

COVER SHEET

**FEDERAL ENERGY REGULATORY COMMISSION
FINAL ENVIRONMENTAL IMPACT STATEMENT
FOR THE OROVILLE FACILITIES PROJECT
Docket No. P-2100-052**

Table of Contents
Pages xi to xxii
FEIS

TABLE OF CONTENTS

LIST OF FIGURES	xv
LIST OF TABLES	xvii
ACRONYMS AND ABBREVIATIONS	xxi
EXECUTIVE SUMMARY	xxiii
1.0 PURPOSE OF ACTION AND NEED FOR POWER	1
1.1 PURPOSE OF ACTION	1
1.2 NEED FOR POWER	3
1.2.1 Regional Power Considerations	3
1.2.2 DWR Power Considerations	4
1.3 SCOPING PROCESS	4
1.4 AGENCY CONSULTATION AND PUBLIC INVOLVEMENT	6
1.4.1 Alternative Licensing Process	6
1.4.2 Interventions and Comments	6
1.4.3 Settlement Agreement	8
1.4.3.1 Comments by Equestrians in Opposition to the Settlement Agreement	10
1.4.3.2 Comments by Native Americans in Opposition to the Settlement Agreement	11
1.4.3.3 Comments by Butte County in Opposition to the Settlement Agreement	11
1.4.4 Comments on the Draft Environmental Impact Statement	11
2.0 PROPOSED ACTION AND ALTERNATIVES	13
2.1 NO-ACTION ALTERNATIVE	13
2.1.1 Existing Project Facilities	13
2.1.2 Project Boundary	19
2.1.3 Existing Project Operations	20
2.1.3.1 Overall Project Operations	20
2.1.3.2 Lake Oroville	20
2.1.3.3 Thermalito Forebay, Diversion Pool, and Power Canal	21
2.1.3.4 Thermalito Afterbay	22
2.1.3.5 Minimum Instream Flows and Water Temperature	23
2.1.4 Existing Environmental Measures	25
2.1.5 Project Safety	25
2.2 DWR'S PROPOSAL (PROPOSED ACTION)	26
2.2.1 Proposed Project Facilities	26
2.2.2 Proposed Project Operations	26
2.2.3 Proposed Environmental Measures	27
2.3 MODIFICATIONS TO DWR'S PROPOSAL	37
2.3.1 Water Quality Certification	37
2.3.2 Section 18 Fishway Prescriptions	37
2.3.3 Section 4(e) Federal Land Management Conditions	38
2.3.4 Section 10(j) Recommendations	38
2.3.5 Staff Alternative	39

2.4	ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS.....	40
2.4.1	Federal Government Takeover of the Project.....	40
2.4.2	Issuing a Non-power License	40
2.4.3	Retiring the Project.....	41
3.0	ENVIRONMENTAL ANALYSIS	43
3.1	GENERAL SETTING	43
3.2	CUMULATIVELY AFFECTED RESOURCES.....	43
3.2.1	Geographic Scope.....	45
3.2.2	Temporal Scope.....	45
3.3	PROPOSED ACTION AND ACTION ALTERNATIVES	45
3.3.1	Geology, Soils, and Paleontological Resources	45
3.3.1.1	Affected Environment.....	45
3.3.1.2	Environmental Effects.....	56
3.3.1.3	Cumulative Effects.....	62
3.3.1.4	Unavoidable Adverse Effects.....	64
3.3.2	Water Quantity and Quality.....	65
3.3.2.1	Affected Environment.....	65
3.3.2.2	Environmental Effects.....	93
3.3.2.3	Cumulative Effects.....	104
3.3.2.4	Unavoidable Adverse Effects.....	106
3.3.3	Aquatic Resources	106
3.3.3.1	Affected Environment.....	106
3.3.3.2	Environmental Effects.....	135
3.3.3.3	Cumulative Effects.....	145
3.3.3.4	Unavoidable Adverse Effects.....	145
3.3.4	Terrestrial Resources	145
3.3.4.1	Affected Environment.....	145
3.3.4.2	Environmental Effects.....	161
3.3.4.3	Cumulative Effects	167
3.3.4.4	Unavoidable Adverse Effects.....	167
3.3.5	Threatened and Endangered Species	167
3.3.5.1	Affected Environment.....	167
3.3.5.2	Environmental Effects.....	177
3.3.5.3	Cumulative Effects	199
3.3.5.4	Unavoidable Adverse Effects.....	200
3.3.6	Recreational Resources.....	201
3.3.6.1	Affected Environment.....	201
3.3.6.2	Environmental Effects.....	233
3.3.6.3	Unavoidable Adverse Effects.....	280
3.3.7	Land Use and Management	280
3.3.7.1	Affected Environment.....	280
3.3.7.2	Environmental Effects.....	290
3.3.7.3	Unavoidable Adverse Effects.....	295
3.3.8	Cultural Resources.....	295
3.3.8.1	Affected Environment.....	295
3.3.8.2	Environmental Effects.....	310
3.3.8.3	Cumulative Effects on Cultural Resources	315
3.3.8.4	Unavoidable Adverse Effects.....	315
3.3.9	Aesthetic Resources.....	315

