APPENDIX A

SCOPING, CONSULTATION, AND COMPLIANCE

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APPENDIX A
SCOPING, CONSULTATION, AND COMPLIANCE

This appendix summarizes DWR's consultation with other government agencies and scoping efforts through the collaborative process that have been conducted to date. A list of other laws and regulations that may pertain to the relicensing is also provided.

Table A-1. Plenary and Work Group meeting dates.

Collaborative Group	Meeting Dates
Plenary Group	*2000:* November 16 *2001:* January 18, February 28, March 28, May 1, June 11, July 17, August 30, September 24, November 1, December 11 *2002:* January 28, February 25, March 28, April 23, May 21, June 25, July 23, August 20, September 24, October 22, November 19 *2003:* January 7, January 28, February 25, March 25, May 20, July 29, September 23, October 28, December 16 *2004:* January 27, March 23
Environmental Work Group	*2000:* December 7 *2001:* January 23, February 27, March 20, April 18, May 23, July 25, August 22, September 26, November 28 *2002:* January 29, March 7, March 27, April 24, May 22, June 26, July 24, August 21, September 25, November 20, December 11 *2003:* January 29, February 19, March 26, April 23, May 21, June 25, July 30, August 27, September 24, October 29, November 19, December 17 *2004:* January 28, February 25, March 24
Recreation and Socioeconomics Work Group	*2000:* December 7 *2001:* January 25, February 22, March 22, April 19, May 24, June 28, July 26, August 23, October 25, December 6 *2002:* January 29, February 28, March 26, April 25, June 27, September 26, November 21 *2003:* January 16, February 27, March 27, April 24, May 22, June 26, July 31, August 28, September 25, October 16, October 30, November 20, December 18 *2004:* January 29, February 24, March 25
Cultural Work Group	*2001:* March 27, April 17, May 22, June 26, July 24, August 28, September 25, October 23, November 27 *2002:* January 29, March 19, June 18, September 17, November 12 *2003:* February 18, April 15, May 13, June 17, July 22, August 19, September 16, October 21 *2004:* February 17

Table A-1. Plenary and Work Group meeting dates.

Collaborative Group	Meeting Dates
Land Use, Land Management, and Aesthetics Work Group	*2001:* March 13, April 10, May 15, June 12, July 10, August 14, October 9, November 13 *2002:* January 31, February 19, March 25, April 22, June 24, August 19, October 21, December 9 *2003:* February 24, March 24, April 21, May 19, June 23, July 28, August 25, September 22, October 27, November 17, December 15 *2004:* January 26, February 23, March 22
Engineering and Operations Work Group	*2001:* March 1, April 5, April 26, May 25, June 25, July 31, November 16, December 5 *2002:* January 25, March 1, April 26, May 24, June 28, September 27, October 25, November 22 *2003:* January 10, January 31, February 21, March 28, April 25, May 30, June 27, August 1, August 29, September 26, October 31, December 19 *2004:* January 30, February 27, March 26

Source: DWR.

Table A-2. Scoping and history of the collaborative process.

Date / Timeframe	Relicensing Activity
October 1999	DWR sent out informational mailer about relicensing of the Oroville Facilities to known and potentially interested parties.
June 29, 2000	A public meeting was held to present and consider use of the Alternative Licensing Procedures (ALP).
July 13, 2000	DWR distributed information and requested comments on the proposed use of the ALP. A copy of a draft Communications Protocol, outlining how communications would be facilitated among FERC, DWR, and other participants in the relicensing process was also provided for review and comment.
Fall 2000	DWR held meetings and discussions with State and federal resource agencies, and contacted local Indian Tribes. Presentations were made at formal meetings of local governmental bodies and the proposed relicensing process was discussed with other local organizations. DWR also met informally with other NGOs.
November 15, 2000	DWR held a follow-up meeting with the public to discuss specifics of the ALP, including the ALP framework, the draft Communications Protocol, and the ground rules for participation in the relicensing collaborative process.
November 16, 2000	DWR hosted a Plenary Group kick-off meeting to begin the collaborative process. Sixty-three stakeholders attended the meeting and agreed to follow the participatory ground rules and support an ALP process involving a three-tiered "Collaborative" that included a Plenary Group, resource-specific work groups, and issue-specific task forces.

Table A-2. Scoping and history of the collaborative process.

Date / Timeframe	Relicensing Activity
January 11, 2001	DWR's formal *Request for Alternative Licensing Procedures to Include an Applicant Prepared Environmental Assessment* received approval from FERC (as allowed under FERC's Final Rule issued on October 29, 1997, Docket No. RM 95-116-000; Order No. 596).
January 2001	DWR distributed an Initial Information Package (IIP) as part of the ALP. The purpose of the IIP was to acquaint resource agencies and the public with the Oroville Facilities and the environmental resources potentially affected by current and future project operations. The IIP provided basic, comprehensive information about the facilities and their influence on the surrounding environment and resources. In addition, it identified resource areas where additional information may be needed to make informed and responsible decisions about future project operations.
May 2001	The process protocols were finalized following extensive input and review by relicensing participants. The process protocols provide a framework for communication, cooperation, and consultation among all relicensing participants throughout the relicensing process.
January–July 2001	The Collaborative work groups identified and refined issue statements for inclusion in Scoping Document 1 (Draft SD1).
September 2001	DWR issued Draft SD1, which initiated formal scoping for the relicensing. The purpose of the document was to identify potential issues, initiate study and evaluation programs, and better define the expected analytical approaches of the environmental documents being prepared for relicensing-related decision-making. 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, an important building block in DWR's preparation of an Environmental Impact Report (EIR) for relicensing. Final SD1 (which includes comment letters on SD1) can be viewed on the relicensing website, http://orovillerelicensing.water.ca.gov.
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, 72 study programs were developed and approved through the collaborative process.
September 20, 2002	DWR issued Scoping Document 2 and Amended Notice of Preparation (SD2). SD2 reflected the progress made since September 2001 in working collaboratively with resource agencies, 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. SD2 and associated comment letters can be viewed on the relicensing website, http://orovillerelicensing.water.ca.gov.

Table A-2. Scoping and history of the collaborative process.

Date / Timeframe	Relicensing Activity
October 29, 2001, 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. 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 was encouraged to submit written comments and information to the licensee by November 26, 2001. A follow-up field tour of the facilities was conducted for all interested parties in conjunction with the public scoping meetings.
Throughout 2002	DWR, agencies, Indian Tribes, NGOs, and interested parties continued their involvement in the relicensing process through participation in ongoing collaborative efforts, including the review of preliminary study results and development of potential resource actions.
Throughout 2003	Relicensing participants continued collaboration to develop and implement resource actions and study programs, and to begin development of preliminary PM&E measures.
Early 2004	Work on studies continued and settlement discussions were initiated.

Source: DWR.

Table A-3. Relicensing compliance.

Regulation / Requirement	Description and Status
Water Quality Certification (Section 401 of the federal Clean Water Act)	DWR intends to apply for a §401 permit either when it files the Final License Application or when FERC is ready to begin environmental review. The California RWQCB is expected to issue a Water Quality Certificate in 2006.
Fishway Prescriptions (Section 18 of the Federal Power Act [FPA])	The USFWS, NOAA Fisheries, and DFG have been working with DWR and other interested parties to develop appropriate §18 conditions. The agencies are expected to file final §18 conditions (or preliminary conditions with a schedule for final conditions) in late 2005 to early 2006.
Federal Land Management Conditions (Section 4(e) of the FPA)	The BLM and USFS have authority over lands occupied by the Oroville Facilities and have been involved throughout the collaborative process. BLM and USFS are expected to issue §4(e) conditions in late 2005 to early 2006.
Section 7 of the Federal Endangered Species Act (FESA)	Species protected under FESA and potentially affected by the Proposed Action were identified early in the relicensing process through consultation with NOAA Fisheries and USFWS. DWR plans to develop a Draft Biological Assessment (BA) for submission to FERC, USFWS, and NOAA Fisheries in 2004. FERC is expected to subsequently submit its draft BA to USFWS and NOAA Fisheries in 2005, and USFWS and NOAA Fisheries will issue a Final Biological Opinion (BO) in 2006.

Table A-3. Relicensing compliance.

Regulation / Requirement	Description and Status
Recommendations under Section 10(j) of the FPA	USFWS and NOAA Fisheries are expected to issue recommendations regarding fish and wildlife mitigation measures. In 2005-2006, FERC will decide whether to adopt these recommendations.
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 Indian Tribes that may have cultural affiliations with affected properties. Representatives from key agencies and entities involved in historic preservation, including the Advisory Council on Historic Preservation (ACHP), participate in the Cultural Resources Work Group. DWR plans to issue draft and final Historic Properties Management Plans in 2004 and 2005, respectively. Draft and final Programmatic Agreements should be filed in September 2005 and January 2007, respectively.
Americans with Disabilities Act	Public recreation facilities must comply with the Americans with Disabilities Act (ADA) to the extent possible. Access needs of the disabled and ADA standards are being addressed in the Recreation and Socioeconomics Work Group as recreation facilities are updated, expanded, or newly developed.
Other laws and regulations	Compliance with these and other laws and regulations will be addressed in the January 2005 PDEA: ∉ CALFED; ∉ Clean Water Act—§412 Total Maximum Daily Load (TMDL) and §404 Dredge and Fill; ∉ Central Valley Project Improvement Act; ∉ California Water Commission Act; ∉ California Fish & Game Code—§§1600–1700 (Streambed Alteration), §5937 (Flows Below Dams), and §5980 (Fish Screening); ∉ CESA; ∉ Executive Orders for Protection of Wetlands, Floodplain Management, and Environmental Justice; ∉ Noxious Weeds Act; ∉ California Native Plant Protection Act; ∉ Native American Graves Protection and Repatriation Act; ∉ American Indian Religious Freedom Act; ∉ Antiquities Act; ∉ Archaeological Resources Protection Act; ∉ Section 4(f) Department of Transportation Act of 1966; ∉ Farmland Protection Policy Act; ∉ Wild & Scenic Rivers Act; ∉ Federal Land Policy and Management Act of 1976; and ∉ Mining laws.

Source: DWR.

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APPENDIX B

OROVILLE FACILITIES DESCRIPTION

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APPENDIX B
OROVILLE FACILITIES DESCRIPTION

Federal Energy Regulatory Commission (FERC) Project No. 2100 encompasses 41,100 acres. It includes all of the following:

- Oroville Dam;
- Lake Oroville;
- Three power plants (Hyatt Pumping-Generating Plant, Thermalito Diversion Dam Power Plant, and Thermalito Pumping-Generating Plant);
- Thermalito Diversion Dam;
- The Feather River Fish Hatchery;
- The Fish Barrier Dam;
- The Thermalito Power Canal;
- The Oroville Wildlife Area (OWA);
- Thermalito Forebay;
- Thermalito Forebay Dam;
- Thermalito Afterbay;
- Thermalito Afterbay Dam;
- Transmission lines; and
- A number of recreational facilities.

This appendix describes the operation of all of these project elements. The appendix first describes the power generation facilities of the respective dams, reservoirs, and power plants. It then summarizes the numerous recreational facilities in the project region, project vicinity, and project area. Finally, this appendix provides specific descriptions of the operations of the Feather River Fish Hatchery and OWA.

B.1 POWER GENERATION FACILITIES

This section describes the power generation facilities associated with the Oroville Facilities. Power generation facilities are described in order based on their geographical location, from upstream to downstream.

B.1.1 Oroville Facilities

B.1.1.1 Lake Oroville

Lake Oroville (Figure B.1-1) stores winter and spring runoff that is released into the Feather River, as necessary, for project purposes. Lake Oroville is contained by Oroville Dam (described below) and by two small embankments, Bidwell Canyon and Parish Camp Saddle Dams. The reservoir has a storage capacity of 3,538,000 acre-feet (af) and is fed by the North, Middle, and South Forks of the Feather River. Average annual unimpaired runoff into the reservoir is about 4.2 million acre-feet (maf). The water surface elevation and water surface area at maximum operating storage are 900 feet above mean sea level (msl) and 15,810 acres, respectively. The shoreline covers 167 miles at maximum operating storage.

B.1.1.2 Oroville Dam

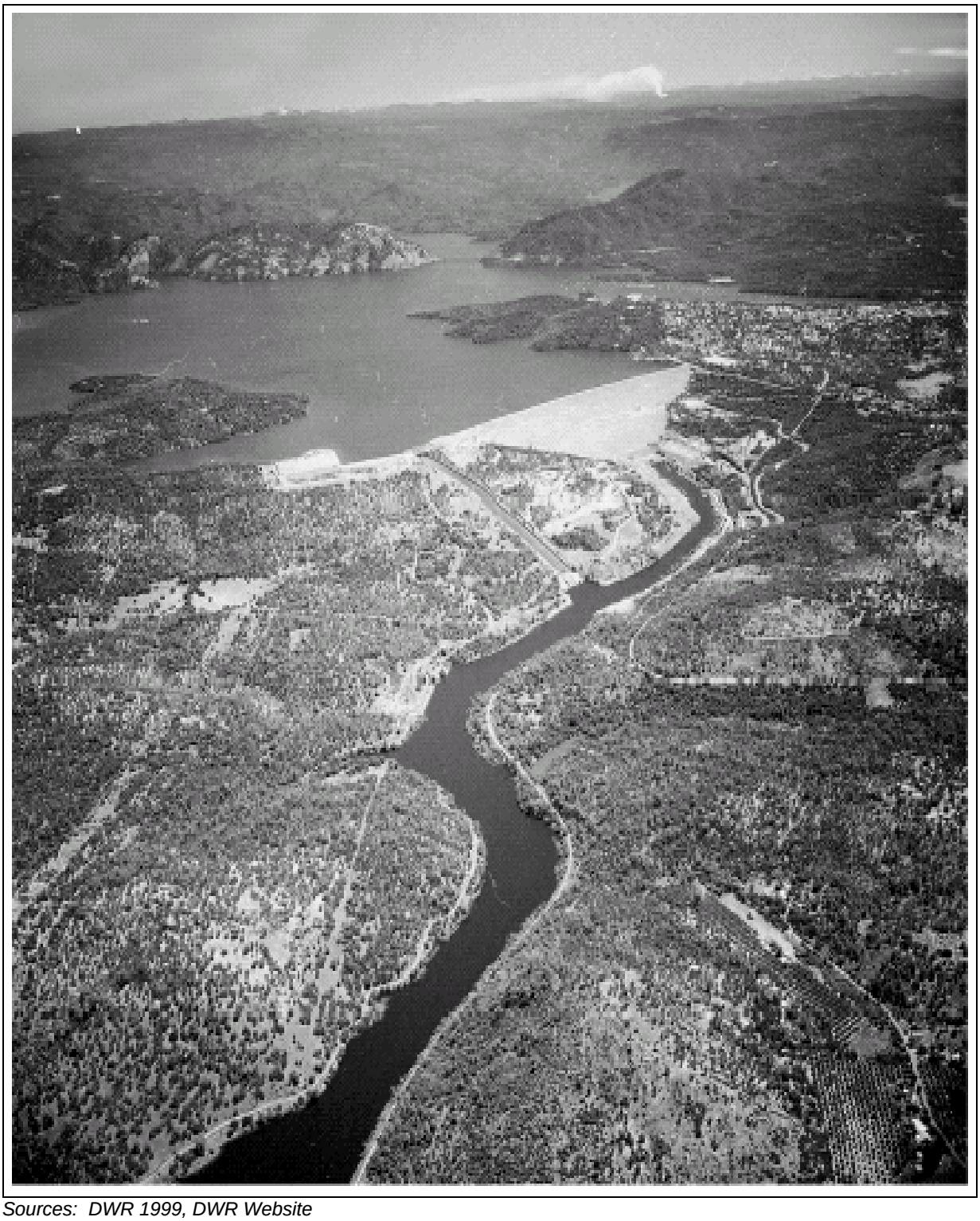
Oroville Dam is depicted in Figure B.1-1. Construction of the dam began in 1961 and was completed in 1968. Oroville Dam is a zoned earthfill dam with an embankment volume of 80 million cubic yards. At 770 feet high, it is the highest dam in the United States. The crest of the dam is 6,920 feet long, 51 feet wide, and at an elevation of 922 feet.

The spillway, located on the right abutment of the dam, has two separate elements: a controlled gated outlet and an emergency uncontrolled spillway. The gated control structure was designed to permit controlled releases of up to 150,000 cubic feet per second (cfs) into a concrete-lined chute that extends to the Feather River. The emergency uncontrolled spillway is designed so that if the reservoir were to fill above 901 feet, water could flow over the emergency spillway weir and down the undeveloped canyon slope to the river.

B.1.1.3 Hyatt Pumping-Generating Plant

Located in rock in the left abutment near the axis of Oroville Dam, Hyatt Pumping-Generating Plant is an underground, hydroelectric pumping-generating facility. The Hyatt Pumping-Generating Plant is the largest of the three power plants in the project area. Construction of the plant began in 1964 and was completed in 1967. A maximum flow of 17,000 cfs can be released through Hyatt Pumping-Generating Plant. Three of the six units are conventional generators driven by vertical-shaft, Francis-type turbines; the other three are generator/motors coupled to Francis-type, reversible pump turbines. The latter units allow off-peak pumped storage operations. The intake structure has an overflow type shutter system that determines the level from which water is drawn.

Table B.1-1 summarizes the pumping and generating information for the Hyatt Pumping-Generating Plant.



Sources: DWR 1999, DWR Website

Figure B.1-1. Lake Oroville, Oroville Dam, and the Thermalito Diversion Pool.

Table B.1-1. Pumping and generating information for the Hyatt Pumping-Generating Plant.

	Pumping	Generating
License Capacity	5,610 cfs and 519,000 hp	645 MW and 16,950 cfs
Normal Static Head	500–600 feet	410–676 feet
Design Dynamic Head	592 feet	615 feet
Number of Units	3 pumping/generating	6 (3 generating, 3 pumping/generating)
Unit Size	1,870 cfs and 173,000 hp	3 @ 115 MVA and 2,800 cfs 3 @ 123 MVA and 2,850 cfs
Penstock Diameter		2 @ 22 feet

Notes: hp = horsepower; MVA = megavolt amperes; MW = megawatts
Source: DWR Website

B.1.2 Thermalito Diversion Facilities

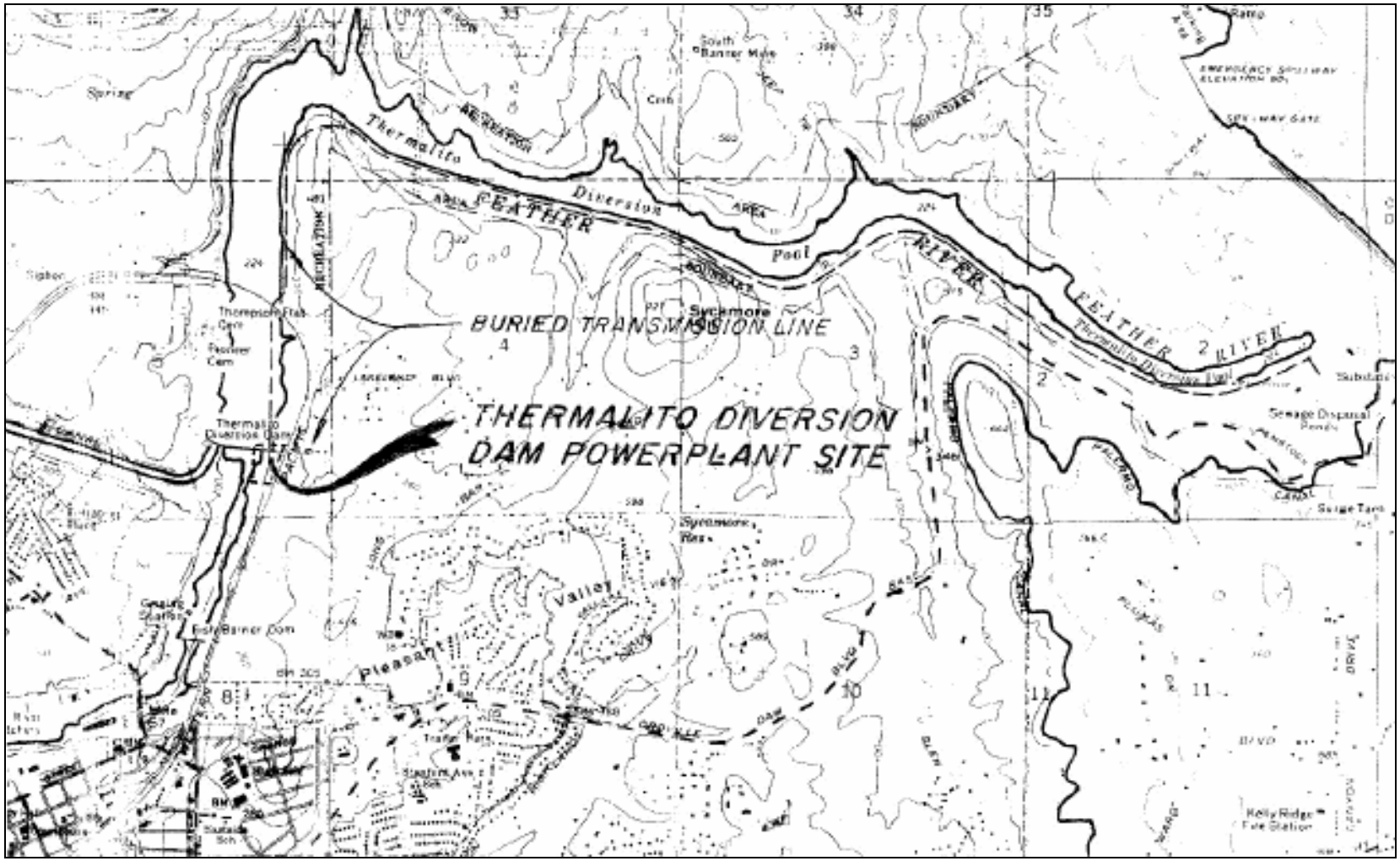
B.1.2.1 Thermalito Diversion Pool

The Thermalito Diversion Pool (Figures B.1-1 and B.1-2) acts as a forebay when the Hyatt Pumping-Generating Plant is pumping water back into Lake Oroville. The Thermalito Diversion Pool holds a maximum of 13,350 af. The water surface elevation and water surface area at maximum operating storage are 225 feet and 320 acres, respectively. The shoreline covers 10 miles at maximum operating storage.

B.1.2.2 Thermalito Diversion Dam

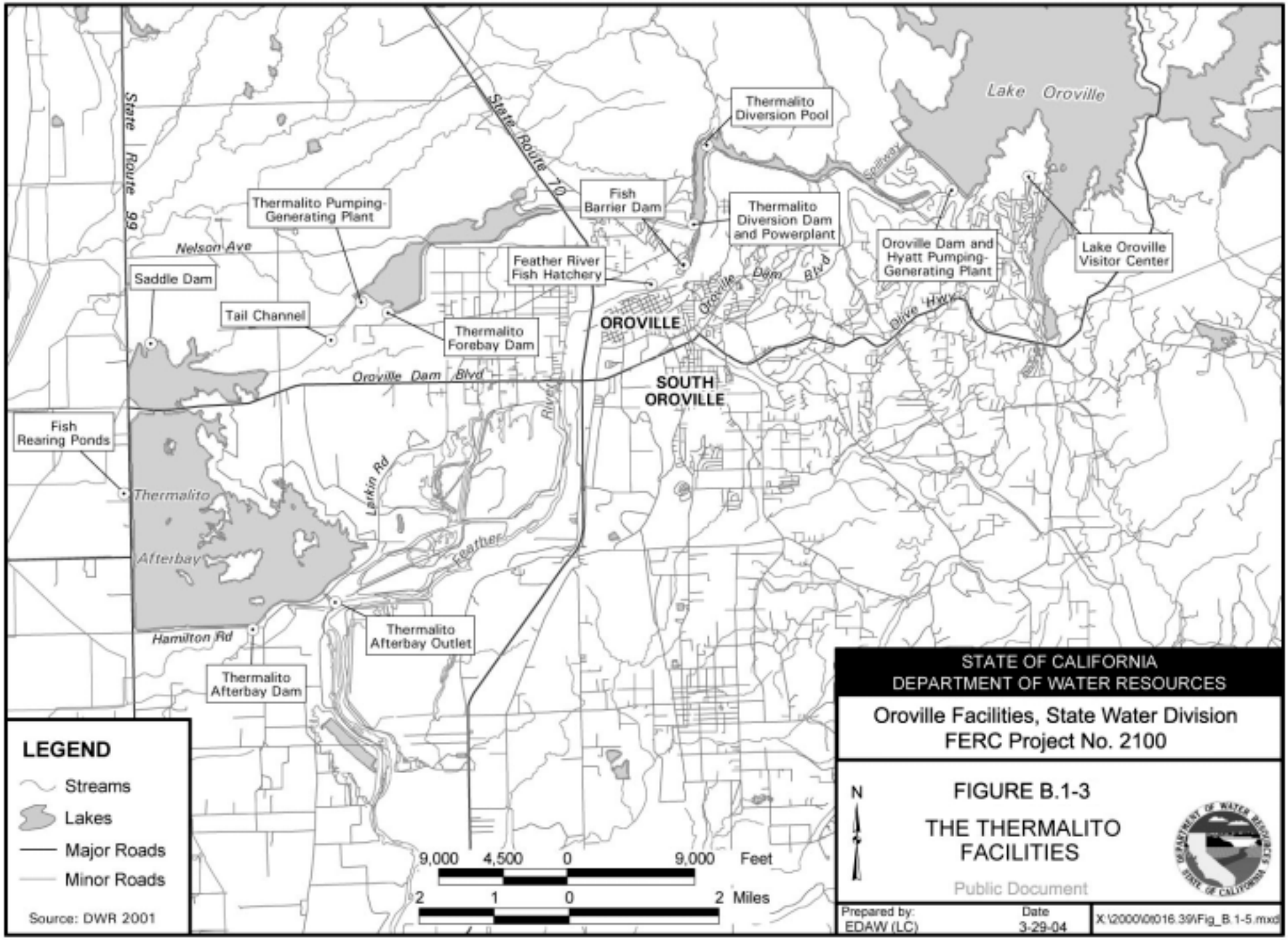
Approximately 4 miles downstream of Oroville Dam and the Hyatt Pumping-Generating Plant is the Thermalito Diversion Dam (Figures B.1-2, B.1-3, and B.1-4). This facility, which was constructed between 1963 and 1968, consists of a 625-foot-long, concrete gravity dam with a regulated ogee spillway that releases water to the low-flow channel of the Feather River. The dam has an embankment volume of 154,000 cubic yards, a height of 143 feet, a crest length of 1,300 feet, and an elevation of 233 feet.

The dam has two purposes: (1) to divert water into the 2-mile-long Thermalito Power Canal, which transports it to the Thermalito Pumping-Generating Plant for power generation (Figure B.1-6); and (2) to create a tailwater pool for the Hyatt Pumping-Generating Plant (the Thermalito Diversion Pool, described above) (Figure B.1-2).



Sources: DWR 1999, DWR Website

Figure B.1-2. The Thermalito Diversion Pool.


Lake Oroville
Thermalito Diversion Pool
Spillway
State Route 70
State Route 99
Fish Barrier Dam
Thermalito Diversion Dam and Powerplant
Thermalito Pumping-Generating Plant
Nelson Ave
Feather River Fish Hatchery
Oroville Dam and Hyatt Pumping-Generating Plant
Lake Oroville Visitor Center
Saddle Dam
Oroville Dam Blvd
Tail Channel
Thermalito Forebay Dam
OROVILLE
Olive Hwy
Oroville Dam Blvd
SOUTH OROVILLE
Fish Rearing Ponds
Larkin Rd
Thermalito Afterbay
Feather River
Hamilton Rd
Thermalito Afterbay Outlet
Thermalito Afterbay Dam
LEGEND
Streams
Lakes
Major Roads
Minor Roads
Source: DWR 2001
9,000 4,500 0 9,000 Feet
2 1 0 2 Miles
N
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Facilities, State Water Division
FERC Project No. 2100
FIGURE B.1-3
THE THERMALITO FACILITIES
Public Document
Prepared by: EDAW (LC)
Date 3-29-04
X:\2000\06016.39\Fig_B.1-5.mxd

Sources: DWR 1999, DWR Website

Figure B.1-4. Thermalito Diversion Dam and the Thermalito Power Canal.

B.1.2.3 Thermalito Diversion Dam Power Plant

The Thermalito Diversion Dam Power Plant is on the left abutment of the Thermalito Diversion Dam. It was constructed between 1985 and 1987. The power plant generates electricity from water released to the low-flow channel of the Feather River to maintain fish habitat between the Diversion Dam and the Thermalito Afterbay River outlet. It releases a maximum of 615 cfs to the low-flow channel of the river. Table B.1-2 lists the generating information for the Thermalito Diversion Dam Power Plant.

Table B.1-2. Generating information for the Thermalito Diversion Dam Power Plant.

License Capacity	3 MW and 615 cfs
Normal Static Head	63–77 feet
Design Dynamic Head	67 feet
Number of Units	1
Unit Size	3.3 mVA and 615 cfs
Discharge Lines/Diameter	2 @ 5 feet to 1 @ 7.5 feet

Source: DWR Website

B.1.2.4 Thermalito Power Canal

The Thermalito Power Canal (Figure B.1-4) hydraulically links the Thermalito Diversion Pool to Thermalito Forebay and can convey water in either direction between the two facilities. The water in the power canal is used for pumping and power generation at the Hyatt Pumping-Generating Plant and the Thermalito Pumping-Generating Plant.

The headwork structure for the Thermalito Power Canal is located on the right abutment of the Thermalito Diversion Dam. The power canal is a concrete-lined canal 10,000 feet in length. The maximum generating and pumping flows are 16,900 cfs and 9,000 cfs, respectively.

B.1.3 Thermalito Forebay Facilities

B.1.3.1 Thermalito Forebay

Thermalito Forebay (Figures B.1-3 and B.1-5) is the offstream regulating reservoir for the Thermalito Pumping-Generating Plant. It is contained by the Thermalito Forebay Dam on the south and east and by Campbell Hills on the north and west. The forebay has three purposes: (1) to convey generating and pumping flows between the Thermalito Power Canal and the Thermalito Pumping-Generating Plant; (2) to provide regulatory storage and surge damping for the Hyatt-Thermalito power complex; and (3) to serve as a recreation site.

Thermalito Forebay holds a maximum of 11,768 af of water. The water surface elevation and water surface area at maximum operating storage are 225 feet and 630 acres, respectively. The shoreline covers 10 miles at maximum operating storage.

B.1.3.2 Thermalito Forebay Dam

Thermalito Forebay Dam (Figure B.1-5) was constructed between 1965 and 1968. Located about 4 miles west of the City of Oroville, this dam is a homogeneous and zoned earthfill dam. It has an embankment volume of 1,840,000 cubic yards, a height of 91 feet, and a crest length and elevation of 15,900 feet and 231 feet, respectively.

B.1.3.3 Thermalito Pumping-Generating Plant

The Thermalito Pumping-Generating Plant (Figure B.1-5) was constructed from 1964 to 1969 with operations beginning in 1968. It is operated in tandem with the Hyatt Pumping-Generating Plant to produce power during times of peak electricity demand. Table B.1-3 provides the pumping and generating information for the plant.

Table B.1-3. Pumping and generating information for the Thermalito Pumping-Generating Plant.

	Pumping	Generating
License Capacity	9,120 cfs and 120,000 hp	114 MW and 17,400 cfs
Normal Static Head	85–102 feet	85–102 feet
Design Dynamic Head	99 feet	95 feet
Number of Units	3 (pumping/generating)	4 (1 generating, 3 pumping/generating)
Unit Size	3,040 cfs and 40,000 hp	3 @ 30.6 mVA (p/g) and 4,200 cfs 1 @ 34 mVA (g) and 4,800 cfs
Penstock/Diameter		1 @ 24 to 21 feet 3 @ 21 to 18 feet

Notes: g = generating; p/g = pumping/generating
Source: DWR Website

Sources: DWR 1999, DWR Website

Figure B.1-5. Thermalito Forebay, Thermalito Forebay Dam, and the Thermalito Pumping-Generating Plant.

B.1.4 Thermalito Afterbay Facilities

B.1.4.1 Thermalito Afterbay

Thermalito Afterbay (Figures B.1-6 and B.1-7) has five purposes: (1) to provide storage for the water required by pump-back operations; (2) to help regulate the power system; (3) to produce controlled flow in the Feather River downstream of the Oroville Thermalito Facilities; (4) to deliver local irrigation water; and (5) to provide recreational opportunities.

Thermalito Afterbay holds a maximum of 57,040 af of water. The water surface elevation and water surface area at maximum operating storage are 136.5 feet and 4,300 acres, respectively. The shoreline covers 26 miles at maximum operating storage.

B.1.4.5 Thermalito Afterbay Dam

Thermalito Afterbay Dam (Figures B.1-6 and B.1-7) is located about 6 miles southwest of the city of Oroville. Constructed from 1965 to 1968, it is a homogeneous earthfill dam with the longest crest (42,000 feet) in the State Water Project (SWP) system. It has an embankment volume of 5,020,000 cubic yards, a height of 39 feet, and a crest elevation of 142 feet.

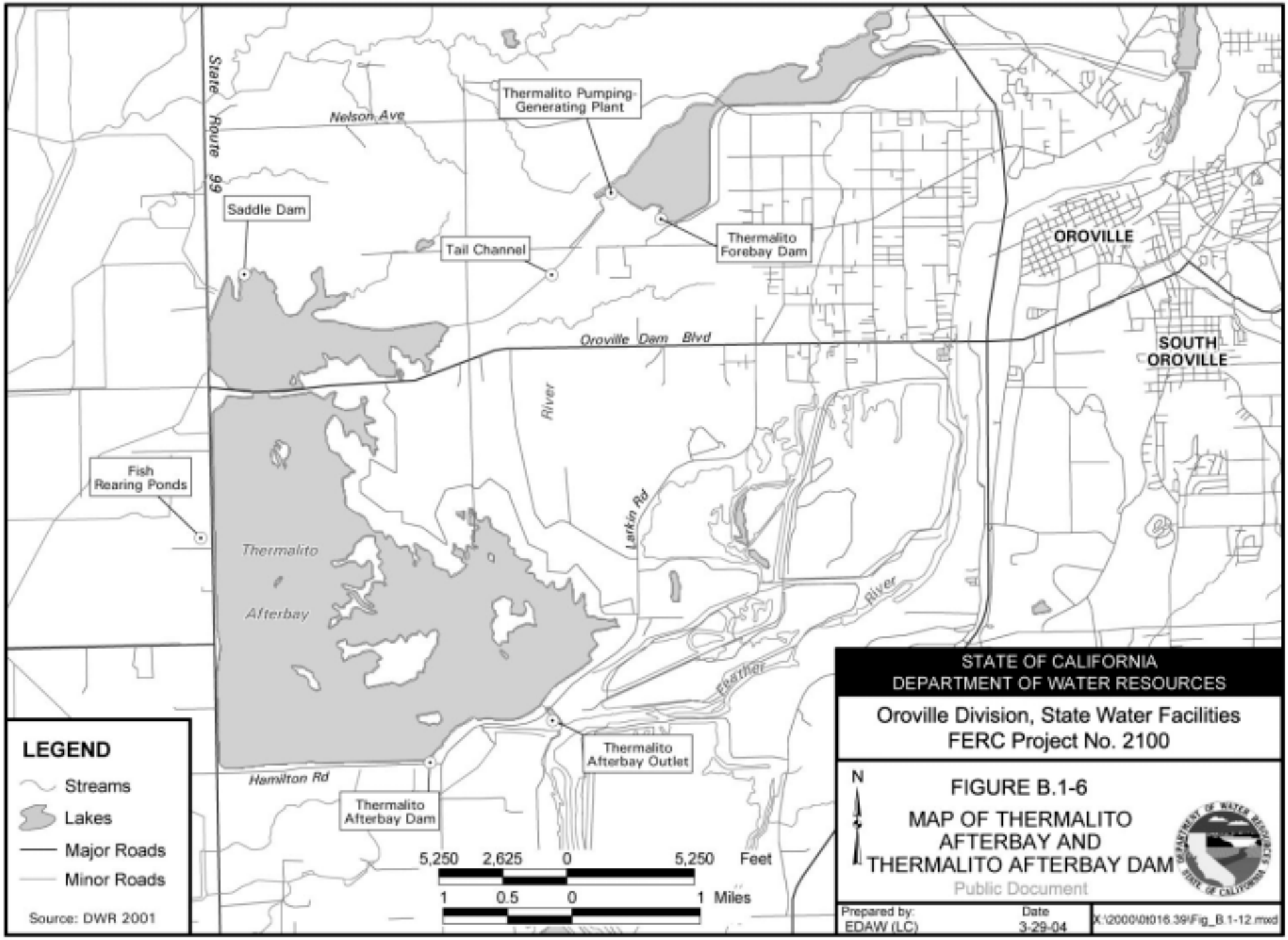
B.1.5 Transmission and Interconnection Facilities

B.1.5.1 Hyatt Pumping-Generating Plant

A 230-kilovolt (kV) switchyard is located above ground approximately 1,500 feet southwest of the underground powerhouse. Three 230-kV circuits on 2 sets of double-circuit towers extend overhead approximately 9 miles from the switchyard to Pacific Gas and Electric Company's (PG&E) Table Mountain Substation.

B.1.5.2 Thermalito Diversion Dam Power Plant

Two 15-kV underground distribution lines extend approximately 3.9 miles and 1.1 miles from the Thermalito Diversion Dam Power Plant Switchyard to the Hyatt Pumping-Generating Plant Switchyard and the Feather River Fish Hatchery, respectively.


State Route 99
Nelson Ave
Thermalito Pumping-Generating Plant
Saddle Dam
Tail Channel
Thermalito Forebay Dam
OROVILLE
Oroville Dam Blvd
SOUTH OROVILLE
River
Fish Rearing Ponds
Larkin Rd
Thermalito
Afterbay
River
Feather
Thermalito Afterbay Outlet
Hamilton Rd
Thermalito Afterbay Dam
LEGEND
Streams
Lakes
Major Roads
Minor Roads
Source: DWR 2001
5,250 2,625 0 5,250 Feet
1 0.5 0 1 Miles
N
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Division, State Water Facilities
FERC Project No. 2100
FIGURE B.1-6
MAP OF THERMALITO AFTERBAY AND THERMALITO AFTERBAY DAM
Public Document
Prepared by: EDAW (LC)
Date 3-29-04
K:\2000\0t016.39\Fig_B.1-12.mxd

Sources: DWR 1999, DWR Website

Figure B.1-7. Thermalito Afterbay and Thermalito Afterbay Dam.

B.1.5.3 Thermalito Pumping-Generating Plant

The Thermalito Pumping-Generating Plant Switchyard is located between the headworks structure and the powerhouse proper, using a portion of the top deck of the powerhouse structure. One 230-kV transmission line on double-circuit towers extends overhead approximately 2.3 miles from the switchyard to PG&E's Table Mountain Substation.

DWR maintains the area around transmission lines, including managing vegetation and trimming trees, to provide for necessary clearance under and around the electrical lines.

B.2 RECREATION FACILITIES

The purpose of the following discussion is to place the Oroville Facilities in a regional context as one of Northern California's major recreation resources. Table B.2-1 provides a summary of the recreation opportunities in the general area surrounding and including the Oroville Facilities.

Table B.2-1. Existing recreational opportunities in the project region, project vicinity, and project area.*

Location	Operator	Public Use	Shoreline Access	Parking	Camping	Boating	Picnic	Cabins	Trailheads	Toilets	Information
Project Region											
Lake Almanor	PG&E	Yes	X	X	X	X	X	X		X	X
Bucks Lake	PG&E	Yes	X	X	X	X	X	X	X	X	X
Butt Valley Reservoir	PG&E	Yes	X	X	X	X	X		X	X	X
Plumas NF	USFS	Yes	X	X	X	X	X		X	X	X
Lassen NF	USFS	Yes	X	X	X	X	X		X	X	X
Lassen Volcanic NP	NPS	Yes	X	X	X	X	X		X	X	X
Upper Feather River Lakes	USFS	Yes	X	X	X	X	X		X	X	X
Project Vicinity											
North Fork Feather River Projects	PG&E	Yes	X	X	X	X	X	X	X	X	X
Gasner Bar Campground	USFS concession	Yes	X	X	X		X			X	X
North Fork Campground	USFS concession	Yes	X	X	X		X			X	X
Queen Lilly Campground	USFS concession	Yes	X	X	X		X			X	X

Table B.2-1. Existing recreational opportunities in the project region, project vicinity, and project area.*

Location	Operator	Public Use	Shoreline Access	Parking	Camping	Boating	Picnic	Cabins	Trailheads	Toilets	Information
Project Area											
Lake Oroville Visitors Center	DWR DPR	Yes	X	X			X		X	X	X
Loafer Creek Recreation Area	DPR	Yes	X	X	X	X	X	X	X	X	X
Bidwell Canyon Recreation Area	DPR	Yes	X	X	X	X	X		X	X	X
Bidwell Canyon Marina	DPR concession	Yes	X	X		X	X			X	X
Lime Saddle Recreation Area	DPR	Yes	X	X	X	X	X		X	X	X
Lime Saddle Marina	DPR concession	Yes	X	X		X	X			X	X
Spillway Recreation Area	DPR	Yes	X	X	X	X	X			X	
Car-top Boat Ramps (5)	DPR	Yes	X	X		X	X			X***	
Oroville Dam Overlook	DPR	Yes	X	X			X		X		
Boat-In Camp Sites	DPR	Yes			X	X					
Floating Camp Sites	DPR	Yes			X	X					
Oroville Wildlife Area	DFG	Yes	X	X	X	X	X		X	X	X
Brad P. Freeman Trail	DPR, DWR	Yes	X	X					X	X	
Dan Beebe Trail	DPR	Yes		X					X	X	
Diversion Pool	DPR	Yes	X	X		X	X		X		
North Thermalito Forebay	DPR	Yes	X	X		X	X		X	X	
Aquatic Center	**	No	X	X		X	X				
South Thermalito Forebay	DPR	Yes	X	X		X	X			X	
Thermalito Afterbay	DWR, DFG	Yes	X	X		X	X			X	
Clay Pit SVRA	DPR	Yes		X							
Feather River Fish Hatchery	DFG, DWR	Yes		X			X			X	X

**Notes:*
DFG = California Department of Fish and Game; DPR = California Department of Parks and Recreation; DWR = California Department of Water Resources; NF = National Forest; NP = National Park; NPS = National Park Service; SVRA = State Vehicular Recreation Area; USFS = U.S. Forest Service. An "X" indicates the presence of a facility or recreation opportunity at a particular site.
***California State University, Chico, and Butte Sailing Club.*
****Seasonally.*
Sources: DWR, DPR.

