chief consequence would be a delayed expansion of trails opportunities for both equestrians and bike riders that had been negotiated with trails users and other interested stakeholders, and possibly a loss of the settlement coalition that had resulted in the agreement for the proposed shared trails. Because current trail use opportunities would continue to be available during any revision of the RMP and additional studies, the impact of this measure would be **less-than-significant** and no mitigation would be required.

Impact 5.7-b: Conflict with Local, State, or Federal Agency Recreation Management Plans.

There are no measures that have the potential to conflict with local, State, or federal agency recreation management plans.

Impact 5.7-c: Substantially Diminish Values for a Stream Segment Eligible for Wild and Scenic River System Inclusion.

There are no measures that have the potential to substantially diminish values for a stream segment eligible for inclusion within the Wild and Scenic River system.

Project-Level Impacts and Mitigation Measures

The Proposed Project would provide many **beneficial** impacts to recreation. Terrestrial habitat improvements for wildlife could improve wildlife watching opportunities and provide additional wildlife for hunting (Please refer to Table 5.7-1 for description of

beneficial effects). Water quality monitoring and education could increase safety and enhance the recreation experience.

Impact 5.7-a: Cause a direct or indirect substantial physical degradation of either public recreation uses or public recreational facilities.

NO

Under the No-Project Alternative, routine operations and maintenance activities would continue. Therefore, substantial physical degradation of public recreation uses and facilities would not occur, and there would be a **less-than-significant** impact as compared to existing conditions. Existing conditions of the No-Project Alternative are discussed in the Affected Environment section (Section 4.7.1).

PRO

Temperature, Flows, Operations

Flow/Temperature to Support Anadromous Fish (SA Article A108) and Feather River Fish Hatchery Water Temperature (SA Article A107).

Proposed water temperature targets would likely be unnoticeable to anglers and boaters within the Feather River. The Feather River is not commonly used for body contact recreation, but mainly used by boaters and shoreline anglers wearing waders. Water temperatures are already cold and a change of a few degrees colder would likely not be noticeable to most recreationists. Therefore, this measure would have a **less-than-significant** impact on recreation.

Minimum Flow and Other Measures in the LFC to Support Anadromous Fish (SA Article A108).

This measure would increase the minimum flow of the LFC by 100–200 cubic feet per second (cfs). This would likely not be noticeable to river users and therefore would have a **less-than-significant** impact on recreation. This measure could have a **beneficial** impact on recreation by increasing spawning and potentially, in the long term, increasing the number of fish in the Feather River. If temperature targets are not met with the specified minimum flow, then flow releases in the LFC could increase to a maximum of 1,500 cfs. Test flows between 1,000 and 1,750 cfs were conducted for 3 days in August 2002. Interviews with river users revealed that some anglers felt the increased flows were beneficial for fishing or would improve the fishery in the longer term. A few anglers commented that it was more difficult to wade in the river with the higher flows. Increased flows up to 1,500 cfs may increase use by small motorized fishing

boats, but this use would likely not increase substantially. Overall, this measure would provide **beneficial** impacts to recreation and **less-than-significant** impacts for wading anglers if flows are increased to 1,500 cfs.

Terrestrial

Protection of Vernal Pools (SA Article A117). Measures prescribed in the Terrestrial Biological Assessment may influence location of recreation site expansion at the South Thermalito Forebay Boat Ramp/Day Use Area and may affect the location of a proposed trail along the south side of North Thermalito Forebay. Though proposed recreation development locations may be altered based on vernal pool locations, pools would not preclude recreation development. A vernal pool protection measure to abandon and revegetate roads that DWR determines are no longer necessary could affect recreation by reducing informal trail access on these roads. Specific roads have not yet been identified; therefore, the specific level and location of impacts on recreation cannot be identified at this time. Level of impact significance to recreation will depend on the location and current use of roads proposed for revegetation. However, prior to abandonment, DWR would assess potential affects and mitigate to **less-than-significant** levels through avoidance, minimization, or compensation.

Minimization of Disturbances to Nesting Bald Eagles (SA Article A118). DWR is required to develop a management plan to minimize disturbance to nesting bald eagles and submit the plan to USFWS within 30 days of nest discovery. DWR currently has four management plans covering the four active nests within the project area. There are two existing trails that are within or skirt the primary zone for one of these nests near the Diversion Pool; however, the nest has been productive in recent years under the existing level of recreational activity on these trails, and therefore, impacts on this nest are considered **less-than-significant**. The dynamic nature of bald eagle nesting from year to year and the potential for new nest discovery requires that mitigation measures be developed for individual management plans as bird use is documented and impacts assessed. These management plans contain mitigation measures necessary to reduce disturbance during critical nesting months from recreation to **less-than-significant** levels. Proposed day use development along Burma Road would likely not be affected by any measures to reduce disturbance to nesting bald eagles at the Diversion Pool, as proposed sites would be outside of the primary and secondary protection zones.

Protection of Giant Garter Snake and Red-Legged Frog (SA Articles A119 and A121). The Terrestrial Biological Assessment identifies minimal value giant garter snake habitat and states that potentially suitable habitat is currently not of sufficient quality to support the California red-legged frog. Furthermore, no giant garter snakes or red-legged frogs have been observed within the FERC Project boundary. Thus, existing recreation activities would not likely cause significant impacts on these species. Protection measures to minimize activities that modify habitat within 200 feet of giant garter snake and red-legged frog wetland habitat may result in specific trail alignments for shoreline access to avoid and minimize impacts to **less-than-significant** levels for these species at North and South Thermalito Forebay.

Additional development of the Larkin Road Car-Top Boat Ramp at the Thermalito Afterbay is proposed and would include five to ten new picnic tables, a beach, and a swimming area. Currently, visitors are informally swimming at the site and have impacted existing vegetation. Placement of the new day use facilities would be located to avoid or minimize impacts to potential giant garter snake habitat. Creation of a beach and associated connecting trail between the picnic area and the new beach designed to impact less than 0.10 acre as specified in the terrestrial biological assessment would be a **less-than-significant** impact to existing giant garter snake and red-legged frog habitat.

Protection of Valley Elderberry Longhorn Beetle (SA Article A120). Protection measures to maintain the existing amount of habitat and avoid impacts on existing elderberry shrubs may influence the location of proposed day use and camping facilities at the Thermalito Afterbay Outlet and two watchable wildlife sites within the OWA. However, protection measures would not preclude recreation development and therefore would have a **less-than-significant** impact on recreation.

Construction and Recharge of Brood Ponds (SA Article A122). The Thermalito Afterbay water level would be drawn down for an extended period during construction of waterfowl brood ponds. This drawdown could result in temporarily restricting access to the Thermalito Afterbay water surface for recreational activities and impact angling activity at the existing brood ponds. This is a short-term construction impact and is considered **less-than-significant** when compared to the benefits afforded to recreation by the anticipated increased to waterfowl populations at Thermalito Afterbay.

Recreation Management Plan (SA Article A127)

Provide Additional Allowable Uses on Some Trails.

There are four measures that would change allowable uses on trails. Equestrian use would be allowed on Burma Road, adjacent portions of the Brad Freeman Trail, and on the Bidwell Canyon Trail. Bicycle use would be allowed on the Dan Beebe Trail (except for the Sycamore Hill segment) and on the access road south of the Loafer Creek Equestrian Campground. Changing allowable uses on these trails may make them less attractive to some recreationists who prefer the existing allowable uses on these trails. However, additional trail opportunities would be provided by allowing more types of use on these trails, and substantial opportunities for hiking and equestrian-only use would remain on trails whose use designation would not change. Therefore, changing allowable uses on the five trails would have a **less-than-significant** impact on recreation.

Deploy Two New Floating Campsites in the Lime Saddle Area and Deploy One New Floating Campsite in the West or North Fork Areas of the Reservoir.

This measure may decrease acreage available for high speed boat cruising due to the restricted speed zones that would be established around the new campsites. However, new floating campsites could be located in existing no-wake zones, and therefore acreage for high-speed boat cruising would not be reduced. In the event that campsites are located outside of existing no-wake zones, minimal surface water acreage would be unavailable for high-speed boat cruising; thus, this measure would have a **less-than-significant** impact on recreation.

FERC

Recreation Management Plan as Amended by FERC

Closure of Foreman Creek Area to Recreation Use while DWR Develops a Plan, in Consultation with Local Native American Tribes, for Protecting Cultural Resources that Considers Redirecting Recreation Use (SA Article A129).

This measure would prevent use of the Foreman Creek area by visitors while a plan to protect cultural resources is developed. The alternative proposes that the plan be developed within 6 months of license issuance, but the period of closure could be longer. Few locations with similar gently sloped shorelines suitable for boat launching and day use exist on this side of the lake. The primary population affected by closure would be a localized group of

residents, who have few other nearby day use or boat launching facilities; however, the temporary nature of the closure is considered to result in a **less-than-significant** impact**.**

Reconstruction of Boat-in Camps at Bloomer, Goat Ranch, and Craig Saddle.

Reconstruction of these facilities would temporarily preclude use of the facilities while construction was occurring. However, it would be expected that the construction would not occur at all sites simultaneously and that the construction would be scheduled for the low-demand period such as late summer and fall. Recreation visitors would benefit following construction from the improved facilities. Therefore, this measure would have **less-than-significant** impacts on recreation while reconstruction was occurring. Once reconstruction was completed, the improved facilities would have a **beneficial** impact on recreation. No mitigation would be required.

Impact 5.7-b: Conflict with Local, State, or Federal Agency Recreation Management Plans.

There are no measures that have the potential to conflict with local, State, or federal agency recreation management plans.

Impact 5.7-c: Substantial Diminishment of Values for a Stream Segment Eligible for Wild and Scenic River System Inclusion.

There are no measures that have the potential to substantially diminish values for a stream segment eligible for inclusion within the Wild and Scenic River system.

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5.8 CULTURAL RESOURCES

5.8.1 Regulatory Setting

CEQA requires public agencies to consider the effects of proposed projects on both "historical resources" and "unique archaeological resources." Pursuant to Public Resources Code (PRC) Section 21084.1, a "project that may cause a substantial adverse change in the significance of an historical resource is a project that may have a significant effect on the environment." Section 21083.2 of the PRC also requires agencies to determine whether a proposed project would have a significant effect on "unique archaeological resources." Section 15064.5 of the State CEQA Guidelines (California Code of Regulations [CCR] Title 14, Chapter 3) provides additional guidance on how agencies are to determine the significance of impacts on historical and archaeological resources. Pending the future evaluation of cultural resources against the criteria noted below, DWR would manage these resources as though they were eligible.

5.8.1.1 Historical Resources

Section 15064.5 of the State CEQA Guidelines defines a "historical resource" as a resource that meets at least one of the following three criteria:

- A resource listed in or determined to be eligible by the State Historical Resources Commission, for listing in the California Register of Historical Resources (CRHR), as defined in PRC Section 5024.1 and CCR Section 4850 et seq.;

- A resource included in a local register of historical resources, as defined in PRC Section 5020.1(k) or identified as significant in a historical resources survey meeting the requirements of PRC Section 5024.1(g)—unless the preponderance of evidence demonstrates that it is not historically or culturally significant; or

- Any object, building, structure, site, area, place, record, or manuscript which a lead agency determines to be historically significant or significant in the architectural, engineering, scientific, economic, agricultural, educational, social, political, military, or cultural annals of California, provided the lead agency's determination is supported by substantial evidence in light of the whole record.

However, PRC Section 21084.1 and Section 15064.5(a)(4) also acknowledge that even if a resource does not meet the above criteria, this fact shall not preclude a lead agency from determining that the resource may be a historical resource as defined in PRC Sections 5020.1(j) or 5024.1.

The CRHR was created in 1992 and is intended as an authoritative listing of the State's significant historical and archaeological resources (PRC Section 5024.1 and CCR Section 4852). The criteria for listing in the CRHR (codified in PRC Section 5024.1 and clarified in CCR Section 4852) are intended to serve as the definitive criteria for assessing the significance of historical resources for purposes of CEQA.

By definition, the CRHR includes the following resources:

- Listed in the National Register of Historic Places (NRHP);
- Formally determined eligible for listing in the NRHP;
- California Historical Landmarks beginning with #770; and
- California Points of Historical Interest beginning with those designated in January 1998.

The second category of "historical resources" under PRC Section 21084.1 is those "deemed significant pursuant to criteria set forth in subdivision (g) of Section 5024.1." Subdivision (g) of the statute provides that a resource identified as significant in a historical survey may be listed in the CRHR if the survey meets all of the following criteria:

- The survey has been or will be included in the State Historic Resources inventory;
- The survey and the survey documentation were prepared in accordance with procedures and requirements of the State Office of Historic Preservation;
- The resource is evaluated and determined to have a significance rating of Category 1 to 5 on the DPR Historic Resources Inventory Form; and
- If the survey is 5 years or older at the time of its nomination for inclusion in the CRHR, the survey is updated to identify historical resources which have become eligible or ineligible due to changed circumstances, or further documentation is provided on those resources which have been demolished or altered in a manner that substantially diminished the significance of the resource.

A resource is presumed to constitute an "historical resource" if it is included in a "local register of historical resources" meeting the above criteria, unless "the preponderance of evidence demonstrates that it is not historically or culturally significant" (CCR Section 15064.5(a)(2)).

In addition to assessing whether historical resources potentially affected by a proposed project are listed in the CRHR or have been identified in a survey process meeting the requirements of PRC Section 5024.1(g), lead agencies have a responsibility to evaluate resources against the CRHR criteria for eligibility before making a finding as to a proposed project's impacts on historical resources (PRC Section 21084.1; CCR Section 15064.5(a)(3)). A resource shall be considered historically significant if it is significant at the local, state, or national level under one or more of the following criteria:

(1) Is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage;

(2) Is associated with the lives of persons important in our past;

(3) Embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of an important creative individual, or possesses high artistic values; or

(4) Has yielded, or may be likely to yield, information important in prehistory or history.

For a resource to be determined eligible for listing in the CRHR, it must be historically significant and retain enough of its historic character or appearance to be recognizable as a historic resource and to convey the reasons of its significance. "Integrity" is defined as the retention of the resource's physical identity that existed during its period of significance. Integrity is determined by considering the location, design, setting, materials, workmanship, feeling, and association of the resource. Formal evaluations of resources within the Area of Potential Effects established for the Oroville Facilities are currently underway. Pending the results of this evaluation process, DWR would manage resources as though they were eligible for listing in the CRHR.

5.8.1.2 Archaeological Resources

CEQA and the State CEQA Guidelines also require lead agencies to consider whether projects will affect archaeological resources (PRC Section 21083.2 and CCR Section 15064.5(c)). If an archaeological site is a historical resource meeting one of the above criteria, agencies shall follow the provisions of PRC Section 21084.1. However, if an archaeological site does not meet these criteria, but does meet the definition of a "unique archaeological resource" as defined in PRC Section 21083.2(g), the resource must be considered under CEQA in compliance with PRC Section 21080.1. A unique archaeological resource is defined in PRC Section 21083.1(g) as "an archaeological artifact, object, or site about which it can be clearly demonstrated that, without merely adding to the current body of knowledge, there is a high probability that it meets any of the following criteria:

(1) Contains information needed to answer important scientific research questions and that there is a demonstrable public interest in that information;

(2) Has a special and particular quality such as being the oldest of its type or the best available example of its type; or

(3) Is directly associated with a scientifically recognized important prehistoric or historic event or person."

5.8.1.3 Native American Human Remains

Section 15064.5(d) of the State CEQA Guidelines addresses situations when Native American human remains are known or are likely to occur within a project area. The guidelines require the lead agency to work with appropriate Native Americans as identified by the Native American Heritage Commission (NAHC) as provided in PRC

Section 5097.98. An agreement between the lead agency and the appropriate Native American representatives is encouraged to allow for the appropriate treatment and disposition of human remains and items associated with Native American burials.

CCR Section 15064.5(e) and Section 7050.5(b) of the California Health and Safety Code require that if human remains are accidentally discovered or recognized in a location other than a dedicated cemetery, there shall be no further excavation or disturbance of the site or any nearby area reasonably suspected to overlie adjacent remains until the coroner of the county in which the remains are discovered has determined if an investigation into the cause of death is required. If the county coroner determines that no investigation is required and the remains are those of a Native American, the procedures outlined in Section 5097.98 of the PRC, as amended, must be followed. These procedures require that once the NAHC has been notified pursuant to Section 7050.5(c), of the California Health and Safety Code, the NAHC must identify the person or persons it believes to be the most likely descendant (MLD) of the deceased person. The MLD may inspect the site (with landowner permission) and may make recommendations for treating or disposing of, with appropriate dignity, the human remains and associated grave goods. The MLD shall make recommendations on appropriate treatment within 48 hours of being granted access to the site, and may mutually agree with the landowner to extend the period for discussion about appropriate treatment.

If the NAHC is unable to identify an MLD, if the identified MLD does not make a recommendation, or if the landowner rejects the recommendations of the MLD and mediation described in Section 5097.94(k) of the PRC fails to provide measures acceptable to the landowner, the landowner “shall reinter the human remains and items associated with Native American human remains with appropriate dignity on the property in a location not subject to further and future subsurface disturbance” and shall implement protective measures as described in Section 5097.98(e).

5.8.2 Impact Thresholds

The following thresholds are used to determine whether the alternatives would have a significant effect on cultural resources. There would be a significant impact if the alternatives would:

- 5.8-a: Cause a substantial adverse change in the significance of a historical resource as defined in State CEQA Guidelines Section 15064.5;
- 5.8-b: Cause a substantial adverse change in the significance of an archaeological resource pursuant to State CEQA Guidelines Section 15064.5; or
- 5.8-c: Disturb any human remains, including those interred outside of formal cemeteries.

5.8.3 Method of Analysis

The analysis of potential project-related impacts on cultural resources was based on the results of studies conducted between 2002 and 2005. These studies, conducted under Cultural Resources Study Plan C-1 (inventory), which was developed collaboratively during the ALP, provide information on historical resources and archaeological sites, as well as data on locations of ethnographic and ethnohistoric concern. A summary of this information is provided in Section 4.8 of this document.

The Proposed Project described in Chapter 3 includes specific actions (e.g., addition of picnic tables at an existing recreation site) as well as programs with defined objectives but limited detail on the precise nature and location of future activities that could affect cultural resources. Therefore, a two-tiered approach to the impact assessment was conducted to determine whether the Proposed Project or FERC Staff Alternative would result in a significant impact relative to the impact thresholds presented in Section 5.8.2.

First, the programs were reviewed to see whether they were likely to include ground-disturbing activities that could affect prehistoric or historic-era archaeological sites, interfere with access to areas of traditional ethnographic concern, or lead to increased public access that might lead indirectly to adverse effects on these resources. For example, programs such as the Fish Weir Program detailed in Section 5.8.4 were considered to have the potential to significantly impact cultural resources. Mitigation measures provided in Section 5.8.4 indicate that DWR would conduct an assessment of these actions to determine whether these potential impacts would, in fact, occur, once the specific actions of this program are defined.

Programs such as water quality monitoring do not involve ground disturbance or other activities that could lead to a substantial adverse change in historical or archaeological resources, as defined in Section 15064.5(b) of the CCR. As such, this program and similar programs are considered to have no potential to significantly impact cultural resources, and no further evaluation of potential impacts on cultural resources is required.

The second level of impact analysis was conducted for elements of the alternatives that are more clearly defined in terms of location and the nature of the activity. Each of these actions was then considered relative to the above criteria (e.g., involving potential ground disturbance, restricting access to areas of traditional concern, increasing public access to sensitive resources). Project elements that did not include these types of activities (e.g., modifying operations relative to minimum flow conditions) were considered to have no potential to significantly affect cultural resources, and no further analysis was conducted.

For actions with the potential to adversely affect cultural resources through ground disturbance, each action was reviewed through a Geographic Information System (GIS)–based analysis by comparing the locations of known cultural resources (archaeological sites, ethnographic resources, and historic structures) to those of the Proposed Project and FERC Staff Alternative activities. If the location had been

previously surveyed for cultural resources and no CRHR-eligible resources had been found, the action was considered to have no potential to significantly impact cultural resources. If a known cultural resource is present at, or in close proximity to, the location of the proposed activity, a conservative estimate that the action could result in significant impacts was made, and mitigation measures to avoid or reduce those impacts are proposed.

Proposed Project and FERC Staff Alternative activities that would involve increased access (e.g., a new recreation trail) have the potential for both direct impacts (e.g., construction of a trail through an archaeological site) and indirect impacts (e.g., providing increased public access to an area containing sensitive cultural resources). These actions are therefore considered to have a potentially significant impact due to both direct impacts and increased access. Mitigation measures to reduce these potential impacts to a less-than-significant level are proposed.

5.8.4 Impacts and Mitigation Measures

The following section describes the beneficial effects and potentially adverse impacts of the Proposed Project, including both programmatic and project-level analyses. Table 5.8-1 indicates the SA articles that could have an effect on cultural resources, and whether these effects are expected to be beneficial, less than significant, or would be less than significant following implementation of recommended mitigation measures.

The Proposed Project would provide several beneficial impacts on cultural resources as described at the beginning of the following discussions of both program-level and project-level impacts.

In addition to the Proposed Project, this DEIR analyzes the No-Project Alternative and the FERC Staff Alternative. Impacts on cultural resources from implementing the FERC Staff Alternative are similar to those anticipated from implementation of the Proposed Project unless otherwise noted. Potential impacts are identified as follows: NO (No Project), PRO (Proposed Project), and FERC (FERC Staff Alternative). All alternatives analyzed would result in **less-than-significant** impacts on cultural resources with the implementation of measures incorporated in the draft Historic Properties Management Plan (HPMP) noted below, and no further mitigation would be required.

The Proposed Project also includes future studies that would evaluate different ways to address temperature habitat needs for anadromous fish in the Low Flow Channel and the High Flow Channel of the Feather River. Potential future facility modifications and resultant operational changes resulting from this study would be subject to additional CEQA review and analysis.

Table 5.8-1. Environmental effects on cultural resources.

Alternative(s)	Article # and Title	Level of CEQA Analysis	Nature of Potential Impact(s)	Effects
PRO, FERC	A128—Historic Properties Management Plan	Programmatic	Aid in protection and management of archaeological sites, historical resources, and ethnographic resources	B
PRO	A129—Improve and Redirect Recreation Usage to Specific Areas at Foreman Creek (Plan development)	Project	Aid in protection of archaeological sites and ethnographic resources at Foreman Creek	B
FERC	A129 (revised by FERC staff to include temporary closure)—Improve and Redirect Recreation Usage to Specific Areas at Foreman Creek (Plan development)	Project	Aid in protection of archaeological sites and ethnographic resources at Foreman Creek	B
PRO, FERC	A102—Gravel Supplementation and Improvement Program (Also see B105)	Programmatic	Implementation could result in construction-related impacts on cultural resources	LTS
PRO, FERC	A103—Channel Improvement Program (This action is programmatic; however, Moe's and Hatchery Ditch activities are project-level)	Programmatic with some Project elements	Implementation could result in construction-related impacts on cultural resources	LTS
PRO, FERC	A104—Structural Habitat Supplementation and Improvement Program (SHSI)	Programmatic	Implementation could result in construction-related impacts on cultural resources	LTS
PRO, FERC	A105—Fish Weir Program	Programmatic	Implementation could result in construction-related impacts on cultural resources	LTS
PRO, FERC	A106—Riparian and Floodplain Improvement Program	Programmatic	Implementation could result in construction-related impacts on cultural resources	LTS
PRO, FERC	A110—Lake Oroville Warm Water Fishery Habitat Improvement Program	Programmatic	Implementation could result in construction-related impacts on cultural resources	LTS
PRO, FERC	A118—Minimization of Disturbances to	Project	Implementation could result in	LTS

Table 5.8-1. Environmental effects on cultural resources.

Alternative(s)	Article # and Title	Level of CEQA Analysis	Nature of Potential Impact(s)	Effects
	Nesting Bald Eagles		reduced access to areas of traditional concern to local Native Americans	
PRO, FERC	A120—Protection of Valley Elderberry Longhorn Beetle	Project	Implementation could result in reduced access to areas of traditional concern to local Native Americans	LTS
PRO, FERC	A122—Construction and Recharge of Brood Ponds	Project	Implementation could result in construction-related impacts on cultural resources	LTS
PRO	A127—Recreation Management Plan Trails Equestrian facilities Day Use Area (DUA) improvements Docks, boat ramps Campgrounds	Programmatic with some Project elements	Implementation of specific actions could result in construction-related impacts on cultural resources, or could provide increased public access to areas that could result in indirect adverse impacts	LTS
FERC	A127 SA Recreation Management Plan (Revised by FERC Staff to include modifications to trails development/implementation; reconstruction of boat-in campsites; delay of DUA at Foreman Creek)	Programmatic with some Project elements	Implementation of specific actions could result in construction-related impacts on cultural resources, or could provide increased public access to areas that could result in indirect adverse impacts	LTS
PRO	Appendix F—Habitat Expansion Agreement	Programmatic	Implementation could result in construction-related impacts on cultural resources, or could affect access to areas of traditional concern to local Native Americans	LTS

Coding:

B = Action with potential to result in a beneficial effect; could involve short-term, less-than-significant, construction-related impacts that would be avoided or reduced through the use of Best Management Practices (BMPs). See Appendix D.

LTS = Project that would result in less-than-significant impact on resource.

5.8.4.1 Program-Level Impacts and Mitigation Measures

Effects that would occur under each alternative are identified and summarized below as follows: NO (No Project), PRO (Proposed Project), and FERC (FERC Staff Alternative). Implementation of the HPMP (Article A128) under the Proposed Project would have a beneficial impact on cultural resources through enhanced protection of significant cultural resources and measures such as expansion of the Site Stewardship Program, setting aside areas for planting and harvesting of traditionally used plants, establishing a curation facility for housing collections associated with the Oroville Facilities, and providing information for the Interpretive and Educational Program.

The Proposed Project also includes programs that have the potential to adversely affect cultural resources, as noted in Table 5.8-1 and described below.

Impact 5.8-a: Cause a substantial adverse change in the significance of a historical resource as defined in State CEQA Guidelines Section 15064.5.

Impact 5.8-b: Cause a substantial adverse change in the significance of an archaeological resource pursuant to State CEQA Guidelines Section 15064.5.

The continuation of certain operations and maintenance activities, construction of new or improved facilities, implementation of new programs involving ground disturbance, and actions that would increase public access to sensitive locations could result in the loss of or damage to significant archaeological sites, ethnographic resources, and historic structures. These programs are listed in Table 5.8-1.

NO

Under the No-Project Alternative, routine operations and maintenance activities (e.g., water quality monitoring, fish hatchery operations, replacement of picnic tables) that have no potential to affect significant cultural resources would continue. These activities are addressed as “exempt actions” in Appendix A of the draft HPMP. There would be **no impact** from these activities.

However, impacts on archaeological sites, ethnographic resources, and historic structures from reservoir level fluctuations, public use, and operations and maintenance activities would continue to occur under the No-Project Alternative. In addition, elements of the draft Biological Assessment and other mandatory actions (e.g., regulatory permit requirements) could result in construction activities or other programs that would adversely affect significant cultural resources through physical disturbance, increasing the potential for vandalism, or otherwise adversely affecting important resource values. This impact is considered **significant.**

PRO

The Proposed Project includes development and implementation of an HPMP in compliance with Section 106 of the National

Historic Preservation Act and FERC Guidelines. A draft HPMP was prepared and submitted to FERC in April 2006. The draft HPMP includes measures to address ongoing effects (resource monitoring, impact avoidance, site protection, and data recovery), protocols for proposed future actions, programs for future archaeological inventory and evaluation, and procedures for inadvertent discoveries and emergency situations.

Revisions to the draft HPMP to address comments from FERC, Native American tribes, BLM, USFS, and State Historic Preservation Officer are anticipated prior to FERC adoption of a final HPMP. These revisions would include additional management information in appendices to the HPMP, and development of more specific management recommendations for high-priority areas noted in the draft HPMP. However, the basic provisions for the protection of significant cultural resources contained in the draft HPMP referred to in this DEIR are expected to remain unchanged. Implementation of the HPMP is considered a **beneficial** effect.

Programs that would not involve ground disturbance (e.g., the monitoring of bacteria levels) and would not indirectly affect significant cultural resources (e.g., interfering with the use of traditional cultural properties) would have **no impact** on significant cultural resources.

Significant archaeological sites, ethnographic resources, and historic structures could be lost or substantially damaged through the construction of new facilities, modifications to the licensed power facilities (e.g., diversion canal around Thermalito Afterbay and Alternate Afterbay Channel and Outlet), and habitat improvement programs and plans (e.g., SA Article A102 Gravel Supplementation and Improvement Program and SA Article A106 Riparian and Floodplain Improvement Program). These programs could involve ground disturbance that would substantially alter resources or could result in indirect impacts such as limiting access to traditionally used plants. However, the protective measures from the draft HPMP described above would be implemented. These measures emphasize planning of new and modified facilities/programs to avoid significant cultural resources where feasible, and provide measures such as data recovery and/or public interpretation to reduce impacts if a significant cultural resource cannot be avoided. With implementation of the measures described in the draft HPMP, this impact would be **less-than-significant** and no mitigation would be required.

FERC

Impacts on significant archaeological sites, ethnographic

resources, and historic structures under the FERC Staff Alternative would be similar to those under the Proposed Project. The FERC Staff Alternative includes more robust monitoring of some activities (e.g., the Gravel Supplementation and Improvement Program (SA Article A102)) and earlier implementation of some elements of the Proposed Project (e.g., the Riparian and Floodplain Improvement Program (SA Article A106)). The FERC Staff Alternative also includes temporary closure of the boat launch at Foreman Creek pending development of a plan for protecting cultural resources at this location. Some programs included in the Proposed Project, such as the Flow/Temperature to Support Anadromous Fish program described in Section B108, would not be implemented under this alternative. The FERC Staff Alternative incorporates the HPMP considered under the Proposed Project. As such, this impact would be **less-than-significant** and no mitigation would be required**.**

Impact 5.8-c: Disturb any human remains, including those interred outside of formal cemeteries.

The continuation of certain operations and maintenance activities, construction of new or improved facilities, implementation of new programs involving ground disturbance (see Table 5.8-1), and actions that would increase public access to sensitive locations could result in the disturbance of Native American human remains, including those interred in archaeological deposits outside of formal cemeteries. Ongoing erosion, particularly in the fluctuation zone, also has the potential to disturb and expose human remains located within the project area.

NO, PRO, FERC As noted in the draft HPMP, procedures for the treatment and appropriate disposition of Native American human remains encountered during archaeological inventory and excavation efforts would be described in related work plans and implemented accordingly. The plans and procedures would be developed in consultation with the appropriate local Maidu tribes and the MLDs from these tribes.

As described in the draft HPMP, if human remains are discovered in non-archaeological contexts on State or private lands, Sections 7050.2 and 7052 of the California Health and Safety Code and PRC Section 5097 would be followed. If human remains or objects of cultural patrimony are discovered on federal lands, the requirements of the Native American Graves Protection and Repatriation Act would also be followed.

Measures identified in the draft HPMP that address ongoing

effects (e.g., resource monitoring and protection/stabilization), as well as protocols for proposed future actions (e.g., site avoidance, data recovery, public interpretation) would be implemented to avoid or reduce potentially significant impacts on cultural resources eligible for inclusion in the CRHR. In addition, the procedures for inadvertent discoveries provided in the draft HPMP related to human remains would be followed. As such, this impact would be **less-than-significant** and no mitigation would be required.

5.8.4.2 Project-Level Impacts and Mitigation Measures

The Proposed Project includes a measure to improve and redirect recreational usage to specific areas at Foreman Creek (Article A129). By providing enhanced protection of significant cultural resource values at this location, this action would result in a beneficial impact on cultural resources.

The Proposed Project also includes project-level impacts that could result in adverse impacts on cultural resources, as noted in Table 5.8-1 and described below.

Impact 5.8-a: Cause a substantial adverse change in the significance of a historical resource as defined in State CEQA Guidelines Section 15064.5.

Impact 5.8-b: Cause a substantial adverse change in the significance of an archaeological resource pursuant to State CEQA Guidelines Section 15064.5.

Construction of new or improved facilities in locations containing significant cultural resources and actions that would increase public access to sensitive locations could result in the loss of or damage to significant archaeological sites, ethnographic resources, and historic structures. Projects with the potential to result in the loss of or damage to significant cultural resources are listed in Table 5.8-1. Projects not listed in Table 5.8-1 are located in areas where significant cultural resources do not occur, or would not result in ground disturbance or increased public access (e.g., operational measures related to minimum flows (SA Article A108.1)); therefore, these proposed activities would have no impact on cultural resources eligible for inclusion in the CRHR.

NO — No activities of a project-specific nature (i.e., precise action in a specific location) are proposed under the No-Project Alternative. Therefore, there would be **no impact** on significant cultural resources from specific projects under this alternative (see Impact 5.8-a for a discussion of program-level impacts).

PRO — Projects located in areas that do not contain significant cultural resources and those that would not involve ground disturbance (e.g., new trash receptacles) would have **no impact** on significant cultural resources.

Significant archaeological sites, ethnographic resources, and

historic structures could be lost or substantially damaged through the construction of certain new recreation facilities (e.g., improvements at Bidwell Canyon, new trails), modifications to the licensed power facilities (e.g., alterations to the Moe's and Hatchery ditches), and ground-disturbing actions undertaken to improve wildlife and plant habitat (e.g., construction of brood ponds in the Oroville Wildlife Area). However, the protective measures from the draft HPMP described above would be implemented. These measures emphasize planning of new and modified facilities/programs to avoid significant cultural resources where feasible, and provide measures such as data recovery and/or public interpretation to reduce impacts if a significant cultural resource cannot be avoided. With implementation of the measures described in the draft HPMP, this impact would be **less-than-significant** and no mitigation would be required.

FERC — Impacts on significant archaeological sites, ethnographic resources, and historic structures under the FERC Staff Alternative would be similar to impacts under the Proposed Project. Under the FERC Staff Alternative, the Foreman Creek boat launch would be closed to recreational use while DWR develops a plan to protect significant cultural resource values. The FERC Staff Alternative specifies that this plan be developed within 6 months of license issuance, and that it be prepared in coordination with local Native American tribes. While temporary closure of the Foreman Creek area would minimize potential impacts on cultural resources for a period of time, there would be no substantive, long-term difference in the nature and magnitude of impacts from recreation use at Foreman Creek as compared to the Proposed Project. The FERC Staff Alternative incorporates the HPMP considered under the Proposed Project. As such, this impact would be **less-than-significant** and no mitigation would be required**.**

Impact 5.8-c: Disturb any human remains, including those interred outside of formal cemeteries.

The construction of new or improved facilities involving ground disturbance (see Table 5.8-1), and actions that would increase public access to sensitive locations could result in the disturbance of Native American human remains, including those interred in archaeological deposits outside of formal cemeteries. Ongoing erosion, particularly in the fluctuation zone, also has the potential to disturb and expose human remains located within the project area.

NO, PRO, FERC — As noted in the draft HPMP, procedures for the treatment and appropriate disposition of Native American human remains

encountered during archaeological inventory and excavation efforts would be described in related work plans and implemented accordingly. The plans and procedures would be developed in consultation with the appropriate local Maidu tribes and the MLDs from these tribes.

As described in the draft HPMP, if human remains are discovered in non-archaeological contexts on State or private lands, Sections 7050.2 and 7052 of the California Health and Safety Code and PRC Section 5097 would be followed. If human remains or objects of cultural patrimony are discovered on federal lands, the requirements of the Native American Graves Protection and Repatriation Act would also be followed.

Measures identified in the draft HPMP that address ongoing effects (e.g., resource monitoring and protection/stabilization), as well as protocols for proposed future actions (e.g., site avoidance, data recovery, public interpretation) would be implemented to avoid or reduce potentially significant impacts on cultural resources eligible for inclusion in the CRHR. In addition, the procedures for inadvertent discoveries provided in the draft HPMP related to human remains would be followed. As such, this impact would be **less-than-significant** and no mitigation would be required.

5.9 POPULATION, HOUSING, AND PUBLIC SERVICES

5.9.1 Population and Housing

5.9.1.1 Regulatory Setting

Although no federal or State plans, policies, or regulations apply to the potential population and housing issues related to implementing the project alternatives, local plans and policies, such as the *Butte County General Plan*, the *City of Oroville General Plan*, and housing plans of both jurisdictions, could indirectly guide growth and housing patterns associated with potential project-related growth.

The Butte County Association of Governments (BCAG) is an association of all the local governments within Butte County. Its members include the cities of Biggs, Chico, Gridley, Oroville, the Town of Paradise, and the County of Butte. BCAG works in cooperation with local government, State and federal agencies, and the public to improve transportation in Butte County, as well as to provide a forum for studying and resolving other regional issues. As such, part of BCAG's function is to develop population and housing projections for its jurisdictional area.

The latest BCAG population projections estimate growth in the Butte County area for the years between 2006 and 2030. BCAG staff collaborated through meetings of the City/Town/County Planning Directors Group and reached consensus with city, town, and county planning staff on the development of the projections. Each jurisdiction integrates the growth projections into its general plan updating efforts, which guide future development rates in those jurisdictions. Proposed development projects are evaluated against whether they would result in a population and housing increase that would exceed projected rates, as identified by BCAG projections.

5.9.1.2 Impact Thresholds

The following thresholds are used to determine whether the alternatives would have a significant effect related to population and housing conditions. There would be a significant impact if the alternatives would:

- 5.9.1-a: Induce substantial population growth, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure);

- 5.9.1-b: Cause substantial adverse physical impacts associated with the need for constructing housing;

- 5.9.1-c: Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere; or

- 5.9.1-d: Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere.

5.9.1.3 Method of Analysis

The analysis of population and housing effects focuses on population growth potentially supported by the need for workers and population to implement the Proposed Project. (Population-related effects also are discussed in Section 6.1, Growth Inducement.)

The analysis of population and housing effects of the project alternatives was conducted using estimates of population directly and indirectly generated by Oroville Facilities–related visitor and operations and maintenance (O&M) spending. Population estimates for 2002 are included as an existing conditions baseline, and projections are provided for the year 2020 for the No-Project and Proposed Project Alternatives. Although population projections beyond 2020 are not presented, population growth attributable to recreation use and associated visitor spending related to the Oroville Facilities is presumed to increase at similar rates throughout the 50-year term of the anticipated new license.

Project-related population estimates for 2002, which are based on estimates of spending by out-of-county visitors and for O&M that were developed for the PDEA, were generated by internal calculations of the economic-fiscal model developed for Study Plan R-19 (SP-R19), Fiscal Impacts (DWR 2004), one of the studies conducted for the project's relicensing process. Based on the 2002 ratio of population to jobs in Butte County and the number of jobs estimated to be generated by Oroville Facilities–related visitor and O&M spending, the model generated estimates of the population that would be supported by this spending.

The project-related population estimates for 2002 of 2,360 persons were then used as a baseline to characterize the relative magnitude of projected changes in population under the project alternatives, which also were calculated using the economic-fiscal model, and to assess the associated effects on local housing conditions, including the significance of these effects. In addition to population effects from visitor and O&M spending, project-related construction activities could affect the countywide population; these effects also are discussed.

5.9.1.4 Impacts and Mitigation Measures

In addition to the Proposed Project, this DEIR analyzes the No-Project Alternative and the FERC Staff Alternative. Impacts on population and housing from implementing the FERC Staff Alternative are similar to those anticipated from implementing the Proposed Project unless noted. Potential impacts are identified as follows: NO (No-Project), PRO (Proposed Project), and FERC (FERC Staff Alternative). All alternatives analyzed result in **less-than-significant** population and housing effects and no further mitigation would be required.

Program-Level Impacts and Mitigation Measures

Impact 5.9.1-a: Induce Substantial Population Growth, Either Directly (for Example, by Proposing New Homes and Businesses) or Indirectly (for Example, through Extension of Roads or Other Infrastructure).

Impact 5.9.1-b: Cause Substantial Adverse Physical Impacts Associated with the Need for Constructing Housing.

Impact 5.9.1-c: Displace Substantial Numbers of Existing Housing, Necessitating the Construction of Replacement Housing Elsewhere.

Impact 5.9.1-d: Displace Substantial Numbers of People, Necessitating the Construction of Replacement Housing Elsewhere.

The program-level actions contained within all alternatives analyzed against the thresholds of significance result in **less-than-significant** impacts on population and housing.

Project-Level Impacts and Mitigation Measures

Impact 5.9.1-a: Induce Substantial Population Growth, Either Directly (for Example, by Proposing New Homes and Businesses) or Indirectly (for Example, through Extension of Roads or Other Infrastructure).

Impact 5.9.1-b: Cause Substantial Adverse Physical Impacts Associated with the Need for Constructing Housing.

Impact 5.9.1-c: Displace Substantial Numbers of Existing Housing, Necessitating the Construction of Replacement Housing Elsewhere.

Impact 5.9.1-d: Displace Substantial Numbers of People, Necessitating the Construction of Replacement Housing Elsewhere.

The project-level actions contained within all alternatives analyzed against the thresholds of significance would result in **no impacts** on population and housing.

No-Project Alternative

Under the No-Project Alternative, the Oroville Facilities would continue to be operated as it is now under the terms and conditions in the existing FERC license, and no new protection, mitigation, and enhancement (PM&E) measures would be implemented, other than those arising from existing legal obligations and agreements. In addition, DWR would continue existing maintenance practices needed to maintain the Oroville Facilities. Local population is expected to increase in the future with or without implementation of the Proposed Project in response to regional and statewide population growth trends.

Although no changes in recreation facilities provided by the Oroville Facilities would occur under the No-Project Alternative, regional and statewide growth would result in an increased demand for recreation, generating increased use of the Oroville Facilities and increased visitor and O&M spending in Butte County. This increased spending would directly and indirectly generate new employment opportunities in Butte County, resulting in population growth in the county. Based on population projections developed for the

No-Project Alternative, the population in Butte County supported by the jobs directly and indirectly generated by visitor and O&M spending is estimated to increase from 2,360 in 2002 to 2,770 in 2020 under the No-Project Alternative, representing an increase of 410 persons, or an average annual increase of about 23 persons when spread over the 18-year period. (Growth in recreation use, and resulting growth in visitor-supported population, is presumed to increase at a similar rate throughout the license term.) The 2,770 persons supported by visitor and O&M spending in 2020 would represent 1.0 percent of Butte County's 2020 population (276,300 persons), as projected by BCAG (BCAG 2006) (see Table 4.9-2 in Section 4.9.1, Population and Housing, for population projections).

Because changes in projected populations are expected to be small (23 persons annually) and gradual over the license period under the No-Project Alternative, population effects would not be substantial, and effects on local housing conditions would be minor. There would be **no significant impact** on population and housing from implementing the No-Project Alternative.

Proposed Project

Implementation of the Proposed Project could generate population growth in Butte County by attracting additional workers and their families to the county to fill temporary jobs required to construct new and improved project facilities; by attracting workers to fill new permanent jobs required to operate new and improved project facilities; and from increased demand for workers who would be supported by increases in spending by recreational visitors to the Oroville Facilities.

Construction activities under the Proposed Project are expected to support, on average, an estimated 180 construction-related jobs annually over a 10-year period as individual actions to improve and develop recreational and operational facilities are implemented. For several reasons, these construction jobs are unlikely to draw many new permanent residents to Butte County. The construction jobs would be mostly temporary, lasting only as long as needed to construct individual actions, thereby discouraging workers currently residing outside of Butte County from permanently relocating to Oroville or elsewhere in Butte County. Additionally, the size and diversity of the region's construction sector suggests that most construction activities could be undertaken by construction firms already located within Butte County or in nearby counties, such as Yuba, Placer, and Sacramento. These considerations suggest that most construction workers would commute to job sites from locations in Butte County or from nearby counties, substantially limiting the number of workers who would temporarily or permanently relocate to Butte County to fill construction jobs.

Operations of new and improved recreation facilities developed as part of the Proposed Project's SA RMP would likely support some permanent new jobs and also attract additional visitors to project facilities, thereby indirectly generating temporary and permanent jobs in local business that provide goods and services to visitors. To the extent that the new employment opportunities attract workers and their families to Butte

County, the population of the local area could increase, resulting in an increased demand for public services and housing.

Based on population estimates developed for the Proposed Project, the population supported by jobs generated by visitor and O&M spending under the Proposed Project could increase from 2,360 in 2002 to 3,160 in 2020, with about half of this project-generated growth expected to occur as a result of regional and statewide population growth unrelated to the Proposed Project. (Refer to effects under the No-Project Alternative.) (Although population estimates are not available for the Proposed Project beyond 2020, expected increases in recreation use and resulting growth in visitor-supported population are presumed to increase at a similar rate throughout the remainder of the 50-year term of the anticipated new license.) Using 2002 population as a point of reference, the 800-person increase between 2002 and 2020 would represent average annual growth of 44 persons when spread over the 18-year period. Using the No-Project condition as a point of reference, the 390-person increase would represent an average annual contribution to growth of about 22 persons when spread over the 18-year period. In 2020, the 3,160 persons supported by the project would represent 1.1 percent of Butte County's total population (276,300 persons), as projected by BCAG. (See Table 4.9-2 in Section 4.9.1, Population and Housing, for population projections.) The effects of this population growth, including the resulting need for housing construction, are considered minor for the following reasons:

- The population growth would be gradual and spread over a number of years, limiting the population increase that would be generated by changes in visitor and O&M spending in any given year. This minor, gradual growth would therefore result in minor, gradual increases in the local demand for housing, substantially limiting impacts on the local housing market and the need for constructing new housing.

- Many of the new jobs supported by visitor and O&M spending could be filled by unemployed or underemployed persons who already reside within Butte County. This is especially true for visitor-serving jobs, many of which would be in the retail and services sectors. Therefore, not every new job directly or indirectly generated by the Proposed Project would create an increase in population and a resulting increase in the demand for local housing.

- Population growth that would be generated by the Proposed Project would be spread across a number of jurisdictions, including the City of Oroville and locations within unincorporated Butte County, and potentially including other nearby communities both within and outside of Butte County, indicating that any increase in the demand for local housing would also be spread across several jurisdictions. This would lessen the impact on the housing market in any one jurisdiction.

- Housing vacancy rates in Butte County indicate that adequate housing would be available to meet the anticipated small increase in population caused by any project-related employment. As described in Section 4.9.1, Population and

Housing, vacancy rates in much of Butte County were relatively high in 2004, with a 9.9-percent vacancy rate in Oroville and an 8.7-percent vacancy rate in unincorporated Butte County. These vacancy rates suggest that little, if any, new housing would be required to be constructed to accommodate the demand for housing generated by new workers attracted to the county by project-related employment opportunities.

Because the increase in employment and resulting population growth in Butte County under the Proposed Project is expected to be minor and gradual (i.e., estimated to be fewer than 44 new persons per year), many new jobs could be filled by persons already residing in Butte County, project-related population growth could be spread across a number of jurisdictions, and adequate housing appears to be available to meet an increased demand for housing, it is unlikely that the Proposed Project would result in substantial population effects, either directly or indirectly, including effects on the local housing market. Therefore, the population and housing impacts of the Proposed Project would be **less-than-significant** when compared to Existing Conditions and the No-Project Alternative and no mitigation would be required.

The Proposed Project contains no actions that would displace people or residences. Therefore, there would be no need to construct any replacement housing.

FERC Staff Alternative

The population and housing effects of the FERC Staff Alternative would be similar to those of the Proposed Project because the alternative proposes only minor changes to the actions comprising the Proposed Project's SA RMP, indicating that changes in visitation levels and resulting population levels would be similar. Additionally, project construction activities and O&M activities under the FERC Staff Alternative would be similar to those under the Proposed Project, indicating that related population and housing effects would be similar. Therefore, the population and housing impacts of the FERC Staff Alternative would be **less-than-significant** and no mitigation would be required.

The FERC Staff Alternative contains no actions that would displace people or residences. Therefore, there would be no need to construct any replacement housing.

5.9.2 Public Services

5.9.2.1 Regulatory Setting

Federal Plans, Policies, Regulations, and Laws

No federal plans, policies, regulations, or laws specifically apply to the potential public services issues related to implementation of the alternatives. As described in Section 4.9.2, USFS is responsible for managing 1,620 acres, or 4.0 percent, of the Oroville Facilities Project area. USFS's Plumas National Forest manages parcels of land in the eastern portion of the project area. The National Forest has no formalized law enforcement patrols in the project area, but does respond to calls for mutual support. Additionally, USFS has an agreement with DPR (dating back to 1978) that permits DPR, to the extent permissible, to enforce applicable laws and regulations on National Forest lands within the project boundary.

BLM is responsible for managing 4,620 acres, or 11.2 percent, of the project area. BLM collaborates with State agencies (DPR, DWR) and allows them to patrol BLM-managed lands within the project area.

State Plans, Policies, Regulations, and Laws

No State plans, policies, regulations, or laws specifically apply to the potential public services issues related to implementation of the project alternatives. As described in Section 4.9.2, several State agencies, including DPR and the California Department of Forestry and Fire Protection (CDF), provide law enforcement, fire protection, and emergency medical services to the project area and to other areas near the Oroville Facilities. As a major fire protection service provider in the region, CDF has prepared a Fire Management Plan (2002) for the Butte Unit, which includes information on level of service. CDF bases its level of service on initial attack success rates for lands of a similar type. Generally, the goal of CDF is to attain approximately 95–98 percent success rates across planning belts (i.e., grass, brush, interior-timber, woodland, and agricultural or urban).

Local Plans, Policies, Regulations, and Laws

Local agencies, including the City of Oroville and Butte County, also provide public services (and utilities) in the project area. Adopted desired service ratios (i.e., staffing levels relative to population levels) employed by local agencies, particularly for the provision of law enforcement, fire protection, and emergency medical services are described, where relevant, in Section 4.9.2.

5.9.2.2 Impact Thresholds

CEQA does not treat social and economic effects of projects as significant effects on the environment if they do not create, or are not caused by, physical effects. The demand for public services, and a local government's ability to pay for them, is not itself

a physical effect on the environment, but instead is a socioeconomic issue that could potentially lead to physical effects. For example, the need to build or change existing facilities to accommodate the demand for public services could result in physical effects on the environment. Appendix G of the State CEQA Guidelines therefore focuses on the public services topic with respect to whether an increased demand for public services could lead to a substantial adverse physical impact.

Thus, the following threshold, based on the guidance provided by State CEQA Guidelines Appendix G, is used to determine whether the alternatives would have a significant effect related to public services. There would be a significant impact if an alternative would:

- 5.9.2-a: Result in substantial, adverse physical impacts associated with the provision of new or physically altered governmental facilities needed to maintain acceptable service ratios, response times, or other performance objectives for any public service, including law enforcement, fire protection, schools, parks, emergency medical services, and other public facilities.

5.9.2.3 Method of Analysis

The analysis of effects on public services focuses on changes in the demand coming from outside of Butte County and from cities within the county on services provided to visitors to the Oroville Facilities, which are located in unincorporated Butte County. (Residents of unincorporated areas of Butte County who recreate at the Oroville Facilities are presumed to not affect the overall demand for public services because they would use public services in the county regardless of whether they recreate at the Oroville Facilities or, alternatively, engage in some other activity in the county.) In addition, the effects of construction and O&M workers who commute to the project area from out-of-county locations and could affect the demand for public services are considered. Finally, the analysis also considers the public services effects of the population in Butte County supported by jobs directly and indirectly generated by visitor and O&M spending under the alternatives. (Traffic and road maintenance impacts are specifically discussed in Section 5.14.4.)

The effects of the Proposed Project and FERC Staff Alternative on recreation conditions and use are characterized in Section 5.7, Recreational Resources. Specific programs and actions that can be expected to affect recreation resources and use are described in Table 5.7-1. The potential effect of these programs and actions on expected recreation use provides the basis for assessing potential recreation-related impacts on service providers and the need for new or modified public service facilities under each alternative.

The analysis of recreation visitor effects on the demand for public services was conducted using estimates and projections of recreation-related visitation to the Oroville Facilities developed for the recreation resources assessment conducted for the PDEA (DWR 2005). As part of the PDEA assessment, visitation estimates were developed for existing (2002) conditions, and projections were developed for 2020 for the No-Action

and Proposed Action Alternatives. Visitation numbers in the PDEA reflect estimates developed for SP-R9, Existing Recreation Use (DWR 2004a), and projections for SP-R12, Projected Recreation Use (DWR 2004b), 2 of the 19 recreation-related studies conducted for the Oroville Facilities License Application. The visitation estimates for 2002 were based on recreation use data collected for SP-R9, and the projections for 2020 are based on growth trends and analysis of demand factors described in SP-R12.

Although visitation projections beyond 2020 are not available for this analysis, growth in recreation use is presumed to increase at rates similar to the rate between 2002 and 2020 throughout the 50-year term of the anticipated license. Visitor projections to 2050 were developed as part of early relicensing studies (SP-R12, Projected Recreation Use); however, these projections were made for no-project conditions only (as action alternatives were not developed at that time). Thus, these data were not intended for alternatives impact analysis purposes, such as the assessment of public services effects in this DEIR.

The analysis of effects from commuting O&M workers on the demand for public services was similarly based on estimates and projections of O&M employment conducted for the PDEA. The number of O&M jobs that would be filled by workers commuting from outside of Butte County was estimated based on the commuting patterns of Oroville Facilities–related State employees in 2002-03, which indicated that 4.8 percent of the employees commuted to their jobs from locations outside of Butte County. The analysis of effects from commuting construction workers on public services was based on estimates of the number of construction worker jobs that would be generated by capital spending for non-program-related PM&E measures under the Proposed Project, which were estimated at $134.4 million over the FERC license period. Using this cost estimate, construction employment was estimated through internal calculations using the economic-fiscal model developed for SP-R19, Fiscal Impacts, one of the studies conducted for the project's relicensing process. The number of construction jobs that would be filled by construction workers commuting from outside of Butte County was then estimated by assuming that 10.8 percent of construction workers would commute from residential locations outside of the county. (This in-commuting rate is approximately twice the in-commuting rate for all jobs in Butte County in 2000, based on data from the U.S. Census and the Bureau of Economic Analysis.)

The analysis of effects on the demand for public services generated by the population in Butte County supported by jobs directly and indirectly generated by visitor and O&M spending was based on population estimates for 2002 and projections for 2020 developed for the PDEA. (Although population projections beyond 2020 are not available for this analysis, the project-supported population is presumed to continue to grow at rates similar to the rate between 2002 and 2020 throughout the 50-year term of the anticipated license.) The sources and methods used to develop the population estimates and projections are described in Section 5.9.1, Population and Housing.

Although estimates of project-related visitation, commuting workers, and project-supported population were not developed specifically for the FERC Staff Alternative,

effects on public services under this alternative are anticipated to be similar to those of the Proposed Project.

5.9.2.4 Impacts and Mitigation Measures

In addition to the Proposed Project, this DEIR analyzes the No-Project Alternative and the FERC Staff Alternative. Impacts on public services from implementing the FERC Staff Alternative are similar to those anticipated from implementing the Proposed Project unless noted. Potential impacts are identified as follows: NO (No-Project), PRO (Proposed Project), and FERC (FERC Staff Alternative). All alternatives analyzed result in **less-than-significant** impacts on public services.

Program-Level Impacts and Mitigation Measures

Impact 5.9.2-a: Substantial, Adverse Physical Impacts Associated with the Provision of New or Physically Altered Governmental Facilities Needed to Maintain Acceptable Service Ratios, Response Times, or Other Performance Objectives for Any Public Service, Including Law Enforcement, Fire Protection, Schools, Parks, and Emergency Medical Services.

The program-level actions contained within all alternatives analyzed against the threshold of significance result in **less-than-significant** impacts on public services.

Project-Level Impacts and Mitigation Measures

Impact 5.9.2-a: Substantial, Adverse Physical Impacts Associated with the Provision of New or Physically Altered Governmental Facilities Needed to Maintain Acceptable Service Ratios, Response Times, or Other Performance Objectives for Any Public Service, Including Law Enforcement, Fire Protection, Schools, Parks, and Emergency Medical Services.

The project-level actions contained within all alternatives analyzed against the threshold of significance result in **less-than-significant** impacts on public services.

NO — Use of recreation facilities in the project area and the population supported by jobs directly and indirectly generated by visitor and O&M spending would increase in the future with or without implementation of the Proposed Project because of recreation demand generated by regional and statewide population growth. However, because annual changes in projected visitor and project-supported resident populations are expected to be small relative to existing visitor and resident populations, public services effects would be minor. There would be a **less-than-significant** impact as compared to Existing Conditions.

PRO, FERC — Only those programs and actions that would increase the number of recreation visitors or commuting workers to the project area, or that would increase the population supported by jobs directly and indirectly generated by visitor and O&M spending, would have the potential to increase the demand for public services. The proposed actions listed in Tables 5.7-1 and 5.7-2 of Section 5.7, Recreational Resources, and other actions requiring construction and O&M could result in an increase in recreational visits and worker trips to the project area, and an increase in the resident population supported by visitor and O&M spending, and an increase in demand for public services. However, this increase in demand for public services by recreation visitors, commuting workers, and the project-supported resident population would be minor relative to the existing and future demand for public services. The increased demand would be spread among many State and local agencies, minimizing the impact of the increased demand on local service providers. Therefore, this impact would be **less-than-significant** and therefore no mitigation would be required.

No-Project Alternative

Under the No-Project Alternative, the Oroville Facilities would continue to be operated as it is now under the terms and conditions in the existing FERC license, and no new PM&E measures would be implemented, other than those arising from existing legal obligations and agreements. In addition, DWR would continue existing routine operations and maintenance practices needed for the Oroville Facilities.

Under the No-Project Alternative, use of recreation facilities in the project area would increase in the future because of growth in the demand for recreation opportunities generated by regional and statewide population growth. Because the No-Project Alternative does not include any substantial construction activities or changes in O&M operations, effects on the demand for public services from out-of-county workers are expected to be minimal.

Based on visitation projections prepared for the PDEA, total visitation to the Oroville Facilities generated solely by regional and statewide population growth could increase by about 42 percent between 2002 and 2020, growing at an average rate of 2.3 percent per year over this period. However, only visitation by persons who do not reside in unincorporated Butte County would potentially increase the demand for public services in the county because residents of the unincorporated areas of Butte County likely would generate service calls from other recreation areas or elsewhere in Butte County if they were not recreating at the Oroville Facilities. (Note that residents of incorporated cities in Butte County who recreate at the Oroville Facilities would likely travel into the unincorporated areas of Butte County and impact service providers even if they were not recreating at the Oroville Facilities; therefore, the inclusion of residents of the incorporated areas in the visitor estimates used in this analysis likely overestimates the actual increase in the demand for public services.)

Visitation to the Oroville Facilities by out-of-county residents and residents of cities within the county is projected to potentially increase from about 697,970 visitor-days in 2002 to about 861,070 visitor-days in 2020, representing an average annual increase of about 9,060 visitor-days. In terms of public service demands, this increase in visitor days equates to an average daily population of about 450 additional persons that could require services throughout the year in 2020. Additionally, the population in Butte County supported by jobs directly and indirectly generated by visitor and O&M spending is projected to increase from 2,360 in 2002 to 2,770 in 2020, representing a 410-person increase. Local service providers in Butte County are expected to meet the daily public service needs of a projected 276,000 county residents in 2020. (Growth in recreation use and the project-supported population beyond 2020 is presumed to increase at a similar rate throughout the license term.)

Although regional and statewide population growth would increase visitation to the project area and generate an increase in the resident population supported by visitor and O&M spending, resulting in additional demand for local public services under the No-Project Alternative, the change in the demand for public services is expected to be small (0.3 percent) relative to service demand levels for the countywide resident population in 2020. The change in service demand also is anticipated to be gradual over the 2002-through-2020 period of analysis and would be spread among several State, federal, and local service providers. Therefore, effects on public services are expected to be minor, with no substantial, adverse physical impacts associated with the need for new or physically altered governmental or school facilities to maintain acceptable service ratios, response times, or other performance objectives for any public service. The impact of the No-Project Alternative on public services would be **less-than-significant**.

Proposed Project

Under the Proposed Project, implementation of SA articles, such as the proposed Lake Oroville Cold Water Fishery Improvement Program and the Lake Oroville Warm Water Fishery Improvement Program, when combined with the project-level actions included in SA Article A127, the SA Recreation Management Plan (RMP), could result in a minor

increase in the demand for public services by drawing additional visitors to the project area. In addition, construction and O&M workers who commute to the project area and the resident population supported by jobs directly and indirectly generated by visitor and O&M spending under the Proposed Project would contribute to a minor increase in the local demand for public services.

Although many of the project-level actions in the SA RMP serve to enhance the quality of existing recreation opportunities, several of the actions (see Table 5.7-2), including development of new campsites and improvements to boating facilities, could increase the recreational use of sites within the project area by enhancing the quality and capacity of facilities. To the extent that these improvements attract recreationists who are not local residents already affecting the demand for local public services, the increased use of the Oroville Facilities could result in an increased demand for services, including law enforcement and criminal justice services, fire protection, and emergency medical services.

Based on visitation projections prepared for the PDEA, total visitation to the Oroville Facilities could increase by about 45 percent between 2002 and 2020 under the Proposed Project Alternative, growing at an average rate of 2.5 percent per year over this period. However, as discussed previously, only visitation by persons who do not reside in unincorporated Butte County would increase the demand for public services in the county. Visitation by non-residents of unincorporated Butte County is projected to potentially increase from about 697,970 visitor-days in 2002 to about 1,028,400 visitor-days in 2020, representing an average annual increase of 18,360 visitor-days. In terms of public service demands, this increase in non-resident visitor days equates to an average daily population of about 910 additional persons requiring services throughout the year in 2020. However, about half of this increase would occur as a result of regional and statewide population growth unrelated to project improvements. As previously indicated, local service providers in Butte County are expected to meet the daily public service needs of a projected 276,000 county residents in 2020. (Growth in recreation use is presumed to increase at a similar rate throughout the license term.) . (As noted previously, residents of incorporated cities in Butte County who recreate at the Oroville Facilities would likely travel into the unincorporated areas of Butte County and impact service providers even if they were not recreating at the Oroville Facilities; therefore, the inclusion of residents of the incorporated areas in the visitor estimates used in this analysis likely overestimates the actual increase in the demand for public services.)

Under the Proposed Project, the population directly and indirectly supported by increased visitor and O&M spending would also increase the demand for public services throughout the county. This population, which includes resident O&M workers, is projected to increase from a level of 2,360 in 2002 to 3,160 in 2020, representing an 800-person increase. About half of this growth, however, would be attributable to regional and statewide population growth unrelated to project improvements.

Implementation of the Proposed Project also would entail construction activities and changes in O&M practices at the Oroville Facilities that would likely increase the

number of workers commuting from out-of-county locations. The increased level of worker commuting would affect the local demand for public services. Based on internal calculations from the economic-fiscal model developed for SP-R18, Recreation Activity, Spending, and Associated Economic Impacts, and SP-R19, Fiscal Impacts, the number of additional O&M workers needed to implement the Proposed Action in the PDEA is estimated to be about 65 positions. Of these additional jobs, most are believed to be filled by persons who either currently live in Butte County or would relocate to Butte County. Based on the current commuting patterns of Oroville Facilities–related State workers, fewer than five of the additional O&M jobs are anticipated to be filled by persons commuting from locations outside of Butte County

Construction activities associated with implementing the PM&E measures are estimated to generate a need for the equivalent of about 1,800 jobs over the 50-year FERC license period. These jobs would be mostly temporary, lasting only as long as needed to construct individual actions. As described in Section 5.9.1, Population and Housing, the size and diversity of the region's construction sector suggests that many if not most construction activities could be undertaken by construction firms and workers already located within Butte County. Assuming that PM&E construction occurs over a 10-year period, construction-related employment would average about 180 jobs annually. Fewer than 20 of these annual jobs would be anticipated to be filled by workers commuting from locations outside of Butte County, assuming that the commuting rate of construction workers is twice the rate for all other workers in the county. The number of construction workers who would need to commute from out-of-county locations is therefore expected to be minimal.

To the extent that facility improvements and enhancements of the Proposed Project contribute to increased demand for local public services, including law enforcement, criminal justice, fire protection, and emergency services, the following factors would serve to alleviate the need for local service providers to construct or substantially alter public services and parks facilities to maintain adequate service levels.

- Relative to the demand for public services generated by the countywide population, the potential increase in demand for public services solely attributable to the Proposed Project is anticipated to be minor, with the increase occurring gradually over the 50-year license period as actions in the SA RMP (Article A127) are implemented. Considered together, project visitors, O&M commuters, and the population supported by the project would permanently add about 1,715 persons to the overall service area population of service providers within Butte County in 2020, with about half of this additional population attributable to regional and statewide population growth unrelated to project improvements. This increase would represent about 0.6 percent of the projected countywide population of 276,000 in 2020.

- The relatively small increase in calls for law enforcement, fire suppression, and medical emergency services generated by recreation visitors, the population supported by the project, and workers commuting to the Oroville Facilities under the Proposed Project would be spread among many potential responders, as

described in 4.9.2, Public Services Setting. For example, within the Lake Oroville State Recreation Area (LOSRA) where most calls are likely to originate, State agencies have the primary responsibility for responding to service calls. DPR is often the first responder for law enforcement and emergency medical service calls in the LOSRA, with backup provided by several agencies, including the California Highway Patrol, Butte County Sheriff's Department, and the City of Oroville Police Department for law enforcement calls, and Butte County Fire-Rescue Department, the City of Oroville Fire-Rescue Department, and CDF for emergency medical services calls. For law enforcement and emergency service calls outside of the LOSRA, DFG, Butte County Sheriff's Department, and the City of Oroville Police Department are first responders, depending on the location of an incident. For wildland fire calls surrounding Lake Oroville, CDF is the first responder; near the Oroville Wildlife Area (OWA), Thermalito Forebay, and Thermalito Afterbay, the fire-rescue departments of Butte County and the City of Oroville are the first responders, depending upon the location of the fire. Given that the increase in service calls generated by the Proposed Project would be spread among several agencies, with State agencies likely to respond to the majority of calls, the increased demand on local public service providers attributable to the Proposed Project is anticipated to be minor.

- Other conditions of the Proposed Project are expected to further reduce or fully offset negative public services impacts. For example, under SA Section B111, Oroville Wildlife Area Funding, in Appendix B of the SA, DWR agreed to provide funding to DFG to manage the OWA. An interagency agreement between DFG and DWR, signed in accordance with Section B111, provides an estimated $850,000 annually to support 9.5 full-time positions (2 of which are full-time, peace officer positions), in part to provide additional public safety in the OWA. The additional DFG positions are expected to lead to a reduction in the demand for Butte County law enforcement services at the OWA.

Although enhanced recreation facilities and opportunities under the Proposed Project are expected to likely attract more visitors to the Oroville Facilities, thereby generating a larger resident population compared to current and future No-Project visitation and population levels, the increase is not expected to be substantial over the 50-year term of the anticipated new license. Considering the small and gradual increase in the demand for public services that would be generated by implementing the Proposed Project, and the distribution of law enforcement, fire, and emergency medical services calls among several agencies, the need to construct or alter government facilities to provide public services to maintain adequate service levels is considered unlikely under the Proposed Project. Additionally, changes in the project-supported resident population under the Proposed Project would have minor effects on schools because the potential increase in students would be small and spread across several schools and districts. The public services impact of the Proposed Project is therefore considered to be **less-than-significant**.

Although the impact on local public service providers is considered less-than-significant, DWR offered during settlement discussions to provide funding that it believes would

address the minor public service impacts in the unincorporated portions of Butte County that are generated by visitors to the Oroville Facilities. No official response to the offer was provided by the County of Butte; however, the proposed level of funding is considered sufficient to address these impacts, which would thereby reduce the **less-than-significant** impact on local public services and no mitigation would be required.

FERC Staff Alternative

Program- and project-level actions that could affect visitation levels and the demand for public services would be the same as under the Proposed Project because the alternative proposes only minor changes to the actions comprising the Proposed Project's Recreation Management Plan. Therefore, the public service impacts of the FERC Alternative would be **less-than-significant** and no mitigation would be required.

5.10 ENVIRONMENTAL JUSTICE

5.10.1 Regulatory Setting

5.10.1.1 Federal Plans, Policies, Regulations, and Laws

Executive Order 12898, Environmental Justice for Low-Income and Minority Populations

Executive Order 12898 (1994) provides that each federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations. Environmental justice programs promote the protection of human health and the environment, empowerment via public participation, and the dissemination of relevant information to inform and educate affected communities.

5.10.1.2 State Plans, Policies, Regulations, and Laws

California Government Code

Section 65040.12 of the California Government Code defines environmental justice as "the fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies."

State CEQA Guidelines

Under the State CEQA Guidelines, economic or social information may be included in an EIR, or may be presented in whatever form the agency desires. Economic or social effects of a project shall not be treated as significant effects on the environment. (State CEQA Guidelines, Section 15131.)

California Resources Agency

It is the policy of The Resources Agency that the fair treatment of people of all races, cultures, and incomes shall be fully considered during the planning, decision-making, development and implementation of all Resources Agency programs, policies, and activities. The intent of this policy is to ensure that members of the public, including minority and low-income populations, are informed of opportunities to participate in the development and implementation of all Resources Agency programs, policies, and activities; and that they are not discriminated against, treated unfairly, or caused to experience proportionately high and adverse human health or environmental effects from environmental decisions.

5.10.2 Discussion

The following section describes the beneficial effects of the Proposed Project. Table 5.10-1 indicates that SA Articles A127 and A128 could have a beneficial effect on environmental justice.

The Proposed Project includes ongoing operation of the existing Oroville Facilities infrastructure, including meeting the contractual obligation for the Feather River Service Area (FRSA). The Project will continue to provide relatively affordable water to SWP customers. The specific actions contained in the Proposed Project mainly aim to improve upon existing conditions affecting local recreation, environmental, and cultural resources. Because the Proposed Project is generally beneficial and affects all users equally, no adverse effects will occur disproportionately on low-income or minority groups.

Under the Proposed Project, recreation facilities in the FERC Project area would be upgraded and new recreation facilities constructed over the term of the new license to address current needs and future needs (based on monitoring) as described in the Recreation Management Plan. Improvements to recreation facilities and opportunities in the Proposed Project area would provide a benefit to residents of the City of Oroville and Butte County, including the region's low-income population and its American Indian population, by increasing the region's access to recreation.

The Proposed Project proposes that DWR draft a Historic Properties Management Plan (HPMP). The basic provisions for the protection of significant cultural resources contained in the draft HPMP are expected to remain unchanged. Implementation of the HPMP would provide a benefit to the American Indian community. The draft HPMP lists a number of tools to address impacts on historic properties, among which are (1) resource monitoring, (2) impact avoidance, (3) protection/stabilization, and (4) data recovery. It also includes a number of supporting or improvement measures such as establishment of a curation facility for prehistoric materials collected during inventory; evaluation and mitigation activities; a public education and information program to increase public awareness of and appreciation for cultural resources and to help reduce intentional and unintentional damage to these resources; and the identification of areas to set aside, improve, or develop traditionally used plants for the local Native American community.

As defined in Section 4.10.4, Identification of Minority and Low-Income Groups for Potentially Analyzing Environmental Justice Impacts, for the purposes of the environmental justice analysis, a low-income population is considered to exist in the FERC Project area (Butte County and the City of Oroville). Furthermore, the American Indian population in Butte County and the City of Oroville is considered a minority population in the project area. These populations are the focus of the environmental justice analysis.

Table 5.10-1. Environmental effects on environmental justice.

Alternative(s)	Article # and Title	Level of CEQA Analysis	Nature of Potential Impact(s)	Effects
PRO, FERC	A127—Recreation Management Plan	Programmatic	Recreation facilities would be improved, upgraded, or new recreation facilities constructed over the term of the new license to address current needs and future needs (based on monitoring).	B
PRO, FERC	A128—Historic Properties Management Plan	Programmatic	Implementation of measures such as establishment of a curation facility for prehistoric materials collected during inventory; evaluation and mitigation activities; a public education and information program to increase public awareness of and appreciation for cultural resources and to help reduce intentional and unintentional damage to these resources; and the identification of areas to set aside, improve, or develop traditionally used plants for the local Native American community.	B

Coding:

B = Action with potential to result in a beneficial effect; could involve short-term, less-than-significant, construction-related impacts that would be avoided or reduced through the use of Best Management Practices (BMPs). See Appendix D.

Under the No-Project Alternative, the Oroville Facilities would continue to be operated under the terms and conditions in the existing FERC license, and no new protection, mitigation, and enhancement (PM&E) measures would be implemented, other than those arising from existing legal obligations and agreements.

The FERC Staff Alternative is similar to the Proposed Project; therefore, in terms of this evaluation of environmental justice, the difference between these alternatives is negligible, thereby providing a benefit to the residents of the City of Oroville and Butte County, including the region's low-income populations and its American Indian population.

No adverse socioeconomic effects have been identified for any of the alternatives that would disproportionately affect low-income or minority populations; therefore, no environmental justice effects are expected. Consequently, no mitigation measures are identified.

5.11 AESTHETIC RESOURCES

5.11.1 Visual Resources

5.11.1.1 Regulatory Setting

Several entities with management responsibilities for lands in the Oroville Facilities project area also have policies, elements, standards, and/or guidelines for aesthetic/visual resources. USFS and BLM have visual resources policies and standards that apply to lands within the project area and FERC Project boundary. The California Department of Transportation (Caltrans) is the State entity with review responsibility (for scenic highways) to ensure compliance with the visual resource components of CEQA. DPR is responsible for managing the Lake Oroville State Recreation Area (LOSRA), but it does not have specific visual regulations. Butte County (County) has a Scenic Highways element in its General Land Use Plan as well as a Scenic Highways zoning designation. Several highways in the project area have a Scenic Highway zoning designation but have not been designated as scenic highways by the County. The report for Study Plan L-4 (SP-L4), Aesthetic/Visual Resources Report (DWR 2004a), contains more detailed information regarding relevant policies, elements, standards, and/or guidelines for visual resources.

Federal Plans, Policies, Regulations, and Laws

U.S. Forest Service

Plumas National Forest and Lassen National Forest have lands adjacent to the project area along the North Fork, Middle Fork, and South Fork branches of Lake Oroville. All USFS lands in the project area are managed by Plumas National Forest and fall under the management direction of the *Plumas Land and Resource Management Plan* (LRMP) (USFS 1988). In general, the policies for land near the project area emphasize resource conservation, provision of high-quality recreational opportunities, and protection of visual resources.

The LRMP uses the USFS Visual Management System (VMS) to manage the visual resources of Plumas National Forest (USFS 1974). Visual resources throughout Plumas National Forest have been inventoried, and the management direction is reflected in terms of Visual Quality Objectives (VQOs). The VQOs represent a composite rating of the scenic integrity or visual variety of the landscape, combined with a sensitivity level rating that can reflect the number and relative concern of viewers for the scenic quality of the landscape. Landscape variety and sensitivity levels are combined with a distance zone rating, which identifies the distance from which viewers typically experience the landscape. Based on inventory ratings and management direction, lands within Plumas National Forest are assigned one of several VQOs. The USFS VQOs, listed from “most” to “least” aesthetically/visually protective, are Preservation, Retention, Partial Retention, Modification, and Maximum Modification. The following is a description of the VQOs (USFS 1974).

- *Preservation:* This VQO allows ecological changes only.
- *Retention:* This VQO provides for management activities that are not visually evident to the casual National Forest visitor.
- *Partial Retention:* Management activities are visually evident but subordinate to the characteristic landscape when managed according to the partial-retention visual quality objective.
- *Modification:* Under the Modification VQO, management activities may visually dominate the original characteristic landscape.
- *Maximum Modification:* Management activities of vegetative and landform alterations may dominate the characteristic landscape.

Based on the LMRP, USFS lands within the project area have been assigned two of the five possible VQOs: Retention and Partial Retention (USFS 1988). The locations of the VQOs are depicted in the SP-L4 report. The Retention VQO has been applied to the lands of Plumas National Forest that follow corridors along the South Fork Feather River, the Middle Fork Feather River (into the Feather Falls Scenic Area), and the Upper North Fork Feather River. USFS lands in the project area that are outside the areas with VQOs of Retention have been assigned a VQO of Partial Retention.

A National Forest Scenic Byway passes through the FERC Project boundary. The Feather River National Forest Scenic Byway begins at State Route (SR) 70 approximately 10 miles north of the City of Oroville and passes through the FERC Project boundary (via a bridge) near the West Branch on lands that are not part of the National Forest. USFS lands through which the byway passes and that can be seen from the byway are frequently assigned VQOs such as Retention and Partial Retention to protect the scenic qualities of the byway. However, it should be noted that VQO requirements apply only to USFS lands.

U.S. Bureau of Land Management

BLM manages approximately 2,000 acres of land in scattered, noncontiguous parcels along the West Branch and the Lower North, Middle, and South Forks of the Feather River, inside and outside of the FERC Project boundary (see the report for SP-L2, Land Management [DWR 2004b]). BLM is responsible for managing these lands and their resources, including visual resources, under the direction of the 1993 *Redding Resource Management Plan* (RRMP).

BLM's management of visual resources is based on the agency's Visual Resource Management (VRM) system. BLM's VRM system involves inventorying scenic values and establishing management objectives for those values through the resource management planning process. One component of the VRM is to assign visual resource "Inventory Classes" to parcels of land. There are four classes, each of which has objectives that differ in terms of allowable changes to the visual conditions of those parcels of land. The four VRM classes and their objectives are listed below.

- **Class I Objective:** To *preserve* the existing character of the landscape.
- **Class II Objective:** To *retain* the existing character of the landscape.
- **Class III Objective:** To *partially retain* the existing character of the landscape.
- **Class IV Objective:** To provide for management activities which require *major modification* of the existing character of the landscape.

BLM lands in the project area have been designated as Class II lands. This designation means that BLM is to retain the visual character of lands in the project area until potential transfers of much of the land are complete (see Section 4.6, Land Use).

State Plans, Policies, Regulations, and Laws

The California State Scenic Highway Program is part of the California Streets and Highways Code, which is administered by Caltrans. The goal of the State Scenic Highway Program is to preserve and enhance the natural beauty of California. A highway may be designated a State Scenic Highway based on the extent to which passing motorists see the natural landscape and the extent to which visual intrusions (e.g., buildings, unsightly land uses, noise barriers) affect the "scenic corridor." The only highway in the project area eligible for the State Scenic Highway designation is a portion of SR 70 north of the main basin of Lake Oroville. Being "eligible" indicates that the route is shown on the *Master Plan of State Scenic Highways* but does not mean that it is nominated. The segment of SR 70 crossing the project area near Vinton Gulch is not currently protected by a State-approved or County-developed plan.

Local Plans, Policies, Regulations, and Laws

The *Butte County General Plan*, adopted in 1996, contains a Scenic Highways element. The Scenic Highways Element has the following eight policies:

- **Policy 1:** Protect valuable scenic areas for enjoyment by residents and visitors.
- **Policy 2:** Delineate scenic corridors with careful consideration of all factors.
- **Policy 3:** Consider scenic values in the design and improvement of rights-of-way.
- **Policy 4:** Control access to scenic highways to control safety.
- **Policy 5:** Locate and design utility structures to minimize visual effect, where economically feasible.
- **Policy 6:** Encourage compatible land use patterns in scenic corridors.
- **Policy 7:** Promote the County's scenic highways program.

- **Policy 8:** Consider economic effects on property affected by a scenic highway designation.

The County has not designated any highway in the project area as a Scenic Highway. The County Zoning Plan has assigned the zoning designation of "Scenic Highway" (S-H) to portions of four roadways within the project area. None of these highway segments have been designated as scenic highways by the County, but they are considered eligible for designation. The four eligible segments are:

- Pentz Road (within the study area west of the West Branch);
- SR 162 (along the east side of the main basin of Lake Oroville from the Canyon Creek area to south of Bidwell Bar Bridge);
- SR 70 (on the south side of the West Branch of Lake Oroville near Vinton Gulch); and
- Lumpkin Road (at the east end of the South Fork).

See Figure 5.3-2 in the SP-L4 report (DWR 2004a) for the locations of the segments of the highways zoned Scenic Highway.

5.11.1.2 Impact Thresholds

The following thresholds are used to determine whether the alternatives would have a significant effect on visual resources. There would be a significant impact if the alternatives would:

- 5.11.1-a: Have a substantial adverse effect on a scenic vista;
- 5.11.1-b: Substantially damage scenic resources, including but not limited to trees, rock outcroppings, and historic buildings within a state scenic highway;
- 5.11.1-c: Substantially degrade the existing visual character or quality of the site and its surroundings; or
- 5.11.1-d: Create a new source of substantial light or glare that would adversely affect views in the area.

5.11.1.3 Method of Analysis

Potential impacts on visual resources were assessed by qualitative methods. Baseline data for this assessment, including representative site area photographs from Key Observation Points (KOPs), were collected during the Oroville Facilities Relicensing studies. These studies were developed in coordination with stakeholders, including the regulatory agencies. Determination of KOPs was made in concert with other relicensing studies work groups. For a detailed description of the study plan methodology, please refer to the study plan report for SP-L4.

The following documents were consulted in order to address in this analysis the specific aesthetic resource issues identified during scoping:

- SP-L4, Aesthetic/Visual Resources Report; and
- *Settlement Agreement for Licensing of the Oroville Facilities, March 2006*, which includes the SA Recreation Management Plan (RMP).

5.11.1.4 Impacts and Mitigation Measures

The following section describes the beneficial effects and potentially adverse impacts of the Proposed Project, including both programmatic and project-level analyses. Table 5.11-1 indicates the SA articles that could have an effect on aesthetic resources, and whether these effects are expected to be beneficial, less-than-significant, or would be less-than-significant following implementation of recommended mitigation measures.

The Proposed Project would provide several **beneficial** impacts to aesthetic resources described at the beginning of the following discussions of both program-level and project-level impacts.

In addition to the Proposed Project, this DEIR analyzes the No-Project Alternative and the FERC Staff Alternative. Impacts on aesthetic resources from implementing the FERC Staff Alternative are similar to those anticipated from implementation of the Proposed Project unless noted. Potential impacts are identified as follows: NO (No-Project), PRO (Proposed Project), and FERC (FERC Staff Alternative). All alternatives analyzed result in **less-than-significant** impacts on aesthetic resources with the implementation of Best Management Practices (BMPs) included in both the Proposed Project and the FERC Staff Alternative and as described in Appendix D to address short-term, construction-related impacts, and no mitigation would be required.

Program-Level Impacts and Mitigation Measures

A number of the program-level activities proposed as part of the project would have visually **beneficial** impacts. Each is described below and is therefore not included in the discussion of adverse impacts in this section.

- Gravel Supplementation and Improvement Program (SA Article A102). Riffle rehabilitation proposed as part of the Gravel Supplementation and Improvement Program would add variety to the visual character observed in views of spawning areas in the lower Feather River. Riffles disrupt river flow, creating turbulence and increasing flow velocity by forming rapids. The rehabilitation of existing riffles would increase these characteristics, thus leading to the increase of visual variety.

Table 5.11-1. Environmental effects on visual resources.

Alternative(s)	Article # and Title	Level of CEQA Analysis	Nature of Potential Impact(s)	Effects
PRO, FERC	A103—Channel Improvement Program (This action is programmatic; however, Moe's and Hatchery Ditch activities are project-level)	Programmatic with some Project elements	The channel riffle/glide complexes would include cover and vegetation as part of their habitat and would have a beneficial effect on the aesthetics of the area.	B
PRO, FERC	A104—Structural Habitat Supplementation and Improvement Program (SHSI)	Programmatic	Additional cover, edge, and channel complexity through the addition of structural habitat (including large woody debris, boulders, and other objects) would enhance views within certain riparian areas.	B
PRO, FERC	A132—Screening of Material Storage Area	Project	Vegetation (using native plants, to the extent practical) would be planted to screen the storage/staging area.	B
PRO	A102—Gravel Supplementation and Improvement Program (SA Section 105)	Programmatic with some Project elements	Variety would add to the visual character observed in views of spawning areas in the lower Feather River. The staging of spawning gravel stockpiles would result in the deposit upon a flat and exposed terrain of relatively large mounds of gravel. Depending on size and placement, these stockpiles could be visible from public viewpoints within the surrounding area.	B/LTS
FERC	A102—Gravel Supplementation and Improvement Program	Programmatic with some Project elements	Variety would add to the visual character observed in views of spawning areas in the lower Feather River. The staging of spawning gravel stockpiles would result in the deposit upon a flat and exposed terrain of relatively large mounds of gravel. Depending on size and placement, these stockpiles could be visible from public viewpoints within the surrounding area.	B/LTS

Table 5.11-1. Environmental effects on visual resources.

Alternative(s)	Article # and Title	Level of CEQA Analysis	Nature of Potential Impact(s)	Effects
PRO, FERC	A105—Fish Weir Program	Programmatic	The weirs would represent a visual change; however, they would be low profile and located near other water structures.	LTS
PRO, FERC	A110—Lake Oroville Warm Water Fishery Habitat Improvement Program	Programmatic	Construction within the fluctuation zone would represent a visual change; however, since the program is a continuation of an existing program, the structures would be similar to existing structures in the fluctuation zone.	LTS
PRO, FERC	A112 (a–c)—Comprehensive Water Quality Monitoring Program	Programmatic	Additional monitoring station siting would represent a minor visual change; however, additional structures would be designed to be consistent with existing monitoring stations.	LTS
PRO, FERC	A125—Installation of Wildlife Nesting Boxes	Project	Installation of nesting boxes would alter visual resources in the Oroville Wildlife Area.	LTS
PRO	A129—Improve and Redirect Recreation Usage to Specific Areas at Foreman Creek	Project	Facility improvements would alter visual resources.	LTS
FERC	A129—Close Foreman Creek, pending development of a plan in coordination with Native American tribes	Project	Temporary closure would not alter visual resources; however, facility improvements as described in the Proposed Project would alter visual resources.	LTS
PRO, FERC	A117—Protection of Vernal Pools	Project	Minimization and conservation measures for vernal pools and associated wildlife species would include the addition of signage and gravel covering of seepage-pump access roads.	LTS
PRO, FERC	A122—Construction and Recharge of Brood Ponds	Project	Construction of berms related to brood pond development would alter visual resources.	LTS

Table 5.11-1. Environmental effects on visual resources.

Alternative(s)	Article # and Title	Level of CEQA Analysis	Nature of Potential Impact(s)	Effects
PRO	A127—Recreation Management Plan ADA compliance for existing facilities Trails Roads Parking Campgrounds Docks and Boat Ramps Other Facilities	Project	Upgrades and/or construction of new recreation facilities may impact visual resources.	LTS
FERC	A127—Modified Recreation Management Plan Same as A127 Recreation Management Plan with: Develop a plan to install facility upgrades at Foreman Creek, and Reconstruct boat-in campgrounds.	Project	Upgrades and/or construction of new recreation facilities may impact visual resources.	LTS
FERC	A129 (revised by FERC staff to include temporary closure)—Improve and Redirect Recreation Usage to Specific Areas at Foreman Creek (Plan development) Boat Ramp while Plan is Developed to Protect Cultural Resources	Project	Upgrades and/or construction of new recreation facilities may impact visual resources.	LTS
PRO	B103—Additional Gaging	Project	Gauging stations could be placed within views of scenic resources.	LTSM
FERC	Re-seed, as necessary, the downstream face of Oroville Dam	Project	Would enhance aesthetic quality of downstream dam face.	NI

Coding:

B = Action with potential to result in a beneficial effect; could involve short-term, less-than-significant, construction-related impacts that would be avoided or reduced through the use of Best Management Practices (BMPs). See Appendix D.

LTS = Action that would result in less-than-significant impact on resource.

LTSM = Action that would result in less-than-significant impact on resource following mitigation.

NI = Action that would result in no impact.

- Structural Habitat Supplementation and Improvement Program (SA Article A104). The additional cover, edge, and channel complexity through the addition of structural habitat (including large woody debris, boulders, and other objects) included in the Structural Habitat Supplementation and Improvement Program would similarly enhance views within certain riparian areas. This would be a **beneficial** effect on the aesthetics of the area.

- Channel Improvement Program (SA Article A103). The program includes five additional side-channel riffle/glide complexes that could be visible from within the vicinity of the Low Flow Channel (LFC). However, these channel riffle/glide complexes would include cover and vegetation as part of their habitat and would therefore have a **beneficial** effect on the aesthetics of the area.

Impact 5.11.1-a: Have a substantial adverse effect on a scenic vista; or

Impact 5.11.1-b: Substantially damage scenic resources, including but not limited to trees, rock outcroppings, and historic buildings within a state scenic highway; or

Impact 5.11.1-c: Substantially degrade the existing visual character or quality of the site and its surroundings; or

Impact 5.11.1-d: Create a new source of substantial light or glare that would adversely affect views in the area.

NO — No changes to the existing visual characteristics would occur.

PRO, FERC — Gravel Supplementation and Improvement Program (SA Article A102). The staging of spawning gravel stockpiles would result in the deposit upon a flat and exposed terrain of relatively large mounds of gravel. Depending on their size and placement, which are indefinite at present, these stockpiles could be visible from public viewpoints within the surrounding area. However, as these stockpiles would be temporary and of natural materials common to the area, they would result in a **less-than-significant** impact on aesthetic resources.

Fish Weir Program (SA Article A105). Activities associated with the Fish Weir Program, Comprehensive Water Monitoring Program, and Flow/Temperature to Support Anadromous Fish Program could alter public views of scenic resources. The weirs would be of a relatively low profile and in an area where other water structures are found and would not create a substantial contrast with the existing scenic views. Thus, this program would have a **less-than-significant** impact on aesthetic resources.

Lake Oroville Warm Water Fishery Habitat Improvement Program (SA Article A110). Additional structures placed within the

fluctuation zone of Lake Oroville could be visible during low-water conditions. However, because the program is an extension of an existing program, this program would have a **less-than-significant** impact on aesthetic resources.

Comprehensive Water Quality Monitoring Program (SA Article A112). Additional monitoring stations may be installed under this program, resulting in minor visual changes. However, additional structures would be designed to be consistent with existing monitoring stations and would therefore have a **less-than-significant** impact on aesthetic resources.

Project-Level Impacts and Mitigation Measures

A number of the project-level activities proposed would have visually **beneficial** impacts. Each is described below and is therefore not included in the discussion of adverse impacts in this section.

- Channel Improvement Program (SA Article A103). The two existing side channels at the upstream end of the LFC, Moe's Ditch and Hatchery Ditch, would be modified to provide suitable discharge, velocity, depth, substrate, cover, and riparian vegetation to support salmonid spawning and rearing. This would enhance the variety found within views of these locations, resulting in a **beneficial** impact to aesthetics.

- Screening of Material Storage Area (SA Article A132). Within 1 year following issuance of the license, the Licensee would plant appropriate vegetation (using native plants, to the extent practical) to screen the storage/staging area located northwest of the emergency spillway from view of Oroville Dam Boulevard. This would provide a **beneficial** impact to aesthetics.

Impact 5.11.1-a: Have a substantial adverse effect on a scenic vista; or

Impact 5.11.1-b: Substantially damage scenic resources, including but not limited to trees, rock outcroppings, and historic buildings within a state scenic highway; or

Impact 5.11.1-c: Substantially degrade the existing visual character or quality of the site and its surroundings; or

Impact 5.11.1-d: Create a new source of substantial light or glare that would adversely affect views in the area.

NO No changes to the existing visual characteristics would occur.

PRO Protection of Vernal Pools (SA Article A117). Vernal pools within the FERC Project boundary are limited primarily to the vicinity of

Thermalito Afterbay, North and South Thermalito Forebays, and the Oroville Wildlife Area (OWA). Minimization and conservation measures for vernal pools and associated wildlife species would be implemented in these areas and include the addition of signage and gravel covering of seepage-pump access roads. Because both activities would occur within established roadways, this would not constitute a substantial adverse effect on visual resources within the project area and would thus have a **less-than-significant** impact on aesthetics.

Construction and Recharge of Brood Ponds (SA Article A122). The waterfowl brood ponds proposed for Thermalito Afterbay would not be considered a substantial adverse effect to visual resources. Although Thermalito Afterbay is adjacent to the OWA, the Thermalito Afterbay shoreline has been modified in many areas and construction of brood ponds would not cause any substantial visual contrast. Therefore, this measure would have a **less-than-significant** impact on aesthetics.

Installation of Wildlife Nesting Boxes (SA Article A125). The wildlife nesting boxes proposed for the OWA would be constructed and maintained consistent with the existing OWA environment to the extent possible and thus would not be considered a substantial adverse effect on visual resources. This action represents a continuation of the nesting box program that currently exists in the OWA. Therefore, this measure would have a **less-than-significant** impact on aesthetics.

Gravel Supplementation and Improvement Program (SA Article A102). The gravel supplementation in the LFC or High Flow Channel (HFC) of the Feather River would not be considered a substantial adverse effect on visual resources. Gravel supplementation would be beneath the water surface of the LFC or HFC and would therefore not be prominent in views. Therefore, this measure would have a **less-than-significant** impact on aesthetics.

Additional Gaging (SA Section B103). After an evaluation of need, gauging stations could be placed within views of scenic resources and therefore could result in a substantial adverse effect. With implementation of Mitigation Measure 5.11.1-b, this impact would be reduced to **less-than-significant.**

Recreation Management Plan

The RMP (SA Article A127) describes projects that can be categorized for this analysis as pertaining to the following aspects of

the project area: compliance with the Americans with Disabilities Act (ADA), trails, roads, parking, campgrounds, docks and boat ramps, and other facilities.

ADA. Any construction related to ADA compliance would consist of the upgrading of existing facilities (e.g., at the Marina stores, Loafer Creek Equestrian Campground, Lime Saddle Day Use Area, Oroville Dam Day Use Area, Diversion Pool Day Use Area, and Thermalito Forebay). Because this action is limited to the potential upgrade of existing facilities, there would not be substantial adverse visual impacts, and thus a **less-than-significant** impact on aesthetic resources from such upgrades.

Trails. Most trails proposed to be developed would connect existing facilities, such as the trail proposed to connect Lime Saddle Campground to Lime Saddle Marina. New trails would be designed to avoid potential impacts on and/or loss of wetland and other sensitive habitat, minimizing the visual impact. New trails would be aligned along existing railroad grade/service roads or other existing corridors to the extent possible. As such, there would be a **less-than-significant** impact on aesthetic resources from trail-related actions.

Roads. Road-related projects primarily include the addition of interpretive and wayfinding signage. An existing road would be re-graveled near the OWA Day Use Area. Vehicular access to the Diversion Pool (south shoreline) from the Lakeland Boulevard Trailhead Access could be constructed along the old railroad grade trail corridor. Because there would be no construction of new roadway alignments, there would be a **less-than-significant** impact on aesthetic resources as a result of these actions.

Parking. All proposed parking developments would take place within or adjacent to existing parking areas, with the exception of a new day use facility proposed near the Diversion Pool. The parking for this proposed area would be on an old railroad grade. Because there would be no parking built on undeveloped land, this would constitute a **less-than-significant** impact.

Campgrounds. New campground facilities are proposed for the Bidwell Canyon Recreation Area (new recreational vehicle [RV]/tent campground loop), Loafer Creek Recreation Area (new group RV campsites); Lime Saddle Recreation Area (additional RV campsites, group RV campsites, and floating campsites); the West Branch or North Fork areas of the reservoir (one new floating campsite); and the OWA (new, primitive RV/tent camping area). However, all proposed facilities are either within or adjacent to existing

campgrounds and other developed areas and would therefore have a **less-than-significant** impact on aesthetic resources.

Docks and Boat Ramps. All new docks or boat ramps are proposed in areas where docks and/or boat ramps already exist. Most of the proposed changes include extension of existing docks and ramps to lower elevations, the provision of new boarding or floating docks, and upgrade of ramp approaches (including the paving of currently graveled areas and the installation of signs near boat ramps). Since these actions would occur at existing docks and boat ramps, the impacts from these additional facilities would be **less-than-significant** on aesthetic resources.

Other Facilities. A number of actions supplement existing facilities and may include the addition of new vault toilets, fish cleaning stations, horse watering troughs, hand-washing sinks, picnic tables, pole stoves, shade ramadas, parking areas, trash receptacles, and beach areas. All of these actions would be constructed within areas containing existing facilities. Therefore these actions would have a **less-than-significant** impact on aesthetic resources.

FERC

The FERC Staff Alternative would defer recreational facility development at Foreman Creek until a plan is developed in coordination with Native American tribes (SA Article A129).

The FERC Staff Alternative would reconstruct the boat-in campgrounds at Bloomer, Goat Ranch, and Craig Saddle.

These facilities would be constructed within areas containing existing facilities. Therefore, the impacts on aesthetic resources from such actions would be **less-than-significant**.

The FERC Staff Alternative recommends reseeding the Oroville Dam face. DWR has made previous, unsuccessful attempts to seed the face of Oroville Dam. Based on that experience, California poppies are not considered adequately "self-sustaining" in this location to produce the desired effect. Vegetation (including various native and non-native wildflowers) currently covers the face of Oroville Dam in virtually all areas that are not rock. However, much of the dam face is rock, generally lacking sufficient soil for efficient poppy seed germination. The diversity of wildflowers on the dam was not successfully displaced by the 2003 Interim Project poppies. For these reasons, there would be **no impact** on aesthetic resources from such an action.

Therefore, with regard to potential substantial adverse effects on

aesthetic resources, there would be no difference between the FERC Staff Alternative and the Proposed Project from project-level activities and no mitigation would be required.

Mitigation measure 5.11.1-d: Screening of Gaging Stations.

NO	No mitigation is required.
PRO, FERC	If needed, implementation of additional stream gaging could affect some visual characteristics associated with installation of gaging stations. Therefore, measures to avoid, reduce, or compensate for changes to visual resources could include partial screening from public view or planting of other vegetation to reduce potential visual impacts to **less-than-significant.**

Implementation of this mitigation measure would reduce visual impacts associated with gaging stations to **less-than-significant**.

5.11.2 Noise

5.11.2.1 Regulatory Setting

There are no federal or State noise or vibration regulations applicable to the Oroville Facilities Project area. The Noise Element of the *Butte County General Plan* was adopted in March 1977. The existing *Butte County General Plan* Noise Element is based upon recommendations by the California State Office of Noise Control as contained in the *Guidelines for the Preparation and Content of Noise Elements of the General Plan* (Butte County 2005). According to the *Butte County General Plan* Noise Element:

> The primary objective of the Noise Element is to prescribe policies that lead to the residents of Butte County by securing and maintaining an environment free from hazardous and annoying noise. Secondary objectives of the Noise Element are to provide information concerning the community noise environment to make noise a consideration in the on-going planning process and the development of ordinances relating thereto; abate and control excessive noise; avoid a mix of incompatible noise generating and noise-sensitive activities; protect areas of the community which have "acceptable" or "sensitive" noise environments; provide indoor noise environments that allow undisturbed conversation, sleep, study, work, relaxation and privacy; provide outdoor noise environments that do not significantly interfere with conversation, relaxation, and privacy.

Butte County does not have a noise ordinance.

5.11.2.2 Impact Thresholds

The following thresholds are used to determine whether the alternatives would have a significant effect on noise. There would be a significant impact if the alternatives would:

- 5.11.2-a: Expose people to noise levels exceeding established standards of the local general plan or noise ordinance, or of other agencies;
- 5.11.2-b: Result in a substantial temporary or periodic increase in ambient noise levels in the project vicinity above existing levels; or
- 5.11.2-c: Result in a permanent increase in ambient noise above existing levels.

5.11.2.3 Method of Analysis

Program-Level Analysis

Analysis of impacts relative to applicable standards was not relevant, as there are no applicable standards. Analysis of long-term impacts on ambient noise levels was based on the experience and professional judgment of the noise engineer after review of the program descriptions.

Project-Level Analysis

Analysis of impacts relative to applicable standards was not relevant, as there are no applicable standards. Analysis of long-term impacts on ambient noise levels from direct project activities was based on the experience and professional judgment of the noise engineer after review of the project descriptions. Analysis of the noise impacts from boats on Thermalito Afterbay was based on a review of land use maps, aerial photos, and traffic volume data from Caltrans (Caltrans Website). With respect to long-term noise impacts resulting from vehicle trips associated with the Proposed Project, an assumption was made relative to new vehicle trips that would occur upon completion of the Proposed Project actions. Using the assumption and traffic volume data from Caltrans, the noise increase resulting from the additional traffic was calculated using accepted volume-noise relationships.

5.11.2.4 Impacts and Mitigation Measures

The following section describes the effects of the Proposed Project, including both programmatic and project-level analyses. Table 5.11-2 indicates the SA articles or actions that could have an effect on noise and whether these effects are expected to be beneficial, less-than-significant, or would be less-than-significant following implementation of recommended mitigation measures.

In addition to the Proposed Project, this DEIR analyzes the No-Project Alternative and the FERC Staff Alternative. Impacts on noise from implementing the FERC Staff Alternative are similar to those anticipated from implementation of the Proposed Project unless otherwise noted. Potential impacts are identified as follows: NO (No-Project), PRO (Proposed Project), and FERC (FERC Staff Alternative).

Both the Proposed Project and the FERC Staff Alternative analyzed result in **less-than-significant** impacts to noise with the implementation of BMPs, as described in Appendix D, to address short-term, construction-related impacts.

Table 5.11-2. Environmental effects on noise.

Alternative(s)	Article # and Title	Level of CEQA Analysis	Nature of Potential Impact(s)	Effects
PRO	A102—Gravel Supplementation and Improvement Program (Also see B105)	Programmatic with some Project elements	Short-term construction noise from vehicles and equipment hauling and placing gravel.	LTSM
FERC	A102—Gravel Supplementation and Improvement Program	Programmatic with some Project elements	Short-term construction noise from vehicles and equipment hauling and placing gravel.	LTSM
PRO, FERC	A103—Channel Improvement Program (This action is programmatic; however, Moe's and Hatchery Ditch activities are project-level)	Programmatic with some Project elements	Short-term construction noise from vehicles and equipment during grading and excavation. Long-term noise from vehicles used to support monitoring program.	LTSM LTS
PRO, FERC	A104—Structural Habitat Supplementation and Improvement Program (SHSI)	Programmatic	Short-term construction noise from vehicles and equipment hauling and placing woody debris, boulders, and other native objects.	LTSM
PRO	A106—Riparian and Floodplain Improvement Program	Programmatic	Short-term construction noise from vehicles and equipment.	LTSM
FERC	A106—Riparian and Floodplain Improvement Program (as revised by FERC staff to accelerate schedule)	Programmatic	Short-term construction noise from vehicles and equipment.	LTSM

Table 5.11-2. Environmental effects on noise.

Alternative(s)	Article # and Title	Level of CEQA Analysis	Nature of Potential Impact(s)	Effects
PRO, FERC	A110—Lake Oroville Warm Water Fishery Habitat Improvement Program	Programmatic	Short-term construction noise from vehicles and equipment hauling and placing brush shelters, rubble, boulders, and objects and constructing supporting shore facilities. Long-term noise from vehicles and watercraft used to support monitoring program.	LTSM LTS
PRO, FERC	A108, A107—Minimum Flow and Other Measures	Programmatic	Short-term construction noise from vehicles and equipment during grading and excavation, construction of new structures associated with the six alternative projects. Short-term construction noise from vehicles and equipment required to refurbish or replace river valve.	LTS/LTSM
PRO, FERC	A105—Fish Weir Program	Programmatic	Short-term construction noise from vehicles and equipment hauling and placing weirs.	LTSM
PRO, FERC	A111—Lake Oroville Cold Water Fishery Improvement Program	Programmatic	Noise from vehicles and equipment used to transport and place stock.	LTSM

Table 5.11-2. Environmental effects on noise.

Alternative(s)	Article # and Title	Level of CEQA Analysis	Nature of Potential Impact(s)	Effects
			Long-term noise from vehicles and watercraft used to support monitoring program.	LTS
PRO, FERC	A112—Comprehensive Water Quality Monitoring Program	Programmatic	Long-term noise from vehicles and watercraft used to support monitoring program.	LTS
PRO, FERC	A122—Construction and Recharge of Brood Ponds	Project	Short-term construction noise from vehicles and equipment during grading and construction of berms.	LTSM
PRO	A127—Recreation Management Plan Americans with Disabilities Act (ADA) compliance at existing facilities Trails Roads Parking Campgrounds Docks and Boat Ramps Other Facilities	Project	Short-term construction noise from vehicles and equipment during grading and excavation, construction of new facilities. Long-term increase in ambient noise levels at recreation facilities.	LTSM LTS
FERC	A127—SA Recreation Management Plan (RMP) (Revised by FERC staff to include modifications to trails development/implementation; reconstruction of boat-in campsites; delay of day use area at Foreman Creek)	Project	Short-term construction noise from vehicles and equipment during grading and excavation, construction of new facilities.	LTSM

Table 5.11-2. Environmental effects on noise.

Alternative(s)	Article # and Title	Level of CEQA Analysis	Nature of Potential Impact(s)	Effects
PRO	B102—Fuel Load Management Plan in Oroville Wildlife Area (OWA)	Programmatic	Short-term construction noise from equipment used for fuel treatment, construction of fire roads, fuel breaks.	LTSM
PRO	B107—Revision of Speed Limit Regulation for Thermalito Afterbay	Project	Long-term noise from watercraft.	LTS

Coding:

B = Action with potential to result in a beneficial effect; could involve short-term, less-than-significant, construction-related impacts that would be avoided or reduced through the use of Best Management Practices (BMPs). See Appendix D.

LTS = Action that would result in less-than-significant impact on resource.

LTSM = Action that would result in less-than-significant impact on resource following mitigation.

Program-Level Impacts and Mitigation Measures

Continuation of operations, maintenance, and recreation activities, construction of new or improved facilities, and implementation of new programs involving the use of construction equipment and operations of additional vehicles and watercraft would result in noise generation. The proposed programs that may result in noise generation are listed in Table 5.11-2.

Impact 5.11.2-a: Expose people to noise levels exceeding established standards of the local general plan or noise ordinance, or of other agencies.

NO — Under the No-Project Alternative, routine operations, maintenance, and recreational activities would continue. The noise levels resulting from these activities would not be anticipated to change from the existing conditions. There would be **no impact.**

PRO — The *Butte County General Plan* Noise Element has no standards applicable to the proposed programs. Butte County has no noise ordinance. There are no established standards of known to be applicable to the proposed programs. Therefore, there would be **no impact.**

FERC — Impacts associated with noise under the FERC Staff Alternative would be similar to those under the Proposed Project. The FERC Staff Alternative includes more robust monitoring of the Gravel Supplementation and Improvement Program (SA Article A102) and earlier implementation of the Riparian and Floodplain Improvement Program (SA Article A106). These impacts would be considered **less-than-significant** and no mitigation would be required.

Impact 5.11.2-b: Result in substantial temporary or periodic increase in ambient noise levels in the project vicinity above existing levels

NO — Under the No-Project Alternative, routine operations, maintenance, and recreational activities would continue. The noise levels from these activities would not be anticipated to change noticeably from the existing conditions. There would be **no impact**.

PRO, FERC — The programs listed in Table 5.11-2, with the exception of Water Quality Monitoring, would be anticipated to include projects that would include the use of construction equipment for creation of new facilities or improvement of existing facilities. As noted in the table, many of the programs include the transportation and placement of heavy materials, and some programs include elements that would require grading. During construction, the

principal source of noise would be the operation of diesel engine–driven heavy construction equipment and trucks performing the above tasks. Table 5.11-3 shows typical noise levels for construction equipment types that would likely be used on projects developed from the programs listed in Table 5.11-2. It is seen that most equipment has a maximum noise level of 85 A-weighted decibels (dBA) measured at a distance of 50 feet from the piece of equipment, and an acoustic usage of 40 percent, which would result in an hourly average noise level of 81 dBA at 50 feet.

Assuming a hard terrain in an urban setting, developed area, or over water, the noise levels would be reduced over distance at a rate of 6 dBA per doubling of distance. For the typical piece of equipment described above, the maximum noise level would be 79 dBA at 100 feet, 75 dBA at 160 feet, and 65 dBA at 500 feet. With soft terrain, such as agricultural or undeveloped forest land, noise levels would be reduced at an approximate rate of 7.5 dBA per doubling of distance, and the maximum noise level from 1 piece of equipment would be 75 dBA at 125 feet, 65 dBA at 315 feet, and 60 dBA at 500 feet. Hourly average noise levels would be approximately 4 dBA less. With 2 pieces of equipment operating, noise levels would be increased by 3 dBA.

Ambient daytime noise levels in recreational and agricultural areas are typically 50–55 dBA except in areas of powerboat or off-road vehicle use, or near heavily traveled roads. Nighttime noise levels are approximately 10 dBA less than during the daytime. Thus, people within 500 feet of daytime construction work would be likely to experience a substantial increase in the ambient noise level, and there would be periods when normal conversation would be disturbed. If construction were performed at night, the change in nearby noise levels would be severe with a high probability of sleep disturbance.

During the daytime, construction is not an unexpected activity, and while noisy, the operation of 1 or a few pieces of would not be considered a significant impact unless the receptor is within 75 feet of the equipment. While nighttime construction is not a normal occurrence, there are no applicable ordinances prohibiting nighttime work. Nighttime construction noise, with the greater change in noise levels and greater sensitivity of people to noise at night, could be a significant impact at distances up to 1,000 feet or more.

In recreational areas, it is reasonable to assume that persons using the areas on weekdays understand the need for ongoing construction, but on weekends these persons have expectations of

a relatively quiet environment.

Based on the above facts and discussion, it is concluded that a the construction noise resulting from the programs listed in Table 5.11-2, if occurring during the daytime on weekdays and requiring the use of diesel engine–driven heavy equipment, would cause a substantial temporary increase in ambient noise levels to receptors within 75 feet of the work area, and the impact would be **potentially significant.** With implementation of mitigation measures 5.11.2-b1 and 5.11.2-b2 described below, this impact would be reduced to **less-than-significant**.

Further, construction noise resulting from the programs listed in Table 5.11-2, if occurring during the nighttime or on weekends and requiring the use of diesel engine–driven heavy equipment, would cause a substantial temporary increase in ambient noise levels to receptors within 1,000 feet of the work area, and the impact would be potentially **significant.** With implementation of mitigation measures 5.11.2-b1 and 5.11.2-b2 described below, this impact would be reduced to **less-than-significant**.

Table 5.11-3. Construction equipment noise levels.

Equipment Description	L_{max} Noise Limit at 50 ft (dBA)	Acoustic Usage Factor[1]
Backhoe	80	40%
Compactor (ground)	80	20%
Concrete Mixer Truck	85	40%
Dozer	85	40%
Dump Truck	84	40%
Excavator	85	40%
Front End Loader	80-85	40%
Grader	85	40%
Paver	85-89	50%
Scraper	85-89	40%
All other equipment > 5 hp	85	50%

Notes: dBA = A-weighted decibels; hp = horsepower; L_{max} = maximum noise level (the maximum instantaneous noise level during a specific period)

[1] *Represents the percent of time that equipment is assumed to be running at full power while working on site.*

Sources: Thalheimer 2000; FTA 2006

Mitigation measure 5.11.2-b1: Implement Noise Abatement Measures for Daytime Heavy Construction Close to Sensitive Receptors.

PRO, FERC — If projects developed from the programs listed in Table 5.11-2 require the use of heavy construction equipment closer than 75 feet to residences, campgrounds, or similar recreation or noise-

sensitive areas, the construction manager would either (a) arrange for all persons who would otherwise be within 75 feet of the work area to be moved to a farther distance or prevented from camping or recreating within the 75-foot limit, or, if not feasible, (b) erect temporary barriers of wood, noise abatement blankets, or similar material between the work area and the receptors. The barriers should be at least 8 feet high and solid from the ground to the top, and made of material that would reduce noise through the barrier (transmission loss) by at least 20 dBA. Plywood one-half inch thick would meet this requirement. This mitigation measure would provide protective measures to avoid a substantial temporary increase in ambient noise levels near sensitive receptors due to daytime construction activities. Consequently, this impact would be reduced to a **less-than-significant** level.

Mitigation measure 5.11.2-b2: Limit the Hours of Construction to Weekday Daytime Hours.

PRO, FERC — The project applicant would require construction contractors to limit noise-generating construction activities to the hours of 7 a.m. to 8 p.m., Monday through Friday, with no noise-generating activities on Saturdays, Sundays, or legal holidays. However, this restriction would not be applicable if it would result in operational impacts on the Oroville Facilities or prevent activities to mitigate adverse conditions such as response to emergencies or other unforeseen situations. This measure does not prevent the accomplishment of work that does not generate unusual noise, such as inspections or surveying. This mitigation measure would provide protective measures to avoid a substantial temporary increase in ambient noise levels near sensitive receptors due to nighttime and weekend construction activities. Consequently, this impact would be reduced to a **less-than-significant** level.

Impact 5.11.2-c: Result in a permanent increase in ambient noise above existing levels.

NO — Under the No-Project Alternative, routine operations, maintenance, and recreational activities would continue. The noise levels from these activities would not be anticipated to change noticeably from the existing conditions. There would be **no impact**.

PRO, FERC — Table 5.11-2 shows the programs that would have a continuing potential for noise impacts. Each of these projects includes ongoing monitoring that would entail the use of light vehicles and watercraft. For some of the programs, the monitoring would likely be infrequent, such as once every 3 years or 5 years. Overall, the

additional noise generated from the few trips by the light vehicles and watercraft used in these programs would be **less-than-significant.**

The goals of most of the programs listed in Table 5.11-2 are to improve the aquatic habitat, and these programs would not generate a noticeable increase in use of the recreational facilities. It is presumed that the projects that improve recreation facilities and add campsites would induce more recreational visitors, and would increase the number of vehicle trips to and from the area. Provision of up to 15 new campsites at Loafer Creek could generate additional traffic, but the additional number of trips would be very small when compared with existing traffic. The impact to an increase in noise would be **less-than-significant** and no mitigation would be required.

Project-Level Impacts and Mitigation Measures

Continuation of operations, maintenance, and recreation activities, construction of new or improved facilities, and implementation of new projects involving the use of construction equipment and operation of additional vehicles and watercraft would result in the generation of noise. The proposed projects that may result in noise generation are listed in Table 5.11-2.

Impact 5.11.2-a: Expose people to noise levels exceeding established standards of the local general plan or noise ordinance, or of other agencies.

NO — Under the No-Project Alternative, routine operations, maintenance, and recreational activities would continue. The noise environment would not be anticipated to change from the existing conditions. There would be **no impact.**

PRO, FERC — The *Butte County General Plan* Noise Element has no standards applicable to the Proposed Project. Butte County has no adopted noise ordinance. There are no established standards of other agencies known to be applicable to the Proposed Project activities. Therefore, there would be **no impact** and no mitigation would be required.

Impact 5.11.2-b: Result in a substantial temporary or periodic increase in ambient noise levels in the project vicinity above existing levels.

NO — Under the No-Project Alternative, routine operations, maintenance, and recreational activities would continue. The noise levels from these activities would not be anticipated to change noticeably from

the existing conditions. There would be **no impact**.

PRO, FERC

The projects listed in Table 5.11-2 would be anticipated to include the use of construction equipment for creation of new facilities or improvement of existing facilities. During construction, the principal source of noise would be the operation of diesel engine–driven heavy construction equipment and trucks performing the above tasks. Table 5.11-3 shows typical noise levels for construction equipment types that would likely be used. It is seen that most equipment has a maximum noise level of 85 dBA measured at a distance of 50 feet from the piece of equipment, and an acoustic usage of 40 percent, which would result in an hourly average noise level of 81 dBA at 50 feet.

Assuming a hard terrain in an urban setting, developed area, or over water, the noise levels would be reduced over distance at a rate of 6 dBA per doubling of distance. For the typical piece of equipment described above, the maximum noise level would be 79 dBA at 100 feet, 75 dBA at 160 feet, and 65 dBA at 500 feet. With soft terrain, such as agricultural or undeveloped forest land, noise levels would be reduced at an approximate rate of 7.5 dBA per doubling of distance, and the maximum noise level from 1 piece of equipment would be 75 dBA at 125 feet, 65 dBA at 315 feet, and 60 dBA at 500 feet. Hourly average noise levels would be approximately 4 dBA less than these levels. With 2 pieces of equipment operating, noise levels would be increased by 3 dBA.

Ambient daytime noise levels in recreational and agricultural areas are typically 50–55 dBA except in areas of powerboat or off-road vehicle use, or near heavily traveled roads. Nighttime noise levels are approximately 10 dBA less than during the daytime. Thus, people within 500 feet of daytime construction work would be likely to experience a substantial increase in the ambient noise level, and there would be periods when normal conversation would be disturbed. If construction were performed at night, the change in nearby noise levels would be severe with a high probability of sleep disturbance.

During the daytime, construction is not an unexpected activity, and while noisy, the operation of 1 or a few pieces of equipment would not be considered a significant impact unless the receptor is within 75 feet of the equipment. While nighttime construction is not a normal occurrence, there are no applicable ordinances prohibiting nighttime work. Nighttime construction noise, with the greater change in noise levels and greater sensitivity of people to noise at night, could be a significant impact at distances up to 1,000 feet or more.

In recreational areas, it is reasonable to assume that persons using the areas on weekdays understand the need for ongoing construction, but on weekends these persons have higher expectations of a relatively quiet environment.

Based on the above facts and discussion, it is concluded that a the construction noise resulting from the projects listed in Table 5.11-2, if occurring during the daytime on weekdays and requiring the use of diesel–engine driven heavy equipment, would cause a substantial temporary increase in ambient noise levels to receptors within 75 feet of the work area, and the impact would be **potentially significant.** With implementation of mitigation measures 5.11.2-b1 and 5.11.2-b2 described below, this impact would be reduced to **less-than-significant**.

Further, construction noise resulting from the programs listed in Table 5.11-2, if occurring during the nighttime or on weekends and requiring the use of diesel engine–driven heavy equipment, would cause a substantial temporary increase in ambient noise levels to receptors within 1,000 feet of the work area, and the impact would be **potentially significant.** With implementation of mitigation measures 5.11.2-b1 and 5.11.2-b2 described below, this impact would be reduced to **less-than-significant**.

Mitigation measure 5.11.2-b1: Implement Noise Abatement Measures for Daytime Heavy Construction Close to Sensitive Receptors.

PRO, FERC

If projects listed in Table 5.11-2 require the use of heavy construction equipment closer than 75 feet to residences, campgrounds, or similar recreation or noise-sensitive areas, the construction manager would either (a) arrange for all persons who would otherwise be within 75 feet of the work area to be moved to a farther distance or prevented from camping or recreating within the 75-foot limit, or, if not feasible, (b) erect temporary barriers of wood, noise abatement blankets, or similar material between the work area and the receptors. The barriers should be at least 8 feet high and solid from the ground to the top, and made of material that would reduce noise through the barrier (transmission loss) by at least 20 dBA. Plywood one-half inch thick would meet this requirement. This mitigation measure would provide protective measures to avoid a substantial temporary increase in ambient noise levels near sensitive receptors due to daytime construction activities. Consequently, this impact would be reduced to a **less-than-significant** level.

Mitigation measure 5.11.2-b2: Limit the Hours of Construction to Weekday Daytime Hours.

PRO, FERC — The project applicant would require construction contractors to limit noise-generating construction activities to the hours of 7 a.m. to 8 p.m., Monday through Friday, with no noise-generating activities on Saturdays, Sundays, or legal holidays. This measure does not prevent the accomplishment of work that does not generate unusual noise, such as inspections or surveying. This mitigation measure would provide protective measures to avoid a substantial temporary increase in ambient noise levels near sensitive receptors due to nighttime and weekend construction activities. Consequently, this impact would be reduced to a **less-than-significant** level.

Impact 5.11.2-c: Result in a permanent increase in ambient noise above existing levels.

NO — Under the No-Project Alternative, routine operations, maintenance, and recreational activities would continue. The long-term ambient noise levels would not be anticipated to change noticeably from the existing conditions. There would be **no impact** from these activities.

PRO, FERC — Table 5.11-2 shows the projects that would have a continuing potential for noise impacts. Each of these projects, except the revision of the speed limit for Thermalito Afterbay, includes ongoing monitoring that would entail the use of light vehicles and watercraft. For some of the programs, the monitoring would be infrequent, such as once every 3 years or 5 years. Overall, the noise generation from the occasional vehicle use would be **less-than-significant.**

Revision of the speed limit for Thermalito Afterbay (SA Section B107) would include allowing higher legal speeds on the portion of the afterbay south of SR 162, and improving enforcement of the 5 mph speed limit on the remainder of the afterbay. Since current boat operation occurs at higher speeds already, the Proposed Project is not expected to increase ambient noise levels. Nearly all of the land use adjacent to the afterbay south of SR 162 is agricultural. On the west, there are some residences, and the dominant noise to these homes is traffic noise from SR 99, which is between the afterbay and the homes. Scattered residences to the south are further from SR 99, and are closer to another noise source, the Oroville Municipal Airport. At the few residences near the afterbay, the noise increase from boat operations would likely be heard on occasion. However, with the small number of residences and the existing noise environment, the increase would

be **less-than-significant.**

In addition to the projects listed in Table 5.11-2, it is presumed that the projects that improve recreation facilities and add campsites would induce more recreational visitors, and would increase the number of vehicle trips to and from the area. While the number of additional visitors has not been calculated, it was assumed that the improved and additional facilities could add an average of 500 trips per day. These trips would be divided among the various roadways used for access to the recreation areas. Average daily traffic (ADT) volumes on SR 70, SR 99, and SR 162 in the local area range from 1,850 to more than 10,000 ADT, with the lowest volume of 1,850 occurring on SR 162 between Forbestown Road and Loafer Creek Campground (Caltrans Website). If 500 ADT were added to this segment, the traffic noise increase would be 1 dBA, which would be imperceptible. If 500 ADT were added to segments with greater volumes than 1,850, the traffic noise increase would be less than 1 dBA. The impact would be **less-than-significant** and no mitigation would be required.

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5.12 AIR QUALITY

5.12.1 Regulatory Setting

5.12.1.1 Federal Plans, Policies, Regulations, and Laws

At the federal level, the U.S. Environmental Protection Agency (USEPA) has been charged with implementing national air quality programs. USEPA's air quality mandates are drawn primarily from the federal Clean Air Act (CAA), which was enacted in 1970. The most recent major amendments made by Congress were in 1990.

The CAA required USEPA to establish national ambient air quality standards (NAAQS). As shown in Table 4.12-1 in Section 4.12, USEPA has established primary and secondary NAAQS for the following criteria air pollutants: ozone, carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), respirable particulate matter (PM_{10}), fine particulate matter ($PM_{2.5}$), and lead. The primary standards protect the public health and the secondary standards protect public welfare. The CAA also required each state to prepare an air quality control plan referred to as a State Implementation Plan (SIP). The SIP is periodically modified to reflect the latest emissions inventories, planning documents, and rules and regulations of the air basins as reported by their jurisdictional agencies. If USEPA determines a SIP to be inadequate, a Federal Implementation Plan (FIP) may be prepared for the nonattainment area that could impose additional control measures.

Federal Hazardous Air Pollutant Programs

USEPA has programs for identifying and regulating Toxic Air Contaminants (TACs), or in federal parlance hazardous air pollutants (HAPs). The emissions standards are promulgated in two phases. HAP statutes and regulations generally require the use of the maximum or best available control technology for toxics (MACT and BACT) to limit emissions. In the first phase (1992–2000), USEPA developed technology-based emission standards designed to produce the maximum emission reduction achievable. In the second phase (2001–2008), USEPA is required to promulgate health risk–based emissions standards where deemed necessary to address risks remaining after implementation of the technology-based standards.

The CAA also required USEPA to promulgate vehicle or fuel standards containing reasonable requirements that control toxic emissions, at a minimum to benzene and formaldehyde. Performance criteria were established to limit mobile-source emissions of toxics, including benzene, formaldehyde, and 1,3-butadiene. In addition, Section 219 required the use of reformulated gasoline in selected areas with the most severe ozone nonattainment conditions to further reduce mobile-source emissions.

5.12.1.2 State Plans, Policies, Regulations, and Laws

The California Air Resources Board (ARB) is the agency responsible for coordination and oversight of State and local air pollution control programs in California and for

implementing the California Clean Air Act (CCAA) (1988). The CCAA, which was adopted in 1988, required ARB to establish California ambient air quality standards (Table 4.12-1). In most cases the California standards are more stringent than national standards. The California standards incorporate a margin of safety to protect sensitive individuals. The CCAA specifies that local air districts should focus particular attention on reducing the emissions from transportation and area-wide emission sources, and provides districts with the authority to regulate indirect sources.

Other ARB responsibilities include, but are not limited to, overseeing local air district compliance with California and federal laws, approving local air quality plans, submitting SIPs to USEPA, monitoring air quality, determining and updating area designations and maps, and setting emissions standards for new mobile sources, consumer products, small utility engines, off-road vehicles, and fuels.

State Toxic Air Contaminant Programs

In California, TACs are primarily regulated through the Tanner Air Toxics Act and the Air Toxics Hot Spots Information and Assessment Act of 1987. Through these laws, ARB can designate substances as TACs. To date, ARB has identified over 21 TACs, and adopted USEPA's list of HAPs as TACs. Once a TAC is identified, ARB then adopts an Airborne Toxics Control Measure for sources that emit that particular TAC. If there is a safe threshold for a substance at which there is no toxic effect, the control measure must reduce exposure below that threshold. If there is no safe threshold, the measure must incorporate BACT to minimize emissions. Most recently, diesel particulate matter (PM) was added to the ARB list of TACs.

ARB has adopted diesel exhaust control measures and more stringent emission standards for various on-road mobile sources of emissions, including transit buses, and off-road diesel equipment (e.g., tractors, generators). Future control measures include the low-sulfur diesel fuel requirement, and tighter emission standards for heavy-duty diesel trucks (2007) and off-road diesel equipment (2011) nationwide.

ARB recently published the *Air Quality and Land Use Handbook: A Community Health Perspective*, which provides guidance concerning land use compatibility with TAC sources (ARB 2005). While not a law or adopted policy, the handbook offers advisory recommendations for the siting of sensitive receptors near uses associated with TACs such as freeways and high-traffic roads, commercial distribution centers, rail yards, ports, refineries, dry cleaners, gasoline stations, and industrial facilities to help keep children and other sensitive populations out of harm's way.

State regulations on asbestos are related to demolition and renovations, and waste deposal of asbestos-containing materials. California also has a statewide regulation covering naturally occurring asbestos (NOA). The Asbestos ATCM for Asbestos-Containing Serpentine, adopted in 1990, prohibited the use of serpentine aggregate for surfacing if the asbestos content was 5% or more, which was lowered to 0.25% in 2000 and modified to include ultramafic rock.

In July 2001, ARB adopted an ATCM for construction, grading, quarrying, and surface mining operations that regulates grading and excavation activities in areas of serpentine or ultramafic rocks. In addition, the Governor's Office of Planning and Research issued a memorandum providing guidance to lead agencies in analyzing the impacts of NOA through the CEQA review process.

Executive Order S-3-05

On June 1, 2005, Governor Arnold Schwarzenegger issued Executive Order S-3-05 establishing greenhouse gas (GHG) emission targets for California and requiring biennial reports on potential climate change effects on several areas, including water resources. A Climate Action Team (CAT) was established by the governor to lead the reporting efforts. The order established the following goals for reducing GHG emissions in the state:

- By 2010, reduce emissions to the 2000 level.
- By 2020, reduce emissions to the 1990 level.
- By 2050, reduce emissions to 80 percent below 1990 emissions.

The Executive Order identifies the agencies involved and coordination expected:

> The Secretary of the California Environmental Protection Agency shall coordinate oversight of the efforts to meet the targets with: the Secretary of the Business, Transportation and Housing Agency, Secretary of the Department of Food and Agriculture, Secretary of the Resources Agency, Chairperson of the Air Resources Board, Chairperson of the Energy Commission, and the President of the Public Utilities Commission.

Due to the low GHG emissions from California reservoirs relative to replacement power sources, it is anticipated that under future implementation of the Renewable Portfolio Standards, hydroelectric generation will play a role in meeting these statewide reduction targets by replacing power produced by higher GHG-emitting thermal power sources. (*Renewables Portfolio Standard (RPS) Eligibility Guidebook*, publication #CEC-300-2006-007-F, adopted April 26, 2006 [CEC Website].)

Assembly Bill 32

In 2006, the California Legislature passed Assembly Bill 32 (also known as the Global Warming Solutions Act of 2006), which establishes a State goal of reducing GHG emissions to 1990 levels by 2020. The bill requires ARB to adopt regulations and develop an enforcement mechanism to ensure compliance. ARB is currently developing policy for GHG reductions in the state.

5.12.1.3 Local Plans, Policies, Regulations, and Laws

Butte County Air Quality Management District

Butte County Air Quality Management District (BCAQMD) is the primary local agency responsible for protecting the people and the environment of Butte County from the effects of air pollution. BCAQMD is responsible for adopting rules that limit pollution, issuing permits to ensure compliance, and inspecting pollution sources. BCAQMD also monitors air quality in the county and prepares plans to demonstrate how compliance with state and federal standards would be attained and maintained.

Air Quality Plans

Federal and State air quality laws also require regions designated as nonattainment to prepare plans that demonstrate how the region will attain the pollutant standard. Air quality planning in the Northern Sacramento Valley Air Basin has been undertaken on a joint basis by the air districts in seven counties, including Butte County. The current plan, the *2003 Air Quality Attainment Plan* (2003 AQAP), is an update of plans prepared in 1994, 1997, and 2000. The purpose of the plan is to achieve and maintain healthful air quality throughout the air basin. The 2003 AQAP addresses the progress made in implementing the 2000 plan and proposes modifications to the strategies necessary to attain the California ambient air quality standard for the 1-hour ozone standard at the earliest practicable date. BCAQMD has current air quality plans for ozone and PM_{10}.

Butte County

There is no air quality element in the existing *Butte County General Plan*. Butte County (County) is in the process of updating its general plan and has produced technical background reports, including one for air quality. This implies that there could be an air quality element when the updated general plan is adopted by the County.

5.12.2 Impact Thresholds

The following thresholds are used to determine whether the alternatives would have a significant effect on air quality. There would be a significant impact if the alternatives would:

- 5.12-a: Violate any air quality standard or contribute substantially to an existing or projected air quality violation;
- 5.12-b: Conflict with or obstruct implementation of an applicable air quality plan;
- 5.12-c: Expose sensitive receptors to substantial pollutant concentrations;
- 5.12-d: Create objectionable odors affecting a substantial number of people; or

- 5.12-e: Result in a cumulatively considerable net increase of any criteria pollutant for which the Project region of influence is nonattainment under an applicable federal or State ambient air quality standard.

BCAQMD does not have quantitative thresholds. There are currently no regulatory standards for GHG emissions or other scientific data to help define what could constitute a significant impact.

5.12.3 Method of Analysis

5.12.3.1 Quantitative Thresholds

Quantitative thresholds were developed from the USEPA General Conformity Rule governing federal actions. The most recent thresholds were published in the Federal Register on July 17, 2006.

5.12.3.2 Program-Level Analysis

Program-level actions indicate that all of the actions except one would require the use of construction equipment. Based on the review of both the program-level and project-level descriptions, an "example" project was developed. This example would be a 12-month project that includes grading with 3 pieces of heavy equipment working concurrently, followed by construction with 3 pieces of heavy equipment, followed by painting and asphalt paving. The emissions of this "example" were quantified using the URBEMIS 2002 software package, version 8.7 (ARB 2005). URBEMIS is a calculation tool designed to estimate air emissions from land use development and the model contains data that are specific for each California air basin. Although programs might occur over 10 years or more, emission factors for 2008 were used, which is a conservative assumption because emission factors would decrease in later years with the continuing improvement in emission reduction technology for diesel engines.

Post-construction emissions at the program level were not quantified because a review of the programs indicated that the post-construction activities would be minimal. Potential mitigation measures were developed to be consistent with the Rules of the BCAQMD and accepted emission control methods.

The GHG emissions from the Oroville Facilities when compared to Existing Conditions are expected to either remain unchanged or decrease with age of the reservoir under any of the alternatives. No actions in any of the alternatives analyzed would result in a significant increase in GHG emissions from the Oroville Facilities and therefore, there are **no impacts**.

5.12.3.3 Project-Level Analysis

Although actions are more specifically described at the project level, the detail is not specific enough to assess individual projects quantitatively. For construction impacts, the "example" project analysis developed for the program-level analysis was also used

at the project level. Post-construction emissions associated with some of the actions would be negligible.

5.12.4 Impacts and Mitigation Measures

The following section describes the effects of the No-Project, Proposed Project, and the FERC Staff Alternative. Impacts on air quality from implementing the FERC Staff Alternative are similar to those anticipated from implementation of the Proposed Project. Potential impacts are identified as follows: NO (No-Project), PRO (Proposed Project), and FERC (FERC Staff Alternative). Table 5.12-1 indicates the SA articles or actions that could have an effect on air quality and whether these effects are expected to be beneficial, less-than-significant, or would be less-than-significant following implementation of recommended mitigation measures. All alternatives analyzed result in **less-than-significant** impacts on air quality with the implementation of best management practices (BMPs) included in both the Proposed Project and the FERC Staff Alternative and as described in Appendix D, and mitigation measures described below to address short-term, construction-related impacts.

5.12.4.1 Program-Level Impacts and Mitigation Measures

Continuation of operations, maintenance, and recreation activities, construction of new or improved facilities, implementation of new programs involving ground disturbance, and the use of construction equipment and operations of additional vehicles and watercraft would result in the emission of air pollutants. The proposed programs that may result in the emission of air pollutants are listed in Table 5.12-1.

Impact 5.12-a: Violate any air quality standard or contribute substantially to an existing or projected air quality violation.

NO — Under the No-Project Alternative, routine operations, maintenance, and recreational activities would continue. Emissions of gaseous and particulate pollutants, including GHGs, would not be anticipated to change noticeably from Existing Conditions. There would be **no impact** from these activities.

PRO — BCAQMD does not have quantitative thresholds to define CEQA significance or substantial quantities of emissions. Guidance may be taken from the USEPA General Conformity Rule governing federal actions, which has de minimis levels of 100 tons per year for oxides of nitrogen (NO_X), reactive organic gases (ROG), PM_{10}, and $PM_{2.5}$ in areas where the air quality is better than "serious," which is the case for Butte County (Federal Register, July 17, 2006; 40 Code of Federal Regulations [CFR] Parts 51 and 93). Projects with emissions less than these de minimis thresholds are presumed to conform with plans for attaining and maintaining ambient air quality standards, and therefore would not have a

Table 5.12-1. Environmental effects on air quality.

Alternative(s)	Article # and Title	Level of CEQA Analysis	Nature of Potential Impact(s)	Effects
PRO	A102—Gravel Supplementation and Improvement Program	Programmatic with some Project elements	Short-term pollutant emissions from vehicles and equipment hauling and placing gravel	LTSM
FERC	A102—Gravel Supplementation and Improvement Program	Programmatic with some Project elements	Short-term pollutant emissions from vehicles and equipment hauling and placing gravel	LTSM
PRO, FERC	A103—Channel Improvement Program (This action is programmatic; however, Moe's and Hatchery Ditch activities are project-level)	Programmatic with some Project elements	Short-term pollutant emissions from vehicles and equipment during grading and excavation Long-term pollutant emissions from vehicles used to support monitoring program	LTSM LTS
PRO, FERC	A104—Structural Habitat Supplementation and Improvement Program (SHSI)	Programmatic	Short-term pollutant emissions from vehicles and equipment hauling and placing woody debris, boulders, and other native objects	LTSM
PRO	A106—Riparian and Floodplain Improvement Program	Programmatic	Short-term pollutant emissions from vehicles and equipment during construction	LTSM

Table 5.12-1. Environmental effects on air quality.

Alternative(s)	Article # and Title	Level of CEQA Analysis	Nature of Potential Impact(s)	Effects
FERC	A106—Riparian and Floodplain Improvement Program (as revised by FERC staff to accelerate schedule)	Programmatic	Short-term pollutant emissions from vehicles and equipment during construction	LTSM
PRO, FERC	A110—Lake Oroville Warm Water Fishery Habitat Improvement Program	Programmatic	Short-term pollutant emissions from vehicles and equipment hauling and placing brush shelters, rubble, boulders, and objects and constructing supporting shore facilities Long-term pollutant emissions from vehicles and watercraft used to support monitoring program	LTSM LTS
PRO, FERC	A108, A107—Minimum Flow and Other Measures	Programmatic	Short-term construction pollutant emissions from vehicles and equipment during grading and excavation, construction of new structures associated with the six alternative projects Short-term construction pollutant emissions from vehicles and equipment required to refurbish or replace river valve	LTS

Table 5.12-1. Environmental effects on air quality.

Alternative(s)	Article # and Title	Level of CEQA Analysis	Nature of Potential Impact(s)	Effects
PRO, FERC	A105—Fish Weir Program	Programmatic	Short-term pollutant emissions from vehicles and equipment hauling and placing weirs	LTSM
PRO, FERC	A111—Lake Oroville Cold Water Fishery Improvement Program	Programmatic	Short-term pollutant emissions from vehicles and equipment used to transport and place stock Long-term pollutant emissions from vehicles and watercraft used to support monitoring program	LTS LTS
PRO, FERC	A112—Comprehensive Water Quality Monitoring Program	Programmatic	Long-term pollutant emissions from vehicles and watercraft used to support monitoring program	LTS
PRO, FERC	A122—Construction and Recharge of Brood Ponds	Project	Short-term pollutant emissions from vehicles and equipment during grading and construction of berms	LTSM
PRO	A127—Recreation Management Plan ADA compliance at existing facilities Trails Roads Parking Campgrounds Docks and Boat Ramps Other Facilities	Project	Short-term pollutant emissions from vehicles and equipment during grading and excavation, construction of new facilities Long-term pollutant emissions from vehicles and watercraft from use of recreation facilities	LTSM LTS

Table 5.12-1. Environmental effects on air quality.

Alternative(s)	Article # and Title	Level of CEQA Analysis	Nature of Potential Impact(s)	Effects
FERC	A127—Modified Recreation Management Plan Same as A127 with: Reconstruct boat-in campgrounds	Project	Short-term pollutant emissions noise from vehicles and equipment during grading and excavation, construction of new facilities	LTSM
PRO	B107—Revision of Speed Limit Regulation for Thermalito Afterbay	Project	Long-term pollutant emission from watercraft	LTS

Coding:

B = Action with potential to result in a beneficial effect; could involve short-term, less-than-significant, construction-related impacts that would be avoided or reduced through the use of Best Management Practices (BMPs). See Appendix D.

LTS = Action that would result in less-than-significant impact on resource.

LTSM = Action that would result in less-than-significant impact on resource following mitigation.

significant impact. No increases in GHG emissions are expected from the Proposed Project; therefore, there would be **no impact** from these activities.

Short-Term Construction

The programs listed in Table 5.12-1, with the exception of Water Quality Monitoring, would be anticipated to include projects that would include the use of construction equipment for creation of new facilities or improvement of existing facilities. With respect to air quality standards, the principal pollutant of concern from construction equipment engine exhaust is NO_X. Engine exhaust also includes ROG, PM_{10}, $PM_{2.5}$, and other pollutants. Grading and other ground disturbance activities produce particulates, PM_{10}, and $PM_{2.5}$. Painting and paving emit ROG.

While specific projects are not defined for some of the programs listed in Table 5.12-1, emissions were calculated for an "example" 12-month project that includes grading with 3 pieces of heavy equipment working concurrently, followed by construction with 3 pieces of heavy equipment, followed by painting and asphalt paving. NO_X emissions for this "sample" project would be less than 5 tons per year; ROG emissions would be less than 1 ton per year; PM_{10} emissions would be less than 2 tons per year. Some of the projects implied by the programs listed in Table 5.12-1 would be of the order of magnitude of the "sample" project described above; many would be of lesser magnitude; some projects could be more intense. (Typical projects are discussed further in Section 5.12.4.2 below.) The projects included in the programs would not all occur in the same year. As the emissions of the "sample" project are less than 5 percent of the de minimis thresholds, it is concluded that the air quality impacts of the programs listed in Table 5.12-1 would be **less-than-significant.**

One program, the Fuel Load Management Program, would have the potential to violate an air quality standard. Fuel management programs may include prescribed burning. Smoke from fires can be a source of high concentrations of particulates, including PM_{10} and $PM_{2.5}$. If the fuel management projects were limited to mechanical treatment for fuel removal, the sources of emissions would be construction equipment and ground disturbance, and air quality impacts would be less-than-significant, as described above. If the projects include prescribed burns, the impact would be **potentially significant**. With implementation of mitigation measure 5.12-a, this impact would be reduced to less-than-significant.

Long-term Operations

Table 5.12-1 shows the programs that would have a continuing potential for air quality impacts. Each of these programs includes ongoing monitoring that would entail the use of light vehicles and watercraft. For some of the programs, the monitoring would likely be infrequent, such as once every 3 years or 5 years. Overall, the emissions from light vehicles and watercraft used in these programs would be very small and **less-than-significant.**

The goals of most of the programs listed in Table 5.12-1 are to improve the aquatic habitat, and these programs would not generate a noticeable increase in use of the recreational facilities. It is presumed that the projects that improve recreation facilities and add campsites would induce more recreational visitors, and would increase the number of vehicle trips to and from the area. Provision of up to 15 new campsites at Loafer Creek could generate additional traffic, but the additional number of trips would be very small when compared with existing traffic. Therefore, the impact would be **less-than-significant.**

FERC — Impacts on air resources under the FERC Staff Alternative would be similar to those under the Proposed Project. The FERC Staff Alternative includes more robust monitoring of the Gravel Supplementation and Improvement Program (SA Article A102) and earlier implementation of the Riparian and Floodplain Improvement Program (SA Article A106). These impacts would be considered **less-than-significant.**

Mitigation measure 5.12-a: Conduct Prescribed Burns in Accordance with the Rules of BCAQMD.

PRO, FERC — If projects developed under the Fuel Load Management Program include prescribed burns, the burns would be planned and coordinated with the BCAQMD in accordance with their Rule 309—Wildland Vegetation Management Burning. All prescribed burns would be approved by BCAQMD prior to execution. This mitigation measure would ensure that prescribed burns would be designed and conducted to avoid significant PM_{10} and $PM_{2.5}$ concentrations. Consequently, the impact would be **less-than-significant**.

Impact 5.12-b: Conflict with or obstruct implementation of an applicable air quality plan.

NO — Under the No-Project Alternative, routine operations, maintenance, and recreational activities would continue. Emissions of gaseous and particulate pollutants, including GHGs, would not be anticipated to change noticeably from Existing Conditions. There would be **no impact** from these activities.

PRO, FERC — Air quality planning in the Northern Sacramento Valley Air Basin (NSVAB) has been undertaken on a joint basis by the air districts in seven counties, including Butte County. The current plan, the 2003 AQAP, is an update of plans prepared in 1994, 1997, and 2000. The purpose of the plan is to achieve and maintain healthful air quality throughout the air basin. The 2003 AQAP addresses the progress made in implementing the 2000 plan and proposes modifications to the strategies necessary to attain the California ambient air quality standard for the 1-hour ozone standard at the earliest practicable date.

As described in the Impact 5.12-a discussion, actions that are anticipated to emit pollutants at a rate less than the General Conformity Rule de minimis levels are presumed to conform with attainment plans. The proposed programs of Table 5.12-1 would have annual emissions of the ozone precursors, NO_X and ROG, less than these de minimis thresholds. Therefore, there would be no conflict with the 2003 AQAP, **no impact** and no mitigation would be required.

Mitigation measure 5.12-b: No mitigation is required.

Impact 5.12-c: Expose sensitive receptors to substantial pollutant concentrations.

NO — Under the No-Project Alternative, routine operations, maintenance, and recreational activities would continue. Emissions of gaseous and particulate pollutants would not be anticipated to change noticeably from Existing Conditions. Some of these activities may expose residents or persons involved in recreational activities to pollutants, such as dust and the exhaust from watercraft engines and maintenance vehicles and equipment. The quantity of pollutants would not be substantial and the impact would be **less-than-significant**.

PRO — Each of the proposed programs of Table 5.12-1, with the exception of the Lake Oroville Cold Water Fishery Improvement and Comprehensive Water Quality Monitoring Programs, could

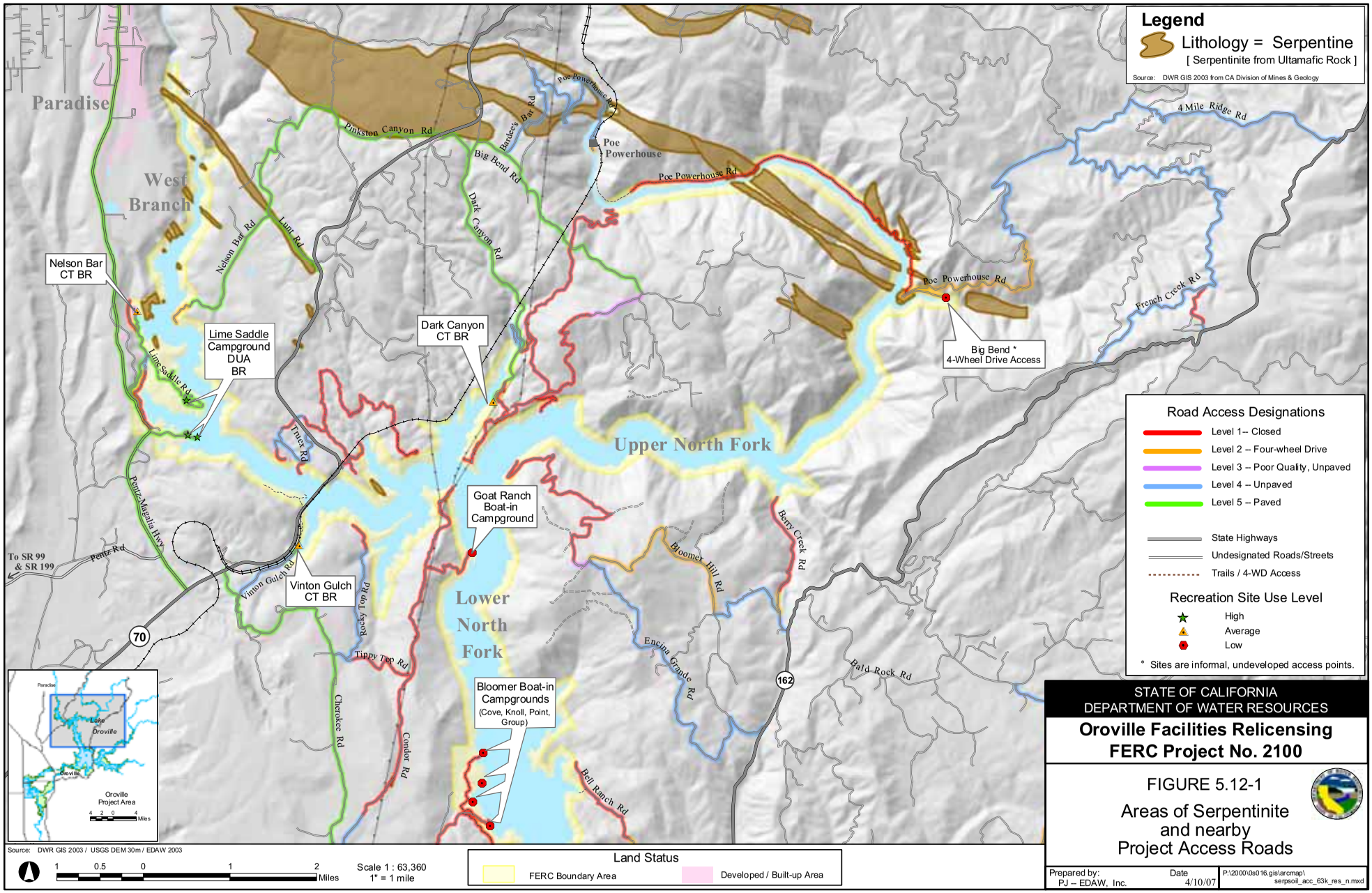
include projects with the potential for the generation of dust from grading activities or diesel engine exhaust from construction equipment, or both. If the grading work was performed in close proximity to sensitive receptors, there would be a potential for exposure to substantial concentrations of pollutants. Therefore, there would be a **potentially significant** impact. With implementation of mitigation measure 5.12-c, this impact would be reduced to less-than-significant.

Particulate exhaust emissions from diesel-fueled engines (diesel PM) were identified as a TAC by ARB in 1998. Implementation of some projects would result in the generation of diesel PM emissions from the use of off-road diesel equipment required for site grading and excavation, paving, and other construction activities. According to ARB, the potential cancer risk from the inhalation of diesel PM outweighs the potential non-cancer health impacts (ARB 2003).

The dose to which receptors are exposed is the primary factor used to determine health risk (i.e., potential exposure to TAC emission levels that exceed applicable standards). Dose is a function of the concentration of a substance or substances in the environment and the duration of exposure to the substance. Dose is positively correlated with time, meaning that a longer exposure period would result in a higher exposure level for the maximally exposed individual. Thus, the risks estimated for a maximally exposed individual are higher if a fixed exposure occurs over a longer period of time.

For the projects anticipated from the programs listed in Table 5.12-1, the use of mobile equipment would be temporary and project construction activities would not be atypical in comparison to similar development-type projects (i.e., no excessive material transport or unique operations requiring concentrated equipment groups), short-term construction activities would not result expose sensitive receptors to substantial TAC concentrations. This would be a **less-than-significant** impact.

NOA was identified as a TAC by ARB in 1986. Exposure to soil dust containing asbestos can occur from dust raised from unpaved roads and driveways covered with crushed serpentine, and construction and grading activities. As shown in Figure 5.12-1, there are several unpaved project access roads located in areas that are more likely to contain NOA. These include Bardee's Bar Road, a portion of Poe Powerhouse Road immediately north of the Poe Powerhouse, and another portion of Poe Powerhouse Road near the Big Bend 4-Wheel Drive Access. The Proposed Project



STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Oroville Facilities Relicensing
FERC Project No. 2100

FIGURE 5.12-1

Areas of Serpentinite and nearby Project Access Roads

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does not include any construction or improvement activities (e.g., resurfacing) on these roadways. With respect to long-term operations, any such activities that would occur as part of roadway maintenance would comply with ARB's Asbestos ACTMs (Title 17, California Code of Regulations Sections 93105 and 93106) and BCAQMD Rule 1000, as required by law. Section 93106, which took effect in November 2001, prohibits the sale or use of restricted material for unpaved surfacing unless it has been tested and found to have an asbestos content that is less than 0.25%. . In addition, implementation of the Proposed Project would not be anticipated to result in a substantial increase in vehicle travel on these roadways segments. Thus, long-term operations would not expose sensitive receptors to substantial TAC concentrations. This would be a **less-than-significant** impact.

FERC — Impacts on air resources under the FERC Staff Alternative would be similar to those under the Proposed Project. The FERC Staff Alternative includes an earlier implementation of the Riparian and Floodplain Improvement Program (SA Article A106). These impacts would be considered **less-than-significant.**

Mitigation measure 5.12-c: Include Dust Control Measures in Project Specifications.

PRO, FERC — If projects developed under the programs included in Table 5.12-1 include grading, the dumping of soil or gravel, or similar dust-generating actions, the following requirements shall be included in project specifications:

Persons performing grading, excavation, or similar dust-generating activities shall take every reasonable precaution not to cause or allow the emissions of fugitive dust to be airborne into areas occupied by residents or persons visiting the areas adjacent to the work site. Reasonable precautions shall include, but are not limited to:

- The use of water or chemicals for control of dust in active grading areas or on stockpiles;
- The suspension of activities during periods of high winds; and
- The temporary closing of use areas downwind of the grading site.

Implementation of this mitigation measure would ensure that sensitive receptors would not be exposed to substantial pollutant concentrations and the impact would be **less-than-significant**.

Impact 5.12-d: Create objectionable odors affecting a substantial number of people.

NO — Under the No-Project Alternative, routine operations, maintenance, and recreational activities would continue. Emissions of substances with objectionable odors would not be anticipated to change noticeably from Existing Conditions. There would be **no impact** from continuation of these activities.

PRO — Some of the proposed programs of Table 5.12-1 may have the potential for the short-term generation of odors if soil from lake or channel bottoms were disturbed. Asphalt paving on some projects may generate odors for a few hours. It is unlikely that there would be a substantial number of people in the area during these occasional occurrences. Because of the short period of odors and the small number of people affected, the impact would be **less-than-significant** and no mitigation would be required**.**

FERC — Impacts on air resources under the FERC Staff Alternative would be similar to those under the Proposed Project. The FERC Staff Alternative includes more robust monitoring of the Gravel Supplementation and Improvement Program (SA Article A102) and earlier implementation of the Riparian and Floodplain Improvement Program (SA Article A106). These impacts would be considered **less-than-significant** and no mitigation would be required**.**

Impact 5.12-e: Result in a cumulatively considerable net increase of any criteria pollutant for which the Project region of influence is nonattainment under an applicable federal or State ambient air quality standard.

NO — Under the No-Project Alternative, routine operations, maintenance, and recreational activities would continue. Emissions of gaseous and particulate pollutants, including GHGs, would not be anticipated to change noticeably from Existing Conditions. There would be **no impact** from these activities.

PRO — The region is nonattainment relative to a federal or state standard for ozone and PM_{10}. NO_X and ROG are the precursor pollutants for ozone. As described for Impact 5.12-a, NO_X emissions for a "sample" project would be less than 6 tons per year; ROG emissions would be less than 1 ton per year; PM_{10} emissions would be less than 2 tons per year. With a number of projects occurring concurrently, the total emissions would remain less than

the 100 tons-per-year levels where emissions are considered de minimis. Therefore, the cumulative emissions of the programs would not be considerable and the impact would be **less-than-significant** and no mitigation would be required**.**

FERC — Impacts on air resources under the FERC Staff Alternative would be similar to those under the Proposed Project. The FERC Staff Alternative includes more robust monitoring of the Gravel Supplementation and Improvement Program (SA Article A102) and earlier implementation of the Riparian and Floodplain Improvement Program (SA Article A106). These impacts would be considered **less-than-significant** and no mitigation would be required**.**

5.12.4.2 Project-Level Impacts and Mitigation Measures

Continuation of operations, maintenance, and recreation activities, construction of new or improved facilities, implementation of new projects involving ground disturbance and the use of construction equipment, and operations of additional vehicles and watercraft would result in the emission of air pollutants.