	3.3.9.1	Affected Environment.....	315
	3.3.9.2	Environmental Effects.....	322
	3.3.9.3	Unavoidable Adverse Effects.....	323
	3.3.10	Socioeconomics.....	324
	3.3.10.1	Affected Environment.....	324
	3.3.10.2	Environmental Effects.....	332
	3.3.10.3	Cumulative Effects.....	349
	3.3.10.4	Unavoidable Adverse Effects.....	349
3.4		NO-ACTION ALTERNATIVE.....	349
3.5		IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES.....	349
3.6		RELATIONSHIP BETWEEN SHORT-TERM USES AND LONG-TERM PRODUCTIVITY	350
4.0		DEVELOPMENTAL ANALYSIS.....	351
4.1		POWER AND ECONOMIC BENEFITS OF THE PROJECT	351
	4.1.1	Economic Assumptions	351
	4.1.2	Current Annual Costs and Future Capital Costs for the Oroville Facilities under the No-action Alternative.....	352
4.2		COST OF ENVIRONMENTAL MEASURES	354
	4.2.1	Cost of Environmental Measures for Oroville Facilities	354
	4.2.2	Effect of Proposed Operations on Oroville Facilities	354
4.3		COMPARISON OF ALTERNATIVES	356
4.4		OTHER ECONOMIC CONSIDERATIONS	357
4.5		EFFECT OF ALTERNATIVES ON GREENHOUSE GASES	357
5.0		STAFF'S CONCLUSIONS.....	359
5.1		COMPREHENSIVE DEVELOPMENT AND RECOMMENDED ALTERNATIVE.....	359
	5.1.1	Staff Alternative (DWR's Proposal with Staff Modifications)	360
	5.1.2	Rationale for Staff Recommendations.....	363
	5.1.2.1	Geology and Soils	363
	5.1.2.2	Water Quality	365
	5.1.2.3	Aquatic Resources	366
	5.1.2.4	Terrestrial Resources	372
	5.1.2.5	Recreation	374
	5.1.2.6	Land Use and Aesthetics.....	382
	5.1.2.7	Cultural Resources	382
	5.1.2.8	Socioeconomics	383
	5.1.2.9	Administrative.....	385
	5.1.3	Forest Service Terms and Conditions.....	387
	5.1.4	Additional Measures Recommended by Staff	387
	5.1.4.1	Reseeding Oroville Dam.....	387
	5.1.4.2	Protection of Forest Service Special Status Species (Forest Service 4(e) Condition No. 17)	387
	5.1.4.3	Fuels Management Plan (Forest Service 4(e) Condition No. 19)	388
5.2		CUMULATIVE EFFECTS	388
5.3		FISH AND WILDLIFE AGENCY RECOMMENDATIONS	390
5.4		CONSISTENCY WITH COMPREHENSIVE AND OTHER RESOURCE PLANS.....	391
5.5		RELATIONSHIP OF LICENSE PROCESS TO LAWS AND POLICIES	392