B.2.1 Regional Resources

B.2.1.1 Lassen National Forest

Located approximately 40 miles northeast of the project area, Lassen NF offers a variety of recreational experiences, including camping, hiking, bicycling, fishing and boating, wildlife viewing, and off-highway vehicle driving. All campgrounds have fire rings, tables, and restroom facilities (LNF 2000).

B.2.1.2 Lassen Volcanic National Park

Located on the southwest edge of Lassen NF, Lassen Volcanic NP is approximately 40 miles from the Oroville Facilities and offers unique access to an “active” volcano. All four types of the world's volcanoes can be found at the park. Various recreation activities occur in the park including camping, hiking, sightseeing, and museum visiting. The park covers 106,000 acres of forested foothills and volcanic relics. Snow arrives early and stays late, which accounts for the park being operational for just a few months of the year. Lassen Volcanic NP is one of the least crowded of the national parks (LVNP 2000).

B.2.1.3 Lake Almanor Recreation Area

The Lake Almanor Recreation Area, located approximately 50 miles northeast of the project area, includes Butt Valley Reservoir and Lake Almanor, which together offer 28,664 water surface acres and approximately 64 miles of shoreline for recreation. PG&E has provided a number of family and large group camping areas and picnicking/day use facilities at the Lake Almanor Campground, which has increased public recreation opportunities for fishing, swimming, boating, water skiing, rental cabins, and summer homes. At this campground there are 130 campsites for tents or motor homes (PG&E 2000). Lassen NF also manages a campground on Lake Almanor containing 103 campsites for tents or motor homes, piped-in water, vault toilets, picnic tables, and fireplaces (LNF 2000). Campgrounds and day-use facilities at Lake Almanor receive an estimated annual usage of more than 130,000 visitor days (PG&E 1997).

B.2.1.4 Bucks Lake Recreation Area

The Bucks Lake Recreation Area, approximately 20 miles northeast of the project area, includes Grizzly Forebay, Three Lakes, Lower Bucks Lake, and Bucks Lake, together offering approximately 2,084 water surface acres and approximately 20 miles of shoreline for public recreation. The Bucks Lake Recreation Area provides recreational opportunities ranging from primitive camping to resort areas providing rental cabins and restaurant services. Other facilities at Bucks Lake include areas for group and family camping, picnicking, boating, water skiing, fishing, and swimming. The Bucks Lake

Recreation Area provides a total of 66 camping units (PNF 2000). PG&E owns about half of the shoreline and the remainder is managed by the USFS, Plumas NF.

B.2.1.5 Butt Valley Reservoir

Butt Valley Reservoir is located approximately 46 miles to the northeast of the project area and 4 miles south of Lake Almanor at an elevation of 4,140 feet. At maximum pool level, the reservoir has 1,600 surface acres. Opportunities for recreation at Butt Valley Reservoir include camping, fishing, hiking, and swimming. Recreation facilities developed by PG&E at the reservoir comprise two campgrounds on the east side: Cool Springs and Ponderosa Flat. Cool Springs is a fee campground with 25 camp units and 5 walk-in units. It is located 2.5 miles south of Ponderosa Flat Campground on the east shore of Butt Valley Reservoir. Located on the north end of Butt Valley Reservoir, Ponderosa Flat is also a fee campground and contains 63 camp units. There is also a boat launch and day-use area at the facility. Powerboats are allowed on the reservoir; however, a Plumas County ordinance limits boat speeds to a maximum of 25 miles per hour (Plumas County 1998).

B.2.1.6 Upper Feather River Reservoirs

Antelope, Frenchman, and Davis Lakes, located 60–75 miles northeast of Oroville, are situated within Plumas NF and mark the beginning of the SWP. USFS or its concessionaires operate all recreational facilities at the three reservoirs.

Antelope Lake and Dam are located on Indian Creek, a tributary of the North Fork Feather River. Camping, fishing (including handicapped access), picnicking, boating, water skiing, swimming, hunting, hiking, snow skiing, and snowmobiling are recreational activities occurring on or around the lake. Sanitation and trailer dumpsites are available (DWR 1997).

Frenchman Lake and Dam are located on Little Last Chance Creek, a tributary of the Middle Fork Feather River. The area offers activities and services similar to those found at Antelope Lake (DWR 1997).

Lake Davis and Grizzly Valley Dam are located on Big Grizzly Creek, a tributary of the Middle Fork Feather River. The area offers activities and services similar to those found at Antelope and Frenchman Lakes (DWR 1997).

B.2.1.7 Area Trail Systems

The Pacific Crest Trail extends across Plumas NF for about 75 miles, crossing two major canyons (the Middle Fork and North Fork Feather River). Trail elevations range from 2,400 to 7,000 feet above sea level (PG&E 1997). Mid-June is the earliest that it is

usually feasible to hike in this area, as snow is prevalent until then and streams run high.

B.2.2 Project Vicinity

Several recreational opportunities exist in the project vicinity, just upstream of the project area. Intermittent opportunities for whitewater boating exist in the area but are dependent on rainfall and dam release for instream river flows. Driving tours of historical and scenic interest are included in the draw of tourists to the area, particularly related to the area's distinctive mining and train history in the Feather River Canyon. The Feather River Canyon offers two recreational gold panning sites, as well as opportunities for bird watching and wildflower viewing.

The Feather River Canyon offers hunting and fishing opportunities, but fishing along the shoreline of the river is constrained by rocky terrain that makes walking difficult. Hunters travel to the area seeking opportunities to hunt mule deer, bear, ducks, geese, quail, pigeon, and grouse. Rainbow trout fishing in the lower canyon is the primary attraction for people interested in fishing in the Feather River Canyon.

B.2.2.1 Plumas National Forest

Located adjacent to Lake Oroville, the forest covers more than a million acres of tree-covered mountains with dozens of lakes and hundreds of miles of streams. The headwaters of Plumas NF into the project reservoir. Camping facilities include family car camp units, recreation vehicle (RV) hook-ups, and remote sites with minimal services. Most developed facilities include piped water, flush or vault toilets, stoves or fire circles, tables with benches, and parking spaces. The area is typically used for hiking, fishing, hunting, camping, mountain biking, rafting, snow sports, scenic drives, and wildlife viewing (PNF 2000).

B.2.2.2 State Route 70 Scenic Byway

The State Route 70 Scenic Byway begins 10 miles north of the project area, runs through the Feather River Canyon, and offers spectacular views and countless points of cultural, geologic, and historical interest. It is a popular access route for the region's recreational opportunities. State Route (SR) 70 was officially dedicated in October 1998 as a Scenic Byway by USFS and is eligible for State Scenic Highway status (PNF 2000).

B.2.2.3 Feather Falls Scenic Area

The Feather Falls National Recreation Trail leads to Feather Falls, the sixth highest waterfall in the continental United States and fourth highest in California. The 15,000-acre Feather Falls Scenic Area is located in the La Porte Ranger District of

Plumas NF. In respect to the project area, access to a 9-mile loop trail that leads to the Feather Falls Overlook is from Lumpkin Road in the South Fork arm of Lake Oroville. The trailhead has camping and toilets available.

B.2.2.4 Four-Wheel Drive Access

Other recreational opportunities in the project vicinity include four-wheel drive (4WD) ORV access along the dirt road that parallels Lake Oroville on its north shore. The primitive road begins just south of the Poe Powerhouse and ends near French Creek. The Feather River can be accessed along certain portions of this road. Extensive Plumas NF land is also available for ORV use. The forest plans for Plumas NF and Lassen NF indicate that most federal forestlands in the project vicinity are open for ORV use (PNF 1988). For example, there is a 4WD road paralleling the North Fork Feather River, running northeast from the town of Pulga. Off-road vehicle travel is excluded from protected areas such as the Bucks Lake Wilderness and the Pacific Crest Trail.

B.2.2.5 North Fork Feather River Hydroelectric Projects

This area includes four hydroelectric developments and their associated recreation opportunities along the North Fork Feather River from Lake Almanor to LOSRA. The four hydroelectric developments are the Upper North Fork Feather River (UNFFR), Rock Creek, Cresta, and Poe Projects. Lake Almanor Recreation Area and Butt Valley Reservoir are part of the UNFFR Project and are discussed above under Regional Resources.

These projects are managed by PG&E and afford similar recreational opportunities. They provide public river access, parking, camping, and picnicking areas. Rock Creek, Cresta, and Poe all have small reservoirs with no developed facilities. Shady Rest, located near Cresta Reservoir, is a highway rest stop developed by PG&E in 1962. Below Lake Almanor to Lake Oroville, whitewater boating opportunities are available on the North Fork Feather River and range in difficulty from Class III to Class V.

B.2.2.6 North Fork Feather River U.S. Forest Service Campgrounds

There are three USFS campgrounds along the North Fork Feather River: the Gasner Bar, North Fork, and Queen Lilly Campgrounds. The campgrounds are located approximately 18 miles northeast of the project area and are operated by Plumas NF. Gasner Bar Campground is about 2 miles east of Belden Town along SR 70, via Caribou Road. This campground contains 14 campsites, piped-in water, flush toilets, showers, fireplaces, picnic tables, space for trailer parking, and fishing opportunities (Stratton 1991).

B.2.3 Project Area

The Oroville Facilities offer a wide variety of recreational opportunities. These recreational opportunities include boating (several types), fishing (several types), fully developed and primitive camping (including boat-in 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 project area can be divided into six main sections, each with land and water components: Lake Oroville, Diversion Pool, Thermalito Forebay, Thermalito Afterbay, OWA, and low-flow channel of the Feather River. The project land and water areas at Lake Oroville, the Thermalito Diversion Pool, and Thermalito Forebay comprise the Lake Oroville State Recreation Area (LOSRA), managed by the State of California Department of Parks and Recreation (DPR). OWA, Thermalito Afterbay, and the Feather River Fish Hatchery are managed by the California Department of Fish and Game (DFG), and Thermalito Afterbay recreation facilities are managed by DWR. The Lake Oroville Visitors Center is co-managed with DWR, and the concessionaire-run marinas at Lime Saddle and Bidwell Canyon are overseen by DPR. As will be apparent in the descriptions to follow, the majority of recreation facilities and opportunities in the project area are within the LOSRA. The State Water Contractors also work with DWR to complete projects and manage Lake Oroville efficiently.

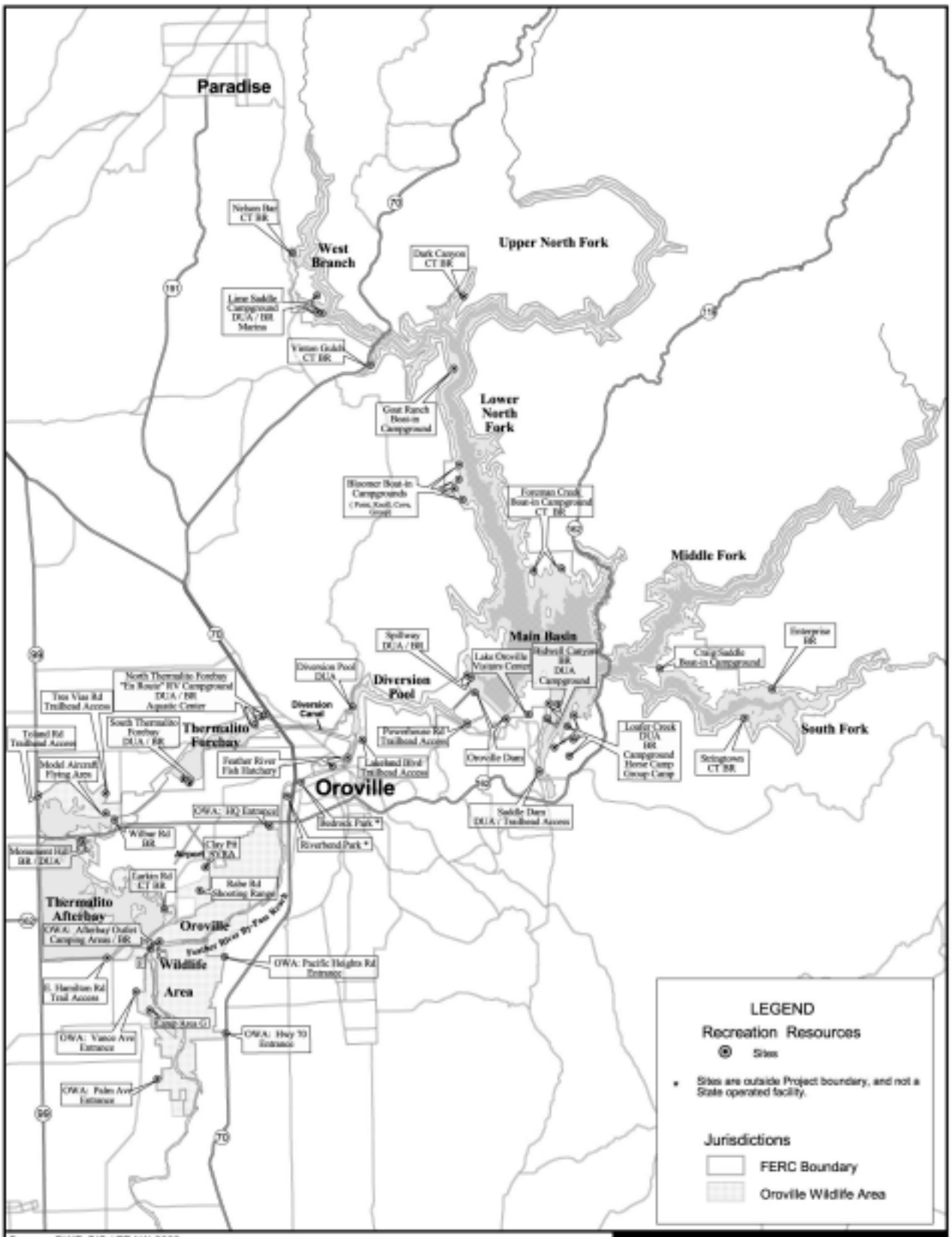
B.2.3.1 Lake Oroville

Lake Oroville is the second largest reservoir in California, after Lake Shasta. There are major recreation facilities on the lake at the Lime Saddle, Loafer Creek, Bidwell Canyon, and Spillway Recreation Areas. Additionally, there are two full-service marinas, five car-top boat launch ramps, ten floating campsites, five boat-in campsite areas, and seven strategically placed floating toilets to provide for the sanitary needs of visitors. The locations of the LOSRA facilities are shown in Figure B.2-1.

Lime Saddle Recreation Area

This area is located on the western shoreline of the West Branch of the North Fork arm of the reservoir. Recent improvements to the Lime Saddle Recreation Area include an improved boat ramp, more parking, lighting, restrooms, a fish cleaning station, and better landscaping. The boat ramp has five launch lanes and provides launching at both high and low pool elevations (as low as 702 feet, nearly 200 feet below full pool). Parking is provided for several hundred vehicles and boat trailers.

Lime Saddle Marina is concessionaire-operated and offers a variety of boats to rent including houseboats, patio boats, and fishing boats. Also offered are fishing and boating supplies and services, gas and oil, a snack bar, general store, and toilets. The area concessionaire operates a fee collection booth and entry station.



Source: DWR GIS / EDAW 2003

1 0 1 2 3 4 5 6 Miles

Scale 1 : 142,560
1" = 2.25 miles

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Oroville Division, State Water Facilities
FERC Project No. 2100

Figure B.2-1
Lake Oroville
State Recreation Area Facilities

Public Document

Prepared by: PJ – EDAW, Inc. Date: 4/1/04

In July 2001, a newly constructed campground opened nearby with 44 individual campsites (28 car/tent sites and 16 that are available for RVs with full hookups) and six group sites. Both campsite areas have restroom/shower buildings and potable water.

Spillway Area

Development consists of boat launching ramps and parking areas at two levels to accommodate seasonal water level changes. This is the largest launching facility at Lake Oroville, with 12 lanes on the upper ramp and 8 lanes on the lower ramp. The main upper parking area has space for 350 vehicles with boat trailers and more than 100 single vehicles. In 2002, site improvements were completed that include toilets, shaded picnic sites, grass and shade tree landscaping, potable water, and a grandstand to accommodate fishing tournaments. The upper parking area can accommodate overnight camping for self-contained recreational vehicles.

Oroville Dam Overlook and Crest

Located on the southwest shoreline of Lake Oroville, the crest of Oroville Dam can be used for driving, jogging, bicycling, or rollerblading. As the tallest earthfill dam in the nation with a height of 770 feet, the dam provides good views of Lake Oroville and the reservoirs and valley downstream and is a regional sightseeing attraction. At night, lights accent the 6,920-foot-long roadway along the dam's crest to facilitate some evening recreation. An overlook area at the north end near the spillway provides parking, picnic tables and historical monuments but has been closed to vehicles since September 2002 for security reasons. A similar area with a restroom at the south end remains open.

Lake Oroville Visitors Center

Located east of Oroville Dam on Kelly Ridge, the 10,000-square-foot, award-winning Lake Oroville Visitors Center features exhibits on the engineering and construction of the hydropower facilities, including the dam, and explains how the Oroville Facilities distributes water and electrical power to multiple destinations. There are also interpretive displays on the native culture and the natural resources of the area. The visitors' center hosts individual visitors as well as large groups such as K-12 school field trips. In addition to the informational displays inside the visitors' center, there is a 47-foot viewing tower that provides a panoramic view of Lake Oroville and its surroundings. The Lake Oroville Visitors Center is universally accessible and has picnic tables, shade trees and shelters, drinking fountains, a gift shop, a telephone, a restroom, and parking for automobiles and buses. The Dan Beebe Trail, an equestrian trail, can be accessed from the visitors' center.

Loafer Creek Recreation Area

This is a major recreation area on the southern shoreline of the reservoir, on the east side of Bidwell Canyon. Within this complex is a family campground, several group campgrounds, a horse camp, a day-use site, and a boat launch ramp. Each of the 137 family campsites has a picnic table, a fire ring, a parking space, and nearby restrooms, showers, telephone, and potable water. Each of the group camps has

five tent sites, a large barbecue pit, picnic tables, a food storage locker, fire pit, and sink with running water. Restroom facilities and hot showers are nearby. Each group site accommodates a maximum of 25 persons and parking for 8 vehicles. The horse camp features 15 sites with pullouts for horse trailers, a restroom, showers, a horse washing station, and horse tethering and feeding stations near each campsite. Recent additions include a horse exercise pen.

The large day-use site centered on a sandy swim beach has 80 picnic tables, barbecue stands, and large grassy area with shade trees, bathrooms, showers, and parking for 248 vehicles. The swim beach itself is only usable at relatively high pool elevations because the swim cove dewaters as the lake level decreases. The seasonal, 8-lane boat launch ramp has a floating dock and a parking area for 14 cars and 177 car/trailer combinations. The launch ramp is usable to pool elevations 125 feet below full pool, making it available to area campers and others through most summers. The Loafer Creek area also has more than 20 miles of riding and hiking trails that loop through the area and connect with the campgrounds and day use area.

Bidwell Canyon Recreation Area

Bidwell Canyon is a major recreation area with camping, boat launching, a marina, and small day use area. The two campground loops contain both tent and RV sites, with picnic tables, fire rings, potable water, and toilets. A boat ramp offers seven launch lanes when the lake is at or near full pool, and provides parking for over 200 vehicles and boat trailers. The ramp has a floating dock and restrooms. A smaller low-water ramp provides launching down to the 700 foot pool elevation (200 feet below full pool).

A small day use area provides picnic sites and a trail encircling a small island and around a reconstructed historic bridge and toll house.

The concessionaire-operated Bidwell Canyon Marina offers boat rentals, groceries, fishing supplies, a snack bar, covered slips and open mooring, a fuel dock, a pumping station for boat holding tanks, and boat storage. Several trails pass through the area.

Enterprise Boat Ramp and Car-Top Boat Ramps

The Enterprise boat ramp and the Stringtown car-top ramp are located on the South Fork arm of the reservoir. Foreman Creek car-top ramp is located on the north shore of the main basin of the reservoir. Dark Canyon, Vinton Gulch, and Nelson Bar Car-top ramps are located on the West Branch arm at the north end of the reservoir. Enterprise is a paved two-lane ramp that is only available at pool elevations within about 60 feet of full pool. The area has paved parking and a pit toilet. The car-top ramps are minimally developed to allow the launching of small boats onto the reservoir. Most sites have vault toilets.

Boat-In and Floating Campsites

The North Fork, Goat Ranch, Foreman Creek, Craig Saddle, and Bloomer primitive recreation areas have boat-in camps, reachable only by boat. Each camp contains

several individual campsites. The sites are cleared and leveled for pitching tents. Pit toilets, garbage cans, tables, and fire rings or stoves are at each site. No water service is available.

The floating campsites are anchored in different areas of the reservoir, such as at the Potter Ravine and Canyon Creek coves. Each campsite is a two-story structure with living space and amenities such as a gas grill, camp table, sink, restroom, shelves, storage room, cabinets, and a sleeping area. Users must bring potable water to the floating campsites.

Floating Toilets
There are seven floating sanitary stations (toilets) around the reservoir. These are intended to decrease water pollution and facilitate the needs of boaters.

B.2.3.2 Thermalito Forebay

North Thermalito Forebay Recreation Area
Located on the northern shoreline of the forebay, the North Thermalito Forebay Recreation Area offers a 300-acre day use area for picnicking, barbecuing, fishing, and swimming. The site has over 100 picnic tables, many under shade structures and a large grassy area with mature shade trees. The facility is located on a shallow swim lagoon connected to the north Forebay, and has a broad sandy swim beach with restrooms and outdoor shower. A trail encircles the lagoon. Potable water and a telephone are also provided. The adjacent Aquatic Center, operated by a local sailing club, provides storage for boats and space for sailing events and instruction. There are also two boat ramps and an accessible fishing pier. Boating is restricted to non-gasoline-powered boats such as sailboats and canoes (DWR 2000).

South Thermalito Forebay Recreation Area
Located on the southern shoreline of the forebay, the South Thermalito Forebay Recreation Area has picnic tables, shade trees, barbecue grills, potable water, a two-lane boat launch with floating dock, toilets, a small swim beach, and a fish cleaning station. Power boating and fishing are the forebay's main uses.

B.2.3.3 Thermalito Afterbay

With 17 miles of shoreline and 4,300 surface acres of water, Thermalito Afterbay is open for boating, swimming, fishing, picnicking, and limited hunting. There are three boat launch facilities on the eastern shore used by pleasure boaters, anglers, and hunters. The Wilbur Road ramp near the north end of the pool provides two launch lanes with a floating dock, a vault toilet, and paved parking area. The Monument Hill boat ramp and DUA also provides two launch lanes and a floating dock, along with a small sand beach with picnic table, popular with personal watercraft riders. The site also has a restroom, picnic sites, and a fish cleaning station on a hill overlooking the

ramp area. The Larkin Road Car-top boat ramp is on the southern portion of Thermalito Afterbay and provides a low-gradient paved ramp used to launch personal watercraft riders and other small boats, and a vault toilet.

Thermalito Afterbay is managed by DFG as part of OWA. Brood ponds to support waterfowl reproduction have been constructed at several areas near shore on the north and east sides of the pool. Hunting occurs on the area during the fall and winter, primarily for pheasant and waterfowl. Hunting blinds have been installed at various points along the shoreline. Hunters access the area at several road-end trailheads, as well as at the boat ramps.

B.2.3.4 Thermalito Diversion Pool

The Thermalito Diversion Pool consists of a 4.5-mile stretch of the Feather River from the Oroville Dam to the Thermalito Diversion Dam. The pool covers 320 acres and rests between steep wooded hillsides and provides opportunities for visitors to enjoy quiet, uncrowded conditions.

The gravel Burma Road runs alongside about a mile of the west shoreline and provides access to the pool for bank anglers and car-top boaters. Only non-gasoline-powered boats are allowed on the pool. A vault toilet is provided. The road terminates at a trailhead where hikers, bicyclists, and equestrians can access the Brad P. Freeman Trail, which follows the north shoreline of the Thermalito Diversion Pool before climbing to Oroville Dam. The Brad P. Freeman trail also follows the opposite shore, running on an old railroad bed. The Dan Beebe trail winds through the hillsides just above. The Lakeland Boulevard Trailhead sits above the Thermalito Diversion Dam on the south side of the pool and provides access to both trails.

B.2.3.5 Low-Flow Channel of the Feather River

The section of river between Thermalito Diversion Dam and Thermalito Afterbay is commonly referred to as the low-flow channel of the Feather River. This section of the river runs past the City of Oroville, the Clay Pit SVRA, and OWA. It flows southwest under SR 162 and along SR 70 adjacent to the City of Oroville, and meets the outflow from Thermalito Afterbay. This river section is considered low-flow because much of the water that is released from Lake Oroville is diverted to Thermalito Forebay and Thermalito Afterbay.

This section of the Feather River is an important recreational resource for the residents of Oroville and the nearby residential areas. Access is available south of the City of Oroville, along SR 70. The river is closed to fishing north of the Table Mountain Bicycle Bridge. The river is open for fishing seasonally in accordance with DFG regulations. In the spring and fall, thousands of salmon are known to congregate at the Thermalito Afterbay outlet. Several types of fish are sought by anglers in this section of the river

with a good success rate (Stienstra 1999). The low-flow channel is also used and enjoyed by swimmers, wildlife and bird watchers, sightseers, hikers, and bicyclists. The Brad P. Freeman trail runs beside this section of river from Thermalito Diversion Dam to SR 162. Below the Thermalito Afterbay outlet, the river continues through OWA where it gains water from the Thermalito Afterbay outflow.

B.2.3.6 Major Trails and Other Facilities

Brad P. Freeman Trail

The Brad P. Freeman Trail was developed as a bicycle trail and provides 41 miles of scenic off-road recreation for all-terrain bikes and other users. The trail circles the North Thermalito Forebay, Thermalito Afterbay, and Diversion Pool and crosses the crest of Oroville Dam. About 30 miles of the trail are mainly flat but include some rolling terrain. Steep grades are found on either side of the dam within a few miles of Lake Oroville. The trail has been used for downhill and cross-country bike races; it is now managed for multiple uses.

Dan Beebe Trail

The Dan Beebe Trail is a 14.3-mile that rises from an elevation of 200 to 1,000 feet and traverses the Bidwell Canyon and Kelly Ridge areas near Lake Oroville as well as the area to the south of the Thermalito Diversion Pool. The trail can be accessed at the Saddle Dam Trailhead, from the Bidwell Canyon Recreation Area, from the Lake Oroville Visitors Center, from pull-offs along Oroville Dam Boulevard, and from the Lakeland Boulevard Trailhead. Equestrians, joggers, and mountain bikers use the trail. Some sections present a challenge to users as they winds up and down steep hills.

Clay Pit State Vehicular Recreation Area

Clay Pit SVRA, operated by DPR, provides good beginner terrain for off-road enthusiasts. The clay used to build Lake Oroville was taken from the Feather River Valley, 3 miles west of Oroville. The resulting depression—a large shallow pit ringed with low hills—is the site of this 220-acre recreation area. It is a motorcycle, all-terrain vehicle, and dune buggy use area.

Rabe Road Shooting Range

Adjacent to the SVRA, and also in the Clay Pit borrow area, the shooting range provides a gravel parking area and a vault restroom. The shooting range is within OWA and managed by DFG.

B.3 FEATHER RIVER FISH HATCHERY

This section provides a description of the Feather River Hatchery along with its operational activities. In addition, there is a brief description of the fish that are artificially spawned and reared.

B.3.1 Introduction

B.3.1.1 History of the Feather River Fish Hatchery

Oroville Dam was constructed in the early 1960s on the Feather River near the City of Oroville. Construction of the dam altered a portion of the Feather River and its tributaries; as a result, spawning grounds and rearing areas were lost to salmon and steelhead returning to their home stream to deposit eggs. To compensate for this loss, the Feather River Fish Hatchery (Figure B.3-1) was constructed and opened in 1967. Because the fish hatchery had been built, DWR was not required to install fish passage facilities for upstream and downstream migrating anadromous salmonids. The fish hatchery was cooperatively planned by DFG and DWR, with advice and assistance from the U.S. Fish and Wildlife Service (USFWS) and other resource agencies.

B.3.1.2 Purposes and Primary Functions

The hatchery mitigates the loss of spawning habitat for two races of Chinook salmon, the spring and fall runs, and steelhead rainbow trout. This mitigation is particularly important now, in that the spring-run and steelhead are listed as threatened under provisions of the Federal Endangered Species Act. The fall-run is a candidate species.

Over the years, the Feather River Fish Hatchery has assumed three additional important functions:

- The hatchery is a critical source of juvenile Chinook salmon used in various studies, leading to a better understanding of salmon life history and management.
- In the 1990s the hatchery began providing fingerling and juvenile Chinook salmon for planting in Lake Oroville. Because of disease problems, the hatchery has converted its rearing and planting program to provide coho salmon obtained from the Pacific Northwest. DFG also plants surplus juveniles from the hatchery into other Northern California reservoirs.
- The Feather River Fish Hatchery provides juvenile Chinook salmon for enhancement (beyond mitigation) projects at the Thermalito grow-out facilities and at the Mokelumne River Fish Facility.

Sources: DWR 1999, DWR Website.

Figure B.3-1. The Feather River Fish Hatchery.

B.3.1.3 Overview of Hatchery Operations

DFG operates the hatchery under contract to DWR. DWR pays all hatchery-associated expenses, which include DFG staff at the fish hatchery, except for some costs as part of the enhancement of the Thermalito facilities.

The Feather River Fish Hatchery includes a variety of spawning and rearing facilities. 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 raised at the hatchery are transported in oxygenated, temperature-controlled tanks and released in the Feather and Sacramento Rivers, in Lake Oroville and other California reservoirs, and in San Pablo Bay near San Francisco Bay. These fish account for an estimated 20 percent of the ocean sport and commercial catch of Chinook salmon in the Pacific Ocean. Spawning and rearing facilities and operations are described in further detail in Section B.3.2 below.

The hatchery complex also includes an office and maintenance building, storage areas, a fish food storage bin, and a visitor observation complex. Visitor facilities include several large parking lots east of the hatchery building, along with an observation platform near the Fish Barrier Dam, restrooms, and a fish viewing window along the fish ladder. The hatchery complex also has a visitor viewing area to observe the artificial spawning process.

DWR provides two full-time staff members to conduct tours of the Feather River Fish Hatchery and other areas of the Oroville Facilities. The hatchery is available for public observation year-round with visiting hours from 8 a.m. to sundown. Interpretive signage is posted throughout the complex explaining various facilities and operational activities. During the school year, the fish hatchery draws a large number of K-12 school children for daytime tours. In addition, a salmon festival is held at the hatchery in mid-September of each year. The hatchery is considered an important public relations and recreational facility.

B.3.2 Spawning and Rearing Facilities and Operations

The hatchery complex consists of a barrier dam and fish ladder, collection and holding tanks, enclosed spawning and early incubation facilities, grow-out ponds, and fish transport vehicles. A fish rearing facility near Thermalito Afterbay is used as a grow-out facility for some salmon and steelhead hatched at the Feather River Fish Hatchery.

B.3.2.1 Fish Barrier Dam and Fish Ladder

The Fish Barrier Dam and Fish Barrier Pool are located upstream of the Feather River Fish Hatchery. They were constructed between 1962 and 1964. The dam diverts fish into a fish ladder that leads to the hatchery. The dam is a 91-foot-high concrete gravity

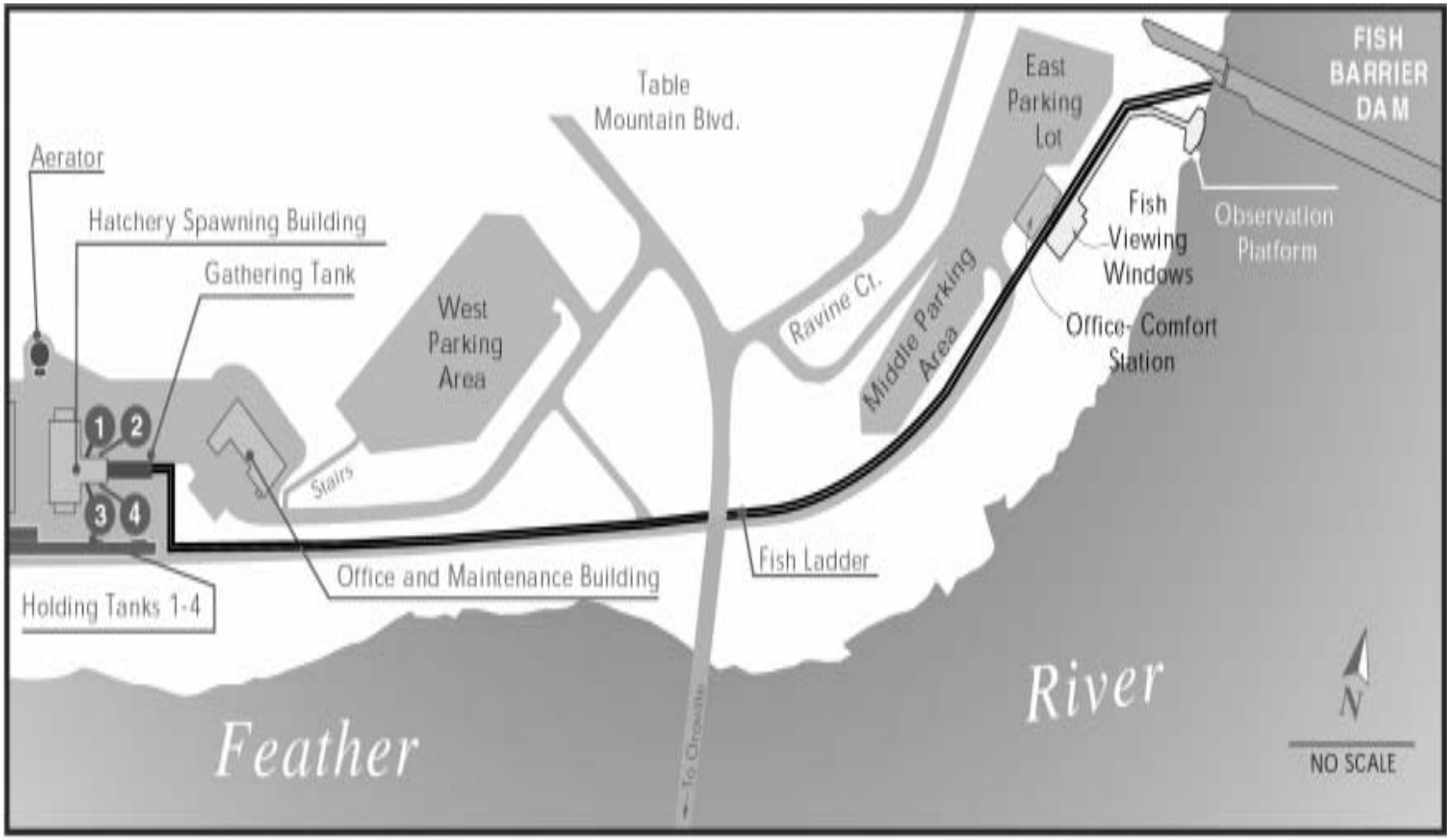
dam with a volume of 9,300 cubic yards. The dam's crest elevation and length are 181 feet and 600 feet, respectively.

The Fish Barrier Dam diverts fish into a ladder (Figure B.3-2) leading to the hatchery. All fish are stopped at the barrier dam. When the gates are open, upstream migrating fish can move into the 0.5-mile-long ladder leading to the hatchery. The ladder consists of a series of pools with a minimum width of 6 feet and a minimum depth of 2 feet. Flow velocity is 2–5 feet per second, and the maximum drop between pools is 1 foot. A chamber in the lower section of the ladder allows the public to view the migrating adult salmon and steelhead. Gates to the fish ladder are generally open from about September 1 (for the early spring run) through the end of March (for steelhead). An enlarged section of the fish ladder at its upstream terminus functions as a gathering tank, entrapping fish ascending the ladder. A mechanical sweep gathers the fish and deposits them into the abutting spawning building. Four concrete circular tanks hold the fish until they are ready to spawn.

The Fish Barrier Pool is the small reservoir located between Thermalito Diversion Dam and the Fish Barrier Dam. No stocking or sampling has been conducted in this reservoir, but the sport fish found in the Thermalito Diversion Pool also probably occur in the Fish Barrier Pool to some degree. The Fish Barrier Pool has a storage capacity of 560 af and covers 50 acres. Water is drawn from behind Thermalito Diversion Dam and fed through a gravity flow pipeline to an aerator tower adjacent to the fish hatchery building. Baffles within the aerator serve to enhance the oxygen level in the water before it enters the hatchery complex. An ultraviolet water treatment facility provides treated water for two of the raceways at the main hatchery complex and all water used in the expansion area. There is a chiller for reducing the temperature of the hatchery water, if needed. However, because of the depth of Lake Orville and the water that is obtained from behind Thermalito Diversion Dam, the chiller is seldom required. Up to 130 cfs can be drawn through the gravity pipeline and used in the fish hatchery complex.

B.3.2.2 Adult Collection and Holding Facilities

Four concrete circular tanks at the head of the fish ladder collect and hold the adults until they are ready to spawn. Hatchery staff members periodically examine the fish for signs of maturation and select those that are ready for artificial spawning.



Source: DWR 1999, DWR Website

Figure B.3-2. Location of the fish ladder and fish viewing area.

B.3.2.3 Hatchery Building

The spawning-hatchery building is where the artificial spawning takes place, which is conducted by trained DFG employees. Milt is taken from the male and mixed with eggs taken from the female. The eggs are kept in incubators capable of holding up to 25 million eggs. The fry, or young fish, are held in incubators until they can be transferred to the rearing channels. Mature fish are spawned in a separate building, and hatchery staff members attempt to separate adult spring-run from adult fall-run. All Chinook salmon are killed during the artificial spawning process.

B.3.2.4 Raceways

Fingerling Chinook salmon are reared in a series of eight 600-foot-long, concrete-lined channels that can be blocked at intervals to provide 48 individual pools of 100 feet by 10 feet. Water flow and velocity in the raceways are a nominal 3–5 cfs and 0.1 foot per second, respectively. Steelhead fingerlings are raised in the two raceways that receive water from a nearby ultraviolet water treatment facility. A spawning channel with a gravel bottom is located directly south of the salmon raceways and is occasionally used as a temporary holding place for the fingerling salmon and steelhead. All raceways are covered with an overhead wire netting to protect the fish from predators such as hawks and herons.

B.3.2.5 Isolated Hatchery Facilities

In 1997, DWR expanded the fish hatchery with additional facilities behind (to the east of) the existing operation. The purpose of these facilities was to increase the number of fish that could be spawned and reared along with the need to have an isolated operation from the primary hatchery. Salmon reared in this facility would be used for the inland planting program planned for Lake Oroville. The expansion included an additional hatchery building for spawning and incubation; two 300-foot-long, concrete-lined channels for rearing the fingerlings; and an ultraviolet water treatment facility. All water used throughout the expanded facility is treated through the ultraviolet system and kept separate from the main hatchery operation. Because of ongoing disease problems, this expanded facility is currently not operating. The inland planting program is proceeding with Pacific Northwest coho salmon reared at the Thermalito Facility.

B.3.2.6 Thermalito Facility

The Thermalito Facility is located on the west side of Thermalito Afterbay and was built in 1988 for the California Salmon Stamp funded enhancement program. The facility consists of 2 rearing pond raceways and can raise 2.5 million fingerlings for planting in San Pablo Bay or for study purposes. Currently, the facility is used to raise salmon fry susceptible to the Sacramento River Chinook Disease (a coldwater virus) as well as coho salmon obtained from a farm in the Pacific Northwest. Chinook salmon reared for

this enhancement program are derived from gametes taken at the main hatchery and production is mixed with that from the main hatchery for release into San Pablo Bay. Water from a local groundwater well is used for rearing the fish in the raceways.

B.3.2.7 Fish Transport Vehicles

Three vehicles, one of 500-gallon capacity and two of 2,000-gallon capacity, are used to transport juvenile salmon and steelhead to planting locations in the Feather River, the Sacramento River, the San Francisco Bay/Delta area, and inland reservoirs, including Lake Oroville. The transport tanks are internally baffled to minimize physical damage to the juvenile salmon and are fully oxygenated. Ice and salt can be added to reduce transport stress.

B.3.3 Production Goals and Constraints

In 1983 DWR negotiated with DFG for the current production goals and constraints at the fish hatchery. Information from that agreement is provided in Table B.3-1.

Table B.3-1. Rearing and stocking goals and constraints.