Impact 5.12-a: Violate any air quality standard or contribute substantially to an existing or projected air quality violation.

NO — Under the No-Project Alternative, routine operations, maintenance, and recreational activities would continue. Emissions of gaseous and particulate pollutants would not be anticipated to change noticeably from the existing conditions. There would be **no impact** from these activities.

PRO — BCAQMD does not have quantitative thresholds to define CEQA significance or substantial quantities of emissions. Guidance may be taken from the USEPA General Conformity Rule governing federal actions, which has de minimis levels of 100 tons per year for NO_X, ROG, PM_{10}, and $PM_{2.5}$ in areas where the air quality is better than "serious," which is the case for Butte County (Federal Register, July 17, 2006; 40 CFR Parts 51 and 93). Projects with emissions less than the de minimis thresholds are presumed to conform with plans for attaining and maintaining ambient air quality standards, and therefore would have **no impact** and no mitigation would be required.

Short-term Construction

The actions listed in Table 5.12-1 would likely use diesel engine construction equipment for creation of new facilities or improvement of existing facilities. With respect to air quality

standards, the principal pollutant of concern from construction equipment engine exhaust is NO_X. Engine exhaust also includes ROG, PM_{10}, $PM_{2.5}$, and other pollutants. Grading and other ground disturbance activities produce particulates, PM_{10}, and $PM_{2.5}$. Painting and paving emit ROG.

Emissions were calculated for a "sample" 12-month project that includes grading with 3 pieces of heavy equipment working concurrently, followed by construction with 3 pieces of heavy equipment, followed by painting and asphalt paving. NO_X emissions for this "sample" project would be less than 5 tons per year; ROG emissions would be less than 1 ton per year; PM_{10} emissions would be less than 2 tons per year. Some projects would be of the order of magnitude of the "sample" project described above. The projects would not all occur in the same year. As the emissions of the "sample" project are less than 5 percent of the de minimis thresholds, and many projects would be smaller, and projects will be spread out over a number of years, it is assumed that the air quality impacts of the actions listed in Table 5.12-1 would be **less-than-significant** and no mitigation would be required**.**

Long-term Operations

Table 5.12-1 shows the actions that would have a continuing potential for air quality impacts. Each of these projects, except the revision of the speed limit for Thermalito Afterbay, includes ongoing monitoring that would entail the use of light vehicles and watercraft. For some of the projects, the monitoring would be infrequent, such as once every 3 years or 5 years. Overall, the emissions from these projects would be very small and **less-than-significant** and no mitigation would be required**.**

Revision of the speed limit for Thermalito Afterbay would include allowing higher legal speeds on the portion of the afterbay south of State Route (SR) 162, and improving enforcement of the 5-mph speed limit on the remainder of the afterbay. These would be somewhat offsetting actions, but the net effect would likely be the displaced use of larger boats south of SR 162 and increased exhaust emissions. No data are available for emissions calculations, but the likely increase in number of boats and resultant emissions would be small with respect to the de minimis thresholds and the impact would be **less-than-significant** and no mitigation would be required**.**

In addition to the actions of Table 5.12-1, it is presumed that the projects that improve recreation facilities and add campsites would

induce more recreational visitors, and would increase the number of vehicle trips to and from the area. While the number of additional visitors has not been estimated, emission calculations were made to indicate the order of magnitude of air quality impact. It was assumed that the improved and additional facilities would add an average of 500 trips per day for a 12-month period, and that the average trip distance would be 30 miles. With these assumptions, NO_X and PM_{10} emissions would be less than 5 tons per year; ROG emissions would be less than 3 tons per year. These values are much less than the 100 tons per year de minimis guidelines. The impact would be **less-than-significant** and no mitigation would be required**.**

It is noted that the provision of additional campsites may result in the elimination of some existing trips because people who currently make serial day trips because they cannot stay overnight would be able to stay, thereby eliminating the intermediate trips between the start and end of the visit.

FERC — Impacts on air resources under the FERC Staff Alternative would be similar to those under the Proposed Project. The FERC Staff Alternative includes more robust monitoring of the Gravel Supplementation and Improvement Program (SA Article A102) and earlier implementation of the Riparian and Floodplain Improvement Program (SA Article A106). These impacts would be considered **less-than-significant** and no mitigation would be required**.**

Impact 5.12-b: Conflict with or obstruct implementation of an applicable air quality plan.

NO — Under the No-Project Alternative, routine operations, maintenance, and recreational activities would continue. Emissions of gaseous and particulate pollutants would not be anticipated to change noticeably from the existing conditions. There would be **no impact** from these activities.

PRO, FERC — Air quality planning in the NSVAB has been undertaken on a joint basis by the air districts in seven counties, including Butte County. The current plan, the 2003 AQAP, is an update of plans prepared in 1994, 1997, and 2000. The purpose of the plan is to achieve and maintain healthful air quality throughout the air basin. The 2003 AQAP addresses the progress made in implementing the 2000 plan and proposes modifications to the strategies necessary to attain the California ambient air quality standard for the 1-hour ozone standard at the earliest practicable date.

As described in the Impact 5.12-f discussion, actions that are anticipated to emit pollutants at a rate less than the General Conformity Rule de minimis levels are presumed to conform with attainment plans. The additional traffic anticipated as a result of enhanced and new facilities would have annual emissions of the ozone precursors, NO_X and ROG, less than the de minimis thresholds. Therefore, there would be no conflict with the 2003 AQAP, and **no impact** and no mitigation would be required**.**

Impact 5.12-c: Expose sensitive receptors to substantial pollutant concentrations.

NO

Under the No-Project Alternative, routine operations, maintenance, and recreational activities would continue. Emissions of gaseous and particulate pollutants would not be anticipated to change noticeably from the existing conditions. Some of these activities may expose residents or persons involved in recreational activities to pollutants, such as dust and the exhaust from watercraft engines and maintenance vehicles and equipment. The quantity of pollutants would not be substantial and the impact would be **less-than-significant**.

PRO

Each of the proposed actions of Table 5.12-1 would have the potential for the generation of dust from grading activities or diesel engine exhaust from construction equipment, or both. If the grading work was performed in close proximity to sensitive receptors, there would be a potential for exposure to substantial concentrations of PM_{10} and $PM_{2.5}$. Therefore, there would be a **potentially significant impact.**

Construction of the projects listed in Table 5.12-1 would result in short-term diesel exhaust emissions from on-site heavy-duty equipment required for site grading and excavation, handling of boulders and other materials, paving, and other construction activities. Particulate exhaust emissions from diesel-fueled engines (diesel PM) were identified as a TAC by ARB in 1998. According to ARB, the potential cancer risk from the inhalation of diesel PM outweighs the potential non-cancer health impacts (ARB 2003).

The dose to which receptors are exposed is the primary factor used to determine health risk (i.e., potential exposure to TAC emission levels that exceed applicable standards). Dose is a function of the concentration of a substance or substances in the environment and the duration of exposure to the substance. Dose is positively correlated with time, meaning that a longer exposure period would result in a higher exposure level for the maximally exposed individual. Thus, the risks estimated for a maximally

exposed individual are higher if a fixed exposure occurs over a longer period of time.

For the projects listed in Table 5.12-1, the use of mobile equipment would be temporary and project construction activities would not be atypical in comparison to similar development-type projects (i.e., no excessive material transport or unique operations requiring concentrated equipment groups). In addition, as shown in Figure 5.12-2, the only action that would occur in an area that is more likely to contain NOA would be one action contained within SA A127 that involves sign placement in the northern portion of the FERC Project boundary. This action would not be anticipated to include any major construction or grading operations, as it only entails installing directional signs for Dark Canyon Car-Top Boat Ramp at SR 70. Nonetheless, the disturbance of any portion of this area that is more likely to contain NOA from construction or grading operations would comply with ARB's Asbestos ACTM (Title 17, California Code of Regulations Section 93105) and BCAQMD Rule 1000, as required by law. Thus, short-term construction activities would not result expose sensitive receptors to substantial TAC concentrations. This would be a **less-than-significant** impact and no mitigation would be required.

The projects listed in Table 5.12-1 would not have the potential for exposure of sensitive receptors to substantial concentrations of pollutants, as these projects would use light vehicles and watercraft, and would not be occurring near sensitive receptors. There would be **no impact** and no mitigation would be required.

FERC

Impacts on air resources under the FERC Staff Alternative would be similar to those under the Proposed Project. The FERC Staff Alternative includes more robust monitoring of the Gravel Supplementation and Improvement Program (SA Article A102) and earlier implementation of the Riparian and Floodplain Improvement Program (SA Article A106). These impacts would be considered **less-than-significant** and no mitigation would be required.

Mitigation measure 5.12-c: Include dust control measures in project specifications.

PRO, FERC

If projects in Table 5.12-1 include grading, the dumping of soil or gravel, or similar dust-generating actions, the following requirements shall be included in project specifications:

Persons performing grading, excavation or similar dust-generating activities shall take every reasonable precaution not to cause or allow the emissions of fugitive dust to be airborne into areas

occupied by residents or persons visiting the areas adjacent to the work site. Reasonable precautions shall include, but are not limited to:

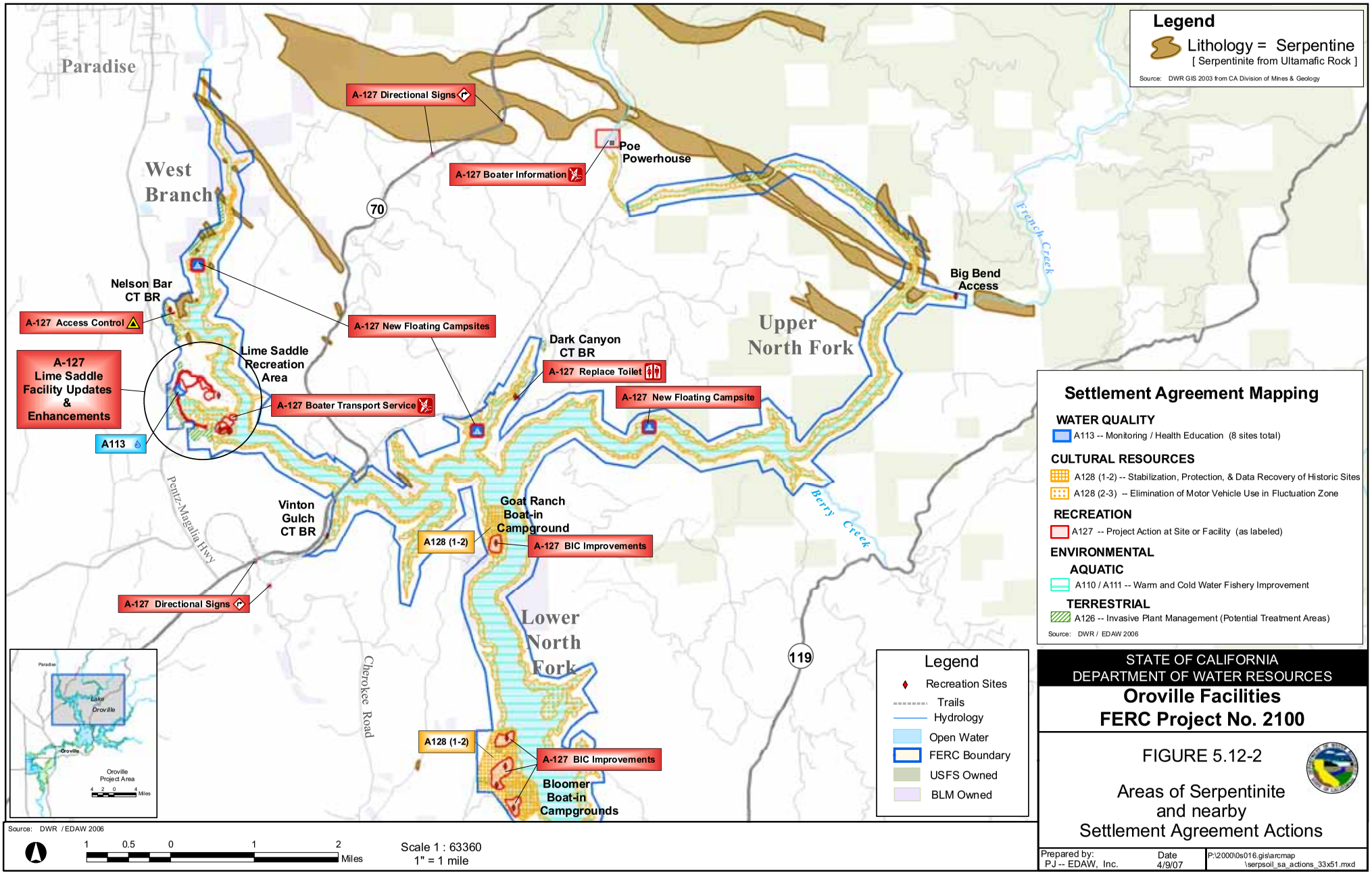
- The use of water or chemicals for control of dust in active grading areas or on stockpiles;
- The suspension of activities during periods of high winds; and
- The temporary closing of use areas downwind of the grading site.

Implementation of this mitigation measure would ensure that sensitive receptors would not be exposed to substantial pollutant concentrations and the impact would be **less-than-significant.**

Impact 5.12-d: Create objectionable odors affecting a substantial number of people

NO — Under the No-Project Alternative, routine operations, maintenance, and recreational activities would continue. Emissions of substances with objectionable odors would not be anticipated to change noticeably from the existing conditions. There would be **no impact** from continuation of these activities.

PRO, FERC — Some of the proposed actions of Table 5.12-1 may have the potential for the short-term generation of odors if soil from lake or channel bottoms were disturbed. Some projects may include asphalt paving that may generate odors for a few hours. It is unlikely that there would be a substantial number of people in the area during these occasional occurrences. Because of the short period of odors and the small number of people affected, the impact would be **less-than-significant** and no mitigation would be required**.**



STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Oroville Facilities
FERC Project No. 2100

FIGURE 5.12-2

Areas of Serpentinite and nearby Settlement Agreement Actions

Prepared by:	Date	
PJ -- EDAW, Inc.	4/9/07	P:\2000\0s016.gis\arcmap \serpsoil_sa_actions_33x51.mxd

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Impact 5.12-e: Result in a cumulatively considerable net increase of any criteria pollutant for which the Project region of influence is nonattainment under an applicable federal or State ambient air quality standard.

NO — Under the No-Project Alternative, routine operations, maintenance, and recreational activities would continue. Emissions of gaseous and particulate pollutants would not be anticipated to change noticeably from the existing conditions. There would be **no impact** from these activities.

PRO — The region is nonattainment relative to a federal or State standard for ozone and PM_{10}. NO_X and ROG are the precursor pollutants for ozone. As described for Impact 5.12-f, NO_X emissions for a "sample" project would be less than 5 tons per year; ROG emissions would be less than 1 ton per year; PM_{10} emissions would be less than 2 tons per year. Increasing visits to the area could add 5 tons per year of NO_X and PM_{10} and 3 tons per year of ROG. With a number of projects occurring concurrently, the total emissions would remain less than the 100-tons-per-year levels where emissions are considered de minimis. Therefore, the cumulative emissions of the projects would not be considerable and the impact would be **less-than-significant** and no mitigation would be required**.**

FERC — Impacts on air resources under the FERC Staff Alternative would be similar to those under the Proposed Project. The FERC Staff Alternative includes more robust monitoring of the Gravel Supplementation and Improvement Program (SA Article A102) and earlier implementation of the Riparian and Floodplain Improvement Program (SA Article A106). These impacts would be considered **less-than-significant** and no mitigation would be required**.**

Mitigation measure 5.12-e: No mitigation is required.

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5.13 AGRICULTURAL RESOURCES

5.13.1 Regulatory Setting

Land management agencies, the location of lands within the study area managed by various local, State, and federal entities, and the management direction of these entities are discussed below. The description of land ownership, management, and use patterns within the study area applicable to agricultural resources is presented in Section 5.6.1, Land Use Regulatory Setting.

5.13.1.1 Williamson Act

The California Land Conservation Act of 1965, also known as the Williamson Act, is designed to preserve agriculture and open space lands by discouraging their premature and unnecessary conversion to urban uses. The act enables local governments to enter into contracts with private landowners for the purpose of restricting specific parcels of land to agricultural or related open space use. In return, landowners receive favorable tax assessments, with assumed property values much lower than full market value because they are based on farming and open space uses.

5.13.1.2 California Department of Conservation Farmland Mapping and Monitoring Program

The goal of the Farmland Mapping and Monitoring Program (FMMP) is to provide consistent, timely, and accurate data to decision makers for use in planning for the present and future of California's agricultural land resources. To meet this goal, the FMMP's objective is to provide maps and statistical data to the public, academia, and local, State, and federal governments to assist them in making informed decisions for the best utilization of California's farmland.

The FMMP was established in 1982 in response to what was by then a critical need for data on the nature, location, and extent of farmland, grazing land, and urban built-up areas in the State. Government Code Section 65570 mandates the FMMP to biennially report to the Legislature on the conversion of farmland and grazing land, and to provide maps and data to local government and the public. The FMMP was also directed to prepare and maintain an automated map and database system to record and report changes in the use of agricultural lands.

It was the intent of the Legislature and a broad coalition of building, business, government, and conservation interests that FMMP be non-regulatory, and provide a consistent and impartial analysis of agricultural land use and change in California. With this in mind, FMMP provides basic data from which observations and analyses can be made in the land use planning process.

5.13.1.3 Prime Farmland and Farmland of Statewide Importance

In order to be shown on the Farmland Mapping and Monitoring Program's Important Farmland Maps as Prime Farmland and Farmland of Statewide Importance, land must meet both the following land use and soil criteria:

Land Use—Has been used for irrigated agricultural production at some time during the 4 years prior to the Important Farmland Map date. Irrigated land use is determined by FMMP staff during examination of current aerial photos, local comment letters, and field verification.

Soil—The soil must meet the physical and chemical criteria for Prime Farmland or Farmland of Statewide Importance as determined by the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS). NRCS compiles lists of which soils in each survey area meet the quality criteria. Factors considered in qualification of a soil by NRCS include:

- Water moisture regimes, available water capacity, and developed irrigation water supply;
- Soil temperature range;
- Acid-alkali balance;
- Water table;
- Soil sodium content;
- Flooding (uncontrolled runoff from natural precipitation);
- Erodability;
- Permeability rate;
- Rock fragment content; and
- Soil rooting depth.

The term "Prime" as it refers to rating for agricultural uses has two meanings in California. The FMMP determines the location and extent of "Prime Farmland" as described above, while under the State's Williamson Act, land may be enrolled under the "Prime Land" designation if it meets certain economic or production criteria.

5.13.2 Impact Thresholds

The following thresholds are used to determine whether the alternatives would have a significant effect on agricultural resources. There would be a significant impact on agricultural resources if the alternatives would:

- 5.13-a: Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use;

- 5.13-b: Conflict with existing zoning for agricultural use, or a Williamson Act contract; or

- 5.13-c: Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland to non-agricultural use.

5.13.3 Method of Analysis

Qualitative effects assessments were completed to evaluate the potential impacts of the No-Project Alternative, the Proposed Project, and the FERC Staff Alternative on agricultural production in the vicinity of the Oroville Facilities. These qualitative effects evaluations included the potential for the No-Project, Proposed Project, or FERC Staff Alternative to convert Prime Farmland, Unique Farmland or Farmland of Statewide importance to non-agricultural use; change agricultural zoning or conflict with Williamson Act contracts; or alter existing environmental conditions such that it could result in conversion of Farmland to non-agricultural use. Consideration of potential project affects on existing conditions, which could result in conversion of Farmland to non-agricultural uses included Feather River Service Area (FRSA) changes in irrigation water temperature as well as ongoing effects of increased reliability of irrigation water supply under each of the alternatives.

Local FRSA water and irrigation districts have expressed concerns regarding the suitability of irrigation water temperatures at the Thermalito Afterbay agricultural diversions and the potential for exposure to cold water during critical periods to reduce rice yields in some portions of the FRSA. Although a variety of crops are grown in the FRSA, rice is the only crop with a concern regarding irrigation water temperatures that have been identified or expressed by the FRSA water and irrigation districts or growers. Therefore, the evaluation of potential changes in irrigation water temperature from the implementation of the project alternatives and the potential for those changes to result in conversion of Farmland to non-agricultural uses was the focus of this component of the effects analysis.

The evaluation period chosen for the analyses of potential effects of irrigation water temperature changes on rice was May 1 through July 31. Because water temperature–related effects on rice yield reportedly occur between planting and the onset of the reproductive phase of rice growth (see Section 4.13 for discussion) and because the majority of planting in the FRSA occurs during May, the period between May 1 and July 31 encompasses the period during which the majority of rice in the FRSA is potentially vulnerable to cold water–related effects. Water quality modeling for Thermalito Afterbay does not support absolute water temperature value prediction or provide values suitable for alternatives comparison. This is due to the dynamic nature of the flow and water temperature regime as well as the short period of available record

of agricultural diversion water temperatures in Thermalito Afterbay (see discussion in Section 5.2.2.3, Surface Water Quality Method of Analysis). The evaluation of potential changes in irrigation water temperature was conducted qualitatively for the implementation of the initial new license period of the Proposed Project. Similarly, the potential future facilities modification(s) of the Proposed Project were qualitatively analyzed due to the constraints of the Thermalito Afterbay modeling and due to the uncertainty of the detailed design and operational characteristics of the potential future facilities modifications at this time. Analysis of potential water temperature changes resulting from the potential implementation of the future facilities modifications is presented in Section 5.2.2, Surface Water Quality. For the purposes of the analysis of potential effects on irrigation water temperatures, there are no differences between the Proposed Project and the FERC Staff Alternative; therefore, the analysis was focused on the Proposed Project.

5.13.4 Impacts and Mitigation Measures

The following section describes the beneficial effects and potentially adverse impacts of the Proposed Project, including both programmatic and project-level analyses. Table 5.13-1 indicates the SA articles or actions that could have an effect on agricultural resources, and whether these effects are expected to be beneficial, less-than-significant, or would be less-than-significant following implementation of recommended mitigation measures.

Table 5.13-1. Environmental effects on agricultural resources.

Alternative(s)	Article # and Title	Level of CEQA Analysis	Nature of Potential Impact(s)	Effect
PRO, FERC	A107—Feather River Fish Hatchery water temperature	Project (107.2)	No change in water temperatures at agricultural diversions	NI
PRO, FERC	A108—Minimum Flow and Other Measures	Project (A108.1 only); Programmatic (A108.2 and A108.3 only)	Slightly reduced water temperatures at agricultural diversions in the Thermalito Afterbay	B/LTS

Coding:

B = Action with potential to result in a beneficial effect; could involve short-term, less-than-significant, construction-related impacts that would be avoided or reduced through the use of Best Management Practices (BMPs). See Appendix D.

LTS = Action that would result in less-than-significant impact on resource.

NI = Action that would result in no impact.

In addition to the Proposed Project, this DEIR analyzes the No-Project Alternative and the FERC Staff Alternative. Impacts on agricultural resources from implementing the FERC Staff Alternative are the same as those anticipated from implementation of the Proposed Project unless noted. Potential impacts are identified as follows:
NO (No-Project), PRO (Proposed Project), and FERC (FERC Staff Alternative). All alternatives analyzed result in **less-than-significant** impacts on agricultural resources.

5.13.4.1 Program and Project-Level Impacts and Mitigation Measures

Continuation of Oroville Facilities operations, construction of new or improved facilities, and implementation of new programs could result in impacts on agricultural resources. Project-level impact evaluations include initial new license period, water temperature management actions (under SA Article 107.2 and A108.1). Program-level impact evaluations include potential future facility modifications (SA Articles A108.2 and A108.3), which currently include, but are not necessarily limited to, Palermo Canal improvements, a Hyatt intake extension, river valves improvements, a canal around Thermalito Afterbay, a canal through Thermalito Afterbay, an alternate Thermalito Afterbay Outlet and channel, and a water temperature curtain within Thermalito Afterbay. Preliminary analysis of potential water temperature changes resulting from implementation of the future facilities modifications is presented in Section 5.2.2, Surface Water Quality.

Impacts of the No-Project Alternative Relative to Existing Conditions

Under the No-Project Alternative, operations affecting Thermalito Afterbay would not differ appreciably from operations under Existing Conditions during the period of rice yield sensitivity to irrigation water temperatures (May through July). Therefore, the Thermalito Afterbay water temperature regime is not expected to significantly change under the No-Project Alternative compared to the water temperature regime observed under Existing Conditions. Project benefits that occur under Existing Conditions and that would continue to occur and accrue under the implementation of the No-Project Alternative include water supply reliability, flood control, foregone canal conveyance system maintenance, and foregone diversion fish screen amortized capital costs and maintenance. Some changes in future water allocation and delivery timing patterns would occur under the No-Project Alternative compared to Existing Conditions, which would slightly alter the seasonal pattern of flow releases from the project. However, these changes likely would not substantively affect water residence times in Thermalito Afterbay during the May-through-July analytical period. (See Section 5.2.1, Surface Water Quantity, for additional information on flow changes associated with any of the project alternatives.) Because changes to the effective residence time of water in Thermalito Afterbay under the No-Project Alternative would be minor, it is likely that irrigation water temperatures at the agricultural diversions also would not be substantively altered under the No-Project Alternative compared to Existing Conditions.

In addition, no conversion of Prime Farmland, Unique Farmland, or Farmland of Statewide Importance to a non-agricultural use is anticipated. No conflict with existing zoning for agricultural use, a Williamson Act contract, or other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland to non-agricultural use would occur under the No-Project Alternative, relative to Existing Conditions.

Impacts of the Proposed Project Relative to Existing Conditions

Oroville Facilities operations provide substantial benefits to agricultural production in the FRSA, but also affect water temperatures and their distribution in Thermalito Afterbay, which affect water temperatures at the agricultural diversions (see Section 5.2.2, Surface Water Quality, for additional information on water temperatures in Thermalito Afterbay). Project benefits that occur under Existing Conditions as well as the No-Project Alternative and that would continue to occur and accrue under implementation of the Proposed Project include water supply reliability, flood control, foregone canal conveyance system maintenance, and foregone diversion fish screen amortized capital costs and maintenance. Oroville Facilities operations that affect Thermalito Afterbay water temperatures include Oroville Dam release water temperatures, and those operational variables that determine the effective residence time of water in Thermalito Afterbay (see Section 5.2.2, Surface Water Quality, for additional information on water temperatures in Thermalito Afterbay). Implementation of the Proposed Project would occur in two stages as described in Chapter 3.

Description of the second stage, which includes study of potential future facilities modifications for the Proposed Project, is contained in Section 3.3.2. The potential future facilities modifications, as they are presently defined in the SA, are preliminarily evaluated for water temperature changes at the Thermalito Afterbay agricultural diversions for potential effects on Basin Plan agricultural beneficial uses in Section 5.2.2, Surface Water Quality.

As discussed in Section 5.2.2, Surface Water Quality, new minimum Low Flow Channel (LFC) flows and water temperature targets under the Proposed Project to benefit anadromous fish would result in reductions in water temperature, consistent with SA targets, of up to 2 degrees Fahrenheit (°F) at Robinson Riffle. Depending on the time of year, and hydrologic and ambient conditions, this benefit would likely result in either no water temperature change, or under conditions that are expected to occur only infrequently, a less than 2°F reduction in water temperature at the Thermalito Afterbay agricultural diversions. This discussion pertains to the evaluation of water temperature effects on rice under the Proposed Project initial new license period as compared to Existing Conditions.

Water temperature targets could differ between the initial new license period (operational changes only) and the period after completion of potential future facilities modifications (see Section 3.3.2, Proposed Project). Any future facilities modifications would be subject to subsequent environmental documentation prior to construction.

During the Proposed Project initial new license period, either no water temperature changes would occur or infrequent changes of less than 2°F at the Thermalito Afterbay agricultural diversions would occur. Since these changes would be infrequent and of relatively small magnitude, water temperature changes would not be expected to substantially increase rice yield loss attributable to cold water exposure, relative to Existing Conditions. Potential rice yield loss with the implementation of the Proposed Project would not be expected to result in any conversion of farmland to non-agricultural

use. Additionally, with the continued benefit of reliable water supply to the FRSA, the net result of the implementation of the Proposed Project initial new license period would have **no impact** on conversion of farmland to nonagricultural use.

Implementation of the potential future facilities modifications (as they are currently defined in the SA) under the Proposed Project may likely result in either **beneficial** effects or **less-than-significant** impacts of conversion of farmland to non-agricultural uses. Prior to construction, these potential future facilities modifications would be subject to a subsequent environmental analysis and documentation that would include a detailed analysis of potential effects on agricultural beneficial uses or potential conversion of farmland to other uses.

No conversion of Prime Farmland, Unique Farmland, or Farmland of Statewide Importance to a non-agricultural use is anticipated with implementation of the Proposed Project. No conflict with existing zoning for agricultural use, a Williamson Act contract, or other changes in the existing environment that, due to their location or nature, could result in conversion of Farmland to non-agricultural use would occur under the Proposed Project, relative to Existing Conditions.

Impacts of the Proposed Project Relative to the No-Project Alternative

Impacts associated with implementation of the Proposed Project relative to the No-Project Alternative are expected to be similar to those associated with implementation of the Proposed Project relative to Existing Conditions. Therefore, implementation of the Proposed Project would likely reduce water temperatures slightly at the agricultural diversions during the agricultural analytical period (May through July) over the entire period of the new FERC license. Potential rice yield loss with the implementation of the Proposed Project would not be expected to result in any conversion of farmland to nonagricultural use. Additionally, with the continued benefit of reliable water supply to the FRSA, the net result of the implementation of the Proposed Project initial new license period would have **no impact** on conversion of farmland to nonagricultural use.

Implementation of the potential future facilities modifications (as they are currently defined in the SA) under the Proposed Project as compared to the No-Project Alternative may likely result in either **beneficial** effects or **less-than-significant** impacts of conversion of farmland to non-agricultural uses. These potential future facilities modifications would be subject to subsequent environmental analysis and documentation that would include a detailed analysis of potential effects on agricultural beneficial uses or potential conversion of farmland to other uses, prior to construction.

No conversion of Prime Farmland, Unique Farmland, or Farmland of Statewide Importance to a non-agricultural use is anticipated with implementation of the Proposed Project. No conflict with existing zoning for agricultural use, a Williamson Act contract, or other changes in the existing environment that, due to their location or nature, could result in conversion of Farmland to nonagricultural use would occur under the Proposed Project relative to the No-Project Alternative.

Impacts of the FERC Staff Alternative Relative to Existing Conditions and No-Project Alternative

The FERC Staff Alternative does not differ substantively from the Proposed Project in regard to potential effects on agricultural diversion water temperatures or agricultural land use. Therefore, the effects on agricultural water temperatures and on land use are the same for the FERC Staff Alternative as described above for the Proposed Project for both comparisons with Existing Conditions as well as the No-Project Alternative. Implementation of the FERC Staff Alternative, both for the initial new license period and after the potential future facilities modifications, would result in **no impact** on conversion of farmland to non-agricultural use.

Impact 5.13-a: Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use.

Impact 5.13-b: Conflict with existing zoning for agricultural use, or a Williamson Act contract.

Continuation of Oroville Facilities operations, construction of new or improved facilities, and implementation of new programs could result in impacts on agricultural resources.

NO, PRO, FERC — No conversion of Farmland to a nonagricultural use, or conflicts with existing agricultural zoning or Williamson Act contracts; therefore, **no impact** would occur and therefore no mitigation would be required.

Impact 5.13-c: Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland to non-agricultural use.

Continuation of Oroville Facilities operations, construction of new or improved facilities, and implementation of new programs could result in impacts on agricultural resources.

NO — Changes to the effective residence time of water in Thermalito Afterbay would be small relative to Existing Conditions. Therefore, irrigation water temperatures either would not change or would slightly decrease resulting in little or no change in rice yields. Therefore, rice yield changes would not be substantial enough to result in conversion of farmland to nonagricultural use. Therefore, **no impact** would occur.

PRO, FERC — The Proposed Project and FERC Staff Alternative irrigation water temperatures during the initial new license period either would not change or would slightly decrease, resulting in little or no change in rice yields. Therefore, rice yield changes would not be substantial enough to result in conversion of farmland to nonagricultural use. Therefore, **no impact** would occur.

Proposed Project and FERC Staff Alternative potential future facilities modifications could result in either **beneficial** effects or **less-than-significant** impacts of conversion of farmland to non-agricultural uses and therefore no mitigation would be required.

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5.14 TRANSPORTATION AND TRAFFIC

5.14.1 Regulatory Setting

5.14.1.1 State and Regional Transportation Plans

Transportation planning agencies involved in developing and maintaining Butte County's regional and countywide circulation system include the California Transportation Commission (CTC) and the Butte County Association of Governments (BCAG). The California Department of Transportation (Caltrans) is responsible for implementing statewide policy of the CTC. Both the CTC and BCAG are required to develop and maintain respective state and regional transportation plans that rely on input from local city and county government general plans, including their respective circulation elements.

The major emphasis of the Butte County Regional Transportation Plan (RTP) is on transportation improvements that are needed during the next 5 years. New transportation projects that plan to utilize State or federal monies must be included in the RTP. Projects for maintenance, rehabilitation, and reconstruction are not included in the RTP (Government Code Section 65082). The Butte County RTP is prepared and updated by BCAG and used as a guide for preparing BCAG's annual Regional Transportation Improvement Program (RTIP) and Federal Transportation Improvement Program (FTIP). The Butte County RTIP annually identifies and sets priority for new transportation projects proposed and needed in Butte County during the next 5-year period, and the FTIP sets priorities for federally funded transportation projects in the Chico urban area.

The planning relationship between the RTP and the County's Circulation Element is parallel. The Circulation Element's countywide guidance and programs, however, should precede and influence those programs stated in the RTP. The principal difference between the Circulation Element and the RTP is that the former is intended to provide more long-term transportation planning guidance as part of Butte County's General Plan whereas the latter focuses on shorter term transportation development programs that include both city and County plans.

5.14.1.2 Butte County General Plan Circulation Element

The Circulation Element of the Butte County General Plan is a guide to managing and developing Butte County’s future transportation and circulation system. The Circulation Element provides guidance regarding continued maintenance of Butte County’s transportation system, which is vital for ensuring a continued present level of mobility, as well as facilitating improved development and mobility in the future. The Circulation Element also identifies minimum Level of Service standards for urban streets and rural roads.

5.14.2 Impact Thresholds

The following thresholds are used to determine whether the alternatives would have a significant effect related to transportation and traffic. There would be a significant impact if the alternatives would:

- 5.14-a: Cause an increase in traffic, which is substantial in relation to the existing traffic load and capacity of the street system (i.e., result in a substantial increase in either the number of vehicle trips, the volume-to-capacity ratio on roads, or congestion at intersections);
- 5.14-b: Exceed, either individually or cumulatively, an LOS standard established by the county congestion management agency for designated roads or highways;
- 5.14-c: Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks;
- 5.14-d: Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses;
- 5.14-e: Result in inadequate emergency access;
- 5.14-f: Result in inadequate parking capacity; or
- 5.14-g: Conflict with adopted policies, plans, or programs supporting alternative transportation (e.g. bus turnouts, bicycle racks).

5.14.3 Method of Analysis

The analysis of traffic effects was conducted by characterizing potential changes in traffic volumes resulting from additional recreation visitors, construction and operations and maintenance (O&M) activities, and local population supported by recreation visitor and O&M spending. Specific programs and projects that can be expected to affect recreation, construction, and O&M activity are described in Table 5.7-1 in Section 5.7, Recreational Resources. The potential effect of these programs and projects on recreation use, commuting workers, and the local population provides the basis for assessing the potential impact on traffic-related issues under each alternative.

The sources and methods used to develop the visitation, employment, and population projections used to estimate traffic volumes are discussed in Section 5.9.1, Population and Housing, and Section 5.9.2, Public Services. Although visitation, employment, and population projections were not developed specifically for the FERC Staff Alternative, effects on traffic volumes under this alternative are anticipated to be similar to those of the Proposed Project.

For assessing whether the projected increases in traffic are substantial in relation to the existing traffic load and capacity of the street system, Level of Service (LOS) is the measure employed. The Butte County General Plan Circulation Element identifies LOS

B as the goal for rural roads but indicates that service should be considered to be acceptable at level of Service C, particularly when fiscal, environmental or site constraints are prohibitive. For the purpose of assessing county roads, LOS C is considered the minimum acceptable LOS on weekdays.

The Caltrans Transportation Concept Reports for SR 70, SR 99 and SR 162 indicate the Concept LOS for segments of each road. The Concept LOS is the long term goal for each facility. In this case, the concept LOS for SR 70 in Butte County ranges from LOS D south of Oroville, to LOS B on the freeway through Oroville, to LOS C north of Oroville. The concept LOS for SR 99 in Butte County is LOS D south of the Skyway in Chico, LOS C through Chico, and LOS D north of Chico to the Tehama County line. The concept LOS on SR 162 is LOS E west of SR 70 and LOS B east of SR 70.

Caltrans District 3 has recently established a basis for identifying incrementally significant impacts to mainline highways. Traffic impacts on roadway segments are significant if they cause currently acceptable conditions to deteriorate to an unacceptable Level of Service, or if a project results in a 1% increase in volume on a freeway that will operate at an unacceptable LOS without the project.

Areawide Travel Effects

Implementation of the project alternatives may increase the volume of traffic to and from the project area. This increased travel will affect roadways in three ways. First, the regional roadway system providing access to the project may see additional traffic as motorists drive to and from the facilities. Second, the roads in the immediate area of the facilities may be used to reach individual features. Thirdly, the entire Butte County road system would theoretically see an incremental traffic increase as a result of the growth sustained by the operation of Oroville Facilities.

To estimate recreation visitor-related traffic volumes for evaluating area wide travel effects, information from Study Plan R-9 (SP-R9), Existing Recreation Use (DWR 2004), regarding visitation at various locations in the Oroville Facilities area was used. Visitation estimates were derived from traffic counts conducted at permanent count stations on access routes. Average daily visitation during the 2002-03 recreation seasons (May 15 through September 15) is estimated to be 6,724 recreation days on a weekday basis. (Weekdays are used to characterize visitation here because baseline traffic volumes and LOS established by most regional transportation planning agency, including BCAG, reflect weekday data.) This estimate reflects the average number of recreation days by all visitors (i.e., visitors from all locations, both within and outside of Butte County). To account for use of multiple facilities within the recreation area on one day by the same visitor, “recreation days” were converted to “visitor days.” An equivalency factor of 0.627, which was derived by TCW Economics using data compiled from responses to the Onsite Visitor Survey conducted for the Oroville Facilities Relicensing, was used for this conversion. Applying the overall automobile occupancy rate developed for SP-R9 (i.e., 2.5 persons per vehicle) suggests that the existing automobile traffic flow associated with use of recreation areas would be in the range of 1,690 inbound and 1,690 outbound vehicles on a summer weekday.

Under all of the alternatives, including the No-Project Alternative, use of recreation facilities and travel on roadways in the project area would increase in the future due to recreation demand generated by regional and statewide population growth. Regionally, the population in Butte County supported by jobs directly and indirectly generated by visitor and O&M spending also is expected to increase. Under the Proposed Project and FERC Staff Alternative, implementation of the SA Articles also would result in an increase in visitors because of recreation improvements, construction activity, and O&M workers commuting from out of county. The change in the number of recreation visitors, the local population supported by the spending of recreation visitors, and commuting workers would contribute to increased use of local roads, potentially resulting in deterioration of levels of service and roadway conditions.

Under the No-Project Alternative, anticipated statewide population growth will increase the level of visitation to the Oroville Facilities over the next 20 years and increase the amount of traffic on roads that lead to the project area. Current peak weekday visitation is expected to increase from the current 6,724 recreation days to 9,032 recreation days under the No-Project Alternative and 9,779 recreation days under the Proposed Project. This increase of 2,308 recreation days under the No-Project Alternative is the equivalent of 1,450 visitor days, and using the assumed automobile occupancy rate, an additional 580 inbound and 580 outbound daily vehicle trips are projected. Under the Proposed Project, the increase of 3,055 recreation days is the equivalent of 1,920 visitor days, and an additional 780 inbound and 780 outbound daily trips.

Areawide traffic to and from the Oroville Facilities would also increase as a result of changes to O&M practices. Implementation of the Proposed Project would entail changes in O&M practices at the Oroville Facilities that would likely increase the number of O&M workers commuting to the project area, thereby contributing to the usage of local roadways. As discussed in Section 5.9.2, Public Services, the number of additional O&M workers needed to implement the Proposed Action in the PDEA was estimated at 65 positions. Assuming 1 inbound and 1 outbound daily trip per position, 65 additional inbound and 65 additional outbound daily trips could be expected. Of these additional jobs, only a small number (fewer than five, based on the existing commuting patterns of Oroville Facilities employees) would likely be filled by persons who would commute into Butte County.

Implementation of the Proposed Project could result in construction activity that would increase automobile and truck traffic to and from the Oroville Facilities. Construction projects are estimated to generate a total of about 1,800 jobs, or an average of 180 jobs per year if the projects were all constructed within a 10-year timeframe. Commuting by construction workers could add 180 inbound and 180 outbound trips to the roads serving the Oroville Facilities. Although the extent of truck traffic is uncertain because the projects involving construction have not been fully defined, construction activity is assumed for analysis purposes to generate up to several hundred truckloads annually. Depending on the distribution of truck activity across the construction season, this level of annual truck activity would generate about five truckloads (i.e, five inbound and five outbound trucks) on a daily basis.

All together, compared to current conditions, the No-Project Alternative could result in an additional 580 inbound and 580 outbound daily trips on the streets providing access to the project area, as measured at the end of the 20-year planning horizon. Combining increased visitation, O&M changes, and construction workers and trucks, the Proposed Project could result in an additional 1,030 inbound and 1,030 outbound trips, as compared to current conditions. Compared to the No-Project Alternative, the Proposed Project increase would be 450 inbound and 450 outbound daily trips spread across all of the roads providing access to the Oroville Facilities. The overall traffic increase described above would be distributed to streets near the site and to the regional circulation system. However, the incremental increase in traffic volumes under the Proposed Project would be about 0.8% in comparison to existing conditions based on the increase in average daily population. (Although visitation and project-related population projections beyond 2020 are not available for this analysis, growth in recreation use and population supported by visitor spending is presumed to increase at rates similar to the rate between 2002 and 2020 throughout the 50-year term of the anticipated license).

Under the project alternatives, the local population directly and indirectly supported by recreation visitor spending also would increase, thereby increasing the use of roadways throughout the county. Under the No-Project Alternative, this population is projected to increase from 2,360 persons in 2002-03 to 2,770 persons in 2020, representing a 410-person increase. Under the Proposed Project, this population, which also includes resident O&M workers, is projected to increase from 2,360 persons in 2002-03 to 3,160 persons in 2020, representing an 800-person increase. About half of this increase would be attributable to regional and statewide population growth unrelated to project improvements. Based on an average density per household of 2.4 persons per household (California Department of Finance 2007) and 9.6 trips per household (Institute of Transportation Engineers 2003), the increased population supported by visitor and O&M spending under the No-Project Alternative would generate about 1,640 additional vehicle trips daily and the Proposed Project would generate about 3,200 additional vehicle trips daily on highways and roads throughout the county.

Localized Impacts

Under the Proposed Project, the Recreation Management Plan (SA Article A127) identifies the need for recreation enhancements at several existing recreation sites that could have localized roadway impacts. Table 5.14-1 identifies the recreation enhancements, and presents traffic volume information for the road segments immediately adjoining these facilities that would most likely experience traffic volume increases. As shown in the table, proposed actions include establishing additional campsites and parking spaces at marinas, campgrounds, and day use areas at Lake Oroville and Thermalito Afterbay. Because of existing capacity and use conditions, the recreational enhancements would likely lead to some increase in recreational activity, and consequently an increase in traffic volumes on the road segments identified in Table 5.14-1.

Table 5.14-1. Traffic volume information for roadways potentially affected by proposed recreation enhancement measures.

	Recreation Facility Traffic		Primary Road Affected			Projected Peak Season Daily Traffic Increase (% of existing background)				Total Projected Daily Traffic	
							Proposed Project				
Proposed Measure (location and description)	Lowest Monthly Weekday Average (2002 counts)[1,3]	Peak Season Weekday Average (2002 counts)[2,3]	Road Name and Uses	Existing Traffic (24-Hour Weekday Counts)[4]	Level of Service (2003 est.)[5]	No Project[6]	Due to Increased Capacity	Due to Enhanced Quality[7]	Total of No Project and Proposed Project[8]	Existing, No Project, and Proposed Project[9]	Level of Service
Lime Saddle Campground: 10 additional RV camp-sites, 1 six-unit group RV campsite	50 (November/ January)	150–200	Lime Saddle Road (Butte Co.) Note: road used only for recreation access	341 (June 2001)	C	50 to 70	70	20 to 25	140 to 165	480 to 505	C
Lime Saddle Boat Ramp and Marina: 60 additional vehicle/trailer parking spaces	180 (October)	600–800	Pentz Road (Butte Co.) Note: road serves rural residential areas and links City of Paradise and SR 70	1,959 (Aug. 1999) 2,017 (July 2003)	C	205 to 275	100	70 to 95	375 to 570	2,395 to 2,590	C
Bidwell Canyon Marina: 90 additional vehicle parking spaces	340 (October)	800–1,200	Kelly Ridge Road (Butte Co.) Note: road serves residential area	2,187 (July 2001)	C	275 to 415	80	95 to 140	450 to 635	2.640 to 2,825	C
Oroville Dam Day Use Area: 100 additional parking spaces	460 (December)	800–920	Canyon Drive (Butte Co.— Olive Hwy. to Oro Dam Blvd.) Note: Road serves residential area	1,873 (July 2001) 3,199 (July 2001)	C	275 to 315	200	95 to 110	570 to 625	3,770 to 3,825	C

Table 5.14-1. Traffic volume information for roadways potentially affected by proposed recreation enhancement measures.

	Recreation Facility Traffic		Primary Road Affected			Projected Peak Season Daily Traffic Increase (% of existing background)				Total Projected Daily Traffic	
							Proposed Project				
Proposed Measure (location and description)	Lowest Monthly Weekday Average (2002 counts)[1,3]	Peak Season Weekday Average (2002 counts)[2,3]	Road Name and Uses	Existing Traffic (24-Hour Weekday Counts)[4]	Level of Service (2003 est.)[5]	No Project[6]	Due to Increased Capacity	Due to Enhanced Quality[7]	Total of No Project and Proposed Project[8]	Existing, No Project, and Proposed Project[9]	Level of Service
Afterbay Outlet: 20-site primitive campground, five to ten day-use sites	60 (February)	180–430	Larkin Road (Butte Co.) Note: road serves rural agricultural and residential area	2,589 (July 1998)	C	60 to 275	100	20 to 50	180 to 425	2,770 to 3,015	C

Notes:

[1] *Data presented reflect average daily traffic volumes (inbound and outbound) during the lowest month of the 2002-03 study period, which is identified in parentheses for each recreation site. Data are drawn from DWR traffic counter data.*

[2] *Data presented reflect average daily traffic volumes (inbound and outbound) during the May through September (peak season) of 2002. Data are drawn from DWR traffic counter data.*

[3] *Data for Lime Saddle Campground reflects weekend daily average use of facility by recreation visitors at that site and at Nelson Bar car-top boat ramp (served by the same road) as reported in SP-R9 report. Because site observations indicated approximately 2 people per vehicle, average use was divided by 2 to arrive at an approximation of daily vehicle traffic. Traffic counts for Oroville Dam DUA include traffic accessing the Spillway DUA via the Oroville Dam crest road.*

[4] *Data from Butte County Public Works, Traffic Counts table, August 22, 2006. Data selected are from traffic counter stations in closest proximity to the recreation facility of interest. Weekend counts were not available.*

[5] *Data from Butte County Association of Governments, 2004 Regional Transportation Plan. Level "C" is defines as "stable flow" but with "occasional backups behind left-turning vehicles at intersections." However, the Regional Transportation Plan does not specify Level of Service above "C." Roads with Levels of Service of A or B (less traffic congestion) are categorized in the Plan as level "C."*

[6] *Increase based on increase in visitor days due to statewide population increase over 20 years. This is equal to 34.3% of existing travel, and would also represent the "no project" increase.*

[7] *Increase based on increase in visitor days due to the enhancement included in overall project. This is equal to 11.8% of existing travel.*

[8] *Sum of specific project traffic, traffic increase due to statewide growth and increase due to overall area enhancements.*

[9] *Sum of 8 plus existing traffic volumes.*

Locally, the amount of additional traffic associated with increased visitation due to statewide population growth and the additional traffic resulting from increased visitation due to the overall effect of project enhancements also is noted in Table 5.14-1. Measured as a percentage of total existing traffic to and from the facilities, the increase due to statewide growth is equal 34.5% of existing travel. Traffic associated with overall enhancement is equal to 11.8% of existing travel. For each recreation area where improvements are proposed, traffic volumes have been estimated and the associated effect on Levels of Service for the primary road affected is assessed.

5.14.4 Impacts and Mitigation Measures

This DEIR analyzes the No-Project Alternative, the Proposed Project, and the FERC Staff Alternative. Project alternatives are identified as follows: NO (No-Project), PRO (Proposed Project), and FERC (FERC Staff Alternative).

Following the analysis of the No-Project Alternative, the beneficial effects and potentially adverse impacts of the Proposed Project, including both programmatic and project-level analyses, are evaluated. Impacts resulting from implementation of the FERC Staff Alternative are similar to those anticipated from implementation of the Proposed Project unless noted and are all **less-than-significant**.

Impact 5.14-a: Cause an increase in traffic, which is substantial in relation to the existing traffic load and capacity of the street system (i.e., result in a substantial increase in either the number of vehicle trips, the volume-to-capacity ratio on roads, or congestion at intersections).

The construction of new or improved facilities, and implementation of new programs and actions that would increase public recreation use at the Oroville Facilities, could result in an increase in traffic in relation to existing traffic load, capacity of the street system and affect the LOS of roads.

NO — Under the No-Project Alternative, the Oroville Facilities would continue to be operated as they are now under the terms and conditions of the existing FERC license, and no new protection, mitigation, and enhancement (PM&E) measures would be implemented, other than those arising from existing legal obligations and agreements. In addition, DWR would continue existing routine operations and maintenance practices needed for the Oroville Facilities. Average daily use of recreation facilities in the project area would increase by 1,450 visitor-days in 2020 due to demand generated by regional and statewide population growth. The increase in recreation visitor days would generate the equivalent of an additional 1,160 daily vehicle trips (580 inbound and 580 outbound). This increase in vehicle trips is not expected to affect LOS on local roadways and therefore this impact is considered **less-than-significant**.

Additionally, the population directly and indirectly supported by visitor and O&M spending is projected to increase from a current level of 2,360 to 2,770 in 2020, representing a 410-person increase. This increase in population would generate an additional 1,640 trips daily that would use roads throughout the county. This countywide traffic volume increase spread across all county roads would be too small to have a significant impact on operating LOS. Thus, there would be a **less-than-significant impact** associated with the No-Project Alternative.

PRO

Areawide Effects

Under the Proposed Project, implementation of the SA articles could result in an increase in recreation activity and commuting workers in the project area. Implementation of the Proposed Project is expected to generate an additional 1,560 daily trips (780 inbound and 780 outbound) by recreation visitors to the Oroville Facilities, and an additional 130 daily trips (65 inbound and 65 outbound) by O&M workers at the Oroville Facilities. In addition, during the first 10 years of the license term, the Proposed Project is expected to generate about 360 daily trips (180 inbound and 180 outbound) by construction workers in the project area.

Combining increased visitation, O&M changes and construction workers and trucks, the Proposed Project could result in an additional 1,030 inbound and 1,030 outbound trips, as compared to current conditions. Compared to the No-Project Alternative, the Proposed Project increase would be 450 inbound and 450 outbound daily trips spread across all of the roads providing access to the Oroville Facilities. The overall traffic increase described above would be distributed to streets near the site and to the regional circulation system. However, the incremental increase in traffic volumes under the Proposed Project would be less than 1% in comparison to existing conditions based on the increase in the average daily population generating vehicle trips.

Because project-related changes in total travel to and from the project area is low (2,060 daily trips), the projected average number of persons using local roadways (1,715 persons) daily are relatively small (about 0.6 percent compared to the projected 2020 population for Butte County) and would occur gradually over time, effects on the traffic load and capacity of the street system related to use of the Oroville Facilities would be minor with no change to LOS expected. Thus, this impact is considered to be **less-than-significant** and no mitigation is required.

Additionally, the population directly and indirectly supported by visitor and O&M spending is projected to increase from a current level of 2,360 to 3,160 in 2020, although about half of this increase would be attributable to regional and statewide population growth unrelated to project improvements. Regionally, implementation of the project could result in an incremental increase in the volume of traffic on State Highways in proportion to the relative population increase cited above. The overall traffic increase described above would be distributed to streets near the site and to the regional circulation system. This countywide traffic volume increase spread across all County roads would be too small to have a significant impact on operating LOS. Consequently the incremental increase of vehicle trips would be **less-than-significant** based on the thresholds applied to mainline facilities (i.e., 1.0% increase).

In addition to the ongoing increase in roadway use associated with additional recreation visitors, the local population supported by visitor and O&M spending, and commuting O&M workers, construction activity associated with implementing the SA articles would impact roadways by increasing truck traffic and construction workers commuting from out-of-county locations. Assuming that construction occurs over a 10-year period, the equivalent of about 180 jobs would be supported annually by this construction activity, of which less than 20 workers would be expected to be commuting from out-of-county locations. Because the number of project-related construction workers using local roadways daily is relatively small compared to the projected 2020 population for Butte County that would be using local roadways, the effect of this short-term activity on the traffic load and capacity of the street system would be minor. Thus, this impact is considered to be **less-than-significant** and no mitigation is required.

Localized Impacts

Implementation of the Recreation Management Plan (SA Article 127) would increase the number of campsites at Lime Saddle Campground; provide a new primitive campground at the Thermalito Afterbay Outlet; provide additional parking spaces at the Lime Saddle Boat Ramp and Marina, Bidwell Canyon Marina, and Oroville Dam Day Use Area; and provide improvements to day-use sites at the Thermalito Afterbay Outlet. These recreation enhancements would generate a total of about 550 additional vehicle trips (275 inbound and 275 outbound) spread to the primary access roads serving each facility.

As indicated in Table 5.14-1, recreation-related vehicle trips represent a relatively small percent of the total number of trips along four of the five local roads. These four road segments (Pentz Road, Kelly Ridge Road, Canyon Drive, and Larkin Road) also serve residential, rural residential, and/or agricultural uses. Improvements also would occur at Lime Saddle Campground, which is served by Lime Saddle Road where recreation-related trips account for a larger proportion of traffic, in part, because the road also serves another nearby recreation facility. However, total traffic volumes on this road are low, and there are no existing capacity issues. This level of traffic volume increase would not change current LOS and would not result in conditions in excess of adopted standards. No change to LOS is projected. Thus, this impact is considered to be **less-than-significant** and no mitigation is required.

FERC — Impacts related to traffic under the FERC Staff Alternative would be similar to those under the Proposed Project. The FERC Staff Alternative includes a schedule acceleration of the Riparian and Floodplain Improvement Program (SA Article A106). This, in turn, could result in minor increases in traffic volumes and congestion in and near the project. No change to LOS is projected. These impacts would be considered **less-than-significant.**

Impact 5.14-b: Exceed, either individually or cumulatively, an LOS standard established by the county congestion management agency for designated roads or highways.

The construction of new or improved facilities and implementation of new programs and actions that would increase public recreation use at the Oroville Facilities could result in a change in LOS related to existing traffic load and capacity for roads and highways in the Project area. However, there are no designated Congestion Management Plan (CMP) roadways in Butte County.

NO — Under the No-Project Alternative, the Oroville Facilities would continue to be operated as they are now under the terms and conditions of the existing FERC license, and no new PM&E measures would be implemented, other than those arising from existing legal obligations and agreements. In addition, DWR would continue existing routine operations and maintenance practices needed for the Oroville Facilities. No CMP roadways exist in Butte County. Thus, there would be a **less-than-significant** impact associated with the No-Project Alternative.

PRO; FERC — Under the Proposed Project, implementation of the SA articles could result in an increase in recreation activity, the local population supported by visitor spending, and commuting workers in the project area. No CMP roadways exist in Butte County Thus, this impact is considered to be **less-than-significant** and no mitigation is required.

Impact 5.14-c: Result in a Change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks.

There are no actions under the project alternatives that have the potential to change air traffic patterns.

Impact 5.14-d: Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses.

There are no actions under the project alternatives that have the potential to increase hazards due to design features or incompatible uses.

Impact 5.14-e: Result in inadequate emergency access.

The construction of new facilities and the resultant increase in use could result in a decrease in emergency access.

NO — Under the No-Project Alternative, use of recreation facilities in the project area would increase in the future due to demand generated by regional and statewide population growth. However, because changes in projected populations are expected to be relatively small and gradual, effects on emergency access near the Oroville Facilities would be minor. There would be a **less-than-significant** impact associated with the No-Project Alternative.

PRO, FERC — Implementation of the Proposed Project or the FERC Staff Alternative would involve the construction of various facilities at the project site such as parking lots, Americans with Disabilities Act–related enhancement of some campsites, widening and graveling of some dirt roads, and opening of new trails. These actions would result in better circulation and access throughout the project area. Neither the Proposed Project nor the FERC Staff Alternative would prevent efficient emergency access to any portion of the project area. These actions would result in **less-than-significant** impacts and no mitigation is required.

Impact 5.14-f: Result in Inadequate Parking Capacity.

The construction of new facilities could result in inadequate parking capacity.

NO — Under the No-Project Alternative, use of recreation facilities in the project area would increase in the future due to demand generated by regional and statewide population growth. However, because changes in projected populations are expected to be relatively small and gradual, effects on parking capacity near the Oroville Facilities would be minor. There would be **less-than-significant** impact associated with the No-Project Alternative.

PRO, FERC — Implementation of the Proposed Project or the FERC Staff Alternative would involve the construction of additional parking spaces proposed at 3 locations, which would be expected to add approximately 380 weekday trips if the new spaces were used at full capacity. These actions would result in **beneficial** effects with regard to parking capacity and therefore no mitigation is required.

Impact 5.14-g: Conflict with adopted policies, plans, or programs supporting alternative transportation.

There are no actions under the project alternatives that have the potential to conflict with adopted policies, plans or programs supporting alternative transportation.

Other Considerations

As described above, the potential increase in public recreation use at the Oroville Facilities and the construction of new and improved facilities under the Proposed Project and FERC Staff Alternative are expected to increase roadway usage in the project area. This expected increase in roadway usage could result in additional roadway deterioration and maintenance needs. Although not specifically identified in Appendix G of the CEQA guidelines as an impact topic, this potential issue is addressed here.

The construction of new or improved facilities, implementation of new programs and actions that would increase recreation use at the Oroville Facilities, increases in project-related O&M and construction activity, and increases in the population supported directly and indirectly by visitor and O&M spending are expected to contribute to an increase in roadway usage in relation to existing usage. To evaluate how this increase in roadway usage may affect roadway deterioration and road maintenance needs, estimates of changes in the average number of recreation visitors, commuting workers, and the local population supported by the Oroville Facilities are considered. For this evaluation, the average number of daily visitor days by nonresidents of the unincorporated area of Butte County (i.e., coming from outside of Butte County or from cities within Butte County) is used. This measure of visitation is used because it is reasonable to assume that if residents of unincorporated Butte County, where the Oroville Facilities are located, were not recreating at the Oroville Facilities, they would still be using the roads in the unincorporated county, and therefore contributing to usage and potential deterioration of these roads. The County-maintained roads regularly or

sometimes used by visitors to reach the Oroville Facilities are shown in Figure 4.14-5 and are identified in Section 4.14.4, Road Maintenance.

Under the No-Project Alternative, the average daily number of recreation visitors coming from outside of Butte County or from cities within Butte County to the Oroville Facilities is anticipated to increase from 1,910 visitor days in 2002-03 to a projected 2,360 visitor days in 2020, representing an increase of 450 daily visitor days. (As mentioned above, only visitation by persons who do not reside in unincorporated Butte County would increase roadway usage in the county because county residents already use local roads.) Additionally, the population directly and indirectly supported by visitor and O&M spending is projected to increase from a current level of 2,360 to 2,770 in 2020, representing a 410-person increase. Together, project visitors and the population supported by the project would add 860 persons to the overall population using roadways within Butte County in 2020. This increase would represent 0.4 percent of Butte County's 2003 population of 210,030 and 0.3 percent of Butte County's projected population of 276,280 in 2020 (BCAG 2006).

Under the Proposed Project, average daily visitation by non-residents of unincorporated Butte County to the Oroville Facilities is projected to increase from 1,910 visitor days in 2002-03 to about 2,820 visitor days in 2020, representing an average daily increase of 910 visitor days. (As discussed previously, only visitation by persons who do not reside in Butte County would result in increased use of local roadways in the county.) However, about half of this 910-visitor increase would occur as a result of regional and statewide population growth unrelated to project improvements. Additionally, the population directly and indirectly supported by visitor and O&M spending is projected to increase from a current level of 2,360 to 3,160 in 2020, representing a 800-person increase, about half of which would be attributable to regional and statewide growth unrelated to project improvements.

Implementation of the Proposed Project also would entail changes in O&M practices at the Oroville Facilities that likely would increase the number of workers commuting to the project area from out-of-county locations, thereby contributing to local road maintenance needs. Of the 65 additional O&M workers, however, fewer than 5 are estimated to commute from out-of-county locations based on the existing commuting patterns of Oroville Facilities employees.

Considered together, recreation visitors (non-residents of the unincorporated area of Butte County), the population supported by visitor and O&M spending, and O&M workers under the Proposed Project would permanently add about 1,715 persons to the overall daily population using roadways within Butte County in 2020. This increase would represent 0.8 percent of Butte County's 2003 population of 210,030 and 0.6 percent of Butte County's projected population of 276,280 in 2020 (BCAG 2006).

In addition to the ongoing increase in roadway use associated with additional recreation visitors, the local population supported by visitor and O&M spending, and commuting O&M workers, construction activity associated with implementing the SA Articles would impact roadways by increasing truck traffic and construction workers commuting from

out-of-county locations. Assuming that construction occurs over a 10-year period, the equivalent of about 180 jobs would be supported annually by this construction activity, of which less than 20 workers would be expected to be commuting from out-of-county locations. Construction activities also would be accompanied by truck traffic, assumed to be up to several hundred truckloads annually. Depending on the distribution of truck activity across the construction season, this level of annual truck activity would generate about five truckloads (i.e, five inbound and five outbound trucks) on a daily basis. While the introduction of truck traffic could have localized impacts on roadway pavement in the immediate project area, the extent of impacts would be dependent on the actual haul routes used and the amount of material involved.

The relative impact of truck traffic can be suggested based on factors employed by public agencies in the design of roads. The Caltrans Highway Design Manual (HDM) determines the structural requirements of roadway pavement sections based on *Traffic Index (T.I)* which in turns is based on the number of Equivalent Axel Loads (ESAL's) expected over the life cycle of the road. Over a 20 year period a typical two axle truck used each day to haul construction material results 1,380 ESAL's, while a 3 axle truck results in 3,680 ESAL's. In comparison, a HDM table 603.4A notes that typical two lane collector road designed with a T.I. of 7.5 can handle 164,000 to 288,000 ESAL's over its useful life, while an intra-regional road designed for a T.I. of 10.0 can handle 1,980,000 to 3,020,000 ESAL's per lane.

The various construction activities anticipated over the next 10 to 20 years at the Oroville facilities, including the actions identified in the settlement agreement, could result in up to 2,000 truck loads of construction materials, concrete, aggregate and gravel shipped to the site. Over twenty years, this would be the equivalent of fewer than 1 truck per average day. Assuming a 1:2 mix of two and 3 axel trucks, 1 truck trip per lane per day would result in less than 3,000 ESAL's per lane. This would represent only 2% of the load bearing capacity of a collector road and 0.2% of the capacity of an intra-regional road.

Over the life of the project, the incremental impact of phased implementation of construction activities would be too small to have a substantial impact on the conditions of regional roadway system. Locally, standard practice at the Oroville Facilities is to require that contractors repair any streets damaged by the local access activities of construction trucks. Assuming this practice continues, the local access impacts of construction activities would also be insignificant.

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5.15 PUBLIC HEALTH AND SAFETY

5.15.1 Regulatory Setting

5.15.1.1 Federal Plans, Policies, Regulations, and Laws

Hazardous Materials Handling

At the federal level, the principal agency regulating the generation, transport, and disposal of hazardous substances is the U.S. Environmental Protection Agency (USEPA), under the authority of the Resource Conservation and Recovery Act (RCRA). The RCRA established an all-encompassing federal regulatory program for hazardous substances that is administered by USEPA. Under the RCRA, USEPA regulates the generation, transportation, treatment, storage, and disposal of hazardous substances. The RCRA was amended in 1984 by the Hazardous and Solid Waste Amendments of 1984, which specifically prohibits the use of certain techniques for the disposal of various hazardous substances. The Federal Emergency Planning and Community Right to Know Act of 1986 imposes planning requirements for hazardous materials to help protect local communities in the event of accidental release. USEPA has delegated much of the RCRA requirements to the California Department of Toxic Substances Control (DTSC).

Worker Safety Requirements

The U.S. Department of Labor, Occupational Safety and Health Administration (OSHA), is responsible at the federal level for ensuring worker safety. OSHA sets federal standards for implementation of workplace training, exposure limits, and safety procedures for the handling of hazardous substances (as well as other hazards). OSHA also establishes criteria by which each state can implement its own health and safety program.

5.15.1.2 State Plans, Policies, Regulations, and Laws

Hazardous Materials Handling

The California Hazardous Materials Release Response Plans and Inventory Law of 1985 (Business Plan Act) requires preparation of hazardous materials business plans and disclosure of hazardous material inventories. A business plan includes an inventory of hazardous materials handled, facility floor plans showing where hazardous materials are stored, an emergency response plan, and provisions for employee training in safety and emergency response procedures (California Health and Safety Code, Division 20, Chapter 6.95, Article 1). Statewide, DTSC has primary regulatory responsibility for management of hazardous materials, with delegation of authority to local jurisdictions that enter into agreements with the State.

Worker Safety Requirements

The California Occupational Safety and Health Administration (Cal-OSHA) assumes primary responsibility for developing and enforcing workplace safety regulations within California. Cal-OSHA regulations pertaining to the use of hazardous materials in the workplace, as detailed in California Code of Regulations Title 8, include requirements for safety training, availability of safety equipment, accident and illness prevention programs, hazardous substance exposure warnings, and preparation of emergency action and fire prevention plans. Cal-OSHA enforces regulations for hazard communication programs that contain training and information requirements, including procedures for identifying and labeling hazardous substances, communicating hazard information related to hazardous substances and their handling, and preparation of health and safety plans to protect workers and employees at hazardous waste sites. The hazard communication program requires that Material Safety Data Sheets be available to employees and that employee information and training programs be documented.

Emergency Response to Hazardous Materials Incidents

The State of California has developed an emergency response plan to coordinate emergency services provided by federal, State, and local governments and private agencies. Response to hazardous materials incidents is one part of this plan. The plan is managed by the Governor's Office of Emergency Services (OES), which coordinates the responses of agencies including the California Environmental Protection Agency (Cal EPA), California Highway Patrol, DFG, and Central Valley Regional Water Quality Control Board.

Hazardous Materials Transport

The U.S. Department of Transportation regulates transportation of hazardous materials between states. California agencies with primary responsibility for enforcing federal and State regulations and responding to hazardous materials transportation emergencies are the California Highway Patrol and the California Department of Transportation. Together, these agencies determine container types used and license hazardous waste haulers for transportation of hazardous waste on public roads.

5.15.1.3 Local Plans, Policies, Regulations, and Laws

Butte County maintains an Interagency Hazardous Materials Team (Team). The Team was organized by the Butte County Fire Chiefs' Association beginning in 1989 through the use of a Joint Powers Agreement. Team members are provided by the various departments: Cities of Chico, Oroville, Paradise, Biggs, and Gridley; and the County of Butte/California Department of Forestry and Fire Protection (CDF Fire). Funding is provided through the Joint Powers Agreement at $0.10 per capita (serving 210,000 people of Butte County), Cal EPA grants, and reimbursements. Annual responses number about 120, with drug labs and waste being the main cause of incidents. Other

significant incidents include train derailments, tanker overturns, and agricultural incidents.

The Team is composed of 33 specialists/technicians and an additional 10 technicians who provide support. The Team trains together monthly, and, using the State-approved hazardous materials training grounds at Butte College, training includes a variety of hands-on experiences. The Team's use is guided by written operational procedures.

The Team staffs two units: the first unit, Haz Mat 64, is stationed at the Kelly Ridge CDF Fire/Butte County Station, and Haz Mat 1 is stationed at Chico Station 1.

Regional Response

Through a contract with Cal EPA, this Team is available for response throughout OES Region III (Marysville north to the Oregon border). Cal EPA guarantees covering team costs if the requesting jurisdiction helps to secure reimbursement from the responsible party (if possible). This regional concept also involves the Marysville hazardous materials team, which rotates on call with the Butte County team.

The teams respond to between 60 and 120 calls per year. About 30 percent of the calls are from methamphetamine labs and waste dumps. Other significant calls are railroad and highway oriented.

5.15.2 Impact Thresholds

The following thresholds are used to determine whether the alternatives would cause a significant effect related to hazardous waste. There would be a significant impact if the alternatives would:

- 5.15-a: Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials;
- 5.15-b: Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment;
- 5.15-c: Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school;
- 5.15-d: Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan; or
- 5.15- e: Expose people or structures to a significant risk of loss, injury, or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands.

5.15.3 Method of Analysis

A thorough search of available environmental databases was conducted in order to determine whether any sites containing hazardous materials are located within the FERC Project boundary and whether sites relate to existing underground storage tanks, aboveground storage tanks, hazardous materials handling, hazardous waste generation, or hazardous materials spill incidents.

In addition, the Proposed Project actions were evaluated for the potential of each action to release hazardous materials into the environment.

5.15.4 Impacts and Mitigation Measures

The following section describes the beneficial effects and potentially adverse impacts of the Proposed Project, including both programmatic and project-level analyses. Table 5.15-1 indicates the SA articles that could have an effect on public health and safety, and whether these effects are expected to be beneficial, less-than-significant, or would be less-than-significant following implementation of recommended mitigation measures. Refer to Section 5.12.4 Air Quality, Impacts and Mitigation Measures, for a discussion of the exposure of sensitive receptors to naturally occurring asbestos (NOA).

In addition to the Proposed Project, this DEIR analyzes the No-Project Alternative and the FERC Staff Alternative. Impacts on public health and safety from implementing the FERC Staff Alternative are similar to those anticipated from implementation of the Proposed Project unless noted. Potential impacts are identified as follows: NO (No-Project), PRO (Proposed Project), and FERC (FERC Staff Alternative). All alternatives analyzed result in **less-than-significant** impacts on public health and safety with the implementation of best management practices (BMPs) included in both the Proposed Project and the FERC Staff Alternative and as described in Appendix D, to address short-term, construction-related impacts, and no further mitigation would be required.

Impact 5.15-a: Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials.

There are no actions proposed under the project alternatives that have the potential to increase or create significant hazards to the public or the environment through the routine transport, use, or disposal of hazardous materials. DWR currently implements a spill prevention plan while conducting routine operations and maintenance, designed to avoid the creation of significant hazards to the public or the environment resulting from routine transport, use, or disposal of hazardous materials. No additional mitigation is required.

Table 5.15-1. **Environmental effects on public health and safety.**

Alternative(s)	Article # and Title	Level of CEQA Analysis	Nature of Potential Impact(s)	Effects
PRO, FERC	B102—Fuel Load Management Plan	Programmatic	Potential to decrease wildland fire hazards at urban interface.	B
PRO, FERC	A102—Gravel Supplementation and Improvement Program	Programmatic	Construction activities could lead to accidental releases of hazardous materials into the soil and/or adjacent watercourses. Use of heavy equipment could result in accidental spills.	LTSM
PRO, FERC	A104—Structural Habitat Supplementation and Improvement Program	Programmatic	Construction activities could lead to accidental releases of hazardous materials into the soil and/or adjacent watercourses. Use of heavy equipment could result in accidental spills.	LTSM
PRO, FERC	A106—Riparian and Floodplain Improvement Program	Programmatic	Construction activities could lead to accidental releases of hazardous materials into the soil and/or adjacent watercourses. Use of heavy equipment could result in accidental spills.	LTSM
PRO, FERC	A108—Instream Flow and Temperature Improvement for Anadromous Fish	Programmatic	Construction activities could lead to accidental releases of hazardous materials into the soil and/or adjacent watercourses. Use of heavy equipment could result in accidental spills.	LTSM
PRO, FERC	A127—Recreation Management Plan	Programmatic, with some Project elements	Construction activities could lead to accidental releases of hazardous materials into the soil and/or adjacent watercourses. Use of heavy equipment could result in accidental spills.	LTSM

Coding

B = Action with potential to result in a beneficial impact.

LTSM = Action that would result in less-than-significant impact on resource following mitigation.

Impact 5.15-b: Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment.

Hazardous materials could be accidentally released into the soil or an adjacent watercourse during construction activities.

NO — The No-Project Alternative does not include new construction activities. Ongoing maintenance and operations are conducted using BMPs to avoid exposing the public to hazardous materials. Therefore, potential effects from the No-Project Alternative are considered **less-than-significant**.

PRO, FERC — Some actions included in the Proposed Project and the FERC Staff Alternative do not involve the use of heavy equipment (and the use of materials such as oil, grease, or fuel), hence, they would have **no impact** related to hazardous materials and no mitigation would be required.

The Gravel Supplementation and Improvement Program (SA Article A102), Structural Habitat Supplementation and Improvement Program (SA Article A104), Riparian and Floodplain Improvement Program (SA Article A106), Flow/Temperature to Support Anadromous Fish (SA Article A108), and the SA Recreation Management Plan (SA Article A127) could involve the presence of hazardous materials such as oil, grease, or fuel near and/or in the FERC Project boundary. Accidental release of these materials into the soil or an adjacent watercourse could be **potentially significant**.

Mitigation measure 5.15-b: Implement safe-handling procedures; prepare a Spill Prevention, Control, and Countermeasure Plan; and contain runoff.

PRO, FERC — DWR would incorporate into program implementation on-site handling rules to keep hazardous materials out of the soil and receiving waters. The rules could include measures to:

- Store all reserve fuel supplies only within the confines of a designated staging area;
- Refuel equipment only in designated areas within the staging area;
- Regularly inspect all vehicles for leaks;
- Require preparation of a Spill Prevention, Control, and Countermeasure Plan; and

- Require that staging areas be designed to contain contaminants such as oil, grease, and fuel products so that they do not drain toward receiving waters or storm drain inlets.

This mitigation measure would reduce the potential impacts related to the hazardous materials release to **less-than-significant**.

Impact 5.15-c: Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school.

There are no actions proposed under the project alternatives that have the potential to emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school. Thus, there is **no impact** and no mitigation is required.

Impact 5.15-d: Impair implementation of or physically interfere with an adopted Emergency Response Plan or Emergency Evacuation Plan.

There are no actions proposed under the project alternatives that have the potential to impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan. Thus, there is **no impact** and no mitigation is required.

Impact 5.15-e: Expose people or structures to a significant risk of loss, injury, or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands.

There are no actions proposed under the project alternatives that have the potential to expose people or structures to a significant risk of loss, injury, or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands. The Proposed Project and the FERC Staff Alternative both include development of a fuel load management plan (SA Section B102, FS 4(e) condition). It is expected that the completion and implementation of the plan would result in improved fuel load management on project lands and lead to an associated reduction in the risk of wildfires in the future. This is a **beneficial** effect and thus, no mitigation is required.

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5.16 CEQA SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE PROPOSED PROJECT AND FERC STAFF ALTERNATIVE

This section presents the results of the impact analysis for the Proposed Project and the FERC Staff Alternative in tabular format by SA Articles (Appendix A) and Sections (Appendix B) and identifies when mitigation measures would be used to reduce impacts to less than significant levels. Table 5.16-1 identifies beneficial effects as well as adverse impacts.

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Table 5.16-1. CEQA Summary of Impacts and Mitigation Measures for the Proposed Project and FERC Staff Alternative.

Article #	Article Title	Environmental Topics: Level of CEQA Analysis - Project-level, Programmatic Level, or No Analysis at this time	5.1 Geology	5.2.1 Surface Water Quantity	5.2.2Surface Water Quality	5.3 Ground Water Quality/Quantity	5.4 Aquatic	5.5.1 Terrestrial - Wildlife	5.5.2 Terrestrial - Botanical	5.6 Land Use	5.7 Recreation	5.8 Cultural	5.9.1 Population and Housing[1]	5.9.2 Public Services[1]	5.10 Environmental Justice	5.11.1 Visual Resources	5.11.2 Noise	5.12 Air Quality	5.13 Agricultural Resources	5.14 Transportation and Traffic	5.15 Public Health and Safety
APPENDIX A																					
A102	Gravel Supplementation and Improvement Program (Also see B105)	Programmatic with some Project elements	B	NI	B/LTS	NI	B/LTS	LTS/LTSM	B/LTS	NI	B	LTS	LTS	LTS	NI	B/LTS	LTSM	LTSM	NA	LTS	LTSM
A102 - FERC EIS	Gravel Supplementation and Improvement Program	Programmatic with some Project elements	B	NI	B/LTS	NI	B/LTS	LTS/LTSM	B/LTSM	NI	B	LTS	LTS	LTS	NI	B/LTS	LTSM	LTSM	NA	LTS	LTSM
A102 - Mitigation Measures	Gravel Supplementation and Improvement Program							During construction activities, avoid wildlife nursery areas during critical nesting periods.	Implement invasive species management and revegetate with appropriate native species. Stockpile soil if avoidance is not possible. Avoid ground-disturbing activities whenever possible, lessen areas of disturbance during project construction, and revegetate disturbed area with native species. Stockpile soil for reuse in areas of special resources to reinoculate the soils and seed bank.								If using heavy construction equipment closer than 75 feet to residences, campgrounds, or similar recreation or noise-sensitive areas, the construction manager would either (a) arrange for all persons who would otherwise be within 75 feet of the work area to be moved to a farther distance or prevented from camping or recreating within the 75-foot limit, or, if not feasible, (b) erect temporary barriers of wood, noise abatement blankets, or similar material between the work area and the receptors. The barriers should be at least 8 feet high and solid from the ground to the top, and made of material that would reduce noise through the barrier (transmission loss) by at least 20 dBA. Plywood one-half inch thick would meet this requirement. Require construction contractors to limit noise-generating construction activities to the hours of 7 a.m. to 8 p.m., Monday through Friday, with no noise-generating activities on Saturdays, Sundays, or legal holidays. However, this restriction would not be applicable if it would result in operational impacts on the	Persons performing grading, excavation, or similar dust-generating activities shall take every reasonable precaution not to cause or allow the emissions of fugitive dust to be airborne into areas occupied by residents or persons visiting the areas adjacent to the work site.			DWR would incorporate into program implementation on-site handling rules to keep hazardous materials out of the soil and receiving waters. The rules could include measures to: Store all reserve fuel supplies only within the confines of a designated staging area; Refuel equipment only in designated areas within the staging area; Regularly inspect all vehicles for leaks; Require preparation of a Spill Prevention, Control, and Countermeasure Plan; and Require that staging areas be designed to contain contaminants such as oil, grease, and fuel products so that they do not drain toward receiving waters or storm drain inlets.

Table 5.16-1. CEQA Summary of Impacts and Mitigation Measures for the Proposed Project and FERC Staff Alternative.

Article #	Article Title	Environmental Topics																		
		Level of CEQA Analysis - Project-level, Programmatic Level, or No Analysis at this time	5.1 Geology	5.2.1 Surface Water Quantity	5.2.2Surface Water Quality	5.3 Ground Water Quality/Quantity	5.4 Aquatic	5.5.1 Terrestrial - Wildlife	5.5.2 Terrestrial - Botanical	5.6 Land Use	5.7 Recreation	5.8 Cultural	5.9.1 Population and Housing[1]	5.9.2 Public Services[1]	5.10 Environmental Justice	5.11.1 Visual Resources	5.11.2 Noise	5.12 Air Quality	5.13 Agricultural Resources	5.14 Transportation and Traffic	5.15 Public Health and Safety
																	Oroville Facilities or prevent activities to mitigate adverse conditions such as response to emergencies or other unforeseen situations.				
A103	Channel Improvement Program (This action is programmatic however, Moes and Hatchery Ditch activities are project-level)	Programmatic with some Project elements	NA	NI	B/LTS	NI	B/LTS	LTS/LTSM	B/LTS/LTSM	NI	B/LTS	LTS	LTS	LTS	NI	B	LTS/LTSM	LTS/LTSM	NA	LTS	NA
A103 Mitigation Measures	Channel Improvement Program (This action is programmatic however, Moes and Hatchery Ditch activities are project-level)							Spatial and/or temporal avoidance	For work related to the Feather River Improvement Program, use measures such as fencing to prevent access/ disturbance into adjacent wetland/sensitive areas from construction/maintenance vehicles. Use erosion control and stabilization devices to prevent sediment from entering wetland and riparian habitats. Wetland/sensitive areas that cannot be avoided will be revegetated with appropriate native species. Use appropriate native species when revegetating adjacent wetland/riparian areas.								Same mitigation as described for A102	Same mitigation as described for A102			

Table 5.16-1. CEQA Summary of Impacts and Mitigation Measures for the Proposed Project and FERC Staff Alternative.

Article #	Article Title	Environmental Topics																		
		Level of CEQA Analysis - Project-level, Programmatic Level, or No Analysis at this time	5.1 Geology	5.2.1 Surface Water Quantity	5.2.2Surface Water Quality	5.3 Ground Water Quality/Quantity	5.4 Aquatic	5.5.1 Terrestrial - Wildlife	5.5.2 Terrestrial - Botanical	5.6 Land Use	5.7 Recreation	5.8 Cultural	5.9.1 Population and Housing[1]	5.9.2 Public Services[1]	5.10 Environmental Justice	5.11.1 Visual Resources	5.11.2 Noise	5.12 Air Quality	5.13 Agricultural Resources	5.14 Transportation and Traffic	5.15 Public Health and Safety
A104	Structural Habitat Supplementation and Improvement Program (SHSI)	Programmatic	B	NI	B/LTS	NI	B/LTS	LTS/LTSM	B/LTS/LTSM	NI	B/LTS	LTS	LTS	LTS	NI	B	LTSM	LTSM	NA	LTS	LTSM
A104 Mitigation Measures	Structural Habitat Supplementation and Improvement Program (SHSI)							Retain screening vegetation to limit indirect habitat loss and wildlife disruption/displacement. Retain key wildlife habitat elements to the extent possible including snags, woody dead and down material, live trees containing cavities, and shrub cover. Retain mature trees and minimize use of non-native landscaping. Minimize recreational development in riparian or wetland habitats. Revegetate areas of disturbed soil.	Same mitigation as described for A103				LTS				Same mitigation as described for A102	Same mitigation as described for A102			Same mitigation as described for A102
A105	Fish Weir Program	Programmatic	NI	NI	B/LTS	NI	B	LTS/LTSM	B/LTS/LTSM	NI	LTS	LTS	LTS	LTS	NI	LTS	LTSM	LTSM	NA	LTS	NA
A105 Mitigation Measures	Fish Weir Program							Modify weir design and operation to allow turtles passage without allowing salmon passage. Allow shoreline/shallow-water passage during periods of stable flow.	Same mitigation as described for A102								Same mitigation as described for A102	Same mitigation as described for A102			
A106	Riparian and Floodplain Improvement Program	Programmatic	B	NI	B/LTS	NI	B/LTS	B	B/LTSM	NI	B/LTS	LTS	LTS	LTS	NI	NA	LTSM	LTSM	NA	LTS	LTSM
A106 - FERC EIS	Riparian and Floodplain Improvement Program	Programmatic	B	NI	B/LTS	NI	B/LTS	B	B/LTSM	NI	B/LTS	LTS	LTS	LTS	NI	NA	LTSM	LTSM	NA	LTS	LTSM

Table 5.16-1. CEQA Summary of Impacts and Mitigation Measures for the Proposed Project and FERC Staff Alternative.

Article #	Article Title	Environmental Topics																		
		Level of CEQA Analysis - Project-level, Programmatic Level, or No Analysis at this time	5.1 Geology	5.2.1 Surface Water Quantity	5.2.2Surface Water Quality	5.3 Ground Water Quality/Quantity	5.4 Aquatic	5.5.1 Terrestrial - Wildlife	5.5.2 Terrestrial - Botanical	5.6 Land Use	5.7 Recreation	5.8 Cultural	5.9.1 Population and Housing[1]	5.9.2 Public Services[1]	5.10 Environmental Justice	5.11.1 Visual Resources	5.11.2 Noise	5.12 Air Quality	5.13 Agricultural Resources	5.14 Transportation and Traffic	5.15 Public Health and Safety
A106 Mitigation Measures	Riparian and Floodplain Improvement Program								Same mitigation as described for A103								Same mitigation as described for A102	Same mitigation as described for A102			Same mitigation as described for A102
A107	Feather River Fish Hatchery water temperature	Project (107.2)	NA	NI	B/LTS	NI	B	NA	NA	NI	LTS	NI	LTS	LTS	NI	NA	LTS	LTS	NI	LTS	NI
A108	Minimum Flow and Other Measures	Project (A108.1 only); Programmatic (108.2 and 108.3 only)**	NA	NI	B/LTS	NI	B/LTS	NA	B/LTS	NI	B/LTS	NI	LTS	LTS	NI	NA	LTSM	LTS	B/LTS	LTS	LTSM
A108 Mitigation Measures	Minimum Flow and Other Measures																Same mitigation as described for A102	Same mitigation as described for A102			Same mitigation as described for A102
A110	Lake Oroville Warm Water Fishery Habitat Improvement Program	Programmatic	NA	NI	B/LTS	NI	B	B	B/LTS	NI	B/LTS	LTS	LTS	LTS	NI	LTS	LTS/LTSM	LTS/LTSM	NA	LTS	NA
A110 Mitigation Measures	Lake Oroville Warm Water Fishery Habitat Improvement Program																Same mitigation as described for A102	Same mitigation as described for A102			
A111	Lake Oroville Cold Water Fishery Improvement Program	Programmatic	NA	NI	NA	NI	B	B	NA	NI	NA	NI	LTS	LTS	NI	NA	LTSM	LTS	NA	LTS	NA
A111 Mitigation Measures	Lake Oroville Cold Water Fishery Improvement Program																Same mitigation as described for A102	Same mitigation as described for A102			
A112	Comprehensive Water Monitoring Program	Project (all of A112 except A112[a-c]=Programmatic)	NA	NI	NA	NI	NA	NA	NI/LTS	NI	B	NI	LTS	LTS	NI	LTS	LTS	LTS	NA	LTS	NA
A113	Monitoring of Bacteria Levels and Public Education	Project	NA	NI	NA	NI	NA	NA	NI	NI	B	NI	LTS	LTS	NI	NA	NI	NA	NA	LTS	NA
A114	Public Education Regarding Risks of Fish Consumption	Project	NA	NI	NA	NI	NA	NA	NI	NI	B	NI	LTS	LTS	NI	NA	NI	NA	NA	LTS	NA
A117	Protection of Vernal Pools	Project	NA	NI	NA	NI	NA	B	B/LTS	NI	LTS	NI	LTS	LTS	NI	LTS	NI	NA	NA	LTS	NI

Table 5.16-1. CEQA Summary of Impacts and Mitigation Measures for the Proposed Project and FERC Staff Alternative.

Article #	Article Title	Environmental Topics																		
		Level of CEQA Analysis - Project-level, Programmatic Level, or No Analysis at this time	5.1 Geology	5.2.1 Surface Water Quantity	5.2.2Surface Water Quality	5.3 Ground Water Quality/Quantity	5.4 Aquatic	5.5.1 Terrestrial - Wildlife	5.5.2 Terrestrial - Botanical	5.6 Land Use	5.7 Recreation	5.8 Cultural	5.9.1 Population and Housing[1]	5.9.2 Public Services[1]	5.10 Environmental Justice	5.11.1 Visual Resources	5.11.2 Noise	5.12 Air Quality	5.13 Agricultural Resources	5.14 Transportation and Traffic	5.15 Public Health and Safety
A118	Minimization of Disturbances to Nesting Bald Eagles	Project	NA	NI	NA	NI	NA	B	B/LTS	NI	LTS	LTS	LTS	LTS	NI	NA	NI	NA	NA	LTS	NI
A119	Protection of Giant Garter Snake	Project	NA	NI	NA	NI	NA	B	NI/B/LTS	NI	LTS	NI	LTS	LTS	NI	NA	NI	NA	NA	LTS	NI
A120	Protection of Valley Elderberry Longhorn Beetle	Project	NA	NI	NA	NI	NA	B	NI/B/LTS	NI	LTS	LTS	LTS	LTS	NI	NA	NI	NA	NA	LTS	NI
A121	Protection of Red-Legged Frog	Project	NA	NI	NA	NI	NA	B	NI/B/LTS	NI	LTS	NI	LTS	LTS	NI	NA	NI	NA	NA	LTS	NI
A122	Construction and Recharge of Brood Ponds	Project	LTSM	NI	LTS	NI	NA	B/LTS	B/LTS	NI	B/LTS	LTS	LTS	LTS	NI	LTS	LTSM	LTSM	NA	LTS	NI
A122 Mitigation Measures	Construction and Recharge of Brood Ponds		Screen for presence of fossils; If avoidance is not possible, have plans in place for the recovery/preservation of any fossils encountered.														Same mitigation as described for A102	Same mitigation as described for A102			
A123	Provision of Upland Food for Nesting Waterfowl	Project	NA	NI	NA	NI	NA	B	B/LTS	NI	B	NI	LTS	LTS	NI	NA	NI	NA	NA	LTS	NI
A124	Provision of Nest Cover for Upland Waterfowl	Project	NA	NI	NA	NI	NA	B	B/LTS	NI	B	NI	LTS	LTS	NI	NA	NI	NA	NA	LTS	NI
A125	Installation of Wildlife Nesting Boxes	Project	NA	NI	NI	NI	NA	B	NA	NI	B	NI	LTS	LTS	NI	LTS	NI	NA	NA	LTS	NI
A127	Recreation Management Plan	Programmatic with some Project elements	LTSM	NI	LTS	NI	NA	LTSM	LTSM	NI	B/LTS	LTS	LTS	LTS	B	LTS	B/LTSM	LTS/LTSM	NA	B/LTS	LTSM
A127 Mitigation Measures	Recreation Management Plan		Perform geologic investigation for facilities proposed in the Bidwell Marina area.					Same Mitigation as described for A104	Retain key wildlife habitat elements to the extent possible including snags, woody dead and down material, live trees containing cavities, and shrub cover. Retain mature trees and minimize use of non-native								Same mitigation as described for A102	Same mitigation as described for A102			Same mitigation as described for A102

Table 5.16-1. CEQA Summary of Impacts and Mitigation Measures for the Proposed Project and FERC Staff Alternative.

Article #	Article Title	Environmental Topics																		
		Level of CEQA Analysis - Project-level, Programmatic Level, or No Analysis at this time	5.1 Geology	5.2.1 Surface Water Quantity	5.2.2Surface Water Quality	5.3 Ground Water Quality/Quantity	5.4 Aquatic	5.5.1 Terrestrial - Wildlife	5.5.2 Terrestrial - Botanical	5.6 Land Use	5.7 Recreation	5.8 Cultural	5.9.1 Population and Housing[1]	5.9.2 Public Services[1]	5.10 Environmental Justice	5.11.1 Visual Resources	5.11.2 Noise	5.12 Air Quality	5.13 Agricultural Resources	5.14 Transportation and Traffic	5.15 Public Health and Safety
									landscaping. Minimize recreational development in riparian or wetland habitats. Revegetate areas of disturbed soil with native species. To reduce impacts on woodland communities, design new recreational features and improvements to minimize loss of large trees and special resource areas within the woodland communities.												
A128	Historic Properties Management Plan	Programmatic	NA	NI	NA	NI	NA	LTS	NA	NI	LTS	B	LTS	LTS	B	NA	NA	NA	NA	LTS	NI
A128 - FERC EIS	Historic Properties Management Plan	Programmatic	NA	NI	NA	NI	NA	LTS	NA	NI	LTS	B	LTS	LTS	B	NA	NA	NA	NA	LTS	NI
A129	Improve and Redirect Recreation Usage to Specific Areas at Foreman Creek (Plan development)	Project	NA	NI	B/LTS	NI	NA	B	B/LTS	NI	NA	B	LTS	LTS	NI	LTS	NI	NA	NA	LTS	NI
A129 - FERC EIS	Improve and Redirect Recreation Usage to Specific Areas at Foreman Creek (Temporary closure during Plan development)	Project	NA	NI	LTS	NI	NA	B	B/LTS	NI	LTS	B	LTS	LTS	NI	LTS	NI	NA	NA	LTS	N
A132	Screening of Material Storage Area	Project	NA	NI	NA	NI	NA	NA	B/LTS	NI	NA	NA	LTS	LTS	NI	B	NI	NA	NA	LTS	NI
FERC EIS	Re-seed, as necessary, the downstream face of Oroville dam. [FERC]	Project	NA	NI	NA	NI	NA	NA	NI	NI	NA	NI	LTS	LTS	NI	NI	NI	NA	NA	LTS	NI

Table 5.16-1. CEQA Summary of Impacts and Mitigation Measures for the Proposed Project and FERC Staff Alternative.

Article #	Article Title	Environmental Topics																		
		Level of CEQA Analysis - Project-level, Programmatic Level, or No Analysis at this time	5.1 Geology	5.2.1 Surface Water Quantity	5.2.2Surface Water Quality	5.3 Ground Water Quality/Quantity	5.4 Aquatic	5.5.1 Terrestrial - Wildlife	5.5.2 Terrestrial - Botanical	5.6 Land Use	5.7 Recreation	5.8 Cultural	5.9.1 Population and Housing[1]	5.9.2 Public Services[1]	5.10 Environmental Justice	5.11.1 Visual Resources	5.11.2 Noise	5.12 Air Quality	5.13 Agricultural Resources	5.14 Transportation and Traffic	5.15 Public Health and Safety
APPENDIX B																					
B102	Development of a Fuel Load Management Plan		NA	NI	NA	NA	NA	NA	NA	NA	NA	NA	LTS	NA	NA	NA	LTSM	LTSM	NA	LTS	B
B102 Mitigation Measures	Development of a Fuel Load Management Plan																Same mitigation as described for A102	If Fuel Load Management Program includes prescribed burns, the burns would be planned and coordinated with the BCAQMD in accordance with their Rule 309—Wildland Vegetation Management Burning. All prescribed burns would be approved by BCAQMD prior to execution.			
B103	Evaluation of need for Additional Gaging	Project (Visual), Programmatic (Terrestrial-Wildlife)	NA	NI	NA	NI	NA	LTS	NI	NI	NA	NI	LTS	LTS	NI	LTSM	NI	NA	NA	LTS	NI
B103 Mitigation Measures	Evaluation of need for Additional Gaging															If needed, implement measures to avoid, reduce, or compensate for changes to visual resources with partial screening from public view or planting of other vegetation to reduce potential visual impacts.					

Table 5.16-1. CEQA Summary of Impacts and Mitigation Measures for the Proposed Project and FERC Staff Alternative.

Article #	Article Title	Environmental Topics																		
		Level of CEQA Analysis - Project-level, Programmatic Level, or No Analysis at this time	5.1 Geology	5.2.1 Surface Water Quantity	5.2.2Surface Water Quality	5.3 Ground Water Quality/Quantity	5.4 Aquatic	5.5.1 Terrestrial - Wildlife	5.5.2 Terrestrial - Botanical	5.6 Land Use	5.7 Recreation	5.8 Cultural	5.9.1 Population and Housing[1]	5.9.2 Public Services[1]	5.10 Environmental Justice	5.11.1 Visual Resources	5.11.2 Noise	5.12 Air Quality	5.13 Agricultural Resources	5.14 Transportation and Traffic	5.15 Public Health and Safety
B107	Revision of Speed Limit Regulation for Thermalito Afterbay - recommendation by DFG	Programmatic (Air Quality); Project (Terrestrial-Wildlife)	NA	NI	NA	NI	NA	LTS	NI	NI	NI	NI	LTS	LTS	NI	NA	NI	LTS	NA	LTS	NI
APPENDIX F	Habitat Expansion Agreement	Programmatic	NA	NA	NA	NA	B	NA	NA	NA	NA	LTS	NA	NA	NA	NA	NA	NA	NA	NA	NA

Coding:

B = Action with potential to result in a beneficial effect; could involve short-term, less-than-significant, construction related impacts that would be avoided or reduced through the use of Best Management Practices (BMPs). See Appendix D.

NA = No Analysis

NI = Action that would result in no impact.

LTS = Action that would result in less-than-significant impact on resource.

LTSM = Action that would result in less-than-significant impact on resource following mitigation.

CHAPTER 6.0

OTHER STATUTORY REQUIREMENTS

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6.0 OTHER STATUTORY REQUIREMENTS

6.1 GROWTH INDUCEMENT

The analysis of growth-inducing effects addresses the effects that economic and population growth fostered by the Proposed Project could have on local resource conditions, including housing, provision of public services, and other resources (i.e., air quality, water quality, and biological resources). The analysis of growth-inducing effects of the project alternatives is based on the expected change in population attributed to the Oroville Facilities, which is addressed in Section 5.9.1, Population and Housing. These effects are summarized below for each alternative.

Under the No-Project Alternative, the Oroville Facilities would continue to be operated and maintained as they are now under the terms and conditions in the existing FERC license, and no new protection, mitigation, and enhancement (PM&E) measures would be implemented, other than those arising from existing legal obligations and agreements. The population of the local area is expected to increase in the future in response to regional and statewide population growth trends. As described in Section 5.9.1, Population and Housing, the population in Butte County supported by the jobs directly and indirectly supported by visitor and operations and maintenance (O&M) spending is estimated to increase from 2,360 in 2002 to 2,770 in 2020 under the No-Project Alternative, representing an increase of 410 persons, or an average annual increase of about 23 persons when spread over the 18-year period. (Growth in recreation use, and resulting growth in visitor-supported population, is presumed to increase at a similar rate throughout the remainder of the anticipated 50-year FERC project license period.) Because changes in projected populations are expected to be small and gradual, population-related effects on the demand for housing and public services (discussed in more detail in Section 5.9.1, Population and Housing, and Section 5.9.2, Public Services, respectively) and ancillary effects on natural resource conditions would be minor. The growth-inducing effects of the No-Project Alternative would be **less-than-significant**.

Under the Proposed Project, recreation facilities in the FERC Project area would be upgraded and new recreation facilities constructed over the term of the new license to address current needs and future needs based on monitoring. As discussed in Section 5.9.1, Population and Housing, implementation of the Proposed Project could generate permanent population growth in Butte County by attracting workers and their families. The population supported by jobs generated by visitor and O&M spending under the Proposed Project could increase from 2,360 in 2002 to 3,160 in 2020, with about half of this project-related growth expected to occur with or without implementation of the Proposed Project in response to regional and statewide population growth trends. (No population estimates are available for the Proposed Project beyond 2020; however, growth in recreation use, and resulting growth in visitor-supported population, is presumed to increase at a similar rate throughout the remainder of the anticipated 50-year FERC project license period.) The 800-person increase between 2002 and 2020 would represent average annual growth of 44 persons, including the annual 23-person

increase that would occur under the No-Project Alternative, when spread over the 18-year period. The effects of this increment of growth generated by the Proposed Project are anticipated to be small because the increase in employment and resulting population growth is expected to be minor and gradual, many new jobs could be filled by persons already residing in Butte County, and project-related population growth would be spread across a number of jurisdictions. Therefore, the growth-inducing effects of the Proposed Project on the demand for housing and public services (discussed in more detail in Section 5.9.1, Population and Housing, and Section 5.9.2, Public Services, respectively), and ancillary effects on natural resource conditions, would be minor and considered **less-than-significant**.

Under the FERC Staff Alternative, the population growth induced would be similar to that induced by the Proposed Project because the alternative proposes only minor changes to the actions comprising the Proposed Project, indicating that changes in visitation levels and resulting population levels would be similar. Therefore, the growth-inducing effects of the FERC Staff Alternative are also considered **less-than-significant**.

6.2 CUMULATIVE IMPACTS

CEQA requires that an EIR contain an assessment of the cumulative impacts that could be associated with a proposed project. This assessment involves examining project-related effects on the environment in the context of similar effects that have been caused by past or existing projects and that would be caused by reasonably foreseeable future projects. Even when project-related impacts are individually minor, the cumulative effects of these impacts, in combination with the impacts of other projects, could be significant under CEQA and must be discussed (State CEQA Guidelines, Sections 15130 and 15355[b]).

As described in Section 15065(c) of the State CEQA Guidelines, an EIR must discuss the cumulative impacts of a project when its incremental effect would be cumulatively considerable. This means that the incremental effects of an individual project would be cumulatively considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects.

Section 15355 of the State CEQA Guidelines defines cumulative impacts as "two or more individual effects which, when considered together, are considerable or which compound or increase other environmental impacts." This section states further that "[I]individual effects may be changes resulting from a single project or a number of separate projects. The cumulative impact from several projects is [defined as] the change in the environment which results from the incremental impact of the project when added to other closely related past, present, and reasonably foreseeable future projects. Cumulative impacts can result from individually minor but collectively significant projects taking place over a period of time." Cumulative effects occur when the incremental impacts of a project or action under consideration overlap with the effects of related actions in space (geographic) or in time (temporal).

The fact that a cumulative impact is significant on the whole does not necessarily mean that the project-related contribution to that impact is significant as well. Instead, under CEQA, a project-related contribution to a significant cumulative impact is only significant if the contribution is cumulatively considerable. The significance conclusion of the project's contribution to a cumulative impact considers whether the project implements or funds its fair share of a mitigation measure or measures designed to alleviate the cumulative impact. Where a lead agency is examining a project with an incremental effect that is not cumulatively considerable, it need not consider the effect significant, but must briefly describe the basis for its conclusion. However, Section 15130(a) of the State CEQA Guidelines requires that EIRs discuss the cumulative impacts of a project when the project's incremental effect is cumulatively considerable.

Section 15130(b) of the State CEQA Guidelines also indicates that the level of detail of the cumulative analysis need not be as great as for the project impact analyses; however, it should reflect the severity of the impacts and its likelihood of occurrence, and it should be focused, practical, and reasonable.

To be adequate, a discussion of cumulative effects must include the following elements:

- Either (a) a list of past, present, and probable future projects, including, if necessary, those outside the agency's control, or (b) a summary of projections contained in an adopted general plan or related planning document, or in a prior adopted or certified environmental document, that described or evaluated regional or area-wide conditions contributing to the cumulative impact, provided that such documents are referenced and made available for public inspection at a specified location;

- A summary of the individual projects' expected environmental effects; and

- A reasonable analysis of all the relevant projects' cumulative impacts, with an examination of reasonable, feasible options for mitigating or avoiding the project's contribution to such effects (Section 15130(b)).

The above CEQA guidance was used to develop the approach and format for each of the resource-specific cumulative impacts analyses in this DEIR. Each subsection below describes the cumulative effects of past and present related actions that have interacted with the baseline conditions of the Oroville Facilities and led to the related conditions described in Chapter 4.0, Environmental Setting. The discussion of historical impacts is limited by the amount of available information. Potential cumulative impacts in the future are then defined for each of the resources. These potential impacts may occur as reasonably foreseeable related actions interact with the incremental effects of the alternatives defined in Chapter 3.0.

6.2.1 Cumulatively Affected Resources and Related Actions

The resources listed below have the potential to be cumulatively affected by continued operation of the Oroville Facilities and other past, existing, and reasonably foreseeable related actions. The resource topics that are the focus of the analysis are indicated in parentheses. Other resource topics were considered but are not the focus of the cumulative analysis for the reasons noted in the related cumulative effects subsections of this chapter:

- Geology and soils (gravel recruitment, sediment transport, and large woody debris [LWD]);

- Surface water quantity (Feather River releases below Oroville Dam, Thermalito Diversion Dam, and Thermalito Afterbay, and Lake Oroville water surface elevations) and quality (water temperature);

- Aquatic resources (spring-run Chinook salmon and Central Valley steelhead, green sturgeon, river lamprey, and Sacramento splittail);

- Terrestrial resources (riparian vegetation in the Feather River below Oroville Dam and around Thermalito Afterbay and associated botanical and wildlife species, including special-status species);

- Recreational resources (project recreational resources affected by related actions, Feather River flows downstream of Oroville Dam, or Lake Oroville water surface elevations);

- Cultural resources (resources within the FERC Project boundary affected by related actions, Feather River flows below Oroville Dam, or Lake Oroville water surface elevations);

- Public services (local public services, including law enforcement, criminal justice, fire protection, emergency, and road maintenance services); and

- Agricultural resources (agricultural production within the Feather River Service Area [FRSA]).

Past, present, and reasonably foreseeable related actions addressed in the cumulative effects analysis are listed below. Past and present actions were considered related if they have contributed to cumulative effects on the resources listed above. Future actions were listed below if they were considered "reasonably foreseeable" (i.e., likely to occur given the status of such factors as project approvals, NEPA and/or CEQA compliance, permitting, and funding):

- Urban development and land uses and related population growth;

- Mining and dredging activities;

- Agricultural development and land uses;

- Water resource development needed to support urban or agricultural development (e.g., upstream and downstream diversions, storage and conveyance for supply purposes, upstream hydroelectric facilities, and downstream levee and dike construction for flood management purposes), including original construction of the Oroville Facilities;

- Local, State, or federal agency resource management and land use plans;

- Management of special-status species (including implementation of recovery plans, biological opinions, etc.);

- Ocean and stream harvesting of fish;

- Regional fish hatchery activities;

- Other recreational activities outside of the FERC Project boundary;

- Timber harvesting;

- Watershed management activities;

- The CALFED Bay-Delta Program (CALFED) and its implementation (for more information see http//calwater.ca.gov);

- The Central Valley Project Improvement Act (CVPIA) and its implementation including the Anadromous Fish Restoration Program (AFRP) (for more information see http://www.usbr.gov/mp/cvpia/);

- Pacific Gas and Electric Company's (PG&E's) Upper North Fork Feather River Project relicensing (P-2105), Bucks Creek relicensing (P-619), Poe Project relicensing (P-2107), and Rock Creek-Cresta license implementation (P-1962) (for more information see http://www.FERC.gov);

- South Feather Water and Power Agency's South Fork Feather River Project (P-2088) relicensing (for more information see http://www.FERC.gov);

- Delta Pumping Plant Fish Protection (Four Pumps) Agreement (for more information see http://www.des.water.ca.gov/mitigation_restoration_branch/fourpumps/);

- South Delta Improvements Program and its implementation (for more information see http://sdip.water.ca.gov/);

- Lower Yuba River Accord and its implementation (for more information see http://www.ycwa.com/); and

- The Yuba-Feather Supplemental Flood Control Project (for more information see http://www.ycwa.com/).

Section 5.4.1 contains additional information regarding many of the projects and regulatory proceedings listed above. The SWP, of which the Oroville Facilities are a vital part, and the recent Monterey Agreement, developed to address water allocation and issues pertaining to the management and financing of the SWP, are described below.

6.2.1.1 The State Water Project

The State Water Resources Development System, commonly known as the SWP, is the project authorized and financed by the California Water Resources Development Bond Act, also known as the Burns-Porter Act (Water Code Section 12930 et seq.). The Act was passed by the California Legislature in 1959 and approved by voters in 1960.

The Burns-Porter Act expressly authorized the State of California to enter into contracts for the sale, delivery, or use of water made available by the SWP in return for payment of a major portion of the capital and operation costs of the SWP. The first of these contracts was signed with the Metropolitan Water District of Southern California on November 4, 1960, and served as a prototype for all subsequent SWP long-term water supply contracts. The Burns-Porter Act and the long-term contracts provide the institutional structure supporting the operation and financing of the SWP (Water Code

Section 11450 et seq.; Water Code 12930 et seq.). DWR currently has contracts with 29 water agencies. Collectively known as the SWP contractors, these 29 water agencies deliver water directly to agricultural and urban water users or to water wholesalers or retailers.

Each contract for long term-term water supply contains a Table A that sets forth the maximum amount of dependable SWP water that the State agrees to deliver, if available for delivery, to a contractor on an annual basis. The State and SWP contractors also use Table A amounts to serve as a basis for allocation of some SWP costs among the contractors. Delivery of the Table A amount is not assured, but rather provides the basis for proportional allocation of available SWP supplies among the contractors. The precise amount of water received in any given year will depend on hydrological conditions and SWP operations. If deliveries have not reached the total of Table A amounts held by all 29 contractors, the actual amount received in any given year by a particular contractor will be a proportion of the available water supplies based on its Table A amount.

The water supply contracts call for progressive increases in the amount of Table A water delivered to each contractor, and are structured to reflect increasing water demands. Most contractors reached their maximum Table A in 1990. Originally, the maximum Table A amounts were anticipated to be a collective total of 4,230,000 acre-feet per year (afy) by 2020. This number is also referred to as the minimum project yield. As a result of contract amendments in the 1980s and the Monterey Amendment in 1995, the current combined maximum annual Table A amount is 4,172,686 acre-feet (afy).

As the contractors' Table A amounts increased, the expectation was that additional facilities would be built to meet the expected demand. Project development unfolded substantially as planned through the 1960s and early 1970s. Major components of the SWP were built and put into service, and the contractors took increasing quantities of water from the SWP.

Circumstances began to change in the 1970s. Various concerns, including environmental, political, financial, and hydrologic factors, prevented the development of some components of the SWP. Demands for SWP water are expected to rise as the population of California continues to increase.

6.2.1.2 The Monterey Agreement

The SWP contracts were originally executed in the 1960s. Contract provisions reflected DWR's expectations at that time with respect to future water demand and the construction schedule of SWP components. DWR and the contractors made many amendments to the contracts to resolve disagreements and address matters that arose over a 30-year period, but the most important contract provisions remained substantially unchanged until the early 1990s.

The water contracts in place through the mid-1990s contained provisions that specified how water would be allocated to contractors when the requested Table A amounts exceeded the available water supply. Specifically, Article 18 included 2 provisions intended to address short-term and permanent shortages, and 1 that addressed changes in the minimum project yield. Article 18(a) directed the State to reduce deliveries to agricultural contractors by a percentage not to exceed 50 percent in any year in which a shortage occurred due to drought or other temporary outages that reduced Table A amounts up to an aggregate limit of 100 percent in any series of 7 years before reducing water deliveries for other purposes. If additional reductions were needed, the contract specified that further reductions would be borne by all contractors. Article 18(b) dealt with permanent shortages and specified that DWR would reduce Table A amounts to all contractors such that the Table A amount equaled the minimum project yield. Article 18(d) allowed DWR to revise Table A amounts upward after implementing Article 18(b) if future conditions justified a revision.

During the drought in 1986–1992, water supply to agricultural contractors was drastically reduced. They were exposed to 50 percent reductions before the municipal and industrial (M&I) contractors experienced reductions in deliveries. Then in 1991, the supplies to agricultural contractors were cut 100 percent. During this time agricultural contractors were contractually required to make payments for Table A amounts even though they received no water. M&I contractors also recognized that the SWP supplies were not as dependable from year to year as they had anticipated, and began developing local water supplies and projects that could more effectively use surplus SWP water available only in wet periods to place in local groundwater or underground storage. However, opportunities for such projects were limited within each contractor's service area and M&I users were seeking contract amendments to store SWP water outside their service area.

Certain agricultural contractors began to complain about the lack of supply from the SWP during dry years, and disagreements arose among DWR, the agricultural contractors, and the urban contractors over water allocations during shortages. In 1994, in order to resolve these disagreements, DWR, some of the water contractors, and the Central Coast Water Authority (a joint powers authority representing two contractors, San Luis Obispo County Flood Control and Water Conservation District (CFC & WCD) and Santa Barbara CFC & WCD began mediated negotiations. Soon after negotiations began, the parties determined that the water allocation problem could not be addressed as a single issue. The parties adopted a broader approach to address water allocation and a number of other interrelated issues pertaining to the management and financing of the SWP.

These discussions, which took place in Monterey, led to the development of a set of 14 principles to modify the long-term water supply contracts. With regard to water allocation, they deleted the provisions that required agricultural contractors to take first shortages and also allowed them first priority on surplus water. Instead, all water was to be allocated on a pro-rata share based on each contractor's Table A amount. The broader issues that the negotiators addressed included development of measures to

facilitate the more effective management of the more limited SWP water supplies anticipated to be available to them in the future.

Later in 1994, DWR and 27 of the 29 SWP contractors agreed to the Monterey Agreement. An EIR was prepared on the Monterey Agreement with the Central Coast Water Authority acting as the lead agency. Following certification of the EIR in 1995, DWR and the contractors incorporated most of the principles into a contract amendment named the Monterey Amendment. All SWP contractors except Plumas CFC & WCD and the Empire West Side Irrigation District signed the Monterey Amendment. These two contractors continue to receive SWP water from DWR in accordance with the SWP contracts in effect before the Monterey Amendment.

6.2.1.3 The Monterey Settlement Agreement

After completion and certification of the Monterey Agreement EIR, the Planning and Conservation League (PCL) (and several other plaintiffs) filed a lawsuit challenging the adequacy of the EIR for the Monterey Amendment. It also argued that DWR should be lead agency for the preparation and certification of the EIR. A Sacramento County Superior Court judge later dismissed the lawsuit. PCL appealed the decision and on September 15, 2000, the Third District Court of Appeal reversed the Superior Court ruling. On December 13, 2000, the California Supreme Court denied review. The parties commenced mediation and proceedings in Superior Court were stayed pending completion of mediation.

The parties executed a Settlement Agreement in May 2003. The Monterey Settlement Agreement allows the SWP to continue to operate pursuant to the Monterey Agreement while the new EIR is being prepared. SWP operational issues concerning the Monterey Amendment will be addressed in that new EIR.

The Monterey Settlement Agreement provides a way for the contractors and the plaintiffs to advise DWR in the preparation of the new EIR and commits DWR to a number of actions, including deleting reference to the term “entitlement “in the long-term water supply contract, developing a water supply reliability report to be published every 2 years, and providing more opportunity for public involvement in SWP activities. The Monterey Settlement Agreement also provides that DWR and the contractors will not approve any new project or activity in reliance on the Monterey Agreement EIR that was not approved, initiated, or implemented prior to March 26, 2001, which could require separate environmental documentation. Provisions in the Monterey Settlement Agreement also provide that up to $8 million will be paid to Plumas CFC & WCD beginning in 2003, primarily for watershed improvement for the mutual benefit of Plumas CFC & WCD and the SWP in the Feather River watershed, and for the district’s related purposes, to be disbursed with input from a forum composed of representatives of Plumas CFC & WCD, DWR, and SWP contractors. To date, $4 million has been paid to Plumas CFC & WCD. The new EIR is currently being prepared and the draft will be released in 2007.

6.2.2 Geographic Scope

This section describes the geographic areas where cumulative effects on the resources listed above have occurred or are expected to occur. Per CEQA guidance, the geographic (or spatial) scope for selected resources typically varies and is based on the geographic reach or boundaries of the effects of existing Oroville Facilities operations, the effects of the Proposed Project defined in Chapter 3.0, and the effects of the related actions described in Chapter 5.0.

The geographic scope of the geomorphic resource topics (gravel recruitment, sediment transport, and LWD) ranges from the upper Feather River watershed, downstream in the Feather River to its confluence with the Sacramento River. Oroville Facilities operations in combination with flow contributions from downstream tributaries (Yuba and Bear Rivers) affect flows and water quality in the lower Feather River down to the confluence with the Sacramento River and, in conjunction with other Central Valley tributaries and hydroelectric/flood management operations, affect water quality and flows downstream to the Sacramento–San Joaquin Delta (Delta). Therefore, the geographic scope of the analysis for water quality and quantity extends downstream from the FERC Project boundary to the Delta.

The geographic scope of the analysis of cumulative effects on aquatic resources, including spring-run Chinook salmon and Central Valley steelhead, is broad, given their large geographic distribution and the many different types of related actions that affect these anadromous fish species. It ranges from the upper portions of the Feather River basin where the species spawned prior to construction of other mining, hydroelectric, and water development projects by mining entities, electric utilities, and water agencies, down to the Feather and Sacramento Rivers, to the San Francisco Bay/Sacramento–San Joaquin Delta (Bay-Delta) and even the Pacific Ocean.

The geographic scope of the terrestrial resources in the cumulative analysis varies with individual species affected but generally includes the California range for species identified in Chapter 5.5 as being affected by the Proposed Project. The scope includes lands within and near the FERC Project boundary and adjacent to the Feather River downstream to the Sacramento River.

The geographic scope of the recreational resources analysis is confined to lands within and near the FERC Project boundary and adjacent to the Feather River and water-based recreational opportunities in Northern California within a few hours drive of the Oroville Facilities. For the analysis of cumulative effects on cultural resources, the geographic scope incorporates the Feather River watershed. The geographic scope of the public services impacts is contained within the boundary of Butte County, and the scope of the agricultural resources impacts is confined to the FRSA and to Central Valley rice production areas.

6.2.3 Temporal Scope

The temporal scope of the cumulative analysis varies by selected resource, but in general it is from the time a selected resource is initially affected by past, related actions through the period of time covered by the new license for the Oroville Facilities (assuming 50 years).

This section briefly summarizes the temporal scope of the cumulative analysis, including some of the key events over time that affected the resources found in the FERC Project area. Additional information regarding the nature and timing of key events and related actions that provides historic context and other background information related to the selected resources is found in Chapter 4.0.

Cumulative effects on geology and soils and surface water quantity and quality began during the 1849 California Gold Rush with extensive hydraulic, placer, and hard-rock mining activities. While hydraulic mining activities were stopped by court order before 1900, the activity led to major amounts of sediment and heavy metals moving into streams and other receiving waters. The downstream transport of sediment and metals from this and other historic and current mining activities continues today. Starting in the 1910s, the Feather River and its tributaries were diverted by water agencies and irrigation districts to supply urban communities and large-scale agricultural development along both sides of the lower Feather River and in the Sacramento Valley. Major engineering activities in the lower Feather River, including channel dredging, levee construction, and ongoing maintenance, have been undertaken by the U.S. Army Corps of Engineers (USACE), U.S. Bureau of Reclamation (USBR), and State and local agencies to provide nearby urban and agricultural areas with much-needed flood protection. Congress initially authorized the Sacramento River Flood Control Project in 1917, and most of the related lower Feather River channelization and levee construction was completed by 1940, prior to the construction of Oroville Dam.

Despite all of these efforts, flooding in the lower Feather River can still occur, with substantial amounts of regular levee maintenance required. New levee setback projects are being investigated and implemented along the lower Feather River by USACE, the Three Rivers Levee Improvement Authority, and others as a way to improve flood protection, reduce maintenance requirements, and enhance natural riparian and floodplain habitat values. DWR also is investigating the feasibility of taking additional steps to coordinate Lake Oroville flood management operations with operations at Yuba County Water Agency's New Bullards Bar Reservoir.

Starting in the early 1900s with Miocene and Big Bend Dams (1907 and 1908, respectively), a number of upstream hydroelectric power and water storage projects were constructed and have affected Feather River hydrology and runoff patterns. Most of Pacific Gas and Electric Company's (PG&E's) upstream hydroelectric project–related facilities (including Lake Almanor Dam, Butt Valley Dam, Poe Dam, etc.) were constructed beginning in the 1910s through the 1980s. Oroville Dam planning was started in the late 1950s. Section 204 of the Flood Control Act of 1958 (Public Law (PL) 85-500, 72 Stat. 297) appropriated federal funds to contribute to the construction of

Oroville Dam, contingent upon an agreement that was subsequently entered into between the State of California and USACE pursuant to the provisions of Section 7 of the Flood Control Act of 1944 (PL 78-534, 58 Stat. 890). Construction of Oroville Dam and Lake Oroville was completed in 1968. Additional information concerning upstream water development projects is found in Section 4.2.1, Surface Water Quantity.

Cumulative effects on aquatic resources, including spring-run Chinook salmon and steelhead, began in the mid-1800s with mining activities, including dewatering of the Big Bend area, and continued during the first few decades of the 1900s as approximately 750,000 acres of undeveloped Delta wetlands and tidal marsh were converted to what is now a 700-mile maze of channelized streams with dikes and levees, and about 57 man-made islands. By 1930, almost all of the Delta's marshland had been converted to agricultural and urban uses. During the 1940s through 1970s, California's salmon and steelhead continued to be affected by many related actions, including unscreened agricultural and urban stream diversions; and the construction of local, federal, and State pumps in the southern Delta and along the Sacramento, Feather, Yuba, and other rivers. In addition, construction of dams and other water projects in the Sierra Nevada foothills and the range's upper elevations; ocean harvesting; the construction and operations of hatcheries; and the introduction of such predators as striped bass also affect aquatic resources. Some relatively recent legislation and programs, including the CVPIA, CALFED, and State bond initiatives, have started to improve conditions for many species; however, steelhead and spring-run Chinook salmon remain the focus of recovery efforts and their population numbers are a concern in many portions of their range. Section 4.4, Aquatic Resources, summarizes the status of these species throughout their range and in the Feather River basin.

The temporal scope for cumulative effects on terrestrial resources, recreation, and cultural resources would be the same as that described above for geology and soils, and water quantity and quality. The temporal scope for cumulative impacts on public services ranges from construction of the Oroville Facilities through the term of the future FERC license. Agricultural impacts range from initial agricultural diversions from the Feather River through the term of the future FERC License.

6.2.3.1 Climate Change

Climate change refers to the significant change in climate measurements such as temperature, precipitation, wind, and solar input measured over several decades. Theories regarding climate change have existed since the 1800s, and by the late 1900s, the science had progressed sufficiently to convince many that the Earth's climate was not static but had changed over time. Today, most scientists agree that some warming has occurred over the past century (DWR 2006). The United Nations Intergovernmental Panel on Climate Change predicts that changes in the Earth's climate will continue through the 21st century and that the rate of change may increase significantly in the future because of human activity (IPCC 2001). These activities include human-induced alterations to the land and activities that involve the burning of fossil fuels that have contributed to the alteration of the historical composition of the atmosphere.

On June 1, 2005, Governor Arnold Schwarzenegger issued Executive Order S-3-05 (Order) establishing greenhouse gas (GHG) emission targets for California and requiring biennial reports on potential climate change effects on several areas, including water resources. A Climate Action Team (CAT) was established by the governor to lead the reporting efforts. The Order established the following goals for reducing GHG emissions in the state:

- By 2010, reduce emissions to the 2000 level.
- By 2020, reduce emissions to the 1990 level.
- By 2050, reduce emissions to 80 percent below 1990 emissions.

Executive Order S-3-05 identifies the agencies involved and coordination expected:

> The Secretary of the California Environmental Protection Agency shall coordinate oversight of the efforts to meet the targets with: the Secretary of the Business, Transportation and Housing Agency, Secretary of the Department of Food and Agriculture, Secretary of the Resources Agency, Chairperson of the Air Resources Board, Chairperson of the Energy Commission, and the President of the Public Utilities Commission.

In 2006, the California Legislature passed Assembly Bill 32 (also known as the Global Warming Solutions Act of 2006) that establishes a State goal of reducing GHG emissions to 1990 levels by 2020. The bill requires the California Air Resources Board (ARB) to adopt regulations and develop an enforcement mechanism to ensure compliance. ARB is currently developing policy for GHG reductions in the state.

In accordance with resulting State Goals and standards, hydroelectric generation can play a role in meeting these statewide GHG reduction targets when compared with higher GHG-emitting thermal power sources. With extensive resource monitoring plans and adaptive management measures, the Oroville Facilities also provide managers with an ability to respond to the impacts of climate change upon resources associated with the Oroville Facilities.

6.2.3.2 Climate Change and DWR Water Management

Climate change is identified in the 2005 update of the *California Water Plan* (Bulletin 160-05) (Water Plan) as a key consideration in planning for the state's future water management (DWR 2005). The 2005 Water Plan update qualitatively describes the effects that climate change may have on the state's water supply. It also describes efforts that should be taken to quantitatively evaluate climate change effects for the next Water Plan update.

On July 9, 2006, DWR released a report on climate change and its potential impact on California's water resources. Entitled *Progress on Incorporating Climate Change into Management of California's Water Resources,* the report was prepared in response to Executive Order S-3-05 and summarizes recent research into changes in precipitation,

air temperatures, snow levels, rainfall, and snowmelt runoff, and the related potential future impact on California's water resources. The climate change report explicitly cautions that all results presented are "preliminary, incorporate several assumptions, reflect a limited number of climate change scenarios, and do not address the likelihood of each scenario. Therefore, the results are not sufficient by themselves to make policy decisions." DWR and USBR have formed a joint Climate Change Work Team to provide and regularly update information for decision makers on potential impacts and risks of climate change, flexibility of existing facilities to cope with climate change, and available mitigation measures.

6.2.3.3 Consequences From Climate Change

As summarized by the DWR climate report, there is a significant amount of uncertainty over the magnitude of climate change that will occur over this century and, according to Dettinger (2005), it is unlikely that the level of uncertainty will diminish significantly in the foreseeable future. There is also uncertainty about changes in hydrologic conditions, aquatic ecosystems, and water demand that could occur as the result of various amounts of climate change.

It is questionable whether climate change is a reasonably foreseeable "action" in the CEQA context, partly because of the uncertainty and speculative nature of predicted outcomes. However, the potential consequences of climate change on resources associated with the Oroville Facilities can be preliminarily discussed in the context of regional climate changes. These regional climate changes could include changes in both quantity and timing of precipitation and runoff that could affect water quantity, water quality, aquatic resources, recreation, cultural resources, and agricultural practices. Further discussion of the regional effects of future climate change on specific resources associated with the Oroville Facilities is included in the appropriate sections below.

6.2.4 Geology, Soils, and Paleontological Resources

Potential cumulative effects discussed in this subsection address geologic, soils, and paleontological resources, along with the various alternatives associated with the Oroville Facilities. Because no significant impacts were identified for paleontological resources, there will be no further discussion regarding this topic. The analysis of potential impacts and associated mitigation measures on geology and soils is provided in Section 5.1.4.

Cumulative effects include past, present, and probable future projects that incrementally affect resources in combination with a proposed project. For this analysis, the source of these effects is not restricted to activities directly associated with the Oroville Facilities. For example, sediments being trapped by upstream projects above Lake Oroville that disrupt the natural geomorphic processes of sediment transportation are considered in this discussion.

The principal effects on the natural geomorphic process and function of the Feather River from the many current and historic human-induced changes and land uses include:

- A reduction in gravel recruitment, sediment transport, and LWD transport through the watershed;
- A loss of channel meandering, a reduction in sinuosity, incision, and an overall loss in channel complexity;
- Disconnection of the river channel from its natural floodplain through the development of levees; and
- Large-scale erosion and sediment deposition from historical and current mining, timber harvesting, and wildfires.

6.2.4.1 Past and Present Related Actions

Historically, rivers in the Sacramento Valley were bordered by extensive floodplains that supported natural geomorphic and fluvial processes, including natural hydrologic flow regimes, erosional and depositional processes, and sediment transport. The Feather River has a long history of land uses that have affected natural river processes within its floodplain, including hydraulic mining, gravel mining, gold dredging, timber harvesting, construction of levees and dams, water diversion, agricultural encroachment, and urbanization. In the 1800s riparian forests within the watershed were logged for lumber and fuel. The primary result of these activities included the loss of the soil-retaining riparian cover, leading to increased erosion and sedimentation into the river channel. By the late 1800s, hydraulic mining had introduced massive amounts of sediment into the system, and in the early 1900s, Feather River water diversions began for agricultural and urban uses. Channelization and levee construction was mostly completed by the 1940s. In addition, starting in the early 1900s, a number of hydroelectric and reservoir projects were constructed upstream of the City of Oroville, which regulated streamflow and blocked sediment transport above Oroville in the watershed. Furthermore, as the risk of floodflows decreased downstream, more lands within the floodplain were converted to agricultural and urban use, which further reduced the historical connection of the river with its floodplain. The construction of Oroville Dam in the 1960s further altered streamflow patterns, reduced floodflows, reduced erosion and channel migration rates, and reduced sediment loads and sediment transport downstream.

The channel morphology of the Feather River upstream of the Oroville Facilities is influenced partially by the presence of upstream hydroelectric and reservoir projects on the North Fork, West Branch of the North Fork, and South Fork; however, the dominating factor affecting the shape of the river has been the steep bedrock-lined canyons in much of the upper watershed that confine the river's channel morphology, and thereby maintain a moderate-to-steep channel gradient.

Although the Feather River reaches upstream of Lake Oroville have continued to flow between steep canyon walls, upstream hydroelectric and reservoir projects, including the Oroville Facilities, have affected the Feather River's natural geomorphic function. These facilities have been responsible for the reduction in sediment transport, gravel recruitment, and LWD transport though the Feather River watershed. For example, while the Middle Fork Feather River remains relatively hydrologically unaltered before it enters Lake Oroville, much of the bedload material transported by the North Fork Feather River is captured in upstream reservoirs before the North Fork enters Lake Oroville.

Geomorphic Processes

For over 100 years, the Feather River has been affected by a number of human-induced events, resulting in a change in the natural geomorphic processes. Several of the effects from historic land uses and human-induced changes to the watershed are discussed below. Many of these human-induced activities have affected the geomorphic function of the upper watershed, resulting in a number of physical and ecological effects.

Timber Harvesting and Wildfires

The impact on riparian forests within the watershed from timber harvesting and wildfire has resulted in the loss of soil retaining riparian cover. Both timber harvesting and wildfire expose the barren soils to increased rates of erosion and potential loss of the most productive soil layers in a forest system, causing an increase of sedimentation into the Feather River.

Hydraulic Mining

Hydraulic mining activities in the Feather River watershed associated with gold mining caused massive amounts of soil erosion, and the runoff from hydraulic mining operations introduced enormous quantities of sediment into the system. The consequence of this was to increase sediment loads in the Feather River beyond the river's capacity to move the sediments, resulting in an accumulation and subsequent buildup of the channel bed throughout the lower river system. This increased channel bed elevation relative to surrounding floodplain elevation resulted in a need for additional levee placement.

Levee Construction

The winter flood event of 1861-62 convinced citizens of Marysville and the surrounding Feather River watershed of the need to install levees around cities to protect the populations from inundation, and preserve their property from destruction. The first levees were constructed in Marysville in 1862, and the city was surrounded by levees by 1868. The winter floods of 1875 caused the overtopping of the levees and by 1876, the legislature authorized the city to borrow funds to increase the levee height to 3 feet (ft) above the 1875 high-water mark. The levee construction eventually extended from near the southern FERC Project boundary to the Sacramento River. While levee

placement has resulted in a reduction in flooding, the Feather River has become almost completely disconnected from its historic floodplain.

Agriculture and Urbanization

Agriculture and urbanization are some of the main land use changes affecting the lower Feather River. Inspection of 1997 aerial photographs suggests that almost all of the riparian vegetation on the floodplain south of the FERC Project boundary has been converted to agriculture, and only a minimal percentage of the original riparian vegetation remains. Removal of streambank vegetation also reduces the amount of LWD contribution in the river.

Urbanization and economic development have modified the land use within the watershed, initially through logging, road building, and grazing. Furthermore, as the risk of floodflows decreased with the installation of protective levees, more lands within the historic floodplain were converted to agricultural and urban uses. This, along with more recent urban development in the upper watershed, has altered hydrologic conditions, causing increased sedimentation and runoff, and larger peak flows have affected the entire Feather River system. This effect, however, has largely been ameliorated by the flood management provided by the Oroville Facilities and the downstream levee system.

Dams, Flow Regulation, and Flood Management

Starting in the early 1900s, a number of hydroelectric and reservoir projects were constructed in the upper watershed, above Lake Oroville. These projects regulated streamflow and blocked sediment transport through the watershed. The construction of Oroville Dam in the 1960s further altered Feather River flow regimes, reduced floodflows, and reduced sediment discharge downstream. In addition to those projects upstream of the present-day Oroville Dam, there were also two downstream agricultural diversion dams. These dams were referred to as the Western Canal Dam and the Hazelbush Dam and both dams were constructed prior to approximately 1920. Construction of Thermalito Afterbay replaced both dams. Because both dams required reinstallation or reconstruction after high-flow events, it is doubtful that these dams significantly affected geomorphic processes.

Sediment Transport, Large Woody Debris, and Gravel Recruitment

Beginning in 1967, the Oroville Facilities started to regulate the lower Feather River, adding to the change in streamflow and amount of LWD recruitment and sediment discharge in the system. More than 97 percent of the sediment from the upstream watershed is trapped in the upstream reservoirs (including Lake Oroville), resulting in sediment starvation downstream. The loss of gravel recruited from reaches upstream of Oroville Dam has reduced the suitability of salmonid spawning gravel in downstream reaches. In addition, the loss of LWD recruitment has reduced the ability of the river to trap sediments as they move through the system during high-flow events. The reduction of gravel and LWD recruitment reduces the channel complexity of the lower Feather River.

Channel Meandering

Before 1855, the lower Feather River below the City of Oroville was a meandering river, probably similar to the present Sacramento River between Red Bluff and Colusa (WET 1990). Between 1855 and the early 20th century, a large increase in sediment resulting from hydraulic mining caused buildup of the channel bed in the lower Feather River and subsequent seasonal overbank flooding, necessitating levee construction and/or improvements. This levee construction associated with agricultural and urban development within the floodplain and flow attenuation caused by hydroelectric development interrupted the river's ability to meander across its historic floodplain.

Channel Depth and Width

The Feather River channel and width is still adjusting to changes caused by historic hydraulic mining and dam construction. Currently, the river is eroding vertically through the hydraulic mining debris, incising the river channel. The U.S. Geological Survey (USGS) (Blodgett 1972) documented channel changes between 1909 and 1970. USACE surveyed the lower Feather River between the city of Oroville and Verona and published a series of topographic river surveys between 1909 and 1911; DWR resurveyed the USACE cross sections in 1965 and 1969, and then again in 2002–2003. Detailed descriptions and analysis of these sections are provided in the report for Study Plan G-2 (SP-G2) Task 3/Task 4, Channel Cross-Sections and Photography. These cross sections are also shown in the reports for SP-G2 Task 7, Hydraulic and Sediment Transport Modeling with Fluvial 12, and SP-G2 Task 5, Dam Effects on Channel Hydraulics and Geomorphology. In general, the cross sections show continuing scour with a large increase in cross-sectional area and an increase in both depth and width. This has also increased channel capacity and the ability to convey high flows without flooding. The increase in depth and width is characteristic of the entire lower Feather River. Channel widening is also related to the fact that dams in the upper watershed continue to trap sediment. As a result, sediment eroded from the banks and bed in the lower river is not replenished from upstream sources. However, the reduced floodflows attributed to Oroville Dam's flood management functions would tend to reduce this effect, and therefore reduce the rates of bank erosion and property loss along the river.

6.2.4.2 Cumulative Effects of the Alternatives and Future Related Actions on Geology, Soils, and Paleontological Resources

No-Project Alternative

The interruption of natural geomorphic processes that has been occurring in the Feather River watershed beginning with timber harvesting and hydraulic mining activities in 1800s, followed by hydroelectric facility construction within the watershed since the early 1900s, would continue under the No-Project Alternative. The Oroville Facilities and other upstream hydroelectric dams would continue to reduce the contribution of sediment, gravel recruitment, and LWD in the lower Feather River. The continued deprivation of sediment load in the lower Feather River from related actions would also result in a reduction in the formation of sediment benches and point bars, which in turn

affects the ability of the channel to capture and retain quantities of LWD. These geomorphic effects result in incremental reductions to channel complexity downstream of the Oroville Facilities. The most significant reductions in downstream channel complexity are the continued coarsening of the Feather River salmonid spawning beds and reduced woody debris, both of which reduce the quantity and quality of salmonid spawning and rearing habitat over time. The Oroville Facilities would continue to attenuate peak flows, providing flood protection benefits downstream.

Proposed Project

The Proposed Project includes actions that mitigate the Oroville Facilities' contribution to loss of connectivity between the upper Feather River watershed and the lower Feather River. For example, although the Oroville Facilities would continue to block the recruitment of LWD and gravel to the lower Feather River from upstream tributaries below the next hydroelectric facility, the LWD and gravel supplementation actions would simulate connectivity between upstream and downstream reaches of the watershed. The Channel Improvement Program (SA Article A103), Structural Habitat Supplementation and Improvement Program Plan (SA Article A104), and Riparian and Floodplain Improvement Program (SA Article A106) included in the Proposed Project combined with the Gravel Supplementation and Improvement Program (SA Article 102) would increase channel complexity below Oroville Dam and address the Oroville Facilities' contribution related to sediment and LWD blockage and the downstream results from controlled flows and loss of connectivity with upstream reaches.

FERC Staff Alternative

There are no substantive differences in cumulative effects on geology, soils, and paleontological resources that would occur with the implementation of the FERC Staff Alternative as compared to the Proposed Project.

6.2.5 Surface Water

Surface water analyses include discussions of cumulative effects on both surface water quantity as well as surface water quality.

6.2.5.1 Water Quantity

This section addresses potential cumulative effects on water quantity. Water quantity cumulative effects addressed in this section are the result of local and upstream actions, as well as actions located outside the FERC Project boundary that have affected or could affect operations of the Oroville Facilities. The analysis of potential impacts and associated mitigation measures on surface water quantity is provided in Section 5.2.1.4.

The CALSIM II modeling conducted for this analysis was designed to simulate existing and future cumulative water quantity effects of past, present, and reasonably foreseeable future actions. The modeling incorporated the effects of the following actions on project operations and local hydrology:

- Diversion, storage, and conveyance of water by water projects upstream of the Oroville Facilities;

- Local water diversions used to supply local agricultural and urban water demands;

- Flood management operations at the Oroville Facilities per related USACE flood control criteria and agreements with DWR;

- SWP and CVP coordinated operations whereby DWR and USBR work together to meet a variety of water quality and other environmental flow standards in the Delta and its major tributaries. Lake Oroville is the major SWP storage facility that DWR relies upon to meet such environmental commitments;

- Existing SWP water demands (as represented by 2001 level-of-development assumptions in the CALSIM II modeling) and an increase in such demands over time in the many different areas served by the SWP (future SWP water demands are represented by 2020 level-of-development modeling assumptions);

- Future SWP and CVP infrastructure improvements expected to affect future operations at the Oroville Facilities, including an increase in the capacity of the Banks Pumping Plant and other South Delta improvements; and

- Implementation of other actions affecting project operations, including higher Trinity River releases by the CVP (see Appendix C of the PDEA for more information regarding the assumptions used in the CALSIM II modeling; see also Section 5.2, Surface Water).

CALSIM currently relies on historic monthly hydrological data to assess project impacts. CALSIM is constrained to utilize hydrological data related to the 73 years of historical data for which the model has been calibrated. DWR recognizes the potential for significant impacts associated with climate change. Because only limited data and tools exist to provide answers to important questions for decision makers, water managers, and resource planners, DWR is working in conjunction with others to develop a new analytical approach for the preparation of the *California Water Plan 2010*. Climate changes could produce hydrologic conditions and extremes of a different nature than current systems were designed to manage. Through development of a functional water management tool capable of incorporating climate change data, ordered reductions in GHG emissions, and proper resource planning, agencies in California will continue preparing for climate change impacts.

Past and Present Related Actions

Historically, the entire Feather River watershed has been developed and altered. In 1907 and 1908, the Miocene and Big Bend Dams were constructed. Additional water development occurred during the 1920s and 1950s with construction of Lake Almanor, Bucks Lake, and Butt Valley, Poe, Rock Creek, and Cresta Reservoirs. In the 1960s, DWR constructed three reservoirs: Frenchman Lake, Antelope Lake, and Lake Davis.

These upstream reservoirs have a cumulative effect on the hydrology of the Feather River, upstream and downstream of the Oroville Facilities. In general, these reservoirs alter the unimpaired runoff magnitude, volume, and timing of flow in the Feather River upstream of Lake Oroville. The average annual inflow into Lake Oroville is a little less than 4.0 million acre-feet (maf). Mean monthly Feather River flow below the Thermalito Afterbay Outlet is generally below unimpaired conditions from November through June and is generally increased from July through October.

Operations of the Oroville Facilities in combination with other facilities in the CVP/SWP system affect baseline flows and reservoir storage throughout the system. The CVP and SWP use the Sacramento River and the Delta as common conveyance facilities. CVP/SWP reservoir releases and Delta exports must be coordinated to ensure that each project receives its share of benefit from shared water supplies and bears its share of joint obligations to protect beneficial uses. Project agencies operate the CVP and SWP to meet these requirements through the Coordinated Operations Agreement (COA). The Operations Criteria and Plan (OCAP) Biological Assessment (BA) describes the ongoing operations of the system under the COA and its effects on environmental resources.

Cumulative Effects of the Alternatives and Future Related Actions

There are no expected cumulative impacts on surface water quantity that would result from continued operation of the Oroville Facilities under any of the alternatives. Although the SA includes increases of minimum flows and potential increases in flows for water temperature management in the Low Flow Channel (LFC) to benefit anadromous salmonids, it would not increase net facility releases. Changes to net facility releases are in response to timing or future changes to allocations that would apply equally to the No-Project, Proposed Project, and FERC Staff Alternatives. The Lower Yuba River Accord could alter quantity and timing of flows in the lower Feather River downstream of the confluence with the Yuba River. The Yuba-Feather Supplemental Flood Control Project could alter the timing and magnitude of flood management releases from the Oroville Facilities.

Climate Change and Water Supply

According to the DWR climate change report, temperatures in California are projected to increase several degrees Celsius (^{o}C) by the end of this century as a result of climate change. One expected consequence of this is a reduction in the State's annual snowpack, with more precipitation falling as rain, and earlier melting of snow. In addition to altering watershed characteristics from snowpack-fed to rainfall-fed, climate change could also affect the intensity, duration, and timing of precipitation events and the spatial distribution and temporal variability of precipitation in California. Significant changes in one or more of these factors will present major challenges for water supply management in the state. Warming and reduction to the State's snowpack would affect the operation of most major multi-purpose reservoirs at low and mid-elevations in the Sierra Nevada, including the Oroville Facilities (DWR 2006).

Climate change would likely also have an effect on future water demand patterns and quantities needed for agricultural and urban uses and environmental water demand for both salinity and water temperature control. However, many other factors such as population, land development, and economic conditions that are not directly related to climate change would also affect future demand.

6.2.5.2 Water Quality

This section addresses potential cumulative effects on water quality. Water quality cumulative effects addressed in this section are the result of local and upstream related actions, as well as actions located outside the FERC Project boundary that have affected or could affect water quality–related operations of the Oroville Facilities. The analysis of potential impacts and associated mitigation measures on surface water quality is provided in Section 5.2.2.4.

Past and Present Related Actions

Reduced riparian shade, increased water surface area in reservoirs, and increased residence time of water in the system all tend to increase water temperatures in portions of the Feather River basin rivers and reservoirs. Water released from the hypolimnion of the reservoirs provides water for portions of the river that can be colder than water that would have occurred in these tributaries prior to construction of these reservoirs. Specifically, the areas of the lower Feather River immediately below Oroville Dam are, at some times of the year, 10 degrees Fahrenheit (^{o}F) cooler than those that occurred in these locations prior to the construction of the Oroville Facilities (DWR 2001). At certain times of the year, Diversion Pool water temperatures can also be influenced by inflows from the South Feather Water and Power Agency's Kelly Ridge Power Plant. Water releases from the Oroville Facilities and some of the upstream reservoirs are managed to benefit coldwater fish species.

Cumulative Effects of the Alternatives and Future Related Actions

No-Project Alternative

Under the No-Project Alternative, the Oroville Facilities would continue to be operated under the terms and conditions of the existing FERC license. Water temperatures downstream of the Oroville Facilities are not anticipated to change relative to existing conditions.

Proposed Project

The Proposed Project would result in a reduction in water temperatures in the lower Feather River to benefit the coldwater fisheries. The reduced water temperatures singularly and in combination with the lower Feather River habitat enhancement actions included in the Proposed Project would result in a reduction in anadromous salmonid pre-spawn mortality rates, reduced in-vivo and in-redd egg mortality rates, increased juvenile rearing survival, and increased juvenile and smolt emigration survival rates. See Section 6.2.6, Aquatic Resources.

Additional reductions in water temperatures as compared to historical or Existing Conditions would incrementally adversely affect contact and non-contact recreation. See Section 6.2.8, Recreational Resources.

Additional reductions in water temperatures compared to historical or Existing Conditions with implementation of the Proposed Project would result in a small incremental reduction in water temperatures at the agricultural diversions in Thermalito Afterbay. These reductions in water temperatures at the agricultural diversions would likely result in an incremental additional yield loss in rice production in some areas of the FRSA. See Section 6.2.10, Agricultural Resources.

FERC Staff Alternative

There are no substantive differences in cumulative impacts on surface water quality resources that would occur with the implementation of the FERC Staff Alternative as compared to the Proposed Project.

Climate Change and Water Quality

Climate change could have a significant effect on water quality in the Feather and Sacramento Rivers and the Delta. Water quality salinity control requirements (environmental releases for salinity control in the Delta) could be affected by sea level changes while the ability to meet the needs of the Delta with freshwater releases from foothill reservoirs such as Lake Oroville could be affected by the decreased availability of water in storage during the warmer summer months as precipitation falls earlier in the year and as rainfall instead of snow. Increased water temperatures could cause decreased dissolved oxygen and other water quality problems, including a likely increase in algae growth and aquatic weed production.

6.2.6 Aquatic Resources

Federally listed species (spring-run Chinook salmon, Central Valley steelhead, and green sturgeon) have the potential to be cumulatively affected by continued operation of the Oroville Facilities and other past, existing, and reasonably foreseeable related actions. Similarly, species of management concern (fall-run Chinook salmon, river lamprey, and Sacramento splittail) also have the potential to be cumulatively affected by continued operation of the Oroville Facilities and other past, existing, and reasonably foreseeable related actions. Other species of management concern occurring in the project area, including American shad, black bass, hardhead, and striped bass, are not expected to be affected by Oroville Facilities operations.

Actions affecting spring-run Chinook salmon would have similar effects on fall-run Chinook salmon; therefore, they are not discussed separately. Most Oroville Facilities–related actions affecting aquatic resources are designed to reduce water temperatures and enhance habitat in the lower Feather River to benefit anadromous salmonids. These actions may have a slightly adverse effect on black bass, as they prefer warmer water temperatures. However, most lower Feather River black bass spawning and

juvenile rearing occurs downstream of the FERC Project boundary and potential adverse effects are likely to be minimal. Therefore, this section focuses on potential cumulative effects on spring-run Chinook salmon, Central Valley steelhead, green sturgeon, river lamprey, and Sacramento splittail. Additional information regarding the current status of these species is provided in Section 4.4.2.3, Listed Fish Species.

Study plan report summaries addressing project effects on spring-run Chinook salmon and steelhead are presented in Appendix G-AQUA1.3 of the PDEA, Fish and Their Habitat within Lake Oroville, its Upstream Tributaries, the Thermalito Complex, and the Oroville Wildlife Area; Appendix G-AQUA1.5 of the PDEA, Fisheries Management; Appendix G-AQUA1.8 of the PDEA, Salmonids and Their Habitat in the Feather River Below the Fish Barrier Dam; and Appendix G-AQUA1.11 of the PDEA, Predation. A description of each spring-run Chinook salmon and steelhead life stage and the associated time periods is presented in Section 4.4.2. Descriptions of green sturgeon, river lamprey, and Sacramento splittail are also available in Section 4.4.2.

6.2.6.1 Past and Present Related Actions

Historically, naturally reproducing populations of Chinook salmon and steelhead were abundant in the Central Valley of California. At least 25 Central Valley streams supported an annual Chinook salmon run, with at least 18 of those streams supporting 2 or more runs (Yoshiyama et al. 1996). Early estimates of Chinook salmon runs did not differentiate run timing, but those estimates indicate populations of 800,000–1 million returning adults prior to 1915 (DFG 1993). In 1965, DFG estimates for annual escapement of Chinook salmon to the Central Valley were about 421,000, of which 28,000 were classified as spring-run (DFG 1993). Current estimates of the Central Valley evolutionarily significant unit (ESU) for spring-run Chinook salmon are approximately 6,700, of which 4,300 return to the Feather River each year (DFG 1993).

Prior to the construction of Oroville Dam, spring-run Chinook salmon population estimates in the Feather River ranged from 500 to 4,000 (Painter et al. 1977). The Feather River spring-run population of Chinook salmon was affected by hydropower facilities in the upper watershed upstream of Oroville Dam well before the construction of Oroville Dam. Prior to Oroville Facilities construction, DFG found significant overlap in the spawning distribution of spring- and fall-run Chinook salmon upstream of the present-day location of Oroville Dam (DWR and USBR 2001). Following construction of Oroville Dam in 1967, the spring-run population of Chinook salmon dropped to 146, but averaged 312 per year between 1968 and 1974 (Painter et al. 1977). The highest post-Oroville spring-run Chinook salmon population estimate for the Feather River occurred in 1998 when 8,430 adults returned (based on the number of fish returning to the Feather River Fish Hatchery) (DWR and USBR 2001) with reportedly over 10,000 hatchery adult returns in 2006. The Feather River run numbered at least 3,400 in 2004 (DWR 2004). The Central Valley spring-run Chinook salmon ESU is more thoroughly discussed in Section 4.4.2.3.

Like Chinook salmon, steelhead abundance in California has been greatly reduced from historic levels (DFG 1996). McEwan (2001) reviewed the literature on steelhead and

Chinook salmon distributions in California and suggests that historic steelhead distribution can be inferred from Chinook salmon distribution, as studies examining Chinook salmon distribution almost always reported steelhead. Furthermore, because steelhead are often found at higher elevations in streams than Chinook salmon, Yoshiyama et al. (1996) concluded that steelhead were more broadly distributed than Chinook salmon. The *California Fish and Wildlife Plan* of 1965 estimated a combined annual steelhead run size for the Central Valley and tributaries to San Francisco Bay to be about 40,000 during the 1950s (DFG 1965 in DFG 1996). The steelhead spawning population for the Central Valley was estimated to be 27,000 in the 1960s (DFG 1996). McEwan and Jackson (DFG 1996) estimated the annual run size of steelhead to the Central Valley to be less than 10,000 by the early 1990s.

Historically, the Feather River supported a large naturally spawning steelhead population. The Feather River Fish Hatchery steelhead program was established to compensate for habitat loss as a result of the construction of Oroville Facilities and steelhead losses due to SWP Delta pumping facilities. Today, the Feather River steelhead population is substantially supported by the Feather River Fish Hatchery, which produces about 400,000 yearling steelhead each year (DWR 2001). The Central Valley steelhead ESU is more thoroughly discussed in Section 4.4.2.3.

Several factors influence overall populations of steelhead and Chinook salmon. The construction of dams and other water storage projects has created impassable barriers to upstream migration, significantly reducing the quantity of available habitat for spawning and juvenile rearing as well as a reduction in the quality and complexity of available habitat. Effects of this alteration of geomorphic processes on aquatic habitat are most acute immediately following dam construction. Longer term, dams block the recruitment of spawning gravel and LWD to downstream reaches, causing streambed armoring and a reduction in habitat quality for adult spawning and juvenile rearing as a result of the construction of the Oroville Facilities. The lack of gravel and woody debris recruitment combined with controlled flow regimes also reduces channel complexity. Other factors influencing salmon and steelhead populations include ocean and in-river harvest, ocean conditions and climatic cycles (e.g., El Niño events), timber harvest, water supply diversions, and agricultural practices.

A number of existing environmental programs and measures provide protection for at-risk fish species and/or their habitats, many of which are described in Section 5.4.1, Aquatic Resources Regulatory Setting. These include: (1) CALFED, which includes a long-term plan to restore the Bay-Delta and consists of the ecosystem restoration program, water quality program, levee system integrity program, water use efficiency program, water transfer program, watershed program, storage, and conveyance; and (2) the CVPIA (PL 102-575, Title 34), which amends the authorization of the CVP to include fish and wildlife protection, restoration, and mitigation as project purposes having equal priority with irrigation and domestic water uses and power generation.

The Environmental Water Account (EWA) is a key component of CALFED's water management strategy. Created to address the problems of declining fish populations and water supply reliability, the EWA is an adaptive management tool that aims to

protect both fish and water users as it modifies water project operations in the Bay-Delta. The EWA provides water for the protection and recovery of fish beyond that which would be available through the existing baseline of regulatory protection related to CVP/SWP operations.

USBR and DWR work closely with USFWS, NMFS, and DFG to coordinate CVP/SWP operations with fishery needs. This coordination is facilitated through several forums. The CALFED Operations Group consists of USBR, DWR, USFWS, NMFS, and DFG (collectively referred to as the Management Agencies), SWRCB staff, and the U.S. Environmental Protection Agency (USEPA). The CALFED Operations Group meets to discuss the operation of the CVP and SWP, as well as implementation of the CVPIA and coordination with endangered species protection. Several teams were established through the Operations Group process, including the Operations and Fishery Forum, the Data Assessment Team, the B2 Interagency Team, and the EWA Team. In addition, several fisheries-specific teams have been established to provide guidance on resource management issues: the Sacramento River Temperature Task Group, the Delta Smelt Working Group, the American River Operations Work Group, the San Joaquin River Technical Committee, and the Delta Cross Channel Project Work Team.