5.5.1	Water Quality Certification	392
5.5.2	Endangered Species Act	393
5.5.3	Essential Fish Habitat	395
5.5.4	National Historic Preservation Act.....	396
5.5.5	California Environmental Quality Act	396
6.0	LITERATURE CITED	399
7.0	LIST OF PREPARERS.....	415
8.0	LIST OF RECIPIENTS	417

APPENDIX A—REVIEW OF SOCIOECONOMIC MODEL AND RELATED DOCUMENTS
APPENDIX B—DETAILED COSTS OF THE OROVILLE FACILITIES
APPENDIX C—STAFF RESPONSES TO COMMENTS ON THE DRAFT EIS

LIST OF FIGURES

Figure 1.	Oroville Facilities location.....	2
Figure 2.	Oroville Facilities features.	14
Figure 3.	Oroville Facilities flow diagram	15
Figure 4.	Lake Oroville daily elevations under various water conditions.....	21
Figure 5.	Lake Oroville historic storage volume and water surface elevations, water year 1971–2004	22
Figure 6.	Thermalito afterbay historical water surface elevations, water year 2001.....	23
Figure 7.	North Fork of the Feather River hydroelectric projects	44
Figure 8.	Distance in river miles from the confluence with the Sacramento River	48
Figure 9.	Lake Oroville fish passage barriers.....	52
Figure 10.	Flow exceedance graph for Feather River at Oroville gage.....	71
Figure 11.	Flood frequency graph for Feather River at Oroville gage.....	72
Figure 12.	Maximum, mean, and minimum daily temperatures in the Feather River low flow channel	82
Figure 13.	Maximum, mean, and minimum daily temperatures in the Feather River high flow channel.....	83
Figure 14.	Concentrations of mercury in individual fish from the Oroville Facilities area	89
Figure 15.	Historical Chinook salmon spawning distribution (Yoshiyama et al., 1988) and current expected geographic scope of the cumulative effects analysis for fish passage.	113
Figure 16.	Feather River Fish Hatchery returns from 1967 to 2005	120
Figure 17.	Low flow channel Chinook salmon spawning weighted useable area.....	188
Figure 18.	Lake Oroville recreational sites	213
Figure 19.	Lake Oroville trails	220
Figure 20.	DWR’s proposed trails and trail designations for Oroville Facilities	257
Figure 21.	Primary land management responsibility.....	281
Figure 22.	Average annual population growth in the Sacramento Valley region and Plumas County from 1960 through 2000, by county.....	325
Figure 23.	Butte County employment by industry	326
Figure 24.	Butte County economic base	327

This page intentionally left blank.