Species	Egg Allotment	Type	Number	Average Size	Release Site	Release Dates
Spring Chinook	7,000,000	Smolts	5,000,000[1]	60/lb	San Pablo Bay	4/1 to 8/15
Fall Chinook	12,000,000	Smolts	6,000,000[1]	60/lb	San Pablo Bay or study release site in Delta	4/1 to 8/15
		Post Smolts	2,000,000[2]	30/lb	San Pablo Bay	4/1 to 8/15
		Fingerlings	Up to 1,000,000[3]	1,500/lb	Appropriate tributaries	Jan to Feb
Steelhead	1,000,000	Yearlings	400,000[1]	4/lb	Feather River at or below Gridley	Jan to Feb
		Yearlings	50,000[4]	4/lb	Feather River at or below Gridley	Jan to Feb

[1] *Mitigation—DWR*
[2] *Ocean Enhancement—Salmon Stamp—Fish and Game Code §7861*
[3] *Restoration*
[4] *Mitigation—four pumps (Delta Pumps Fish Protection Agreement)*
Source: DWR 1983

B.4 OROVILLE WILDLIFE AREA

This section provides a description of OWA along with its operational activities.

B.4.1 Introduction

OWA is an approximately 11,000-acre area located west of Oroville that is managed for wildlife habitat, recreational activities, and some limited gravel mining (Figure B.4-1). It includes approximately 6,000 acres of Thermalito Afterbay and surrounding lands along with a 5,000-acre preserve just east of the afterbay. The preserve straddles 12 miles of the Feather River, which includes willow- and cottonwood-lined ponds, islands, and channels.

As a result of several agreements negotiated with DWR, DFG manages OWA. The first significant management agreement occurred in 1968 when DWR transferred control and possession of property for the preserve. This agreement stated that DFG would be responsible for establishing, operating, and maintaining a public fish and wildlife management area and providing for recreation on that property. In addition, DFG became responsible for all costs associated with operation and maintenance. DWR did retain the right to use the property for construction, reconstruction, repair, operation, or maintenance of SWP facilities including, but not limited to, removal of materials and inundation. These use rights retained by DWR have resulted in numerous agreements over the years that included substantial gravel mining, which continues to the present day.

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 wildlife area and associated recreation. It should be noted that DWR did not transfer possession of the property but did transfer an easement to allow DFG access and management responsibilities. As with the first agreement in 1968, DWR retained the right to use the property for construction, reconstruction, repair, operation, or maintenance of SWP facilities. Again, DFG became responsible for all costs associated with operation and maintenance.

DFG maintains an operation and maintenance facility that is located on 10th Street just south of SR 162. This facility is described below.

B.4.2 Description of Facilities

B.4.2.1 DFG Administration

As mentioned above, the local DFG office is located on 10th Street just south of SR 162. The staff consists of 1 supervisor, 3 full-time permanent employees, and 1.5 partial-year

employees (9 months). Buildings at this location are an administration building with several offices; a large barn that stores heavy machinery and equipment (tractors, etc.) and includes a workshop; a hazardous materials storage building; and another large building with one side completely open for storing boats and other outdoor equipment.

The hazardous materials storage facility contains oil and gas products along with herbicides for controlling weeds within OWA.

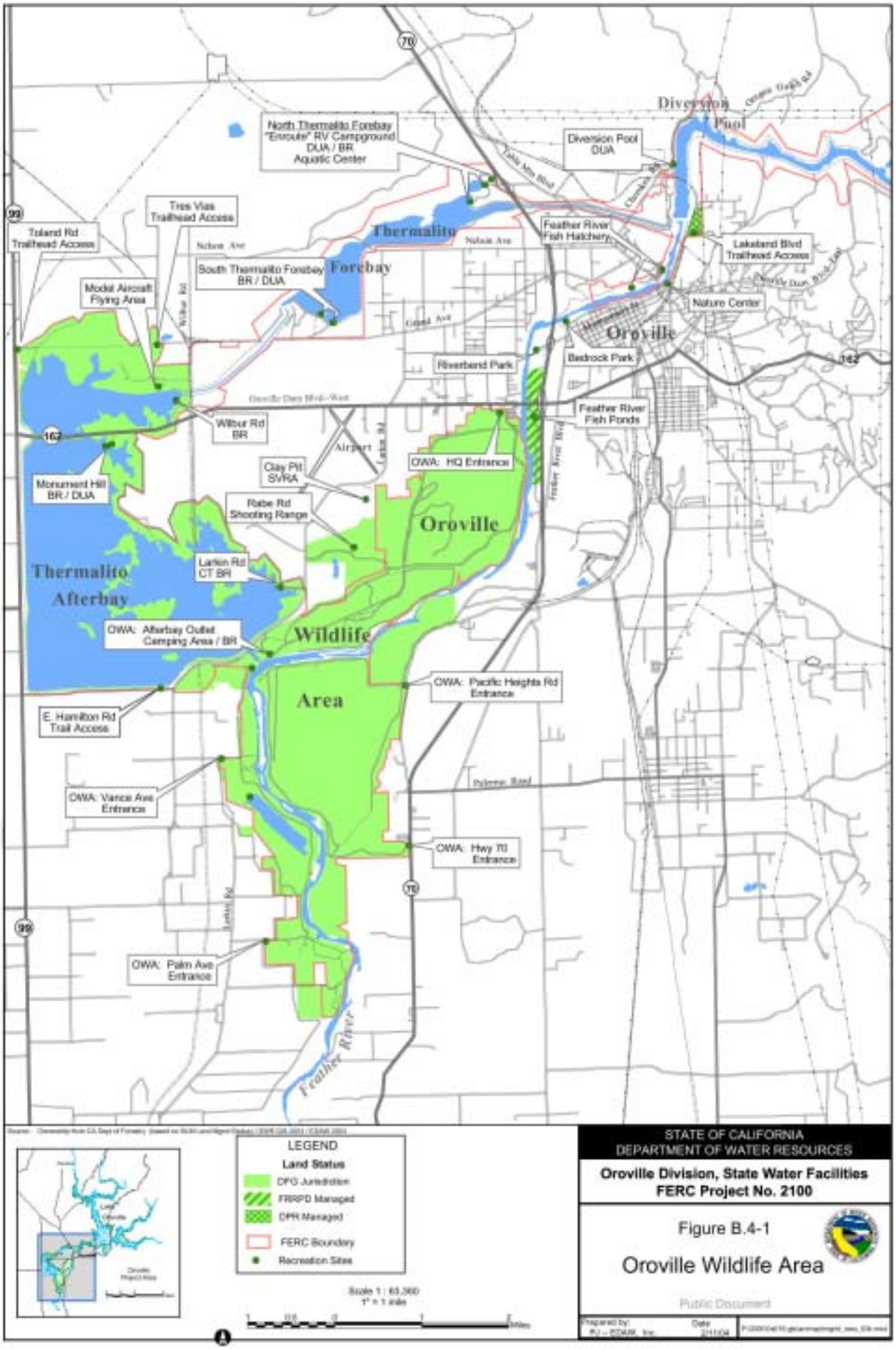
B.4.2.2 Land Area Description

There are a diverse number of vegetation communities and wildlife habitat types throughout OWA. The preserve location, which straddles the Feather River, was mined for gold during the Gold Rush years around 1849-50. As a result, significant dredging and hydraulic mining left the area with many medium to large ponds (dredger ponds) and mounds of gravel/cobble. Nature began to reclaim this area in the early to mid-1900s. In the early 1960s, the area was again mined heavily, this time for material to build Oroville Dam. Large amounts of clay, gravel, cobble, and boulders were taken from the area and deposited in the dam. Again, this resulted in significant changes to the topography and vegetation communities. Much of this area has been reestablished with vegetation communities and supports a large and diverse wildlife population.

Thermalito Afterbay is a reservoir that is an integral part of the operation of the Oroville Facilities. Water from this location is also used to irrigate farm crops within the surrounding countryside. Water from the afterbay is also pumped back into Lake Oroville during times of off-peak energy use. This activity results in a changing water level in the afterbay that affects the vegetation and wildlife communities.

Vegetation communities include the following:

- Grass and herb dominated communities:
  - Non-native grassland;
  - California annual grassland; and
  - Vernal pools;
- Meadows and seeps not dominated by grasses:
  - Sedges; and
  - Spikerushes;


North Thermalito Forebay "Enroute" RV Campground DUA / BR Aquatic Center
Diversion Pool DUA
Diversion Pool
Tres Vias Trailhead Access
Toland Rd Trailhead Access
Thermalito Forebay
Feather River Fish Hatchery
Lakeland Blvd Trailhead Access
South Thermalito Forebay BR / DUA
Model Aircraft Flying Area
Nature Center
Oroville
Bedrock Park
Riverbend Park
Feather River Fish Ponds
Wilbur Rd BR
Airport
Clay Pit SVRA
OWA: HQ Entrance
Monument Hill BR / DUA
Rabe Rd Shooting Range
Oroville
Larkin Rd CT BR
Thermalito Afterbay
OWA: Afterbay Outlet Camping Area / BR
Wildlife
Area
OWA: Pacific Heights Rd Entrance
E. Hamilton Rd Trail Access
OWA: Vance Ave Entrance
OWA: Hwy 70 Entrance
OWA: Palm Ave Entrance
Feather River
LEGEND
Land Status
DFG Jurisdiction
FRRPD Managed
DPR Managed
FERC Boundary
Recreation Sites
Scale 1 : 63,360
1" = 1 mile
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Division, State Water Facilities
FERC Project No. 2100
Figure B.4-1
Oroville Wildlife Area
Public Document

- Bog and marsh:
  - Marsh;
  - Fresh–brackish water marsh;
  - Bulrush;
  - Bulrush–cattail wetland;
  - Cattail wetland; and
  - Duckweed wetland;
- Riparian and bottomland:
  - Riparian forest and woodland; and
  - Willow riparian forests and woodlands; and
- Broad leafed upland tree dominated:
  - Oak woodlands and forests; and
  - Eucalyptus.

B.4.2.3 Habitat Management Activity Areas

As noted above, DFG is responsible for operation and maintenance of OWA. The current staff is considerably reduced from several years ago and a significant amount of its activity is taken up with garbage collection throughout the area. However, several significant efforts have been undertaken to enhance the vegetation communities and wildlife habitat.

Brood Ponds

During the mid-1990s, DWR, DFG, and the California Waterfowl Association worked to establish five brood ponds for waterfowl within Thermalito Afterbay. Because of the changing water elevation, waterfowl broods were having a difficult time establishing nests and hatching offspring. It was decided to establish small, dammed areas in shallow-end bays throughout the afterbay. When the water of the afterbay started to drop or rise, the shoreline within the brood pond areas would remain more stable, thereby allowing brooding waterfowl adequate cover adjacent to aquatic habitat.. Ongoing maintenance activities include thinning/removal of vegetation to provide a variety of wetland successional stages and the construction/installation of wooden duck boxes. This habitat management activity has been very successful and resulted in significant numbers of waterfowl within the afterbay and adjacent lands.

B.4.2.4 Habitat Enhancement

DFG conducts habitat enhancement programs throughout the entire OWA. However, most of this activity consists of planting nesting and foraging vegetation cover for waterfowl, 100 percent of which is in and around Thermalito Afterbay.

B.4.2.5 Recreation Activity Areas

Thermalito Afterbay and the preserve are heavily used by the public for hunting, fishing, and recreation. These activities are described below.

Camping

Currently, there are two camping locations in OWA. There is an undeveloped camping area next to the Thermalito Afterbay outlet (in the southeast corner of the afterbay). This location includes a vault restroom, picnic tables, and trash receptacles. A dirt boat ramp in the northern campground provides access to the Feather River. One other unimproved campground is located on the northwest end of One Mile Pond (near the southern end of OWA).

Boating Facilities

Two improved boat ramps and one semi-improved boat ramp are provided for powerboat and watercraft access to Thermalito Afterbay. The improved boat ramps include Monument Hill (on the east side of the afterbay) and Wilbur Road just off SR 162 in the northeast corner of the afterbay. The Larkin Road location is a semi-improved boat ramp in the southeast section of the afterbay. There is also a semi-improved boat ramp that provides access to the Feather River adjacent to (north of) the Thermalito Afterbay outlet. The Monument Hill location also includes several improvements such as a paved parking lot, picnic tables, barbecue pits, a small swim beach, and flush toilets.

Boating and Water Skiing

The three improved boat ramps provide public access for recreational activities on the Thermalito Afterbay including boating and water skiing. A water ski slalom course was installed in the southeastern corner of the afterbay. The area is heavily used by water ski boats, pleasure and fishing boats, and personal watercraft (jet skis). Sailboarding is also a popular activity.

Picnicking

Facilities for picnicking activities are limited to those located at Monument Hill, on the east side of Thermalito Afterbay. The area includes several picnic tables with permanent barbecue facilities, a small swim beach, a paved boat ramp, parking facilities, and flush toilets.

Hunting

One of the primary activities at OWA involves bird and mammal hunting. There are approximately 150,000–200,000 user days per year at OWA related to both hunting and fishing. Rifles and pistols are not allowed for hunting in OWA. Table B.4-1 presents the primary animals that are hunted during the various hunting seasons throughout the year. In addition to the scheduled hunting seasons, DFG sponsors semiannual junior (children under 16) pheasant hunts with stocked birds.

Fishing

Some of the best fishing opportunities in the state of California are available at OWA. Fish in the Feather River include anadromous species such as Chinook salmon, steelhead, shad, striped bass, and sturgeon. Thermalito Afterbay and dredger ponds throughout the area include bass, blue gill, catfish, and crappie. DFG stocked fish in the dredger ponds in years past but no longer continues that activity.

Table B.4-1. Hunting seasons for the primary animals hunted in OWA*.

Animal Species	Hunting Season
Deer by archery	From the third Saturday in August, extending for 23 consecutive days
Deer by shotgun	From the fourth Saturday in September, extending for 37 consecutive days.
Dove	September 1-15, and from the second Saturday in November, extending for an additional 45 days (November 9–December 23, 2002)
Quail	From the third Saturday in August, extending for 21 consecutive days (August 17–September 6, 2002) and from the third Saturday in October, extending through the last Sunday in January (October 19, 2002–January 26, 2003)
Duck	From the second Saturday in October through the third Sunday in January.
Goose	From the Saturday closet to November 2 through the last Sunday in January.
Pheasant	November 9–December 22.
Turkey—spring	From the last Saturday in March, extending for 37 consecutive days (by special permit only).

** Note that season dates vary from year to year.*
Source: DFG.

Bird Watching

OWA provides many opportunities for bird watching and has been designated as a "significant bird area" by the National Audubon Society. OWA receives significant use for nature study by local educational groups including local schools and colleges.

Shooting Range

DFG maintains a shooting range in the old clay pit just south of the Oroville airport. This area includes some improvements such as a parking lot, picnic tables, trash receptacles, and dirt mounds for backdrops of the targets. DFG routinely removes trash and contracts to remove spent ammunition from the area. The current license identifies a lease to Butte College for administration of a shooting range near the model airplane club (at the northeast corner of the afterbay).

Model Airplane Course

A gated facility maintained by DWR is located in the northeast corner of Thermalito Afterbay. There is a small shed and the facility is used by a model airplane club. Other facilities include shade armadas, restrooms, paved runway, fencing, and picnic tables.

B.4.2.6 Gravel Mining

DWR, in cooperation with DFG, maintains several contracts with local companies for the mining and use of gravel within the preserve portion (southern half) of OWA. These areas are all located within the floodplain of the Feather River and provide significant gravel resources for projects throughout the surrounding area of the county. There are current contracts for gravel mining with the following companies:

- Granite Construction;
- Matthews Ready Mix;
- Joint Water Board; and
- City of Gridley and City of Biggs.

Additionally, on an intermittent basis DWR utilizes a gravel source operation located in the southwest corner of OWA, known as the Palm Avenue Gravel Pit.

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APPENDIX C

HISTORICAL HYDROLOGY

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APPENDIX C
HISTORICAL HYDROLOGY

C.1 OVERVIEW

Although the State Water Project (SWP) was built primarily for water supply, it is a multipurpose project whose benefits also include flood control, power generation, local recreation opportunities, and fish and wildlife enhancement. Additionally, the Oroville Facilities play a vital role in controlling salinity in the Sacramento–San Joaquin Delta (Delta). Figure C.1-1 illustrates the physical arrangement of the Oroville Facilities. The Oroville Facilities are a critical part of the SWP, providing much of the system's water collection and storage, flood control, and power production. The Oroville Facilities provide water supply to more than two-thirds of California's population and power production to meet operational demands of the SWP.

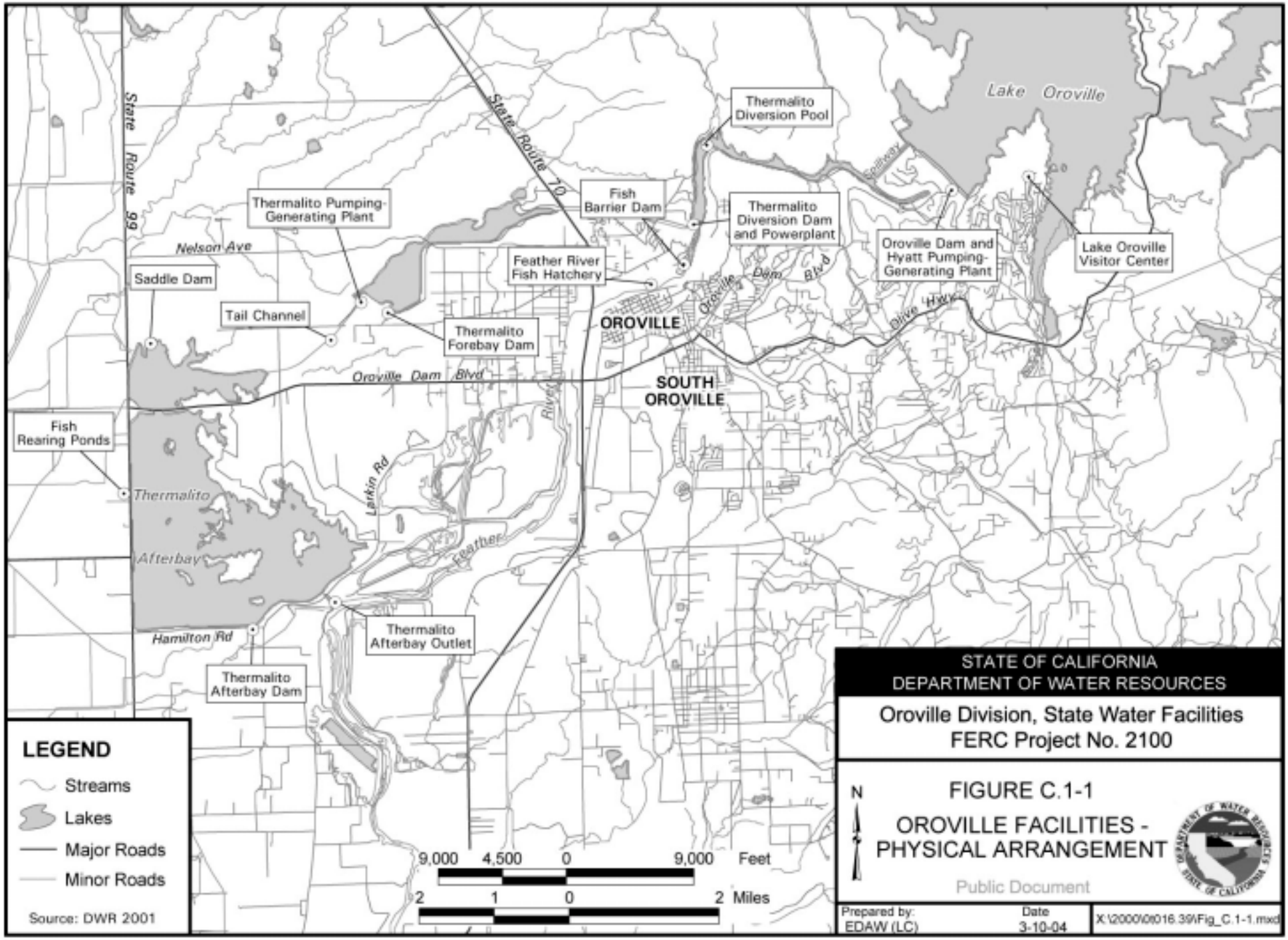
Evaluating the Oroville Facilities operation resulting from water management goals and limitations can be useful in identifying potential resource effects and investigating alternative resource actions for protection, mitigation, or enhancement. Two primary impact drivers that result from project operation are streamflow alteration and fluctuations in the surface level of Lake Oroville.

Streamflow in the Feather River is altered by regulation at the Lake Oroville impoundment and by diversions for hydropower. Streamflow in a river environment governs habitat parameters such as depth of flow, velocity, and habitat availability. Streamflow can also influence other environmental conditions, such as temperature, oxygen, channel morphology, and substrate particle sizes. Changes in streamflow can modify the distribution and availability of habitat, which can potentially have adverse consequences on resources. Over time these alterations can also affect channel shape and stability. Evaluation of streamflow data can be useful in understanding potential resource effects related to operation of the Oroville Facilities.

In addition to streamflow data, information describing the stage of Lake Oroville can be used to help identify and quantify potential effects on resources influenced by fluctuations in the reservoir level. Both the range of and fluctuations in Lake Oroville surface elevations are important to consider. An operational summary of the Oroville Facilities, including general information on resultant streamflow and reservoir levels, is provided in Section C.2 below. The purpose of this section is to present a description of the Oroville Facilities, its water management goals and limitations, and general streamflow and reservoir level data.

C.2 OROVILLE FACILITIES OPERATING SUMMARY

It is important to understand conditions that influence operation of the Oroville Facilities. Conditions placed on the project guide operations and limit operational flexibility.


Lake Oroville
Thermalito Diversion Pool
Spillway
State Route 70
State Route 99
Fish Barrier Dam
Thermalito Diversion Dam and Powerplant
Thermalito Pumping-Generating Plant
Nelson Ave
Feather River Fish Hatchery
Oroville Dam and Hyatt Pumping-Generating Plant
Lake Oroville Visitor Center
Saddle Dam
Oroville Dam Blvd
Tail Channel
Thermalito Forebay Dam
OROVILLE
Olive Hwy
Oroville Dam Blvd
SOUTH OROVILLE
Fish Rearing Ponds
Larkin Rd
Thermalito Afterbay
Feather River
Hamilton Rd
Thermalito Afterbay Outlet
Thermalito Afterbay Dam
LEGEND
Streams
Lakes
Major Roads
Minor Roads
Source: DWR 2001
9,000 4,500 0 9,000 Feet
2 1 0 2 Miles
N
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Division, State Water Facilities
FERC Project No. 2100
FIGURE C.1-1
OROVILLE FACILITIES - PHYSICAL ARRANGEMENT
Public Document
Prepared by: EDAW (LC)
Date 3-10-04
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Conditions can include physical restrictions such as diversion and storage capacity. Figure C.2-1 provides a schematic arrangement of the Oroville Facilities that describes physical project features. Conditions also include limitations resulting from external conditions, such as the requirement to meet downstream Delta water quality standards.

The Oroville Facilities, in coordination with the Central Valley Project (CVP), have a great influence on Delta water quality and critical habitat for the winter-run Chinook salmon, spring-run salmon and Delta smelt. Release from storage and diversions to meet water supply demands from the Oroville Facilities and the CVP are subject to requirements to maintain flow and water quality (salinity) standards and protect sensitive habitat for fish species. Figure C.2-2 provides an illustration of the Delta.

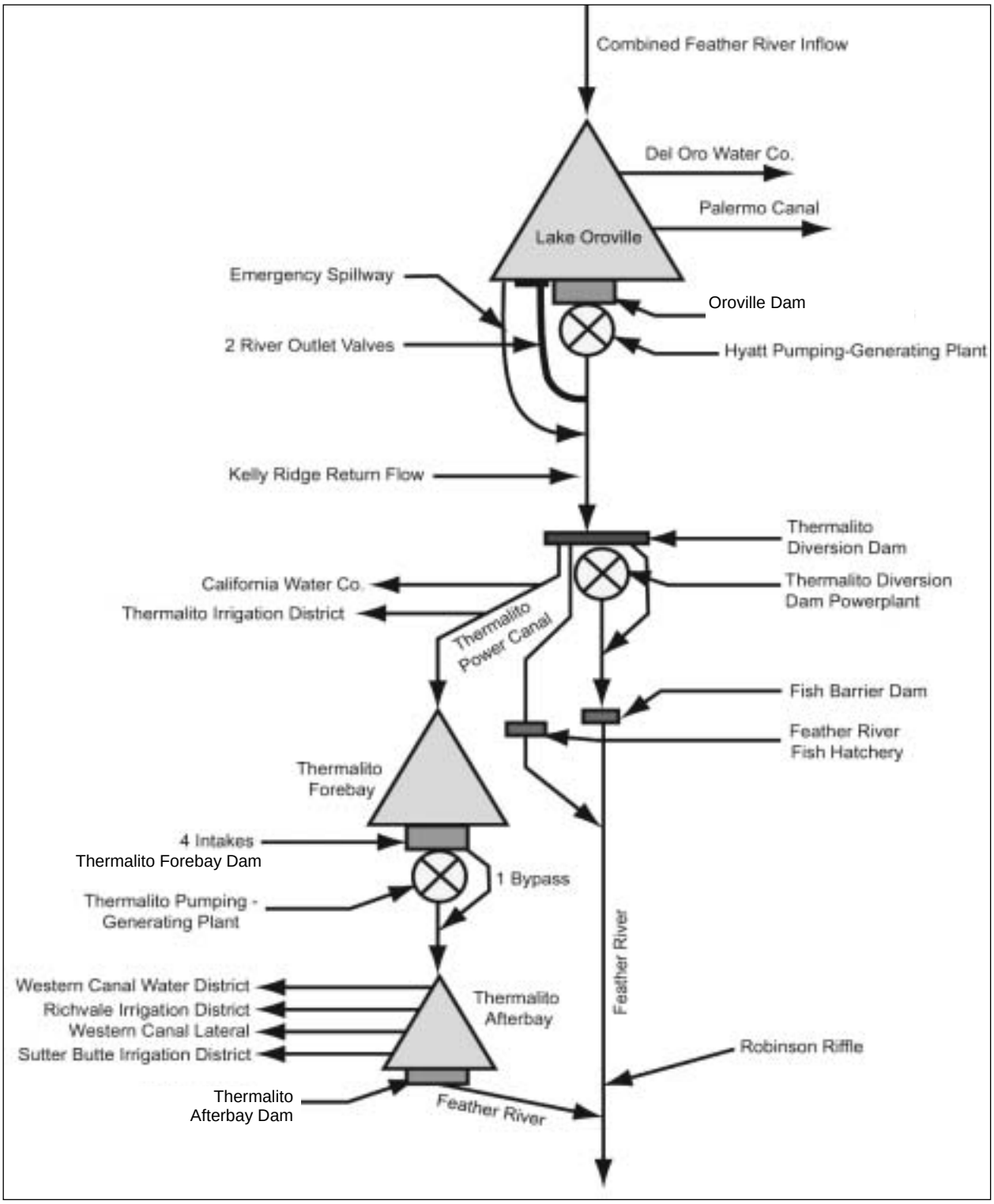
Operational considerations for the Oroville Facilities are listed and a general description of streamflow and reservoir level variations is provided in the sections below.

C.2.1 Lake Oroville (3.5 Million Acre-Feet Capacity)

C.2.1.1 Seasonal Changes

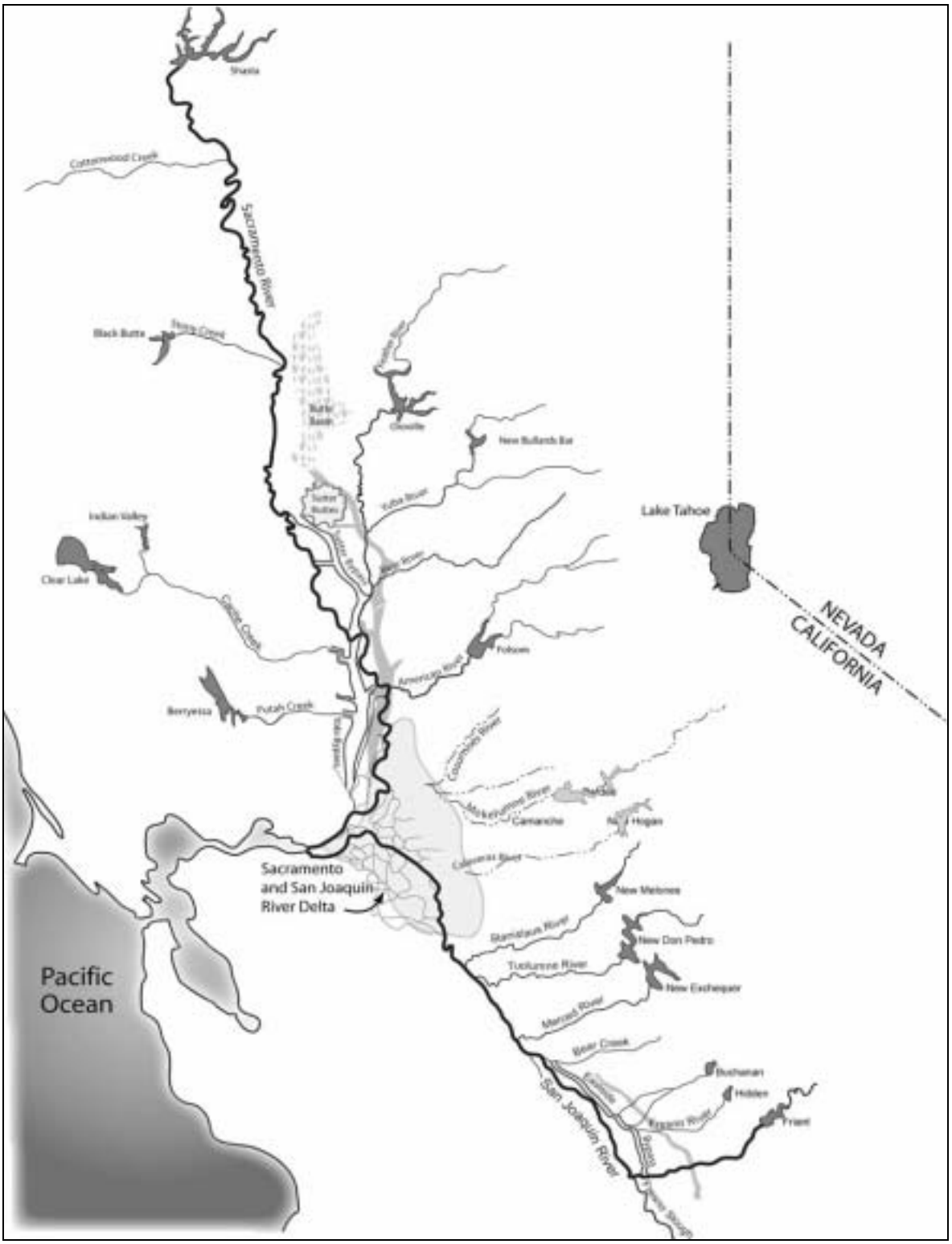
Lake Oroville's changes in storage (and surface level) are most apparent on a seasonal basis:

- During normal and wet hydrologic years, Lake Oroville typically reaches its maximum level in June (and typically fills to or near capacity).
- During dry hydrologic years, Lake Oroville reaches its maximum level as early as March, and does not fill.
- During critical (i.e., critically dry) years like 1977, Lake Oroville storage may progressively diminish without any substantial net increase over the year.
- Lake Oroville storage typically reaches its minimum level in the September–January period, primarily as a function of fall precipitation. Drier-than-normal fall seasons tend to result in a later minimum storage.
- During March–June, Lake Oroville normally receives the majority of its annual inflow from snowmelt, although its storage capacity can respond quickly to rain and/or rain or snow events, as can be observed in Figure C.2-3 during January of water year (WY) 1995.
- Figure C.2-3 depicts seasonal elevation variations for Lake Oroville for 4 representative years in plotting mean daily flows. These include WY 1977 as the driest on record (21 percent of average), WY 2001 as more typical of dry conditions (43 percent of average), WY 1999 as average conditions (111 percent of average), and WY 1995 as extremely wet conditions (195 percent of average).



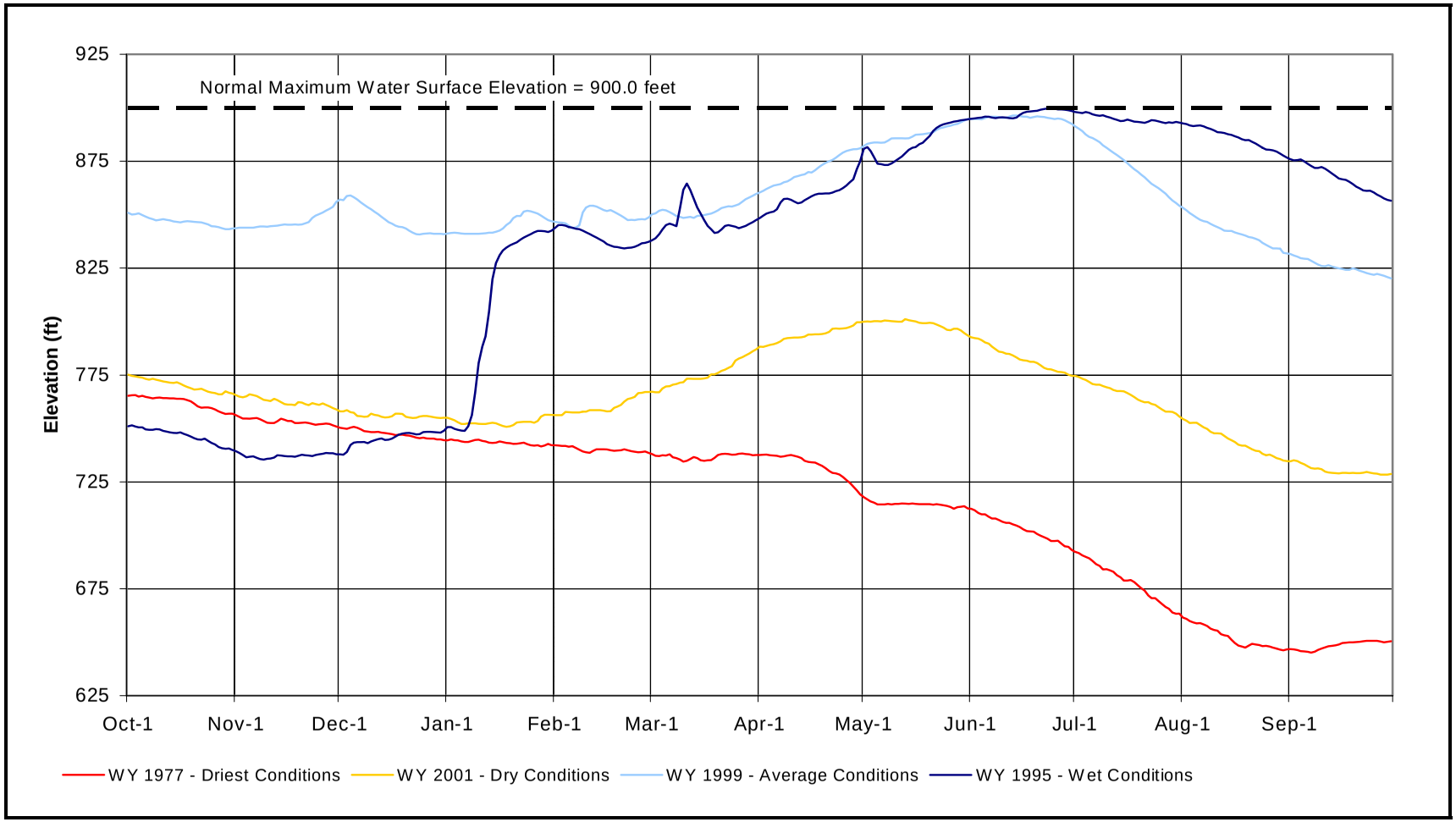
Source: DWR.

Figure C.2-1. Oroville Facilities flow operation diagram.



Source: DWR.

Figure C.2-2. Bay-Delta area map.



Source: DWR California Data Exchange Center.

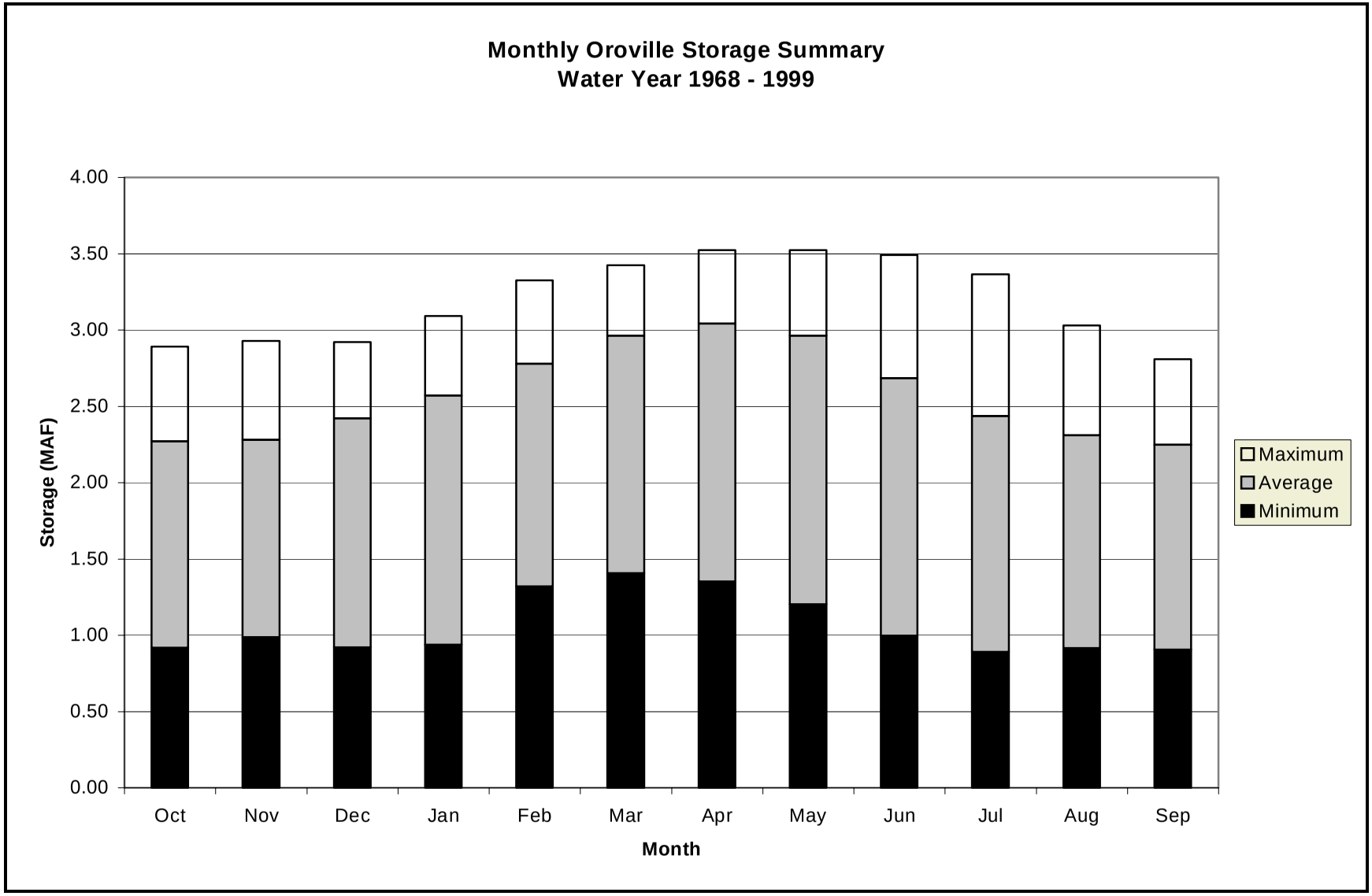
Figure C.2-3. Lake Oroville—daily elevations.

(Please note that WY 1977 includes actual data, and has not been adjusted for how post-1983 environmental controls may have influenced operations differently.)

- Flood control reservations of up to 750,000 acre-feet (af) in Lake Oroville storage apply and vary according to season (exclusive of summer) and according to a wetness index as computed from accumulated precipitation. These limits are also depicted in Figure C.2-3.
- Figure C.2-4 illustrates historical minimum, average, and maximum mean monthly storage in Lake Oroville during 1968–1999.