Agreements between DFG and facility operators have been established for minimum flow regimes and water temperature goals to benefit anadromous salmonids. For example, a 1983 agreement between DFG and DWR established minimum flow regimes in the lower Feather River and water temperature requirements downstream of the Fish Barrier Dam (DWR 2001). Federal ocean fisheries management and restoration programs that have been implemented to reduce ocean harvest impacts on Sacramento River winter-run Chinook salmon populations are also likely providing some benefit to spring-run populations. Existing ocean harvest regulations likely reduce spring-run harvest through minimum size limits, gear restrictions, reduced bag limits, and shortened recreational salmon fishing seasons (DFG 2002). Additionally, inland sport fishing regulations likely reduce harvest of spring-run Chinook salmon and steelhead through gear restrictions, fishing hour regulations, and special regulations (e.g., closures of certain areas, zero bag limits) in key tributaries (DFG 2002).

In 1986, DWR and DFG signed an agreement to provide for offsetting direct losses of fish caused by the diversion of water at the Banks Pumping Plant. The agreement is commonly referred to as the Four Pumps Agreement because it was adopted as part of the mitigation package for four new pumps at the Banks Pumping Plant. Among its provisions, the agreement provides for the estimation of annual fish losses and mitigation credits, and for the funding and implementation of mitigation projects. The agreement gives priority to mitigation measures for habitat restoration and other non-hatchery measures to help protect the genetic diversity of fish stocks and reduce reliance on hatcheries.

Anadromous fish hatcheries in California provide a substantial fraction of the commercial and recreational fisheries harvest for Chinook salmon and steelhead (DFG and NMFS 2001). DFG operates four hatcheries in the Central Valley to compensate

for the loss of Chinook salmon spawning habitat caused by dams. DFG-operated hatcheries in the Central Valley include the Feather River Fish Hatchery on the Feather River, the Nimbus Hatchery on the American River, the Mokelumne Hatchery on the Mokelumne River, and the Merced Hatchery on the Merced River. In addition, Coleman National Fish Hatchery, located on Battle Creek and operated by USFWS, produces Chinook salmon to compensate for habitat lost by the construction of Shasta Dam. USFWS also operates the Livingston Stone National Fish Hatchery on the upper Sacramento River to aid in the recovery of winter-run Chinook salmon (DFG and NMFS 2001). Hatcheries in California have also implemented programs to enhance steelhead populations. The four hatcheries located in the Central Valley have programs to mitigate for lost habitat and supplement steelhead populations.

The Feather River Fish Hatchery was opened in 1967 to compensate for the loss of upstream habitat caused by the construction of Oroville Dam. The hatchery is part of the licensed project under FERC Project No. 2100, and is operated for DWR by DFG. The hatchery raises spring- and fall-run Chinook salmon and steelhead. It normally spawns about 10,000 adult salmon per year. Chinook salmon are released at various locations in the Feather River, Sacramento River, and San Pablo Bay. Most steelhead releases occur in the Feather River (see Appendix G-AQUA1.7 of the PDEA for more detailed information on Feather River Fish Hatchery operations). The Feather River Fish Hatchery program is the only program in the Central Valley attempting to compensate for the loss of spring-run Chinook salmon (CPUC 2000).

Quantity of Spawning Habitat

Prior to construction of major dams in the Central Valley, anadromous salmonids had access to approximately 6,000 river miles of freshwater habitat (USFWS 1988 in CPUC 2000). From 1900 to 1930, hydroelectric projects and other diversions had created impassable fish barriers blocking access to approximately 80 percent of this habitat (Fisher 1994). Because these projects blocked access to higher elevation habitats, both spring-run Chinook salmon and steelhead were primarily affected. Spring-run Chinook salmon were extirpated from the San Joaquin River drainage with the completion of Friant Dam in 1942 (Fisher 1994). At the same time, construction of Shasta Dam affected approximately 200 miles of spring-run Chinook salmon and steelhead habitat in the upper Sacramento River (Fisher 1994). To date, it is estimated that 95 percent of habitat once utilized by anadromous salmonids in the Central Valley has been lost (USFWS 1988 in CPUC 2000).

Prior to any dam construction in the Feather River, it is estimated that 211 river miles of freshwater habitat was available to anadromous salmonids in the Feather River basin (Yoshiyama et al. 2001). This estimate of 211 river miles should be considered a minimum because only mainstems and major tributaries were considered. Numerous smaller tributaries were likely used by salmonids to some extent (Yoshiyama et al. 2001). Furthermore, the extent of habitat lost to steelhead was likely greater as steelhead were more extensively distributed due to their superior jumping ability, timing of upstream migration, and less restrictive preferences for spawning substrate

(Yoshiyama et al. 2001). Figure 6.2-1 shows the location of the dams in the Feather River basin and the date of construction associated with each dam.

Development of permanent hydroelectric and water diversion facilities in the Feather River basin began in 1907 with the construction of the Miocene Dam on the West Branch North Fork Feather River and ended with the construction of the Oroville Facilities in 1967. Table 6.2-1 lists the dams in the Feather River and the anadromous salmonid habitat lost as a result of blocking upstream migration. Note that in some cases, dam construction resulted in no habitat loss because barriers to upstream migration were already in place. For example, no habitat was lost as a result of Rock Creek Dam construction in 1950 because the Cresta Dam is located downstream and was constructed in 1927.

In addition to the upstream dams listed above, two dams downstream of the present-day Oroville Dam were constructed for agricultural diversions. Both dams were constructed prior to 1920 and were replaced by the construction of Thermalito Afterbay. Additionally, both dams required reinstallation or reconstruction after high-flow events. Western Canal Dam was seasonal; flashboards would not have been installed until the flows were reduced in the later spring. Once the lower flows occurred, not much gravel or LWD movement would have occurred to be disrupted by the flashboard dam. Hazelbush Dam, being a year-round installation, would have had some temporary affect on gravel and LWD, but this temporary affect would have been effectively erased every time the dam was washed out by a flood event. These dams may have contributed to some warming of water temperatures in the lower Feather River at some times of the year, although this is speculative as no supporting data could be located.

It is also possible that the Western Canal and Hazelbush Dams partially blocked upstream adult anadromous salmonid migration; however, this blockage was likely only partial, flow dependent, or just a migration impediment, as DFG did much of its fish counting in the Feather River at a counting weir that was located near the current Oroville Dam location for a number of years pre-project. Yoshiyama (1998a, 1998b) describes Hazelbush Dam in his treatment of historic anadromous salmonid presence in the Central Valley as “The Sutter-Butte Dam, 6 miles below Oroville, was a 5-ft-high irrigation diversion dam with a reportedly ineffective fishway, and lacking fish screens on the intake ditches, although the salmon nonetheless surmounted it (Clark 1929). Yoshiyama’s reference to the Sutter-Butte Dam is believed to refer to Hazelbush Dam, which was the diversion dam for the Sutter-Butte Canal located just downstream of the Thermalito Afterbay Outlet.

The effects of reduced habitat availability in the Feather River caused by development of the Feather River basin include high pre-spawning mortality, lower egg-to-smolt survival, and genetic introgression between the spring and fall runs of Chinook salmon. Reduction in the quantity of spawning habitat, as well as hatchery return contributions, has resulted in increased spawning densities of anadromous salmonids leading to high rates of redd superimposition. Redd superimposition occurs when spawning Chinook salmon dig redds on top of redds previously dug by other Chinook salmon. Redd disruption can result in increased egg and alevin mortality, leading to reduced

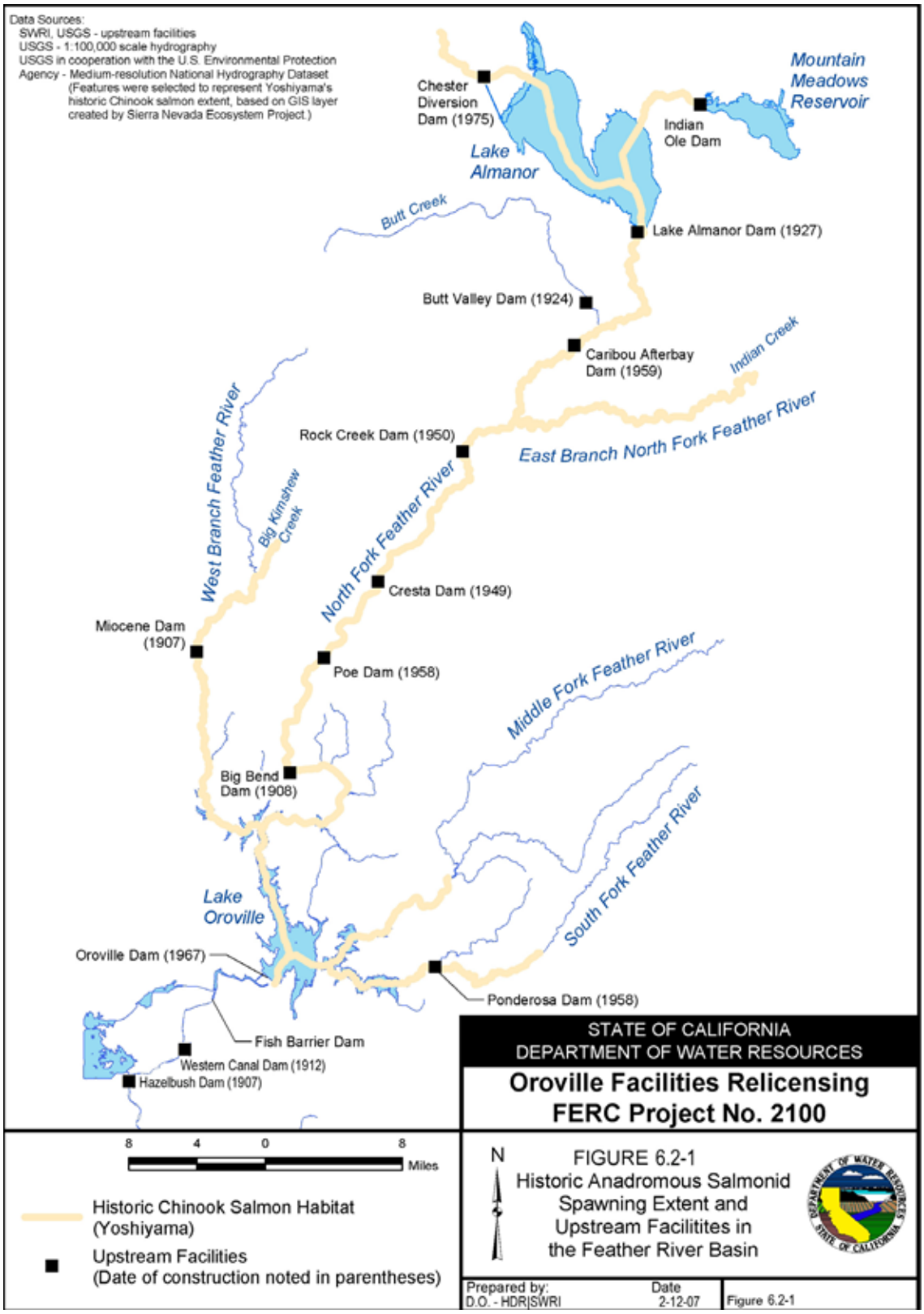
Data Sources:
SWRI, USGS - upstream facilities
USGS - 1:100,000 scale hydrography
USGS in cooperation with the U.S. Environmental Protection Agency - Medium-resolution National Hydrography Dataset (Features were selected to represent Yoshiyama's historic Chinook salmon extent, based on GIS layer created by Sierra Nevada Ecosystem Project.)
Chester Diversion Dam (1975)
Lake Almanor
Indian Ole Dam
Mountain Meadows Reservoir
Butt Creek
Lake Almanor Dam (1927)
Butt Valley Dam (1924)
Caribou Afterbay Dam (1959)
Indian Creek
West Branch Feather River
Big Kimshew Creek
Rock Creek Dam (1950)
East Branch North Fork Feather River
North Fork Feather River
Cresta Dam (1949)
Miocene Dam (1907)
Poe Dam (1958)
Middle Fork Feather River
Big Bend Dam (1908)
South Fork Feather River
Lake Oroville
Oroville Dam (1967)
Ponderosa Dam (1958)
Fish Barrier Dam
Western Canal Dam (1912)
Hazelbush Dam (1907)
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Facilities Relicensing
FERC Project No. 2100
8 4 0 8
Miles
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FIGURE 6.2-1
Historic Anadromous Salmonid Spawning Extent and Upstream Facilitites in the Feather River Basin
Historic Chinook Salmon Habitat (Yoshiyama)
Upstream Facilities (Date of construction noted in parentheses)
Prepared by: D.O. - HDR|SWRI
Date 2-12-07
Figure 6.2-1

Table 6.2-1. Dam construction and anadromous salmonid habitat losses in the Feather River Basin.

Tributary	Dam	Date Constructed	River Miles Lost	Cumulative Loss
West Branch	Miocene	1907	11.1	11.1
Feather River	Hazelbush (Sutter-Butte) [1]	1907	0.0	11.1
North Fork	Big Bend [2]	1908	0.0	11.1
Feather River	Western Canal	1912	0.0	11.1
North Fork	Butt Valley [3]	1924	0.0	11.1
North Fork	Canyon [4]	1927	30.9	42.0
North Fork	Cresta	1949	56.7	98.7
North Fork	Rock Creek	1950	0.0	98.7
North Fork	Poe	1958	6.6	105.3
South Fork	Ponderosa	1958	8.4	113.7
North Fork	Caribou Afterbay	1959	0.0	113.7
Feather River	Oroville	1967	66.9	180.6
North Fork	Chester Diversion	1975	0.0	180.6

Notes:

[1] Sutter-Butte was reportedly "an ineffective fishway, and lacking fish screens on the intake ditches, although the salmon nonetheless surmounted it."

[2] Big Bend Dam was constructed with a fish ladder—assuming that it was functional at the time of construction, 0 miles lost.

[3] Butt Valley Dam constructed on Butt Creek. Salmonid usage of Butt Creek is unknown.

[4] Canyon Dam forms Lake Almanor.

Sources: Yoshiyama et al. 1996; Yoshiyama et al. 2001

production. Redd superimposition may disproportionately affect early spawners and therefore have a greater negative impact on spring-run Chinook salmon. Field observations indicate high rates of redd superimposition in the lower Feather River (Sommer et al. 2001). High spawning densities also result in high densities of rearing juveniles; this in turn can lead to competition for resources, potentially precipitate early out-migration of juveniles, and reduce fry to smolt survival, as these smaller fish would be more susceptible to predation.

Another effect of blocking upstream migration has been the elimination of spatial separation between fall and spring-run Chinook salmon spawning. Restricted access to historic spawning grounds causes spring-run Chinook salmon to spawn in the same lowland reaches utilized by fall-run Chinook salmon. The overlap in spawning site location, combined with a slight overlap in spawning timing (Moyle 2002) with temporally adjacent runs, may be responsible for in-breeding between spring-run and fall-run Chinook salmon populations in the lower Feather River (Hedgecock et al. 2001).

Straying

Hatcheries raising anadromous salmonids in the Central Valley are listed in Table 6.2-2. California's anadromous fish hatcheries were constructed to compensate for the loss of spawning and juvenile rearing habitat as a result of dam construction. Hatcheries provide a substantial fraction of the harvest of California Chinook salmon. The policy of

the California Fish and Game Commission regarding hatcheries is that "California anadromous salmonid hatcheries are to be operated in such a way that the population and genetic integrity of salmon and steelhead stocks are maintained, with management emphasis on natural stocks" (DFG and NMFS 2001).

Table 6.2-2. Anadromous salmonid hatcheries in the Central Valley.

Hatchery	Location	Operator	Anadromous Stocks
Coleman	Battle Creek	USFWS	Fall-run, late fall-run, winter-run Chinook salmon, steelhead
Livingston Stone	Upper Sacramento River	USFWS	Winter-run Chinook salmon
Feather River	Feather River	DFG	Fall-fun, spring-run Chinook salmon, steelhead
Nimbus	American River	DFG	Fall-run Chinook salmon, steelhead
Merced	Merced River	DFG	Fall-run Chinook salmon
Mokelumne	Mokelumne River	DFG	Fall-run Chinook salmon, steelhead

Source: DFG and NMFS 2001

Between September 1999 and December 2000, DFG and NMFS conducted a joint review of California's anadromous fish hatcheries. One of the conclusions of this review was that the artificial propagation of salmon poses management, ecological, and genetic hazards to natural populations and that straying of hatchery populations increases the risk of these hazards (DFG and NMFS 2001). Furthermore, off-site releases result in increased rates of straying of hatchery-reared salmon relative to fish released on-site (at or near the hatchery) (DFG and NMFS 2001). The straying of hatchery fish could result in hybridization of hatchery and natural populations, leading to a reduction in genetic variation among populations and reducing fitness. Straying by hatchery fish could also cause ecological risks such as competition for food and habitat, reduced productivity of natural populations, and disease transmission.

Several authors have investigated the straying of Chinook salmon raised at the Feather River Fish Hatchery. Cramer and Chapman (2002) analyzed straying rates for Chinook salmon reared at the hatchery and released at different locations in the Feather River and San Pablo Bay. Mean straying rates of fish released in the Feather River were estimated to be less than 8 percent, while the straying rates of fish released in San Pablo Bay were estimated to be approximately 54 percent. These straying rates are consistent with a DFG study of the Coleman National Fish Hatchery operations that reported straying rates of 8 and 54 percent for in-river releases and San Pablo Bay releases, respectively (DFG and NMFS 2001). This same report cited straying rates of 8 percent from on-site releases and 32 percent for San Pablo Bay releases for the Nimbus Hatchery Chinook salmon on the American River. In contrast, a DFG study as reported in the report for SP-F9, Evaluation of the Feather River Hatchery Effects on Naturally Spawning Salmonids, which is summarized in Appendix G-AQUA1.7 of the PDEA, reported straying rates of 5 percent for Feather River–released fish and 10 percent straying rates for fish released in San Pablo Bay.

Overall Habitat Quality and Quantity

The CVP has 11 power plants and some 20 reservoirs impounding more than 11 maf of water. These facilities are generally operated as an integrated project whose purposes include flood control; navigation; provision of water for irrigation and domestic uses; fish and wildlife protection, restoration, and enhancement; and power generation (Allan 1995), and also operate in an integrated manner with the SWP, of which the Oroville Facilities are a major component. Major dams blocking access to historic anadromous salmonid spawning and rearing habitat in the Central Valley include Nimbus Dam on the American River; Keswick Dam and Red Bluff Diversion Dam on the Sacramento River; Friant Dam on the San Joaquin River; Crocker Diversion Dam on the Merced River; Goodwin Dam on the Stanislaus River; New Hogan Dam on the Calaveras River; New Bullards Bar Dam and Daguerre Point Dam on the Yuba River; and Camanche Dam on the Mokelumne River. Although not the first dam constructed on the Feather River, Oroville Dam presently constitutes the first barrier to upstream migration on the Feather River. Camp Far West Dam on the Bear River and Englebright Dam on the Yuba River present migration barriers in the lower Feather River system.

Dams have several negative effects on river ecosystems. Dams cause fundamental changes in the ecosystem as the continuous free-flowing river is transformed into river segments interrupted by impoundments (Allan 1995). The most obvious biological effect in the Central Valley is the blocking of upstream passage to anadromous fish species. Unless a mechanism is provided for fish passage, habitat upstream of the dam is effectively lost to the anadromous fish species. Dams that do not provide for anadromous fish passage also deprive upland areas of marine-derived nutrients from the decay of salmon carcasses. Several studies have demonstrated the importance of salmon carcasses to stream productivity (Bilby et al. 1996; Bilby et al. 1998; Wipfli et al. 1998). Reduced nutrient loading in upstream areas may reduce ecosystem productivity and macroinvertebrate quantity and diversity, and therefore reduce downstream juvenile salmonid rearing foodbase quantity and quality.

Natural river systems form a continuum from headwaters to river mouth, in which processes taking place upstream influence downstream dynamics. Dams interrupt this continuum. For example, dams reduce or eliminate upstream tributary contributions of sediment and LWD to downstream reaches. Sediment, in the form of gravel, is important to salmonid spawning, and LWD provides cover for juvenile rearing. Periodic high-flow events carry gravel and woody debris downstream, and because dams block recruitment of these materials, armoring of the salmonid spawning gravel and a reduction in habitat complexity can occur. The result is a reduction in the quantity and quality of spawning habitat, and LWD that served as cover for juveniles is depleted over time. In addition, lack of gravel and LWD combined with regulated flow regimes reduce channel complexity and habitat diversity.

Controlled flow regimes in the lower Feather River may cumulatively affect green sturgeon. Although the historic extent of green sturgeon usage of the lower Feather River is not known, lower flows may currently impede upstream migration of green

sturgeon. One potential migration barrier that has been identified is at Shanghai Bench in the lower Feather River (DWR 2003). Additionally, there is some evidence that sturgeon are attracted to the Feather River at flows of 5,000 cubic feet per second (cfs) or higher (DWR 2003). Controlled flow regimes may reduce the amount of time that suitable attraction flow exists in the lower Feather River to attract upstream migrating sturgeon in the Sacramento River.

From a cumulative perspective, river lamprey have been affected by lack of gravel recruitment, which has reduced the quantity and quality of spawning habitat. Actions that have negatively affected anadromous salmonids in the project area have had a similar effect on river lamprey.

Sacramento splittail make use of flooded benches and the inundated floodplain in the lower Feather River, below the southern FERC Project boundary, for spawning and juvenile rearing. Levee construction and controlled flows have reduced the quantity and quality of inundated floodplain habitat available to splittail.

Other actions that have contributed to the degradation of aquatic habitat in the Central Valley include urban development, agriculture, forestry, mining, levee and dike construction and maintenance for flood management, and road building. Normally, in areas of urban and agricultural development, channel morphologies are made straighter and deeper to promote drainage of low-lying areas. Channelization results in a reduction of flooding and thus, an increase in tillable land. However, it also results in a loss of floodplain aquatic habitat and a reduction in the quantity, quality, and complexity of in-river aquatic habitat. Water diversions for agricultural irrigation result in reduced flow in rivers and streams utilized by anadromous salmonids and may result in entrainment of young salmonids in diversion facilities. Agricultural drainage is also a major source of pollutants to aquatic habitats. Forestry practices that do not incorporate adequate riparian area buffer zones can also lead to reduced or degraded aquatic habitat. Logging activity can expose the streambed to reduced riparian shade, increasing water temperatures. Logging activities and wildfires are also associated with increased sediment production as a result of erosion. Accelerated erosion is a soil loss greater than natural geologic conditions, which can reduce reservoir capacity, degrade water quality, and harm fish and wildlife (DFG and NMFS 2001). Road building in riparian zones may also lead to increased fine sediment loading and erosion, reducing the quality of aquatic habitat.

6.2.6.2 Cumulative Effects of the Alternatives and Future Related Actions

The following sections address future operations of the Oroville Facilities under the No-Project Alternative, the Proposed Project, and the FERC Staff Alternative.

No-Project Alternative

From a cumulative affect on aquatic resources perspective, as it relates to threatened and endangered species, there are very few differences between Existing Conditions and the No-Project Alternative (see Chapter 3.0, Description of the Proposed Project

and Alternatives, for a detailed description of existing conditions and each alternative). Ongoing impacts associated with upstream migration barriers and loss of connectivity with upstream tributaries that affect quantity and quality of aquatic habitat would continue under the No-Project Alternative.

Proposed Project

Actions included in the Proposed Project address ongoing resource impacts associated with upstream migration barriers that cumulatively affect spring-run Chinook salmon and steelhead. The Proposed Project implements actions targeted at increasing the quantity and quality of anadromous salmonid and river lamprey spawning and juvenile rearing habitat downstream of the Fish Barrier Dam. Actions under the Proposed Project include increased minimum flows in the LFC (SA Article A108), supplementation of spawning gravel (SA Article A102), LWD supplementation (SA Article A104), Riparian and Floodplain Improvement Program (SA Article A106), and the enhancement of side-channel habitat (SA Article A103). Increased minimum flows in the LFC would increase the quantity of suitable spawning habitat for spring-run Chinook salmon and potentially reduce water temperatures in the LFC, benefiting all life stages of Chinook salmon and steelhead. These lower Feather River habitat enhancements mitigate the Oroville Facilities' contribution to the ongoing incremental affects of loss of access to upstream habitat.

Fish barrier weirs (SA Article A105) would be installed in the LFC under the Proposed Project to provide selective access to spawning habitat for Chinook salmon. For example, appropriately placed weirs could potentially simulate historic spatial segregation of runs by selectively allowing or blocking fish passage on a temporal basis. Additionally, by controlling access to spawning habitat on a temporal basis, the elevated levels of redd superimposition resulting from spring- and fall-run Chinook salmon spawning habitat spatial overlap would be reduced or eliminated, depending on the location and operation of the fish segregation weirs. Additional information on the implementation and potential benefits of a fish barrier weir system is included in Appendix C3, Impacts of the Proposed Project Relative to Existing Conditions.

The Proposed Project also includes a Habitat Expansion Agreement (HEA) (SA Appendix F) that would fully mitigate the loss of habitat associated with the Oroville Facilities blocking of upstream fish migration (see Section 3.3 for a description of the HEA). The HEA complements and expands upon other fish habitat programs to benefit spring-run Chinook salmon and steelhead.

The Proposed Project would implement an adaptive management approach to program operations at the Feather River Fish Hatchery (SA Article A107). The goal of this program is to provide for continuous evaluations and improvements to hatchery practices and operations. Different release strategies are among the hatchery practices to be reviewed (see Appendix G-AQUA1.7 of the PDEA for more information on Feather River Fish Hatchery operations). Release location can be highly correlated with straying rates. A common practice of anadromous salmonid hatcheries in the Central Valley is to release a portion of their fish in San Pablo Bay rather than on-site. For

example, in 1999 the Feather River Fish Hatchery released 78 percent of its fall-run Chinook salmon downstream of the Delta; Nimbus Hatchery released 100 percent of its fall Chinook salmon there; and the Mokelumne River released 57 percent of its fall Chinook salmon there. In addition, the Feather River Fish Hatchery released 100 percent of its spring-run Chinook salmon in San Pablo Bay (DFG and NMFS 2001). Because of the potential risks to the genetic integrity of stocks and potentially negative ecological impacts, the DFG and NMFS joint review of California's anadromous fish hatcheries recommends that spring-run Chinook salmon from the Feather River Fish Hatchery be released in-stream, and fall-run Chinook salmon from both the Feather River and Nimbus Hatcheries be released in-stream (DFG and NMFS 2001). Under the Proposed Project, adaptive management of in-river release of Feather River Fish Hatchery stocks would result in a cumulative reduction in the contribution of hatchery straying to the degradation of anadromous salmonid stock genetic integrity.

The Gravel Supplementation, Riparian and Floodplain Improvement, and LWD Supplementation Programs (SA Articles A102, A104, and A106) are included in the Proposed Project. Under current regulated flow regimes, LWD and gravel placements would provide localized fish habitat benefits until a high-flow event. When that occurs, the magnitude of the flow event would redistribute both naturally recruited and supplemented LWD and gravel. This redistribution is a normal ecosystem function; however, the LWD and gravel in the upstream reaches of the LFC would need to be replenished following these events. Because high-flow events cannot be predicted, both the LWD and Gravel Supplementation Programs would be implemented for the duration of the project. In the event that LWD and gravel are mobilized during high-flow events, they would provide fish habitat benefits farther downstream in the Feather River, Sacramento River, and perhaps as far as the Delta.

Channel complexity downstream of the Fish Barrier Dam would be increased by the proposed improvements to Moe's Ditch and Hatchery Ditch and the establishment of additional side-channel habitat with implementation of the Proposed Project (see Appendices C3 and C4 regarding impacts under the Proposed Project). The supplementation of gravel and LWD may indirectly enhance channel complexity by diverting flows and creating more interaction with the floodplain. Increased channel complexity could cumulatively contribute to increased quantity and quality of aquatic habitat downstream of the Fish Barrier Dam.

No actions included in the Proposed Project would contribute to cumulative impacts on green sturgeon. Continued moderated flows from the Oroville Facilities (that would occur under all alternatives) and other Feather River tributaries would be expected to reduce the frequency and magnitude of attraction flow to the Feather River.

In summary, implementation of the actions described above and included in the Proposed Project would increase habitat availability for both spring-run Chinook salmon and steelhead spawning and juvenile rearing. Increased habitat availability in terms of both quantity and quality may lead to increased egg-to-smolt survival for anadromous salmonids. Furthermore, installation of fish barrier weirs and an adaptive hatchery management program would aid managers in better understanding current population

dynamics of both Chinook salmon and steelhead. These actions would contribute to the mitigation of cumulative effects on spring-run Chinook salmon and Central Valley steelhead associated with the continued operation of the Oroville Facilities and other past, existing, and reasonably foreseeable related actions. Additionally, actions included in the Proposed Project would partially mitigate for the cumulative effects on river lamprey, and Sacramento splittail.

FERC Staff Alternative

There are no substantive differences in cumulative effects on aquatic resources with the implementation of the FERC Staff Alternative as compared to the Proposed Project other than implementation of the HEA. Under the FERC Staff Alternative, the HEA would not be implemented and there would be no mitigation for the ongoing loss of habitat access for spring-run Chinook salmon and steelhead as a result of the continued existence of the Oroville Facilities.

Climate Change and Aquatic Resources

According to the DWR climate change report, Sierra Nevada watersheds with snowpack (such as the Feather River) are predicted to get less snow and more rain, more winter and less spring and summer runoff, and warmer runoff. Increased water temperatures pose a threat to aquatic species that are sensitive to temperature, including anadromous fish. Increased water temperatures would also cause decreased dissolved oxygen concentrations in water and would likely increase production of algae and some aquatic weeds (DWR 2006).

In many low- and middle-elevation streams in California today, summer temperatures often come close to the upper tolerance limits for salmon and trout. Thus, anticipated climate change that raises air temperatures a few degrees Celsius may be enough to raise water temperatures above the tolerance of salmon and trout in many streams, favoring instead non-native fishes such as carp and sunfish. Spring-run Chinook salmon and steelhead trout that migrate up the Feather River early in the year, spending the summer in deep, cold pools, and spawning the following fall (salmon) or winter (steelhead), depend on the availability of cold water for survival over the summer months. Climate change could reduce the volume of cold water in storage at Oroville Reservoir since it would receive less snowmelt and have reduced carryover storage. Thus, the availability of cold water volumes needed to maintain releases of cold water to support fish spawning and rearing below the Oroville Facilities may decline. Due to the combination of anticipated warmer and shallower streams and rivers, climate change may diminish most summer habitat for steelhead and potentially all such habitat now used by spring-run salmon. (DWR 2006.)

6.2.7 Terrestrial Resources

6.2.7.1 Wildlife

Potential cumulative effects discussed in this section address wildlife and wildlife habitat, State-listed species, special-status species, and federally listed species

protected under the Endangered Species Act (ESA). For purposes of this discussion on cumulative impacts on wildlife species from the implementation of the No-Project Alternative, Proposed Project, and FERC Staff Alternative, these species include the federally listed bald eagle, giant garter snake, California red-legged frog, valley elderberry longhorn beetle (VELB), and vernal pool invertebrates, and the State-listed Swainson's hawk and bank swallow. The analysis of potential impacts and associated mitigation measures on wildlife resources is presented in Section 5.5.1.

Cumulative effects could include the loss or degradation of wildlife species and habitats as a result of flow fluctuations, project operations, maintenance activities, or changes in project recreational facilities or uses, as well as non-project related activities (see Section 5.5.1.4 for more detailed information on effects). Detailed information regarding wildlife and wildlife habitats, State-listed species, and special-status species is contained in the reports for SP-T1, SP-T2, and SP-T9.

Detailed information regarding State-listed and federally listed species trends, historical information, and current threats to the species is contained in Appendix E of the PDEA, Draft Terrestrial BA, and the reports for SP-T2, SP-T3/5, and SP-T9.

Past and Present Related Actions

Reservoir development has resulted in the conversion of upland, riparian, and wetland habitats in the Feather River floodplain to less productive habitats. Reservoir water level fluctuations result in barren shorelines used by relatively few wildlife species. The lack of cover in barren areas potentially increases predation rates for upland species traversing from upland habitats to lacustrine habitats. Further, reservoirs can act as dispersal barriers to some sedentary wildlife species, affecting territorial behaviors and reducing gene flow among local populations.

Flood management in the Feather River floodplain and controlled flow regimes in the Feather River have resulted in disruption of geomorphic processes essential for the maintenance and development of riparian and wetland habitats. An indirect effect of flood management activities is that it allows for urban and agricultural development in the Feather River historic floodplain and the consequent loss of wildlife habitat. Flood management–related bank stabilization actions have also resulted in loss of riparian habitats.

Fire suppression, increased recreational development and use, and urban development have all cumulatively contributed to wildlife habitat loss and degradation. Additionally, maintenance activities associated with increased recreation and urban development including pesticide use, road and trail building activities, and gravel harvest and drainage control activities have all contributed incrementally to decreased quantity, quality, and diversity of wildlife habitat.

Cumulative Effects of the Project and Past and Present Related Actions on Federally Listed Wildlife Species

Bald Eagle

The bald eagle was reclassified from Endangered to Threatened in 1995 throughout its range, and the species has been petitioned for delisting. While the Recovery Plan goals were met or exceeded for 6 of the 7 states in the Pacific Recovery Zone, including California, the Recovery Plan target goal for distribution by management zone has not been met for Zone 27, which includes the Lake Oroville area. The target goal for Zone 27 is 15 nesting territories, including 4 in the Lake Oroville area. In 1985, there were 4 known territories in Zone 27. Historically, at least 5 bald eagle nest territories have been documented within and adjacent to the project area; of these, 4 territories were occupied and produced young in 2005 and 2006 (see Appendix E of the PDEA and Draft Terrestrial BA for additional discussion). A January 2007 survey documented a new winter roost site in the North Fork Feather River and increased use compared to previous monitoring.

Historic actions that have served to reduce bald eagle populations in the project area include habitat alterations and loss, human disturbance, shooting, and environmental contaminants. Reservoir developments (including project reservoirs) have generally benefited bald eagle populations by increasing habitat and providing a more stable year-round food source. Nesting bald eagles are currently present at all of the larger reservoirs within the Feather River watershed (Jurek 1997).

Cumulative actions that may currently affect the bald eagle in the project area include project recreational development and use, project water level fluctuations, non-project recreational use and development, non-project logging and other forest harvest activities, non-project establishment of new roads and trails, and non-project residential development around Lake Oroville.

Giant Garter Snake

The giant garter snake is endemic to the Sacramento and San Joaquin River valleys and historically (pre-European settlement) occurred coincidental with the historical distribution of large floodplain basins, freshwater wetlands, and tributary streams. Agriculture and flood management activities have extirpated the giant garter snake from the southern third of its range. There are currently 13 existing populations that largely coincide with historical riverine flood basins and tributary streams in the Central Valley. These populations are distributed discontinuously in small isolated patches and are vulnerable to extirpation by naturally occurring environmental events, population dynamics, and genetic processes (Miller and Hornaday 1999).

Historic actions that have adversely affected giant garter snake and their habitat within the project area include flood management, agricultural conversion, environmental contaminants, livestock grazing, introductions of non-native species, and road kills. At the same time, development of rice production as well as irrigation supply and drainage

canals in the Sacramento Valley has resulted in the creation of some suitable giant garter snake habitat.

Cumulative actions that may affect giant garter snakes or their habitat in the project area include project recreational use and development, project water level fluctuations, mosquito abatement activities, illegal dumping in aquatic systems, and urban/residential development.

California Red-legged Frog

Historically, the California red-legged frog inhabited suitable habitat from coastal Marin County to northern Baja California and inland to near Redding, California, and was documented in 46 counties. Today, the California red-legged frog is considered extirpated from 24 of the 46 California counties.

Current and historical factors associated with declining populations of California red-legged frogs include degradation and loss of habitat through urbanization, mining, improper management of grazing, recreation, invasion of nonnative plants, water impoundments, water diversions, degraded water quality and introduced predators (66 Federal Register [FR] 14626–14757). Several researchers have attributed the decline and extirpation of California red-legged frogs to the introduction of bullfrogs and introduced predatory fishes (Hayes and Jennings 1986; Moyle 1973). The fragmentation of existing habitat and the continued colonization of existing habitat by non-native species, likely represent the most significant current threats to California red-legged frogs (66 FR 14626–14757).

Valley Elderberry Longhorn Beetle

VELB is found in isolated populations throughout the Central Valley, although it is locally common in the project area. Historically the species occurred in association with its host plant, the elderberry (*Sambucus* sp.), which was common in riparian forests and adjacent grasslands in the Central Valley (Barr 1991), which historically was estimated to cover 900,000 acres. In 1991, approximately 324,000 acres supported VELB habitat in parks, wildlife areas, and public lands in the Central Valley and adjacent foothills, of which valley elderberry longhorn beetle was present in about 187,000 acres (Barr 1991). Current and historical factors contributing to this species' current population status include habitat loss, degradation or fragmentation associated with agricultural and urban conversion, maintenance associated with waterways, insecticide use, livestock grazing, and bank stabilization/protection activities.

Current threats to this species include continued conversion of land to urban, industrial, and agricultural land uses, transportation, and additional future water–related facilities in the foreseeable future (USFWS 1996), which result in habitat destruction, degradation, and isolation of existing populations.

Vernal Pool Invertebrates

Vernal pool wildlife species are endemic to vernal pools in the Central Valley. A wide range of activities has historically affected vernal pool habitats and vernal pool wildlife and plant species (USFWS 1994). Vernal pool habitat in the Central Valley has been reduced 50–85 percent since the 1970s from agricultural and urban development; water and flood management, highway and utility projects, chemical contaminants, and agricultural practices (USFWS 1994). Current threats to vernal pool invertebrates in the project area include agricultural conversion, urban development, and expansion of transportation systems.

Cumulative Effects of the Project and Past and Present Related Actions on State-Listed Species and Species of Special Concern

Principal historic actions affecting habitats of two State-listed species occurring in or near the FERC Project area (Swainson's hawk) and downstream of the FERC Project area (bank swallow) include both project and non-project urban and agricultural conversion of habitat and flood management activities resulting in the loss or degradation of riparian, wetland, and upland habitats. These losses have cumulatively contributed to a decline in the Swainson's hawk population in the project area. Flood management–related bank stabilization actions downstream of the Oroville Facilities have resulted in a reduction in bank swallow nesting habitat, which has cumulatively contributed to a reduction in bank swallow population size and the number of nesting colonies.

Current project and non-project actions affecting Swainson's hawk and bank swallow populations include non-project urban development, resulting in alteration, loss, and degradation of upland, riparian, and wetland habitats. Feather River controlled flow regimes and sediment blockage have resulted in a disruption of natural geomorphic processes, which are essential for the maintenance and development of riparian and wetland habitats. Changes in river flow during bank swallow nesting periods could affect nesting success. Additionally, increased recreational use and development with associated maintenance activities (i.e., pesticide and herbicide use, grading, and road and trail construction), have incrementally contributed to habitat alteration, degradation, and loss.

Cumulative Effects of the Alternatives and Future Related Actions

Wildlife habitat (especially annual grassland, blue oak woodland, and blue oak/foothill pine habitats) would continue to be lost to urban development within the project area. Both direct and indirect wildlife habitat losses and degradation associated with increased recreational use would continue to increase over time as the human population increases and recreational demand increases. Recreational use and development are expected to continue under each of the project alternatives.

No-Project Alternative

The No-Project Alternative, because it does not include recreation facility development or habitat enhancement actions, would result in the least direct and indirect wildlife habitat conversion or loss. Increased recreational use would still be anticipated, but not to the extent that would occur under the alternatives with recreational improvements. Effects on habitat quantity, quality, and diversity caused by regulated flow regimes and the loss of connectivity with upstream reaches of the Feather River caused by Oroville Facilities and operations would continue.

Proposed Project

Increased recreational use and access provided by some of the actions included in the Proposed Project would likely have a cumulatively negative effect on wildlife habitat. However, actions included in the Proposed Project as Draft Terrestrial BA measures would serve to alleviate effects within annual grassland, freshwater emergent wetland, riparian, vernal pool, and mature coniferous forest habitats.

Flow regime and the effect of reduced upstream sediment contribution on riparian habitat would continue under the Proposed Project. The increase in minimum flows in the LFC in the Proposed Project would not result in a significant change in the quantity and quality of riparian habitat within the Feather River floodplain or stimulate natural geomorphic processes. However, any retention of LWD and side-channel enhancement and creation as well as the riparian and floodplain improvements included in the Proposed Project would increase riverine and riparian habitat values.

Several resource actions designed to protect specific species of management concern (i.e., California red-legged frog, giant garter snake, vernal pool invertebrates, and VELB) would also serve to protect and enhance wildlife habitat within the project area. Implementation of the Oroville Wildlife Area Management Plan (SA Article A115) and the Invasive Plant Management action (SA Article A126) would also likely lead to wildlife habitat improvements and mitigates for habitat disrupted by increased recreational use and development.

FERC Staff Alternative

There are no substantive differences in cumulative impacts on wildlife resources with the implementation of the FERC Staff Alternative as compared to the Proposed Project with the exception of the accelerated implementation schedule developed by FERC for the Riparian and Floodplain Improvement Program. While floodplain benefits may be realized earlier under the FERC Staff Alternative, impacts on sensitive species may limit potential project options or increase potential impacts from construction and therefore lessen total benefits to terrestrial resources.

Federally Listed Wildlife Species

Bald Eagle. Water level fluctuations have been documented to adversely affect bald eagle production at Shasta Lake (USBR 1992). However, the limited bald eagle

production data available for Lake Oroville are insufficient to draw similar conclusions at Lake Oroville. Implementation of any of the alternatives would not change Lake Oroville water levels.

No-Project Alternative. Residential development adjacent to the project area is likely to continue to occur in the future and could result in the reduction of the suitability of these areas for bald eagle nesting.

Increased recreational development and use in the project area could result in disturbance/displacement of wintering bald eagles. However, recreational use of Lake Oroville, which is the primary wintering habitat in the project area, is currently minimal during the period when wintering bald eagles are present (December through February).

Timber harvest activity can adversely affect bald eagles through habitat modification and disturbance. Future commercial timber harvest, including fire fuel load reduction activity, is planned and would likely continue in the project area.

Proposed Project. The adoption of Bald Eagle Territory Management plans (SA Article A118) (see Appendix E of the PDEA for further discussion) as part of the Proposed Project serves to limit habitat disturbance due to recreational use and development within the FERC Project boundary.

FERC Staff Alternative. There are no substantive differences in cumulative effects on bald eagles or their habitat with the implementation of the FERC Staff Alternative as compared to the Proposed Project.

Giant Garter Snake. A potential cumulative effect on this species is the current and future anticipated use of insecticides by county and municipal agencies. Both the Butte County Mosquito and Vector Control District and the City of Oroville (City) annually administer active mosquito abatement programs, which apply insecticide fog around the Feather River and the Thermalito Complex, including the Oroville Wildlife Area (OWA). This program has the potential to reduce insect populations in the project area and could affect elements of the giant garter snake habitat and food chain. Efforts to control West Nile virus are likely to increase the level of mosquito abatement actions in the future.

Illegal dumping of trash and hazardous materials in aquatic systems within the project area would continue to occur on a sporadic basis. Residential development and associated grading or drainage improvements adjacent to the project area have the potential to alter or destroy wetland habitat and reduce the connectivity of giant garter snake habitat within the project area.

No-Project Alternative. Under the No-Project Alternative, cumulative effects related to Thermalito Afterbay water level fluctuations would continue. The 4,281 acres of giant garter snake habitat would continue to be managed for multiple uses. Periodic minor habitat degradation and loss of giant garter snake aquatic and upland habitat would likely occur related to recreation use, recreation development, and project maintenance activities.

Proposed Project. The Proposed Project contains Draft Terrestrial BA conservation measures (SA Articles A117, A119, A120, and A121) and brood pond construction (SA Article A122) developed in consultation with USFWS to minimize or avoid potential project effects associated with water level fluctuations, recreational development and use, environmental contaminants, and maintenance activities. These measures would serve to reduce cumulative effects as compared to the No-Project Alternative. The Proposed Project would further reduce cumulative effects through increased patrol and enforcement as well as the installation of vehicular barriers within the OWA. Both of these actions would serve to reduce habitat degradation and the potential for illegal dumping of environmental contaminants.

FERC Staff Alternative. There are no substantive differences in cumulative effects impacts on giant garter snake or their habitat with the implementation of the FERC Staff Alternative as compared to the Proposed Project.

California Red-Legged Frog. Potential habitat exists in the project area for California red-legged frog, although the habitat quality is poor. Actions that may degrade the habitat quality include insecticide use within the project area. The Butte County Mosquito and Vector Control District and the City both administer annual active mosquito abatement programs, which apply insecticide fog around the Feather River and around the Thermalito Complex. These applications have the potential to decrease insect populations in the project area and, as such, could affect the California red-legged frog's food supply and degrade potential habitat.

No-Project Alternative. None of the measures within the No-Project Alternative would affect California red-legged frogs or their habitat. Degradation of potential California red-legged frog habitat would continue through increased urbanization and recreational use.

Proposed Project. The Proposed Project includes conservation actions specifically targeted at protection of California red-legged frog habitat (SA Article A121); see Chapter 3.0. Additionally, the Proposed Project includes measures to improve OWA visitor management through patrol/enforcement and the erection of additional vehicular barriers (SA Article A117). Both of these actions would serve to reduce potential effects associated with dispersed recreation use, including off-highway vehicle (OHV) use, on potential California red-legged frog habitat.

FERC Staff Alternative. There are no substantive differences in cumulative effects impacts on California red-legged frogs or their habitat with the implementation of the FERC Staff Alternative as compared to the Proposed Project.

Valley Elderberry Longhorn Beetle. Future activities that would have a cumulative effect on VELB populations in the FERC Project area include herbicide and insecticide use, recreational use and development, road and levee maintenance, and gravel extraction activities with the FERC Project area.

Mosquito abatement programs apply insecticide fog around the Feather River and around the Thermalito Complex. These applications have the potential to increase

effect on insects, including VELB, in the FERC Project area. Efforts to control West Nile virus are likely to increase the level of mosquito abatement actions in the future.

Recreational activities affecting VELB include camping, OHV travel, fires, and establishment of new trails in areas populated with valley elderberry shrubs. VELB may be adversely affected through soil disturbance and/or compaction affecting the elderberry shrubs.

Mining companies extract gravel from the dredger spoils piles within the Feather River floodplain. Operations potentially could affect VELB habitat through dust and habitat disturbance or destruction from extraction activities and truck traffic.

No-Project Alternative. Under the No-Project Alternative, cumulative effects related to project road and maintenance activities and recreational use would continue. The 95 acres of VELB habitat within the project boundary would continue to be managed for multiple uses. Periodic minor habitat degradation and loss of beetle habitat would likely continue to occur related to recreation use, recreation development, and project maintenance activities.

Proposed Project. The Proposed Project contains Draft Terrestrial BA conservation measures (SA Articles A117, A119, A120, and A121) developed in consultation with USFWS to minimize or avoid potential project effects associated with recreational development or use, environmental contaminants, and maintenance activities. These measures would serve to mitigate cumulative effects as compared to the No-Project Alternative. Further, the Proposed Project includes measures to improve OWA visitor management through patrol and enforcement and the installation of additional vehicular barriers. These actions would serve to reduce potential effects associated with dispersed recreation use including OHV use to VELB habitats.

FERC Staff Alternative. There are no substantive differences in cumulative effects impacts on VELB and their habitat with the implementation of the FERC Staff Alternative as compared to the Proposed Project with the exception of the accelerated implementation schedule developed by FERC for the Riparian and Floodplain Improvement Program. While floodplain benefits may be realized earlier under the FERC Staff Alternative, impacts on sensitive species may limit potential project options or increase potential impacts from construction and therefore lessen total benefits to terrestrial resources.

Vernal Pool Invertebrates. The Butte County Mosquito and Vector Control District and the City annually administer an active mosquito abatement program, which applies insecticide fog around the Feather River and around the Thermalito Complex, including the OWA. These applications have the potential to directly affect vernal pool invertebrates and indirectly affect them by changing the fragile balance between water, soil, plants, and other vernal pool species. Efforts to control West Nile virus are likely to increase the level of mosquito abatement actions in the future.

No-Project Alternative. Continued urban development in and adjacent to the project area would result in the continuation of degradation and loss of additional vernal pool habitats. Soil compaction may also result in decreasing habitat suitability for some vernal pool plant species or encourage algae growth, thus directly affecting the pools' suitability to sustain a viable invertebrate population. OHV use outside the FERC Project boundary may also result in physically crushing or directly damaging adults and cysts within a vernal pool adjacent to the Project area.

Proposed Project. Under the Proposed Project, OHV use and other recreational use of vernal pool areas within the project area would be reduced through implementation of conservation measures, including signage, patrol, enforcement, and barrier maintenance (SA A117).

Additionally, project road and levee maintenance practices would be modified to reduce potential sediment, compaction, chemical contamination, or altered hydrology of pool habitats. Road improvements, expansion, or maintenance undertaken by an agency other than DWR may affect vernal pool integrity through grading, mechanical and/or chemical weed control, alteration of drainage patterns, and alteration of soil chemical and physical characteristics.

FERC Staff Alternative. There are no substantive differences in cumulative effects impacts on vernal pools with the implementation of the FERC Staff Alternative as compared to the Proposed Project.

State-Listed Wildlife Species and Species of Concern

Cumulative effects on State-listed species and species of concern would continue under the alternatives with actions that result in the loss or degradation of habitat utilized by these species, especially riparian and riverine habitats. Continuing project operations as described above could affect Swainson's hawk and bank swallow habitat and production. No significant differences in cumulative effects were identified between project alternatives for the State-listed Wildlife Species of Concern.

Swainson's Hawk. Flow regime effects on riparian habitat would continue under all of the project alternatives. The proposed flow modifications considered under the Proposed Project would not result in significant change in the quantity and quality of Swainson's hawk nesting habitat. The Proposed Project would likely have beneficial effects on Swainson's hawk nesting habitat through the implementation of the Riparian and Floodplain Improvement Program (SA Article A106).

Bank Swallow. Flow regime effects on bank swallow habitat along the Feather River downstream of the OWA and outside the FERC Project boundary would continue under all of the project alternatives.

6.2.7.2 Botanical

Potential cumulative effects discussed in this section address botanical resources including vegetation communities, special-status plants, and invasive non-native plant

species. The analysis of potential impacts and associated mitigation measures on botanical resources is provided in Section 5.5.2.

Federally listed Threatened or Endangered plant species were not located within the FERC Project area during the relicensing studies. Therefore, there would be no cumulative effects on federally listed plant species under any of the project alternatives. Future actions conducted in potentially suitable habitat for vernal pool species and serpentine species would require the completion of floristic surveys to determine presence or absence of these listed plant species. For any future actions that may affect listed plant species, DWR would be required to coordinate with USFWS.

Cumulative effects could include the loss or degradation of native plant communities; the introduction and spread of non-native and noxious terrestrial and aquatic weeds; and the loss or reduction of special-status plant species populations (see Section 5.5.2 for more detailed information on effects). Detailed information regarding historic information, trends, and current threats to these botanical resources also can be found in the reports for SP-T2, SP-T3/5, SP-T4, SP-T7, and SP-T10.

The cumulative effects evaluations are limited to the additive nature of project-related and non-project-related effects on botanical resources, including native plant communities, special-status plant species, and non-native invasive plants.

Plant Communities

Riparian Resources

Historically, rivers in the Sacramento Valley were flanked by extensive floodplains that supported riparian forests and associated wetlands (Katibah 1984). Complex fluvial geomorphic processes, including hydrology, erosion, sediment transport, and depositional patterns, maintained these forests. In the 1800s riparian forests were logged for lumber and fuel. By the late 1800s, hydraulic mining had introduced massive amounts of sediment into the system and, in the early 1900s, Feather River water diversions began for agricultural and urban uses. Regulated streamflow from hydroelectric and reservoir projects as well as levee construction resulted in a reduced risk of downstream flooding, allowing more floodplain plant communities to be converted to agricultural and urban use.

The construction of Oroville Facilities in the 1960s further altered streamflow patterns, reduced floodflows, and reduced sediment discharge downstream. As a result of these hydrologic and floodplain alterations, the riparian forests along the Feather River downstream of Oroville Dam are narrow and fragmented, with little or no recruitment of riparian successional species, and are therefore relatively low in structural and species diversity. The Proposed Project includes a Riparian and Floodplain Improvement Program (SA Article A106) to address the ongoing contribution of the Oroville Facilities to the overall effects on riparian plant communities in the Feather River. Additional information on riparian resources in the project vicinity can be found in the SP-T3/5 report.

Upland Plant Communities and Associated Wetlands

Upland plant communities in the project vicinity consist of oak/pine woodlands, chaparral, and conifer forest types in the foothills of the Sierra Nevada and annual grasslands containing vernal pools and swales in the Sacramento Valley. Urban development, recreational use, wildfire suppression, and the introduction of invasive plant species have resulted in loss and degradation of upland communities. Additional information on historic and project effects on plant communities can be found in the SP-T10 report.

Over the last century, California grasslands have been heavily affected by the invasion of non-native species. Soil disturbance and seed dispersal by vehicles increase the rate of invasive species colonization. Construction of the 4,930-acre Thermalito Forebay and Thermalito Afterbay included the conversion of grasslands, some with vernal pools and swales, to project waters and emergent wetland vegetation. Subsequently, DFG converted over 200 acres of grasslands containing vernal pools and swales around Thermalito Afterbay to non-native crops to enhance waterfowl foraging and nesting cover. Outside the FERC Project boundary, upland plant communities and associated wetlands have been and continue to be lost largely due to non-project-related agricultural and urban development. The quality of upland plant communities has been and would continue to be degraded by soil disturbance related to construction and maintenance activities and by invasive species seed dispersal by recreational activities. The Proposed Project includes Protection of Vernal Pools (SA Article A117) and Invasive Plant Management (SA Article A126) to address the ongoing contribution of the Oroville Facilities to the overall effects on upland plant communities.

Special-Status Plant Species

Historic effects on special-status species habitats date back to Euro-American settlement of the 1800s. The majority of special-status species that occur in the vicinity of Lake Oroville inhabit openings in woodlands, forests, and chaparral communities. As wildland fire suppression began around the turn of the century, stand densities increased and the quantity and quality of special-status species habitats has decreased. The loss of special-status species populations and habitats has also occurred from urban development and non-native species invasions. Special-status species habitats in valley grasslands and associated vernal pools and swales have been affected by non-native species invasions. Non-project conversion of lands for agricultural and urban uses has also affected these species' habitats. The construction of Thermalito Forebay and Thermalito Afterbay converted over 3,000 acres of grasslands, some containing vernal pools and potential special-status plant species habitat to open water habitat with emergent vegetation habitat along the shorelines. The Proposed Project includes Draft Terrestrial BA actions (SA Articles A117, A119, and A121) to address the ongoing contribution of the Oroville Facilities to the overall effects on special-status species.

Non-Native Invasive Plant Species

Non-native species have been recorded in California prior to the 1800s, although their proliferation has been greatest during the last century. These species are highly adapted to disturbance and colonize areas affected by human and natural factors, including stream flows, change in wildfire frequencies, urbanization, and other human activities. Historically, these species have increased in numbers due to land use practices that favor invasive species. Construction of the Oroville Facilities led to further disturbance of natural areas and potential sites for invasive plant species colonization. The Proposed Project includes Invasive Plant Management (SA Article A126) to address the ongoing contribution of the Oroville Facilities to the overall effects on non-native invasive plant species.

Cumulative Effects of the Alternatives and Future Related Actions

No-Project Alternative

Plant Communities. Under the No-Project Alternative, effects on botanical resources as identified in Section 5.5.2. would continue. Flow management, reduced sediment load and LWD transport, and water use downstream of Oroville Dam would continue to adversely affect riparian plant communities within the Feather River floodplain. Non-native plant species would continue to colonize riparian and wetland plant communities both inside the FERC Project boundary as well as within surrounding areas. Upland plant communities around Lake Oroville would continue to be affected by fire suppression as plant community densities increase and catastrophic fires occur. Effects from non-native plant species invasions would continue. Direct effects on natural communities would occur from urban development adjacent to the project area. Direct and indirect losses associated with recreation use and development would continue. Valley grassland and associated vernal pools and swales would continue to be affected as natural areas are lost to urban development. Within the FERC Project boundary, grasslands and swales not designated as listed species habitat, and thus not protected under State or federal regulations, would continue to have moderate adverse effects from project-related activities, recreational use, and invasions by non-native plant species. Introduction of non-native plant species and continued fertilizer use, which favors non-native species over native species, would continue to affect grasslands, vernal pools, and swales.

Special-Status Plant Species. Effects on special-status plant species and their habitats would continue. These effects in the vicinity of Lake Oroville would be primarily from fire suppression activities and encroachment into natural areas from urban development. Special-status species associated with annual grasslands, vernal pools, and wetlands in the vicinity of the project area below Lake Oroville would continue to be affected as these areas are lost to non-project urban development. Although conservation measures relating to vernal pool invertebrates would reduce effects on these species' habitats in the FERC Project boundary, there would continue to be some adverse effects from project-related activities, recreational use, and invasions by non-native plant species into special status plant habitats.

Non-native Invasive Species. Invasive plant species affect both natural plant communities and special-status species habitats. Non-native species effects would continue to occur under the No-Project Alternative.

Proposed Project

Under the Proposed Project, effects on botanical resources would be reduced by the implementation of Invasive Plant Management, the Riparian and Floodplain Improvement Program, and the Draft Terrestrial BA–related SA Articles 117–121 (including vernal pool protection, protection measures implemented for the giant garter snake, valley elderberry longhorn beetle, and red-legged frog), which would have beneficial effects on native plant communities in the project area and those associated with waters downstream. The Invasive Plant Management actions would target specific species that are considered to have the greatest impact on plant communities of the project area, especially wetland and riparian vegetation, and those that are affecting special-status species habitats. The continuation of upland forage and cover crop programs (SA Articles A123 and A124) and construction of additional waterfowl brood ponds (SA Article 122) would continue to benefit special-status wetland plant species.

FERC Staff Alternative

There are no substantive differences in cumulative impacts on botanical resources with the implementation of the FERC Staff Alternative as compared to the Proposed Project.

6.2.8 Recreational Resources

The recreational resources that are potentially cumulatively affected by the continued operation of the Oroville Facilities and other past, existing, and reasonably foreseeable related actions are primarily recreation facilities and dispersed recreational use opportunities. The analysis of cumulative effects also addresses Lake Oroville surface water elevations and Feather River flows downstream of Oroville Dam. Section 4.7.1 provides additional information on other similar recreational resources in the region, public recreational access and facilities in the project area, past and current recreation use levels, and current recreation use patterns, capacity, and management. The 17 recreation studies completed as part of the relicensing effort as well as the report for SP-L3, Comprehensive Plans Consistency Evaluation, provide information utilized in this analysis.

6.2.8.1 Cumulative Effects of the Project and Past and Present Related Actions

Past and Present Actions in the Project Area

Past actions that have affected project recreation resources include the development of over 30 recreational facilities beginning in 1968, soon after construction of the Oroville Facilities. Prior to the construction of the Oroville Facilities, recreation in the area included angling, camping, picnicking, swimming, river boating, hunting, and hiking activities with access to some areas limited by rugged terrain and lack of developed roadways. Most of the current recreation facilities have been managed as part of the

Lake Oroville State Recreation Area (LOSRA), which has reported visitor attendance between 500,000 and 950,000 visits most years since the mid-1970s. Additional recreation use, much of it dispersed in nature, has occurred at the OWA (estimated between 100,000 and 250,000 visitors per year).

Present actions include the operation and maintenance of the recreation facilities discussed above, as well as management of lands for dispersed uses such as hunting, hiking, bike riding, equestrian use, and boating. The SP-R9 report estimated that these facilities supported over 1.6 million recreation days (RDs) of use by visitors engaged in a wide range of recreation activities, including power and non-power boating, camping, swimming, picnicking, angling, hiking, bike riding, horseback riding, hunting, wildlife viewing, and nature appreciation within the FERC Project area during the 12-month relicensing study period. Past and present actions in the project area also include normal project operations for water storage and hydroelectric power, which result in annual water surface level fluctuations at Lake Oroville and modified flows in the Feather River.

Related Actions by Regional Recreation Providers

Regional past and present related actions include the construction and recreational development of many moderate to large reservoirs in California. The SP-R14 report described 20 reservoirs, ranging from about 700 acres to nearly 30,000 acres in size, within a few hours' drive of the project area. This includes the 2 largest reservoirs in the State in surface area: Shasta Lake (29,500 acres) and Lake Almanor (27,000 acres). The region also offers two large natural lakes: Lake Tahoe (122,000 acres) and Clear Lake (40,000 acres). These reservoirs and lakes provide a wide range of public and private recreation development, and many offer recreation opportunities similar to those available at the Oroville Facilities.

In addition to the primarily water-based recreation opportunities provided by these regional water bodies, the region also contains large areas of federal lands managed by USFS, BLM, and the National Park Service. Plumas National Forest to the west and Lassen National Forest to the north of the project area each provide over 1 million acres of primarily forested and mountainous public lands for recreation, including hundreds of lakes and thousands of miles of streams. Lassen Volcanic National Park covers over 100,000 acres of forested foothills and includes unique volcanic features. BLM manages scattered parcels of public land in the project vicinity, often interspersed with other federal lands. These areas offer developed camping and boating opportunities similar to those provided in the project area, in addition to much more extensive areas for dispersed activities like hunting and wildlife viewing and for OHV use. These areas clearly play an important role in providing both developed and dispersed recreation opportunities that complement those provided by the Oroville Facilities within the FERC Project boundary.

Cumulative Effects of Past and Present Actions on Recreation

Cumulatively, the effect of past and present actions within the FERC Project boundary has been to substantially increase the amount and range of recreation opportunities in the region, particularly with regard to water-based recreation such as boating, angling, and swimming. Opportunities for other activities that may be enhanced by proximity to a reservoir and water-based recreation opportunities, such as camping and hiking, and dispersed-use activities such as hunting and wildlife viewing have also increased substantially.

6.2.8.2 Cumulative Effects of the Alternatives and Future Related Actions

This section describes the reasonably foreseeable future actions of federal, State, and local agencies that provide recreation opportunities in the region, as well as the cumulative effects of those actions and the project alternatives on recreation in the region.

Future Related Actions of Regional Recreation Providers

As discussed below, several providers of recreation facilities and opportunities in the region surrounding the FERC Project boundary have plans for future related actions that would increase recreation opportunities.

Regional Reservoirs

Several of the reservoirs in the region have recently completed or plan to make additions and improvements to recreation facilities (the SP-R14 report provides additional detail on these actions). The recreation opportunities are generally provided by the federal or State agencies that own and/or operate the reservoirs or their concessionaires and permittees.

Federal Agencies

Plumas National Forest is the primary federally managed area within and adjacent to the project area. The National Forest's Land and Resource Management Plan (LRMP), adopted in 1988, directs the management of the National Forest, and emphasizes continued cooperation with DPR in managing USFS lands within the LOSRA. Additional recreation management described in the LRMP is focused primarily on providing semi-primitive and primitive recreation facilities and programs, extending and improving the trail system, upgrading forest roads as needed, and protecting unique scenic values on forest lands.

BLM owns scattered parcels of land in the project area. All of these lands are within the Redding Resource Area and are addressed by the 1993 *Redding Resource Management Plan* (RRMP). In general, the BLM lands are managed for similar types of primitive, undeveloped, and dispersed recreation as nearby USFS lands. A primary focus of the RRMP as it relates to lands in and near the FERC Project boundary is the potential transfer of public lands within the boundary from BLM to other federal, State,

or local entities. In particular, 6,900 acres of land within and adjacent to the LOSRA are identified as available for transfer to the State of California pending DPR application under the Recreation and Public Purposes Act (68 Statute 173; 43 U.S. Code [USC] 869 et seq.1954).

In general, these USFS- and BLM-managed lands provide for undeveloped, dispersed, and open-space-dependent forms of recreation, such as hunting, hiking, and primitive camping, along with roads and trails for OHV use. As such, the future management of these federal lands provides opportunities that complement the similar opportunities available within the FERC Project area.

State Agencies

At the State level, the SP-R14 report highlights the conclusions drawn by DPR in the 2002 *California Outdoor Recreation Plan* (CORP) regarding latent demand and public support for government funding for particular recreation activities. Although the CORP does not indicate what actions would result from these conclusions, they are intended to guide State actions in the near future for expanding recreation opportunities. Camping in both developed and primitive sites, hiking and walking, nature study, and picnicking in developed sites all were identified to have high unmet demand in California, and strong public support for expanded opportunities.

Local Governments

At the local level, the *Butte County General Plan* (1971, as amended) has elements addressing recreation, open space, and scenic highways. Although the plan is county-wide in scope, the Recreation and Open Space elements are focused on promoting recreation development within the LOSRA and the OWA. The Scenic Highways Element proposes pursuing State Scenic Highway designation for a portion of State Route 70 in the FERC Project vicinity. Related policies aim to establish scenic areas and corridors.

The *City of Oroville General Plan* (1995) states the City's long-term vision, including for open space and natural resources. Recreation is addressed in several elements. The Land Use Element designates land for parks, including parks within the city and lands within Oroville's unincorporated planning area, which are managed by DPR. The policies set out in the plan are generally aimed at fostering cooperation with the State and local entities to encourage continued recreation development, particularly at Thermalito Forebay, Thermalito Afterbay, and along the Feather River.

DWR provided over $5 million toward funding the planning, design, permitting, and construction for the expansion of Riverbend Park along the eastern bank of the LFC adjacent to the city of Oroville. Expansion activities include trails, picnic facilities, boat launch, playgrounds, a frisbee golf course, and paved parking.

These plans suggest that the Feather River Recreation and Park District and the City would continue to function both as park providers and as cooperators with the State in recreation development in the project area.

Regional FERC Relicensing Efforts

Of particular interest for this analysis is the anticipated FERC relicensing of three other hydroelectric power projects. PG&E is currently involved in the relicensing of two hydroelectric power projects: the Poe Project (FERC Project No. 2107) and the Upper North Fork Feather River Project (FERC Project No. 2105). The Poe Project consists of 2 dams on the North Fork Feather River that create 2 small reservoirs (each about 50 acres) and related tunnels, penstocks, powerhouses, and related facilities immediately upstream of the Oroville Project area. The Upper North Fork Feather River Project consists of three dams and reservoirs and related powerhouses, tunnels, and penstocks. Project reservoirs include Lake Almanor (27,000 acres), Butt Valley Reservoir (1,600 acres), and Belden Forebay (42 acres). These reservoirs regulate and store water in the upper Feather River basin before it flows downstream to Lake Oroville. FERC completed a DEIS on the Upper North Fork Feather River Project in 2004 and a Draft and Final Environmental Assessment in August 2006 and March 2007 respectively, for the Poe Project.

The Settlement Agreement for the Upper North Fork Feather River Project was signed in April 2004 and filed with FERC in September 2004. FERC's DEIS for the relicensing indicates that recreation developments and improvements are planned for family and group campgrounds, day use areas, swim beaches, and boat ramps on Project waters. The SWRCB is currently directing a CEQA analysis on the Upper North Fork Feather River Project in accordance with its role of water quality certificate issuance pursuant to Section 401 of the Clean Water Act.

The South Feather Water and Power Agency (formerly Oroville Wyandotte Irrigation District) is currently relicensing its 118-MWh South Feather Power Project (FERC Project No. 2088). The project includes diversions from the South Fork of the Feather River.

Cumulative Effects of Regional and Project Area Actions

No-Project Alternative

The cumulative effects of the No-Project Alternative in the project area and the actions of regional providers of recreation opportunities would result in a moderate degree of growth in recreation opportunities. Most of the growth in opportunities would occur outside the project area. Due to future population growth and increased demand for recreation activities, recreation attendance in the project area and the region would be expected to continue to increase.

Proposed Project

The cumulative effects of the Proposed Project, which includes more than 60 actions that would enhance recreation facilities and management in the FERC Project area, and the actions of regional providers of recreational opportunities, would result in growth in recreation opportunities in the region. Cumulatively, these measures would have

beneficial effects on the full range of recreational opportunities available in the FERC Project area, including boating, camping, angling, swimming and other shoreline use, trails use, and open space–dependent activities such as hunting and wildlife viewing. The region would benefit from growth in recreational opportunities within the FERC Project area, in particular for boating and camping. The boating season would be extended for reservoir boaters during low-water periods. The past, present, and future development of recreational opportunities across the region, along with future population growth and associated increased demand for recreation activities, would lead to steady growth in recreation attendance in the FERC Project area and the region.

FERC Staff Alternative

There are no substantive differences in cumulative effects on recreational resources with the implementation of the FERC Staff Alternative as compared to the Proposed Project.

Climate Change and Recreational Resources

As previously described and according to the DWR climate change report, Sierra Nevada watersheds with snowpack (such as the Feather River) are predicted to get less snow and more rain, more winter and less spring and summer runoff, and warmer runoff. Such changes could reduce the volume of water in storage at Oroville Reservoir during the summer months since it would receive less snowmelt, could have reduced carryover storage, and could have increased environmental water demands during the warmer months. A reduced volume could result in lower reservoir water levels and an expanded fluctuation zone during the summer recreation months. Access to some recreation facilities could be affected by lower water levels.

6.2.9 Cultural Resources

As discussed previously, cumulative effects include past, present, and reasonably foreseeable related actions that incrementally affect individual resources in combination with a proposed action. For the analysis of cumulative impacts on cultural resources, the source of the effects is not restricted to activities directly associated with the Oroville Facilities. Local population growth and related urban development, for example, and actions taken by federal land management agencies such as USFS and BLM are considered in this analysis.

Cumulative effects are relevant to archaeological sites and ethnographic and ethnohistoric resources, as described in Section 4.8. Because of their unique nature, the 14 NRHP-eligible historical structures associated with the Oroville Facilities noted in Section 4.8.2 are not considered subject to cumulative effects.

6.2.9.1 Cumulative Effects of the Project and Past and Present Related Actions

Section 4.8, Cultural Resources, noted that effects on archaeological sites and ethnographic and ethnohistoric resources were occurring before construction of the Oroville Facilities. These effects included the loss of archaeological sites as a result of

erosion, with a substantially increased rate of effects on these resources with the onset of mining and later historical developments such as establishment of the City of Oroville. (Some of these activities resulted in the creation of resources now documented as historic-era archaeological sites.) These activities also affected ethnographic resources and altered the traditional Native American use of the land.

Construction of the Oroville Facilities also affected archaeological sites and ethnographic resources. Archaeological sites were inundated, buried by fill, disturbed by vegetation removal, or affected by archaeological excavations conducted prior to inundation of the reservoir. The extensive historic-era dredge mining tailings along the Feather River provided a source for materials used during construction of Oroville Dam. Traditionally used plant gathering areas, hunting and fishing grounds, swimming holes, and even residences and burial sites were inundated with construction of the project. Since that time, the construction and use of campgrounds, trails, and other support facilities, Lake Oroville water surface fluctuation, and some O&M activities have affected cultural resources.

Continued development in and around the FERC Project area, the construction of hydroelectric projects elsewhere on the Feather River and its tributaries, and actions such as timber harvesting and road building have all led to the loss of archaeological sites. Alterations to the landscape resulting from activities such as reservoir construction and inundation also affected resources such as native plants traditionally used by the local Native American community, and impacted resources of sacred and traditional concern to the local Maidu community.

6.2.9.2 Cumulative Effects of the Project Alternatives and Future Related Actions

This section describes the potential cumulative effects of past, present, and reasonably foreseeable related actions when combined with the environmental effects for the No-Project Alternative, Proposed Project, and FERC Staff Alternative as documented in Section 5.8.4. The Proposed Project and FERC Staff Alternatives include implementation of a draft Historic Properties Management Plan (HPMP) that addresses ongoing effects (e.g., resource monitoring and protection/stabilization) as well as protocols for proposed actions (e.g., site avoidance, data recovery, public interpretation) to avoid or reduce potentially significant impacts on cultural resources. This analysis is qualitative in nature and highlights the relative degree of cumulative effects under each of these scenarios.

No-Project Alternative

Under the No-Project Alternative, the ongoing project effects on cultural resources would continue, including public use and related effects from OHV use, vandalism, and looting. Future non-project-related activities involving new ground disturbance could further affect archaeological sites and ethnographic resources. The loss of archaeological sites and access to traditionally used resources resulting from future non-project-related actions (e.g., continued development in and around the City of Oroville, timber harvesting) would continue.

Proposed Project

With the inclusion of the draft HPMP and other measures to reduce, avoid, or otherwise resolve project-related effects on cultural resources, as described in Section 5.8.4, the potential for long-term cumulative effects on archaeological sites and ethnographic resources would be reduced under the Proposed Project. A number of new development projects that require ground-disturbing activities would be constructed under this scenario; therefore, recreational use and potential related effects on cultural resources would be greater than under the No-Project Alternative. The Proposed Project includes measures that would reduce impacts with implementation of the HPMP and result in beneficial effects on these resources (e.g., the Interpretation and Education Program).

FERC Staff Alternative

There are no substantive differences in cumulative effects on cultural resources with the implementation of the FERC Staff Alternative as compared to the Proposed Project.

6.2.9.3 Climate Change and Cultural Resources

Climate changes that would result in less snowmelt and thus reduce the volume of water in storage at Oroville Reservoir could result in lower reservoir water levels and an expanded fluctuation zone during the summer recreation months. Cultural resources that are currently submerged during the summer recreation months could be exposed more often by lower reservoir water surface levels and subject to vandalism if actions were not taken to protect these resources.

6.2.10 Public Services

This section focuses on the potential cumulative impacts of the project alternatives related to changes in the demand for local public services. It should be noted that CEQA does not treat social and economic effects of projects as significant effects on the environment if they do not create, or are not caused by, physical effects. The demand for public services, and a local government's ability to pay for them, is not itself a physical effect on the environment, but instead is a socioeconomic issue that could potentially lead to physical effects. For example, the need to build or change existing facilities to accommodate the cumulative demand for public services could result in physical effects on the environment. Thus, the cumulative impact assessment in this section focuses on how past, present, and reasonably foreseeable actions have affected the demand for public services in Butte County and whether the incremental contribution of the project alternatives to the need for new or altered public services facilities to meet this demand is considerable.

The analysis therefore addresses the increment contributed by the project alternatives to the demand for local public services, including the direct change in demand generated by recreation visitors and workers commuting to the Oroville Facilities and the change generated by the local population supported by jobs directly and indirectly generated by visitor spending and Oroville Facilities O&M activities. The project's

effects on public services are discussed in Section 5.9.2, Public Services, and Section 5.14, Transportation and Traffic.

For the purposes of the analysis of cumulative impacts related to the provision of public services, the focus is on projects and actions that have generated or will generate public services impacts similar to those that would be generated by the project alternatives. These projects and actions specifically include those affecting the demand for public services most frequently used by visitors to the Oroville Facilities, including law enforcement, criminal justice, fire protection, emergency services, and road maintenance services. Relevant projects and actions considered by the cumulative analysis include:

- Past and future urban development in Butte County and related population growth; and
- Original construction and ongoing operation and maintenance of the Oroville Facilities.

Rather than focus on a lengthy list of past and future development projects that have generated or that could generate population growth and a resulting change in the demand for local public services, the cumulative analysis uses past growth trends and projections of future growth to characterize cumulative changes in the demand for public services. Population projections used for this analysis were prepared by the Butte County Association of Governments (BCAG) (2006). BCAG staff collaborated and reached consensus with city, town, and Butte County (County) planning staff on the development of the projections, which reflect the growth trends that are anticipated to occur by local planners within Butte County and incorporated cities and towns between 2006 and 2030.

6.2.10.1 Cumulative Effects of the Project and Past and Present Related Actions

The current ability of local agencies, including the City and County, to provide adequate public services has been shaped by how the demand for public services and the funding to meet that demand have changed over time.

Over the past several decades, innumerable actions have occurred that have added to the cumulative demand for public services in the vicinity of the Oroville Facilities, including the City and County. These actions include approval of residential, commercial, industrial, and public projects that have drawn and supported populations requiring public services. Between 1970 and 2004, Oroville's population grew by 77 percent, adding 5,800 persons. Over the same time, the countywide population grew by 48 percent, reflecting the addition of 68,900 new persons requiring public services.

Other past actions, including the development of public projects and facilities, have also resulted in changes in the demand for public services. Among these actions were the construction and operation of the Oroville Facilities in the mid-1960s, which drew visitors to recreation sites and workers to the Oroville area to construct and later

operate project facilities and to fill new jobs generated by local area spending by recreationists. The visitor and resident population related to the Oroville Facilities contributes a small but constant increment to the cumulative demand for public services that has grown over several decades. Based on estimates prepared for the SP-R9 report, an estimated 697,970 visitors from outside of Butte County and from cities within Butte County were drawn to the Oroville Facilities during a 12-month period in 2002-03. On an average daily basis, these visitors added an estimated 1,910 persons to the service area population of local service providers, effectively increasing the countywide population by 0.9 percent in 2003. Additionally, O&M activities and visitor spending in 2002-03 indirectly supported an estimated 2,360 persons residing in Butte County, representing 1.1 percent of the county's 2003 population.

The ability of local service providers to meet the cumulative demand for public services such as law enforcement, criminal justice, fire protection, emergency, and road maintenance services depends to a large extent on the availability of funding to construct and operate public services facilities and to support adequate staffing levels, especially for law enforcement and fire protection services. Since the mid-1970s, when Proposition 13 was passed by California voters, several actions have occurred that have made funding public services more difficult for public agencies, especially for counties such as Butte. Proposition 13 greatly slowed the growth of property tax revenues for cities and counties over time, reducing general revenues available to agencies to fund services. Subsequently, several other actions affected the fiscal condition of public agencies, with these changes often adversely limiting the flexibility of local agencies and their ability to react to changes in the demand for services. These changes include, but are not limited to, State/local agency service realignments and property tax shifts in the early 1990s, local and statewide sales tax initiatives, vehicle license fee revenue realignments, new State and federal mandates for providing services, and changes in State and federal subvention payments to local agencies. The changes have made counties heavily reliant on State allocations of revenue, much of which is generated at the local level but allocated by the State. According to a State Legislative Analyst's Office report (*Why County Revenues Vary: State Laws and Local Conditions Affecting County Finance*, 1998), the California Legislature largely controls the allocation of virtually all major county general purpose revenues.

The structural budget challenges faced by the County and other counties, largely caused by their reliance on State funding sources, is exacerbated by State and federal mandates to provide services countywide that generate governmental costs that are not necessarily offset by local public revenue sources. Many revenues transferred to the County by the State and federal governments to offset the costs of providing mandated countywide services do not necessarily increase in response to population growth, potentially resulting in net costs to the County when the countywide population expands.

Past and present actions that have increased the demand for public services in Butte County, including urban development that has led to population growth, and operation and use of the Oroville Facilities, have cumulatively resulted in considerable growth in the demand for public services in Oroville and countywide, requiring the construction of

facilities to accommodate this demand that have resulted in physical effects on the environment.

6.2.10.2 Cumulative Effects of the Project Alternatives and Future Related Actions

This section describes the potential cumulative effects of past, present, and reasonably foreseeable related actions when combined with the environmental effects for the No-Project Alternative, Proposed Project, and FERC Staff Alternatives documented in Sections 5.9.2, Public Services, and Section 5.14, Transportation and Traffic. For the Proposed Project and FERC Staff Alternatives, this analysis highlights the relative degree of cumulative effects under each of these scenarios.

Future Urban Development and Population Growth

Future urban development in Butte County, including residential, commercial, industrial, and public facilities development, will generate population growth that will result in an increased demand for public services in Oroville and Butte County. BCAG has developed projections of population growth that are consistent with development anticipated under the current general plans of the County and the towns and cities within the county. These projections are shown in Table 6.2-3. As shown, the overall population of Butte County is projected to grow by 31.5 percent between 2003 and 2020, adding 66,250 persons. This level of growth would likely lead to the need to develop new public service facilities to meet the related increase in the demand for public services, potentially resulting in physical effects on the environment.

Table 6.2-3. Projected population in Butte County, 2003–2020.

Jurisdiction	2003 [1]	2010 [2]	2015 [2]	2020 [2]	Increase 2003–2020
Biggs	1,810	1,960	2,310	3,060	1,250
Chico	68,480	85,610	94,520	104,360	35,880
Gridley	5,760	7,230	9,140	10,800	5,040
Oroville	13,250	15,700	20,030	23,450	10,200
Paradise	26,650	27,590	29,430	30,780	4,130
Butte County (unincorporated)	94,080	93,990	98,790	103,830	9,750
Butte County (Total)	**210,030**	**232,080**	**254,220**	**276,280**	**66,250**

[1] *Source: California Department of Finance 2006*

[2] *Source: BCAG 2006*

Future Traffic Growth

The 2004 Regional Transportation Plan includes information regarding future traffic volumes and Levels of Service on State highways and key County roads based on peak hour traffic volume. The forecasts for the State highways have been interpolated to

daily traffic volumes and are presented in Table 6.2-4. As noted, background traffic growth on the regional circulation system is projected to result in LOS F conditions at many locations on SR 70, SR 99 and SR 162.

Table 6.2-4. Year 2025 annual average daily traffic.

Route	From (Postmile)	To (Postmile)	2005 Annual Average Daily Traffic	2025 Estimated Daily Traffic	Year 2025 Level of Service
SR 70	Yuba County line (0.00)	Beginning of Freeway south of Oroville (13.51)	12,100 to14,900	22,600	F
	Beginning of freeway South of Oroville	SR 162 (Oroville) (13.90)	14,900	32,000	F
	SR 162	Montgomery Street (Oroville) (14.61)	23,300	45,200	C
	Montgomery Street	Grand Avenue (Oroville) (15.43)	31,500	45,000	C
	Grand Avenue	Nelson Avenue (Oroville) (15.72)	23,600	48,500	C
	Nelson Avenue	End of Freeway (20.14)	21,600	40,600	C
	End Of Freeway	SR 149 (20.48)	21,600	40,600	C
	SR 149	SR 191 (21.87)	8,200	21,000	F
	SR 191	Plumas County line (48.08)	3,100 to 1,450	4,800 to 10,000	D
SR 99	Sutter County line (0.00)	Wilson Street (Gridley) (4.12)	16,400 to 19,200	29,000	F
	Wilson Street (Gridley)	Spruce Street (Gridley) (4.38)	23,100	35,000	F
	Spruce Street (Gridley)	SR 162 (east) (13.16)	15,100 to 10,900	26,000 to 22,000	F
	SR 162 (east)	SR 149 (21.81)	11,100	21,000	F
	SR 149	Begin Freeway (30.40)	25,500	43,000	F
	Begin Freeway	Skyway (Chico) (30.60)	34,000	48,000	F
	Skyway	East 20th St (Chico) (31.50)	52,000	64,000	D
	East 20th St	SR 32 (Chico) (32.45)	72,000	86,000	E
	SR 32	Cohassatt Hwy (Chico) (34.25)	75,000 to 61,000	92,000 to 82,000	E
	Cohassatt Hwy	East Avenue (Chico) (34.93)	42,500	85,000	D
	East Avenue	End of Freeway (37.32)	29,000 to 19,500	69,000 to 29,000	D
	End of Freeway	Tehama County Line (45.98)	19,500 to 11,900	29,000 to 20,000	F

Table 6.2-4. Year 2025 annual average daily traffic.

Route	From (Postmile)	To (Postmile)	2005 Annual Average Daily Traffic	2025 Estimated Daily Traffic	Year 2025 Level of Service
SR 162	Glen County line (0.00)	SR 99 (Biggs) (9.73)	1,500 to 1,050	3,000 to 2,000	C
	SR 99 (9.73)	12th Street (Oroville) (14.96)	2,700 to 8,600	4,000 to 12,000	C
	12th Street	SR 70 (Oroville) (15.83)	13,200	30,800	F
	SR 70	Washington Ave (Oroville) (17.55)	32,000 to 30,500	42,500 to 40,500	D
	Washington Avenue	Lower Wyandotte Road (Oroville) (18.01)	29,000	35,000	F
	Lower Wyandotte Rd	Foothill Blvd (18.46)	20,900	33,000	F
	Foothill Blvd	Canyon Drive (21.26)	12,400 to 11,000	22,500 to 29,000	F
	Canyon Drive	Forbestown Road (24.19)	7,600 to 4,550	10,000 to 6,000	D
	Forbestown Road	Foreman Road (31.07)	1,850 to 1,500	2,500	C

Source: 2004 Regional Transportation Plan

No-Project Alternative

Under the No-Project Alternative, recreation-related visitation to the Oroville Facilities would increase as a result of regional and statewide population growth unrelated to the project improvements. Similarly, employment supported by visitor spending would increase as visitation increases. Thus, the visitor and resident population would increase over time, requiring additional public services from local service providers.

As discussed in Section 5.9, Population, Housing, and Public Services, regional and statewide growth is projected to result in visitation by non-residents of unincorporated Butte County to the Oroville Facilities to potentially increase from about 697,970 visitor-days in 2002-03 to about 861,070 visitor-days in 2020, an increase of 163,100 visitors. Additionally, the population in Butte County supported by the jobs directly and indirectly generated by visitor and O&M spending is estimated to increase from 2,360 in 2002-03 to 2,770 in 2020 under the No-Project Alternative, representing an increase of 410 persons. (Visitor and population projections are not available for the period beyond 2020; however, growth in recreation use, and resulting growth in visitor-supported population, is presumed to increase at a similar rate throughout the remainder of the FERC Project license period.)

On an average daily basis, recreation visitors in 2020 coming from outside of Butte County and from incorporated cities within Butte County would potentially add about 2,360 persons to the service area population of local service providers, effectively

increasing the countywide service area population by 0.8 percent in 2020. Workers who commute from out-of-county locations also could contribute to the countywide service area population; however, as discussed in Section 9.5.2, Public Services, the number of workers commuting from outside of the county is anticipated to be minor. Additionally, the 2,770 persons potentially supported by jobs directly and indirectly generated by O&M activities and visitor spending in 2020 would represent 1.0 percent of Butte County's projected 2020 population. Combined, the project-supported population, including visitors, would potentially represent 1.8 percent of Butte County's 2020 population, potentially accounting for a similar percentage of the cumulative demand for public services in the county. Because the potential project-supported population is expected to be relatively small, the No-Project Alternative's contribution to the total demand for public services would be minor. (Note that residents of incorporated cities in Butte County who recreate at the Oroville Facilities would likely travel into the unincorporated areas of Butte County and impact service providers even if they were not recreating at the Oroville Facilities; therefore, the inclusion of residents of the incorporated areas in the visitor estimates used in this analysis likely overestimates the actual increase in the demand for public services.) Background traffic volume forecasts for the regional street and highway system can reasonably be assumed to include the continuing operation of the Oroville Facilities under the No-Project alternative.

Although the cumulative demand for public services in 2020 could require the development of new facilities to accommodate this demand, potentially resulting in physical effects on the environment, the fact that a cumulative impact is significant on the whole does not necessarily mean that the project-related contribution to that impact is significant as well. Instead, under CEQA, a project-related contribution to a significant cumulative impact is only significant if the contribution is cumulatively considerable. As discussed previously, the contribution of the No-Project Alternative to cumulative effects would be minor; therefore, the No-Project Alternative's cumulative impact would be considered **less-than-significant**.

Proposed Project

Under the Proposed Project, implementation of the SA Recreation Management Plan (RMP) and other programs and actions could result in an increase in recreational visits and workers commuting to the project area and an accompanying increase in demand for public services. Additionally, implementation of the Proposed Project could generate population growth and an increased demand for public services in Butte County by attracting additional workers and their families to relocate to the county to fill permanent jobs required to construct and operate new and improved project facilities and to fill new jobs that would be supported by increased visitor spending.

Under the Proposed Project, visitation by non-residents of unincorporated Butte County to the Oroville Facilities is projected to potentially increase from about 697,970 visitor-days in 2002-03 to about 1,028,400 visitor-days in 2020, an increase of 330,430 visitors, with about half of this increase expected to occur with or without implementation of the project improvements due to regional and statewide growth in the demand for recreation. Workers who commute to the project area from out-of-county

locations also could contribute to the countywide service area population, although this increase in anticipated to include fewer than 5 workers, as discussed in Section 5.9.2, Public Services. Additionally, as discussed in Section 5.9.1, Population and Housing, the population supported by jobs generated by visitor and O&M spending under the Proposed Project could increase from 2,360 in 2002 to 3,160 in 2020, with about half of this project-generated growth expected to occur with or without implementation of the Proposed Project in response to regional and statewide population growth trends. (No visitor or population estimates are available for the Proposed Project beyond 2020; however, growth in recreation use, and resulting growth in visitor-supported population, is presumed to increase at a similar rate throughout the remainder of the FERC Project license period.)

On an average daily basis, recreation visitors in 2020 coming from outside of Butte County and from incorporated cities within Butte County would potentially add about 2,820 persons to the service area population of local service providers, effectively increasing the countywide service area population by 1.0 percent in 2020. Workers who commute to the project area from out-of-county locations also could contribute a minor number of persons (estimated at fewer than five) to the daily countywide service area population. Additionally, the 3,160 persons potentially supported by O&M activities and visitor spending in 2020 would represent 1.1 percent of Butte County's projected 2020 population. Combined, the project-supported population, including visitors, would potentially represent 2.2 percent of Butte County's 2020 population, potentially accounting for a similar percentage of the cumulative demand for public services in the county. This percentage of countywide demand for public services is similar to the percentage of countywide demand attributable to the project in 2002-03 (2.0 percent). (Note that residents of incorporated cities in Butte County who recreate at the Oroville Facilities would likely travel into the unincorporated areas of Butte County and impact service providers even if they were not recreating at the Oroville Facilities; therefore, the inclusion of residents of the incorporated areas in the visitor estimates used in this analysis likely overestimates the actual increase in the demand for public services.)

Because this potential project-supported population is anticipated to be relatively small, the Proposed Project's contribution to the total demand for public services is anticipated to be minor relative to the total demand for public services in Butte County. Additionally, the increased demand for services would be spread among a number of State and local agencies, and funding provided by the Proposed Project, such as the OWA funding, is expected to minimize the increased demand on local service providers. DWR also offered during settlement discussions to provide additional funding that it believes would fully mitigate the public service impacts on Butte County that are generated by visitors to the Oroville Facilities.

As noted in Section 5.14, implementation of the Proposed Project is projected to result in increased traffic as compared to the No-Project Alternative, with an additional 900 daily trips spread among all of the streets and highways serving the site. This increase would be slight in proportion to forecast traffic volumes and would not result in the baseline volume increasing by more than 1.0%. Thus, while cumulative impacts on

traffic on the regional circulation system are significant, the incremental contribution of the Proposed Project is not significant.

Although the Proposed Project would add to the overall cumulative impact on local public service providers, potentially requiring the development of facilities that could result in physical effects on the environment, under CEQA, the Proposed Project's contribution to the significant cumulative public services impact would be considered significant only if the project's contribution is cumulatively considerable. As discussed previously, the Proposed Project's incremental contribution to the cumulative demand for local public services is anticipated to be minor. Additionally, DWR has previously expressed a willingness to provide funding for mitigation of public services impacts; this would fund its fair share of measures designed to alleviate the project's cumulative impact. The Proposed Project's contribution to cumulative impacts related to the provision of public services would be considered **less-than-significant**.

FERC Staff Alternative

Program- and project-level measures that could affect visitation levels and project-related population levels and the demand for public services would be the same as under the Proposed Project because the alternative proposes only minor changes to the actions comprising the Proposed Project's SA RMP. Therefore, the cumulative public service impacts of the FERC Staff Alternative would be less-than-significant.

6.2.11 Agricultural Resources

A qualitative effects assessment was completed to evaluate the potential cumulative effects of the No-Project Alternative, Proposed Project, and FERC Staff Alternative on agricultural resources in the vicinity of the Oroville Project area. The effects assessment focuses on the incremental effects of water temperature changes on rice production induced by project operations under the alternatives. Because water temperature–related effects on rice production reportedly occur between planting and the reproductive phase of rice growth and because the majority of planting in the FRSA occurs during May, the period of primary concern is from May 1 through July. For the purposes of this section, the cumulative effects of the project over time and in combination with other historical, current, or reasonably foreseeable projects on agricultural resources, and specifically rice production, are evaluated.

6.2.11.1 Cumulative Effects of the Project and Past and Present Related Actions

Prior to construction of the Oroville Facilities, water and irrigation districts in Butte County built several projects for diverting water from the Feather River for irrigation purposes. The first of these projects was the Butte County Canal, built in 1905. The purpose of the canal was to divert water from the Feather River for irrigation purposes. Water entered the Butte County Canal through eight cement gates located near the current Thermalito Afterbay Outlet. Water from the canal was delivered to areas north and south of Gridley, up to 30 miles away from the river. To facilitate summer diversions, Hazelbush Dam was built in 1907 near the intake of the Butte County Canal.

The structure was a rock barrier that raised the water level several feet to provide adequate head for summer diversions into the canal. The barrier had to be rebuilt after every flood event, as it was subject to repeated damage from flood events on the Feather River.

The Western Canal was built by the Feather River Canal Company during the years from 1912 through 1915. The purpose of the Western Canal was to deliver water northeast of Biggs and east of Nelson. Additionally, a flashboard dam referred to as the Western Canal Dam was built across the Feather River at River Mile 63 for diverting water into the Western Canal. Western Canal Dam had to be reinstalled every year, as it was also subject to repeated damage from flood events on the Feather River.

Prior to the construction of the Oroville Facilities, a number of hydroelectric dams were constructed in the tributaries upstream of the current FERC Project boundary. These hydroelectric facilities altered the hydrology and water temperatures of the lower Feather River and may have cumulatively reduced the water temperatures at the historical points of diversion during the May-through-July rice water temperature sensitive growth stages by as much as several degrees.

The construction of Thermalito Afterbay replaced the Hazelbush Dam and Western Canal Dam headworks and several miles of the irrigation canals. In 1969, DWR executed two agreements, one with the Joint Water Districts Board and one with PG&E, to resolve issues related to water deliveries to senior water rights holders. In 1986 PG&E assigned its agreement to the Western Canal Water District. The agreements acknowledge the new delivery points at Thermalito Afterbay and specified annual delivery amounts, rates of deliveries and timing for water diversions.

An effect of the construction and operation of the Oroville Facilities has been a reduction in the water temperature of deliveries to the districts during the rice-growing season. After the construction of the Oroville Facilities, water temperatures at the agricultural diversions are generally slightly warmer during the initial phase of the rice growing season but become cooler (mid-May) for the duration of the season. These cooler water temperatures are a result of the Oroville facilities–mandated operating requirements to deliver cooler water to the lower Feather River to support anadromous salmonids. These cooler water temperatures have the potential to negatively affect rice yields in the areas of the rice pads adjacent to the irrigation water outlets. At the same time, construction of the Oroville Facilities has resulted in an increase in acreage of rice production, likely due in part to the increased reliability of the water supply and flood protection benefits. Total rice production has also increased in part because of improved cultural practices; pest, weed, and fertility management; water management; and rice genetics.

6.2.11.2 Cumulative Effects of the Project Alternatives and Future Related Actions

No-Project Alternative

Under the No-Project Alternative, rice yield losses due to water temperature would be expected to continue at generally the same rate as currently occur under the Existing Conditions. Some hydroelectric facilities upstream of the Oroville Facilities are in the process of undergoing FERC relicensing, which may result in decreased water temperatures in the tributaries upstream of Oroville Reservoir that, in turn, would result in potential changes to cold water pool resources in the reservoir; however, the changes in cold water pool resources upstream would not be expected to result in changes to water temperatures at the agricultural diversions in Thermalito Afterbay during the May-through-July period.

Proposed Project

Under the Proposed Project, during the initial new license period, operations of Thermalito Afterbay are not expected to change substantially. As described in Section 5.13.4, lower water temperature targets at Robinson Riffle have the potential to result in a less than 2^{o}F decrease in water temperatures at the agricultural diversions in Thermalito Afterbay. Water temperature reductions at Robinson Riffle do not necessarily directly equate to water temperature changes of the same magnitude at the agricultural diversions within Thermalito Afterbay. During the rice-water-temperature sensitive-growth stages, water temperatures at Robinson Riffle are at times more than 2^{o}F cooler than the current water temperature requirements. These conditions would also occur in the same proportions under the Proposed Project, with no water temperature changes needed to meet the Proposed Project's water temperature objectives at Robinson Riffle relative to Existing Conditions. Therefore, under these conditions no change in the source water temperatures for Thermalito Afterbay would occur. For almost all conditions, water temperatures under Existing Conditions at Robinson Riffle are somewhat cooler than the current water temperature requirements. These conditions would also occur under the Proposed Project with probable water temperature reductions of less than 2^{o}F, resulting in less than a 2^{o}F reduction in the source water temperatures for Thermalito Afterbay during May through July. These decreases in water temperature at the agricultural diversions during the initial new license period would not be expected to substantially increase the amount of rice yield loss or increase the amount of rice production area affected by cold water exposure within the FRSA.

Future changes to water temperatures at the agricultural diversions after implementation of the potential future facilities modifications are uncertain and dependent upon which modifications or what combination of modifications could be selected. After the completion of any potential future facilities modifications designed to reduce water temperatures in the lower Feather River to benefit anadromous salmonids, it is likely that water temperature requirements in the lower Feather River would change relative to water temperature targets during the initial new license period. However, the

degree of water temperature change in Thermalito Afterbay associated with any operational changes is unknown until the potential future facilities modifications have been selected and further evaluated in subsequent environmental documentation.

Implementation of the Proposed Project would likely also reduce water temperatures at the agricultural diversions slightly during the initial new license period and subsequent potential future facilities modifications would further alter the water temperatures at the diversions, relative to the initial new license period. However, these alterations in water temperature are not expected to be of a magnitude sufficient to substantially increase the amount of rice yield loss attributable to cold water exposure.

FERC Staff Alternative

There are no substantive differences in cumulative effects on agricultural resources with the implementation of the FERC Staff Alternative as compared to the Proposed Project.

6.2.11.3 Climate Change and Agricultural Resources

Some changes in crop type, planting cycles, time of planting, and crop productivity would likely occur as the result of increased temperatures from climate change. Regional irrigation water demand may increase or decrease as the result of these changes. Several factors related to climate change, such as possible changes in humidity, cloudiness, wind, and increasing temperatures, could affect evapotranspiration rates and related water demand. Irrigation water temperatures may increase, coincident with source water temperature increase, and this could affect future crop choices, especially with regard to water-temperature-sensitive crops. Crop yields currently impacted by cold water temperatures could increase as water temperatures increase.

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6.3 SIGNIFICANT IRREVERSIBLE ENVIRONMENTAL CHANGES WHICH WOULD BE CAUSED BY THE PROPOSED PROJECT SHOULD IT BE IMPLEMENTED

Section 15126.2(c) of the State CEQA Guidelines requires a discussion of any significant irreversible and irretrievable environmental changes that would be caused by the proposed project. Section 15126.2(c) states:

> Uses of nonrenewable resources during the initial and continued phases of the project may be irreversible, since a large commitment of such resources makes removal or nonuse thereafter unlikely. Primary impacts and, particularly, secondary impacts (such as highway improvement which provides access to a previously inaccessible area) generally commit future generations to similar uses. Also, irreversible damage can result from environmental accidents associated with the project. Irretrievable commitments of resources should be evaluated to assure that such current consumption is justified.

Generally, a project would result in significant irreversible and irretrievable environmental changes if:

- The primary and secondary impacts would generally commit future generations to similar uses;
- The project would involve a large commitment of nonrenewable resources;
- The project would involve uses in which irreversible damage could result from any potential environmental accidents associated with the project; or
- The proposed consumption of resources is not justified (e.g., the project involves the wasteful use of energy).

The Proposed Project represents the continued operation and maintenance of an existing project with no substantive commitment of nonrenewable resources. The Oroville Facilities produce clean energy from a renewable resource, thereby avoiding the wasteful consumptive use of other energy sources. The Proposed Project includes many actions that address the ongoing and incremental degradation of resources by the continued existence and/or operations of the Oroville Facilities.

Implementation of the Proposed Project would result in the continued commitment of the Oroville Facilities for electric power generation and other project purposes, including water supply, water quality, flood management, recreation, and fish and wildlife protection, including implementation of any terms and conditions to be considered for inclusion in the new FERC hydroelectric license, thereby precluding any other uses for the lifespan of the project. Implementation of the Proposed Project would not conflict or alter any existing environmental commitment of resources outside of the existing or new FERC license conditions and requirements (e.g., Delta water quality management standards, OCAP, COA).

Irretrievable commitments of resources that could result from implementation of the Proposed Project include a potential reduction in power generation as water is redirected from power plants to increase minimum streamflows in the LFC and water temperature management flows for salmonid spawning, holding, and rearing. Other energy resource commitments would occur during construction of SA actions and for operation and maintenance of both existing and new facilities.

Resources that would be permanently and continually consumed by project implementation include electricity, natural gas, and fossil fuels; however, the amount and rate of consumption of these resources would not result in the unnecessary, inefficient, or wasteful use of resources. With respect to operational activities, compliance with all applicable resource protection laws and codes, as well as mitigation measures, planning policies, and standard conservation features, would conserve natural resources to the maximum extent possible. It is also possible that new technologies or systems will emerge, or will become more cost-effective to further reduce the reliance upon nonrenewable natural resources. Nonetheless, construction activities related to the Proposed Project would result in the irretrievable commitment of nonrenewable energy resources, primarily in the form of fossil fuels (including fuel oil), natural gas, and gasoline for automobiles and construction equipment. Operations associated with the Proposed Project would also consume natural gas and electrical energy; however, benefits of the Proposed Project and the ability to generate clean, reliable energy far outweigh the consumption impact.

The State CEQA Guidelines also require a discussion of the potential for irreversible environmental damage caused by an accident associated with the project. While the project would result in the use, transport, storage, and disposal of hazardous wastes, all activities would comply with applicable State and federal laws related to hazardous materials, dam safety, and flood management, which significantly reduces the likelihood and severity of accidents that could result in irreversible environmental damage.

6.4 SIGNIFICANT ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED IF THE PROPOSED PROJECT IS IMPLEMENTED

The physical presence of the Oroville Facilities and the on-going facilities operations made irreversible changes in the environmental conditions within and downstream of the Project area. The resulting environmental conditions form the baseline conditions for the Project CEQA analysis. In some instances there are no feasible means to improve these conditions such as the inundation of oak woodlands, grasslands and other native communities. However, the implementation of both the Proposed Project and the FERC Staff Alternative would result in improvements in most resource categories over baseline conditions.

The purpose of this Section 15126.2(b) is to analyze the actions that will be taken under the Proposed Project and the significant impacts which cannot be avoided as a result of those actions.

The environmental effects of the No-Project Alternative, Proposed Project, and FERC Staff Alternative on various aspects of the environment are discussed in detail in Chapter 5 of this DEIR. There are no significant impacts that cannot be avoided if the Proposed Project or FERC Staff Alternative is implemented.

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6.5 RELATIONSHIP BETWEEN SHORT-TERM USES OF THE ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

Short-term impacts are those of a limited duration, such as impacts that would occur during the construction of a project. Long-term impacts are those of greater duration, including those that would endure for the life of a project and beyond. Both short-term and long-term impacts are described in detail in Chapter 5.0 of this DEIR, including mitigation measures intended to avoid or reduced potentially significant impacts. The following discussion addresses how implementation of the Proposed Project would affect the long-term productivity of the natural and human environment.

Resources that could be adversely impacted in the short term, but that would realize long-term beneficial effects with the implementation of the Proposed Project, include power generation, aquatic resources, terrestrial resources, recreational resources, water quality, and geological, cultural, and agricultural resources.

6.5.1 Power Generation

Implementation of the Proposed Project would continue operation of the Oroville Facilities for electrical power generation and alleviate the need for new power resources that would otherwise be required to replace the 762 megawatts of capacity and roughly 2.4 million megawatt-hours per year of energy generated by the three power plants.

6.5.2 Geological Resources

The Oroville Facilities have altered natural geological processes that would occur in the Feather River below Oroville Dam. Processes that have been altered include sediment and LWD recruitment, dampening of flow regime changes that lead to channel complexity, and loss of floodplain connectivity. Construction activities associated with implementation of some actions under the Proposed Project could potentially alter geological processes on a short-term basis; however, this alteration of geological processes would be offset by measures that address the loss of connectivity between upstream and downstream reaches of the Feather River. For example, gravel supplementation, LWD supplementation, the Channel Improvement Program, and the Riparian and Floodplain Improvement Programs all serve to partially simulate pre-project conditions and would result in long-term improvements to fluvial geomorphic functions.

6.5.3 Water Quality

Water quality may be adversely affected by short-term construction-related activities associated with implementation of the Proposed Project. Implementation of Best Management Practices as described in Appendix D during construction would minimize temporary, localized adverse effects on water quality. Longer term water quality, as it pertains to aquatic life criteria, particularly anadromous salmonids, would improve relative to Existing Conditions and would more than offset short-term water quality degradations associated with construction activities.

6.5.4 Aquatic Resources

In addition to the short-term construction-related effects with implementation of the Proposed Project, there would be short-term localized disruptions to habitat and disturbance of fish during construction and for a short duration following construction. Fish utilizing affected habitats during these disruptions would be displaced to other available habitats. Once the short period of disturbance is past, the resulting habitat values and benefits created would be substantial in comparison to the amount of habitat disturbance and short duration of disruption created by implementation of the Proposed Project.

All of the Proposed Project actions that have short-term and localized adverse effects on aquatic resources are included in the Lower Feather River Habitat Improvement Plan (SA Article A101). While these actions have a short-term localized adverse effect on aquatic resources, they result in long-term overall habitat enhancements. These actions include the Gravel Supplementation and Improvement Program (SA Article A102), Channel Improvement Program (SA Article A103), Structural Habitat Supplementation and Improvement Program (SA Article A104), Fish Weir Program (SA Article A105), and Riparian and Floodplain Improvement Program (SA Article A106).

Gravel supplementation would result in localized disturbance of fish utilizing these habitats prior to construction. Disturbance would be minimized by selecting a construction period during times of the year in which habitat utilization is at a minimum. In addition to construction disturbance, supplemented gravel must “naturalize” in the river for 1–3 years prior to the fish fully utilizing the enhanced habitat. This delay in utilization of the habitat after construction would result in a short-term overall reduction in the amount of available salmonid spawning habitat, but would result in a long-term increase in the quality and quantity of available salmonid spawning habitat.

LWD supplementation and side-channel enhancement and creation would result in the short-term loss of juvenile salmonid rearing habitat. Once the constructed and enhanced features have naturalized with the river, the quantity, quality, and duration of habitat values created would more than offset the short-term and localized loss of juvenile rearing habitat.

Overall, actions that would result in short-term effects on aquatic resources would result in a long-term increase in the productivity of aquatic resources.

6.5.5 Terrestrial Resources

Wildlife species can be adversely affected by indirect habitat loss associated with disturbance or displacement resulting from short-term construction-related activities or long-term increases in recreational use. Actions with the potential to result in short-term reduction in wildlife use include increased human disturbance and the impacts of construction-related activities. Long-term increases in wildlife disturbance/displacement are likely to be associated with those measures that serve to increase recreational use, extend the period of recreational use, or expand the area of recreational use. However,

although increased recreational use may result in localized increases in wildlife disturbance or displacement, resource actions associated with endangered species protection, terrestrial habitat improvement, and invasive plant management included in the Proposed Project would result in a long-term increase in the productivity of terrestrial resources.

6.5.6 Recreational Resources

Recreational resources may be adversely affected by short-term construction-related activities associated with implementation of resource actions included in the SA RMP. Overall, actions that would result in short-term adverse effects on recreation would provide an increase in recreational opportunities in the project area. Some resource actions related to the improvement of aquatic resources may result in localized adverse effects on recreation. For example, lower water temperatures in the lower Feather River may adversely affect contact recreation (i.e., swimming) and potential obstacles to boating may be created by the installation of fish segregation weirs and LWD installation. These potential localized adverse effects are expected to be more than offset by enhanced recreation opportunities provided by implementation of the SA RMP.

6.5.7 Cultural Resources

Construction-related activities associated with the Proposed Project have the potential to adversely affect cultural resources. Increased protection of cultural resources in the long-term is provided by implementation of an HPMP, including the improved and redirected recreation usage at Foreman Creek. Additionally, elements of the draft HPMP such as public information and education programs, establishment of a local curation facility, and opportunities that would protect traditional plant gathering areas are expected to enhance cultural resource values in the project area over the long term.

6.5.8 Agricultural Resources

Actions under the Proposed Project designed to lower water temperatures downstream of Lake Oroville have the potential to incrementally decrease rice yield in the FRSA due to coldwater effects. However, potential decreases in rice yield are offset by the long-term reliability of the water supply to the FRSA.

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CHAPTER 7.0

REGULATORY PERMITS, APPROVALS, AND AUTHORITIES
RELATED TO RELICENSING THE OROVILLE FACILITIES

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7.0 REGULATORY PERMITS, APPPOVALS, AND AUTHORITIES RELATED TO RELICENSING THE OROVILLE FACILITIES

Table 7-1 below lists the regulatory permits, approvals, and authorities related to relicensing the Oroville Facilities and the status of each.

Table 7-1. Regulatory permits, approvals, and authorities.

Regulatory Permit or Approval	Status
Water Quality Certification (Section 401 of the Federal Clean Water Act)	The SWRCB has been involved throughout the collaborative process in reviewing study plan design and implementation and providing guidance on analyses needed to support the Section 401 application and certification process. The application for Section 401 certification was filed and received by the SWRCB on October 26, 2005 (within 60 days of FERC's issuance of the Ready for Environmental Analysis [REA] notice). The application was withdrawn and resubmitted on October 16, 2006. The SWRCB is expected to issue Section 401 certification within 1 year of the re-submittal of the application for Section 401 certification.
Fishway Prescriptions (Section 18 of the Federal Power Act [FPA])	USFWS and NMFS have been working with DWR and other interested parties to develop appropriate Section 18 conditions. The Department of the Interior, on behalf of USFWS, filed its reservation of authority to prescribe fishways on March 31, 2006, and NMFS filed its preliminary fishway prescription (in the form of a reservation of authority) on January 31, 2007.
Federal Land Management Conditions (Section 4(e) of the FPA)	BLM and USFS have authority over lands occupied by the Oroville Facilities and have been involved throughout the collaborative process. BLM did not exercise its 4(e) conditioning authority but USFS issued Final Section 4(e) conditions on January 31, 2007.
Section 7 of the Federal Endangered Species Act (FESA)	Species protected under FESA and potentially affected by the Proposed Project were identified early in the relicensing process through consultation with NMFS and USFWS. DWR developed draft biological assessments (BAs) for submission to FERC. FERC initiated formal consultation under FESA on October 24, 2006, and referenced the DWR-prepared draft BA. USFWS and NMFS are expected to issue a final biological opinion (BO) within 135 days from initiation of formal consultation.
Recommendations under Section 10(j) of the FPA	The Department of the Interior, on behalf of the USFWS, filed its recommendations on March 31, 2006, NMFS filed its preliminary terms and conditions on March 29, 2006, and DFG issued recommendations regarding fish and wildlife mitigation measures on March 29, 2006. FERC would decide whether to adopt these recommendations prior to license issuance.
Section 106 of the National Historic Preservation Act (NHPA)	FERC is responsible for ensuring that the Oroville Facilities are compliant with the NHPA. FERC is also required to consult with the California Office of Historic Preservation (OHP); other land management agencies where the undertaking may have an effect; and federally recognized Indian Tribes that may have cultural affiliations with affected properties. FERC authorized DWR to initiate consultation with the OHP under Section 106 of the NHPA. Representatives from key agencies and entities involved in historic preservation participated in the Cultural Resources Work Group. DWR continues to consult with FERC and OHP in compliance with Section 106, including submittal of a draft Historic Properties Management Plan for review and comment.

Table 7-1. Regulatory permits, approvals, and authorities.

Regulatory Permit or Approval	Status
Americans with Disabilities Act (ADA)	Access needs of the disabled and ADA standards were addressed in the collaborative process. As public facilities are updated, expanded, or newly developed, ADA issues would be addressed.
Clean Water Act Section 303(d) Total Maximum Daily Load (TMDL)	The lower Feather River is identified on the SWRCB's most recent 303(d) list as being impaired by the pesticide diazinon, Group A. The TMDL has been developed for the control of pesticides (i.e., organochlorine pesticides), mercury, and unknown toxicity (State Water Resources Control Board 2003). The TMDL for control of diazinon was recently prepared and is designed to control diazinon primarily from agricultural operations (Central Valley RWQCB 2003). TMDL development programs have not been established yet for the other listed contaminants of concern.
Clean Water Act Section 402 National Pollutant Discharge Elimination System (NPDES) Permit Compliance	The most applicable NPDES permit for the anticipated activities associated with the Oroville Facilities is the Statewide stormwater permit for general construction activity (SWRCB Order 99-08-DWQ, as amended) that applies to all construction projects that disturb greater than 1 acre of land. The construction activity permit requires filing a Notice of Intent with the SWRCB and preparation of a storm water pollution prevention plan. DWR would file for these permits as construction activities proceed.
Clean Water Act Section 404 Dredge and Fill	Implementation of the Proposed Project would require Section 404 permits and their associated Section 401 water quality certification. Engineering designs, environmental reviews, and plans required for regulatory agency reviews and permit processes would be completed in a timely manner as necessary for construction activities.
California Fish and Game Code—Section 1600 (Streambed Alteration)	DWR has worked with DFG throughout the Oroville Facilities FERC relicensing process. DWR would obtain all necessary permits in compliance with California Fish and Game Code Section 1600.
California Fish and Game Code Section 5937 (Flows below Dams)	The Proposed Project (SA) requires DWR to release water for the benefit of fishery resources. Since DFG is a signatory to the SA, DWR expects the Oroville Facilities would be operated in a manner consistent with Section 5937 of the California Fish and Game Code.
California Endangered Species Act (CESA) (Fish and Game Code Sections 2050–2116)	The Oroville Facilities have the potential to affect species listed under CESA. DWR would consult with DFG and obtain appropriate authorization in accordance with Section 2081 of CESA as necessary. The SA indicates that the SA articles satisfy the statutory, regulatory, or other legal requirements for the protection, mitigation, or enhancement of natural resources.
SWP Authorization (Burns-Porter Act)	DWR is charged as the State agency responsible for management of the SWP with managing operation, maintenance, renewals and replacements, and power purchases necessary for the ongoing operation of the Oroville Facilities.
State Water Code Sections 11900–11901 (Implementing the Davis-Dolwig Act)	DWR implements the provisions of this act in accordance with Agency Order No. 6, dated March 13, 1963, and in coordination with other State departments, including DPR, the California Department of Boating and Waterways, and DFG, with designated responsibilities defined by this act.
Fish and Wildlife Coordination Act (16 United States Code 661 et seq.)	Reports and recommendations of the fish and wildlife agencies are to be included in any authorizing documents for construction or for modification of projects. The decision to adopt fish and wildlife agency recommendations presented in association with the Oroville Facilities relicensing rests with FERC.

Table 7-1. Regulatory permits, approvals, and authorities.

Regulatory Permit or Approval	Status
Magnuson-Stevens Fishery Conservation and Management Act	It is anticipated that NMFS would provide its essential fish habitat conservation recommendations coincident with its BO.
Federal Migratory Bird Treaty Act of 1918 (MBTA)	The federal MBTA protects eggs, nests, young, and the adult life stages of migratory birds. The MBTA was initiated in 1918 and most recently amended in 1989. Migratory game birds and birds of prey, including members of the families Tytonidae (barn owls), Strigidae (typical owls), Acciptridae (kites, eagles, hawks), and Falconidae (caracaras and falcons) are protected under this act.
U.S. Army Corps of Engineers (USACE) Flood Storage Requirements under Flood Control Act of 1944 (Act of Congress, Public Law 78-534, 58 Stat. 890)	Flood control releases are based on the release schedule in the flood control diagram or the emergency spillway release diagram prepared by USACE, whichever requires the greater release. Decisions regarding such releases are made in consultation with USACE.
Executive Order 11988 (Protection of Floodplains), 1977	DWR has reviewed development plans with all agencies having jurisdiction to avoid to the extent possible any long- and short-term adverse effects associated with the occupancy and modification of floodplains. Goals are to reduce the risk of flood loss; to minimize the impact of floods on human safety, health, and welfare; and to restore and preserve the natural and beneficial values served by floodplains.
Executive Order 11990 (Protection Of Wetlands), 1977	DWR would review development plans with each agency having jurisdiction over federal lands or any action funded, authorized, or permitted by the federal government. The goal is to ensure that actions taken would minimize the destruction, loss, or degradation of wetlands, while preserving and enhancing the natural and beneficial values of wetlands.
Executive Order 12898 (Environmental Justice for Low Income and Minority Populations), 1994	The goals of Executive Order 12898 are twofold: (1) to identify and address, as appropriate, disproportionately high and adverse human health, environmental, economic, and social effects of federal programs, policies, and activities on minority populations and low-income populations; and (2) to ensure the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.
Federal Land Policy and Management Act of 1976	DWR would review development plans with each agency having jurisdiction to ensure that public lands shall continue to be managed in a manner that would provide protection of lands in accordance with this act.
American Indian Religious Freedom Act of 1978	In collaboration with the Cultural Resources Work Group, DWR has completed an ethnographic and ethnohistoric study into areas of sacred and traditional concern to the local Native American community, and continues to consult with local Maidu tribes on behalf of FERC.
Antiquities Act of 1906	BLM and USFS have been involved with DWR throughout the collaborative process. Before conducting archaeological excavations on these federal lands, DWR would ensure that the proper permits were obtained.
Archaeological Resources Protection Act (ARPA) of 1979	BLM and USFS have been involved with DWR throughout the collaborative process, and would issue ARPA permits before archaeological excavations or the collection of archaeological materials from federal lands.

Table 7-1. Regulatory permits, approvals, and authorities.

Regulatory Permit or Approval	Status
Wild and Scenic Rivers Act	The Middle Fork Feather River component of the National Wild and Scenic Rivers System is to be administered by the Secretary of Agriculture. The Middle Fork Feather River was one of the nine original rivers designated under the act in 1968. The Oroville Facilities are not affected and do not affect this designation.
CEQA	DWR officially initiated the CEQA process in the September 20, 2002, *Final NEPA Scoping Document 1 and CEQA Notice of Preparation* and the January 6, 2003, *NEPA Scoping Document 2 and Amended CEQA Notice of Preparation*. These two documents indicate that DWR has used the scoping documents, meetings, study results, and documentation to satisfy the consultation and reporting requirements of both processes.
NEPA	In September 2001, DWR distributed Draft SD1 to interested parties, which initiated formal scoping for the NEPA process. SD1 supported the development of either two separate environmental documents or a single joint NEPA/CEQA document. It also served as the CEQA notice of preparation. On October 29 and October 30, 2001, public scoping meetings were held in the cities of Oroville and Sacramento, respectively. On September 20, 2002, DWR distributed the *Final NEPA Scoping Document 1 and CEQA Notice of Preparation*, and on January 6, 2003, DWR distributed *NEPA Scoping Document 2 and Amended CEQA Notice of Preparation*. These two documents indicated that DWR would be using the scoping documents, meetings, study results, and documentation to satisfy the consultation and reporting requirements of both processes. On January 26, 2005, DWR submitted the PDEA as part of its Application for License to FERC. The FERC is responsible for NEPA compliance for new License Applications.
Regional Water Quality Control Board (RWQCB) Stormwater Permit	Dischargers whose projects disturb 1 or more acres of soil or whose projects disturb less than 1 acre but are part of a larger common plan of development that in total disturbs 1 or more acres, are required to obtain coverage under the General Permit for Discharges of Storm Water Associated with Construction Activity (Construction General Permit, 99-08-DWQ). Construction activity subject to this permit includes clearing, grading, and disturbances to the ground such as stockpiling or excavation, but does not include regular maintenance activities performed to restore the original line, grade, or capacity of the facility. DWR would apply for these permits as necessary.
Surface Mining and Reclamation Act	This act's requirements apply to anyone, including government agencies, engaged in surface mining operations in California (including those on federally managed lands) that disturb more than 1 acre or remove more than 1,000 cubic yards of material. This includes, but is not limited to, prospecting and exploratory activities, dredging and quarrying, streambed skimming, borrow pitting, and the stockpiling of mined materials.
Reclamation Board Authorization	Any project that proposes to work in a regulated stream, designated floodway on federal flood control project levee slopes or within 10 feet of the levee toe. Such activities might include, but are not limited to, boat docks, ramps, bridges, sand and gravel mining, placement of fill, fences, landscaping, and irrigation facilities.
Federal Emergency Management Agency Review	DWR would confer with applicable counties for projects occurring in 100-year floodplains.

Table 7-1. Regulatory permits, approvals, and authorities.

Regulatory Permit or Approval	Status
RWQCB Waste Discharge	RWQCBs regulate discharges under Porter-Cologne primarily through issuance of waste discharge requirements. If DWR were to discharge materials that could affect water quality (other than to a community sewer system), it would file a report of waste discharge.
Site Assessment	DWR would continue to comply with applicable State, federal, and local environmental laws and regulations, which include site assessment. Site assessment may be necessary to confer boundaries, for the protection and restoration of the ecosystem, and to minimize liability for hazardous substance contamination and remediation.

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CHAPTER 8.0

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CHAPTER 9.0

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9.0 DISTRIBUTION LIST

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CHAPTER 10.0

CONSULTATION AND COORDINATION WITH APPLICABLE AGENCIES

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10.0 CONSULTATION AND COORDINATION WITH APPLICABLE AGENCIES

10.1 COORDINATION

On January 11, 2001, FERC approved DWR's request to use the ALP for the relicensing of the Oroville Facilities. The ALP is intended to facilitate participation and improve communication among interested parties, avoid unnecessary conflict, increase confidence that all reasonable alternatives have been adequately and fairly evaluated, and increase the likelihood of a comprehensive settlement. Under the ALP, information and analyses relevant to relicensing are developed in collaboration with federal, State, and local agencies as well as federally recognized Indian tribes, nongovernmental organizations (NGOs), interested parties, and members of the public.

The Oroville Facilities relicensing process has involved extensive coordination and commitment by a variety of stakeholders over the past several years. From late 2000 through 2004, DWR hosted monthly Plenary and Work Group meetings, as well as ongoing Task Force meetings. Of the estimated 1,500 hours of total meeting time, approximately 80 percent were held in the Oroville area. The collaborative process resulted in an SA that became the basis of the Proposed Project. FERC has indicated that it would consider the SA in its decision to issue a new hydroelectric license.

10.1.1 Agency Consultation

In October 1999, DWR distributed an informal mailer to known and potentially interested government agencies, federally recognized Indian tribes, and other interested parties and organizations to initiate development of a mailing list of those interested in the Oroville Facilities. After January 11, 2001, DWR initiated the collaborative process that is supported by the ALP. The collaborative process functioned on three levels: (1) a Plenary Group; (2) five resource-specific Work Groups; and (3) issue-specific Task Forces (as needed). Each of the three collaborative levels are described below.

10.1.1.1 Plenary Group

The Plenary Group was composed of spokespersons for stakeholder groups involved in the relicensing process (Table 10.1-1). The Plenary Group was responsible for maintaining a global perspective on the relicensing process, overseeing the progress of the five Work Groups, and determining how recommendations and proposals interrelate and interact with other issues and resource needs.

Table 10.1-1. Plenary Group participants.

Federal Agencies	State Agencies	Local Government
• National Marine Fisheries Service • National Park Service • U.S. Forest Service, Plumas National Forest • U.S. Army Corps of Engineers • U.S. Fish and Wildlife Service	• California Department of Fish and Game • California Department of Water Resources • California Department of Parks and Recreation • State Water Resources Control Board • California Department of Boating and Waterways	• Butte County • City of Oroville • Feather River Recreation and Park District • Lake Oroville Joint Powers Authority • Oroville Chamber of Commerce • City of Yuba City • Yuba County Water Agency
Native American Tribes	**Water Agencies**	**Nongovernmental Organizations**
• Berry Creek Rancheria of Tyme Maidu Indians • Konkow Valley Band of Maidu • Enterprise Rancheria of Estom Yumeka Maidu • Mooretown Rancheria of Concow Maidu • Pacific Cherokee Tribal Council	• State Water Contractors • Metropolitan Water District • Santa Clara Water District • Zone 7 Water Agency	• American Rivers • American Whitewater/ Chico Paddleheads • Berry Creek Citizens Committee • Butte County Tax Payers Association • Butte Sailing Club • Butte County Citizens for Fair Government • California Horsemen's Association—Region II • Equestrian Trail Riders/Hikers • Feather River Low Flow Alliance • JEM Farms • Oroville Foundation of Flight • Oroville Recreation Advisory Committee [1] • Natural Heritage Institute representing American Rivers • General public

[1] *The Oroville Recreation Advisory Committee includes local representatives from the Butte Sailing Club, Citizens for Fair and Equitable Recreation, Lake Oroville Fish Enhancement Committee, Butte County Citizens for Fair Government, the City of Oroville, Butte County, and the Oroville Chamber of Commerce.*

10.1.1.2 Work Groups

Work Groups were established in five resource-specific areas and were responsible for identifying resource issues, developing study plans, considering existing and new information (including study reports), and making recommendations to the Plenary Group on PM&E measures (Table 10.1-2).

- **Environmental Work Group:** Addressed project-related issues related to water quality, terrestrial resources, fisheries, and geomorphology.

- **Recreation and Socioeconomics Work Group:** Addressed project-related issues related to recreational facilities, access, use, and socioeconomic issues related to recreation.

- **Cultural Resources Work Group:** Addressed project-related issues related to historic and prehistoric cultural resources.

- **Land Use, Land Management, and Aesthetics Work Group:** Addressed project-related issues related to the uses and management of lands within and adjacent to the FERC Project boundary and issues related to the visual and auditory environment.

- **Engineering and Operations Work Group:** Addressed project-related issues related to the engineering, operation, and maintenance of the Oroville Facilities; also provides modeling support services to the Collaborative.

Table 10.1-2. Work Group participants.

Environmental Work Group Participants		
Federal Agencies	**State Agencies**	**Local Government**
• National Marine Fisheries Service • U.S. Forest Service, Plumas National Forest • U.S. Army Corps of Engineers • U.S. Fish and Wildlife Service	• California Department of Fish and Game • California Department of Water Resources • California Department of Parks and Recreation • California Department of Conservation • State Water Resources Control Board	• Butte County • City of Yuba City • Yuba County Water Agency
Native American Tribes	**Water Agencies**	**Nongovernmental Organizations**
• Enterprise Rancheria of Estom Yumeka Maidu	• State Water Contractors • Metropolitan Water District • South Feather Water and Power Agency • Kern County Water District	• American Rivers • California Waterfowl • Association • Natural Heritage Institute • General public
Recreation and Socioeconomics Work Group Participants		
Federal Agencies	**State Agencies**	**Local Government**
• National Park Service • Plumas National Forest	• California Department of Fish and Game • California Department of Water Resources • California Department of Parks and Recreation • State Water Resources Control Board	• Butte County • City of Oroville • Feather River Recreation and Park District • Lake Oroville Joint Powers Authority • City of Paradise

Table 10.1-2. Work Group participants.

Recreation and Socioeconomics Work Group Participants (continued)		
Native American Tribes	**Water Agencies**	**Nongovernmental Organizations**
• Berry Creek Rancheria of Tyme Maidu Indians • Enterprise Rancheria of Estom Yumeka Maidu • Mooretown Rancheria of Concow Maidu • Mechoopda Indian Tribe of Chico Rancheria • Pacific Cherokee Tribal Council	• State Water Contractors • Metropolitan Water District • Kern County Water Agency	• American Whitewater/Chico Paddleheads • Berry Creek Citizens Committee • Butte County Tax Payers Association • Butte Sailing Club • Butte County Citizens for Fair Government • Citizens for Fair and Equitable Recreation • California Horsemen's Association—Region II • Equestrian Trail Riders/Hikers • Experimental Aircraft Association, Chapter 1112 • Feather River Low Flow Alliance • Lake Oroville Bicycle Organization • Lime Saddle Marina • Lake Oroville Fish Enhancement Committee • Oroville Chamber of Commerce • Oroville Foundation of Flight • Oroville Model Airplane Club • Oroville Recreation Advisory Committee • Oroville Water Ski Club • Shasta Paddlers • General public
Cultural Resources Work Group Participants		
Federal Agencies	**State Agencies**	**Local Government**
• U.S. Bureau of Indian Affairs • U.S. Bureau of Land Management • U.S. Forest Service, Plumas National Forest	• California Department of Water Resources • California Department of Parks and Recreation	• Butte County

Table 10.1-2. Work Group participants.

Cultural Resources Work Group Participants (continued)		
Native American Tribes	**Water Agencies**	**Nongovernmental Organizations**
• Berry Creek Rancheria of Tyme Maidu Indians • Pacific Cherokee Tribal Council • Konkow Valley Band of Maidu • Enterprise Rancheria of Estom Yumeka Maidu • Mechoopda Indian Tribe of Chico Rancheria • Mooretown Rancheria of Concow Maidu • California Autochthon Peoples Foundation	• State Water Contractors • Metropolitan Water District	• Butte County Citizens for Fair Government • California Horsemen's Association—Region II • General public
Land Use, Land Management, and Aesthetics Work Group Participants		
Federal Agencies	**State Agencies**	**Local Government**
• U.S. Bureau of Land Management	• California Department of Fish and Game • California Department of Water Resources • California Department of Parks and Recreation	• Butte County
Native American Tribes	**Water Agencies**	**Nongovernmental Organizations**
• Enterprise Rancheria of Estom Yumeka Maidu	• State Water Contractors • Metropolitan Water District • Zone 7 Water Agency	• Oroville Recreation Advisory Committee • General public
Engineering and Operations Work Group Participants		
Federal Agencies	**State Agencies**	**Local Government**
• National Marine Fisheries Service • U.S. Army Corps of Engineers • U.S. Fish and Wildlife Service	• California Department of Fish and Game • California Department of Water Resources	• Butte County • Butte County Public Works • Butte Water Commission • Plumas County • Sutter County • City of Yuba City • Yuba County Water Agency

Table 10.1-2. Work Group participants.

Engineering and Operations Work Group Participants (continued)		
Water Agencies	**Nongovernmental Organizations**	
• State Water Contractors • Kern County Water Agency • Metropolitan Water District • Western Canal Water District • South Feather Water and Power Agency • Yuba County Water Agency	• JEM Farms • Natural Heritage Institute representing American Rivers • General public	

10.1.1.3 Task Forces

Task Forces were established as needed to undertake specific tasks identified by a work group or the Plenary Group. As part of the Task Force process, technical specialists and other participants reviewed and discussed specific subjects associated with one or more resources and provided recommendations to the group that established the task force. More than a dozen Task Forces were established during consultation.

10.1.2 CEQA Scoping

CEQA requires that lead agencies conduct scoping meetings to assist in determining potential resources areas that could be affected by a project. The scoping history for the Oroville Facilities relicensing effort includes the initial public meetings as well as the meetings conducted under the Collaborative process.

The Collaborative Work Groups spent the first half of 2001 identifying and refining issue statements for study plan development and inclusion in Scoping Document 1 (SD1). SD1 supported the development of either two separate environmental documents or a single joint NEPA/CEQA document. It also provided the CEQA notice of preparation.

On October 29 and October 30, 2001, public scoping meetings were held in the cities of Oroville and Sacramento, respectively. The purpose of the meetings was to receive input from any parties interested in the relicensing process, and to gather information and identify issues regarding specific aspects of the Oroville Facilities relicensing process. More than 100 people signed in at the meetings, and public statements were provided in person by 21 individuals representing a variety of interested parties. Any person who was unable to attend a public scoping meeting or desired to provide further comment was encouraged to submit written comments and information to DWR by November 26, 2001. The entities listed in Table 10.1-3 provided written comments on SD1 as well as in response to the scoping meetings.

Table 10.1-3. Comments during scoping for the Oroville Facilities relicensing process.

Commenting Entities
Feather River Diverters (Joint Water Districts and Western Canal Water Districts)
U.S. Department of Commerce, National Oceanic and Atmospheric Administration (National Marine Fisheries Service)
California Chamber of Commerce
Oroville Foundation of Flight
Southern California Water Committee
State of California Electricity Oversight Board
Association of California Water Agencies
Kern County Water Agency
Alameda County Flood Control & Water Conservation District
Castaic Lake Water Agency
Plumas National Forest
National Park Service, California Hydro Program
Civil Engineering Services, F.D. Pursell
State Water Resources Control Board
California State Department of Fish and Game
California Independent System Operator
Paleo Resource Consultants, F&F Geo Resources Associates Inc.
Metropolitan Water District of Southern California
Santa Clara County Water District
State Water Contractors Inc.
California Business Properties Association
Pacific Cherokee Tribal Council
Ron Davis
Catherine H. Hodges
Northern California Water Association
Butte County
County of Sutter, Board of Supervisors
California Department of Forestry and Fire Protection
U.S. Fish and Wildlife Service
The Baiocchi Family

DWR issued Scoping Document 2 and Amended Notice of Preparation (SD2) on September 20, 2002. SD2 addressed comments received on SD1 and reflected the progress made since September 2001 in working collaboratively with resource agencies, NGOs, and other interested parties in identifying issues and initiating 71 study programs. SD2 also fulfilled requirements allowing DWR to prepare a PDEA that both complies with NEPA and is adequate in supporting the FERC decision-making process as well as allowing DWR to prepare an EIR separate of the FERC process.

10.1.3 Settlement Agreement Process

The process for the relicensing of the project was broad-based, collaborative, and representative of a wide array of stakeholder interests, including affected federal and State agencies, local government agencies, local government entities, tribal interests, non-governmental organizations, and local residents. The participants in the

collaborative relicensing process were extensively involved in scoping issues, submitting study requests, formulating study scopes, reviewing study results, and formulating protection, mitigation, and enhancement measures.

Beginning in April 2004, many of the Collaborative members spent 23 months negotiating a Settlement Agreement. The SA is the culmination of the relicensing process. The SA is unique in that the parties have reviewed all reasonable alternatives during the relicensing process and agreed that the measures contained in it resolve all issues that have been or could have been raised by the parties in connection with FERC issuing a New Project License for the Oroville facilities. Therefore, only three alternatives are contained in the DEIR.

10.1.3.1 Interventions

FERC's notice of filing of the license application included a statement that organizations and individuals may petition to intervene and become a party to any subsequent proceedings.

10.2 COORDINATION WITH APPLICABLE AGENCIES

10.2.1 CEQA State Lead Agency

Under the State CEQA Guidelines the lead agency is the agency carrying out the project or having the most responsibility for the project (State CEQA Guidelines Section 15051).

10.2.2 CEQA State Responsible Agencies

A "responsible agency" is the public agency that proposes to carry out or approve a project for which a lead agency is preparing or has prepared an environmental document. For the purposes of CEQA, the term "responsible agency" includes all public agencies other than the lead agency that have discretionary approval power over the project. The SWRCB has discretionary approval power and therefore is considered to be a "responsible agency." The SWRCB will issue a 401 Water Quality Certification under the Clean Water Act for the Oroville Facilities.

10.2.3 CEQA State Trustee Agencies

A "trustee agency" is a public agency having jurisdiction by law over natural resources affected by a project that are held in trust for the people of the State of California. Trustee agencies include:

- DFG with regard to the fish and wildlife of the State, to designated rare or endangered native plants, and to game refuges, ecological reserves, and other areas administered by the department;

- The State Lands Commission with regard to state-owned "sovereign" lands such as the beds of navigable waters and State school lands;

- DPR with regard to units of the State Park System;
- The California Department of Boating and Waterways; and
- The University of California with regard to sites within the Natural Land and Water Reserves System.

10.2.4 Federal Agencies

Implementation of the Proposed Project will require issuance of a new FERC License to DWR. Issuance of the new hydroelectric power license may involve additional permits or approval from the following agencies:

- FERC;
- NMFS;
- USFWS;
- The U.S. Army Corps of Engineers;
- USFS; and
- The U.S. Environmental Protection Agency.

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CHAPTER 11.0

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CHAPTER 7.0, REGULATORY PERMITS AND APPROVALS REQUIRED FOR THIS PROJECT

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STUDY PLAN REPORTS

The following is a list of the study plans and available study plan reports associated with the Oroville Facilities Relicensing. Reports for each study plan are listed underneath the study plan with which they are associated. Some of these study plan reports are referred to in the text of the EIR; these reports should be considered supporting information and can be found at the Oroville Facilities public Website, http://orovillerelicensing.water.ca.gov.

Land Use, Land Management and Aesthetics

SP-L1: Land Use
Final Report, Land Use Study (July 2004)

SP-L2: Land Management
Final Report, Land Management Study (August 2004)

SP-L3: Comprehensive Plan Consistency
Final Report, Comprehensive Plan Consistency Evaluation (May 2004)

SP-L4: Aesthetics
Final Report, Aesthetic/Visual Resources (July 2004)

SP-L5: Fuel Load Management
Final Report, Fuel Load Management Evaluation (May 2004)

Recreation and Socioeconomics

SP-R1: Public and Private Vehicular Access
Final Report, Vehicular Access Study (September 2003)

SP-R2: Recreation Safety Assessment
Final Report, Recreation Safety Assessment (January 2004)

SP-R3: Assess Relationship of Project Operations and Recreation
Final Report, Assessment of the Relationship of Project Operations and Recreation (May 2004)

SP-R4: Assess Relationship of Fish/Wildlife Management and Recreation
Final Report, Relationship Assessment of Fish/Wildlife Management of Recreation (May 2004)

SP-R5: Assess Recreation Areas Management
Final Report, Assessment of Recreation Areas Management (June 2004)

SP-R6: ADA Accessibility Assessment
Final Report, ADA Accessibility Assessment (September 2003)

SP-R7/R9/R13 (Reservoir Boating/Existing Recreation Use/Recreation Surveys)
Interim Report, Critical Path Recreation Field Studies (February 2003)

SP-R7: Reservoir Boating Survey
Final Report, Reservoir Boating (March 2004)

SP-R8: Carrying Capacity Study
Final Report, Recreation Carrying Capacity (June 2004)

SP-R9: Existing Recreation Use Study
Final Report, Existing Recreation Use (February 2004)

SP-R10: Recreation Facility and Condition Inventory
Final Report, Recreation Facility Inventory and Condition Report (September 2003)

SP-R11: Recreation and Public Use Impact Assessment
Final Report, Recreation and Public Use Impact Assessment (January 2004)

SP-R12: Projected Recreation Use
Final Report, Projected Recreation Use (May 2004)

SP-R13: Recreation Surveys
Final Report, Recreation Surveys (December 2004)

SP-R14: Assess Regional Recreation and Barriers to Recreation
Final Report, Assessment of Regional Recreation and Barriers to Recreation (February 2004)

SP-R15: Recreation Suitability Study
Final Report, Recreation Suitability Analysis (February 2004)

SP-R16: Whitewater and River Boating
Final Report, Whitewater and River Boating (January 2004)

SP-R17: Recreation Needs Analysis
Final Report, Recreation Needs Analysis (June 2004)

SP-R18: Recreation Activity, Spending, and Associated Economic Impacts
Final Report, Recreation Activity, Spending, and Associated Economic Impacts (May 2004)

SP-R19: Fiscal Impacts
Final Report, Fiscal Impacts (May 2004)

SP-R18/R19 (Recreation Activity, Spending, and Associated Economic Impacts/Fiscal Impacts):
Final Report, Phase 1 Background Report – Economic and Fiscal Conditions (May 2003)
Draft Report, Phase 2 Background Report – Property Value Analysis using a Hedonic Property-Pricing Model (January 2004)
Draft Report, Phase 2 Background Report – Recreation and Tourism Economy in Oroville (January 2004)

Engineering and Operations

SP-E1: Model Development
Model Development (June 2003)

SP-E1.1: Statewide Operations Model Development
Statewide Operations Model Development (June 2003)

SP-E1.2: Local Operations Model Development

SP-E1.3: Oroville Reservoir Temperature Model Development

SP-E1.4: Thermalito Complex Temperature Model Development

SP-E1.5: Feather River Temperature Model Development

SP-E1.3/E1.4/E1.5 (Oroville Reservoir/Thermalito Complex/Feather River Temperature Model Development):
Interim Report, Temperature Model Presented to Engineering & Operations Work Group (April 2003)

SP-E1.6: Feather River Flow-Stage Model Development
Feather River Flow-Stage Model Development (April 2003)

SP-E2: Perform Modeling Simulations
Operations Modeling Seminar #1 (June 2003)
Operations Modeling Workshop #2 (August 2003)
Operations Modeling Workshop #3 (October 2003)
Operations Modeling Workshop #4 (February 2004)
Operations Modeling Workshop #5 (April 2004)
Benchmark Study Results for CALSIM II, HYDROPS™ & WQRRS (September 2004)
PDEA Alternatives Analysis and Simulations (November 2004)

SP-E3: Evaluate the Potential for Additional Hydropower Generation at Oroville
Draft Report, Evaluate the Potential for Additional Hydropower Generation at Oroville (Executive Summary) (May 2004)

SP-E4: Flood Management Study
Final Report, Flood Management Study (November 2004)

SP-E6: Downstream Extent of Reasonable Control of Feather River Temperature by Oroville-Thermalito
Downstream Extent of Reasonable Control of Feather River Temperature by Oroville-Thermalito (October 2003)

SP-E7A: Oroville Reservoir Cold Water Pool Evaluation
Draft Report, Oroville Reservoir Cold Water Pool Availability Analysis (May 2003)

SP-E8: Temperature Impacts of Pumpback Operation on Oroville Reservoir Cold Water Pool
Temperature Impacts of Pumpback Operations on Oroville Reservoir Cold Water Pool (ongoing) (Note: This activity reflects a commitment to collect data related to pump-back operations.)

Engineering Exhibits A-D (April 2005)

Cultural Resources

SP-C1: Cultural Resources Inventory

The following documents contain confidential information on the nature and location of cultural resources and are exempt from the Freedom of Information Act.

Final Report, Ethnographic and Ethnohistoric Inventory of Konkow Maidu Cultural Places (July 2004)
Draft Report, Historic Properties Inventory and Evaluation: Oroville Facilities, Butte County, California (July 2004)
Final Report, Archaeological and Historical Resources Inventory Report (June 2005)

SP-C2: Cultural Resources Evaluation

The following documents contain confidential information on the nature and location of cultural resources and are exempt from the Freedom of Information Act.

Draft Report, Historic Properties Inventory and Evaluation: Oroville Facilities, Butte County, California (July 2004).

Evaluation reports for ethnographic, archaeological, and historical resources are in preparation.

SP-C3: Cultural Resources Management
Draft Report, Historic Properties Management Plan (April 2006)

SP-C4: Cultural Resources Interpretive Evaluation
Draft Report, Cultural Resources Interpretive Evaluation (November 2004)

Environmental – Terrestrial

SP-T1: Effects of Project Features and Operation on Wildlife and Wildlife Habitat
Final Report, Effects of Project Operations and Features on Wildlife and Wildlife Habitat (April 2004)

SP-T2: Project Effects on Special Status Species
Final Report, Project Effects on Special Status Wildlife Species (February 2004)
Final Report, Project Effects on Special Status Plant Species (March 2004)

SP-T3/5: Riparian Resources, Wetlands, and Associated Floodplains
Final Report, Project Effects on Riparian Resources, Wetlands, and Associated Floodplains (July 2004)

SP-T4: Biodiversity, Vegetation Communities, and Wildlife Habitat Mapping
Final Report, Biodiversity, Vegetation Communities, and Wildlife Habitat Mapping (December 2003)

SP-T6: Interagency Wildlife Management Coordination and Wildlife Management Plan Development
Interim Report, Interagency Wildlife Management Coordination and Wildlife Management Plan Development (February 2004)
SP-T7: Project Effects on Noxious Terrestrial and Aquatic Plant Species
Final Report, Project Effects on Noxious Terrestrial and Aquatic Plant Species (June 2004)

SP-T8: Project Effects on Non-Native Wildlife
Final Report, Project Effects on Non-Native Wildlife (September 2003)

SP-T9: Recreation and Wildlife
Final Report, Recreation and Wildlife (June 2004)

SP-T10: Effects of Project Features, Operations, and Maintenance on Upland Plant Communities
Final Report, Effects of Project Features, Operation and Maintenance on Upland Plant Communities (August 2004)

SP-T11: Effects of Fuel Load Management and Fire Prevention on Wildlife and Plant Communities
Final Report, Effects of Fuel Load Management and Fire Prevention on Wildlife and Plant Communities (October 2003)

Environmental – Geomorphology

SP-G1: Effects of Project Operations on Geomorphic Processes Upstream of Oroville Dam
Interim Report, Task 2 – Map the Channel Resources in the Tributaries above Oroville Dam and Task 3 – Re-Survey Reservoir Cross-Sections and Determine Sediment in Storage (April 2003)
Final Report, Effects of Project Operations on Geomorphic Processes Upstream of Oroville Dam (April 2004)

SP-G2: Effects of Project Operations on Geomorphic Processes Downstream of Oroville Dam
Interim Report, Effects of Project Operations on Geomorphic Processes Downstream of Oroville Dam (April 2003)
Final Report, Task 1.1 – Bibliography and Index (June 2004)
Final Report, Task 1.2 – Physiographic Setting and Mesohabitat (April 2004)
Final Report, Task 2 – Spawning Riffle Characteristics (August 2004)
Final Report, Task 3/Task 4 – Channel Cross-Sections and Photography (September 2004)
Final Report, Task 5 – Dam Effects on Channel Hydraulics and Geomorphology and Task 8 – Summary and Conclusions (July 2004)
Final Report, Task 6 – Channel Meanders and Bank Erosion Monitoring (July 2004)
Final Report, Task 7 – Hydraulic and Sediment Transport Modeling with Fluvial 12 (March 2004)

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Final Report, Project Effects on Water Quality Designated Beneficial Uses for Surface Waters (September 2004)

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Draft Report, Phase 1 – Contaminant Accumulation in Fish, Sediments and the Aquatic Food Chain (February 2004)
Contaminant Accumulation in Fish, Sediments, and the Aquatic Food Chain, Phase 2 Report (February 2006)

SP-W3: Recreational Facilities and Operations Effects on Water Quality
Interim Report, Task 1 – Effects of Current Recreation Facilities and Operations and Task 1A – Identification of Potential Effects to Water Quality (November 2002)
Final Report, Task 1B – First Year of Monitoring (August 2004)

SP-W5: Project Effects on Groundwater
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Final Report, Task 1/Task 2 – Evaluation of Project Effects on Non-Fish Aquatic Resources (August 2004)
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Draft Report, Task 1/Task 2 – Evaluation of Project Effects on Fish Diseases (March 2003)
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Final Report, Task 4C – Evaluation of Water Surface Fluctuations on Bass Nest Dewatering and Characterization of Inundated Littoral Habitat in the Thermalito Afterbay (August 2004)
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SP-F3.2: Evaluation of Project Effects on Non-Salmonid Fish and Their Habitat in the Feather River Downstream of the Thermalito Diversion Dam
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Draft Report, Task 1 and F21 Task 2 – Fish Distribution in the Feather River below the Thermalito Diversion Dam to the Confluence with the Sacramento River (January 2003)
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Final Report, Task 2, F15 Task 1, and F21 Task 1 – Literature Review of Life History and Habitat Requirements for Feather River Fish Species (April 2004)
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Interim Report, Task 4A and F3.1 Task 1C – Fish Habitat GIS Coverage (GIS Maps) (June 2003)
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Final Report, Task 2 – Evaluate the Achievement of Current Stocking Goals (September 2004)
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SP-F8: Transfer of Energy and Nutrients by Anadromous Fish Migrations
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Interim Report, Task 1E – Identification and Characterization of Early Up-Migrant Chinook Salmon Holding Habitat and Habitat Use Patterns (April 2003)
Final Report, Task 1D/Task 1E – Evaluation of Oroville Facilities Operations on Water Temperature Related Effects on Pre-Spawning Adult Chinook Salmon And Characterization of Holding Habitat (July 2004)
Final Report, Task 2A – Evaluation of Spawning and Incubation Substrate Suitability for Salmonids in the Lower Feather River (July 2004)
Interim Report, Task 2B – Steelhead Spawning Methods (May 2003)
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Final Report, Task 2B – Evaluation of Potential Effects of Oroville Facilities Operations on Spawning Chinook Salmon (July 2004)
Final Report, Task 2C – Evaluation of the Timing, Magnitude and Frequency of Water Temperatures and Their Effects on Chinook Salmon Egg and Alevin Survival (July 2004)
Final Report, Task 2D – Evaluation of Flow Fluctuation Effects on Chinook Salmon Redd Dewatering in the Lower Feather River (July 2004)
Interim Report, Task 3A – Distribution and Habitat Use of Steelhead and

Other Fishes in the Lower Feather River (January 2003)
Final Report, Task 3A – Distribution and Habitat Use of Juvenile Steelhead and other Fishes of the Lower Feather River (April 2004)
Interim Report, Task 3B – Growth Investigations of Wild Juvenile Steelhead in the Feather River using Mark and Recapture Techniques (June 2003)
Interim Report, Task 3B – Steelhead Rearing Temperatures (July 2003)
Final Report, Task 3B – Growth Investigations of Wild and Hatchery Steelhead in the Lower Feather River (February 2004)
Interim Report, Task 3C – Redd Dewatering and Juvenile Steelhead and Chinook Salmon Stranding in Lower Feather River (June 2003)
Final Report, Task 3C – Juvenile Steelhead and Chinook Salmon Stranding in the Lower Feather River (August 2004)
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Final Report, Task 4A – River Flow Effects on Emigrating Juvenile Salmonids in the Lower Feather River (December 2003)
Final Report, Task 4B – Timing, Thermal Tolerance Ranges and Potential Water Temperature Effects on Emigrating Juvenile Salmonids in the Lower Feather River (October 2003)
Final Report, Task 1E – Adult Chinook Salmon Migration and Holding Patterns (August 2005)

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Final Report, Task 2, F3.1 Task 1C – Inventory of Potentially Available Habitat, and Distribution of Juvenile and Adult Fish Upstream from Lake Oroville (June 2004)
Final Report, Task 3 – Evaluation of Methods and Devices Used in the Capture, Sorting, Holding, Transport and Release of Fish (June 2004)
Final Report, Task 4 – Fish Passage Model (January 2004)

SP-F16: Evaluation of Project Effects on Instream Flows and Fish Habitat
Draft Report, Phase 1, Evaluation of Project Effects on Instream Flows and Fish Habitat (July 2002)
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SP-F21: Project Effects on Predation of Feather River Juvenile Anadromous Salmonids
Interim Report, Task 1 and F3.2 Task 2 – Literature Review of Life History and Habitat Requirements for Feather River Fish Species (January 2003)
Final Report, Task 1, F3.2 Task 2, and F15 Task 1 – Literature Review of Life History and Habitat Requirement for Feather River Fish Species (April 2004)
Draft Report, Task 2 and F3.2 Task 1 – Fish Distribution in the Feather River below Thermalito Diversion Dam to the Confluence with the Sacramento River (January 2003)
Final Report, Task 3 – Incorporate Results of Tasks 1 and 2 (May 2004)
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SETTLEMENT AGREEMENT

FOR LICENSING OF THE OROVILLE FACILITIES

FERC Project No. 2100

March 2006

State of California
Resources Agency
Department of Water Resources

SETTLEMENT AGREEMENT FOR LICENSING OF THE OROVILLE FACILITIES

Changes to the Settlement Agreement since March 10, 2006

- Added “Inc.” after State Water Contractors in section 1.1 and signature block

- Entered missing text to A107:

> A107.1 Feather River Fish Hatchery Fish Production Program. Upon license issuance, and until the completion and implementation of the Plan set forth in section A107.3 of this article, the Licensee shall ensure the continued operation of the Feather River Fish Hatchery in cooperation with the California Department of Fish and Game for the production of anadromous salmonids such as steelhead,
> fall-run Chinook salmon, spring-run Chinook salmon, as well as other salmonids that may be stocked as part of the license.

- Added Littlerock Creek Irrigation District as a party in section 1.1 and the signature block

- Changed "Tulare Lake Water SUPPLY District" to "Tulare Lake Water STORAGE District" in Parties list and signature page

- Added California Department of Boating and Waterways as a party in section 1.1 and the signature block

- Added “After the executed Settlement Agreement is approved by the Department of Finance,” to the beginning of Section B100(E)(2.0) on page B-5

- Added Napa County Flood Control and Water Conservation District as a party in section 1.1 and the signature block

SETTLEMENT AGREEMENT FOR LICENSING OF THE OROVILLE FACILITIES

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EXHIBITS AND APPENDICES

1. Introduction

1.1 Parties

This Settlement Agreement for Licensing of the Oroville Facilities ("Settlement Agreement") is made and entered into pursuant to Federal Energy Regulatory Commission ("FERC") Rule, 18 C.F.R. § 385.602, by and among:

Alameda County Flood Control & Water Conservation District, Zone 7
Alameda County Water District
American Rivers
American Whitewater
Antelope Valley – East Kern Water Agency
Berry Creek Citizens Association
California Department of Boating and Waterways
California Department of Fish and Game ("Fish & Game")
California Department of Parks and Recreation ("Parks & Recreation")
California Department of Water Resources ("Licensee" or "DWR")
California State Horsemen's Association
California State Horsemen's Association Region II
Castaic Lake Water Agency
Central Coast Water Authority
Chico Paddleheads
Citizens for Fair and Equitable Recreation
City of Oroville ("Oroville")
Coachella Valley Water District
County of Kings
Crestline – Lake Arrowhead Water Agency
Desert Water Agency
Empire West Side Irrigation District
Feather River Low Flow Alliance ("Alliance")
Feather River Recreation and Parks District
International Mountain Bicycling Association
Kern County Water Agency
Kon Kow Valley Band of Maidu
Lake Oroville Bicyclist Organization
Littlerock Creek Irrigation District
Metropolitan Water District of Southern California
Mojave Water Agency
Napa County Flood Control and Water Conservation District
National Marine Fisheries Service ("NMFS")
Oak Flat Water District
Oroville Area Chamber of Commerce
Oroville Downtown Business Association
Oroville Economic Development Corporation
Oroville Parks Commission
Oroville Recreation Advisory Committee

Oroville Redevelopment Agency
Oroville Rotary Club
Palmdale Water District
San Bernardino Valley Municipal Water District
San Gabriel Valley Municipal Water District
San Gorgonio Pass Water Agency
Santa Clara Valley Water District
Solano County Water Agency
State Water Contractors, Inc. ("State Water Contractors")
Town of Paradise ("Paradise")
Tulare Lake Basin Water Storage District
United States Department of the Interior ("Interior"), on behalf of its component bureaus
Certain Individuals as identified on the signature page of this Settlement Agreement;

each referred to individually as a "Party" and collectively as "Parties."