LIST OF TABLES

Table 1.	Terminology used in the EIS to describe project-related geographic areas.....	16
Table 2.	Minimum instream flow requirements on the Feather River at Lake Oroville surface elevation greater than 733 feet msl.....	24
Table 3.	National Marine Fisheries Service 2002 biological opinion required ramping rates.....	24
Table 4.	Feather River ramping criteria for reducing flow	25
Table 5.	Existing temperature objectives at the Feather River Fish Hatchery	25
Table 6.	Proposed articles included in appendix A of the Settlement Agreement.....	28
Table 7.	Major tributary areas and flow contribution to Lake Oroville inflow	43
Table 8.	Geomorphic reaches of the Feather River	54
Table 9.	Selected Feather River segments and riprap lengths	56
Table 10.	Meteorological summary for Oroville, California (elevation 199 feet msl)	66
Table 11.	Meteorological summary for Meadow Valley, California (elevation 3,410 feet msl)	66
Table 12.	Summary of daily average flow discharge (cfs) data, by month and overall, for the Feather River at Oroville, CA (USGS Gage No. 11407000), water year 1971 to 2004	67
Table 13.	Summary of daily average flow discharge (cfs) data, by month and overall, for the Thermalito afterbay release to Feather River, CA (USGS Gage No. 11406920), water years 1971 to 2004.....	69
Table 14.	Downstream use of water from the Oroville Facilities (2001 and 2002).....	74
Table 15.	Flood control requirements for Lake Oroville	74
Table 16.	Major spill events for Lake Oroville.....	75
Table 17.	DWR's water rights for the Oroville Facilities	76
Table 18.	Applicable water quality objectives for Oroville Facilities	77
Table 19.	Feather River Fish Hatchery temperature objectives ($\pm 4^{\circ}\text{F}$ between April 1 and November 30)	78
Table 20.	Mean water temperatures ($^{\circ}\text{F}$) in Feather River pools downstream of Lake Oroville, June–October 2002.....	81
Table 21.	Frequency at which fish hatchery water temperatures met temperature objectives from April 2002 to March 2004.....	84
Table 22.	Summary of Basin Plan DO exceedances during 2002 to 2003	85
Table 23.	Water quality objectives and criteria for trace metals in waters of the Feather River watershed	86
Table 24.	Summary of metal concentrations that exceeded Basin Plan objectives	87
Table 25.	Number of exceedances of either the Basin Plan and/or DHS fecal coliform thresholds based on 10 samples collected at recreation sites in June through August 2003.....	91
Table 26.	List of fish species within the study area	107
Table 27.	Salmonid stocking activities in Lake Oroville (1993–2005)	115
Table 28.	Thermalito forebay fish stocking history	118
Table 29.	Metrics used to describe benthic macroinvertebrate samples collected following the California Stream Bioassessment Procedure	132
Table 30.	Summary information by geographic area for macroinvertebrates collected by DWR and CSU-Chico with a kick screen and metal frame in fall 2002 and spring 2003	134
Table 31.	Summary information by geographic area for macroinvertebrates collected by DWR with a ponar grab in fall 2002 and spring 2003	135
Table 32.	Vegetation/land use within the study area	146

Table 33.	Acreages of wetland vegetation types for major project features	148
Table 34.	Target weed species identified in the study area.....	149
Table 35.	Special-status plant species with potential for occurring within the study area	152
Table 36.	Summary of wildlife habitat acreages within the study area	156
Table 37.	List of non-native vertebrate wildlife potentially found within the study area.....	157
Table 38.	State-listed wildlife species potentially occurring in the study area	158
Table 39.	Other special-status species with the potential to occur in the project vicinity	159
Table 40.	Federally listed plant species with potential to occur in the study area	171
Table 41.	Federally listed species occurring in the project vicinity	174
Table 42.	Regional riding and hiking trails within 100 miles of the Feather River Project	203
Table 43.	Recreation facilities at Lake Oroville, Thermalito Complex, low flow channel, and OWA	207
Table 44.	Trails and trailheads at and near the Oroville Facilities.....	223
Table 45.	Primary types of trail use by visitors to the Lake Oroville State Recreation Area	231
Table 46.	Recreation Management Plan revision schedule	241
Table 47.	Proposed recreational improvements and actions in the first 10 years following license issuance at Lake Oroville.....	242
Table 48.	Proposed recreational enhancements in the first 10 years at Thermalito diversion pool	250
Table 49.	Proposed recreational enhancements in the first 10 years at Thermalito forebay.....	252
Table 50.	Proposed recreational enhancements in the first 10 years at Thermalito afterbay.....	253
Table 51.	Current and proposed trail designations for project trails.....	255
Table 52.	DWR mail-back survey responses indicating need for additional types of trails	263
Table 53.	Locations of trails with obvious erosion problems and their causes (Source: DWR, 2006f)	264
Table 54.	Summary of public entity land management	282
Table 55.	DWR third-party leases	285
Table 56.	Land uses in the study area	288
Table 57.	Fire management policies and plans in the study area.....	289
Table 58.	Survey results by strategy	303
Table 59.	Number and percentage of prehistoric archaeological sites by categories within the APE.....	304
Table 60.	Historic-era archaeological sites within the area of potential effects	306
Table 61.	Ethnographic and ethno-historic site categories within the APE.....	307
Table 62.	Historical structures within the area of potential effects.....	308
Table 63.	Lake Oroville exceedance data at three elevations	318
Table 64.	Historical data on economic indicators in Butte County 1980–2000	325
Table 65.	Estimates of annual operations and maintenance expenditures by state agencies related to the Oroville Facilities.....	329
Table 66.	Summary of current recreation-related spending in Butte County by county residents and out-of-county visitors to the Oroville Facilities (in thousands of nominal dollars)	330
Table 67.	Summary of jobs generated by recreation-related spending and operation and maintenance of the Oroville Facilities.	330
Table 68.	Summary of earnings generated by recreation-related spending and operation and maintenance of the Oroville Facilities (in thousands of nominal dollars).	331
Table 69.	Oroville Facilities fiscal effects on Butte County	335
Table 70.	Staff assumptions for economic analysis of the Oroville Facilities	351
Table 71.	Summary of current annual costs and future capital costs for DWR’s Oroville Facilities under the No-action Alternative	352