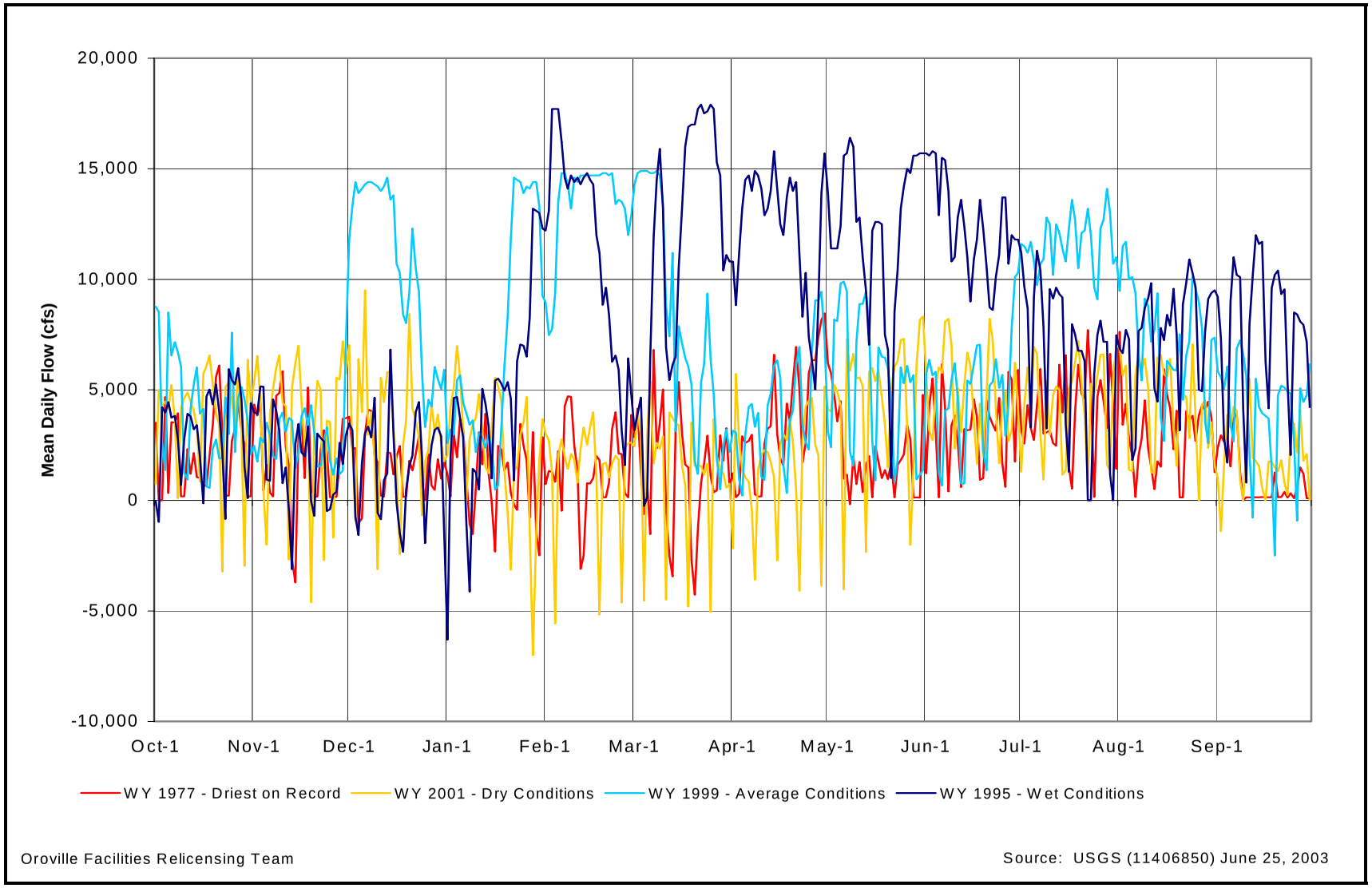
C.2.1.2 Weekly/Daily Changes and Hyatt Pumping-Generating Plant Operations

- Daily reductions in Lake Oroville elevation as a result of flood control operations can be as much as about 4 feet per day, as can be observed in Figure C.2-3 during March of WY 1995 (see the rapid rise followed by the rapid fall in reservoir level).
- Daily changes in Lake Oroville elevation as a result of operations at the Hyatt Pumping-Generating Plant are normally on the order of 6 inches per day. In practice during the most opportune power generation peaking conditions (July–September), reservoir elevation decreases up to about 2 feet per day.
- The 645-megawatt (MW) Hyatt Pumping-Generating Plant can discharge up to 16,950 cubic feet per second (cfs) when generating with all six units, and return up to 5,610 cfs when pumping with the three units capable of pump-back.
- Flows are normally scheduled on a daily and hourly basis to maximize generation during on-peak hours when power values are highest, subject to weekly operation plans for project releases from Thermalito Afterbay.
- Flow releases from Oroville require about 3–5 days travel time to convey through the Feather River and Sacramento River and into the Delta.
- Figure C.2-5 illustrates mean daily flows during both generation and pumping modes for WYs 1977, 2001, 1999, and 1995. These years are also represented individually in Figures C.2-6, C.2-7, C.2-8, and C.2-9, respectively.
- Pump-back normally occurs during off-peak hours of weekdays, and on weekends. The cycle of primarily generating on weekdays and pumping on weekends is particularly evident in Figure C.2-7.



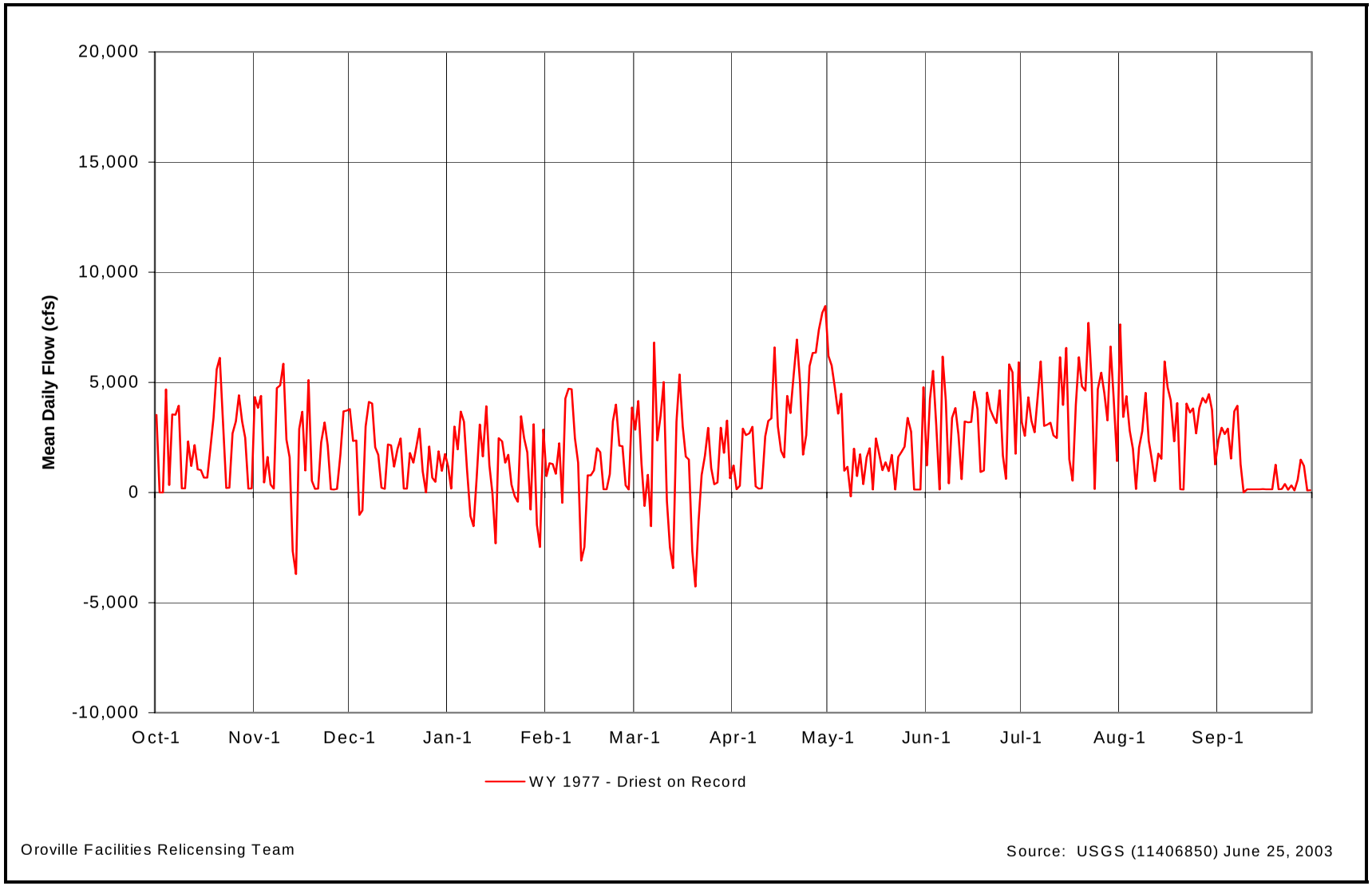
Source: DWR California Data Exchange Center.

Figure C.2-4. Monthly Oroville storage summary—historical minimum.



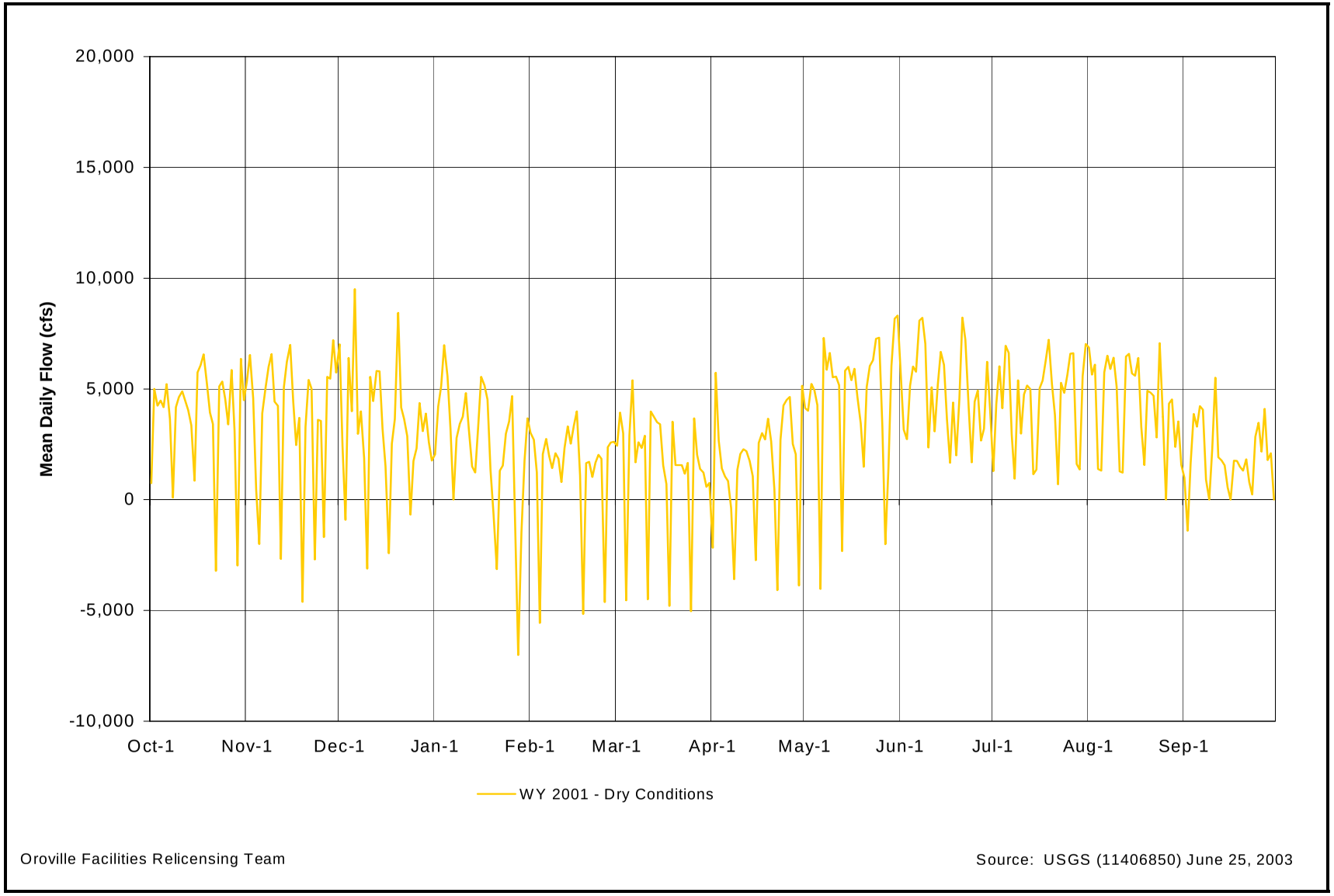
Source: U.S. Geological Survey.

Figure C.2-5. Hyatt Pumping-Generating Plant—mean daily flow.



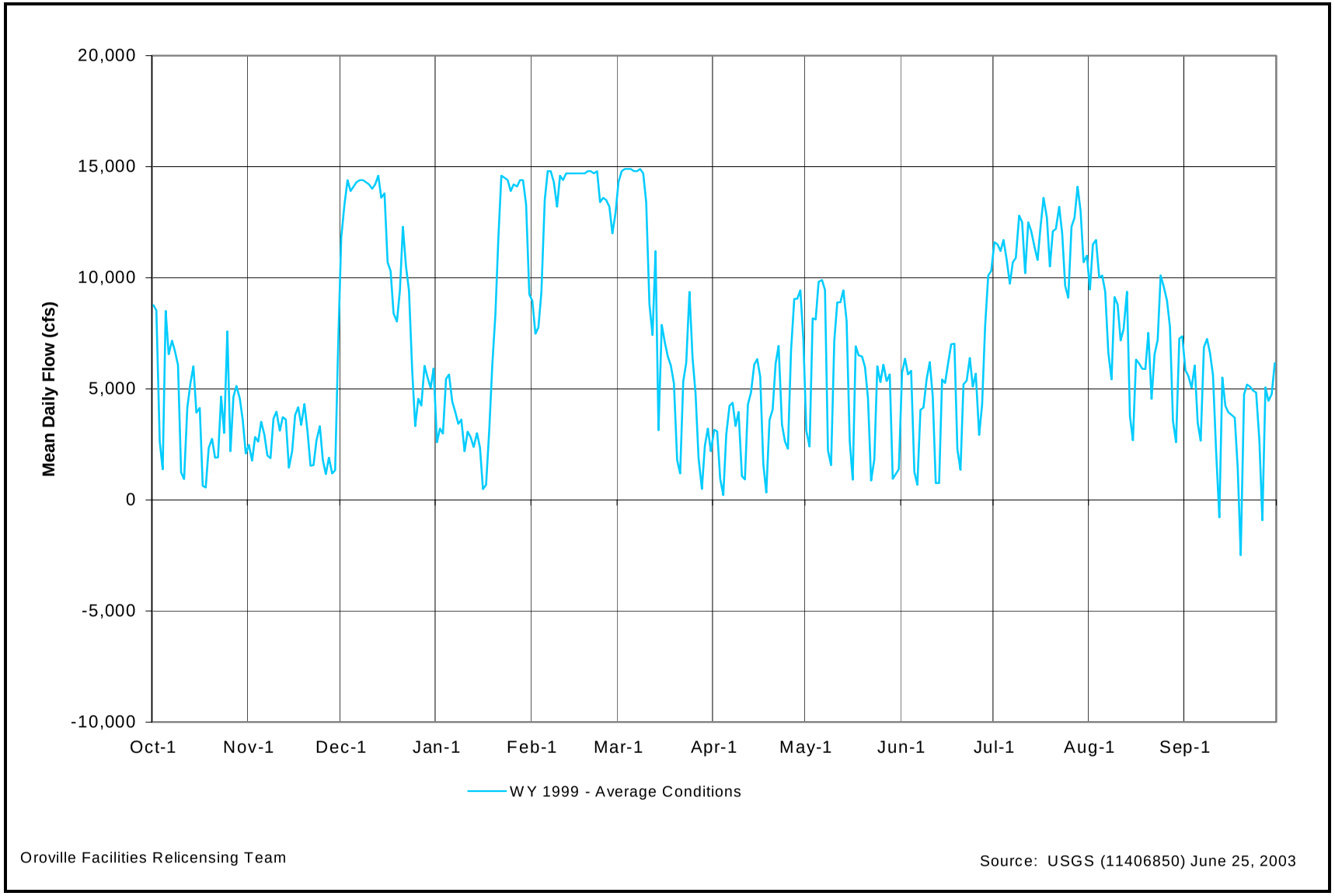
Source: U.S. Geological Survey.

Figure C.2-6. Hyatt Pumping-Generating Plant—mean daily flow, WY 1977 (driest on record).



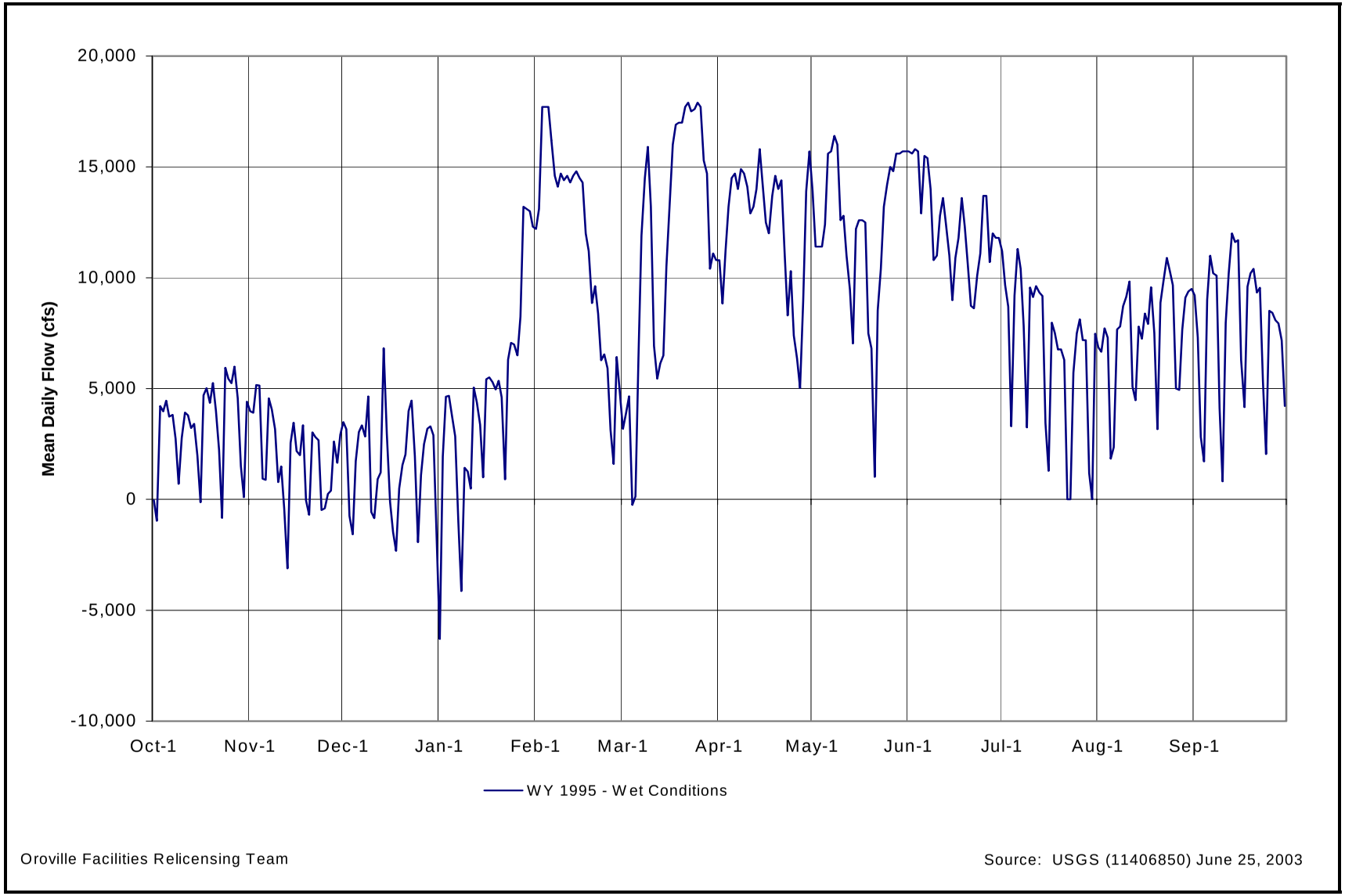
Source: U.S. Geological Survey.

Figure C.2-7. Hyatt Pumping-Generating Plant—mean daily flow, WY 2001 (dry conditions).



Source: U.S. Geological Survey.

Figure C.2-8. Hyatt Pumping-Generating Plant—mean daily flow, WY 1999 (average conditions).



Source: U.S. Geological Survey.

Figure C.2-9. Hyatt Pumping-Generating Plant—mean daily flow, WY 1995 (wet conditions).

C.2.1.3 Duration, Frequency, and Guidelines for Spill

- The historical peak flood release occurred in January 1997 with a spill of 160,000 cfs.
- Significant spills of record are summarized in Table C.2-1.

Table C.2-1. Lake Oroville—significant spill events.

Spill Begin Date	Spill Ending Date	Duration of Spill (Days)	Maximum Release (x 1,000 cfs)	Total Volume Over Spillway (x 1,000 af)	Maximum Inflow (x 1,000 cfs)
1/13/70	2/2/70	21	77	1,563	147
1/12/80	1/20/80	9	85	726	155
2/15/86	3/1/86	15	150	1,420	266
3/9/95	3/27/95	19	87	1,235	141
12/27/96	1/17/97	22	160	2,013	302

Note: Spill flows do not include maximum releases through the Hyatt Pumping–Generating Plant of up to 16,950 cfs.
Source: Memo from Maurice Roos, DWR, to Lori Brown, DWR, 7/18/03

- Spills from Lake Oroville are managed so as to not exceed maximum allowable flow rates in the Feather River (Table C.2-2) combined with other cumulative inflows.

Table C.2-2. Feather River—maximum flow rates for flood control.

Location	Maximum Allowable Flow
Below Lake Oroville	150,000 cfs
Above confluence with Yuba River	180,000 cfs
Below confluence with Yuba River	300,000 cfs
Below confluence with Bear River	320,000 cfs

Note: These maximum allowable flow rates are further avoided by Lake Oroville encroaching into the maximum allowable storage limits for flood control if needed.
Source: USACE 1970

C.2.1.4 Temperature Control

- Water temperature of releases from Lake Oroville can be regulated to meet water temperature objectives downstream as a result of the multilevel intake structures (see Section C.2.2.4, Flow Releases to Support the Feather River Fish Hatchery, below).

- Two multilevel intake structures serve the six Hyatt units, each consisting of sloping structures with 13 control shutters and ranging in elevation from about 650 to 900 feet. Intake 1 serves Units 1–3 and Intake 2 serves Units 4–6.
- The intake structures in Lake Oroville serve as diffusers of water pumped back from the Thermalito Diversion Pool.

C.2.2 Thermalito Diversion Pool (13,350 af Capacity)

C.2.2.1 Seasonal Changes

- The pool elevation developed by Thermalito Diversion Dam remains fairly constant throughout the year, and is most susceptible to change when Lake Oroville is spilling.
- The pool acts as an afterbay when the Hyatt Pumping-Generating Plant is generating, and as a forebay when it is pumping.
- The pool also acts as a forebay for water supply to the Feather River Fish Hatchery and Thermalito Diversion Dam Power Plant, discharging into the Feather River.
- Figure C.2-10 illustrates the end-of-month elevation of the Thermalito Diversion Pool.

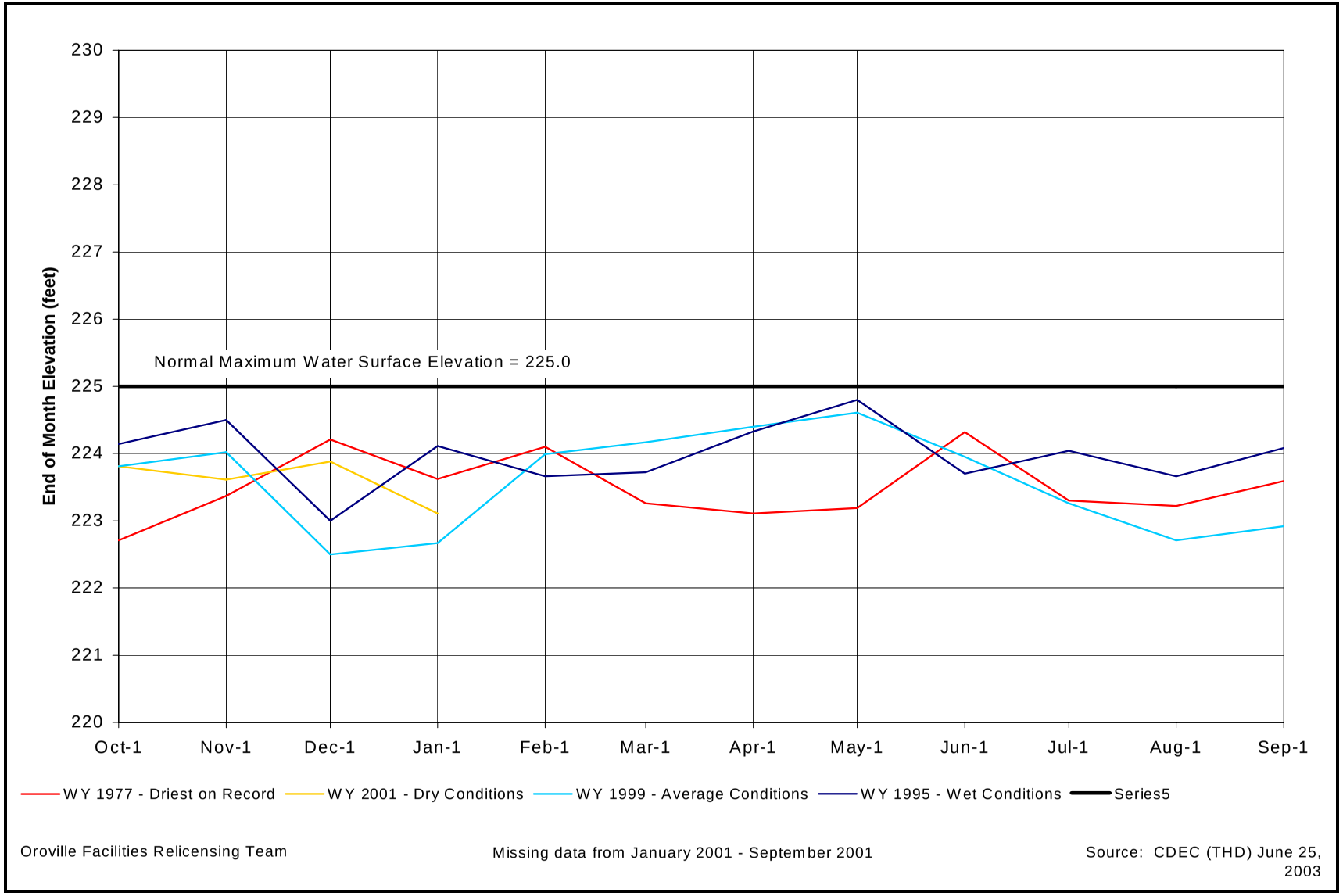
C.2.2.2 Weekly/Daily Changes

Changes in the elevation of the Thermalito Diversion Pool are minimal and normally vary within a range of 222.5 feet to 224.5 feet for a total of about 2 feet (not accounting for spill conditions).

C.2.2.3 Thermalito Diversion Dam Power Plant Operations

- Flow through the 3-MW Thermalito Diversion Dam Power Plant remains fairly constant throughout the year up to its capacity of 615 cfs in order to meet the minimum instream flow release requirement of 600 cfs at all times.
- The instream flow requirement is to maintain at all times a minimum of 600 cfs combined flow through the Thermalito Diversion Dam Power Plant, diversion dam outlet, and Feather River Fish Hatchery.

The requirement is a result of the 1983 agreement between the California Department of Water Resources (DWR) and California Department of Fish and Game (DFG), Agreement Concerning the Operation of the Oroville Division of the State Water Project for Management of Fish & Wildlife (1983 Agreement).



Source: DWR California Data Exchange Center.

Figure C.2-10. Thermalito Diversion Pool—end-of-month elevation.

C.2.2.4 Flow Releases to Support the Feather River Fish Hatchery

- Flows through the fish hatchery range from about 30 cfs to about 130 cfs depending on hatchery operations, considering factors such as operations supporting seasonal migrations, fish population (number of rearing ponds in use), and life stages of the fish.
- Figure C.2-11 illustrates mean daily flows diverted to the Feather River Fish Hatchery.
- The 1983 Agreement also specifies water temperature objectives that must be met within a deviation of plus or minus 4°F during April 1–November 30 (Table C.2-3).
- The water temperatures are facilitated by the use of a shutter controlled intake gate system in Lake Oroville that provides for withdrawing water of varying temperatures from different depths of the reservoir, blended with warmer water pumped back from Thermalito Afterbay.
- Operations of the Hyatt and Thermalito Pumping-Generating Plants for generation versus pumping modes can be influenced by these temperature objectives.

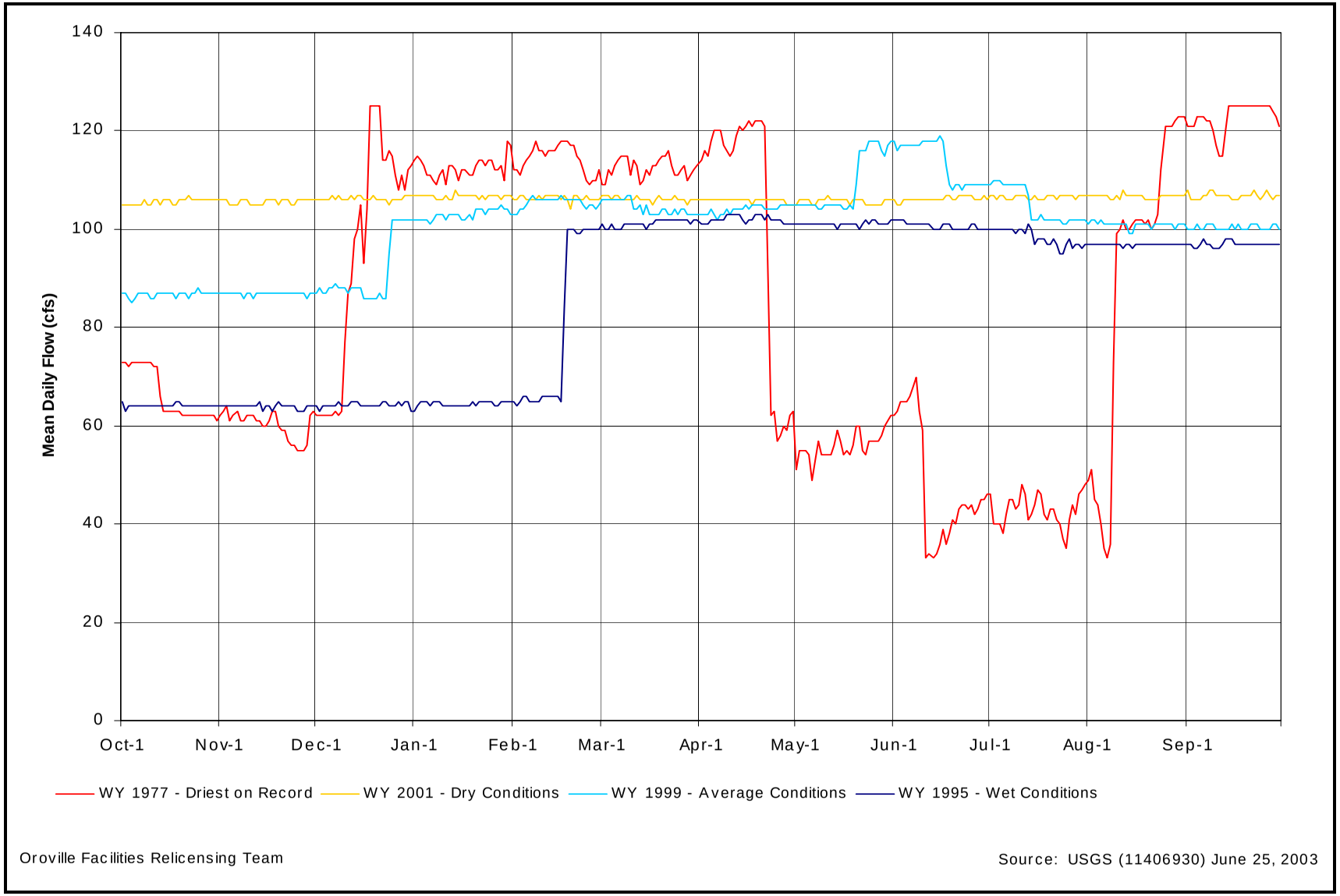
Table C.2-3. Feather River Fish Hatchery water temperature objectives.

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: DWR and DFG 1983

C.2.2.5 Effects on the Fish Barrier Dam and Fish Barrier Pool

Because of the relatively constant minimum flow release of 600 cfs from the Thermalito Diversion Dam Power Plant, water surface elevation in the Fish Barrier Pool remains fairly constant except during periods of spill from Lake Oroville.



Source: U.S. Geological Survey.

Figure C.2-11. Feather River Fish Hatchery—mean daily flow.

C.2.2.6 Frequency of Spill

The frequency, duration, and magnitude of spill from Thermalito Diversion Dam is generally consistent with spill events from Lake Oroville.

C.2.2.7 Temperature Control

- The Thermalito Diversion Pool serves as the primary location for monitoring the mixing of warmer and cooler waters for meeting the downstream temperature requirements at the Feather River Fish Hatchery and Robinson Riffle.
- During the course of generating and pump-back operations, warmer water can be introduced into the pool when pumping back through the Thermalito Pumping-Generating Plant, while cooler water can be introduced when generating through the Hyatt Pumping-Generating Plant.
- The need to meet temperature requirements can sometimes dictate the timing of pumping and generation operations at the Oroville Facilities.

C.2.3 Fish Barrier Dam (580 af Capacity)

Flow over the dam maintains fish habitat in the bypassed reach of the Feather River between the Feather River Fish Hatchery and the Thermalito Afterbay outlet.

C.2.4 Power Canal

- Flows through the Thermalito Power Canal can be in either a downstream direction into Thermalito Forebay or upstream to Thermalito Diversion Dam, subject to Hyatt Pumping-Generating Plant generation or pumping operations, respectively.
- Water level in the Thermalito Power Canal is generally consistent with the elevations of the Thermalito Diversion Pool and Thermalito Forebay, with elevation varying up to about 4–6 feet as a result of head loss and depending on flow conditions.
- The Thermalito Power Canal is concrete lined for about 80 percent of its length and unlined for about 20 percent at the transition to Thermalito Forebay.

C.2.5 Thermalito Forebay (11,770 +/- af Capacity)

C.2.5.1 Seasonal Changes

Generally, there are no seasonal patterns related to Thermalito Forebay storage or elevation, as the forebay does not have sufficient capacity.

C.2.5.2 Weekly/Daily Changes

- Figure C.2-12 illustrates daily variations in reservoir elevation.
- In general, Thermalito Forebay varies in elevation from 221 feet to 224.5 feet for a total of about 3.5 feet.
- Thermalito Forebay regulates the discharge from the Hyatt Pumping-Generating Plant (or Hyatt's withdrawal during pumping mode), influencing the pool elevation for the Thermalito Power Canal and Thermalito Diversion Pool.

C.2.5.3 Thermalito Pumping-Generating Plant Operations

- The 114-MW Thermalito Pumping-Generating Plant can discharge up to 17,400 cfs when generating with all four units, and return up to 9,120 cfs when pumping with the three units capable of pump-back.
- Flows are scheduled on a daily and hourly basis to maximize generation during weekday on-peak hours when power values are highest, subject to weekly operation plans for project releases from Thermalito Afterbay.
- Figure C.2-13 illustrates mean daily flows during both generation and pumping modes for WYs 1977, 2001, 1999, and 1995. These years are also represented individually in Figures C.2-14, C.2-15, C.2-16, and C.2-17, respectively.
- Pumping normally occurs during off-peak hours on weekdays, and on weekends. The cycle of primarily generating on weekdays and pumping on weekends is particularly evident in Figure C.2-15.

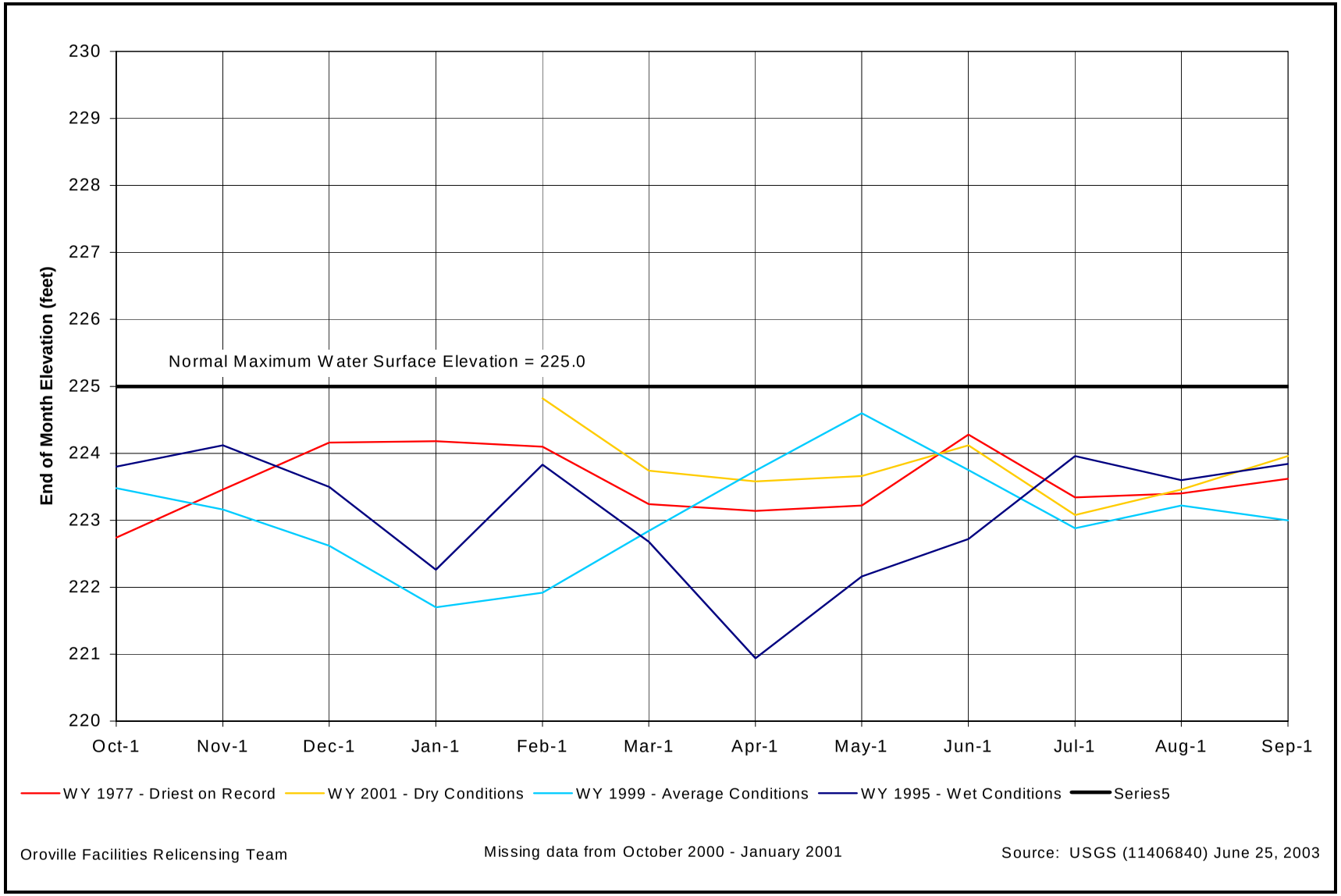
C.2.5.4 Frequency of Spill

Floodflows do not pass through Thermalito Forebay, and thus the forebay does not normally spill. Instead, floodflows pass through the low-flow channel over Thermalito Diversion Dam.

C.2.6 Thermalito Afterbay (57,040 af Capacity)

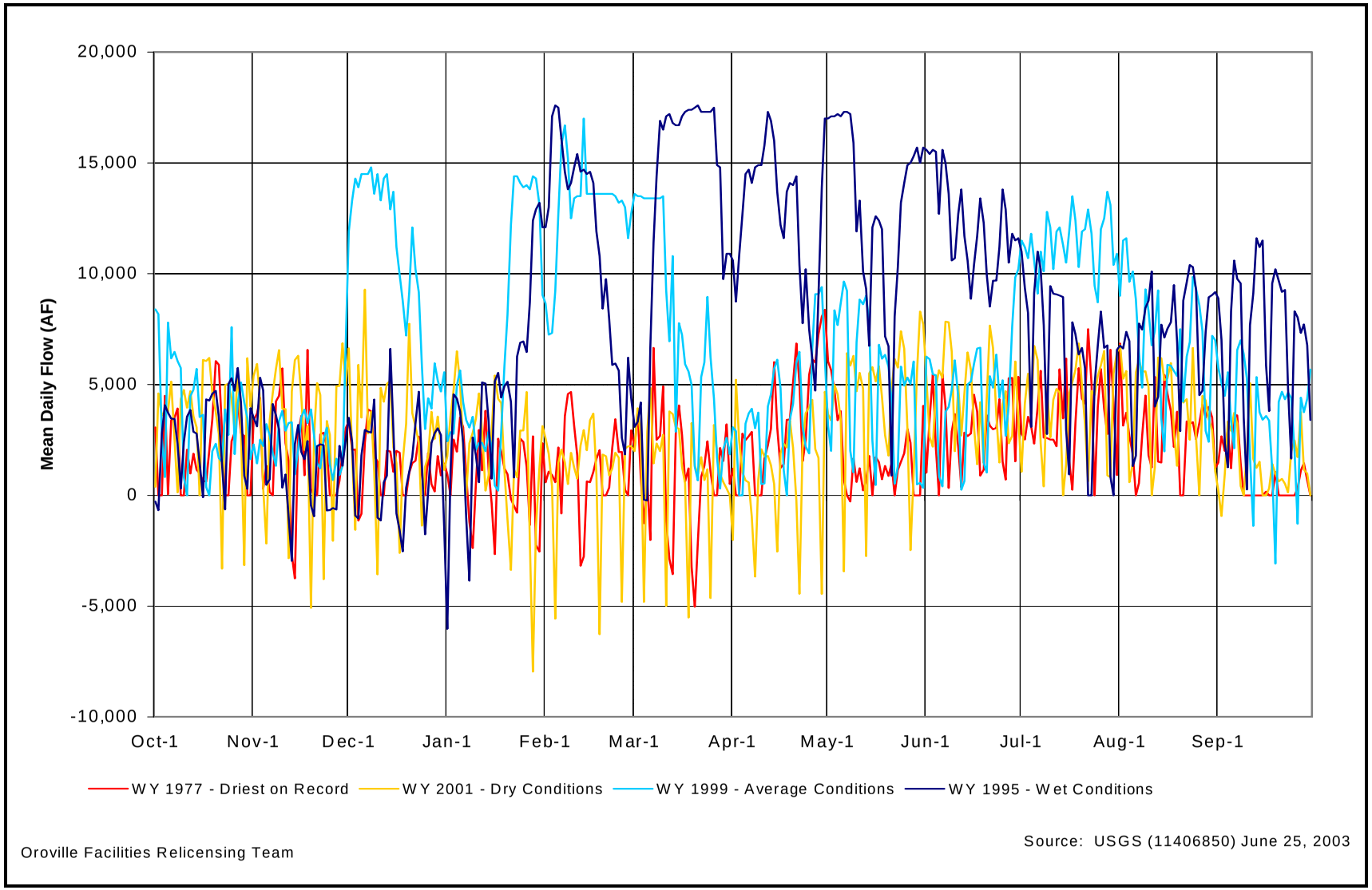
C.2.6.1 Seasonal Changes

- Generally, there are no seasonal patterns related to Thermalito Afterbay storage or elevation, as the afterbay does not have sufficient capacity.
- Thermalito Afterbay provides controlled flow to the Feather River to meet San Joaquin Bay Delta salinity standards.
- Thermalito Afterbay serves to deliver water to the Feather River Service Area (FRSA) contractors.