The Parties to this Settlement Agreement agree as follows:

1.2 Recitals

1.2.1 Licensee constructed and operates the Oroville Facilities, FERC Project No. 2100 ("Project"). The Project was developed as part of the California State Water Project, a water storage and delivery system of reservoirs, aqueducts, power plants, and pumping plants. The State Water Project makes deliveries of supplemental water to two-thirds of California's population and over 750,000 acres of agricultural lands. The Project also is operated to provide power generation, improve water quality in the Sacramento and San Joaquin Delta, manage Feather River floodwaters, provide recreation, and enhance fish and wildlife.

1.2.2 The Project operates under a license originally issued by FERC on February 11, 1957 for a term of 50 years. The current license for the Project will expire on January 31, 2007. Under requirements of the Federal Power Act (FPA) and the FERC regulations, Licensee filed a timely application for a New Project License on January 26, 2005.

1.2.3 After consulting with state and federal resource agencies, Native American Tribes, local governments, local agencies, nongovernmental organizations, and the public, Licensee requested and received approval from the FERC to use an Alternative Licensing Process (ALP) for the relicensing of the Project. The ALP is intended to expedite the licensing process by combining the prefiling consultation and federal and State environmental review process into a single process, and to improve and facilitate communications among participants in the process. A Collaborative group was formed (Collaborative), which conducted

numerous meetings, reviewed existing data, commissioned and reviewed additional studies, conducted settlement negotiations, and prepared and relied on a record of its actions.

1.2.4 This Settlement Agreement is the end product of the Collaborative's work.

1.3 Effective Date of Settlement Agreement.

Except as provided in Section 1.3.1, this Settlement Agreement shall become effective upon execution by all Parties listed above and upon approval by California Department of Finance ("Effective Date").

1.3.1 Effective Date of Licensee Obligations.

The contractual obligations of the Licensee under any appendix shall become effective only upon Licensee's affirmative acceptance of a Final New Project License for the Project unless (a) this Settlement Agreement specifically provides for early implementation; or (b) the Licensee provides Notice that it intends to withdraw from this Settlement Agreement pursuant to Section 6. While acknowledging FERC's current policy that the Licensee's regulatory obligations become effective upon issuance of a New Project License, the Parties intend that the contractual obligations shall become effective only upon the Licensee's acceptance of a Final New Project License. Within 45 days of the New Project License becoming Final, Licensee shall provide Notice to all Parties whether it affirmatively accepts the New Project License and its obligations under this Settlement Agreement. If Licensee does not timely provide such Notice, the Licensee shall be deemed to have affirmatively accepted the New Project License and its obligations under the Settlement Agreement to the extent those obligations are not modified by the New Project License.

1.3.2 Effective Date of Parties' Obligations

The Parties' obligations under Sections 2 through 8, including the obligation to support this Settlement Agreement in the licensing and related regulatory proceedings, take effect on the Effective Date.

1.4 Term of Settlement Agreement

The term of this Settlement Agreement shall commence on the Effective Date and shall continue (unless terminated as otherwise provided herein) for the term of the New Project License plus the term(s) of any annual license(s) that may be issued after the foregoing New Project License has expired.

1.5 Definitions

1.5.1 **Collaborative** shall mean the collaborative group that was formed in the Alternative Licensing Process for the relicensing of the Project.

1.5.2 **Commission** or **FERC** shall mean the Federal Energy Regulatory Commission.

1.5.3 **Consultation** shall mean the process by which the Licensee seeks views through providing drafts of proposals, plans and reports, and seeking and considering comments on such proposals, plans and reports as appropriate from relevant Parties. Consultation shall **not** mean consultation under § 7 of the Endangered Species Act or other federal laws specifically requiring consultation unless specifically provided.

1.5.4 **Disputing Party (-ies)** shall mean the Party providing Notice of the dispute, the Party alleged to have not performed an obligation, and any other Party that provides Notice of its intent to participate in the dispute resolution.

1.5.5 **Federal and State Regulatory Parties** shall mean Interior, NMFS, and Fish and Game.

1.5.6 **Final**, with respect to the New Project License under this Settlement Agreement, shall mean Licensee's acceptance of such license after exhaustion of administrative and judicial remedies for any challenge which any Party or other person brings against the New Project License or against any other permit or approval associated with issuance of the New Project License. Such exhaustion shall relate only to a challenge: (A) against the New Project License or any associated approval other than a judicial challenge to the Biological Opinion, brought within 30 days after issuance of the New Project License; or (B) against the Biological Opinion, brought in court prior to the expiration of all appeals of the New Project License.

1.5.7 **Final Mandatory Terms and Conditions** shall mean conditions required pursuant to Section 4(e) or Section 18 of the Federal Power Act.

1.5.8 **Inconsistent with this Settlement Agreement** shall mean:
(i) any material modification to, addition to, or deletion of a Proposed License Article in the New Project License issued by FERC; or (ii) any material modification to or addition to any Proposed License Article in any Final Mandatory Terms and Conditions, ESA Section 7 Biological Opinions or CWA Section 401 Certification issued in conjunction with the New Project License; or (iii) a New Project License issued for a term of less than 50 years. Inconsistent with this Settlement Agreement shall not mean: (A) the inclusion of standard articles from the L-Form (as defined by 18 C.F.R. § 2.9) in the New Project License; (B) FERC's reservation of its authority to require changes to implementation schedules, plans, or other requirements of any of the New

Project License; (C) the inclusion in any Final Mandatory Terms and Conditions or CWA Section 401 Certification of the issuing agency's reservation of authority to reopen its conditions, provided that the reservation of authority is consistent with this Settlement Agreement, including Section 4.4, proposed License Article A109, and the Habitat Expansion Agreement (2006), which is included in draft form in Appendix F, and provided further that each Party reserves its right to contest the exercise of such reserved authority at such time as the agency may exercise the reserved authority; (D) the inclusion in any ESA Section 7 Biological Opinions of the issuing agency's criteria for re-initiation of Section 7 consultation pursuant to 50 C.F.R. § 402.16; or (E) the inclusion in the New Project License or in any Final Mandatory Term and Condition, ESA Section 7 Biological Opinion or CWA Section 401 Certification, of such reasonable reporting requirements as FERC or the issuing agency, respectively, determines are necessary to ensure the Licensee's compliance.

1.5.9 **Licensee** shall mean the California Department of Water Resources, the legal entity to which the Commission issues the New Project License for the Project.

1.5.10 **Material New Information** shall mean significant and relevant new information which: (A) for the purpose of the Parties' obligations before New Project License issuance, is not in the administrative record for the New Project License as of the Effective Date; (B) for the purpose of the Parties' obligations after New Project License issuance but prior to the New Project License becoming Final, is not in the administrative record as of the date the New Project License is issued; or (C) for the purpose of the Parties' obligations after the New Project License is Final, is not in the administrative record as of the date the New Project License becomes Final; or (D) for any purpose, was neither in the administrative record nor otherwise known to the Party who seeks to use the Material New Information, as of the applicable date.

1.5.11 **New Project License** shall mean the new License, not to include any annual license extending the original license, issued by the Commission to the Licensee pursuant to Section 15 of the FPA for the continued operation of Project No. 2100.

1.5.12 **Notice** shall mean a written communication which meets the requirements of Section 7.11 and any other requirements for notice specifically provided in any other applicable section of this Settlement Agreement.

1.5.13 **Party** or **Parties** shall mean the signatories to this Settlement Agreement.

1.5.14 **Project** shall mean the Oroville Facilities, licensed to the California Department of Water Resources as FERC Project No. 2100.

1.5.15 **Project Boundary** shall mean the external geographic boundaries of the Project, which enclose all Project lands, waters, works and other features that

have been or may be approved by FERC, and that are subject to FERC jurisdiction.

1.5.16 **Proposed License Article** shall mean the terms and conditions set forth in Appendix A of this Settlement Agreement that the Parties respectfully recommend the Commission include, without material modification, in the New Project License issued to the Licensee for the continued operation of the Project.

1.5.17 **Public Agency** shall mean Licensee, Interior, NMFS, Fish & Game, Parks & Recreation, Town of Paradise, and City of Oroville.

1.5.18 **Settlement Agreement** shall mean the entirety of this Settlement, including the Appendices.

1.6 Acronyms

1.6.1 ALP – Alternative Licensing Process
1.6.2 CEQA – California Environmental Quality Act
1.6.3 CFS – cubic feet per second
1.6.4 CWA – Clean Water Act
1.6.5 EC – Ecological Committee
1.6.6 ESA – Endangered Species Act
1.6.7 FPA – Federal Power Act
1.6.8 FS – U.S. Department of Agriculture Forest Service
1.6.9 NA – not applicable
1.6.10 NEPA – National Environmental Policy Act
1.6.11 PM&E – protection, mitigation and enhancement measure
1.6.12 RAC – Recreation Advisory Committee
1.6.13 SWP – State Water Project
1.6.14 SWRCB – State Water Resources Control Board
1.6.15 USFWS – U.S. Fish and Wildlife Service

2. Purpose of Settlement Agreement

2.1 Purpose

The Parties have entered into this Settlement Agreement for the purpose of resolving all issues that have or could have been raised by the Parties in connection with FERC's order issuing a New Project License. While recognizing that several regulatory and statutory processes are not yet completed, it is the Parties' intention that this Settlement Agreement also resolves all issues that may arise in the issuance of all permits and approvals associated with the issuance of the New Project License, including but not limited to ESA Section 7 Biological Opinions, CWA Section 401 Certification, NEPA and CEQA. This Settlement Agreement also enhances the mutual benefits of the Project for the Licensee, Project beneficiaries, local community, and other Parties. Pursuant to

the Parties' various rights, authorities, and responsibilities under Sections 4(e), 10(a), 10(j), and 18 of the Federal Power Act, as well as other statutory and regulatory authorities and implied powers, this Settlement Agreement establishes the Licensee's obligations for the protection, mitigation and enhancement of resources affected by the Project under the New Project License. It also specifies procedures to be used among the Parties to ensure that implementation of the New Project License is not Inconsistent with this Settlement Agreement, and with other legal and regulatory mandates. For these purposes, the Parties agree that this Settlement Agreement is fair and reasonable and in the public interest, consistent with the standards under the FPA. Except as specifically provided below, each of the Federal and State Regulatory Parties agrees that the Licensee's performance of its obligations under this Settlement Agreement will be consistent with and is intended to fulfill the Licensee's existing statutory and regulatory obligations as to each Federal and State Regulatory Party relating to the relicensing of the Project. The Parties further agree that this Settlement Agreement provides sufficient PM&Es for FERC to find a balance of beneficial uses as required under Section 10 of the FPA.

2.2 No Precedent for Other Proceedings

This Settlement Agreement is made with the understanding that it constitutes a negotiated resolution of issues relating to the New Project License, operation of the Project, and local community concerns related to the Project. Accordingly, this Settlement Agreement shall not be offered against a Party as argument, admission or precedent in any mediation, arbitration, litigation, or other administrative or legal proceeding that does not involve or relate to the New Project License or the operation of the Project. Further, no Party shall be deemed to have approved, admitted, accepted, or otherwise consented to any operation, management, valuation, or other principle underlying any of the matters covered by this Settlement Agreement, except as expressly provided herein. With respect to any mediation, arbitration, litigation or other administrative or legal proceeding involving or relating to the New Project License, the Parties rights and responsibilities shall be as set forth in this Settlement Agreement. This Section shall survive any termination of this Settlement Agreement.

3. Compliance with Legal Responsibilities and Reservations of Rights

3.1 Public Agency Parties

Except as otherwise provided in this Settlement Agreement, by entering into this Settlement Agreement, each Party that is a Public Agency represents that it believes and expects that: (A) the Proposed License Articles set forth in Appendix A satisfy the statutory, regulatory, or other legal requirements for the protection, mitigation, and enhancement of natural resources, water quality,

recreation, and cultural and historic resources affected by the Project under the New Project License; and (B) the Public Agency's statutory, regulatory, or other legal responsibilities are, or can be, met through approval without material modification of this Settlement Agreement and subsequent implementation of the New Project License. This representation applies only to those requirements that the Public Agency administers.

3.1.1 Nothing in this Settlement Agreement is intended or shall be construed to be an irrevocable commitment of resources or a pre-decisional determination by a Public Agency. After the Effective Date of this Settlement Agreement but prior to the issuance of the New Project License, each Public Agency shall participate in the relicensing proceeding, including environmental review and consideration of public comments, as required by applicable law. Further, NMFS and USFWS shall consult with FERC and the Licensee under the ESA. Each Public Agency shall give consideration to any new information arising in the relicensing proceeding or ESA consultation, as required by applicable law.

3.1.2 Nothing in this Settlement Agreement is intended to, or shall be construed to, affect or limit the authority or obligation of any Party to fulfill its constitutional, statutory, and regulatory responsibilities or to comply with any judicial decision or order. Among other things, as provided in Section 1.5.8, this reservation permits a reservation of authority in the New Project License or any Final Mandatory Term and Condition, or Section 401 Certification, or inclusion in any ESA Section 7 Biological Opinion of the issuing agency's criteria for reinitiation of Section 7 consultation pursuant to 50 C.F.R. § 402.16; provided that each other Party reserves its right to contest the exercise of such reservation. Notwithstanding this Section, any reservation of authority pursuant to Sections 4(e) or 18 shall be consistent with the provisions of this Settlement Agreement, including Section 4.4, proposed License Article A109, and the Habitat Expansion Agreement (2006), which is included in draft form in Appendix F.

3.2 Future Relicensings

Nothing in this Settlement Agreement is intended or shall be construed to affect or restrict any Party's participation in or comments about the provisions of any future relicensing of the Project subsequent to the current relicensing, or any other project licensed to the Licensee under the Federal Power Act.

4. Settlement Agreement Commitments and Implementation

4.1 Parties Bound by Settlement Agreement

The Parties shall be bound by this Settlement Agreement for the term stated in Section 1.4, provided the New Project License is not Inconsistent with this

Settlement Agreement. However, Interior is not a Party to Appendix B of this Settlement Agreement.

4.2 Final Mandatory Terms and Conditions and Section 10(a) and 10(j) Recommendations

4.2.1 Protection, Mitigation, and Enhancement Measures to be included in Final Mandatory Terms and Conditions and Section 10(a) and 10(j) Recommendations

4.2.1.1 Except as to Material New Information, the Parties agree:

(a) Final Mandatory Terms and Conditions and other recommendations under FPA sections 10(a) and 10(j) shall not be Inconsistent with this Settlement Agreement;

(b) except as provided in Section 4.3.1, any information, comments, or responses to comments filed in the context of this relicensing process shall not be Inconsistent with this Settlement Agreement;

(c) they will use reasonable efforts to obtain a FERC order approving this Settlement Agreement and issuing a New Project License not Inconsistent with this Settlement Agreement in a timely manner; and

(d) they will support, in all relevant regulatory proceedings in which they participate, regulatory actions not Inconsistent with this Settlement Agreement.

4.2.1.2 Limitation on Parties to Revisit Settlement Agreement Provisions. No Party will use any Material New Information generated in the environmental review, public comments, or otherwise in this relicensing process to revisit the compromises inherent in this Settlement Agreement for the purpose of improving its bargained-for benefits. Instead, a Party may use such information to submit Section 10(a) and 10(j) recommendations or comments Inconsistent with this Settlement Agreement only if it believes in good faith that such information significantly undermines this Settlement Agreement, taken as a whole for the affected Party, and significantly affects the adequacy of the Proposed License Articles under Sections 10(a) or 10(j).

4.2.2 Final Mandatory Terms and Conditions Inconsistent with Settlement Agreement

4.2.2.1 As provided in Section 4.2.1, the Federal and State Regulatory Parties intend that any Final Mandatory Terms and Conditions submitted to FERC in connection with the issuance of the New Project License will not be Inconsistent with this Settlement Agreement, and shall contain a statement regarding whether they are consistent with this Settlement Agreement. If the Forest Service

submits final 4(e) conditions to FERC that are in all material respects consistent with the draft 4(e) conditions attached to this Settlement Agreement as Appendix E, the Parties agree that those final 4(e) conditions will not be considered Inconsistent with this Settlement Agreement.

4.2.2.2 If any of the Final Mandatory Terms and Conditions are Inconsistent with this Settlement Agreement, this Settlement Agreement shall be deemed modified to conform to the inconsistency unless a Party provides Notice to the other Parties that it objects to the inconsistency and initiates dispute resolution within 30 days after the date the inconsistent terms or conditions are filed with FERC.

4.2.2.3 The Disputing Party may, in addition and to the extent provided by applicable law, seek administrative and/or judicial review of any action by a Federal or State Regulatory Party that is Inconsistent with this Settlement Agreement. The Parties shall follow the dispute resolution process to the extent reasonably practicable while any such appeal of an inconsistent action is pursued. If a Party has filed for administrative rehearing or judicial review and the Parties subsequently agree to modify this Settlement Agreement to conform to the Federal or State Regulatory Party's action, the filing Party or Parties shall withdraw the petition or dismiss the judicial action, or recommend such withdrawal or dismissal, as appropriate.

4.2.2.4 Except as provided in Section 4.6.5.4 for omissions based on jurisdiction or if the Settlement Agreement is terminated pursuant to Section 6.6, if any Final Mandatory Terms and Conditions are Inconsistent with this Settlement Agreement after a final and non-appealable administrative or judicial decision, this Settlement Agreement shall be deemed modified to conform to that decision.

4.2.2.5 Regarding any Mandatory Terms and Conditions filed with FERC pursuant to this Section that are not Inconsistent with this Settlement Agreement, each Party waives any right it may have to request an agency trial-type hearing on issues of material fact under Sections 4(e) and 18 of the Federal Power Act and to propose alternatives under Section 33 of the Federal Power Act. The Parties shall not support any trial-type hearing requested by any non-party and will make reasonable efforts to support Interior, NMFS, and the Forest Service, as appropriate, if a trial-type hearing is requested by any non-party. If a non-party requests a trial-type hearing, the Parties may intervene in the hearing to support this Settlement Agreement. Notwithstanding the above, each Party reserves their rights to request a trial-type hearing or propose alternatives with respect to a Section 18 prescription if NMFS or USFWS submits such a prescription pursuant to the Habitat Expansion Agreement or otherwise.

4.3 ESA and Magnuson-Stevens Act Consultation

4.3.1 Biological Opinion/EFH Conservation Measures

The Licensee has been designated as FERC's non-federal representative for the purposes of preparing (a) a Biological Assessment under the ESA, which will serve as FERC's draft Biological Assessment; and (b) an essential fish habitat (EFH) Assessment, which must be provided to NMFS to begin EFH consultation under the Magnuson-Stevens Fishery Conservation and Management Act. If FERC adopts the provisions of this Settlement Agreement as the proposed action in its draft NEPA document, such proposed federal action shall be the basis for the Section 7 consultation between FERC and NMFS, and FERC and Interior, and any biological opinion relating to the New Project License shall address and evaluate such provisions. If FERC adopts the provisions of this Settlement Agreement as the proposed action in an EFH Assessment, NMFS will evaluate such provisions and provide FERC with recommended EFH conservation measures based on such provisions. As of the Effective Date of this Settlement Agreement, NMFS and Interior represent that they enter into this Settlement Agreement believing that the information in the record supports the PM&E measures provided herein. However, NMFS and Interior are not making a pre-decisional determination of the outcome of any consultation and expressly reserve the right to take such future action or to issue such terms and conditions in any Biological Opinions and Incidental Take Statements as necessary to meet their obligations under the ESA. Further, NMFS expressly reserves the right to recommend such EFH conservation measures as necessary to meet its obligations under the Magnuson-Stevens Act.

4.3.2 Biological Opinion Inconsistent with Settlement Agreement

4.3.2.1 Consistent with Section 4.3.1, NMFS and Interior anticipate that the measures contained in this Settlement Agreement will be adequate to avoid a jeopardy finding and minimize any incidental take occurring as a result of implementation of this Settlement Agreement for species presently listed as threatened or endangered, and that any measures contained in the Biological Opinion will not be Inconsistent with this Settlement Agreement, and the Biological Opinion shall be accompanied by a statement regarding whether it is consistent with this Settlement Agreement.

4.3.2.2 If any Biological Opinion issued pursuant to Section 7 of the ESA is Inconsistent with this Settlement Agreement, this Settlement Agreement shall be deemed modified to conform to the provisions of the Biological Opinion, unless a Party provides notice to the other Parties that it objects to the inconsistency and initiates dispute resolution within 30 days after the Biological Opinion is filed with FERC.

4.3.2.3 The Disputing Party may, in addition and to the extent provided by applicable law, seek administrative and/or judicial review of any Biological Opinion that is Inconsistent with this Settlement Agreement; such rehearing shall be filed with FERC within 30 days of the issuance of the New Project License or judicial review shall be filed in court within 90 days of the issuance of the New Project License or the Biological Opinion, whichever is later. The Parties shall follow the dispute resolution process to the extent reasonably practicable while such administrative or judicial review is pursued. If a Party has filed for administrative rehearing or judicial review of any provision of the Biological Opinion that is Inconsistent with this Settlement Agreement and the Parties subsequently agree to modify this Settlement Agreement to conform to the inconsistent provision, the filing Party or Parties shall withdraw or dismiss the administrative or judicial action, or recommend such withdrawal or dismissal, as appropriate.

4.3.2.4 Except as provided in Section 4.6.5.4 for omissions based on jurisdiction or if the Settlement Agreement is terminated pursuant to Section 6.6, if any Biological Opinion is Inconsistent with this Settlement Agreement after a final and non-appealable decision on the administrative or judicial action, this Settlement Agreement shall be deemed modified to conform to the final decision.

4.4 Habitat Expansion Agreement

The Parties agree that the Licensee's obligations with respect to the blockage or passage of fish are satisfied if the Licensee enters into and complies with a final, signed agreement on Habitat Expansion in substantial conformity with the draft agreement dated March 9, 2006, attached to this Settlement Agreement as Appendix F.

NMFS and Interior will exercise their authority to prescribe fishways pursuant to Section 18 of the Federal Power Act by reserving that authority during the term of the license. Such reservation will be exercised only as provided in the Habitat Expansion Agreement (2006), which is provided in draft form in Appendix F, and will be finalized, signed and submitted to FERC before FERC acts on proposed License Article A109. In addition, the Parties recognize and agree that NMFS and Interior may include in their reservation of authority that is submitted to FERC the ability to modify that reservation, and may prescribe fishways, in the event that the Habitat Expansion Agreement and the underlying agreement between Pacific Gas and Electric Company and the Licensee are not executed within 30 days following FERC's issuance of a Final EIS. If NMFS and Interior submit reservations of their authority to prescribe fishways that are in all material respects the same as proposed License Article A109 and consistent with this Section, the Parties agree that those reservations of authority will not be considered Inconsistent with this Settlement Agreement.

4.5 CWA Section 401 Certification

4.5.1 Protection Mitigation and Enhancement Measures Recommended to be included in CWA Section 401 Certification

The Parties shall respectfully request that the California State Water Resources Control Board accept and incorporate, without material modifications, as conditions to the Section 401 Certification, all the PM&E measures stated in Appendix A of the Settlement Agreement that are within the California State Water Resources Control Board's jurisdiction pursuant to Section 401 of the CWA and the Porter Cologne Water Quality Control Act. The Parties shall further request that the California State Water Resources Control Board not include as conditions to the Section 401 Certification additional conditions that are Inconsistent with this Settlement Agreement.

4.5.2 Section 401 Certification Inconsistent with Settlement Agreement

4.5.2.1 If the California State Water Resources Control Board denies the Licensee's application for Section 401 Certification for the Project, the Parties agree such a denial shall be considered Inconsistent with this Settlement Agreement. If the California State Water Resources Control Board issues the Section 401 Certification and any provision of the Section 401 Certification is Inconsistent with this Settlement Agreement, this Settlement Agreement shall be deemed modified to conform to the provisions of the Section 401 Certification, unless a Party provides notice to the other Parties that it objects to the inconsistency and initiates dispute resolution within 30 days after the issuance of the Section 401 Certification.

4.5.2.2 The Disputing Party may, in addition, file a petition for reconsideration under California Code of Regulations, title 23, sections 3867-3869, and/or judicial review, of any provision of the Section 401 Certification that is Inconsistent with this Settlement Agreement; such petition must be filed within 30 days of the issuance of the Section 401 Certification. The Parties shall follow the dispute resolution process, if appropriate, to the extent reasonably practicable while such petition or judicial review is pursued. If a Party has filed for administrative rehearing or judicial review of any provision of the Section 401 Certification that is Inconsistent with this Settlement Agreement and the Parties subsequently agree to modify this Settlement Agreement to conform to the inconsistent provision, the filing Party or Parties shall withdraw the petition or dismiss the judicial action, or recommend such withdrawal or dismissal, as appropriate.

4.5.2.3 Except as provided in Section 4.6.5.4 for omission based on jurisdiction or if the Settlement Agreement is terminated pursuant to Section 6.6, if any provision of the Section 401 Certification is Inconsistent with this Settlement Agreement after a final and non-appealable decision on the petition or judicial action, this Settlement Agreement shall be deemed modified to conform to the final decision.

4.6 New Project License

4.6.1 Support for Issuance of New Project License

To the extent permitted by applicable law, all Parties shall support and advocate through appropriate written communications to FERC, Forest Service, applicable bureaus within Interior, NMFS, and SWRCB this Settlement Agreement and the PM&E measures stated in Appendix A hereto. Subject to Sections 4.2.1, 4.3.1, and 4.5.1, the Parties agree not to propose, support, or advocate proposed PM&E measures, or license conditions Inconsistent with this Settlement Agreement.

4.6.2 Term of New Project License

The Parties agree to respectfully recommend to FERC that the term of the New Project License be 50 years.

4.6.3 Comments on the NEPA Document

The Parties respectfully request that FERC Staff include Staff's recommended License Articles in the draft or final NEPA document for comment. The Parties shall comment on any recommended License Articles which, if approved in the New Project License, would be Inconsistent with this Settlement Agreement, in an effort to resolve such potential inconsistency before the issuance of the New Project License.

4.6.4 PM&E Measures Recommended to be Included in New Project License

Subject to Sections 4.2.1, 4.3.1 and 4.5.1, the Parties shall respectfully request that FERC accept and incorporate, without material modification, as license articles, all the PM&E measures stated in Appendix A of this Settlement Agreement. Subject to the same limitation, the Parties shall further request that FERC not include in the New Project License articles that are Inconsistent with this Settlement Agreement. The Parties shall respectfully request that measures and actions agreed to among the Parties as set forth in Appendix B not be incorporated in the New Project License.

4.6.5 New Project License Inconsistent with Settlement Agreement

4.6.5.1 Consistency of Final License with Agreement. If the New Project License issued by FERC, either initially or following conclusion of any rehearing or judicial review, is Inconsistent with this Settlement Agreement, this Settlement Agreement shall be deemed modified to conform to the inconsistency, unless a Party provides notice to the other Parties that it objects to the inconsistency and, if appropriate, initiates dispute resolution within 30 days after the date of the FERC Order.

4.6.5.2 Disputing Inconsistencies. The Disputing Party may, in addition, if they have intervened in the FERC relicensing proceeding, petition FERC for rehearing or seek judicial review of any New Project License article, or omission of any PM&E measure stated in Appendix A, that is Inconsistent with this Settlement Agreement. If any Party or non-party seeks rehearing or judicial review, the Licensee may seek a stay or an extension of time of the New Project License or other order. The Parties shall follow the dispute resolution process while any such rehearing, appeal or request for stay or extension is pursued. Any Disputing Party may ask FERC or the court to defer action on the merits of any rehearing request or appeal while dispute resolution is pursued. If a Party has filed for administrative rehearing or judicial review and the Parties subsequently agree to modify this Settlement Agreement to conform to the inconsistent action, the filing Party or Parties shall withdraw the appeal or recommend such withdrawal as appropriate.

4.6.5.3 Modification of Agreement if Inconsistency. Except as provided in Section 4.6.5.4 for omission based on jurisdiction and Section 4.6.5.5 for inclusion based on jurisdiction, or if the Settlement Agreement is terminated pursuant to Section 6.6, if an article in the Final New Project License is Inconsistent with this Settlement Agreement, this Settlement Agreement shall be deemed modified to conform to the final decision.

4.6.5.4 Omission Based on Jurisdiction. If the New Project License does not contain all the PM&E measures stated in Appendix A because FERC expressly determines that it does not have jurisdiction to adopt or enforce the omitted PM&E measures, this Settlement Agreement shall not be deemed modified to conform to such omission, and such omission shall not be used as the basis for dispute among the Parties; provided that any PM&E measure that FERC excludes from Appendix A based on a lack of jurisdiction shall be automatically included in Appendix B without material modification (including all funds needed to carryout or implement any such PM&E measure) and such inclusion shall not result in any reduction of funds already allocated under Appendix B.

4.6.5.5 Inclusion Based on Jurisdiction. If the New Project License includes PM&E measures stated in Appendix B of this Settlement Agreement because FERC determines that such measures are within FERC's jurisdiction to enforce, such action shall not be considered Inconsistent with this Settlement Agreement

provided there is no material change to the PM&E measure other than its inclusion in the New Project License. However, Parties may not assert in any regulatory forum including FERC that any PM&E measures in Appendix B of this Settlement Agreement should be included in the New Project License.

4.6.6 Requests for Stay or Extension of Implementation

The Parties support this Settlement Agreement and acknowledge that the operations of the Project as provided for in this Settlement Agreement are important to the Licensee's ability to fund the implementation of the PM&E measures and ensure the resource benefits provided for in this Settlement Agreement. The Parties recognize there may be challenges to the New Project License. As a result of such a challenge, the Licensee may at its discretion request from FERC or a court a stay or extension of implementation of any measure, action, or activity for so long as the New Project License is subject to administrative or judicial review. The other Parties will endeavor to support the Licensee's request to FERC for a stay or extension. If a Party cannot support the request for a stay or extension, that Party may oppose the request for a stay or extension only if:

(1) The challenge, if successful, would not add material requirements to the New Project License; or

(2) The scope of the request for stay or extension is not reasonably justified by the nature of the challenge. The scope of the request would be deemed reasonably justified if the magnitude of the request for stay or extension were comparable to the magnitude of risk posed by the challenge, and either (a) the stay or extension relates to the challenge or to measures physically or biologically linked to the challenge, or (b) the requested stay or extension of time relates to measures that would result in material capital cost to the Licensee or that would materially affect Project generation, operations, or economics; or

(3) The stay or extension is inconsistent with that Party's responsibility under law or regulation; or

(4) The Licensee challenges the New Project License and the opposing Party reasonably disagrees with the Licensee's determination that the New Project License being challenged is Inconsistent with this Settlement Agreement.

If the Licensee intends to seek a stay or extension, the Licensee shall contact the other Parties and make reasonable efforts to meet with the other Parties to explain and discuss the scope and extent of any such request for stay or extension. If any Party opposes a request for stay or extension, that Party shall contact the other Parties and make reasonable efforts to meet with the other Parties to explain and discuss the scope and extent of any opposition.

4.7 Cooperation Among Parties

The Parties shall cooperate in the implementation of this Settlement Agreement and the New Project License. No Party shall exercise discretion in a manner that results in an action or requirement that is Inconsistent with the Settlement Agreement unless necessary to comply with statutory, regulatory or other legal responsibility; in which event, the Party shall provide timely notice to other Parties of this obligation in order to permit Dispute Resolution as provided in Section 5 of this Settlement Agreement.

4.8 Support for Implementation

Upon notification by the Licensee of the need therefore, the other Parties shall provide written communications (or orally, in the event written communication is impossible to obtain due to reasons outside a Party's control) of support in any administrative approval process that may be required for implementation of this Settlement Agreement or related articles of the New Project License, subject to available agency resources and agency authority. The preceding sentence shall not apply to the Federal or State Regulatory Party exercising the authority or to the Federal or State Regulatory Party not participating in the proceeding. All Parties are encouraged to intervene in the relicensing proceeding at FERC and support this Settlement Agreement.

4.9 Defense against Conditions Inconsistent with This Settlement Agreement or Amendment

If a Party files a pleading or other document before FERC or another Regulatory Agency advocating a condition Inconsistent with this Settlement Agreement or a proposed amendment to the New Project License which is not based on Material New Information as provided by Section 4, any other Party may defend by: (a) stating its opposition to the condition Inconsistent with this Settlement Agreement or proposed amendment; (b) requesting that FERC or other Public Agency disapprove the condition Inconsistent with this Settlement Agreement or proposed amendment; and (c) explaining what other reasonable conditions should be included in and/or excluded from the New Project License if the condition Inconsistent with this Settlement Agreement or proposed amendment is approved. Since the Parties recognize that a dispute that results in the defense described in (c) may threaten the viability of this Settlement Agreement or may result in an action for specific performance pursuant to Section 5.3.2, the Parties affirm their commitment to make best efforts to resolve any such dispute regarding advocacy of a condition Inconsistent with this Settlement Agreement or proposed amendment in a timely manner to avoid such results. The Parties recognize that advocacy of conditions Inconsistent with this Settlement Agreement or proposed amendments based on Material New Information is permissible as described in Section 4.

4.10 Flood Control

The Parties agree that the Licensee pursuant to proposed Article A130, will comply with the rules and regulations prescribed by the U.S. Army Corps of Engineers. The Parties reserve the right to present evidence or argument relative to the impacts posed by any flood control proposal raised by any intervenor or otherwise before the Commission or the U.S. Army Corps of Engineers.

4.11 Responsibility for Funding

The Licensee shall ensure that funding needed to implement its obligations under this Settlement Agreement and the New Project License is provided. The Licensee shall not be excused from its duty to provide such funds due to a failure by any other Party, entity or person to provide funding or carry out a duty, obligation, or responsibility it may have with respect to the Project pursuant to other laws or agreements, including but not limited to the Federal Power Act (16 U.S.C. Section 791 et seq.) and the Davis Dolwig Act (California Water Code Section 11900 et seq.). Notwithstanding the foregoing, this Settlement Agreement does not alter or abrogate any duty, obligation or responsibility that any other Party or person may have to provide such funding pursuant to other laws or agreements, nor does this Settlement Agreement prevent the Licensee or any other Party from seeking to enforce such duty, obligation or responsibility. Further, the Licensee shall have no obligation to reimburse or otherwise pay any other Party for its assistance, participation or cooperation in any activities pursuant to this Settlement Agreement of the New Project License unless expressly agreed to by the Licensee or as required by law. In the event of administrative rehearing or judicial review, Parties shall bear their own costs and attorneys' fees.

4.12 Licensee Responsible for Compliance with New Project License

Upon acceptance of the New Project License, the Licensee is ultimately responsible for compliance with the New Project License. By entering into this Settlement Agreement, except as expressly provided herein, none of the Parties are accepting any new or additional legal liability or responsibility for compliance with the obligations under the New Project License. The Licensee shall not be excused from its duty to comply with its obligations under the New Project License due to a failure by any other Party, entity or person to provide funding or carry out a duty, obligation or responsibility it may have with respect to the Project pursuant to other laws or agreements, including but not limited to the Federal Power Act (16 U.S.C. Section 791 et seq.) and the Davis Dolwig Act (California Water Code Section 11900 et seq.). Notwithstanding the foregoing, this Settlement Agreement does not alter or abrogate any duty, obligation or responsibility that any other Party or person may have with respect to the Project pursuant to other laws or agreements, nor does this Settlement Agreement

prevent the Licensee or any other Party from seeking to enforce such duty, obligation or responsibility.

4.13 Availability of Funds

Implementation of this Settlement Agreement by any Party other than the Licensee is subject to the availability of funds. In addition, implementation of this Settlement Agreement by any Federal agency is subject to the requirements of the Anti-Deficiency Act, 31 U.S.C. Section 1341 et seq. Implementation of this Settlement Agreement by any State agency is subject to Article 16, Section 7 of the California Constitution. During any such period of deficiency affecting Licensee's obligations under the New Project License or this Settlement Agreement, Licensee shall take prompt action to secure necessary funds to meet its obligations under the New Project License and this Settlement Agreement. Further, nothing in this Settlement Agreement is intended or shall be construed to require the obligation, appropriation or expenditure of any money from the Treasury of the State of California by any State Regulatory Party other than the Licensee except as otherwise provided by law. The Licensee represents that all funds to be provided by it under this Settlement Agreement are not subject to the availability of annually appropriated funds from the State of California. However, the availability of funds may be delayed due to the failure of the state legislature to pass an annual budget by the State constitutional deadline of June 15. If there is such a delay in the state's annual budget, the Licensee shall take prompt action to make the delayed funds available upon passage of the state annual budget. The Parties agree there is no remedy for breach of contract for failure of the state legislature to pass an annual budget.

4.14 Implementation

4.14.1 Implementation Schedule

Licensee shall ensure that implementation of the PM&E measures stated in Appendix A shall begin after acceptance of the Final New Project License and be consistent with any schedule specified in Appendix A (as it may be modified by the New Project License). Licensee and other responsible Parties shall implement the measures stated in Appendix B consistent with the applicable schedules. Within 6 months after acceptance of the New Project License, the Licensee shall prepare and provide to all Parties and FERC the Licensee's planned detailed schedule for implementing the PM&E measures recommended in this Settlement Agreement and incorporated in the Final New Project License. The schedule shall specify dates for initiation, additional environmental review, permitting, design, development, progress reporting, monitoring, and completion, as appropriate, for each such PM&E measure and shall include milestones for major activities.

4.14.2 Permits

Upon acceptance of the New Project License and FERC approval of the applicable plans, Licensee shall apply for and use reasonable efforts to obtain in a timely manner and in final form all applicable federal, state, regional, and local permits, licenses, authorizations, certifications, determinations, and other governmental approvals for purposes of implementing this Settlement Agreement and the New Project License (Permits). The applications for such Permits shall be consistent with the terms of this Settlement Agreement. Each Party, upon the Licensee's request, shall use reasonable efforts to support the Licensee's applications for Permits, and shall not file comments or recommend Permit conditions that are Inconsistent with this Settlement Agreement. However, the duty to affirmatively support the Licensee's applications for Permits, such as filing letters in support, shall not apply to a Federal or State Regulatory Party not participating in the Permit application proceeding. The Licensee shall pay all fees required by law related to such Permits. The Parties shall work together and cooperate as appropriate during the permitting, environmental review, and implementation of this Agreement. Except as expressly provided in this Settlement Agreement, the Licensee shall not be required by this Settlement Agreement to implement an action required under this Settlement Agreement or the New Project License if a Permit has been denied, contains inconsistent or unreasonable conditions, or until all applicable Permits required for that action are obtained. If a proceeding challenging any Permit required for the action has been commenced, the Licensee shall be under no obligation under this Settlement Agreement to implement the action or any related action until any such proceeding is terminated. In the event any Permit has been denied, Licensee determines that the Permit contains inconsistent or unreasonable conditions, or any Permit is not obtained in a timely manner, the Parties shall confer to evaluate the effect of such event on implementation of this Settlement Agreement and seek to develop actions to respond to that event. If the Parties do not agree on actions to respond to that event and nonperformance or prolonged delay in performance of one or more PM&E measures due to the event materially reduces the benefit of this Settlement Agreement, a Party may initiate dispute resolution, except that dispute resolution regarding denial of a Permit shall be restricted to the issue of actions to respond to that event. In addition, if the event results in nonperformance or prevents performance of one or more PM&E measures for a prolonged period, the Parties recognize that re-initiation of consultation under the ESA may be required. Nothing contained in this section shall be construed to limit the Licensee's right to apply for a Permit before issuance of the New Project License, provided that any such applications shall not be Inconsistent with this Settlement Agreement.

4.15 Reopener or Amendment of New Project License

4.15.1 Reopener by a Party Other Than the Licensee

A Party to this Settlement Agreement, other than the Licensee, may seek to modify, or otherwise reopen during the term of this Settlement Agreement, the PM&E measures included in the New Project License, only if the Party, relying on Material New Information, reasonably demonstrates that such proposed modification or reopener is required to fulfill statutory, regulatory, or court-ordered responsibilities or is otherwise in the public interest. If the subject matter covered by the proposed reopener is within the scope of the EC, RAC, or other applicable committee, the Party seeking to reopen the license shall first bring the matter to the appropriate committee for consideration, unless an emergency exists wherein committee review is impracticable. The provisions of this Settlement Agreement shall remain in effect as unmodified by any reopener sought by any Party until the effective date of any order by FERC approving the reopener and amending the New Project License. As stated in proposed License Article A109, NMFS and Interior may prescribe fishways consistent with the Habitat Expansion Agreement (2006), attached to this Settlement Agreement as Appendix F.

4.15.1.1 Notice

Prior to seeking modification or reopener, a Party shall provide all Parties at least 90-days Notice to consider the Material New Information and that Party's position. This Notice requirement is satisfied when the Party brings the matter to the EC, RAC or other applicable committee. A Party shall not be required to comply with this 90-day Notice provision if it reasonably believes an emergency situation exists. In such an emergency situation, the Party shall give Notice to the EC, RAC, Forest Service, NMFS, Interior, State Water Resources Control Board, and the State Water Contractors within 5 days of recognition of the need for such modification or reopener. If a Party proposes a modification or reopener that another Party believes would be Inconsistent with this Settlement Agreement and objects, then the Dispute Resolution provisions of Section 5 apply, and the objecting Party must invoke Dispute Resolution during the 90-day Notice period or waive its objection.

4.15.2 Amendment of New Project License

Nothing in this Settlement Agreement is intended, or shall be construed, to affect or limit the right of the Licensee to seek amendments of the New Project License that are not Inconsistent with this Settlement Agreement. The Licensee may seek a Project license amendment that would be Inconsistent with this Settlement Agreement only if the Licensee, relying on Material New Information, or any other Party's proposal to modify or reopen under Section 4.13.1, or a challenge to any Biological Opinion issued for the New Project License after the

New Project License becomes final that results in an inconsistency with this Settlement Agreement, reasonably demonstrates such proposed amendment is required to fulfill statutory or regulatory responsibilities or is otherwise in the public interest. If the subject matter covered by the proposed amendment is within the scope of the EC, RAC, or other applicable committee, the Licensee shall first bring the matter to the appropriate committee for consideration, unless an emergency exists wherein committee review is impracticable. The provisions of this Settlement Agreement shall remain in effect as unmodified by any amendment sought by the Licensee until the effective date such amendment is approved by FERC.

4.15.2.1 Notice

Prior to filing a proposed license amendment that relates to the subject of this Settlement Agreement, the Licensee shall provide the other Parties at least 90-days Notice of its intention to do so. This Notice requirement is satisfied when the Licensee brings the matter to the EC, RAC or other applicable committee. Promptly following the giving of such Notice, the Licensee shall consult with Parties responding within 30 days of such Notice regarding the need for and the purpose of the amendment. If a Party believes the proposed amendment is Inconsistent with the Settlement Agreement and objects, then the Dispute Resolution provisions in Section 5 apply, and the objecting Party must invoke Dispute Resolution within this 90-day Notice period or waive its objection. The Licensee shall not be required to comply with this 90-day Notice provision if it believes an emergency situation exists or if required to meet its responsibilities under applicable law or an order of an agency with jurisdiction over the Licensee and provided further that the Licensee shall comply with any statutory or regulatory requirements for such notice or consultation. In such an emergency or compliance situation, the Licensee shall give Notice to the EC, RAC, Forest Service, NMFS, Interior, State Water Resources Control Board, and the State Water Contractors within 5 days of recognition of the need for such amendment.

4.15.2.2 Consultation on Amendments

Except as provided in the New Project License or in the case of an emergency, the Licensee shall allow a minimum of 30 days for any Party to comment and to make recommendations before filing any study, operating or implementing plan, report, or facility design with the Commission for any application for a Project license amendment that relates to a subject covered by this Settlement Agreement and where consultation with Federal or State Regulatory Parties or other Parties is required. If the Licensee does not adopt a recommendation or comment of a Party, it shall include in any filing with FERC copies of the comments/recommendations and an explanation as to why the comment/recommendation was not adopted.

4.15.2.3 Parties' Option to Intervene in Amendment Proceeding

The Licensee shall not oppose, based on the issue of standing, an intervention request by any Party in a proceeding for a Project license amendment that any Party has concluded would be Inconsistent with this Settlement Agreement. The Parties acknowledge that intervention in the relicensing proceeding docket at FERC does not make the Party an intervener in any post-licensing proceedings, such as an amendment proceeding.

4.16 Amendment of Settlement Agreement

This Settlement Agreement may be amended at any time through the term of the New Project License plus the term(s) of any annual license(s) that may be issued after the New Project License has expired, after Notice by the Party seeking amendment, with the unanimous agreement of all Parties still in existence, including any successor thereto. If the Licensee seeks to amend this Settlement Agreement, the Licensee shall give each Party at least sixty (60) days prior written Notice. Such Notice shall state that failure of any Party still in existence (excepting all such Federal, State, or local governmental agency Parties) to respond in writing or by electronic mail to the Licensee's Notice within the applicable 60-day period shall be deemed to be an approval of such amendment proposed by Licensee. Any amendment of this Settlement Agreement shall be in writing and executed by the responding Parties. The Parties recognize that any amendment to Appendix A of the Settlement Agreement may also require an amendment to the New Project License.

4.17 Consultation on Provisions in New Project License

Except as provided in the New Project License or in the case of an emergency, the Licensee, where consultation with the EC and/or other Party is required by this Settlement Agreement, shall allow a minimum of 30 days for EC and/or such Party to comment and to make recommendations before filing any study, operating, or implementing plan, report, or facility design with the Commission. If the Licensee does not adopt a recommendation or comment of the EC and/or such Party, it shall include in any filing with the Commission copies of the comments/recommendations and an explanation as to why the comment/recommendation was not adopted.

4.18 Project Boundary Modification

The Parties agree that the Licensee may seek the removal of a small amount of acreage from the Foreman Creek Unit of the Lake Oroville State Recreation Area from the Project Boundary for the purpose of making land available to Native American tribes for the purpose of reburial of repatriated human remains.

4.19 Cost Caps

Notwithstanding any inclusion in the New Project License of the Commission's reservation of rights to require the Licensee to undertake such measures as may be appropriate and reasonable to implement approved plans and other requirements in the New Project License in excess of the agreed-upon cost caps, the Parties agree to be bound by the cost caps in this Settlement Agreement, subject to any conditions or exceptions expressly provided in this Settlement Agreement. The Parties agree not to seek the Licensee's expenditure of additional funds in excess of the agreed-upon cost caps if the Licensee is in compliance with the relevant license article. Cost caps may be adjusted by Section 7.1 of this Settlement Agreement. Cost caps do not include those items identified as cost estimates.

5. Dispute Resolution

5.1 General Applicability

5.1.1 All disputes among the Parties regarding any Party's performance or compliance with this Settlement Agreement, including resolution of any disputes related to any provision of the New Project License, Final Mandatory Terms and Conditions, Section 401 Certification, Permits related to the New Project License, or other mandatory license condition that is Inconsistent with the Settlement, shall be the subject to the dispute resolution process provided in this Section 5, unless otherwise specifically provided in this Settlement Agreement. The Parties agree that disputes shall be brought in a prompt and timely manner.

5.1.2 The Disputing Parties shall devote such resources as are needed and as can be reasonably provided to resolve the dispute expeditiously.

5.1.3 The Disputing Parties shall cooperate in good faith to promptly schedule, attend and participate in the dispute resolution.

5.1.4 Unless otherwise agreed among the Disputing Parties, each Disputing Party shall bear its own costs for its participation in this or any administrative dispute resolution process related to the Settlement Agreement.

5.1.5 Each Disputing Party shall promptly implement any resolution of the dispute.

5.1.6 The dispute resolution process in this Section does not preclude any Party from timely filing and pursuing an action for administrative or judicial relief of any FERC order, compliance matter, or other regulatory action related to the New Project License; provided that any such Party shall pursue dispute resolution

pursuant to this process as soon as practicable thereafter or concurrently therewith.

5.1.7 The Party initiating a dispute under this Section shall notify FERC when dispute resolution proceedings are initiated relevant to an issue related to the New Project License. The Parties acknowledge that the initiation of dispute resolution proceedings shall have no effect on filing deadlines or applicable statutes of limitation before FERC.

5.2 Process

5.2.1 Dispute Initiation Notice. A Party claiming a dispute shall give Notice of the dispute. If the dispute includes a claim that the New Project License, or any preliminary or final condition thereof, is Inconsistent with this Settlement Agreement, the Notice shall be issued within the applicable time periods specified in Section 4. Such Notice shall describe: (A) the matter(s) in dispute, (B) the identity of any other Party alleged to have not performed an obligation provided by the Settlement Agreement, and (C) the specific relief sought. The Parties agree that disputes shall be brought in a prompt and timely manner.

5.2.2 Informal Meetings. The Disputing Parties shall hold at least two informal meetings to resolve the dispute, commencing within 30 days after the Dispute Initiation Notice.

5.2.2.1 If the dispute arises after acceptance of the New Project License and falls within the scope of the Ecological Committee or Recreation Advisory Committee, the dispute shall be referred to that committee if: (A) the Settlement Agreement or New Project License expressly assigns the disputed matter to the committee or (B) a quorum of the Committee members provide Notice of their intent to participate in the dispute resolution. In the event of such referral, all members of the Committee shall be deemed "Disputing Parties." For this purpose, a quorum shall mean two-thirds of the voting members of the committee.

5.2.2.2 The committees shall attempt to resolve the matter according to the internal decision rules for the committees. Specifically, in the Ecological Committee, decisions are made by consensus as provided in Section 4.2 of Appendix C. In the Recreation Advisory Committee, advice and recommendations are made by a majority plus one vote as provided in Section 4.4 of the Recreation Management Plan. If the dispute is properly referred to both committees, then the committees shall hold a joint meeting to consider the dispute. Any decisions made in such a joint meeting shall be by consensus as provided in Section 4.2 of Appendix C. A committee's consideration of a dispute under this provision shall fulfill the requirement of the two informal meetings otherwise required for disputes not within the scope of a committee.

5.2.3 Mediation. If the dispute is not resolved in the informal meetings or by the Ecological Committee or Recreation Advisory Committee, the Disputing Parties shall decide whether to use a neutral mediator, such as FERC's Office of Dispute Resolution Services. The decision whether to pursue mediation shall be made within 20 days after conclusion of the informal meeting in Section 5.2.2. The Disputing Parties shall agree on an appropriate allocation of any costs of the mediator employed under this section. Mediation shall not occur if the Disputing Parties cannot agree on the allocation of costs. The Disputing Parties shall select a mediator within 30 days of the decision to pursue mediation, including the agreement of allocation of costs. The mediation process shall be concluded not later than 60 days after the mediator is selected. The above time periods may be shortened or lengthened upon mutual agreement of the Disputing Parties.

5.2.4. Dispute Resolution Notice. The Disputing Parties shall provide Notice of any resolution of the dispute achieved under Sections 5.2.2 - 5.2.3. The Notice shall: (A) restate the disputed matter, as initially described in the Dispute Initiation Notice; (B) describe the alternatives which the Disputing Parties considered for resolution; (C) state whether resolution was achieved, in whole or part, and state the specific relief agreed-to as part of the resolution.

5.3 Enforcement of Settlement Agreement After Dispute Resolution

5.3.1 Enforcement Regarding New Project License. A Disputing Party may seek administrative or judicial relief for an unresolved dispute regarding the Licensee's performance of its obligations under the New Project License only after exhaustion of the dispute resolution process under Section 5. Any such relief shall be sought and obtained from FERC or other appropriate regulatory or judicial forum. No Party to the Settlement Agreement may seek damages for breach of the Proposed License Articles stated in Appendix A, whether before or after acceptance of the New Project License.

5.3.2 Enforcement Regarding Contractual Obligations. A Disputing Party may seek administrative or judicial relief for breach of a contractual obligation established by this Settlement Agreement only after exhaustion of the dispute resolution process in Section 5. Venue for such action shall lie in a court with jurisdiction located in Sacramento, California. In such action, a Disputing Party may only seek specific performance of the contractual obligation or other equitable relief. No Party shall be liable for damages for such breach of contractual obligations. By executing this Settlement Agreement, no Party waives any equitable or legal defenses that may be available.

6. Withdrawal from Settlement Agreement

6.1 Withdrawal of Party from Settlement

A Party may withdraw from this Settlement Agreement only if (a) it objects to an order issuing a New Project License that is Inconsistent with this Settlement or to a Biological Opinion issued before the New Project License becomes final that is Inconsistent with this Settlement Agreement, (b) it has complied with the required dispute resolution procedures stated in Section 5 to attempt to resolve the objection, and (c) that Party does not file for appeal. If the Party files an appeal to resolve the inconsistency, that Party may not withdraw until its appeal is exhausted. In addition, the Licensee may withdraw as provided in Section 6.2. A Party that withdraws will provide Notice of withdrawal, including its basis for withdrawal.

6.2 Withdrawal of Licensee from Settlement Agreement Prior to Acceptance of the New Project License.

In addition to the provisions of Section 6.1, prior to the acceptance of the New Project License, the Licensee may withdraw from this Settlement Agreement without first complying with the Dispute Resolution process stated in Section 5 if a Party withdraws from this Settlement Agreement and the Licensee reasonably determines at its sole discretion, after providing the other Parties a reasonable opportunity to meet and discuss with Parties, that the withdrawal: (a) may adversely affect the likelihood of NMFS or Interior issuing biological opinions not Inconsistent with this Settlement Agreement, or (b) substantially diminishes the value of this Settlement Agreement. Licensee shall give Notice identifying the reason for withdrawal within 30 days of the Licensee's knowledge of the event creating the right to withdraw. If Licensee withdraws from Settlement Agreement, Licensee agrees to support any Federal or State Regulatory Party's request of FERC for a stay of the licensing process to allow the Federal or State Regulatory Party to comply with FERC's regulatory processes.

6.3 Effective Date of Withdrawal

Withdrawal by a Party shall become effective 10 calendar days after Notice is given by the withdrawing Party.

6.4 Effect of Withdrawal on the Project Supplemental Benefits Fund

6.4.1 Effect of Withdrawal of the Licensee on the Project Supplemental Benefits Fund. If the Licensee elects to withdraw from this Settlement Agreement, it and the State Water Contractors shall thereafter initiate negotiations with the Fund Administrator within 30 days and those three parties shall use their best efforts to reach agreement within 6 months with respect to a reasonable, separate agreement with the Fund Administrator for a revised Supplemental Benefits Fund agreement. The goal of the new Supplemental Benefits Fund agreement would

be to achieve a reasonable new balance of the benefits expected by the parties to the Supplemental Benefits Fund portion of Appendix B, taking into account the increase in costs and burdens and the decrease in value of the license issued by FERC.

6.4.2 Effect of Withdrawal of the State Water Contractors on the Project Supplemental Benefits Fund. If the State Water Contractors elect to withdraw from this Settlement Agreement, it and the Licensee shall thereafter initiate negotiations with the Fund Administrator within 30 days and those three parties shall use their best efforts to reach agreement within 6 months with respect to a reasonable, separate agreement with the Fund Administrator for a revised Supplemental Benefits Fund agreement. The goal of the new Supplemental Benefits Fund agreement would be to achieve a reasonable new balance of the benefits expected by the parties to the Supplemental Benefits Fund portion of Appendix B, taking into account the increase in costs and burdens and the decrease in value of the license issued by FERC.

6.4.3 Effect of Withdrawal of the City of Oroville on the Project Supplemental Benefits Fund. If the City of Oroville withdraws from the Settlement Agreement, if necessary the Licensee shall consult with the other Parties and designate a new Fund Administrator pursuant to Paragraph C (1.0) of the Project Supplemental Benefits Fund portion of Appendix B. Further, the Licensee and the State Water Contractors shall thereafter initiate negotiations with the Steering Committee and those parties shall attempt to reach agreement within 6 months with respect to a reasonable, separate agreement for a revised Supplemental Benefits Fund agreement. The new Supplemental Benefits Fund agreement may be a substantially smaller Supplemental Benefits Fund reflecting a significantly different balance of the benefits expected by the parties to the Supplemental Benefits Fund portion of Appendix B, reflecting a decrease in value to the Licensee and the State Water Contractors due to the withdrawal of the member of the Supplemental Benefits Fund Steering Committee from the Settlement Agreement and the loss of their support for the new license at FERC.

6.5 Continuity After Withdrawal

The withdrawal of a Party, other than the Licensee, does not terminate this Settlement Agreement for the remaining Parties. If a Party withdraws from this Settlement Agreement, the withdrawing Party shall not be bound by any term contained in this Settlement Agreement, except as provided in Section 2.2. The withdrawing Party shall not use any documents and communications related to the development, execution, and submittal of this Settlement Agreement to FERC as evidence, admission, or argument in any forum or proceeding for any purpose to the fullest extent allowed by applicable law, including 18 C.F.R. § 385.606. This provision does not apply to the results of resource studies or other technical information developed for use by the Collaborative. This provision does

not apply to any information that was in the public domain prior to the development of this Settlement Agreement or that became part of the public domain at some later time through no unauthorized act or omission by any Party. This provision does not apply to: (a) any information held by a federal agency that is not protected from disclosure pursuant to the Freedom of Information Act or other applicable law; or (b) any information held by a state or local agency that is not protected from disclosure pursuant to the California Public Records Act or other applicable state or federal law. The withdrawing Party shall continue to maintain the confidentiality of all settlement communications to the extent permitted by applicable law.

6.6 Termination of Settlement Agreement

This Settlement Agreement shall terminate as to all Parties and have no further force or effect upon expiration of the New Project License and any annual licenses issued after expiration thereof or upon withdrawal from this Settlement Agreement by the Licensee. Upon termination, all documents and communications related to its development, execution, and submittal of this Settlement Agreement to FERC shall not be used as evidence, admission, or argument in any forum or proceeding for any purpose to the fullest extent allowed by applicable law, including 18 C.F.R. § 385.606. This provision does not apply to the results of resource studies or other technical information developed for use by the Collaborative. This provision does not apply to any information that was in the public domain prior to the development of this Settlement Agreement or that became part of the public domain at some later time through no unauthorized act or omission by any Party. This provision does not apply to: (a) any information held by a federal agency that is not protected from disclosure pursuant to the Freedom of Information Act or other applicable law; or (b) any information held by a state or local agency that is not protected from disclosure pursuant to the California Public Records Act or other applicable state or federal law. Notwithstanding the termination of this Settlement Agreement, all Parties shall continue to maintain the confidentiality of all settlement communications to the extent permitted by applicable law, and all Parties remain subject to Section 2.2 of this Settlement Agreement.

7. General Provisions

7.1 Escalation of Costs

Unless otherwise indicated, costs specified in this Settlement Agreement shall be escalated (starting in December 2005) based upon a Composite Index defined as the arithmetic average of the Producer Price Index for the Materials and Components for Construction (Producer Price Index) published by the U.S. Department of Labor Bureau of Labor Statistics and the Gross Domestic Product Implicit Price Deflator published by the U.S. Department of Commerce Bureau of Economic Analysis. The Composite Index will be computed on January 31 of

each year or the next business day if January 31 is a state holiday or a weekend day. The computation will use the latest version of data available as of January 31 for the annual average values of the Producer Price Index and the Gross Domestic Product Implicit Price Deflator ending December 31 of the prior year. The Composite Index will not be adjusted during the year and its value will remain constant from January 31 of one year to January 30 of the following year.

If during the term of the New Project License either of the two indices are significantly modified or eliminated, then the time value of money shall be based on the remaining index. If both indices are significantly modified or eliminated, the Licensee shall propose a new index or combination of indices and the Parties shall use their best efforts to agree on a substitute index. If the Parties are unable to reach agreement on a substitute index within a reasonable amount of time, or by January 31 if needed sooner, then the Licensee's proposed index shall be used.

This provision does not apply to the Supplemental Benefits Fund set forth in Appendix B.

7.2 Non-Severable Terms of Settlement Agreement

The terms of this Settlement Agreement are not severable one from the other. This Settlement Agreement is made on the understanding that each term is in consideration and support of every other term, and each term is a necessary part of the entire Settlement Agreement. If a court of competent jurisdiction rules that any provision in Sections 1 through 8.2 of this Settlement Agreement is invalid, this Settlement Agreement is deemed modified to conform to such ruling, unless a Party objects. If a Party objects, the other Parties agree to meet and confer regarding the continued viability of this Settlement Agreement.

7.3 Relationship to Water Rights

Nothing in this Settlement Agreement is intended, or shall be construed to, affect any non-Party's existing rights. Nothing in this Settlement Agreement is intended to, or shall be construed to, affect any Party's contract or water rights except as provided by this Settlement Agreement.

7.4 No Third-Party Beneficiaries

This Settlement Agreement shall not create any right or interest in the public, or any member thereof, as a third-party beneficiary hereof, and shall not authorize any non-Party to maintain a suit at law or equity pursuant to this Settlement Agreement. The duties, obligations, and responsibilities of the parties with respect to third parties shall remain as imposed under applicable law.

7.5 Successors and Assigns

This Settlement Agreement shall be binding on and inure to the benefit of the Parties and their successors and approved assigns, unless otherwise specified in this Settlement.

7.5.1 Assignment

Any voluntary assignment by a Party shall not be effective unless approved by the Licensee, which approval shall not be unreasonably withheld. A partial assignment is not permitted. After the Licensee's approval of the assignment, the assignee shall sign the Settlement Agreement and become a Party.

7.5.2 Succession

In the event of succession between public agencies, whether by statute, executive order, or operation of law, the successor agency shall become a Party to and be bound by the terms of this Settlement Agreement, to the extent permitted by law.

7.5.3 Continuation of Certain Obligations

7.5.3.1 Upon completion of a succession or assignment, the initial Party shall no longer be a Party. It shall continue to be bound by Sections 2.2, 6.5, 6.6, 7.4, and 7.5. Except as provided in Sections 3 and 4, the initial Party shall not take any action adverse to the Settlement Agreement, or the New Project License to the extent it incorporates the Settlement Agreement.

7.5.3.2 No change in ownership of the Project or transfer of the existing or New Project License by the Licensee shall in any way modify or otherwise affect any other Party's rights or obligations under this Settlement Agreement. Unless prohibited by applicable law, the Licensee shall require in any transaction for a change in ownership of the Project or transfer of the existing or New Project License, that such new owner shall be bound by, and shall assume all of the rights and obligations of the Licensee under this Settlement Agreement upon completion of the change of ownership and approval by FERC of the license transfer.

7.5.4 Notice

A Licensee transferring pursuant to Section 7.5.3.2 or an assigning Party shall provide Notice to the other Parties at least 30 days prior to the proposed effective date of such transfer or assignment.

7.6 Extension of Time; Inability to Perform

7.6.1 Obligations under New Project License

7.6.1.1 Extension of Time

If Licensee has good cause, consistent with FERC's standard in 18 C.F.R. § 385.2008, to seek an extension of time to fulfill an obligation under the New Project License, the Licensee may file with FERC such a request. The Parties acknowledge that FERC's standard for any such request shall apply. If any Party provides Notice that it disputes the good cause for extension, the Licensee and the Disputing Party shall follow the dispute resolution process in Section 5 of this Settlement Agreement. If the dispute cannot be timely resolved by such process, the Licensee may proceed with its request, if it has not done so already, and any Disputing Party may oppose the request.

7.6.1.2 Inability of Licensee to Perform

If the Licensee is unable to perform an obligation under the New Project License due to an event or circumstances beyond its reasonable control, the Licensee may file with FERC an appropriate request for relief. The Parties acknowledge that FERC's standard for any such request shall apply. If any Party provides Notice that it disputes the non-performance, the Licensee and the Disputing Party shall follow the dispute resolution process in Section 5 of this Settlement Agreement. If the dispute cannot be timely resolved by such process, the Licensee may proceed with its request to FERC, if it has not done so already, and any Disputing Party may oppose the Licensee's request.

7.6.2 Contractual Obligations

No Party shall be in breach of a contractual obligation under this Settlement Agreement, as established by Sections 1 through 8.2 and Appendix B of this Settlement Agreement, if it is unable to perform or delays performance due to any Uncontrollable Force reasonably beyond its control, unless otherwise provided by this Settlement Agreement. For this purpose, a "Uncontrollable Force" may include, but is not limited to, natural events, labor or civil disruption, action or non-action of a governmental agency (other than DWR), or breakdown or failure of the Project works.

7.6.3 Provisions Applicable to New Project License and Contractual Obligations

7.6.3.1 Delay in Funding

As provided in Section 4.11, the availability of funds may be delayed due to the failure of the California Legislature to pass an annual budget by the State constitutional deadline of June 15. If the Licensee determines that any funds needed to fulfill any of its obligations under the New Project License or Appendix

B, including funding to another state agency, are delayed due to any such failure, then Licensee shall provide the Notice required by Section 7.6.3.2. The Notice also shall include a good faith estimate by the Licensee of the amount of the funds delayed and the Licensee's obligations that were to be funded. Upon passage of the State annual budget, the Licensee shall take prompt action to make the delayed funds available. In the event of such a delay in performance of an obligation under the New Project License, the Licensee shall seek an extension of time as provided in Section 7.6.1.1.

7.6.3.2 Notice of Delay or Inability to Perform

The Party whose performance of an obligation under this Settlement Agreement is affected by any delay or inability to perform under Section 7.6 shall provide Notice as soon as reasonably practicable. This Notice shall include: (1) a description of the event causing the delay or anticipated delay; (2) an estimate of the anticipated length of the delay; (3) a description of the measures taken or to be taken to avoid or minimize the delay; and (4) a proposed timetable for the implementation of the measures or performance of the obligation. The affected Party shall make all reasonable efforts to promptly resume performance of the obligation. It shall provide Notice when it resumes performance of the obligation.

7.7 Governing Law

The New Project License and any other terms of this Settlement Agreement over which a federal agency has statutory or regulatory jurisdiction shall be governed, construed, and enforced in accordance with such authorities. This Settlement Agreement shall otherwise be governed and construed under the laws of the State of California. By executing this Settlement Agreement, no federal agency is consenting to the jurisdiction of a state court unless such jurisdiction otherwise exists. All activities undertaken pursuant to this Settlement Agreement shall be in compliance with all applicable law.

7.8 Elected Officials Not to Benefit

No elected officials shall be entitled to any share or part of this Settlement Agreement or to any benefit that may arise from it.

7.9 No Partnership

Except as otherwise expressly set forth herein, this Settlement Agreement does not and shall not be deemed to make any Party the agent for, partner of, or joint venturer with any other Party.

7.10 Reference to Regulations

Any reference in this Settlement Agreement to any federal or state regulation shall be deemed to be a reference to such regulation, or successor regulation, in existence as of the date of the action at the time in question.

7.11 Notice

Except as otherwise provided in this Section, any Notice required by this Settlement Agreement shall be written. To the extent practicable, Notice shall be sent to all Parties still in existence and to the State Water Resources Control Board by first-class mail or comparable method of distribution, and as applicable, filed with FERC. For the purpose of this Settlement Agreement and unless otherwise specified, a Notice shall be effective upon receipt, but if provided by U.S. Mail, seven (7) days after the date on which it is mailed. The Parties agree that if practicable, e-mail or fax are the preferred methods of providing Notice under this Settlement Agreement. When this Settlement Agreement requires Notice in fewer than seven (7) days, Notice shall be provided by telephone, facsimile, or electronic mail and shall be effective when provided. For the purpose of Notice, the list of authorized representatives of the Parties and State Water Resources Control Board as of the Effective Date is attached as Appendix G. The Licensee shall keep the names and contact information for the Parties to this Settlement Agreement. The Parties and State Water Resources Control Board shall provide Notice of any change in the authorized representatives designated in Appendix G, and the Licensee shall maintain the current distribution list of such representatives. The Parties agree it is their responsibility to keep Licensee informed of their current address, telephone, facsimile and electronic mail information, and that failure to provide Licensee with current contact information will result in a waiver of that Party's right to Notice under this Settlement Agreement.

7.12 Section Titles for Convenience Only

The titles for the Sections of this Settlement Agreement are used only for convenience of reference and organization and shall not be used to modify, explain, or interpret any of the provisions of this Settlement Agreement or the intentions of the Parties. This Settlement Agreement has been jointly drafted by the Parties and therefore shall be construed according to its plain meaning and not for or against any Party.

8. Execution of Settlement Agreement

8.1 Signatory Authority

Each signatory to this Settlement Agreement certifies that he or she is authorized to execute this Settlement Agreement and to legally bind the Party he or she represents, and that such Party shall be fully bound by the terms hereof upon such signature without any further act, approval, or authorization by such Party.

8.2 Signing in Counterparts

This Settlement Agreement may be executed in any number of counterparts, and each executed counterpart shall have the same force and effect as an original instrument as if all the signatory Parties to all of the counterparts had signed the same instrument. Any signature page of this Settlement Agreement may be detached from any counterpart of this Settlement Agreement without impairing the legal effect of any signatures thereon, and may be attached to another counterpart of this Settlement Agreement identical in form hereto but having attached to it one or more signature pages.

Alameda County Flood Control and Water Conservation District, Zone 7

_____

Vince Wong , Assistant General Manager

Alameda County Water District

_____

Paul Piraino, General Manager

American Rivers

_____

Rebecca Wodder, President

American Whitewater

_____

Dave Steindorf, California Stewardship Director

Antelope Valley – East Kern Water Agency

_____

Andy Rutledge, President, Board of Directors

Berry Creek Citizens Association

_____

Loren Gill, President

California Department of Boating and Waterways

_____

Raynor Tsuneyoshi, Director

California Department of Fish and Game

_____

Ryan Broddrick, Director

California Department of Parks and Recreation

_____

Ruth Coleman, Director

California Department of Water Resources

_____

Lester Snow, Director

California State Horsemen's Association

_____

Robert C. Adams, President

California State Horsemen's Association Region II

_____

Liz Murphy, Trails Chairperson

Castaic Lake Water Agency

_____

Dan Masnada, General Manager

Central Coast Water Authority

_____

Leo Trujillo, Chair, Board of Directors

Chico Paddleheads

_____

Dave Steindorf, Conservation Chair

Citizens for Fair and Equitable Recreation

_____

Larry Grundmann, Representative

City of Oroville

_____

Gordon Andoe, Mayor

Coachella Valley Water District

_____

Steve Robbins, General Manager/Chief Engineer

County of Kings

_____

Tony Oliveira, Chair, Board of Supervisors

Crestline – Lake Arrowhead Water Agency

_____

Roxanne M. Holmes, General Manager

Desert Water Agency

_____

David Luker, General Manager

Empire West Side Irrigation District

_____

John Howe, Member, Board of Directors

Feather River Low Flow Alliance

_____

John Allen

Feather River Recreation and Parks District

_____

Vene Thompson, Board of Directors

International Mountain Bicycling Association

_____

Jim Haagen-Smit, State Representative

Kern County Water Agency

_____

James Beck, General Manager

Kon Kow Valley Band of Maidu

_____

Patsy Seek, Chairwoman

Lake Oroville Bicyclist Organization

_____

Lyle Wright, President

Littlerock Creek Irrigation District

_____

Brad Bones, General Manager

Metropolitan Water District of Southern California

_____

Jeffrey Kightlinger, General Manager

Mojave Water Agency

_____

Kirby Brill, General Manager

Napa County Flood Control and Water Conservation District

_____

Don Ridenhour, Assistant District Engineer

National Marine Fisheries Service

_____

Rodney McInnis, Regional Administrator

Oak Flat Water District

_____

William Harrison, General Manager

Oroville Area Chamber of Commerce

_____

Don Reighley

Oroville Downtown Business Association

_____

Kristine Armstrong, President

Oroville Economic Development Corporation

_____

Bud Tracy, President

Oroville Parks Commission

_____

Carolyn Norton, Chairperson

Oroville Recreation Advisory Committee

_____

Kevin Zeitler, Chairman

Oroville Redevelopment Agency

_____

Robert Sharkey, Chairperson

Oroville Rotary Club

_____

Michael Hutton, President

Palmdale Water District

_____

Jon Pernula, Facilities and Operations Manager

San Bernardino Valley Municipal Water District

_____

Robert L. Reiter, General Manager and Chief Engineer

San Gabriel Valley Municipal Water District

_____

Darin Kasamoto, General Manager

San Gorgonio Pass Water Agency

_____

Jeff Davis, General Manager

Santa Clara Valley Water District

_____

Stanley M. Williams, Chief Executive Officer

Solano County Water Agency

_____

David Okita, General Manager

State Water Contractors, Inc.

_____

Terry Erlewine, General Manager

Town of Paradise

_____

Melvin “Sam” Dresser, Mayor

Tulare Lake Basin Water Storage District

_____

Brent L. Graham, General Manager

United States Department of Interior

_____

Daniel G. Shillito, Regional Solicitor, Pacific Southwest Region

INDIVIDUAL SIGNATORIES TO THIS SETTLEMENT AGREEMENT

Arthur G. Baggett, Jr.[*]

_____

DC Jones

_____

[*] Mr. Baggett is signing this Settlement Agreement as a recommendation to the California State Water Resources Control Board, and not as a Party to the Settlement Agreement. Mr. Baggett will not be participating in the State Water Resources Control Board’s consideration of the Licensee’s petition for water quality certification for the Project pursuant to Section 401 of the federal Clean Water Act.

APPENDIX A

Protection, Mitigation, and Enhancement Measures Recommended to be Included in New Project License

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ENVIRONMENTAL PROVISIONS

Ecological Committee

Article A100. Ecological Committee

Within three months following license issuance, Licensee shall establish and convene an Ecological Committee for the purpose of consultation, review of plans and providing advice to the Licensee as expressly provided in specific license articles pursuant to the procedures stated in the Settlement Agreement Appendix C.

Fish and Wildlife Improvement Program

Article A101. Lower Feather River Habitat Improvement Plan

(a) Within three years following license issuance, the Licensee shall develop a comprehensive Lower Feather River Habitat Improvement Plan. The Plan shall provide an overall strategy for managing the various environmental measures developed for implementation within the areas integrated in the Plan, including the implementation schedules, monitoring, and reporting. The Plan shall be developed in consultation with the Ecological Committee, including specifically U.S. Fish and Wildlife Service, National Marine Fisheries Service, California Department of Fish and Game, California State Water Resources Control Board, and Central Valley Regional Water Quality Control Board (consultees), and in coordination with the Feather River Technical Team. Upon completion of the development of the Plan, the Licensee shall submit the Plan to the Commission for information.

(b) Each of the programs and components of the Lower Feather River Habitat Improvement Plan shall be individually evaluated to assess the overall effectiveness of each action within the Lower Feather River Habitat Improvement Plan. Each program or component may be updated or modified as appropriate to continue to best meet the Plan goals.

(c) The following programs and plans shall be included in the comprehensive Lower Feather River Habitat Improvement Plan:

(1) Gravel Supplementation and Improvement Program

(2) Channel Improvement Program

(3) Structural Habitat Supplementation and Improvement Program

(4) Fish Weir Program

(5) Riparian and Floodplain Improvement Program including the evaluation of pulse/flood flows

(6) Feather River Fish Hatchery Improvement Program

(7) Comprehensive Water Quality Monitoring Program

(8) Oroville Wildlife Area Management Plan

(9) Instream Flow and Temperature Improvement for Anadromous Fish.

(d) The Plan shall provide for and include:

(1) Coordination of implementation and monitoring activities agreed to in the individual components included in the comprehensive Plan;

(2) Coordination with any Project-specific biological opinions and Operations Criteria and Plan findings or recommendations;

(3) Annual reporting of monitoring results and activities, if appropriate, for the individual components to the Ecological Committee throughout the term of the license;

(4) The integration of the programs and plans listed in subdivision (c) above, including an evaluation of synergistic effects and an evaluation and consideration of predation management; and

(5) Development of a single, comprehensive monitoring and adaptive management summary report by the Licensee as set forth in (e) below.

(e) During the sixth year following license issuance and at five year intervals for the duration of the license, the Licensee shall develop and submit a single, comprehensive monitoring and adaptive management summary report. The Lower Feather River Habitat Improvement Plan report shall be submitted to the consultees listed in (a) above for review and comment at least 60 days prior to filing the report with the Commission. The Licensee shall submit the report to the Commission for information. The comprehensive report shall include the results of each of the various components of each program during the implementation period. The report shall also include information on any proposed changes or updates to the individual plans or programs within the Lower Feather River Habitat Improvement Plan.

Article A102. Gravel Supplementation and Improvement Program

(a) Within two years following license issuance, the Licensee shall develop and file for Commission approval, a Gravel Supplementation and Improvement Program Plan to address gravel management for the lower Feather River throughout the term of the license. The Plan shall be developed in consultation with the Ecological Committee, including specifically the U.S. Fish and Wildlife Service, National Marine Fisheries Service, the California Department of Fish and Game, and the State Water Resources Control Board (consultees). The Licensee shall include with the filing of the Plan copies of the comments, including recommendations, made in the course of such consultation, and an explanation as to why any such comment was not adopted. Upon Commission approval, and after obtaining all necessary permits, the Licensee shall implement the Plan, including any changes required by the Commission. The Commission reserves the right to make further changes to the Plan.

(b) The Licensee, in consultation with the consultees listed in A102(a) above, shall coordinate the gravel supplementation activities with the measures conducted within the Lower Feather River Habitat Improvement Plan.

(c) The Plan shall include a schedule to complete, within five years of license issuance, the supplementation of at least 8,300 cubic yards over the December 31, 2006 baseline of spawning gravels suitable for spring-run Chinook salmon or steelhead which shall be distributed over up to 15 locations in the Low Flow Channel or High Flow Channel of the Feather River.

(d) The Plan shall provide for: (1) a physical assessment of the spawning riffles from River Mile 54.2 up to River Mile 67.2 of the Feather River; (2) a gravel budget for the Low Flow Channel and, if necessary, portions of the High Flow Channel within the Project Boundary; (3) a strategy to augment existing gravel recruitment beyond the 8300 cubic yards referenced in subdivision (c) above in the Low Flow Channel and High Flow Channel with gravel injections, placements, or other methods developed through site-specific investigations; (4) plans to monitor and evaluate the effectiveness of gravel augmentation, particularly the biological response of fish species to the gravel supplementation and enhancement activities; (5) an annual summary account of the activities conducted; and (6) coordination with other components of the license and the Lower Feather River Habitat Improvement Plan to enhance natural reproduction of steelhead and Chinook salmon.

(e) The Gravel Supplementation and Improvement Program Plan shall also include the following measures, criteria and timelines:

(1) All work within the Ordinary High Water mark of the Lower Feather River shall take place during the months of June and July, or at other times as allowed by permit conditions to produce minimal impact to the target species (steelhead and Chinook salmon) and other river attributes (*i.e.* water quality).

(2) Gravel placement or riffle rehabilitation at the treated riffles shall, where feasible, cover the extent of naturally observed spawning areas, be within an area extending between river banks, and extend at least 50 feet upstream and 50 feet downstream of the riffle, and be a depth of at least one foot.

(3) Licensee shall monitor and replenish or rehabilitate gravel at individual sites every five years, as needed, for the term of the License. At five year intervals after the initial supplementation period, the Licensee shall monitor and maintain a minimum of 10 riffle complexes in the Low Flow Channel so that approximately 80% of the spawning gravels randomly sampled in riffle complexes shall be in the median size range preferred by Chinook salmon or steelhead. All work will be done in consultation with the consultees listed in A102(a) above. High flow events shall be defined in the Gravel Supplementation and Improvement Plan.

(4) The Licensee, in consultation with the consultees listed in A102(a) above, shall also determine the need for additional gravel supplementation activities to be conducted in the High Flow Channel of the Feather River (within the Project Boundary). If and when the need arises, but no sooner than ten years after license issuance, the Licensee shall prepare a gravel budget for supplementation activities in the High Flow Channel of the lower Feather River (within the Project Boundary). This budget shall include the staging of spawning gravel stockpiles, of up to 2,000 cubic yards, of a size distribution determined by the Licensee in consultation with the consultees listed in A102(a) above in the immediate vicinity below or near the pool below the Thermalito Afterbay Outlet.

(f) The Licensee shall prepare an annual summary report describing the activities completed pursuant to the Program and submit the report to the consultees listed in A102(a) above. Throughout the term of the license, the Licensee shall compile these annual reports at least once every five years in the Lower Feather River Habitat Improvement Plan Report.

(g) The Licensee, in consultation with the consultees listed in A102(a) above, shall reevaluate the Gravel Supplementation and Improvement Program Plan every five years after initial implementation. Every five years the Licensee shall submit for the Commission's information a Lower Feather River Habitat Improvement Plan report which includes any Plan updates. If any changes are recommended beyond the objectives, activities, or schedules identified in this article or the Gravel Supplementation and Improvement Program Plan, the Licensee shall submit final recommendations to the Commission for approval. The Licensee shall include with the filing copies of the comments, including recommendations, made in the course of such consultation, and an explanation as to why any such comment was not adopted. Upon Commission approval, the Licensee shall implement the Gravel Supplementation and

Improvement Program Plan, including any changes required by the Commission. The Commission reserves the right to make further changes to the Plan. The Licensee shall include any Commission approved revisions to the Plan into any updates to the Lower Feather River Habitat Improvement Plan set forth in Article A101.

Article A103. Channel Improvement Program

(a) Within one year of license issuance, the Licensee shall develop and file for Commission approval a Moe and Hatchery Ditch Plan to improve two existing side channels at the upstream end of the low flow channel, Moe's Ditch, and Hatchery Ditch, by modifying these channels to provide suitable discharge, velocity, depth, substrate, cover and riparian vegetation to support salmonid spawning and rearing. The Plan shall be developed in consultation with the Ecological Committee, including specifically the U.S. Fish and Wildlife Service, National Marine Fisheries Service, and the California Department of Fish and Game (consultees). The Licensee shall include with the filing of the Moe and Hatchery Ditch Plans copies of the comments, including recommendations, made in the course of such consultation, and an explanation as to why any such comment was not adopted. The Plan shall include a schedule to complete the improvements to Moe's Ditch and Hatchery Ditch within three years of license issuance. Upon Commission approval, and after obtaining all necessary permits, the Licensee shall implement the Plan, including any changes required by the Commission. The Commission reserves the right to make further changes to the Plan.

(b) Within four years of license issuance, the Licensee shall develop and file for Commission approval a Channel Construction Plan to identify and construct, within ten years of license issuance, five additional side channel riffle/glide complexes of not less than a cumulative total of 2,460 feet in length of new habitat. These side channels shall be located and designed to maximize quantity/quality of suitable salmonid attributes (depth, velocity, substrate, cover, and vegetation) while minimizing the potential for warming, stranding, and predation problems. The Plan shall be developed in consultation with the consultees listed in A103(a) above. The Licensee shall including with the filing of the Channel Construction Plan copies of the comments, including recommendations, made in the course of such consultation, and an explanation as to why any such comment was not adopted. Upon Commission approval, and after obtaining all necessary permits, the Licensee shall implement the Plan, including any changes required by the Commission. The Commission reserves the right to make further changes to the Plan.

(c) Maintenance activities shall be developed by the Licensee in consultation with the consultees listed in A103(a) above. Maintenance activities shall occur at least every five years, or as often as necessary to maintain channel functions. High flow events shall be defined in the Channel Construction Plan.

(d) Licensee shall annually collect data appropriate for evaluating the effectiveness of the Channel Improvement Program and the achievement of the Channel

Improvement Program objectives. The Licensee shall prepare an annual summary report describing monitoring and implementation activities completed pursuant to the Program and submit the report to the consultees listed in A103(a) above for review on an annual basis. Throughout the term of the License, the Licensee shall compile these annual reports every five years in the Lower Feather River Habitat Improvement Plan Report that is submitted to FERC.

(e) The Licensee, in consultation with the consultees listed in A103(a) above shall reevaluate the Channel Construction Plan every five years after initial implementation. The Licensee shall provide all Plan updates to the Commission for information. If any changes are recommended beyond the objectives, activities, or schedules identified in this article or the Plan, the Licensee shall submit final recommendations to the Commission for approval. The Licensee shall include with the filing copies of the comments, including recommendations made in the course of such consultation, and an explanation as to why any comment was not adopted. Upon Commission approval, the Licensee shall implement the Plan, including any changes required by the Commission. The Commission reserves the right to make further changes to the Plan. The Licensee shall include any Commission approved revisions to the Plan into any updates to the Lower Feather River Habitat Improvement Plan set forth in Article A101.

Article A104. Structural Habitat Supplementation and Improvement Program Plan

(a) Within two years of license issuance, the Licensee shall develop and file for Commission approval a Structural Habitat Supplementation and Improvement Program Plan to provide additional salmonid rearing habitat in the Lower Feather River by creating additional cover, edge, and channel complexity through the addition of structural habitat, including large woody debris, boulders, and other objects. The Plan shall be developed in consultation with the Ecological Committee, including specifically U.S. Fish and Wildlife Service, National Marine Fisheries Service, and California Department of Fish and Game (consultees). The Licensee shall include with the filing of the Plan copies of the comments, including recommendations, made in the course of such consultation, and an explanation as to why any such comment was not adopted. Within two years following Commission approval of the Plan, and after obtaining all necessary permits, the Licensee shall implement the Plan, including any changes required by the Commission. The Commission reserves the right to make further changes to the Plan.

(b) The Plan shall contain the following elements:

(1) Proposed locations for structural placements, including large woody debris, boulders, or other material. Large woody debris for this Program is defined as multi-branched trees at least 12 inches in diameter at chest height, and a minimum of 10 feet in length (with a preference for approximately 20 feet or longer), with approximately 50% of the structures

containing intact rootwads. Large woody debris or other native materials shall be located within the river to maximize the instream benefit at the lowest minimum flow specified in Article A108 with the rootwad (if attached) oriented upstream.

(2) Development and implementation of a strategy to map existing large woody debris, riparian habitat, and sources of riparian and large woody debris recruitment.

(3) Placement of a minimum of 2 pieces of large woody debris, boulders, or other appropriate material per riffle in the Low Flow Channel and High Flow Channel from River Mile 54.2 to River Mile 67.2 of the Feather River for a total of between 50 and 500 pieces in locations that maximize benefits for salmonids. Additional large woody debris, boulders, or other material may be placed in glide, riffle or pool habitat where appropriate.

(4) Completion of a safety analysis, and any resulting necessary modifications to the Plan, prior to program implementation to ensure that issues relating to human safety are adequately addressed.

(5) Monitoring of the structural placements after major high flow events, or at least once every five years in the absence of a high flow event, to collect data appropriate for evaluating the effectiveness of the Program and its objectives. High flow events shall be defined in the Structural Habitat Supplementation Improvement Program Plan.

(6) Inclusion of specific maintenance criteria, including the interval for replacement of large woody debris or other structures. Replacement shall occur at a minimum of every five years.

(c) The Licensee shall annually collect data appropriate for evaluating the effectiveness of the Program and the achievement of the Program objectives. The Licensee shall prepare an annual summary report describing monitoring and implementation activities completed pursuant to the Program and submit the report to the consultees listed in A104(a) above for review on an annual basis. Throughout the term of the license, the Licensee shall compile these annual reports every five years in the Lower Feather River Habitat Improvement Plan Report that is submitted to FERC.

(d) The Licensee, in consultation with the consultees listed in A104(a) above, shall reevaluate the Plan every five years after initial implementation. The Licensee shall provide all Plan updates to the Commission for information. If any changes are recommended beyond the objectives, activities, or schedules identified in this article or the Plan, the Licensee shall submit final recommendations to the Commission for approval. The Licensee shall include with the filing copies of the comments, including recommendations, made in the course of such consultation, and an explanation as to why the comment was not adopted. Upon Commission approval, the Licensee shall

implement the Plan, including any changes required by the Commission. The Commission reserves the right to make further changes to the Plan. The Licensee shall include any Commission approved revisions to the Plan into any updates to the Lower Feather River Habitat Improvement Plan set forth in Article A101.

Article A105. Fish Weir Program

(a) Within one year following license issuance, the Licensee shall develop and file for Commission approval a Phase 1 weir construction and operations Plan consistent with the Project biological opinion(s). The Plan shall be developed in consultation with the Ecological Committee, including specifically U.S. Fish and Wildlife Service, National Marine Fisheries Service, and California Department of Fish and Game (consultees). The Licensee shall include with the filing of the Phase 1 Plan copies of the comments, including recommendations, made in the course of such consultation, and an explanation as to why any such comment was not adopted. Upon Commission approval, and after obtaining all necessary permits, the Licensee shall implement the Plan, including any changes required by the Commission. The Commission reserves the right to make further changes to the Plan.

(b) The Phase 1 Plan shall include a schedule to install and operate a monitoring weir in the vicinity upstream of the Thermalito Afterbay Outlet within three years of license issuance.

(c) The Phase 1 Plan shall be designed to document run timing for spring- and fall-run Chinook salmon and steelhead, and include design and safety analysis including boating compatibility, detailed engineering design, and a permitting process schedule. The Plan may consider using the monitoring weir to provide interim spatial and/or temporal segregation of Chinook salmon runs. The Plan shall be a part of the Lower Feather River Habitat Improvement Plan.

(d) Licensee shall correlate data from the monitoring weir to carcass surveys or other existing population counts. The Licensee, in consultation with the consultees listed in A105(a) above, shall use the data collected in Phase 1 to develop recommendations to the Commission regarding Phase 2 as set forth below.

(e) Within eight years of license issuance, the Licensee shall develop and file for Commission approval a Phase 2 Anadromous Fish Segregation Weir Plan for the purpose of providing spatial separation for the spawning of spring-run and fall-run Chinook salmon. The Plan shall be developed in consultation with the consultees listed in A105(a) above. The Licensee shall include with the filing of the Phase 2 Plan copies of the comments, including recommendations, made in the course of such consultation, and an explanation as to why any such comment was not adopted. Upon Commission approval, and after obtaining all necessary permits, the Licensee shall implement the Plan, including any changes required by the Commission. The Commission reserves the right to make further changes to the Plan.

(f) The Phase 2 Plan shall include a weir operations protocol, safety analysis including boating compatibility, detailed engineering design, and identification of the required permitting process. The Phase 2 Plan shall also evaluate the installation of an egg-taking station, if appropriate, to collect fall-run Chinook salmon eggs for transport to the Feather River Fish Hatchery.

(g) The Phase 2 Plan shall include a schedule to install and operate a Phase 2 anadromous fish segregation weir in the lower Feather River upstream of the Thermalito Afterbay Outlet within twelve years of license issuance.

(h) The Licensee shall annually collect data appropriate for evaluating the effectiveness of the Fish Weir(s) and Egg-Taking Station, and correlate this data to carcass surveys or other existing population counts. The Licensee shall prepare annual summary reports for Phase 1 and Phase 2 describing the monitoring results and provide these reports to the consultees listed in A105(a) above for review. Every five years the annual reports shall be compiled in the Lower Feather River Habitat Improvement Plan Report.

(i) The Licensee, in consultation with the consultees listed in A105(a) above, shall reevaluate the Program every five years after initial implementation. The Licensee shall provide all Plan updates to the Commission for information. If any changes are recommended beyond the objectives, activities, or schedules identified in this article or the Plan, the Licensee shall submit final recommendations to the Commission for approval. The Licensee shall include with the filing copies of the comments, including recommendations, made in the course of such consultation, and an explanation as to why any such comment was not adopted. Upon Commission approval, the Licensee shall implement the Plan, including any changes required by the Commission. The Commission reserves the right to make further changes to the Plan. The Licensee shall include any Commission approved revisions to the Plan into any updates to the Lower Feather River Habitat Improvement Plan set forth in Article A101.

Article A106. Riparian and Floodplain Improvement Program

(a) Within six months of license issuance the Licensee shall develop and file for Commission approval a Plan for a phased program to enhance riparian and other floodplain habitats for associated terrestrial and aquatic species. The Plan shall address the connection of portions of the floodplain habitat with the Feather River within the Oroville Wildlife Area and shall include a description of areas in which gravel extraction may take place, in anticipation of improving fish and wildlife benefits. The Plan shall also include a definition of high flow events. The Plan shall be developed in consultation with the Ecological Committee, including specifically U.S. Fish and Wildlife Service, National Marine Fisheries Service, State Water Resources Control Board, and California Department of Fish and Game (consultees). The Licensee shall include with the filing of the Plan copies of the comments, including recommendations, made in the

course of such consultation, and an explanation as to why such comment was not adopted. Upon Commission approval, and after obtaining all necessary permits, the Licensee shall implement the Plan, including any changes required by the Commission. The Commission reserves the right to make further changes to the Plan.

(b) The Program set forth in the Plan shall be implemented in the following four phases:

(1) Phase 1 – Within one year of license issuance and in consultation with the consultees listed in A106(a) above, the Licensee shall develop, and submit to the Commission a screening level analysis of proposed riparian/floodplain improvement projects, including how flood/pulse flows may contribute to floodplain values and benefit fish and wildlife species. This phase shall include the identification of a Phase 1 recommended alternative. This phase shall also include an assessment of the gravel value and potential extraction processes in order to provide guidance on the scope, timing, and magnitude of the Program.

(2) Phase 2 – Within four years of license issuance and in consultation with the consultees listed in A106(a) above, the Licensee shall initiate Phase 2 of the Program. Phase 2 shall begin with conducting a full scope and feasibility evaluation and development of an implementation schedule of the Phase 1 recommended alternative. Within six years of license issuance the Licensee shall submit the Phase 1 recommended alternative and implementation schedule to the Commission for approval. Within eight years of license issuance, the Licensee shall complete the final design and commence construction and implementation of the approved alternative. Within fifteen years of license issuance the Licensee shall fully implement this approved alternative.

(3) Phase 3 – Within fifteen years of license issuance and in consultation with the consultees listed in A106(a) above, the Licensee shall complete an evaluation of other potentially feasible projects and the identification of a Phase 3 recommended alternative. This phase shall include a reevaluation of how flood/pulse flows may contribute to floodplain values and benefit fish and wildlife species and shall include an assessment of the gravel value and potential extraction processes similar to the one completed in Phase 1.

(4) Phase 4 – Upon Commission approval, and within twenty-five years of license issuance, the Licensee shall complete construction of the Phase 3 recommended alternative.

(c) The Licensee shall annually collect data appropriate for evaluating the effectiveness of the Program and the achievement of the Program objectives. The Licensee shall prepare an annual summary report describing monitoring and

implementation activities completed pursuant to the Program and submit the report to the consultees listed in A106(a) above, for review on an annual basis. Throughout the term of the license, the Licensee shall compile these annual reports every five years in the Lower Feather River Habitat Improvement Plan Report that is submitted to FERC.

(d) The Licensee, in consultation with the consultees listed in A106(a) above, shall reevaluate the Plan every five years after initial implementation. The Licensee shall provide all Plan updates to the Commission for information. If any changes are recommended beyond the objectives, activities, or schedules identified in this article or the Plan, the Licensee shall submit final recommendations to the Commission for approval. The Licensee shall include with the filing copies of the comments, including recommendations, made in the course of such consultation, and an explanation as to why any comment was not adopted. Upon Commission approval, the Licensee shall implement the Plan, including any changes required by the Commission. The Commission reserves the right to make further changes to the Plan. The Licensee shall include any Commission approved revisions to the Plan into any updates to the Lower Feather River Habitat Improvement Plan set forth in Article A101.

(e) The Licensee's total cost for the Program shall not exceed $5 million, excluding any net profits realized from any sales of gravel.

Article A107. Feather River Fish Hatchery Improvement Program

A107.1 Feather River Fish Hatchery Fish Production Program. Upon license issuance, and until the completion and implementation of the Plan set forth in section A107.3 of this article, the Licensee shall ensure the continued operation of the Feather River Fish Hatchery in cooperation with the California Department of Fish and Game for the production of anadromous salmonids such as steelhead, fall-run Chinook salmon, spring-run Chinook salmon, as well as other salmonids that may be stocked as part of the license.

A107.2 Feather River Fish Hatchery Water Temperature

(a) Upon License issuance, the Licensee shall use the temperatures set forth in Table 107A as targets, and shall seek to achieve them through the use of operational measures as set forth below.

Table 107A

September 1-September 30	56 °F
October 1 – May 31	55 °F
June 1 – August 31	60°F

The temperatures in Table 107A are Maximum Mean Daily Temperatures and shall be calculated by adding the hourly temperatures achieved each day and dividing by 24. Water temperatures shall be measured year-round at the Feather River Fish Hatchery

intake/aeration tower. The licensee shall seek to not exceed these Maximum Mean Daily Temperatures through operational changes including but not limited to (i) curtailing pump-back operation and (ii) removing shutters on Hyatt intake and (iii) after river valve refurbishment, DWR will consider the use of the river valve up to a maximum of 1500 cfs; provided however these flows need not exceed the actual flows in the HFC, but in no event would HFC flows be less than those specified in A108.2. During this interim period, the Licensee shall not be in violation of this article if the Maximum Mean Daily Temperatures are not achieved through operational changes.

Upon completion of Facilities Modification(s) as provided in A108, and no later than the end of year ten following license issuance, Table 107A temperatures shall become requirements, and the Licensee shall not exceed the Maximum Mean Daily Temperatures in Table 107A for the remainder of the License term, except in Conference Years as referenced in A107.2(d).

(b) Licensee shall, in no instance, exceed the temperatures set forth in Table 107B during the term of the license. Temperatures in table 107B shall be measured hourly year-round at the Feather River Fish Hatchery intake/aeration tower. There shall be no minimum temperature requirement except for the period of April 1 through May 31, during which the temperatures shall not fall below 51 degrees Fahrenheit.

Table 107B

September 1-September 30	56 °F
October 1 – November 30	55 °F
December 1 – March 31	55 °F
April 1 – May 15	55 °F
May 16-May 31	59°F
June 1-June 15	60°F
June 16- August 15	64°F
August 16 – August 31	62°F

(c) Upon completion of Facilities Modification(s) as provided in A108, the Licensee may develop a new table for hatchery temperature requirements that is at least as protective as Table 107A. If a new table is developed, it shall be developed in consultation with the Ecological Committee, including specifically U.S. Fish and Wildlife Service, National Marine Fisheries Service, California Department of Fish and Game, California State Water Resources Control Board, and Central Valley Regional Water Quality Control Board. The new table shall be submitted to the Commission for approval, and upon approval shall become the temperature requirements for the hatchery for the remainder of the license term.

(d) During Conference Years, as defined in A108.6, the Licensee shall confer with the U.S. Fish and Wildlife Service, National Marine Fisheries Service, California

Department of Fish and Game, and California State Water Resources Control Board to determine proper temperature and disease management goals.

A107.3 Feather River Fish Hatchery Management Program

(a) Within two years of license issuance, the Licensee shall develop and file for Commission approval, a management plan for the Feather River Fish Hatchery. The Plan shall be developed in consultation with the Ecological Committee, including specifically the U.S. Fish and Wildlife Service, National Marine Fisheries Service, the California Department of Fish and Game, California State Water Resources Control Board, and the Central Valley Regional Water Quality Control Board (consultees) and in coordination with the Feather River Technical Team. The Plan shall include a schedule to begin implementation of the Program within three years of license issuance. The Licensee shall include with the filing of the Plan copies of the comments, including recommendations, made in the course of such consultation, and an explanation as to why any such comment was not adopted. Upon Commission approval, the Licensee shall implement the Plan, including any changes required by the Commission. The Commission reserves the right to make further changes to the Plan.

(b) The development of this Program will include review and consideration of the recommendations for the Feather River Fish Hatchery put forth in the *Joint Hatchery Review Committee Final Report on Anadromous Salmonid Fish Hatcheries in California* (December 2001).

(c) Components of the Plan shall include:

1) Hatchery and Genetics Management Plans for each anadromous fish species managed by the hatchery.

2) Adaptive management protocols for hatchery production including egg taking, spawning, incubation, hatching, rearing, and stocking of fish.

3) A methodology to implement appropriate form(s) of tagging or marking of the Feather River Fish Hatchery artificial propagation programs, along with recovery of these tags/marks.

4) A methodology to study Feather River Fish Hatchery management effects on salmonids, and the interaction between in-river and hatchery-produced salmonids.

5) A methodology to study the phenotypic or genotypic traits that may be lost due to management actions or the adverse effects of the facilities if existing literature on these subjects is insufficient.

6) Development of a disease management methodology to reduce the incidence of disease outbreaks within the Feather River Fish Hatchery

facilities and a plan to implement the methodology, as well as a requirement that the Licensee monitor and report to the EC on disease and water quality issues. This component of the Plan shall include investigation of the mechanisms to control disease, including water supply disinfection, temperature control devices (e.g., chillers, shade screens, well water), chemical treatments, fish stress reduction methods (fish density manipulation, flow increases, aeration) and standards for acceptable loss.

7) A methodology to work with other Central Valley hatcheries to improve methods of integrating operations, marking and tag recovery, and data management.

8) A methodology to minimize straying of salmonids produced at the Feather River Fish Hatchery.

9) A methodology for the release of fish that evaluates full in-river release for the spring-run production, and in-river fall-run releases starting with 25% of the hatchery fall-run production, or other suitable amount to be determined by Licensee, in consultation with the Ecological Committee, and specifically the California Department of Fish and Game.

10) A methodology to utilize the results of studies, monitoring, and other information, in order to make changes to the operations of the Feather River Fish Hatchery.

(d) Within one year following Plan approval, the Licensee shall annually collect data appropriate for evaluating the effectiveness of the Program and the achievement of the Program objectives. The Licensee shall prepare an annual summary report describing monitoring and implementation activities completed pursuant to the Program and submit the report to the consultees listed in A107.3(a) above for review on an annual basis. Throughout the term of the license, the Licensee shall compile these annual reports every five years in the Lower Feather River Habitat Improvement Plan Report that is submitted to FERC.

(e) The Licensee, in consultation the consultees listed in A107.3(a) above, shall reevaluate the Program/Plan ("Plan") every five years after initial implementation. When possible, the Plan shall be reevaluated concurrently with the renewal of the Hatchery and Genetics Management Plans. The Licensee shall provide all Plan updates to the Commission for information. If any changes are recommended beyond the objectives, activities, or schedules identified in this article or the Plan, the Licensee shall submit final recommendations to the Commission for approval. The Licensee shall include with the filing copies of the comments, including recommendations, made in the course of such consultation, and an explanation as to why any such comment was not adopted. Upon Commission approval, the Licensee shall implement the Plan, including any changes required by the Commission. The Commission reserves the right to make further changes to the Plan. The Licensee shall include any Commission approved

revisions to the Plan into any updates to the Lower Feather River Habitat Improvement Plan set forth in Article A101.

(f) The licensee shall consult with the Ecological Committee and the consultees listed in A107.3(a) above regarding new information relating to disease control when it becomes available.

(g) The Licensee shall continue to utilize adaptive management practices for spring run salmonids until the Hatchery Genetics and Management Plans are developed and implemented.

(h) The Licensee shall prepare an annual hatchery report beginning in the year following the calendar year the license is issued. The annual report shall contain, but not be limited to, the following information:

1) The number of each species and/or run of fish taken, along with the number of adults, grilse, steelhead and half-pounders.

2) An estimate of the number of eggs for each species and/or run.

3) The number, size and species and/or run of all fish reared at the hatchery.

4) The number, size, and release location and date of each species stocked and/or transferred.

5) An annual summary of disease management activities, including the diseases detected, the species infected and the number of losses, treatment methods, etc.

6) The egg take and stocking goal used that year.

7) A description of any significant operational changes that may have occurred as a result of the adaptive management process.

A107.4 Feather River Fish Hatchery Water Supply Disinfection System

In the event that anadromous salmonids are passed upstream of the Feather River Fish Hatchery, the Licensee shall install a water disinfection system for the Feather River Fish Hatchery water supply prior to such passage. The system shall be developed in consultation with the U.S. Fish and Wildlife Service, National Marine Fisheries Service, California Department of Fish and Game, California State Water Resources Control Board and Central Valley Regional Water Quality Control Board. Prior to installing the system, the Licensee shall develop and file a plan for Commission approval. The Licensee shall include with the filing copies of comments, including recommendations, made in the course of such consultation, and an explanation as to why any such comment was not adopted. Upon Commission approval, the Licensee shall implement

the Plan, including any changes required by the Commission. The Commission reserves the right to make further changes to the Plan.

A107.5 Feather River Fish Hatchery Annual Operation and Maintenance

Within two years of license issuance, the Licensee, in coordination with the California Department of Fish and Game, shall conduct a comprehensive facility assessment of the Feather River Fish Hatchery, and shall conduct such an assessment at least once every 5 years thereafter. The Licensee shall include all findings of the assessment in the Lower Feather River Habitat Improvement Plan Report filed with the Commission as set forth in Article A101.

Article A108. Flow/Temperature to Support Anadromous Fish

A108.1 Minimum Flow and other Measures in the Low Flow Channel to Support Anadromous Fish

(a) Upon license issuance, the Licensee shall release a minimum flow of 700 cfs into the Low Flow Channel ("LFC"). The minimum flow shall be 800 cfs from September 9 to March 31 of each year to accommodate spawning of anadromous fish, unless the National Marine Fisheries Service, U.S. Fish and Wildlife Service, California Department of Fish and Game, and California State Water Resources Control Board provide a written notice that a lower flow (between 700 cfs and 800 cfs) substantially meets the needs of anadromous fish. If the Licensee receives such a notice, it may operate consistent with the revised minimum flow. Within 30 days of receipt, the Licensee shall file such notice with the Commission for information.

(b) Prior to the Facilities Modification(s) described in Article A108.4, if the Licensee does not achieve the applicable Table 1 temperature upon release of the specified minimum flow, the Licensee shall singularly, or in combination (i) curtail pump-back operation, (ii) remove shutters on Hyatt Intake, and (iii) increase flow releases in the LFC up to a maximum of 1500 cfs; provided however these flows need not exceed the actual flows in the HFC, but in no event would HFC flows be less than those specified in A108.2 to meet Table 1 temperatures or minimize exceedances thereof. Prior to the Facilities Modification(s) described in Article A108.4, Table 1 temperatures are targets and if they are not met there is no license violation so long as Licensee is otherwise in compliance with this article. If in any given year the Licensee anticipates that these measures will not achieve the temperatures in Table 1, the Licensee shall consult with the National Marine Fisheries Service, U.S. Fish and Wildlife Service, California Department of Fish and Game, and California State Water Resources Control Board to discuss potential approaches to best managing the remaining coldwater pool in Lake Oroville, which may result in changes in the way Licensee performs the actions in (i), (ii), and (iii). Licensee shall provide prompt notice to the Commission of any actions taken under this subdivision.

Table 1
LFC
as measured at Robinson Riffle
(all temperatures are in daily mean value (degrees F))

MONTH	Temperature
January	56
February	56
March	56
April	56
May 1-15	56-63*
May 16-31	63
June 1 – 15	63
June 16 – 30	63
July	63
August	63
September 1-8	63-58*
September 9 – 30	58
October	56
November	56
December	56

* Indicates a period of transition from the first temperature to the second temperature.

(c) After completion of the Facilities Modification(s), Licensee shall no longer be required to perform the measures listed in subdivision (b)(2)(i), (ii), and (iii), unless Table 1 temperatures are exceeded.

(d) Upon completion of the Facilities Modification(s), the Licensee shall operate the project to meet temperature requirements in Table 1 in the LFC, unless it is a Conference Year as described in Article 108.6. The Licensee shall monitor the effectiveness of the project facilities to achieve Table 1 temperatures.

A108.2 Minimum Flow and Other Measures in the High Flow Channel to Support Anadromous Fish

(a) Upon license issuance, the Licensee shall, based upon the April through July unimpaired runoff of the Feather River near Oroville of the preceding water year (October 1 through September 30), maintain a minimum flow in the High Flow Channel ("HFC") in accordance with the following schedule, provided that such releases will not cause Oroville Reservoir to be drawn down below elevation 733 feet (approximately 1,500,000 acre-feet).

Preceding April through July unimpaired runoff, Percent of normal	Minimum Flow in HFC October - February	March	April - September
55% or greater	1,700 cfs	1,700 cfs	1,000 cfs
Less than 55%	1,200 cfs	1,000 cfs	1,000 cfs

The preceding water year's unimpaired runoff shall be reported in Licensee's Bulletin 120, "Water Conditions in California-Fall Report." The term "normal" is defined as the April through July 1911-1960 mean unimpaired runoff near Oroville of 1,942,000 acre-feet.

(b) If the April 1 runoff forecast in a given water year indicates that, under normal operation of Project 2100, Oroville Reservoir will be drawn to elevation 733 feet (approximately 1,500,000 acre-feet), minimum flows in the HFC may be diminished on a monthly average basis, in the same proportion as the respective monthly deficiencies imposed upon deliveries for agricultural use from the Project; however, in no case shall the minimum flow releases be reduced by more than 25 percent. If, between October 15 and November 30, the highest total 1-hour flow exceeds 2500 cfs, Licensee shall maintain a minimum flow within 500 cfs of that peak flow, unless such flows are caused by flood flows, an inadvertent equipment failure or malfunction.

(c) Upon completion of the Facilities Modification(s), the Licensee shall attempt to meet the temperature targets in Table 2A during the Testing Period. Upon Completion of the Testing period and after the Commission's approval of the Testing Period Report, Table 2A, together with any amendments to it, shall be designated as Table 2B, and the Licensee shall thereafter achieve the temperatures in Table 2B, unless it is a Conference Year as described in Article A108.6

A108.3 Submittal of October 2006 Reconnaissance Study of Potential Facilities Modification(s)

Within sixty days of license issuance, the Licensee shall submit to the Commission for information the October 2006 Reconnaissance Study of Potential Facilities Modification(s) to address temperature habitat needs for anadromous fish in the LFC and HFC.

A108.4 Submittal of Feasibility Study and Implementation Plan for Facilities Modification(s)

(a) Within 3 years following license issuance, the Licensee shall prepare and submit to the Commission for approval, a Feasibility Study and Implementation Plan for Facilities Modification(s) (Plan) to protect and improve temperature conditions for

spawning, egg incubation, rearing, and holding habitat for anadromous fish in the LFC and HFC in the least costly manner (taking into account capital, operational, and maintenance costs, including foregone power generation, third-party impacts, and beneficial uses) over the term of the New License. The Plan shall include a summary of the conclusions of the Reconnaissance Study and shall be prepared in consultation with the Ecological Committee, including specifically National Marine Fisheries Service, U.S. Fish and Wildlife Service, California Department of Fish and Game, and the California State Water Resources Control Board.

(b) As part of the Plan, building upon findings of the Reconnaissance Study, the Licensee shall analyze alternatives with consideration of all project purposes, including water supply, flood control, power generation, recreation, fish and wildlife protection and other beneficial uses, and shall evaluate physical and operation effects of considered alternatives. Benefits to temperature and anadromous fishery habitat in the LFC and HFC shall be identified and quantified. The Plan shall recommend a specific alternative for implementation. The recommended alternative shall be designed to meet Table 1 and to meet the objectives for the HFC as stated in A108.4(a), except for those years that are considered severe dry years under the Oroville Temperature Management Index (OTMI). It shall also include Table 2A, which shall state the temperatures that the Licensee shall attempt to achieve in the HFC through implementation of the recommended alternative. The Table 2A temperatures shall be based upon preliminary modeling to determine where lower temperatures can be feasibly achieved in the HFC. Table 2A shall be developed starting from Table 2, below. The Plan will evaluate the OTMI definition and recommend changes based upon hydrology and modeling results on how well the recommended alternative will be able to meet Table 1 and the applicable Table 2.

Table 2
HFC as measured at
Downstream Project Boundary
(all temperatures are in daily mean value (degrees F))

MONTH	Temperature
January	56
February	56
March	56
April	61
May	64
June	64
July	64
August	64
September	61
October	60
November	56
December	56

(c) The Plan shall include a proposed implementation schedule and include adaptive management features. The Plan shall also propose a fisheries monitoring program, including a multi-year study of the utilization of the HFC by anadromous fish prior to installation of any Facilities Modification(s) in order to accumulate data on existing conditions. This monitoring program shall be coordinated with and may be integrated into the Lower Feather River Habitat Improvement Plan described in Article A101.

(d) The licensee shall submit a draft Plan to the Ecological Committee, including specifically National Marine Fisheries Service, U.S. Fish and Wildlife Service, California Department of Fish and Game, and the California State Water Resources Control Board at least three months before submitting the Plan to the Commission. The recommended alternative is subject to the approval of the Executive Director of the State Water Resources Control Board.

(e) The final Plan shall include the results of such consultation, response to comments, and an explanation as to why any comments were not incorporated. It shall be submitted to the Commission for public notice and approval.

(f) The Licensee's capital cost estimate for the Facilities Modification(s) to meet the purposes described in (c)(2) is not expected to exceed $60 million (2005).

(g) Upon the Commission's approval, the Licensee shall implement one or more Facilities Modification(s) for the benefit of the LFC and the HFC. The Commission reserves the right to make further changes to the Plan.

A108.5 Five-Year Test of Facilities Modification(s) Effects and Report

(a) Upon completion of the Facilities Modification(s), the Licensee shall test the adequacy of the Facilities Modification(s) to achieve Table 2A, and to provide other benefits for fish, for a five-year testing period (Testing Period). In the event that the Licensee considers that the five years do not include a representative sample of year-types for the generation of reliable test results, the Licensee shall confer with the Ecological Committee, including specifically U.S. Fish and Wildlife, National Marine Fisheries Service, and California Department of Fish and Game and the State Water Resources Control Board, and may recommend that the Commission approve a continuation of the Testing Period for such additional time as may be reasonable.

(b) At the conclusion of the Testing Period (as may be extended), the Licensee shall file with the Commission for approval a Testing Period Report which: (i) describes and analyzes monitoring data for temperature, habitat use by anadromous fish, and operations; (ii) describes whether the Facilities Modification(s) has achieved Table 2A during the testing period, and whether the testing results confirm that the Facilities Modification(s) will likely achieve 2A over the remainder of the New License; (iii) analyzes whether the temperatures resulting from the Facilities Modification(s) have increased availability or suitability of HFC habitat for anadromous fish as predicted; (iv)

if appropriate, recommends alterations to the Facilities Modification(s); (v) if appropriate, recommends changes in the definition of OTMI; and (vi) if the Facilities Modification(s) has not achieved Table 2A during the testing period appropriate, recommends alterations to Table 2A. At the end of the testing period, Table 2A becomes table 2B either with or without alterations, consistent with Article A108.4(b). The Licensee shall submit a draft Testing Period Report to the Ecological Committee, including specifically National Marine Fisheries Service, U.S. Fish and Wildlife Service, California Department of Fish and Game, and California State Water Resources Control Board for review, comment and consultation three months prior to submitting the report to the Commission. The final Report shall be submitted to the Commission, and shall include the results of such consultation, response to comments, and an explanation as to why any comments were not incorporated. The Licensee shall operate and maintain the Facilities Modification(s), as required by or as may be modified by the Commission's approval of the Testing Period Report, including Table 2B, unless it is a Conference Year.

A108.6 Conference Years Actions

(a) After completion of the Facilities Modification(s), by May 1 of a Conference Year, the Licensee shall consult with the Ecological Committee, including specifically the National Marine Fisheries Service, U.S. Fish and Wildlife Service, California Department of Fish and Game, and California State Water Resources Control Board, and prepare a strategic plan that states the specific actions that it will take to manage the coldwater pool to minimize exceedances of Table 1 and the applicable version of Table 2, consistent with its water supply and other legal obligations. After consultation, the Licensee shall submit the strategic plan to the Commission for information and shall implement the strategic plan. As part of any strategic plan, the minimum flows as described in Articles 108.1 and 108.2 shall be maintained.

(b) The Licensee shall inform the Ecological Committee, including specifically U.S. Fish and Wildlife Service, National Marine Fisheries Service, and California Department of Fish and Game within ten days of the initial determination of a Conference Year and subsequent updates of that year-type classification.

(c) A Conference Year is defined as any year in which the Oroville Temperature Management Index (OTMI) is equal or less than 1.35 million acre-feet. OTMI is calculated by multiplying the total volume of stored water in Lake Oroville on May 1 by one half and adding to that the projected May-through-September unimpaired Feather River flow at Oroville. The unimpaired Feather River flow at Oroville means the runoff that would be in the Feather River at Oroville if there were no human development on the Feather River. The amount of Feather River unimpaired flows used for calculating the OTMI will be the median value (with an exceedance probability of 50 percent) of May 1 forecast published in DWR Bulletin 120. As the actual amount of unimpaired flow after May 1 becomes available, the OTMI will be recomputed in the beginning of June, July, and August to account for the potential errors of the May 1 prediction. The OTMI will not be updated after the August 1 update.

A108.7 Inability to Meet Temperature Requirements Due to Uncontrollable Forces

If the Licensee is unable to meet the temperature requirements in Articles A107.2, A108.1, A108.2 or A108.5 due to an event or circumstances beyond its reasonable control, the Licensee shall file a notice within ten days of such event or circumstance with the Commission describing the event or circumstances causing the inability to meet those temperature requirements. It shall provide a copy to the Ecological Committee, including specifically U.S. Fish and Wildlife Service, National Marine Fisheries Service, California Department of Fish and Game and the State Water Resources Control Board (consultees) for comment and opportunity for dispute resolution pursuant to A135. Such notice shall include a statement of specific actions that the Licensee will take to address the event or circumstance and how it will manage the coldwater pool to minimize exceedances of Table 1 and the applicable version of Table 2, consistent with its water supply and other legal obligations. If the Commission finds that there is a pattern of exceedances that could result in adverse impacts to fishery resources, it may require the Licensee to file a plan developed in consultation with the consultees identifying any feasible measures that the Licensee may undertake, or modifications to other license requirements, to address the exceedances.

Article A109. Reservation of Section 18 Authority

Authority is reserved for the National Marine Fisheries Service and the Department of the Interior to prescribe the construction, operation, and maintenance of fishways at the Oroville Project, No. 2100, including measures to determine, ensure, or improve the effectiveness of such prescribed fishways, pursuant to Section 18 of the Federal Power Act, as amended, during the term of the project license, as provided in the Habitat Expansion Agreement (2006) [note: This agreement in draft form is provided in Appendix F, it will be finalized, signed and submitted to the Commission before the Commission acts on this article.]

Article A110. Lake Oroville Warm Water Fishery Habitat Improvement Program

(a) Within one year following license issuance, the Licensee shall develop and file for Commission approval a Plan to improve the habitat of the warm water fishery in Lake Oroville, primarily for the benefit of spawning and rearing. The Licensee shall consult with the Ecological Committee, including specifically the U.S. Fish and Wildlife Service, National Marine Fisheries Service, State Water Resources Control Board, and California Department of Fish and Game (consultees) in developing this Plan. The Licensee shall include with the filing of the Plan copies of the comments, including recommendations, made in the course of such consultation, and an explanation as to why any such comment was not adopted. Upon Commission approval, the Licensee shall implement the Plan, including any changes required by the Commission. The Commission reserves the right to make further changes to the Plan.

(b) The Plan shall provide for: (1) construction, operation, and maintenance of projects to improve warm water fishery habitat within the reservoir or fluctuation zone; (2) implementation of the Plan in seven-year intervals, except that the final interval may be adjusted as appropriate to coincide with license expiration; (3) the Licensee to expend an average of $40,000 annually, or $280,000 total, for this purpose during each such interval, with 75% of such funds to be spent on construction, operation, and maintenance and the remainder on monitoring and program oversight; (4) the annual construction of an average of 15 habitat units (defined as projects costing $2,000 each in material and labor); (5) specific habitat units to be constructed in the first interval and that, for each subsequent seven-year interval, the Licensee shall plan further habitat units in consultation with the Ecological Committee, including specifically the consultees; (6) a monitoring program, including angler creel surveys, electrofishing, and springtime snorkel surveys, to evaluate the success of the habitat improvement program; and (7) modification of habitat units based on monitoring results, need, or improvements in technology, within the cost limitations stated above.

(c) After consultation with the Ecological Committee and the consultees listed in A110(a) above the Licensee may modify the implementation measures contained within the Plan without Commission approval to the extent the measures are within the scope of the approved Plan. Any modification to the implementation measures not within the scope of the approved Plan must be filed with the Commission for approval.

(d) The Licensee shall file annually with the Commission a compliance report for information. The Licensee shall first prepare the report in consultation with the Ecological Committee and the consultees listed in A110(a) above. The Licensee shall include with the filing any comments, including recommendations made in the course of such consultation, and an explanation as to why any such comment was not adopted. The annual compliance report shall describe all work performed on such habitat improvements during the previous calendar year. The annual report at the end of each seven-year interval shall describe all such work during that interval, including monitoring results.

Article A111. Lake Oroville Cold Water Fishery Improvement Program

(a) Within one year following license issuance, the Licensee shall develop and file for Commission approval a Plan to provide a cold water fishery primarily for the purpose of recreational fishing. The Licensee shall consult with the Ecological Committee, including specifically the U.S. Fish and Wildlife Service National Marine Fisheries Service, State Water Resources Control Board, and California Department of Fish and Game (consultees) in developing this Plan. The Licensee shall include with the filing of the Plan copies of the comments, including recommendations, made in the course of such consultation, and an explanation as to why any such comment was not adopted. Upon Commission approval, the Licensee shall implement the Plan, including any

changes required by the Commission. The Commission reserves the right to make further changes to the Plan.

(b) The Plan shall provide for: (1) the stocking of 170,000 yearling salmon or equivalents per year, plus or minus ten percent; (2) the Licensee to expend an amount not to exceed an average of $75,000 annually, with $68,000 for stocking related costs and $7,000 in monitoring costs; (3) identification of a primary source of salmonids for stocking in the lake; (4) addressing disease issues associated with the source or handling of salmonids; (5) identification of alternative sources of salmonids for stocking in the lake; (6) analysis of the feasibility of providing a disinfection system for hatchery water resources; and (7) a monitoring program.

(c) After consultation with the consultees listed in A111(a) above, the Licensee may modify the implementation measures contained within the Plan without Commission approval to the extent the measures are within the scope of the approved Plan. Modifications shall be shared with the Recreation Advisory Committee at the next meeting. Any modification to the implementation measures not within the scope of the approved Plan must be filed with the Commission for approval.

(d) The Plan shall be reviewed and updated by the Licensee every ten years. The Licensee shall consult with the Ecological Committee and the consultees listed in A111(a) above, and then file the updated Plan with the Commission for approval. The Licensee shall include with the filing any comments, including recommendations made in the course of such consultation, and an explanation as to why any such comment was not adopted.

(e) The Licensee shall submit a monitoring report to the consultees listed in A111(a) above for review and recommendations every two years. After review of the report by the Ecological Committee, the Licensee shall file the monitoring report for information with the Commission, and shall include with the filing copies of the comments, including recommendations, made by the Ecological Committee, and an explanation as to why any such comment was not adopted.

Article A112. Comprehensive Water Quality Monitoring Program

(a) Within six months following license issuance, Licensee shall begin preparation of a draft initial Comprehensive Water Quality Monitoring Program to track potential changes in water quality associated with the Project, and collect data necessary to develop a water quality trend assessment through the life of the FERC license. This Program shall be developed in consultation with the Ecological Committee, including specifically U.S. Fish and Wildlife Service, National Marine Fisheries Service, California Department of Fish and Game, California State Water Resources Control Board, the Central Valley Regional Water Quality Control Board, as well as Butte County Health Department (consultees). The Program will include components to sample water chemistry, fish tissue bioaccumulation, recreation site pathogens and petroleum product

concentrations, water temperatures, bioassays, and aquatic macroinvertebrate monitoring.

(b) Within nine months following license issuance, and following the consultation set forth in (a), the draft initial Program shall be submitted to the California State Water Resources Control Board for review and approval. Upon approval by the Chief of the Division of Water Rights, California State Water Resources Control Board, the Licensee shall file the Program with the Commission for approval. The Licensee shall include with the filing of the Program copies of the comments, including recommendations, made in the course of consultation with the consultees, and an explanation as to why any such comment was not adopted. Upon Commission approval, the Licensee shall implement the Program, including any changes required by the Commission. The Commission reserves the right to make further changes to the Program.

(c) In each of the first five years of the initial Program, Licensee shall collect, analyze and compile the water quality data into annual reports. The annual reports shall be provided to the Ecological Committee and the consultees listed in A112(a) above, and any other entity upon request, by May 30th of the following year. Following completion of all data collected for year 5, the Licensee shall compile a summary report of the initial Program, which shall be provided to the Commission, the Ecological Committee and the consultees listed in A112(a) above, and any other entity upon request. A 45-day notice shall accompany the report, inviting all recipients to attend a water quality meeting, scheduled by the Licensee, to discuss the finding of the 5-year data set. After consultation, the Licensee shall submit recommendations for a final Comprehensive Water Quality Monitoring Program to the Chief of the Division of Water Rights, California State Water Resources Control Board, for review and approval prior to the Licensee's filing of the Program with the Commission. The Licensee shall include with the filing copies of the comments, including recommendations, made in the course of consultation with the consultees, and an explanation as to why any such comment was not adopted. Upon Commission approval, the Licensee shall implement the Program, including any changes required by the Commission. The Commission reserves the right to make further changes to the Program. Water quality data shall be analyzed and compiled by the Licensee into five-year reports and distributed to the Ecological Committee and the consultees listed in A112(a) above, and any other entity upon request.

(d) Within six months of Commission approval of the final Comprehensive Water Quality Monitoring Program, Licensee shall begin implementation of the Water Chemistry Monitoring Plan component of the Program, including the following:

(1) In-situ Physical Parameters. The Licensee shall monitor between 15 and 20 locations four times each year (seasonally) for in-situ physical parameters necessary for determining water quality. In-situ data collected at each sampling location shall include water temperature, dissolved oxygen, pH, specific conductivity, and turbidity. Monitoring at Lake Oroville, the Diversion Pool at Oroville Dam, and one site within the

Thermalito Afterbay shall include vertical profiles for temperature, DO, pH, and specific conductivity collected at one meter intervals from surface to substrate.

(2) Nutrients. The Licensee shall monitor between 15 and 20 locations two times each year (spring and fall), for nutrients necessary for determining water quality. Nutrient data collected at each sampling location shall include nitrate plus nitrite, ammonia, organic nitrogen, dissolved orthophosphate, and total phosphorus.

(3) Metals. The Licensee shall monitor between 18 and 22 locations four times each year (seasonally), for metals necessary for determining water quality. The developed marinas (Bidwell and Lime Saddle) shall be included in the locations, along with sites to be specified in Lake Oroville, the Diversion Pool, Thermalito Forebay, Thermalito Afterbay, the Low Flow Channel, Mile Long Pond, and the Feather River at the southern boundary of the Project. Additional monitoring shall occur at both marinas one time each month during the recreation season (June-September) and one time after the first three significant storm events. Metals shall be analyzed and reported as total concentrations and dissolved fractions for aluminum, arsenic, cadmium, chromium, copper, iron, lead, manganese, nickel, selenium, silver, zinc, and mercury; in addition, total hardness shall be analyzed for each sampling location.

(4) Minerals and Alkalinity. The Licensee shall monitor between 15 and 20 locations two times each year (spring and fall), for minerals and alkalinity necessary for determining water quality. Minerals data collected at each sampling location shall include calcium, sodium, potassium, magnesium, sulfate, chloride, boron, and alkalinity.

(5) Plankton. The Licensee shall monitor 2 locations, two times each year, for phytoplankton and zooplankton as part of the water quality assessment. The monitoring sites are Lake Oroville and Thermalito Afterbay.

(e) Within three years of Commission approval of the final Comprehensive Water Quality Monitoring Program, Licensee shall begin implementation of the Fish Tissue Bioaccumulation Monitoring Plan component of the Program. The Licensee shall collect resident fish species from 7 locations within project waters, one time every five years and analyze tissue for metals and organic compounds. Sampling strategy for target species, numbers of individuals, sampling locations, and analytical methods used shall be consistent with the California State Water Resources Control Board's Surface Water Ambient Monitoring Program (or successor program) needs and shall be determined through Licensee consultation with the California State Water Resources Control Board, California Office of Environmental Health Hazard Assessment, Central Valley Regional Water Quality Control Board, U.S. Fish and Wildlife Service, National Marine Fisheries Service, California Department of Fish and Game and the Ecological Committee prior to

each sampling year. Constituents to be analyzed include metals (arsenic, cadmium, chromium, copper, iron, lead, nickel, selenium, silver, zinc, and mercury), and organic compounds (chlordane, chlorpyrifos, DDT isomers, dieldrin, hexachlorobenzene, and polychlorinated biphenyls).

(f) Within six months of Commission approval of the final Comprehensive Water Quality Monitoring Program, Licensee shall begin implementation of the Recreation Site Water Quality Monitoring Plan component of the Program, including the following:

(1) Pathogens. The Licensee shall conduct bacteriological monitoring at 12 to 16 locations within project waters each summer season. Near-shore water samples shall be collected five times within a 30-day period at each location from June 15 through September 15, consistent with the Basin Plan objectives for protection of the REC-1 beneficial uses. Potential sampling locations shall include developed beach areas, marinas, and boat launch areas along with high-use dispersed beach and shoreline locations in all waters affected by project operations. Prior to April 30th each year, the Licensee, in consultation with the California State Water Resources Control Board, Central Valley Regional Water Quality Control Board, Butte County Health Department and the Ecological Committee shall select the locations to be included in the upcoming seasonal sampling program. The list of bacteriological sampling locations shall always include North Forebay Cove and South Forebay Swim Area, in addition to sampling at 10-14 annually rotating stations. Additionally, at the North Forebay Beach area, individual screening samples shall be collected seasonally, four times throughout the year. Laboratory analyses for pathogens shall include: total coliform, fecal coliform, e-coli, and enterococcus, or other representative bacterial species consistent with any future amendment to the Basin Plan objectives.

(2) Petroleum Products. The Licensee shall monitor 6 locations for petroleum products in project waters (Bidwell Marina, Lime Saddle Marina, Foreman Creek Boat-in Campground, Spillway Boat Ramp/Day Use Area, Oroville Dam, and Monument Hill). Petroleum products shall be sampled one time each month from June through September and once after the first three significant storm events. Field sampling methods shall include both surface and bottom samples at each location. Petroleum products to be analyzed include Total Petroleum Hydrocarbons, MTBE and benzene.

(3) Soil Erosion. The Licensee shall inspect trails between May 1 and May 15 and following summer recreation season to identify soil erosion and potential subsidence into reservoirs or flowing waterways.

(g) Within three months of Commission approval of the final Comprehensive Water Quality Monitoring Program, Licensee shall begin implementation of the Water

Temperature Monitoring Plan to provide information that demonstrates compliance with the Feather River Fish Hatchery requirements (Article A107.2), the Operations Criteria and Plan Biological Opinion, and Basin Plan water quality standards. The Licensee shall site 4 permanent continuous temperature monitoring devices, one each at the following locations: (1) Feather River Hatchery aeration tower, (2) Robinson's Riffle, (3) Thermalito Afterbay Outlet, and (4) the Feather River adjacent to the most southern FERC Project 2100 boundary. The permanent temperature gages shall be capable of providing real-time data to the hatchery operators and to the public via an internet-based medium such as the Department of Water Resources' California Data Exchange Center. The four permanent gages shall remain operational throughout the life of the license.

The Water Temperature Monitoring Plan shall be designed and implemented to provide data necessary for additional modeling or study associated with reconnaissance and feasibility studies of the flow and temperature program (Article A108). The Licensee shall install and collect temperature data from temporary continuous recording devices at appropriate locations to provide data necessary for additional modeling or study associated with Article A108, as determined by the needs and results of the Flow/Temperature Reconnaissance (conducted by Licensee pursuant to Settlement Agreement Section B108 and reported pursuant to Article A108[c]).

The Water Temperature Monitoring Plan shall be reviewed after five years, to determine if modifications to the Comprehensive Water Quality Monitoring Program are necessary for consistency with measures that may be implemented following decisions on water temperature management in the Low Flow Channel and High Flow Channel. Continuous temperature monitoring will include both stream stations and reservoir stations, including vertical profile data collection adequate to evaluate changes in cold water pool and stratification in other deep water bodies within the Project boundary.

(h) Within three years of Commission approval of the final Comprehensive Water Quality Monitoring Program, Licensee shall implement the Water Quality Bioassay Monitoring Plan component of the Program. The Licensee shall collect water column samples from 2 locations in the Low Flow Channel, 4 times in a single year (seasonally), every 5 years, to conduct bioassay tests on aquatic organisms. Field sampling and laboratory analysis shall be consistent with methods recognized by the California State Water Resources Control Board's Surface Water Ambient Monitoring Program (or successor program). Aquatic organisms to be used in bioassays are: *Ceriodaphnia* and Fathead minnow (*Pimephales promelas*).

(i) Within one year of Commission approval of the final Comprehensive Water Quality Monitoring Program, Licensee shall implement the Aquatic Macroinvertebrate Monitoring Plan component of the Program. The Licensee shall collect benthic macroinvertebrate samples from a minimum of 7 stream locations during the fall index period one time every three years. Field sampling, laboratory identification, and statistical analysis shall be consistent with the California Stream Bioassessment Procedures (California Department of Fish and Game) or subsequent methodologies

acceptable to the California State Water Resources Control Board Surface Water Ambient Monitoring Program (or successor program) and the California Department of Fish and Game. A minimum of four sites shall be located in the Low Flow Channel and one site in the HFC at the southern-most project boundary. Following construction of any side channel habitat created as part of the Lower Feather River Habitat Improvement Program, sampling sites representative of each channel shall be added to the monitoring program.

(j) The Licensee, in consultation with the consultees listed in A112(a) above shall reevaluate the Program every five years after initial implementation. Any recommendations acceptable to the Licensee for changes to the Program shall be submitted to the Chief Division of Water Rights, California State Water Resources Control Board, for review and approval. The Licensee shall provide all Program updates to the Commission for information. If any changes are recommended beyond the objectives, activities, or schedules identified in the Program, the Licensee shall submit final recommendations to the Commission for approval. The Licensee shall include with the filing copies of the comments, including recommendations, made in the course of such consultation, and an explanation as to why any such comment was not adopted. Upon Commission approval, the Licensee shall implement the Program, including any changes required by the Commission. The Commission reserves the right to make further changes to the Program. The Licensee shall include any Commission approved revisions to the Plan into any updates to the Lower Feather River Habitat Improvement Plan set forth in Article A101.

Article A113. Monitoring of Bacteria Levels and Public Education

(a) The Licensee shall, in coordination with the Butte County Health Department, California Department of Health Services, California Department of Parks and Recreation, State Water Resources Control Board, Central Valley Regional Water Quality Control Board, and any other appropriate public agency, perform monitoring of fecal coliform, enterococcus bacteria or other bacterial indicators as required by the Basin Plan from June 1 through September 30 at developed and popular undeveloped swim areas within the Project boundary, specifically North Forebay recreation area, South Forebay recreation area, Loafer Creek recreation area, Monument Hill recreation area, Lime Saddle recreation area, Foreman Creek boat launch area, Stringtown boat launch area, and Mile Long Pond. Monitoring shall be performed as required in the applicable CVRWQCB Water Quality Control Plan (Basin Plan).

(b) The Licensee shall promptly provide monitoring information to appropriate public agencies and confer with them on additional measures that may be necessary to inform and educate the public about bacteria levels in Project waters. Such information shall be shared with the Recreation Advisory Committee at the next meeting.

(c) Upon direction from an appropriate agency, Licensee shall place notices notifying the public if unsafe levels of bacteria are present in the water.

(d) The Licensee shall place notices educating the public on sanitary measures designed to prevent or minimize contamination of water.

(e) The Licensee, in consultation with the Butte County Health Department, California Department of Health Services, State Water Resources Control Board and Central Valley Regional Water Quality Control Board shall determine if a public education program is needed to inform visitors to the project about water quality and the risks associated with recreating in contaminated waters. If needed, the Licensee shall develop the public education program in consultation with the above agencies.

(f) The Licensee shall reevaluate these measures every five years.

(g) The Licensee shall not be required to expend more than $124,000 on these actions in the first five years following license issuance, and shall not be required to expend more than $23,500 annually thereafter.

(h) The Licensee shall file annually with the Commission a compliance report for information.

Article A114. Public Education Regarding Risks of Fish Consumption

(a) The Licensee, in consultation with the Office of Environmental Health Hazard Assessment, State Water Resources Control Board, Central Valley Regional Water Quality Control Board, and Butte County Health Department, shall post notices at all boat ramps and any other locations specified by the Office of Environmental Health Hazard Assessment within the Project boundary notifying the public about health issues associated with consuming fish taken from within Project waters.

(b) The Licensee shall provide funding to the Office of Environmental Health Hazard Assessment to facilitate the publishing of written materials notifying the public about health issues associated with consuming fish taken from within Project waters.

(c) The Licensee shall not be required to spend more than $20,800 in the first five years of the Program and the Licensee's funding obligation shall not exceed $1,800 per year after the first five years.

(d) The Licensee shall file annually with the Commission a compliance report for information.

Article A115. Oroville Wildlife Area Management Plan

(a) Within two years of license issuance the Licensee shall develop and file for Commission approval a management Plan for the Oroville Wildlife Area, including the

Thermalito Afterbay. The Plan shall be developed in conjunction with the California Department of Fish and Game and the California Department of Parks and Recreation, and in consultation with the Ecological Committee, including specifically U.S. Fish and Wildlife Service, National Marine Fisheries Service, California State Water Resources Control Board, and Central Valley Regional Water Quality Control Board (consultees). The Licensee shall include with the filing of the Plan copies of the comments, including recommendations, made in the course of such consultation, and an explanation as to why any such comment was not adopted. Upon Commission approval, and after obtaining all necessary permits, the Licensee shall implement the Plan, including any changes required by the Commission. The Commission reserves the right to make further changes to the Plan.

(b) The Plan shall contain the following elements:

(1) Conservation measures required by Final Federal Biological Opinions

(2) Resource actions included in this license that may affect the OWA

(3) Strategies to minimize current and future conflicts between wildlife and recreation

(4) Wildlife management goals and objectives

(5) Recreation management goals and objectives (Consistent with the recreation measures outlined in the Recreation Management Plan, the Recreation Advisory Committee shall have an opportunity to provide input.)

(6) Other best management practices, including fuel load management for the reduction of fire risk to nearby properties and human life

(7) Certain common elements of the Lower Feather River Habitat Improvement Plan

(8) Actions designed to improve conditions for special status species and their habitats

(9) An implementation schedule

(10) Monitoring and reporting requirements

(11) A provision for periodic updates to the Plan as needed

(12) Agency management and funding responsibilities.

(c) The Licensee, in consultation with the California Department of Fish and Game and the consultees listed in A115(a) above, shall reevaluate the Plan every five years after initial implementation. Consistent with the recreation measures outlined in the

Recreation Management Plan, the Recreation Advisory Committee shall have an opportunity to provide input. The Licensee shall provide all Plan updates to the Commission for information. If any changes are recommended beyond the objectives, activities, or schedules identified in the Plan, the Licensee shall submit final recommendations to the Commission for approval. The Licensee shall include with the filing copies of the comments, including recommendations, made in the course of such consultation, and an explanation as to why any such comment was not adopted. Upon Commission approval, the Licensee shall implement the Plan, including any changes required by the Commission. The Commission reserves the right to make further changes to the Plan. The Licensee shall include any Commission approved revisions to the Plan into any updates to the Lower Feather River Habitat Improvement Plan set forth in Article A101.

(d) The Licensee shall not be required to expend more than $200,000 to develop the initial Plan.

Article A116. Oroville Wildlife Area Access

The Licensee shall allow reasonable access for hunting and fishing in the Oroville Wildlife Area, except where such access poses safety, security, operational risks, or adverse environmental impacts, and subject to applicable State and Federal hunting and fishing regulations and other reasonable conditions.

Article A117. Protection of Vernal Pools

(a) The Licensee shall implement conservation measures required by the U.S. Fish and Wildlife Service Final Biological Opinion to protect the vernal pool invertebrate habitat within the Project boundaries.

(b) The Licensee shall evaluate the effectiveness of these conservation measures in accordance with the Biological Opinion. The Licensee, in coordination with U.S. Fish and Wildlife Service, shall evaluate and report to the Commission for information on the effectiveness of the conservation measures annually by June 21 of each year through 2010. The measures shall be reevaluated in the spring every other year thereafter in accordance with the Biological Opinion. If the conservation measures implemented are deemed to be unsuccessful in protecting the vernal pool habitat, the Licensee shall coordinate with U.S. Fish and Wildlife Service to develop and implement additional or alternative conservation measures to protect the vernal pool habitat. Proposed modifications outside the scope of the Biological Opinion shall be filed with the Commission for approval prior to implementation.

Article A118. Minimization of Disturbances to Nesting Bald Eagles

(a) The Licensee shall include the conservation measures required by the U.S. Fish and Wildlife Service Final Federal Biological Opinion in any bald eagle management Plan(s). The Licensee shall file any bald eagle nest territory Plan(s) with the Commission for approval. Upon Commission approval, the Licensee shall implement the Plan(s), including any changes required by the Commission. The Commission reserves the right to make changes to the Plan(s). The Licensee shall evaluate the conservation measures in the Plan(s) according to the provisions of the Biological Opinion, and implement modifications deemed necessary accordingly. Proposed modifications outside the scope of the Biological Opinion shall be filed with the Commission for consultation and approval prior to implementation.

(b) The Licensee shall develop additional management Plan(s) or amend the current Plan(s) if new bald eagle nest territories are identified within the Project boundary. The Plan(s) shall be developed or amended in consultation with the U.S. Fish and Wildlife Service. The Plan(s) shall be filed with the Commission for approval. The Licensee shall include with the filing copies of the comments, including recommendations, made in the course of consultation, and an explanation as to why any such comment was not adopted. Upon Commission approval, the Licensee shall implement the Plan(s), including any changes required by the Commission. The Commission reserves the right to make further changes to the Plan(s).

Article A119. Protection of Giant Garter Snake

(a) The Licensee shall implement conservation measures required by the U.S. Fish and Wildlife Service Final Biological Opinion to protect the giant garter snake within the Project Boundary.

(b) The Licensee shall evaluate the effectiveness of these conservation measures in accordance with the Biological Opinion. The Licensee, in coordination with the U.S. Fish and Wildlife Service, shall annually evaluate and report to the Commission for information on the effectiveness of the conservation measures. If the conservation measures implemented are deemed to be unsuccessful in protecting the giant garter snake, the Licensee shall coordinate with U.S. Fish and Wildlife Service to develop and implement additional or alternative conservation measures to protect the giant garter snake. Proposed modifications outside the scope of the Biological Opinion shall be filed with the Commission for approval prior to implementation.

Article A120. Protection of Valley Elderberry Longhorn Beetle

(a) The Licensee shall implement conservation measures required by the U.S. Fish and Wildlife Service Final Biological Opinion to protect the valley elderberry longhorn beetle within the Project Boundary.

(b) The Licensee shall evaluate the effectiveness of these conservation measures in accordance with the Biological Opinion. The Licensee, in coordination with the U.S. Fish and Wildlife Service, shall annually evaluate and report to the Commission for information on the effectiveness of the conservation measures. If the conservation measures implemented are deemed to be unsuccessful in protecting the valley elderberry longhorn beetle, the Licensee shall coordinate with U.S. Fish and Wildlife Service to develop and implement additional or alternative conservation measures to protect the valley elderberry longhorn beetle. Proposed modifications outside the scope of the Biological Opinion shall be filed with the Commission for approval prior to implementation.

Article A121. Protection of Red-Legged Frog

(a) The Licensee shall implement conservation measures required by the U.S. Fish and Wildlife Service Final Biological Opinion to protect the red-legged frog within the Project Boundary.

(b) The Licensee shall evaluate the effectiveness of these conservation measures in accordance with the Biological Opinion. The Licensee, in coordination with the U.S. Fish and Wildlife Service, shall annually evaluate and report to the Commission for information on the effectiveness of the conservation measures. If the conservation measures implemented are deemed to be unsuccessful in protecting the red-legged frog, the Licensee shall coordinate with U.S. Fish and Wildlife Service to develop and implement additional or alternative conservation measures to protect the red-legged frog. Proposed modifications outside the scope of the Biological Opinion shall be filed with the Commission for approval prior to implementation.

Article A122. Construction and Recharge of Brood Ponds

(a) Within one year following license issuance, the Licensee shall develop and file for Commission approval a Plan to construct four waterfowl brood ponds within the Thermalito Afterbay. The Plan shall be developed in conjunction with the California Department of Fish and Game and the Licensee shall consult with the Ecological Committee, including specifically the U.S. Fish and Wildlife Service, in developing the Plan. The Licensee shall include with the filing of the Plan copies of the comments, including recommendations, made in the course of such consultation, and an explanation as to why any such comment was not adopted. Upon Commission approval, the Licensee shall implement the Plan, including any changes required by the Commission. The Commission reserves the right to make further changes to the Plan.

(b) The Plan shall contain the following elements:

(1) Construction of one brood pond every five years over the 20-year period beginning upon issuance of this license. The ponds shall be constructed by creating a small earthen berm across an inlet in the Thermalito Afterbay.

(2) Maintenance of adequate water surface elevations within existing and future waterfowl brood ponds located within the Thermalito Afterbay by sufficiently filling the brood ponds no later than April 15 of each year. Once the brood ponds are filled, Licensee shall ensure that the water surface level of the ponds shall not fluctuate more than one foot throughout the primary waterfowl brooding season of April 15th through July 31st.

(3) Monitoring of the ponds on a weekly basis to ensure that adequate water surface elevations are maintained during the period of April 15th through July 31st.

(4) A requirement that the Licensee shall report to the California Department of Fish and Game's Oroville Wildlife Area Manager within 48 hours of discovering a fluctuation of more than one foot to report what the Licensee has done to remedy the situation or what the Licensee needs to further do to remedy the situation.

(5) Weekly inspection of the ponds from April 15 through July 31 of each year and maintenance as needed to ensure their structural integrity.

(c) The Licensee shall file an annual report with the Commission for information on water elevation monitoring. In addition, the Licensee shall provide a copy of such annual report to California Department of Fish and Game and U.S. Fish and Wildlife Service.

(d) The Licensee shall not be required to expend more than $920,000 to build the four brood ponds.

Article A123. Provision of Upland Food for Nesting Waterfowl

(a) The Licensee shall prepare and plant a total of 60 to 70 acres of upland cover/forage crops on an annual basis to support upland game birds and wintering waterfowl within the Thermalito Afterbay portion of the Oroville Wildlife Area on a rotational basis. The Licensee shall implement this measure in coordination with the California Department of Fish and Game.

(b) The Licensee shall not be required to expend more than $9,000 annually to carry out this article.

Article A124. Provision of Nest Cover for Upland Waterfowl

(a) The Licensee shall actively manage 240 acres of waterfowl nest cover, including preparing and planting 60 acres and maintaining an additional 180 acres annually within the Thermalito Afterbay portion of the Oroville Wildlife Area on a rotational basis. The Licensee shall implement this measure in coordination with the California Department of Fish and Game.

(b) The Licensee shall not be required to expend more than $15,000 annually to carry out this article.

Article A125. Installation of Wildlife Nesting Boxes

The Licensee shall install and thereafter structurally maintain 100 wildlife nesting boxes within the Oroville Wildlife Area within one year of issuance of this license. The Licensee shall also operate the 100 wildlife nesting boxes within the Oroville Wildlife Area consistent with generally accepted practices, including regular servicing of the boxes and any necessary maintenance and supplies needed for the boxes.

Article A126. Invasive Plant Management

(a) Within one year of license issuance, the Licensee shall develop and file for Commission approval a Plan to manage and reduce native and non-native invasive plant species populations within the Project boundary. The Plan shall be developed in conjunction with the U.S. Forest Service, Bureau of Land Management, California Department of Fish and Game, and California Department of Parks and Recreation, and in consultation with the Ecological Committee, including specifically the U.S. Fish and Wildlife Service (consultees). Prior to filing the Plan for Commission approval, the Licensee shall: 1) submit the portion of the Plan pertaining to National Forest System lands to the Forest Service for approval, 2) submit the portion of the Plan pertaining to Bureau of Land Management lands to Bureau of Land Management for approval, 3) submit the portion of the Plan pertaining to California Department of Fish and Game lands to California Department of Fish and Game for approval, and 4) submit the portion of the Plan pertaining to California Department of Parks and Recreation lands to California Department of Parks and Recreation for approval. The Licensee shall include with the filing of the Plan copies of the comments, including recommendations, made in the course of consultation, and an explanation as to why any such comment was not adopted. Upon Commission approval, the Licensee shall implement the Plan, including any changes required by the Commission. The Commission reserves the right to make further changes to the Plan.

(b) The Plan shall specify areas/acreage, treatment/control methods, best management practices, needs for multiple year treatments and monitoring, including an annual inspection. The Plan shall specifically address, but not be limited to, the

following species: purple loosestrife (*Lythrum salicaria)*; giant reed (*Arundo donax*); tree of heaven (*Ailanthus altissima*); scarlet wisteria (*Sesbania punicea*); parrot feather (*Myriophyllum aquaticum*); Himalyan blackberry (*Rubus discolor*); aquatic primrose (*Ludwigia peploides*); yellow starthistle (*Centaurea solstitialis*); Spanish broom (*Spartium junceum*); French broom (*Genista monspessulana*); Scotch broom (*Cytisus scoparius*); and skeleton weed (*Chondrilla juncea*).

(c) After coordination with the appropriate land management agency and then consultation with the consultees listed in A126(a) above, the Licensee may modify the implementation measures contained within the Plan without Commission approval to the extent the measures are within the scope of the approved Plan. Any modification to the implementation measures that are not within the scope of the approved Plan must be filed with the Commission for approval.

(d) The Licensee shall coordinate the Plan and ongoing efforts with applicable federal, state and local agencies and shall take into full consideration state and federally listed species.

(e) In consultation with the U.S. Forest Service, Bureau of Land Management, California Department of Fish and Game, and California Department of Parks and Recreation, the Licensee shall reevaluate the Plan five years after initial implementation, and shall consult with the consultees listed in A126(a) above and any other applicable federal, state and local agencies regarding the reevaluation. The reevaluation shall take into consideration the need to treat other invasive plant species, as well as alternative or additional control methods that may be implemented.

(f) The Licensee shall file annually with the Commission a compliance report for information. The Licensee shall first prepare the report in coordination with U.S. Forest Service, Bureau of Land Management, California Department of Fish and Game, and California Department of Parks and Recreation, and in consultation with the consultees listed in A126(a) above .The Licensee shall include with the filing copies of the comments, including recommendations, made in the course of such consultation, and an explanation as to why any such comment was not adopted.

(g) The Licensee shall not be required to expend more than $450,000 to develop and implement the Plan during the first five years after issuance of this license, and shall not be required to expend more than $35,000 every year thereafter.

RECREATION PROVISIONS

Article A127. Recreation Management Plan

(a) Upon license issuance, the Licensee shall implement the Recreation Management Plan (dated March 2006) as approved by the Commission, including, but not limited to, the following:

(1) The Licensee shall operate and maintain the Project recreation features in accordance with Section 7.2 of the Recreation Management Plan.

(2) The Licensee shall form a Recreation Advisory Committee in accordance with Section 4.4 of the Recreation Management Plan within 6 months of license acceptance.

(3) The Licensee shall implement a recreation monitoring program in accordance with Section 7.3 of the Recreation Management Plan. Every six years after license acceptance, the Licensee shall submit a FERC Form 80 report to the Commission. Prior to submitting the FERC Form 80 report to the Commission, the Licensee shall prepare the FERC Form 80 report in consultation with the Recreation Advisory Committee. The Licensee shall include with the filing copies of the comments, including recommendation, made in the course of such consultation, and an explanation as to why any such comment was not adopted. The FERC Form 80 report shall provide all relevant monitoring information substantially in accordance with Section 7.3 of the approved Recreation Management Plan.

(4) The Licensee shall establish the FERC License Coordination Unit (LCU) in accordance with Section 4.3 of the Recreation Management Plan within 6 months of license acceptance.

(5) Licensee shall conduct community workshops in the City of Oroville/Oroville area twice per year in accordance with Section 4.3.1 of the Recreation Management Plan.

(b) Within one year following the acceptance of the license, and after consultation with the Recreation Advisory Committee, the Licensee shall file a Recreation Implementation Plan, including a schedule for implementation in the first twelve years, to the Commission for approval. The Licensee shall include with the filing copies of the comments, including recommendations, made in the course of such consultation, and an explanation as to why any such comment was not adopted. The Commission reserves the right to make changes to the Recreation Management Plan and the Implementation Plan. The Licensee shall implement the approved Implementation Plan.

CULTURAL PROVISIONS

Article A128. Historic Properties Management Plan

(a) The Licensee shall implement the Historic Properties Management Plan (HPMP) as approved by the Commission. The Commission reserves the right to make further changes to the Plan.