Table 72.	Summary of annualized costs for measures included in the Proposed Action and Proposed Action with Staff Modifications for the Oroville Facilities	355
Table 73.	Summary of annual net benefits for the No-action, Proposed Action, and Proposed Action with Staff Modifications for the Oroville Facilities	356
Table 74.	Summary of the effect of greenhouse gases on the No-action, Proposed Action, and Proposed Action with Staff Modifications for the Oroville Facilities	357

This page intentionally left blank.

ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
°F	degrees Fahrenheit
µg/L	micrograms per liter
µmhos/cm	micro-mhos per centimeter
ADA	Americans with Disabilities Act
APE	area of potential effects
Basin Plan	Central Valley Regional Water Quality Control Board's Water Quality Control Plan
Berry Creek Rancheria	Berry Creek Rancheria of Maidu Indians of California
BLM	U.S. Bureau of Land Management
CDF	California Department of Forestry and Fire Protection
CEQA	California Environmental Quality Act
cfs	cubic feet per second
Commission	Federal Energy Regulatory Commission
Corps	U.S. Army Corps of Engineers
DBW	California Department of Boating and Waterways
Delta	Sacramento-San Joaquin Delta
DFG	California Department of Fish and Game
DHS	California Department of Health Services
DO	dissolved oxygen
DPR	California Department of Parks and Recreation
DPS	Distinct Population Segment
DWR	California Department of Water Resources
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
ESA	federal Endangered Species Act
ESU	evolutionarily significant unit
FERC	Federal Energy Regulatory Commission
Forest Service	U.S. Department of Agriculture, Forest Service
FPA	Federal Power Act
FR	Federal Register
FWS	U.S. Fish and Wildlife Service
HPMP	Historic Properties Management Plan
IHN	Infectious Hematopoietic Necrosis
kV	kilovolt
kWh	kilowatt-hour
LWD	large woody debris
MCL	maximum contaminant level
mg/L	milligrams per liter
mL	milliliter
Mooretown Rancheria	Mooretown Rancheria of Maidu Indians of California
msl	mean sea level

MTBE	methyl tertiary butyl ether
MW	megawatt
MWh	megawatt-hour
National Register	National Register of Historic Places
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
O&M	operations and maintenance
OEHHA	California/EPA Office of Environmental Health Hazard Assessment
OHV	off-highway vehicle
ORCA	Oroville Recreation Coordination Agencies
OWA	Oroville Wildlife Area
PG&E	Pacific Gas and Electric Company
Regional Board	Central Valley Regional Water Quality Control Board
RM	river mile
RV	recreational vehicle
SHPO	State Historic Preservation Officer
USGS	U.S. Geological Survey
Water Board	State Water Resources Control Board