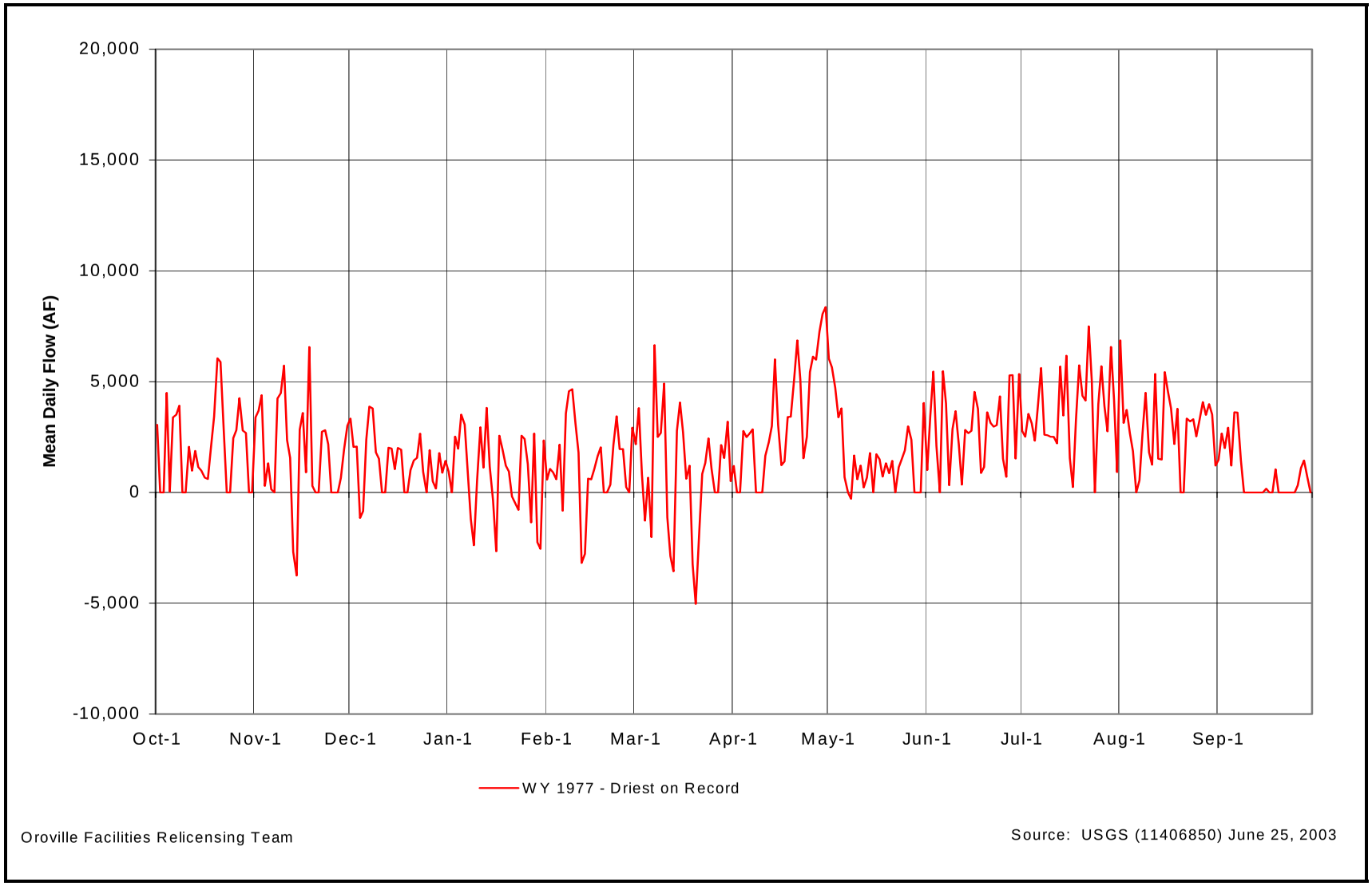
Source: U.S. Geological Survey.

Figure C.2-12. Thermalito Forebay—end-of-month elevation.



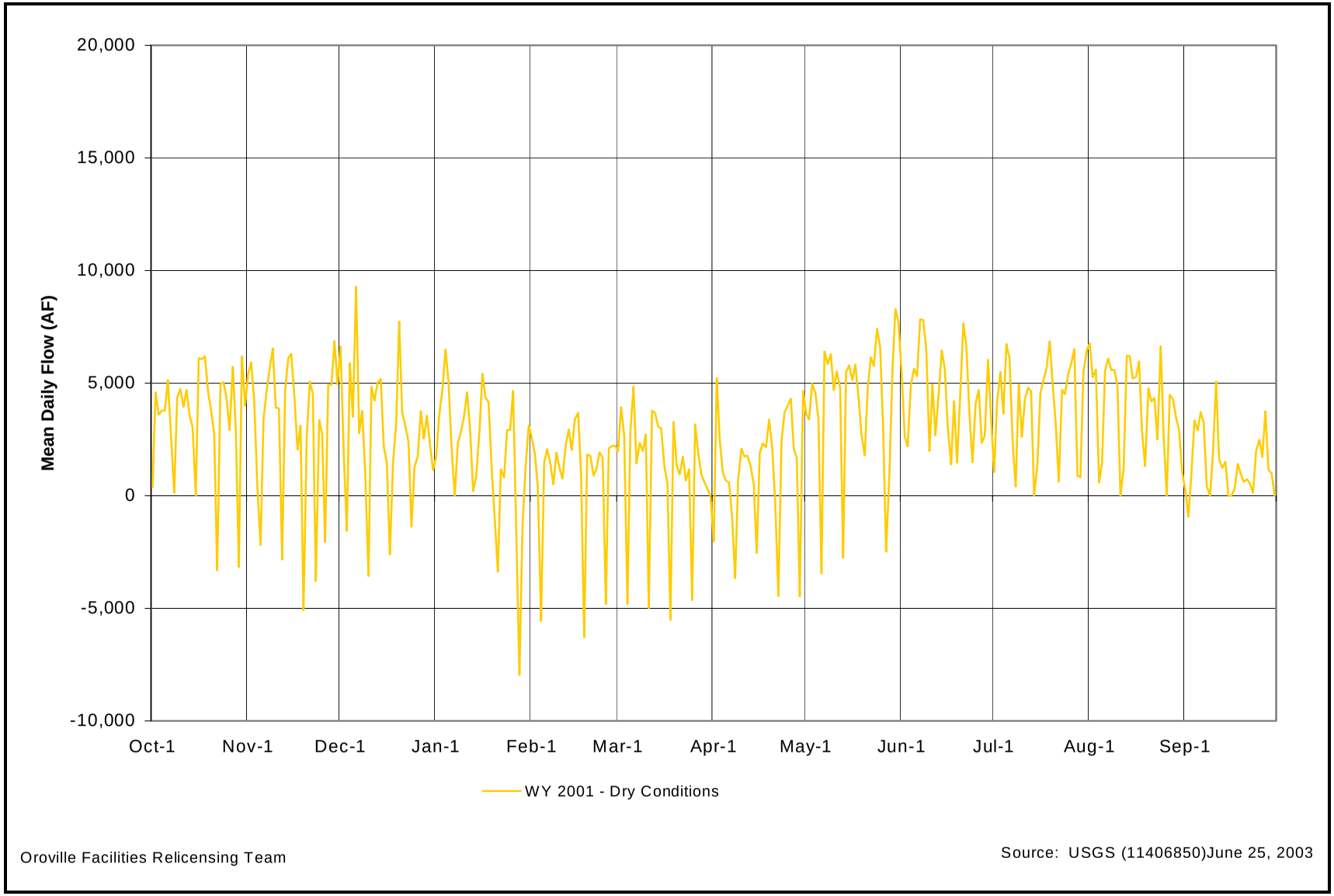
Source: U.S. Geological Survey.

Figure C.2-13. Thermalito Pumping-Generating Plant—mean daily flow.



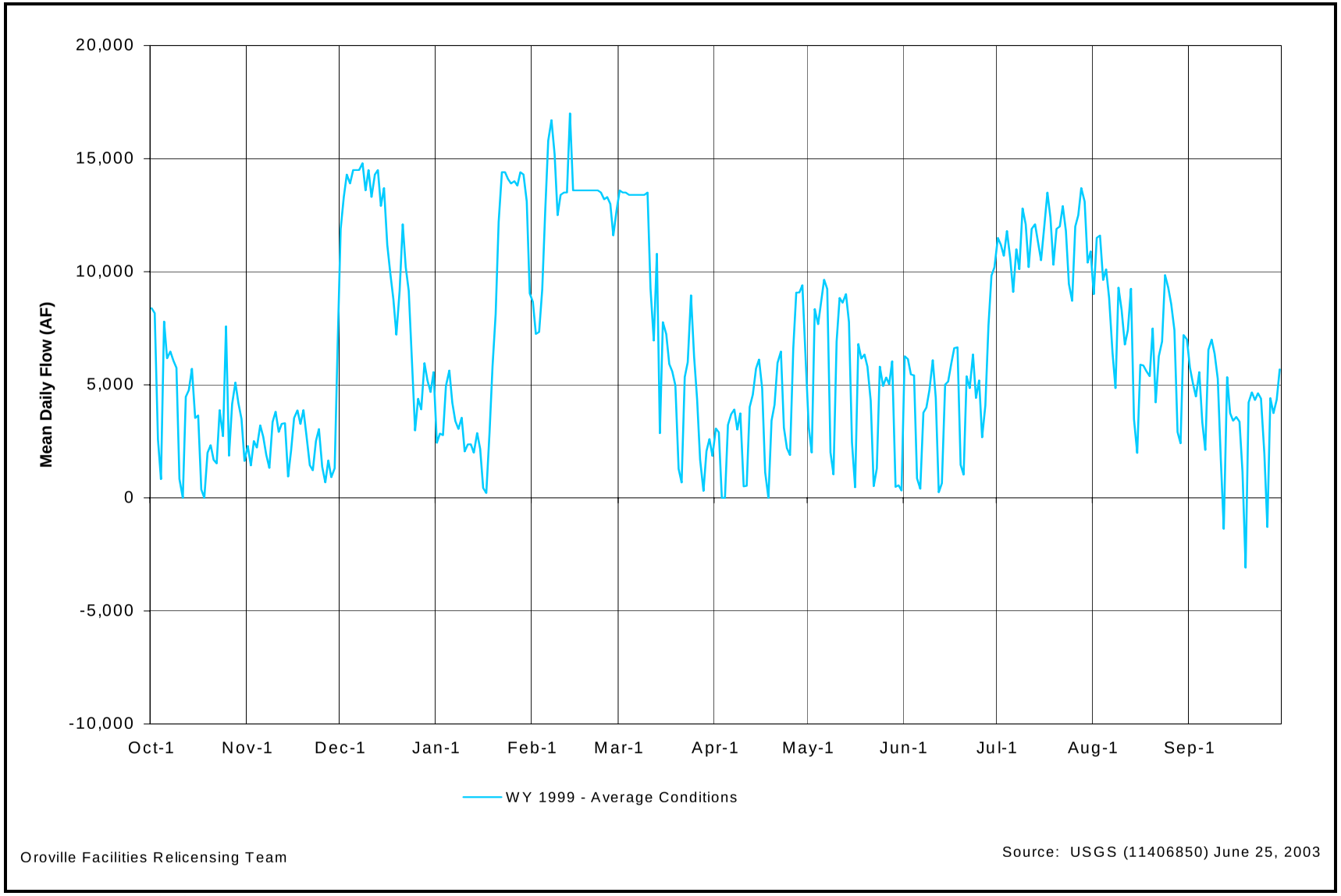
Source: U.S. Geological Survey.

Figure C.2-14. Thermalito Pumping-Generating Plant—mean daily flow, WY 1977 (driest on record).



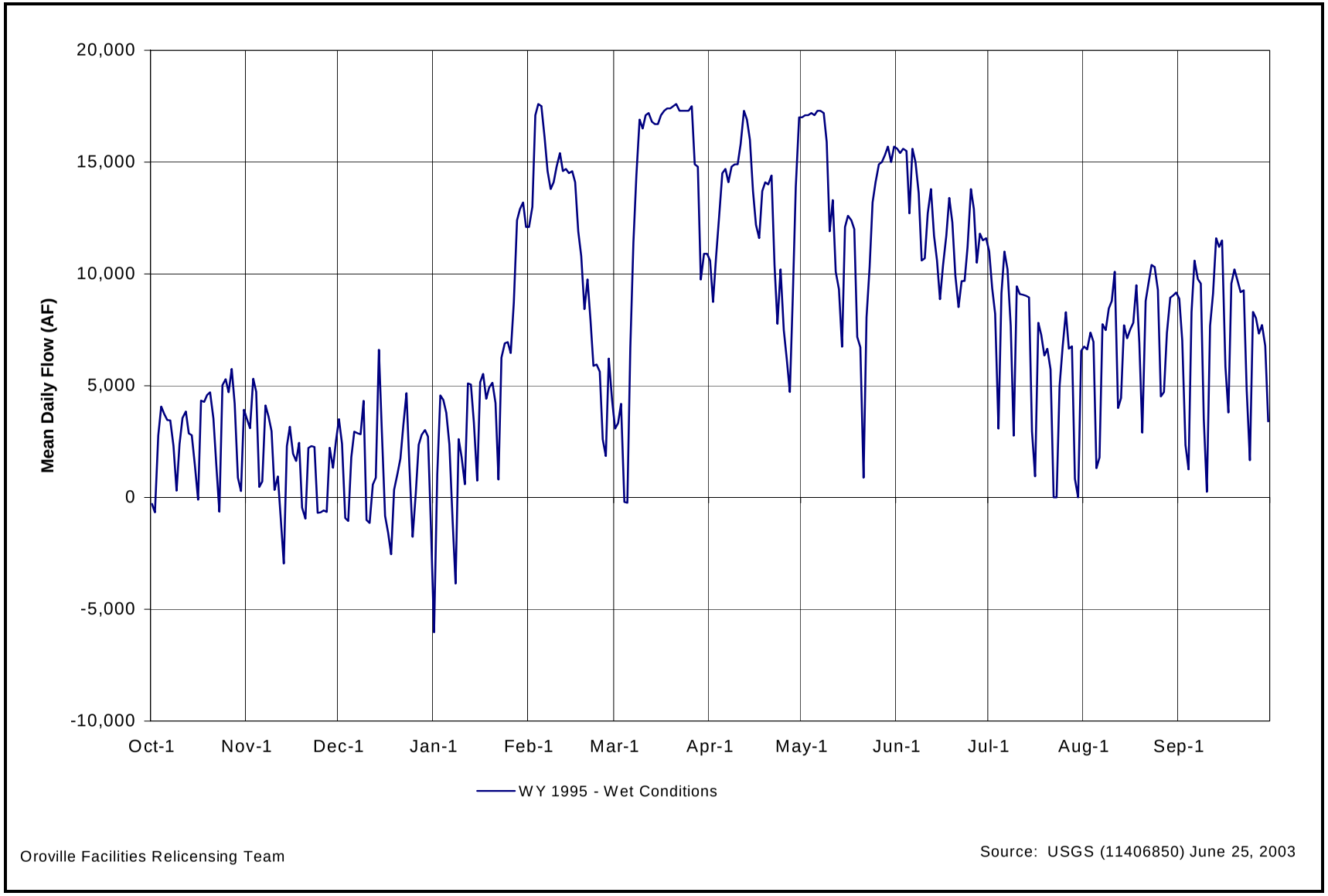
Source: U.S. Geological Survey.

Figure C.2-15. Thermalito Pumping-Generating Plant—mean daily flow, WY 2001 (dry conditions).



Source: U.S. Geological Survey.

Figure C.2-16. Thermalito Pumping-Generating Plant—mean daily flow, WY 1999 (average conditions).



Source: U.S. Geological Survey.

Figure C.2-17. Thermalito Pumping-Generating Plant—mean daily flow, WY 1995 (wet conditions).

C.2.6.2 Weekly/Daily Changes

- Figure C.2-18 illustrates daily variations in reservoir elevation for WYs 1977, 2001, 1999, and 1995. Figure C.2-19 shows the weekly pattern of Thermalito Afterbay's rise and fall during periods when peaking and/or pump-back operations are in effect, and during periods when they are not.
- Thermalito Afterbay regulates the inflow from Thermalito Pumping-Generating Plant (and withdrawal during its pumping mode), as well as the releases through the Thermalito Afterbay outlet to the Feather River.

C.2.6.3 Thermalito Afterbay Outlet Operations

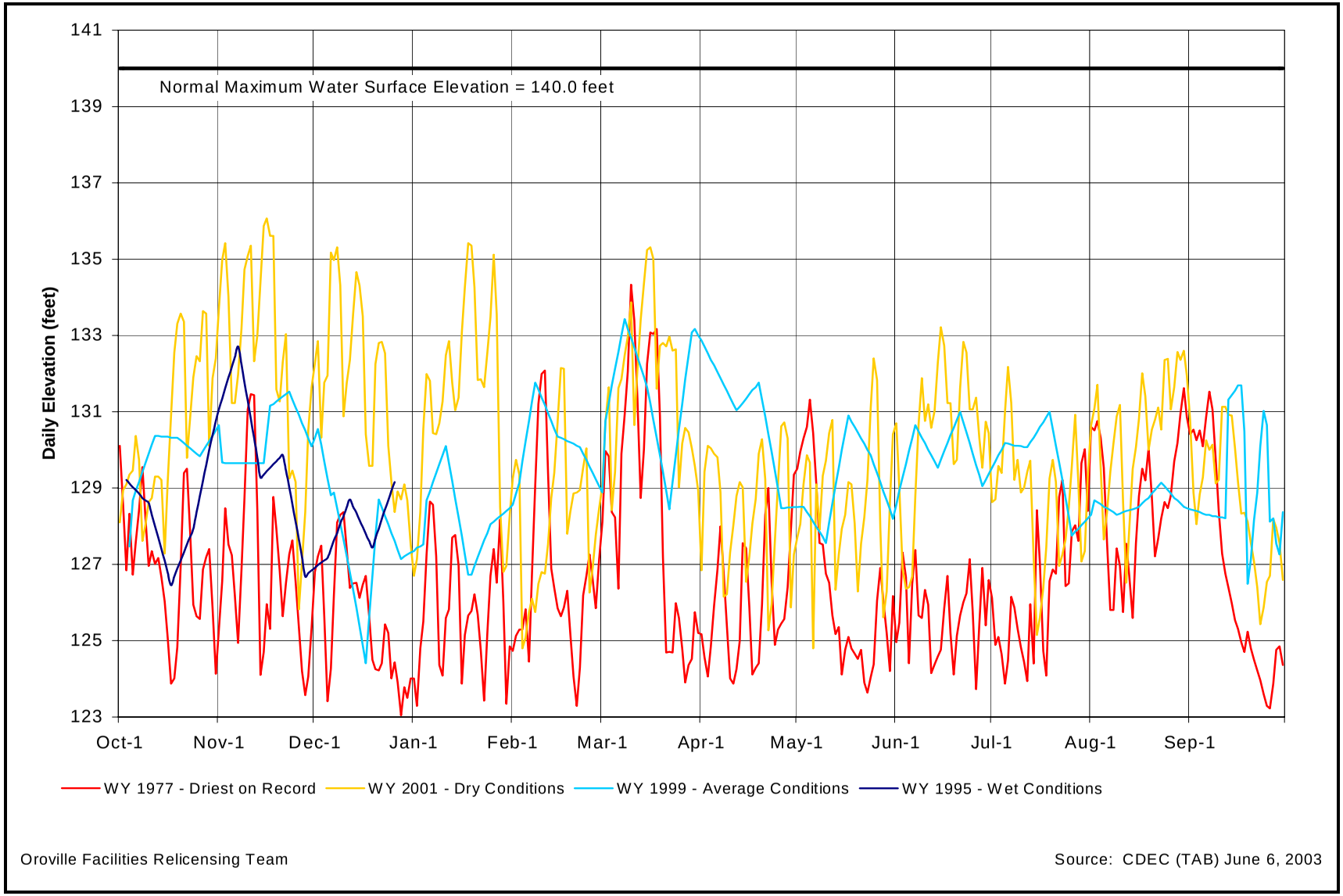
- The Thermalito Afterbay outlet is operated to meet minimum instream flow requirements and to meet demands for SWP delivery and Delta environmental protection. Minimum flow requirements representing the combined discharge from the Thermalito Afterbay outlet with flow released into the low-flow channel below the Thermalito Diversion Pool are summarized in Table C.2-4.

Table C.2-4. Combined minimum instream flow requirements in the Feather River below Thermalito Afterbay outlet.

Projected Lake Oroville Elevation (Current Water Year), and Water Conditions for April–July of Preceding Water Year	Period	Minimum Flows
Projected Lake Oroville Elevation: Greater than 733 feet *Water Conditions:* ≥ 55 percent of normal [1]	October–February	1,700 cfs
	March	1,700 cfs
	April–September	1,000 cfs
Projected Lake Oroville Elevation: Greater than 733 feet *Water Conditions are* < 55 percent of normal [1]	October–February	1,200 cfs
	March	1,000 cfs
	April–September	1,000 cfs
Projected Lake Oroville Elevation: Less than 733 feet [2]	October–February	900 cfs < Q < 1,200 cfs
	March	750 cfs < Q < 1,000 cfs
	April–September	750 cfs < Q < 1,000 cfs

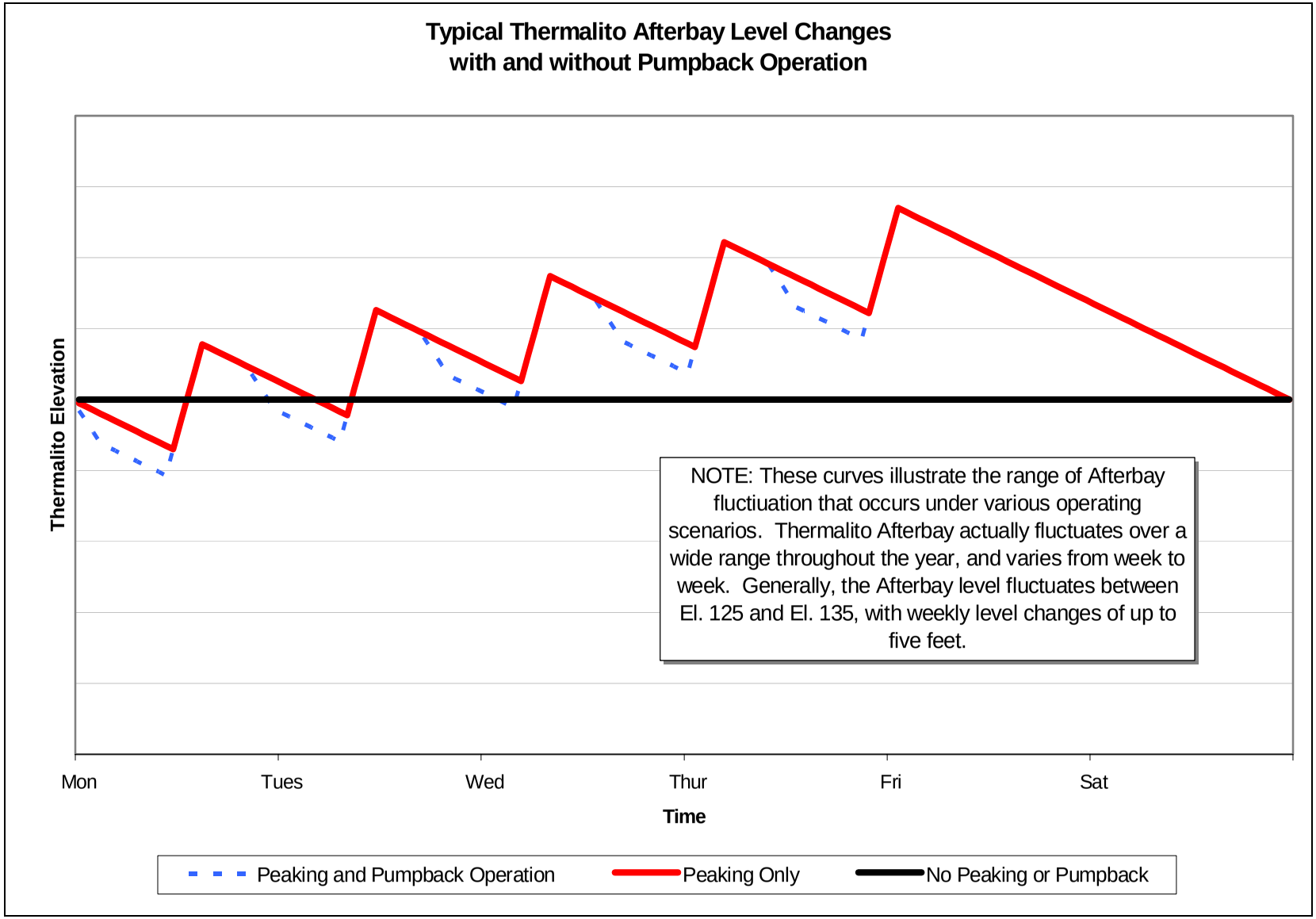
1. *Normal is defined as the mean April–July unimpaired runoff of the Feather River near Oroville of 1,942,000 af (1911–1960).*
2. *In accordance with the Federal Energy Regulatory Commission's (FERC) Order Amending License dated September 18, 1984, Article 53 was amended to provide a third tier of minimum flow requirements defined as follows: If the April 1 runoff forecast in a given water year indicates that, under normal operation of Project 2100, the reservoir level will be drawn to elevation 733 feet (approximately 1,500,000 af), releases for fish life in the above schedule may suffer monthly deficiencies in the same proportion as the respective monthly deficiencies imposed upon deliveries of water for agricultural use from the project. However, in no case shall the fish water releases in the above schedule be reduced by more than 25 percent.*

Source: DWR and DFG 1983



Source: DWR California Data Exchange Center.

Figure C.2-18. Thermalito Afterbay daily reservoir storage.



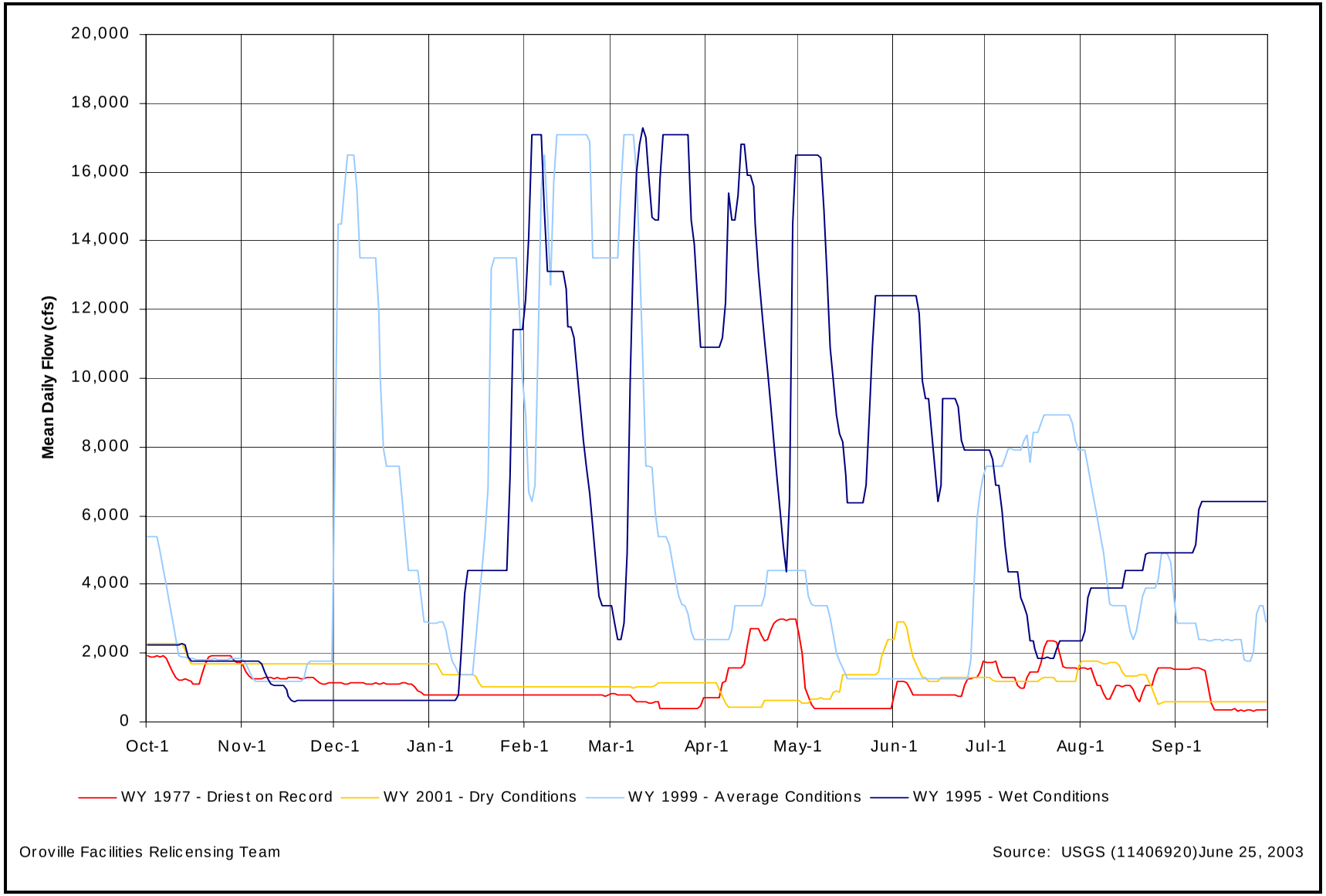
Source: SWRI 2004.

Figure C.2-19. Thermalito Afterbay daily level fluctuation.

- 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.
- Figure C.2-20 illustrates mean daily flow releases for the four WY types included in Figure C.2-4.
- To the extent practical, DWR does use its operational flexibility to accommodate FRSA contractors' temperature objectives by releasing water as close as possible to the maximum temperature allowed under the 1983 Agreement (i.e., 4º F higher than the objectives summarized for the Feather River Fish Hatchery, consistent with the allowable deviation).
- The 1983 Agreement specifies a narrative water temperature objective for fall-run salmon (after September 15) and from May through August for warmwater fish including shad and striped bass.
- In practice during October 15–November 30, flows are maintained below 2,500 cfs to prevent spawning in overbank areas of the Feather River downstream of the confluence with the Thermalito Afterbay outlet.
- If the hourly flow exceeds 2,500 cfs during this period, unless the high flow resulted from flood control releases or mechanical problems, then the flow less than 500 cfs must be maintained until the following March.
- Figure C.2-21 illustrates the combined mean daily flows delivered to the Western Canal and Richvale Irrigation Districts, Western Canal Lateral, and Sutter Butte Canal.
- Figure C.2-22 illustrates mean daily flows.

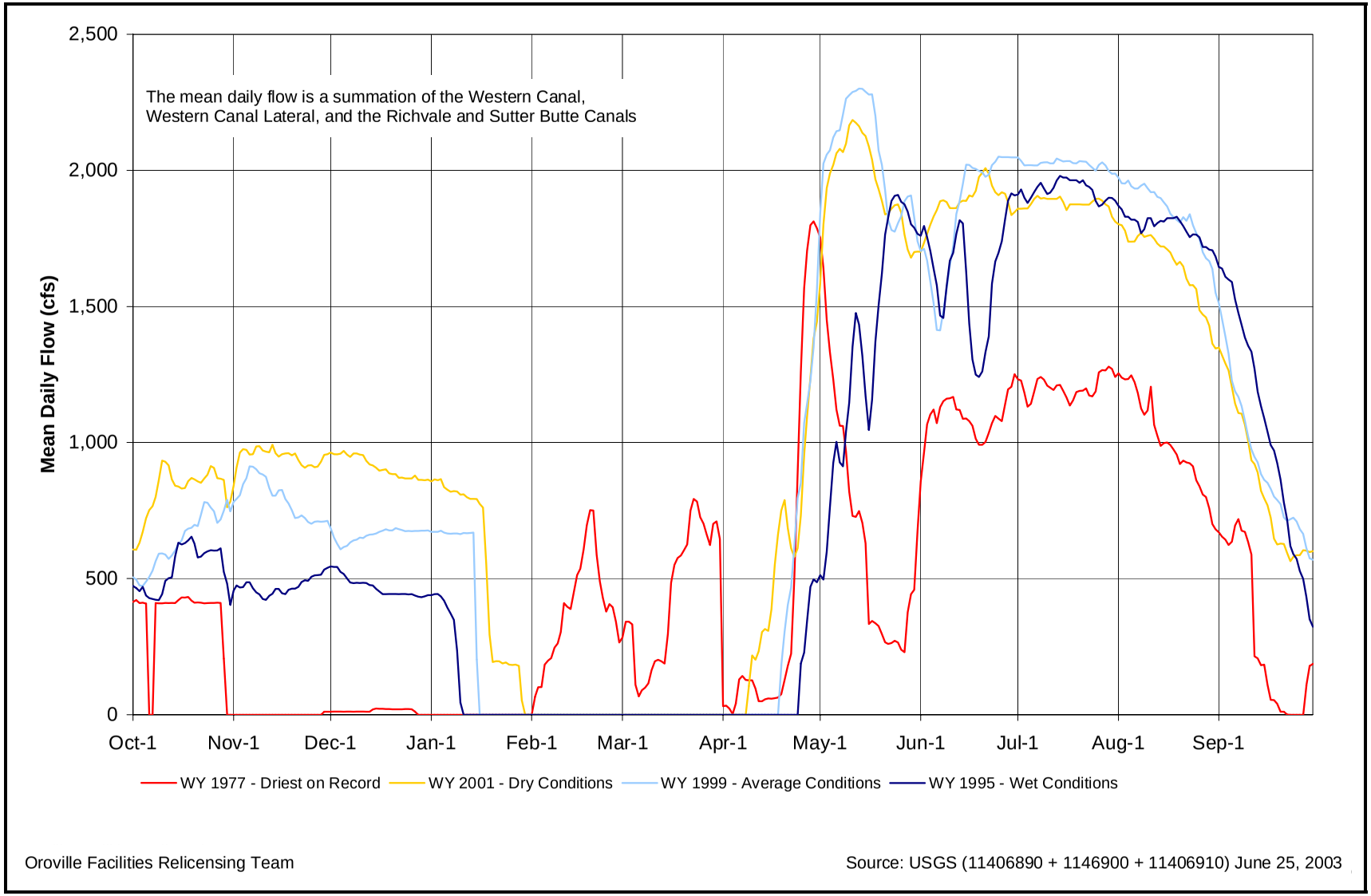
C.2.6.4 Frequency of Spill

- Floodflows do not pass through Thermalito Afterbay, and thus it does not normally spill. Instead, floodflows pass through the low-flow channel over Thermalito Diversion Dam spillway.
- Because there is no powerhouse for afterbay releases, discharges through the Thermalito Afterbay outlet are controlled from five radial gates, and are not distinguished as spill.



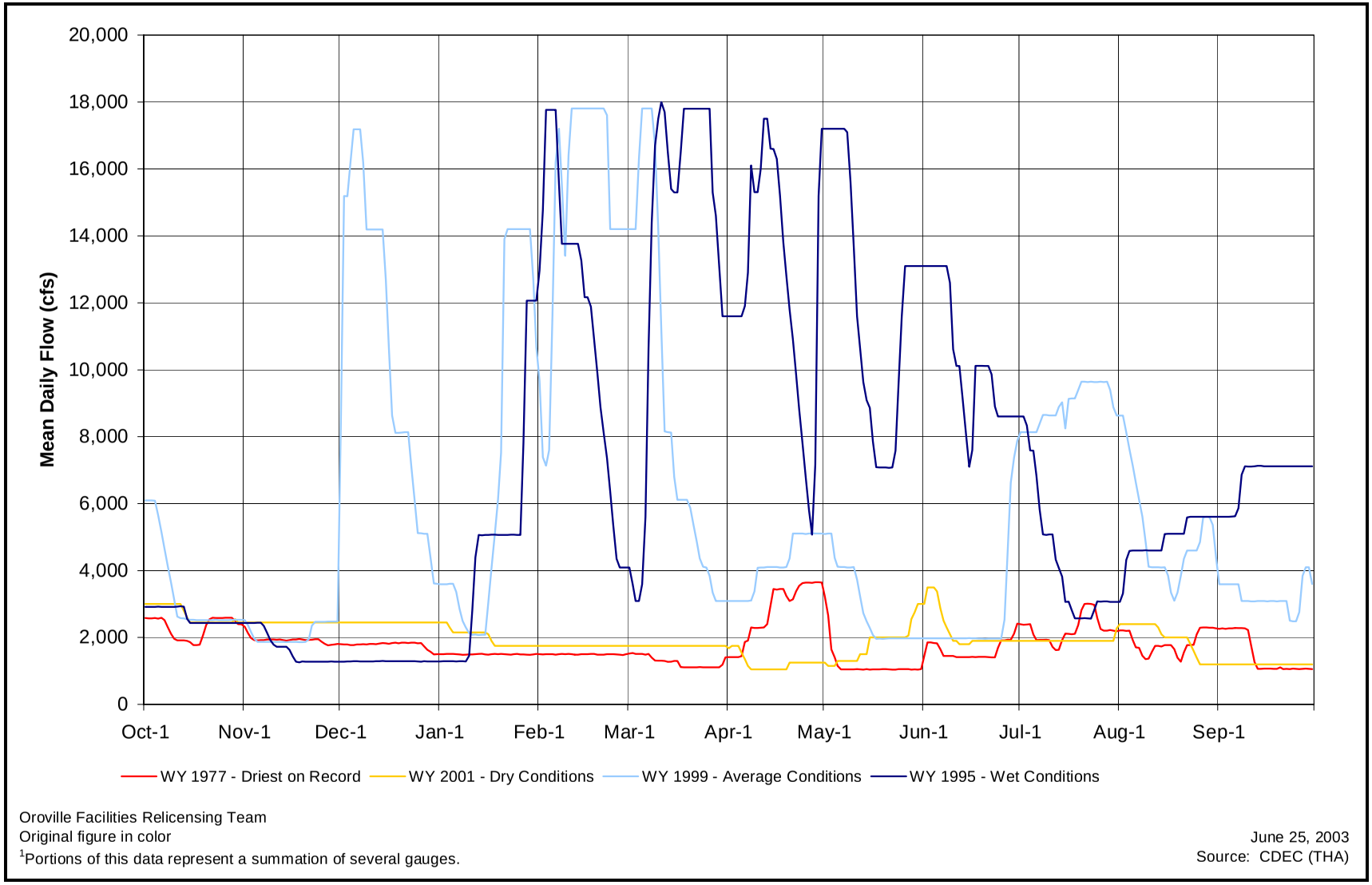
Source: U.S. Geological Survey.

Figure C.2-20. Thermalito Afterbay Outlet—mean daily flow.