Article A129. Improve and Redirect Recreation Usage to Specific Areas at Foreman Creek

(a) Within one year following license issuance, the Licensee shall develop and file for Commission approval a Plan to protect cultural resources at Foreman Creek while continuing to provide recreation at that location. The Licensee shall consult with the four federally recognized Native American Tribes located in Butte County, the Kon Kow Valley Band of Maidu and the Recreation Advisory Committee (consultees) in developing this Plan. The Licensee shall include with the filing of the Plan copies of the comments, including recommendations, made in the course of such consultation, and an explanation as to why any such comment was not adopted. Upon Commission approval, the Licensee shall implement the Plan, including any changes required by the Commission. The Commission reserves the right to make further changes to the Plan.

(b) The Plan shall include measures to restrict the usage of the existing car-top boat ramp and develop facility improvements to encourage recreational use at Foreman Creek in designated areas, including the installation of a restroom and picnic tables.

(c) The Licensee, in consultation with the consultees listed in A129(a) above shall review the Foreman Creek Plan annually over the first five years, and as necessary thereafter to ensure that the Plan is achieving the stated goals.

FLOOD CONTROL & EARLY WARNING SYSTEM

Article A130. Flood Control

The Licensee shall operate the project in accordance with the rules and regulations prescribed by the Secretary of the Army pursuant to Section 204 of the Flood Control Act of 1958 and other applicable law.

Article A131. Early Warning System

(a) Within one year following license issuance, the Licensee shall develop and file for Commission approval, an Early Warning Plan. The Licensee shall consult with the United States Army Corps of Engineers, the Department of Interior Bureau of Reclamation, the California Office of Emergency Services, and the Butte County Office

of Emergency Services (consultees) in developing this Plan. Upon Commission approval, the Licensee shall implement the Plan, including any changes required by the Commission. The Commission reserves the right to make further changes to the Plan.

(b) The Plan shall describe how the Licensee will communicate and coordinate project operations with the United States Army Corps of Engineers, the California Office of Emergency Services, and the Butte County Office of Emergency Services before and during flood emergency events. The Plan shall be consistent with the Standardized Emergency Management System (SEMS). The Plan shall describe measures the licensee shall take before and during greater than normal operational releases and during flood emergency events, including, at a minimum, the consulted agencies; a description of emergency response procedures, including dam operations; and a schedule for implementing and evaluating the Plan.

(c) The Licensee shall provide a minimum of 30 days for the consultees listed in A131(a) above to comment and make recommendations before filing the Plan with the Commission. The Licensee shall include with the filing copies of the comments, including recommendations, made in the course of such consultation, and an explanation as to why any such comment was not adopted.

LAND USE

Article A132. Screening of Material Storage Area

Within one year following issuance of the license, the Licensee shall plant appropriate vegetation to screen the storage/staging area located northwest of the emergency spillway from view of Oroville Dam Boulevard, and shall thereafter maintain the vegetation. To the extent practical, native plants shall be used.

PROJECT BOUNDARY

Article A133. Project Boundary Modifications

Within two years following license issuance, the Licensee shall file, for Commission approval, a revised Exhibit G and narrative statement as an application to amend its license. The revised Exhibit G shall show all Project works, including environmental and recreation measures, access roads, transmission lines and any other lands necessary for project purposes in the Project Boundary. The narrative statement shall explain any changes to the proposed Project Boundary and the amount of federal land occupied by the Project, and how the proposed Project Boundary includes those lands necessary for Project purposes. For any subsequent changes to the Project Boundary necessary to carry out the measures required by the license, the Licensee shall file an additional revised Exhibit G for Commission approval, which also shall be accompanied by a narrative statement. Prior to making any filing under this article, the Licensee shall

consult with the Recreation Advisory Committee or the Ecological Committee as appropriate.

COST CAPS

Article A134. Expenditures

Notwithstanding the limitation on expenditures included in this license, the Commission reserves the right to require the Licensee to undertake such measures as may be appropriate and reasonable to implement approved plans and other requirements in this license.

PROCEDURAL REQUIREMENTS

Article A135. Procedural Requirements

The Licensee shall comply with the procedural requirements found in Section 5 (Dispute Resolution), 4.15.1 (Reopener) and 4.15.2 (Amendment of New Project License) of the Settlement Agreement filed with the Commission. The Commission will not consider motions to reopen or amend the license filed by either the Licensee or non-licensee signatories to the Settlement Agreement who have failed to comply with these procedural requirements.

APPENDIX B

Measures Agreed to Among the Parties But Not to be Included in New Project License

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APPENDIX B

Measures Agreed to Among the Parties But Not to be Included in New Project License

Section B100. Project Supplemental Benefits Fund

A. General Provisions

1.0 The parties agree that their intent in establishing the Project Supplemental Benefits Fund (Fund) is to:

1.1 Allow the benefits of the Oroville Facilities to be extended into the local communities in the vicinity of the FERC boundary in a manner consistent with DWR's authority to provide such benefits through operation of the State Water Project (SWP).

1.2 Create benefits for the parties that are in concert with and do not conflict with the actions taken by DWR pursuant to the new FERC license issued for the Oroville Facilities and the Settlement Agreement.

2.0 If a significant representation from the local community, as determined by DWR, enters into the Settlement Agreement, then DWR shall establish and maintain the Fund, as further provided herein.

B. Fund Usage and the Oroville Facilities Boundary

1.0 Subject to subsection 2.0 below, the Fund shall be used solely to support projects that are selected in accordance with Section D or as otherwise provided herein and that supplement the benefits provided by the Oroville Facilities, but which are located outside of the Oroville Facilities' boundary.

2.0 At DWR's sole discretion and subject to FERC approval, the Fund may be used to support projects located within the Oroville Facilities' boundary, but which are not within the jurisdiction of FERC, i.e., a non-project use of project lands. Any such use of the Oroville Facilities' lands shall be subject to such terms and conditions as DWR and/or FERC deems appropriate.

C. Fund Administrator

1.0 Upon the effective date of the Settlement Agreement and subject to its execution of such agreement, the City of Oroville shall be designated as and assume the duties of Fund Administrator. If the City does not execute

the Settlement Agreement or withdraws from the Settlement Agreement, then DWR shall consult with other signatories and designate a different Fund Administrator.

2.0 The Fund Administrator shall use its internal protocols to formally designate a person within its organization to serve as the responsible person for performance of all such administrative duties required to ensure the orderly and efficient operation of the Fund. Such person, or successor thereto, will serve as the principal liaison with DWR during the establishment and operation of the Fund and will be fully authorized by the Fund Administrator to undertake actions on all administrative matters specified in the Fund Implementation Agreement.

3.0 As delineated further herein, the principal duties of the Fund Administrator shall consist of:

3.1 Convening meetings and implementing the decisions of a Fund Steering Committee in accordance with Section D;

3.2 Performing grant funding tasks in accordance with Section F;

3.3 Developing a regional Fund Strategic Plan in accordance with Section G; and

3.4 Entering into a Fund Implementation Agreement with DWR and discharging obligations thereto, in accordance with Section H.

D. Fund Steering Committee

1.0 Within six months of assumption of duties by the Fund Administrator, a Fund Steering Committee composed of five voting members and three advisory members, selected in accordance with subsection 2.0 below, shall be convened by the Fund Administrator to provide direction regarding proposed projects to be funded through the Fund.

2.0 The voting members of the Steering Committee shall be composed of the following publicly elected officials:

2.1 three members from the Oroville City Council; and

2.2 two members from the Board of Directors of the Feather River Recreation and Parks District.

The members of the Steering Committee will be selected by the appropriate governing body at the beginning of each calendar year and will serve one year terms, except that the initial term will be one year plus

the time from the date the initial member(s) are selected to the beginning of the next calendar year.

3.0 If one or more of the local agencies named in subsection 2.0 above fail to execute the Settlement Agreement, then DWR shall consult with the Fund Administrator and other local governmental agency signatories to determine an appropriate replacement agency(s), if any, for the non-signing agency(s).

4.0 DWR will participate on the Steering Committee in a non-voting advisory role.

5.0 Subject to their execution of the Settlement Agreement, the following stakeholders may, at their discretion, become non-voting advisory members of the Steering Committee:

5.1 the State Water Contractors (SWC),

5.2 the Oroville Area Chamber of Commerce, and

5.3 American Rivers.

6.0 The Steering Committee shall be the sole decision-maker, through majority vote of its members, for purposes of adopting the Fund Strategic Plan, selecting proposed projects eligible for funding, and determining the level of funding appropriate for such projects. If the majority vote on any given measure or action results solely from the votes of a single agency, a majority plus one vote will be required for approval of the measure or action.

7.0 At the first meeting of the Steering Committee, a Chair will be elected to provide for the orderly performance of Steering Committee functions. Thereafter, the Steering Committee will elect a new chair annually. No member agency of the Steering Committee shall serve as Chair for more than two consecutive years.

8.0 At the first meeting of the Steering Committee, the Fund Administrator shall propose written procedures governing committee and membership activities for consideration and adoption by the Steering Committee. In no event shall such procedures conflict with or modify any provision of the Settlement Agreement; provided, however, that members may be added to the Steering Committee upon unanimous vote of the voting members of the Steering Committee, provided they were among the original signatories to the Settlement Agreement and written concurrence of DWR.

9.0 Principal duties of the Steering Committee will consist of:

9.1 facilitating administration of the Fund in a manner consistent with the prudent use of public funds for public purposes;

9.2 adopting the Fund Strategic Plan;

9.3 selecting proposed projects eligible for funding; and

9.4 determining the level of funding appropriate for such projects.

10.0 The Steering Committee will hold public meetings as necessary, but no less than annually, to take action on:

10.1 development and adoption of the regional Fund Strategic Plan pursuant to Section G;

10.2 review and approval of proposed projects to be funded that meet the criteria of the Fund Strategic Plan;

10.3 approval of the level of funding for approved projects; and

10.4 election of a new chair.

E. DWR Commitment to Establish and Maintain Fund

1.0 Subject to the DWR determination required under Section A(2.0), DWR shall establish the Fund that will provide up to $61,270,000 of unescalated funds, with a combination of initial payments and annual payments as provided below.

2.0 After the executed Settlement Agreement is approved by the Department of Finance, the first $1,935,000 of these funds will be made available in accordance with an annual schedule to be determined by the Fund Administrator in consultation with the Steering Committee. Payments shall be made in arrears upon invoice by the Fund Administrator to DWR of actual expenses up to the total $1,935,000.

3.0 The second $4,135,000 of these funds, as well as any unexpended funds from those made available pursuant to Section E(2.0), will be transferred as a lump sum to the Fund Administrator upon acceptance by DWR of a new license for the Oroville Facilities with terms and conditions that are consistent with and substantially similar to the provisions set forth in the Settlement Agreement.

4.0 DWR shall provide the following unescalated annual payments, as appropriate for the new license term, to the Fund Administrator by June 30

of each year beginning with the first year following DWR acceptance of a new license:

4.1 fifty year term: $1,000,000 per year;

4.2 forty-five year term: $900,000 per year;

4.3 forty year term: $800,000 per year.

4.4 For any license term less than forty years, DWR shall use its discretion to determine the annual payment, if any, which, at a minimum, shall be less than the amount listed in section 4.3 above.

5.0 The Fund also includes $3,000,000 that DWR has already committed to Riverbend Park pursuant to an agreement with Feather River Recreation and Parks District, dated September 26, 2002, and an additional $2,200,000 that was added to this contract via a contract amendment with approval from original signatories of the Interim Settlement Agreement for Riverbend Park Improvements.

6.0 If in any year in which DWR has, during its May determination, approved allocations of 35% or less of the maximum contractual amount SWP contractors can annually request pursuant to their long term water supply contracts, annual payments will be re-scheduled as follows:

6.1 when the approved allocation is 25% or less of the total annual contractual maximum, the next annual payment shall be reduced to $300,000;

6.2 when the approved allocation is between 26% and 35% of the total annual contractual maximum, the next annual payment shall be reduced to $500,000;

6.3 the reduced amounts shall be recovered in full through five equal annual installments beginning with the subsequent first year in which the May approved allocation exceeds 35% of the total annual maximum contractual amount the SWP contractors can request; provided that, the repayment obligation will be made in the years that the allocation exceeds 35% of the total annual maximum contractual amount the SWP contractors can request. The repayment obligation shall survive termination of this agreement and shall be added to the regular annual payments identified in Section 4.

7.0 DWR will use its best efforts to provide a transparent and stable funding stream for the Fund, consistent with its spending authorities.

8.0 If in any year(s) the annual generation (MWH) at the Oroville Facilities is reduced by more than 10% due to a forced physical outage or a regulatory, legislative, or judicial action, the payment(s) to the Fund for the following year(s) will be reduced by the percentage that exceeds 10%. This reduction in payment(s) shall remain in effect only until and to the extent that the reduction in annual generation remains in effect.

9.0 Payments to the Fund will constitute DWR's entire contribution to the funded projects and no contributions from DWR will be solicited by any party for any project that is denied funding by the Steering Committee.

10.0 At DWR's discretion and per its specifications, completed projects may include recognition of DWR funding.

F. Pursuit of Grant Funds by SWC and Steering Committee

1.0 The State Water Contractors (SWC), and the Steering Committee, agree to form a partnership,[1] the goals of which are to (1) solicit grant funds in addition to those made available under Section E. above, and (2) obtain grant funds to supplement the Fund such that the future purchasing ability of the proposed annual payments will at least keep pace with inflation.

2.0 To accomplish this, the SWC agree to use best efforts to:

2.1 develop a grant assistance program aimed at securing funding in an amount equal to or greater than the amount needed to keep pace with inflation;

2.2 work with the Fund Administrator in exploring various political avenues that may be a productive source of various grants;

2.3 work with the Fund Administrator by making available appropriately qualified in-house staff trained in locating, researching, evaluating, and writing grant proposals for effective fundraising; and

2.4 make available staff resources in an amount not to exceed 50 percent time of one FTE. The staffing for obtaining grant funding will be in effect until five years prior to the expiration of the new license.

[1] Use of the term "partnership" does not connote or create a legal relationship between the SWC and other parties. The parties are not partners, joint venturers or any other legal entity. Rather, use of the term "partnership" is limited to signifying a cooperative endeavor between the SWC and local interests to seek to obtain grant funds, consistent with the concepts set forth herein.

3.0 The Fund Administrator, in coordination with the resources of the Steering Committee voting members, agrees to make available appropriate staff and other resources to complement the grant funding efforts of the SWC without using any Fund allocations.

4.0 Due to the local community's existing desire for recreational and economic development benefits, it is expected that fundraising efforts should be pursued particularly aggressively during the first ten years of the new license term.

5.0 The SWC grant assistance program efforts and the local community grant assistance program efforts will be coordinated. The SWC's efforts will be managed by a SWC representative who shall serve in an advisory capacity to the Steering Committee. The SWC representative also will be responsible for reporting on the SWC grant assistance program activities and performance to the Steering Committee at least once a year. The SWC may designate different personnel to serve on the Steering Committee and to manage the grant funding process. The Fund Administrator shall designate a local representative who will manage the grant program activities on behalf of the Steering Committee.

6.0 The SWC and local community grant assistance program's performance will be evaluated by the Steering Committee during and in accordance with future updates and revisions of the regional Fund Strategic Plan described below. The purpose of the evaluation will be to: review past SWC and local community grant assistance program performance; ensure that "best efforts" by the SWC and local community have been made; and, if necessary, recommend and adjust the program's future fundraising strategy and efforts for greater fundraising effectiveness.

7.0 The parties agree that grant funding cannot be assured due to the competitive process for obtaining such funds. As a result, the SWC are not obligated to guarantee any level of grant funding. The sole SWC commitment is to provide staff resources and political capital to assist and work with the local community to obtain grant funds. It is further agreed that the SWC shall have no obligation to pursue any particular grant if in its judgment to do so would be detrimental to the economic or political interests of the SWC or any of its members. It is further agreed that in those cases where the SWC or any of its members are, or would be, competing with the local community for funds from the same source, there shall be no obligation on the part of the SWC to undertake any actions in pursuit of the grant.

8.0 At the request of either the SWC or the Steering Committee, the grant funding provision of this agreement may be reviewed after the first 10 years of the license term if the grant assistance program has not resulted

in the procurement of any grant funding. If no grant funding has been obtained, the SWC and the Steering Committee will negotiate in good faith to develop additional or alternative jointly- pursued actions or methodologies for obtaining grant funds. This renegotiation shall constitute the sole remedy for failure to obtain grant funds.

9.0 Payments to DWR for the Fund will constitute the SWP contractors' and their member agencies' entire contribution to local projects, and no further contributions from the SWP contractors or their member agencies will be solicited by any local party. Further, at the request of the SWC, completed projects made possible through grant funding will include recognition of SWC efforts.

G. Regional Fund Strategic Plan

1.0 At the direction of the Steering Committee, the Fund Administrator shall develop a regional Fund Strategic Plan to guide the Steering Committee in selecting and funding proposed projects in a manner that optimizes the overall benefits to the local region consistent with the availability of funds.

2.0 Subject to subsection 3.0 below, only those projects consistent with the goals of the Fund Strategic Plan shall be eligible for funding.

3.0 Prior to adoption of the Fund Strategic Plan, the Steering Committee may direct the Fund Administrator to fund administrative activities and selected projects only from funds obtained through the initial payments as provided in subsections E.2.0 and E.3.0.

4.0 Development of the Fund Strategic Plan shall include a series of public meetings to obtain input about the need for proposed projects. Such meetings shall be open to any person.

5.0 At a minimum, the Fund Strategic Plan shall include the following:

5.1 phasing of projects to complement the implementation of DWR's Recreation Management Plan, including consideration for development of the recreational and economic benefits of the Feather River.

5.2 a statement of goals and policies that provide a basis for optimizing Fund benefits based upon sound business practices consistent with public purposes;

5.3 allocations of the overall Fund for administrative costs, capital expenditures, operation and maintenance costs, feasibility costs,

and environmental permitting and related costs, with the intent of maximizing benefits to the local region;

5.4 a discussion of the consistency of the Fund Strategic Plan with identified goals for economic and recreational development in the greater Oroville region, including the potential for energy and water incentives or programs;

5.5 measurable performance standards to ensure that economic and recreational benefits are distributed in a manner that is consistent with the goals of the Fund Strategic Plan and that benefits are distributed appropriately in the region;

5.6 a list of the Fund Strategic Plan policies that will ensure consistency with the identified goals;

5.7 protocols for ensuring the consistency of the Fund Strategic Plan with the new license for the Oroville Facilities, including the approved Recreation Management Plan;

5.8 adaptive management features to ensure that the Fund Strategic Plan remains effective throughout the term of the Settlement Agreement, or, as determined by the Steering Committee, periodic review and update of the Strategic Plan no less than every 10 years;

5.9 Project selection criteria, which shall include:

5.9.1 priority consideration for funding projects with a documented source of matching funds or other cost-sharing mechanism and priority consideration for projects with an ability to return a portion of generated revenue to the Fund; if matching funds will be made available, the project proponent must provide documentation of such firm commitment before allocations of the Fund can be made;

5.9.2 consistency with existing environmental and recreational projects, and local land use plans;

5.9.3 ability of the proposal to adequately define a project description, with concept level drawings, if applicable; map; estimated cost of project (capital and O&M); amount of funds already allocated (capital and O&M), if any; name of project proponent (party that will implement project); proposed timeframe for implementation; and identification of required permits;

H. Fund Implementation Agreement

1.0 DWR and the Fund Administrator will use best efforts to develop and execute a Fund Implementation Agreement within four months of the effective date of the Settlement Agreement. The purpose of the Fund Implementation Agreement is to direct future performance of all administrative duties associated with implementation of the Fund. This Fund Implementation Agreement will include, but not be limited to, detailed language addressing the following duties of the Fund Administrator:

1.1 entering into appropriate contracts with developers of selected projects and ensuring compliance with applicable state and federal environmental laws;

1.2 monitoring the progress of selected projects and enforcing any contractual remedies for non-performance;

1.3 documenting all use of the Fund in a manner consistent with auditing requirements associated with the use of public funds;

1.4 working with DWR to resolve in a timely manner any of its issues related to administration of the Fund;

1.5 working with the Steering Committee to implement its decisions;

1.6 developing criteria to be followed during project implementation and inserted into contracts with developers, including:

1.6.1 schedule and benchmark conditions for phased release of Funds, as determined appropriate by the Steering Committee;

1.6.2 identification of responsible parties for securing any necessary permits and for implementing the project in accordance with conditions, timelines, benchmarks;

1.6.3 requirements for periodic status reports to Administrator;

1.6.4 penalties for failure to comply with conditions such as withdrawal of allocation of funds to that project.

I. Fund Administrative Expenditures

1.0 Portions of the Fund will be allocated for administration of the Fund and Fund Strategic Plan development, as specified below:

1.1 For the first two years beginning with the effective date of this agreement, an annual average amount of $300,000 per year will be allocated to the Fund Administrator for administrative duties associated with establishment and initial administration costs of the Fund, including development of a Fund Strategic Plan in accordance with the applicable provisions herein. Any amount allocated to administrative costs in the first two years that is not expended for administrative duties shall be reallocated to the Fund by the Fund Administrator.

Thereafter, a maximum annual amount to be determined by the Steering Committee will be allocated to the Fund Administrator for administrative duties. Administrative duties include, but are not limited to, activities associated with management of the Fund, including implementation of the Fund Implementation Agreement, disbursement of funds allocated to projects, oversight of projects that receive an allocation of the Fund, coordination of Steering Committee meetings, public notice of Steering Committee meetings, preparation of minutes of Steering Committee meetings, and staff for the Fund Administrator, as appropriate. Any amount allocated to administrative costs that is not expended for administrative duties shall be reallocated to the Fund.

Section B101. Feather River Whitewater Boating Opportunity Feasibility Study

(a) After filing the signed Settlement Agreement with FERC, Licensee will initiate and fund a whitewater boating opportunity and recreation feasibility study to assist the Fund Steering Committee of the Project Supplemental Benefits Fund in determining whether to fund the construction and operation of such a project, or cost share on such a project somewhere in the region, pursuant to their funding criteria. This feasibility study will be conducted in consultation with signatory Parties of this Settlement Agreement for the Oroville Facilities. Specifically, American Rivers, American Whitewater, and the City of Oroville may actively contribute to the completion of the study and participate in its funding.

(b) This feasibility study will build off of the results of R-16 Whitewater and River Boating Report (DWR 2004). Components of this study will include: 1) a study scoping process; 2) a review of potential whitewater opportunities within this area, including park and non-park options, and constraints (physical, operational, environmental, estimated conceptual costs, and permitting/approvals needed); 3) a review of other existing and

proposed whitewater boating park and non-park opportunities in the region (N. California, N. Nevada, other nearby western states, or other appropriate analogs if possible), including boating experience and opportunities provided, seasonal timeframe availability, typical user distance traveled; visitation census if available; 4) whitewater demand trends, market feasibility, ownership and management (and financing) options, estimates of direct and indirect economic activity potentially generated by such a facility, and potentially competing venues or opportunities; and 5) conclusions regarding the feasibility of constructing and operating a whitewater boating (park and non-park) facility in the project area or region.

(c) Except as provided in the Project Supplemental Benefits Fund, the Licensee's financial obligation under this provision does not extend beyond this feasibility study. Study cost contribution by the Licensee will be a maximum of $250,000. The study scoping process, including any necessary contracting efforts, will commence within 90 days of the execution of this Settlement Agreement. Target study completion will be within 15 months of execution of this Settlement Agreement.

LAND USE AND ENGINEERING/OPERATIONS

Section B102. Development of a Fuel Load Management Plan

Within one year of license issuance, the Licensee agrees to develop and file for Commission information a Fuel Load Management Plan for the Project lands. The plan will be developed in coordination with the U.S. Forest Service, Bureau of Land Management, California Department of Forestry and Fire Protection Butte Unit, California Department of Parks and Recreation, California Department of Fish and Game, Licensee, Paradise Fire Department, Butte County Fire Safe Council, Butte County Resource Conservation District, State Water Contractors, Native American Tribes, and other appropriate agencies and associated public processes. The plan will include identification of the issues, prioritization, and recommended actions to address them. The plan will be prepared to be consistent with the plans adopted by the above entities for non-project lands, to the extent permitted by the license and operational constraints of the Project. The plan will be prepared to be consistent with the Oroville Wildlife Area Management Plan. The Parties acknowledge that the Forest Service is submitting a 4(e) condition regarding a Fuel Load Management Plan for Forest Service lands within the FERC boundary, and that FERC will include that condition in the New Project License. The Parties agree that the inclusion of the Forest Service 4(e) condition on fuel load management will not make the New Project License Inconsistent with this Settlement Agreement.

Section B103. Additional Gaging

The Licensee agrees to evaluate and potentially implement additional stage and/or precipitation gaging locations in order to improve flood forecasting and monitoring.

ENVIRONMENTAL PROVISIONS

Section B104. Feather River Fish Hatchery Funding

The Licensee shall provide all necessary funding to the California Department of Fish and Game to implement the Feather River Fish Hatchery Program as set forth in Article 107.

Section B105. Gravel Supplementation

Upon execution of this Settlement Agreement, the Licensee shall proceed to obtain all necessary permits for the supplementation of at least 8,300 cubic yards over the December 31 2005 baseline of spawning gravels suitable for spring-run Chinook salmon or steelhead which shall be distributed over up to 15 locations in the Low Flow Channel or High Flow Channel of the Feather River as set forth in Article 102. Upon obtaining all necessary permits, the Licensee shall implement this provision.

Section B106. Oroville Wildlife Management Plan

The California Department of Fish and Game shall use best efforts to obtain adequate funding to develop the Oroville Wildlife Management Plan as set forth in Article 115.

Section B107. Revision of Speed Limit Regulation for Thermalito Afterbay

Upon the execution of this Settlement Agreement, the California Department of Fish and Game shall make a recommendation to the California Fish and Game Commission to rescind the speed limit for the Thermalito Afterbay south of Highway 162.

Section B108. Flow/Temperature to Support Anadromous Fish

(a) River Valve. Upon execution and filing of the Settlement Agreement, Licensee shall begin the necessary studies for the refurbishment or replacement of the river valve. Licensee shall refurbish or replace the river valve as necessary in its sole discretion. The river valve will continue to be used primarily for meeting the hatchery temperature requirements (which has the incidental effect of helping to achieve Table 1

temperatures) until a Facilities Modification(s) for providing colder water to the Low Flow Channel and High Flow Channel is constructed. After the refurbishment or replacement of the river valve and prior to the completion of construction of the Facilities Modification(s), the Licensee shall consider using the new valve to meet the hatchery temperatures targets in A107.2(a).

(b) Reconnaissance Study for Potential Facilities Modification(s) for Fish Habitat Temperature Needs.

(1) By October 31, 2006, Licensee shall submit to National Marine Fisheries Service, U.S. Fish and Wildlife Service, California Department of Fish and Game, California State Water Resources Control Board, American Rivers, and the State Water Contractors, a Reconnaissance Study of Potential Facilities Modification(s) to address temperature habitat needs for anadromous fisheries in the Low Flow Channel and High Flow Channel. The study shall clearly: identify resource issues and goals to be addressed; identify and describe an array of alternatives to address the issues and goals; and identify potential issues, benefits, impacts and likely costs of the identified alternatives. The alternatives to be considered include, at a minimum: (i) Palermo Canal improvements; (ii) Hyatt intake extension; (iii) replacement of the river valves with valves specifically designed to incrementally control water releases; (iv) construction of a diversion canal around or through the Thermalito Afterbay; and (v) construction of an alternative Thermalito Afterbay Outlet and channel in the OWA to the Feather River. Alternatives shall be analyzed with consideration of all project purposes, including water supply, flood control, power generation, recreation and fish and wildlife protection. If appropriate, alternatives may be eliminated from further study if: (i) the benefits do not exceed the costs, (ii) there are significant environmental impacts, or (iii) they are otherwise impractical. This study is not expected to determine a preferred alternative, but rather is intended to narrow the range of potential actions. However, the Parties shall rely on a future in-depth Feasibility Study and Implementation Plan for Facilities Modification(s) to eventually select Facilities Modification(s) or other actions to meet Table 1 temperatures and address appropriate temperature resource goals in the High Flow Channel.

(2) Licensee shall provide a draft Reconnaissance Study to the National Marine Fisheries Service, U.S. Fish and Wildlife Service, California Department of Fish and Game, California State Water Resources Control Board, American Rivers, and the State Water Contractors by August 31, 2006. It shall attempt to resolve any disputes regarding the study through consultation. The final study shall include the results of such consultation, including response to comments and an explanation why any comments were not incorporated.

(3) Licensee shall provide a copy of the final Reconnaissance Study to the Commission for information purposes by approximately October 31, 2006.

(c) Cost Caps for Facilities Modification(s) for Fish Habitat Temperature Needs. The Parties agree to a cost cap of $5 million for the Reconnaissance Study and subsequent Feasibility Study and Implementation Plan for Facilities Modification(s). The Parties agree to a capital cost for the Facilities Modification(s) not to exceed $60 million (2005). Capital costs include those costs normally associated with large construction projects as estimated using standard procedures. Parties will not request that the Commission order Facilities Modification(s) that cost in excess of this cap, provided the Reconnaissance Study and Feasibility Study and Implementation Plan for Facilities Modification(s) show that a Facilities Modification(s) within the cap will achieve the stated purposes in Article A108. If the total estimated costs exceed a total of $65 million, the Parties agree to seek additional third party funding. If such third party funding cannot be obtained within a reasonable time, the Parties may then request the Commission to order the Facilities Modification(s) notwithstanding that it may exceed the cost cap.

(d) If the Commission does not approve the recommended Plan, the Licensee shall refine the Plan in consultation with the National Marine Fisheries Service, U.S. Fish and Wildlife Service, California Department of Fish and Game, California State Water Resources Control Board, American Rivers, and the State Water Contractors and resubmit the Plan to the Commission for approval.

Section B109. Riparian/Floodplain Screening Level Analysis

The Licensee shall develop the screening level analysis for potential riparian/floodplain improvement projects required in Proposed License Article A106(b)(1) consistent with the Oroville Wildlife Area Management Plan currently in effect.

Section B110. Analysis of Non-Motorized Water Trail Shoreline Access

(a) Within one year of License issuance, the Licensee shall complete an analysis of non-motorized water trail shoreline access opportunities along the Feather River within and in the vicinity of the Project boundary. Suitable sites will be identified and ranked in consultation with the signatory Parties of this Settlement Agreement.

(b) Licensee shall fund and/or construct or improve a total of two to three river access sites within five years after the New Project License becomes final.

(c) Licensee shall work cooperatively with California Department of Boating and Waterways and other appropriate state or local agencies to expand the boating trail

opportunities downstream in the Feather River to the Sacramento River confluence or beyond where practical.

Section B111. Oroville Wildlife Area Funding

Within 120 days of the signing of the Settlement Agreement or by July 1, 2006, whichever is sooner, the Licensee shall complete an Interagency Agreement to provide the annual funding to the California Department of Fish and Game (CDFG) as agreed upon to manage the Oroville Wildlife Area (OWA) and implement those continuing tasks associated with the FERC Project No. 2100. The commitment and resources to be committed in the IA that will be effective on July 1, 2006 are as follows:

The current estimate of the staff resources needed by DFG pursuant to the Settlement Agreement is estimated as the equivalent of 5.5 full-time positions to perform and manage various activities that include public safety, recreational management, facilities management and protection, and the protection of fish and wildlife resources within the OWA. Specifically, these positions would be a combination of: (1) Habitat Supervisor II, (2) Habitat Supervisor I, (3) Environmental Scientist/Biologist, (4) Tractor Operator/Laborer, (5) Fish and Wildlife Technician and (6) Seasonal Aide(s). These positions would be employees of the CDFG. The estimated cost of funding these positions is $350,000 annually (2005). The Licensee shall reimburse CDFG within (45) days of receipt of invoice; CDFG shall give the Licensee an invoice detailing the cost, as often as monthly in arrears. The records of expenditures will be available for Licensee's review.

The Licensee shall provide sufficient funds to CDFG for the purchase of: (1) one air boat and trailer. (2) One 4x4 Back Hoe, (3) two 4x4 ATVs, and (4) five 4WD pick up trucks. The estimated cost of the above is $232,000. The Licensee shall, upon Signing of the Settlement Agreement, pay CDFG $232,000 for the purchase of this equipment. CDFG shall give the Licensee a copy of all invoices or bills of sale and indicate the total cost of the equipment. If the actual cost exceeds $232,000, then the Licensee shall pay the additional actual costs within forty five (45) days of receipt of the invoices or bills of sale by CDFG. The records of expenditures will be available for Licensee's review. The Licensee and CDFG agree that this equipment may need to be replaced during the term of the license. The Licensee and CDFG shall meet every five years as described below to make necessary funding adjustments.

The Licensee shall provide $82,500 annually (2005) to CDFG and thereafter on or about July first of the new fiscal year. This money may be spent by CDFG for expenses including but not limited to utilities, phone service, equipment maintenance, vehicle maintenance, refuse disposal, and general operating and maintenance costs. This amount is for minor administrative expenses only and is not intended to encompass expenses beyond such minor administrative expenses. Any costs associated with mosquito abatement shall be sent directly to the Licensee for payment. Any regulatory or compliance costs, or other third party costs, associated with FERC Project No. 2100

and its effect on the operation of the OWA are the responsibility of the Licensee. The records of CDFG's administrative expenditures will be available for Licensee's review. The Licensee shall provide CDFG $170,000 (2005) annually and thereafter on or about July first of the new fiscal year to assist CDFG with its Wildlife Protection activities within the OWA and Project boundary (FERC Project No. 2100). The records of expenditures will be available for Licensee's review.

Additionally, the Licensee shall provide CDFG their costs, not to exceed $100,000 annually (for the term of the license), for public safety and enforcement overtime within the OWA and FERC Project No. 2100 Boundary. These overtime dollars are to be uses for enforcement of the California Code of Regulation, Fish and Game Code and other state laws. The records of expenditures will be available for Licensee's review.

Upon license issuance and at five year intervals for the remainder of the license, the commitments identified above shall be reviewed by the Licensee and CDFG and funds necessary for the operation of the Oroville Wildlife Area and implementation of tasks associated with the new license (FERC Project No. 2100) provided to CDFG. The Licensee and CDFG shall mutually agree to adjust these commitments and resources as necessary to better reflect then current costs of operating the OWA and implementing the new FERC Project No. 2100 license conditions within the OWA and FERC Project No. 2100 boundary.

APPENDIX C
ECOLOGICAL COMMITTEE

1.0 PURPOSE AND GOAL OF COMMITTEE

1.1 The purpose of the Ecological Committee (EC) is to advise the licensee, Department of Water Resources (DWR), on ecological issues related to implementation of the New License for Federal Energy Regulatory Commission Project No. 2100. The primary goal of the EC is to achieve consensus on the matters within the scope of the EC's responsibilities under the Settlement Agreement and the New Project License.

2.0 COMMITTEE MEMBERSHIP AND MEETING PARTICIPATION

2.1 The EC shall be comprised of DWR and the following members, subject to their signing the Settlement Agreement:

a) State and Federal Members - One representative each from: U.S. Fish and Wildlife Service, Bureau of Land Management, California Department of Fish and Game, California Department of Parks and Recreation, and National Marine Fisheries Services.

b) Other Members (6) – One representative each from: the State Water Contractors; local Native American tribes; Butte County; the City of Oroville; American Rivers; Oroville Area Chamber of Commerce; as selected by each stakeholder category according to their own methods.

2.2 The State Water Resources Control Board and the Central Valley Regional Water Quality Control Board shall also be members of the EC even though they have not signed the Settlement Agreement.

2.3 Each member or category of members may designate a primary representative to the EC within 30 days after the Effective Date, or at any time thereafter with 5 days' notice. Designation shall be by notice to the Parties in accordance with Section 7.11 of the Settlement Agreement. Each member or category of members may name alternate representatives to the EC. Failure to designate a representative shall not prevent the EC from convening or conducting its functions in accordance with the time schedules set forth in this Article or otherwise established in the Settlement Agreement or the New Project License.

2.4 The EC, by unanimous agreement not subject to dispute resolution, may grant any other entity membership status on the EC, provided that the entity seeking membership submits a proposal to the EC that requests membership and demonstrates: (1) reasons why its interests are not adequately represented by present EC membership; and (2) appropriate qualifications of the entity to

participate in the EC. Any new member must agree in writing to be bound by the terms of the Settlement Agreement.

2.5 Each member should select a representative who has relevant training or experience with natural resource management.

2.6 Members with representation on more than one license committee will be expected to coordinate their participation in a consistent and coherent manner across all committees.

2.7 Participation by identified state or federal resource agencies complements their statutory responsibility for resources contained within the license boundary and does not otherwise affect their authority. Issues involving the exercise of specific agency authority can be discussed, but decisions are not delegated to the committee.

3.0 MEETING PROVISIONS

3.1 DWR shall establish the EC not later than three months after license issuance.

3.2 DWR will arrange, administer, and chair all meetings. A meeting facilitator may be used if necessary. DWR will provide no fewer than 10 days' prior notice of any meeting, including public notice, unless otherwise agreed to by the EC or required in order to meet a license deadline or other emergency circumstance.

3.3 DWR, or the facilitator, will provide draft meeting summaries for concurrence by the committee prior to final distribution. Meeting summaries will note member concerns.

3.4 The EC will establish protocols for meetings such as agenda development, location and scheduling. Meetings will be fairly distributed between Oroville and Sacramento with teleconferencing provided between sites.

3.5 Meeting agendas will list specific license articles and all other topics for action or discussion.

3.6 Meetings will be scheduled as determined by milestone events contained within specific license provisions, but no less frequently than annually. The EC shall meet jointly with the RAC annually.

3.7 DWR will bear all costs associated with conducting meetings. Each member will bear its own cost of attendance.

3.8 The Licensee will post final meeting summaries and any other written comments on the LCU website and file them with FERC.

3.9 The role of the EC will be evaluated at the end of 5 years after license issuance. The members will review the EC and determine if it should remain the same, be modified or discontinued.

4.0 COMMITTEE DELIBERATIONS

4.1 During meetings, prior to committee deliberations, the public may address the committee and provide comments on each agenda topic being discussed.

4.2 Following public comment and committee deliberation, the committee shall seek to reach consensus.

4.2.1 For any decision which the license does not assign to a specific agency for approval, consensus is defined as non-opposition of all committee members present. DWR or the facilitator will poll all EC members present and provide the results of the final poll to all EC members within three working days. Non-opposition means the absence of notice within seven working days that a member will seek dispute resolution pursuant to Section 5 of the Settlement Agreement.

4.2.2 For any decision assigned to a specific agency for approval, consensus is defined as the approval of such agency and the non-opposition of other members present. DWR or the facilitator will poll all EC members present and provide the results of the final poll to all EC members within three working days. Non-opposition means the absence of notice within seven working days that a member will seek dispute resolution pursuant to Section 5 of the Settlement Agreement. As provided in Section 2.8, the opposition of other members does not override the agency's approval. For any such decision, the EC may take public comments, discuss the matter, and provide its view to be documented for the Commission. The agency with such approval authority will convey its determination to the Licensee, the EC, and the Commission.

4.3 DWR will implement consensus on a given matter, subject to the requirements of the license article and any necessary regulatory approval. In the absence of consensus, DWR may proceed in a manner which complies with the license after obtaining any necessary regulatory approval. Thus, where a license article assigns a decision to an agency for approval, DWR will proceed in a manner which is consistent with the approval, subject to the reservations stated in Administrative Provision Section 3 of the Settlement Agreement. DWR will file with the Commission documentation of all consultation with the EC or specific agencies as required by the specific license article; any member's concerns and responses thereto; and any other written comments provided to DWR.

4.4 Any requirement for DWR to consult with a resource agency or other member under a license article that specifically references that agency or other member

shall be deemed satisfied by consultation with that agency or other member through the EC, provided that the EC is in existence and that agency or other member has participated through the EC in consultation on the requisite items. To the extent agency consultation is not provided through committee participation, DWR shall comply with all applicable regulatory consultation requirements including plan submission to appropriate agencies, including agencies specified in the license provision, when filing the plan and/or study with FERC for approval.

4.5 The Licensee will seek to resolve concerns expressed by the federal and state fish and wildlife agencies on matters in which they have expertise prior to seeking consensus of the EC.

5.0 SUPPORT FOR COMMITTEE DECISIONS

5.1 Committee members shall first use the dispute resolution process of Settlement Agreement Section 5 to resolve disputes arising from committee deliberations, prior to seeking remedies in any other forum.

5.2 All committee members participating in a consensus decision will support DWR's defense of such decision in any forum where the decision is challenged and the member is participating, to the extent permitted by applicable law. For this purpose, participating means non-opposition and does not include absence or abstention.

5.3 No committee member participating in a consensus decision will seek rehearing or judicial review, unless required by applicable law.

6.0 COMMITTEE FUNCTIONS

6.1 (a) The Committee shall meet, discuss, and seek to reach consensus on actions in accordance with the following license provisions;

(i) Lake Oroville Warm Water Fishery Habitat Improvement Program, Article A110

(ii) Lake Oroville Cold Water Fishery Improvement Program, Article A111

(iii) Construction and Recharge of Brood Ponds, Article A122

(iv) Invasive Plant Management, Article A126

(b) The Committee shall meet, discuss, and seek to reach consensus for the purpose of adaptive management in the implementation of the following license provisions:

(i) Lower Feather River Habitat Improvement Plan, Article A101

(ii) Gravel Supplementation and Improvement Program, Article A102

(iii) Channel Improvement Program, Article A103

(iv) Structural Habitat Supplementation and Improvement Program, Article A104

(v) Fish Weir Program, Article A105

(vi) Riparian and Floodplain Improvement Program, Article A106

(vii) Feather River Fish Hatchery Improvement Program, Article A107

(viii) Flow/Temperature to Support Anadromous Fish, Article A108

(ix) Comprehensive Water Quality Monitoring Program, Article A112

(x) Oroville Wildlife Area Management Plan, Article A115

6.2 For each plan and/or study identified in the above license provisions, DWR shall provide the committee with a draft for timely review and comment before filing the plan and/or study with FERC.

APPENDIX D
SWRCB Collaborative Process Participation Statement

The State Water Resources Control Board (SWRCB) and the nine Regional Water Quality Control Boards are the principal state agencies responsible for administering the state's water quality control program. (Wat. Code, §§ 13000-14958.) This includes responsibility to grant, waive, or deny water quality certification as provided for under section 401 of the federal Clean Water Act. (Wat. Code, § 13160; see generally 33 U.S.C. § 1341.) The SWRCB issues water quality certification before a license to operate a hydropower project may be issued by the Federal Energy Regulatory Commission (FERC). In addition, the SWRCB is the state agency responsible for administering surface water rights throughout the state. (Wat. Code, §§ 1000-5976.)

Where the SWRCB's regulatory approval is required, the SWRCB has a legal duty, independent of any arguments raised by parties to the proceeding before the SWRCB, to assure that the requirements for that approval are satisfied. In this case, the SWRCB has an independent statutory duty under the Clean Water Act and the applicable regional water quality control plan to ensure that the operation of the Oroville Project will not adversely affect water quality or the beneficial uses of the affected lakes and stream reaches within the Feather River drainage.

The SWRCB agrees to participate in the development of information regarding the Oroville Project that may lead to a settlement among the interested parties. It is the policy of the SWRCB to promote voluntary settlements among the parties to adjudicative proceedings before the SWRCB. It is also the policy of the SWRCB to assist applicants and members of the public by making available information about the requirements of the programs it administers. The SWRCB will participate in the collaborative process with a view towards encouraging settlement among the parties and other persons interested in proceedings before the SWRCB, and providing applicants, protestants and other interested persons with information concerning the requirements applicable to SWRCB approvals.

While the SWRCB can provide information that will help guide the parties towards a settlement that is likely to obtain the necessary regulatory approvals, however, the SWRCB cannot make a prior commitment to the outcome of any regulatory approval that must be issued by the SWRCB. The SWRCB acts in an adjudicative capacity when it acts on a request for water quality certification, water right application, change petition, or other water right approval that may be required for or requested in connection with a proposed project. The SWRCB must be an impartial decision-maker, avoiding bias, prejudice or interest, in any adjudicative proceedings conducted in accordance with the SWRCB's regulatory approvals. Consistent with its adjudicative responsibilities, including its obligation to consider any arguments that may be raised or information provided by parties to a SWRCB proceeding, the SWRCB cannot execute any settlement agreement or make any other commitment that would be binding on the SWRCB as part of its action on a request for water quality certification or other necessary SWRCB permit, license, or other regulatory approval.

APPENDIX E
FOREST SERVICE DRAFT 4(e) CONDITIONS

PRELIMINARY LICENSE TERMS AND CONDITIONS
NECESSARY FOR THE PROTECTION AND UTILIZATION
OF THE LASSEN AND PLUMAS NATIONAL FORESTS
IN CONNECTION WITH
THE APPLICATION FOR LICENSE

Oroville Facilities
FERC No. 2100

Index

Enclosure 1

III. Resource Protection Conditions

PACIFIC SOUTHWEST REGION, USDA FOREST SERVICE
PRELIMINARY 4(E) TERMS AND CONDITIONS
NECESSARY FOR THE PROTECTION AND UTILIZATION OF THE
LASSEN AND PLUMAS NATIONAL FORESTS
OROVILLE FACILITIES
FERC PROJECT No. 2100

I. Introduction

The Forest Service (FS) provides the following Preliminary Section 4(e) Conditions (Conditions) for the Oroville Facilities project, FERC No. 2100 in accordance with 18 CFR 4.34(b)(1)(i). The Forest Service is also submitting "Recommendations", as allowed under Section 10(a) of the Federal Power Act. The "Recommendations" are applicable to areas where project effects do not directly affect NFS lands, and are optional for consideration by the FERC, as the lead federal agency. The "Recommendations" are shown in Enclosure 1 as italicized text. The rationale for the "Recommendations" is included in Enclosure 2.

Section 4(e) of the Federal Power Act states the Commission may issue a license for a project within a reservation only if it finds that the license will not interfere or be inconsistent with the purpose for which such reservation was created or acquired. This is an independent threshold determination made by FERC, with the purpose of the reservation defined by the authorizing legislation or proclamation (see Rainsong v. FERC, 106 F.3d 269 (9th Cir. 1977). The FS, for its protection and utilization determination under Section 4(e) of the FPA may rely on broader purposes than those contained in the original authorizing statutes and proclamations in prescribing conditions (see Southern California Edison v. FERC, 116F.3d 507 (D.C. Cir. 1997)).

The following terms and conditions are based on those resource and management requirements enumerated in the Organic Administration Act of 1897 (30 Stat. 11), the Multiple-Use Sustained Yield Act of 1960 (74 Stat. 215), the National Forest Management Act of 1976 (90 Stat. 2949), and any other law specifically establishing a unit of the National Forest System or prescribing the management thereof (such as the Wilderness Act or the Wild and Scenic River Act), as such laws may be amended from time to time, and as implemented by regulations and approved Land and Resource Management Plans prepared in accordance with the National Forest Management Act. Specifically, the 4(e) conditions are based on the Land and Resource Management Plan (as amended) for the Plumas National Forest (and portions of the Lassen National Forest administered by the Plumas), as approved by the Regional Forester of the Pacific Southwest Region.

Pursuant to Section 4(e) of the Federal Power Act, the Secretary of Agriculture, acting by and through the Forest Service, considers the following conditions necessary for the adequate protection and utilization of the land and resources of the Lassen and Plumas National Forests. License articles contained in the Federal Energy Regulatory Commission's (Commission) Standard Form L-1 (revised October 1975) issued by Order No. 540, dated October 31, 1975,

cover general requirements. This document includes both administrative provisions (Section II) and specific resource requirements (Section III) deemed necessary for protection and utilization of National Forest System lands and resources.

II. Administrative Provisions

Condition No. 1-Forest Service Reserves the Right to Revise Section 4(e) Conditions

The Forest Service reserves the right to modify final Section 4(e) conditions submitted to FERC for inclusion in the new license for the Oroville Facilities, FERC No.2100, to resolve any conflict between FS 4(e) conditions and: 1) water quality certificate conditions issued by the State of California Department of Water Resources Control Board, 2) Section 18 conditions issued by the National Oceanographic and Atmospheric Administration Fisheries Service, or 3) terms and conditions imposed by existing or revised U.S. Fish and Wildlife Service Biological Opinion issued for the relicensing of the Project.

Condition No. 2—Approval of Changes After Initial Construction

Notwithstanding any license authorization to make changes to the Project, the Licensee shall obtain written approval from the Forest Service prior to making changes on or affecting National Forest System lands:

- to any constructed project features or facilities,
- in the uses of project lands and waters,
- or any departure from the requirements of any approved exhibits files with the Commission.

Following receipt of such approval from the Forest Service, and a minimum of 60 days prior to initiating any such changes, the Licensee shall file a report with the Commission describing the changes, the reasons for the changes, and showing the approval of the Forest Service for such changes. The Licensee shall file an exact copy of this report with the Forest Service at the same time it is filed with the Commission. This article does not relieve the Licensee from the requirement for license amendment or other requirements of Article 2 or Article 3 of this license. Any changes to the license made for any reason pursuant to Article 2 or Article 3 shall be made subject to any new terms and conditions the Secretary of Agriculture may make pursuant to section 4(e) of the Federal Power Act.

Condition No. 3—Surrender of License or Transfer of Ownership

Prior to any surrender of this license, the Licensee shall provide assurance acceptable to the Forest Service that Licensee shall restore National Forest System resources to a condition satisfactory to the Forest Service upon or after surrender of the license, as appropriate. The restoration plan shall identify the measures to be taken to restore National Forest System resources and shall include adequate financial assurances such as a bond or letter of credit, to ensure performance of the restoration measures.

In the event of any transfer of the license or sale of the Project, the Licensee shall guarantee or assure that, in a manner satisfactory to the Forest Service, the Licensee or transferee will provide for the costs of surrender and restoration. If deemed necessary by the Forest Service to assist in evaluating the Licensee's proposal, the Licensee shall conduct an analysis, using experts approved by the Forest Service, to estimate the potential costs associated with surrender and restoration of the Project area directly affecting NFS lands to Forest Service specifications. In addition, the Forest Service may require the Licensee to pay for an independent audit of the transferee to assist the Forest Service in determining whether the transferee has the financial ability to fund the surrender and restoration work on or affecting NFS lands specified in the analysis.

Condition No. 4—Investigation of Project Related Fires

The Licensee agrees to fully cooperate with the Forest Service on all fire investigations. The Licensee shall produce upon request all material and witnesses, not subject to attorney client or attorney work product privilege, over which the Licensee has control, related to the fire and its investigation including:

- All investigation reports
- All witness statements
- All photographs
- All drawings
- All analysis of cause and origin
- All other, similar materials and documents regardless of how collected or maintained

The Licensee shall preserve all physical evidence, and give custody to the Forest Service of all physical evidence requested. The Forest Service shall provide the Licensee with reasonable access to the physical evidence and documents the Licensee requires in order to defend any and all claims, which may arise from a fire within the Project boundaries, to the extent such access is not precluded by ongoing criminal or civil litigation.

Condition No. 5-Area Access

The United States shall have unrestricted use of any road, over which the Licensee has control, constructed within the project area, for all purposes deemed necessary and desirable in connection with the protection, administration, management, and utilization of NFS lands and resources thereon. The United States shall have the right to extend rights and privileges for use of such right-of-way and road thereon to States and local subdivisions thereof, as well as to other users, including members of the public, except contractors, agents, and employees of the Licensee. The Forest Service shall control such use so as not to unreasonably interfere with safety or security uses, or cause the Licensee to bear a share of the costs of maintenance disproportionate to Licensee's use in comparison to the use of the road by others.

Condition No. 6—Maintenance of Improvements on or Affecting National Forest System Lands

The Licensee shall maintain all its improvements and premises on or affecting National Forest System (NFS) lands to standards of repair, orderliness, neatness, sanitation, and safety acceptable to the Forest Service. Disposal will be at an approved existing location. Except as otherwise agreed by the Forest Service.

Condition No. 7—Pesticide Use Restrictions on National Forest System Lands

Pesticides may not be used on NFS lands or in areas affecting NFS lands to control undesirable woody and herbaceous vegetation, aquatic plants, insects, rodents, undesirable fish, or other pests without the prior written approval of the Forest Service. If pesticide use is proposed, the Licensee shall submit a request for approval of planned uses of pesticides. The request must cover annual planned use and be updated as required by the Forest Service. The Licensee shall provide information essential for review in the form specified by the Forest Service. Exceptions to this schedule may be allowed only when unexpected outbreaks of pests require control measures that were not anticipated at the time the request was submitted. In such an instance, an emergency request and approval may be made.

The Licensee shall use on National Forest System lands only those materials registered by the U. S. Environmental Protection Agency for the specific purpose planned. The Licensee must strictly follow label instructions in the preparation and application of pesticides and disposal of excess materials and containers.

Condition No. 8—Valid Claims and Existing Rights

This license is subject to all valid claims and existing rights of third parties. The United States is not liable to the Licensee for the exercise of any such right or claim.

Condition No. 9—Compliance with Regulations on National Forest System Lands

The Licensee shall comply with the regulations of the Department of Agriculture for activities on NFS lands, and all applicable Federal, State, county, and municipal laws, ordinances, or regulations in regard to the area or operations on or affecting NFS lands, to the extent federal law does not preempt ordinances or regulations.

Condition No. 10—Protection of United States Property

The Licensee shall exercise diligence in protecting from damage the land and property of the United States covered by and used in connection with this license.

Condition No. 11—Indemnification

The Licensee shall indemnify, defend, and hold the United States harmless for any violations incurred under any applicable laws and regulations or for judgments, claims, or demands assessed against the United States caused by the construction, maintenance, or operation of the project works or of the works appurtenant or accessory thereto under the license. The licensee's indemnification of the United States shall include any loss by personal injury, loss of life or damage to property in connection with the construction, maintenance, or operation of the project works or the works appurtenant or accessory thereto under the license. Indemnification shall include, but is not limited to, the value of resources damaged or destroyed; the costs of restoration, cleanup, or other mitigation; fire suppression or other types of abatement costs; third party claims and judgments; and all administrative, interest, and other legal costs. Upon surrender, transfer, or termination of the license, the Licensee's obligation to indemnify the United States shall survive all valid claims for action that occurred prior to such surrender, transfer or termination.

Condition No. 12—Surveys, Land Corners

The Licensee shall protect all public land survey monuments, private property corners, and forest boundary markers located on NFS lands from damage arising from the Licensee's construction, maintenance, or operation of the project works or of the works appurtenant or accessory thereto under the license. In the event that any such land markers or monuments are destroyed by an act or omission of the Licensee, in connection with the use and/or

occupancy authorized by this license, depending on the type of monument destroyed, the Licensee shall reestablish or reference same in accordance with (1) the procedures outlined in the "Manual of Instructions for the Survey of the Public Land of the United States," (2) the specifications of the County Surveyor, or (3) the specifications of the Forest Service. Further, the Licensee shall ensure that any such official survey records affected are amended as provided by law.

Condition No. 13—Damage to Land, Property, and Interests of the United States

The Licensee has an affirmative duty to protect the land, property and interests of the United States from damage arising from the Licensee's construction, maintenance, or operation of the project works or of the works appurtenant or accessory thereto under the license. The Licensee is liable for and shall pay, after being afforded an opportunity to review Forest Service claimed costs, all damages, costs and expenses associated with damage to the land, property and interests of the United States occasioned by the construction, maintenance, or operation of the project works or of the works appurtenant or accessory thereto under the license, including but not limited to damages, costs and expenses resulting from fire. Such damages, costs and expenses shall include, but not be limited to:

1. Fire suppression costs
2. Rehabilitation and restoration costs
3. Value of lost resources
4. Abatement costs
5. Investigative and administrative expenses
6. Attorneys' fees

The Licensee's liability under this condition shall not extend to acts or omissions of third parties outside of the Licensee's control. Licensee's contractors or employees of contractors are not considered third parties. Damages will be determined by the value of the resources lost or impaired, as determined by the Forest Service. The basis for damages will be provided to the Licensee. The Licensee shall accept transaction registers certified by the appropriate Forest Service official as evidence of costs and expenses. The Licensee shall have an opportunity to review the basis for the Forest Service's damages, costs and expenses, and to meet and confer with the Forest Service to resolve any questions or disputes regarding such damages, costs and expenses. After the opportunity for review, the Licensee shall promptly pay to the United States such damages, costs and expenses upon written demand by the United States.

Condition No. 14—Risks and Hazards

As part of the occupancy and use of the license area, the Licensee has a continuing responsibility to identify and report all known or observed hazardous conditions on or affecting NFS lands that would affect the improvements, resources, or pose a risk of injury to

individuals. Licensee will abate those conditions, except those caused by third parties not related to the occupancy and use authorized by the License. Any non-emergency actions to abate such hazards on NFS lands shall be performed after consultation with the Forest Service. In emergency situations, the Licensee shall notify the Forest Service of its actions as soon as possible, but not more than 48 hours, after such actions have been taken. Whether or not the Forest Service is notified or provides consultation, the Licensee shall remain solely responsible for all Licensee abatement measures performed. Other hazards should be reported to the appropriate agency as soon as possible.

Condition No. 15—Consultation

Each year in March or as otherwise agreed, the Licensee shall consult with the Forest Service with regard to measures needed to ensure protection and utilization of the National Forest resources affected by the Project. Within 60 days following such consultation, the Licensee shall file with the Commission evidence of the consultation with any recommendations made by the Forest Service. 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 4(e) conditions that require measures necessary to accomplish protection and utilization of National Forest resources.

When Forest Service section 4(e) conditions require the Licensee to file a plan with the Commission that is approved by the Forest Service, the Licensee shall provide the Forest Service a minimum of 60 days to review and approve the plan before filing the plan with the Commission. Upon Commission approval, the Licensee shall implement Forest Service required and approved plans.

III. Resource Protection Conditions

Condition No. 16-Heritage Resources

Licensee shall file with the Commission, within one year following license issuance, a Historic Properties Management Plan (HPMP) approved by the Forest Service, for the purpose of protecting and interpreting heritage resources located on National Forest System lands (NFS lands). The Licensee shall consult with the State Historic Preservation Officer, Native American Tribes, Forest Service, and other applicable agencies and communities during the preparation of the Plan. The HPMP shall accurately define the area of potential effects, including effects of implementing Section 4(e) conditions, Native American traditional cultural values, and Project-induced recreational impacts to archaeological properties on or affecting National Forest System lands. The HPMP shall also provide measures to mitigate the identified impacts, including a monitoring program, and management protocols for the ongoing protection of archaeological properties.

If, prior to or during ground-disturbing activities or as a result of project operations, items of potential cultural, historical, archaeological, or paleontological value are reported or discovered, or a known deposit of such items is disturbed on NFS lands, the Licensee shall immediately cease work in the area affected, and implement the provisions in the HPMP.

Condition No. 17 – Protection of Forest Service Special Status Species

Before taking actions to construct new project features on NFS lands that may affect Forest Service special status species (i.e. Forest Service sensitive and/or management indicator species) or their critical habitat, the Licensee shall prepare a biological evaluation evaluating the potential impact of the action on the species or its habitat and submit it to the Forest Service for approval. In coordination with the Commission, the Forest Service may require mitigation measures for the protection of the affected species.

The biological evaluation shall

- Include procedures to minimize adverse effects to special status species.
- Ensure project-related activities shall meet restrictions included in site management plans for special status species.
- Develop implementation and effectiveness monitoring of measures taken or employed to reduce effects to special status species.

Condition No. 18-Invasive Weed Management

Within one year of license issuance, Licensee shall develop and file for Commission approval a plan to manage and reduce native and non-native invasive plant species populations on or affecting NFS lands. The plan shall be developed in conjunction with the Forest Service (FS), Bureau of Land Management (BLM), California Department of Fish and Game (DFG), and California Department of Parks and Recreation (DPR), and in consultation with the Ecological Committee (EC), including specifically the U.S. Fish and Wildlife Service (USFWS). Prior to filing the plan for Commission approval, the Licensee shall: 1) submit the portion of the plan pertaining to National Forest System lands to the Forest Service for approval, *2) submit the portion of the plan pertaining to BLM lands to BLM for approval, 3) submit the portion of the plan pertaining to DFG lands to DFG for approval, and 4) submit the portion of the plan pertaining to DPR lands to DPR for approval.* Upon Commission approval, the Licensee shall implement the plan, including any changes required by the Commission. Commission approval to use pesticides for noxious weed control constitutes the approval required by Condition 7.

(b) The plan shall specify areas/acreage, treatment/control methods, best management practices, needs for multiple year treatments and monitoring, including an annual inspection. The plan shall specifically address, but not be limited to, the following species: purple loosestrife (Lythrum salicaria); giant reed (Arundo donax), tree of heaven (Ailanthus altissima); scarlet wisteria (Sesbania punicea); parrot feather

(Myriopyllum aquaticum); Himalayan blackberry (Rubus discolor); aquatic primrose (Ludwigia peploides); yellow starthistle (Centaurea solstitialis); Spanish broom (Spartium junceum); French broom (Genista monspessulana); Scotch broom (Cytisus scoparius); and skeleton weed (Chondrilla juncea).

(c) *After coordination with the appropriate land management agency and then consultation with the EC, including specifically USFWS, the Licensee may modify the implementation measures contained within the plan without Commission approval to the extent the measures are within the scope of the approved plan.* Any modification to the implementation measures that are not within the scope of the approved plan must be filed with the Commission for approval.

(d) The Licensee shall coordinate the plan and ongoing efforts with applicable federal, state and local agencies and shall take into full consideration state and federally listed species including Forest Service Sensitive species located on NFS lands.

(e) In coordination with the FS, BLM, DFG, and DPR, the Licensee shall reevaluate the plan five years after initial implementation, and shall consult with the EC, including specifically USFWS, and any other applicable federal, state and local agencies regarding the reevaluation. The reevaluation shall take into consideration the need to treat other invasive plant species, as well as alternative or additional control methods that may be implemented.

(f) Following license issuance, the Licensee shall file annually with the Commission a compliance report for informational purposes. The Licensee shall first prepare the report in coordination with the FS, BLM, DFG, and DPR, and in consultation with the EC, including specifically USFWS. The report as filed with the Commission shall include any comments of EC members and the Licensee's responses.

(g) The *Licensee shall not be required to expend more than $450,000 to develop and implement the plan during the first five years after issuance of this license, and shall not be required to expend more than ($25,000) every year thereafter.*

Condition No. 19-Development of a Fuel Management Plan

Within one year of license issuance, the Licensee shall prepare for Forest Service approval and filing with the Commission, a Fuel Management Plan for National Forest System lands (NFS lands) located within the project area. The plan shall identify fuel management issues, prioritization, and recommended actions to address them. The plan encompassing NFS lands within the project area may be coordinated with the Oroville Relicensing Settlement Agreement, Appendix B, Fuel Load Management plan.

Appendix F
Habitat Expansion Agreement For Central Valley Spring-Run Chinook Salmon and Central Valley Steelhead

This Habitat Expansion Agreement for Central Valley Spring-Run Chinook Salmon and Central Valley Steelhead ("Agreement") is entered into this _____ day of _____, 2006 by and among Pacific Gas and Electric Company ("PG&E"), California Department of Water Resources ("DWR") (individually "Licensee" and collectively "Licensees"), Department of Commerce National Marine Fisheries Service ("NMFS"), U. S. Department of Interior Fish and Wildlife Service ("USFWS"), California Department of Fish and Game ("CDFG"), U. S. Department of Agriculture Forest Service ("USFS"), (collectively "Resource Agencies"), Arthur G. Baggett[2], American Rivers, and State Water Contractors, Inc. (all collectively "Signatories").

Definitions:

Consultation: Except as provided in Paragraph 13, consultation refers to the act of conferring and is distinct from the term "Consultation" under the Endangered Species Act.

Fish Passage: Upstream or downstream movement of fish past Feather River hydroelectric project facilities.

Material New Information: Significant and relevant new information which is not in any relevant administrative record as of the date of the execution of this Agreement or otherwise known to the Party who seeks to use the Material New Information, as of that date.

Notice: A written communication sent by U.S. Mail, guaranteed overnight or other delivery, telefacsimile, email or by other reliable means and meeting any additional requirements specified in a paragraph below.

1. Background. FERC relicensing of hydroelectric projects in the Feather River basin has focused attention on the desirability of expanding the amount of spawning, rearing and adult holding habitat available for Central Valley spring-run Chinook salmon *(Oncorhynchus tshawytscha*) ("Spring-Run") and Central Valley steelhead *(O. mykiss)* ("Steelhead"). This

[2] Mr. Baggett is signing this Agreement as a recommendation to the California State Water Resources Control Board, and not as a Party to the Agreement. Mr. Baggett will not be participating in the State Water Resources Control Board's consideration of any petition for water quality certification for any Habitat Expansion Plan pursuant to Section 401 of the federal Clean Water Act.

Agreement establishes an approach for identifying, evaluating, selecting and implementing the most promising action(s) to expand such spawning, rearing and adult holding habitat in the Sacramento River Basin as an alternative to the Resource Agencies or other Signatories seeking project-specific Fish Passage prescriptions or license conditions in the relicensing of the Licensees' Oroville, Poe, Rock Creek-Cresta, and Upper North Fork Feather River hydroelectric projects ("Feather River hydroelectric projects").

2. Habitat Expansion Goal and Threshold. The overall goal of this Agreement is to expand the amount of habitat with physical characteristics necessary to support spawning, rearing and adult holding of Spring-Run and Steelhead in the Sacramento River basin as a contribution to the conservation and recovery of these species. The expansion shall be accomplished through enhancements to existing accessible habitat, improving access to habitat, or other action(s). The specific goal of the Agreement is to expand spawning, rearing and adult holding habitat sufficiently to accommodate an estimated net increase of 2,000 to 3,000 Spring-Run for spawning ("Habitat Expansion Threshold") as compared to the habitat available under any relevant existing requirements or commitments, as defined in Paragraph 3. The Habitat Expansion Threshold is focused on Spring-Run as the priority species, as expansion of habitat for Spring-Run typically accommodates Steelhead as well.

3. Eligible Habitat Expansion Actions.

   A. Scope of Eligible Habitat Expansion Actions. Potential actions to expand Spring-Run and Steelhead spawning, rearing and adult holding habitat will be identified, evaluated, selected and implemented according to Paragraph 4. Actions may include, among other things, dam removals, dam re-operation, creation or enhancement of Fish Passage, water temperature/flow improvements or other physical habitat enhancements, and shall ensure future operation and maintenance if such operation and maintenance is needed after initial implementation. Actions shall also include functional start-up testing, if needed, for technical validation of the action's design (e.g. that a fish ladder operates as designed), but not long-term monitoring of species utilization or benefit. Actions identified in other venues, including unfunded actions, are acceptable for consideration, provided that implementation of this Agreement results in a net expansion of habitat over any existing requirements and commitments, whether by the Licensees or others, as defined below.

   B. Existing Requirements and Commitments. For purposes of this Agreement, the phrase "existing requirements and commitments" is intended to encompass actions expected to occur in a timeframe

comparable to implementation of action(s) under the Agreement. Existing requirements and commitments may include but are not limited to:

(i) legal or regulatory requirements that are the subject of any form of binding order issued by a regulatory agency or court of competent jurisdiction, at the time the habitat expansion action(s) are approved by NMFS under Paragraph 4(B);

(ii) legal or regulatory requirements that are the subject of ongoing or imminent administrative or judicial action by an agency or court of competent jurisdiction at the time the habitat expansion action(s) are approved by NMFS under Paragraph 4(B);

(iii) obligations or commitments set forth in a draft license application, final license application, settlement agreement, or agreement-in-principle in a pending hydroelectric relicensing proceeding at the time the habitat expansion action(s) are approved by NMFS under Paragraph 4(B); and

(iv) reasonable and prudent alternatives, reasonable and prudent measures, and terms and conditions of any final Biological Opinion that has been issued at the time the habitat expansion action(s) are approved by NMFS under Paragraph 4(B).

By recommending, approving, and implementing actions under this Agreement, the Signatories do not intend to encourage non-compliance by third parties with applicable laws and regulations or preclude appropriate enforcement actions.

4. Planning and Implementation of Habitat Expansion Action(s). The Licensees and other Signatories shall follow the planning and implementation phases described below.

   A. Identification, Evaluation and Recommendation of Action(s). Within 2 years of signing the Agreement, the Licensees shall complete identification, evaluation and recommendation of habitat expansion action(s), in consultation with the Signatories and other directly affected and responsive third parties, using the following criteria:

      i. Evaluation Criteria. The Licensees shall use the following non-exclusive and non-prioritized Evaluation Criteria to screen potential habitat expansion actions and develop a preliminary list of viable actions:

(a) favorable feasibility (technically feasible; supported by accepted science; low potential for disease and other risks; proven actions are favored over experimental actions);
(b) adequate scale of expansion of spawning, rearing and adult holding habitat (one or more larger contiguous gains is favored over numerous smaller gains; increased habitat is favored over enhanced habitat);
(c) favorable sustainability of action;
(d) favorable cost-effectiveness and economic feasibility (including consideration of costs necessary to operate and maintain the expansion);
(e) minimal human intervention needed to achieve access to expanded spawning, rearing and adult holding habitat (volitional access is favored over that which requires a high degree of human intervention);
(f) favorable spatial separation from other populations or runs to maintain genetic diversity by minimizing interbreeding;
(g) favorable spatial separation from other spawning streams to minimize population impacts of a stream-specific adverse event (geographic distribution is favored over centralization);
(h) acceptable length of time to implement (earlier gains are favored over later gains);
(i) favorable local/political support;
(j) consistency with NMFS Viable Salmonid Population guidance, Endangered Species Act (ESA) recovery goals and recovery plan (as available), and expected contribution to species recovery (higher consistency and greater contributions are favored);
(k) balance of benefits to Spring-run and Steelhead (actions that provide a balance of benefits to both Spring-run and Steelhead are favored over actions that primarily benefit one species; if multiple actions are undertaken, a combination of actions that provides a balance of benefits to both salmon and steelhead is favored);
(l) consistency with other resource uses such as water supply, public safety, flood control, recreation, and power production;
(m) favorable relative availability of appropriate stocks for reintroduction;
(n) low expectation for the action to be undertaken by the Licensees or others in the near future;
(o) favorable potential to benefit other anadromous, catadromous and resident fisheries affected by the Feather River hydroelectric projects; and
(p) low potential for adverse impact on listed species and destruction or adverse modification of critical habitat under the ESA (actions with low or no impact are favored).

ii. Selection Criteria. After developing a preliminary list of viable action(s) using the Evaluation Criteria above, the Licensees shall use the following Selection Criteria to select recommended action(s) for implementation:
(a) Contribution to achieving the Habitat Expansion Threshold;
(b) Most cost-effective compared to other potential habitat expansion actions;
(c) Feasibility (action(s) can reasonably be accomplished); and
(d) Timing (action(s) can be accomplished in a reasonable period of time).

iii. Draft Habitat Expansion Plan. After selecting recommended action(s) for implementation, the Licensees shall prepare and distribute a Draft Habitat Expansion Plan to the Signatories and other directly affected third parties for a 90-day review and comment period. The Draft Habitat Expansion Plan shall include a description of:
(a) the recommended action(s), including any functional start-up testing and future operation and maintenance;
(b) the rationale for their selection based on the Evaluation Criteria and the Selection Criteria;
(c) a preliminary schedule for each of the remaining phases in this Paragraph 4, including provisions for anticipated schedule uncertainties;
(d) the responsibilities of each Licensee for implementing the action(s);
(e) the estimated contribution of the action(s) to the Habitat Expansion Threshold; and
(f) a pre feasibility-level cost estimate for implementing the action(s).

B. Approval of Final Habitat Expansion Plan. Within 90 days after the close of the review and comment period on the Draft Habitat Expansion Plan, the Licensees shall prepare and submit a Final Habitat Expansion Plan to NMFS for approval of the habitat expansion action(s) recommended in the Plan. For purposes of this Agreement, "approval" of the Plan and recommended action(s) applies only to the elements of the Plan specified in Paragraph 4(A)(iii)(a), (c), (e) above. The Licensees and NMFS may extend the time periods set forth below by mutual agreement to accommodate the approval process.

i. The Final Habitat Expansion Plan shall address all comments received during the 90-day review and comment period, and shall include an explanation why any such comment was not adopted. It shall include all elements required by Paragraph 4(A)(iii) and shall

be distributed to all Signatories and directly affected and responsive third parties.

ii. Prior to taking final action on the Final Habitat Expansion Plan, NMFS shall consult with USFWS, SWRCB, CDFG, USFS, any other Signatories, and other directly affected and responsive third parties, and give due consideration to any comment received during this consultation. NMFS' consultation shall specifically address any comment by a Signatory or other commenter that the action(s) recommended by the Licensees are existing requirements or commitments. In addition, NMFS' consultation with USFWS shall include consideration of recommended action(s)' potential benefits and impacts on resident fish at the location of the action(s).

iii. In determining whether to approve the Final Habitat Expansion Plan, NMFS shall review information submitted by the Licensees, comments by other Signatories as well as any other relevant information and consider the extent to which the action(s) recommended in the Plan meet the following Approval Criteria:
(a) Estimated to meet the Habitat Expansion Threshold;
(b) Assures necessary testing, operation and maintenance;
(c) Supports establishing a geographically separate, self-sustaining population of Spring-Run;
(d) Supports segregating Spring-Run habitat from Central Valley fall-run Chinook salmon;
(e) Meets the requirements for eligible habitat expansion action(s) pursuant to Paragraph 3; and
(f) Expected to be implemented within a reasonable period of time.

iv. NMFS shall not withhold approval for any recommended action(s) determined by NMFS to meet all six Approval Criteria. In addition, NMFS may approve recommended action(s) that meet at least the following four Approval Criteria: (a) as may be modified in Paragraph 4(B)(vi)(a) below, (b), (e), and (f).

v. If the Licensees and NMFS disagree that the action(s) recommended in the final Habitat Expansion Plan are estimated to meet the Habitat Expansion Threshold, the Licensees and NMFS shall select a neutral third party with appropriate expertise to make an independent estimate. The cost of retaining the neutral third party shall be borne by the Licensees. NMFS shall give due consideration to the independent estimate before making its final decision on approval of the recommended action(s) for the purposes of this Agreement.

vi. If NMFS determines that the action(s) recommended in the Final Habitat Expansion Plan are estimated not to meet the Habitat Expansion Threshold, NMFS shall consult with the Licensees to consider the acceptability of the recommended action(s) and, at NMFS' discretion, either:

(a) accept the recommended action(s) as substantially meeting the goal of this Agreement as stated in Paragraph 2, within a reasonable margin of estimating error;
(b) identify other action(s) mutually acceptable to NMFS and the Licensees that may be approved per Paragraph 4(B)(iv), in which case NMFS may approve the Final Habitat Expansion Plan (as modified to incorporate the mutually acceptable actions) after consulting with the Resource Agencies, other Signatories, and other directly affected and responsive third parties as described in Paragraph 4(B)(ii) above; or
(c) deny approval of the Final Habitat Expansion Plan.

vii. After completing its review of the Final Habitat Expansion Plan, NMFS shall provide the Licensees with written Notice of its decision. If NMFS denies approval, the written Notice shall identify the specific reasons the Plan was not approved. The Licensees shall have a reasonable opportunity to assess and cure the deficiencies identified by NMFS and submit a modified Plan for NMFS' review and approval.

viii. Within 90 days after approval by NMFS, the Licensees shall distribute to Signatories and other directly affected and responsive third parties for information an Approved Habitat Expansion Plan reflecting any modifications made during the approval process, and an updated schedule for each of the remaining phases in this Paragraph 4.

ix. ESA permits or approvals related to implementation of any approved action(s) shall be handled separately in accordance with Paragraph 13. By approving action(s) under this Paragraph, NMFS does not represent that it is an action agency or that it has authority to provide any other permits or approvals necessary to implement the approved action(s).

C. Preliminary Design of Action(s). After the Licensees have distributed an Approved Habitat Expansion Plan, they shall begin the Preliminary Design phase. During the Preliminary Design phase the Licensees shall prepare feasibility-level designs and cost estimates of approved action(s). Where plans involve engineered fishway designs, Fish Passage systems, or major engineered components, the Licensees

shall consult with NMFS-Southwest Region Fisheries Engineering Team. The Licensees shall prepare and distribute semi-annual status reports to Signatories and other directly affected and responsive third parties for information purposes. At the completion of this phase, the Licensees shall distribute to Signatories and other directly affected and responsive third parties for information a Preliminary Design Report with preliminary design of the approved action(s), updated cost estimates and schedule for each of the remaining phases in this Paragraph 4. NMFS shall determine whether the Preliminary Design Report is consistent with the Approved Habitat Expansion Plan. After completing its determination, NMFS shall provide the Licensees with written Notice of its determination. If NMFS determines the Preliminary Design Report is inconsistent with the Approved Habitat Expansion Plan, the written Notice shall identify the specific inconsistencies. The Licensees shall have a reasonable opportunity to assess and cure the inconsistencies identified by NMFS and submit a modified Report for NMFS' determination of consistency.

D. Final Design and Permitting of Action(s). During the Final Design and Permitting phase the Licensees shall prepare bid-level designs and cost estimates, and obtain all necessary permits, approvals, and rights. Where plans involve engineered fishway designs, Fish Passage systems, or major engineered components, the Licensees shall consult NMFS-Southwest Region Fisheries Engineering Team. The Licensees shall prepare and distribute semi-annual status reports to Signatories and other directly affected and responsive third parties for information purposes. At the completion of this phase, the Licensees shall distribute to Signatories and other directly affected and responsive third parties for information a Final Design and Permitting Report with final designs and permit status of the approved action(s), updated cost estimates and schedule for each of the remaining phases in this Paragraph 4. NMFS shall determine whether the Final Design and Permitting Report is consistent with the Approved Habitat Expansion Plan. After completing its determination, NMFS shall provide the Licensees with written Notice of its determination. If NMFS determines the Final Design and Permitting Report is inconsistent with the Approved Habitat Expansion Plan, the written Notice shall identify the specific inconsistencies. The Licensees shall have a reasonable opportunity to assess and cure the inconsistencies identified by NMFS and submit a modified Report for NMFS' determination of consistency.

E. Implementation of Action(s). The Licensees shall implement the Approved Habitat Expansion Plan, as may be modified by permitting conditions pursuant to Paragraph 4(D). Implementation may be by DWR and PG&E individually, DWR and PG&E jointly, or through cooperative efforts with others, as provided in the Plan or in

subsequent communications with NMFS. Implementation shall not be required to begin prior to acceptance by the Licensees of the new FERC licenses for the Oroville, Poe, and Upper North Fork Feather River projects ***[add concept of differential schedule for implementation based on the terms of the recent FERC licenses]***. The Licensees shall prepare and distribute semi-annual status reports to Signatories and other directly affected and responsive third parties for information purposes. At the completion of implementation, the Licensees shall distribute to Signatories and other directly affected and responsive third parties for information a Final Report with updated cost information and schedule for each of the remaining phases in this Paragraph 4.

F. Testing of Implemented Action(s). Upon completion of implementation of the habitat expansion action(s) pursuant to the Approved Habitat Expansion Plan, the Licensees shall perform functional start-up testing for technical validation of the specified designs for the action(s). At the completion of this phase, the Licensees shall distribute to Signatories and other directly affected and responsive third parties for information a Final Test Report with test results and conclusions. The Licensees shall take reasonable and necessary actions as approved by NMFS to correct functional deficiencies.

5. Timeframes. The Signatories share a mutual interest in completing implementation of selected and approved action(s) as early as reasonably feasible, consistent with the Licensees obtaining necessary approvals and permits. If it appears that the Licensees will not be able to achieve dates specified or approved pursuant to this Agreement, they may request an extension of time from NMFS, which extension shall be granted if good cause exists. Good cause includes events or circumstances beyond the Licensees' reasonable control.

6. Licensee Obligations. The Licensees shall be responsible for identifying, evaluating, selecting, implementing, and, if included in the Approved Habitat Expansion Plan, testing, operating and maintaining the habitat expansion action(s) to be performed under the Agreement. The Licensees shall separately agree on a distribution of responsibility between them, with each being independently responsible for achieving its portion of the total responsibility. Timely and complete implementation of the Approved Habitat Expansion Plan fulfills the Licensees' obligations under this Agreement. The Licensees are not obligated to guarantee or verify fish production or utilization.

7. Resource Agency Obligations.

A. The Resource Agencies shall be responsible for providing timely information and consultation as requested by the Licensees, and for diligent and timely processing of all permits, approvals, and rights necessary for implementation of this Agreement, subject to available agency resources and agency authority. Any obligation under this Agreement of any Federal agency is subject to the requirements of the Anti-Deficiency Act, 31 U.S.C. § 1341 et seq. Any obligation under this Agreement for a State agency other than DWR is subject to Article 16, Section 7 of the California Constitution.

B. This Agreement is not intended nor shall it be construed to be a predecisional determination by a Resource Agency as to whether permits, approvals, and rights necessary to implement a habitat expansion action approved by NMFS will be issued. Agency procedures for processing permits or other approvals are not affected by this Agreement. Discretionary decisions related to requests for permits, approvals, and rights necessary to implement the approved action(s) are not subject to the provisions of this Agreement.

8. Uncontrollable Forces.

A. General. No Signatory shall be in breach of its obligations under this Agreement if it is unable to perform or delays required performance due to any Uncontrollable Force reasonably beyond its control, unless otherwise provided by this Agreement. For this purpose, an "Uncontrollable Force" may include, but is not limited to, natural events, labor or civil disruption, action or non-action of a governmental agency (other than DWR), or breakdown or failure of facilities.

B. Notice of Delay or Inability to Perform. The Signatory whose performance of an obligation under this Agreement is affected by a delay in required performance or inability to perform shall provide Notice as soon as reasonably practicable. This Notice shall include: (1) a description of the event causing delay, anticipated delay, or inability to perform; (2) an estimate of the anticipated length of the delay or inability to perform; (3) a description of the measures taken or to be taken to avoid or minimize the delay or inability to perform; and (4) a proposed timetable for the performance of the obligation. The affected Signatory shall make all reasonable efforts to promptly resume performance of the obligation and shall provide Notice when it resumes performance of the obligation.

9. Consultation and Coordination. In implementing their obligations, including selection of habitat expansion action(s), the Licensees shall confer with the Signatories and other directly affected and responsive third parties, and shall diligently seek to obtain all necessary permits,

approvals, and rights from agencies with jurisdiction. All habitat expansion action(s) determined by FERC to be within its jurisdiction are subject to FERC approval. All such submittals to FERC shall include the results of applicable consultation and coordination, including any comments or recommendations received and an explanation why any such comment was not adopted.

10. Cost Effectiveness. The Signatories recognize that cost is a key consideration in the successful implementation of this Agreement, and agree to make a good faith effort to achieve the Habitat Expansion Threshold at the least cost to the Licensees.

11. Withdrawal or Unexcused Failure to Perform by One or Both Licensees.

    A. Licensee Withdrawal Options. If at any point during the Approval of Action(s) (Paragraph 4(B)), Preliminary Design of Action(s) (Paragraph 4(C)), and Final Design and Permitting of Action(s) (Paragraph 4(D)), the Licensees' estimate that the net present value (January 2006 cost basis) of the life-cycle cost of implementing all of the recommended or approved habitat expansion action(s) exceeds $15 million for the two Licensees combined, either or both of the Licensees may withdraw from the Agreement. The Licensees may also decide to proceed with the recommended or approved habitat expansion action(s) with an estimated cost that exceeds $15 million or propose to NMFS an alternative as provided in Paragraph 11(C). The $15 million threshold is for the sole purpose of establishing a Licensee decision point. It is not the Signatories' estimate of the cost of meeting the Habitat Expansion Threshold, and the Signatories recognize that the actual cost to achieve the Habitat Expansion Threshold may exceed this amount. The Licensees are solely responsible for estimating the cost of the habitat expansion action(s) for purposes of this Paragraph.

    B. Withdrawal or Unexcused Failure to Perform by One Licensee.

        i. If one Licensee withdraws from the Agreement or fails to perform, the remaining Licensee shall have the option to:

            (a) proceed with the full scope of the Approved Habitat Expansion Plan, subject to its timely reaching an acceptable cost-sharing arrangement with the non-performing Licensee, or
            (b) propose to NMFS an alternative Habitat Expansion Plan which the remaining Licensee would perform to meet one-half of the Habitat Expansion Threshold.

        ii. If the remaining Licensee chooses to proceed with the full scope of the Approved Habitat Expansion Plan, the remaining Licensee's

compliance with the Approved Habitat Expansion Plan shall satisfy both Licensees' obligations under this Agreement.

iii. If the remaining Licensee proposes to NMFS an alternative Habitat Expansion Plan that meets one-half of the Habitat Expansion Threshold, NMFS shall have the discretion to approve the remaining Licensee's alternative plan after consulting with the other Resource Agencies, other Signatories, and other directly affected and responsive third parties as set forth in Paragraph 4(B).

(a) If NMFS approves the remaining Licensee's alternative Habitat Expansion Plan, then the remaining Licensee shall comply with Paragraphs 4(C) – (F) to the extent the obligations set forth in these Paragraphs have not already been met.
(b) If NMFS does not approve the remaining Licensee's alternative Habitat Expansion Plan, NMFS shall provide the remaining Licensee with Notice of its decision as set forth in Paragraph 4(B)(vii), including a reasonable opportunity to assess and cure any deficiencies identified by NMFS and resubmit a revised alternative Habitat Expansion Plan for NMFS' review and approval. If NMFS does not approve the revised alternative Habitat Expansion Plan and determines that no revisions will result in an acceptable alternative, it shall provide the Licensee with Notice of its final decision.

C. Unexpected Inability to Perform by Both Licensees or Determination of Cost Exceeding $15 Million. If both Licensees determine that they are unable to perform under the Agreement, or determine, as provided in Paragraph 11(A), that the estimated cost of implementing all of the recommended or approved habitat expansion action(s) exceeds $15 million, the Licensees shall have the option of proposing to NMFS an Alternative Habitat Expansion Plan, which NMFS shall have the discretion to approve after consulting with the other Resource Agencies, Signatories, and other directly affected and responsive third parties as set forth in Paragraph 4(B).

i. If NMFS approves the Licensees' Alternative Habitat Expansion Plan, then the Licensees shall comply with Paragraphs 4(C) through 4(F) to the extent the obligations set forth in these Paragraphs have not already been met.

ii. If NMFS does not approve the Licensees' Alternative Habitat Expansion Plan, NMFS shall provide the Licensees with written Notice of its decision as set forth in Paragraph 4(B)(vii). The Licensees shall have a reasonable opportunity to assess and

cure any deficiencies identified by NMFS and resubmit a revised Alternative Habitat Expansion Plan for NMFS' review and approval.

12. Support and Relationship to Relicensing.

A. The Signatories agree that implementation of this Agreement shall fully mitigate for any presently unmitigated impacts due to the blockage of Fish Passage of all fish species caused by the Feather River hydroelectric projects. This Agreement is separate from settlement agreements which have been, or may be, reached for the Licensees' respective Feather River hydroelectric projects, and shall not be incorporated as a condition in those FERC licenses except as specifically provided in such settlement agreements. The Signatories shall support the Agreement in the Feather River hydroelectric project license proceedings. The Signatories understand and acknowledge that PG&E will not sign a settlement agreement for the Oroville Project, and DWR will not sign a settlement agreement for the Poe, Rock Creek-Cresta, or Upper North Fork Feather River projects.

B. Throughout the terms of the new licenses for the Feather River hydroelectric projects the Signatories agree not to directly impose or indirectly seek through other agencies (including through exercise of authority under the state or federal Endangered Species Acts, Sections 18, 4(e) and 10(j) of the Federal Power Act, and Section 401 of the Clean Water Act) conditions for Fish Passage associated with or related to any of the Licensees' Feather River hydroelectric projects in excess of the action(s) contemplated under this Agreement, provided the Licensees are complying with their obligations under this Agreement.

C. A Signatory may exercise any authority to impose or seek conditions for Fish Passage if the Licensee(s) withdraws or otherwise fails to perform, as provided in the Agreement.

D. If NMFS approves an alternative Habitat Expansion Plan that meets one-half of the Habitat Expansion Threshold as proposed by one Licensee after the other Licensee has withdrawn or failed to perform as set forth in Paragraph 11(B)(iii), the Signatories may seek conditions to mitigate for Fish Passage in the withdrawing or non-performing Licensee's Feather River hydroelectric project(s), provided they do so in a manner that does not result in additional operational constraints or mitigation requirements in the performing Licensee's Feather River hydroelectric project(s).

E. Prior to a Signatory imposing or seeking conditions for Fish Passage, the Signatory shall provide written Notice to the affected Licensee(s). The Notice shall include the specific obligations under this Agreement with which the Signatory asserts the Licensee(s) has failed to comply. The affected Licensee(s) shall have 30 days from the date of the Notice to initiate the dispute resolution procedures described in Paragraph 14. If the affected Licensee(s) initiates the dispute resolution procedures, the Signatory shall comply with the procedures set forth in Paragraph 14 before seeking conditions for Fish Passage in the affected Licensee(s) Feather River hydroelectric project. The Notice obligation in this Paragraph 12(D) shall not apply to 1) a Licensee that withdraws from this Agreement pursuant to Paragraph 11; or 2) a final decision by NMFS pursuant to Paragraph 11(B)(iii)(b) not to approve the remaining Licensee's alternative Habitat Expansion Plan or revised alternative Habitat Expansion Plan.

F. This Agreement does not limit the right of the Signatories to seek mitigation for project impacts other than blockage of Fish Passage in any of the Feather River hydroelectric project licenses. This Agreement does not address mitigation for passage of fish through turbines, availability and quality of aquatic habitat above or below such facilities, fish access to tributaries between such facilities, or planting of fish from the Feather River Fish Hatchery in Lake Oroville. Nothing in this Agreement is intended to limit the right of the Signatories to seek appropriate protection, mitigation, or enhancement measures for amphibian species in the licenses for the Feather River hydroelectric projects.

G. Within 30 days of signing this Agreement, each of the Resource Agencies shall modify any existing prescriptions and license conditions relating to Fish Passage they have filed in the relicensing proceedings for the Oroville, Poe and Upper North Fork Feather River projects, if necessary to be consistent with this Agreement.

13. Endangered Species Act. In selecting recommended habitat expansion action(s) the Licensees shall consider the potential of the action(s) to cause incidental take of listed species or the destruction or adverse modification of critical habitat under the ESA and shall favor action(s) with little or no effect on listed species. In the event, however, that a habitat expansion action(s) is recommended and approved that has the potential to affect listed species and/or critical habitat, the Signatories agree that compliance with the ESA shall be achieved as set forth in this Paragraph.

A. With respect to listed species potentially affected by implementation of the approved habitat expansion action(s), the Licensees intend that any necessary measures to address potential impacts would be

identified and incorporated into the approved habitat expansion action(s), and that any necessary authorization for direct or incidental taking of listed species would be obtained from FWS and NMFS through an appropriate ESA mechanism, such as Section 7 or Section 10 of the ESA.

B. The Signatories agree to develop appropriate ESA mechanisms to provide authorization for: (1) any actions taken to implement the approved habitat expansion action(s), and (2) potential impacts to anadromous fish if the habitat expansion action(s) result in the introduction of the species into areas where they may be affected by existing Licensee facilities or operations.

C. The Signatories intend that any costs related to ESA compliance shall be included in the estimated cost of the action(s) subject to Paragraph 11A.

D. NMFS and USFWS represent that they enter into this Agreement believing that the information in the record supports the Agreement. However, NMFS and USFWS are not making a predecisional determination of the outcome of any ESA Consultation or approval and expressly reserve the right to take such future action or to issue such terms and conditions in any Biological Opinions, Incidental Take Statements, or other approvals as necessary to meet their obligations under the ESA. Further, NMFS expressly reserves the right to recommend such EFH conservation measures as necessary to meet its obligations under the Magnuson-Stevens Act.

E. In the event of USFWS and NMFS Section 7 ESA Consultation in response to a newly listed species on river reaches affected by the Feather River hydroelectric projects, USFWS and NMFS shall consider the actions implemented under the Habitat Expansion Plan and potential modifications to such actions in determining whether, and to what degree, new actions on the Feather River are necessary. ***[Need to finalize this section.]***

14. Dispute Resolution and Enforceability.

A. General.

i. This Agreement is enforceable by any Signatory under Federal or California law, as applicable. By executing this Agreement, no federal agency is consenting to the jurisdiction of a state court unless such jurisdiction otherwise exists. To the extent any approved habitat expansion action(s) are within FERC's jurisdiction,

implementation of those action(s) shall be subject to FERC approval and oversight.

ii. Except to the extent that one or more of the Resource Agencies is precluded by law from participating in the dispute resolution procedures set forth below, all disputes among the Signatories regarding any Signatories' performance or compliance with this Agreement, shall be the subject of a non-binding alternative dispute resolution ("ADR") procedure among the Disputing Parties, as described below.

iii. Each Signatory participating in a dispute ("Disputing Party," or collectively, "Disputing Parties") shall cooperate in good faith to promptly schedule, attend and participate in the ADR.

iv. The Disputing Parties agree to devote such time, resources and attention to the ADR as is needed and as can reasonably be provided to attempt to resolve the dispute at the earliest time possible.

v. Each Disputing Party shall implement promptly all final agreements reached, consistent with its applicable statutory and regulatory responsibilities.

vi. The ADR procedures in this Paragraph 14 do not preclude any Signatory from timely filing and pursuing an action for administrative or judicial relief of any FERC order or other regulatory action when the dispute is within FERC's or another regulatory agency's jurisdiction; provided that such Signatory shall pursue the ADR procedures as soon as practicable thereafter.

vii. If the dispute involves a matter within the jurisdiction of FERC or another regulatory agency, the Signatory initiating the dispute under this Paragraph 14 shall notify the regulatory agency when it initiates the ADR procedures.

viii. The initiation of the ADR procedures in this Paragraph 14 shall have no effect on filing deadlines or applicable statutes of limitations before FERC or other regulatory agency of competent jurisdiction.

ix. Nothing in these ADR procedures is intended nor shall be construed to affect or limit the authority of any of the Resource Agencies to resolve a dispute brought before them in accordance with their own procedures and applicable law.

B. ADR Procedures.

i. Notice. A Signatory claiming a dispute shall give Notice of the dispute within 30 days of the Signatory's actual knowledge of the act, event, or omission that gives rise to the dispute, unless this Agreement provides otherwise. Such Notice shall describe:

(a) the matter(s) in dispute;
(b) the identity of any other Signatory who is alleged to have failed to perform or comply with this Agreement; and
(c) the specific relief sought.

ii. Informal Meetings. At a minimum in any dispute subject to these ADR procedures, the Disputing Parties shall hold two informal meetings within 45 days after Notice, to attempt to resolve the disputed issue(s).

iii. Mediation. If the informal meetings fail to resolve the dispute, the Disputing Parties shall decide whether to attempt to resolve the dispute using a neutral mediator. The decision whether to pursue mediation shall be made within 20 days after conclusion of the informal meetings. Mediation shall not occur unless the Disputing Parties agree on the selection of the mediator and an allocation of mediation costs. The Disputing Parties shall select a mediator within 30 days of the decision to pursue mediation. It is anticipated that the mediation process shall be completed within 90 days after selection of the mediator.

iv. Time Periods. Any of the time periods set forth in these ADR procedures may be reasonably extended or shortened by agreement of the Disputing Parties, or as necessary to conform to the procedure of an agency or court with jurisdiction over the dispute.

v. Dispute Resolution Notice. Within 15 days of conclusion of the ADR procedures, the Signatory that initiated the dispute shall provide Notice to all other Signatories participating in the dispute resolution of the outcome achieved under these ADR procedures. The Notice shall:

(a) restate the disputed matter, as initially described in the dispute initiation Notice;
(b) state whether the resolution was achieved, in whole or part; and
(c) state the specific relief agreed to or sought.

C. Rights and Remedies After Dispute Resolution. After exhaustion of dispute resolution, the Signatories shall have the following rights and remedies.

i. 30-Day Waiting Period. Unless otherwise prohibited by law, a Disputing Party shall wait at least 30 days after receipt of the dispute resolution Notice described in Paragraph 14(B)(v) before exercising its rights and remedies under this Paragraph 14(C).

ii. No Damages. No Signatory shall be liable in damages for any breach of this Agreement, any performance or failure to perform a mandatory or discretionary obligation imposed by this Agreement, or any other cause of action arising from this Agreement.

iii. Remedy for Material Breach by Licensees. The exclusive remedy for material breach of this Agreement by one or both of the Licensees shall be the ability of a Signatory to impose or seek conditions for Fish Passage in the appropriate Licensee's Feather River hydroelectric project(s), consistent with this Agreement.

iv. Remedy for Material Breach by Signatories Other Than Licensees. The exclusive remedy for material breach of this Agreement by a Signatory other than one of the Licensees shall be specific performance of the Signatory's obligations under this Agreement or other equitable relief from a court or agency of competent jurisdiction. Obligations under this Agreement that are discretionary shall be reviewed under the arbitrary and capricious standard, shall be supported by substantial evidence in the record compiled in the consultation procedures required by this Agreement. Licensees must seek their remedy under this Paragraph within 90 days after the dispute resolution Notice under Paragraph 14(B)(v). Final decisions under Paragraph 11(B)(iii)(b) are not subject to review under this Paragraph. This Agreement does not create jurisdiction (or remedy) to challenge the adequacy of a condition for Fish Passage under applicable statutory or regulatory law.

Signatories

California Department of Water Resources

by _____
(Print) (Title)

Pacific Gas & Electric Company

by _____
(Print) (Title)

National Marine Fisheries Service

by _____
(Print) (Title)

United States Department of Interior

by _____
(Print) (Title)

United States Forest Service

by _____
(Print) (Title)

American Rivers

by _____
(Print) (Title)

Arthur G. Baggett

by _____
(Print) (Title)

State Water Contractors, Inc.

by _____
(Print) (Title)

Appendix G
List of Authorized Representatives

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January 31, 2007

Ms. Magalie R. Salas, Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington, D. C. 20426

Subject: Final Section 4(e) Conditions
Oroville Facilities Project No. 2100-134

Dear Ms. Salas:

The Federal Energy Regulatory Commission (FERC) Office of Energy Products staff issued a Draft Environmental Impact Statement (DEIS) for the Oroville Facilities FERC Project No. 2100-134 on September 29, 2006. A portion of the project is located on lands of the Plumas and Lassen National Forests managed by the USDA Forest Service. The following comments and conditions comprise the report of the Secretary of Agriculture in accordance with section 4(e) of the Federal Power Act.

This project does not conflict with any project of which we are aware that should be or has been constructed by the United States. It neither interferes with nor is inconsistent with the purposes for which the Plumas National Forest or Lassen National Forest were created or acquired. We have no objection to a license being issued, subject to certain conditions necessary for the protection and utilization of National Forest System lands and resources affected by the project.

We filed preliminary conditions on March 29, 2006. These preliminary conditions have been modified to reflect changes and clarifications that resulted from other proceedings under the new Energy Policy Act rules. Enclosure 1 contains the final conditions approved by the Regional Forester, Pacific Southwest Region, to be included in the license, necessary for the protection and utilization of the affected National Forest System lands. Enclosure 2 provides a crosswalk between the preliminary and final conditions. The conditions are based on the Forest Service review of the application, extensive coordination with Federal and State agencies and others, public comment, and consultation with the licensee. These conditions are consistent with the goals, objectives, standards, and guidelines of the *Plumas National Forest Land and Resource Management Plan* and the *Lassen National Forest Land and Resource Management Plan*. These conditions are also consistent with the Oroville Facilities Relicensing Settlement Agreement. Under authority delegated from the Secretary of Agriculture, the Regional Forester considers these conditions necessary to avoid or mitigate resource and environmental impacts caused by proposed project operations.

A rationale document that describes the information and process used to develop the section 4(e) conditions has previously been filed with FERC.

Please contact Cheryl Mulder, Plumas National Forest (530-283-7771), if you have questions.

Respectfully submitted,

/s/ Joshua S. Rider
Joshua S. Rider
Attorney for the Forest Service

Enclosures

cc: Jim Peña, Forest Supervisor, Plumas NF
Cheryl Mulder, Plumas NF
Bob Hawkins, RHAT
Service List

FINAL LICENSE TERMS AND CONDITIONS NECESSARY FOR THE PROTECTION AND UTILIZATION OF THE LASSEN AND PLUMAS NATIONAL FORESTS IN CONNECTION WITH THE APPLICATION FOR LICENSE

Oroville Facilities
FERC No. 2100

Index

ENCLOSURE 1

PACIFIC SOUTHWEST REGION, USDA FOREST SERVICE
FINAL 4(E) TERMS AND CONDITIONS
NECESSARY FOR THE PROTECTION AND UTILIZATION OF THE
LASSEN AND PLUMAS NATIONAL FORESTS
OROVILLE FACILITIES
FERC PROJECT No. 2100

I. Introduction

The Forest Service (FS) provides the following Final Section 4(e) Conditions (Conditions) for the Oroville Facilities project, FERC No. 2100 in accordance with 18 CFR 4.34(b)(1)(i). The Forest Service is also submitting "Recommendations", as allowed under Section 10(a) of the Federal Power Act. The "Recommendations" are applicable to areas where project effects do not directly affect NFS lands, and are optional for consideration by the FERC, as the lead federal agency. The "Recommendations" are shown in Enclosure 1 as italicized text.

Section 4(e) of the Federal Power Act states the Commission may issue a license for a project within a reservation only if it finds that the license will not interfere or be inconsistent with the purpose for which such reservation was created or acquired. This is an independent threshold determination made by FERC, with the purpose of the reservation defined by the authorizing legislation or proclamation (see Rainsong v. FERC, 106 F.3d 269 (9th Cir. 1977). The FS, for its protection and utilization determination under Section 4(e) of the FPA may rely on broader purposes than those contained in the original authorizing statutes and proclamations in prescribing conditions (see Southern California Edison v. FERC, 116F.3d 507 (D.C. Cir. 1997)).

The following terms and conditions are based on those resource and management requirements enumerated in the Organic Administration Act of 1897 (30 Stat. 11), the Multiple-Use Sustained Yield Act of 1960 (74 Stat. 215), the National Forest Management Act of 1976 (90 Stat. 2949), and any other law specifically establishing a unit of the National Forest System or prescribing the management thereof (such as the Wilderness Act or the Wild and Scenic River Act), as such laws may be amended from time to time, and as implemented by regulations and approved Land and Resource Management Plans prepared in accordance with the National Forest Management Act. Specifically, the 4(e) conditions are based on the Land and Resource Management Plan (as amended) for the Plumas National Forest (and portions of the Lassen National Forest administered by the Plumas), as approved by the Regional Forester of the Pacific Southwest

Region.

Pursuant to Section 4(e) of the Federal Power Act, the Secretary of Agriculture, acting by and through the Forest Service, considers the following conditions necessary for the adequate protection and utilization of the land and resources of the Lassen and Plumas National Forests. License articles contained in the Federal Energy Regulatory Commission's (Commission) Standard "L" Forms (revised October 1975) issued by Order No. 540, dated October 31, 1975, and incorporated into this license, cover general requirements. In addition, this document includes both administrative provisions (Section II) and specific resource requirements (Section III) deemed necessary for protection and utilization of National Forest System lands and resources.

II. Administrative Provisions

Condition No. 1-Forest Service Reserves the Right to Revise Section 4(e) Conditions

The Forest Service reserves the right to modify final Section 4(e) conditions submitted to FERC for inclusion in the new license for the Oroville Facilities, FERC No.2100, to resolve any conflict between FS 4(e) conditions and: 1) water quality certificate conditions issued by the State of California Department of Water Resources Control Board, 2) Section 18 conditions issued by the National Oceanographic and Atmospheric Administration Fisheries Service, or 3) terms and conditions imposed by existing or revised U.S. Fish and Wildlife Service Biological Opinion issued for the relicensing of the Project.

Condition No. 2—Approval of Changes

Notwithstanding any license authorization to make changes to the project, when such changes directly affect National Forest System lands the Licensee shall obtain written approval from the Forest Service prior to making any changes in any constructed project features or facilities, or in the uses of project lands and waters or any departure from the requirements of any approved exhibits filed with the Commission. Following receipt of such approval from the Forest Service, and a minimum of 60-days prior to initiating any such changes, the Licensee shall file a report with the Commission describing the changes, the reasons for the changes, and showing the approval of the Forest Service for such changes. The Licensee shall file an exact copy of this report with the Forest Service at the same time it is filed with the Commission. This article does not relieve the Licensee from the amendment or other requirements of Article 2 or Article 3 of this license.

Condition No. 3—Surrender of License or Transfer of Ownership

Prior to any surrender of this license, the Licensee shall provide assurance acceptable to the Forest Service that Licensee shall restore any project area directly affecting National Forest System lands to a condition satisfactory to the Forest Service upon or after surrender of the license, as appropriate. To the extent restoration is required, Licensee shall prepare a restoration plan which shall identify the measures to be taken to restore such National Forest System lands and shall include or identify adequate financial mechanisms to ensure performance of the restoration measures.

In the event of any transfer of the license or sale of the project, the Licensee shall assure that, in a manner satisfactory to the Forest Service, the Licensee or transferee will provide for the costs of surrender and restoration. If deemed necessary by the Forest Service to assist it in evaluating the Licensee's proposal, the Licensee shall conduct an analysis, using experts approved by the Forest Service, to estimate the potential costs associated with surrender and restoration of any project area directly affecting National Forest System lands to Forest Service specifications. In addition, the Forest Service may require the Licensee to pay for an independent audit of the transferee to assist the Forest Service in determining whether the transferee has the financial ability to fund the surrender and restoration work specified in the analysis.

Condition No. 4— Fire Prevention, Response, and Investigation

Within one year of license issuance the Licensee shall file with the Commission a Fire Prevention and Response Plan for National Forest System lands within the Project that is approved by the Forest Service, and developed in consultation with appropriate State and local fire agencies. The plan shall set forth in detail the Licensee’s responsibility for the prevention, reporting, control, and extinguishing of fires in the vicinity of the project resulting from project operations.

At a minimum the plan shall address the following categories:

1. Prevention: Availability of fire access roads, community road escape routes, helispots to allow aerial firefighting assistance in the steep canyon, water drafting sites and other fire suppression strategies. Address fire danger and public safety associated with project induced recreation, including fire danger associated with dispersed camping, existing and proposed developed recreation sites, trails, and vehicle access.

2. Emergency Response Preparedness: Analyze fire prevention needs including equipment and

personnel availability.

3. Reporting: Licensee shall report any project related fires to the Forest Service within 24 hours.

4. Fire Control/Extinguishing: Provide the Forest Service a list of the locations of available fire suppression equipment and the location and availability of fire suppression personnel.

Investigation of Project Related Fires

The Licensee agrees to fully cooperate with the Forest Service on all fire Investigations. The Licensee shall produce upon request all materials and witnesses not subject to the attorney-client or attorney work product privileges, over which the Licensee has control, related to the fire and its investigation including:

- All investigation reports
- All witness statements
- All photographs
- All drawings
- All analysis of cause and origin
- All other, similar materials and documents regardless of how collected or maintained

The Licensee shall preserve all physical evidence, and give custody to the Forest Service of all physical evidence requested. The Forest Service shall provide the Licensee with reasonable access to the physical evidence and documents the Licensee requires in order to defend any and all claims, which may arise from a fire resulting from project operations, to the extent such access is not precluded by ongoing criminal or civil litigation

Condition No. 5- Access by the United States

The United States shall have unrestricted use of any road over which the Licensee has control within the project area for all purposes deemed necessary and desirable in connection with the protection, administration, management, and utilization of Federal lands or resources. When needed for the protection, administration, and management of Federal lands or resources the United States shall have the right to extend rights and privileges for use of the right-of-way and road thereon to States and local subdivisions thereof, as well as to other users. The United States shall control such use so as not to unreasonably interfere with the safety or security uses, or cause the Licensee to bear a share of costs disproportionate to the Licensee's use in comparison to the use of the road by others.

Condition No. 6—Maintenance of Improvements on or Affecting National Forest System Lands

The Licensee shall maintain all its improvements and premises on or affecting National Forest System (NFS) lands to standards of repair, orderliness, neatness, sanitation, and safety acceptable to the Forest Service. Disposal will be at an approved existing location, except as otherwise agreed by the Forest Service.

Condition No. 7—Pesticide Use Restrictions on National Forest Lands

Pesticides may not be used on NFS lands or in areas affecting NFS lands to control undesirable woody and herbaceous vegetation, aquatic plants, insects, rodents, trash fish, etc., without the prior written approval of the Forest Service. During the Annual Consultation meeting described in Condition 15, the Licensee shall submit a request for approval of planned uses of pesticides for the upcoming year. The Licensee shall provide information essential for review including specific locations and timeframes for application. Exceptions to this schedule may be allowed only when unexpected outbreaks of pests require control measures that were not anticipated at the time the report was submitted. In such an instance, an emergency request and approval may be made.

As an alternative, the Licensee may provide an Integrated Pest Management plan that describes planned pesticide use on a regular basis for the term of the license, which includes an annual reporting element.

The Licensee shall use on National Forest System land only those materials registered by the U.S. Environmental Protection Agency for the specific purpose planned. The Licensee must strictly follow label instructions in the preparation and application of pesticides and disposal of excess materials and containers.

Condition No. 8—Valid Claims and Existing Rights

This license is subject to all valid claims and existing rights of third parties. The United States is not liable to the Licensee for the exercise of any such right or claim.

Condition No. 9—Compliance with Regulations on National Forest System Lands

The Licensee shall comply with the regulations of the Department of Agriculture for activities on National Forest System lands, and all applicable Federal, State, county, and municipal laws, ordinances, or regulations in regards to the area or operations on or directly affecting National Forest System lands, to the extent those laws, ordinances or regulations are not

preempted by federal law.

Condition No. 10—Protection of United States Property

This condition has been combined with Condition 13.

Condition No. 11—Indemnification

The Licensee shall indemnify, defend, and hold the United States harmless for:

- any violations incurred under any laws and regulations applicable to, or
- judgments, claims, penalties, fees, or demands assessed against the United States caused by, or
- costs, damages, and expenses incurred by the United States caused by, or
- the releases or threatened release of any solid waste, hazardous substances, pollutant, contaminant, or oil in any form in the environment related to

the construction, maintenance, or operation of the project works or of the works appurtenant or accessory thereto under the license.

The Licensee's indemnification of the United States shall include any loss by personal injury, loss of life or damage to property caused by the construction, maintenance, or operation of the project works or of the works appurtenant or accessory thereto under the license. Indemnification shall include, but is not limited to, the value of resources damaged or destroyed; the costs of restoration, cleanup, or other mitigation; fire suppression or other types of abatement costs; third party claims and judgments; and all administrative, interest, and other legal costs. Upon surrender, transfer, or termination of the license, the Licensee's obligation to indemnify and hold harmless the United States shall survive for all valid claims for actions that occurred prior to such surrender, transfer or termination.

Condition No. 12—Surveys, Land Corners

The Licensee shall avoid disturbance to all public land survey monuments, private property corners, and forest boundary markers. In the event that any such land markers or monuments on National Forest System lands are destroyed by an act or omission of the Licensee, in connection with the use and/or occupancy authorized by this license, depending on the type of monument destroyed, the Licensee shall reestablish or reference same in accordance with (1) the procedures outlined in the "Manual of Instructions for the Survey of the Public Land of the United States," (2) the specifications of the County Surveyor, or (3) the specifications of

the Forest Service. Further, the Licensee shall ensure that any such official survey records affected are amended as provided by law.

Condition No. 13—Damage to Land, Property, and Interests of the United States

The Licensee has an affirmative duty to protect the land, property, and interests of the United States from damage arising from the Licensee's construction, maintenance, or operation of the project works or the works appurtenant or accessory thereto under the license. The Licensee's liability for fire and other damages to National Forest System lands shall be determined in accordance with the Federal Power Act and Standard Form L-1 Articles 22 and 24.

Condition No. 14—Risks and Hazards

As part of the occupancy and use of the project area, the Licensee has a continuing responsibility to reasonably identify and report all known or observed hazardous conditions on or directly affecting National Forest System lands within the project boundary that would affect the improvements, resources, or pose a risk of injury to individuals. Licensee will abate those conditions, except those caused by third parties or not related to the occupancy and use authorized by the License. Any non-emergency actions to abate such hazards on National Forest System lands shall be performed after consultation with the Forest Service. In emergency situations, the Licensee shall notify the Forest Service of its actions as soon as possible, but not more than 48 hours, after such actions have been taken. Whether or not the Forest Service is notified or provides consultation; the Licensee shall remain solely responsible for all abatement measures performed. Other hazards should be reported to the appropriate agency as soon as possible.

Condition No. 15—Consultation

Each year, the Licensee shall consult with the Forest Service with regard to measures needed to ensure protection and utilization of the National Forest resources affected by the project. The date of the consultation meeting will be mutually agreed to by the Licensee and the Forest Service but in general will be held 60 days prior to the beginning of the recreation season to facilitate implementation of flow management requirements and recreational management activities. Representatives from the U.S. Fish and Wildlife Service, California Department of Fish and Game, or other interested agency representatives concerned with operation of the project may request to attend the meeting.

Consultation shall 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 the Licensee 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, e.g. road maintenance.

A record of the meeting shall be kept by the Licensee and shall include any recommendations made by the Forest Service for the protection of National Forest System lands (NFSL) and resources. The Licensee shall file the meeting record, if requested by FS, with the Commission no later than 60 days following the meeting.

Copies of other reports related to project safety and non-compliance shall be submitted to the Forest Service concurrently with submittal to the FERC. These include, but are not limited to: any non-compliance report filed by the licensee, geologic or seismic reports, and structural safety reports for facilities located on or affecting NFSL.

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 4(e) conditions to accomplish protection and utilization of National Forest lands.

III. Resource Protection Conditions

Condition No. 16-Heritage Resources

Licensee shall file with the Commission, within one year following license issuance, a Historic Properties Management Plan (HPMP) approved by the Forest Service, for the purpose of protecting and interpreting heritage resources located on National Forest System lands (NFS lands). The Licensee shall consult with the State Historic Preservation Officer, Native American Tribes, Forest Service, and other applicable agencies and communities during the preparation of the Plan. The HPMP shall accurately define the area of potential effects, including effects of implementing Section 4(e) conditions, Native American traditional cultural values, and Project-induced recreational impacts to archaeological properties on or affecting National Forest System lands. The HPMP shall also provide measures to mitigate the identified impacts, including a monitoring program, and management protocols for the ongoing protection of archaeological properties.

If, prior to or during ground-disturbing activities or as a result of project operations, items of potential cultural, historical, archaeological, or paleontological value are reported or discovered, or a known deposit of such items is disturbed on NFS lands, the Licensee shall immediately cease work in the area affected, and implement the provisions in the HPMP.

Condition No. 17 – Protection of Forest Service Special Status Species

Before taking actions to construct new project features on NFS lands that may affect Forest Service special status species (i.e. Forest Service sensitive and/or management indicator species) or their critical habitat, the Licensee shall prepare a biological evaluation evaluating the potential impact of the action on the species or its habitat and submit it to the Forest Service for approval. In coordination with the Commission, the Forest Service may require mitigation measures for the protection of the affected species.

The biological evaluation shall

- Include procedures to minimize adverse effects to special status species.
- Ensure project-related activities shall meet restrictions included in site management plans for special status species.
- Develop implementation and effectiveness monitoring of measures taken or employed to reduce effects to special status species.

Condition No. 18-Invasive Weed Management

Within one year of license issuance, Licensee shall develop and file for Commission approval a plan to manage and reduce native and non-native invasive plant species populations on or affecting NFS lands. The plan shall be developed in conjunction with the Forest Service (FS), Bureau of Land Management (BLM), California Department of Fish and Game (DFG), and California Department of Parks and Recreation (DPR), *and in consultation with the Ecological Committee (EC),* including specifically the U.S. Fish and Wildlife Service (USFWS). Prior to filing the plan for Commission approval, the Licensee shall: 1) submit the portion of the plan pertaining to National Forest System lands to the Forest Service for approval, *2) submit the portion of the plan pertaining to BLM lands to BLM for approval, 3) submit the portion of the plan pertaining to DFG lands to DFG for approval, and 4) submit the portion of the plan pertaining to DPR lands to DPR for approval.* Upon Commission approval, the Licensee shall implement the plan, including any changes required by the Commission. Commission approval to use pesticides for noxious weed control constitutes the approval required by Condition 7.

(b) The plan shall specify areas/acreage, treatment/control methods, best management practices, needs for multiple year treatments and monitoring, including an annual

inspection. The plan shall specifically address, but not be limited to, the following species: purple loosestrife (Lythrum salicaria); giant reed (Arundo donax), tree of heaven (Ailanthus altissima); scarlet wisteria (Sesbania punicea); parrot feather (Myriopyllum aquaticum); Himalayan blackberry (Rubus discolor); aquatic primrose (Ludwigia peploides); yellow starthistle (Centaurea solstitialis); Spanish broom (Spartium junceum); French broom (Genista monspessulana); Scotch broom (Cytisus scoparius); and skeleton weed (Chondrilla juncea).

(c) *After coordination with the appropriate land management agency and then consultation with the EC, including specifically USFWS, the Licensee may modify the implementation measures contained within the plan without Commission approval to the extent the measures are within the scope of the approved plan.* Any modification to the implementation measures that are not within the scope of the approved plan must be filed with the Commission for approval.

(d) The Licensee shall coordinate the plan and ongoing efforts with applicable federal, state and local agencies and shall take into full consideration state and federally listed species including Forest Service Sensitive species located on NFS lands.

(e) In coordination with the FS, BLM, DFG, and DPR, the Licensee shall reevaluate the plan five years after initial implementation, *and shall consult with the EC,* including specifically USFWS, and any other applicable federal, state and local agencies regarding the reevaluation. The reevaluation shall take into consideration the need to treat other invasive plant species, as well as alternative or additional control methods that may be implemented.

(f) Following license issuance, the Licensee shall file annually with the Commission a compliance report for informational purposes. The Licensee shall first prepare the report in coordination with the FS, BLM, DFG, and DPR, *and in consultation with the EC,* including specifically USFWS. The report as filed with the Commission shall include any comments *of EC members* and the Licensee's responses.

(g) The *Licensee shall not be required to expend more than $450,000 to develop and implement the plan during the first five years after issuance of this license, and shall not be required to expend more than ($25,000) every year thereafter.*

Condition No. 19-Development of a Fuel Management Plan

Within one year of license issuance, the Licensee shall prepare for Forest Service approval and filing with the Commission, a Fuel Management Plan for National Forest System lands (NFS lands) located within the project area. The plan shall identify fuel management issues, prioritization, and recommended actions to address them. The plan encompassing NFS lands within the project area may be coordinated with the Oroville Facilities Relicensing Settlement Agreement, Appendix B, Fuel Load Management plan.

Enclosure 2

Oroville Project, FERC No. 2100

Final 4(e) Terms and Conditions

To clarify modifications between the Preliminary 4(e) Conditions and the enclosed Final 4(e) Conditions, we have included this crosswalk table.

#	Preliminary 4(e) Title	Final 4(e) Title	Remarks
1	Forest Service Reserves the Right to Revise Section 4(e) Conditions	Forest Service Reserves the Right to Revise Section 4(e) Conditions	No Change
2	Approval of Changes After Initial Construction	Approval of Changes	Minor changes
3	Surrender of License or Transfer of Ownership	Surrender of License or Transfer of Ownership	Minor Changes
4	Investigation of Project Related Fires	Fire Prevention, Response, and Investigation	Added requirements for fire prevention and response
5	Area Access	Access by the United States	Minor Changes
6	Maintenance of Improvements on or Affecting NFS lands	Maintenance of Improvements on or Affecting NFS lands	No Change
7	Pesticide Use Restrictions on NFS lands	Pesticide Use Restrictions on NFS lands	Modified to provide Licensee option to use Integrated Pest Management
8	Valid Claims and Existing Rights	Valid Claims and Existing Rights	No Change
9	Compliance with Regulations on NFS lands	Compliance with Regulations on NFS lands	Minor Changes
10	Protection of United States Property	Protection of United States Property	Combined with Condition 13
11	Indemnification	Indemnification	Reworded for consistency with FS policy
12	Surveys, Land Corners	Surveys, Land Corners	Minor Changes
13	Damage to Land, Property, and interests of the United States	Damage to Land, Property, and interests of the United States	Reworded for consistency with FS policy

#	Preliminary 4(e) Title	Final 4(e) Title	Remarks
14	Risks and Hazards	Risks and Hazards	No Change
15	Consultation	Consultation	Expanded to define consultation requirements
16	Heritage Resources	Heritage Resources	No Change
17	Protection of Forest Service Special Status Species	Protection of Forest Service Special Status Species	No Change
18	Invasive Weed Management	Invasive Weed Management	No Change
19	Development of a Fuel Management Plan	Development of a Fuel Management Plan	No Change

Submission Contents

APPENDIX C1
AQUATIC RESOURCES METHODOLOGY

C1.1 INTRODUCTION

Appendix C1 describes the processes and bases used to evaluate the No-Project Alternative, the Proposed Project, and the Federal Energy Regulatory Commission (FERC) Staff Alternative and their potential effects on aquatic and fisheries resources. Implementation of any of the alternatives is anticipated to produce two distinct types of effects: (1) direct effects related to construction activities or changes in Oroville Facilities operations; and (2) indirect effects related to changes in hydrologic conditions. The potential effects related to changes in hydrologic conditions may affect environmental resources beyond the project study area and are addressed under the cumulative analysis (see Section 6.2, Cumulative Impacts).

Qualitative assessments were completed to evaluate potential effects on aquatic resources. Qualitative analyses were conducted based on a combination of previous hydrologic and water temperature modeling for the Preliminary Draft Environmental Assessment (PDEA), literature reviews, study plan results, and the best professional judgment and experience of qualified individuals. These qualitative analyses examined potential effects associated with all of the following:

- Changes in flow regimes and associated potential changes in water temperatures;
- Fish interactions (e.g., competition for food or habitat, genetic introgression, predation);
- Fisheries resources management (stocking programs and disease management); and
- Potential effects on Chinook salmon spawning segregation, macroinvertebrate populations, woody debris distribution, gravel recruitment, and water quality criteria for aquatic life in relationship to aquatic resources and habitat quality.

A detailed quantitative analysis of effects on aquatic resources was not conducted for this draft environmental impact report (DEIR) based on the discussion included in Section 5.4.3, Aquatic Resources, Method of Analysis. A quantitative analysis of hydrologic and water temperature conditions would only reflect those changes applicable to the “initial new license operating period” which includes use of the River Valves to meet hatchery water temperature requirements, and additional minimum instream flows and other temperature control actions to meet water temperature objectives for the lower Feather River. During the initial new license operating period water temperature targets are the same or more beneficial to coldwater species as those under Existing Conditions. The modeling reflects operations for about the next ten years because specific facilities modifications to be implemented in future years (e.g., River Valves improvements, Palermo Canal improvements, or Hyatt intake extension)

are not yet known. Therefore, it is not possible to model conditions associated with project operations including unknown, potential future facilities modifications. Potential facilities modifications will be analyzed in greater detail in a subsequent feasibility study and future environmental documentation.

C1.2 QUALITATIVE EVALUATION OF OPERATIONS-RELATED EFFECTS

C1.2.1 Operations-Related Effects on Reservoir Fish species

Implementation of the No-Project Alternative, the Proposed Project, or the FERC Staff Alternative could result in alterations to storage volumes and water surface elevations within Oroville Facilities reservoirs. Day-to-day operations and changes in runoff patterns could result in changes in the timing and magnitude of reservoir drawdown. The resulting fluctuation of Oroville Facilities reservoirs could potentially affect recreationally important reservoir fish species of primary management concern. Methods used to determine potential effects on reservoir fish species within Lake Oroville and other project reservoirs are discussed below.

The analysis of aquatic biological resources focuses on how reductions and fluctuations in the coldwater pools and water surfaces of Oroville Facilities reservoirs could affect coldwater and warmwater fish habitat and aquatic resources. For example, the seasonal timing and rate of reductions in reservoir water surface elevation during the black bass spawning period determines the proportion of bass nests that potentially could be dewatered. Bass populations reportedly require approximately 60 percent nest success to remain self-sustaining (Friesen 1998; Goff 1996; Hunt and Annett 2002; Hurley 1975; Knotek and Orth 1998; Kramer and Smith 1962; Lukas and Orth 1995; Neves 1975; Philipp et al. 1997; Raffetto et al. 1990; Steinhart 2004; Turner and MacCrimmon 1970). Reservoir coldwater pool volume is affected by project releases and coldwater pool is required for coldwater fish habitat. Changes in the proportion of available coldwater pool volume are an indicator of the potential changes in the amount of available coldwater fish habitat. Potential changes in seasonal timing and fluctuations of water surface elevations and coldwater pool availability are evaluated qualitatively based on proposed operational changes under the No-Project Alternative, Proposed Project, and FERC Staff Alternative.

Extensive sediment deposits, or sediment wedges, were identified in all four major tributaries of the Feather River at approximately 720 feet above mean sea level (msl) and below during field investigations conducted during October and December 2002 (DWR 2004a). Sediment wedges are subject to periodic exposure events when the reservoir surface elevation drops below the elevations at which the wedges occur. Such exposure events may inhibit or prohibit the movement of fish from the reservoir to tributaries upstream of Lake Oroville. Currently, the upper Feather River watershed is reportedly producing high sediment loads because of accelerated erosion. The Natural Resources Conservation Service estimated that 90 percent of the erosion in the 1,209-square-mile study area was accelerated erosion (NRCS 1998). Accelerated erosion is a soil loss greater than natural geologic conditions, which can reduce reservoir capacity, degrade water quality, and harm fish and wildlife.

The presence or absence of exposed sediment wedges is a potentially important factor to be considered in the analysis of project operations on aquatic resources. If sediment wedges are exposed during large portions of the upstream migration periods of stocked salmonid species, access to upstream spawning habitat could be affected substantially. In contrast, if the sediment wedges are not exposed for large portions of the migration periods of stocked salmonids, it is likely that upstream migration would not be affected substantially by sediment wedge exposure. The absence of exposed sediment wedges may allow for the undesirable upstream migration of stocked salmonid species or warmwater species currently in Lake Oroville. Upstream migration of stocked salmonid species could result in competition for spawning and juvenile rearing habitat with resident native salmonids or genetic introgression among stocks if the same species are stocked (e.g., rainbow trout). Upstream migration of warmwater species (e.g., black bass) could potentially increase predation rates on native resident juvenile salmonids.

As reported in Study Plan (SP) G1, sediment wedges are dynamic and mobilize differently based on different hydrologic conditions in tributaries and reservoirs. If the reservoir elevation is greater than the uppermost elevation of the wedge, lentic conditions predominate and wedge material does not move appreciably. If the reservoir elevation is lower than the wedge material, fluvial conditions predominate and typical stream processes transport wedge materials downstream. Because of the dynamic nature of the sediment wedges in the upper Feather River/Lake Oroville interface, it is difficult to assess the frequency, magnitude, and duration of sediment wedge exposure over time and its resulting effect on fisheries interactions in the reservoir and upstream tributaries. Further, the ability to determine that an exposed sediment wedge is a potential fish migration barrier depends on a number of conditions that are variable and, thus, cannot be reliably predicted. Therefore, a qualitative evaluation of the potential effects of sediment wedge exposure and resulting fish migration conditions was performed for the No-Project Alternative, the Proposed Project, and the FERC Staff Alternative.

C1.2.1.1 Warmwater Reservoir Fish Species of Primary Management Concern

Warmwater fish species present in Lake Oroville, including largemouth bass, smallmouth bass, spotted bass, green sunfish, crappie, and catfish, use the warm upper layer of the reservoir and nearshore littoral habitats throughout most of the year. Therefore, seasonal changes in reservoir storage, as they affect reservoir water surface elevation, and the rates at which the water surface elevation changes during specific periods of the year, can directly affect the reservoir's warmwater fisheries resources. Reduced water surface elevations can potentially reduce the availability of nearshore littoral habitats used by warmwater fish for spawning and rearing, thereby reducing spawning and rearing success and subsequent year-class strength. In addition, decreases in reservoir water surface elevation during the primary spawning period for warmwater fish nest building may result in reduced initial year-class strength as a result of nest “dewatering.” Potential effects of project operations on warmwater fish species of management concern are evaluated qualitatively based on changes in reservoir operations associated with implementation of the No-Project Alternative, Proposed Project, and the FERC Staff Alternative.

Criteria for reservoir elevation increases (nest flooding events) have not been developed by the California Department of Fish and Game (DFG). Because of overall reservoir fishery benefits (e.g., an increase in the availability of littoral habitat for warmwater fish rearing), greater reservoir surface elevations that would be associated with rising water levels would offset negative effects caused by nest flooding (Lee 1999). Therefore, the effects on spawning warmwater fishes from increases in reservoir water surface elevations are not addressed for reservoir fisheries. A qualitative assessment of the availability of littoral habitat for juvenile bass rearing was conducted for both Lake Oroville and Thermalito Afterbay. Additionally, a qualitative assessment was conducted to evaluate the potential effects associated with changes in reservoir surface elevations, drawdown rate and timing, and habitat enhancement programs on stocking and fish interactions (competition for food and habitat, genetic introgression, predation, and disease).

C1.2.1.2 Coldwater Reservoir Fish Species of Primary Management Concern

During the period when Lake Oroville is thermally stratified (April through November), coldwater fish (e.g., salmonids) within the reservoir reside primarily within the reservoir's metalimnion and hypolimnion, where water temperatures remain suitable. Reduced reservoir storage during this period could reduce the reservoir's coldwater pool volume, thereby reducing the quantity of potential habitat available to coldwater fish species. The size of the reservoir coldwater pool generally decreases as reservoir storage decreases, although not always in direct proportion because of the influence of reservoir basin morphometry and management of water temperature releases from the reservoir.

The water temperature criterion used in the analysis of potential effects on coldwater fish habitat is based on the most stringent criteria recommended by the U.S. Environmental Protection Agency (USEPA) for protection of aquatic life and for growth of adult and juvenile salmonids. The criterion chosen is based on the weekly maximum average water temperature because no monthly criterion is recommended by USEPA for protection of aquatic life. USEPA suggests two types of criteria for water temperature for coho salmon:

- Maximum weekly average water temperature for growth of juvenile and adult coho salmon (18 degrees Celsius (°C) or 64.4 degrees Fahrenheit (°F)); and

- Maximum weekly average water temperature for survival of juvenile and adult coho salmon (24°C or 75.2°F) (USEPA 2002).

Eighteen degrees Celsius was chosen as the water temperature defining the upper layer of the usable coldwater salmonid habitat for two reasons: (1) 18°C (64.4°F) was a more protective estimate than the 24°C (75.2°F) water temperature criterion for survival of juvenile and adult coho salmon; and (2) of all the salmonids for which specific criteria are recommended, coho salmon had the most stringent water temperature recommendations. Additionally, coho salmon have recently been stocked in Lake Oroville. For the purpose of this analysis, water with a temperature less than 18°C (64.4°F) was considered usable coldwater salmonid habitat.

Coldwater fish habitat also requires dissolved oxygen (DO) concentrations at or above 6.5 milligrams per liter (mg/L), based on USEPA criteria for sustainable coldwater fisheries, as well as a food base appropriate for coldwater fisheries. No characterizations of DO or food base are available from prior project modeling results, so the relative proportion of change in the coldwater pool volume was used as an indicator of the potential change in the quantity of coldwater fish habitat. The potential for substantial reductions in reservoir storage with implementation of the No-Project Alternative, Proposed Project, and FERC Staff Alternative were evaluated qualitatively.

The water temperature regime for Thermalito Afterbay is dynamic and is controlled by Oroville Facilities, the temperature of water released from Thermalito Pumping-Generating Plant, peaking and pumpback operations, and rates of agricultural diversions to the FRSA and Thermalito Afterbay releases into the Feather River. Section 4.2 of the DEIR, Surface Water Quantity and Quality, provides information relating to the characteristics of coldwater conditions in Thermalito Afterbay. Project-related changes were qualitatively assessed for their potential effects on coldwater fish habitat in Thermalito Afterbay.

Additionally, qualitative assessments were conducted of potential changes in reservoir surface elevations, drawdown rate and timing, and effects of habitat enhancement programs on stocking and fish interactions (competition for food, habitat, introgression, predation, and disease).

C1.2.2 Flow-Related Effects on Lower Feather River Fish Habitat

Changes in flow affect water surface elevations based on site-specific stage discharge relationships in the river. Changes in water surface elevations, in turn, potentially change the suitability of habitat with respect to water depth for species with minimum or maximum water depth requirements, inundation of habitat, and water velocity for some fish species and life stages.

Flows in the Low Flow Channel (LFC) of the Feather River, which extends from the Fish Barrier Dam to the Thermalito Afterbay Outlet, currently are governed by a 1983 agreement between the California Department of Water Resources (DWR) and DFG (DWR 1983). The agreement specifies that DWR "…shall release into the Feather River from the Thermalito Diversion Dam for fishery purposes a flow of 600 cfs [cubic feet per second]…" (DWR 1983). With implementation of the Proposed Project or the FERC Staff Alternative, flow in this reach of the river would increase above the basis of comparison, 600 cfs. Total releases to the lower Feather River below the Thermalito Afterbay Outlet (i.e., High Flow Channel (HFC)) would not change, nor would the minimum flow requirements for the HFC change. As a result of the potential flow changes in the LFC with implementation of the Proposed Project or the FERC Staff Alternative, the qualitative analyses evaluate the LFC and HFC separately for flow-related effects on aquatic resources. See Chapter 3.0, Description of Existing Facilities and Operations, the Proposed Project, and Alternatives, for additional information describing flows.

Qualitative analyses were conducted to determine the relationship between flow changes and the quantity and distribution of anadromous salmonid spawning habitat in the LFC. These analyses were based on site-specific stage discharge relationships developed to characterize the availability of habitat for the spawning life stage of Chinook salmon and steelhead. Results from the physical habitat simulation (PHABSIM) model were used in the effects analyses to evaluate the relationship of flows to availability of spawning habitat for Chinook salmon and steelhead (DWR 2004b).

Additionally, for each of the alternatives, qualitative analyses of flow changes and their potential effects were conducted for fish species and life stages for which specific, quantified flow-habitat availability relationships have not been established. Qualitative analyses of flow changes occurring with implementation of the alternatives were conducted to characterize the types of effects that could potentially occur on the relative quality and quantity of fish habitat for all of the following fish species and life stages:

- American shad adult immigration and spawning;
- Chinook salmon adult immigration and holding;
- Chinook salmon juvenile rearing and downstream movement;
- Steelhead/rainbow trout adult immigration and holding/residence;
- Steelhead/rainbow trout juvenile rearing and downstream movement;
- Steelhead smolt emigration; and
- Striped bass adult spawning.

Flow changes were evaluated qualitatively to determine the relative changes in habitat with respect to water depth, water velocity, and the amount of inundated habitat area compared to the known distribution and relative abundance for each species and life stage evaluated.

C1.2.3 Water Temperature–Related Effects on Lower Feather River Fish Habitat

Current criteria for managing water temperatures in the lower Feather River were established in the 1983 agreement between DFG and DWR, which stated that: (1) water temperatures below the Thermalito Afterbay Outlet must be suitable for fall-run Chinook salmon after September 15; (2) water temperatures below the Thermalito Afterbay Outlet must be suitable for American shad, striped bass, and other warmwater fish from May through August; and (3) daily average temperatures for water supplied to the Feather River Fish Hatchery must not exceed the following:

- 60°F from June 16 through August 15;
- 58°F from August 16 through August 31;

- 56°F from June 1 through June 15;
- 55°F from December 1 through March 31, and May 16 through May 31;
- 52°F from September 1 through September 30; and
- 51°F from October 1 through November 30, and April 1 through May 15.

A deviation of plus or minus 4°F for these average daily water temperatures is allowed between April 1 through November 30 (DWR 1983).

With implementation of the No-Project Alternative, the current water temperature criteria for management of aquatic resources in the lower Feather River would remain in place. The Proposed Project and FERC Staff Alternative would modify the water temperature targets at Robinson Riffle. No alternative would modify hatchery water supplies such that water temperature management constraints for the lower Feather River would change. However, flow changes in the LFC from 600 cfs (Existing Conditions and No-Project Alternative) to 700 cfs (Proposed Project) or 800 cfs (FERC Staff Alternative) also would alter the water temperature regime in the lower Feather River. See Chapter 3.0, Description of the Existing Facilities and Operations, the Proposed Project, and Alternatives, for further definition of the water temperature management and flow standards proposed under the No-Project Alternative, the Proposed Project, and the FERC Staff Alternative.

The first step in developing the qualitative analysis for water temperature effects was to determine the current location and distribution of potentially suitable fish habitat for each species and life stage selected for analysis. Suitable habitat requirements for each species and life stage evaluated were defined using the matrices from SP-F3.2, Task 2, Fish Life History and Habitat Requirement, which were produced from a comprehensive literature review, as well as from the results of other study plan reports. Fish habitat component requirements included mesohabitat (generalization of hydraulic conditions, i.e., glide, pool, riffle, run), substrate type, and water depth. Fish habitat component distribution in the lower Feather River was mapped and presented in SP-G2 and was used as the basis of the SP-F3.2, Task 4, Comparison of Fish Distribution to Fish Habitat in the Lower Feather River report. Appendix G-AQUA1, Affected Environment of the PDEA, provides summaries of the aquatic resources study plan reports, and Section C1.4, Lower Feather River Fish Species of Primary Management Concern, below, identifies habitat component requirements for specific species and life stages.

Because cooler water temperatures in the lower Feather River are expected with implementation of either the Proposed Project or the FERC Staff Alternative, the second step in the qualitative analysis of potential water temperature effects was to evaluate potential effects of cooler water temperatures on all fish species of management concern and their associated life stages. Potential changes in the quantity and quality of fish habitat with implementation of the No-Project Alternative, Proposed Project, and the FERC Staff Alternative were evaluated qualitatively based on proposed changes in flows and water temperatures in the LFC.

C1.3 QUALITATIVE FISH HABITAT COMPONENT EVALUATIONS

C1.3.1 Chinook Salmon Spawning Segregation

Blocking upstream migration has eliminated the spatial separation between spawning fall-run and spring-run Chinook salmon. Reportedly, spring-run Chinook salmon migrated to the upper Feather River and its tributaries from mid-March through the end of July (DFG 1998b). Fall-run Chinook salmon reportedly migrated later and spawned in lower reaches of the Feather River than spring-run Chinook salmon (Yoshiyama et al. 2001). Restricted access to historic spawning grounds currently causes spring-run Chinook salmon to spawn in the same lowland reaches that fall-run Chinook salmon use as spawning habitat. The overlap in spawning site locations, combined with a slight overlap in spawning timing (Moyle 2002) with temporally adjacent runs, may be responsible for inbreeding between spring-run and fall-run Chinook salmon in the lower Feather River (Hedgecock et al. 2001).

The Proposed Project and the FERC Staff Alternative include actions that would address effects on anadromous fishes caused by the blockage of upstream passage by the Oroville Facilities. In both scenarios, fish segregation weirs would be installed downstream of the Fish Barrier Dam to segregate spring-run and fall-run Chinook salmon. The reason for implementing this action is that spring-run Chinook salmon migrate upstream earlier during the year than fall-run Chinook salmon, which allows the runs to be segregated by allowing fish passage on a temporal basis. The effects of this action were evaluated on a qualitative basis using historic information on escapements, information collected during preparation of the SP-F10 Study Plan Report, and various agency reports on Chinook salmon run timing in the Feather River.

C1.3.2 Macroinvertebrate Populations

Aquatic macroinvertebrates consist primarily of insects, snails, clams, shrimp, and zooplankton. The current status of macroinvertebrate populations in the project study area was described in the interim and final reports for SP-F1, Task 1, Evaluation of Project Effects on Non-Fish Aquatic Resources, and is summarized in Section G-AQUA1.1 of Appendix G-AQUA1 of the PDEA. Construction of Oroville Dam changed the hydrologic cycle of the lower Feather River. These changes likely affected invertebrate life cycles and communities that evolved over time. Fluctuating reservoir surface elevations, controlled flows, and less frequent scouring events likely have affected non-fish aquatic resources. Macroinvertebrates and plankton communities may be directly affected by future changes in project operations that affect the amount of surface water, flow rates, water temperatures, or water quality in the project area.

Aquatic macroinvertebrates and plankton are important components of the biological food web in any aquatic ecosystem. Many invertebrate species are important to the recycling of nutrients in aquatic systems. They also are an important food source for fish, and their community structure and diversity are important factors in determining general ecosystem conditions. Stream health generally is determined by macroinvertebrate species diversity or through groupings at higher taxonomic levels.

Negative effects from environmental shifts or anthropogenic effects are shown by decreasing species diversity, organism size, or changes in taxa composition (Erman 1996).

As a basis for this assessment, projected physical and chemical changes associated with future project operations were compared with ecological requirements for macroinvertebrates and plankton populations within waters affected by the project. A qualitative assessment of potential effects was conducted to evaluate the general direction of such potential effects. Professional judgment was used to qualitatively assess effects, as supported by biological information cited herein.

C1.3.3 Woody Debris Recruitment

The Oroville Facilities prevent the recruitment of large woody debris (LWD) from the upstream reaches of the Feather River and its tributaries to the lower Feather River below Oroville Dam. Current sources of LWD in the lower Feather River are the riparian zone along the river, occasional inputs from orchards adjacent to the river, and other tributaries flowing into the lower Feather River. Moderated flow regimes in the lower Feather River also have reduced recruitment of LWD. In addition, current LWD recruitment is different in quality than under pre-dam conditions because the origin of the pre-dam wood would have been from mixed hardwood and coniferous forests not present in riparian zones downstream of Lake Oroville.

LWD is an important component of geomorphic processes and ecological functions in rivers and streams. Woody debris enhances the complexity of fish habitat and may redirect streamflow to create pools that serve as holding areas for anadromous salmonids. In addition, decaying LWD provides a source of nutrients for aquatic organisms. Generally, the influence of LWD on stream geomorphology and ecology varies with stream size (Lassettre and Harris 2001). On larger streams such as the Feather River the effects of LWD on geomorphic processes are limited, but it still performs important ecological functions. In these larger streams, LWD can provide shelter for salmonids, and when associated with secondary channels, it contributes to the quality and diversity of juvenile rearing habitat.

LWD supplementation programs for the lower Feather River are included under the Proposed Project and the FERC Staff Alternative. Effects of LWD supplementation were evaluated qualitatively for the Proposed Project and the FERC Staff Alternative using a literature review, and comparisons were made between the current quantity, distribution, and habitat function of LWD in the lower Feather River and fish habitat quality.

C1.3.4 Gravel/Sediment Recruitment

Chinook salmon, steelhead, and river lamprey use riffles and runs with a gravel substrate for spawning. Females of each species construct nests (redds) in the substrate by creating a shallow depression in the gravel. Eggs are then deposited in the depression while males release sperm over the eggs for fertilization. Next, eggs are

covered with a layer of gravel where they incubate, and juveniles emerge from the gravel at a later date depending on egg incubation time required for the species. Because the incubating eggs require a constant supply of oxygenated water, gravel is the required substrate.

Spawning habitat for anadromous salmonids below Oroville Dam has been affected by changes to the geomorphic processes caused by several factors, including hydraulic mining, land use practices, construction of flood management levees, regulated flow regimes, and construction and operation of Oroville Dam. The dam blocks sediment recruitment from the upstream areas of the watershed. In the lower reaches of the river, levees and bank armoring prevent gravel recruitment. Periodic flows of sufficient magnitude to mobilize smaller sized gravel from spawning riffles result in armoring of the remaining substrate. DWR (1996) evaluated the quality of spawning gravels in the lower Feather River based on bulk gravel samples and Wolman surface samples obtained during spring 1996. The study concluded that the worst scoured areas had an armored surface layer too coarse for spawning salmonids. Additionally, much of the streambed substrate in the reach from the Fish Barrier Dam to the Thermalito Afterbay Outlet is composed of large gravel and cobble, which is too large for construction of spawning redds for Chinook salmon and steelhead. This reach of the lower Feather River is by far the most intensively used spawning habitat of the river for salmon and steelhead.

Gravel supplementation is a proposed measure under both the Proposed Project and the FERC Staff Alternative. Both the Proposed Project and the FERC Staff Alternative would implement rip and raking of selected armored stream bottoms, in addition to the placement of gravel at targeted sites in the river reach between the Fish Barrier Dam and the Thermalito Afterbay Outlet. Effects of the Gravel Supplementation and Improvement Program on the quality of fish habitat were evaluated qualitatively for both alternatives using a literature review and professional judgment.

The Proposed Project and the FERC Staff Alternative include actions to improve the quality and quantity of salmonid spawning gravel, as well as to potentially create new spawning habitat. The effects of superimposition on egg mortality and alevin survival were qualitatively evaluated for the Proposed Project and the FERC Staff Alternative based on changes in habitat quality, quantity, and distribution in relation to salmonid spawning habitat use characteristics.

C1.3.5 Channel Complexity

For purposes of this analysis, channel complexity refers to the diversity of geomorphologic features in a particular river reach. Such features include undercut stream banks, meanders, point bars, side channels, backwaters, etc. Regulation of the lower Feather River by the Oroville Facilities has changed both streamflow and sediment discharge. As discussed in the PDEA, more than 97 percent of the sediment is trapped in the reservoir, resulting in sediment starvation downstream. Attenuation of peak flows, decreased winter flows, increased summer flows, and changes to historic

flow frequencies have led to a general decrease in channel complexity downstream of Oroville Dam.

Because several fish species of management concern and different life stages of these species occur in the lower Feather River, a diversity of habitat types is required. Increases in channel complexity lead to an increase in habitat diversity and habitat quality. Increases in channel complexity are proposed in several different actions under the Proposed Project and the FERC Staff Alternative. These actions include gravel and LWD supplementation, as well as the restoration and creation of side channels to increase spawning and juvenile rearing habitat for steelhead and Chinook salmon. Effects of increasing channel complexity were evaluated qualitatively for the Proposed Project and the FERC Staff Alternative using a literature review and professional judgment.

C1.3.6 Water Quality Criteria for Aquatic Life

Water quality, as it affects aquatic life in the project area, was evaluated in the SP-F3.2, Task 1, 4, 5 Report, Final Report—Comparison of Fish Distribution to Fish Habitat in the Lower Feather River, which is summarized in Section G-AQUA1.4.1 of Appendix G-AQUA1 of the PDEA. DO concentrations were evaluated separately in the report but are included in the discussion of water quality effects on aquatic life in this appendix. The National Ambient Water Quality Criteria (NAWQC) is the applicable regulatory standard that is calculated by USEPA. These criteria represent half the value of toxic substance concentration that would cause 50 percent mortality in 5 percent of a briefly exposed population (USEPA 2002). In addition to NAWQC criteria, on May 18, 2000, USEPA published 40 Code of Federal Regulations (CFR) 131, Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California, generally known as the California Toxics Rule (CTR). Section 5.2.2 of the DEIR, Surface Water Quality, provides additional information on these water quality standards.

USEPA reports that the 30-day mean water column DO concentration required for the protection of adult life stages of coldwater fish species is 6.5 mg/L (USEPA 2002). USEPA also reports criteria for a single-day minimum to be 4.0 mg/L and 7-day mean minimum to be 3.0 mg/L; however, both of these criteria are less protective than the 30-day mean value provided by USEPA as a minimum DO concentration suitable for coldwater aquatic life (USEPA 2002).

Although no actions included in the No-Project Alternative, Proposed Project, or the FERC Staff Alternative directly target water quality in the project area as it pertains to aquatic species, construction activities related to mitigation and enhancement measures within and adjacent to the Oroville Facilities and the lower Feather River could result in short-term impacts to water quality. Water quality effects on aquatic life were evaluated qualitatively for the Proposed Project and the FERC Staff Alternative using a literature review and professional judgment. Water quality–related effects associated with instream construction activities are included in Section 5.2.2, Surface Water Quality, of the DEIR.

C1.3.7 Lake Oroville Warmwater Fishery Habitat Improvement

Both the Proposed Project and the FERC Staff Alternative include provisions for habitat improvements in Lake Oroville benefiting warmwater species. Although these provisions currently are not explicitly defined, they may include providing cover for juvenile black bass, spawning structures for catfish, and planting of native plants within the reservoir's fluctuation zone. Because potential Lake Oroville warmwater fishery habitat improvements are not explicitly defined at this time, they are not evaluated in this document.

C1.3.8 Construction and Recharge of Brood Ponds

Both the Proposed Project and the FERC Staff Alternative include provisions for establishing four waterfowl brood ponds in the Thermalito Afterbay. Although this action is targeted towards benefiting waterfowl, there will be an indirect benefit to warmwater fish species in the Thermalito Afterbay during the primary waterfowl brooding season (April 15 through July 31) by providing additional juvenile rearing habitat and reducing surface fluctuations in those portions of the Thermalito Afterbay where brood ponds are constructed. Because the locations and sizes of the brood ponds are not explicitly defined at this time, they will not be evaluated in this EIR.. However, because construction may result in minor temporary adverse effects, brood pond construction will likely require future analysis and environmental documentation.

C1.3.9 Spring-run Chinook Salmon and Steelhead Habitat Expansion Program

The Proposed Project and the FERC Staff Alternative include a habitat expansion program benefiting spring-run Chinook salmon and steelhead in the Sacramento River watershed. The specific goal of the program is to expand spawning, rearing, and adult holding habitat to accommodate an estimated net increase of 2,000 to 3,000 spawning Spring-run Chinook salmon within the Sacramento River watershed, but not necessarily within the FERC Project boundary. Although the focus of the program is on Spring-run Chinook salmon, this new habitat also would accommodate steelhead.

Actions undertaken to implement this program may include removal of migration barriers, deployment of LWD or gravel to enhance habitat, facilities for fish passage, and riparian zone improvements. Under the proposed habitat expansion program, the National Marine Fisheries Service (NMFS) will be required to approve any proposed measures prior to implementation. Because the specifics of any projects included as part of the program have not yet been developed, no evaluation of this program is included in this EIR.

C1.3.10 Potential Future Facility Modifications

Settlement Agreement (SA) Article 108 calls for future facilities modifications for improving water temperatures in the LFC and HFC to protect anadromous fishes over the term of the FERC license. Potential facility modifications include:

- Palermo Canal improvements;

- Hyatt Intake extension;
- River valve replacement;
- Canal around Thermalito Afterbay;
- Canal through Thermalito Afterbay;
- Thermalito Afterbay temperature curtain; and
- Alternate Thermalito Afterbay Outlet and channel.

Each of these potential modifications is described in Section 3.3, Description of Alternatives under Consideration, in the DEIR. A report entitled Reconnaissance Study of Potential Future Facility Modifications was completed per the terms of the SA, and submitted to stakeholders and FERC in January 2007. A more in-depth feasibility study of selected measures will be initiated once the new FERC license is issued. For purposes of this DEIR, since plans are only conceptual in nature at this early stage of study, each of the potential facility modifications is evaluated qualitatively for each fish species of management concern.

C1.4 LOWER FEATHER RIVER FISH SPECIES OF PRIMARY MANAGEMENT CONCERN

Changes in Oroville Facilities operations during the initial new license operating period could potentially alter seasonal drawdown rates in Lake Oroville and, thus, lower Feather River flows and water temperatures, which could change the relative availability of habitat for fish species present in the lower Feather River. The lower Feather River is used by a number of fish species of primary management concern, primarily as habitat during one or more of their life stages, but also as a migration corridor to upstream habitat in other river systems (e.g., the Yuba River). For these reasons, species-specific effect assessments were conducted for the following species of primary management concern:

- Fall-run Chinook salmon;
- Spring-run Chinook salmon;
- Steelhead/Rainbow trout;
- American shad;
- Black bass (largemouth bass, smallmouth bass, redeye bass, and spotted bass);
- Green sturgeon;
- Hardhead;

- River lamprey;
- Sacramento splittail; and
- Striped bass.

Implementation of the No-Project Alternative, the Proposed Project, or the FERC Staff Alternative could potentially alter lower Feather River water temperatures. Proposed changes in Feather River water temperature targets as outlined in the SA are oriented primarily to meet coldwater fisheries water temperature requirements for salmonids. As such, the salmonid fish species of management concern are the primary focus of the evaluations of the alternatives with regard to water temperature. Moreover, thermal requirements of Chinook salmon and steelhead are generally similar; and the NMFS Biological Opinion on interim operations of the Central Valley Project (CVP) and State Water Project (SWP) on federally listed threatened Central Valley spring-run Chinook salmon and Central Valley steelhead (Operations Criteria and Plan [OCAP] Biological Opinion [BO], NMFS 2002) has established quantitative water temperature criteria for the lower Feather River at the Feather River Fish Hatchery and for the LFC (monitored near Robinson Riffle [below river mile (RM) 62]) to protect spring-run Chinook salmon and steelhead. Therefore, the assessment methodologies for this DEIR focus primarily on the Chinook salmon and steelhead life stages. The species and life stage–specific flow and water temperature assessment methodologies for the Feather River effect analyses are discussed in the following sections.

C1.4.1 Spring- and Fall-run Chinook Salmon

Potential fisheries effects in the two reaches of the lower Feather River (LFC and HFC) were evaluated separately because of the differences in the characteristics of the flow regimes, and because each reach provides different values to the different life stages of anadromous salmonids (adult immigration and holding, adult spawning and embryo incubation, and juvenile rearing and downstream movement). Detailed descriptions of spring-run and fall-run Chinook salmon life stages and time periods are provided in Section 4.4.2, Fish Species Overview, of the DEIR.

C1.4.1.1 Flow-Related Effects

Because of the differences in the proposed changes in flow in the LFC and HFC for the Proposed Project and the FERC Staff Alternative, the reaches were evaluated separately for flow-related effects on aquatic resources. Chapter 3.0, Description of Existing Facilities and Operations, the Proposed Project, and Alternatives, provides additional information describing flows.

Site-specific flow-related effects on the spawning and egg incubation life stage of Chinook salmon and steelhead were determined by analyzing the results of Instream Flow Incremental Methodology (IFIM) studies (DWR 2004b). IFIM is a decision-support analytical tool designed to aid resources managers and stakeholders in determining the effects of different water management alternatives (Bovee et al. 1998), and currently is reported to be the most widely used and defensible technique worldwide for assessing

instream flow requirements for fisheries purposes. IFIM includes a wide variety of analytical tools of varying complexity to address multiple aspects of riverine dynamics and ecology, including sophisticated computer models such as PHABSIM. PHABSIM results were used to quantify changes in available habitat between alternatives.

In general, three main components are needed to obtain PHABSIM results. First, hydraulic data along with substrate and cover data characterizing the conditions in the river are required. The data are subsequently used to create hydraulic models (i.e., models that describe the movement and force of water), which evaluate and predict habitat variables (e.g., water depth, water velocity, substrate, and cover) at a selected study site throughout a range of flows. The hydraulic models, in turn, are combined with habitat suitability criteria (HSC) models that evaluate the relative incremental utility of habitat attributes to each life stage and species under consideration. HSC curves are derived from observations of hydraulic and physical habitat variables associated with each species and life stage being analyzed (Bovee et al. 1998). PHABSIM results are an index of the quantity and quality of the relative amount of fish habitat by species and life stage and typically are referred to as Weighted Usable Area (WUA), or sometimes relative suitability index (RSI) values.

The results of the PHABSIM model calculations, expressed as WUA, were used in the quantification of habitat changes associated with flow changes among alternatives in the PDEA and are used in this DEIR. Therefore, a brief explanation of WUA is necessary. WUA is a relative indicator of suitability and, as such, is an index representing available habitat area. WUA does not represent actual physical area available for use by the species. Because WUA is an index of habitat suitability, it cannot be directly related to the number of individuals that could occupy the lower Feather River under different flow regimes. WUA does, however, indicate the differences in relative habitat suitability among alternatives. Figures C1.4-1 and C1.4-2 show the Chinook salmon WUA index curves for the LFC and HFC, respectively.

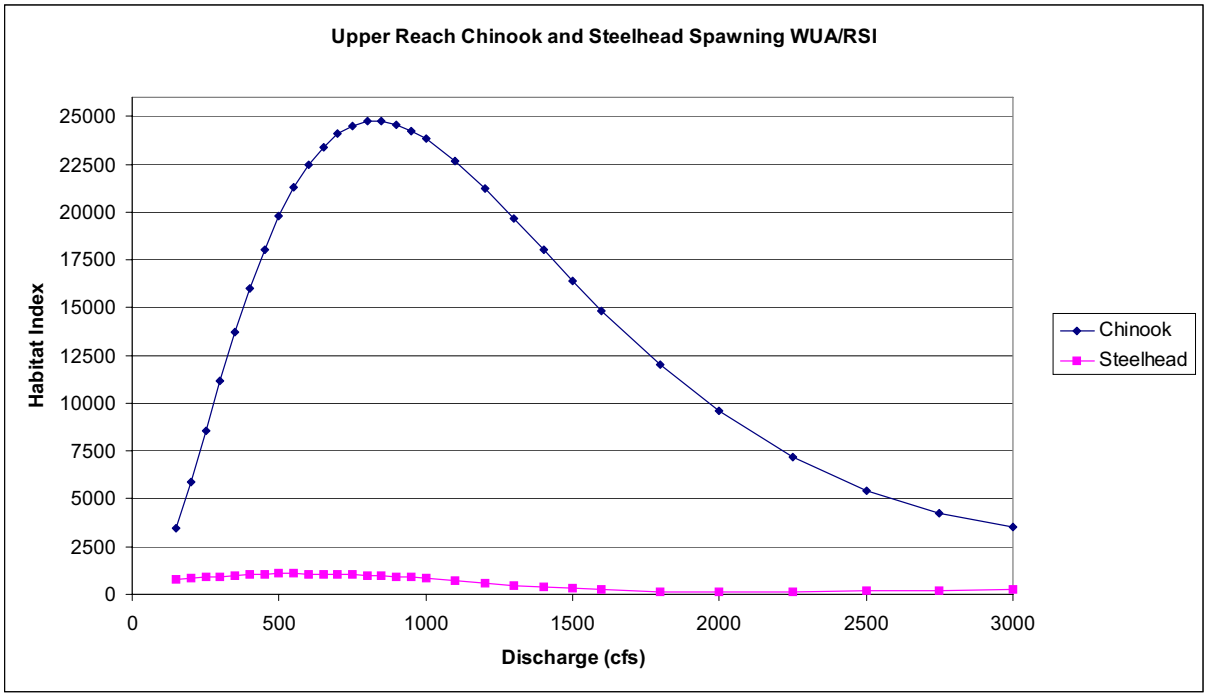

Figure C1.4-1. WUA/relative suitability index for Chinook salmon and steelhead spawning in the LFC of the lower Feather River.

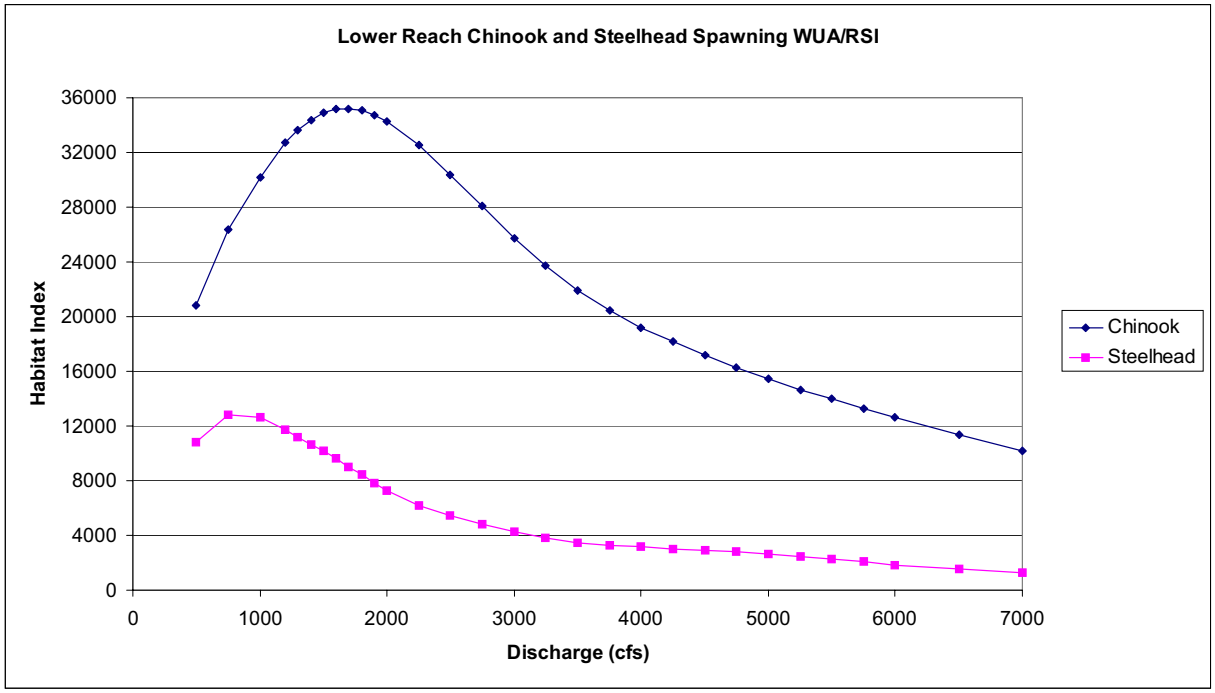

Figure C1.4-2. WUA/relative suitability index for Chinook salmon and steelhead spawning in the HFC of the lower Feather River.

Qualitative analysis of flow-related effects on fisheries and aquatic resources in the LFC and the HFC was completed. To assess flow-related effects on spring- and fall-run Chinook salmon spawning life stages in the lower Feather River, PHABSIM results at

flows associated with each alternative were compared to those associated with the basis of comparison.

Detailed descriptions of the methodology associated with the IFIM studies conducted on the lower Feather River, including descriptions of the PHABSIM model and HSC curves used for calculation of Chinook salmon spawning WUA, are available in the Final Report for SP-F16 (see Section G-AQUA1.10 of Appendix G-AQUA1 of the PDEA).

Analysis of available spawning area using PHABSIM model results does not provide information regarding the potential for stage reductions during the embryo incubation portion of the adult spawning and embryo incubation life stage. However, because flows under the alternatives would remain constant in the LFC, and fluctuate within the minimum flow and maximum flow agreed upon by DFG and DWR in the HFC, further analysis of the effects of flow fluctuations in the LFC or HFC on embryo incubation is unnecessary.

Flow changes and flow fluctuations associated with the alternatives also were evaluated qualitatively for potential effects on Chinook salmon adult immigration (see Section G-AQUA1.8.1 of Appendix G-AQUA1 of the PDEA), and Chinook salmon juvenile rearing and downstream movement (see Section G-AQUA1.8.4 of Appendix G-AQUA1 of the PDEA). The analysis focused on determining the relative changes to fish habitat with respect to water depth, water velocity, and the amount of inundated habitat area compared to the known fish distribution and relative abundance.

C1.4.1.2 Water Temperature–Related Effects

Increased flows in the LFC during the initial new license operating period associated with implementation of the Proposed Project or FERC Staff Alternative would result in lower water temperatures throughout the LFC during all months of the year. Additionally, because net releases from the Oroville Facilities do not change with implementation of the Proposed Project or FERC Staff Alternative, the LFC would be contributing a higher proportion of the total flow in the lower Feather River downstream of the Thermalito Afterbay Outlet. Therefore, slightly lower water temperatures can be expected to propagate farther downstream than under existing conditions or the No-Project Alternative. The potential effects of lower water temperatures in the lower Feather River on Chinook salmon are described by life stage in the sections below. The effects analyses utilize information obtained from the detailed quantitative analysis completed for the PDEA and include a qualitative extension of that analysis to include the new colder water temperature requirements incorporated in the Proposed Project and the FERC Staff Alternative.

Adult Immigration and Holding (Spring-run, March through August; Fall-run, September through November)

After spending 3 to 4 years in the ocean, Chinook salmon begin their return to fresh water to spawn (Moyle 2002). Chinook salmon show considerable temporal variation in the timing of their spawning migrations; this life history variation is evident in the

classification of Chinook salmon by run type (i.e., fall-run, late fall–run, winter-run, and spring-run). In the Central Valley, adult spring-run Chinook salmon generally migrate upstream from March to September, and individuals exhibiting fall-run life history characteristics migrate upstream from June to December (Fisher 1994). The holding period extends from the time that adult Chinook salmon enter their natal streams until the onset of spawning site selection. On the Feather River, the entire adult immigration and holding period lasts from March through October for spring-run Chinook salmon and from mid-July through December for fall-run Chinook salmon (Moyle 2002; DWR 2004c; Eaves 1982; Sommer et al. 2001).

Water temperature is an important factor in determining suitable habitat for adult Chinook salmon immigration and holding. To sufficiently protect pre-spawning fish, water temperatures that provide high adult survival and high egg viability must be available throughout the entire pre-spawning freshwater period. Although studies examining the effects of thermal stress on immigrating Chinook salmon are few, it has been demonstrated that thermal stress during the upstream spawning migration of sockeye salmon negatively affected the secretion of hormones controlling sexual maturation, causing numerous reproductive difficulties (Macdonald et al. in McCullough et al. 2001).

Potential water temperature effects that could occur during the Chinook salmon adult immigration and holding life stage are evaluated qualitatively utilizing information obtained from the analysis conducted for the PDEA, new temperature requirements associated with implementation of the Proposed Project and FERC Staff Alternative, and review of available literature.

Adult Spawning and Embryo Incubation (September through mid-February)

In the Sacramento River basin, spring-run Chinook salmon spawn from late August to October and individuals exhibiting fall-run life history characteristics spawn from late September to December (Fisher 1994). In the Feather River, adult spawning and embryo incubation occurs from September through mid-February. The duration of embryo incubation is dependent on water temperature and can be variable (NMFS 2002). In Butte and Big Chico Creeks, emergence of spring-run Chinook salmon generally occurs from November through January (NMFS 2002). In Mill and Deer Creeks, colder water temperatures delay emergence to January through March (DFG 1998a). In the lower American River, fall-run Chinook salmon emergence generally begins in March (SWRI 2004).

The adult spawning and embryo (i.e., eggs and alevins) incubation life stage includes redd construction and egg deposition, and embryo incubation through emergence. Potential effects on the adult spawning and embryo incubation life stages are evaluated together because it is difficult to separate the effects of water temperature between life stages that are closely linked temporally. Studies elucidating how water temperature affects embryonic survival and development based on varying water temperature treatments on holding adults often report results similar to those of water temperature

experiments conducted on fertilized eggs (Marine 1992; McCullough 1999; Seymour 1956; SWRI 2004).

Potential water temperature effects that could occur during the Chinook salmon adult spawning and embryo incubation life stage are evaluated qualitatively utilizing information obtained from the analysis conducted for the PDEA, new temperature requirements associated with implementation of the Proposed Project and FERC Staff Alternative, and review of available literature.

Juvenile Rearing and Downstream Movement (Spring-run, November through June; Fall-run, February through June)

The juvenile life stage is composed of fry, fingerlings, and smolts; the parr stage is included in the fingerling category. Chinook salmon are fry from the time that the juvenile leaves the gravel of the spawning redd to swim up into the water column as a free-swimming fish until skeletal development is complete, at which point it reaches the fingerling stage (Bovee et al. 1998). Chinook salmon fry make the transition to the fingerling stage at approximately 45 millimeters (mm) to 60 mm (DWR 2003; NMFS 1997; NMFS 2003). Fingerling Chinook salmon become smolts when physiological changes occur that allow juveniles to survive the transition from fresh water to salt water during seaward migration. In addition to physiological changes, morphological changes also take place during smoltification (Hoar 1988). Salmonid smolts can be distinguished from pre-smolts by their silvery appearance and relatively slim, streamlined bodies (Hoar 1988).

In the Sacramento River basin, the length of time that juvenile Chinook salmon rear in natal streams varies according to run type. Juveniles displaying spring-run (stream type) life history characteristics emerge from the spawning substrate from November to March and rear for 3 to 15 months (Fisher 1994), while juveniles displaying fall-run (ocean type) life history characteristics emerge from the spawning substrate from December to March and rear for 1 to 7 months (Fisher 1994). Recent studies from the American and Feather Rivers indicate that most juvenile Chinook salmon move downstream as fry shortly after they emerge from the spawning gravel (DWR 2002; Snider and Titus 2000). In the Sacramento River, juvenile Chinook salmon move downstream during all months, as both fry and smolts (Moyle 2002).

Water temperature is a major limiting factor for juvenile Chinook salmon because it strongly affects survival and growth. Water temperatures that are too high can be lethal or cause sublethal effects such as reduced appetite and growth, increased incidence of disease, increased metabolic costs, and decreased ability to avoid predators. Available scientific literature indicates that a similar range of water temperatures provides positive growth and high survival for Chinook salmon fry, fingerlings, and smolts. Chinook salmon juveniles reportedly rear and move downstream year-round as fry, fingerlings, or smolts, and available scientific literature indicates that a range of water temperatures that is important for fry also is important for fingerlings and smolts. Therefore, evaluation of all of the phases of the juvenile life stage together is appropriate.

Potential water temperature effects that could occur in the lower Feather River during the Chinook salmon juvenile rearing and downstream movement life stage are evaluated qualitatively utilizing information obtained from the analysis conducted for the PDEA, new temperature requirements associated with implementation of the Proposed Project and FERC Staff Alternative, and review of available literature.

C1.4.1.3 Predation-Related Effects

The high concentration of spawning salmonids in the reach of the Feather River between the Fish Barrier Dam and the Thermalito Afterbay Outlet results in a high concentration of juvenile salmonids in the reach (Seesholtz et al. 2003). Additionally, Seesholtz et al. (2003) reported that most outmigration of juvenile Chinook salmon occurs between January and March. Based on historic accounts of juvenile salmonid emigration, the current peak in the emigration period is somewhat earlier than under pre-dam conditions (Painter et al. 1977; Warner 1955). Seesholtz et al. (2003) speculate that the early emigration may be caused by competition for resources resulting from unnaturally high populations of juvenile salmonids.

Water temperature and flow changes during the initial new license operating period included as components of the Proposed Project and FERC Staff Alternative to benefit anadromous salmonids also would affect predator fish species distribution, relative abundance, feeding behavior, and consumption rates. Water temperature changes, flow changes, and actions anticipated to improve the quantity, quality, and distribution of rearing habitat for juvenile salmonids (i.e., LWD placement and side-channel habitat improvement and creation) also affect rearing behavior and duration, growth rates, predator avoidance cover availability and use, and emigration timing and behavior of juvenile Chinook salmon. The alternatives were evaluated qualitatively to determine the nature and general magnitude of potential predation-related effects on Chinook salmon juvenile rearing and downstream movement. Section G-AQUA1.11.3 of Appendix G-AQUA1 of the PDEA contains a summary report and additional information on project-related effects on salmonid predation.

C1.4.1.4 Fisheries Management–Related Effects

There would be no changes in fish stocking or reservoir coldwater fisheries management programs under the alternatives; therefore, these existing programs are not included in the evaluation of alternatives. Adaptive hatchery management practices are included in the Proposed Project and the FERC Staff Alternative, and include proposals for experimental releases of different sized juvenile fish at different times and locations, predator avoidance and cover utilization conditioning, changes to brood stock selection, disease management and screening, and other hatchery management changes. These changes in hatchery management were evaluated qualitatively for their potential effects on predation, juvenile rearing and emigration survival rates, adult immigration straying rates, genetic introgression, and the incidences of fish diseases. Section G-AQUA1.5.1 of Appendix G-AQUA1 of the PDEA contains additional information related to salmonid management–related effects.

Fishing Regulations

Increases in recreation-related access, including increases in visitation and fisheries-related use of recreational resources, are anticipated under all of the alternatives. Chapter 3.0 of the DEIR, Description of Existing Facilities and Operations, the Proposed Project, and Alternatives, contains descriptions of recreation-related changes included in each of the alternatives, and Section 5.7, Recreational Resources, contains evaluations of recreation-related effects. Effects of increased recreational fishing and poaching on angling-related mortality and the contribution to adult pre-spawning mortality rates were evaluated qualitatively to determine the effects on fisheries resources, and specifically, on Chinook salmon.

Fish segregation weirs for Chinook salmon are included in the Proposed Project and the FERC Staff Alternative, and are described in detail in Chapter 3.0, Description of Existing Facilities and Operations, the Proposed Project, and Alternatives. These actions would result in changes in fishing regulations. Therefore, placement of weirs was evaluated qualitatively to determine the effects on fishing take limits and poaching. Effects on recreational activities resulting from changes in fishing regulations associated with these actions are included in Section 5.7, Recreational Resources.

C1.4.1.5 Future Facility Modification Effects

Potential future facility modifications to meet water temperature objectives in the LFC and HFC are listed in Section C1.3.10, above. Potential effects of any of the future facility modifications that are currently under study on Chinook salmon are evaluated qualitatively, relative to the potential water temperature effects of the Proposed Project and FERC Staff Alternative on Chinook salmon during the initial new license operating period.

C1.4.2 Steelhead/Rainbow Trout

Similar to the Chinook salmon analyses, the steelhead effects analysis is based upon individual life stages, because each life stage has specific flow and water temperature requirements. The steelhead life stages included in this analysis are:

- Adult immigration and holding (September through April 15);
- Adult spawning and embryo incubation (December through May);
- Fry and fingerling rearing and downstream movement (year-round); and
- Smolt emigration (January through June).

More detailed descriptions of steelhead life stages and periods are provided in Section 4.4.2, Fish Species Overview.

C1.4.2.1 Flow-Related Effects

Qualitative analyses of the alternatives were conducted for steelhead adult spawning and embryo incubation using the available WUA-discharge relationship of flow to steelhead spawning habitat availability for the LFC and HFC in the lower Feather River. Section C1.4.1 of this appendix provides additional detail describing the PHABSIM analysis conducted; Figures C1.4-1 and C1.4-2 show the steelhead WUA index curves for the LFC and HFC, respectively.

Analysis of available spawning area using PHABSIM model results does not provide information regarding the potential for stage reductions during the embryo incubation portion of the adult spawning and embryo incubation life stage. Flows under the alternatives would remain constant in the LFC, however, and would fluctuate within the minimum flow and maximum flow agreed upon by DFG and DWR in the HFC; therefore, further analysis of flow fluctuations in the LFC or HFC is unnecessary.

Flow changes and flow fluctuations associated with the alternatives were evaluated qualitatively for potential effects on steelhead/rainbow trout adult immigration and holding, steelhead/rainbow trout fry and fingerling rearing and downstream movement, and steelhead smolt emigration. The objective of this analysis was to determine the relative changes to available habitat with respect to water depth, water velocity, and the amount of inundated habitat area compared to the known fish distribution and relative abundance.

C1.4.2.2 Water Temperature–Related Effects

Increased flows in the LFC associated with implementation of the Proposed Project or FERC Staff Alternative would result in lower water temperatures throughout the LFC during all months of the year. Additionally, because net releases from the Oroville Facilities do not change with implementation of the Proposed Project or FERC Staff Alternative, the LFC would be contributing a higher proportion of the total flow in the lower Feather River downstream of the Thermalito Afterbay Outlet. Therefore, slightly lower water temperatures can be expected to propagate further downstream than under Existing Conditions or the No-Project Alternative. The potential effects of lower water temperatures in the lower Feather River on steelhead are described by life stage in the sections below. The effects analysis will utilize information obtained from the detailed quantitative analysis completed for the PDEA and include a qualitative extension of that analysis to include the new colder water temperature requirements incorporated in the Proposed Project and the FERC Staff Alternative.

Adult Immigration and Holding (September through April 15)

Most Central Valley steelhead spend 1 to 2 years in the ocean before entering fresh water beginning during August, with a peak in late September to October. Steelhead then hold in fresh water until spawning. Movement of adult steelhead from freshwater holding areas to spawning grounds generally can occur any time from December to March, with peak activities occurring in January and February (Moyle 2002). In the

Feather River, the adult immigration and holding time period lasts from September through mid-April, with peak migration extending from October through November (Moyle 2002; Cavallo, pers. comm. 2004; McEwan 2001; S. P. Cramer & Associates 1995).

The adult immigration and adult holding life stages are evaluated together in this subsection because it is difficult to determine the thermal regime to which steelhead have been exposed before spawning. Additionally, to be sufficiently protective of pre-spawning fish, water temperatures that provide high adult survival and high in-vivo egg survival must be available throughout the entire pre-spawning freshwater period. Although there is a paucity of studies examining the effects of thermal stress on immigrating steelhead, it has been demonstrated that thermal stress during the upstream spawning migration of sockeye salmon negatively affected the secretion of hormones controlling sexual maturation, causing numerous reproductive impairments (Macdonald et al. in McCullough et al. 2001).

Potential water temperature effects that could occur during the steelhead adult immigration and holding life stage are evaluated qualitatively utilizing information obtained from the analysis conducted for the PDEA, new temperature requirements associated with implementation of the Proposed Project and FERC Staff Alternative, and review of available literature.

Adult Spawning and Embryo Incubation (December through May)

Steelhead spawning includes the time period from redd construction until spawning is completed with the deposition and fertilization of eggs. The embryo incubation period extends from egg deposition through alevin emergence. In the Central Valley, steelhead spawning reportedly occurs from October through June (McEwan 2001) and embryo (i.e., eggs and alevins) incubation generally lasts 2 to 3 months after deposition (Moyle 2002; McEwan 2001; Myrick and Cech 2001). In the Feather River, steelhead spawning and embryo incubation extends from December through May, with peak spawning occurring in January and February (Moyle 2002; Busby et al. 1996; Cavallo, pers. comm. 2004; Interagency Ecological Program Steelhead Project Work Team Website 1998). As with Chinook salmon, the steelhead embryo life stage is the most sensitive to water temperature.

Potential water temperature effects that could occur during the steelhead adult spawning and embryo incubation life stage are evaluated qualitatively utilizing information obtained from the analysis conducted for the PDEA, new temperature requirements associated with implementation of the Proposed Project and FERC Staff Alternative, and review of available literature.

Fry and Fingerling Rearing and Downstream Movement (Year-round)

The juvenile life stage is composed of fry and fingerlings. Steelhead are fry from the time that the juvenile leaves the gravel of the spawning redd to swim up into the water column as a free-swimming fish until skeletal development is complete, at which point it

reaches the fingerling stage (Bovee et al. 1998). Steelhead fry make the transition to the fingerling stage at approximately 45 mm to 60 mm (Moyle 2002; Bovee et al. 1998; DWR 2003; NMFS 1997). After Central Valley steelhead emerge from the gravel, juveniles remain in fresh water for 1 to 3 years before smolting and migrating to salt water (Myrick and Cech 2001).

Potential water temperature effects that could occur during the steelhead fry and fingerling rearing and downstream movement life stage are evaluated qualitatively utilizing information obtained from the analysis conducted for the PDEA, new temperature requirements associated with implementation of the Proposed Project and FERC Staff Alternative, and review of available literature.

Smolt Emigration (January through June)

Fingerling steelhead become smolts when physiological changes occur that allow the juvenile to survive the transition from fresh water to salt water during seaward migration. In addition to physiological changes, morphological changes also take place during smoltification (Hoar 1988). Salmonid smolts can be distinguished from pre-smolts by their silvery appearance and relatively slim, streamlined bodies (Hoar 1988). Steelhead smolts migrate out to sea between 1 and 3 years of age, between 10 and 25 centimeters (cm) fork length (FL) (Moyle 2002). In the Feather River, steelhead smolt emigration occurs from January through June (Cavallo, pers. comm. 2004; McEwan 2001; Newcomb and Coon 2001; Snider and Titus 2000; USFWS 1995).

Potential water temperature effects that could occur during the steelhead smolt emigration life stage are evaluated qualitatively utilizing information obtained from the analysis conducted for the PDEA, new temperature requirements associated with implementation of the Proposed Project and FERC Staff Alternative, and literature review.

C1.4.2.3 Predation-Related Effects

The high concentration of spawning salmonids in the LFC results in a high concentration of juvenile salmonids (Seesholtz et al. 2003). In addition, water temperature and flow changes included as components of the alternatives to benefit anadromous salmonids also would affect predator fish species distribution, relative abundance, feeding behavior, and consumption rates. Water temperature changes, flow changes, and actions anticipated to improve the quantity, quality, and distribution of rearing habitat for juvenile salmonids (LWD placement and side-channel habitat improvement and creation) also affect steelhead fry and fingerling rearing behavior and distribution, growth rates, predator avoidance cover availability and use, and smolt emigration timing and behavior. The alternatives were evaluated qualitatively to determine the nature and general magnitude of potential predation-related effects on rearing and downstream movement by steelhead fry and fingerlings. Section G-AQUA1.11.3 of Appendix G-AQUA1 of the PDEA contains additional information related to salmonid predation.

C1.4.2.4 Fisheries Management–Related Effects

There would be no changes in fish stocking or reservoir fisheries habitat enhancement programs under the alternatives; therefore, these programs are not included in the evaluation of alternatives. Adaptive hatchery management practices are included in the Proposed Project and the FERC Staff Alternative and include proposals for experimental releases of different sized juvenile fish at different times and locations, predator avoidance and cover utilization conditioning, changes to brood stock selection, disease management and screening, and other hatchery management changes. These changes in hatchery management were evaluated qualitatively for their potential effects on predation, juvenile rearing and emigration survival rates, adult immigration straying rates, genetic introgression, and the incidences of fish diseases. Section G-AQUA1.5.1 of Appendix G-AQUA1 of the PDEA contains additional information related to the effects of salmonid management on Feather River fishes.

Fishing Regulations

Increases in recreation-related access, including increases in visitation and fisheries-related use of recreational resources, are anticipated under all of the alternatives. Chapter 3.0, Description of the Existing Facilities and Operations, the Proposed Project, and Alternatives, contains descriptions of recreation-related changes included in each of the alternatives; Section 5.7, Recreational Resources, contains evaluations of recreation-related effects. Effects of increased recreational fishing and poaching on angling-related mortality and the contribution to adult pre-spawning mortality rates were evaluated qualitatively to determine effects on fisheries resources, and specifically, on steelhead.

Fish segregation weirs for Chinook salmon are included in the Proposed Project and the FERC Staff Alternative, and are described in detail in Chapter 3.0, Description of Existing Facilities and Operations, the Proposed Project, and Alternatives. These actions would result in changes in fishing regulations. Therefore, placement of weirs was evaluated qualitatively to determine their effects on fishing take limits and poaching. Effects on recreational activities resulting from changes in fishing regulations associated with these actions are described in Section 5.7, Recreational Resources.

C1.4.2.5 Future Facility Modification Effects

Potential future facility modifications to meet new SA water temperature objectives in the LFC and HFC are listed in Section C1.3.10, above. Potential effects of each of the potential facility modifications currently being studied on steelhead are evaluated qualitatively, relative to the potential water temperature effects of the Proposed Project and FERC Staff Alternative on steelhead during the initial new license operating period.

C1.4.3 American Shad

C1.4.3.1 Flow-Related Effects

Flow changes and flow fluctuations associated with the alternatives were evaluated qualitatively to determine the potential effects on American shad adult immigration and spawning based on the relative changes to fish habitat with regard to water depth, water velocity, and fish passage impediments compared to the known fish distribution and relative abundance. The American shad spawning migration period in the Feather River occurs from April through June. Sections G-AQUA1.4.2 and G-AQUA1.4.3 of Appendix G-AQUA1 of the PDEA provide additional information on American shad immigration and potential flow-related passage impediments in the lower Feather River.

C1.4.3.2 Water Temperature–Related Effects

Water temperature–related effects were evaluated qualitatively using the process described in Section C1.2.3 of this appendix. The water temperature range reported to be suitable for American shad adult immigration and spawning is 46°F to 79°F, and this life stage occurs from April through June in the lower Feather River (Moyle 2002; DFG 1986; Leggett and Whitney 1972; Painter et al. 1979; USFWS 1995; Walburg and Nichols 1967; Wang 1986).

The water temperature analysis for American shad habitat qualitatively compares the relative decreases in lower Feather River water temperatures expected with implementation of the Proposed Project or FERC Staff Alternative with current conditions and the No-Project Alternative during the life stage period evaluated. Section 4.4.2 of the DEIR, Fish Species Overview, and Section G-AQUA1.4.2 of Appendix G-AQUA1 of the PDEA provide additional information on American shad life history, and habitat and water temperature requirements.

C1.4.3.3 Future Facility Modification Effects

Potential future facility modifications to meet new SA water temperature objectives in the LFC and HFC are listed in Section C1.3.10, above. The effects that could occur as a result of potential future facility modifications on American shad also are evaluated qualitatively, relative to the potential water temperature effects of the Proposed Project and FERC Staff Alternative on American shad during the initial new license operating period.

C1.4.4 Black Bass

C1.4.4.1 Water Temperature–Related Effects

The water temperature analysis for black bass habitat qualitatively compares the relative decreases in lower Feather River water temperatures expected with implementation of the Proposed Project or FERC Staff Alternative with current conditions and the No-Project Alternative during the life stage period evaluated. The black bass analysis includes several fish species with similar water temperature

requirements, including largemouth bass, smallmouth bass, redeye bass, and spotted bass. Section 4.4.2, Fish Species Overview, of the DEIR and Sections G-AQUA1.4.2, G-AQUA1.3.2, and G-AQUA1.3.4 of Appendix G-AQUA1 of the PDEA contain additional information on black bass life history, and habitat and water temperature requirements.

C1.4.4.2 Future Facility Modification Effects

Potential future facility modifications that are being studied to determine their effectiveness in meeting new SA water temperature objectives in the LFC and HFC are listed in Section C1.3.10, above. Potential effects of future facility modifications on black bass are evaluated qualitatively, relative to the potential water temperature effects of the Proposed Project and FERC Staff Alternative on black bass during the initial new license operating period.

C1.4.5 Green Sturgeon

The analysis of potential effects on green sturgeon is based upon individual life stages because each life stage has specific flow and water temperature requirements. The green sturgeon life stages included in this analysis are:

- Adult immigration and holding (February through July);
- Adult spawning and embryo incubation (March through July);
- Juvenile rearing (year-round); and
- Juvenile emigration (May through September).

More detailed descriptions of green sturgeon life stage water temperature requirements and periods are provided in Section 4.4.2, Fish Species Overview, of the DEIR and Section G-AQUA1.4.2 of Appendix G-AQUA1 of the PDEA.

C1.4.5.1 Water Temperature–Related Effects

Water temperature–related effects were evaluated using the process described in Section C1.2.3 of this appendix. The water temperature analysis for green sturgeon is based on the expected water temperature decreases associated with implementation of the Proposed Project or the FERC Staff Alternative.

Adult Immigration and Holding (February through July)

Water temperatures ranging from 44°F to 61°F are reported as “preferred,” “optimal,” “suitable,” or “observed” for green sturgeon adult immigration and holding (Beamesderfer and Webb 2002; DFG Leetet al. 2001; DFG Website 2002; Emmett et al. 1991; Environmental Protection Information Center et al. 2001d; Erickson et al. 2002; USFWS 1995). The range of reported water temperatures was used as an evaluation

guideline to qualitatively assess the potential effects of each alternative on green sturgeon adult immigration and holding, relative to the basis of comparison.

Adult Spawning and Embryo Incubation (March through July)

Water temperatures ranging from 46°F to 68°F are reported as "preferred," "optimal," "suitable," or "observed" for green sturgeon adult spawning and embryo incubation (Artyukhin and Andronov 1990; Beamesderfer and Webb 2002; DFG Leetet al. 2001; DFG Website 2002; Cech et al. 2000; Environmental Protection Information Center et al. 2001c; Erickson et al. 2002; Moyle et al. 1995; USFWS 1995). The range of reported water temperatures was used as an evaluation guideline to qualitatively assess the potential effects of each alternative on green sturgeon adult spawning and embryo incubation, relative to the basis of comparison.

Juvenile Rearing (Year-round)

Water temperatures ranging from 50°F to 66°F are reported as "preferred," "optimal," "suitable," or "observed" for green sturgeon juvenile rearing (Moyle 2002; Cech et al. 2000; Conservation Management Institute Website 1996; Environmental Protection Information Center et al. 2001b; Farr et al. 2001). The range of reported water temperatures was used as an evaluation guideline to qualitatively assess the potential effects of each alternative on green sturgeon juvenile rearing, relative to the basis of comparison.

Juvenile Emigration (May through September)

Water temperatures ranging from 50°F to 66°F are reported as "preferred," "optimal," "suitable," or "observed" for green sturgeon juvenile emigration (Moyle 2002; Adams et al. 2002; Beamesderfer and Webb 2002; Cech et al. 2000; Conservation Management Institute Website 1996; Environmental Protection Information Center et al. 2001a; Erickson et al. 2002; Farr et al. 2001). The range of reported water temperatures was used as an evaluation guideline to qualitatively assess the potential effects of each alternative on green sturgeon juvenile emigration, relative to the basis of comparison.

C1.4.5.2 Future Facility Modification Effects

Potential future facility modifications being studied to meet new water temperature objectives in the LFC and HFC are listed in Section C1.3.10, above. Potential effects of future facility modifications on green sturgeon are evaluated qualitatively, relative to the potential water temperature effects of the Proposed Project and FERC Staff Alternative on green sturgeon during the initial new license operating period.

C1.4.6 Hardhead

C1.4.6.1 Water Temperature–Related Effects

Water temperature–related effects were evaluated using the process described in Section C1.2.3 of this appendix. The water temperature range reported as suitable for

hardhead adult spawning is 55°F to 75°F, and this life stage occurs from April through August in the lower Feather River (Moyle 2002; Cech Jr. et al. 1990; Wang 1986). The water temperature analysis for hardhead is based on the expected water temperature decreases associated with implementation of the Proposed Project or the FERC Staff Alternative.

C1.4.6.2 Future Facility Modification Effects

Potential future facility modifications being studied to meet new SA water temperature objectives in the LFC and HFC are listed in Section C1.3.10, above. Potential effects of future facility modifications on Hardhead are evaluated qualitatively, relative to the potential water temperature effects of the Proposed Project and FERC Staff Alternative on hardhead during the initial new license operating period.

C1.4.7 River Lamprey

C1.4.7.1 Water Temperature–Related Effects

Water temperature–related effects were evaluated using the process described in Section C1.2.3 of this appendix. The water temperature range reported as suitable for river lamprey adult spawning and embryo incubation is 43°F to 72°F, and this life stage reportedly occurs from April through June in the lower Feather River (Moyle 2002; Beamish 1980; Kostow 2002; Meeuwig et al. 2003; Meeuwig et al. 2002; Stone et al. 2001; Wang 1986). Because little literature was available regarding the life stage timing and water temperature tolerance range of river lamprey, literature describing Pacific lamprey (*Lampetra tridentata)* was used because several of the species life history and behavioral characteristics reportedly are similar. The water temperature analysis for river lamprey is based on the expected water temperature decreases associated with implementation of the Proposed Project or the FERC Staff Alternative.

C1.4.1.5 Future Facility Modification Effects

Potential future facility modifications being studied to meet new SA water temperature objectives in the LFC and HFC are listed in Section C1.3.10 above. Potential effects of future facility modifications on river lamprey are evaluated qualitatively, relative to potential water temperature effects of the Proposed Project and FERC Staff Alternative on river lamprey during the initial new license operating period.

C1.4.8 Sacramento Splittail

C1.4.8.1 Water Temperature–Related Effects

Water temperature–related effects were evaluated using the process described in Section C1.2.3 of this appendix. The water temperature range reported as suitable Sacramento splittail adult spawning, egg incubation, and initial rearing is 45°F to 75°F, and this life stage occurs from February through May in the lower Feather River. Young (1996) investigated thermal tolerances for juvenile splittail and reported a tolerance range of 7°C to 32°C (44.6°F to 89.6°F). Caywood (1974) reported splittail spawning in

water temperatures from 9°C to 20°C (48.2°F to 68.0°F). Sommer et al. (2002) reported splittail spawning in water temperatures from 11°C to 24°C (51.8°F to 75.2°F). The water temperature analysis for splittail habitat qualitatively evaluates potential effects of lower water temperatures anticipated with implementation of the Proposed Project or FERC Staff Alternative during the life stage period evaluated.

C1.4.8.2 Future Facility Modification Effects

Potential future facility modifications being studied to meet new SA water temperature objectives in the LFC and HFC are listed in Section C1.3.10 above. Potential effects of the facility modifications on Sacramento splittail are evaluated qualitatively, relative to the potential water temperature effects of the Proposed Project and FERC Staff Alternative on Sacramento splittail during the initial new license operating period.

C1.4.9 Striped Bass

C1.4.9.1 Flow-Related Effects

Flow changes and flow fluctuations associated with the alternatives were evaluated qualitatively to assess potential effects on striped bass adult spawning habitat with regard to water depth, water velocity, and fish passage impediments compared to the known fish distribution and relative abundance. The striped bass adult spawning period in the lower Feather River occurs from April through June. Section 4.4.2 of the DEIR, Fish Species Overview, and Section G-AQUA1.4.2 of Appendix G-AQUA1 of the PDEA provide additional information on striped bass adult spawning, egg incubation, initial rearing, and life history habitat requirements.

C1.4.9.2 Water Temperature–Related Effects

Water temperature–related effects were evaluated using the process described in Section C1.2.3 of this appendix. The water temperature range reported as suitable for striped bass adult spawning is 59°F to 68°F, and this life stage occurs from April through June in the lower Feather River (Moyle 2002; Bell 1991; Hassler 1988; Hill et al. 1989). The water temperature analysis for striped bass adult spawning is qualitative and based on anticipated cooler water temperatures associated with implementation of the Proposed Project or the FERC Staff Alternative during the life stage period evaluated.

C1.4.9.3 Future Facility Modification Effects

Potential future facility modifications being studied to meet new SA water temperature objectives in the LFC and HFC are listed in Section C1.3.10, above. Potential effects of future facility modifications on striped bass are evaluated qualitatively, relative to the potential water temperature effects of the Proposed Project and FERC Staff Alternative on striped bass during the initial new license operating period.

C1.5 DETERMINATION OF EFFECTS

The evaluation process for determining potential effects resulting from implementation of the alternatives was based on the integration of the effects identified for each species and life stage selected for evaluation. The results of the qualitative evaluation of potential effects on each life stage were aggregated and evaluated to determine the overall effect of an alternative on a species. Positive and negative effects on the species and life stages were evaluated using professional experience and judgment to weigh the relative magnitude, biological effects, and importance of a life stage in contributing to the overall success and condition of the species. The overall effect of an alternative on a species was the basis for the evaluation of the alternatives. Section 5.4.4 of the DEIR provides a summary of the overall effects of the alternatives on each species of primary management concern.

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APPENDIX C2
IMPACTS OF THE NO-PROJECT ALTERNATIVE RELATIVE TO EXISTING CONDITIONS

This appendix provides a qualitative analysis of potential effects on aquatic resources under the No-Project Alternative, relative to Existing Conditions. Although the following topical outline is consistent for analysis of all alternatives, effects in several issue areas are not anticipated to occur under the No-Project Alternative. From an aquatic resources perspective, there are only a few differences between Existing Conditions and the No-Project Alternative. (See Section 3.3, Description of Alternatives Under Consideration, for a detailed description of the No-Project Alternative, and Section 4.4, Aquatic Resources, for a detailed description of Existing Conditions.)

Qualitative analyses of potential effects on aquatic resources were performed using the methodology described in Appendix C1, Aquatic Resources Methodology. These analyses evaluated reservoir surface elevations, flow releases from the Oroville Facilities, blockage of gravel and large woody debris (LWD) recruitment in the lower Feather River, water quality criteria for aquatic life, predation, straying, Chinook salmon genetic introgression and redd superimposition, water temperature in the lower Feather River, and availability of fish species habitat.

Although future operations of the Oroville Facilities are expected to differ from Existing Conditions, some effects of the No-Project Alternative on aquatic resources—such as potential effects on predation and salmonid adult straying—are not expected to differ from those that would occur under Existing Conditions. Detailed descriptions of the effects of Oroville Facilities operations on predation and salmonid adult straying are provided in Appendix G-AQUA1 of the Preliminary Draft Environmental Assessment (PDEA).

C2.1 HABITAT COMPONENTS AFFECTED BY THE OROVILLE FACILITIES

C2.1.1 Chinook Salmon Spawning Segregation

Under the No-Project Alternative, the Oroville Facilities would continue to block the upstream migration of anadromous salmonids into historical spawning habitat in Lake Oroville's upstream tributaries, which would continue to result in an overall reduction of total available salmonid spawning habitat. The existing lack of access to historical upstream conditions would continue to affect natural selection processes, eventually resulting in effects on the genetic characteristics of the fish species.

In addition, with continued restricted access to historic spawning grounds, spring-run Chinook salmon would continue to spawn in the same lowland reaches that fall-run Chinook salmon use. Continued geographic overlap in spawning habitat between spring-run and fall-run Chinook salmon and the inter-breeding between these runs would result in the continued incremental degradation of the genetic distinctness between the runs.

The Fish Barrier Dam would continue to block upstream migration of anadromous salmonids and increase the intensity of habitat use in the Low Flow Channel (LFC). This increased intensity of habitat use would continue to cause increased competition for spawning habitat and continue to contribute to increased adult pre-spawning mortality rates and redd superimposition rates, which contribute to egg and alevin mortality. (See Section G-AQUA1.8, Tasks 2B, 2C, and 2D, in Appendix G-AQUA1 of the PDEA for additional information on salmonid life stages and associated project effects.)

Under the No-Project Alternative, the increased intensity of existing habitat use would continue and likely would cause additional incremental effects on spring-run and fall-run Chinook salmon genetic introgression, adult pre-spawning mortality, and redd superimposition rates.

C2.1.2 Macroinvertebrate Populations

Under the No-Project Alternative, operation of the Oroville Facilities likely would continue to incrementally contribute to the reduction of macroinvertebrate species diversity and abundance in the lower Feather River. Study Plan (SP) F1 (see Section G-AQUA1.1 in Appendix G-AQUA1 of the PDEA) provides a detailed description of the current effects of the Oroville Facilities on macroinvertebrate communities. The existing blockage of LWD and gravel transport to the lower Feather River would continue to decrease the quality, quantity, and diversity of macroinvertebrate habitat.

C2.1.3 Woody Debris Recruitment

Under the No-Project Alternative, the Oroville Facilities would continue to block the upstream contribution of LWD to the lower Feather River. (See Section 5.1, Geology, Soils, and Paleontological Resources, of the draft environmental impact report (DEIR) for additional information on LWD recruitment.) The lowest proportion of LWD availability likely would continue to occur in the LFC. Downstream of the Thermalito Afterbay Outlet, the river likely would continue to support a greater availability of LWD cover than the reach upstream of the outlet because opportunities for LWD recruitment likely would remain higher in the High Flow Channel (HFC). The existing blockage of LWD to the lower Feather River would result in a continued incremental degradation of the quantity and quality of LWD present in the lower Feather River and would result in reduced quality and diversity of habitat for aquatic resources.

C2.1.4 Gravel Recruitment

Under the No-Project Alternative, Oroville Dam, the Thermalito Diversion Dam, and the Fish Barrier Dam would continue to block gravel contribution from the upper Feather River watershed to the lower Feather River. (See Section 5.1, Geology, Soils, and Paleontological Resources, of the DEIR for additional information on gravel recruitment and lower Feather River substrate conditions.) High Oroville Facilities releases, such as those implemented for flood management purposes, would continue to mobilize smaller substrate particle sizes. Consequently, a gradual relative coarsening of the particle size

distribution of the substrate in the upper portions of the lower Feather River also would continue. Currently, the reach of river with the highest proportion of coarse substrate components is the portion of the lower Feather River below the Fish Barrier Dam and above the Thermalito Afterbay Outlet. Under the No-Project Alternative, the upper reaches of the lower Feather River likely would become more armored, resulting in an incremental detrimental effect on the quality and quantity of suitable salmonid spawning gravels in the lower Feather River.

In addition to reduced gravel recruitment, fine sediments also would continue to become trapped upstream of the Oroville Facilities. Currently, more than 97 percent of the sediment from the upstream watershed is trapped in Oroville Facilities reservoirs, resulting in sediment deprivation downstream. (See Section 5.1, Geology, Soils, and Paleontological Resources, for additional information on sediment recruitment.) Only very fine sediment is discharged from Lake Oroville to the lower Feather River. The existing deprivation of the sediment load in the lower Feather River results in reduced formation of sediment benches, which affects riparian vegetation colonization and succession (see the discussion of botanical resources in Section 5.5, Terrestrial Resources, of the DEIR for additional information on riparian vegetation). Riparian vegetation provides overhanging cover for rearing fish, riparian shade, invertebrate contributions to the fish food base, and future LWD contributions. Additionally, soft sediment substrates contribute to the capture and retention of LWD. Therefore, under the No-Project Alternative, a continued lack of sediment recruitment to the lower Feather River would result in the incremental degradation of geomorphic processes, contributing to a decrease in the quality and diversity of habitat for aquatic resources in the lower Feather River.

C2.1.5 Channel Complexity

Under the No-Project Alternative, channel complexity would be reduced through continued riverbed incision and channel confinement. (See Section 5.1, Geology, Soils, and Paleontological Resources, for additional information on channel complexity.) Continued operation of the Oroville Facilities with relatively static and moderated flow regimes in the LFC under the No-Project Alternative likely would continue to limit the geomorphic processes that result in channel complexity, resulting in the ongoing incremental degradation of the quality and diversity of aquatic resource habitat relative to Existing Conditions.

C2.1.6 Water Quality Criteria for Aquatic Life

Operation of the Oroville Facilities under the No-Project Alternative is not expected to result in any changes to water quality conditions for aquatic life. Therefore, the number of exceedances of water quality criteria for aquatic life is not expected to change relative to Existing Conditions; see Section 4.4, Aquatic Resources.

C2.2 WARMWATER RESERVOIR FISHERIES

C2.2.1 Operations-Related Effects

C2.2.1.1 Spawning and Initial Rearing

Under the No-Project Alternative, changes in Oroville Reservoir water surface elevations and rates of reduction would occur, relative to Existing Conditions, because reservoir operations would be modified to reflect changes in future water supply demand patterns. (See Section 5.2.1, Surface Water Quantity, for additional information on changes in demand patterns, reservoir operations, and water surface elevations.) However, there would be no appreciable change in the rate of Lake Oroville surface elevation reductions during the March through June bass nesting period; therefore, no appreciable change in the rate of bass nest dewatering in Lake Oroville is anticipated under the No-Project Alternative, relative to Existing Conditions. Thermalito Afterbay operation and resulting water surface elevation fluctuations would not change under the No-Project Alternative; therefore, no change in the rate of bass nest dewatering within the Thermalito Afterbay is anticipated.

C2.2.1.2 Fish Interactions

Under the No-Project Alternative, stocked salmonid species and warmwater fish species within Lake Oroville could potentially continue to interact with upstream tributary fisheries through predation, competition for food and habitat, disease transmission, and genetic introgression. (See Section G-AQUA1.5, Task 1, in Appendix G-AQUA1 of the PDEA for additional information on potential fisheries interactions.) Lake Oroville reservoir operations would continue to influence the accessibility of the upstream tributaries to fish species within Lake Oroville through changes in reservoir water surface elevations. When Lake Oroville water surface elevations are near full pool, Big Bend Dam becomes passable to fish. Conversely, when reservoir stage elevations are reduced, sediment wedges in the tributary arms of the reservoir may be exposed and may inhibit or prohibit fish movement from the reservoir into the upstream tributaries. Increases or decreases in reservoir stage elevations also would increase or decrease the distance from the reservoir to habitat in the upstream tributaries above the reservoir high-pool mark, which also could influence the amount and frequency of interactions between reservoir fishes and fishes in the upstream tributaries.

The Oroville Facilities would continue to influence fish species interactions and sediment wedge locations in the upstream tributaries and reservoir arms, respectively. However, the nature and relative effect of the reservoir surface elevations are not expected to change with implementation of the No-Project Alternative relative to Existing Conditions.

No changes in fish stocking or in the frequency or nature of sediment wedge exposure associated with Lake Oroville water surface elevations are anticipated. Therefore, no effects on warmwater reservoir fish interactions are expected under the No-Project Alternative.

C2.2.2 Fisheries Management–Related Effects

C2.2.2.1 Stocking

No changes in warmwater fish stocking or the existing habitat enhancement program are anticipated under the No-Project Alternative.

C2.2.2.2 Disease

No changes in the types or transmission rates of warmwater fish diseases are anticipated under the No-Project Alternative.

C2.2.2.3 Recreational Access or Fishing Regulations

As described in Section 5.7 of the DEIR, Recreational Resources, a one-third increase in recreation and angling activities under the No-Project Alternative is anticipated. A one-third increase in angling coupled with no other fisheries changes would equate to increased sport fish harvest rates and potentially result in reduced catch sizes and catch rates. No changes in fishing access or regulations for warmwater sport fishing are anticipated under the No-Project Alternative.

C2.2.3 Summary of Potential Effects on Warmwater Reservoir Fisheries

The quality of the warmwater sport fishery would be reduced under the No-Project Alternative by increased angling and resulting reduced catch rates and sizes. Increased warmwater sport fish harvest rates could potentially affect population sustainability under the No-Project Alternative.

C2.3 COLDWATER RESERVOIR FISHERIES

C2.3.1 Operations-Related Effects

C2.3.1.1 Habitat Availability

Under the No-Project Alternative, changes in reservoir water surface elevations and drawdown rates during the summer months (see Section 5.2.1, Surface Water Quantity, of the DEIR) likely would not affect the availability of coldwater habitat in Lake Oroville. Oroville Facilities reservoir water surface elevations are not expected to reach sufficiently low elevations to affect the amount of suitable coldwater fisheries habitat availability below the thermocline. Additionally, drawdown rates are not expected to be sufficiently rapid to cause reservoir mixing. Water temperature management targets for the Feather River Fish Hatchery and Robinson Riffle would not change under the No-Project Alternative. Therefore, release of the coldwater pool from Lake Oroville, and the resulting relative quantity of suitable coldwater fisheries habitat, is not expected to change under the No-Project Alternative, relative to Existing Conditions. For these reasons, Oroville Facilities operations under the No-Project Alternative likely would have no effect on the availability of coldwater fisheries habitat in Lake Oroville.

Operations of Thermalito Afterbay would not change under the No-Project Alternative. Therefore, there are no anticipated effects on the availability of coldwater habitat, relative to Existing Conditions.

C2.3.1.2 Fish Interactions

No changes in fish stocking or in the frequency or nature of sediment wedge exposure associated with Lake Oroville water surface elevations are anticipated under the No-Project Alternative. (See Appendix C1 and Section C2.2.1.2, Fish Interactions, above, for further discussion.) Therefore, no effects on coldwater reservoir fish interactions are expected relative to Existing Conditions under the No-Project Alternative.

C2.3.2 Fisheries Management–Related Effects

C2.3.2.1 Stocking

No changes in existing coldwater fish stocking are anticipated under the No-Project Alternative.

C2.3.2.2 Disease

No changes in the incidence of disease are anticipated under the No-Project Alternative.

C2.3.2.3 Recreational Access or Fishing Regulations

A one-third increase in recreation and angling activities is anticipated under the No-Project Alternative (see Section 5.7, Recreational Resources). A one-third increase in angling with no other fisheries changes would equate to increased sport fish harvest rates and potentially result in reduced catch sizes and catch rates. No changes to recreational access or fishing regulations are anticipated under the No-Project Alternative.

C2.3.3 Summary of Potential Effects on Coldwater Reservoir Fisheries

The quality of the coldwater sport fishery would be reduced in the No-Project Alternative as a result of increased angling and resulting reduced catch rates and sizes.

C2.4 LOWER FEATHER RIVER FISH SPECIES

Qualitative analyses were performed on various potential effects resulting from Oroville Facilities operations under the No-Project Alternative to determine the incremental effects of continued operations relative to Existing Conditions. The results of the detailed quantitative analysis conducted as part of the PDEA are utilized to assist in qualitatively evaluating effects of changes to flow regimes and water temperatures in the lower Feather River.

C2.4.1 Fall-run Chinook Salmon

Study plan report summaries addressing project-related effects on fall-run Chinook salmon are presented in Section G-AQUA1.5, Fisheries Management; Section G-AQUA1.7, Feather River Fish Hatchery; Section G-AQUA1.8, Salmonids and Their Habitat in the Feather River Below the Fish Barrier Dam; Section G-AQUA1.9, Upstream Fish Passage; Section G-AQUA10, Instream Flows and Fish Habitat; and Section G-AQUA1.11, Predation, in Appendix G-AQUA1, Affected Environment, of the PDEA. A description of each fall-run Chinook salmon life stage and the time period associated with it is presented in Appendix C1.

C2.4.1.1 Flow-Related Effects

Under the No-Project Alternative, there would be no changes in flows in the LFC relative to Existing Conditions. Effects of flow changes in the HFC are expressed in the qualitative analyses presented below.

Adult Immigration and Holding

Mean monthly flow changes under the No-Project Alternative compared to Existing Conditions during the fall-run Chinook salmon adult immigration and holding period would occur in the HFC. Increased mean monthly flows during July and August and decreased mean monthly flows for the remainder of the immigration and holding period would cause small changes in river stage elevation. Because the flow-related changes in river stage elevation during the Chinook salmon adult immigration and holding period would be small, they would not affect immigration at potential critical riffles and would not be sufficiently large to appreciably affect holding habitat depths.

Flow fluctuations that could potentially occur under the No-Project Alternative would be similar to flow fluctuations that occur under Existing Conditions. Because flow fluctuations currently do not affect fall-run Chinook salmon adult immigration and holding (DWR 2003a, 2003b), flow fluctuation under the No-Project Alternative also would not affect fall-run Chinook salmon adult immigration and holding.

Adult Spawning and Embryo Incubation

Under the No-Project Alternative, minimum instream flows in the LFC would remain at 600 cubic feet per second (cfs) year-round. Flow fluctuations that could potentially occur under the No-Project Alternative would be similar to flow fluctuations that occur under Existing Conditions.

Evaluation of the Weighted Usable Area (WUA) index generated by the physical habitat simulation (PHABSIM) model for the adult spawning life stage of Chinook salmon indicated that the maximum amount of spawning area in the LFC, given the current channel configuration, would occur at flows from 800 to 825 cfs (DWR 2004a). Figure C2.4-1 shows the WUA curve generated by the PHABSIM model for Chinook salmon spawning in the LFC.

Current flows in the LFC during the fall-run Chinook salmon spawning period are 600 cfs, which, according to PHABSIM model results, correspond to approximately 91 percent of maximum WUA. Because proposed flows in the LFC under the No-Project Alternative would be the same as Existing Conditions, flows under the No-Project Alternative also would result in approximately 91 percent of maximum WUA, representing no change from Existing Conditions.

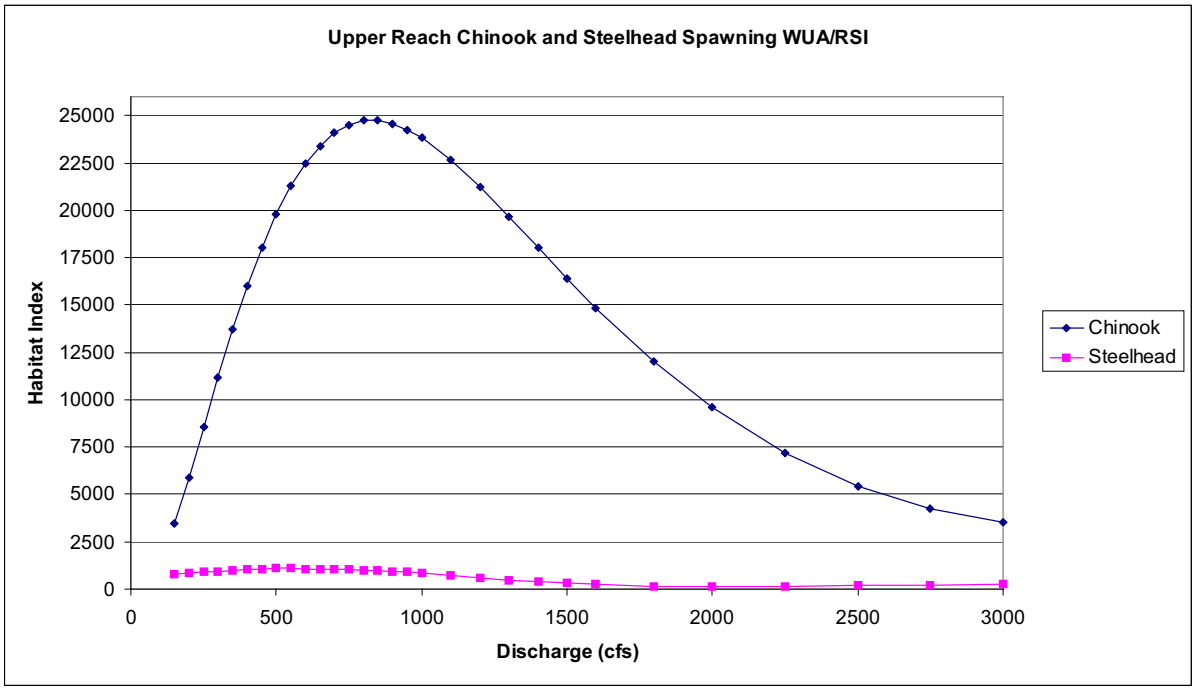

Figure C2.4-1. Low Flow Channel WUA curves for steelhead and Chinook salmon.

Under the No-Project Alternative, flow fluctuations in the HFC are not expected to differ from flow fluctuations that occur under Existing Conditions. However, flow releases likely would change on a monthly basis compared to Existing Conditions; see Section 5.2.1, Water Quantity. Daily minimum and maximum flows within the fall-run Chinook salmon spawning period would not differ from those described in the 1983 agreement between the California Department of Fish and Game (DFG) and California Department of Water Resources (DWR), which governs current operations. Under Existing Conditions, during normal operations, flows in the HFC are maintained above specified minimum and below specified maximum flows, in part, to protect fisheries resources in the lower Feather River. Flow requirements for the HFC under Existing Conditions and the No-Project Alternative are described in Section 5.2.1, Surface Water Quantity. Under normal operating conditions the No-Project Alternative daily releases into the HFC would not fluctuate outside the minimum and maximum flows described in Section 5.2.1, Surface Water Quantity, which are the same minimum and maximum flow requirements described for Existing Conditions.

During drought conditions, flows under the No-Project Alternative would be lowered to a constant minimum flow of 750 cfs prior to the onset of fall-run Chinook salmon spawning and raised to 900 cfs in early October. According to the U.S. Bureau of Reclamation (USBR 2004), the minimum and maximum flow requirements, as well as the fluctuations allowed in the HFC under Existing Conditions during the fall-run Chinook salmon spawning and embryo incubation period, have not affected this life stage. Therefore, it is expected that the flow requirements and the associated flow fluctuations that would occur in the HFC under the No-Project Alternative also would not affect this life stage.

Evaluation of the WUA index generated by the PHABSIM model for the adult spawning life stage of Chinook salmon indicated that the maximum amount of spawning area in the HFC, given the current channel configuration, would occur at flows between 1,650 and 1,750 cfs (DWR 2004a). Figure C2.4-2 shows the WUA curve generated by the PHABSIM model for Chinook salmon spawning in the HFC.

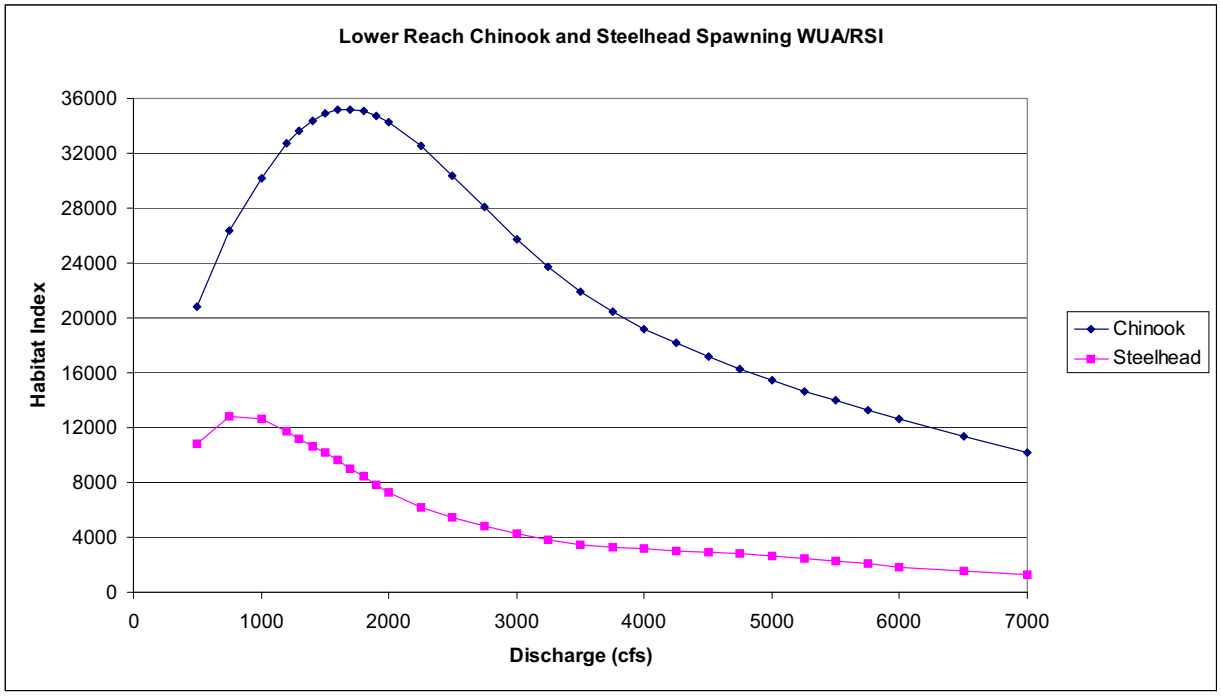

Figure C2.4-2. High Flow Channel WUA curves for steelhead and Chinook salmon.

Current minimum flows in the HFC during the fall-run Chinook salmon spawning period are 1,000 cfs during September and 1,700 cfs during October, November and December, which produce approximately 86 percent and 100 percent of maximum WUA, respectively. Minimum flows under the No-Project Alternative likely would not change from Existing Conditions. Therefore, minimum flows in the HFC under the No-Project Alternative also would produce approximately 86 percent of maximum WUA during September and 100 percent of maximum WUA for Chinook salmon spawning from October through December, representing no change from Existing Conditions.

Juvenile Rearing and Downstream Movement

Under the No-Project Alternative, flow fluctuations in the HFC would be similar to those occurring under Existing Conditions. Because flow fluctuations under Existing Conditions do not measurably affect juvenile fall-run Chinook salmon, it is expected that flow fluctuations occurring under the No-Project Alternative also would have no measurable effect on fall-run Chinook salmon juvenile rearing and downstream movement, relative to Existing Conditions.

C2.4.1.2 Water Temperature–Related Effects

Effects of water temperature changes associated with the No-Project Alternative are expressed in the qualitative analyses presented below. These analyses are qualitative in nature, but anticipated changes in water temperature under the No-Project Alternative likely would be similar to those found with the detailed quantitative analyses of the No-Action Alternative provided in the PDEA.

Adult Immigration and Holding

Flows and water temperatures in the LFC are anticipated to be similar under the No-Project Alternative to those under Existing Conditions. Flows in the HFC would increase slightly during July and August and decrease slightly during the rest of the adult immigration and holding life stage period. Slight changes in water temperatures likely would occur as a result of the slight changes in flows. However, the PDEA analysis of habitat suitability indicated a less than one percent difference in habitat suitability occurred with implementation of the No-Action Alternative, relative to Existing Conditions. Because water temperatures are similar under the PDEA alternatives to water temperatures under the DEIR alternatives, the slight changes in water temperatures associated with implementation of the No-Project Alternative are expected to result in a similarly small change in fall-run Chinook salmon adult immigration and holding habitat suitability, relative to Existing Conditions.

Adult Spawning and Embryo Incubation

Flows and water temperatures in the LFC, where most Chinook salmon spawning occurs, are anticipated to be the same under the No-Project Alternative as those observed under Existing Conditions. Flows in the HFC may change slightly as water supply demand patterns shift in future years (i.e., 2020 level of development). However, the analysis of spawning and embryo incubation habitat suitability provided in the PDEA indicated less than one percent difference in habitat suitability occurred with implementation of the No-Action Alternative, relative to Existing Conditions. Because water temperatures are similar under the PDEA alternatives to water temperatures under the EIR alternatives, the slight changes in water temperatures associated with implementation of the No-Project Alternative are expected to result in a similarly small change in fall-run Chinook salmon adult spawning and embryo incubation habitat suitability, relative to Existing Conditions.

Juvenile Rearing and Downstream Movement

Flows and water temperatures in the LFC are anticipated to be the same under the No-Project Alternative as those observed under Existing Conditions. Flows in the HFC may change slightly as water supply demand patterns shift. However, the PDEA analysis of juvenile rearing and downstream movement habitat suitability indicated less than one percent difference occurred with implementation of the No-Action Alternative, relative to Existing Conditions. Because water temperatures are similar under the PDEA alternatives to water temperatures under the EIR alternatives, the slight changes in water temperatures associated with implementation of the No-Project Alternative are expected to result in a similarly small change in fall-run Chinook salmon juvenile rearing and downstream movement habitat suitability, relative to Existing Conditions.

C2.4.1.3 Predation-Related Effects

The slight change in water temperatures resulting from slight changes in seasonal flow patterns in the HFC under the No-Project Alternative is not anticipated to affect predation rates or the composition of predator species.

C2.4.1.4 Fisheries Management–Related Effects

Hatchery

No changes to hatchery management practices are anticipated under the No-Project Alternative. Therefore, no hatchery-related effects on fall-run Chinook salmon are expected.

Disease

The slight change in water temperatures resulting from slight changes in seasonal flow patterns in the HFC under the No-Project Alternative is not anticipated to affect the incidence of disease in fall-run Chinook salmon in the lower Feather River.

Fishing Regulations, Poaching, and Change in Recreational Access and Visitation

Section 5.7, Recreational Resources, forecasts a one-third increase in recreation and angling activities with implementation of the No-Project Alternative. This increase in angling, with no other protective measures related to fisheries, likely would result in increased sport fish harvest rates. No changes to fishing regulations are anticipated to occur under the No-Project Alternative, which could result in a negative effect on the Chinook salmon natural spawning population.

C2.4.1.5 Summary of Potential Effects on Fall-run Chinook Salmon

Adult Immigration and Holding

Changes in flows and water temperatures under the No-Project Alternative would not affect fall-run Chinook salmon adult immigration and holding. Modeling conducted as

part of the PDEA indicated that differences in habitat suitability due to decreased water temperatures are less than one percent between Existing Conditions and the No-Action Alternative, which would be similar to decreased habitat suitability associated with implementation of the No-Project Alternative. Therefore, changes in water temperatures would not affect fall-run Chinook salmon adult immigration and holding.

Overall, operation of the Oroville Facilities under the No-Project Alternative would result in no effect on fall-run Chinook salmon adult immigration and holding.

Adult Spawning and Embryo Incubation

Changes in mean monthly flows in the HFC under the No-Project Alternative would result in no effect on fall-run Chinook salmon adult spawning and embryo incubation. The minor changes in water temperature expected under the No-Project Alternative would not affect fall-run Chinook salmon adult spawning and embryo incubation. However, continued degradation of gravel spawning substrate in the lower Feather River would result in an adverse effect on fall-run Chinook salmon adult spawning and embryo incubation by reducing the quantity and quality of available habitat. Also, continued utilization of the same spawning areas and ongoing inter-breeding between the two runs would continue to incrementally degrade the genetic distinctness between spring-run and fall-run Chinook salmon in the lower Feather River.

Overall, operation of the Oroville Facilities under the No-Project Alternative would result in an adverse effect on fall-run Chinook salmon adult spawning and embryo incubation.

Juvenile Rearing and Downstream Movement

Changes in average monthly flows and water temperatures under the No-Project Alternative are not expected to affect fall-run Chinook salmon juvenile rearing and downstream movement. However, continued blockage of LWD and gravel, and the degradation of side-channel habitat quality would result in an adverse effect on the quality and quantity of available habitat.

Overall, operation of the Oroville Facilities under the No-Project Alternative would have an adverse effect on fall-run Chinook salmon juvenile rearing and downstream movement.

Conclusion

Based on the above summary of potential effects, it is expected that the No-Project Alternative would have an overall adverse effect on fall-run Chinook salmon, relative to Existing Conditions.

C2.4.2 Spring-run Chinook Salmon

Study plan report summaries addressing project effects on spring-run Chinook salmon are presented in Section G-AQUA1.5, Fisheries Management; Section G-AQUA1.7, Feather River Fish Hatchery; Section G-AQUA1.8, Salmonids and Their Habitat in the

Feather River Below the Fish Barrier Dam; Section G-AQUA1.9, Upstream Fish Passage; Section G-AQUA10, Instream Flows and Fish Habitat; and Section G-AQUA1.11, Predation, in Appendix G-AQUA1, Affected Environment of the PDEA. A description of each spring-run Chinook salmon life stage and the time period associated with it is presented in Appendix C1.

C2.4.2.1 Flow-Related Effects

Under the No-Project Alternative, there would be no changes to flows in the LFC. Effects of flow changes in the HFC are expressed in the qualitative analyses of habitat suitability presented below.

Adult Immigration and Holding

Mean monthly flow changes would occur in the HFC during the spring-run Chinook salmon adult immigration and holding period under the No-Project Alternative, relative to Existing Conditions. Increased mean monthly flows from May through August and decreased mean monthly flows in March and April, and in September and October would cause very small changes in river stage. Because the flow-related changes in river stage during the spring-run Chinook salmon adult immigration and holding period would be small, they would not affect immigration at potential critical riffles and would not appreciably affect holding habitat depths.

Flow fluctuations that could potentially occur under the No-Project Alternative would be similar to flow fluctuations that occur under Existing Conditions. Because flow fluctuations currently do not affect spring-run Chinook salmon adult immigration and holding (DWR 2003a, 2003b), flow fluctuations under the No-Project Alternative also would not affect spring-run Chinook salmon adult immigration and holding.

Adult Spawning and Embryo Incubation

Refer to the above discussion in Section C2.4.1 for the evaluation of flow-related effects on spring-run Chinook salmon adult spawning and embryo incubation.

Juvenile Rearing and Downstream Movement

Under the No-Project Alternative, flow fluctuations in the HFC would be similar to those occurring under Existing Conditions. Because flow fluctuations under Existing Conditions do not measurably affect juvenile spring-run Chinook salmon, it is expected that flow fluctuations occurring under the No-Project Alternative also would have no measurable effect on spring-run Chinook salmon juvenile rearing and downstream movement, relative to Existing Conditions.

C2.4.2.2 Water Temperature–Related Effects

Effects of water temperature changes associated with the No-Project Alternative are expressed in the qualitative analyses of relative habitat suitability presented below.

Adult Immigration and Holding

No changes in water temperatures are anticipated in the LFC with implementation of the No-Project Alternative relative to Existing Conditions. Modeling conducted as part of the PDEA analyses showed slight decreases in water temperature in the HFC associated with the No-Action Alternative and, as such, slightly lower water temperatures in the HFC are anticipated with implementation of the No-Project Alternative. Increased habitat suitability due to decreased water temperatures under the No-Project Alternative would provide a slight beneficial effect on spring-run Chinook salmon adult immigration and holding.

Adult Spawning and Embryo Incubation

Flows and water temperatures in the LFC, where most Chinook salmon spawning occurs, are anticipated to be the same under the No-Project Alternative as those observed under Existing Conditions. Flows in the HFC may change slightly as water supply demand patterns shift in future years (i.e., 2020 level of development). However, in the analyses conducted as part of the PDEA, differences in habitat suitability due to decreased water temperatures during the spring-run Chinook salmon adult spawning and embryo incubation period were less than one percent between existing conditions and the No-Action Alternative. Therefore, changes in water temperature associated with implementation of the No-Project Alternative would not affect spring-run Chinook salmon adult spawning and embryo incubation.

Juvenile Rearing and Downstream Movement

In the analyses conducted as part of the PDEA, differences in habitat suitability due to decreased water temperatures are less than one percent between existing conditions and the No-Action Alternative. Therefore, changes in water temperature under the No-Project Alternative would not affect spring-run Chinook salmon juvenile rearing and downstream movement.

C2.4.2.3 Predation-Related Effects

The slight changes in water temperatures resulting from slight changes in seasonal flow patterns in the HFC under the No-Project Alternative are not anticipated to affect predation rates or the composition of predator species.

C2.4.2.4 Fisheries Management–Related Effects

Hatchery

No changes to hatchery management are anticipated under the No-Project Alternative. Therefore, no hatchery-related effects on spring-run Chinook salmon are expected.

Disease

The slight change in water temperatures resulting from slight changes in seasonal flow patterns in the HFC under the No-Project Alternative is not anticipated to affect the incidence of disease in spring-run Chinook salmon in the lower Feather River.

Fishing Regulations, Poaching, and Change in Recreational Access and Visitation

Section 5.7 of the DEIR, Recreational Resources, forecasts a one-third increase in recreation and angling activities with implementation of the No-Project Alternative. This increase in angling, with no other fisheries management alterations, would result in increased sport fish harvest rates. No changes to fishing regulations are anticipated to occur under the No-Project Alternative. Therefore, a negative effect on Chinook salmon natural spawning population could occur.

C2.4.2.5 Summary of Potential Effects on Spring-run Chinook Salmon

Adult Immigration and Holding

Slight changes in flows under the No-Project Alternative would result in no effective change in spring-run Chinook salmon adult immigration and holding habitat quantity or quality. Increased habitat suitability due to decreased water temperatures under the No-Project Alternative would provide a slight beneficial effect on spring-run Chinook salmon adult immigration and holding. Increased angling and sport harvest would have an adverse effect on spring-run Chinook salmon adult immigration and holding.

Overall, operation of the Oroville Facilities under the No-Project Alternative would result in a slightly adverse effect on spring-run Chinook salmon adult immigration and holding.

Adult Spawning and Embryo Incubation

Changes in flows under the No-Project Alternative would have no effect on spring-run Chinook salmon adult spawning and embryo incubation. Differences in habitat suitability due to slightly decreased water temperatures during the spring-run Chinook salmon adult spawning and embryo incubation period would not affect spring-run Chinook salmon adult spawning and embryo incubation. Continued degradation of spawning gravel quality in the lower Feather River would result in an adverse effect on spring-run Chinook salmon adult spawning and embryo incubation by reducing the quality and quantity of available habitat. Also, continued utilization of the same spawning areas by spring-run and spring-run Chinook salmon and on-going inter-breeding of the two runs would continue to incrementally degrade the genetic distinctness of the Chinook salmon runs that spawn in the lower Feather River.

Overall, operation of the Oroville Facilities under the No-Project Alternative would result in an adverse effect on spring-run Chinook salmon adult spawning and embryo incubation.

Juvenile Rearing and Downstream Movement

Slight changes in flows and water temperatures under the No-Project Alternative are not expected to affect spring-run Chinook salmon juvenile rearing and downstream movement. However, continued blockage of LWD and gravel, and degradation of side-channel habitat quality in the upper reaches of the lower Feather River would result in an adverse effect on juvenile rearing and downstream movement.

Overall, operation of the Oroville Facilities under the No-Project Alternative would result in an adverse effect on spring-run Chinook salmon juvenile rearing and downstream movement.

Conclusion

Based on the above summary of potential effects, it is expected that the No-Project Alternative would have an overall adverse effect on spring-run Chinook salmon, relative to Existing Conditions.

C2.4.3 Steelhead

Study plan report summaries addressing project effects on steelhead are presented in Section G-AQUA1.5, Fisheries Management; Section G-AQUA1.7, Feather River Fish Hatchery; Section G-AQUA1.8, Salmonids and Their Habitat in the Feather River Below the Fish Barrier Dam; Section G-AQUA1.9, Upstream Fish Passage; Section G-AQUA10, Instream Flows and Fish Habitat; and Section G-AQUA1.11, Predation, in Appendix G-AQUA1, Affected Environment of the PDEA. A description of each steelhead life stage and the time period associated with it is presented in Appendix C1.

C2.4.3.1 Flow-Related Effects

Under the No-Project Alternative, there would be no changes to flows in the LFC. Effects of flow changes in the HFC are expressed in the qualitative analyses of habitat suitability presented below.

Adult Immigration and Holding

Mean monthly flow decreases under the No-Project Alternative compared to Existing Conditions during the steelhead adult immigration and holding period would occur in the HFC, which would cause very small changes in river stage. Because the flow-related changes in river stage during the steelhead adult immigration and holding period would be small, they would not affect immigration at potential critical riffles and would not appreciably affect holding habitat depths.

Flow fluctuations that could potentially occur under the No-Project Alternative would be similar to flow fluctuations that occur under Existing Conditions. Because flow fluctuations currently do not affect steelhead adult immigration and holding, flow fluctuations under the No-Project Alternative also would not affect steelhead adult immigration and holding.

Adult Spawning and Embryo Incubation

Under the No-Project Alternative, minimum instream flows in the LFC would remain at 600 cfs year-round. Flow fluctuations in the LFC that could potentially occur under the No-Project Alternative in order to meet water temperature objectives prescribed by NMFS would be the same as those that occur under Existing Conditions.

Evaluation of the WUA index generated by the PHABSIM model for the adult spawning life stage of steelhead indicated that the maximum amount of spawning area in the LFC, given the current channel configuration, would occur at flows around 500 cfs. Figure C2.4-3 shows the steelhead spawning WUA curve generated by the PHABSIM model for the LFC.

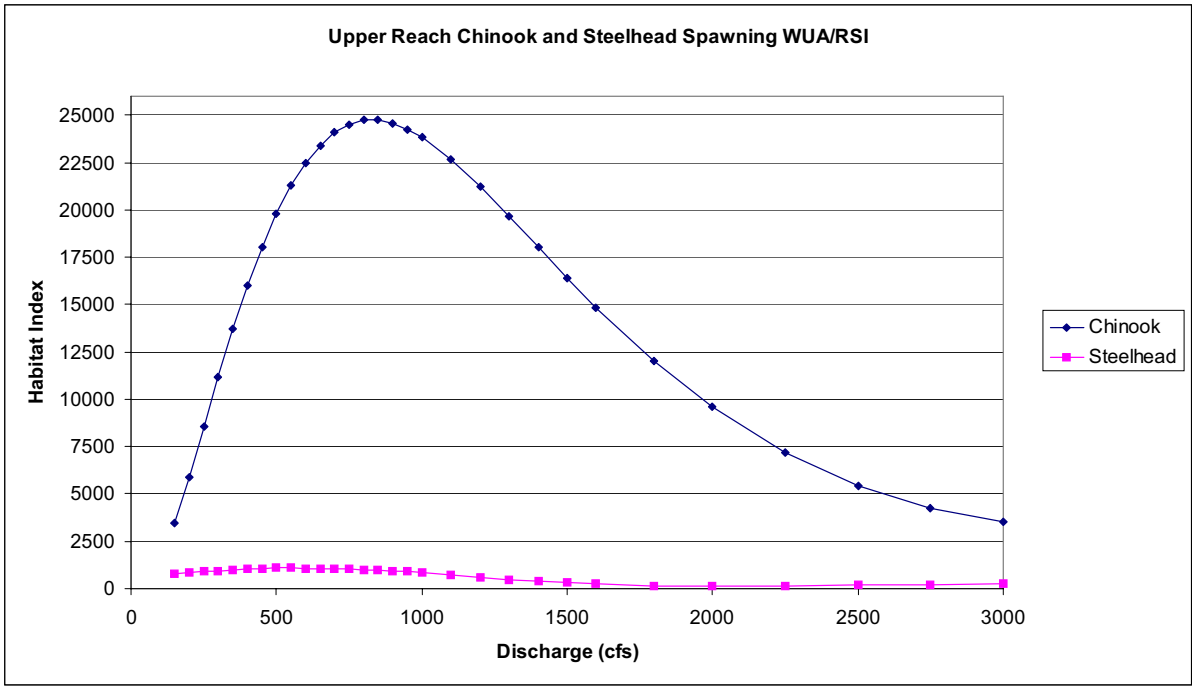

Figure C2.4-3. Low Flow Channel WUA curves for steelhead and Chinook salmon.

Current flows in the LFC during the steelhead spawning period are 600 cfs, which result in approximately 98 percent of maximum WUA. Because proposed flows in the LFC under the No-Project Alternative would be the same as Existing Conditions, flows under the No-Project Alternative also would result in approximately 98 percent of maximum WUA.

Under the No-Project Alternative, flow fluctuations in the HFC are not expected to differ substantially from flow fluctuations that occur under Existing Conditions. Flow releases likely would change seasonally with implementation of the No-Project Alternative, but daily minimum and maximum releases within the steelhead spawning period likely would not differ from Existing Conditions. Current operations maintain flows within the minimum and maximum flows prescribed in the 1983 agreement between DWR and

DFG. According to the USBR (2004), the minimum and maximum flow requirements, as well as the fluctuations permitted during the steelhead spawning and embryo incubation period in the HFC, have not affected this life stage. Therefore, it is expected that the flow requirements and the associated flow fluctuations in the HFC under the No-Project Alternative also would not affect this life stage.

Flood management releases could require release of flows above the maximum flow specified under normal operating conditions, and drought conditions could require flow releases below the minimum flow specified under normal operating conditions. Flood management releases could potentially cause high flow conditions in the HFC, while during drought conditions, flows likely would be lowered to a constant minimum flow of 900 cfs during October, prior to the onset of steelhead spawning, and further lowered to 750 cfs during March, during the steelhead spawning period. Reduction in flows from 900 cfs to 750 cfs during March could potentially affect steelhead spawning in the HFC. Potential effects associated with a reduction in flow could result in redd dewatering or a slight increase in the overall amount of spawning habitat. PHABSIM results indicate that flows of 900 cfs in the HFC would result in approximately 98 percent of maximum WUA while a decrease in flow to 750 cfs would result in approximately 100 percent of maximum WUA.

Evaluation of the WUA index generated by the PHABSIM model for the adult spawning life stage of steelhead indicated that the maximum amount of spawning area in the HFC, given the current channel configuration, would occur at flows around 750 cfs. Figure C2.4-4 shows the WUA curve generated by the PHABSIM model for steelhead spawning in the HFC.

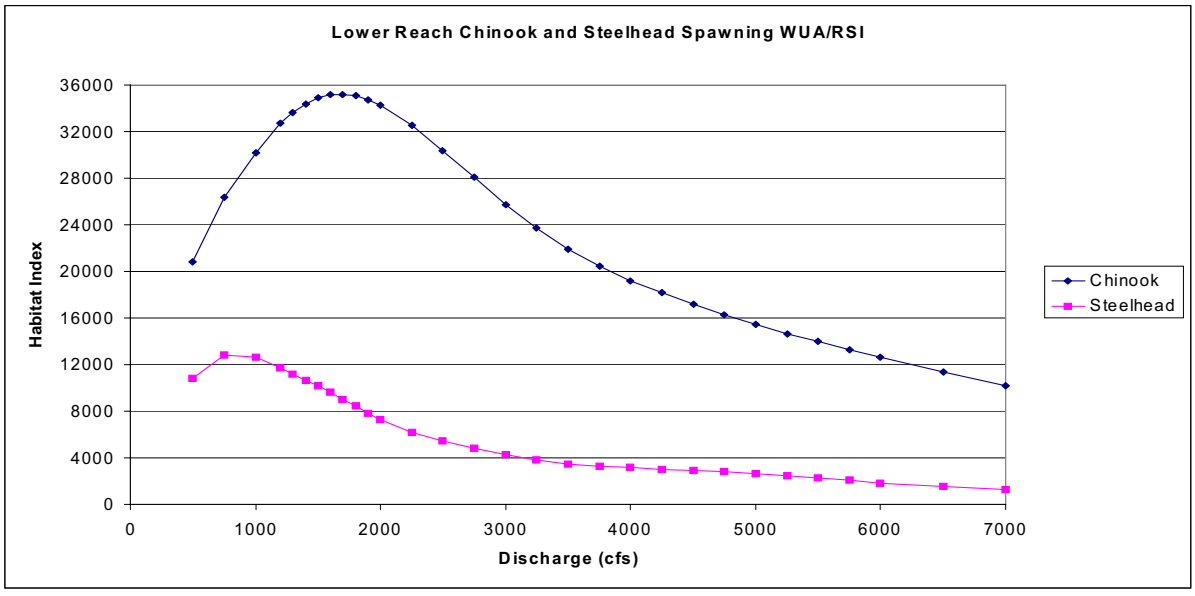

Figure C2.4-4. High Flow Channel WUA curves for steelhead and Chinook salmon.

Current minimum flows in the HFC during the steelhead spawning period are 1,700 cfs, which produce approximately 70 percent of maximum WUA. Average monthly flows under the No-Project Alternative are lower from January through April and from September through December, and are higher from May through August. However, minimum flow requirements are not proposed to differ from Existing Conditions. Therefore, minimum flows in the HFC under the No-Project Alternative also would produce approximately 70 percent of maximum WUA during the steelhead spawning period, representing no change from Existing Conditions.

During extreme drought conditions, total releases from the lower Feather River could be reduced such that releases are no greater than 25 percent of the normal minimum flow requirement below the Thermalito Afterbay Outlet. The 25 percent reduction in flow below normal minimum flows results in a total flow of 750 cfs below the Thermalito Afterbay Outlet from March through September and 900 cfs from October through February. Under the No-Project Alternative, during extreme drought conditions, flow in the LFC would be 600 cfs during the beginning of the steelhead spawning period (December through February), while 300 cfs would be released from the Thermalito Afterbay Outlet. During the remainder of the steelhead spawning period flows in the HFC would be reduced to 750 cfs, 150 cfs of which would come from the Thermalito Afterbay Outlet (i.e., 600 cfs would remain flowing through the LFC). During extreme drought conditions, flow reductions from 900 cfs to 750 cfs in the HFC could affect spawning adult steelhead by creating the opportunity for redd dewatering during the flow reduction. Additionally, PHABSIM model results indicate that a reduction in flow in the HFC from 900 cfs to 750 cfs would increase available spawning habitat from approximately 98 percent of maximum WUA to almost 100 percent of maximum WUA.

Based on modeling results conducted as part of the PDEA, mean monthly flows under the No-Project Alternative during the steelhead spawning period would be lower in the HFC than under Existing Conditions. Changes in mean monthly flows during the steelhead spawning period would result in changes in spawning WUA. Due to the generalized nature of the WUA index and the inherent limitations in the methodology associated with Instream Flow Incremental Methodology (IFIM) and PHABSIM models, small changes in flow at the flows modeled were not able to determine exact changes in WUA. However, examination of Figure C2.4-4 shows that, from December through March, slight decreases in flow would result in slight increases in WUA compared to Existing Conditions Overall, the average monthly changes in flow under the No-Project Alternative would result in an increase in spawning WUA over the course of the spawning period compared to Existing Conditions.

Fry and Fingerling Rearing and Downstream Movement

Under the No-Project Alternative, flow fluctuations in the HFC would be similar to those occurring under Existing Conditions. Because flow fluctuations under Existing Conditions have no effect on steelhead fry and fingerling downstream movement, it is expected that flow fluctuations occurring under the No-Project Alternative also would have no effect on this life stage.

Smolt Emigration

Under the No-Project Alternative, flow fluctuations in the HFC would be similar to those occurring under Existing Conditions. Because flow fluctuations that could potentially occur under the No-Project Alternative would be similar to flow fluctuations that occur under Existing Conditions, implementation of the No-Project Alternative is not expected to result in a change in the rate of juvenile stranding resulting from flow fluctuations.

C2.4.3.2 Water Temperature–Related Effects

Effects of water temperature changes associated with the No-Project Alternative are expressed in the qualitative analyses of relative habitat suitability presented below.

Adult Immigration and Holding

No changes in water temperatures are anticipated in the LFC with implementation of the No-Project Alternative. Modeling conducted as part of the PDEA showed slight decreases in water temperature in the HFC associated with the No-Action Alternative and, as such, slightly lower water temperatures in the HFC are anticipated with implementation of the No-Project Alternative. Increased habitat suitability due to decreased water temperatures under the No-Project Alternative would provide a slight beneficial effect on steelhead adult immigration and holding.

Adult Spawning and Embryo Incubation

Under the No-Project Alternative flows and water temperatures in the LFC, where most steelhead spawning occurs, are not anticipated to differ from Existing Conditions. Flows in the HFC may change slightly as demand patterns for water supply shift in future years (see Section 5.2.1, Surface Water Quantity). However; the analysis of habitat suitability under the No-Action Alternative in the PDEA indicated less than a one percent difference in spawning habitat suitability between Existing Conditions and the No-Action Alternative. Therefore, operation of the Oroville Facilities under the No-Project Alternative would result in no changes to steelhead spawning and embryo incubation due to changes in water temperature.

Fry and Fingerling Rearing and Downstream Movement

In the analyses conducted as part of the PDEA, differences in habitat suitability due to decreased water temperatures during the steelhead fry and fingerling downstream movement life stage period are less than one percent between Existing Conditions and the No-Action Alternative. Therefore, changes in water temperature would not affect steelhead fry and fingerling rearing and downstream movement.

Smolt Emigration

The analysis of water temperature effects on steelhead smolt emigration conducted as part of the PDEA between Existing Conditions and the No-Action Alternative showed a slight beneficial effect because water temperatures were slightly reduced during the

smolt emigration life stage. It is anticipated that implementation of the No-Project Alternative would alter water temperatures similarly and result in the same slight benefits on steelhead smolt emigration.

C2.4.3.3 Predation-Related Effects

The slight changes in water temperature resulting from slight changes in seasonal flow patterns in the HFC under the No-Project Alternative are not anticipated to affect predation rates or the composition of predator species.

C2.4.3.4 Fisheries Management–Related Effects

Hatchery

No changes to hatchery management practices are anticipated under the No-Project Alternative. Therefore, no hatchery-related effects on steelhead are expected.

Disease

The slight changes in water temperature resulting from slight changes in seasonal flow patterns in the HFC under the No-Project Alternative are not anticipated to affect the incidence of disease associated with steelhead.

Fishing Regulations, Poaching, and Change in Recreational Access and Visitation

As described in Section 5.7 of the DEIR, Recreational Resources, a one-third increase in recreation and angling activities is anticipated with implementation of the No-Project Alternative. A one-third increase in angling with no other fisheries changes would result in increased sport fish harvest rates. No changes to fishing regulations are anticipated to occur under the No-Project Alternative. Therefore, a negative effect on the steelhead natural spawning population could occur.

C2.4.3.5 Summary of Potential Effects on Steelhead

Adult Immigration and Holding

Changes in mean monthly flows under the No-Project Alternative would have no effect on steelhead adult immigration and holding. Analyses conducted as part of the PDEA showed differences in habitat suitability due to decreased water temperatures are less than one percent between Existing Conditions and the No-Project Alternative. Therefore, changes in water temperature would not affect steelhead adult immigration and holding. Increased angling and sport harvest could have an adverse effect on steelhead adult immigration and holding.

Overall, operation of the Oroville Facilities under the No-Project Alternative would result in a slight adverse effect on steelhead immigration and holding.

Adult Spawning and Embryo Incubation

Mean monthly flow changes associated with implementation of the No-Project Alternative, compared to Existing Conditions, would result in increased WUA, thereby providing a slight beneficial effect on this life stage. Differences in habitat suitability due to decreased water temperatures during the steelhead adult spawning and embryo incubation period would likely be less than one percent between Existing Conditions and the No-Project Alternative. Therefore, changes in water temperature would not affect steelhead adult spawning and embryo incubation. However, continued degradation of spawning gravel quality in the lower Feather River would result in an adverse effect on steelhead adult spawning and embryo incubation by reducing the quality and quantity of available habitat.

Overall, operation of the Oroville Facilities under the No-Project Alternative would result in an adverse effect on steelhead adult spawning and embryo incubation.

Fry and Fingerling Rearing and Downstream Movement

Changes in flows under the No-Project Alternative would have no effect on steelhead fry and fingerling rearing and downstream movement. Differences in habitat suitability due to decreased water temperatures likely would be less than one percent between Existing Conditions and the No-Project Alternative. Therefore, changes in water temperature would not affect steelhead juvenile rearing and downstream movement. However, continued degradation of LWD, gravel, and side-channel habitat quality would result in an adverse effect on rearing and downstream movement.

Overall, operation of the Oroville Facilities under the No-Project Alternative would result in an adverse effect on steelhead fry and fingerling rearing and downstream movement.

Smolt Emigration

Changes in mean monthly flows under the No-Project Alternative would have no effect on steelhead smolt emigration. Differences in habitat suitability due to decreased water temperatures likely would provide a slight benefit under the No-Project Alternative relative to Existing Conditions.

Overall, operation of the Oroville Facilities under the No-Project Alternative likely would result in a slightly beneficial effect on steelhead smolt emigration.

Conclusions

Based on the above summary of potential effects, it is likely that the No-Project Alternative would have an overall adverse effect on steelhead, relative to Existing Conditions.

C2.4.4 American Shad

C2.4.4.1 Flow-Related Effects

No flow changes are anticipated to occur in the LFC under the No-Project Alternative relative to Existing Conditions. Slight changes in mean monthly flow during the American shad adult immigration and spawning period in the HFC would have no effect on American shad spawning, primarily because shad are broadcast spawners and fertilized eggs drift downstream with the current.

C2.4.4.2 Water Temperature–Related Effects

No water temperature changes are anticipated to occur in the LFC under the No-Project Alternative. Slight water temperature changes are anticipated to occur in the HFC as a result of increasing demand for water supply. However, analysis in the PDEA associated with implementation of the No-Action Alternative indicated that habitat suitability would change less than one percent as a result of changes in water temperatures. Additionally, because American shad appear to tolerate a broad range of water temperatures for spawning (between 46 and 79°F (Painter et al. 1979; Wang 1986)), water temperature changes likely to occur in the HFC would be too small to affect American shad spawning and adult immigration.

C2.4.4.3 Summary of Potential Effects on American Shad

Study plan report summaries addressing project effects on American shad are presented in Section G-AQUA1.4, Non-Salmonid Fish in the Feather River Downstream of the Thermalito Diversion Dam, in Appendix G-AQUA1 of the PDEA.

No flow or water temperature–related effects are expected to occur in the LFC under the No-Project Alternative. Flow changes in the HFC are not anticipated to alter river stage substantially over potential passage barriers in the lower Feather River, thereby having no effect on American shad adult immigration and spawning. Differences in habitat suitability due to water temperature changes would likely be less than one percent between Existing Conditions and the No-Project Alternative. Therefore, changes in water temperature would not affect American shad adult spawning.

Overall, operation of the Oroville Facilities under the No-Project Alternative is anticipated to have no effect on American shad adult immigration and spawning, relative to Existing Conditions.

C2.4.5 Black Bass

C2.4.5.1 Water Temperature–Related Effects

No water temperature changes are anticipated to occur in the LFC under the No-Project Alternative. Water temperatures downstream of the Thermalito Afterbay Outlet may decrease slightly under the No-Project Alternative, which could have a slight negative effect on Black bass in the upper reaches of the lower Feather River. However,

modeling conducted as part of the PDEA showed less than a one percent change in black bass habitat suitability.

C2.4.5.2 Summary of Potential Effects on Black Bass

Study plan report summaries addressing project effects on black bass species are presented in Section G-AQUA1.4, Non-Salmonid Fish in the Feather River Downstream of the Thermalito Diversion Dam; Section G-AQUA1.5, Fisheries Management; and Section G-AQUA1.11, Predation, in Appendix G-AQUA1 of the PDEA.

Differences in habitat suitability due to water temperature changes likely would be less than one percent between Existing Conditions and the No-Project Alternative. Therefore, changes in water temperature would not affect black bass adult spawning.

Overall, operation of the Oroville Facilities under the No-Project Alternative is anticipated to have no effect on black bass.

C2.4.6 Green Sturgeon

Study plan report summaries addressing project effects on green sturgeon are presented in Section G-AQUA1.4, Non-Salmonid Fish in the Feather River Downstream of the Thermalito Diversion Dam, in Appendix G-AQUA1 of the PDEA.

C2.4.6.1 Flow-Related Effects

No flow changes are anticipated to occur in the LFC under the No-Project Alternative. Changes in mean monthly flows in the HFC under the No-Project Alternative compared to Existing Conditions are anticipated to result in no effect on green sturgeon adult immigration and holding, adult spawning and embryo incubation, juvenile rearing, and juvenile emigration because the changes in river stage associated with changes in flows would be small. Because analytical tools such as PHABSIM were not available for use on this species, this assessment is based on a qualitative analysis.

C2.4.6.2 Water Temperature–Related Effects

No water temperature changes are anticipated to occur in the LFC. Small changes in water temperature may occur under the No-Project Alternative downstream of the Thermalito Afterbay Outlet where most sturgeon are observed.

Adult Immigration and Holding

Modeling conducted as part of the PDEA showed very small changes in water temperature in the HFC associated with the No-Action Alternative. However, changes in water temperature resulted in a less than one percent change in suitable habitat for this life stage. These changes are not expected to affect the green sturgeon adult immigration and holding life stage under the No-Project Alternative.

Adult Spawning and Embryo Incubation

Based on modeling conducted as part of the PDEA, differences in habitat suitability due to slightly lower water temperatures in the HFC between Existing Conditions and the No-Project Alternative indicate that habitat suitability would increase by approximately one percent under the No-Project Alternative. Therefore, changes in water temperature would provide a slight beneficial effect on green sturgeon adult spawning and embryo incubation.

Juvenile Rearing

Based on modeling conducted as part of the PDEA, differences in habitat suitability due to decreased water temperatures would be less than one percent between Existing Conditions and the No-Project Alternative. Therefore, changes in water temperature would not affect green sturgeon juvenile rearing.

Juvenile Emigration

Based on modeling conducted as part of the PDEA, differences in habitat suitability due to differences in water temperature between Existing Conditions and the No-Project Alternative indicate that habitat suitability would increase by approximately two percent under the No-Project Alternative. Therefore, changes in water temperature would provide a slight beneficial effect on green sturgeon juvenile emigration.

C2.4.6.3 Summary of Potential Effects on Green Sturgeon

No flow or water temperature–related effects are expected to occur in the LFC.

Adult Immigration and Holding

Flow changes in the HFC are not anticipated to appreciably change river stage over potential passage barriers in the lower Feather River below the Thermalito Afterbay Outlet, thereby having no effect on green sturgeon adult immigration and holding. Differences in habitat suitability due to decreased water temperatures are less than one percent between Existing Conditions and the No-Project Alternative.. Therefore, changes in water temperature would not affect green sturgeon adult immigration and holding.

Overall, operation of the Oroville Facilities under the No-Project Alternative is anticipated to have no effect on green sturgeon adult immigration and holding.

Adult Spawning and Embryo Incubation

Flow changes in the HFC are not anticipated to appreciably change river stage in the lower Feather River below the Thermalito Afterbay Outlet, thereby having no effect on green sturgeon adult spawning and embryo incubation. Differences in habitat suitability due to differences in water temperature between Existing Conditions and the No-Project Alternative indicate that habitat suitability would increase by approximately one percent

under the No-Project Alternative. Therefore, changes in water temperature would provide a slight beneficial effect on green sturgeon adult spawning and embryo incubation.

Overall, operation of the Oroville Facilities under the No-Project Alternative is anticipated to have a slight beneficial effect on green sturgeon adult spawning and embryo incubation.

Juvenile Rearing

Flow changes in the HFC are not anticipated to affect green sturgeon juvenile rearing because associated changes in river stage likely would result in very small changes in available rearing habitat area. Differences in habitat suitability due to decreased water temperatures are less than one percent between Existing Conditions and the No-Project Alternative. Therefore, changes in water temperature would not affect green sturgeon juvenile rearing.

Overall, operation of the Oroville Facilities under the No-Project Alternative is anticipated to have no effect on green sturgeon juvenile rearing.

Juvenile Emigration

Flow changes in the HFC are not anticipated to affect green sturgeon juvenile emigration because associated changes in river stage likely would result in very small changes in available habitat area. Differences in habitat suitability due to differences in water temperature between Existing Conditions and the No-Project Alternative indicate that habitat suitability would increase by approximately two percent under the No-Project Alternative. Therefore, changes in water temperature would provide a slight beneficial effect on green sturgeon juvenile emigration.

Overall, operation of the Oroville Facilities under the No-Project Alternative is anticipated to have a slight beneficial effect on green sturgeon juvenile emigration.

Conclusion

Based on the above summary of potential effects, it is likely that the No-Project Alternative would have an overall slight beneficial effect on green sturgeon, relative to Existing Conditions.

C2.4.7 Hardhead

C2.4.7.1 Water Temperature–Related Effects

No water temperature changes are anticipated to occur in the LFC. Small changes in water temperature may occur under the No-Project Alternative downstream of the Thermalito Afterbay Outlet.

Based on modeling conducted as part of the PDEA, differences in habitat suitability due to water temperature changes are less than one percent between Existing Conditions and the No-Project Alternative. Therefore, changes in water temperature in the HFC would not affect hardhead spawning.

C2.4.7.2 Summary of Potential Effects on Hardhead

Study plan report summaries addressing project effects on hardhead are presented in Section G-AQUA1.4, Non-Salmonid Fish in the Feather River Downstream of the Thermalito Diversion Dam, in Appendix G-AQUA1 of the PDEA.

Differences in habitat suitability due to water temperature changes would be less than one percent between Existing Conditions and the No-Project Alternative. Therefore, changes in water temperature would not affect hardhead spawning.

Conclusion

Overall, operation of the Oroville Facilities under the No-Project Alternative is anticipated to have no effect on hardhead, relative to Existing Conditions.

C2.4.8 River Lamprey

C2.4.8.1 Water Temperature–Related Effects

No water temperature changes are anticipated to occur in the LFC. Small changes in water temperature may occur under the No-Project Alternative downstream of the Thermalito Afterbay Outlet.

Based on modeling conducted as part of the PDEA, differences in habitat suitability due to water temperature changes would be less than one percent between Existing Conditions and the No-Project Alternative. Therefore, changes in water temperature would not affect river lamprey spawning.

C2.4.8.2 Summary of Potential Effects on River Lamprey

Study plan report summaries addressing project effects on river lamprey are presented in Section G-AQUA1.4, Non-Salmonid Fish in the Feather River Downstream of the Thermalito Diversion Dam, in Appendix G-AQUA1 of the PDEA.

Differences in habitat suitability due to water temperature changes are less than one percent between Existing Conditions and the No-Project Alternative. Therefore, changes in water temperature would not affect river lamprey spawning. However, continued degradation of spawning gravel quality in the lower Feather River would result in a slightly adverse effect on river lamprey adult spawning by reducing the quality and quantity of available habitat.

Conclusion

Overall, operation of the Oroville Facilities under the No-Project Alternative is anticipated to have a slightly adverse effect on river lamprey, relative to Existing Conditions.

C2.4.9 Sacramento Splittail

C2.4.9.1 Flow-Related Effects

No flow changes are anticipated to occur in the LFC. Downstream of the Thermalito Afterbay Outlet, mean monthly flow changes during the Sacramento splittail spawning period would not be of sufficient magnitude to result in any change in useable flooded area for Sacramento splittail spawning. Therefore, mean monthly flow changes under the No-Project Alternative would have no effect on Sacramento splittail spawning.

C2.4.9.2 Water Temperature–Related Effects

No water temperature changes are anticipated to occur in the LFC. Small changes in water temperature may occur under the No-Project Alternative downstream of the Thermalito Afterbay Outlet.

Based on modeling conducted as part of the PDEA, differences in habitat suitability due to water temperature changes would be less than one percent between Existing Conditions and the No-Project Alternative. Therefore, changes in water temperature would not affect Sacramento splittail spawning.

C2.4.9.3 Summary of Potential Effects on Sacramento Splittail

Study plan report summaries addressing project effects on Sacramento splittail are presented in Section G-AQUA1.4, Non-Salmonid Fish in the Feather River Downstream of the Thermalito Diversion Dam, in Appendix G-AQUA1 of the PDEA.

No flow or water temperature–related effects are expected to occur in the LFC. Flow changes in the HFC are not anticipated to decrease river stage appreciably over potential spawning benches in the lower Feather River, thereby having no effect on Sacramento splittail adult spawning. Differences in habitat suitability due to water temperature changes would be less than one percent between Existing Conditions and the No-Project Alternative. Therefore, changes in water temperature would not affect Sacramento splittail adult spawning.

Conclusion

Overall, operation of the Oroville Facilities under the No-Project Alternative is anticipated to have a no effect on Sacramento splittail, relative to Existing Conditions.

C2.4.10 Striped Bass

C2.4.10.1 Flow-Related Effects

No flow changes are anticipated to occur in the LFC. Mean monthly flow changes in the HFC during the striped bass adult spawning period are not expected to appreciably change river stage. Therefore, mean monthly flow changes under the No-Project Alternative would have no effect on striped bass spawning.

C2.4.10.2 Water Temperature–Related Effects

No water temperature changes are anticipated to occur in the LFC. Small changes in water temperature may occur under the No-Project Alternative downstream of the Thermalito Afterbay Outlet.

Based on modeling conducted as part of the PDEA, differences in habitat suitability due to water temperature changes would be less than one percent between Existing Conditions and the No-Project Alternative. Therefore, changes in water temperature would not affect striped bass spawning.

C2.4.10.3 Summary of Potential Effects on Striped Bass

Study plan report summaries addressing project effects on striped bass are presented in Section G-AQUA1.4, Non-Salmonid Fish in the Feather River Downstream of the Thermalito Diversion Dam, in Appendix G-AQUA1 of the PDEA.

No flow or water temperature–related effects are expected to occur in the LFC. Flow changes in the HFC are not anticipated to appreciably alter river stage in the lower Feather River, thereby having no effect on striped bass spawning. Differences in habitat suitability due to water temperature changes are less than one percent between Existing Conditions and the No-Project Alternative. Therefore, changes in water temperature would not affect striped bass spawning.

Conclusion

Overall, operation of the Oroville Facilities under the No-Project Alternative is anticipated to have a no effect on striped bass, relative to Existing Conditions.

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APPENDIX C3
IMPACTS OF THE PROPOSED PROJECT RELATIVE TO EXISTING CONDITIONS

This appendix provides a qualitative analysis of potential effects on aquatic resources with implementation of the Proposed Project, relative to Existing Conditions. Although the following topical outline is consistent for analysis of both circumstances, effects on several issue areas are not anticipated to occur under the Proposed Project. From an aquatic resources perspective, there are several differences between Existing Conditions and the Proposed Project. (See Section 3.3, Description of Alternatives Under Consideration, for a detailed description of the Proposed Project and Existing Conditions.) Net flow releases from the Oroville Facilities and reservoir water surface elevation fluctuations are anticipated to be the same as those under Existing Conditions with implementation of the Proposed Project. Therefore, no quantitative analysis is required or provided to analyze potential effects on aquatic resources associated with Feather River flow changes below the Thermalito Afterbay Outlet or reservoir surface elevation changes and the resultant effects on the quantity, quality, or distribution of fish habitat. The analysis of potential effects on aquatic resources in the Low Flow Channel (LFC) is partially quantitative based on previous modeling and Instream Flow Incremental Methodology (IFIM) studies conducted as part of the Preliminary Draft Environmental Assessment (PDEA).

Under the Proposed Project, flows in the LFC would increase from 600 cubic feet per second (cfs) to 700 cfs from April 1 through September 14 and 800 cfs from September 15 through March 31. Increased flow in the LFC would decrease water temperatures in the LFC and these decreased water temperatures likely would extend into the upper portions of the High Flow Channel (HFC). These flow and temperature changes are evaluated in the subsections below. Additional description and analysis of the flow changes are available in Section 5.2.1.4. A detailed description of the methodology used to analyze potential effects on aquatic resources is provided in Appendix C1, Aquatic Resources Methodology.

Other actions included in the Proposed Project and not included under Existing Conditions that are relevant to a qualitative assessment of potential effects on aquatic resources consist of: (1) installation of fish barrier weirs for the segregation of spring-run Chinook salmon spawning; (2) supplementing and improving large woody debris (LWD) in the lower Feather River; (3) supplementing and improving gravel substrate in the lower Feather River; (4) improving existing and creating new side-channel fish habitat; (5) implementation of a comprehensive water quality monitoring program that includes establishment of water temperature targets at the lower Project Boundary and the Feather River Fish Hatchery; (6) implementation of a Hatchery Adaptive Management Program and (7) implementation of a habitat expansion program for spring-run Chinook salmon and steelhead. These actions included in the Proposed Project are evaluated qualitatively in the subsections below.

In addition to the actions described above, the Settlement Agreement (SA) identified six potential future facility modifications that are being studied by the California Department of Water Resources (DWR) to try and identify the best means for improving water temperatures in the LFC and HFC to support anadromous salmonids over the term of the new Federal Energy Regulatory Commission (FERC) license. Measures identified for study include: (1) Palermo Canal Improvements; (2) a Hyatt Intake extension; (3) replacement of the river valve; (4) a diversion canal around Thermalito Afterbay; (5) a canal through Thermalito Afterbay; and (6) an alternate Thermalito Afterbay outlet and channel. Descriptions of these measures are provided in Section 3.3. For purposes of this analysis, effects of the potential future facility modifications on each fish species of management concern are evaluated qualitatively based on the general characteristics of each of the measures as they are currently defined following the qualitative evaluation used to describe conditions during the initial new license operating period prior to construction of any future facilities modifications. The environmental effects of the selected facilities modifications would be quantitatively evaluated in a subsequent environmental document, prior to their construction.

C3.1 HABITAT COMPONENTS AFFECTED BY THE OROVILLE FACILITIES

Implementation of some of the actions in the Proposed Project may involve instream construction activities or construction activities within areas adjacent to water bodies in the project area. Utilization of specific design elements, construction techniques, and aquatic conservation measures is incorporated into the proposed actions to minimize and avoid construction-related effects on species of management concern within the immediate vicinity of and downstream of the construction area. Construction activities would be scheduled to avoid impacts during critical life stages when those life stages would be unable to volitionally avoid the construction area (e.g., during salmonid embryo incubation). Additionally, construction-related effects on fisheries resources would be reduced through the implementation of standard construction best management practices (BMPs), and, if necessary, Erosion and Sediment Control Plans.

C3.1.1 Chinook Salmon Spawning Segregation

One or more fish segregation weirs would be installed in the lower Feather River downstream of the Fish Barrier Dam and upstream of the Thermalito Afterbay Outlet with implementation of the Proposed Project (SA Article A105). Installation of weirs may provide for some level of segregation between spring- and fall-run Chinook salmon and would reduce some of the existing adverse effects of high spawning densities in this reach of the lower Feather River. Appropriately placed weirs could potentially simulate historic spatial segregation of runs by selectively allowing or blocking fish passage on a temporal basis.

In addition to providing a mechanism for segregation of spring- and fall-run Chinook salmon, the fish segregation weirs would reduce the rates of redd superimposition and the resulting egg mortality for spring-run Chinook salmon. For a discussion of redd superimposition in the lower Feather River, see Study Plan [SP] F10, Task 2B, *Evaluation of Potential Effects of Facilities Operations on Spawning Chinook Salmon*, in

Section G-AQUA1.8.2 in Appendix G-AQUA1 of the PDEA. Using the fish segregation weir would manage the amount of available habitat to limit the number of early-arriving spawners allowed to enter a portion of the LFC reserved as a spring-run Chinook salmon spawning preserve, thus limiting the rate and adverse effects of redd superimposition, the level of competition for limited habitat, and the resulting contribution to pre-spawn mortality rates on spring-run Chinook.

Other potential benefits of installing weirs in the lower Feather River include providing a mechanism to allow collection of valuable data on timing, abundance, and movements of Feather River fish species. The installation of fish weirs would provide a flexible management tool for the reach of the Feather River between the Fish Barrier Dam and the Thermalito Afterbay Outlet.

Two fish weirs are proposed as part of the Proposed Project. The proposed location for the weir farthest upstream is near Bedrock Park at approximately River Mile (RM) 66. The proposed location for the second weir is downstream near Gateway Riffle at approximately RM 60. The installation of weirs in the lower Feather River may create some potential resource conflicts and necessitate some changes to project operations. For example, weirs could conflict with current fishing and boating recreation in this reach of the Feather River. See Section 5.7, Recreational Resources, for additional information on the potential recreational effects of this action. Additionally, placement of the upper weir at Bedrock Park would inhibit collection of fall-run Chinook salmon brood stock through the existing fish ladder located at the Fish Barrier Dam. The upstream fish barrier weir would include an egg taking station to replace fall-run Chinook salmon access to the Feather River Fish Hatchery fish ladder. Per the SA, the current locations under consideration for the implementation of the fish weirs are provisional and subject to review and comment by the Ecological Committee (EC). Fish weir installation would be subject to more detailed environmental impact analyses in a subsequent environmental document prior to implementation of this action.

C3.1.2 Macroinvertebrate Populations

Macroinvertebrate communities in the lower Feather River likely would benefit from implementation of the Proposed Project. LWD supplementation (under SA Article A104) would benefit macroinvertebrates by increasing habitat diversity and contributing organic nutrients relative to Existing Conditions. Gravel supplementation and improvement would reduce substrate armoring, thereby improving the quality of macroinvertebrate habitat. The side-channel improvement of Moe's Ditch and Hatchery Ditch, and the creation of new side channel habitat also would offer increased and more diverse habitat for aquatic macroinvertebrates.

C3.1.3 Woody Debris Recruitment

Implementation of the Proposed Project would include supplementing LWD in the lower Feather River to satisfy fish habitat improvement goals for the duration of the license period. (See Section 5.1 of the draft environmental impact report [DEIR], Geology, Soils, and Paleontological Resources, for additional information on LWD recruitment).

The reach of the Feather River extending from the Fish Barrier Dam downstream to the Thermalito Afterbay Outlet is used intensively as spawning habitat for anadromous salmonids, but has low availability of LWD. LWD supplementation in this area would: (1) contribute to both the geomorphic and ecological functions of the lower Feather River; (2) enhance rearing habitat for juvenile salmonids by providing cover; (3) create scour pools that may serve as holding habitat for anadromous salmonids; (4) trap sediment, allowing recruitment of riparian vegetation; and (5) provide an additional source of instream nutrients for aquatic organisms from decaying LWD. Additionally, LWD placed or recaptured in backwater mesohabitats below the Thermalito Afterbay Outlet may enhance habitat for warmwater species such as black bass, but could also potentially contribute to bass predation of juvenile salmonids to the extent that it does benefit these black bass species.

The Structural Habitat Supplementation and Improvement Program Plan (SA Article A104) included in the Proposed Project includes the placement of LWD in the lower Feather River primarily from the Fish Barrier Dam to the Thermalito Afterbay Outlet, and possibly in other locations downstream of the Thermalito Afterbay Outlet. In general, single logs, groups of logs, or combinations of logs and boulders that are anchored or cabled together would be placed in the river (Flosi et al. 1998). Anchoring would probably be required for projects that are intended to be site specific, such as riprapped banks or side channels. Wood may also be anchored at banks with cables or between natural or artificial structures.

Placement of LWD could create conflicts with landowners adjacent to the channel if bank erosion is inadvertently increased as a result of LWD-related flow diversion. (See Section 5.6.4 of the DEIR for additional information on potential effects of a LWD supplementation program on land use). Placement of LWD could also decrease river navigability in some areas. See DEIR Section 5.7.4 for additional information on potential effects of a LWD supplementation program on recreation.

Under current regulated-flow regimes, placements of LWD would provide localized benefits on fish habitat until a high-flow event. When a flood control event occurs, the magnitude of the flow event would redistribute both naturally recruited and supplemented LWD. This redistribution is a normal ecosystem function; however, the LWD in the upstream reaches of the LFC would need to be replaced or augmented following these events. In the event that LWD moves out of the Feather River during extreme flow events, it would provide fish habitat benefits downstream on the Sacramento River.

Because the specific methods, timing, and locations of the LWD placement program would be developed as an early license implementation task and are subject to EC review and comment, the LWD program would be subject to a more detailed analysis in a subsequent environmental document prior to the implementation of this action.

C3.1.4 Gravel Recruitment

The Proposed Project includes supplementing gravel in the lower Feather River at selected anadromous salmonid spawning riffles between the Fish Barrier Dam and Honcut Creek that would benefit from spawning substrate improvement. The Proposed Project also provides for the supplementation of appropriately sized salmonid spawning gravel in selected potential salmonid spawning areas of the lower Feather River where the substrate has become armored or sufficiently coarsened in particle size distribution to reduce salmonid spawning habitat quality. (See Section 4.1 of the DEIR for additional information on gravel conditions.)

Information gathered from SP-G2 has identified specific sites downstream of the Fish Barrier Dam and upstream of the Thermalito Afterbay Outlet that may benefit from supplementation of spawning gravel. Supplementation of gravel at these locations is intended to increase suitable spawning habitat quality and quantity for anadromous salmonids by restoring habitat substrate. The spawning Gravel Supplementation and Improvement Program under SA Article A101 would provide the greatest benefit to spawning areas in the upstream-most portions of the LFC below the Fish Barrier Dam because they currently have the most coarsened substrate particle size distribution, which currently is only marginally suitable for salmonid spawning (see SP-G2). Additionally, gravel supplemented near the base of the Fish Barrier Dam would be mobilized during high-flow events and would be redistributed downstream, mimicking normal gravel recruitment. Subsequent gravel placements would be required after future high-flow events to maintain benefits provided by supplementation of spawning gravel. Depending on the findings of surveys conducted after gravel supplementations, additional supplementations may be conducted in the same areas or certain sites may be abandoned. Likewise, potential sites that may benefit from mixing of armored gravel layers or removal of substrate particle sizes that are larger than considered suitable for salmonid spawning (potentially through ripping or raking) were identified in SP-G2. The improvement of spawning substrate in the upstream reaches of the LFC complements the function of the fish barrier weirs—spatial segregation of spring-run Chinook salmon—by providing habitat enhancements in those locations that provide direct benefits to Endangered Species Act (ESA)–listed species (i.e., spring-run Chinook salmon and steelhead).

Because the specific methods, timing, and locations of the gravel supplementation program would be developed as an early license implementation task and are subject to EC review and comment, the Gravel Supplementation and Improvement Program would be subject to a more detailed analysis in a subsequent environmental document prior to implementation of this action.

C3.1.5 Channel Complexity

Implementation of the Proposed Project includes the Channel Improvement Program (SA Article A103) to enhance existing side-channel habitat in Hatchery Ditch and Moe's Ditch, both located downstream of the Fish Barrier Dam adjacent to the Feather River Fish Hatchery. Enhancements to these existing side channels could include reforming

the channel for increased water depth and shoreline diversity, placing boulders and woody debris for cover and velocity diversity, and gravel substrate supplementation. Moe's Ditch enhancements may also include removal of a beaver dam that currently blocks flows at the downstream end of the channel (see Section 5.5, Terrestrial Resources, of the DEIR for additional discussion). The enhancement of these existing side channels primarily would benefit steelhead and spring-run Chinook salmon by increasing the quantity and quality of spawning and rearing habitat.

Additionally, the Proposed Project includes development of five additional side channel riffle/glide complexes over a 5-year period, which would provide a minimum of 2,460 feet of new spawning and rearing habitat for Chinook salmon and steelhead. All side channels created would be adjacent to existing riffle complexes and would approximate historic habitat with respect to base flow ranges and other environmental conditions. Side channel flows likely would range between 10 cfs and 75 cfs and would be designed to provide appropriate depth, velocity, substrate, and instream and riparian cover to benefit primarily juvenile salmonid rearing, but also potentially benefit steelhead spawning as specific side channel construction site conditions allow. To the extent possible, side channel development would coincide with gravel supplementation activities or other habitat improvement measures occurring in the vicinity to minimize habitat disruption as well as facilitate complementary design features among the actions.

Because the methods, timing, and locations of the side channel enhancement and creation would be developed as an early license implementation task and are subject to EC review and comment, the Channel Improvement Program would be subject to a more detailed analysis in a subsequent environmental document prior to implementation of this action.

C3.1.6 Water Quality Criteria for Aquatic Life

Existing water quality conditions for aquatic life (see Section 4.4, Aquatic Resources, in the DEIR) are not expected to change with implementation of the Proposed Project, with the exception of potential short-term water quality effects associated with instream construction activities and slightly cooler water temperatures associated with higher flows in the LFC. See also Section 5.2.2, Surface Water Quality, for the evaluation of construction-related effects on water quality.

As part of the Proposed Project (SA Article A112), permanent continuous water temperature monitoring devices would be installed at the Feather River Fish Hatchery, Robinson Riffle, the Thermalito Afterbay Outlet, and in the lower Feather River adjacent to the lower FERC Project boundary. These monitoring devices would aid in the implementation of the flow and water temperature improvements described in Section C3.1.7 below.

C3.1.7 Flow and Temperature Improvements

Establishment of new water temperature targets at Robinson Riffle and increased minimum instream flows in the LFC would be beneficial to coldwater aquatic resources because they would result in lower water temperatures to improve aquatic habitat conditions. These improvements would be made immediately upon issuance of the new FERC license, and would be in place during the period referred to as "the initial new license operating period" in this document. Further lowering of water temperatures benefiting coldwater species would occur with implementation of the facilities modifications subsequent to the initial new license operating period.

The Proposed Project includes measures to provide water temperatures in the Feather River Fish Hatchery suitable for all salmonid life stages as needed to achieve production goals. Project operations and/or facilities would be modified to meet temperature objectives as specified in Table C3.1-1.

Table C3.1-1. Initial new license period water temperature targets for the Feather River Fish Hatchery.

Time Period	SA Table 107A Daily Mean Maximum (°F)	SA Table 107B Hourly Mean Maximum (°F)
September	56	56
October–November	55	55
December–March	55	55
April–May 15	55	55
May 16–May 31	55	59
June 1–June 15	60	60
June 16–August 15	60	64
August 16–August 31	60	62

The temperatures in the second column of Table C3.1-1 are the initial new license period maximum daily mean temperature targets that DWR would seek to achieve through the use of operational measures until facilities modifications are completed. After facility modifications are completed, and no later than the end of year 10 following license issuance, these temperatures would become requirements. At that time, water temperature objectives listed in the table may be altered, but would not become less protective than those depicted in the second column (SA Table 107A). The hourly maximum temperatures depicted in the third column of Table C3.1-1 (SA Table 107B) represent the upper end of the existing hatchery temperature criteria and at no instance shall DWR exceed these temperatures. There shall be no minimum temperature requirement except for the period of April 1 through May 31, during which the temperatures shall not fall below 51 degrees Fahrenheit. See Section 3.3.2.3, Environmental Facilities and Operations, of the DEIR for a more detailed description of

the hatchery water temperature target and potential requirement development after the construction and testing of any future facilities modifications that may be constructed.

Also included in the Proposed Project are new water temperature targets at Robinson Riffle in the LFC. These new targets are shown in Table C3.1-2.

Table C3.1-2. Water temperature targets at Robinson Riffle.

Dates	Current Mean (°F)	Proposed Project Max. Mean (°F)
May 1–May 15	--	56–63
May 16–May 31	--	63
June 1–August 31	≤ 65	63
September 1–September 08	≤ 65	63–58
September 9–September 30	≤ 65	58
October 1–April 30	--	56

The Proposed Project also includes the development of water temperature requirements for the HFC as measured at the downstream end of the FERC Project boundary. Upon completion of facilities modifications, temperatures depicted in Table C3.1-3 would be evaluated and new targets will be developed, achievement of which at the lower Project Boundary would be verified during a testing period. During the initial new license period, facilities operations would not be changed to meet the temperatures depicted in Table C3.1-3. At the end of the initial new license period, when facility modifications have been completed, there would be 5 years of operational testing to determine what water temperatures can be achieved at the southern project boundary. After testing and verification that they could be achieved, these water temperatures would become requirements. See Section 3.3 of the DEIR for a more detailed description of the Table 1, Robinson Riffle, and Table 2, lower Project boundary, water temperature targets and potential requirement development after the construction and testing of any future facilities modification.

Table C3.1-3. Temperature objectives (maximum mean daily value) for the HFC at the downstream lower Feather River project boundary.

Month	Water Temperature (° F)
April	61
May–August	64
September	61
October	60
November–March	56

Because potential future facilities modifications have not been selected, the alternative design details have not been defined, and the potential combinations of measures into alternatives have not been selected, the final water temperature requirements, as well as the other potential resources effects, are currently unknown and cannot be evaluated in detail at this time. As a result of the unavailability of the definitive characteristics of this action, only the general characteristics of the potential facilities modifications can be qualitatively evaluated for their potential affects on the aquatic resources. Potential future facilities modifications would be evaluated in detail in a subsequent environmental document prior to their construction.

Potential future facilities modifications are described in Section 3.3.2.3 of the DEIR. All of these modifications are designed to reduce water temperatures in the LFC and HFC of the lower Feather River and will benefit coldwater fisheries, particularly anadromous salmonids. DWR has identified seven potential facility modifications.

The Palermo Canal improvements, Hyatt intake extension, and river valve improvement measures are each conceptualized to increase access to coldwater pool reserves in Lake Oroville. These measures for increased coldwater pool access are primarily designed to improve water temperatures at the Feather River Fish Hatchery and in the LFC from the Fish Barrier Dam downstream to Robinson Riffle, the Table 1 water temperature compliance point. These measures also are intended to reduce water temperatures below Robinson Riffle in the LFC and to improve water temperature conditions in the HFC from the Thermalito Afterbay Outlet downstream to the lower FERC Project boundary, the proposed lower Project boundary water temperature compliance point.

Both the river valve and the Hyatt intake extension measures would enable DWR to release cold water below the Oroville Dam into the Diversion Pool and reduce the water temperatures of the entire volume of water released from Lake Oroville. Cooling the entire volume of water released from Lake Oroville would reduce water temperatures in the Diversion Pool and Thermalito Forebay, benefiting those coldwater fisheries resources, the Feather River Fish Hatchery water intake, and the coldwater fisheries resources in the lower Feather River downstream from the Fish Barrier Dam. Because water temperatures are reduced for the entire volume of water released from Lake Oroville, water temperatures in the Thermalito Afterbay also would be reduced, which would reduce the quantity and quality of warmwater fisheries habitat.

The Palermo Canal improvements would release cold water at the intake for the Diversion Dam and minimize the mixing of the cold water release with the water volume in the Diversion Pool prior to discharge to the lower Feather River. Therefore, the Palermo Canal improvements would not benefit the coldwater fisheries in the Diversion Pool or the Thermalito Forebay, but also would not reduce the quantity or quality of warmwater fisheries in the Thermalito Afterbay.

The Feather River Fish Hatchery water supply intake would be provided by using a portion of the Palermo Canal improvement facilities releases to blend with the Diversion

Pool supplies to meet the hatchery water temperature requirements. The upper portion of the LFC would benefit from the release of cold water from the Palermo Canal as a result of improved water temperature suitability for coldwater fisheries. The remainder of the Palermo Canal improvement releases would be transported via pipeline for release at a location farther down the LFC to further enhance the quantity and quality of available coldwater fisheries habitat. Two of the potential locations under consideration for the potential release of this second component of flow from the Palermo Canal improvements are immediately above Robinson Riffle in the LFC or at the bottom of the LFC immediately above the Thermalito Afterbay Outlet. The release location of the second flow component from the Palermo Canal improvements would be evaluated as part of future feasibility studies and subject to review and comment by the EC. It should be noted that the potential biological benefits of the flow release above Robinson Riffle would be substantially higher than the release at the Thermalito Afterbay Outlet. The increased biological benefit of this release location is due to increased spawning habitat suitability for the spawning areas at and immediately downstream of Robinson Riffle, the opportunity to create a side channel that utilizes the discharge water and could be designed to benefit steelhead spawning and rearing (the most limited type of habitat in the lower Feather River), and avoiding the creation of a coldwater refugium that could prolong spring-run Chinook salmon holding in the Afterbay Outlet Pool, which has the highest fishing pressure and poaching potential in the lower Feather River.

The four Thermalito Afterbay measures under study are intended to complement the selected upstream coldwater pool access measure and primarily benefit water temperatures in the lower Feather River below the Thermalito Afterbay Outlet downstream to the lower FERC Project boundary, which is the Table 2 water temperature target location. The four Thermalito Afterbay measures under consideration include: (1) a canal around the Thermalito Afterbay; (2) a canal through the Thermalito Afterbay; (3) an extension of the current Thermalito Afterbay Outlet to release water farther downstream (near the lower FERC Project boundary); and (4) a Thermalito Afterbay water temperature curtain. Of the potential Thermalito Afterbay measures, the canal around the Thermalito Afterbay, a canal through the Thermalito Afterbay, and the Thermalito Afterbay water temperature curtain may provide cooler water temperatures in the HFC during the spring and early summer, but may result in warmer water temperatures in the late summer and fall.

The canal in Thermalito Afterbay may reduce the water temperatures along the northern margins of the afterbay, depending on the specific facilities design, which would result in a water temperature reduction in the locations of the majority of the black bass spawning, which could potentially affect the sustainability of this recreational fishery. The Thermalito Afterbay water temperature curtain may help mitigate the impacts of the upstream measures on water temperatures in the afterbay. This measure would utilize a baffle (temperature curtain) to direct cold water through the afterbay, thus allowing colder water to flow through the eastern portion of the afterbay more quickly, while increasing the residence time of warmer water utilized for agricultural diversions from the western side of the afterbay. The Thermalito Afterbay Outlet extension likely performs best for water temperature reduction in the lower Feather River as LFC water temperatures would be allowed to continue farther downstream before the warmer

Thermalito Afterbay discharge would be mixed with the cooler LFC water. It should be noted that the majority of the anadromous salmonid spawning habitat occurring in the HFC occurs upstream of the discharge location discussed for the Afterbay Outlet extension.

C3.1.8 Habitat Expansion

The Habitat Expansion Agreement (SA Appendix F) included in the Proposed Project is an effort to increase production of spring-run Chinook salmon and steelhead. The goal of the measure is to expand existing habitat within the Sacramento River basin to accommodate an increase of 2,000 to 3,000 spring-run Chinook salmon or steelhead for spawning. Potential habitat expansion actions likely would not occur within the FERC Project boundary. Potential measures include dam removal, flow and water temperature improvements, new fish passage structures or programs, improvement of existing fish passage structures and programs, gravel supplementation at existing habitat, or riparian vegetation enhancements. Habitat expansion actions also would include future operation and maintenance actions if required after implementation, but would not include long-term monitoring of species utilization or benefit.

Because the nature and locations of the habitat expansion actions are not currently known and are subject to National Marine Fisheries Service (NMFS) review and approval prior to implementation, the potential effects of the habitat expansion actions would be subject to subsequent environmental analysis and documentation prior to implementation of specific actions.

C3.2 WARMWATER RESERVOIR FISHERIES

C3.2.1 Operations-Related Effects

C3.2.1.1 Spawning and Initial Rearing

No changes in reservoir water surface elevations, rates of reduction, or surface elevation fluctuations in Lake Oroville or Thermalito Afterbay are anticipated with implementation of the Proposed Project as compared to Existing Conditions. Therefore, the potential for bass nest dewatering would not change. Consequently, no impacts on black bass spawning and rearing are anticipated with implementation of the Proposed Project, relative to Existing Conditions.

C3.2.1.2 Fish Interactions

No changes in fish stocking or in the frequency of sediment wedge exposure from Lake Oroville water surface elevation fluctuations are anticipated with implementation of the Proposed Project as compared to Existing Conditions. Interactions among fish species upstream of Oroville Dam are anticipated to be the same under the Proposed Project, relative to Existing Conditions..

C3.2.2 Fisheries Management–Related Effects

C3.2.2.1 Stocking

No changes in warmwater fish stocking or the existing habitat enhancement program are anticipated with implementation of the Proposed Project as compared to Existing Conditions.

C3.2.2.2 Disease

No changes in the types of warmwater fish diseases or rates of disease transmission are anticipated with implementation of the Proposed Project as compared to Existing Conditions.

C3.2.2.3 Recreational Access or Fishing Regulations

As described in Section 5.7.4 of the DEIR, recreation enhancements included in the Proposed Project are anticipated to result in increased recreation and angling. Increased angling is expected to result in increased sport fish harvest. For example, fishing access would be increased through the construction of a fishing pier or platform at the Diversion Pool and South Forebay Day Use Area (DUA), and increased shoreline access in the north Thermalito Forebay through the construction of trails. No changes in regulations for warmwater sport fishing are anticipated with implementation of the Proposed Project. Increased access and consequent increased harvest of warmwater fish species with no corresponding changes to current regulations could negatively impact warmwater species within the project area.

C3.2.3 Summary of Potential Effects on Warmwater Reservoir Fisheries

Implementation of the Proposed Project would be beneficial to the quality and quantity of warmwater fish habitat available in Lake Oroville but not other Oroville Facilities reservoirs. However, increased levels of harvest through increased angling could have a negative impact on current warmwater fish populations in some of these reservoirs.

C3.3 COLDWATER RESERVOIR FISHERIES

C3.3.1 Operations-Related Effects

C3.3.1.1 Habitat Availability

No changes in reservoir water surface elevations and the associated quality and quantity of effective available coldwater pool habitat in Lake Oroville are anticipated with implementation of the Proposed Project as compared to Existing Conditions. Therefore, no changes to coldwater fish habitat are anticipated under the Proposed Project relative to Existing Conditions.

C3.3.1.2 Fish Interactions

No changes in fish stocking or in the frequency of sediment wedge exposure from Lake Oroville water surface elevation fluctuations are anticipated with implementation of the Proposed Project as compared to Existing Conditions. Therefore, no differences in fish species interactions upstream of Oroville Dam, in Thermalito Forebay, or in Thermalito Afterbay are anticipated with implementation of the Proposed Project, relative to Existing Conditions.

C3.3.2 Fisheries Management–Related Effects

C3.3.2.1 Stocking

No changes in existing coldwater fish stocking are anticipated with implementation of the Proposed Project as compared to Existing Conditions.

C3.3.2.2 Disease

No changes in potential exposure to fish diseases are anticipated with implementation of the Proposed Project as compared to Existing Conditions.

C3.3.2.3 Recreational Access or Fishing Regulations

Recreation enhancements included in the Proposed Project are anticipated to increase recreation and angling. Increased angling is expected to result in increased sport fish harvest. Fishing access would be increased through the construction of a fishing pier or platform at the Diversion Pool and South Forebay DUA, and increased shoreline access in the north Forebay through the construction of trails. See DEIR Section 5.7.4 for additional information on recreation enhancements considered in the Proposed Project. No changes in regulations for coldwater sport fishing are anticipated with implementation of the Proposed Project. Increased access and consequent increased harvest of coldwater fish species, with no corresponding changes to current fishing regulations, could negatively impact coldwater species within the project area.

C3.3.3 Summary of Potential Effects on Coldwater Reservoir Fisheries

Implementation of the Proposed Project during the initial new license period is not expected to affect the quality or quantity of coldwater fish habitat available in Oroville Facilities reservoirs. However, increased levels of harvest could have a negative effect on current stocked coldwater fish populations as compared to Existing Conditions.

Potential coldwater fisheries reservoir resource effects associated with implementation of any future facilities modifications and the potential development of new water temperature requirements at the hatchery, Table 1 targets at Robinson Riffle, and Table 2 objectives at the lower FERC Project boundary, would be evaluated in a subsequent environmental document prior to their construction.

C3.4 LOWER FEATHER RIVER FISH SPECIES

The overall determination of effects on each species of primary management concern in the lower Feather River with implementation of the Proposed Project incorporates the types of effects associated with each proposed measure included in the Proposed Project for each life stage of the species. Qualitative analyses were performed on various potential effects resulting from implementation of the Proposed Project to determine the incremental effects associated with each proposed measure. The results of the effects analysis of each proposed measure on each life stage were synthesized to determine the overall effects of the Proposed Project on the species. As needed, subsequent environmental documentation and evaluation of potential project effects would be developed to address additional details and implementation plans of actions prior to their implementation.

C3.4.1 Fall-run Chinook Salmon

Study plan report summaries addressing project effects on fall-run Chinook salmon are presented in Section G-AQUA1.3, Fish and Their Habitat within Lake Oroville, its Upstream Tributaries, the Thermalito Complex, and the Oroville Wildlife Area; Section G-AQUA1.5, Fisheries Management; Section G-AQUA1.8, Salmonids and Their Habitat in the Feather River Below the Fish Barrier Dam; and Section G-AQUA1.11, Predation, in Appendix G-AQUA1 of the PDEA. A description of each life stage for fall-run Chinook salmon and the time period associated with it is presented in Appendix G-AQUA1 of the PDEA and Appendix C1 of the DEIR.

C3.4.1.1 Flow-Related Effects

Adult Immigration and Holding

Increases in flows from 600 cfs to 700 cfs from April 1 through September 14 and to 800 cfs from September 15 through March 31 in the LFC under the Proposed Project could potentially have a beneficial effect on immigrating and holding fall-run Chinook salmon by increasing the lower Feather River stage over potential critical riffles. Although stage increases would be small, shallow riffles could potentially become deeper, reducing the effort required by immigrating adult fall-run Chinook salmon to proceed through shallow riffles. In addition, water depth would be increased, creating additional amounts of suitable holding habitat.

Flow fluctuations that could potentially occur in the HFC under the Proposed Project would be similar to flow fluctuations that occur under Existing Conditions. Because flow fluctuations currently do not affect fall-run Chinook salmon adult immigration and holding (see SP-F10 Task 1C and SP-F10 Task 1E), flow fluctuation under the Proposed Project also would not affect fall-run Chinook salmon adult immigration and holding.

Adult Spawning and Embryo Incubation

Under the Proposed Project, flows in the LFC would be 800 cfs during the adult spawning and embryo incubation life stage. Flow fluctuations in the LFC could potentially occur under the Proposed Project to meet water temperature objectives prescribed to protect fisheries resources.

Increased flow releases to meet water temperature objectives during September could potentially affect fall-run Chinook salmon spawning and embryo incubation by causing redd dewatering, which could occur as flows return to normal after water temperature objectives are met. Because increasing flows to meet water temperature objectives also increases river stage, spawning individuals could potentially construct redds in areas that could be dewatered as flows are lowered to normal levels (800 cfs). However, based on available stage-discharge relationships and Chinook salmon redd water depth distribution from the SP-F16 report (see Section G-AQUA1.10 of Appendix G-AQUA1, Affected Environment, of the PDEA), the first redds would not be dewatered until there was more than a 0.4-foot change in stage elevation. Water temperature control flow changes are at or less than 200 cfs, and with flows in the range of 800 cfs to 1,000 cfs, all of the spawning riffle stage elevations are anticipated to change less than 0.4 foot. The shallowest redd depth reportedly observed in the lower Feather River is 0.7 foot (DWR 2003). This analysis indicates that no redds would be dewatered during water temperature control–related flow changes in the LFC.

Evaluation of the Weighted Usable Area (WUA) index generated by the PHABSIM model for the adult spawning life stage of Chinook salmon (spring-run and fall-run) indicated that the maximum amount of spawning area in the LFC, given the current channel configuration, would occur at flows from 800 to 825 cfs (DWR 2004). Figure C3.4-1 shows the WUA curve generated by the PHABSIM model for Chinook salmon spawning in the LFC.

Flows in the LFC during the Chinook salmon spawning period would be 600 cfs under Existing Conditions, resulting in approximately 91 percent of maximum WUA. Flows in the LFC during the Chinook salmon spawning period would be 800 cfs under the Proposed Project, which would result in almost 100 percent of maximum WUA, representing an increase in the quantity of available spawning habitat compared to Existing Conditions and the No-Project Alternative.

Under the Proposed Project, flows and flow fluctuations occurring in the HFC are not expected to differ from flows or flow fluctuations that would occur under Existing Conditions as described in Section 4.2, Surface Water Quantity and Quality, of the DEIR. Because there would be no changes in flows or flow fluctuations in the HFC with implementation of the Proposed Project, as compared to Existing Conditions, there would not be a change in the amount of spawning habitat available for fall-run Chinook salmon or in rates of redd dewatering occurring in the HFC.

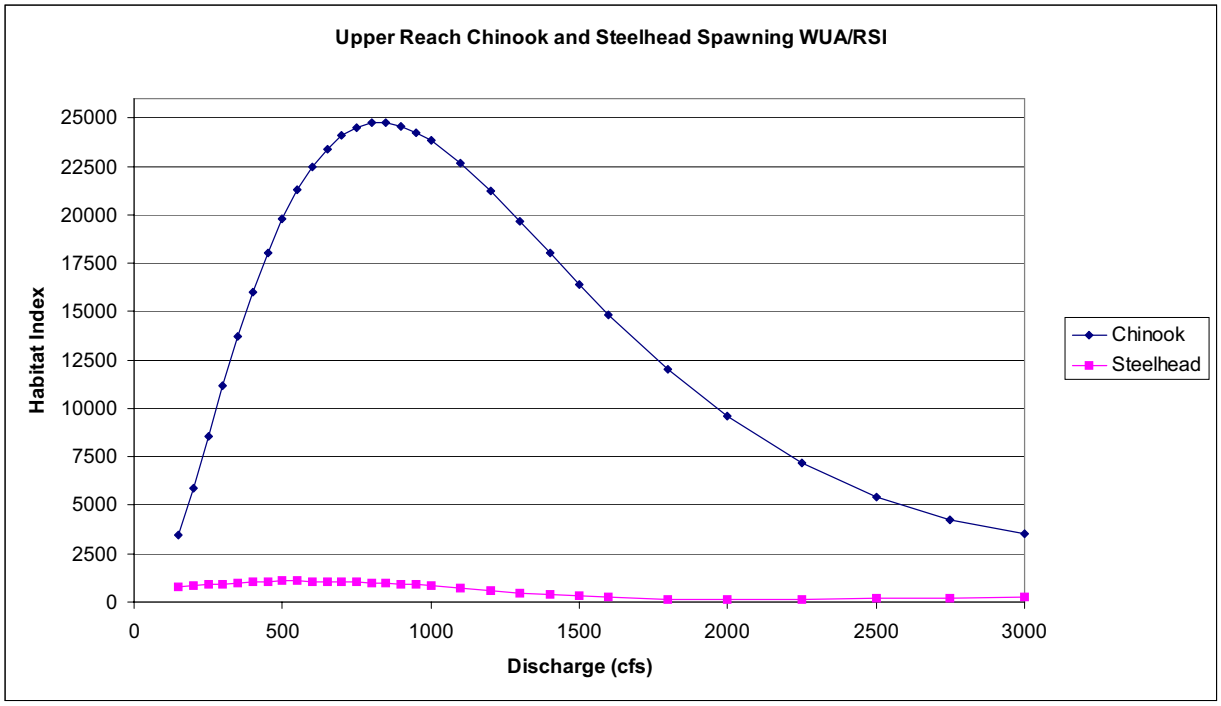

Figure C3.4-1. LFC Weighted Usable Area curves for Chinook salmon.

Juvenile Rearing and Downstream Movement

Increased flows in the LFC under the Proposed Project, relative to Existing Conditions, would increase river stage slightly and could potentially increase available rearing habitat for juvenile salmonids, including fall-run Chinook salmon. However, the increase in river stage associated with a 100-cfs to 200-cfs increase in flow likely would be insufficient to appreciably increase rearing habitat availability. Therefore, increased flows would have no effect on fall-run Chinook salmon juvenile rearing and downstream movement.

Flow fluctuations in the LFC could potentially occur under the Proposed Project to meet water temperature objectives prescribed to protect fisheries resources. Flow fluctuations could result in juvenile salmonid stranding in isolation ponds or beach stranding. However, isolation ponds do not occur in the LFC below 1,200 cfs; therefore, no isolation pond–related stranding is anticipated with implementation of the Proposed Project. Beach stranding could occur with changes in water surface elevation from changes in flows. Juvenile salmonids tend to select deeper water with increased size and become less susceptible to beach-type stranding as they grow. Typically flow fluctuations for water temperature control in the LFC during the summer are expected to be 200 cfs or less. A large portion of the juvenile fall-run Chinook salmon population emigrates from the Feather River system before May and therefore would not be subjected to potential beach stranding from flow fluctuations associated with implementation of the Proposed Project. Those juvenile fall-run Chinook salmon with prolonged rearing periods would be larger and have deeper water depth preferences

before May; therefore, they are less susceptible to beach stranding from flow fluctuations. However, some beach stranding could occur due to flow fluctuations occurring under the Proposed Project. Because water temperature control–related flow changes typically are 200 cfs or less and occur in the summer when rearing juveniles are larger and have preference for deeper water, rearing juvenile fall-run Chinook salmon would not be susceptible to beach stranding resulting from water temperature control–related flow changes.

Implementation of the Proposed Project would not result in any change in the frequency or magnitude of flow fluctuations in the HFC compared to Existing Conditions; therefore, no change in the rate of stranding by juvenile fall-run Chinook salmon would occur in the HFC.

C3.4.1.2 Water Temperature–Related Effects

The analysis of water temperature–related effects is qualitative and based on increased flows in the LFC as proposed in the Proposed Project, relative to Existing Conditions. Increased flows would result in cooler water temperatures in the LFC during most of the year. Additionally, because the LFC would be contributing a higher proportion of overall flow in the lower Feather River, decreases in water temperature are anticipated to extend downstream of the Thermalito Afterbay Outlet.

The California Central Valley Chinook salmon population is at the extreme southern limit of the species range. Water temperature regimes experienced by these populations are different than those experienced by more northern populations. Low water temperatures are rarely a concern in the Sacramento River system. However, warm water temperatures are a critical management issue. Therefore, in general, actions that reduce water temperatures are considered beneficial to all races of Central Valley Chinook salmon.

Adult Immigration and Holding

As a result of increased flows in the LFC, water temperatures in the lower Feather River would be cooler under the Proposed Project, relative to Existing Conditions. Cooler water temperature–related effects on the adult immigration and holding life stage of Chinook salmon would range from insignificant to slightly beneficial. Cooler water extending downstream of the Thermalito Afterbay Outlet also would have an insignificant to slightly beneficial effect on this life stage.

Adult Spawning and Embryo Incubation

Most Chinook salmon spawning in the Feather River occurs in the LFC. With implementation of the Proposed Project, water temperatures are expected to generally decrease, relative to Existing Conditions. Therefore, implementation of the Proposed Project would likely be beneficial to Chinook salmon spawning and embryo incubation. Additionally, because cooler water temperatures would persist downstream into the

HFC, additional suitable spawning habitat may become available for Chinook salmon spawning.

Juvenile Rearing and Downstream Movement

Unlike spring-run Chinook salmon, which may rear year round in the lower Feather River, fall-run Chinook salmon begin their outward migration shortly after emergence and may occur as early as November. Most fall-run Chinook salmon reportedly have emigrated from the Feather River by June. Therefore, effects of cooler water temperatures during the Chinook salmon juvenile rearing and downstream movement life stage period in the lower Feather River resulting from implementation of the Proposed Project likely would be insignificant.

C3.4.1.3 Predation-Related Effects

Changes in minimum flows in the LFC associated with implementation of the Proposed Project are not expected to change the nature or rate of predation on fall-run Chinook salmon, relative to Existing Conditions. Water temperature changes would be small and are not expected to change the distribution, species composition, consumption rates, or nature of predation in the lower Feather River. Changes in hatchery-produced steelhead release practices may reduce predation on naturally produced juvenile fall-run Chinook salmon. The Structural Habitat Supplementation and Improvement Program would improve juvenile Chinook salmon rearing cover conditions, resulting in an overall reduction of predation rates on juvenile fall-run Chinook salmon.

C3.4.1.4 Fisheries Management–Related Effects

Hatchery

A Hatchery Adaptive Management Program included in the Proposed Project (SA Article A107) considers a range of potential changes in Feather River Fish Hatchery practices designed to reduce adverse effects of the hatchery on wild fish stocks and to improve the benefits to the Chinook salmon produced by the hatchery. Changes in hatchery practices intended to more successfully identify and true-breed spring-run and fall-run Chinook salmon would reduce the amount of genetic introgression between these two runs that may have previously occurred in the hatchery. Other potential adaptive management elements may include changes in steelhead size at release and timing of release to reduce potential steelhead predation on juvenile Chinook salmon. Other adaptive management elements could include changes to raceways at the Feather River Fish Hatchery to alter rearing fish conditioning to improve predator avoidance and cover use upon release. An enhanced fish marking program included as one of the potential actions in the adaptive management portion of the program would improve the ability to measure hatchery performance and increase the understanding of the fisheries resources in the lower Feather River. The hatchery program also includes the development of Hatchery Genetic Management Plans (HGMPs) for each of the anadromous fish species managed by the hatchery.

Disease

Water temperature changes associated with implementation of the Proposed Project would be relatively small; therefore, no changes in water temperature–related incidence of fish disease are anticipated. The potential hatchery water treatment action associated with the hatchery improvement program could reduce the incidence and severity of disease in the Feather River Fish Hatchery, which would lower overall disease pressure in the lower Feather River.

Fishing Regulations, Poaching, and Change in Recreational Access and Visitation

Recreation enhancements included in the Proposed Project (see Section 5.7.4 of the DEIR) are anticipated to increase recreation and angling. Increased angling is expected to result in increased sport fish harvest. Fishing access in the lower Feather River is anticipated to increase with the implementation of the Proposed Project through the implementation of recreation enhancements (e.g., construction of a paved trail from the fish hatchery downstream to the FERC project boundary) included in the Proposed Project.

Installation of fish barrier weirs in the Lower Feather River would require no-fishing zones in the immediate proximity of the installations. Although the fish barrier weirs would be navigable by boats, the presence of the weirs may affect boating recreation activities to some degree (see Section 5.7.4 for additional information about effects of fish barrier weirs on recreation). Increased densities of fish below the fish barriers and river access on the weirs may potentially contribute to fish poaching opportunities with implementation of the Proposed Project.

C3.4.1.5 Summary of Potential Effects on Fall-run Chinook Salmon

Adult Immigration and Holding

Actions potentially affecting fall-run Chinook salmon adult immigration and holding include changes to instream flows and water temperatures in the LFC, a hatchery adaptive management program, fish barrier weirs, and LWD supplementation.

Increased stream flows of 700 cfs to 800 cfs in the LFC under the Proposed Project could potentially benefit immigrating fall-run Chinook salmon by increasing lower Feather River stage elevations. Although stage increases would be small, shallow riffles could potentially become deeper, reducing the effort required by immigrating fall-run Chinook salmon to proceed through shallow riffles. Additionally, increasing flows would slightly reduce average daily water temperatures, thereby increasing overall habitat suitability during the immigration and holding period.

The hatchery adaptive management program would potentially have a beneficial effect on immigrating adult fall-run Chinook salmon by allowing more accurate identification of returning Feather River Fish Hatchery fish and by increasing genetic isolation between

runs, thereby potentially reducing effects on phenotypic separation with respect to immigration timing.

Installation of fish barrier weirs would have a beneficial effect on fall-run Chinook salmon immigration by eliminating fishing pressure in the no-fishing zones in the vicinity of the fish barrier weirs. It would also increase genetic segregation of runs by spatially segregating holding adult spring-run Chinook salmon from immigrating fall-run Chinook salmon. However, the potential for increased poaching of fall-run Chinook salmon in the vicinity of the fish barrier weirs likely would be increased because of higher fish densities and increased access to the lower Feather River in those locations.

LWD supplementation would have a beneficial effect on immigrating adult fall-run Chinook salmon by creating potential velocity refuges.

Overall, implementation of the Proposed Project would result in a beneficial effect on fall-run Chinook salmon adult immigration and holding.

Spawning and Embryo Incubation

Actions potentially affecting fall-run Chinook salmon adult spawning and embryo incubation include changes to instream flows and water temperatures in the LFC, a hatchery adaptive management program, fish segregation weirs, gravel supplementation, and creation and enhancement of additional side-channel habitat.