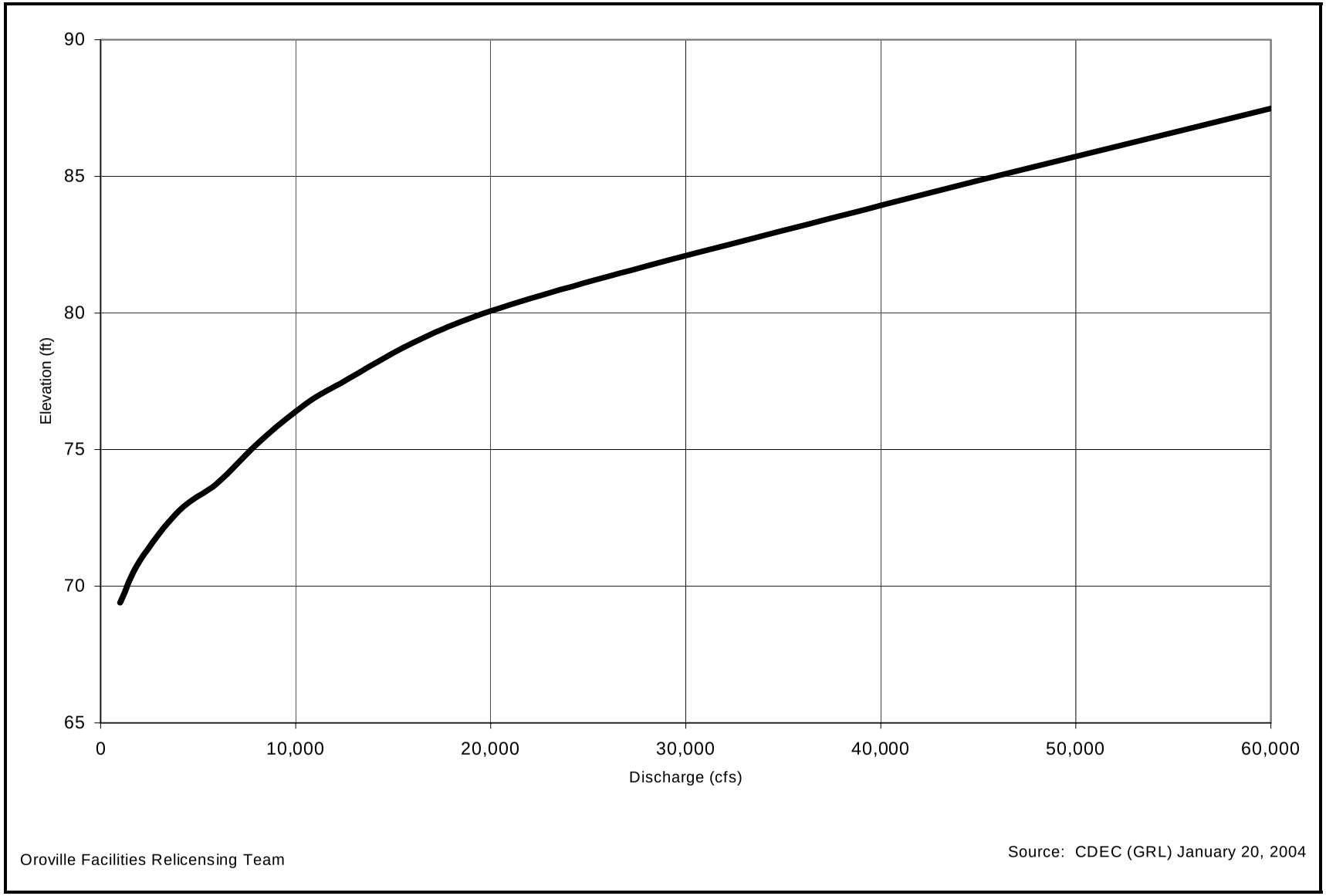
Source: U.S. Geological Survey.

Figure C.2-21. Agricultural diversions from Thermalito Afterbay—combined mean daily flow.



Source: DWR California Data Exchange Center.

Figure C.2-22. Feather River below the Thermalito Afterbay Outlet—estimated mean daily flow.



Source: DWR California Data Exchange Center.

Figure C.2-23. Feather River near Gridley stage/discharge.

C.2.7 Downstream Flow and Temperature Requirements

C.2.7.1 Temperature Requirements for Feather River at Robinson Riffle

- DWR must maintain daily average water temperatures ≤ 65°F in the Feather River upstream of the confluence with the Thermalito Afterbay outlet at Mile 61.6 (Robinson Riffle in the low-flow channel) from June 1 through September 30.
- Maintenance of water temperature at this site governs temperatures downstream to some extent.
- The temperature requirement is not intended to preclude Oroville Facilities pump-back operations needed to assist the State with supplying energy during periods when the California Independent System Operator anticipates a Stage 2 alert or higher.

C.2.8 Feather River Stage/Discharge Relationship

C.2.8.1 Stage/Discharge at Feather River near Gridley

- The Feather River stage below the Oroville Facilities changes with discharge; the higher the discharge, the higher the river stage. Figure C.2-23 illustrates a typical Feather River section below the Oroville Facilities. This information is based on the existing streamflow gauge “Feather River at Gridley.”

C.3 STREAMFLOW AND LAKE LEVEL DATA

The operational considerations described in Section 2.0 provide general information on streamflow and reservoir level data as a result of Oroville Facilities operation. A detailed evaluation of streamflow and reservoir level fluctuations can be useful in identifying potential effects on resources and investigating potential resource actions to protect, mitigate, or enhance specific resources.

It is important to consider the magnitude and direction of streamflow and reservoir level alterations resulting from operation of the Oroville Facilities and to determine whether alterations are potentially significant. Investigation of streamflow and reservoir level alterations can assist in identifying existing effects and evaluating those effects under alternative operational strategies.

Basic hydrology data are available and can be used to describe streamflow and reservoir levels resulting from operation of the Oroville Facilities. These basic data include estimates of streamflow and reservoir level elevations resulting from Oroville Facilities operations. Additionally, these basic data can be developed to describe operational hydrology such as magnitude, frequency, and timing of flows, and the probability of Lake Oroville attaining defined levels throughout the year and to evaluate

the historical fluctuations in Thermalito Afterbay. The hydrology information listed below can be developed or estimated from available basic data at points of interest.

C.3.1 Oroville Facilities Streamflow and Reservoir Level Information

C.3.1.1 Feather River Streamflow

- Annual streamflow hydrographs
- Average monthly streamflow
- Mean daily streamflow
- Hourly streamflow
- 15-minute streamflow
- Flow probability (Log-Pearson plots)
- Flood frequency analysis
- Flow duration curves
- Cumulative hydrographs (over the study period)
- Bankfull discharge and timing

C.3.1.2 Lake Oroville and Thermalito Afterbay Levels

- Historical reservoir levels
- Reservoir level probability (Log-Pearson plots)
- Relationship between reservoir level and surface area

The information listed above is available or can be developed to help carry out resource evaluations. This information can be tailored to meet specific resource evaluation needs. For example, information can be developed specific to WY types based on the "wetness" of the year (wet, above normal, below normal, dry and critical WY types).

C.4 LITERATURE CITED

DWR and DFG (California Department of Water Resources and California Department of Fish and Game). 1983. Agreement concerning the operation of the Oroville Division of the State Water Project for management of fish & wildlife. Sacramento, CA. August 1983.

USACE (U.S. Army Corps of Engineers). 1970. Report on reservoir regulation for flood control, Oroville Dam and Reservoir. USACE Sacramento District. August 1970.

APPENDIX D

MODELING TOOLS

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APPENDIX D
MODELING TOOLS

D.1 INTRODUCTION

This appendix documents the models being used to evaluate Oroville Facilities operations, as well as other selected modeling tools that are being used to assess environmental and socioeconomic impacts. Following this appendix are informational posters that were created to provide a brief overview of some of the major models and modeling processes used in the evaluation.

D.2 SUMMARY OF MODELS BEING REVIEWED

The following is a summary of the models that are documented in this report. More detailed information regarding each model is provided later in the report.

- *CALSIM II:* Models the State Water Project (SWP) and Central Valley Project (CVP) using a monthly time step. Allows for assessment of water supply impacts and provides operational constraints for the other operations models.
- *Local Operations (HYDROPS):* Models Oroville Facilities operations at an hourly time step with the goal of maximizing hydropower production given input constraints.
- *Reservoir-River Temperature (WQRRS):* Models temperatures in the Oroville–Thermalito Complex and in the Feather River downstream of Lake Oroville to the confluence with the Sacramento River.
- *Flow-Stage (HEC-RAS*): Models the channel geometry and flow resistance to develop flow-stage relationships along the Feather River from Lake Oroville downstream to the confluence with the Sacramento River.
- *FLUVIAL-12:* Models sediment movement in the Feather River. Used to provide input to analysis of scour and erosion within the river.
- *Terrestrial Habitat Model:* Models bank and shallow-water terrestrial habitats.
- *Physical Habitat Model:* Simulation used in conjunction with the instream flow incremental methodology. Combines hydraulic data with biological criteria to estimate available optimum habitat in a stream for particular species and life stages of fish.
- *Recreation Visitation Model:* Statistical model. Estimates visitation to different recreation areas in the project area based upon several factors such as water conditions, fish and wildlife abundance, economic conditions, temperature conditions, availability of recreation facilities and access, and demographic conditions.

- *Economic and Fiscal Impact Assessment Modeling System:* Set of computer software and databases. Provides for local-level input on recreation visitation, operations and maintenance, and capital expenditures. Also includes output models for estimating economic impacts on business sections and local economy as well as fiscal (public costs and revenues) impacts on local government.

D.3 MODEL INTEGRATION

The first three models identified above—CALSIM II, Local Operations, and Reservoir-River Temperature models—make up the operations modeling system; that is, they are used to simulate how the Oroville Facilities are operated under varying conditions and assumptions. These models form a single, integrated modeling system to perform the operations, hydropower, and temperature modeling required to produce results throughout the Oroville Facilities and the Lower Feather River. The other models identified above are generally used to assess the effects of the resulting operations on specific resource areas, or to develop important data for input to other, impact assessment models. For these models to pass data to each other, they must be able to “talk” to each other.

To ensure that models can “talk” to each other, a unified, operations modeling database system has been developed. The system allows for translation of data from one operations model to another and will allow for translation of operations simulation data for input to the other modeling tools or for impact analysis. Implementation of the system required development of tools to translate the output from some models and prepare input to subsequent models. The system uses a database to store operations modeling results and to serve as the conduit to pass data between the models.

As critical as it is to share data between the operations models (and subsequently to export operations modeling data to the impact models), it is also important to provide a feedback mechanism. This allows results from lower level operations models to influence the assumptions made for higher level operations models; it also provides a means for feedback of information developed from the impact models to the suite of operations models. To enable feedback within the suite of operations models, the operations models are used in a series of steps, from higher level models to lower level models, as described below.

- *Statewide Operations Modeling:* Each scenario is first simulated using the CALSIM II model. The CALSIM II model is a long-term, large-scale, monthly time-step planning model of the SWP/CVP systems and their operations. The model incorporates operational decisions on the Oroville Facilities based on the SWP’s projectwide goals and provides information on potential statewide impacts for a given scenario. The results from these simulations provide the necessary constraints to lower level models for detailed simulation of proposed alternatives. There will be cases where specific alternatives do not affect the CALSIM II modeling because they are local enough in scope to not have statewide impacts.

In these cases a new CASLSIM II simulation may not be required for the analysis; an existing CALSIM II simulation may be used. When a new CALSIM II simulation is required, the scenario will be simulated by selecting the appropriate CALSIM II benchmark simulation(s), modifying the assumptions as required for the proposed alternative, and running the required simulations. The resulting simulation will then be evaluated; if required, the assumptions will be modified and the simulation repeated until the final results are acceptable. These results will then be available as input to the next level of operations simulation (if such simulation is necessary) or as input to other impact modeling analyses.

- *Local Operation Modeling:* If the proposed alternative has the potential for operational impacts that cannot be measured by CALSIM II, the local operations model is used. The simulation described in Step 1 is used to generate operational constraints based on the statewide operational requirements. These constraints, along with other assumptions modified as required for the proposed alternative, are then used as input to the local operation model. The resulting simulation is evaluated and, if required, the assumptions modified and the local operations simulation repeated until the final results are acceptable.

  The operational constraints noted above are treated as “soft” constraints; that is, the local operations model is allowed to deviate from them if necessary to achieve acceptable results. Furthermore, the local operations model may reveal instances when the assumptions used within, or operational decisions simulated by, the statewide modeling are not acceptable. In these cases, the process goes back to Step 1 and repeats the statewide operations modeling with assumptions modified to reflect the new information from the local operations modeling.

- *Temperature Modeling:* Once the local operations modeling is completed, the temperature model is used to simulate the temperatures throughout the system using the operational data from the local operations simulation. The resulting simulations are then evaluated to determine whether they are acceptable. If the simulated temperatures are not acceptable, there are several possible courses of action. Below is an example of a series of actions that could be tested to achieve an acceptable simulation of temperature operations:

  - *Modify the outlet shutter operation at Lake Oroville.* Oroville release temperature can be manipulated by changing the shutter configuration on the intake structure, with no other changes in operation allowed. In this case, only the temperature model would need to be re-run to perform the next simulation for evaluation.

  - *Modify the local power operations.* Heat gain can occur through pump-back, generation peaking, or Thermalito Complex operations. By changing power operations, and therefore the balance of water that flows through the Oroville Facilities and the Feather River low-flow channel, the temperatures in the Feather River can be manipulated. This type of

evaluation would require that the local operations simulation be repeated with new assumptions, and that the temperature simulation be repeated with the new local operations results.

- *Modify the statewide operations.* Changes to the seasonal operation at Oroville have the potential to affect the coldwater pool in the reservoir at different times of the year. This type of evaluation would require that the statewide operations simulation be repeated with new assumptions, and that the local operation and temperature operations be repeated with the new results.

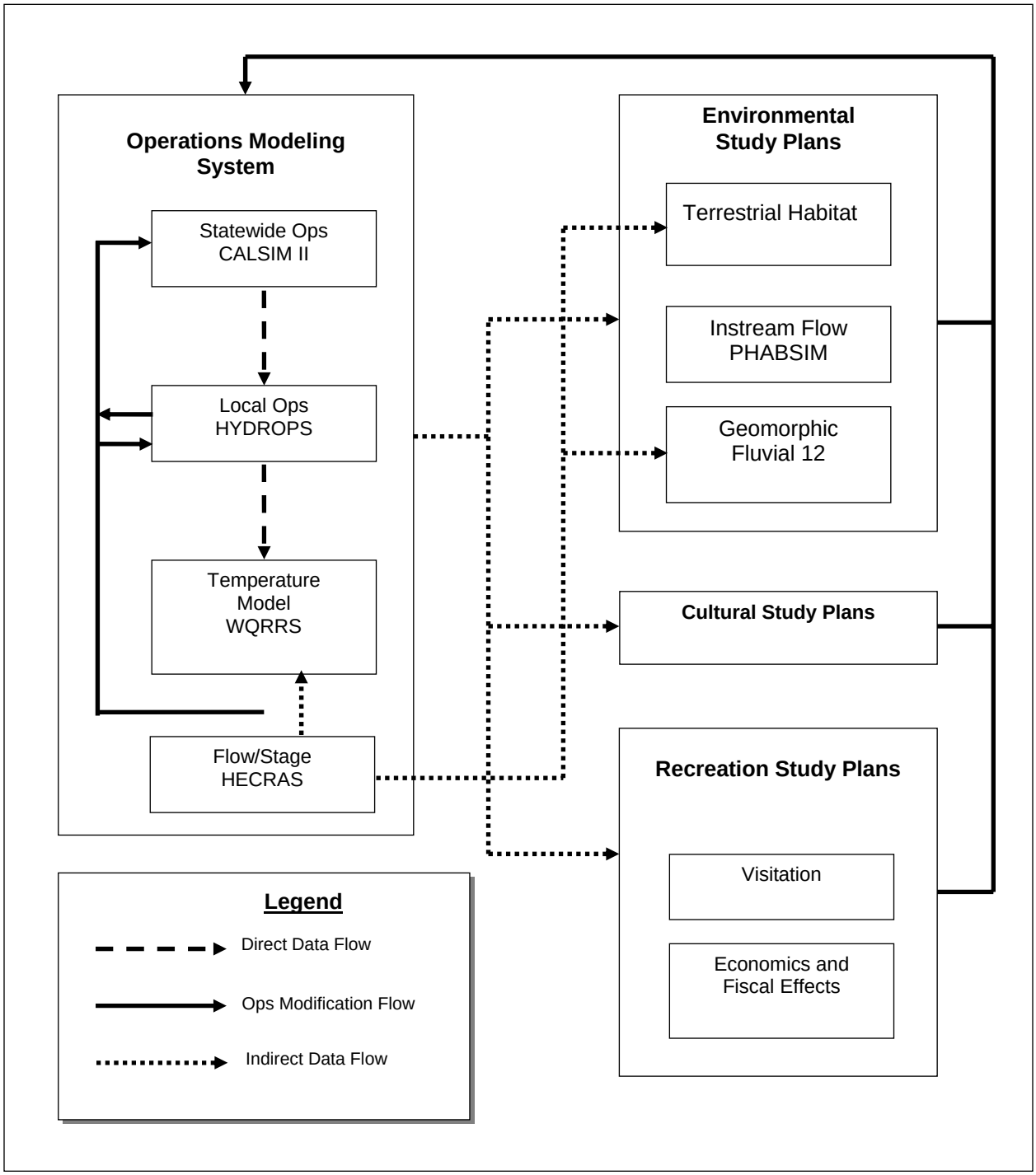
Upon completion of the operations simulations, modeling data are processed and provided to other models as needed. Figure D.3-1 is a flow chart of the model interactions during the simulation and analysis process. Once analyses are performed with the non-operations, resource impact models, it may be necessary to re-run any or all of the operations models with new assumptions.

The core of the model integration is a central modeling database that will be used to store all data produced by the operations models and/or required to produce outputs for analyses or non-operations models. Time series data from the operations modeling will be managed with the Data Storage System (DSS) developed by the U.S. Army Corps of Engineers (USACE) Hydrologic Engineering Center (HEC). This software was selected for several reasons:

- It provides an efficient method for handling large volumes of time series data.
- It is in the public domain, and therefore is available for anyone to use.
- It provides a programming interface that allows for custom tool development if needed.
- It can interface with productivity tools such as Microsoft Excel through another publicly available software.
- It is used to store the CALSIM II time series based input/output data.

The individual operations models do not read or write data directly to or from the central DSS database. Instead, a set of tools has been developed that translates data between the DSS database and models. In addition to linking the central database to the models, the tools will:

- Perform any required data manipulation such as converting monthly reservoir inflow data to daily reservoir inflow data;
- Allow the review of specific model results interactively; and
- Produce customized outputs for additional analyses.

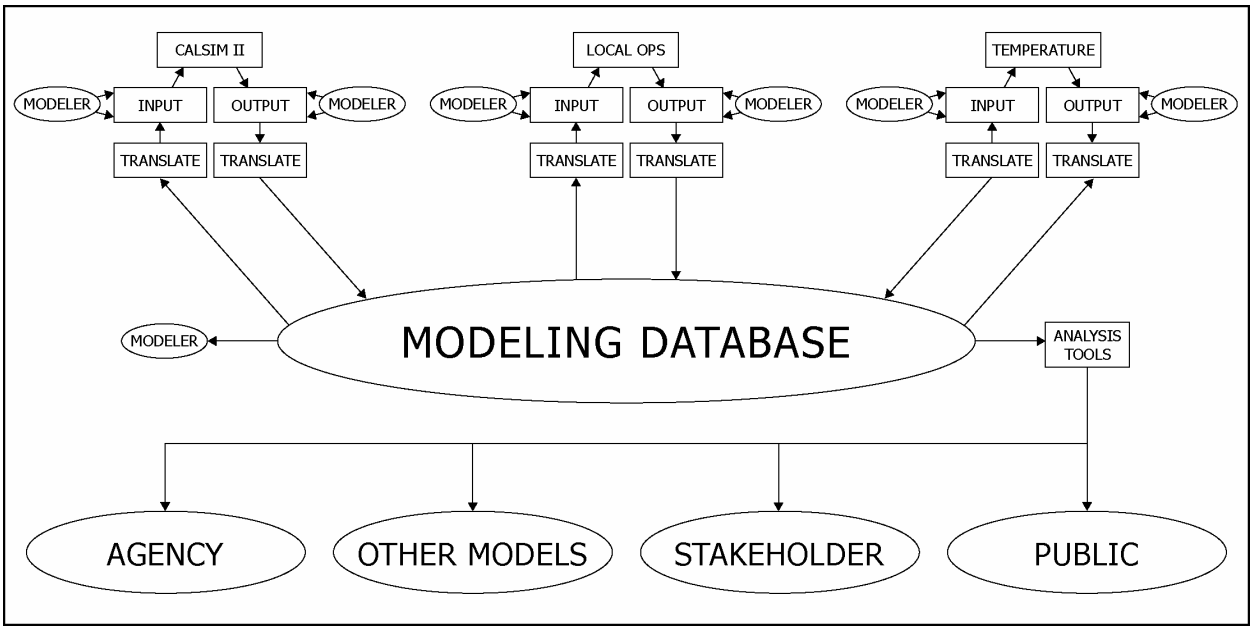


Source: Developed by the Engineering and Operations Work Group.

Figure D.3-1. Model Interaction and Data Flow.

The final database and the tools developed to extract, analyze, and format outputs from the simulation will be made available for distribution when simulations for a scenario are completed and the modeling process is completed.

Figure D.3-2 shows data handling methods within the proposed modeling system as well as the interactions with other modeling, analysis, or presentation processes.



Source: Developed by the Engineering and Operations Workgroup

Figure D.3-2. Database Dataflow Schematic.

D.4 STATEWIDE OPERATIONS MODEL—CALSIM II

D.4.1 Description

CALSIM II is a monthly time-step simulation model of the combined SWP and CVP systems and areas tributary to the Sacramento–San Joaquin Delta (Delta). This includes important non-project facilities on the east side of the Central Valley. CALSIM II is designed to be used for SWP/CVP planning purposes. For a given simulation the model adopts a static depiction of land use, water management facilities, and their operational rules and constraints. The model sequentially applies this depiction to the hydrologic conditions encountered in California during the period of 1922–1994. In effect, the model attempts to simulate what the response of the system, described in the simulation, would have been if it had been operated over the period of record.

Agricultural and urban target demands vary according to variations in precipitation (i.e., all SWP demands and CVP north-of-Delta demands) or are fixed at contract entitlement levels (i.e., CVP south-of-Delta demands). Elements of a depiction of the system can

be adjusted from one simulation to the next in order to explore the implications of land use, infrastructure, and regulatory changes in the system.

CALSIM II is most useful when it is used to compare the results of one simulation against another in a way that isolates the impact of specific elements of the system depiction. It is usual practice to compare simulation results to benchmark simulations. Several benchmark simulations are being developed that may be adopted for various water planning efforts in California. For example, one benchmark simulation is based upon a future level of water development within California; another assumes the current level of water development.

Regardless of the system depiction adopted for a simulation, the model employs a specific set of priorities in making water allocations for the CVP and SWP. The model will first meet environmental and in-basin requirements and then meet project contract and export delivery targets.

D.4.2 Usage

As part of modeling carried out in support of the Oroville Facilities Relicensing process, CALSIM II will be used for two basic purposes:

- Provide input regarding the operation of the Oroville Facilities that will support detailed modeling and analysis of conditions in Lake Oroville, within the Thermalito Forebay/Afterbay complex, and at an appropriate distance downstream in the Feather River.
- Allow identification of potential systemwide impacts that could arise from this detailed modeling and analysis as a result of specific facility or operational changes associated with meeting relevant management objectives in Lake Oroville, within the Thermalito Forebay/Afterbay complex, and at an appropriate distance downstream in the Feather River. This could include impacts on SWP water supply and power generation, environmental requirements, or impacts on CVP operations.

Because the model is capable of emulating systemwide operations of the SWP and CVP, it could facilitate analysis of appropriate system-level measures that that may be considered as part of a cumulative impact assessment.

D.4.3 Limitations

CALSIM II is a planning tool designed for analysis of the long-term impacts of facility or operational changes in the system. It has limited usefulness in the analysis of specific year impacts resulting from short-term trends or operational changes. Because it uses a constant level of development, it cannot be used for direct analysis of changes over

time in a single simulation. To account for the impact of land use change on runoff and for the effects of storage regulation and stream diversions that are upstream of areas simulated in the model, CALSIM II modifies historical hydrology by using inflows to major reservoirs and developing local accretions and depletions. This is a complicated process that invokes multiple assumptions and that requires many months to complete. As such, it is difficult to make changes to the underlying hydrology to evaluate the impact of these changes in a reasonable timeframe.

For the CALSIM II model to be used properly, the analyst using the model must have extensive knowledge of the CVP/SWP systems.

CALSIM II employs a monthly time step, which limits its ability to describe:

- Operational decisions or inputs at intervals shorter than a month, without implementing appropriate assumptions or simplifications;
- Event-specific flood control scenarios (only seasonal flood control criteria such as flood control reservoir reservation can be modeled); and
- Detailed hydropower analysis related to total capacity or on- or off-peak power generation (only gross energy production potential can be evaluated).

D.4.4 Assumptions

CALSIM II was developed to facilitate the analysis of any set of desired assumptions and the comparison of the impacts of these assumptions to a benchmark. There are very few assumptions about the system in CALSIM II that are not under direct user control. For example, the user can produce a depiction of the system with virtually any type of facility or operational assumptions by adjusting the parameters, operational logic, and weights used by the model. However, a relatively small set of processes in the system that use a complicated and extensive set of logic would be difficult and time consuming to change. For example, the decision process that sets the SWP delivery each year is a sequence of computations and procedures that follow a set logic. While changing the parameters used in the process is easy, changing the underlying logic itself is more difficult, although not impossible. Some examples of processes that rely upon logic internal to CALSIM II include:

- The delivery decision process;
- Operation of San Luis Reservoir; and
- Implementation of the Environmental Water Account and Central Valley Project Improvement Act §3406b(2).

Inputs that shape the assumptions of a particular simulation consist of special program code (called WRESL), data files for numeric inputs, and parameters for specific rules.

D.4.5 Inputs

CALSIM II inputs fall into several major categories:

- *Natural System:* Rivers, connectivity.
- *Facilities:* Reservoirs, canals, pumps.
- *Hydrology:* Inflows, in-basin accretions and depletions, evaporation.
- *Operation Rules:* Reservoir rule curves, exports, delivery allocation logic, Coordinated Operations Agreement, contractual requirements, and priorities (weights).
- *Regulatory Requirements:* Minimum flows, water quality, export limits, operational limits, and flood control limits.

D.4.6 Outputs

CALSIM II outputs fall into the following major categories:

- Reservoir operations;
- Flows throughout the system; and
- Deliveries.

D.4.7 Appraisal

CALSIM II cannot be calibrated in the traditional sense of the term because the model does not mimic any real-time data. The conditions in the model are not historic; the modeling conditions represent a planning level analysis with varied precipitation. The model has undergone a rigorous review process with CVP/SWP operations and modeling experts from the California Department of Water Resources (DWR), U.S. Bureau of Reclamation (USBR), and consultants. This process resulted in a version of the model and benchmark simulations that are acceptable to both USBR and DWR that can be used as a starting point for the Oroville Facilities Relicensing process.

D.5 LOCAL OPERATIONS MODEL—HYDROPS

D.5.1 Description

HYDROPS was developed by Powel Technology, Inc., formerly Charles Howard and Associates, Inc. HYDROPS has been used by power utilities in the United States and Canada for operation, planning, and relicensing purposes.

HYDROPS has both long-term and short-term study models. The long-term model has a 1-year time horizon with weekly time steps, and the short-term model runs for 1 week

at hourly time steps. For simulating detailed, short, time-step operations of the Oroville Facilities, only the short-term model is needed.

D.5.2 Usage

HYDROPS is being used to simulate hourly operations of the Oroville Facilities using a weekly modeling horizon. The weekly timeframe is used because power production optimization is done over the same period.

Operational boundary conditions are provided from the CALSIM II statewide operations modeling; these boundary conditions are imposed as targets on the local operations model. HYDROPS then optimizes Oroville Facilities hydropower operations while striving to meet the many operational targets imposed on it. In addition to the boundary targets provided by CALSIM II, the model considers localized facility constraints and targets, as well as operation requirements that could not be captured accurately in the monthly time-step model.

Model output is used to provide information on Oroville Facilities hydropower operations within the other operational limit assumptions, and within the seasonal water supply operation boundaries from the statewide modeling. Potential changes in the operational policy, requirements, or facilities and any associated impacts can be then evaluated based on the modeling results. The optimization function of the selected local operations model is essential to adequately model the hydropower operations.

As with CALSIM II, HYDROPS is being used as a planning model; that is, each scenario that is simulated will be compared to a base condition for subsequent analyses. It is not being used for flood control or real-time operation decisions based on hourly flow predictions for the entire period of record. The model could be used to route specific flood events through the Oroville Facilities if desired.

D.5.3 Limitations

The local operations modeling is based on the CALSIM II simulation results; therefore, the results are subject to the accuracy of the CALSIM II simulations. The reasonableness of the local operations modeling is evaluated on an ongoing basis during the simulation process.

The local operations model uses a synthetic hydrologic flow sequence that contains the same volume of flows as CALSIM II on a monthly basis. The monthly hydrology used from the CALSIM II modeling is disaggregated into weekly or daily data using a process designed to preserve the monthly volumes while accounting for shorter term ramping restrictions not included in the monthly CALSIM II modeling. The resulting hydrology does not reproduce historical flood events.

D.5.4 Assumptions

HYDROPS is used to simulate the Oroville Facilities and the Feather River to a point just downstream of the Thermalito Afterbay outlet to the Feather River. Figure D.5-1 is a schematic of the Oroville Facilities features that are modeled.

D.5.5 Inputs

HYDROPS inputs fall into several major categories:

- *Natural System:* Rivers, connectivity.
- *Facilities:* Reservoirs, canals, pumps, generators.
- *Hydrology:* Inflows, evaporation, diversions.
- *Operation Rules:* Reservoir rule curves, contractual requirements, and priorities (weights).
- *Regulatory Requirements:* Instream minimum flows, instream water quality requirements (these must be estimated as flow constraints for simulation in the local operations model process), operational limits, and flood control limits.

D.5.6 Outputs

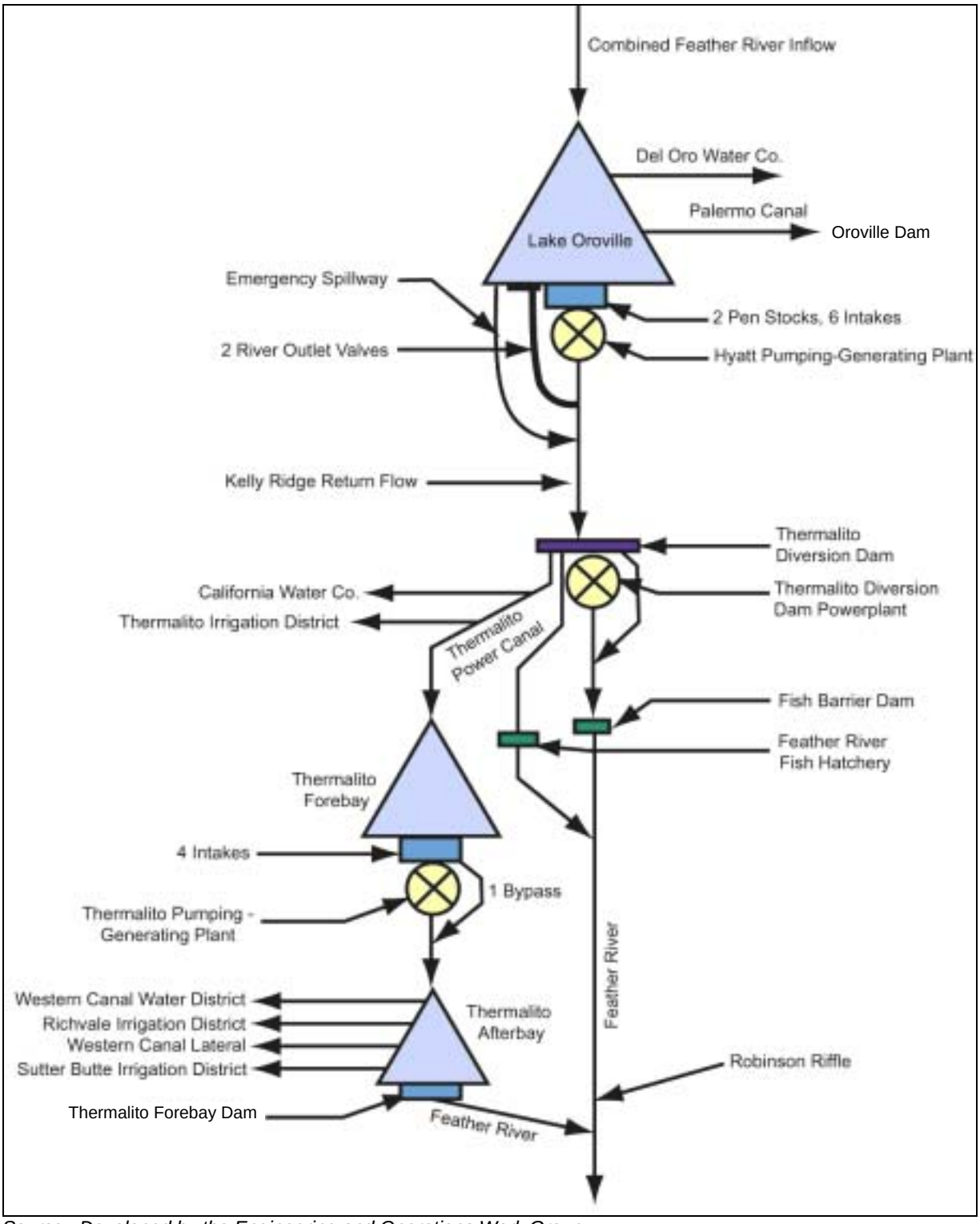
HYDROPS outputs fall into the following major categories:

- Oroville, Thermalito Forebay, and Thermalito Afterbay storages;
- Flows throughout the system;
- Diversions;
- Power generation; and
- Pump-back power requirements.

D.5.7 Appraisal

While the simulations produced by the local operations model can be verified using recent historical data, the benchmark and alternative scenario simulations depend on the CALSIM II model to provide operational boundaries. As such, the results of the simulations are subject to the same limitations as results of the CALSIM II models.

When used in a comparative mode as envisioned in this process, this model will provide results compatible with the needs of the relicensing process.



Source: Developed by the Engineering and Operations Work Group.

Figure D.5-1. Local Operations Model Schematic.

D.6 TEMPERATURE MODEL—WQRRS

D.6.1 Description

WQRRS was developed by the USACE HEC. The software has been widely used and is in the public domain, so it is readily available. WQRRS is used to integrate modeling components to simulate temperatures of Lake Oroville, the Thermalito Forebay/Afterbay complex, and the Feather River from the reservoir downstream to the confluence with the Sacramento River. The integrated model divides the Feather River below Oroville into segments as control volumes for heat budget calculations. These control volumes are located at all compliance locations for critical habitats for fish and fish food organisms.

The integrated model provides continuous temperature simulation of temperatures for all control volumes of the Oroville Facilities. The time step of simulation is hourly,.

D.6.2 Usage

The temperature model is used to simulate the temperatures throughout the system given a set of operational parameters such as storages, flows, releases, pump-back, and diversions from the local operations model.

D.6.3 Limitations

The temperature model does not automatically reoperate the system to meet temperature targets; it simply simulates the temperature from a given set of operational parameters. Simulation of Oroville Facilities re-operation will occur through the modeling process described earlier in this document.

D.6.4 Assumptions

WQRRS emulates heat transfer processes by breaking the system being modeled into specific areas or control volumes. For each time step of computation, every control volume has an estimate of water inflow (flow from an upstream boundary or control volume), outflow (flow to a downstream boundary or control volume), heat gain from solar energy at the surface of the control volume, and heat loss from evaporation.

D.6.5 Inputs

Temperature model inputs fall into several major categories:

- *Meteorological:* Temperature, solar radiation, cloud cover, wind.
- *Natural System:* Rivers, connectivity.

- *Facilities:* Reservoirs, canals, river channel pumps.
- *Hydrology:* Inflow (flow and temperature) in basin accretions and depletions, evaporation.
- *Operational Data:* Reservoir storages, reservoir releases, pump-back, flows throughout the system.

D.6.6 Outputs

The integrated model will produce the temperature profiles of Lake Oroville, which can be used to calculate the volume of cold water in the reservoir. The model will also produce the reservoir surface elevations and temperatures of reservoir releases.

The integrated model will produce temperatures of various control volumes and diversion flows for the Oroville Facilities.

D.6.7 Appraisal

The accuracy of the model is measured by the discrepancy between the predicted values and observed values. This discrepancy actually represents the errors of both data and model. However, the discrepancy is commonly attributed to the model error. The degree of accuracy is unknown at this time. Past experience indicates that the error can be within 1ºC.

D.7 FLOW-STAGE MODELING—HEC-RAS VERSION 3.1

D.7.1 Description

The HEC-RAS computer program was developed by the USACE HEC to simulate one-dimensional steady (constant) or unsteady (time-varying) flow in a network of natural and constructed water channels. HEC-RAS is also capable of simulating conditions at structures that affect the flow of water such as gated and uncontrolled spillways, weirs, bridges, and culverts.

A HEC-RAS model of the Feather River from the base of Oroville Dam to its confluence with the Sacramento River was developed as part of the USACE *Sacramento-San Joaquin Basins Comprehensive Study*. Channel geometry data for this model was collected from topographic data approximately every 0.2–0.25 miles (1,000–1,300 feet) along the river. These data are very detailed and provide a good representation of the river at each cross section.

D.7.2 Usage

The HEC-RAS model was used to develop flow-stage relationships at locations along the river where such information is needed for environmental analyses such as riparian recruitment and temperature.

D.7.3 Limitations

The model data were collected in the period 1997–1998; although the river as a whole likely has not changed significantly since that period, it is possible that specific cross sections are significantly different today than they were when the data were collected. The model cross-section spacing of 0.25 mile is somewhat larger than the ideal spacing for a low-flow model of the river.

Under low-flow conditions, the upper 25 miles (river miles 45–70) of the river may be characterized as a series of pools and riffles that are 1–3 miles in length. At low flows these pools and riffles become hydraulically separated, meaning that the water surfaces in the reaches upstream and downstream of a pool have no effect on the water surface in the pool. This means that the model can accurately simulate conditions at points in the river where data were collected, but it will not be as accurate at locations where data were not collected.

D.7.4 Assumptions

HEC-RAS assumes that the cross section data in the model are representative of the river.

D.7.5 Inputs

HEC-RAS inputs fall into several major categories:

- *Hydrology:* Feather River and tributary inflows for steady-state model, Feather River and tributary hydrographs for unsteady-state model.
- *Geometry:* Cross-section data.
- *Facilities:* Bridges, dams, weirs, culverts, etc.
- *Hydraulic:* Manning's n value for river channel and banks.

D.7.6 Outputs

HEC-RAS outputs fall into the following major categories:

- *Figures:* Cross-section plots including facilities; profile plots; rating curve (flow-stage data at a cross section).

- *Tables:* At each cross section, hydraulic data (velocity, water surface, n value); and geometric data (area, invert, bank).
- *Digital Output:* DSS, ASCII, or spreadsheets.

D.7.7 Appraisal

The HEC-RAS model was calibrated for flows of 2,000, 4,000, and 6,000 cubic feet per second. Calibration data were available at six DWR gauging stations on the Feather River. Calibration results are quite good with predicted water surface elevations at the calibration points typically within 0.5 foot of the actual gauge reading. However, as described above under Limitations, calibration in the upper 25 miles of the river is only valid for short reaches. In uncalibrated reaches the absolute accuracy of the model may be less than desired, but the model should still provide accurate predictions of relative differences in the water surface elevation with a change in flow.

D.8 GEOMORPHIC MODELING—FLUVIAL-12

D.8.1 Description

River channel behavior is studied for its natural state and response to human regulation. Studies of river hydraulics, sediment transport, and river channel changes may be through physical modeling, mathematical modeling, or both. The computer program FLUVIAL-12 is a mathematical model that is formulated and developed for water and sediment routing in natural and human-made channels. The combined effects of flow hydraulics, sediment transport, and river channel changes are simulated for a given flow period. FLUVIAL-12 is capable of modeling changes over time in the following physical parameters:

- Channel scour and fill, aggradation, and degradation;
- Changes in channel cross section, including depth and width;
- Changes in bed material composition, including coarsening or fining (armoring, the condition where the surface layer becomes coarser than the underlying bed material, is also predicted and modeled);
- Changes in cross section location caused by bank erosion, sediment deposition, and meandering;
- Changes in water surface and bed elevation profiles;
- Changes in Manning's n, or the roughness of the channel;
- Changes in sediment transport; and
- Changes in river curvature.

D.8.2 Usage

The model has been developed for water and sediment routing in rivers while simulating river channel changes. River channel changes simulated by the model include channel-bed scour and fill (or aggradation and degradation), width variation, and changes caused by curvature effects. Because changes in channel width and channel-bed profile are closely interrelated, modeling of erodible channels must include both changes. In fact, width changes are usually greater than the concomitant scour and fill in the bed, particularly in ephemeral streams.

While this model is for erodible channels, physical constraints, such as bank protection, grade-control structures, and bedrock outcroppings, may also be specified. Applications of this model include evaluation of general scour at bridge crossings, sediment delivery, channel responses to sand and gravel mining, channelization, and dams. It has been applied to many designs for bank protection and grade-control structures that must extend below the potential channel bed scour and withstand the design flood.

D.8.3 Limitations

FLUVIAL-12 is an erodible boundary model that simulates changes in bed elevation, channel width, and bed topography induced by channel curvature. In this way, bank erosion, changes in channel curvature, and river meandering can also be modeled. Channel changes and bank erosion occurs in the SPG-2 study reach. The FLUVIAL-12 model has the ability to select sediment transport equations that best match river conditions. On studies on the South Fork Trinity River and on Cottonwood Creek, the Parker equation was selected as the most appropriate and this equation was then added to the model. The preliminary analysis of the Feather River indicates that this equation is also the most appropriate available equation for this project.