An increase in instream flows in the LFC from 600 cfs to 800 cfs during the adult spawning and embryo incubation period would increase WUA from 91 percent of maximum to almost 100 percent. Reduced average daily water temperatures under the Proposed Project would result in increased overall habitat suitability for fall-run Chinook salmon adult spawning and embryo incubation.

The hatchery adaptive management program would potentially have a beneficial effect on this life stage by reducing genetic introgression between spring- and fall-run Chinook salmon. The water treatment action associated with the hatchery management adaptive management program under the Proposed Project would potentially have an additional beneficial effect on incubating fall-run Chinook salmon embryos by minimizing the potential for disease-associated embryonic mortality in the Feather River Fish Hatchery and by reducing the accumulated disease pressure in the lower Feather River.

Installation of fish segregation weirs in the lower Feather River likely would benefit fall-run Chinook salmon adult spawning and embryo incubation by maintaining spatial segregation of spawning spring-run and fall-run Chinook salmon, and by eliminating fishing pressure on fish spawning in the no-fishing zones in the vicinity of the fish segregation weirs. However, the potential for poaching fall-run Chinook salmon in the vicinity of the weirs likely would be increased because of higher fish densities and increased access to the lower Feather River in those areas.

Gravel supplementation would benefit fall-run Chinook salmon adult spawning and embryo incubation by increasing the quantity and quality of available spawning habitat,

thereby reducing competition for available habitat and resulting pre-spawn mortality rates, as well as reducing redd superimposition and resulting egg mortality. Likewise, creation and enhancement of side-channel habitat under the Proposed Project would benefit fall-run Chinook salmon spawning and embryo incubation by increasing overall habitat availability.

Overall, implementation of the Proposed Project would result in a beneficial effect on fall-run Chinook salmon adult spawning and embryo incubation.

Juvenile Rearing and Downstream Movement

Actions potentially affecting fall-run Chinook salmon juvenile rearing and downstream movement include changes to instream flows in the LFC, a hatchery adaptive management program, gravel supplementation, LWD supplementation, and creation and enhancement of side-channel habitat.

Flow fluctuations could occur in the LFC during the summer to meet water temperature requirements to protect fisheries resources. This could result in an adverse effect on fall-run Chinook salmon juvenile rearing and downstream movement by increasing the potential for beach stranding. However, based on the SP-G2 analysis that indicates that isolation ponds do not form below 1,200 cfs, the emigration timing of most juvenile Chinook salmon in the Feather River, and on the preference for increased water depths as rearing juveniles grow larger later in the rearing season, it is unlikely that any substantial change in the rate of beach stranding would occur as a result of flow fluctuations in the LFC. Typically flow fluctuations for water temperature control in the LFC during the summer are 200 cfs or less.

The hatchery adaptive management program would potentially have a beneficial effect on this life stage by improving genetic segregation between spring- and fall-run Chinook salmon. Additionally, by potentially altering the size at release and timing of release of juvenile steelhead into the lower Feather River, the hatchery adaptive management program could reduce predation rates on rearing and emigrating fall-run Chinook salmon. By altering raceways at the Feather River Fish Hatchery, the hatchery adaptive management program could increase post-release survival rates of juvenile fall-run Chinook salmon.

Gravel enhancement and LWD supplementation would potentially have a beneficial effect on rearing and downstream migrating fall-run Chinook salmon by increasing channel complexity and the amount and quality of rearing habitat. However, placement of LWD debris could potentially have an adverse effect by increasing warmwater predator habitat.

Creation and enhancement of side-channel habitat under the Proposed Project would increase the amount of juvenile rearing habitat compared to the Existing Conditions.

Overall, implementation of the Proposed Project would result in a beneficial effect on fall-run Chinook salmon juvenile rearing and downstream movement.

C3.4.1.6 Potential Facility Modifications

Although it is not possible to quantify the effects of potential future facility modifications on fall-run Chinook salmon with currently available information, all of the measures being studied by DWR are likely to benefit fall-run Chinook salmon through increased quantity and quality of habitat with suitable water temperature conditions. A qualitative evaluation of the potential effects that future facilities modifications might have on lower Feather River aquatic habitat is presented in Section C3.1.7 above.

C3.4.1.7 Conclusion

Based on the above summary of potential effects, the Proposed Project would result in an overall beneficial effect on fall-run Chinook salmon.

C3.4.2 Spring-run Chinook Salmon

Study plan report summaries addressing project effects on spring-run Chinook salmon are presented in Section G-AQUA1.3, Fish and Their Habitat within Lake Oroville, its Upstream Tributaries, the Thermalito Complex, and the Oroville Wildlife Area; Section G-AQUA1.5, Fisheries Management; Section G-AQUA1.8*,* Salmonids and Their Habitat in the Feather River Below the Fish Barrier Dam; and Section G-AQUA1.11 Predation, in Appendix G-AQUA1 of the PDEA. A description of each spring-run Chinook salmon life stage and the time period associated with it is presented in Appendix G-AQUA1 of the PDEA and Appendix C1 of the DEIR.

C3.4.2.1 Flow-Related Effects

Adult Immigration and Holding

An increased instream flow of 700 cfs to 800 cfs in the LFC under the Proposed Project could potentially have a beneficial effect on immigrating and holding spring-run Chinook salmon by increasing the lower Feather River stage elevation over potential critical riffles. Although stage increases would be small, shallow riffles could potentially become deeper, reducing effort required by immigrating adult spring-run Chinook salmon to proceed through shallow riffles. In addition, water depth would be increased, creating additional amounts of suitable holding habitat.

In addition to a base flow of 700 cfs in the LFC, from May 1 through June 15 flows could increase to 1,500 cfs Increasing the instream flow to 1,500 cfs would further increase river stage, further increasing holding habitat availability in the LFC, providing an additional beneficial effect during the period of increased flows.

No flow changes, relative to Existing Conditions, are expected in the HFC with implementation of the Proposed Project.

Adult Spawning and Embryo Incubation

Flow changes in the LFC included in the Proposed Project would affect spring-run Chinook salmon adult spawning and embryo incubation in the same way that they would affect this life stage for fall-run Chinook salmon. Refer to the above discussion (Section C3.4.1.1) of potential flow-related effects on fall-run Chinook salmon adult spawning and embryo incubation for the evaluation of flow-related effects on spring-run Chinook salmon adult spawning and embryo incubation.

Juvenile Rearing and Downstream Movement

The early and peak juvenile rearing and downstream movement periods are the same for spring-run Chinook salmon as for fall-run Chinook salmon. However, spring-run Chinook salmon can rear in the lower Feather River year round (i.e., after fall-run Chinook salmon have emigrated). Flow changes in the LFC included in the Proposed Project would affect the early portion of the juvenile rearing and downstream movement period for spring-run Chinook salmon in the same way that they would affect this life stage for fall-run Chinook salmon. The above discussion of fall-run Chinook salmon juvenile rearing and downstream movement (Section C3.4.1.1) provides an evaluation of flow-related effects on spring-run Chinook salmon juvenile rearing and downstream movement during the early portion of this period. Flow fluctuations occurring during the later periods of extended spring-run Chinook salmon juvenile rearing (after fall-run Chinook salmon have emigrated) are not expected to cause stranding because larger juveniles are not susceptible to any additional stranding losses associated with implementation of the Proposed Project because larger juveniles display a preference for deeper water habitat.

C3.4.2.2 Water Temperature–Related Effects

The analysis of water temperature–related effects is qualitative and based on increased flows in the LFC as proposed in the Proposed Project, relative to Existing Conditions. Increased flows would result in cooler water temperatures in the LFC during most of the year. Additionally, because the LFC would be contributing a higher proportion of overall flow in the lower Feather River, decreases in water temperature are anticipated to extend downstream of the Thermalito Afterbay Outlet.

Adult Immigration and Holding

Increased flows in the LFC would result in cooler water temperatures in the lower Feather River under the Proposed Project, relative to Existing Conditions. Cooler water temperature effects on the adult immigration and holding life stage of Chinook salmon would range from less than significant to slightly beneficial. Cooler water temperatures extending downstream of the Thermalito Afterbay Outlet also would result in impacts on this life stage that are less than significant or slightly beneficial.

Adult Spawning and Embryo Incubation

The spring-run Chinook salmon adult spawning and embryo incubation life stage has the same periodicity and water temperature requirements as those of fall-run Chinook salmon. The above discussion of water temperature–related effects on fall-run Chinook salmon adult spawning and embryo incubation (Section C3.4.1.2) describes potential water temperature effects of the Proposed Project on spring-run Chinook salmon adult spawning and embryo incubation.

Juvenile Rearing and Downstream Movement

The early and peak juvenile rearing and downstream movement periods are the same for spring-run Chinook salmon as for fall-run Chinook salmon. However, spring-run Chinook salmon can rear in the lower Feather River year round (i.e., after fall-run Chinook salmon have emigrated). While effects of cooler water temperatures for this life stage of fall-run Chinook salmon are expected to be less than significant, cooler water temperatures in the lower Feather River associated with implementation of the Proposed Project likely would be beneficial to this life stage for spring-run Chinook salmon because rearing occurs through the summer months.

C3.4.2.3 Predation-Related Effects

Changes in minimum flows in the LFC resulting from implementation of the Proposed Project are not expected to change the nature or rate of predation on spring-run Chinook salmon. Water temperature changes would be very small and are not expected to change the distribution, species composition, consumption rates, or nature of predation in the lower Feather River. Adaptive management changes in steelhead hatchery release practices may reduce hatchery-produced steelhead predation on wild juvenile spring-run Chinook salmon. The LWD supplementation and improvement program would improve juvenile rearing cover conditions and may result in a reduction of predation rates on juvenile spring-run Chinook salmon. However, placement of LWD in some areas of the river could potentially increase warmwater predator habitat availability downstream of the Thermalito Afterbay Outlet.

C3.4.2.4 Fisheries Management–Related Effects

Hatchery

A hatchery adaptive management program included in the Proposed Project considers a range of potential changes in hatchery practices designed to reduce adverse effects of the Feather River Fish Hatchery on wild fish stocks and improve the benefits to the Chinook salmon produced by the hatchery. Changes in hatchery practices intended to more successfully identify and true-breed spring-run and fall-run Chinook salmon would reduce the amount of genetic introgression between these two runs that may have previously occurred in the hatchery. Other potential adaptive management elements may include changes in steelhead size at release and timing of release to reduce potential steelhead predation on juvenile Chinook salmon. Other adaptive management elements could include changes to raceways at the Feather River Fish Hatchery to alter

rearing fish conditioning to improve predator avoidance and cover use upon release. An enhanced fish marking program included as one of the potential actions in the adaptive management portion of the program would improve the ability to measure hatchery performance and increase the understanding of the fisheries resources in the lower Feather River. The hatchery program also includes the development of HGMPs for each of the anadromous fish species managed by the hatchery.

Disease

Water temperature changes associated with implementation of the Proposed Project would be relatively small; therefore, no changes in water temperature–related incidence of fish disease are anticipated. The proposed hatchery water treatment action associated with the hatchery improvement program could reduce the rate of incidence and severity of disease occurrences in the Feather River Fish Hatchery, which, as a result, would lower overall fish disease pressure in the lower Feather River.

Fishing Regulations, Poaching, and Change in Recreational Access and Visitation

Recreation enhancements included in the Proposed Project are anticipated to increase recreation and angling. Increased angling is expected to result in increased sport fish harvest. Fishing access in the lower Feather River is anticipated to increase with the implementation of the Proposed Project through the installation of fish segregation weirs and other recreation enhancements included in the Proposed Project. See Section 5.7.4 of the DEIR for additional information on recreation enhancements.

Installation of fish segregation weirs in the Lower Feather River would require no-fishing zones in the immediate proximity of the installations. Although the weirs would be navigable by boats, the presence of the weirs may affect boating recreation activities to some degree. See Section 5.7.4 for additional information on fish segregation weir effects on recreation. Increased densities of fish below the weirs and river access on the weirs could potentially contribute to fish poaching opportunities with implementation of the Proposed Project.

C3.4.2.5 Summary of Potential Effects on Spring-run Chinook Salmon

Adult Immigration and Holding

Actions potentially affecting spring-run Chinook salmon adult immigration and holding include changes to instream flows and water temperatures in the LFC, a hatchery adaptive management program, fish segregation weirs, and LWD supplementation.

Increased stream flows of 700 cfs to 800 cfs in the LFC under the Proposed Project could potentially benefit immigrating spring-run Chinook salmon by increasing lower Feather River stage elevations. Although stage increases would be small, shallow riffles could potentially become deeper, reducing the effort required by immigrating spring-run Chinook salmon to proceed through shallow riffles. Additionally, increasing

flows would slightly reduce average daily water temperatures, thereby increasing overall habitat suitability during the immigration and holding period.

The hatchery adaptive management program potentially would provide a beneficial effect by allowing more accurate identification of returning hatchery fish and by increasing genetic isolation between runs, thereby improving phenotypic separation between runs with respect to immigration timing.

Installation of fish segregation weirs would have a beneficial effect on spring-run Chinook salmon adult immigration and holding by eliminating fishing pressure within the no-fishing zones in the vicinity of the weirs, and by increasing genetic segregation between runs by spatially segregating holding adult spring-run Chinook salmon from immigrating fall-run Chinook salmon. However, the potential for poaching spring-run Chinook salmon in the vicinity of the weirs likely would be increased because of higher fish densities and increased access to the lower Feather River in those locations.

LWD supplementation upstream of the fish segregation weirs would have a beneficial effect on this life stage by creating potential velocity refuges for holding adult spring-run Chinook salmon.

Overall, implementation of the Proposed Project would result in a beneficial effect on spring-run Chinook salmon adult immigration and holding.

Adult Spawning and Embryo Incubation

Actions potentially affecting spring-run Chinook salmon adult spawning and embryo incubation include changes to instream flows and water temperatures in the LFC, a hatchery adaptive management program, fish segregation weirs, side-channel habitat enhancement, and gravel supplementation.

An increase in instream flows in the LFC from 600 cfs to 800 cfs during the adult spawning and embryo incubation period would increase WUA from 91 percent of maximum to almost 100 percent. Reduced average daily water temperatures under the Proposed Project would result in increased overall habitat suitability for spring-run Chinook salmon adult spawning and embryo incubation.

The hatchery adaptive management program would potentially provide a beneficial effect by reducing the rate of genetic introgression between spring- and fall-run Chinook salmon.

Installation of fish segregation weirs in the lower Feather River likely would benefit spring-run Chinook salmon adult spawning and embryo incubation by maintaining spatial segregation of spawning spring-run and fall-run Chinook salmon, and by eliminating fishing pressure on fish spawning in the no-fishing zones in the vicinity of the weirs. Additionally, fish segregation weirs would provide a beneficial effect by reducing competition for spawning habitat, which would reduce redd superimposition, and thereby increase embryo survival. However, the potential for poaching spring-run

Chinook salmon in the vicinity of the weirs likely would be increased because of higher fish densities and increased access to the lower Feather River in those areas.

Side-channel habitat enhancement and gravel supplementation could potentially benefit spring-run Chinook salmon adult spawning and embryo incubation by increasing the amount of available spawning habitat, thereby reducing competition for available habitat and reducing redd superimposition.

Overall, implementation of the Proposed Project would result in a beneficial effect on spring-run Chinook salmon adult spawning and embryo incubation.

Juvenile Rearing and Downstream Movement

Actions potentially affecting spring-run Chinook salmon juvenile rearing and downstream movement include changes to instream flows and water temperatures in the LFC, a hatchery adaptive management program, side-channel habitat enhancement, gravel supplementation, and LWD supplementation.

Flow fluctuations could occur in the LFC during the summer to meet water temperature requirements to protect fisheries resources. This could result in an adverse effect on spring-run Chinook salmon juvenile rearing and downstream movement by increasing the potential for beach stranding. However, based on the SP-G2 analysis indicating that isolation ponds do not form below 1,200 cfs, the emigration timing of most juvenile Chinook salmon in the Feather River, and on the preference for increased water depths as rearing juveniles grow larger later in the rearing season, it is unlikely that any substantial change in the rate of beach stranding would occur as a result of flow fluctuations in the LFC. Although flow increases of up to 1,500 cfs would be allowed under the Proposed Project, flow fluctuations for water temperature control in the LFC during the summer are typically 200 cfs or less. Additionally, increasing flows would slightly reduce average daily water temperatures, thereby increasing overall habitat suitability during the summer months when some spring-run Chinook salmon could be rearing in the river.

The hatchery adaptive management program would potentially have a beneficial effect on this life stage by increasing genetic segregation between spring- and fall-run Chinook salmon. Additionally, by potentially altering the size at release and timing of juvenile steelhead releases into the lower Feather River, the hatchery adaptive management program could reduce predation on rearing and emigrating juvenile spring-run Chinook salmon. By altering raceways at the Feather River Fish Hatchery, the hatchery adaptive management program could increase post-release survival rates of juvenile spring-run Chinook salmon.

Side-channel habitat enhancement, gravel enhancement, and LWD supplementation would potentially have a beneficial effect on rearing and downstream migrating spring-run Chinook salmon by increasing channel complexity and increasing the amount and quality of rearing habitat. However, placement of LWD could potentially have an

adverse effect by increasing warmwater predator habitat availability downstream of the Thermalito Afterbay Outlet.

Overall, implementation of the Proposed Project would result in a beneficial effect on spring-run Chinook salmon juvenile rearing and downstream movement.

C3.4.2.6 Potential Facility Modifications

Although it is not possible to quantify the effects of facility modifications on spring-run Chinook salmon with the information available at this time, all of the proposed facility modifications likely would benefit fall-run Chinook salmon through increased quantity and quality of habitat with suitable water temperature conditions. A qualitative evaluation of the potential effects of facilities modifications on lower Feather River aquatic habitat is described in Section C3.1.7 above.

C3.4.2.7 Conclusion

Based on the above summary of potential effects, it is likely that the Proposed Project would result in an overall beneficial effect on spring-run Chinook salmon.

C3.4.3 Steelhead

Study plan report summaries addressing project effects on steelhead are presented in Section G-AQUA1.5, Fisheries Management; Section G-AQUA1.8, Salmonids and Their Habitat in the Feather River Below the Fish Barrier Dam; and Section G-AQUA1.11, Predation, in Appendix G-AQUA1 of the PDEA. A description of each steelhead life stage and the time period associated with it is presented in Appendix G-AQUA1 of the PDEA and Appendix C1 of the DEIR.

C3.4.3.1 Flow-Related Effects

Adult Immigration and Holding

Flow in the HFC would not change with implementation of the Proposed Project, relative to Existing Conditions; therefore, there would be no flow-related effects on steelhead adult immigration and holding in the HFC. Water depths in the LFC would be increased slightly with implementation of the Proposed Project, which would be slightly beneficial to steelhead adult immigration and holding because of the increase in the amount of habitat that would meet minimum water depth requirements. Increased flows in the LFC from May through August would have no effect on steelhead adult immigration and holding because the adult immigration and holding period for adult steelhead migrating to the Feather River begins during September.

Adult Spawning and Embryo Incubation

Under the Proposed Project, flows in the LFC would be 800 cfs during most of the adult steelhead spawning and embryo incubation period. Flow fluctuations in the LFC from 700 cfs to 1,500 cfs from May 1 through June 15, and from 700 cfs to 1,000 cfs for

water temperature control during the summer, could potentially occur with implementation of the Proposed Project. However, these time periods are outside the time period for most steelhead spawning and embryo incubation.

No water temperature management flow increases above 800 cfs would occur before the end of steelhead spawning; therefore, there would be no risk of establishing redds at stage elevations that could potentially be dewatered by a subsequent LFC flow fluctuations.

Implementation of the Proposed Project would not result in any change in the frequency or magnitude of flow fluctuations in the HFC, relative to Existing Conditions; therefore, there would be no change in the rate of steelhead redd dewatering occurring in the HFC with implementation of the Proposed Project.

Evaluation of the WUA index generated by the PHABSIM model for the steelhead adult spawning life stage indicates that the maximum amount of spawning area in the LFC, given the current channel configuration, occurs at flows around 500 cfs. However, no distinct maximum occurs over the range of flow between 150 cfs and 1,500 cfs (DWR 2004). Figure C3.4-2 shows the steelhead spawning WUA curve (lower) generated by the PHABSIM model for the LFC.

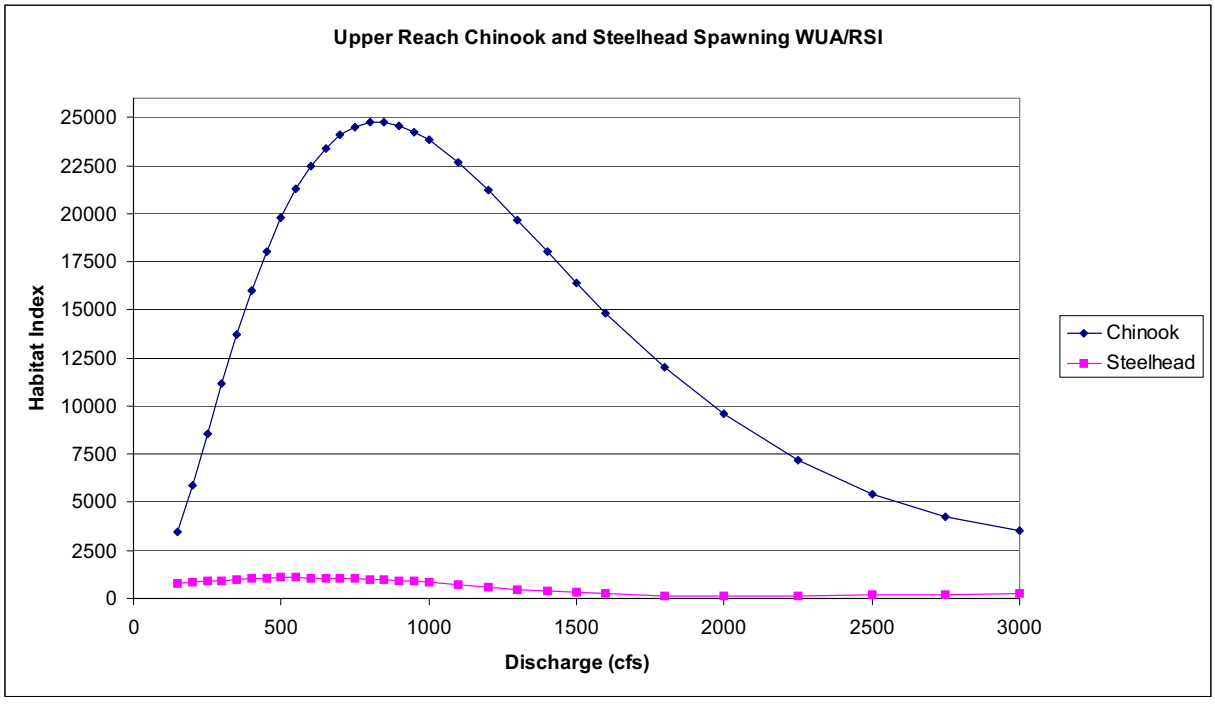

Figure C3.4-2. LFC Weighted Usable Area curves for steelhead.

Under Existing Conditions, flows in the LFC during the steelhead spawning period would be 600 cfs, which would result in approximately 98 percent of maximum WUA. Flows in the LFC under the Proposed Project would be 800 cfs during the steelhead

spawning period, which would result in approximately 91 percent of maximum WUA, representing a small decrease in WUA compared to Existing Conditions.

Under the Proposed Project, flows and flow fluctuations occurring in the HFC are not expected to differ from those occurring under Existing Conditions (described in Section 4.2, Surface Water Quantity and Quality, of the DEIR). As a result, implementation of the Proposed Project would not result in a change in the amount of steelhead spawning habitat available or rates of redd dewatering occurring in the HFC.

Fry and Fingerling Rearing and Downstream Movement

Flow fluctuations in the LFC could potentially occur under the Proposed Project to meet water temperature objectives prescribed to protect fisheries resources. Flow fluctuations can result in juvenile salmonid isolation pond or beach stranding. Isolation ponds do not occur in the LFC below 1,200 cfs; therefore, no isolation pond stranding would be anticipated with implementation of the Proposed Project. Beach stranding can occur due to changes in water surface elevation associated with changes in flows. Juvenile steelhead tend to select deeper water with increased size, and therefore become less susceptible to beach-type stranding as they grow (i.e., later in the juvenile rearing period). Flow fluctuations in the LFC under the Proposed Project may occur from April through August. Typically, flow fluctuations for water temperature control in the LFC during the summer are 200 cfs or less.

Implementation of the Proposed Project would not result in any change in the frequency or magnitude of flow fluctuations in the HFC compared to Existing Conditions; therefore, there would be no change in the rate of juvenile steelhead stranding occurring in the HFC.

Smolt Emigration

Changes in LFC flows with implementation of the Proposed Project are not expected to affect the quality or quantity of habitat for steelhead smolt emigration or the timing behavior of smolt emigration because emigrating smolts spend little time foraging and rearing and the majority of time actively migrating seaward.

C3.4.3.2 Water Temperature–Related Effects

The analysis of water temperature–related effects is qualitative and based on increased flows in the LFC during the initial new license operating period as proposed under the Proposed Project, relative to Existing Conditions. Increased flows would result in cooler water temperatures in the LFC during most of the year. Additionally, because the LFC would be contributing a higher proportion of overall flow in the lower Feather River, decreases in water temperature are anticipated to extend downstream of the Thermalito Afterbay Outlet.

The California Central Valley steelhead population is near the southern limit of the species range. Water temperature regimes experienced by these populations are different than those experienced by more northern populations. Low water

temperatures rarely are a concern in the Sacramento River system. However, warm water temperatures are a critical management issue. Therefore, in general, actions that reduce water temperatures are considered beneficial to steelhead populations.

Adult Immigration and Holding

Because of increased flows in the LFC, water temperatures in the lower Feather River would be cooler under the Proposed Project, relative to Existing Conditions. Because most steelhead adult immigration and holding occurs during the winter months, cooler water temperatures likely would not substantially affect steelhead adult immigration and holding life stage.

Adult Spawning and Embryo Incubation

Most steelhead spawning in the Feather River occurs in the LFC. With implementation of the Proposed Project, water temperatures are expected to decrease, relative to Existing Conditions. Therefore, implementation of the Proposed Project would likely be beneficial to steelhead spawning. Additionally, because cooler water temperatures would persist downstream into the HFC, additional suitable steelhead spawning habitat may become available.

Fry and Fingerling Rearing and Downstream Movement

Steelhead fry and fingerling rearing takes place year round in the lower Feather River. Cooler water temperatures likely would be beneficial to fry and fingerling rearing while effects on downstream movement likely would not be substantial.

Smolt Emigration

Effects of cooler water temperatures during the steelhead smolt emigration life stage in the lower Feather River under the Proposed Project, relative to Existing Conditions, likely would not be substantial with implementation of the Proposed Project.

C3.4.3.3 Predation-Related Effects

Changes in minimum flows in the LFC are not expected to change the nature or rate of predation with implementation of the Proposed Project. Water temperature changes would be small and would not be expected to change the distribution, species composition, consumption rates, or nature of predation in the lower Feather River. Adaptive management changes in steelhead hatchery release practices may reduce predation on juvenile wild steelhead. The Structural Habitat Supplementation and Improvement Program (SA Article A104) would improve juvenile rearing cover conditions and may result in a reduction of predation rates on juvenile steelhead.

C3.4.3.4 Fisheries Management–Related Effects

Hatchery

A hatchery adaptive management program included in the Proposed Project considers a range of potential changes in hatchery practices designed to reduce adverse effects of the Feather River Fish Hatchery on wild fish stocks and improve the benefits to steelhead produced by the hatchery. These potential changes include changes in steelhead size at release and timing of release to reduce potential size advantages of hatchery steelhead over wild steelhead, as well as to reduce potential steelhead predation on wild juvenile steelhead. Other adaptive management elements could include changes to raceways at the Feather River Fish Hatchery to alter rearing fish conditioning to improve predator avoidance and increase cover use. An enhanced fish marking program included as an action in the adaptive management program would improve the ability to measure hatchery performance and increase the understanding of the fisheries resources in the lower Feather River. The hatchery program also includes the development of HGMPs for each of the anadromous fish species managed by the hatchery.

Disease

Water temperature changes associated with implementation of the Proposed Project would be relatively small; therefore, no changes in water temperature–related incidence of fish disease are anticipated. The proposed hatchery water treatment action could reduce the incidence and severity of disease occurrences in the Feather River Fish Hatchery, which would lower overall fish disease pressure in the lower Feather River.

Fishing Regulations, Poaching, and Change in Recreational Access and Visitation

Recreation enhancements included in the Proposed Project are anticipated to increase recreation and angling. Increased angling is expected to result in increased sport fish harvest. Fishing access in the lower Feather River is anticipated to increase with the implementation of the Proposed Project associated with the installation of fish segregation weirs and other recreation enhancements included in the Proposed Project. See Section 5.7.4 for additional information on recreation enhancements.

Installation of fish segregation weirs in the lower Feather River would require no-fishing zones in the immediate proximity of the weirs. Although the fish weirs would be navigable by boats, the presence of the weirs may affect boating recreation activities to some degree. See Section 5.7.4 for additional information on fish segregation weir effects on recreation. Increased densities of fish below the fish weirs and river access on the weirs could potentially contribute to fish poaching opportunities with implementation of the Proposed Project.

C3.4.3.5 Summary of Potential Effects on Steelhead

Adult Immigration and Holding

Actions potentially affecting steelhead adult immigration and holding include changes to instream flows and water temperatures in the LFC, fish segregation weirs, and LWD supplementation.

Increased stream flows of 700 cfs to 800 cfs in the LFC under the Proposed Project could potentially benefit immigrating steelhead by increasing lower Feather River stage elevations. Although stage increases would be small, shallow riffles could potentially become deeper, reducing the effort required by immigrating steelhead to proceed through shallow riffles. Additionally, increasing flows would slightly reduce average daily water temperatures, thereby increasing overall habitat suitability during the immigration and holding period.

Installation of fish segregation weirs would have a beneficial effect on steelhead adult immigration and holding by eliminating fishing pressure within the no-fishing zones in the vicinity of the weirs. However, the potential for poaching of steelhead in the vicinity of the weirs likely would be increased because of higher fish densities and increased access to the lower Feather River in those locations.

LWD supplementation upstream of the fish segregation weirs would have a beneficial effect on this life stage by creating potential velocity refuges and increased cover availability.

Overall, implementation of the Proposed Project would result in a beneficial effect on steelhead adult immigration and holding.

Adult Spawning and Embryo Incubation

Actions potentially affecting steelhead adult spawning and embryo incubation include installation of fish barrier weirs, side-channel habitat enhancement, and gravel supplementation.

Installation of fish segregation weirs in the lower Feather River likely would benefit steelhead adult spawning and embryo incubation by eliminating fishing pressure on fish spawning in the no-fishing zones in the vicinity of the weirs. However, the potential for increased poaching of steelhead in the vicinity of the weirs likely would be increased because of higher fish densities and increased access to the lower Feather River in those areas.

Side-channel habitat enhancement and gravel supplementation could potentially benefit steelhead adult spawning and embryo incubation by increasing the quantity and quality of available spawning habitat, thereby reducing competition for available habitat. Additional habitat availability would result in reduced pre-spawn mortality rates, as well as reduced redd superimposition and resulting egg mortality.

Overall, implementation of the Proposed Project would result in a beneficial effect on steelhead adult spawning and embryo incubation.

Fry and Fingerling Rearing and Downstream Movement

Actions potentially affecting steelhead fry and fingerling rearing and downstream movement include changes to instream flows and water temperatures in the LFC, a hatchery adaptive management program, side-channel habitat enhancement, gravel supplementation, and LWD supplementation.

Flow fluctuations could occur in the LFC during the summer to meet water temperature requirements to protect fisheries resources. This could result in an adverse effect on steelhead juvenile rearing and downstream movement by increasing the potential for beach stranding. However, based on the SP-G2 analysis indicating that isolation ponds do not form below 1,200 cfs, the emigration timing of most juvenile steelhead in the Feather River, and on the preference for increased water depths as rearing juveniles grow larger later in the rearing season, it is unlikely that any substantial change in the rate of beach stranding would occur as a result of flow fluctuations in the LFC. Additionally, increasing flows would slightly reduce average daily water temperatures, thereby increasing overall habitat suitability during the summer months when some steelhead could be rearing in the river.

The hatchery adaptive management program would potentially have a beneficial effect on this life stage by altering the size at release and timing of juvenile steelhead released into the lower Feather River, reducing predation on emigrating wild steelhead. Other adaptive management elements could include changes to raceways at the Feather River Fish Hatchery to improve rearing fish conditioning to improve predator avoidance and cover use.

Side-channel habitat enhancement, gravel enhancement, and LWD supplementation would have a beneficial effect on rearing and downstream migrating steelhead by increasing channel complexity and increasing the quantity and quality of rearing habitat. However, placement of LWD could potentially have an adverse effect by increasing warmwater predator habitat availability.

Overall, implementation of the Proposed Project would result in a beneficial effect on steelhead fry and fingerling rearing and downstream movement.

Smolt Emigration

Actions potentially affecting steelhead smolt emigration include a hatchery adaptive management program, side channel creation, and LWD supplementation. The hatchery adaptive management program would have a beneficial effect on this life stage by potentially altering the size at release and timing of juvenile steelhead released into the lower Feather River, which could reduce predation rates on wild emigrating steelhead smolts. Additionally, by altering raceways at the Feather River Fish Hatchery, the program could increase post-release survival rates of hatchery-produced steelhead smolts.

Creation of side channels provides additional foraging and refuge opportunities for emigrating smolts. LWD supplementation would benefit smolt emigration by providing cover and refuge, but also could potentially have an adverse effect on steelhead smolt emigration by increasing warmwater predator habitat downstream of the Thermalito Afterbay Outlet.

Overall, implementation of the Proposed Project would result in a beneficial effect on steelhead smolt emigration.

C3.4.3.6 Potential Facility Modifications

Although it is not possible to quantify the effects of facility modifications on steelhead with the information available at this time, all of the potential future facility modifications are likely to benefit steelhead due to increased quantity and quality of habitat with suitable water temperature conditions. A qualitative evaluation of the potential effects of future facilities modifications on lower Feather River aquatic habitat is described in Section C3.1.7 above.

C3.4.3.7 Conclusion

Based on the above summary of potential effects, it is likely that the Proposed Project would result in an overall beneficial effect on steelhead.

C3.4.4 American Shad

C3.4.4.1 Flow-Related Effects

American shad adult immigration occurs during May and June, and spawning occurs during June and July. American shad have been frequently observed in the Feather River from the Thermalito Afterbay Outlet downstream to the confluence with the Sacramento River and only infrequently upstream of the Thermalito Afterbay Outlet to Steep Riffle at RM 61. No changes in flow regimes downstream of the Thermalito Afterbay Outlet are included under the Proposed Project, relative to Existing Conditions. Under the Proposed Project, minimum flows in the river reach extending from the Fish Barrier Dam downstream to the Thermalito Afterbay Outlet would be increased from 600 cfs to 700 cfs from April 1 to September 14 and to 800 cfs from September 15 to March 31. Because American shad are observed only infrequently upstream of the Thermalito Afterbay Outlet, an increase in flow in this reach of the river is not anticipated to have any effect on American shad immigration or spawning.

C3.4.4.2 Water Temperature–Related Effects

The reported suitable water temperature range for American shad adult immigration and spawning is 46°F to 79°F, and this life stage occurs from April through June in the lower Feather River (Moyle 2002; DFG 1986; Leggett and Whitney 1972; Painter et al. 1979; USFWS 1995; Walburg and Nichols 1967; Wang 1986). With implementation of the Proposed Project, water temperatures are expected to remain within this broad range. Therefore, no substantial water temperature effects on American shad are anticipated.

C3.4.4.3 Summary of Potential Effects on American Shad

Study plan report summaries addressing project effects on American shad are presented in Section G-AQUA1.4, Non-Salmonid Fish in the Feather River Downstream of the Thermalito Diversion Dam, in Appendix G-AQUA1 of the PDEA.

Implementation of the Proposed Project would not alter flows and would have only a slight effect on water temperatures in the HFC compared to Existing Conditions. Specifically, there would be no changes in immigration or spawning habitat quantity and quality as a result of water temperature or stage elevation changes. Therefore, there would be no water temperature– or flow-related effects on American shad during the initial new license operating period with implementation of the Proposed Project.

C3.4.4.4 Potential Facility Modifications

American shad are not known to utilize the LFC above steep riffle; therefore, any upstream facility modifications made in future years would not be anticipated to have any substantive effect on habitat utilization within the LFC by American shad. Upstream facilities modifications likely would lower water temperatures in the HFC to some extent, but likely would not be of sufficient magnitude to affect American shad. Any downstream facilities modifications made in future years would likely lower water temperatures in the HFC, but also would likely not be of sufficient magnitude to reduce water temperatures below a value that would have biological significance for American shad. Therefore, it is not likely that any of the potential future facility modifications would have any substantive effect on American shad.

C3.4.4.5 Conclusion

Based on the above summary of potential effects, it is likely that the Proposed Project would not result in any significant effect on American shad.

C3.4.5 Black Bass

C3.4.5.1 Water Temperature–Related Effects

Most black bass inhabiting the lower Feather River occur downstream of the Thermalito Afterbay Outlet. Black bass are considered a warmwater species and although slightly lower water temperatures may occur in the lower Feather River with implementation of the Proposed Project, the magnitude of the cooling would not be sufficient to substantially affect black bass habitat availability. Additionally, there is suitable black bass habitat downstream of the southern FERC Project boundary where water temperature reductions likely would be negligible.

C3.4.5.2 Summary of Potential Effects on Black Bass

Study plan report summaries addressing project effects on black bass species are presented in Section G-AQUA1.3, Fish and Their Habitat within Lake Oroville, its Upstream Tributaries, the Thermalito Complex, and the Oroville Wildlife Area; Section

G-AQUA1.4, Non-Salmonid Fish in the Feather River Downstream of the Thermalito Diversion Dam; Section G-AQUA1.5, Fisheries Management; and Section G-AQUA1.11, Predation, in Appendix G-AQUA1 of the PDEA.

Under the Proposed Project, water temperatures would be slightly reduced in the HFC of the lower Feather River during the initial new license operating period as compared to Existing Conditions. Specifically, there would be only slight changes in spawning habitat quantity and quality as a result of water temperature changes. Therefore, there would be no significant adverse water temperature–related and no flow-related effects on black bass with implementation of the Proposed Project during the initial new license operating period.

C3.4.5.3 Potential Facility Modifications

Black bass are not known to utilize the LFC; therefore, any upstream facility modifications made in future years would not be anticipated to have any effect on black bass in the LFC. Any of the facilities modifications being studied would likely lower water temperatures in the HFC and may have an adverse effect on the quantity and quality of black bass habitat downstream to the lower FERC Project boundary. Potential water temperature reductions beyond the lower FERC Project boundary would diminish with diminishing biological effects until water temperatures reach a range suitable for black bass. The distance downstream of the lower FERC Project boundary that adverse water temperature effects on black bass could potentially occur within would depend on the magnitude of the flows as well as the daily weather conditions. Because the lower Feather River downstream of the area influenced by water temperatures controlled by the Oroville Facilities would remain suitable habitat for black bass, the overall potential effect of the Proposed Project on habitat availability for this species would be minimal.

C3.4.5.4 Conclusion

Based on the above summary of potential effects, it is likely that the effects of the Proposed Project on black bass would be less than significant.

C3.4.6 Green Sturgeon

C3.4.6.1 Flow-Related Effects

Flows in the portions of the lower Feather River where sturgeon are distributed would not change with implementation of the Proposed Project, relative to Existing Conditions. Therefore, there would be no flow-related effects on green sturgeon under the Proposed Project.

C3.4.6.2 Water Temperature–Related Effects

Water temperatures downstream of the Thermalito Afterbay Outlet, where sturgeon are known to occur, would cool slightly under the Proposed Project, relative to existing

conditions. A review of available literature on suitable water temperatures for different life stages of green sturgeon indicates the following:

- Adult Immigration and holding—44°F to 61°F (Beamsderfer and Webb 2002; DFG Website 2002; Emmett et al. 1991; Erickson et al.2002; USFWS 1995).

- Adult spawning and embryo incubation—46°F to 68°F (Artyukin and Andronov 1990; Beamsderfer and Webb 2002; DFG Website 2002; Cech et al. 2000; Erickson et al.2002; Moyle et al. 1995; USFWS 1995).

- Juvenile rearing—50°F to 66°F (Moyle 2002; Cech et al. 2000; Conservation Management Website 1996; Farr et al. 2001).

- Juvenile emigration—50°F to 66°F (Moyle 2002; Adams et al. 2002; Beamsderfer and Webb 2002; Cech et al. 2000; Conservation Management Website 1996; Farr et al. 2001).

Water temperature decreases associated with implementation of the Proposed Project are not expected to fall below minimums specified for each life stage. Therefore, water temperature–related effects on green sturgeon would potentially range from no change, relative to Existing Conditions, to slightly beneficial effects.

C3.4.6.3 Summary of Potential Effects on Green Sturgeon

Study plan report summaries addressing project effects on green sturgeon are presented in Section G-AQUA1.3, Fish and Their Habitat within Lake Oroville, its Upstream Tributaries, the Thermalito Complex, and the Oroville Wildlife Area; and Section G-AQUA1.4, Non-Salmonid Fish in the Feather River Downstream of the Thermalito Diversion Dam, in Appendix G-AQUA1 of the PDEA.

Implementation of the Proposed Project would not alter flows and would slightly decrease water temperatures in the lower Feather River compared to Existing Conditions. Specifically, there would be no changes in spawning habitat quantity and quality as a result of water temperature or stage elevation changes. Therefore, there would be no water temperature–related or flow-related effects on green sturgeon with implementation of the Proposed Project during the initial new license operating period.

C3.4.6.4 Potential Facility Modifications

Green sturgeon are not known to utilize the LFC; therefore, any upstream facility modifications made in future years are not anticipated to have any effect on utilization within the LFC. Potential facilities modifications currently being studied would likely lower water temperatures in the HFC but would not be of sufficient magnitude to reduce water temperatures below a value that would have biological significance for green sturgeon. Lower water temperatures in the HFC would likely have a beneficial effect on green sturgeon.

C3.4.6.5 Conclusion

Based on the above summary of potential effects, it is likely that effects on green sturgeon under the Proposed Project would be beneficial.

C3.4.7 Hardhead

C3.4.7.1 Water Temperature–Related Effects

Water temperatures in the lower Feather River are expected to be slightly cooler with implementation of the Proposed Project, relative to existing conditions. The reported suitable water temperature range for hardhead adult spawning is 55°F to 75°F, and this life stage occurs from April through August in the lower Feather River (Moyle 2002; Cech Jr. et al. 1990; Wang 1986). Slightly lower water temperatures in the lower Feather River are not expected to have any adverse effects on hardhead.

C3.4.7.2 Summary of Potential Effects on Hardhead

Study plan report summaries addressing project effects on hardhead are presented in Section G-AQUA1.4, Non-Salmonid Fish in the Feather River Downstream of the Thermalito Diversion Dam, of Appendix G-AQUA1 of the PDEA.

Implementation of the Proposed Project would increase flows and decrease water temperatures in the LFC, relative to Existing Conditions. However, there would be no changes to flows and only slight changes in water temperatures in the HFC under the Proposed Project. Therefore, increased flows and decreased water temperatures in the LFC would have no effect on hardhead spawning during the interim period. Similarly, no negative effects on spawning are expected downstream of Thermalito Afterbay.

C3.4.7.3 Potential Facility Modifications

Implementation of any of the potential facility modifications being studied is not likely to have any substantial water temperature effect on the quantity or quality of available habitat for hardhead.

C3.4.7.4 Conclusion

Based on the above summary of potential effects, it is likely that the Proposed Project would not result in any significant effect on hardhead.

C3.4.8 River Lamprey

C3.4.8.1 Water Temperature–Related Effects

River lamprey reportedly tolerate a relatively broad range of water temperatures for spawning (e.g., 43°F to 72°F) (Moyle 2002; Beamish 1980; Kostow 2002; Meeuwig et al. 2003; Meeuwig et al. 2002; Stone et al. 2001; Wang 1986). Small decreases in

water temperature associated with implementation of the Proposed Project, relative to Existing Conditions, are not expected to have any effect on river lamprey.

C3.4.8.2 Summary of Potential Effects on River Lamprey

Study plan report summaries addressing project effects on river lamprey are presented in Section G-AQUA1.4, Non-Salmonid Fish in the Feather River Downstream of the Thermalito Diversion Dam, of Appendix G-AQUA1 of the PDEA.

Implementation of the Proposed Project would increase flows and decrease water temperatures in the LFC, relative to Existing Conditions. However, there would be no changes to flows and only slight decreases in water temperatures in the HFC under the Proposed Project. Therefore, water temperature changes in the LFC due to increased flows would have no effect on river lamprey spawning. Additionally, river lamprey would benefit from improved spawning substrate conditions resulting from the gravel supplementation and improvement program.

Overall, implementation of the Proposed Project would result in a beneficial effect on river lamprey.

C3.4.8.3 Potential Facility Modifications

Implementation of any of the potential facility modifications being studied would not likely result in decreased water temperatures of sufficient magnitude to result in a change in the quantity and quality of available habitat for river lamprey.

C3.4.8.4 Conclusion

Based on the above summary of potential effects, it is likely that the Proposed Project would result in slightly beneficial effects on river lamprey.

C3.4.9 Sacramento Splittail

C3.4.9.1 Flow-Related Effects

Sacramento splittail have only been reportedly observed in the Feather River downstream of the Thermalito Afterbay Outlet. No changes in flow regimes are anticipated with implementation of the Proposed Project in this portion of the river. Therefore, potential flow-related effects on Sacramento splittail spawning are not included in this analysis.

C3.4.9.2 Water Temperature–Related Effects

Sacramento splittail only inhabit the lower portion of the lower Feather River where water temperature decreases associated with the Proposed Project would be small during the initial new license operating period. Therefore, no water temperature–related effects are anticipated with implementation of the Proposed Project.

C3.4.9.3 Summary of Potential Effects on Sacramento Splittail

Study plan report summaries addressing project effects on Sacramento splittail are presented in Section G-AQUA1.4, Non-Salmonid Fish in the Feather River Downstream of the Thermalito Diversion Dam, of Appendix G-AQUA1 of the PDEA.

There would be no changes to flows and only minimal decreases in water temperatures in the HFC under the Proposed Project. Because only minimal changes would occur and Sacramento splittail have only been observed in the HFC within the project study area, no flow-related or water temperature–related effects on splittail spawning are expected to occur.

C3.4.9.4 Potential Facility Modifications

Sacramento splittail do not utilize the lower Feather River upstream of the Thermalito Afterbay Outlet. Therefore, implementation of any of the potential facility modifications being studied would not likely have any effect on Sacramento splittail in the LFC. Additionally, because the lower Feather River downstream of the area influenced by water temperatures controlled by the Oroville Facilities (i.e., the remainder of the river downstream of the lower Project Boundary) would remain suitable habitat for Sacramento splittail, the overall potential effect of the Proposed Project on habitat availability for this species would be minimal.

C3.4.9.5 Conclusion

Overall, implementation of the Proposed Project is not anticipated to affect Sacramento splittail.

C3.4.10 Striped Bass

C3.4.10.1 Flow-Related Effects

No changes in flows below the Thermalito Afterbay Outlet would result from implementation of the Proposed Project; therefore, the majority of striped bass habitat would not be affected. During the initial new license operating period, minimum flows in the river reach extending from the Fish Barrier Dam downstream to the Thermalito Afterbay Outlet would increase from 600 cfs to 700 cfs from April 1 to September 14 and to 800 cfs from September 15 through March 31 with implementation of the Proposed Project. Because striped bass are infrequently observed upstream of the Thermalito Afterbay Outlet, an increase in flow in this reach of the river is not anticipated to have any substantive effect on the quantity, quality, or distribution of striped bass habitat.

C3.4.10.2 Water Temperature–Related Effects

Water temperatures downstream of the Thermalito Afterbay Outlet, where striped bass are known to occur, would only cool slightly under the Proposed Project, relative to

existing conditions. Therefore, no significant impacts on striped bass spawning are expected as a result of decreased water temperatures.

C3.4.10.3 Summary of Potential Effects on Striped Bass

Study plan report summaries addressing project effects on striped bass are presented in Section G-AQUA1.4, Non-Salmonid Fish in the Feather River Downstream of the Thermalito Diversion Dam, of Appendix G-AQUA1 of the PDEA.

Implementation of the Proposed Project would increase flows and decrease water temperatures in the LFC during the initial new license operating period, relative to Existing Conditions. However, there would be no changes to flows in the HFC under the Proposed Project. Because such changes would not occur and striped bass are frequently observed in the HFC, no flow-related effects on striped bass spawning habitat would occur within most of the areas where striped bass are observed. Because striped bass are only infrequently observed in the LFC, reduced water temperatures are not likely to substantially affect striped bass spawning during the initial new license operating period. Similarly, only minimal decreases in water temperature in the HFC are anticipated under the Proposed Project and would not be of sufficient magnitude to affect striped bass spawning.

C3.4.10.4 Potential Facility Modifications

Striped bass are not frequently observed in the LFC; therefore, any upstream facilities modifications made in future years would have no effect on striped bass utilization within the LFC. Potential facilities modifications being studied have the effect of propagating water temperatures similar to those in the LFC farther downstream and could potentially affect the suitability of existing striped bass habitat upstream of the lower FERC Project boundary. However, because striped bass spawning in the lower Feather River peaks during May and early June (DFG 1971; DeHaven 1979; DeHaven 1977), when water temperature requirements in the LFC rise to 63^{o}F, and because striped bass reportedly prefer water temperatures of 50^{o}F to 68^{o}F (Moyle 2002), no negative effects are anticipated on striped bass spawning.

C3.4.10.5 Conclusion

Based on the above summary of potential effects, it is likely that the Proposed Project would not result in any significant effect on striped bass.

C3.5 REFERENCES

DWR (California Department of Water Resources). 2003. Steelhead Spawning Methods. Interim Report, Study Plan F-10 (SP-F10), Task 2B. Oroville Facilities Relicensing, FERC Project No. 2100.

DWR (California Department of Water Resources). 2004. Phase 2 Report, Evaluation of Project Effects on Instream Flows and Fish Habitat. Study Plan F-16 (SP-F16). Oroville Facilities Relicensing, FERC Project No. 2100.

Flosi, G., S. Downie, J. Hopelain, M. Bird, R. Coey, and B. Collins. 1998. California Salmonid Stream Habitat Restoration Manual—Appendix E: Salmon Spawner Surveys. Fish Document #98. California Department of Fish and Game. Sacramento, California.

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APPENDIX C4
IMPACTS OF THE PROPOSED PROJECT RELATIVE TO THE NO-PROJECT ALTERNATIVE

This appendix provides a qualitative analysis of potential effects on aquatic resources with implementation of the Proposed Project, relative to the No-Project Alternative. Although the following topical outline is consistent for analysis of both alternatives, effects on several issue areas are not anticipated to occur under the Proposed Project. From an aquatic resources perspective, there are only a few differences between the No-Project Alternative and the Proposed Project. (See Section 3.3, Description of Alternatives under Consideration, for a detailed description of the Proposed Project and No-Project Alternative conditions.) Net flow releases from the Oroville Facilities and reservoir water surface elevation fluctuations are anticipated to be the same as those under the No-Project Alternative with implementation of the Proposed Project. Therefore, no quantitative analysis is required or provided to analyze potential effects on aquatic resources associated with Feather River flow changes below the Thermalito Afterbay Outlet or reservoir surface elevation changes and the resultant effects on the quantity, quality, or distribution of fish habitat. The analysis of potential effects on aquatic resources in the Low Flow Channel (LFC) is partially quantitative based on previous modeling and Instream Flow Incremental Methodology studies conducted as part of the Preliminary Draft Environmental Assessment (PDEA).

Actions included in the Proposed Project that are relevant to a partial quantitative assessment of effects on aquatic resources, and that are not included in the No-Project Alternative, consist of changes in water temperature management at Robinson Riffle and increases in minimum flows in the LFC. Under the Proposed Project, flows in the LFC would increase from 600 cubic feet per second (cfs) to 700 cfs from April 1 through September 14 and 800 cfs from September 15 through March 31. These flow and temperature changes are evaluated in the subsections below. Additional description and analysis of the flow changes are available in Section 5.2, Surface Water Quantity and Quality. A detailed description of the methodology used to analyze potential effects on aquatic resources is provided in Appendix C1, Aquatic Resources Methodology.

Actions included in the Proposed Project that are relevant to the qualitative assessment of the effects on aquatic resources, and that are not included in the No-Project Alternative, consist of (1) installation of fish segregation weirs for the segregation of spring-run Chinook salmon spawning; (2) supplementing and improving large woody debris (LWD) in the lower Feather River; (3) supplementing and improving gravel substrate in the lower Feather River; (4) improving existing and creating new side-channel fish habitat; (5) implementation of a comprehensive water quality monitoring program that includes establishment of water temperature targets at the lower Project Boundary and the Feather River Fish Hatchery; and (6) implementation of a habitat expansion program for spring-run Chinook salmon. These actions included in the Proposed Project are evaluated qualitatively in the subsections below.

In addition to the actions described above, the Settlement Agreement (SA) identified six potential future facility modifications that are being studied and compared for their potential to improve water temperatures in the LFC and High Flow Channel (HFC) to support anadromous salmonids over the term of the Federal Energy Regulatory Commission (FERC) license. Measures identified for study include (1) Palermo Canal improvements; (2) a Hyatt Intake extension; (3) refurbishment of the river valve; (4) a canal around Thermalito Afterbay; (5) a canal through Thermalito Afterbay; and (6) an alternate Thermalito Afterbay outlet and channel. Descriptions of these modifications are provided in Section 3.3. For purposes of this analysis, effects of potential future facility modifications on each fish species of management concern are evaluated qualitatively based on the general characteristics of each of the measures as they are currently defined and understood for each fish species of management concern following the qualitative evaluation used to describe conditions during the initial new license operating period prior to the construction of facilities modifications. The environmental effects of the potential future facilities modifications selected will be quantitatively evaluated in a subsequent environmental document, prior to their construction.

C4.1 HABITAT COMPONENTS AFFECTED BY THE OROVILLE FACILITIES

Implementation of some of the actions in the Proposed Project may involve instream construction activities or construction activities within areas adjacent to water bodies in the project area. Utilization of specific design elements, construction techniques, and aquatic conservation measures are incorporated in the proposed measures to minimize and avoid construction-related effects on species of management concern within the immediate vicinity of and downstream from the construction area. Construction activities will be scheduled to avoid impacts during critical life stages when those life stages would be unable to volitionally avoid the construction area (e.g., during salmonid embryo incubation). Additionally, construction-related effects on fisheries resources would be reduced through the implementation of standard construction best management practices (BMPs), and, if necessary, Erosion and Sediment Control Plans.

C4.1.1 Chinook Salmon Spawning Segregation

One or more fish segregation weirs would be installed in the lower Feather River downstream of the Fish Barrier Dam and upstream of the Thermalito Afterbay Outlet with implementation of the Proposed Project. Installation of fish segregation weirs may provide for some level of segregation between spring- and fall-run Chinook salmon and would reduce some of the adverse effects of high spawning densities in this reach of the lower Feather River. Appropriately placed weirs could potentially simulate historic spatial segregation of runs by selectively allowing or blocking fish passage on a temporal basis.

In addition to providing a mechanism for segregation of spring- and fall-run Chinook salmon, the fish segregation weirs would reduce the rates of redd superimposition and the resulting egg mortality for spring-run Chinook salmon. (For a discussion of redd superimposition, particularly in the lower Feather River, see Study Plan [SP] F10, Task

2B, *Evaluation of Potential Effects of Facilities Operations on Spawning Chinook Salmon*, in Section G-AQUA1.8.2 in Appendix G-AQUA1 in the PDEA.) Using the fish segregation weirs would allow management of available habitat to limit the number of early arriving spawners allowed to enter a portion of the LFC reserved as a spring-run Chinook salmon spawning preserve, thus limiting the rate and adverse effects of redd superimposition, and the level of competition for limited habitat, and the resulting contribution to pre-spawn mortality rates on spring-run Chinook salmon.

Other potential benefits of installing weirs in the lower Feather River include providing a mechanism to allow collection of valuable data on timing, abundance, and movements of Feather River fish species. The installation of fish weirs would provide a flexible management tool for the reach of the Feather River between the Fish Barrier Dam and the Thermalito Afterbay Outlet.

Two fish weirs are proposed as part of the Proposed Project. The proposed location for the weir farthest upstream is near Bedrock Park at approximately River Mile (RM) 66. The proposed location for the second weir is downstream near Gateway Riffle at approximately RM 60. Installation of weirs in the lower Feather River may create some potential resource conflicts and necessitate some changes to project operations. For example, weirs could conflict with current fishing and boating recreation in this reach of the Feather River. See Section 5.7.4, Recreational Resources Impacts and Mitigation Measures, for additional information on the potential recreational effects of this action. Additionally, placement of the upper weir at Bedrock Park would inhibit collection of fall-run Chinook salmon brood stock through the existing fish ladder located at the Fish Barrier Dam. The upstream fish segregation weir would include an egg taking station to replace fall-run Chinook salmon access to the Feather River Fish Hatchery fish ladder. The current locations under consideration for the implementation of the fish weirs are provisional and subject to review and comment by the Ecological Committee (EC). Fish weir installation would be subject to more detailed environmental impacts analyses in a subsequent environmental document prior to the implementation of this action.

C4.1.2 Macroinvertebrate Populations

Macroinvertebrate communities in the lower Feather River likely would benefit from implementation of the Proposed Project. LWD supplementation would benefit macroinvertebrates by increasing habitat diversity and contributing organic nutrients. Gravel supplementation and improvement would reduce substrate armoring, thereby improving the quality of macroinvertebrate habitat. The side channel improvement of Moe's Ditch and Hatchery Ditch and the creation of new side channel habitat also would offer increased and more diverse habitat for aquatic macroinvertebrates.

C4.1.3 Woody Debris Recruitment

Implementation of the Proposed Project would include supplementing LWD in the lower Feather River to satisfy fish habitat improvement goals for the duration of the license period. The reach of the Feather River extending from the Fish Barrier Dam downstream to the Thermalito Afterbay Outlet is used intensively as spawning habitat

for anadromous salmonids. LWD supplementation would (1) contribute to both the geomorphic and ecological functions of the lower Feather River; (2) enhance rearing habitat for juvenile salmonids by providing cover; (3) create scour pools that may serve as holding habitat for anadromous salmonids; (4) trap sediment, allowing recruitment of riparian vegetation; and (5) decaying LWD would provide an additional source of instream nutrients for aquatic organisms. Additionally, LWD placed or recaptured in backwater mesohabitats below the Thermalito Afterbay Outlet may enhance habitat for warmwater species such as black bass, but could also potentially contribute to bass predation of juvenile salmonids to the extent that it does benefit these black bass species.

The Proposed Project includes the placement of LWD in the lower Feather River primarily from the Fish Barrier Dam to the Thermalito Afterbay Outlet, and possibly in other locations downstream of the Afterbay Outlet. In general, single logs, groups of logs, or combinations of logs and boulders that are anchored or cabled together would be placed in the river (Flosi et al. 1998). Anchoring would probably be required for projects that are intended to be site specific, such as riprapped banks or side channels. Wood may also be anchored at banks with cables or between natural or artificial structures.

Placement of LWD could create conflicts with landowners adjacent to the channel if bank erosion is inadvertently increased as a result of LWD-related flow diversion. (See Section 5.6 for additional information on potential effects of a LWD supplementation program on land use.) Placement of LWD could also decrease river navigability in some areas. See Section 5.7.4 for additional information on potential effects of a LWD supplementation program on recreation.

Under current regulated-flow regimes, placements of LWD would provide localized benefits for fish habitat until a high flow event. When a flood control event occurs, the magnitude of the flow event would redistribute both naturally recruited and supplemented LWD. This redistribution is a normal ecosystem function; however, the LWD in the upstream reaches of the LFC would need to be replaced or augmented following these events. In the event that LWD moves out of the Feather River during extreme flow events, it would provide fish habitat benefits downstream on the Sacramento River.

Because the specific methods, timing, and locations of the LWD placement program would be developed as an early license implementation task and are subject to EC review and comment, the LWD program would be subject to a more detailed analysis in a subsequent environmental document prior to the implementation of this action.

C4.1.4 Gravel Recruitment

The Proposed Project includes supplementing gravel in the lower Feather River at selected anadromous salmonid spawning riffles between the Fish Barrier Dam and Honcut Creek that would benefit from spawning substrate improvement. The Proposed Project also provides for the ripping and raking of substrate in selected potential

salmonid spawning areas of the lower Feather River where the substrate has become armored or sufficiently coarsened in particle size distribution to reduce salmonid spawning habitat quality. (See Section 4.1, Geology, Soils, and Paleontological Resources, for additional information on gravel conditions.)

Sites that may benefit from gravel supplementation were identified in SP-G2. Depending on the findings of surveys conducted after gravel supplementations, additional supplementations may be conducted in the same areas or certain sites may be abandoned. Likewise, potential sites that may benefit from ripping and raking were identified in SP-G2. Future surveys may determine other areas where substrate ripping and raking of substrate may enhance spawning habitat.

Information gathered from SP-G2 has identified specific sites downstream of the Fish Barrier Dam and upstream of the Thermalito Afterbay Outlet that may benefit from supplementation of spawning gravel. Supplementation of gravel at these locations is intended to increase suitable spawning habitat quality and quantity for anadromous salmonids by restoring habitat substrate. The spawning gravel supplement and improvement program would provide the greatest benefit to spawning areas in the upstream-most portions of the LFC below the Fish Barrier Dam because they currently have the most coarsened substrate particle size distribution which currently is only marginally suitable for salmonid spawning. Additionally, gravel supplemented near the base of the Fish Barrier Dam would be mobilized during high flow events and would be redistributed downstream, mimicking normal gravel recruitment. Subsequent gravel placements would be required after future peak-flow events to maintain benefits provided by supplementation of spawning gravel. The improvement of spawning substrate in the upstream reaches of the LFC complements the function of the fish segregation weirs, spatial segregation of spring-run Chinook salmon by providing habitat enhancements in those locations that provide direct benefits to Endangered Species Act–listed species (i.e., spring-run Chinook salmon and steelhead).

Because the specific methods, timing, and locations of the gravel supplementation program would be developed as an early license implementation task and are subject to EC review and comment, the gravel supplementation program would be subject to a more detailed analysis in a subsequent environmental document prior to the implementation of this action.

C4.1.5 Channel Complexity

Implementation of the Proposed Project includes enhancement of existing side-channel habitat in Hatchery Ditch and Moe's Ditch, both located downstream of the Fish Barrier Dam adjacent to the Feather River Fish Hatchery. Enhancements to these existing side channels could include reforming the channel for increased water depth and shoreline diversity, placing boulders and woody debris for cover and velocity diversity, and gravel substrate supplementation. Moe's Ditch may also include removal of a beaver dam which currently blocks flow at the downstream end of the channel (see "Wildlife" in Section 5.5.1, Terrestrial Resources, for additional discussion). The enhancement of

these existing side channels would primarily benefit steelhead and spring-run Chinook salmon by increasing the quantity and quality of spawning and rearing habitat.

Additionally, the Proposed Project includes development of five additional side channel riffle/glide complexes over a 5-year period, which would provide a minimum of 2,460 feet of new spawning and rearing habitat for Chinook salmon and steelhead. All side channels created would be adjacent to existing riffle complexes and would approximate historic habitat with respect to base flow ranges and other environmental conditions. Side channel flows likely would range between 10 cfs and 75 cfs and should be designed to provide appropriate depth, velocity, substrate, and instream and riparian cover to benefit primarily juvenile salmonid rearing, but also to some extent potentially benefit steelhead spawning as specific side channel construction site conditions allow. To the extent possible, side channel development would coincide with gravel supplementation activities or other habitat improvement measures occurring in the vicinity to minimize habitat disruption, as well as facilitate complementary design features between the actions.

Because the methods, timing, and locations of the side channel enhancement and creation would be developed as an early license implementation task and are subject to EC review and comment, the Channel Complexity Program would be subject to a more detailed analysis in a subsequent environmental document prior to the implementation of this action.

C4.1.6 Water Quality Criteria for Aquatic Life

Water quality conditions for aquatic life are not expected to change with implementation of the Proposed Project, with the exception of any short-term water quality effects associated with instream construction activities. See Section 5.2.2, Surface Water Quality, for the evaluation of construction-related effects on water quality.

As part of the Proposed Project, permanent continuous water temperature monitoring devices would be installed at the Feather River Fish Hatchery, Robinson Riffle, the Thermalito Afterbay Outlet, and in the lower Feather River adjacent to the lower Project Boundary.

C4.1.7 Facilities Modifications

A measure in the Proposed Project is intended to provide water temperatures in the Feather River Fish Hatchery suitable for all salmonid life stages as needed to achieve production goals. Project operations and/or facilities would be modified to meet temperature objectives as specified in Table C4.1-1.

Table C4.1-1. Initial new license operating period water temperature targets for the Feather River Fish Hatchery.

Time Period	SA Table 107A Daily Mean Maximum (°F)	SA Table 107B Hourly Mean Maximum (°F)
September	56°	56°
October–November	55°	55°
December–March	55°	55°
April–May 15	55°	55°
May 16–May 31	55°	59°
June 1–June 15	60°	60°
June 16–August 15	60°	64°
August 16–August 31	60°	62°

Source: DWR 2006

The temperatures in the second column of Table C4.1-1 are the maximum daily mean temperature targets for the initial new license operating period that the California Department of Water Resources (DWR) would seek to achieve through the use of operational measures until facilities modifications are completed. After any future facility modifications are completed and no later than the end of year ten following license issuance, these temperatures would become requirements. At that time, water temperature objectives listed in the table may be altered, but would not become less protective than those depicted in the second column. The hourly maximum temperatures depicted in the third column of Table C4.1-1 represent the upper end of the existing hatchery temperature criteria and at no instance shall DWR exceed these temperatures. There shall be no minimum temperature requirement except for the period of April 1 through May 31, during which the temperatures shall not fall below 51 degrees Fahrenheit (°F). See Section 3.3 for a more detailed description of the hatchery water temperature target and potential requirement development after the construction and testing of facilities modifications.

The Proposed Project also includes the development of water temperature requirements for the HFC as measured at the lower Project Boundary. Upon completion of facilities modifications, temperatures depicted in Table C4.1-2 would be evaluated and new targets will be developed, achievement of which at the Project Boundary would be verified, during a testing period. During the initial new license operating period facilities operations would not be changed to meet the temperatures depicted in Table C4.1-2. At the end of the initial new license operating period, when facility modifications have been completed, there would be 5 years of operational testing to determine what water temperatures can be achieved at the lower Project Boundary. After testing and verification that they could be achieved, these water temperatures would become requirements. See Section 3.3 for a more detailed description of the Table 1, Robinson Riffle, and Table 2, lower Project Boundary, water temperature targets and potential requirements development after the construction and testing of facilities modifications.

Table C4.1-2. Initial new license operating period water temperature objectives (maximum mean daily value) for the HFC at the downstream lower Feather River project boundary.

Month	Water Temperature (°F)
April	61°
May–August	64°
September	61°
October	60°
November–March	56°

Source: DWR 2006

Because the potential facilities modifications have not been selected, the design details have not been defined, and the potential combinations of measures have not been selected, the final water temperature requirements as well as the other potential resources effects are currently unknown and cannot be evaluated in detail at this time. As a result of the unavailability of the definitive characteristics of this action, only the general characteristics of the potential facilities modifications can be qualitatively evaluated for their potential effects on the aquatic resources. The potential facilities modifications would be evaluated in detail in a subsequent environmental document prior to their construction.

Potential facility modifications are described in Section 3.3. Each of the measures being studied would be designed to reduce water temperatures in the LFC and HFC of the lower Feather River and if implemented would benefit coldwater fisheries, particularly anadromous salmonids. DWR has identified seven measures for study.

The Palermo Canal improvements, Hyatt intake extension, and river valve improvement measures are each conceptualized as a potential means of increasing access to coldwater pool reserves in Lake Oroville. These measures that could increase coldwater pool access are primarily designed to improve water temperatures at the Feather River Fish Hatchery and in the LFC from the Fish Barrier Dam downstream to Robinson Riffle, the Table 1 water temperature target location. These measures would also be intended to reduce water temperatures below Robinson Riffle in the LFC and to improve water temperature conditions in the HFC from the Thermalito Afterbay Outlet downstream to the lower Project Boundary, the proposed lower Project Boundary water temperature target location. Both the river valve modifications and the Hyatt intake extension would enable release of cold water from Lake Oroville into the Diversion Pool and reduce the water temperatures of the entire volume of water released from the lake. Cooling the entire volume of water released from Lake Oroville would reduce water temperatures in the Diversion Pool and Thermalito Forebay, benefiting those coldwater fisheries resources, the Feather River Fish Hatchery water intake, and the coldwater fisheries resources in the lower Feather River downstream from the Fish Barrier Dam. Because water temperatures are reduced for the entire volume of water released from Lake Oroville, water temperatures in the Thermalito Afterbay also would be reduced, which would reduce the quantity and quality of warmwater fisheries habitat. The

Palermo Canal improvements would release cold water at the intake for the Diversion Dam and minimize the mixing of the cold water release with the water volume in the Diversion Pool prior to discharge to the lower Feather River. Therefore, the Palermo Canal improvements would not benefit the coldwater fisheries in the Diversion Pool or the Thermalito Forebay, but also would not reduce the quantity or quality of warmwater fisheries in the Thermalito Afterbay. The Feather River Fish Hatchery water supply intake would be provided by a portion of the Palermo Canal improvement facilities releases to blend with the Diversion Pool supplies to meet the hatchery water temperature requirements. The upper portion of the LFC would benefit from the release of cold water from the Palermo Canal as a result of improved water temperature suitability for coldwater fisheries. The remainder of the Palermo Canal improvement releases would be transported via pipeline for release at a location farther down the LFC to further enhance the quantity and quality of available coldwater fisheries habitat. Two of the potential locations under consideration for the potential release of this second component of flow from the Palermo Canal improvements are immediately above Robinson Riffle in the LFC or at the bottom of the LFC immediately above the Thermalito Afterbay Outlet. The release location of the second flow component from the Palermo Canal improvements would be one of the items studied during future feasibility studies and would be subject to review and comment by the EC. It should be noted that the potential biological benefits of the flow release above Robinson Riffle would be substantially higher than the benefits of release at the Afterbay Outlet. The increased biological benefit of this release location is due to increased spawning habitat suitability for the spawning areas at and immediately downstream of Robinson Riffle, the opportunity to create a side channel that utilizes the discharge water, which could be designed to benefit steelhead spawning and rearing (the most limited type of habitat in the lower Feather River), and avoiding creating a coldwater refugium that could prolong spring-run Chinook salmon holding in the Afterbay Outlet Pool, which has the highest fishing pressure and poaching potential in the lower Feather River.

The four Thermalito Afterbay facilities measures under consideration are each intended to complement the coldwater pool access device and primarily benefit the water temperatures in the lower Feather River below the Thermalito Afterbay Outlet downstream to the lower Project Boundary, which is the Table 2 water temperature target location. The four afterbay measures are (1) a canal around the Thermalito Afterbay; (2) a canal through the Thermalito Afterbay; (3) an extension of the current Thermalito Afterbay outlet to release water farther downstream near the lower Project Boundary; and (4) a Thermalito Afterbay water temperature curtain. Of the potential Thermalito Afterbay modifications, the canal around the Thermalito Afterbay, canal through the Thermalito Afterbay and the Thermalito Afterbay water temperature curtain may provide cooler water temperatures in the HFC during the spring and early summer, but may result in warmer water temperatures in the late summer and fall. The canal through the afterbay may reduce the water temperatures along the northern margins of the afterbay, depending on the specific facilities design, which would result in a water temperature reduction in the locations of the majority of the black bass spawning which could potentially affect the sustainability of this recreational fishery. The Thermalito Afterbay curtain may help mitigate the impacts of any upstream measures on water

temperatures in the afterbay. This measure would utilize a baffle (temperature curtain) to direct cold water through the eastern portion of the afterbay, thus allowing colder water to flow through the afterbay faster while increasing the residence time of warmer water utilized for agricultural diversions from the western side. The Thermalito Afterbay Outlet extension would likely perform best for water temperature reduction in the lower Feather River as LFC water temperatures would be allowed to continue farther downstream before the Thermalito Afterbay discharge would be mixed with the cooler LFC water. It should be noted that the majority of the anadromous salmonid spawning habitat occurring in the HFC occurs upstream of the discharge location discussed for the Afterbay Outlet extension.

C4.1.8 Habitat Expansion

The habitat expansion measure included in the Proposed Project (SA Appendix F) is an effort to increase production of spring-run Chinook salmon and steelhead. The goal of the measure is to expand existing habitat within the Sacramento River basin to accommodate an increase of 2,000 to 3,000 spring-run Chinook salmon or steelhead for spawning. Potential habitat actions likely would not occur within the Project Boundary. Potential measures include dam removal, flow and water temperature improvements, new fish passage structures or programs, improvement of existing fish passage structures and programs, gravel supplementation at existing habitat, or riparian vegetation enhancements. Habitat expansion actions also would include future operation and maintenance actions if required after implementation, but would not include long-term monitoring of species utilization or benefit.

Because the nature and locations of the habitat expansion actions are not currently known and are subject to National Marine Fisheries Service review and approval prior to implementation, the potential affects of the habitat expansion actions would be subject to subsequent environmental documentation and analysis prior to the implementation of this action.

C4.2 WARMWATER RESERVOIR FISHERIES

C4.2.1 Operations-Related Effects

C4.2.1.1 Spawning and Initial Rearing

No changes in reservoir water surface elevations, rates of reduction, or surface elevation fluctuations in Lake Oroville or the Thermalito Afterbay are anticipated with implementation of the Proposed Project. Therefore, the potential for bass nest dewatering would not change as compared with the No-Project Alternative.

Consequently, no impacts on black bass spawning and rearing are anticipated with implementation of the Proposed Project relative to the No-Project Alternative.

C4.2.1.2 Fish Interactions

No changes in fish stocking or in the frequency of sediment wedge exposure from Lake Oroville water surface elevation fluctuations are anticipated with implementation of the Proposed Project. Interactions among fish species upstream of Oroville Dam are anticipated to be the same under the Proposed Project relative to the No-Project Alternative.

C4.2.2 Fisheries Management–Related Effects

C4.2.2.1 Stocking

No changes in warmwater fish stocking or the habitat enhancement program are anticipated with implementation of the Proposed Project relative to the No-Project Alternative.

C4.2.2.2 Disease

No changes in the types of warmwater fish diseases or rates of disease transmission are anticipated with implementation of the Proposed Project relative to the No-Project Alternative.

C4.2.2.3 Recreational Access or Fishing Regulations

Recreation enhancements included in the Proposed Project are anticipated to increase recreation and angling. Increased angling is expected to result in increased sport fish harvest. Fishing access would be increased through the construction of a fishing pier or platform at the Diversion Pool and South Forebay Day Use Area (DUA), and increased shoreline access in the north Forebay through the construction of trails. See Section 5.7.4 for additional information on recreation enhancements. No changes in regulations for warmwater sport fishing are anticipated with implementation of the Proposed Project relative to the No-Project Alternative. Increased access and consequent increased harvest of warmwater fish species with no corresponding changes to current regulations could negatively impact warmwater species within the project area.

C4.2.3 Summary of Potential Effects on Warmwater Reservoir Fisheries

Implementation of the Proposed Project would be beneficial to the quality or quantity of warmwater fish habitat available in Lake Oroville but not other Oroville Facilities reservoirs relative to the No-Project Alternative. However, increased levels of harvest could have a negative impact on warmwater fish populations in some of these reservoirs.

C4.3 COLDWATER RESERVOIR FISHERIES

C4.3.1 Operations-Related Effects

C4.3.1.1 Habitat Availability

No changes in reservoir water surface elevations and the associated quality and quantity of effective available coldwater pool habitat in Lake Oroville are anticipated with implementation of the Proposed Project. Therefore, no changes to coldwater fish habitat are anticipated under the Proposed Action relative to the No-Project Alternative.

C4.3.1.2 Fish Interactions

No changes in fish stocking or in the frequency of sediment wedge exposure from Lake Oroville water surface elevation fluctuations are anticipated with implementation of the Proposed Project. Therefore, no differences in fish species interactions upstream of Oroville Dam, in the Thermalito Forebay, or in the Thermalito Afterbay are anticipated with implementation of the Proposed Action relative to the No-Project Alternative.

C4.3.2 Fisheries Management–Related Effects

C4.3.2.1 Stocking

No changes in coldwater fish stocking are anticipated with implementation of the Proposed Project relative to the No-Project Alternative.

C4.3.2.2 Disease

No changes in potential exposure to fish diseases are anticipated with implementation of the Proposed Project relative to the No-Project Alternative.

C4.3.2.3 Recreational Access or Fishing Regulations

Recreation enhancements included in the Proposed Project are anticipated to increase recreation and angling. Increased angling is expected to result in increased sport fish harvest. Fishing access would be increased through the construction of a fishing pier or platform at the Diversion Pool and South Forebay DUA and increased shoreline access in the North Forebay through the construction of trails. See Section 5.7.4 for additional information on recreation enhancements. No changes in regulations for coldwater sport fishing are anticipated with implementation of the Proposed Project relative to the No-Project Alternative. Increased access and consequent increased harvest of coldwater fish species with no corresponding changes to current regulations could negatively affect coldwater species within the project area.

C4.3.3 Summary of Potential Effects on Coldwater Reservoir Fisheries

Implementation of the Proposed Project during the initial new license operating period is not expected to affect the quality or quantity of coldwater fish habitat available in Oroville Facilities reservoirs relative to the No-Project Alternative.

Potential coldwater fisheries reservoir resource effects associated with the implementation of any future facilities modifications and the potential development of new water temperature requirements at the hatchery, Table 1 targets at Robinson Riffle and Table 2 targets at the lower Project Boundary would be evaluated in a subsequent environmental document prior to their construction.

C4.4 LOWER FEATHER RIVER FISH SPECIES

The overall determination of effects on each species of primary management concern in the lower Feather River with implementation of the Proposed Project incorporates all of the types of effects associated with each project measure included in the alternative for each life stage of the species. Qualitative analyses were performed on various potential effects resulting from implementation of the Proposed Project to determine the incremental effects associated with each project measure included in the alternative. The results of the effects analysis of each project measure on each life stage were synthesized to determine the overall effects of the Proposed Project on the species. As needed, subsequent environmental documentation and evaluation of potential project effects would be developed to address additional details and implementation plans of actions prior to their implementation.

C4.4.1 Fall-run Chinook Salmon

C4.4.1.1 Flow-Related Effects

Adult Immigration and Holding

Increases in flows from 600 cfs to 700 cfs from April 1 through September 14 and to 800 cfs from September 15 through March 31 in the LFC during the initial new license operating period under the Proposed Project could potentially have a beneficial effect on immigrating and holding fall-run Chinook salmon by increasing the lower Feather River stage elevation over potential critical riffles. Although stage increases would be small, shallow riffles could potentially become deeper, reducing the effort required by immigrating adult fall-run Chinook salmon to proceed through shallow riffles. In addition, water depth would be increased, creating additional amounts of suitable holding habitat.

No net changes in flows relative to the No-Project Alternative are expected in the HFC with implementation of the Proposed Project. Flow fluctuations that could potentially occur in the HFC under the Proposed Project likely would be similar to flow fluctuations that would occur under the No-Project Alternative. Because flow fluctuations currently do not affect fall-run Chinook salmon adult immigration and holding, flow fluctuations

under the Proposed Project would not affect fall-run Chinook salmon adult immigration and holding.

Adult Spawning and Embryo Incubation

Under the Proposed Project, flows in the LFC would be 800 cfs during the adult spawning and embryo incubation life stage. Flow fluctuations in the LFC could potentially occur under the Proposed Project to meet water temperature objectives prescribed to protect fisheries resources.

Increased flow releases to meet water temperature objectives during September during the initial new license operating period could potentially affect fall-run Chinook salmon spawning and embryo incubation by causing redd dewatering, which could occur as flows return to normal after water temperature objectives are met. Because increasing flows to meet water temperature objectives increases river stage, spawning individuals could potentially construct redds in areas that could be dewatered as flows are lowered to normal levels (800 cfs). However, based on available stage-discharge relationships and Chinook salmon redd water depth distribution from the SP-F16 report (see Section G-AQUA1.10 of Appendix G-AQUA1, Affected Environment, of the PDEA), the first redds would not be dewatered until there was more than a 0.4-foot change in stage elevation. Water temperature control flow changes are at or less than 200 cfs, and from 800 cfs to 1,000 cfs all of the spawning riffle stage elevations are anticipated to change less than 0.4 foot. The shallowest redd depth reportedly observed in the lower Feather River is 0.7 foot (DWR 2003). This analysis indicates that no redds would be dewatered in water temperature control–related flow changes in the LFC.

Evaluation of the Weighted Usable Area (WUA) index generated by the physical habitat simulation (PHABSIM) model for the adult spawning life stage of Chinook salmon (spring-run and fall-run) indicated that the maximum amount of spawning area in the LFC, given the current channel configuration, would occur at flows from 800 to 825 cfs (DWR 2004). Figure C4.4-1 shows the WUA curve generated by the PHABSIM model for Chinook salmon spawning in the LFC.

Flows in the LFC during the Chinook salmon spawning period would be 600 cfs under the No-Project Alternative, resulting in approximately 91 percent of maximum WUA. Flows in the LFC during the Chinook salmon spawning period would be 800 cfs under the Proposed Project which would result in almost 100 percent of maximum WUA, representing an increase in the quantity of available spawning habitat compared to the No-Project Alternative.

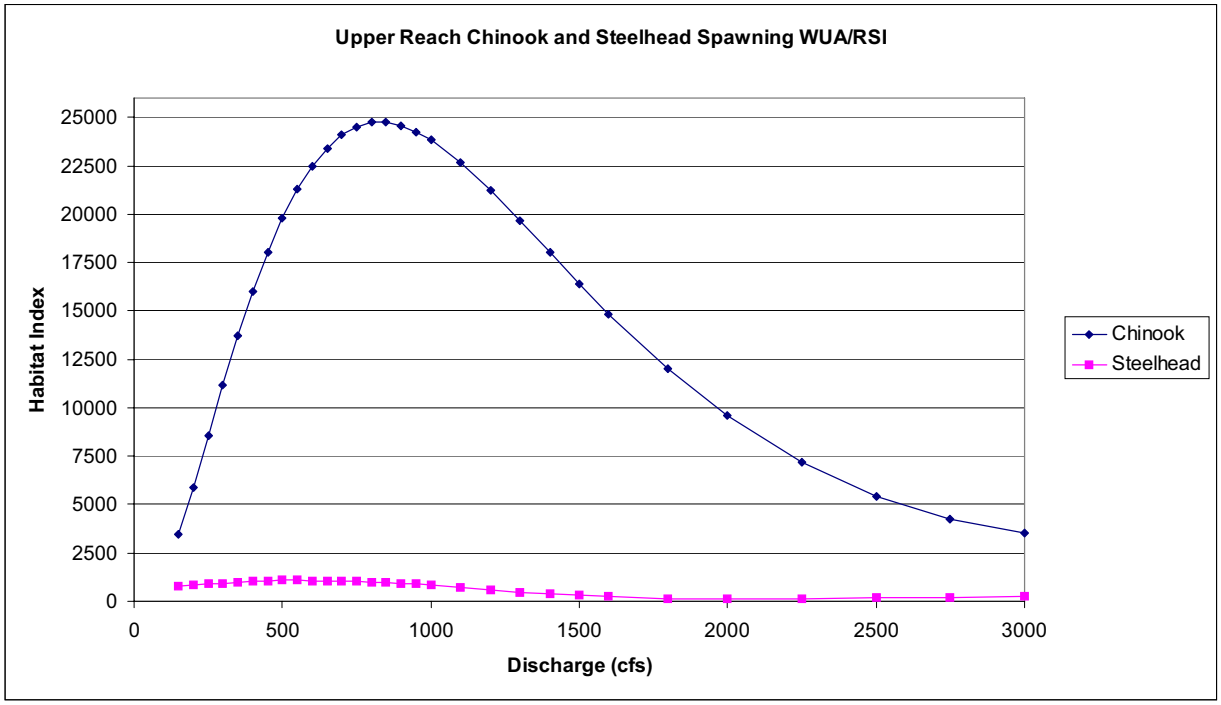

Figure C4.4-1. Low Flow Channel WUA curves for Chinook salmon.

Under the Proposed Project, flows and flow fluctuations occurring in the HFC are not expected to differ from flows or flow fluctuations that would occur under the No-Project Alternative as described in Section 5.2.1, Surface Water Quantity. Because there would be no changes in flows or flow fluctuations in the HFC with implementation of the Proposed Project compared to the No-Project Alternative, the Proposed Project would not result in a change in the amount of spawning habitat available for fall-run Chinook salmon or in rates of redd dewatering occurring in the HFC.

Juvenile Rearing and Downstream Movement

Increased flows in the LFC under the Proposed Project, relative to the No-Project Alternative would increase river stage slightly and could potentially increase available rearing habitat for juvenile salmonids, including fall-run Chinook salmon. However, the increase in river stage associated with a 100-cfs to 200-cfs increase in flow likely would be insufficient to appreciably increase rearing habitat availability. Therefore, increased flows would have no affect on fall-run Chinook salmon juvenile rearing and downstream movement.

Flow fluctuations in the LFC could potentially occur under the Proposed Project to meet new water temperature objectives prescribed to protect fisheries resources. Flow fluctuations could result in juvenile salmonid stranding in isolation ponds or beach stranding. However, isolation ponds do not occur in the LFC below 1,200 cfs; therefore, no isolation pond–related stranding is anticipated with implementation of the Proposed Project. Beach stranding could occur with changes in water surface elevation from changes in flows. Juvenile salmonids tend to select deeper water with increased size

and become less susceptible to beach-type stranding as they grow. Although flow increases of up to 1,500 cfs would be allowed for under the Proposed Project, typically flow fluctuations for water temperature control in the LFC during the summer are 200 cfs or less. A large portion of the juvenile fall-run Chinook salmon population emigrates from the Feather River system before May and therefore would not be subjected to potential beach stranding from flow fluctuations associated with implementation of the Proposed Project. Those juvenile fall-run Chinook salmon with prolonged rearing periods would be larger and have deeper water depth preferences before May; therefore they are less susceptible to beach stranding from flow fluctuations. However, some beach stranding could occur due to flow fluctuations occurring under the Proposed Project. Because water temperature control–related flow changes typically are 200 cfs or less and occur in the summer when rearing juveniles are larger and have preference for deeper water, rearing juvenile fall-run Chinook salmon would not be susceptible to beach stranding resulting from water temperature control–related flow changes.

Implementation of the Proposed Project would not result in any change in the frequency or magnitude of flow fluctuations in the HFC compared to the No-Project Alternative; therefore, no change in the rate of stranding by juvenile fall-run Chinook salmon would occur in the HFC.

C4.4.1.2 Water Temperature–Related Effects

The analysis of water temperature–related effects is qualitative and based on increased flows in the LFC during the initial new license operating period as proposed in the Proposed Project, relative to the No-Project Alternative. Increased flows would result in cooler water temperatures in the LFC during most of the year. Additionally, because the LFC would be contributing a higher proportion of overall flow in the lower Feather River, decreases in water temperature are anticipated to extend downstream of the Thermalito Afterbay Outlet.

The California Central Valley Chinook salmon population is at the extreme southern limit of the species range. Water temperature regimes experienced by these populations are different than those experienced by more northern populations. Low water temperatures are rarely a concern in the Sacramento River system. However, warm water temperatures are a critical management issue. Therefore, in general, actions that reduce water temperatures are considered beneficial to all races of Central Valley Chinook salmon.

Adult Immigration and Holding

As a result of increased flows in the LFC, water temperatures in the lower Feather River would be cooler under the Proposed Project, relative to the No-Project Alternative. Cooler water temperature–related effects on the adult immigration and holding life stage of Chinook salmon would range from insignificant to slightly beneficial. Cooler water extending downstream of the Thermalito Afterbay Outlet also would have an insignificant to slightly beneficial effect on this life stage.

Adult Spawning and Embryo Incubation

Most Chinook salmon spawning in the Feather River occurs in the LFC. With implementation of the Proposed Project, water temperatures are expected to generally decrease relative to temperatures under the No-Project Alternative. Therefore, implementation of the Proposed Project would likely be beneficial to Chinook salmon spawning and embryo incubation. Additionally, because cooler water temperatures would persist downstream into the HFC, additional suitable spawning habitat may become available for Chinook salmon spawning.

Juvenile Rearing and Downstream Movement

Unlike spring-run Chinook salmon, which may rear year-round in the lower Feather River, fall-run Chinook salmon begin their outward migration shortly after emergence and may occur as early as November. Most fall-run Chinook salmon reportedly have emigrated from the Feather River by June. Therefore, effects of cooler water temperatures during the fall-run Chinook salmon juvenile rearing and downstream movement life stage period in the lower Feather River resulting from implementation of the Proposed Project likely would be insignificant.

C4.4.1.3 Predation-Related Effects

Changes in minimum flows in the LFC associated with implementation of the Proposed Project are not expected to change the nature or rate of predation on fall-run Chinook salmon relative to the No-Project Alternative. Water temperature changes would be small and are not expected to change the distribution, species composition, consumption rates, or nature of predation in the lower Feather River. Changes in hatchery-produced steelhead release practices may reduce predation on naturally produced juvenile fall-run Chinook salmon. The LWD supplementation and improvement program would improve juvenile Chinook salmon rearing cover conditions, resulting in an overall reduction of predation rates on juvenile fall-run Chinook salmon.

C4.4.1.4 Fisheries Management–Related Effects

Hatchery

A hatchery adaptive management program (SA Article A107.2) included in the Proposed Project considers a range of potential changes in Feather River Fish Hatchery practices designed to reduce adverse effects of the hatchery on wild fish stocks and to improve the benefits to the Chinook salmon produced by the hatchery. Changes in hatchery practices intended to more successfully identify and true-breed spring-run and fall-run Chinook salmon would reduce the amount of genetic introgression between these two runs that may have previously occurred in the hatchery. Other potential adaptive management elements may include changes in steelhead size at release and timing of release to reduce potential steelhead predation on juvenile Chinook salmon. Other adaptive management elements could include changes to raceways at the Feather River Fish Hatchery to alter rearing fish conditioning to improve predator

avoidance and cover use upon release. An enhanced fish marking program included as one of the potential actions in the adaptive management portion of the program would improve the ability to measure hatchery performance and increase the understanding of the fisheries resources in the lower Feather River. The hatchery program also includes the development of Hatchery Genetic Management Plans (HGMPs) for each of the anadromous fish species managed by the hatchery.

Disease

Water temperature changes during the initial new license operating period of the Proposed Project would be relatively small; therefore, no changes in water temperature–related interactions with the incidence of fish diseases are anticipated. The potential hatchery water treatment action associated with the hatchery improvement program could reduce the incidence and severity of disease in the Feather River Fish Hatchery, which would lower overall disease pressure in the lower Feather River.

Fishing Regulations, Poaching, and Change in Recreational Access and Visitation

Recreation enhancements included in the Proposed Project are anticipated to increase recreation and angling. Increased angling is expected to result in increased sport fish harvest. Fishing access in the lower Feather River is anticipated to increase with the implementation of the Proposed Project through the implementation of recreation enhancements (e.g., construction of a paved trail from the fish hatchery downstream to the lower Project Boundary) included in the Proposed Project. See Section 5.7.4 for additional information on recreation enhancements.

Installation of fish segregation weirs in the Lower Feather River would require no-fishing zones in the immediate proximity of the installations. Although the weirs would be navigable by boats, the presence of the weirs may affect boating recreation activities to some degree. See Section 5.7.4 for additional information about effects of fish segregation weirs on recreation. Increased densities of fish below the weirs and river access on the weirs may potentially contribute to fish poaching opportunities with implementation of the Proposed Project.

C4.4.1.5 Summary of Potential Effects on Fall-run Chinook Salmon

Study plan report summaries addressing project effects on fall-run Chinook salmon are presented in Section G-AQUA1.3, Fish and Their Habitat within Lake Oroville, its Upstream Tributaries, the Thermalito Complex, and the Oroville Wildlife Area; Section G-AQUA1.5, Fisheries Management; Section G-AQUA1.8, Salmonids and Their Habitat in the Feather River Below the Fish Barrier Dam; and Section G-AQUA1.11, Predation, in Appendix G-AQUA1 of the PDEA. A description of each life stage for fall-run Chinook salmon and the time period associated with it is presented in Appendix G-AQUA1 of the PDEA.

Adult Immigration and Holding

Actions during the initial new license operating period potentially affecting fall-run Chinook salmon adult immigration and holding include changes to instream flows and water temperatures in the LFC, a hatchery adaptive management program, fish segregation weirs, and LWD supplementation.

Increased stream flows of 700 cfs to 800 cfs in the LFC under the Proposed Project could potentially benefit immigrating fall-run Chinook salmon by increasing lower Feather River stage elevations. Although stage increases would be small, shallow riffles could potentially become deeper, reducing the effort required by immigrating fall-run Chinook salmon to proceed through shallow riffles. Additionally, increasing flows would slightly reduce average daily water temperatures, thereby increasing overall habitat suitability during the immigration and holding period.

The hatchery adaptive management program would potentially have a beneficial effect on immigrating adult fall-run Chinook salmon by allowing more accurate identification of returning Feather River Fish Hatchery fish and by increasing genetic isolation between runs, thereby potentially reducing effects on phenotypic separation with respect to immigration timing.

Installation of fish segregation weirs would have a beneficial effect on fall-run Chinook salmon immigration by eliminating fishing pressure in the no-fishing zones in the vicinity of the weirs. It would also increase genetic segregation of runs by spatially segregating holding adult spring-run Chinook salmon from immigrating fall-run Chinook salmon. However, the potential for increased poaching of fall-run Chinook salmon in the vicinity of the fish segregation weirs likely would be increased because of higher fish densities and increased access to the lower Feather River in those locations.

LWD supplementation would have a beneficial effect on immigrating adult fall-run Chinook salmon by creating potential velocity refuges.

Overall, implementation of the Proposed Project would result in a beneficial effect on fall-run Chinook salmon adult immigration and holding relative to the No-Project Alternative.

Spawning and Embryo Incubation

Actions potentially affecting fall-run Chinook salmon adult spawning and embryo incubation include changes to instream flows and water temperatures in the LFC, a hatchery adaptive management program, fish segregation weirs, gravel supplementation and creation and enhancement of additional side-channel habitat.

An increase in instream flows in the LFC from 600 cfs to 800 cfs during the initial new license operating period during the adult spawning and embryo incubation period would increase WUA from 91 percent of maximum to almost 100 percent. Reduced average

daily water temperatures, under the Proposed Project, result in increased overall habitat suitability for fall-run Chinook salmon adult spawning and embryo incubation.

The hatchery adaptive management program would potentially have a beneficial effect on this life stage by reducing genetic introgression between spring- and fall-run Chinook salmon. The water treatment action associated with the hatchery management adaptive management program under the Proposed Project would potentially have an additional beneficial effect on incubation fall-run Chinook salmon embryos by minimizing the potential for disease-associated embryonic mortality in the Feather River Fish Hatchery and by reducing the accumulated disease pressure in the lower Feather River.

Installation of fish segregation weirs in the lower Feather River likely would benefit fall-run Chinook salmon adult spawning and embryo incubation by maintaining spatial segregation of spawning spring-run and fall-run Chinook salmon, and by eliminating fishing pressure on fish spawning in the no-fishing zones in the vicinity of the weirs. However, the potential for poaching fall-run Chinook salmon in the vicinity of the fish segregation weirs likely would be increased because of higher fish densities and increased access to the lower Feather River in those areas.

Gravel supplementation would benefit fall-run Chinook salmon adult spawning and embryo incubation by increasing the quantity and quality of available spawning habitat, thereby reducing competition for available habitat and resulting pre-spawn mortality rates as well as reducing redd superimposition and resulting egg mortality. Likewise, creation and enhancement of side-channel habitat under the Proposed Project would benefit fall-run Chinook salmon spawning and embryo incubation by increasing overall habitat availability.

Overall, implementation of the Proposed Project would result in a beneficial effect on fall-run Chinook salmon adult spawning and embryo incubation relative to the No-Project Alternative.

Juvenile Rearing and Downstream Movement

Actions potentially affecting fall-run Chinook salmon juvenile rearing and downstream movement include changes to instream flows in the LFC, a hatchery adaptive management program, gravel supplementation, LWD supplementation and creation, and enhancement of side-channel habitat.

Flow fluctuations could occur in the LFC during the summer during the initial new license operating period to meet water temperature requirements to protect fisheries resources. This could result in an adverse effect on fall-run Chinook salmon juvenile rearing and downstream movement by increasing the potential for beach stranding. However, based on the SP-G2 analysis indicating that isolation ponds do not form below 1,200 cfs, the emigration timing of most juvenile Chinook salmon in the Feather River, and on the preference for increased water depths as rearing juveniles grow larger later in the rearing season, it is unlikely that any substantial change in the rate of beach stranding would occur as a result of flow fluctuations in the LFC. Although flow

increases of up to 1,500 cfs would be allowed for under the Proposed Project, typically flow fluctuations for water temperature control in the LFC during the summer are 200 cfs or less.

The hatchery adaptive management program would potentially have a beneficial effect on this life stage by improving genetic segregation between spring- and fall-run Chinook salmon. Additionally, by potentially altering the size at release and timing of release of juvenile steelhead into the lower Feather River, the hatchery adaptive management program could reduce predation rates on rearing and emigrating fall-run Chinook salmon. By altering raceways at the Feather River Fish Hatchery, the hatchery adaptive management program could increase post-release survival rates of juvenile fall-run Chinook salmon.

Gravel enhancement and LWD supplementation would potentially have a beneficial effect on rearing and downstream migrating fall-run Chinook salmon by increasing channel complexity and the amount and quality of rearing habitat. However, placement of LWD could potentially have an adverse effect by increasing warmwater predator habitat.

Creation and enhancement of side-channel habitat under the Proposed Project would increase the amount of juvenile rearing habitat compared to the No-Project Alternative.

Overall, implementation of the Proposed Project would result in a beneficial effect on fall-run Chinook salmon juvenile rearing and downstream movement relative to the No-Project Alternative.

C4.4.1.6 Potential Facility Modifications

Although it is not possible to quantify the effects of facility modifications on fall-run Chinook salmon with currently available information, each of the potential future facility modifications being studied would likely benefit fall-run Chinook salmon through increased quantity and quality of habitat with suitable water temperature conditions. A qualitative evaluation of the potential effects of future facilities modifications on lower Feather River aquatic habitat is described in Section C4.1.7 above.

Conclusion

Based on the above summary of potential effects, the Proposed Project would result in an overall beneficial effect on fall-run Chinook salmon relative to the No-Project Alternative.

C4.4.2 Spring-run Chinook Salmon

C4.4.2.1 Flow-Related Effects

Adult Immigration and Holding

An increased instream flow of 700 cfs to 800 cfs in the LFC during the initial new license operating period under the Proposed Project, relative to the No-Project Alternative, could potentially have a beneficial effect on immigrating and holding spring-run Chinook salmon by increasing the lower Feather River stage elevation over potential critical riffles. Although stage increases would be small, shallow riffles could potentially become deeper, reducing effort required by immigrating adult spring-run Chinook salmon to proceed through shallow riffles. In addition, water depth would be increased, creating additional amounts of suitable holding habitat.

No flow changes, relative to the No-Project Alternative, are expected in the HFC with implementation of the Proposed Project.

Adult Spawning and Embryo Incubation

Flow changes in the LFC included in the Proposed Project would affect spring-run Chinook salmon adult spawning and embryo incubation in the same way that they would affect this life stage for fall-run Chinook salmon. Refer to the above discussion of potential flow-related effects on fall-run Chinook salmon adult spawning and embryo incubation for the evaluation of flow-related effects on spring-run Chinook salmon adult spawning and embryo incubation.

Juvenile Rearing and Downstream Movement

The early and peak juvenile rearing and downstream movement periods are the same for spring-run Chinook salmon as for fall-run Chinook salmon. However, spring-run Chinook salmon can rear in the lower Feather River year round (i.e., after fall-run Chinook salmon have emigrated). Flow changes in the LFC included in the Proposed Project would affect the early portion of the juvenile rearing and downstream movement period for spring-run Chinook salmon in the same way that they would affect this life stage for fall-run Chinook salmon. The above discussion of fall-run Chinook salmon juvenile rearing and downstream movement provides an evaluation of flow-related effects on spring-run Chinook salmon juvenile rearing and downstream movement during the early portion of this period. Flow fluctuations occurring during the later periods of extended spring-run Chinook salmon juvenile rearing after fall-run Chinook salmon have emigrated are not expected to cause stranding because larger juveniles are not susceptible to any additional stranding type losses associated with implementation of the Proposed Project because larger juveniles display a preference for deeper water habitat.

C4.4.2.2 Water Temperature–Related Effects

The analysis of water temperature–related effects is qualitative and based on increased flows in the LFC under the Proposed Project relative to the No-Project Alternative. Increased flows would result in cooler water temperatures in the LFC during most of the year. Additionally, because the LFC would be contributing a larger proportion of overall flow in the lower Feather River, decreases in water temperature are anticipated to extend downstream of the Thermalito Afterbay Outlet.

Adult Immigration and Holding

Increased flows in the LFC would result in cooler water temperatures in the lower Feather River under the Proposed Project, relative to the No-Project Alternative. Cooler water temperature effects on the adult immigration and holding life stage of Chinook salmon would range from insignificant to slightly beneficial. Cooler water temperatures extending downstream of the Thermalito Afterbay Outlet also would have an insignificant to slightly beneficial effect on this life stage.

Adult Spawning and Embryo Incubation

The spring-run Chinook salmon adult spawning and embryo incubation life stage has the same life stage periodicity and water temperature requirements as those of fall-run Chinook salmon. The above discussion of water temperature–related effects on fall-run Chinook salmon adult spawning and embryo incubation describes potential water temperature effects of the Proposed Project on spring-run Chinook salmon adult spawning and embryo incubation.

Juvenile Rearing and Downstream Movement

The early and peak juvenile rearing and downstream movement periods are the same for spring-run Chinook salmon as for fall-run Chinook salmon. However, spring-run Chinook salmon can rear in the lower Feather River year round (i.e., after fall-run Chinook salmon have emigrated). While effects of cooler water temperatures for this life stage of fall-run Chinook salmon are expected to be insignificant, cooler water temperatures in the lower Feather River associated with implementation of the Proposed Project likely would be beneficial to this life stage for spring-run Chinook salmon because rearing occurs through the summer months.

C4.4.2.3 Predation-Related Effects

Changes in minimum flows in the LFC during the initial new license operating period resulting from implementation of the Proposed Project are not expected to change the nature or rate of predation on spring-run Chinook salmon. Water temperature changes would be very small and are not expected to change the distribution, species composition, consumption rates, or nature of predation in the lower Feather River. Adaptive management changes in steelhead hatchery release practices may reduce hatchery-produced steelhead predation on juvenile spring-run Chinook salmon. The

LWD supplementation and improvement program would improve juvenile rearing cover conditions and may result in a reduction of predation rates on juvenile spring-run Chinook salmon. However, placement of LWD in some areas of the river could potentially increase warmwater predator habitat availability downstream of the Thermalito Afterbay Outlet.

C4.4.2.4 Fisheries Management–Related Effects

Hatchery

A hatchery adaptive management program included in the Proposed Project considers a range of potential changes in hatchery practices designed to reduce adverse effects of the Feather River Fish Hatchery on wild fish stocks and improve the benefits to the Chinook salmon produced by the hatchery. Changes in hatchery practices intended to more successfully identify true-breed spring-run and fall-run Chinook salmon would reduce the amount of genetic introgression between these two runs that may have previously occurred in the hatchery. Other potential adaptive management elements may include changes in steelhead size at release and timing of release to reduce potential steelhead predation on juvenile Chinook salmon. Other adaptive management elements could include changes to raceways at the Feather River Fish Hatchery to alter rearing fish conditioning to improve predator avoidance and cover use upon release. An enhanced fish marking program included as one of the potential actions in the adaptive management portion of the program would improve the ability to measure hatchery performance and increase the understanding of the fisheries resources in the lower Feather River. The hatchery program also includes the development of HGMPs for each of the anadromous fish species managed by the hatchery.

Disease

Water temperature changes associated with implementation of the Proposed Project would be relatively small; therefore, no changes in water temperature–related incidence of fish disease are anticipated. The proposed hatchery water treatment action associated with the hatchery improvement program could reduce the rate of incidence and severity of disease occurrences in the Feather River Fish Hatchery, which, as a result, would lower overall fish disease pressure in the lower Feather River.

Fishing Regulations, Poaching, and Change in Recreational Access and Visitation

Recreation enhancements included in the Proposed Project are anticipated to increase recreation and angling. Increased angling is expected to result in increased sport fish harvest. Fishing access in the lower Feather River is anticipated to increase with the implementation of the Proposed Project through the installation of fish segregation weirs and other recreation enhancements included in the Proposed Project. See Section 5.7.4 for additional information on recreation enhancements.

Installation of fish segregation weirs in the Lower Feather River would require no-fishing zones in the immediate proximity of the installations. Although the weirs would be navigable by boats, the presence of the weirs may affect boating recreation activities to

some degree. See Section 5.7.4 for additional information on fish segregation weir effects on recreation. Increased densities of fish below the weirs and river access on the weirs could potentially contribute to fish poaching opportunities with implementation of the Proposed Project.

C4.4.2.5 Summary of Potential Effects on Spring-run Chinook Salmon

Study plan report summaries addressing project effects on spring-run Chinook salmon are presented in Section G-AQUA1.3, Fish and Their Habitat within Lake Oroville, its Upstream Tributaries, the Thermalito Complex, and the Oroville Wildlife Area; Section G-AQUA1.5, Fisheries Management; Section G-AQUA1.8*,* Salmonids and Their Habitat in the Feather River Below the Fish Barrier Dam; and Section G-AQUA1.11, Predation, in Appendix G-AQUA1 of the PDEA. A description of each spring-run Chinook salmon life stage and the time period associated with it is presented in Appendix G-AQUA1 of the PDEA.

Adult Immigration and Holding

Actions potentially affecting spring-run Chinook salmon adult immigration and holding include changes to instream flows and water temperatures in the LFC, a hatchery adaptive management program, fish segregation weirs, and LWD supplementation.

Increased stream flows of 700 cfs to 800 cfs in the LFC during the initial new license operating period under the Proposed Project could potentially benefit immigrating spring-run Chinook salmon by increasing lower Feather River stage elevations. Although stage increases would be small, shallow riffles could potentially become deeper, reducing the effort required by immigrating spring-run Chinook salmon to proceed through shallow riffles. Additionally, increasing flows would slightly reduce average daily water temperatures, thereby increasing overall habitat suitability during the immigration and holding period.

The hatchery adaptive management program potentially would provide a beneficial effect by allowing more accurate identification of returning hatchery fish and by increasing genetic isolation between runs, thereby improving phenotypic separation between runs with respect to immigration timing.

Installation of fish segregation weirs would have a beneficial effect on spring-run Chinook salmon adult immigration and holding by eliminating fishing pressure within the no-fishing zones in the vicinity of the weirs, and by increasing genetic segregation between runs by spatially segregating holding adult spring-run Chinook salmon from immigrating fall-run Chinook salmon. However, the potential for poaching spring-run Chinook salmon in the vicinity of the fish segregation weirs likely would be increased because of higher fish densities and increased access to the lower Feather River in those locations.

LWD supplementation upstream of the fish segregation weirs would have a beneficial effect on this life stage by creating potential velocity refuges for holding adult spring-run Chinook salmon.

Overall, implementation of the Proposed Project would result in a beneficial effect on spring-run Chinook salmon adult immigration and holding relative to the No-Project Alternative.

Adult Spawning and Embryo Incubation

Actions potentially affecting spring-run Chinook salmon adult spawning and embryo incubation include changes to instream flows and water temperatures in the LFC, a hatchery adaptive management program, fish segregation weirs, side-channel habitat enhancement, and gravel supplementation.

An increase in instream flows in the LFC from 600 cfs to 800 cfs during the adult spawning and embryo incubation period would increase WUA from 91 percent of maximum to almost 100 percent. Reduced average daily water temperatures under the Proposed Action would result in increased overall habitat suitability for spring-run Chinook salmon adult spawning and embryo incubation.

The hatchery adaptive management program would potentially provide a beneficial effect by reducing the rate of genetic introgression between spring- and fall-run Chinook salmon.

Installation of fish segregation weirs in the lower Feather River likely would benefit spring-run Chinook salmon adult spawning and embryo incubation by maintaining spatial segregation of spawning spring-run and fall-run Chinook salmon, and by eliminating fishing pressure on fish spawning in the no-fishing zones in the vicinity of the weirs. Additionally, fish segregation weirs would provide a beneficial effect by reducing competition for spawning habitat, which would reduce redd superimposition, and thereby increase embryo survival. However, the potential for poaching spring-run Chinook salmon in the vicinity of the weirs likely would be increased because of higher fish densities and increased access to the lower Feather River in those areas.

Side-channel habitat enhancement and gravel supplementation could potentially benefit spring-run Chinook salmon adult spawning and embryo incubation by increasing the amount of available spawning habitat, thereby reducing competition for available habitat and reducing redd superimposition.

Overall, implementation of the Proposed Project would result in a beneficial effect on spring-run Chinook salmon adult spawning and embryo incubation relative to the No-Project Alternative.

Juvenile Rearing and Downstream Movement

Actions potentially affecting spring-run Chinook salmon juvenile rearing and downstream movement include changes to instream flows and water temperatures in

the LFC, a hatchery adaptive management program, side-channel habitat enhancement, gravel supplementation, and LWD supplementation.

Flow fluctuations could occur in the LFC during the summer to meet water temperature requirements to protect fisheries resources. This could result in an adverse effect on spring-run Chinook salmon juvenile rearing and downstream movement by increasing the potential for beach stranding. However, based on the SP-G2 analysis indicating that isolation ponds do not form below 1,200 cfs, the emigration timing of most juvenile Chinook salmon in the Feather River, and on the preference for increased water depths as rearing juveniles grow larger later in the rearing season, it is unlikely that any substantial change in the rate of beach stranding would occur as a result of flow fluctuations in the LFC. Typically flow fluctuations for water temperature control in the LFC during the summer are 200 cfs or less. Additionally, increasing flows would slightly reduce average daily water temperatures, thereby increasing overall habitat suitability during the summer months when some spring-run Chinook salmon could be rearing in the river.

The hatchery adaptive management program would potentially have a beneficial effect on this life stage by increasing genetic segregation between spring- and fall-run Chinook salmon. Additionally, by potentially altering the size at release and timing of juvenile steelhead releases into the lower Feather River, the hatchery adaptive management program could reduce predation on rearing and emigrating juvenile spring-run Chinook salmon. By altering raceways at the Feather River Fish Hatchery, the hatchery adaptive management program could increase post-release survival rates of juvenile spring-run Chinook salmon.

Side-channel habitat enhancement, gravel enhancement, and LWD supplementation would potentially have a beneficial effect on rearing and downstream migrating spring-run Chinook salmon by increasing channel complexity and increasing the amount and quality of rearing habitat. However, placement of LWD could potentially have an adverse effect by increasing warmwater predator habitat availability downstream of the Thermalito Afterbay Outlet.

Overall, implementation of the Proposed Project would result in a beneficial effect on spring-run Chinook salmon juvenile rearing and downstream movement relative to the No-Project Alternative.

C4.4.2.6 Potential Facility Modifications

Although it is not possible to quantify the effects of facility modifications on spring-run Chinook salmon with the information available at this time, each of the potential future facility modifications being studied would benefit spring-run Chinook salmon through increased quantity and quality of habitat with suitable water temperature conditions. A qualitative evaluation of the potential effects of future facilities modifications on lower Feather River aquatic habitat is described in Section C4.1.7 above.

Conclusion

Based on the above summary of potential effects, it is likely that the Proposed Project would result in an overall beneficial effect on spring-run Chinook salmon relative to the No-Project Alternative.

C4.4.3 Steelhead

C4.4.3.1 Flow-Related Effects

Adult Immigration and Holding

Flow in the HFC would not change with implementation of the Proposed Project, relative to the No-Project Alternative; therefore, there would be no flow-related effects on steelhead adult immigration and holding in the HFC. Water depths in the LFC would be increased slightly with implementation of the Proposed Project, which would be slightly beneficial to steelhead adult immigration and holding because of the increase in the amount of habitat that would meet minimum water depth requirements. Increased flows in the LFC from May through August would have no effect on steelhead adult immigration and holding because the adult immigration and holding period for adult steelhead migrating to the Feather River begins during September.

Adult Spawning and Embryo Incubation

Under the Proposed Project, flows in the LFC would be 800 cfs during most of the adult steelhead spawning and embryo incubation period. Flow fluctuations in the LFC for water temperature control during the summer, could potentially occur with implementation of the Proposed Project. However, this time period is outside the time period for most steelhead spawning and embryo incubation.

No water temperature management flow increases above 800 cfs would occur before the end of steelhead spawning; therefore, there would be no risk of establishing redds at stage elevations that could potentially be dewatered by a subsequent LFC flow fluctuations.

Implementation of the Proposed Project would not result in any change in the frequency or magnitude of flow fluctuations in the HFC, relative to the No-Project Alternative; therefore, there would be no change in the rate of steelhead redd dewatering occurring in the HFC with implementation of the Proposed Project.

Evaluation of the WUA index generated by the PHABSIM model for the steelhead adult spawning life stage indicates the maximum amount of spawning area in the LFC, given the current channel configuration, occurs at flows around 500 cfs. However, no distinct maximum occurs over the range of flow between 150 cfs and 1,500 cfs (DWR 2004). Figure C4.4-2 shows the steelhead spawning WUA curve (lower) generated by the PHABSIM model for the LFC.

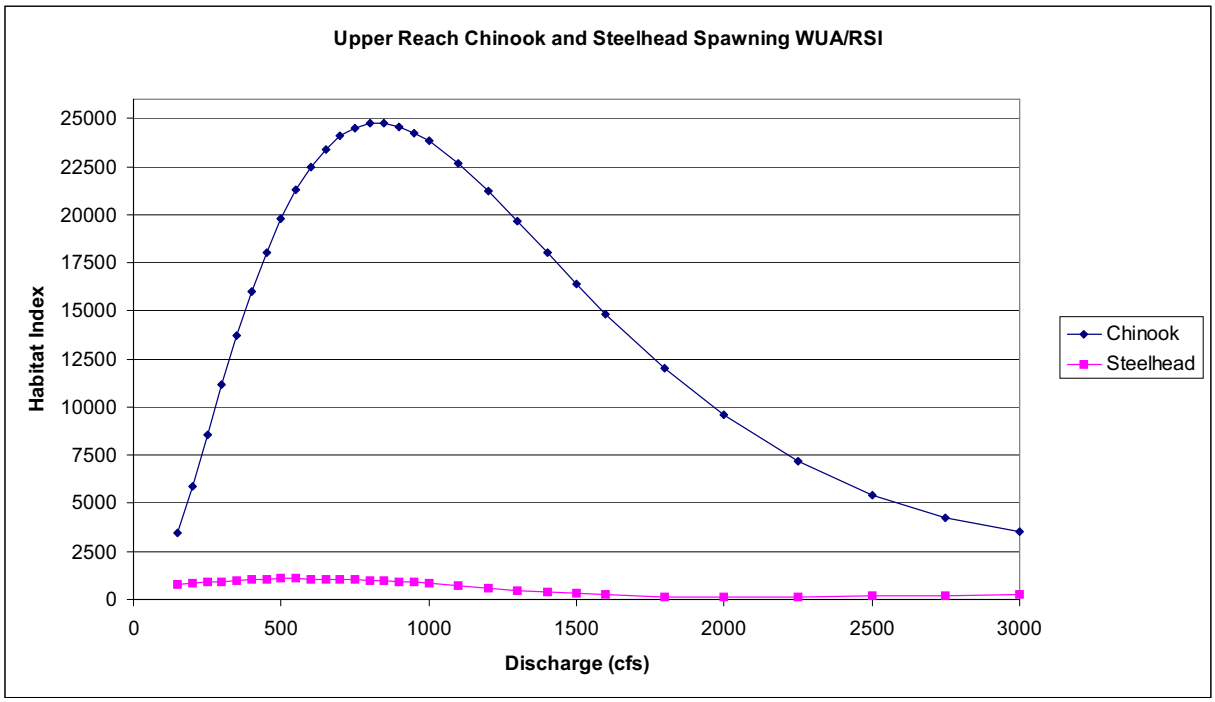

Figure C4.4-2. Low Flow Channel WUA curves for steelhead.

Under the No-Project Alternative, flows in the LFC during the steelhead spawning period would be 600 cfs, which would result in approximately 98 percent of maximum WUA. Flows in the LFC under the Proposed Project would be 800 cfs during the steelhead spawning period, which would result in approximately 91 percent of maximum WUA, representing a small decrease in WUA compared to the No-Project Alternative.

Under the Proposed Project, flows and flow fluctuations occurring in the HFC are not expected to differ from those occurring under the No-Project Alternative (described in Section 5.2, Surface Water). As a result, implementation of the Proposed Project would not result in a change in the amount of steelhead spawning habitat available or rates of redd dewatering occurring in the HFC.

Fry and Fingerling Rearing and Downstream Movement

Flow fluctuations in the LFC could potentially occur under the Proposed Project to meet water temperature objectives prescribed to protect fisheries resources. Flow fluctuations can result in juvenile salmonid isolation pond or beach stranding. Isolation ponds do not occur in the LFC below 1,200 cfs; therefore, no isolation pond stranding would be anticipated with implementation of the Proposed Project. Beach stranding can occur due to changes in water surface elevation associated with changes in flows. Juvenile steelhead tend to select deeper water with increased size, and therefore become less susceptible to beach-type stranding as they grow (i.e., later in the juvenile rearing period). Flow fluctuations of typically 200 cfs or less could occur during the summer as a result of temperature control actions. Water temperature control–related flow changes are typically 200 cfs or less and occur when rearing juveniles are larger

and have preference for deeper water, and therefore are not susceptible to beach-type stranding from water temperature control–related flow changes.

Implementation of the Proposed Project would not result in any change in the frequency or magnitude of flow fluctuations in the HFC compared to the No-Project Alternative; therefore, there would be no change in the rate of juvenile steelhead stranding occurring in the HFC.

Smolt Emigration

Changes in LFC flows with implementation of the Proposed Project are not expected to affect the quality or quantity of habitat for steelhead smolt emigration or the timing behavior of smolt emigration because emigrating smolts spend little time foraging and rearing and the majority of time actively migrating seaward.

C4.4.3.2 Temperature-Related Effects

The analysis of water temperature–related effects is qualitative and based on increased flows in the LFC as proposed under the Proposed Project, relative to the No-Project Alternative. Increased flows would result in cooler water temperatures in the LFC during most of the year. Additionally, because the LFC would be contributing a higher proportion of the overall flow in the lower Feather River, decreases in water temperature are anticipated to extend downstream of the Thermalito Afterbay Outlet.

The California Central Valley steelhead population is near the southern limit of the species range. Water temperature regimes experienced by these populations are different than those experienced by more northern populations. Low water temperatures rarely are a concern in the Sacramento River system. However, warm water temperatures are a critical management issue. Therefore, in general, actions that reduce water temperatures are considered beneficial to steelhead populations.

Adult Immigration and Holding

Because of increased flows in the LFC, water temperatures in the lower Feather River would be cooler under the Proposed Project relative to the No-Project Alternative. Because most steelhead adult immigration and holding occurs during the winter months, cooler water temperatures likely would not substantially affect steelhead adult immigration and holding.

Adult Spawning and Embryo Incubation

Most steelhead spawning in the Feather River occurs in the LFC. With implementation of the Proposed Project, water temperatures are expected to decrease relative to the No-Project Alternative. Therefore, implementation of the Proposed Project would likely be beneficial to steelhead spawning. Additionally, because cooler water temperatures would persist downstream into the HFC, additional suitable steelhead spawning habitat may become available.

Fry and Fingerling Rearing and Downstream Movement

Steelhead fry and fingerling rearing takes place year round in the lower Feather River. Cooler water temperatures likely would be beneficial to fry and fingerling rearing while effects on downstream movement likely would not be substantial.

Smolt Emigration

Effects of cooler water temperatures during the steelhead smolt emigration life stage in the lower Feather River under the Proposed Project, relative to the No-Project Alternative, likely would not be substantial with implementation of the Proposed Project.

C4.4.3.3 Predation-Related Effects

Changes in minimum flows in the LFC during the initial new license operating period are not expected to change the nature or rate of predation with implementation of the Proposed Project. Water temperature changes would be small and would not be expected to change the distribution, species composition, consumption rates, or nature of predation in the lower Feather River. Adaptive management changes in steelhead hatchery release practices may reduce predation on juvenile wild steelhead. The LWD supplementation and improvement program would improve juvenile rearing cover conditions and may result in a reduction of predation rates on juvenile steelhead.

C4.4.3.4 Fisheries Management–Related Effects

Hatchery

A hatchery adaptive management program included in the Proposed Project considers a range of potential changes in hatchery practices designed to reduce adverse effects of the Feather River Fish Hatchery on wild fish stocks and improve the benefits to steelhead produced by the hatchery. These potential changes include changes in steelhead size at release and timing of release to reduce potential size advantages of hatchery steelhead over wild steelhead, as well as to reduce potential steelhead predation on wild juvenile steelhead. Other adaptive management elements could include changes to raceways at the Feather River Fish Hatchery to alter rearing fish conditioning to improve predator avoidance and increase cover use. An enhanced fish marking program included as an action in the adaptive management program would improve the ability to measure hatchery performance and increase the understanding of the fisheries resources in the lower Feather River. The hatchery program also includes the development of HGMPs for each of the anadromous fish species managed by the hatchery.

Disease

Water temperature changes associated with implementation of the Proposed Project would be relatively small; therefore, no changes in water temperature–related incidence of fish disease are anticipated. The proposed hatchery water treatment action could reduce incidence and severity of disease occurrences in the Feather River Fish

Hatchery, which, as a result, would lower overall fish disease pressure in the lower Feather River.

Fishing Regulations, Poaching, and Change in Recreational Access and Visitation

Recreation enhancements included in the Proposed Project are anticipated to increase recreation and angling. Increased angling is expected to result in increased sport fish harvest. Fishing access in the lower Feather River is anticipated to increase with the implementation of the Proposed Project associated with the installation of fish segregation weirs and other recreation enhancements included in the Proposed Project. See Section 5.7.4 for additional information on recreation enhancements.

Installation of fish segregation weirs in the lower Feather River would require no-fishing zones in the immediate proximity of the weirs. Although the fish segregation weirs would be navigable by boats, the presence of the weirs may affect boating recreation activities to some degree. See Section 5.7.4 for additional information on fish segregation weir effects on recreation. Increased densities of fish below the weirs and river access on the weirs could potentially contribute to fish poaching opportunities with implementation of the Proposed Project.

C4.4.3.5 Summary of Potential Effects on Steelhead

Study plan report summaries addressing project effects on steelhead are presented in Section G-AQUA1.5, Fisheries Management; Section G-AQUA1.8, Salmonids and Their Habitat in the Feather River Below the Fish Barrier Dam; and Section G-AQUA1.11, Predation, in Appendix G-AQUA1 of the PDEA. A description of each steelhead life stage and the time period associated with it is presented in Appendix G-AQUA1 of the PDEA.

Adult Immigration and Holding

Actions potentially affecting steelhead adult immigration and holding include changes to instream flows and water temperatures in the LFC, fish segregation weirs, and LWD supplementation.

Increased stream flows of 700 cfs to 800 cfs in the LFC under the Proposed Project could potentially benefit immigrating steelhead by increasing lower Feather River stage elevations. Although stage increases would be small, shallow riffles could potentially become deeper, reducing the effort required by immigrating steelhead to proceed through shallow riffles. Additionally, increasing flows would slightly reduce average daily water temperatures, thereby increasing overall habitat suitability during the immigration and holding period.

Installation of fish segregation weirs would have a beneficial effect on steelhead adult immigration and holding by eliminating fishing pressure within the no-fishing zones in the vicinity of the weirs. However, the potential for poaching of steelhead in the vicinity of the fish segregation weirs likely would be increased because of higher fish densities and increased access to the lower Feather River in those locations.

LWD supplementation upstream of the fish segregation weirs would have a beneficial effect on this life stage by creating potential velocity refuges and increased cover availability.

Overall, implementation of the Proposed Project would result in a beneficial effect on steelhead adult immigration and holding.

Adult Spawning and Embryo Incubation

Actions potentially affecting steelhead adult spawning and embryo incubation include installation of fish segregation weirs, side-channel habitat enhancement, and gravel supplementation.

Installation of fish segregation weirs in the lower Feather River likely would benefit steelhead adult spawning and embryo incubation by eliminating fishing pressure on fish spawning in the no-fishing zones in the vicinity of the weirs. However, the potential for increased poaching of steelhead in the vicinity of the fish segregation weirs likely would be increased because of higher fish densities and increased access to the lower Feather River in those areas.

Side-channel habitat enhancement and gravel supplementation could potentially benefit steelhead adult spawning and embryo incubation by increasing the quantity and quality of available spawning habitat, thereby reducing competition for available habitat. Additional habitat availability would result in reduced pre-spawn mortality rates as well as reduced redd superimposition and resulting egg mortality.

Overall, implementation of the Proposed Project would result in a beneficial effect on steelhead adult spawning and embryo incubation relative to the No-Project Alternative.

Fry and Fingerling Rearing and Downstream Movement

Actions potentially affecting steelhead fry and fingerling rearing and downstream movement include changes to instream flows and water temperatures in the LFC, a hatchery adaptive management program, side-channel habitat enhancement, gravel supplementation, and LWD supplementation.

Flow fluctuations could occur in the LFC during the summer to meet water temperature requirements to protect fisheries resources. This could result in an adverse effect on steelhead juvenile rearing and downstream movement by increasing the potential for beach stranding. However, based on the SP-G2 analysis indicating that isolation ponds do not form below 1,200 cfs, the emigration timing of most juvenile steelhead in the Feather River, and on the preference for increased water depths as rearing juveniles grow larger later in the rearing season, it is unlikely that any substantial change in the rate of beach stranding would occur as a result of flow fluctuations in the LFC. Additionally, increasing flows would slightly reduce average daily water temperatures, thereby increasing overall habitat suitability during the summer months when some steelhead could be rearing in the river.

The hatchery adaptive management program would potentially have a beneficial effect on this life stage by altering the size at release and timing of juvenile steelhead released into the lower Feather River, reducing predation on emigrating wild steelhead. Other adaptive management elements could include changes to raceways at the Feather River Fish Hatchery to improve rearing fish conditioning to improve predator avoidance and cover use.

Side-channel habitat enhancement, gravel enhancement, and LWD supplementation would have a beneficial effect on rearing and downstream migrating steelhead by increasing channel complexity and increasing the quantity and quality of rearing habitat. However, placement of LWD could potentially have an adverse effect by increasing warmwater predator habitat availability.

Overall, implementation of the Proposed Project would result in a beneficial effect on steelhead fry and fingerling rearing and downstream movement relative to the No-Action Alternative.

Smolt Emigration

Actions potentially affecting steelhead smolt emigration include a hatchery adaptive management program, side channel creation, and LWD supplementation. The hatchery adaptive management program would have a beneficial effect on this life stage by potentially altering the size at release and timing of juvenile steelhead released into the lower Feather River, which could reduce predation rates on emigrating wild steelhead smolts. Additionally, by altering raceways at the Feather River Fish Hatchery, the program could increase post-release survival rates of hatchery-produced steelhead smolts.

Creation of side channels provides additional foraging and refuge opportunities for emigrating smolts. LWD supplementation would benefit smolt emigration by providing cover and refuge, but also potentially have an adverse effect on steelhead smolt emigration by increasing warmwater predator habitat downstream of the Thermalito Afterbay Outlet.

Overall, implementation of the Proposed Project would result in a beneficial effect on steelhead smolt emigration relative to the No-Action Alternative.

C4.4.3.6 Potential Facility Modifications

Although it is not possible to quantify the effects of any future facility modifications on steelhead with the information available at this time, all of the potential facility modifications being studied would likely benefit steelhead due to increased quantity and quality of habitat with suitable water temperature conditions. A qualitative evaluation of the potential effects of future facilities modifications on lower Feather River aquatic habitat is described in Section C4.1.7 above.

Conclusion

Based on the above summary of potential effects, it is likely that the Proposed Project would result in an overall beneficial effect on steelhead relative to the No-Action Alternative.

C4.4.4 American Shad

C4.4.4.1 Flow-Related Effects

American shad adult immigration occurs during May and June, and spawning occurs during June and July. American shad have been frequently observed in the Feather River from the Thermalito Afterbay Outlet downstream to the confluence with the Sacramento River and only infrequently upstream of the Thermalito Afterbay Outlet to Steep Riffle at RM 61. No changes in flow regimes downstream of the Thermalito Afterbay Outlet are included under the Proposed Project, relative to the No-Project Alternative. Under the Proposed Project, minimum flows in the river reach extending from the Fish Barrier Dam downstream to the Thermalito Afterbay Outlet would be increased from 600 cfs to 700 cfs from April 1 to September 14 and to 800 cfs from September 15 to March 31. Because American shad are observed only infrequently upstream of the Thermalito Afterbay Outlet, an increase in flow in this reach of the river is not anticipated to have any effect on American shad immigration or spawning.

C4.4.4.2 Water Temperature–Related Effects

The reported suitable water temperature range for American shad adult immigration and spawning is 46°F to 79°F, and this life stage occurs from April through June in the lower Feather River (Moyle 2002; DFG 1986; Leggett and Whitney 1972; Painter et al. 1979; USFWS 1995; Walburg and Nichols 1967; Wang 1986). With implementation of the Proposed Project, water temperatures are expected to remain within this broad range. Therefore, no substantial water temperature effects on American shad are anticipated.

C4.4.4.3 Summary of Potential Effects on American Shad

Study plan report summaries addressing project effects on American shad are presented in Section G-AQUA1.4, Non-Salmonid Fish in the Feather River Downstream of the Thermalito Diversion Dam, in Appendix G-AQUA1 of the PDEA.

Implementation of the Proposed Project would not alter flows and would have only a slight effect on water temperatures in the HFC compared to the No-Project Alternative. Specifically, there would be no changes in immigration or spawning habitat quantity and quality as a result of water temperature or stage elevation changes. Therefore, there would be no water temperature or flow-related effects on American shad during the initial new license operating period with implementation of the Proposed Project.

C4.4.4.4 Potential Facility Modifications

American shad are not known to utilize the LFC above steep riffle; therefore, upstream facility modifications are not anticipated to have any substantive effect on habitat utilization within the LFC by American shad. Upstream facilities modifications being studied would likely lower water temperatures in the HFC to some extent, but likely would not be of sufficient magnitude to affect American shad. Potential downstream facilities modifications being studied would likely lower water temperatures in the HFC, but also likely would not be of sufficient magnitude to reduce water temperatures below a value that would have biological significance for American shad. Therefore, it is not likely that any of the potential future facility modifications would have any substantive effect on American shad.

Conclusion

Based on the above summary of potential effects, it is likely that the Proposed Project would not result in any significant effect on American shad relative to the No-Project Alternative.

C4.4.5 Black Bass

C4.4.5.1 Water Temperature–Related Effects

Most black bass inhabiting the lower Feather River occur downstream of the Thermalito Afterbay Outlet. Black bass are considered a warmwater species and although slightly lower water temperatures may occur in the lower Feather River with implementation of the Proposed Project, the magnitude of the cooling would not be sufficient to substantially affect black bass habitat availability. Additionally, there is suitable black bass habitat downstream of the lower Project Boundary where water temperature reductions likely would be negligible.

C4.4.5.2 Summary of Potential Effects on Black Bass

Study plan report summaries addressing project effects on black bass species are presented in Section G-AQUA1.3, Fish and Their Habitat within Lake Oroville, its Upstream Tributaries, the Thermalito Complex, and the Oroville Wildlife Area; Section G-AQUA1.4, Non-Salmonid Fish in the Feather River Downstream of the Thermalito Diversion Dam; Section G-AQUA1.5, Fisheries Management; and Section G-AQUA1.11, Predation, in Appendix G-AQUA1 of the PDEA.

Implementation of the Proposed Project would not alter flows in the HFC. Water temperatures during the initial new license operating period would be slightly reduced in the HFC of the lower Feather River compared to the No-Project Alternative. Specifically, there would be only slight changes in spawning habitat quantity and quality as a result of water temperature changes. Therefore, there would be no significant adverse water temperature and no flow-related effects on black bass with implementation of the Proposed Project during the initial new license operating period.

C4.4.5.3 Potential Facility Modifications

Black bass are not known to utilize the LFC; therefore, upstream facility modifications being studied would not be expected to have any effect on black bass in the LFC. Potential future facilities modifications likely would lower water temperatures in the HFC and may have an adverse effect on the quantity and quality of black bass habitat downstream to the lower Project Boundary. Potential water temperature reductions beyond the lower Project Boundary would diminish with diminishing biological effects until water temperatures reach a range suitable for black bass. The distance downstream of the lower Project Boundary within which adverse water temperature effects on black bass could potentially occur would depend on the magnitude of the flows as well as the daily weather conditions. Because the lower Feather River downstream of the area influenced by water temperatures controlled by the Oroville Facilities would remain suitable habitat for black bass, the overall potential effect of the Proposed Project on habitat availability for this species would be minimal.

Conclusion

Based on the above summary of potential effects, it is likely that the effects of the Proposed Project on black bass would be less than significant relative to the No-Project Alternative.

C4.4.6 Green Sturgeon

C4.4.6.1 Flow-Related Effects

Flows in the portions of the lower Feather River where sturgeon are distributed would not change with implementation of the Proposed Project relative to the No-Project Alternative. Therefore, there would be no flow-related effects on green sturgeon under the Proposed Project.

C4.4.6.2 Water Temperature–Related Effects

Water temperatures downstream of the Thermalito Afterbay Outlet, where sturgeon are known to occur, would cool slightly under the Proposed Project relative to the No-Project Alternative. A review of available literature on suitable water temperatures for different life stages of green sturgeon indicates the following:

- Adult immigration and holding—44°F to 61°F (Beamsderfer and Webb 2002; DFG Website 2002; Emmett et al. 1991; Erickson et al.2002; USFWS 1995);
- Adult spawning and embryo incubation—46°F to 68°F (Artyukin and Andronov 1990; Beamsderfer and Webb 2002; DFG Website 2002; Cech et al. 2000; Erickson et al. 2002; Moyle et al. 1995; USFWS 1995);
- Juvenile rearing—50°F to 66°F (Moyle 2002; Cech et al. 2000; Conservation Management Website 1996; Farr et al. 2001); and

- Juvenile emigration—50°F to 66°F (Moyle 2002; Adams et al. 2002; Beamsderfer and Webb 2002; Cech et al. 2000; Conservation Management Website 1996; Farr et al. 2001).

Water temperature decreases associated with implementation of the Proposed Project are not expected to fall below minimums specified for each life stage. Therefore, water temperature–related effects on green sturgeon would range from no change, relative to the No-Project Alternative, to slightly beneficial effects.

C4.4.6.3 Summary of Potential Effects on Green Sturgeon

Study plan report summaries addressing project effects on green sturgeon are presented in Section G-AQUA1.3, Fish and Their Habitat within Lake Oroville, its Upstream Tributaries, the Thermalito Complex, and the Oroville Wildlife Area; and Section G-AQUA1.4, Non-Salmonid Fish in the Feather River Downstream of the Thermalito Diversion Dam, in Appendix G-AQUA1 of the PDEA.

Implementation of the Proposed Project would not alter flows or decrease water temperatures in the lower Feather River sufficiently to affect green sturgeon compared to the No-Project Alternative. Specifically, there would be no changes in spawning habitat quantity and quality as a result of water temperature or stage elevation changes. Therefore, there would be no water temperature– or flow-related effects on green sturgeon with implementation of the Proposed Project during the initial new license operating period.

C4.4.6.4 Potential Facility Modifications

Green sturgeon are not known to utilize the LFC; therefore, upstream facility modifications being studied would not be expected to have any effect on utilization within the LFC. Potential future facilities modifications likely would lower water temperatures in the HFC but not below a value that would have biological significance for green sturgeon. The potential future facility modifications would likely benefit the adult immigration and holding, adult spawning and embryo incubation, juvenile rearing, and juvenile emigration life stages for green sturgeon by increasing the quantity and quality of available habitat through reduced water temperatures.

Conclusion

Based on the above summary of potential effects, it is likely that effects on green sturgeon under the Proposed Project would be beneficial relative to the No-Project Alternative.

C4.4.7 Hardhead

C4.4.7.1 Water Temperature–Related Effects

Water temperatures in the lower Feather River are expected to be slightly cooler with implementation of the Proposed Project, relative to the No-Project Alternative. The

reported suitable water temperature range for hardhead adult spawning is 55°F to 75°F, and this life stage occurs from April through August in the lower Feather River (Moyle 2002; Cech Jr. et al. 1990; Wang 1986). Slightly lower water temperatures in the lower Feather River are not expected to have any adverse effects on hardhead.

C4.4.7.2 Summary of Potential Effects on Hardhead

Study plan report summaries addressing project effects on hardhead are presented in Section G-AQUA1.4, Non-Salmonid Fish in the Feather River Downstream of the Thermalito Diversion Dam, of Appendix G-AQUA1 of the PDEA.

Implementation of the Proposed Project would increase flows and decrease water temperatures in the LFC, relative to the No-Project Alternative. However, there would be no changes to flows and only slight changes in water temperatures in the HFC under the Proposed Project. Therefore, increased flows and decreased water temperatures in the LFC would have no effect on hardhead spawning during the interim period. Similarly, no negative effects on spawning are expected downstream of the Thermalito Afterbay Outlet.

C4.4.7.3 Potential Facility Modifications

Implementation of any of the proposed facility modifications is not likely to have any substantial water temperature effect on the quantity or quality of available habitat for hardhead.

Conclusion

Based on the above summary of potential effects, it is likely that the Proposed Project would not result in any significant effect on hardhead relative to the No-Project Alternative.

C4.4.8 River Lamprey

C4.4.8.1 Water Temperature–Related Effects

River lamprey reportedly tolerate a relatively broad range of water temperatures for spawning (e.g., 43°F to 72°F [Moyle 2002; Beamish 1980; Kostow 2002; Meeuwig et al. 2003; Meeuwig et al. 2002; Stone et al. 2001; Wang 1986]). Small decreases in water temperature associated with implementation of the Proposed Project, relative to the No-Project Alternative, are not expected to have any effect on river lamprey.

C4.4.8.2 Summary of Potential Effects on River Lamprey

Study plan report summaries addressing project effects on river lamprey are presented in Section G-AQUA1.4, Non-Salmonid Fish in the Feather River Downstream of the Thermalito Diversion Dam, of Appendix G-AQUA1 of the PDEA.

Implementation of the Proposed Project would increase flows and decrease water temperatures in the LFC, relative to the No-Project Alternative. However, there would be no significant changes to flows and only slight decreases in water temperatures in the HFC under the Proposed Project. Therefore, water temperature changes in the LFC due to increased flows would have no effect on river lamprey spawning. Additionally, river lamprey would benefit from improved spawning substrate conditions resulting from the gravel supplementation and improvement program.

C4.4.8.3 Potential Facility Modifications

Implementation of any of the potential future facility modifications likely would not result in decreased water temperatures of sufficient magnitude to result in a change in the quantity and quality of available habitat for river lamprey.

Conclusion

Based on the above summary of potential effects, it is likely that the Proposed Project would result in slightly beneficial effects on River lamprey relative to the No-Project Alternative.

C4.4.9 Sacramento Splittail

C4.4.9.1 Flow-Related Effects

Sacramento splittail have only been reportedly observed in the Feather River downstream of the Thermalito Afterbay Outlet. No changes in flow regimes are anticipated with implementation of the Proposed Project in this portion of the river. Therefore, potential flow-related effects on Sacramento splittail spawning are not included in this analysis.

C4.4.9.2 Water Temperature–Related Effects

Sacramento splittail only inhabit the lower portion of the lower Feather River where water temperature decreases associated with the Proposed Project would likely be undetectable. Therefore, no water temperature–related effects are anticipated with implementation of the Proposed Project relative to the No-Project Alternative.

C4.4.9.3 Summary of Potential Effects on Sacramento Splittail

Study plan report summaries addressing project effects on Sacramento splittail are presented in Section G-AQUA1.4, Non-Salmonid Fish in the Feather River Downstream of the Thermalito Diversion Dam, of Appendix G-AQUA1 of the PDEA.

There would be no changes to flows and only minimal decrease in water temperatures in the HFC under the Proposed Project relative to the No-Project Alternative. Because only minimal changes would occur and Sacramento splittail have only been observed in the HFC within the project study area, no flow-related or water temperature–related effects on splittail spawning are expected to occur.

C4.4.9.3 Potential Facility Modifications

Sacramento splittail do not utilize the lower Feather River upstream of the Thermalito Afterbay Outlet. Therefore, implementation of any of the proposed facility modifications is not likely to have any effect on Sacramento splittail in the LFC. Additionally, because the lower Feather River downstream of the area influenced by water temperatures controlled by the Oroville Facilities (i.e., the remainder of the river downstream of the southern project boundary) would remain suitable habitat for Sacramento splittail, the overall potential affect of the Proposed Project on habitat availability for this species would be minimal.

Conclusion

Overall, implementation of the Proposed Project is not anticipated to affect Sacramento splittail.

C4.4.10 Striped Bass

C4.4.10.1 Flow-Related Effects

No changes in flows below the Thermalito Afterbay Outlet would result from implementation of the Proposed Project; therefore, the majority of striped bass habitat would not be affected. Minimum flows in the river reach extending from the Fish Barrier Dam downstream to the Thermalito Afterbay Outlet would increase from 600 cfs to 700 cfs from April 1 to September 14 and to 800 cfs from September 15 through March 31 under the initial new license operating period with implementation of the Proposed Project. Because striped bass are infrequently observed upstream of the Thermalito Afterbay Outlet, an increase in flow in this reach of the river is not anticipated to have any substantive effect on the quantity, quality, or distribution of striped bass habitat.

C4.4.10.2 Water Temperature–Related Effects

Water temperatures downstream of the Thermalito Afterbay Outlet, where striped bass are known to occur, would only cool slightly under the Proposed Project, relative to the No-Project Alternative. Therefore no significant impacts on striped bass spawning are expected as a result of decreased water temperature.

C4.4.10.3 Summary of Potential Effects on Striped Bass

Study plan report summaries addressing project effects on striped bass are presented in Section G-AQUA1.4, Non-Salmonid Fish in the Feather River Downstream of the Thermalito Diversion Dam, of Appendix G-AQUA1 of the PDEA.

Implementation of the Proposed Project would increase flows and decrease water temperatures in the LFC, relative to the No-Project Alternative. However, there would be no changes to flows in the HFC under the Proposed Project. Because such changes would not occur and striped bass are frequently observed in the HFC, no flow-related effects on striped bass spawning habitat would occur within most of the areas where

striped bass are observed. Because striped bass are only infrequently observed in the LFC, reduced water temperatures are not likely to substantially affect striped bass spawning during the interim period. Similarly, only minimal decreases in water temperature in the HFC are anticipated under the Proposed Project and would not be of sufficient magnitude to affect striped bass spawning.

C4.4.10.4 Potential Facility Modifications

Striped bass are not frequently observed in the LFC; therefore, upstream facilities modifications would have no effect on striped bass utilization within the LFC, potential future facilities modifications would have the effect of propagating water temperatures similar to those in the LFC farther downstream and could potentially affect the suitability of existing striped bass habitat upstream of the lower Project Boundary. However, because striped bass spawning in the lower Feather River peaks during May and early June (DFG 1971; DeHaven 1979; DeHaven 1977), when water temperature requirements in the LFC rise to 63^{o}F and because striped bass reportedly prefer water temperatures of 50^{o}F to 68^{o}F (Moyle 2002), no negative effects are anticipated on striped bass spawning.

Conclusion

Based on the above summary of potential effects, it is likely that the Proposed Project would not result in any significant effect on striped bass.

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APPENDIX D
BEST MANAGEMENT PRACTICES

The planning and execution of Proposed Project and Federal Energy Regulatory Commission (FERC) Staff Alternative Settlement Agreement (SA) articles that involve site preparation and construction activities to be undertaken by the California Department of Water Resources (DWR) would include the adoption of numerous Best Management Practices (BMPs) designed to avoid or mitigate short-term effects typically associated with such activities. The BMPs to be adopted as part of the Proposed Project are presented here.in Appendix D.

(From the California Stormwater BMP Handbook, Construction, by California Stormwater Quality Association, HTTP://WWW.CABMPHANDBOOKS.COM/CONSTRUCTION.ASP)

Selection and implementation of BMPs is based on the pollution risks associated with the construction activity. The pollution prevention objectives of BMPs are defined by a review of information gathered during the assessment of the site and planned activities. Once defined, BMP objectives are developed and BMPs selected. The BMP objectives for construction projects are as follows:

- Control of Erosion, and Discharge of Sediment:
    - Minimize Disturbed Areas: Only clear land which will be actively under construction in the near term, minimize new land disturbance during the rainy season, and avoid clearing and disturbing sensitive areas (e.g., steep slopes and natural watercourses) and other areas where site improvements will not be constructed.
    - Stabilize Disturbed Areas: Provide temporary stabilization of disturbed soils whenever active construction is not occurring on a portion of the site. Provide permanent stabilization during finish grade and landscape the site.
    - Protect Slopes and Channels: Safely convey runoff from the top of the slope and stabilize disturbed slopes as quickly as possible. Avoid disturbing natural channels. Stabilize temporary and permanent channel crossings as quickly as possible and ensure that increases in runoff velocity caused by the project do not erode the channel.
    - Control Site Perimeter: Delineate site perimeter to prevent disturbing areas outside the project limits. Divert upstream run-on safely around or through the construction project. Runoff from the project site should be free of excessive sediments and other constituents.
    - Retain Sediment: Retain sediment-laden waters from disturbed, active areas within the site.

- Manage Non-Stormwater Discharges and Materials:

    - Practice Good Housekeeping: Perform activities in a manner to keep potential pollutants from coming into contact with stormwater or being transported off site to eliminate or avoid exposure.

    - Contain Materials and Wastes: Store construction, building, and waste materials in designated areas protected from rainfall and contact with stormwater runoff. Dispose of all construction waste in designated areas, and keep stormwater from flowing onto or off of these areas. Prevent spills and clean up spilled materials.

ADDITIONAL GENERAL GUIDELINES

- Pre-construction surveys for sensitive species and environmental permitting/documentation will be done prior to commencement of work.

- No intentional harassment, killing, or collection of plants or animals at or around the work site will occur.

- No firearms are allowed on construction site, except for those used by peace officers, DFG [California Department of Fish and Game]wardens or State Park rangers.

- No pets will be allowed.

- All persons will stay within the boundaries of the work site.

- No other off-road travel or work will be permitted; all vehicles must be confined to existing roads or areas designated for vehicles.

- All trash, including food-related trash and cigarette butts, will be properly disposed of and removed by the workers daily.

- Always choose the site preparation method that creates the least soil disturbance, remains effective and safe, and accomplishes project goals.

- General timing restrictions will be employed to protect environmental resources.

GENERAL GUIDELINES FOR CONTROL OF RUNOFF & SEDIMENT FROM GROUND DISTURBANCE

General Guidelines when Removing Vegetation

- Disturbance of vegetation shall be kept to a minimum. Trees will be flagged and avoided during construction.

- Provide for rapid revegetation of all denuded areas through natural processes supplemented by artificial revegetation where necessary.

- Maintenance of existing woody vegetation:
    - Preservation of existing vegetation shall be provided prior to the commencement of clearing and grubbing operations or other soil disturbing activities in areas identified on the plan as those to be preserved.
    - Mark areas to be preserved with temporary fencing, such as orange polypropylene that is stabilized against UV [ultraviolet] light, and is at least 3 feet tall.
    - Fence posts shall be wood or metal and spacing and depth shall be adequate to completely support the fence in an upright position.
    - Minimize disturbed areas by locating temporary roadways to avoid stands of trees and shrubs and to follow existing contours and reduce cutting and filling.
    - Consider the impact of grade changes to existing vegetation and the root zone.
    - Keep equipment away from trees to prevent trunk and root damage.
    - Construction materials, equipment storage, and parking areas shall be located where they will not cause root compaction.
    - All workers shall be instructed to honor protective devices. No heavy equipment, vehicular traffic, or storage piles of any construction material shall be permitted within the dripline of any tree to be retained. No toxic or construction materials (including paint, acids, nails, gypsum board, chemicals, fuels, or lubricants) shall be stored within 15 meters (50 feet) of the drip line of any retained trees, nor disposed of in any way which would injure vegetation.

General Guidelines to Minimize Surface Erosion and Stabilize Material

Surface erosion measures:

- Erosion control measures involving revegetation (seeding and fertilization) should be planned and implemented as soon as practicable following disturbance.
- An integrated system of collection, control, and dispersal of surface runoff is very important to prevent erosion. Mechanical measures include construction of ditches, slash windrows, straw bale dams, sediment barriers, erosion netting and fabrics, terraces, benching, riprap, and tackifiers.
- Be aware of ongoing conditions of weather, soil conditions, and water movement and how these conditions may affect runoff and erosion.
- Employ regular inspections and maintenance of erosion control features.

Stabilization measures. A combination of practices that promote the reestablishment of vegetation on exposed slopes, provides physical protections to exposed surfaces, prevents the downslope movement of soil, and controls drainage.

- Employ regular inspections and maintenance of erosion control features.
- Measures to reestablish vegetation on exposed soils are usually accomplished by seeding suitable herbaceous vegetation in conjunction with mulching and fertilization. Treatments may include tree seedling planting, sprigging, or bioengineering.
- Measures to physically protect the soil surface from erosion or modify the topography to minimize erosion include the use of gravel on the road surface and use of mulches, riprap, erosion mats, and terracing on cuts, fills, and ditches as appropriate. Temporary waterbars in areas of uncompleted roads and trails can be effectively utilized to reduce sedimentation.
- Measures which physically inhibit the transport of sediments to streams include the use of slash filter windrows on or below the fill slopes, baled straw in ditches or below fillslopes, silt fences, and catch basins in culvert inlets.
- Measures that reduce the amount of solid disturbance in or near streams include immediate placement of large culverts in live streams prior to crossing stream with rock embankment during road construction. Temporary pipes should not be installed unless sedimentation can be minimized during installation, use and removal.

Specifics for Erosion Control and Stabilization

Erosion Control BMPs—source control practices that protect the soil surface and prevent soil particles from being detached by rainfall, flowing water, or wind. Erosion control consists of preparing the soil surface and implementing one or more of the following BMPS to the disturbed soil areas. See Section 3.1 of: http://www.cabmphandbooks.com/Documents/Construction/Section_3.pdf

- Scheduling
- Preservation of Existing Vegetation
- Hydraulic Mulch
- Hydroseeding
- Soil Binders
- Straw Mulch
- Geotextiles or Mats

- Wood Mulching
- Earth Dikes and Drainage Swales
- Velocity Dissipation Devices
- Slope Drains
- Streambank Stabilization
- Polyacrylamide

Sediment Control BMPs—include any practice that traps soil particles after they have been detached and moved by rain, flowing water, or wind. Sediment Control measures are usually passive systems that rely on filtering or settling the particles out of the water or wind that is transporting them. See Section 3.2 of:
http://www.cabmphandbooks.com/Documents/Construction/Section_3.pdf

- Silt fence
- Sediment basin
- Sediment trap
- Check dam
- Fiber rolls
- Gravel bag berm
- Street sweeping and vacuuming
- Sandbag barrier
- Straw bale barrier
- Storm drain inlet protection
- Chemical treatment

Wind Erosion Control—consists of applying water or other dust palliatives to prevent or alleviate dust nuisance. See Section 3.3 of:
http://www.cabmphandbooks.com/Documents/Construction/Section_3.pdf

Non-Stormwater Management BMPs—source control BMPs that prevent pollution by limiting or reducing potential pollutants at their source or eliminating off-site discharge. These BMPs are also referred to as “good housekeeping practices” which involve keeping a clean, orderly construction site. See Section 4.1 of:
http://www.cabmphandbooks.com/Documents/Construction/Section_4.pdf

- Water conservation practices
- Dewatering
- Paving and grinding operations
- Temporary stream crossings
- Clean water diversion
- Illicit connection/discharge
- Potable water/irrigation
- Vehicle and equipment cleaning, fueling and maintenance
- Pile driving operations
- Concrete curing and finishing
- Material and equipment use
- Demolition adjacent to water
- Temporary batch plants

Waste Management and Materials Pollution Control BMPs—source controls to prevent pollution by limiting or reducing potential pollutants at their source before they come in contact with stormwater. These, like the non-stormwater management BMPs, are "good housekeeping practices" which involve keeping a clean, orderly construction site. See Section 4.2 of:
http://www.cabmphandbooks.com/Documents/Construction/Section_4.pdf

- Materials delivery and storage
- Material use
- Stockpile management
- Spill prevention and control
- Waste management
    - Solid waste
    - Hazardous waste
    - Contaminated soil

- Concrete waste
- Sanitary/septic waste

General Practices for Toxic or Hazardous Spills

- Locate service and refueling sites well away from wetlands and stream channels.
- Any chemical spills will be cleaned up and reported immediately.
- Wash chemical containers and clean equipment in special areas designated for these uses.
- Keep chemicals away from surface water when mixing.
- Latrines, vaults, or pit toilets for camps will be located a minimum of 100 feet from all perennial lakes and streams.
- Minor oil spills can be prevented by:
  - Collecting used oil, oil filters, and grease tubes
  - Requiring equipment operators to carry absorbent pads
  - Providing containment and cleanup for portable fuel tanks including hose and nozzle
  - Following approved disposal methods for waste products
  - Regular checks for and prompt repair of leaks
  - Developing Spill Prevention Control and Countermeasure Plans

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APPENDIX E
MODELING COMPARISONS

E.1 INTRODUCTION

Extensive modeling of Oroville Facilities operations were performed for the Preliminary Draft Environmental Assessment (PDEA) analyses. The PDEA determined that the implementation of the Proposed Action would result in an increase in the protection and enhancement over the Existing Conditions, and an overall benefit to the *Regional Water Quality Control Plan for the Sacramento and San Joaquin River Basins* (Basin Plan) beneficial uses and coldwater fisheries resources. The following analysis demonstrates that the CEQA Proposed Project is more protective and enhancing of water quality beneficial uses and coldwater fisheries resources than the PDEA Proposed Action. The California Environmental Quality Act Guidelines (State CEQA Guidelines) do not require detailed analysis of beneficial effects; therefore, the focus of this analysis is to establish that the CEQA Proposed Project is more protective, enhancing, and overall beneficial than the PDEA Proposed Action, which resulted in a beneficial effects determination.