Model inputs for all four of the geomorphic models do not appear to be compatible with the Study Plan E-2 (SP-E2) Operations Model because the models have different data needs. Discussions with the engineers indicated that sharing hydraulic data such as stream flow was highly improbable. The operations models use monthly data, while FLUVIAL-12 uses hourly and daily data. Hourly and daily flow data are readily available from the California Data Exchange Center and the U.S. Geological Survey. Any cross sections developed for the operations model, however, may be used for FLUVIAL-12.

D.8.4 Assumptions

Some of the assumptions used in the model are the following:

- Cross sections used in the analyses are adequate representations of the stream channel at all flows.

- The roughness coefficient remains static at all levels of flow.
- The geometric mean of the bed material size fractions adequately describes the sediment size distribution.
- The selected sediment transport equation properly represents sediment movement at all discharges.
- The river channel is in dynamic equilibrium at all discharges.
- There is uniformity in sediment discharge, power expenditure, energy gradient, water surface slope, and other elements in the short reaches between cross sections.
- The spatial and temporal variations in flow, sediment transport, and channel geometry, are adequately modeled with iterative time, cross section, and flow data.

D.8.5 Inputs

FLUVIAL-12 inputs fall into several major categories:

- Selection of appropriate sediment transport equations;
- Estimate of bank erodibility factor;
- Estimate of Manning's coefficient of roughness;
- Development of flow datasets for representative cross sections in the study reach;
- Calculation of channel slope;
- Identification of reaches of bank protection;
- Measurement of water temperature;
- Estimate of thickness of erodible bed;
- Measurement of sediment characteristics: Specific gravity, number of size fractions, angle of repose;
- Decision about whether unsteady-flow modeling is appropriate;
- Bed material sampling and determination of bedload sediment size fractions;
- Location and resurveying of cross sections and determination of their characteristics: Erodible versus nonerodible banks, degree of curvature of centerline of channel (where banks are static), bank erodibility factor, estimated thickness of erodible gravel bed, size fractions of bed material.

D.8.6 Outputs

FLUVIAL-12 outputs will include:

- Changes in channel scour and fill;
- Bedload;
- Roughness;
- Cross section;
- Gradient;
- Sediment transport; and
- Hydraulic conditions: Bottom shear stress, velocity, and wetted hydraulic radius.

D.12 ECONOMIC/FISCAL IMPACT MODELING SYSTEM

D.12.1 Description

The economic/fiscal impact modeling system consists of four community-level and one county-level (Butte County) spreadsheet models with capabilities to estimate the economic and fiscal effects of recreation activity and recreation-related capital, operations, and maintenance expenditures associated with the Oroville Facilities. The four community areas being modeled are Oroville, Paradise, Biggs/Gridley, and Chico. Together, these four community areas, which include lands within the incorporated area and surrounding lands in the unincorporated area, comprise all of the land area of Butte County.

Community-level models allow analysts to accurately estimate and display economic impacts at the sub-county level. Community impact modeling requires considerable fieldwork to ensure the accuracy of model components and to develop base data for each community area. Community-level modeling allows for a dynamic, through-time dimension that can incorporate baseline projections and changes from this baseline condition.

The economic impact component of the model is based on input-output analysis, which is a means of examining relationships (both business-to-business and business-to-final consumer) within an economy. Input-output analysis captures all monetary market transactions for consumption in a given time period. Other types of models for evaluating economic impacts of recreation activity include economic-based models and econometric models.

Basic economic modeling data at the county level were obtained from the Minnesota IMPLAN Group (i.e., IMPLAN data). IMPLAN (Impact Analysis for Planning) is a computer-driven input-output model originally developed by the U.S. Forest Service

(USFS) in cooperation with the Federal Emergency Management Agency and the U.S. Bureau of Land Management to assist USFS in land and resource management planning. IMPLAN databases, which are available at the state, county, and zip code area level, and which are periodically revised using updated socioeconomic data, provide all the information needed to create regional IMPLAN models. These data are then revised based on community-specific information obtained through field research interviews to more accurately identify key economic relationships.

The fiscal impact component of the models characterizes existing fiscal conditions (i.e., public costs and revenues) in jurisdictions (e.g., counties and cities) and quantifies changes in costs and revenues for these jurisdictions associated with an action that alters a jurisdiction's tax base or cost structure (e.g., increased levels of recreation activity). The fiscal impact model will estimate how economic activity generated by recreation use of the Lake Oroville State Recreation Area (Oroville Facilities) and affected downstream reaches of the Feather River affects fiscal conditions of local government.

The economic/fiscal impact model is constructed following extensive fieldwork to ensure that baseline data (e.g., sector-specific employment and earnings, and public service costs associated with recreation activity) are generally acknowledged as accurate by community representatives. Given a proposed change in visitor spending or level of operations and management, the models then show the associated impact on community-level jobs and earnings, and public costs and revenues. In addition to showing individual community impacts, the economic impact models will be constructed with an intercommunity impact component that enables assessment of the effect that a change in one community will have on economic activity in other communities. Direct and indirect impacts will be distinguished in the models.

D.12.2 Usage

The primary purpose of the models is to assess the economic and fiscal effects of both existing and future levels of recreation use and operations and management activity, and the effects of potential recreation development and enhancement scenarios. These scenarios may involve recreation facility development or resource enhancements that would affect recreation use and management. Specific objectives in developing and applying the economic and fiscal impact models are described below.

D.12.2.1 Economic Impact Assessment

The objectives of the economic impact assessment models are to estimate the effects of spending activity generated by current and projected recreation use, and the operations and management of the Oroville Facilities on local business sales, employment, and personal income. Local economic impacts result primarily from spending associated with recreational use of the Oroville Facilities and from spending

by government agencies responsible for operations and management of these facilities. As recreation activity levels vary in response to water conditions and other factors, spending levels by local residents and visitors to the region also change. These spending levels affect local business sales, which, in turn, affect employment opportunities and levels of personal income. The economic impact assessment models will assess the impacts on local business sales, employment, and personal income within Oroville, Chico, Paradise, and Gridley/Biggs, and in Butte County as a whole related to recreation use and operation and management of the Oroville Facilities.

Data needed for developing the economic impact model include:

- An IMPLAN database for Butte County;
- Information on current economic activity and commuting patterns, by community area;
- Information on the budgets of key agencies that are involved in the operation and management of the Oroville Facilities; and
- Spending profiles by visitors to the Oroville Facilities, by type of user, activity, and location.

Interviews will be conducted with local businesspersons in Oroville, Paradise, Gridley, Biggs, and Chico to gather information on levels and patterns of local trade, sales, and purchase patterns, and employment requirements that will be used to refine the relationships initially developed from the IMPLAN database.

D.12.2.2 Fiscal Impact Assessment

The objectives of the fiscal impact assessment models are to estimate the effects of economic activity generated by current and projected recreation use and by the operations and maintenance 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 recreation activity and management at the Oroville Facilities. Local fiscal effects result primarily from recreation activity and operations and maintenance of the Oroville Facilities. As recreation-related spending levels vary in relation to use, local tax revenues generated by retail sales, hotel and motel stays, fuel purchases, and other expenditures by visitors also will change. Similarly, changes in visitation to the Oroville Facilities may generate increased demand for law enforcement, fire protection, and other governmental services such as roads, parks and recreation, and operations by the Butte County Sheriff's Department and the California Department of Forestry and Fire Protection.

The fiscal impact model will quantify changes in revenues and costs to the government agencies in the four community areas and Butte County most directly affected by changes in recreational use and operations of the Oroville Facilities. Potential revenue impacts would primarily include growth-related changes in taxable sales caused by

changes in visitor spending levels and local procurement of goods and services, changes in transient occupancy (lodging) taxes caused by increases in visitor-related hotel and motel stays, and changes in property tax revenues associated with direct and indirect changes in property values (i.e., from increases in earnings and property investment). Expenditure impacts would primarily include costs for law enforcement, fire protection, and road maintenance resulting from changes in the use of the Oroville Facilities. Based on estimated revenue and expenditure effects, the net fiscal effects of growth in recreational use of the Oroville Facilities will be estimated for each affected jurisdiction.

Data needs for developing the fiscal impact model include:

- Current levels of local public revenues and expenditures by category;
- Current local tax rates (e.g., sales, transient occupancy, property);
- Current and projected recreation expenditure levels by type and location; and
- Information on the budgets and local procurement of goods and services by key agencies that are involved in the operation and maintenance of the Oroville Facilities.

Interviews will be conducted with personnel in the Butte County Sheriff's Office and with other relevant law enforcement, fire protection, and parks and recreation districts to gather information on current and future costs associated with providing law enforcement, fire protection, and parks and recreation services to users of the Oroville Facilities.

D.12.3 Limitations

Economic/fiscal impact modeling will be based on results from the recreation visitation model and estimates of recreation-related expenditures by agencies; consequently, results are subject to the accuracy of the recreation visitation model and completeness of records on agency expenditures. The recreation visitation model is expected to depend, in part, on the results of hydrology modeling. In addition, the models are based primarily on linear relationships between variables. As such, the models can only approximate expected effects of a change in recreation activity or expenditures by resource management agencies on key output variables. The economic/fiscal impact models will be evaluated before and during the simulation process; the reasonableness of key relationships (e.g., jobs per million dollars in sales) will be evaluated closely and sensitivity analysis will be used to test model results.

D.12.4 Assumptions

The following general assumptions underlie the approach to developing the economic impact assessment models:

- Economic activity in areas other than the greater Oroville area, Paradise, Gridley, Biggs, Chico, and Butte County as a whole is largely unaffected by recreation use of the Oroville Facilities.
- The economic structure, including the types of businesses, of the affected communities and Butte County in the future will be similar to the existing structure.

The following general assumptions underlie the approach to developing the fiscal impact assessment models:

- Current tax rates will remain unchanged in the future.
- Fiscal conditions for agencies other than the Cities of Oroville, Paradise, Gridley, Biggs, and Chico, and Butte County, and fire protection and parks and recreation districts within and near the Oroville Facilities are largely unaffected by recreational use of the Oroville Facilities.
- County zoning and general plan designation for properties within and near the Oroville Facilities will not change in the future.
- Ownership and management of lands by State agencies within the Oroville Facilities will remain unchanged in the future unless alternative management assumptions are provided.

D.12.5 Inputs

The data inputs needed for simulating the economic and fiscal impact models are described below.

D.12.5.1 Economic Impact Models

The primary input variable needed for simulating the community-level economic impact models is the dollar change in purchases of products or services (i.e., final demand) by visitors to the Oroville Facilities and by agencies involved in the operations and management of the Oroville Facilities. Changes in final demand drive input-output models because industries respond to meet demands directly or indirectly (i.e., by supplying goods and services to industries responding directly to final demand changes). For the economic impact analysis of changes in recreation activity, final demand changes include changes in the levels of visitor spending for recreation trip–related goods such as food, gasoline, accommodations, and recreation goods and services. For example, the incremental increase in annual expenditures by visitors (i.e., from out of the region) on hotel accommodations associated with development of a nearby recreation facility would represent a change in final demand for the hotels and motels industrial sector. For the economic impact analysis of changes in recreation-related operations and management of the Oroville Facilities, final demand changes included changes in the number of personnel or annual budgets.

D.12.5.2 Fiscal Impact Models

The fiscal impact model addresses direct (visitor- and facility-related) and secondary (income-driven) effects of recreation activity and expenditures by recreation management agencies. The fiscal impact models will estimate recurring effects caused by recreation spending and by agency expenditures on facility construction and operations. Effects on parks maintenance by local districts (e.g., Feather River Recreation and Parks District) will be evaluated independent of the fiscal impact model.

For Butte County and the City of Oroville, public service costs to be estimated by the model will include those generated by visitors (direct effects of visitation) as well as those generated by population growth (secondary effects caused by changes in economic activity). For Biggs, Chico, Gridley, and Paradise, costs will include only population-driven changes. The following relationships are assumed in the fiscal impact models:

- Changes in property tax revenues are primarily a function of the assessed value of property (direct effects) and earnings (secondary effect).
- Changes in sales tax revenues are primarily a function of expenditures by visitors to the Oroville Facilities (direct effect) and population growth (secondary effect).
- Changes in lodging tax revenues are primarily a function of expenditures by visitors to the Oroville Facilities (direct effect) and population growth (secondary effect).
- Changes in public services costs are primarily a function of the number of visitors to the Oroville Facilities (direct effect) and population growth from increased economic activity (secondary effect).
- Changes in the costs of road maintenance are primarily a function of the number of visitors to the Oroville Facilities (direct effect) and population growth (secondary effect).
- Fiscal effects within the Biggs-Gridley area will be allocated between the two jurisdictions based on population shares or similar proportional indicators.
- Changes in secondary public services costs (i.e., sheriff, fire, roads) for Butte County are a function of the countywide increase in population resulting from increased economic activity. For all other jurisdictions, secondary costs are assumed to be a function of the change in population within that region.
- Direct sales tax and lodging tax revenue effects will be allocated between Butte County (unincorporated area) and incorporated areas based on survey data regarding the location of expenditures. Revenues directly generated by sales in unincorporated areas (e.g., at the reservoir) will be assigned to Butte County; all others will be assigned to the communities in which expenditures occur.

D.12.6 Outputs

The primary outputs of the economic impact model are predicted changes in direct, indirect, and induced output (sales), employment, and income. Model output will include incremental changes in these economic variables by community area and business sector.

The primary outputs of the fiscal impact model are predicted changes in direct and secondary effects on public service costs (law enforcement, fire protection, and roads maintenance) and public revenues (sales tax revenues, lodging tax revenues, and property tax revenues). Model outputs will include incremental changes in these fiscal variables by community area.

D.12.7 Appraisal

The economic and fiscal impact models being developed for the analysis are based on sound theoretical underpinnings; similar models have been developed and used extensively in comparable applications. However, as previously indicated, the economic/fiscal impact model depends directly on the output from the recreation visitation model, which in turn depends on the predicted relationship between recreation use and factors, such as lake levels, that help explain annual variation in recreation use levels. As a consequence, errors in the hydrology modeling and/or recreation visitation modeling have the potential of being mirrored and compounded in the economic/fiscal model.

To ensure that model results reasonably approximate the expected effects of current recreation activity and alternative scenarios to be evaluated, it will be necessary to thoroughly review the reasonableness of key relationships in the models and to conduct sensitivity analyses to determine the variability in model output (i.e., potential error) associated with the estimates. Information on the economic and fiscal effects of recreation activity associated with the Oroville Facilities does not currently exist; consequently, the model results cannot be validated using existing or historical information. However, because the models will be applied in a comparative mode (i.e., comparing the economic effects of alternative enhancement measures), modeling results will be compatible with the needs of the relicensing process.

INSERT

[Appendix D Figures]

See Volume II Appendix D Figures folder on this CD for the rest of Appendix D figures.

APPENDIX E

TECHNICAL STUDY PLAN/REPORT ABSTRACTS

The following appendix contains Technical Study Plan/Report abstracts. The Study Plan abstracts were prepared and submitted as part of the Study Plan Package presented to the Plenary Group by the collaborative work groups on October 25, 2002. Some of the following Study Plan abstracts are supplemented by Study Report abstracts that summarize information presented in an Interim or Final Report. Study Report abstracts are only provided for those reports that were completed as of December 31, 2003. Copies of the currently available Study Reports can be found on the DWR Oroville Facilities relicensing website: orovillerelicensing.water.ca.gov

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Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-L1 - LAND USE

Type of Study: ¸ Desktop Study 1 Field Study

Start Date: Winter 2002

Need for Study: Federal Energy Regulatory Commission (FERC) relicensing regulations require that applicants prepare a report on lands in order to determine project conformance and compatibility with local and regional land uses and land plans.

Objective: The objective of this study is to determine and describe existing and planned future land uses within and adjacent to the project boundary, and to identify potential land use conflicts, compatibilities, and opportunities related to project facilities and operations.

Scope/Methodology/Results: The land use study will examine lands within the Oroville Facilities Relicensing Project boundary, contiguous properties, and other lands within 0.25 mile of the project boundary. The methodology for the study will involve an initial data collection effort comprising a literature review and interviews to develop an existing conditions inventory. Information from maps will be compiled with collected data and analyzed. An opportunities and constraints analysis will be performed to identify any potential conflicts related to land uses as well as potential areas for collaboration. Recommendations for future policies and actions for land uses within the project boundary will be developed. A land use report will present findings and recommendations and will include a series of land use maps generated from the land use Geographic Information Systems (GIS) database that will be developed.

Draft Interim Report, November 2003 – Abstract: This report presents the results of a comprehensive evaluation of existing, planned, and proposed land uses in the study area, as well as a brief overview of historical land use that forms the context of current land use planning in the Oroville area. It also delineates complex patterns of land ownership in the study area in an effort to better understand the interrelationships between land ownership and land use in the region. This report uses existing GIS data as the primary tool in delineating and evaluating land use issues.

Land ownership within the FERC boundary is fairly uniform. All of these lands are owned by public interests, with the California Department of Water Resources (DWR) representing the largest public landowner in terms of size of holdings. Other public landowners within the FERC boundary include the U.S. Forest Service (USFS) and U.S. Bureau of Land Management (BLM). These entities also have significant land holdings within the project study area (defined as lands within 0.25 mile of the FERC boundary). Other public entities with land holdings in the study area include the Bureau of Indian

Affairs (BIA), California Department of Fish and Game (DFG), California Department of Parks and Recreation (DPR), Butte County (County), and the City of Oroville (City). The remaining lands outside the FERC boundary, but within the study area, are owned by private interests.

Land use within the FERC boundary and study area is more diverse than land ownership. To categorize the wide variety of land uses, a land use classification system was developed for this report. Land uses were classified based on field surveys conducted by terrestrial resource scientists as part of their vegetative cover mapping efforts for the relicensing effort (Study Plan Report T-4 [SP-T4], Biodiversity, Vegetation Communities and Wildlife Habitat Mapping); review of aerial photographs and other GIS data; and onsite evaluation.

As expected, the land use classification “Reservoir/Open Water” (i.e., Lake Oroville) is the most prevalent land use category within the FERC boundary and study area. Recreation also has a major influence on land use in the study area, especially within the FERC boundary where DPR manages much of the land as part of the Lake Oroville State Recreation Area (LOSRA). Conservation uses are also prevalent in the study area as illustrated by the significant number of public landowners who manage lands primarily for conservation purposes. Outside the FERC boundary, but within the study area, the land use environment is especially diverse with residential, industrial/commercial, and agricultural uses all present. There are also large quantities of land within the FERC boundary and study area that are undeveloped and provide de facto habitat values. Generally, land use conflicts in the project area are limited.

Existing land use patterns and future land use recommendations will be evaluated for compatibility in more detail once protection, mitigation, and enhancement (PM&E) measures for the project are identified.

The information presented in this report will help clarify land ownership and land use patterns that need to be considered when managing the project and when planning for future improvements in the project area. At this point, because future PM&E measures for the project have not been identified, potential land use issues associated with future conditions have not been evaluated.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-L2 - LAND MANAGEMENT

Type of Study: ¸ Desktop Study 1 Field Study

Start Date: Winter 2002

Need for Study: Land within the Oroville Facilities Relicensing Project boundary and contiguous properties have a variety of managing entities responsible for existing and future land use and management. As part of FERC's required report on lands, it is necessary to identify these land management entities and the management objectives for the lands they manage.

Objective: The objective of this study is to determine what entities manage the lands adjacent to and near the project, what the land management objectives are for these lands, and how the management of those lands influences project facilities and operations and vise versa.

Scope/Methodology/Results: The study scope includes lands within the Oroville Facilities Relicensing Project boundary, contiguous properties, and other lands within 0.25 mile of the project boundaries. The study will identify the entities that currently have land management responsibilities and assess their land management plans and objectives. A general overview analysis of land use patterns, trends, consistency, opportunities, and constraints in the study area will also be conducted. These tasks will involve literature reviews, interviews, mapping, and data analysis. The results of the study will be described in a land management report that will include a summary of the current land management environment and GIS-generated maps documenting ownership, management objectives, etc.

Draft Interim Report, October 2003 – Abstract: This report identifies the public agencies responsible for managing lands within the FERC Project study 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.

Lands, facilities, and recreational interests in the study area are managed by a number of State and federal agencies, including DWR, DPR, DFG, USFS, and BLM. The properties and management responsibilities of each agency are detailed in a series of deeds, agreements, and transfers between the agencies involved. In addition to these land managers, two local jurisdictions, the County and the City, are responsible for providing land management direction for the remaining private lands within the study area.

DWR was initially charged with management responsibility for approximately half of the 70,000-acre study area, all of which is located within the FERC Project boundary, on behalf of the State of California. In 1961, the State Legislature passed the Davis-Dolwig Act (Water Code §§11900–11925), which made DWR responsible for acquiring land and planning for recreation and fish and wildlife enhancement as part of the State Water Project (SWP). The State of California holds fee-title ownership to all State lands within the FERC Project boundary and DWR is considered the “maintaining” or “controlling” agency for the Oroville Division of the State Water Resources Development System (SWRDS) on these lands.

The Davis-Dolwig Act also identified two other State stakeholders: DPR and DFG. To fulfill the act’s mandate, DWR transferred management rights of the majority of State-owned land within the project study area to these agencies under a “transfer of control and possession,” a legal document that basically gives the receiving agency an easement to carry out management and maintenance responsibilities. In total, DWR transferred management rights of approximately 28,800 acres to DPR and 12,000 acres to DFG. These lands primarily constitute LOSRA and the Oroville Wildlife Area (OWA). DPR and DFG are charged with managing public recreation facilities and fish and wildlife resources, respectively.

As a result of these transactions, DWR now has primary management responsibilities over 3 percent of the study area. However, DWR does bear the ultimate responsibility under the current FERC license for ensuring funding, development, and management of current and additional recreation facilities. In addition, the Davis-Dolwig Act requires DWR to plan for and acquire land for recreation in conjunction with all State water projects. In keeping with its responsibility, DWR works with DPR and DFG to provide for recreational opportunities and funding throughout the project area.

The entities that manage lands in the study area have developed land management plans that control existing land uses and give direction to future land uses within their jurisdictions. The land management direction for most of the land within the FERC Project boundary encourages current and future recreation, natural resource conservation, and public facilities land uses. Lands adjacent to the project boundary within the study area are managed for different uses, such as agricultural/rural residential development, timber preserve, conservation, recreation, and scenic areas—with the exception of areas along the Thermalito Diversion Pool and Thermalito Forebay and proximate to the City. Land management direction in these areas is more diverse and includes residential, commercial, and agriculture uses. Careful evaluation of land management direction will be required in the southern study area to ensure coordinated land management efforts.

This information will be further evaluated and summarized in a Draft Final Report. The Draft Final Report will identify management opportunities and constraints and those actions needed to maintain or enhance effective management opportunities, and will

examine funding mechanisms that could help accomplish those actions. Recommendations for resolving potential management issues will also be provided.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-L3 – COMPREHENSIVE PLAN CONSISTENCY

Type of Study: ¸ Desktop Study 1 Field Study

Start Date: Winter 2002

Need for Study: FERC relicensing regulations require that applicants prepare a report that identifies all relevant comprehensive and land management plans and discusses the project's consistency or lack of consistency with each plan.

Objective: The objective of this study is to describe existing comprehensive and management plans compared to existing and planned future land uses within and adjacent to the project boundary and to determine project consistency.

The scope of this study includes all plans that manage or address lands within the Oroville Facilities FERC Project boundary, contiguous properties, and other lands within 0.25 mile of the project boundary. This study will consist of two phases: (1) a review and summary of existing comprehensive and land management plans that potentially influence, or are potentially influenced by the project; and (2) a determination of consistency. A report will be produced that describes examined plans and discuss project consistency with those plans.

Final Draft, April 2003 – Abstract: This report evaluates the compatibility and consistency of project operations with 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. The study area includes Lake Oroville; the lands and waters within and adjacent to and within 0.25 mile of the FERC Project boundary; and adjacent lands, facilities, and areas with a clear project nexus.

The Interim Report for this study described relevant land and resource comprehensive management plans. 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 (LUWG). 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 have been incorporated into this Draft Final Report.

The following relevant comprehensive land use and resource management plans in the project area were identified:

Agency	Document Title	Date	FERC Identified Plan
FEDERAL			
USFS	Plumas National Forest Land and Resource and Management Plan	1988	No
USFS	Sierra Nevada Forest Plan Amendment	2000	No
USBR/ USFWS	Record of Decision for Title 34—Central Valley Project Improvement Act (CVPIA)	2000	No
BLM	Redding Resource Management Plan and Record of Decision	1993	No
USFWS	Final Restoration Plan for the Anadromous Fish Restoration Plan	2001	No
CALFED	California's Water Future: A Framework for Action	2000	No
STATE			
DPR	California Outdoor Recreation Plan	1994	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
DWR	The California Water Plan Update	1994	Yes
DWR	Amended Recreation Plan for Lake Oroville State Recreation Area	1993	No
DWR	Lake Oroville Fisheries Habitat Improvement Plan	1995	No
DFG	Oroville Wildlife Management Area Management Plan	1978	No
CDF	Fire Management Plan	2001	No
STATE Cont'd			
CDF and SBF	The California Fire Plan	1996	No
LOCAL			
City of Oroville	General Plan	1995	No
City of Oroville	Bicycle Transportation Plan	1998	No
Butte County	General Plan	1996	No
BCAG	Butte County Bicycle Plan, Butte County 2001 Regional Transportation Plan	2001	No
BCAG	Countywide Bikeway Master Plan	1998	No

Notes:
BCAG = Butte County Association of Governments
CALFED = CALFED Bay-Delta Program
CDF = California Department of Forestry and Fire Protection
SBF = State Board of Forestry
USBR = Bureau of Reclamation
USFWS = U.S. Fish and Wildlife Service

As a result of this study, it will be possible to determine whether potential changes to project features and operations as a result of relicensing activities would be consistent or inconsistent with the comprehensive land and resource management plans reviewed in the report. Equally important will be the ability to evaluate whether PM&E measures

developed for the project will be consistent or inconsistent with the comprehensive plans, and what aspects of proposed actions would need to be altered to attain consistency.

When potential project changes to project features and operations and PM&E measures are proposed, their consistency or inconsistency will be evaluated in the Final Report.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-L4 -- AESTHETICS

Type of Study: 1 Desktop Study , Field Study

Start Date: Spring 2002

Need for Study: FERC requires an applicant to assess how a relicensed project will affect the aesthetic quality of the area in which the project is located.

Objective: The objectives of this study are to inventory and characterize the existing aesthetic quality of the project area, assess the level of contrast and compatibility of existing project features with the project's aesthetic setting, and evaluate the degree to which proposed PM&E measures would affect the aesthetic quality of the project area.

Scope/Methodology/Results: The scope includes the area within the Oroville Facilities Relicensing Project boundary. Working with several work groups and agency staff, key observation points (KOPs) will be identified to represent various views that occur around the project facilities. Field reconnaissance will verify the appropriateness of the KOPs at both high- and low-water pool elevations. Visibility of project and nonproject features that influence visual quality will be documented and analyzed to describe existing aesthetic conditions and to evaluate the aesthetic effects from potential PM&E measures. In addition, an aesthetic opportunity and constraints analysis will be conducted. The results will be presented in an aesthetic resource report and will include photographs from KOPs and GIS-based maps and graphics.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-L5 – FUEL LOAD MANAGEMENT EVALUATION

Type of Study: ¸ Desktop Study 1 Field Study

Start Date: Spring 2002

Need for Study: The California Environmental Quality Act (CEQA) requires evaluation of potential project impacts related to safety including increased risk of wildfire. Stakeholders have expressed concern that historical land management and fire prevention activities within the FERC Project boundary have resulted in increased fuel loading.

Objective: The objectives of this study are to determine fuel loads within the project boundary, evaluate methods to reduce fuel loading and their effects on other resources, and recommend fuel load management and reduction techniques.

Scope/Methodology/Results: The study scope includes the area within the FERC Project boundary, contiguous properties, and lands within 0.25 mile of the project boundary. This study will assess current fuel loads within and adjacent to the project boundary, examine successful fuel load management and reduction programs elsewhere, incorporate information developed from SP-T11 (Fire Prevention/Fuel Load Control) regarding effects of fuel loading and management options on plant communities and wildlife habitats, and develop recommendations for techniques or programs appropriate to the project lands.

Interim Report, June 2003 – Abstract: This Interim Report provides a status update of the current fuel load conditions, reviews relevant fuel load reduction and management techniques, summarizes the programs and policies of several land management and other local agencies, and suggests fuel load reduction measures.

A literature and data review of appropriate study area–related land management and fire control data was conducted to assess current fuel loads. Literature reviews and interviews were conducted to identify fuel load reduction techniques, strategies, management policies, and programs. Fuel reduction measures were suggested based on the review of various techniques, programs, and policies currently being used by local agencies, as well as general vegetation types within the study area.

Details on existing fuel loads within the project area and fuel load reduction techniques are discussed in detail. Fuel treatments that remove ladder fuels reduce the potential for crown fires, which are difficult to control and devastating. Reduced damage and a reduction in the loss of timber resources are evident from areas treated for fuel load. Firefighter safety is increased with fuel management as a result of the removal of

excess fuel and ladder fuels, which are components to high-hazard fires. Areas with natural fire cycles of short intervals and low-intensity fires are likely to have significant ecosystem benefits from fuel treatments conducted by prescribed burning to emulate natural fire effects. USFS indicates that the cost per acre of suppression was 10–60 times the cost of an average prescribed fire.

Relevant fire management policies and plans in the study area are described in detail. The interface zone around communities should be protected by creating fuel breaks, such as community defense zones or shaded fuel breaks. Community members should be educated about fire danger and preventative measures. Some communities have established Fire Safe Councils; these efforts should be encouraged and Fire Safe Councils in other communities should be promoted. Community members should be encouraged to create defensible space around their homes and follow fire safety guidelines for inside and outside of homes. Properties in the wildland-urban interface also should be inspected for hazardous fuel conditions to ensure compliance with city, county, and State ordinances. In other wooded areas, fuel breaks or Defensible Fuel Profile Zones should be created to reduce the chance of fire spreading and to provide a safe area for fire suppression efforts. In grassland areas, prescribed burns should be used where feasible to control weeds, to promote nutrient cycling, and to encourage growth of native species (especially in vernal pool ecosystems). If burning is not feasible, fuels could be reduced by mowing or disking. Grazing in selected areas may be a useful technique to reduce fuel load, if it is compatible with other land use policies and goals in the area. In riparian areas, prescribed burns conducted in the early spring may be an effective method to reduce ground fuels and promote germination of herbaceous species, thus enhancing wildlife habitat.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-R1 – PUBLIC AND PRIVATE VEHICULAR ACCESS

Type of Study: [1] Desktop Study [2] Field Study

Start Date: May 2002

Need for Study: FERC guidelines direct the licensee to provide adequate public access to recreation facilities and project waters. This study is needed to determine whether the Oroville Facilities meet FERC direction to ensure public access.

Objective: The objective of this study is to identify the opportunities for and constraints to public and private vehicular access to project land and water resources.

Scope/Methodology/Results: The study area includes lands within the FERC Project boundary and adjacent lands within 0.25 mile with a clear nexus to the project. This study will involve a quantitative and qualitative assessment of current public access and future development effects on public access through the next license period. The study will identify the current condition of vehicular access and determine whether it poses a barrier to recreation visits in the project area. Results will include recommendations to improve or change access for current and future recreation demand.

Final Draft, September 2003 – Abstract: This study was conducted to identify the adequacy of vehicular access routes to the recreation areas associated with the Oroville Facilities. Adequate access is needed to accommodate current use and future recreation demand. FERC guidelines direct DWR to ensure the public's access to recreation facilities within the project area. Specifically, FERC guidelines state that the licensee, DWR, shall "make provisions for adequate public access to such project facilities and waters" (Part 2, Subchapter A, Chapter 1, §2.7 of 18 Code of Federal Regulations [CFR]).

This study examines opportunities and constraints related to vehicular access to land and water resources in the project area. Current access conditions, identification of potential future development, and effects of project operations on public access are also discussed.

This report summarizes vehicular access to each recreation site within the project area. Vehicular access to trailhead points is discussed, and a list of roads, their type, and condition is provided. Future known road development projects are presented. Finally, the report summarizes constraints to, and opportunities for, vehicular access.

In general, transportation routes to recreation sites in the project area are without constraints to vehicular access. Roads leading to areas that receive the highest use are

paved and in good condition. Average- and low-use areas are serviced by paved roads in good condition. There are some instances where roads are in poor condition within low-use and undeveloped areas, such as within the undeveloped OWA. Recreation management goals will determine what recreation areas will be expanded in the future and thus what roads may need to be widened or improved. If the management goals at OWA are to avoid significant new development and/or to provide a more primitive driving experience, then it may be appropriate to have low-standard roads.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-R2 – RECREATION SAFETY ASSESSMENT

Type of Study: ¸ Desktop Study 1 Field Study

Start Date: May 2002

Need for Study: FERC regulations require the licensee to prepare a Comprehensive Recreation Plan as part of its application for relicensing hydroelectric facilities. This study is needed to meet FERC direction for preparing the portion of a Comprehensive Recreation Plan that addresses significant safety issues and concerns. FERC regulations require that licensees operate their projects for protection of life, health, and property.

Objective: The objectives of this study are to identify recreation safety issues and concerns, assess current and historic recreation-related safety incidents and trends, and evaluate recreation safety-related management policies and procedures.

Scope/Methodology/Results: The study area includes lands within the FERC Project boundary and adjacent lands within 0.25 mile with a clear nexus to the project. This study will involve a quantitative and qualitative assessment of recreation public safety in the study area and will develop a set of recommendations. The study will use data collected from SP-R7, Reservoir Boating Study, and SP-R13, Recreation Surveys, as well as research on recreation facility regulations and enforcement issues, local health/injury issues, and fire issues to develop appropriate action considerations for incorporation into the Comprehensive Recreation Plan.

Draft Final Report, January 2004 – Abstract: The study presents a quantitative and qualitative assessment of public safety as it relates to existing recreation activities within the study area.

The following methods were used to complete this study: interviews with safety-related personnel; review of recreation surveys and safety issues; review of incident reports and accident statistics; field observations of potential hazards, cell phone coverage, and radio communications; and review of wildland fire safety.

During interviews with representatives of law enforcement and land and resource management agencies, the following issues related to recreation safety were identified:

- Watercraft exceeding the 5 miles per hour (mph) limit in designated zones;
- Personal watercraft users jumping wakes and following other boats too closely;
- Alcohol use while boating;

- Need for additional enforcement officers to deal with boating safety issues;
- Boaters not wearing personal floatation devices;
- Aquatic plants getting caught in the jets of personal watercraft or jet boats;
- Daily water fluctuations at Thermalito Afterbay;
- Seasonal water level changes at Lake Oroville;
- Fights and assaults with deadly weapons at the Thermalito Afterbay outlet fishing area;
- Cases of hypothermia along the Feather River below Oroville Dam;
- Fires occurring frequently in OWA and vegetation conditions creating various hazards for hunters and hikers in the area;
- Lack of an evacuation plan for OWA in case of fire;
- Lack of preparedness by DFG for developed recreation management despite the fact that areas within OWA are used as heavily as developed recreation sites; and
- Illegal dumping within the study area, including cars, appliances, and items associated with methamphetamine labs.

Recreation surveys were conducted and included questions related to recreation safety both within the study area and at similar sites in Northern California. Only a small fraction of the respondents identified behavior that put them at risk while visiting the study area. Personal watercraft and boats operated in too close a proximity to each other was mentioned as the most common "at risk" behavior.

An evaluation of information provided by DPR showed that vandalism and alcohol-related violations were the most common illegal activities in LOSRA. The most common types of boating accidents at Lake Oroville, as reported by the California Department of Boating and Waterways (DBW) and DPR, were collisions with other vessels and water skier mishaps. Other types of accidents appear to be fairly isolated incidents.

CDF has recorded nearly 400 fire ignitions in the study area since 1990. The most common recorded cause of wildfire ignitions was the use of equipment; very few were caused by recreational use.

The following public safety actions were identified for consideration during relicensing:

- Facilitate coordination of incident and accident reporting to allow for a more comprehensive and timely analysis of safety-related accidents and incidents.
- Increase the frequency of land-based DFG patrols concentrated on the Thermalito Afterbay outlet area, especially during the fishing season.

- Provide additional warning buoys and/or signs identifying potentially shallow boating areas at Thermalito Afterbay.
- Expand current visitor safety and management (interpretation and education) programs to help reduce safety-related incidents.
- Develop a fire evacuation plan for recreational users in OWA.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-R3 – ASSESS RELATIONSHIP OF PROJECT OPERATIONS AND RECREATION

Type of Study: ¸ Desktop Study 1 Field Study

Start Date: May 2002

Need for Study: FERC regulations require the licensee to prepare a Comprehensive Recreation Plan as part of its application for relicensing hydroelectric facilities. This study is needed to address the relationship between project operations and recreation.

Objective: The objective of this study is to determine the effects of current operations and any proposed changes to those operations on recreational use and visitor experience at project facilities.

Scope/Methodology/Results: The study area includes lands within the FERC Project boundary and adjacent lands within 0.25 mile with a clear nexus to the project. This study will involve a quantitative and qualitative assessment of the effects that project operations have on recreational resources and activities at project facilities. The study will use data collected from SP-R7 (Reservoir Boating Study), SP-R9 (Existing Recreation Use), and SP-R13 (Recreation Surveys), as well as research from Engineering and Operations studies, to describe operational effects and assess how various potential operating scenarios may affect recreation. Results will be used to develop PM&E measures for facilities or areas adversely affected by project operations.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-R4 – ASSESS RELATIONSHIP OF FISH/WILDLIFE MANAGEMENT AND RECREATION

Type of Study: ¸ Desktop Study 1 Field Study

Start Date: January 2003

Need for Study: FERC guidelines require the licensee to cooperate with local, State, and federal agencies in the determination of public recreation needs and to cooperate in the preparation of plans to meet those needs, including those for sport fishing and hunting.

Objective: The objective of this study is to identify the effects of fish and wildlife management on providing recreational opportunities within the project area.

Scope/Methodology/Results: The study area includes lands within the FERC Project boundary and adjacent lands within 0.25 mile with a clear nexus to the project. This study will develop an understanding of management issues and assess existing and future opportunities to enhance wildlife-related recreation. The results of this study will be input to SP-R17, Recreation Needs Analysis, and used to develop that portion of a Comprehensive Recreation Plan focusing on the maintenance or enhancement of fish and wildlife–related recreational opportunities.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-R5 – ASSESS RECREATION AREAS MANAGEMENT

Type of Study: ¸ Desktop Study 1 Field Study

Start Date: January 2003

Need for Study: FERC requires a statement of existing measures to be continued or maintained for the purposes of creating, preserving, or enhancing recreational opportunities at the project. Additionally, FERC guidelines require the licensee to cooperate with local, State, and federal agencies in the determination of public recreation needs and to cooperate in the preparation of plans to meet those needs.

Objective: The objective of this study is to identify the effects of recreation area management on providing recreational opportunities within the project area.

Scope/Methodology/Results: The study area includes lands within the FERC Project boundary and adjacent lands within 0.25 mile with a clear nexus to the project. This study will assess the current range of recreation area management actions being undertaken, will identify the responsible agencies, and will evaluate actions and funding necessary to maintain or enhance recreation opportunities associated with project facilities and waters. The results will include findings and identify recreation area management options to maintain, preserve, or enhance recreational opportunities. The results of this study will be used to develop that portion of a Comprehensive Recreation Plan focusing on the management of recreation facilities.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-R6 - ADA ACCESSIBILITY ASSESSMENT

Type of Study: 1 Desktop Study , Field Study

Start Date: September 2002

Need for Study: This study is needed to meet the FERC direction to ensure public access for people with physical disabilities, and to ensure compliance with the Americans with Disabilities Act (ADA) guidelines for buildings and facilities.

Objective: The main objective of this study is to determine the current accessibility and future accessibility needs for people with disabilities to use project-related recreation facilities and to participate in the project's primary recreation activities such as boating and camping.

Scope/Methodology/Results: The study area includes lands within the FERC Project boundary and adjacent lands within 0.25 mile with a clear nexus to the project. Internal agency studies by DWR and DFG will be acquired and reviewed to note past problem areas that can be evaluated for compliance. Field assessments will augment the data review. This study will produce a field study form for assessing recreation facility compliance with ADA and a summary report.

Proposed Final Draft, September 2003 – Abstract: This study meets FERC's direction to ensure access to public facilities within the Oroville Facilities Relicensing project area by those with physical disabilities. Section 2.7 of 18 CFR was amended in 1974 to include consideration for the needs of the physically disabled. In 1991, the ADA Access Guidelines for Buildings and Facilities were published. Guidelines were specified for new construction or retrofitting construction features such as parking, entrances, access routes, restrooms, and showers. Design guidelines specifically intended for outdoor recreation facilities have been developed since 1991 and are presented in this report.

The objectives of this study are to assess present degrees of adequacy and future accessibility needs for persons with disabilities who may use public recreation facilities within the study area. Recreation facilities in the study area support activities such as camping, fishing, picnicking, swimming, shoreline access, boating, and hiking.

Additionally, the results of this study may be used to provide recommendations for facility improvements. Compliance with the ADA and its associated accessibility requirements are important elements of potential facility upgrades that may be considered for proposed PM&E measures during the Oroville Facilities Relicensing process.

ADA requirements for outdoor recreation facilities are summarized in this report to provide a context for the compliance analysis. ADA reports from DWR, DPR, and DFG, and communications between researchers and department staff, were synthesized; these reports and communications are discussed and their findings summarized. The report covers requirements for campgrounds, day use areas, boat ramps, boat ramps with day use areas, and trailheads and trails.