The purpose of the modeling comparisons between project alternatives is to determine the similarities and differences between water temperatures in the Low Flow Channel (LFC), High Flow Channel (HFC), and Thermalito Afterbay associated with the Proposed Action evaluated in the PDEA accompanying the California Department of Water Resources' (DWR's) Federal Energy Regulatory Commission (FERC) license application (DWR 2005) and the Proposed Project evaluated in this CEQA environmental impact report (EIR). This appendix presents the results of the analyses of the water temperature effects, the project's ability to meet existing and future temperature objectives in the LFC and HFC, and the relative differences in coldwater beneficial use and coldwater fisheries benefits for each of the alternatives.

As part of the Settlement Agreement (SA), which is the CEQA Proposed Project, DWR performed a Reconnaissance Study of potential future facility modifications as described in SA Section B108 designed to study ways to provide colder water to the lower Feather River for greater protection and enhancement of beneficial uses. The Reconnaissance Study was completed in December 2006 and identified a number of conceptual actions that could be further studied for feasibility, individually or in combination with one another. Development of the Reconnaissance Study is part of DWR's compliance with the SA. Further development of design concepts for potential future facilities modifications is part of a long-term study process defined in the SA; the concepts developed within the December 2006 Reconnaissance Study reflect only the first step in the ongoing planning process, and therefore are too speculative to analyze in any depth at this time. As a result, the Reconnaissance Study descriptions and preliminary modeling conducted to support that study are not included or utilized for analysis within this draft CEQA EIR document. Instead, this document analyzes the potential future facilities modifications as they were specified and approved by the collaborative participants and signatories to the SA. Any facilities modifications measures recommended for potential implementation as a result of the Feasibility Study

that will be conducted subsequent to the Reconnaissance Study would be subject to future, more detailed, CEQA analysis.

Because the FERC Staff Alternative has the same operating characteristics as the CEQA Proposed Project, the effects on water quality from the CEQA Proposed Project operations would be the same as for the FERC Staff Alternative.

E.2 MODELING ANALYSIS

The following section provides an overview of the operations modeling conducted for analysis of environmental impacts as part of the FERC Relicensing Program. The following discussion focuses on the comparison of modeling scenarios and results previously completed for the PDEA Proposed Action (hereinafter referred to as the "Proposed Action") versus the CEQA Proposed Project (hereinafter referred to as the "Proposed Project"). The Proposed Project is the same as the Settlement Agreement for Licensing of the Oroville Facilities, FERC Project No. 2100, dated March 2006 (SA), and as described in Chapter 3.0 of this document.

For the PDEA, results of the quantitative operations modeling comparison of the Existing Conditions to the Proposed Action determined that the Proposed Action was beneficial for coldwater beneficial uses and coldwater fisheries (see PDEA Section 5.4 (Water Quality) and Section 5.5 (Aquatic Resources). For the CEQA analyses, because the only difference in assumptions associated with the Existing Conditions and the No-Project Alternative are associated with the timing of flow releases, potential effects on flows and water temperatures associated with the No-Project Alternative are assumed to be equivalent to those of the Existing Conditions.

Furthermore, CEQA guidelines regarding analysis of beneficial effects of a project imply that, because previous modeling analyses showed that the Proposed Action would result in increased beneficial effects over Existing Conditions, and the Proposed Project under CEQA provides even further protections than the previously studied Proposed Action, then no further quantitative analyses of modeling comparisons would be needed to support the analysis of project effects on water quality or aquatic resources for the purposes of this EIR.

The following comparison demonstrates that potential changes in water temperatures under the Proposed Action result in beneficial impacts on the coldwater resources quantitatively evaluated, and that water temperatures would be further reduced, and thus beneficial uses further improved, with implementation of the Proposed Project. Because water temperatures that would occur in the lower Feather River with implementation of the Proposed Project are more protective of coldwater fisheries resources than the water temperatures provided by the Proposed Action, no detailed quantitative analysis utilizing model results is required for the various resource evaluations in this EIR. Specifically, because the Proposed Action was determined to have a beneficial effect on coldwater fisheries resources, and because CEQA does not require detailed analysis of beneficial project effects, no further quantitative evaluation of the colder water temperatures provided by implementation of the Proposed Project is

required. Increases in the protection and enhancement of coldwater fisheries resources included in the Proposed Project specifically protect and enhance beneficial uses of Cold Freshwater Habitat; Migration of Aquatic Organisms; and Spawning, Reproduction, and/or Early Development identified as existing and beneficial uses in the Central Valley RWQCB Basin Plan objectives (see Table 4.2-4).

For those resource areas such as surface water quantity, surface water quality, and aquatic resources, which are typically evaluated utilizing quantitative modeling comparisons, either there are beneficial effects associated with implementation of the Proposed Project (e.g., aquatic resources, as discussed in Section 5.4), no change between alternatives (e.g., surface water quantity, as discussed in Section 5.2.1), or the best available science does not support quantitative comparisons of alternatives (e.g., agricultural diversion water temperatures, as discussed below). For those resource assessments in which modeling comparisons could not be conducted or are not required, analysis of the nature of the effect and general magnitude of water temperature change are based on the qualitative water temperature evaluations discussed below.

E.2.1 Proposed Project vs. Proposed Action Water Temperature Objectives

Proposed Project water temperature objectives at the Feather River Fish Hatchery (SA Article A107) and Robinson Riffle (SA Article A108) are either the same as under the Proposed Action, or the Proposed Project is more protective of coldwater beneficial uses and coldwater fisheries, due to reduced water temperature criteria or an extension of the period during which water temperature criteria are applied. The Proposed Project also provides for more protective water temperature targets during the initial new license period (i.e., the period after the new FERC license is issued, but prior to construction of any potential future facilities modifications). These more protective water temperature targets at Robinson Riffle also would result in increased protection and enhancement of cold freshwater habitat conditions at the Project's lower FERC Project boundary relative to the Existing Conditions/No-Action Alternative as well as the Proposed Action evaluated in the PDEA.

Subsequent to construction and testing of the potential future facilities modifications that would provide improved access to coldwater pool volume in Lake Oroville or the improved "plumbing" of the Thermalito Complex to reduce water warming, additional water temperature objectives would be developed and adopted for the lower Project boundary. After the future facilities modifications, Feather River Fish Hatchery water temperature requirements also may be revised. These water temperature requirements likely would be more protective than those proposed in the SA. The potential effects of the selected facilities modifications would be subject to detailed evaluation in a subsequent environmental document prior to construction.

Comparison of the PDEA Proposed Action and the Proposed Project water temperature requirements for the Feather River Fish Hatchery in Table E.2-1 indicates that the Proposed Action water temperature requirement of "plus or minus 4^{o}F" is the same as the upper water temperature limit for the Proposed Project (SA Table 107B) "maximum"

for all periods. Managing hatchery water temperatures to daily mean targets in SA Table 107A would likely result in a reduction in hatchery water temperatures as compared to Existing Conditions. Therefore, with respect to hatchery water temperature requirements, there are no water temperature changes from the Existing Conditions/No-Project Alternative to the Proposed Action or the Proposed Project to quantitatively compare utilizing surface water modeling. Although there are no changes in the maximum allowable water temperature objectives for the hatchery, water temperature management actions taken for the hatchery could differ among alternatives. However since the water temperature maximums are the same, modeling comparisons of water temperatures at the hatchery (or due to hatchery water temperature management actions) are not needed to complete the evaluations of alternatives in this CEQA EIR.

Comparison of the Proposed Action and the Proposed Project water temperature initial new license period targets for Robinson Riffle in Table E.2-1 indicates that the Proposed Project water temperature targets under the initial new license period of the Proposed Project are more protective of coldwater fisheries and coldwater beneficial uses than the Proposed Action. The Proposed Action was quantitatively evaluated utilizing modeling results compared to Existing Conditions/No-Action Alternative and was determined to result in beneficial effects for cold freshwater beneficial uses and aquatic resources. Therefore, because the Proposed Project would result in an increased frequency, magnitude, or duration of beneficial water temperatures compared to the beneficial effects associated with implementation of the Proposed Action, conducting a detailed quantitative modeling comparison of the beneficial effects of the Proposed Project on coldwater fisheries at Robinson Riffle is not needed for this EIR.

There are no numerical water temperature targets or requirements at the lower FERC Project boundary for the Existing Conditions/No-Action Alternative or for the Proposed Action. As part of SA Article 108, and upon completion of the Feasibility Study, a plan will be developed to include mean daily temperatures for the FERC downstream Project boundary. These temperatures will replace Table 2 temperatures included in the SA and will be based on study and preliminary modeling results. The water temperature values included on Table 2 in the SA are placeholders until the Feasibility Study is conducted and a plan developed. A detailed quantitative modeling comparison of these beneficial effects is not needed for this EIR.

E.2.2 Proposed Project vs. Proposed Action Low Flow Channel Minimum Flows

In addition to the more protective water temperature objectives under the Proposed Project as compared to the Proposed Action, the Proposed Project also includes an increase in the minimum flows in the LFC. The Proposed Action minimum flows for the LFC were the same as the Existing Conditions/No-Action Alternative (i.e., 600 cubic

Table E.2-1. Proposed Action and Proposed Project daily water temperature objectives for the Feather River Fish Hatchery, Robinson Riffle, and the lower FERC Project boundary.

Feather River Fish Hatchery				Robinson Riffle			Lower FERC Project Boundary[2]		
	Proposed Action	Proposed Project[1]			Proposed Action	Proposed Project		Proposed Action	Proposed Project
Date Ranges	(+/- 4˚F)	Maximum Mean (˚F)	Maximum (˚F)	Date Ranges	Mean (˚F)	Maximum Mean (˚F)	Date Ranges	Mean (˚F)	Mean (˚F)
Apr 01– May 15	51	55	55	Apr 01– Apr 30	--	56	Apr 01– Apr 30	--	61
				May 01- May 15	--	56-63*	May 01- May 15	--	64
May 16– May 31	55	55	59	May 16– May 31	--	63	May 16– May 31	--	64
Jun 01– Jun 15	56	60	60	Jun 01– Jun 15	≤ 65	63	Jun 01– Jun 15	--	64
Jun 16– Aug 15	60	60	64	Jun 16– Aug 15	≤ 65	63	Jun 16– Aug 15	--	64
Aug 16– Aug 31	58	60	62	Aug 16– Aug 31	≤ 65	63	Aug 16– Aug 31	--	64
Sep 01– Sep 30	52	56	56	Sep 01– Sep 08	--	63-58*	Sep 01– Sep 08	--	61
				Sep 09– Sep 30	≤ 65	58	Sep 09– Sep 30	--	61
Oct 01– Nov 30	51	55	55	Oct 01– Nov 30	--	56	Oct 01– Oct 31	--	60
							Nov 01– Nov 30	--	56
Dec 01–– Mar 31	≤ 55	55	55	Dec 01– Mar 31	--	56	Dec 01– Mar 31	--	56

Table E.2-1. Proposed Action and Proposed Project daily water temperature objectives for the Feather River Fish Hatchery, Robinson Riffle, and the lower FERC Project boundary.

Feather River Fish Hatchery				Robinson Riffle			Lower FERC Project Boundary[2]		
	Proposed Action	Proposed Project[1]			Proposed Action	Proposed Project		Proposed Action	Proposed Project
Date Ranges	(+/- 4˚F)	Maximum Mean (˚F)	Maximum (˚F)	Date Ranges	Mean (˚F)	Maximum Mean (˚F)	Date Ranges	Mean (˚F)	Mean (˚F)

Notes:

** Indicates a period of transition from the first temperature to the second temperature.*

[1] From April 1 to May 31, the Feather River Fish Hatchery minimum temperature requirement is 51˚F.

[2] Lower Project boundary temperatures are to be evaluated and modified using the phased approach outlined in the SA, therefore temperature management actions will not be taken to achieve these targets.

-- Indicates not provided.

Sources: DWR 2005, 2006

feet per second (cfs). The Proposed Project LFC minimum flows (SA Article A108.1) are increased to 700 cfs from April 1 through September 14, and 800 cfs from September 15 through March 31. These increased minimum flows would increase the velocity and mass of LFC flows, resulting in the same colder water temperature being propagated farther downstream, thereby providing an increase in the quality and quantity of coldwater fisheries habitat compared to the Proposed Action, which was previously determined to result in beneficial effects on coldwater fisheries resources. Because the effect of the increase in minimum flows in the LFC is beneficial compared to a previously analyzed beneficial effect, no additional modeling comparison or further analysis of this effect is needed for this EIR.

Even though the minimum flows in the LFC are increased under the Proposed Project, the net total releases of the facilities downstream of the Thermalito Afterbay Outlet under the Proposed Project compared to the Existing Conditions/No-Project Alternative do not change. Because there are no changes in net facilities releases between the alternatives analyzed under CEQA, there are also no changes in reservoir storage to analyze. There would be no changes in net releases that could potentially influence water supply or reservoir storage. Therefore, no further consideration of model comparisons to evaluate changes in net flow releases to the lower Feather River below the Thermalito Afterbay Outlet are needed to satisfy CEQA analysis requirements. In addition, there would either be no change, or potentially only beneficial effects, under the Proposed Project as compared to the Existing Conditions/No-Project Alternative. Further discussion regarding potential changes in water quantity and additional justification regarding modeling requirements for the CEQA analysis of water quantity are addressed in Section 5.2.1.3, Surface Water Quantity Method of Analysis.

E.2.3 Future Changes in Facilities Net Flow Releases

Slight changes in net Oroville Facilities flow releases to the Feather River occur under future alternative modeling scenarios. Future project alternatives modeling is based on the Operations Criteria and Plan (OCAP) 2020 4A Scenario, which shows a slight increase in magnitude and a slight shift in export timing to earlier in the summer compared to Existing Conditions/No-Project Alternative.

CALSIM II modeling for the Oroville Facilities Project analysis used two different Levels of Development (LOD), 2001 and 2020 LODs, to represent the existing conditions and future conditions, respectively. DWR developed the 1995 and 2020 LODs through preparation of the *California Water Plan 1998 Update* (Bulletin 160-98). Demands were calculated using aggregation of historical land use surveys on the Sacramento Valley floor. For CALSIM II modeling purposes, DWR defined the 2001 LOD by using linear interpolation of the previously developed 1995 and 2020 data. The recent *California Water Plan Update 2005* did not result in any updated LODs; the associated efforts were deferred. Therefore, the currently available 2001 and 2020 LODs are the best available information for local demand projection under the existing and future conditions. The 2001 and 2020 LODs used in the CALSIM II modeling show that, on a percentage basis, the differences in net inflow-depletion between 2001 and 2020

averaged less than 1 percent, and the difference in anticipated diversion for each demand area averaged 4 percent. The maximum annual change in net inflow-depletion was 2 percent, and the maximum change in diversions was 4 percent. The minimums for each were -6 percent and 4 percent, respectively. (Reference: DWR and USBR, CALSIM II Benchmark Assumptions, 2002.) Therefore, the changes in total net releases from 2001 LOD to 2020 LOD are not substantial. These changes in release volume and timing apply equally to the Proposed Action under the PDEA and the No-Project Alternative, Proposed Project, and FERC Staff Alternative under the CEQA EIR. Exceedance plots comparing the probabilities of distribution of mean daily flows of the No-Action (PDEA) and No-Project (EIR) Alternatives (Figure E.2-1) demonstrate that, even with slight changes in the base modeling assumptions regarding Long-Term Environmental Water Account (EWA) and the Trinity River Record of Decision (Trinity ROD) that potentially affect Lake Oroville releases and lower Feather River flows, the flows below the Thermalito Afterbay Outlet (identified as HFC in the exceedance plots) have virtually the same probability distribution for each month of analysis.

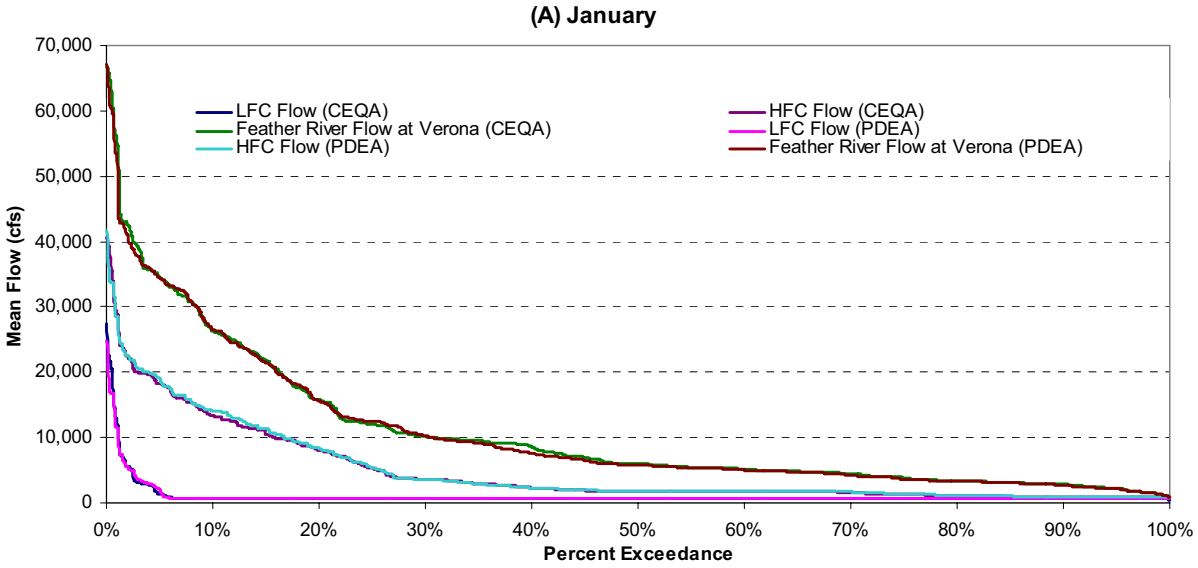


Figure E.2-1. Comparison of exceedance probabilities for simulated mean daily Feather River flow under the No-Project Alternative for CEQA and the Future No-Action Alternative for the PDEA.

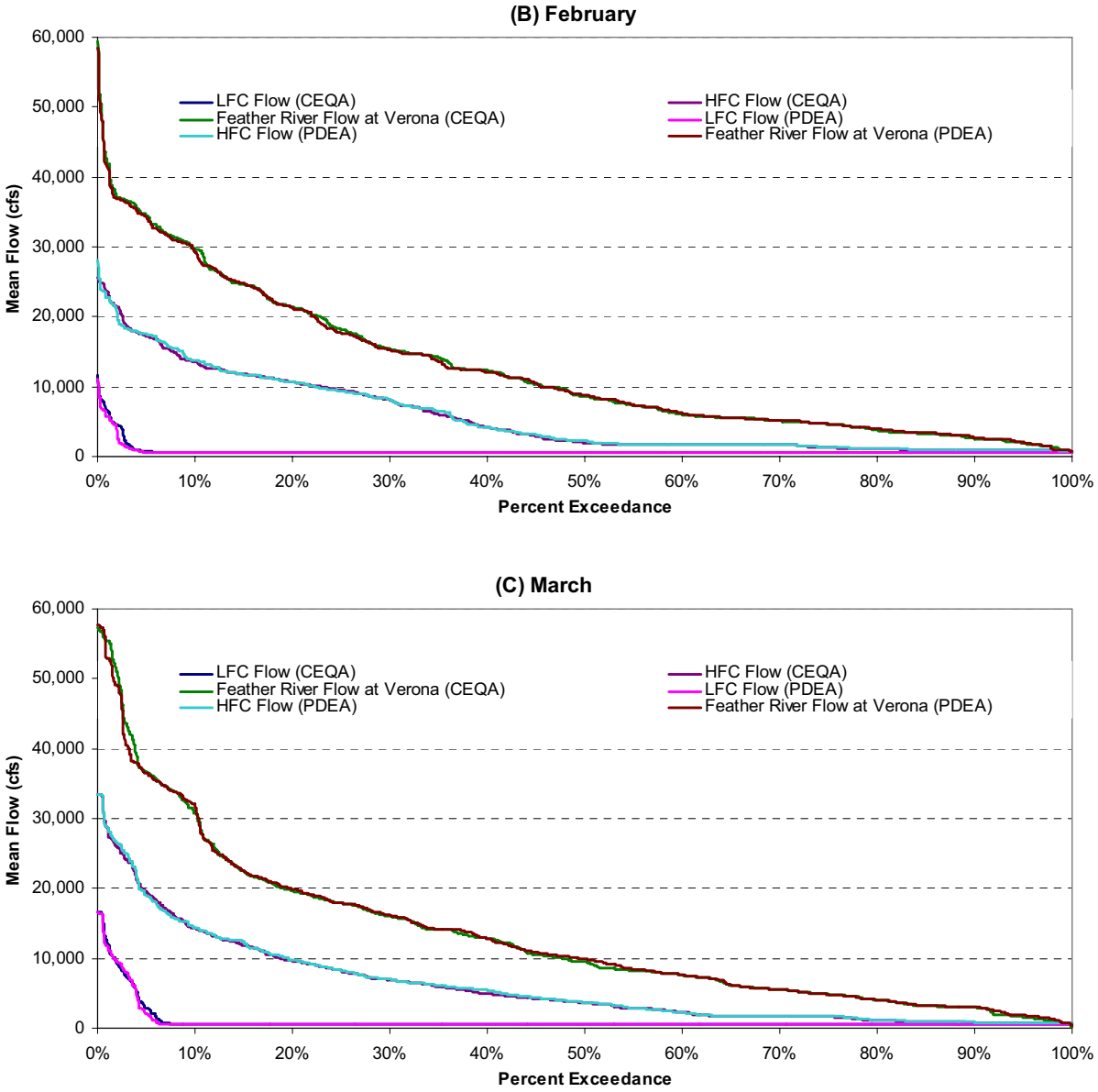


Figure E.2-1 (continued). Comparison of exceedance probabilities for simulated mean daily Feather River Flow under the No-Project Alternative for CEQA and the Future No-Action Alternative for the PDEA.

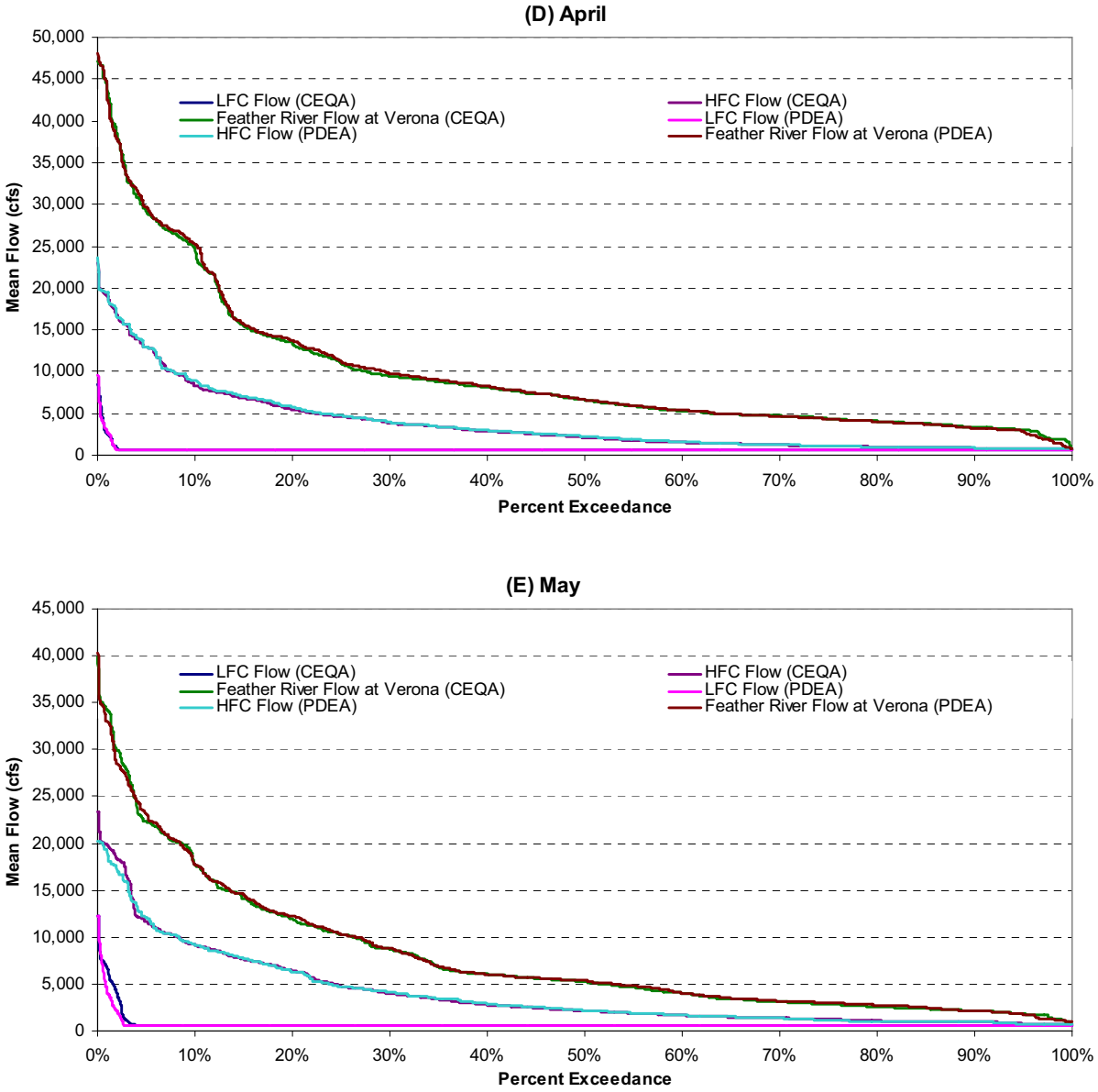


Figure E.2-1 (continued). Comparison of exceedance probabilities for simulated mean daily Feather River Flow under the No-Project Alternative for CEQA and the Future No-Action Alternative for the PDEA.

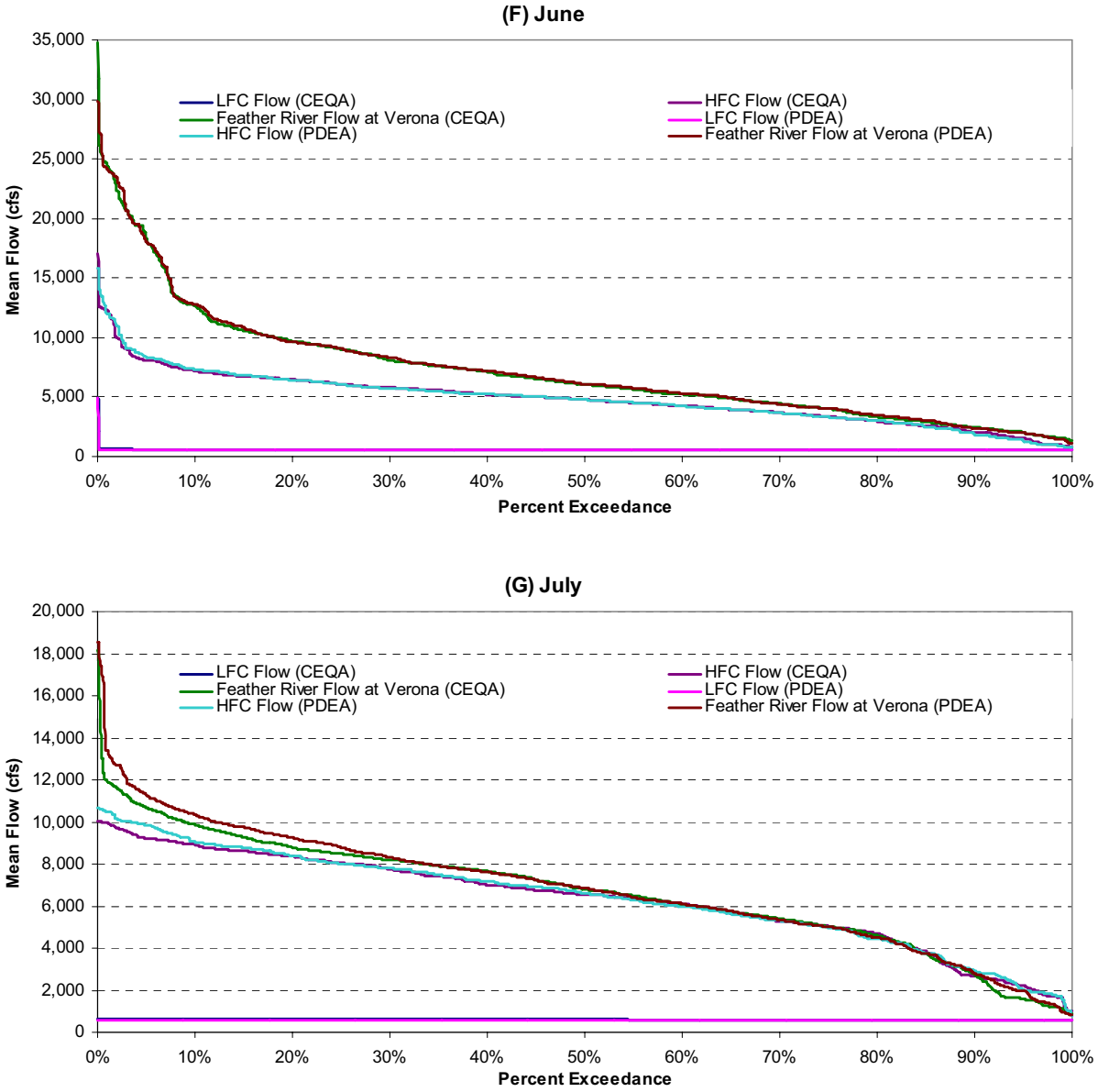


Figure E.2-1 (continued). Comparison of exceedance probabilities for simulated mean daily Feather River Flow under the No-Project Alternative for CEQA and the Future No-Action Alternative for the PDEA.

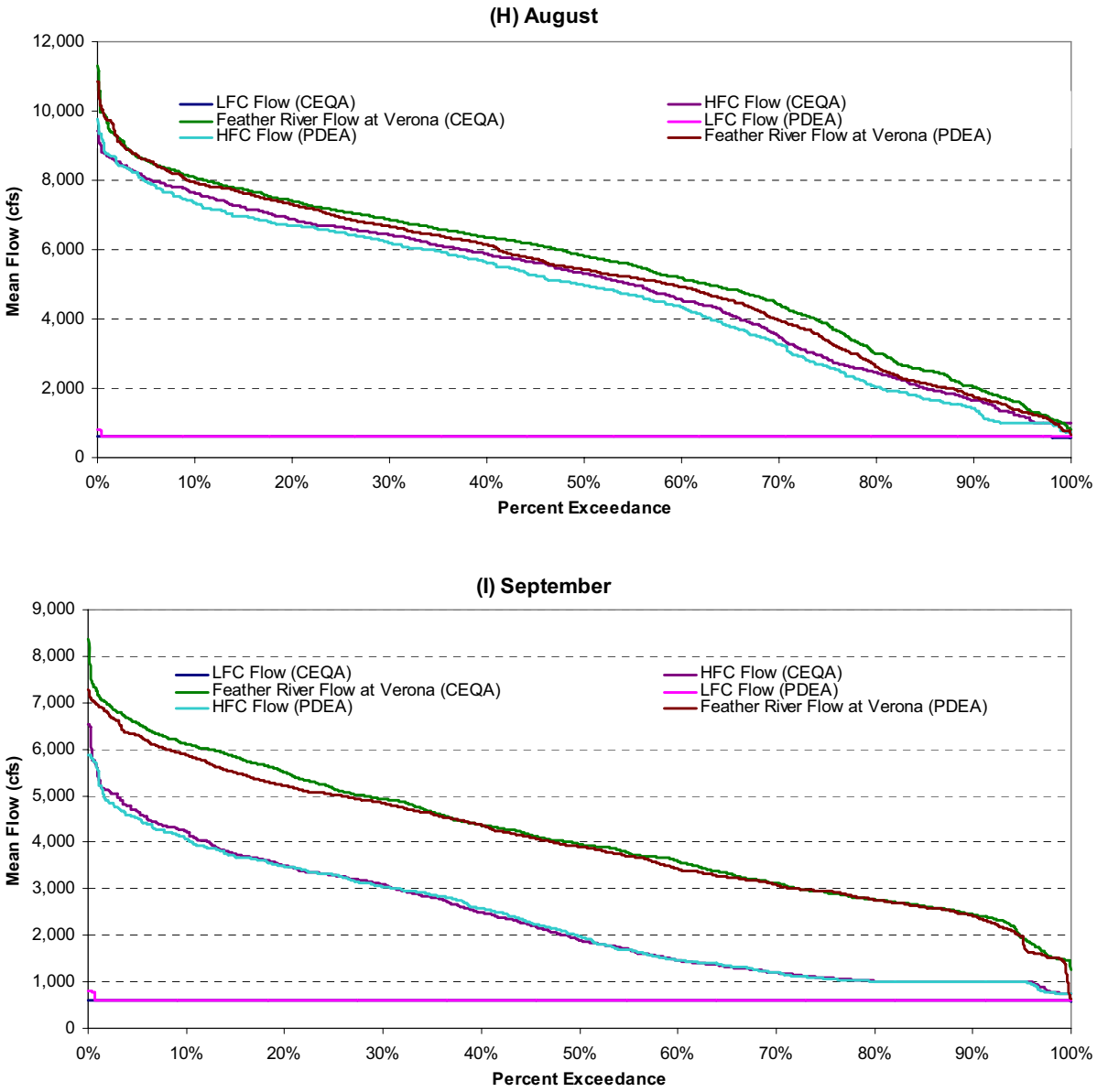


Figure E.2-1 (continued). Comparison of exceedance probabilities for simulated mean daily Feather River Flow under the No-Project Alternative for CEQA and the Future No-Action Alternative for the PDEA.

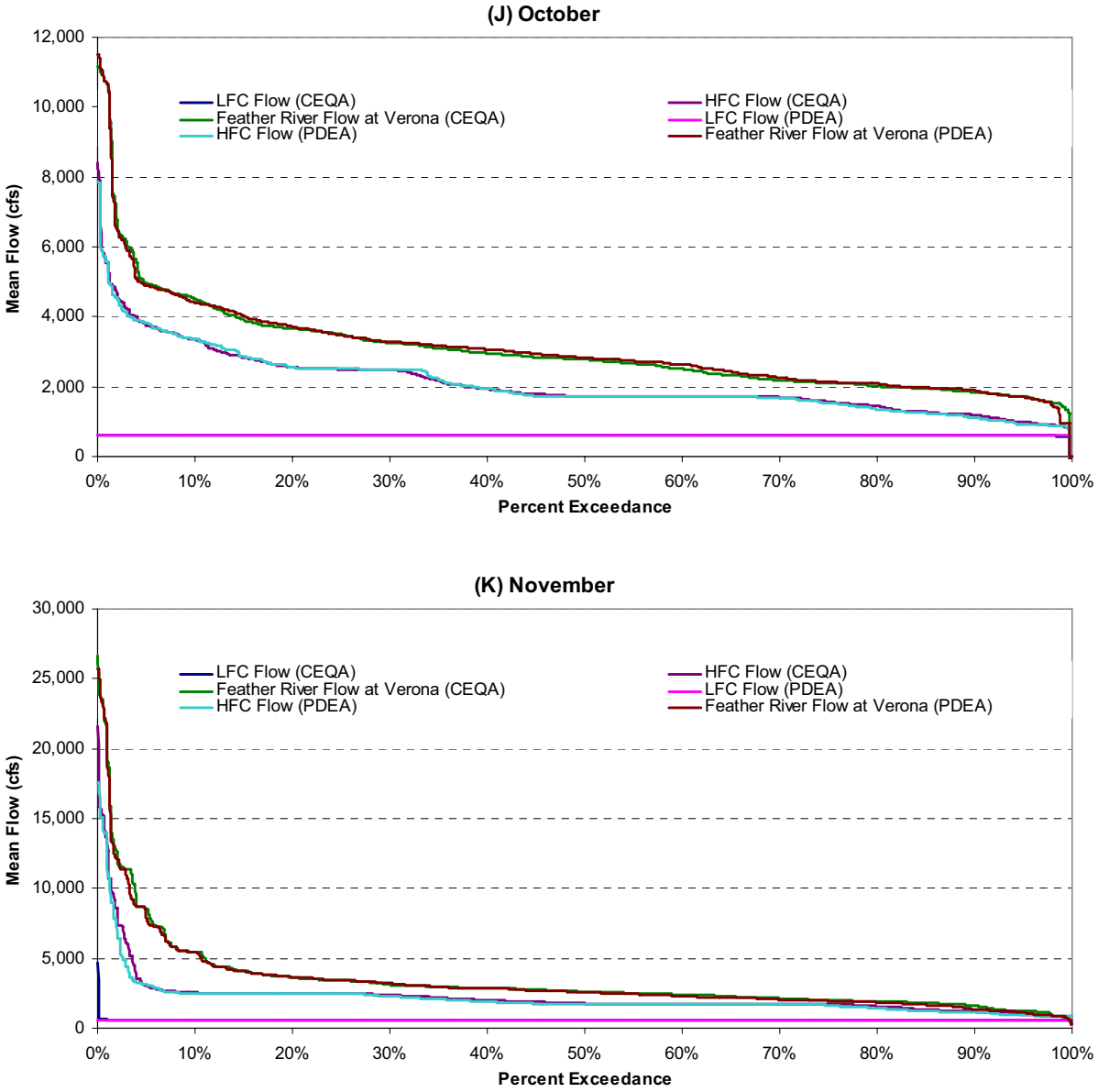


Figure E.2-1 (continued). Comparison of exceedance probabilities for simulated mean daily Feather River Flow under the No-Project Alternative for CEQA and the Future No-Action Alternative for the PDEA.

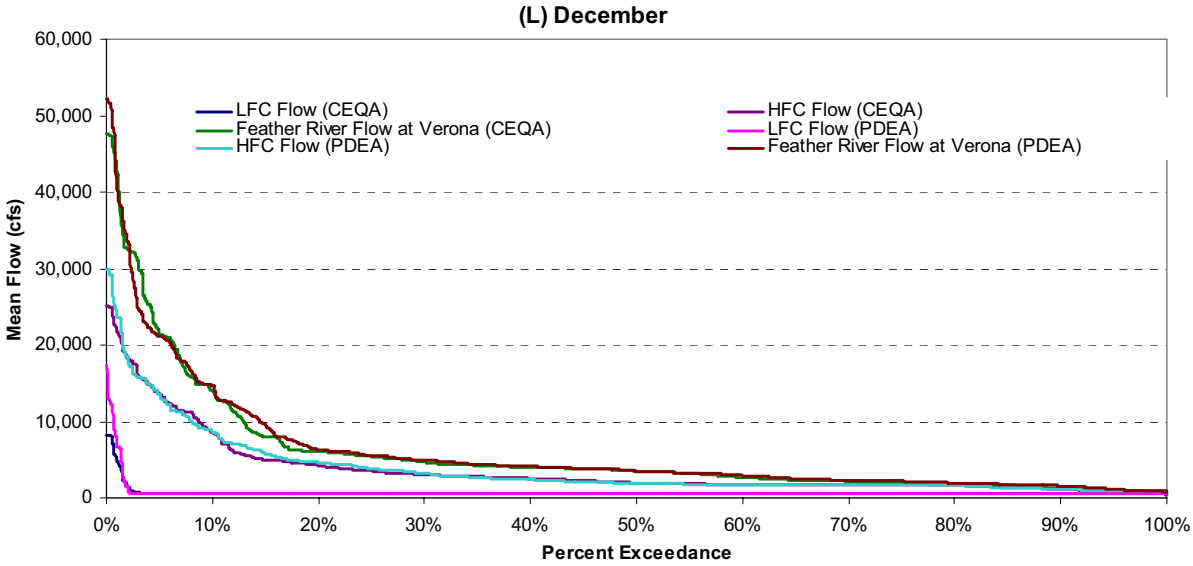


Figure E.2-1 (continued). Comparison of exceedance probabilities for simulated mean daily Feather River Flow under the No-Project Alternative for CEQA and the Future No-Action Alternative for the PDEA.

Since the exceedance plots comparing mean daily flows under the Future No-Action Alternative (PDEA) and No-Project Alternative (EIR) indicate little to no change in net flow releases, it is expected that there would be little to no flow-related water temperature changes as well. Evaluation of water temperature changes comparing mean daily flows under the Future No-Action Alternative (PDEA) and No-Project Alternative (EIR) are included in Section E.2.5.1.

E.2.4 Proposed Project vs. Proposed Action Water Temperature Modeling Results

Water temperature modeling of the Proposed Project was conducted to demonstrate the beneficial effects of the Proposed Project compared to the previously studied Proposed Action (refer to Section 5.4 of the PDEA for further discussion). As a result of the beneficial effects of the Proposed Project demonstrated by these modeling results, modeling comparisons between the alternatives are not necessary to satisfy CEQA analysis requirements. It should be noted that not all of the Project assumptions between the Proposed Action and Proposed Project are the same for each model simulation. The differences in modeling assumptions and the relative potential magnitude of these differences on the results and interpretation of the comparison of the alternatives are discussed in the following section entitled “Proposed Project vs. Proposed Action Modeling Assumption Differences.”

Because the Proposed Action was determined to have beneficial effects relative to the Existing Conditions/No-Action Alternative after an extensive modeling comparison in the PDEA, and the Proposed Project has demonstrated additional protection and

enhancement of the coldwater beneficial uses and aquatic resources compared to the Proposed Action in the preceding analysis, no additional modeling comparison between the alternatives is required.

E.2.5 Proposed Project vs. Proposed Action Modeling Assumption Differences

The differences in the modeling assumptions included in the PDEA modeling analysis versus those applicable to the CEQA modeling analysis are documented in the following section. The primary difference is the use of OCAP Study 4 for the future alternative modeling scenario in the PDEA versus the use of OCAP Study 4A for the future alternative modeling scenario for the CEQA EIR. Another difference in the modeling assumptions occurs because of the difference in reasonably foreseeable future projects related to the Long-Term EWA and Trinity River ROD. See modeling assumption summary comparison Table E.2-2.

Although the inclusion of these reasonably foreseeable projects differs between the PDEA modeling assumptions and the CEQA modeling assumptions, both of these future projects would have relatively minor effects on Feather River flows and Oroville Facilities operations. Therefore, as demonstrated in the following section, the modeling results between the Proposed Action and the Proposed Project remain reasonably and functionally comparable.

Table E.2-2. Summary of assumptions for CALSIM II modeling.

	PDEA Alternatives		CEQA Alternatives	
	Existing Conditions	**Future No-Action and Proposed Action Conditions [2]**	**Existing Conditions**	**No-Project and Proposed Project Conditions**
Period of Simulation	73 years (1922–1994)	Same	Same	Same
Simulation Basis	OCAP Study 3	OCAP Study 4	OCAP Study 3 (modified)[1]	OCAP Study 4a
HYDROLOGY				
Level of Development (Land Use)	2001 level, DWR Bulletin 160-98 [2]	2020 level, DWR Bulletin 160-98	2001 level, DWR Bulletin 160-98 [2]	2020 level, DWR Bulletin 160-98
DEMANDS				
North of Delta (except American River)				
CVP	Land use based, limited by full contract	Same	Same	Same
SWP (Feather River Service Area [FRSA])	Land use based, limited by full contract	Same	Same	Same
Nonproject	Land use based	Same	Same	Same
CVP Refuges	Firm level 2	Same	Same	Same
American River Basin				
Water rights	Fixed annual demands	Fixed annual demands as projected for 2020 by Water Forum analysis	Fixed annual demands	Fixed annual demands as projected for 2020 by Water Forum analysis
CVP	Fixed annual demands	Fixed annual demands as projected for 2020 by Water Forum analysis, but modified with 35 thousand acre-feet (taf) CVP contract supply for the Placer County Water Agency (PCWA) diverted at the new PCWA American River pump station	Fixed annual demands	Fixed annual demands as projected for 2020 by Water Forum analysis, but modified with 35-taf CVP contract supply for PCWA diverted at the new PCWA American River pump station

Table E.2-2. Summary of assumptions for CALSIM II modeling.

	PDEA Alternatives		CEQA Alternatives	
	Existing Conditions	Future No-Action and Proposed Action Conditions [2]	Existing Conditions	No-Project and Proposed Project Conditions
San Joaquin River Basin				
Friant Unit	Regression of historical	Same	Same	Same
Lower Basin	Fixed annual demands	Same	Same	Same
Stanislaus River Basin	New Melones Interim Operations Plan	Same	Same	Same
South of Delta				
CVP	Full contract	Same	Same	Same
Contra Costa Water District	124,000 acre-feet per year (afy) [3]	Same	Same	Same
SWP (w/North Bay Aqueduct)	3.0–4.1 million acre-feet per year (maf/yr)	Same	Same	Same
SWP Article 21 Demand	Metropolitan Water District of Southern California (MWD) up to 50,000 month/month, Dec-Mar; others up to 84,000 month/month	Same	Same	Same
FACILITIES				
Freeport Regional Water Project	None	Included[3]	None	Included [4]
Banks Pumping Capacity	6,680 cfs	8,500 cfs	6,680 cfs	6,680 cfs
Tracy Pumping Capacity	4,200 cfs + deliveries upstream of Delta-Mendota Canal constriction	4,600 cfs w/intertie	4,200 cfs + deliveries upstream of Delta-Mendota Canal constriction	4,600 cfs w/intertie
OPERATIONS CONSTRAINTS AND CRITERIA				
Trinity River				
Minimum Flow below Lewiston Dam	368,600–452,600 afy	Trinity ROD Flows (368,600–815,000 afy)	Trinity ROD Flows (368,600–815,000 afy)	Trinity ROD Flows (368,600–815,000 afy)
Trinity Reservoir End-of-September Minimum Storage	Trinity export-to-inflow Preferred Alternative (600,000 af as able)	Same	Same	Same

Table E.2-2. Summary of assumptions for CALSIM II modeling.

	PDEA Alternatives		CEQA Alternatives	
	Existing Conditions	Future No-Action and Proposed Action Conditions [2]	Existing Conditions	No-Project and Proposed Project Conditions
Clear Creek				
Minimum Flow below Whiskeytown Dam	Downstream water rights, 1963 U.S. Bureau of Reclamation (USBR) proposal to the U.S. Fish and Wildlife Service (USFWS) and the National Park Service, and USFWS use of Central Valley Project Improvement Act (CVPIA) Section 3406(b)(2) water	Same	Same	Same
Upper Sacramento River				
Shasta Lake End-of-September Minimum Storage	State Water Resources Control Board (SWRCB) 1993 Biological Opinion for winter-run Chinook salmon (1.9 maf)	Same	Same	Same
Minimum Flow below Keswick Dam	Flows for SWRCB 1990 Order 90-5 and 1993 Biological Opinion on temperature control for winter-run Chinook salmon, and USFWS use of CVPIA Section 406(b)(2) water	Same	Same	Same
Feather River				
Minimum Flow below Thermalito Diversion Dam	1983 DWR/California Department of Fish and Game (DFG) agreement (600 cfs)	Same	Same	Same
Minimum Flow below Thermalito Afterbay Outlet	1983 DWR/DFG agreement (1,000–1,700 cfs)	Same	Same	Same

Table E.2-2. Summary of assumptions for CALSIM II modeling.

	PDEA Alternatives		CEQA Alternatives	
	Existing Conditions	Future No-Action and Proposed Action Conditions [2]	Existing Conditions	No-Project and Proposed Project Conditions
American River				
Minimum Flow below Nimbus Dam	SWRCB Decision 893 (D-893) and USFWS use of CVPIA Section 3406(b)(2) water	Same	Same	Same
Minimum Flow at H Street Bridge	SWRCB D-893	Same	Same	Same
Lower Sacramento River				
Minimum Flow near Rio Vista	SWRCB D-1641	Same	Same	Same
Mokelumne River				
Minimum Flow below Camanche Dam	FERC 2916-029, 1996 (joint settlement agreement) (100–325 cfs)	Same	Same	Same
Minimum Flow below Woodbridge Diversion Dam	FERC 2916-029, 1996 (joint settlement agreement) (25–300 cfs)	Same	Same	Same
Stanislaus River				
Minimum Flow below Goodwin Dam	1987 USBR/DFG agreement, and USFWS use of CVPIA Section 406(b)(2) water	Same	Same	Same
Minimum Dissolved Oxygen	SWRCB D-1422	Same	Same	Same
Merced River				
Minimum Flow below Crocker-Huffman Diversion Dam	Davis-Grunsky (180–220 cfs, Nov–Mar), and Cowell Agreement	Same	Same	Same
Minimum Flow at Shaffer Bridge	FERC 2179 (25–100 cfs)	Same	Same	Same

Table E.2-2. Summary of assumptions for CALSIM II modeling.

	PDEA Alternatives		CEQA Alternatives	
	Existing Conditions	Future No-Action and Proposed Action Conditions [2]	Existing Conditions	No-Project and Proposed Project Conditions
Tuolumne River				
Minimum Flow at Lagrange Bridge	FERC 2299-024, 1995 (settlement agreement) (94,000–301,000 afy)	Same	Same	Same
San Joaquin River				
Maximum Salinity near Vernalis	SWRCB D-1641	Same	Same	Same
Minimum Flow near Vernalis	SWRCB D-1641, and Vernalis Adaptive Management Program per San Joaquin River Agreement	Same	Same	Same
Sacramento–San Joaquin River Delta				
Delta Outflow Index (Flow and Salinity)	SWRCB D-1641	Same	Same	Same
Delta Cross Channel Gate Operation	SWRCB D-1641	Same	Same	Same
Delta Exports	SWRCB D-1641, USFWS use of CVPIA Section 3406(b)(2) water	Same	Same	Same
OPERATIONS CRITERIA				
SUBSYSTEM				
Upper Sacramento River				
Flow Objective for Navigation (Wilkins Slough)	3,250–5,000 cfs based on Lake Shasta storage condition	Same	Same	Same
American River				
Folsom Dam Flood Control	Sacramento Area Flood Control Agency, Interim Reoperation of Folsom Dam, Variable 400/670 (without outlet modifications)	Same	Same	Same

Table E.2-2. Summary of assumptions for CALSIM II modeling.

	PDEA Alternatives		CEQA Alternatives	
	Existing Conditions	Future No-Action and Proposed Action Conditions [2]	Existing Conditions	No-Project and Proposed Project Conditions
Flow below Nimbus Dam	Operations criteria corresponding to SWRCB D-893 required minimum flow	Same	Same	Same
Sacramento Water Forum Mitigation Water	None	Sacramento Water Forum (up to 47,000 afy in Water Forum Agreement drier and driest years) [5]	None	Sacramento Water Forum (up to 47,000 afy in Water Forum Agreement drier and driest years) [5]
Feather River				
Flow at Mouth	Maintain the DFG/DWR flow target above Verona or 2,800 cfs for April–September dependent on Oroville inflow and FRSA allocation	Same	Same	Same
Stanislaus River				
Flow below Goodwin Dam	1997 New Melones Interim Operations Plan	Same	Same	Same
San Joaquin River				
Flow near Vernalis	San Joaquin River Agreement in support of the Vernalis Adaptive Management Program	Same	Same	Same
SYSTEM-WIDE				
CVP Water Allocation				
CVP Settlement and Exchange	100% (75% in Shasta critical years)	Same	Same	Same
CVP Refuges	100% (75% in Shasta critical years)	Same	Same	Same
CVP Agriculture	100%–0% based on supply	Same	Same	Same
CVP Municipal & Industrial	100%–50% based on supply	Same	Same	Same

Table E.2-2. Summary of assumptions for CALSIM II modeling.

	PDEA Alternatives		CEQA Alternatives	
	Existing Conditions	Future No-Action and Proposed Action Conditions [2]	Existing Conditions	No-Project and Proposed Project Conditions
SWP Water Allocation				
North of Delta (FRSA)	Contract specific	Same	Same	Same
South of Delta	Based on supply; Monterey Agreement	Same	Same	Same
CVP/SWP Coordinated Operations				
Sharing of Responsibility for In-Basin-Use	1986 Coordinated Operations Agreement	Same	Same	Same
Sharing of Surplus Flows	1986 Coordinated Operations Agreement	Same	Same	Same
Sharing of Restricted Export Capacity	Equal sharing of export capacity under SWRCB D-1641; use of CVPIA Section 3406(b)(2) only restricts CVP exports; EWA use restricts CVP and/or SWP exports as directed by CALFED Bay-Delta Program (CALFED) fisheries agencies	Same	Same	Same
Transfers				
Dry Year Program	None	Same	Same	Same
Phase 8	None	Same	Same	Same
MWD/CVP Settlement Contractors	None	Same	None	Same
CVP/SWP Integration				
Dedicated Conveyance at Banks	None	SWP to convey 100,000 af of Level 2 refuge water each year at Banks Pumping Plant	None	None

Table E.2-2. Summary of assumptions for CALSIM II modeling.

	PDEA Alternatives		CEQA Alternatives	
	Existing Conditions	Future No-Action and Proposed Action Conditions [2]	Existing Conditions	No-Project and Proposed Project Conditions
North of Delta Accounting Adjustments	None	CVP to provide the SWP a maximum of 75,000 af of water to meet in-basin requirements through adjustments in Coordinated Operations Agreement accounting	None	None
CVPIA Section 3406(b)(2)	U.S. Department of the Interior 2003 decision	Same	Same	Same
Allocation	800,000 afy, 700,000 afy in 40-30-30 dry years, and 600,000 afy in 40-30-30 critical years	Same	Same	Same
Actions	1995 Water Quality Control Plan for the San Francisco Bay/San Joaquin Delta Estuary, fish flow objectives (Oct–Jan); Vernalis Adaptive Management Plan (VAMP) (Apr 15–May 16) CVP export restriction; 3,000-cfs CVP export limit in May and June (D-1485 striped bass continuation); post-VAMP (May 16-31) CVP export restriction; ramping of CVP export (Jun); upstream releases (Feb–Sep)	Same	Same	Same

Table E.2-2. Summary of assumptions for CALSIM II modeling.

	PDEA Alternatives		CEQA Alternatives	
	Existing Conditions	**Future No-Action and Proposed Action Conditions [2]**	**Existing Conditions**	**No-Project and Proposed Project Conditions**
Accounting Adjustments	Per May 2003 Interior decision, no limit on responsibility for D-1641 requirements, no reset with the storage metric and no offset with the release and export metrics	Same	Same	Same
CALFED Environmental Water Account	None	None	None	None

Notes:

[1] Trinity ROD flow requirements added to OCAP Study 3.

[2] 2000 level of development defined by linearly interpolated values from the 1995 level of development and 2020 level of development from DWR Bulletin 160-98.

[3] Delta diversions include operations of Los Vaqueros Reservoir and represent average annual diversion.

[4] Includes modified East Bay Municipal Utility District operations of the Mokelumne River.

[5] This is implemented only in the PCWA Middle Fork Project releases used in defining the CALSIM II inflows to Folsom Lake.

Source: 2004 CVP/SWP OCAP Biological Assessment, except for CEQA Existing Conditions, which has been updated to reflect the July 2004 Trinity River Record of Decision

E.2.5.1 Effects on Modeling Results

Exceedance plots were developed to enable comparison of the probabilities of mean daily flows exceeding specific flow values under the No-Action Alternative included in the PDEA and the No-Project Alternative evaluated in this CEQA EIR. Those exceedance plots demonstrate that, even with slight changes in the base modeling assumptions regarding the future alternative modeling scenarios (i.e., OCAP Study 4 compared to Study 4A) and two of the reasonably foreseeable projects (i.e., SDIP and CVP/SWP Integration; see above section discussion), and their influence on future alternative modeling scenarios, very little change would occur in either the timing and magnitude of Feather River flows below Thermalito Afterbay Outlet, or operation of the Oroville Facilities.

Additionally, even with changes in assumptions that potentially affect Oroville Facilities releases, river flows below the Thermalito Afterbay Outlet (identified as HFC in the exceedance plots) are virtually the same for each month of analysis (see Figure E.2-1). As previously noted, future changes in net project releases apply equally to all project alternatives. Therefore, based on no net changes in potential future flow impacts, a comparison between the CEQA alternatives was not needed for this EIR.

Because the net flow releases of the Oroville Facilities do not change between the Proposed Action Alternative included in the PDEA and the Proposed Project Alternative evaluated in this CEQA EIR, potential changes in water temperatures due to water temperature objectives contained in the alternatives can be evaluated at three key project locations. Water temperatures at the Feather River Fish Hatchery represent the source water temperatures for the water going both through the Thermalito Complex as well as the water released down the LFC. The Feather River Fish Hatchery is also a water temperature compliance point for the 1983 DFG Operating Agreement and the EIR Proposed Project (SA Article 107.1) and is therefore an important location to evaluate potential water temperature changes comparing between the PDEA Proposed Action and the EIR Proposed Project. Robinson Riffle is also an important water temperature compliance point for both the Proposed Action and the Proposed Project from SA Article 108.1. The third key location for evaluation of water temperatures to compare the Proposed Action and the Proposed Project is downstream of the Thermalito Afterbay Outlet in the HFC. This location is not a water temperature compliance point,. Changes in water temperatures in this location will propagate downstream, so this location is indicative of the nature and magnitude of water temperature changes comparing the Proposed Action and the Proposed Project.

Exceedance plots of mean daily average water temperatures comparing the Proposed Project and the Proposed Action (see Figure E.2-2) demonstrate that water temperatures at the Feather River Fish Hatchery are the same water temperatures or cooler under the Proposed Project for the months of January, February, August, and September for 100 percent of the cumulative probability distribution. Water temperatures at the Feather River Fish Hatchery are the same water temperatures or cooler under the Proposed Project for the months of March, May, June, July, October,

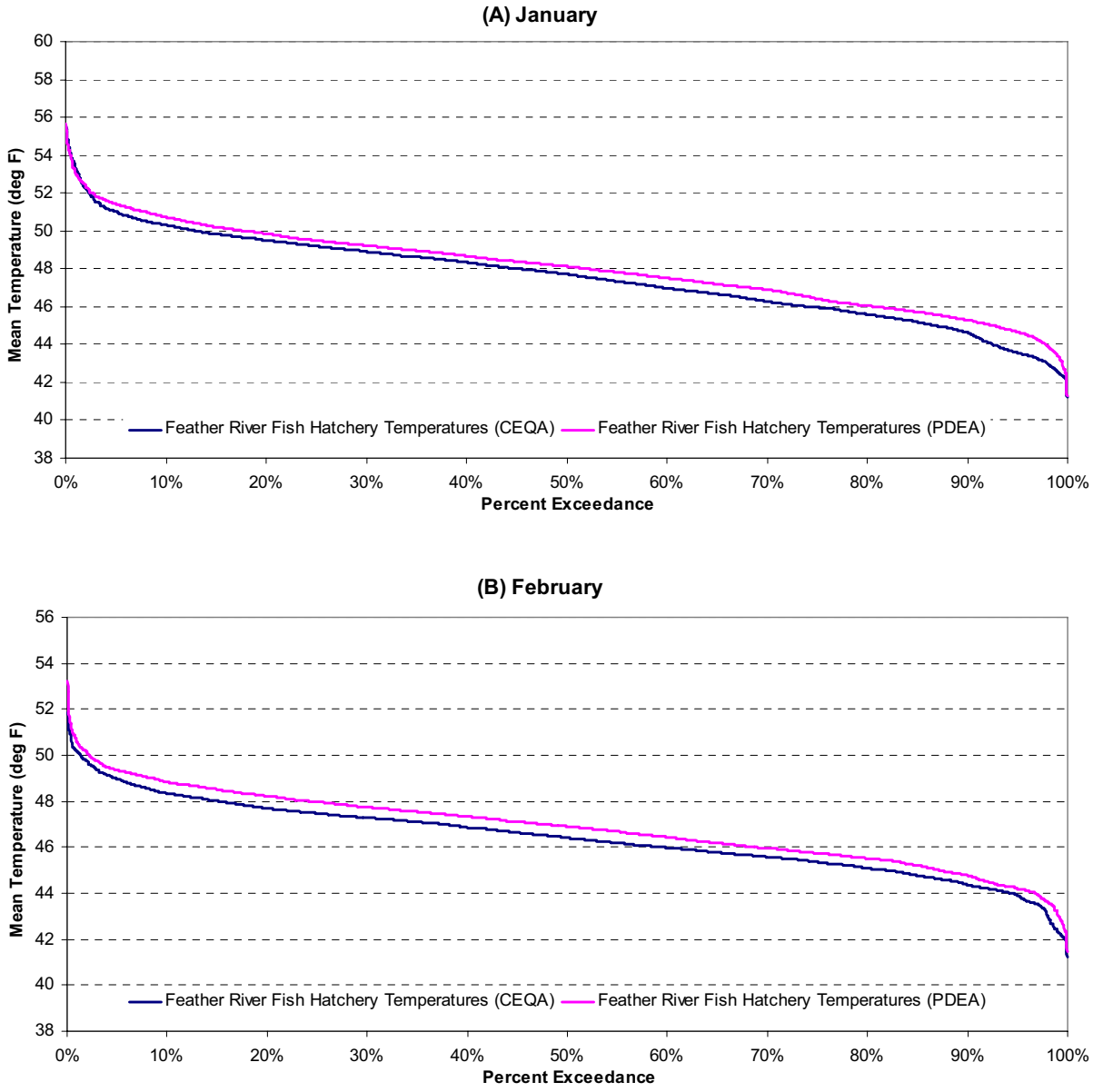
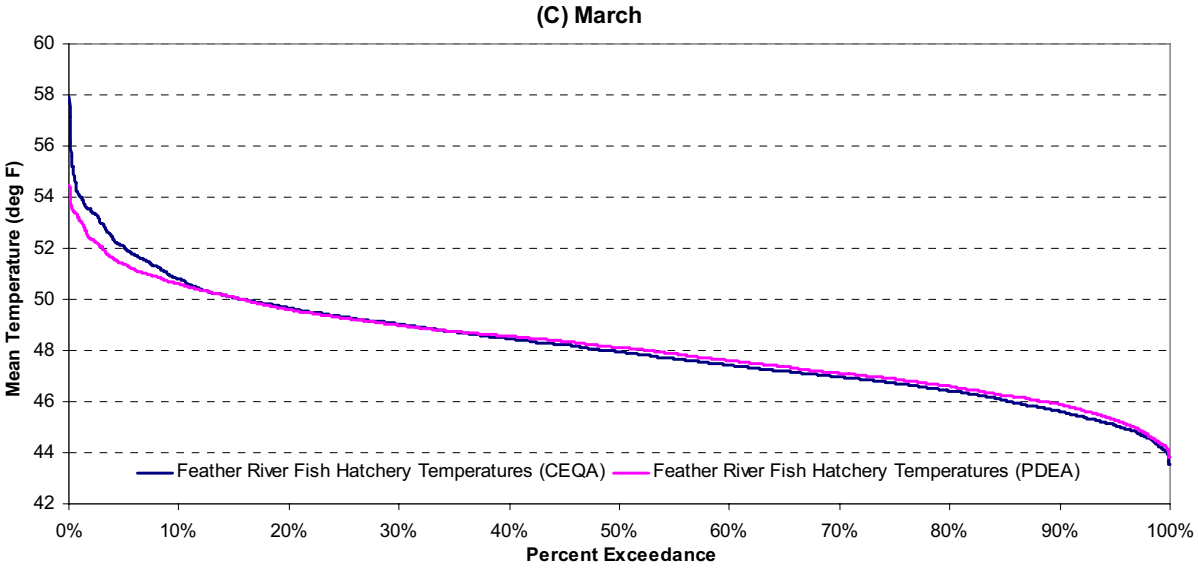


Figure E.2-2. Comparison of exceedance probabilities for simulated mean daily water temperatures at the Feather River Fish Hatchery under the Proposed Project Alternative for CEQA and the Proposed Action Alternative for the PDEA.



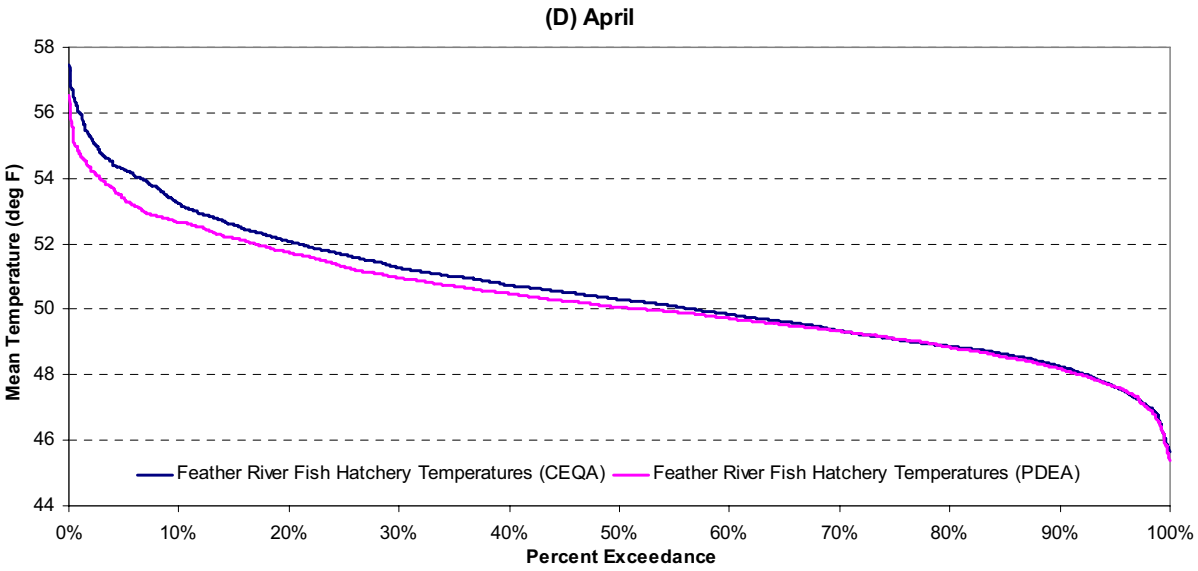
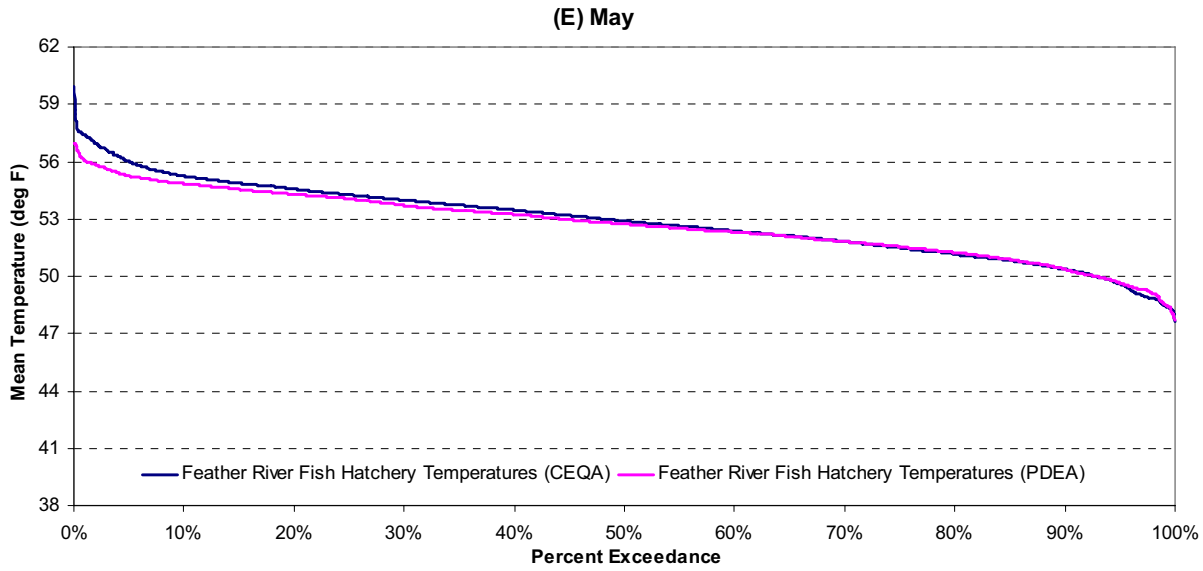


Figure E.2-2 (continued). Comparison of exceedance probabilities for simulated mean daily water temperatures at the Feather River Fish Hatchery under the Proposed Project Alternative for CEQA and the Proposed Action Alternative for the PDEA.



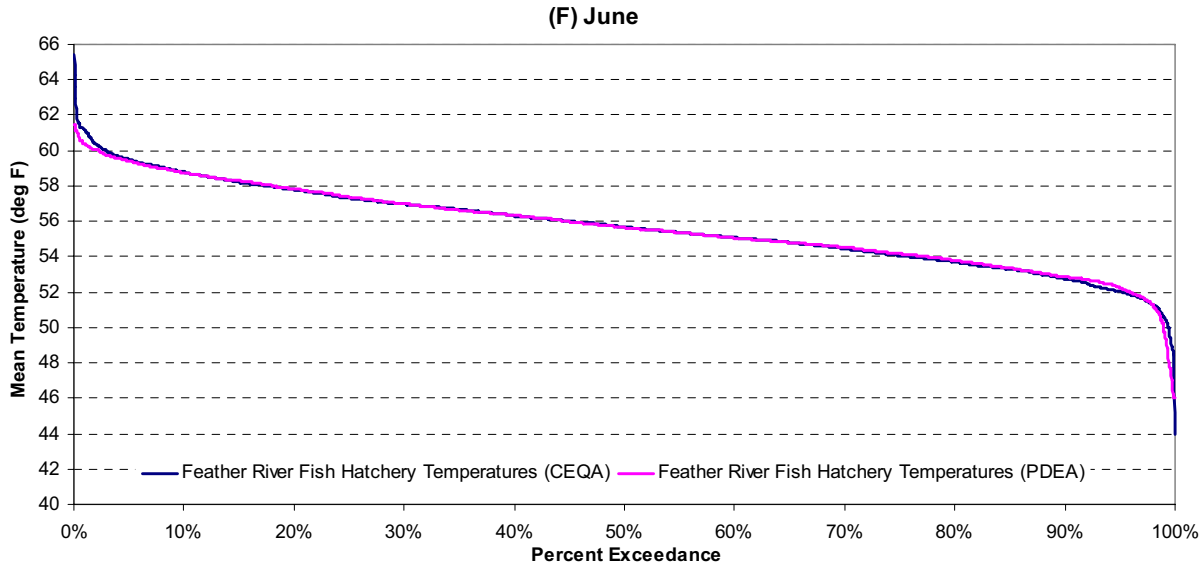
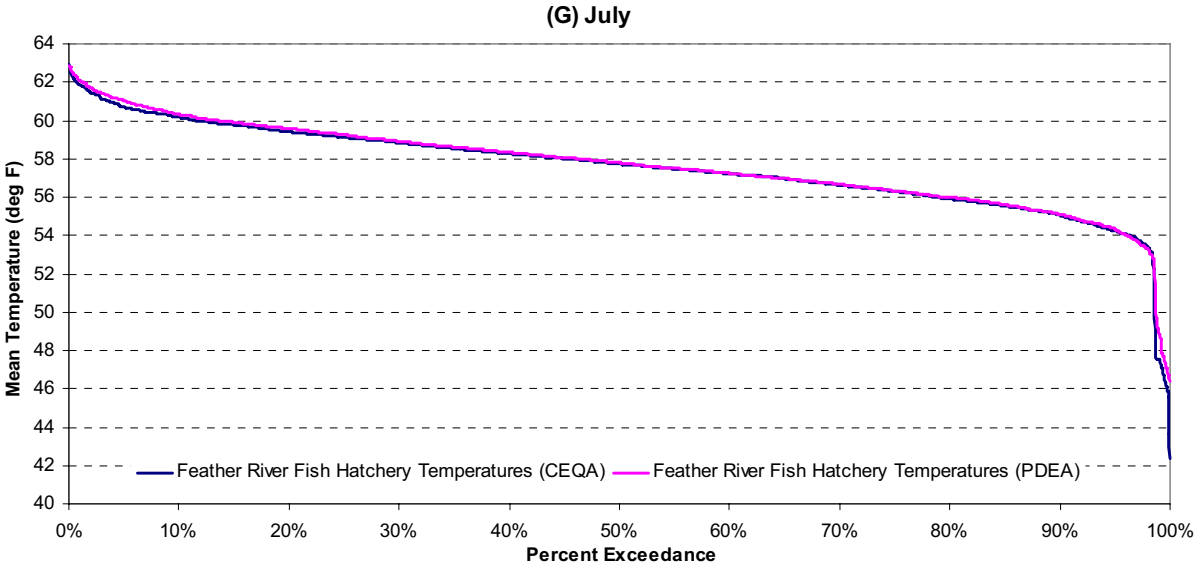


Figure E.2-2 (continued). Comparison of exceedance probabilities for simulated mean daily water temperatures at the Feather River Fish Hatchery under the Proposed Project Alternative for CEQA and the Proposed Action Alternative for the PDEA.



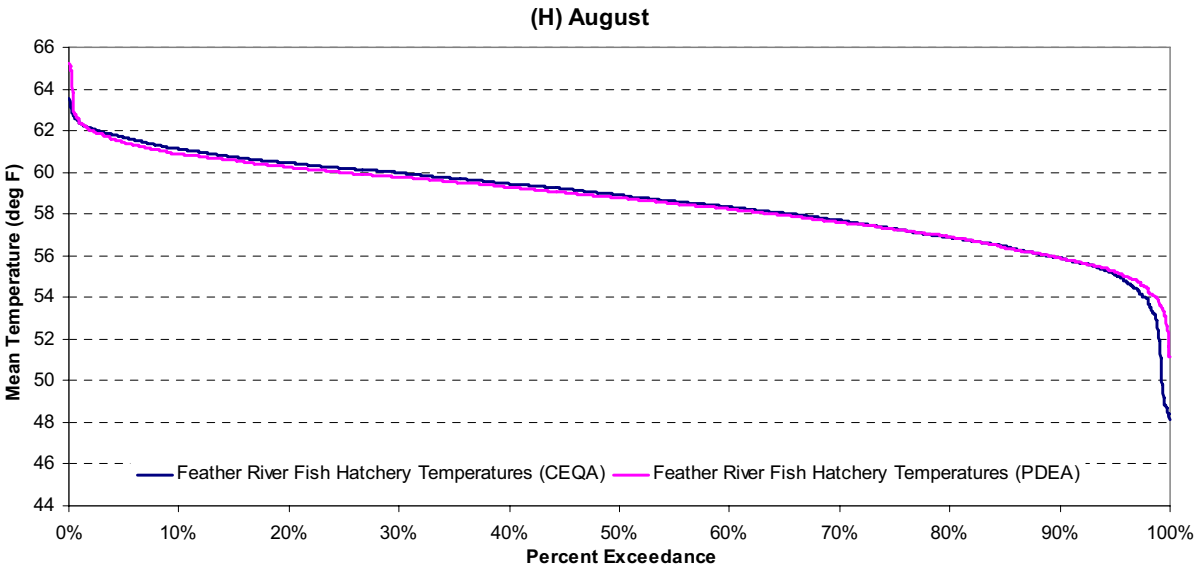
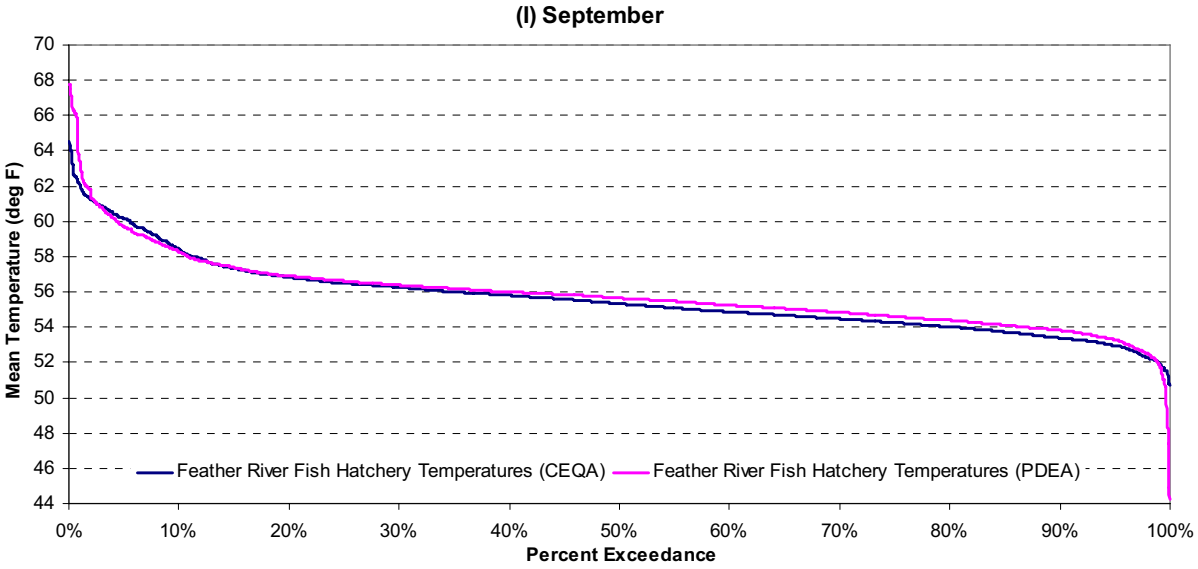


Figure E.2-2 (continued). Comparison of exceedance probabilities for simulated mean daily water temperatures at the Feather River Fish Hatchery under the Proposed Project Alternative for CEQA and the Proposed Action Alternative for the PDEA.



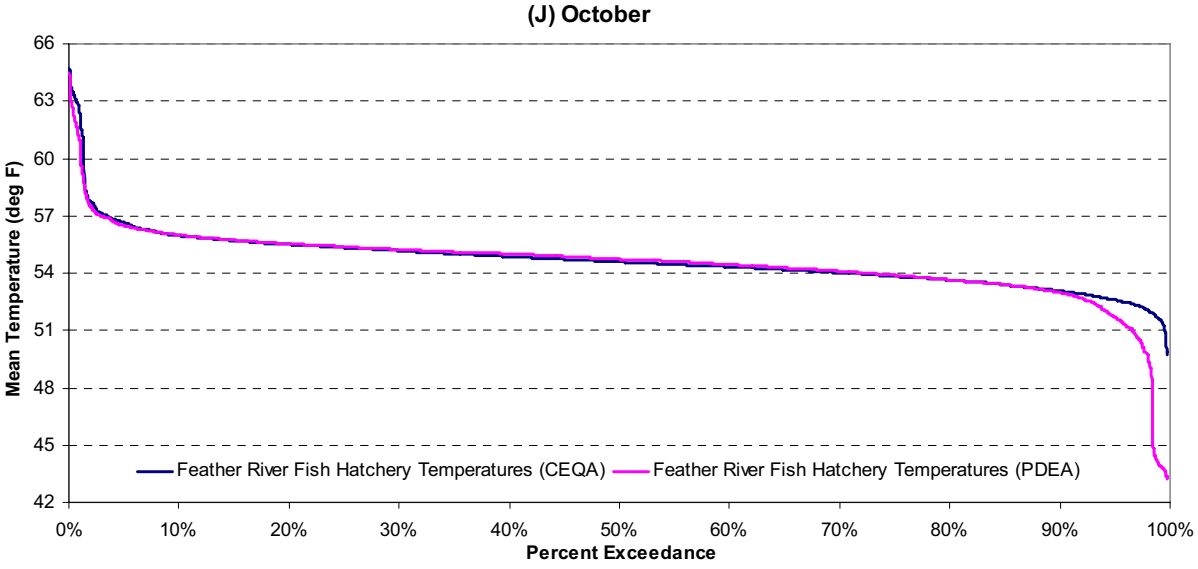


Figure E.2-2 (continued). Comparison of exceedance probabilities for simulated mean daily water temperatures at the Feather River Fish Hatchery under the Proposed Project Alternative for CEQA and the Proposed Action Alternative for the PDEA.

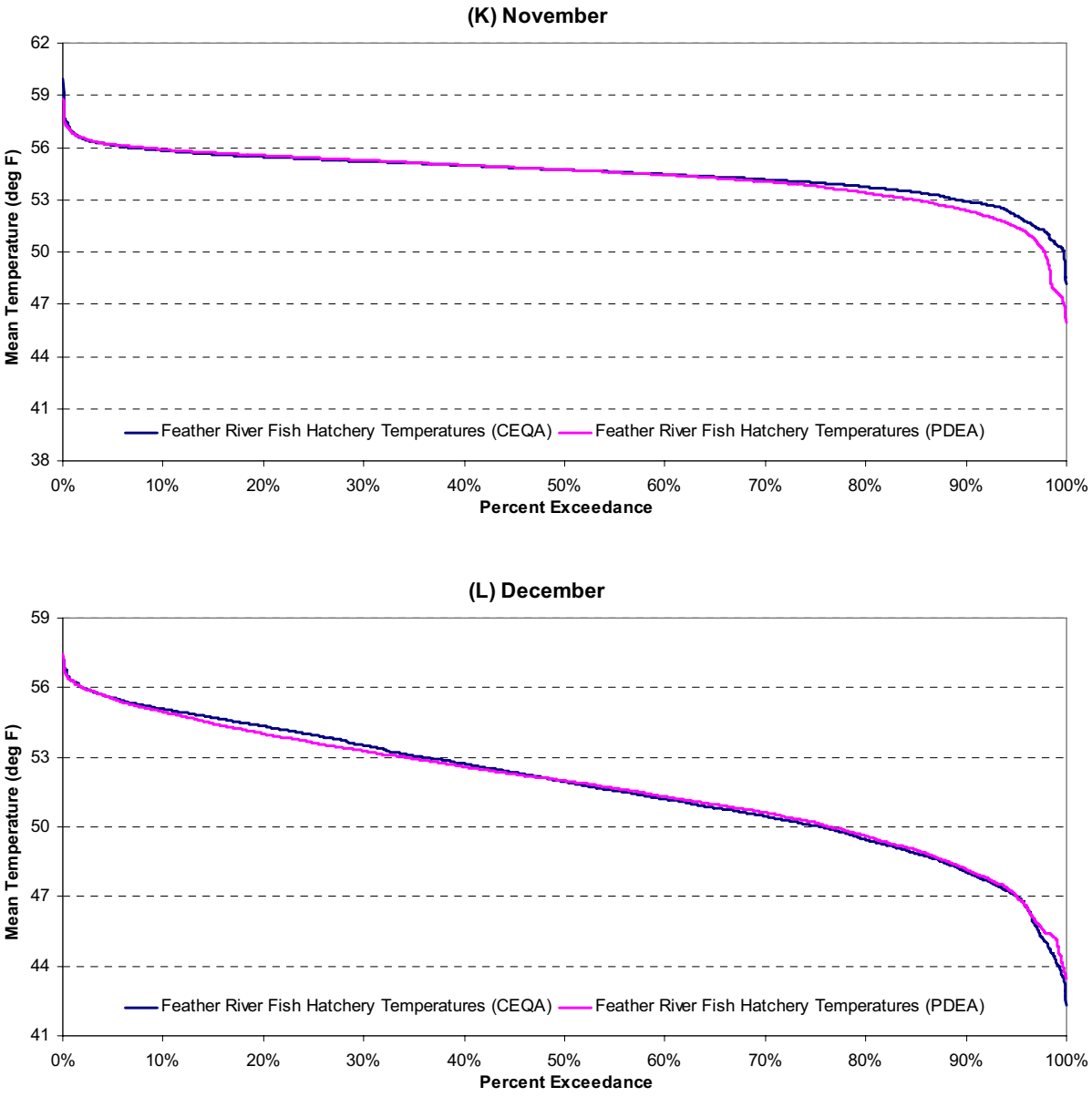


Figure E.2-2 (continued). Comparison of exceedance probabilities for simulated mean daily water temperatures at the Feather River Fish Hatchery under the Proposed Project Alternative for CEQA and the Proposed Action Alternative for the PDEA.

November, and December for 90 percent of the cumulative probability distribution. The exceedance plots show that the water temperatures from the Proposed Project are the same as the Proposed Action for 50 percent of the cumulative probability distribution and warmer than the Proposed Action for 50 percent of the cumulative probability distribution for the month of April. Therefore, the exceedance plot comparison of the Proposed Project vs. the Proposed Action in Figure E.2-2 demonstrates that the

Proposed Project results in an increased percentage probability of water temperature compliance and increased protection of coldwater fisheries resources at the Feather River Fish Hatchery under almost all conditions and months as compared to the Proposed Action.

Exceedance plots of mean daily average water temperatures comparing the Proposed Project and the Proposed Action (see Figure E.2-3) demonstrate that water temperatures at Robinson Riffle are the same water temperature or cooler under the Proposed Project for each month of analysis over 100 percent of the cumulative probability distribution from January through September. In October and November, the Proposed Action has a few percent (less than 10 percent) probability of exceedance of water temperatures cooler than the Proposed Project; however, in all of those probabilities, the water temperatures for both the Proposed Project and the Proposed Action are several degrees below the water temperature objectives at Robinson Riffle. The December exceedance plot shows that the Proposed Project cumulative probability distribution of mean average daily water temperatures is the same or cooler than the Proposed Action. Therefore, the exceedance plot comparison of the Proposed Project vs. the Proposed Action in Figure E.2-3 demonstrates that the Proposed Project results in an increased percentage probability of water temperature compliance and increased protection of coldwater fisheries resources at Robinson Riffle under almost all conditions and months as compared to the Proposed Action.

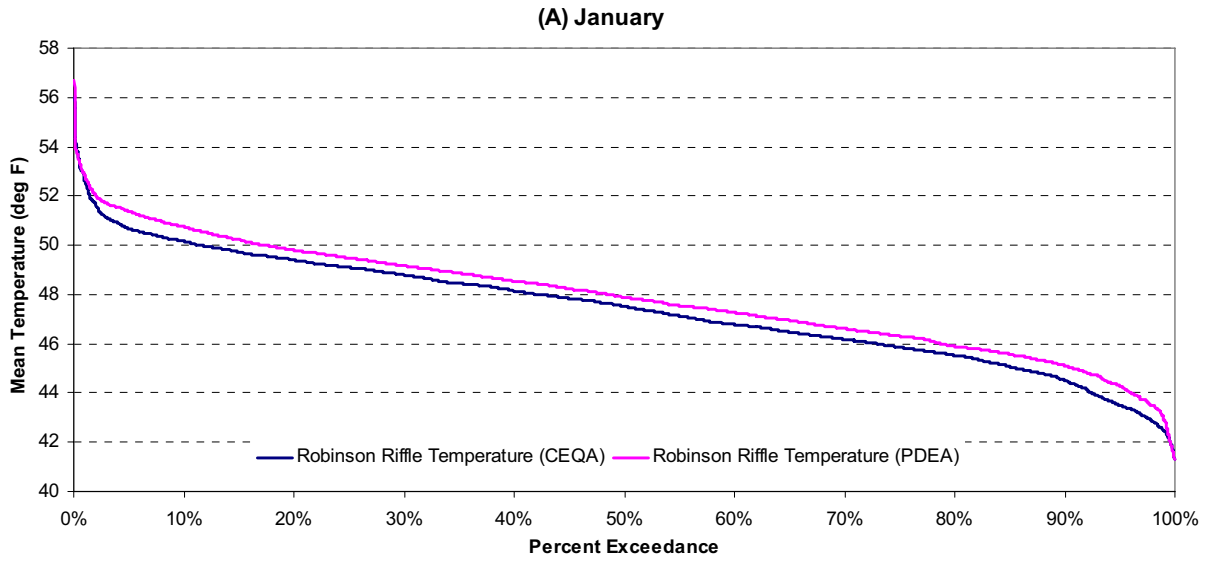
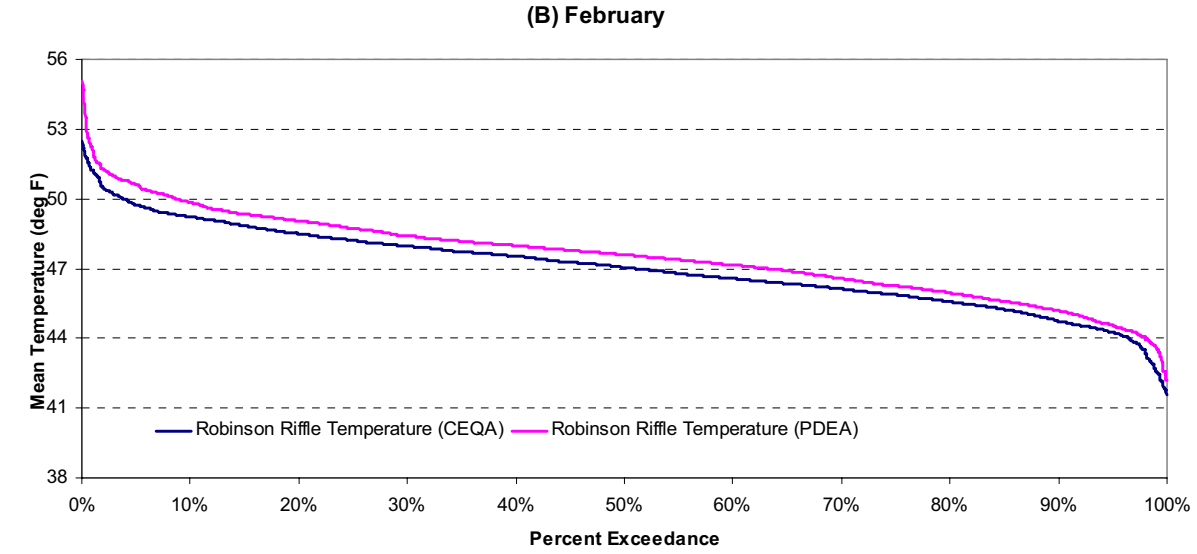


Figure E.2-3. Comparison of exceedance probabilities for simulated mean daily water temperatures at Robinson Riffle under the Proposed Project Alternative for CEQA and the Proposed Action Alternative for the PDEA.



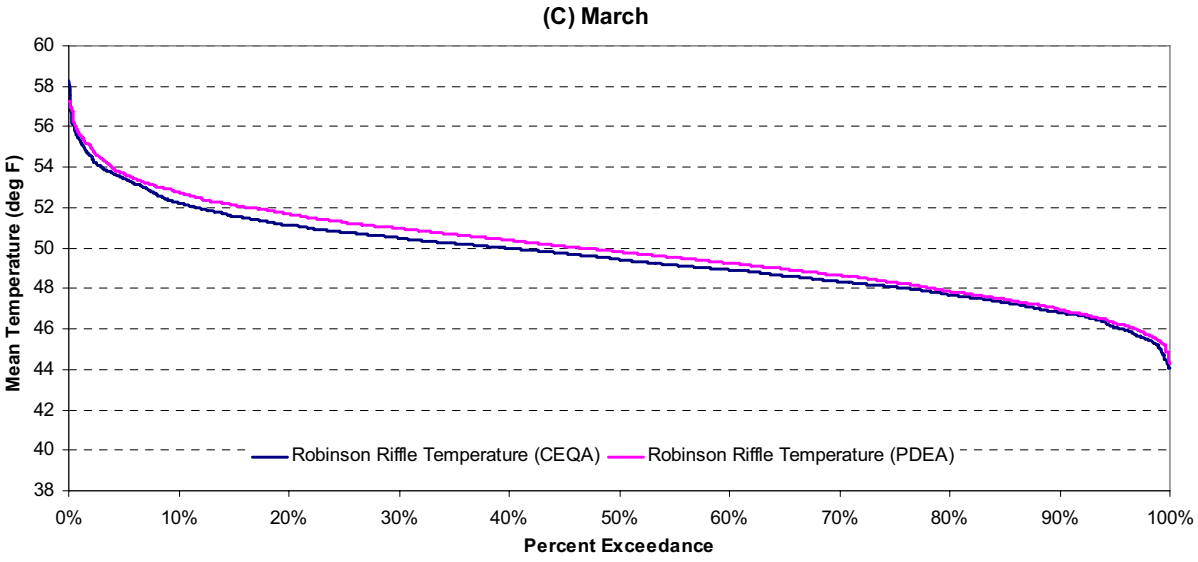
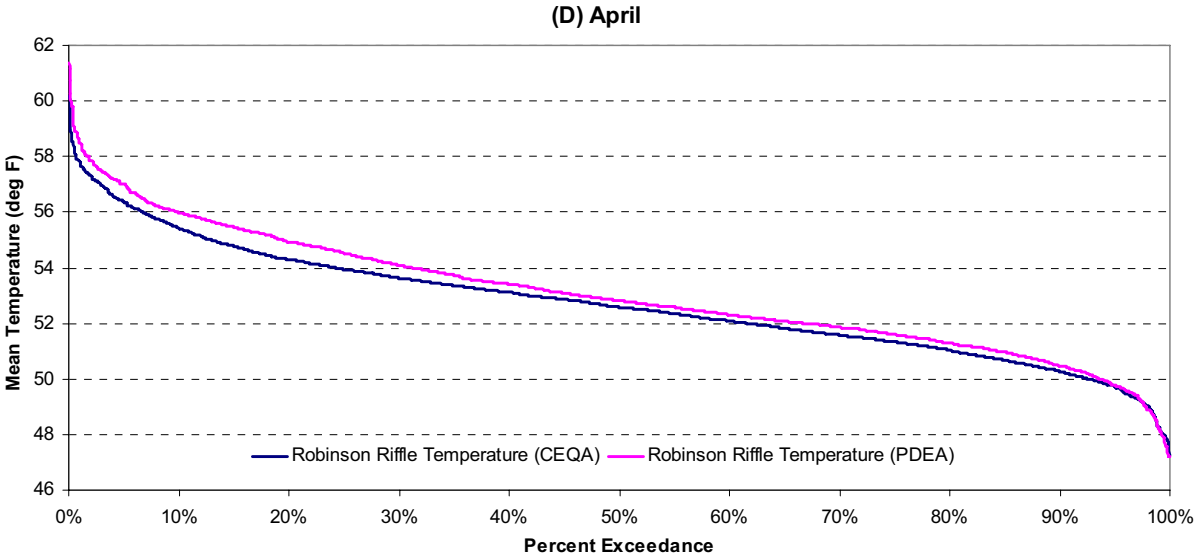


Figure E.2-3 (continued). Comparison of exceedance probabilities for simulated mean daily water temperatures at Robinson Riffle under the Proposed Project Alternative for CEQA and the Proposed Action Alternative for the PDEA.



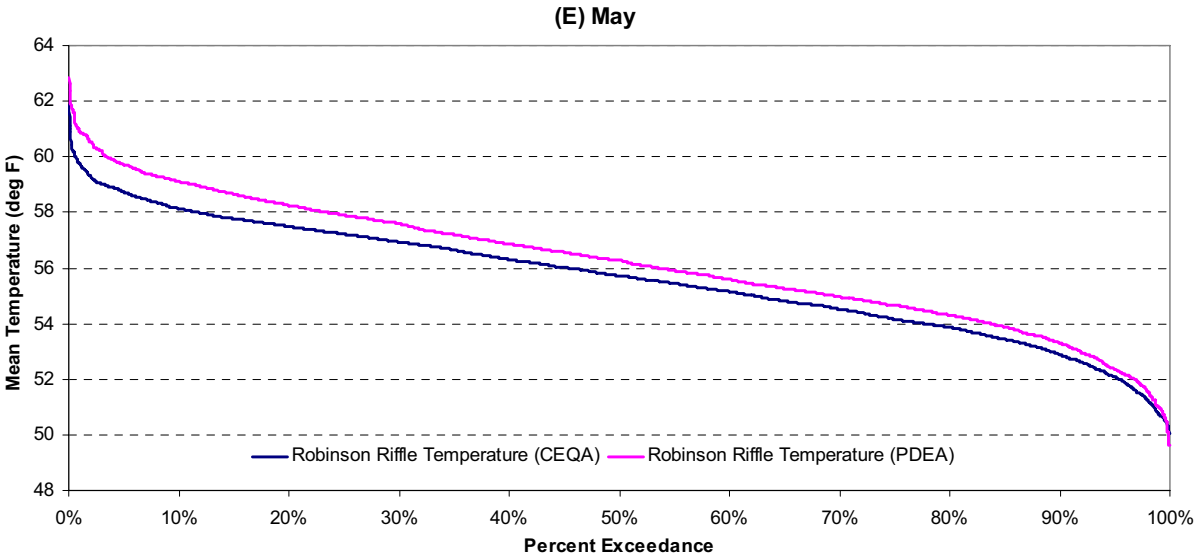


Figure E.2-3 (continued). Comparison of exceedance probabilities for simulated mean daily water temperatures at Robinson Riffle under the Proposed Project Alternative for CEQA and the Proposed Action Alternative for the PDEA.

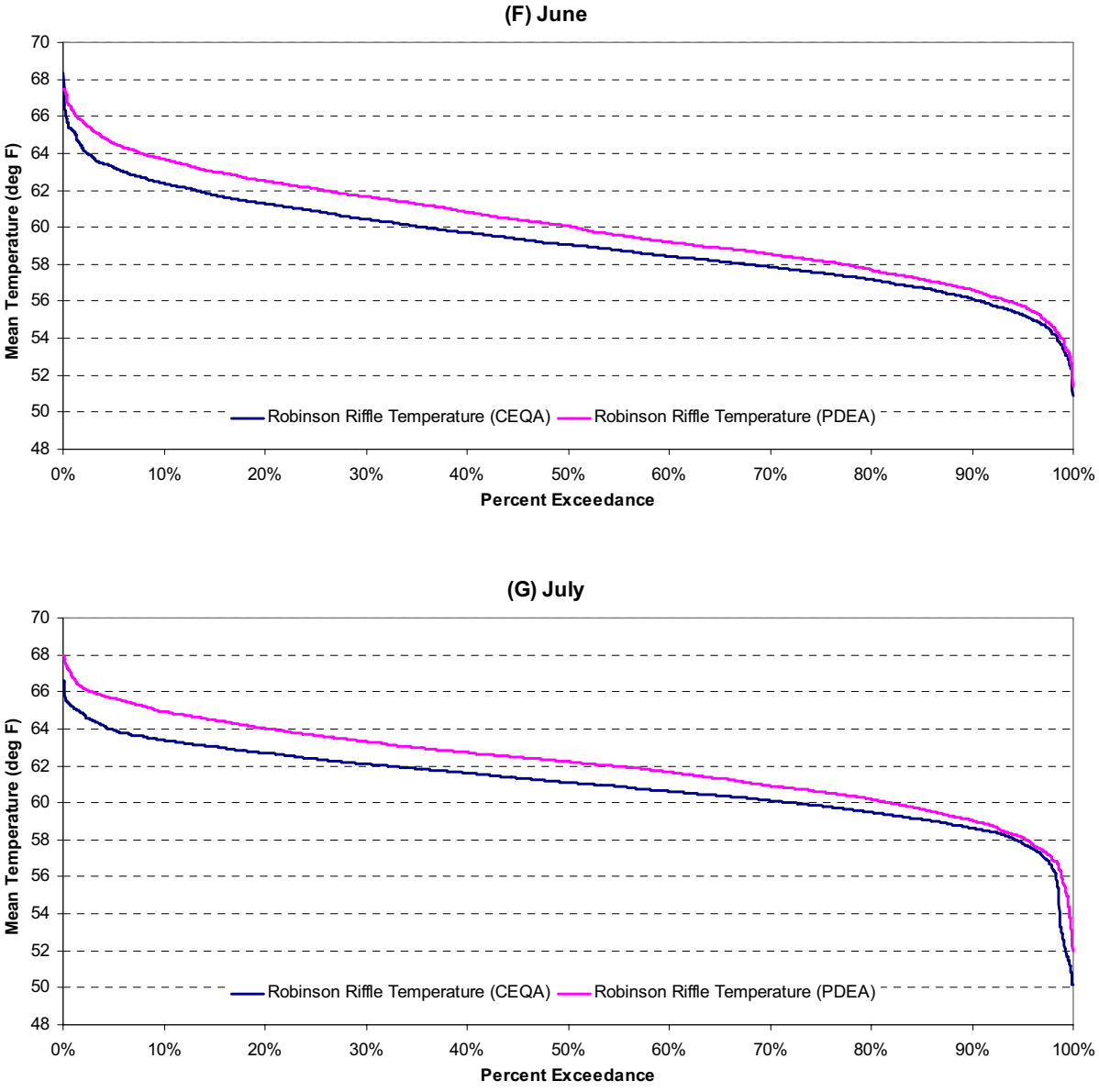
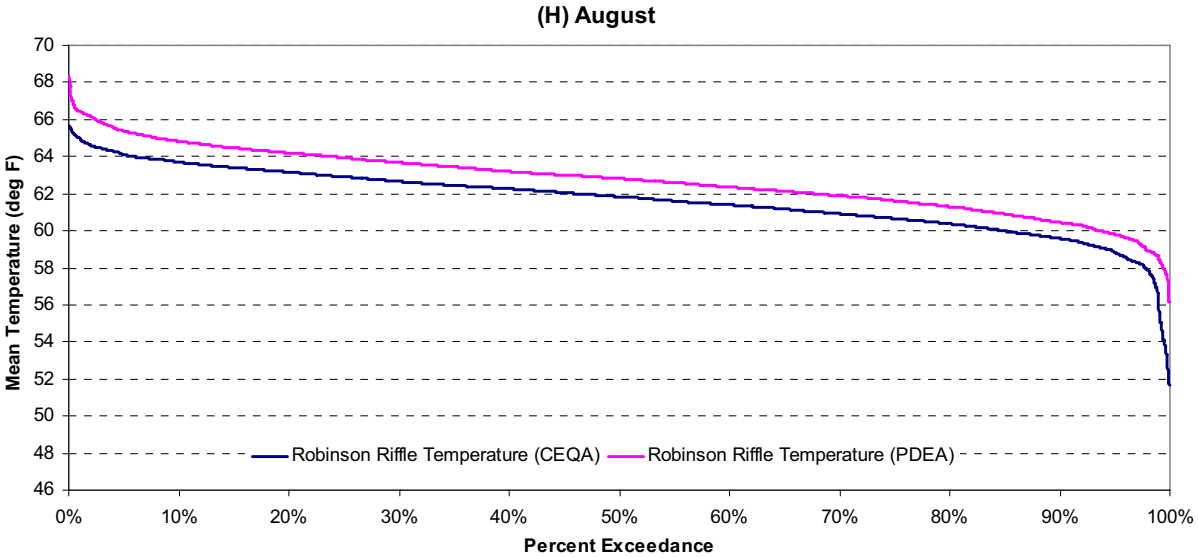


Figure E.2-3 (continued). Comparison of exceedance probabilities for simulated mean daily water temperatures at Robinson Riffle under the Proposed Project Alternative for CEQA and the Proposed Action Alternative for the PDEA.



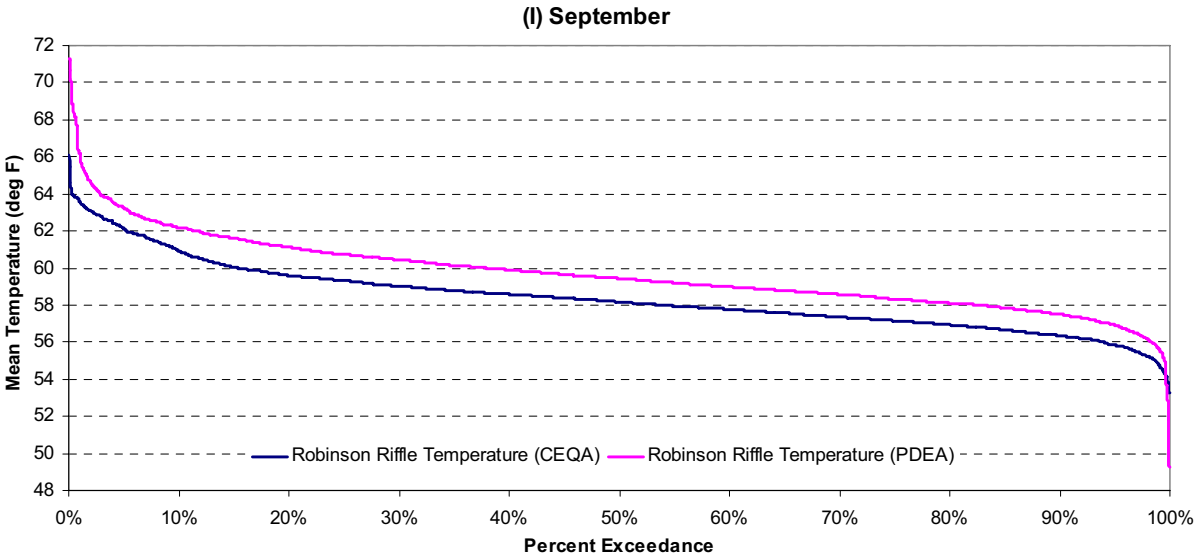
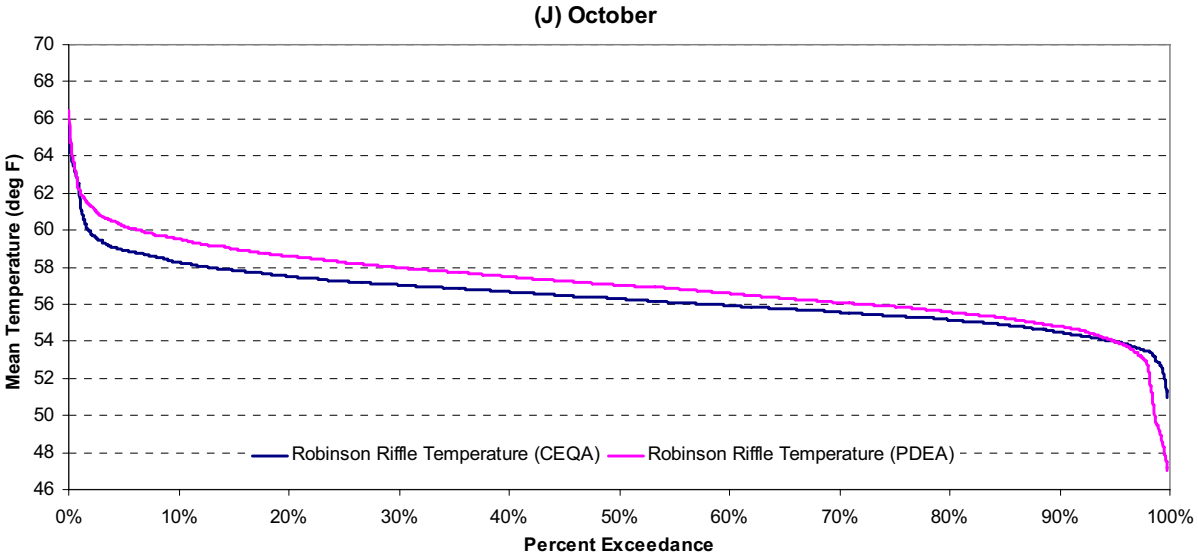


Figure E.2-3 (continued). Comparison of exceedance probabilities for simulated mean daily water temperatures at Robinson Riffle under the Proposed Project Alternative for CEQA and the Proposed Action Alternative for the PDEA.



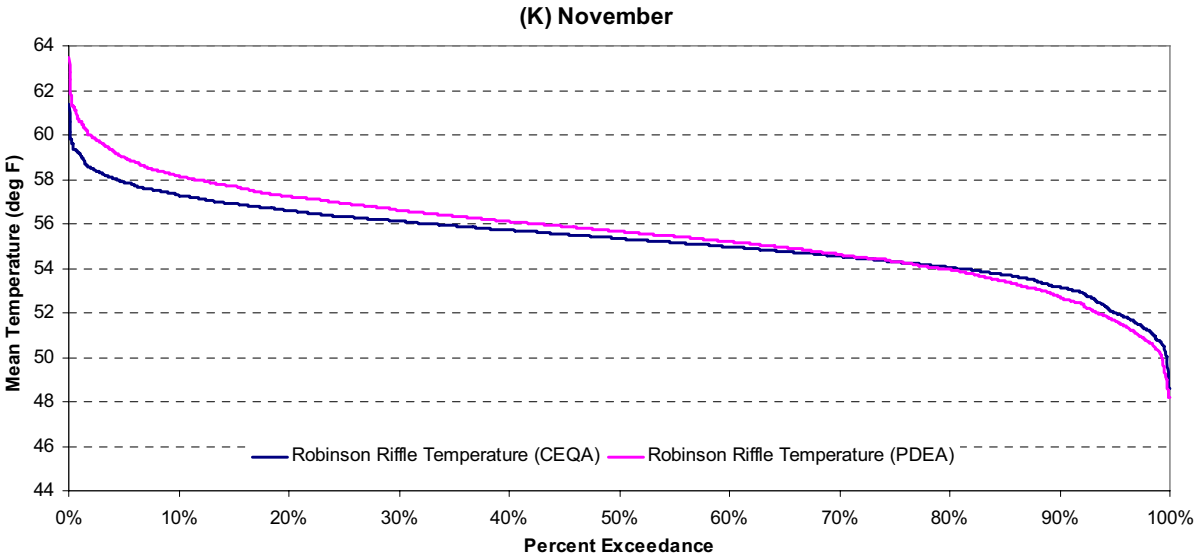


Figure E.2-3 (continued). Comparison of exceedance probabilities for simulated mean daily water temperatures at Robinson Riffle under the Proposed Project Alternative for CEQA and the Proposed Action Alternative for the PDEA.

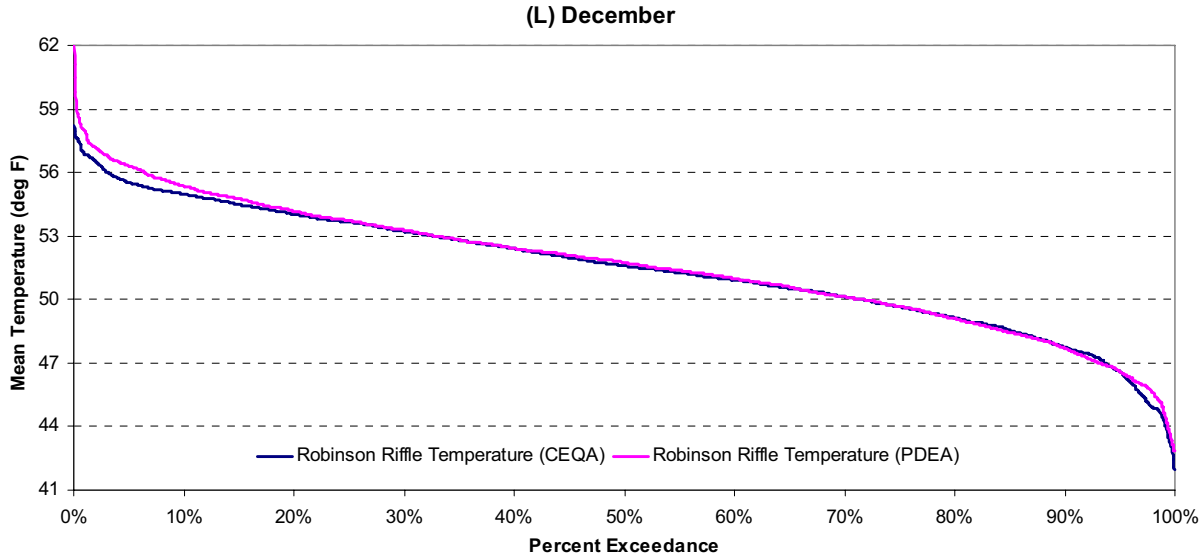


Figure E.2-3 (continued). Comparison of exceedance probabilities for simulated mean daily water temperatures at Robinson Riffle under the Proposed Project Alternative for CEQA and the Proposed Action Alternative for the PDEA.

Exceedance plots of mean daily average water temperatures comparing the Proposed Project and the Proposed Action (see Figure E.2-4) demonstrate that water temperatures in the lower Feather River below the Thermalito Afterbay Outlet are the same water temperatures or cooler under the Proposed Project for the months of January, February, March, April, July, and September for 100 percent of the cumulative probability distribution. Water temperatures in the lower Feather River below the Thermalito Afterbay Outlet are the same water temperatures or cooler under the Proposed Project for the months of May, June, August, and December for 95 percent of the cumulative probability distribution. The exceedance plots show that the water temperatures from the Proposed Project are the same as the Proposed Action for 50 percent of the cumulative probability distribution in the month of November and the same or cooler than the Proposed Action for 20 percent of the cumulative probability distribution for the month of October. Therefore, the exceedance plot comparison of the Proposed Project vs. the Proposed Action in Figure E.2-4 demonstrates that the Proposed Project results in an increased percentage probability of water temperature compliance and increased protection of coldwater fisheries resources in the lower Feather River below the Thermalito Afterbay Outlet under most conditions and months as compared to the Proposed Action.

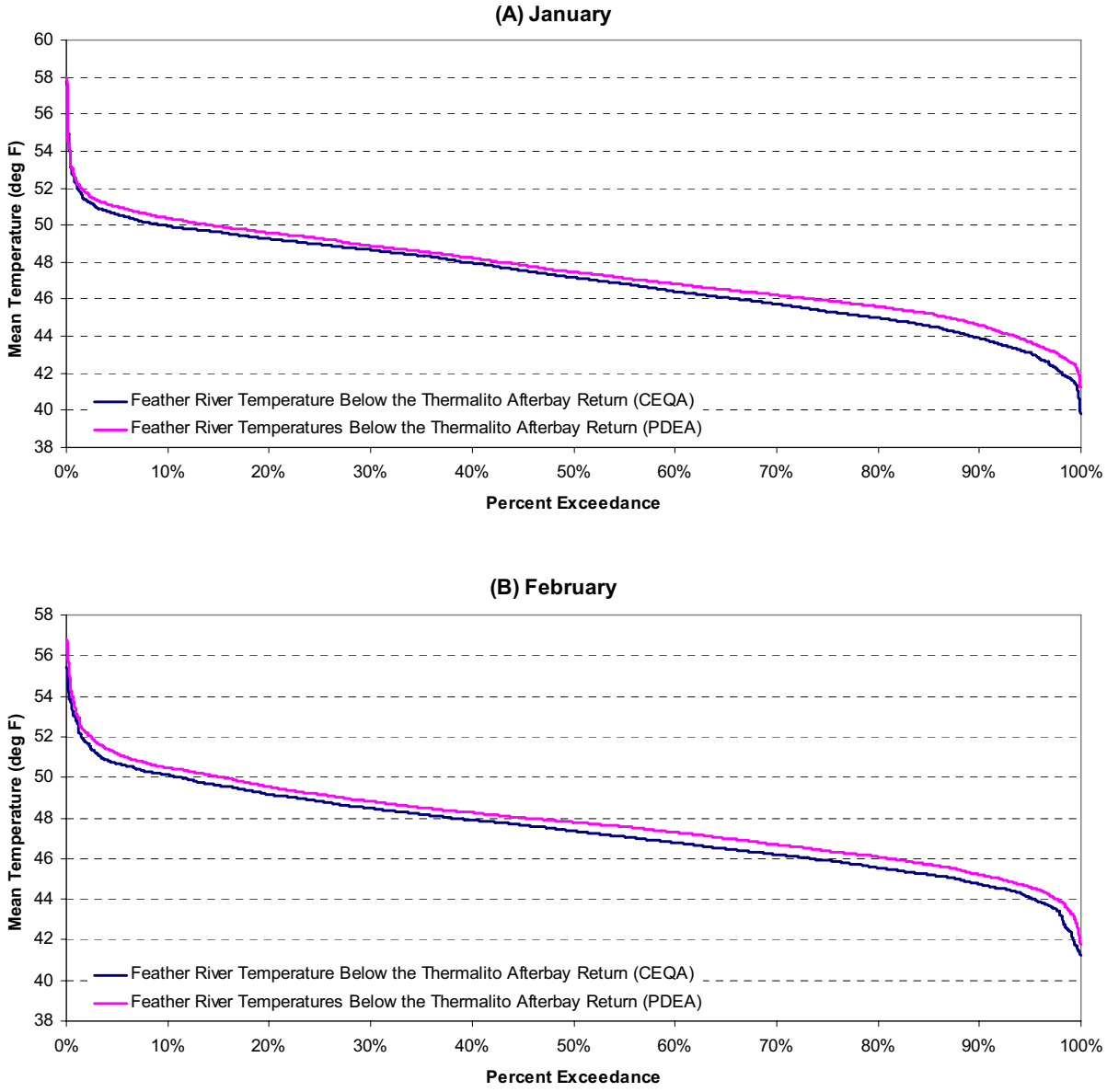


Figure E.2-4. Comparison of exceedance probabilities for simulated mean daily water temperatures below the Thermalito Afterbay return under the Proposed Project Alternative for CEQA and the Proposed Action Alternative for the PDEA.

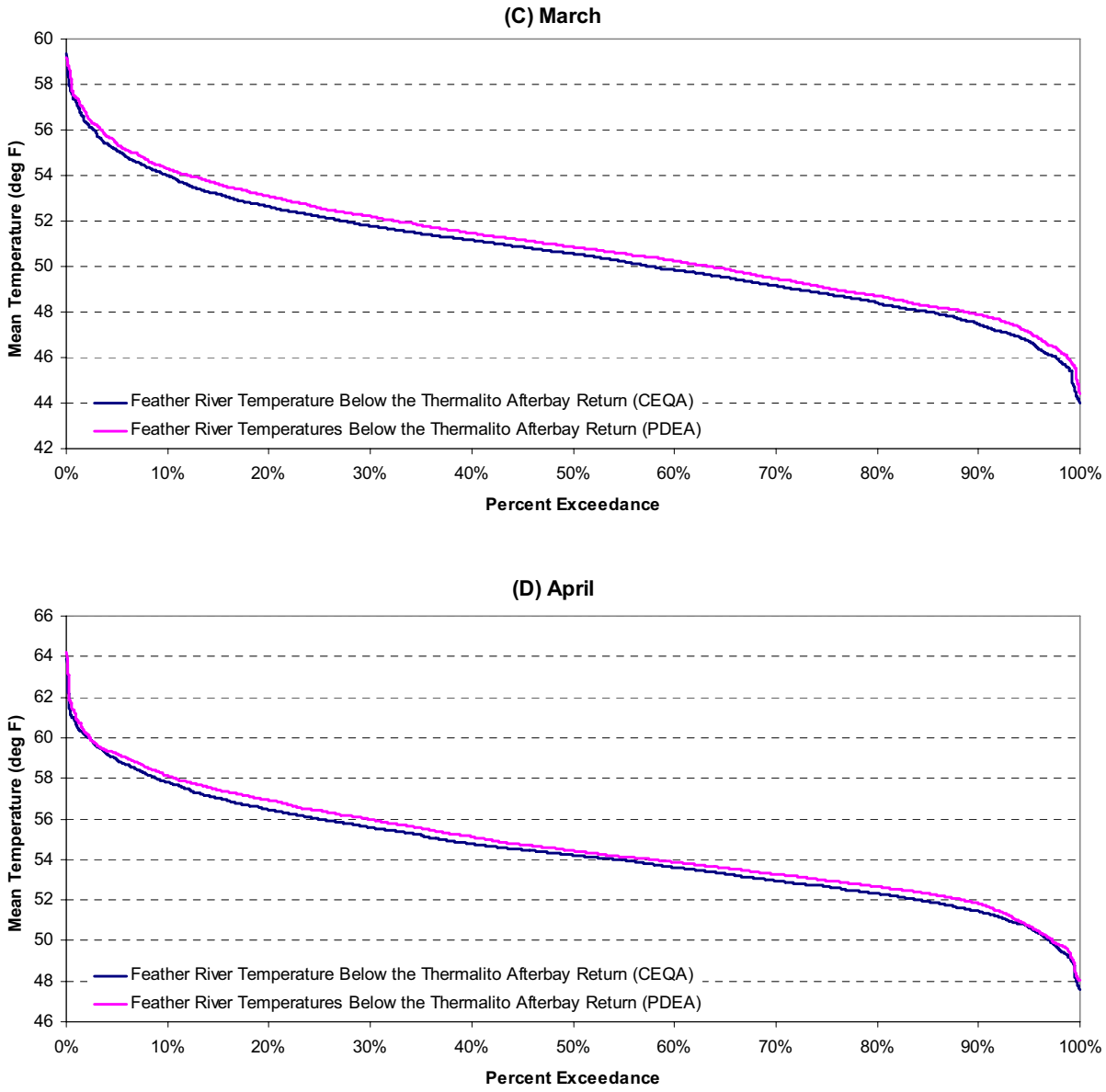


Figure E.2-4 (continued). Comparison of exceedance probabilities for simulated mean daily water temperatures below the Thermalito Afterbay return under the Proposed Project Alternative for CEQA and the Proposed Action Alternative for the PDEA.

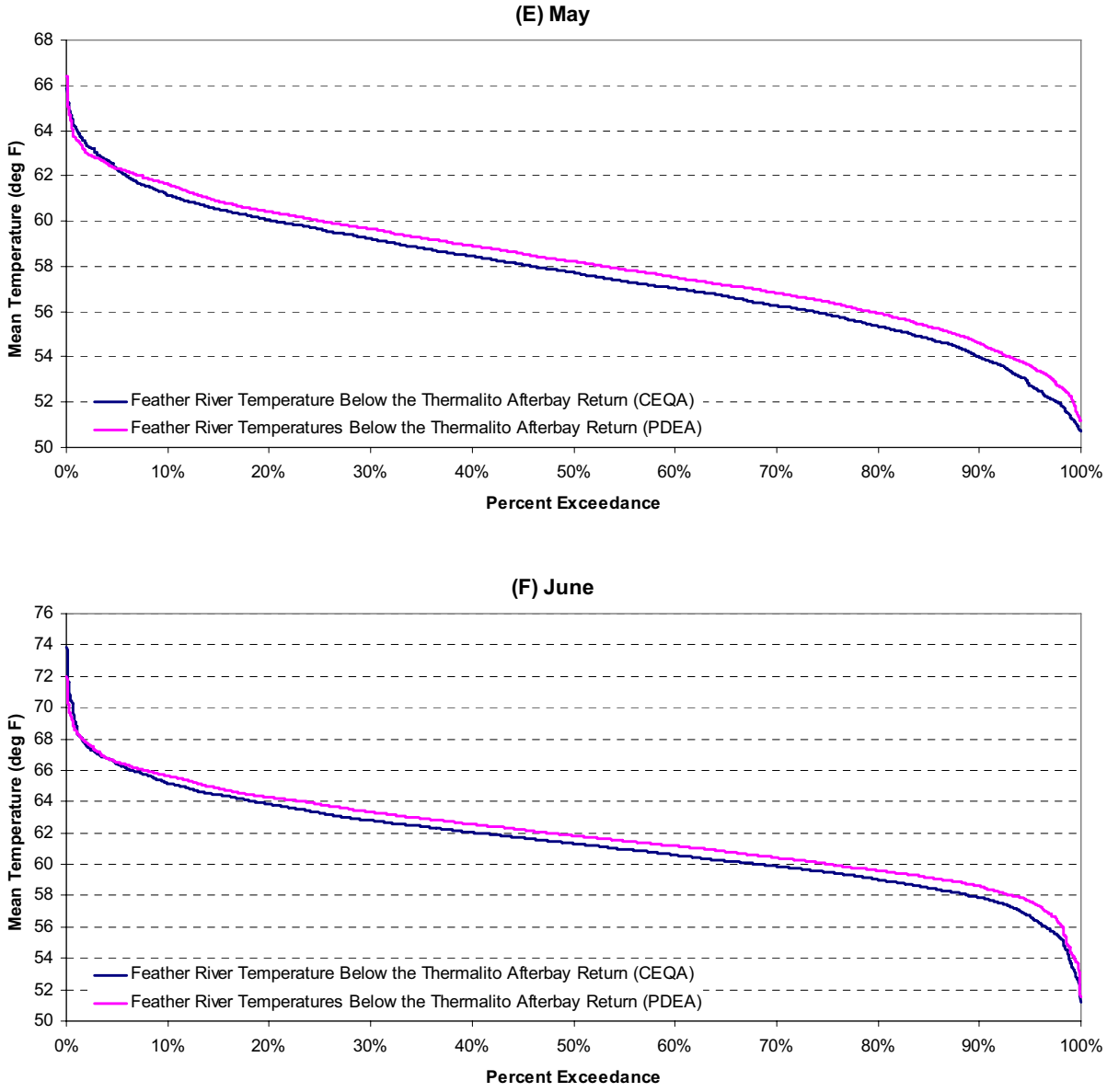


Figure E.2-4 (continued). Comparison of exceedance probabilities for simulated mean daily water temperatures below the Thermalito Afterbay return under the Proposed Project Alternative for CEQA and the Proposed Action Alternative for the PDEA.

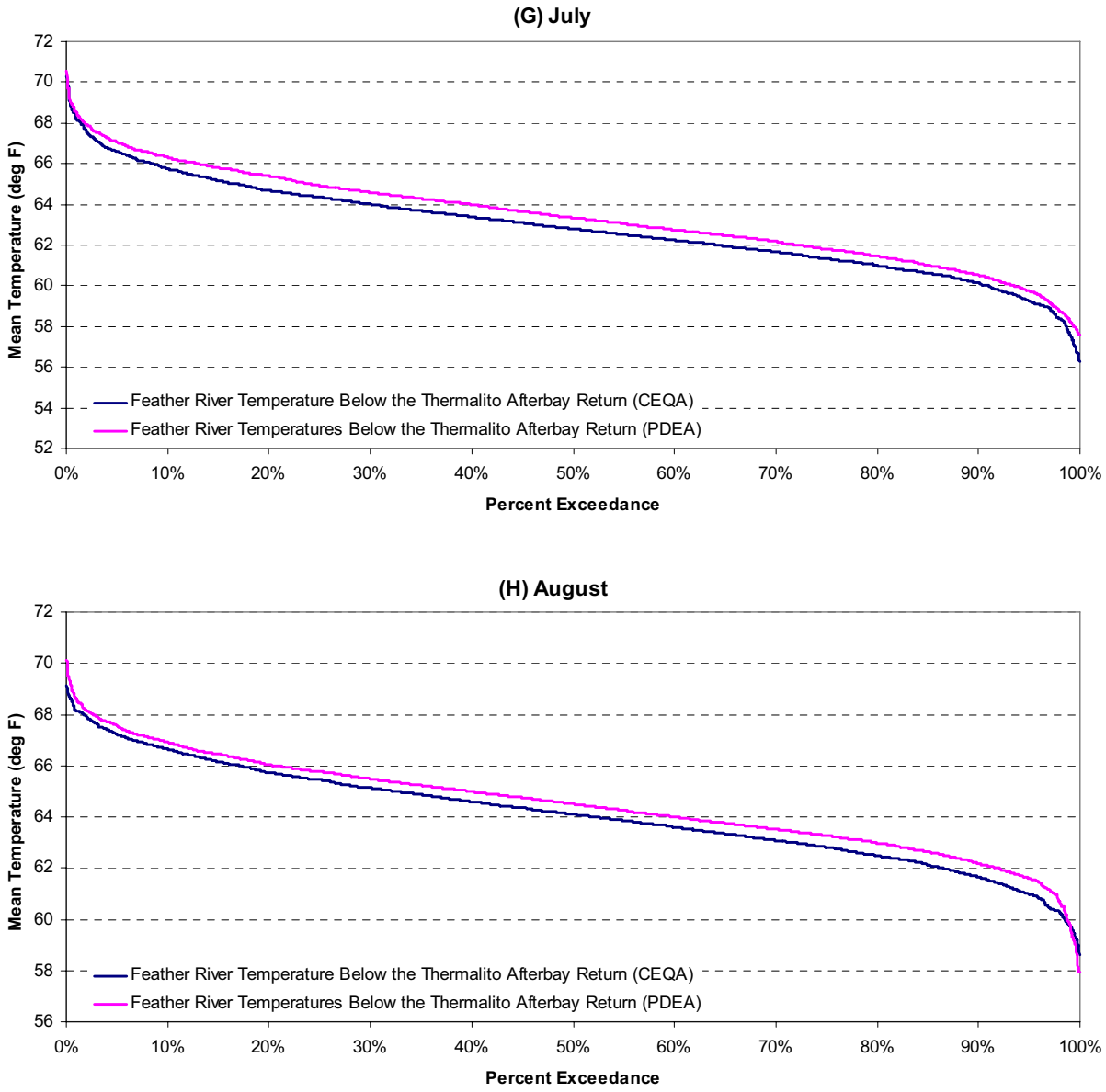


Figure E.2-4 (continued). Comparison of exceedance probabilities for simulated mean daily water temperatures below the Thermalito Afterbay return under the Proposed Project Alternative for CEQA and the Proposed Action Alternative for the PDEA.

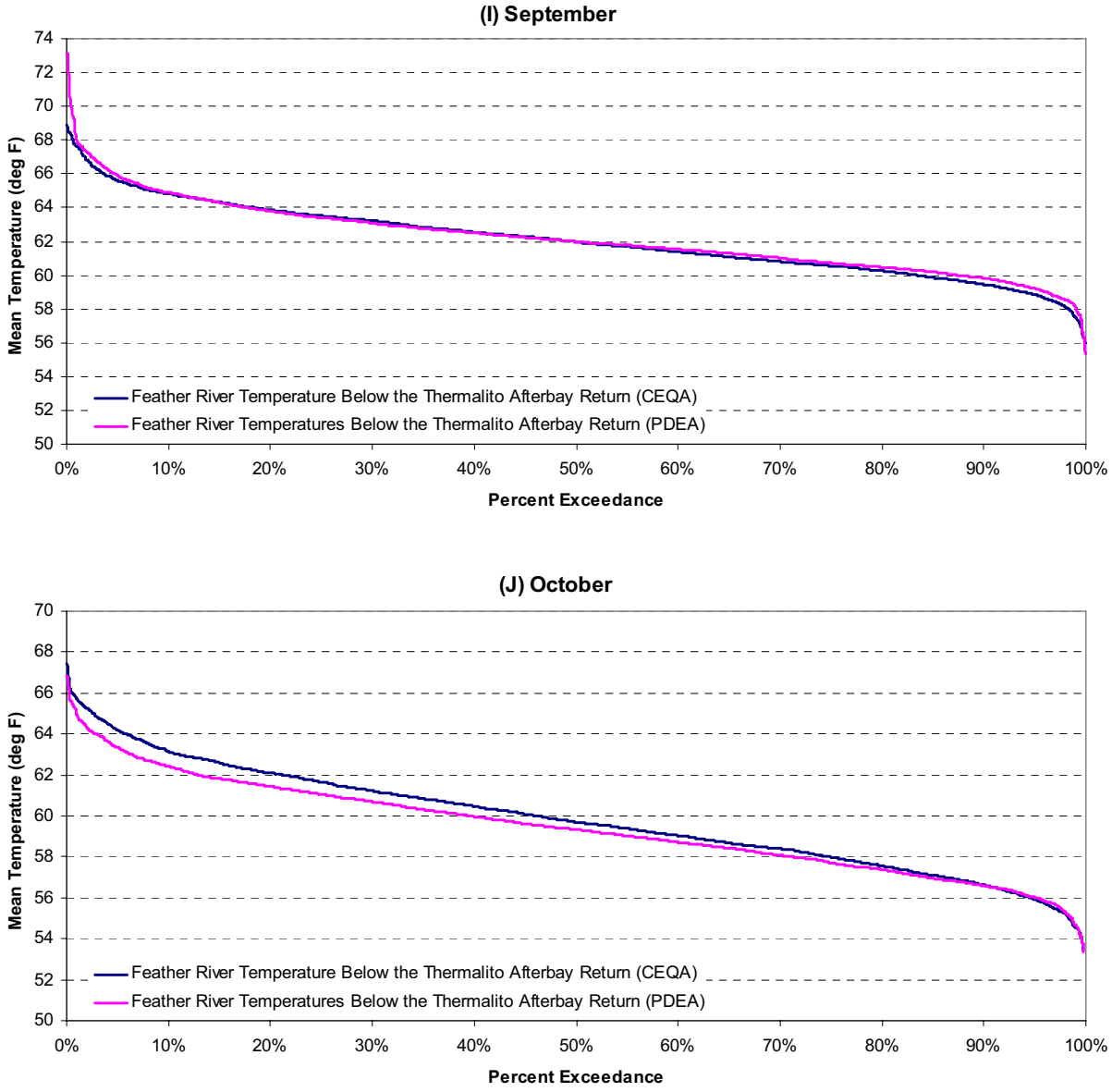


Figure E.2-4 (continued). Comparison of exceedance probabilities for simulated mean daily water temperatures below the Thermalito Afterbay return under the Proposed Project Alternative for CEQA and the Proposed Action Alternative for the PDEA.

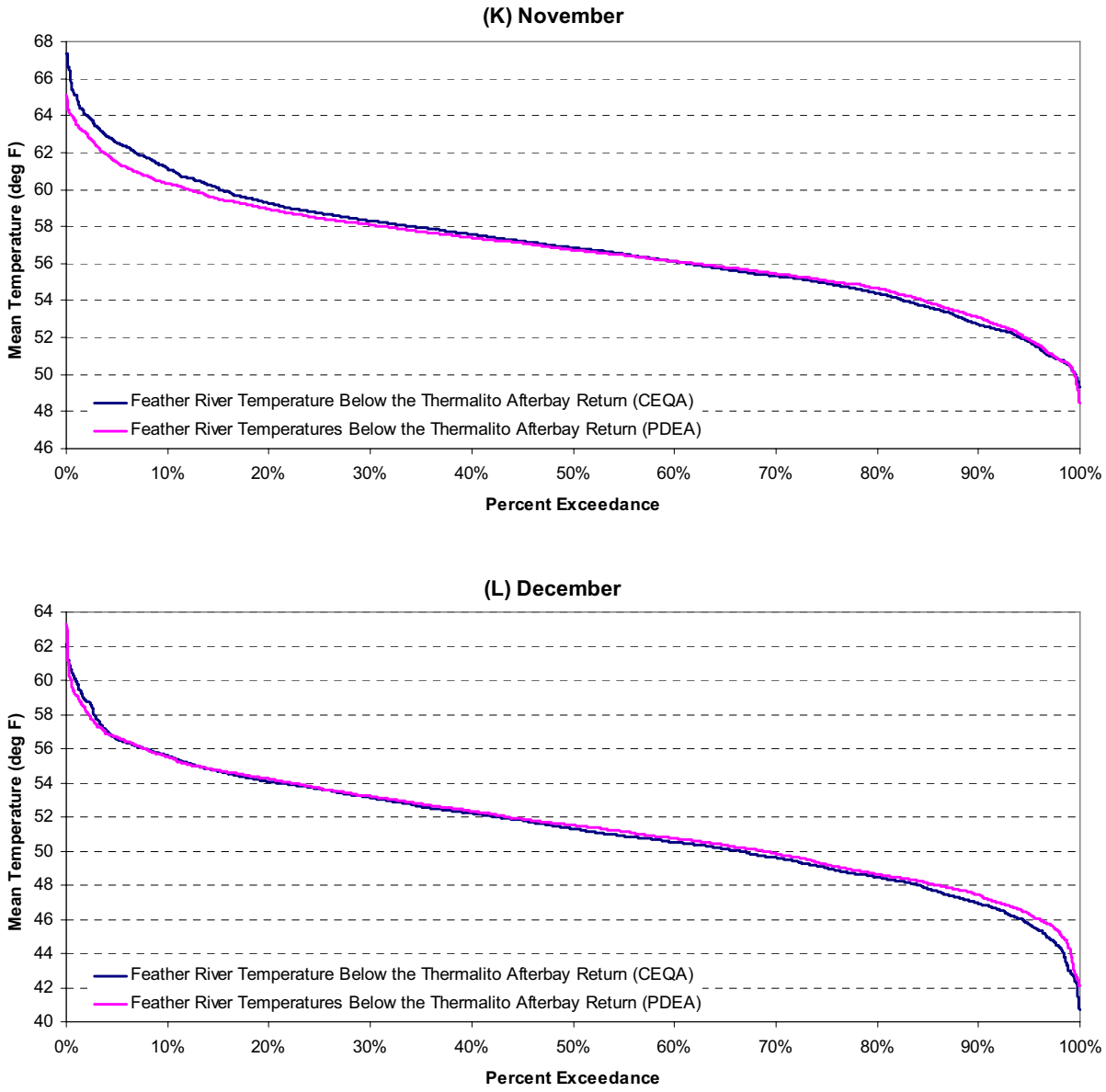


Figure E.2-4 (continued). Comparison of exceedance probabilities for simulated mean daily water temperatures below the Thermalito Afterbay return under the Proposed Project Alternative for CEQA and the Proposed Action Alternative for the PDEA.

The exceedance plots demonstrate that the Proposed Project results in a reduction in the water temperature conditions in all three key water temperature evaluation locations under most conditions in all months as compared to the Proposed Action. Therefore, overall, the Proposed Project as compared to the Proposed Action results in either a reduction or the same water temperature under most conditions and months as compared to the Proposed Action.

The differences in modeling assumptions between modeling conducted for the PDEA and EIR appear to have little to no effect on modeled water temperature results. Therefore, the comparison of Proposed Action and the Proposed Project water temperatures appears to be valid and not materially affected by the differences in the modeling assumptions between these scenarios.

E.2.6 Coldwater Pool Availability

The following section addresses the ability of the Proposed Project to meet the more protective water temperature targets during the initial new license period, compared to either the Existing Conditions/No-Action Alternative or the Proposed Action. The ability of the project to meet the initial new license period water temperature targets is determined by evaluating changes in two water temperature management factors. First, in over 45 percent of the 73-year period of simulated hydrology modeled (see Figure E.2-5), there would be an accessible coldwater pool at the end of the water temperature management season under the Proposed Action. During those years when additional coldwater pool volume is accessible by the current facilities, the more protective water temperature targets of the Proposed Project during the initial new license period would result in additional coldwater fisheries benefits. Second, even in years when additional coldwater pool volume was not accessible, conditions achieved would still be enhanced compared to either the Existing Conditions/No-Action Alternative or the Proposed Action due to the increased efficiency of use of the limited coldwater pool through improved coldwater pool conservation water temperature control actions (TCAs) included in the Proposed Project.

Figure E.2-5 shows that under all probabilities of cumulative distribution in the 73-year model comparison period, the Proposed Project at the end of the water temperature control season has over 100,000 acre-feet more accessible coldwater pool volume than the Proposed Action, even after meeting the more protective water temperature standards included in the Proposed Action. This exceedance plot demonstrates that the Proposed Project has an enhanced ability to meet the more protective water temperature management standards, without increased frequency of use of the river valves, than the less protective standards of the Proposed Action. Therefore, the Proposed Project would provide additional enhancement of coldwater beneficial uses and coldwater fisheries resources than the Proposed Action, but would be more reliably protective as well.

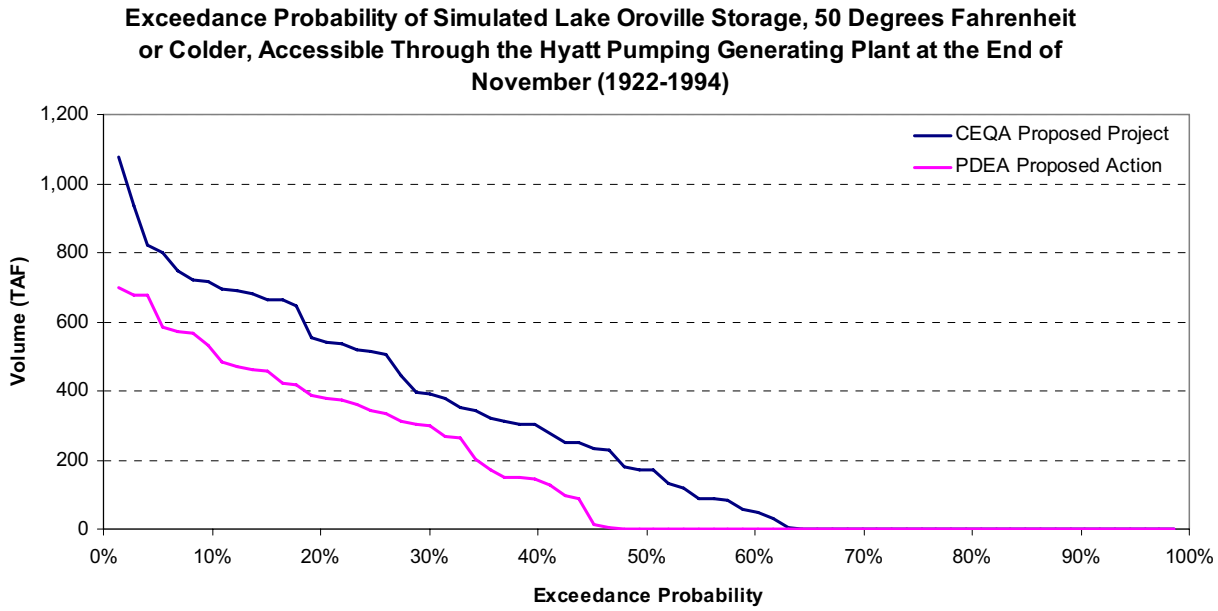


Figure E.2-5. Exceedance plot comparing the Proposed Project to the Proposed Action coldwater pool volume accessible through the Hyatt Intake at the end of the water temperature management season.

For the purposes of this analysis, November is the end of the water temperature management season because (1) water temperature exceedances have occurred in November in the past; (2) significant inflows resulting from precipitation events typically do not occur by the end of November; and (3) reservoir turnover typically occurs in December or later. Therefore, the month of November is most representative of the coldwater pool resource available to manage water temperatures downstream of Oroville Reservoir.

E.2.7 Temperature Control Action Sequence

The Proposed Project changes the sequence of TCAs compared to the Existing Conditions/No-Action Alternative and the Proposed Action evaluated in the PDEA. As demonstrated by Figure E.2-5, the Proposed Project TCA sequence is more efficient at preserving coldwater pool reserves in Lake Oroville. The new TCA sequence enables the Proposed Project to achieve a more rapid response to temperature control management needs than the previous TCA sequence used for the Existing Conditions/No-Action Alternative or Proposed Action modeling in the PDEA.

The TCAs used in all model runs included:

- *Cut pumpback operations*. The Hyatt Pumping-Generating Plant and the Thermalito Pumping-Generating Plant are capable of reversing direction, and

pumping water from the Thermalito Afterbay, through the Thermalito Forebay and Diversion Pool, into Lake Oroville. The decision to pump back or not to pump back is made based on the value of power at a particular time, and the required volume for release from the Oroville Facilities. The typical effect of this operation is a warming of the water around the Hyatt Pumping-Generating Plant Intake in Lake Oroville, and warming the releases from the Thermalito Diversion Pool to the Feather River Fish Hatchery and LFC. By stopping pumpback operations, the Thermalito Diversion Pool and Lake Oroville are not warmed up, thus slightly cooling flows to the Feather River Fish Hatchery and the LFC.

- *Redirecting flow from the Thermalito Afterbay to the LFC*. Heat gain in the low flow channel can be reduced by increasing the releases from the Thermalito Diversion Dam to the LFC, and reducing the diversions into the Thermalito Afterbay. Since the combined outflow from the Thermalito Afterbay and the LFC is consistent, routing flow from the Thermalito Afterbay to the LFC does not affect the water supply of the system. However, increased LFC flow reduces the generation from the Thermalito Pumping-Generating Plant and increases the residence time for storage in the Thermalito Afterbay, potentially warming the Thermalito Afterbay releases to the Feather River and at the agricultural diversions to the Feather River Service Area.

- *Remove shutters*. By removing shutters from the Hyatt Intake towers, water from a lower elevation was released to the river. There are 13 shutters in each intake tower; for purposes of modeling, it was assumed that a shutter from each intake tower would be removed at the same time as needed.

- *Use the river valves*. The river valves at the base of Oroville Dam can release water from near the bottom of Lake Oroville, and have access to substantially more coldwater than the Hyatt Pumping-Generating Plant, which has a higher intake level. While the flow through the river valves is limited to 1,500 cfs due to concerns about valve reliability, releases from the river valves are typically colder than releases through the Hyatt Pumping-Generating Plant. Since no generation is available on releases through the river valves, they are used only as the last resort for making coldwater releases from Lake Oroville to manage water temperature objectives at the Feather River Fish Hatchery.

- As previously described, the sequence of TCA implementation was different for the PDEA and CEQA modeling. The TCA sequences used for each environmental document for temperature management at the Feather River Fish Hatchery and Robinson Riffle are described in Table E.2-3.

Table E.2-3. Temperature control action implementation sequences for the PDEA Proposed Action and the CEQA Proposed Project.

Location	PDEA	CEQA
Feather River Fish Hatchery	Remove Shutters Eliminate Pumpback Use River Valve	Eliminate Pumpback Remove Shutters Use River Valve
Robinson Riffle	Remove Shutters Eliminate Pumpback Redirect Flow to 800 cfs	Eliminate Pumpback Redirect Flow to 1,000 cfs Remove Shutters Redirect Flow to 1,500 cfs

The primary difference between the PDEA and CEQA TCA sequences is the reversal of the order of removing shutters and eliminating pumpback. Modeling for the CEQA scenarios placed a higher value on preserving the coldwater volume in response to the year-around temperature requirements at Robinson Riffle for the Proposed Project. The resulting TCA sequence sacrificed power generation, in the form of opportunities to pumpback and re-release, for greater access to coldwater in the latter months of the year. SA Article A108 does not specify the sequence of TCAs and provides DWR latitude to utilize these TCAs singularly or in combination.

More efficient TCAs that preserve coldwater pool resources allow reliable achievement of more protective water temperature objectives under the Proposed Project that were not feasible with the previous TCA sequence under either the Existing Conditions/No-Action Alternative or the Proposed Action. Overall, the improved sequence of TCAs under the Proposed Project versus the Proposed Action would result in more reliable and more protective water temperature management under the Proposed Project relative to the Proposed Action.

E.2.8 Water Temperature Effects of Potential Future Facilities Modifications

The potential future facilities modifications under SA Article A108.4 have the designed intent to increase the volume of accessible coldwater pool in Lake Oroville, minimize heat gains from the point of release to locations farther downstream in the Feather River, and/or to reduce cold and warmwater mixing in the Thermalito Afterbay. The potential future facilities modifications would be evaluated, defined, and refined through the Feasibility study, as defined in the SA. Because of the design intent, it is reasonably certain that the water temperature objectives in the lower Feather River established after the new facilities testing period defined in Article A108.5 would be even more protective and would further enhance the coldwater fisheries resources than the conditions resulting from the implementation of the initial new license period Proposed Project water temperature management measures. Water temperature changes resulting under the initial new license period of the Proposed Project would result in positive effects for cold freshwater fisheries resources beneficial uses as compared to both the Existing Conditions/No-Action Alternative and the Proposed Action under the PDEA. Furthermore, water temperature targets after the facilities modification period of the Proposed Project would be more protective of coldwater fisheries and cold

freshwater habitat beneficial uses than with implementation of the initial actions of the Proposed Project defined under SA Articles A108.1 and A108.2.

The current descriptions of the potential facilities modifications in the SA lack design specifics and operational characteristics of any future facilities modifications that would be required to support a modeling comparison. This DEIR only evaluates what is currently known regarding these potential facilities modifications. The evaluation utilizes a qualitative approach to assess the general nature and relative magnitude of expected effects on surface water temperatures. Plans for these facilities would not be prepared for several years after the new license acceptance and actual facilities would not be constructed for at least 10 years. Therefore, additional modeling at this time to evaluate effects of the potential future facilities modifications would be premature. . Because the Future Condition modeling scenario for the PDEA evaluation was based on a year 2020 projection of project operations, any "future" scenario modeling comparison of modified facilities would not be appropriate until a more meaningful "future" project scenario is developed and accepted by FERC for modeling. The process for this future evaluation is fully defined in Article A108 of the SA. Any future facilities modifications would be subjected to detailed evaluation in a subsequent CEQA analysis and environmental document prior to construction.

E.2.9 Thermalito Afterbay Agricultural Diversion Modeling

The dynamic nature of Thermalito Afterbay (e.g., variable Thermalito Afterbay outlet and agricultural diversion volumes, peaking and pump-back operations, Thermalito Afterbay storage drawdown or filling, current and flow mixing patterns, climate, and wind effects) and short period of available water temperature records at the agricultural diversions (approximately 4 years) does not support development, testing, or calibration of detailed quantitative modeling of Thermalito Afterbay agricultural diversion water temperatures. Because the best available water temperature modeling does not support predictive or comparative estimates of water temperatures at the Thermalito Afterbay agricultural diversions, analysis of the Proposed Project and the potential effects of water temperature changes associated with the implementation of the initial new license period actions of the Proposed Project (i.e., flow and operational changes only) as well as the potential effects of future facilities modifications, were conducted utilizing a qualitative analysis approach.

E.2.10 Global Climate Change

Modeling comparison of potential effects of global climate change would be speculative for the CEQA analysis because no generally accepted standards exist regarding the assumptions required to model the effects of potential global climate change. Any climate change would likely equally affect each of the project alternatives because there are no changes in net releases from the facilities with the implementation of any of the project alternatives. In the event of any future, substantial change in climate occurring that affects the ability of the facilities to meet water temperature management requirements, the Oroville Facilities and many other projects would be subject to future

revisions in water temperature management goals, and potential additional facilities or operational modifications to adapt to the new climate and hydrologic conditions.

E.3 CONCLUSIONS

In the preceding sections, the Proposed Project has been compared to both the Existing Conditions/No-Action Alternative and the Proposed Action defined in the PDEA. These comparisons demonstrate that either there are no changes to the project to evaluate under CEQA or that flow and habitat conditions are enhanced or more protected under the Proposed Project, both during the initial new license period and after any post-license issuance facilities modifications are implemented. The results supporting this conclusion are summarized as follows:

- Quantitative modeling comparisons performed previously for the PDEA supporting the FERC license application determined that the Proposed Action would result in beneficial cold freshwater beneficial uses and cold freshwater fisheries effects.

- The Proposed Action and Proposed Project water temperature requirements for the Feather River Fish Hatchery are similar. There are no changes in the maximum allowable water temperature objectives for the hatchery. However, water temperature management actions taken for the hatchery could differ among alternatives..

- The Proposed Project water temperature objectives for Robinson Riffle are more protective with respect to Basin Plan beneficial uses and coldwater fisheries resources than all other project alternative water temperature objectives.

- Increased minimum flows in the LFC during the new license period under the Proposed Project would result in improved water temperatures and improved coldwater pool utilization efficiency, and therefore would result in positive effects on Basin Plan beneficial uses and coldwater fisheries resources.

- No changes in net facilities releases would occur (other than future allocation timing, which is equally applicable to all future project alternatives).

- No net flow release change would result in no flow-related water temperature changes to quantitatively analyze below the Thermalito Afterbay Outlet in the lower Feather River.

- Comparison of water temperature modeling results for the Proposed Project versus the Proposed Action demonstrated that water temperature objectives under the initial new license period of the Proposed Project enhances cumulative probability distribution of coldwater temperatures under almost all conditions.

- The differences in the modeling assumptions included in the PDEA versus those in the EIR are fairly minor, and model results were reasonably and functionally comparable.

- Results of SP-E-7A (Oroville Reservoir Coldwater Pool Availability Analysis) confirmed the ability of the Proposed Project to meet the more protective, enhanced surface water temperature conditions prior to any future facilities modifications through increased use of the accessible coldwater pool and more efficient use of coldwater pool reserves through improved TCAs.

- Potential future facilities modifications that either increase access to coldwater pool volume or reduce water warming opportunities would result in even more protective, enhanced, and beneficial uses related to coldwater fisheries habitat conditions as compared to the beneficial effects from the initial new license period of the Proposed Project.

In summary, this appendix to the EIR has demonstrated that the Proposed Action previously analyzed in the PDEA would result in beneficial effects on beneficial uses, that implementation of the initial actions (i.e. increased minimum flow releases and operational enhancement through modified TCAs) under the Proposed Project would result in either no change or a beneficial change compared to the Proposed Action, and that any future facilities modifications included in the Proposed Project would result in further enhancements to the conditions and level of protection of beneficial uses compared to implementation of the initial actions under the Proposed Project. Therefore, because all facets of the Proposed Project that could be evaluated utilizing modeling comparisons would demonstrably indicate no change or only beneficial effects, further detailed analysis is not required under CEQA guidelines.

E.4 REFERENCES

DWR (California Department of Water Resources). 2005. Application for New License Before the Federal Energy Regulatory Commission, Oroville Facilities Project No. 2100. Volume III: Preliminary Draft Environmental Assessment. January 2005.

DWR (California Department of Water Resources). 2006. Settlement Agreement for Licensing of the Oroville Facilities. Signed March 21, 2006.

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