Facilities required to be ADA accessible within the study area meet, or will soon be upgraded to meet, ADA technical standards. Not all of the facilities are required to be made accessible. Additionally, the land and resource management agencies have met the required ADA standards by providing disabled recreationists access to the "programs" available in the area. The programs that are accessible include campgrounds, boating facilities, picnic areas, and beach/water access.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-R7 - RESERVOIR BOATING SURVEY

Type of Study: ☐ Desktop Study ☐ Field Study

Start Date: May 2002

Need for Study: FERC regulations require the licensee to prepare a Comprehensive Recreation Plan as part of its application for relicensing hydroelectric facilities, including information on existing recreation uses at project facilities and waters, and boating is a major activity in the area.

Objective: The study objective is to describe existing boating use and water surface management on Lake Oroville and other water bodies that allow boating within the project area, evaluate adequacy of boating opportunities, and determine whether water surface management changes are appropriate.

Scope/Methodology/Results: The study area includes the area within the Oroville Facilities FERC boundary and adjacent lands with project nexus. The study consists of six tasks: (1) research local boating issues, (2) assess boating use levels, (3) assess boating infrastructure, (4) assess boaters' perceptions, (5) estimate surface water boating carrying capacity, and (6) prepare a report summary that presents the results of tasks 1 through 5. Results will be used to determine whether management changes or facility upgrades are needed to improve boaters' experiences and to identify potential impacts of boating activities on natural and cultural resources on the shoreline.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-R8 - CARRYING CAPACITY STUDY

Type of Study: ☐ Desktop Study ☐ Field Study

Start Date: June 2002

Need for Study: FERC regulations require the licensee to prepare a Comprehensive Recreation Plan as part of its application for relicensing hydroelectric facilities. This study is needed to meet FERC direction for preparing the portion of a Comprehensive Recreation Plan that considers the recreation carrying capacity of the study area.

Objective: The study objective is to determine a sustainable level of recreational facility development and recreational use that provides high quality opportunities to the project's primary constituencies, protects the project's sensitive and natural resources in the area, and is consistent with the planned operation of the project.

Scope/Methodology/Results: The study area includes lands within the FERC Project boundary and adjacent lands within 0.25 mile with a clear nexus to the project. This study involves conducting three interrelated tasks: (1) data collection for the four capacity types (ecological, physical/spatial, facility, and social); (2) identification of limiting factor(s); and (3) assessment of overall capacity of the site, projectwide, and associated activity levels. The results of this study will include an assessment of capacities of each recreational area and the study area as a whole. For each recreation facility, ecological, physical/spatial, facility, and social capacity will be determined and discussed.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-R9 - EXISTING RECREATION USE STUDY

Type of Study: 1 Desktop Study , Field Study

Start Date: May 2002

Need for Study: FERC regulations require estimates of existing and future recreation use at the project, in daytime and overnight visitation, as well as a description of the methods used to estimate use.

Objective: The main objective of this study is to estimate existing project-related recreational use (both day use and overnight use).

Scope/Methodology/Results: The study area includes recreation facilities within the Oroville Facilities FERC Project boundary, and adjacent recreation facilities with a nexus to the project. The study will include field monitoring and counting of actual usage of campgrounds and day use sites, including dispersed recreation use areas. The study will include sampling various time periods (seasons, holidays, etc.), estimating the level of participation in various recreational activities and analyzing use distribution. The study results will help ensure that existing use levels are maintained or enhanced. Study findings will provide input to other recreation use studies, and will be used to help develop recommendations for recreation needs to be included in a Comprehensive Recreation Plan.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-R10 - RECREATION FACILITY AND CONDITION INVENTORY

Type of Study: ¸ Desktop Study ¸ Field Study

Start Date: September 2002

Need for Study: FERC requires a statement of existing measures to be continued or maintained for the purposes of creating, preserving, or enhancing recreational opportunities at the project.

Objective: The study objectives are to inventory existing facilities, determine their condition, and identify maintenance issues.

Scope/Methodology/Results: The study area includes lands within the FERC Project boundary and adjacent lands within 0.25 mile with a clear nexus to the project. The study will provide a detailed inventory and evaluation of recreation facilities, use areas, and conditions for each of the sites in the study area. Results will describe current conditions of facilities and be used to make recommendations for facilities' enhancements. The findings of this study will also provide information needed for other recreation-related studies.

Final Draft, September 2003 – Abstract: This report presents the results of an inventory and conditions evaluation of recreation facilities and sites in the study area, and associated sites with a project nexus. The Oroville Facilities offer a variety of recreational opportunities, including boating, fishing, and camping. Campsites range from fully developed campgrounds to primitive, less developed sites; there are also boat-in and floating campsites. Around Lake Oroville there are two full-service marinas, nine boat ramps, six car-top boat ramps, ten floating campsites, and seven floating restrooms. There are developed recreation facilities at Bidwell Canyon, Lime Saddle, Loafer Creek, North and South Thermalito Forebay, and Spillway. Other recreation opportunities include picnicking, swimming, horseback riding, hiking, off-road bicycle riding, wildlife watching, and hunting. The area also offers visitor information sites with cultural and informational displays about project-developed facilities and the area's natural environment. Additional recreational and visitor facilities are located at the Lake Oroville Visitors Center, the Thermalito Diversion Pool, Thermalito Afterbay, and in OWA.

Researchers conducted an inventory of existing recreation areas in the study area, primarily by counting the units of each type of recreation facility (e.g., picnic tables, campsites, bathrooms) and assessing their general condition. After review, the field inventory and conditions assessment were revisited in 2002 and 2003 to incorporate facilities that were not constructed or completed in 2000.

Methods for the recreation site facility inventory and evaluation study involved a comparison of site-specific field observations with published information from DWR, DPR, and DFG reports. The condition of existing developed recreation facilities in the study area was systematically evaluated through field observations. Researchers observed current conditions at the sites examined.

Overall, most of the developed recreation facilities in the project area are in good condition. There are a few exceptions, including basic facilities maintenance of specific sites and placement of directional signs on major roads and at major intersections for certain car-top boat ramps. The need for evaluation and possible attention was noted for the following areas:

- The Thermalito Afterbay Outlet Boat Ramp (BR) is in relatively poor condition and is typically recommended for four-wheel drive vehicles only (especially when muddy). The ramp is scheduled to be paved in 2004, which would eliminate this problem.
- Maintenance and service of portable toilets is needed in the Bloomer Area and Foreman Creek Boat-in Camps (BICs), and OWA Area G.
- Directional signs are absent or in need of improvement at Dark Canyon Car-top BR; OWA Areas C, F, and G; the Rabe Road Shooting Area; Stringtown Car-top BR; and Vinton Gulch Car-top BR.
- Repair is needed to the shoulders of Nelson Bar Car-top BR and Stringtown Car-top BR.
- Garbage facilities service frequency needs to be increased at Dark Canyon Car-top BR, Enterprise BR, Foreman Creek Car-top BR, Stringtown Car-top BR, and Wilbur Road Thermalito Afterbay BR.
- Lime Saddle Marina was severely damaged by 2003 winter storms. Repairs are the responsibility of the concessionaire; a new concession contract is being solicited and negotiated.
- The secondary gravel/dirt road to OWA Area G needs maintenance.

When Lake Oroville is at its maximum elevation (900 feet above mean sea level [msl]), it covers approximately 15,810 acres and has 167 miles of shoreline. As the pool level decreases during the ensuing recreation season, the use of facilities such as boat ramps, car-top boat ramps, and boat-in camps is increasingly affected. Use of some recreational facilities is prevented during low water, making shoreline exploration difficult and creating other resource impacts and conflicts.

Other facility issues are as follows:

- Generally, the Bidwell Canyon facilities are available at high, medium, and low reservoir levels; however, several houseboaters have stated on visitor surveys

that they cannot reach the gas pumps (located at the Bidwell Marina) at the lowest reservoir levels experienced in 2002.

- Foreman Creek Car-top BR and Enterprise BR have periodically been closed to vehicle access because of the presence of sensitive cultural resources.
- The OWA boat ramps are unimproved and are not in good condition. These ramps are informal sites and not currently scheduled to be upgraded.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-R11 - RECREATION AND PUBLIC USE IMPACT ASSESSMENT

Type of Study: 1 Desktop Study , Field Study

Start Date: April 2002

Need for Study: FERC regulations require the licensee to prepare a Comprehensive Recreation Plan as part of its application for relicensing hydroelectric facilities. This study is needed to meet FERC direction for preparing the portion of a Comprehensive Recreation Plan that addresses the effects of recreation and public use on biological and cultural resources in the project area.

Objective: The study objective is to assess recreation and public use impacts on vegetation, soils, water quality, and cultural resources to study area lands and waters.

Scope/Methodology/Results: The study area includes Lake Oroville, the lands and waters within and adjacent to (within 0.25 mile of) the FERC Project boundary, and adjacent land with a clear project nexus. This study will consist of three tasks: (1) develop site impact assessment forms; (2) conduct fieldwork, site mapping and photography; and (3) prepare a summary report of tasks 1 and 2. The results of this study will focus on ecological and cultural impacts at developed and undeveloped recreation facilities in the study area and will provide a baseline of information for future long-term monitoring of public recreational impacts.

Final Draft, January 2004 – Abstract: The document presents the Recreation and Public Use Impact Assessment. It includes a qualitative assessment of ecological impacts attributed to recreation and public use at recreation sites and areas in the study area. The report summarizes the recreation and public use impacts on vegetation, soils, and water quality at project recreation facilities.

The study first identifies dispersed recreation sites within the study area. Then it discusses what indicators are evaluated and what impacts they may cause. As a part of this plan, conditions of existing recreation facilities are considered. The study compiles and analyzes field data collected in the study area related to ecological impacts at developed recreation sites and undeveloped dispersed recreation sites.

As a part of the study, the following indicators were qualitatively analyzed to evaluate potential recreation and public use impacts or concerns related to sensitive ecological resources:

- Soil erosion;
- Soil compaction;

- Fugitive dust;
- Trash accumulation;
- Sanitation;
- Vegetation damage;
- Prevalence of user-defined trails;
- Impacts on wetlands;
- Impacts on riparian zones;
- Prevalence of downed wood;
- Impacts on shoreline and water quality;
- Off-highway vehicle (OHV)-related impacts (evaluated at dispersed sites); and
- Estimated use levels (evaluated at dispersed sites).

Cultural resource impacts are not addressed in the study; impacts on cultural resources are evaluated in other relicensing studies. Those studies have identified numerous sensitive cultural resource sites in the study area.

Researchers observed study area sites and areas—walking and driving—looking for recreation and public use-related impacts. The results were recorded on assessment forms; notes relating to this qualitative assessment were also included. Two observation periods occurred, one in the summer and another in the winter.

An overall level of impact for each site and indicator was assigned based on a comparison of the two observation periods. Overall, developed recreation sites exhibited few impacts. However, the following few developed recreation sites were identified as areas of higher concern compared to others in the study area:

- Afterbay Outlet Campground and Day Use Area (DUA);
- Clay Pit State Vehicular Recreation Area (SVRA);
- Foreman Creek Car-top BR;
- Rabe Road Shooting Range; and
- Saddle Dam DUA.

The overall level of impact was greater at dispersed recreation sites and areas than at developed recreation sites. The following dispersed recreation sites were identified as being of high concern:

- Old Nelson Bar Road Dispersed Site;
- OWA—Headquarters Entrance Dispersed Use Area;

- OWA—Pacific Heights Road Highway 70 Entrances Dispersed Use Area;
- OWA—Palm Avenue Entrance Dispersed Use Area; and
- Ponderosa Dam Dispersed Site.

Additionally, the following indicators were identified as being of high concern at dispersed recreation sites and areas (there were no indicators identified as being of high concern at developed recreation sites or areas):

- OHV impact;
- Trash accumulation; and
- User-defined trails.

Potential management responses in the study area to commonly observed projectwide concerns may generally include:

- Placement and servicing of trash receptacles at sites with excessive amounts of litter;
- Providing visitor education regarding low-impact recreational techniques;
- Hardening of heavily used areas to reduce vegetation damage and erosion;
- Providing visitor education regarding the potential impacts of use near river and reservoir shorelines;
- Limiting the number of OHV roads or preventing OHV access in some dispersed use areas;
- Providing visitor education regarding potential OHV use impacts in sensitive ecological areas (wetland, riparian); and
- Periodically monitoring conditions over time using current data as a baseline, and adopting management responses to changes in use over time.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-R12 - PROJECTED RECREATION USE

Type of Study: ¸ Desktop Study 1 Field Study

Start Date: May 2002

Need for Study: FERC regulations require estimates of existing and future recreation use at the project, in daytime and overnight visitation, as well as a description of the methods used to estimate use.

Objective: The study objective is to project the amount of recreation use in the study area for various intervals throughout the project's license term.

Scope/Methodology/Results: The study area includes lands within the FERC Project boundary and adjacent lands within 0.25 mile with a clear nexus to the project. The study will involve quantitative and qualitative assessments using previous attendance or use data and expert informed judgment to project future use. Considerations will include statistical demand forecasting, based on estimated population growth, and an assessment of anticipated impacts from other recreational sites. The study results will be used to help determine when recreation facilities and areas may reach capacity, when social carrying capacity of recreation areas may be exceeded, and when user contact levels and natural resource sustainability may become critical. This will include projections for various development scenarios and implications for other recreational studies being developed.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-R13 - RECREATION SURVEYS

Type of Study: 1 Desktop Study , Field Study

Start Date: May 2002

Need for Study: FERC regulations require the licensee to prepare a Comprehensive Recreation Plan as part of its license application. FERC regulations state that a "well documented user survey is an essential part of a good recreation plan."

Objective: The study objectives are to determine user preferences for facility and area development, perceptions of crowding, levels of satisfaction, reasons for visiting the area, reasons for not visiting the area, and background characteristics.

Scope/Methodology/Results: The study area includes the area within the Oroville Facilities FERC Project boundary, and a larger region that will include visitors' area of origin. This study will consist of five tasks: (1) identify primary target groups and topics, (2) review relevant previous questionnaires/coordinate with ongoing studies, (3) develop questionnaire strategy and administration, (4) design and administer the questionnaires, (5) analyze survey data, and (6) prepare a summary report. Summary data tables will be developed for each recreation target group. Descriptive statistics such as the proportion of respondents supporting a new management action, and averages will be computed for all questions. Results will be used to develop a Comprehensive Recreation Plan.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-R14 – ASSESS REGIONAL RECREATION AND BARRIERS TO RECREATION

Type of Study: ¸ Desktop Study 1 Field Study

Start Date: July 2002

Need for Study: FERC guidelines require the licensee to cooperate with local, State, and federal agencies in planning for recreational use of public lands administered by those agencies adjacent to the project area. This requires a regional approach. FERC also requires licensees to develop suitable public recreational facilities with adequate public access. This is best accomplished by evaluating recreation demand in a regional context.

Objective: The objective of this study is to determine barriers to increasing existing and future recreational uses within the project area, including an evaluation of regional recreational opportunities in Northern California.

Scope/Methodology/Results: The study area includes the facilities and lands within the FERC Project boundary; adjacent lands, facilities, and areas with a clear project nexus; and a larger region that will include potential visitors' area of origin. This study will collect and analyze barrier-related data and regional supply and demand information. Results will provide information on the relative attractiveness of the project area compared to other reservoir areas in Northern California, and will identify potential barriers and possible enhancement to increase visitation.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-R15 - RECREATION SUITABILITY STUDY

Type of Study: ¸ Desktop Study 1 Field Study

Start Date: April 2003

Need for Study: FERC regulations require the licensee to prepare a Comprehensive Recreation Plan as part of its relicensing application. This study will identify whether there are areas potentially suitable for new recreation development that may be used to meet the recreation needs of the visitors to the project area.

Objective: The study objective is to determine areas suitable for potential new recreation facility development in the project area consistent with the resource opportunities and constraints of the area.

Scope/Methodology/Results: The study scope focuses on developed and dispersed shoreline recreation opportunities that include Lake Oroville, and the lands and waters within the project boundary and adjacent lands within 0.25 mile with a clear nexus to the project. This study will analyze recreation suitability for potential recreation development and dispersed use that balances recreation needs and visitor experience with resource protection and land use/management needs. Opportunities and constraints will be analyzed and ranked, and a summary report will include mapping and summary text of these findings. Suitability acreage totals will be listed and discussed for each area.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-R16 – WHITEWATER AND RIVER BOATING

Type of Study: 1 Desktop Study , Field Study

Start Date: May 2002

Need for Study: FERC regulations require the licensee to prepare a Comprehensive Recreation Plan as part of its application for relicensing hydroelectric facilities, including information on existing recreation uses at project facilities and waters, and boating is a major activity in the area.

Objective: The study objective is to describe existing boating use and identify ways to enhance or provide recreational experiences for appropriate river-related activities such as rafting, kayaking, canoeing, and boat fishing.

Scope/Methodology/Results: The study area includes three reaches of the Feather River above and below Lake Oroville. One reach extends upstream from the upper end of the north branch of Lake Oroville to the Poe Power Plant. The second reach extends from Lake Oroville downstream to the river outlet while the third reach extends from the river outlet downstream to Gridley. Lands and waters within and adjacent to the FERC Project boundary will also be studied. The study will review existing data, and will perform onsite reconnaissance and controlled flow studies as needed to prepare a river boating opportunity assessment. Results will be used to determine whether management changes or facility upgrades are needed to improve boaters' experiences and to identify potential impacts of boating activities on natural and cultural resources on the shoreline.

Final Draft, November 2003 – Abstract: The objectives of this study are to describe whitewater and river boating activities on the Feather River within the project area, to examine effects of Oroville Facilities operations on boating activities, to evaluate solutions to any identified issues related to whitewater and river boating, and ultimately to help plan for recreational experiences for appropriate water-related activities.

In this report, the Feather River is analyzed in two reaches, the upper reach and the lower reach. The analysis of the upper reach of the North Fork Feather River focuses on the Big Bend whitewater run, its user group, and identified issues, and makes comparisons with similar runs throughout the area, California, and the region. The report describes the lower reach, the lower reach user group, and issues identified for this reach. The report discusses resources and access constraints identified on the Middle Fork Feather River, followed by a discussion of a stakeholder-proposed whitewater park. The report also addresses whitewater and river boating–related issues and concerns, and possible actions to take that would address these concerns.

On the upper reach (North Fork Feather River), the Big Bend run is used mainly by local residents, and only when the reservoir lowers to an elevation where they feel enough whitewater is exposed to make the run worth boating. The Big Bend run is comparable to other runs in the area, in California, and elsewhere in the western United States. Lack of flow information and difficult accessibility are the primary issues affecting use of the upper reach. Possible actions proposed by stakeholders to address these concerns include providing flow information and a water shuttle on weekends to provide easier and faster take-out access.

On the lower reach (Feather River from Oroville Dam to Gridley), river boating is popular with both motorized and nonmotorized boaters. Reported river boating issues include access, flow rates, fishing regulations, and lack of facilities. Possible actions to address these concerns include improving launch access; increasing flow; increasing DFG patrols; adding more toilet and trash facilities; and providing better maps and information on the location of boat ramps, access roads, and other facilities along the Feather River.

One stakeholder proposal for future recreation in the Oroville area is the development of a “whitewater park.” A whitewater focus group convened for this study generated preliminary ideas for potential whitewater park features, usage, and possible locations.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-R17 – RECREATION NEEDS ANALYSIS

Type of Study: 1 Desktop Study , Field Study

Start Date: May 2002

Need for Study: FERC regulations require the licensee to prepare a Comprehensive Recreation Plan as part of its application for relicensing hydroelectric facilities, including information on existing recreation uses at project facilities and waters and future recreation development. As part of this effort, FERC requires the development of a recreation needs analysis.

Objective: The study objective is to summarize findings derived from all other FERC-related studies to identify recreation needs for existing and potential facilities and areas during the next license period.

Scope/Methodology/Results: The study area includes lands within the FERC Project boundary and adjacent lands within 0.25 mile with a clear nexus to the project. The study will compile and review recreation data and results for other FERC-related recreation studies for the project area and identify general recreation needs with a focus on project-related recreation needs. A report will include recommendations regarding needed improvement to meet project recreation needs during the next license period.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-R18 - RECREATION ACTIVITY, SPENDING, AND ASSOCIATED ECONOMIC IMPACTS

Type of Study: ¸ Desktop Study 1 Field Study

Start Date: Early 2002

Need for Study: The study is needed to comply with FERC guidelines for socioeconomic assessments. Specifically, FERC guidelines suggest that "estimates should be provided for changes in employment and income associated with any anticipated modifications to recreation use in the project area, such as whitewater rafting, boating, or fishing."

Objective: The objectives of this study are to estimate the effects of spending activity generated by current and projected recreation use, and the operations and management of the Oroville Facilities on local business sales, employment, and personal income. A secondary objective of the study is to gain 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.

Scope/Methodology/Results: The study area includes communities in close proximity to Lake Oroville, including Oroville, Paradise, Gridley and Biggs, and the unincorporated (countywide) area of Butte County. The study plan will use as inputs economic and other data from existing sources as well as original interviews and surveys of businesses. Data will be used to describe existing conditions for each jurisdiction. Economic impacts will be predicted using numerous models, and an economic impact spreadsheet and summary report will be created. Results of the study will be used to characterize the economic impacts on the cities of Paradise and Oroville, the unincorporated areas of Gridley and Biggs, and Butte County of existing and projected recreation use and operations and management of the Oroville Facilities.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-R19 - FISCAL IMPACTS

Type of Study: ¸ Desktop Study 1 Field Study

Start Date: Spring 2002

Need for Study: The study is needed to comply with FERC guidelines for socioeconomic assessments. Specifically, FERC guidelines suggest that a socioeconomic assessment should include a "local government fiscal impact analysis."

Objective: The study objectives are to estimate the effects of economic activity generated by current and projected recreation use and by the operations and maintenance 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 recreation activity and management at Lake Oroville.

Scope/Methodology/Results: The study area will include communities in close proximity to Lake Oroville, including Oroville, Paradise, Gridley, and Biggs, and the unincorporated (countywide) area of Butte County. The study will examine existing fiscal conditions for each jurisdiction, including impact of the Oroville Facilities. Impacts will be projected by analyzing growth-related changes in taxable sales caused by changes in visitor spending levels and local procurement of goods and services and changes in lodging taxes. Expenditure impacts will include primarily the costs of law enforcement and fire protection. Data will be gathered from interviews and public sources. A fiscal impact spreadsheet model will be created, based on several commonly used fiscal impact techniques. Results of the study will be used to characterize the fiscal effects on affected fire districts, the cities of Paradise, Gridley, and Biggs, the Greater Oroville Area, and Butte County of existing and projected recreation use and operations of the Oroville Facilities.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-C1 - CULTURAL RESOURCES INVENTORY

Type of Study: [1] Desktop Study , Field Study

Start Date: March 2002

Need for Study: The Federal Power Act of 1920 requires that FERC consider the effects of its actions on historic-era and archaeological resources.

Objective: The objective of this study is to determine the nature and distribution of cultural resources (including archaeological sites, historical resources, and traditional use areas) that could be directly or indirectly affected by the Oroville Facilities.

Scope/Methodology/Results: The study area is within the Oroville Facilities Relicensing Project boundary and appropriate areas outside this boundary (e.g., low-flow channel, adjacent public lands accessible to recreation visitors, and nearby areas of traditional and sacred values) that could be affected by the project. The study will involve background research, oral interviews, tribal and agency consultation/coordination, field surveys, and data analysis to produce inventories of Archaeological, Historic-era, and Traditional Cultural Properties with ethnographic context and ethnohistoric background information.

Confidential archaeological and historic-era resource information will be made available only to managing and responsible parties (DWR, FERC, the State Historic Preservation Officer [SHPO], USFS, BLM, DPR, Native American Tribes) and will not be distributed to the public. Summary or nonconfidential reports that do not include sensitive cultural resources information will be prepared for broader distribution.

Continued discussions to formalize the Area of Potential Effects (APE) in coordination with BLM, USFS, the Tribes, and the SHPO in the context of §106. Detailed survey strategies, sampling protocols, and agreements with the Tribes that will influence the cultural resources inventory effort will be completed.

Interim Report, March 2003 - Abstract: Section 106 of the National Historic Preservation Act (NHPA) and State-level legislation promulgated under CEQA require federal agencies (in this case FERC) to consider the effects of their undertakings on important cultural resources, and to provide the Advisory Council on Historic Preservation (ACHP) reasonable opportunity to comment. This is accomplished through the “§106 process” outlined by the ACHP and codified at 36 CFR Part 800, which specifies how historic properties ought to be identified, evaluated, and treated.

The goal of this study is to determine the nature, distribution, and value of cultural resources (including archaeological sites, historical resources, and traditional-use areas) within the APE. The March 2003 Interim Report presented the findings of a cultural resources inventory in support of the Oroville Facilities for the 2002 field season. The remainder of the cultural resources inventory proposed for SP-C1 was completed during the 2003 field season. Additional inventory may be required as future projects in unsurveyed areas are developed.

The archaeological resources inventory of the Oroville Facilities was restricted to the 41,100-acre FERC Project boundary. It followed a staged approach designed to meet State and federal requirements while avoiding unnecessary, redundant, or otherwise unproductive work. Five separate tasks were identified: (1) re-record all accessible previously recorded sites; (2) make a complete inventory of Lake Oroville's fluctuation zone; (3) implement a probabilistic sample survey outside the fluctuation zone; (4) conduct a targeted inventory of historically sensitive locations based on archival information; and (5) carry out inspection of management-specific parcels (e.g., campgrounds, boat launches, planned improvements), as required.

Using all of these inventory strategies, archaeologists examined approximately 42 percent of the available project-area ground surface, excluding inundated areas. The goals established for the fluctuation zone were met; more than 90 percent of the land that became exposed during the 2002 low-water season (680' elevation) were examined, and a detailed map of the coverage was created to be used when water recedes below 2002 levels. The probabilistic survey was also successful, as archaeologists accomplished a systematic survey across much of the targeted project area, with the exception of hazardous areas; only a small percentage (<2%) of the acreage could not be examined because of difficult terrain. These two elements combined account for a systematic survey of approximately 12,500 acres, and provide useful data regarding site types and distribution. Results in the fluctuation zone also suggest that a high number of resources, especially prehistoric sites, may not have been recognized in the above-pool project areas where they are obscured by thick vegetation.

Examination of 83 percent of the 47 historically sensitive areas identified had positive results. Of those examined, about 20 percent were targeted while the other 80 percent fell under other survey strategies. Although the other survey strategies used in the historically sensitive areas proved highly successful, the results of the targeted approach suggest that it is a productive method for identifying important historic-era cultural resources. Targeted surveys resulted in site identification most of the time.

Archaeological inventory of management-specific parcels covered a total of 1,990 acres within the FERC Project boundary, including all existing developed recreation areas. Overall, the coverage of both probabilistic and targeted surveys did not adequately address the 15 locations in the APE that have already been subjected to development.

Therefore, the impact of this development on cultural resources could not be assessed in the March 2003 Interim Report.

A total of 811 archaeological resources were recorded during the inventory effort. These included 483 historic-era sites, 255 prehistoric sites, and 73 sites with both historic and prehistoric components. Of these, 347 were located within the fluctuation zone and 102 were situated in areas currently developed for recreation.

The inventory of traditional-use areas followed a much different approach than the archaeological survey. Ethnographers interviewed knowledgeable Konkow Maidu elders in the Oroville area. The information from these interviews revealed a rich knowledge of natural resources and cultural places, both within the FERC Project boundary and in the general vicinity of the project. The traditional-use areas identified reflect a broad range of activities including, but not limited to, villages, cemeteries, camp sites, resource-gathering sites, fishing sites, ceremonial sites, trails, and place names. Such sites totaled 144 within or very near the FERC Project boundary while approximately 280 other locations were identified in the surrounding region.

Cultural resource inventory results will be documented in separate archaeological and ethnographic inventory reports. Confidential archaeological and ethnographic information will be made available only to managing and responsible parties (DWR, FERC, the SHPO, USFS, BLM, DPR, and Native American Tribes) and will not be distributed to the public. Summary or nonconfidential reports that do not include sensitive cultural resources information will be prepared for broader distribution.

The next step in the process is to plan and implement an evaluation program, the results of which will be presented in SP-C2.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-C2 - CULTURAL RESOURCES EVALUATION

Type of Study: 1 Desktop Study ¸ Field Study

Start Date: April 2003

Need for Study: The Federal Power Act of 1920 requires that FERC consider project effects on historic-era and archaeological resources. Following inventory efforts, an evaluation for eligibility criteria of the National Register of Historic Places (NRHP) and California Register of Historical Resources (CRHR) must be conducted in compliance with §106 of the NHPA.

Objective: The objective of this study is to evaluate the cultural resources identified during the cultural resources inventory to determine whether they are eligible for inclusion in the NRHP or the CRHR.

Scope/Methodology/Results: The scope of the study is within the Oroville Facilities project boundary and appropriate areas outside this boundary (e.g., low-flow channel, adjacent public lands accessible to recreation, visitors, and nearby areas of traditional and sacred values) that could be affected by the project. The evaluation study will be guided by appropriate research designs for various resource types. The evaluation of cultural resources will use information gathered from SP-C1; it is expected to include additional background research, oral interviews, Tribal and agency consultation/coordination, fieldwork, data analysis, and reporting. Where appropriate, some resource information may be kept confidential and made available only to managing and responsible parties. Results will include a cultural resources evaluation report, addressing archaeological, historic-era, and ethnography/ethnohistory evaluations.

Further details will be developed relative to SP-C2, SP-C3, and SP-C4 (e.g., need to create research designs to complete the evaluation) in subsequent years. The inventory results from SP-C1 are needed to detail the evaluation methods; the evaluation results are needed to detail the management issues and interpretive opportunities.

Interim Report, Spring 2004 – Abstract: This study evaluates the cultural resources identified during the cultural resources inventory (SP-C1) to determine whether they are eligible for inclusion in the NRHP or the CRHR. This step will allow for an assessment of project-related effects on significant cultural resources, and development of a management plan to protect and preserve these resources during the term of the new license.

DWR will work with FERC, other agencies including USFS, BLM, and the SHPO, local Native American individuals and groups, and other interested parties to assess whether cultural resources within the study area are eligible for the NRHP or CRHR. The evaluation of cultural resources will use information gathered from SP-C1; it is expected to include additional background research, oral interviews, Tribal and agency consultation/coordination, field work, data analysis, and reporting. The criteria for a resource to be considered eligible for inclusion in the NRHP are established in 36 CFR, Part 60. The criteria for significance under CEQA are found in Public Resources Code (PRC) §5024.1, and in Title 14 of the California Code of Regulations (CCR), §4850 et seq. The National Park Service (NPS) and the California Office of Historic Preservation have issued standards and guidelines for conducting cultural resource evaluations. These standards and guidelines will be used to help refine the procedures to be implemented during this study.

Results will include a cultural resources evaluation report addressing archaeological, historic-era, and ethnography/ethnohistory evaluations. Confidential archaeological and historic-era resource information will be made available only to managing and responsible parties (DWR, FERC, SHPO, USFS, BLM, DPR, and Native American Tribes) and will not be distributed to the public. Summary or nonconfidential reports that do not include sensitive cultural resources information will be prepared for broader distribution.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-C3 - CULTURAL RESOURCES MANAGEMENT

Type of Study: 1 Desktop Study , Field Study

Start Date: Fall 2003

Need for Study: The Federal Power Act of 1920 requires that FERC consider project effects on historic-era and archaeological resources. In addition, FERC must comply with §106 of the NHPA as well as other federal laws and guidelines regulating cultural resources. A Cultural Resources Management Plan is necessary to manage significant cultural resources for the duration of the anticipated new FERC license.

Objective: The objective of this study is to evaluate the need and methods for cultural resource protection, to determine effects of the existing and future project on these resources, and to develop a Cultural Resources Management Plan.

Scope/Methodology/Results: The scope of the study is within the Oroville Facilities Relicensing Project boundary and appropriate areas outside this boundary (e.g., low-flow channel, adjacent public lands accessible to recreation, visitors, and nearby areas of traditional and sacred values that could be affected by the project). The assessment and Plan will be based on the results of the cultural resources inventory and evaluation (SP-C1 and SP-C2). The Plan will consider the effects on cultural resources of ongoing maintenance and operations activities, including developed and undeveloped recreational activities. Results will be used to develop a Cultural Resource Management Plan covering archaeological resources, historic-era resources, and ethnography and ethnohistory. Confidentiality may be necessary and will be honored with respect to some sensitive resource materials and background information.

Further details will be developed relative to SP-C2, SP-C3, and SP-C4 (e.g., need to create research designs to complete the evaluation) in subsequent years. The inventory results from SP-C1 are needed to detail the evaluation methods; the evaluation results are needed to detail the management issues and interpretive opportunities.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-C4 - CULTURAL RESOURCES INTERPRETIVE EVALUATION

Type of Study: ¸ Desktop Study 1 Field Study

Start Date: Spring 2004

Need for Study: Federal laws and regulations require consideration of project effects on historic, cultural, and archaeological resources (Federal Power Act of 1920, §106 of the NHPA, others). State laws and regulations also impose certain requirements relative to cultural resources. Public policies and guidelines further emphasize the value of providing information and displays of the project area's cultural heritage.

Objective: The objective of this study is to evaluate the need and opportunities for making appropriate cultural resources data readily available to public users in and around the Oroville Facilities Relicensing Project. The study will also assess the potential of establishing local facilities to maximize the public benefits of cultural heritage values in the project area.

Scope/Methodology/Results: The scope of the study is within the Oroville Facilities Relicensing Project boundary and appropriate areas outside this boundary that may be more appropriate to conduct interpretive displays. The evaluation of interpretive and educational needs and opportunities will be based on the results of the cultural inventory, evaluation, and management efforts (SP-C1, SP-C2, and SP-C3) and will be coordinated with other work groups. Results of the study will include a report addressing the needs for public interpretation/education and displays, methods for accomplishing these objectives, and potential locations for any display/visitor facilities. The interpretive evaluation will be compiled into a report and will recognize the confidential nature of certain sensitive cultural resource data.

Further details will be developed relative to SP-C2, SP-C3, and SP-C4 (e.g., need to create research designs to complete the evaluation) in subsequent years. The inventory results from SP-C1 are needed to detail the evaluation methods; the evaluation results are needed to detail the management issues and interpretive opportunities.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-E1 - MODEL DEVELOPMENT

Type of Study: ¸ Desktop Study 1 Field Study

Start Date: Spring 2002

Need for Study: Much of the analysis required by FERC in the licensing process involves anticipating and planning for effects of various operating options or scenarios. Computer models are needed to estimate system response to changes to determine potential operational, economic and environmental impacts of proposed changes to the Oroville Facilities or operations.

Objective: The objective of this study is to develop and validate models to simulate the physical attributes of Oroville Facilities operations to support studies involving changes to, or impacts on, flow, water levels, water supply, water temperature, and power generation.

Scope/Methodology/Results: The physical scope of the project includes the Feather River basin from the upstream boundary of Lake Oroville to the confluence with the Sacramento River. The methodology will include defining the modeling scheme; anticipating needs based on past FERC licensing procedures; defining individual model development plans for which a need is already defined; actually producing these models; and developing a broader, comprehensive modeling scheme and standardization of outputs. The result of this study will be a suite of modeling tools available to run simulations and perform the analysis necessary to answer various resource questions associated with the licensing effort.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-E1.1 - STATEWIDE OPERATIONS MODEL DEVELOPMENT

Type of Study: ¸ Desktop Study 1 Field Study

Start Date: Spring 2002

Need for Study: The relicensing process requires analysis of potential impacts from a wide range of operations alternatives. The model developed as a result of this study will be used to produce simulated operational data from these alternatives for use in the required analysis.

Objective: The objective of this study is to develop appropriate statewide modeling tools and perform the benchmark simulations to determine the "boundary" conditions for localized modeling. The study will also evaluate statewide impacts of modified Oroville Facilities operations.

Scope/Methodology/Results: The scope includes the major facilities of the USBR Central Valley Project (CVP) and the DWR SWP. This study will include obtaining the CALSIM II model and the initial 2001 and 2020 benchmark studies from DWR and rerunning the initial benchmark simulations to verify model operations. Depending on the need, revised simulations can then be run. The results of the study plan will be a statewide operations simulation model and 2001 and 2020 benchmark studies for use in the modeling process.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-E1.2 - LOCAL OPERATIONS MODEL DEVELOPMENT

Type of Study: Desktop Study Field Study

Start Date: Spring 2002

Need for Study: FERC requires analysis of potential impacts from a wide range of local operations alternatives to optimize power generation. This study will produce a specific tool needed to conduct this analysis.

Objective: The objective of this study is to develop a computer model that will perform benchmark simulations allowing the evaluation of local water and power operations of the Oroville-Thermalito Complex.

Scope/Methodology/Results: The scope of this study includes Lake Oroville, the Thermalito Forebay–Afterbay complex, and the Feather River low-flow channel from Thermalito Diversion Dam to just downstream of the Thermalito Afterbay outlet. The study will evaluate potential models and tools that could be used to develop a local operations model for the Oroville–Thermalito Complex. This study will include reviewing the products required from the model and identifying existing data and modeling tools. The local operations alternatives will then be identified and benchmark simulations will be run. The results of the study plan will be a local operations simulation model and 2001 and 2020 benchmark studies for use in the modeling process.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-E1.3 - OROVILLE RESERVOIR TEMPERATURE MODEL DEVELOPMENT

Type of Study: ¸ Desktop Study 1 Field Study

Start Date: Spring 2002

Need for Study: Relicensing of the Oroville Facilities by FERC requires certification from the State Water Resources Control Board (SWRCB) that the project complies with §401 of the federal Clean Water Act. Information required by the SWRCB for certification includes evidence of compliance with appropriate temperature requirements in the Basin Plan.

Objective: The objective of this study is to develop a temperature model for Lake Oroville that can simulate release temperatures under different operational alternatives and benchmark simulations.

Scope/Methodology/Results: The scope of this study includes Lake Oroville, including inflows and releases. The methodology used for this study will include an initial determination of model complexity and capability requirements and a review of existing models that could be used followed by model development, calibration and verification. The necessary data for the modeling runs will be identified and collected and the Oroville release temperature simulations for the initial 2001 and 2020 benchmark studies will be performed. The results of this study plan will be a temperature model capable of simulating reservoir temperatures for various operating scenarios. Output will be used for impact analysis and/or as input to other modeling efforts.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-E1.4 - THERMALITO COMPLEX TEMPERATURE MODEL DEVELOPMENT

Type of Study: Desktop Study Field Study

Start Date: Spring 2002

Need for Study: Relicensing of the Oroville Facilities by FERC requires certification from the SWRCB that the project complies with §401 of the federal Clean Water Act. Information required by the SWRCB for certification includes evidence of compliance with appropriate temperature requirements in the Basin Plan.

Objective: The objective of this study is to develop a model to estimate the warming between Lake Oroville release temperatures and the Thermalito Afterbay release temperatures using benchmark simulations.

Scope/Methodology/Results: The scope of this study includes the Thermalito Diversion Pool downstream of Oroville Dam, Thermalito Forebay, and Thermalito Afterbay. The study will evaluate existing data, followed by model development, calibration, and verification. The necessary data for the modeling runs will be identified and collected and the Thermalito temperature simulations for the initial 2001 and 2020 benchmark studies will be performed. The product of this study will be a temperature model for estimating the warming of water in the Thermalito Forebay/Afterbay Complex.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-E1.5 - FEATHER RIVER TEMPERATURE MODEL DEVELOPMENT

Type of Study: ¸ Desktop Study 1 Field Study

Start Date: Spring 2002

Need for Study: Relicensing of the Oroville Facilities by FERC requires certification from the SWRCB that the project complies with §401 of the federal Clean Water Act. Information required by the SWRCB for certification includes evidence of compliance with appropriate requirements in the Basin Plan.

Objective: The objective of this study is to develop a tool that can be used to evaluate the temperature impacts of operational alternatives and benchmark studies in the Lower Feather River through the area of project influence.

Scope/Methodology/Results: The scope of this study includes the Feather River downstream of Thermalito Diversion Dam to its confluence with the Sacramento River. This study will determine the model capability requirements, gather and evaluate existing data needed to calculate temperatures, and investigate/select modeling tools for use. After calibration and verification, benchmark temperature analysis will be performed. The results of this study will include a temperature model that can simulate various operating scenarios in the Lower Feather River and the 2001 and 2002 benchmark studies.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-E1.6 - FEATHER RIVER FLOW-STAGE MODEL DEVELOPMENT

Type of Study: ¸ Desktop Study 1 Field Study

Start Date: Spring 2002

Need for Study: Understanding flow-stage relationships at various points along the Feather River is necessary for analysis of project effects on various resources including riparian habitat, aquatic resources, special-status species, and areas subject to overflow.

Objective: The objective of this study is to develop a flow-stage model of the Feather River for use in defining the flow-stage relationships at various points along the river.

Scope/Methodology/Results: The scope of this study includes the Feather River downstream of Thermalito Diversion Dam to its confluence with the Sacramento River. This study will first collect existing flow-stage related data by reviewing maps, existing models or relationships, flood maps, and temperature data sets. If required, a model will be developed to adequately characterize the variable river morphology and bed geometry so that fluctuating flow conditions can be described. The results of this study will report flow-stage relationships along the Feather River and may include a verified model for use in modeling flow-stage relationships.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-E2 - PERFORM MODELING SIMULATIONS

Type of Study: ¸ Desktop Study 1 Field Study

Start Date:

Need for Study: FERC requires analysis of hypothetical conditions that cannot be evaluated using existing data. Much of this analysis is based on asking “what if” questions and using computer simulation models to derive the economic, environmental, or operational effects and system response.

Objective: The objective of this study is to perform computer simulation studies to evaluate various possible conditions at the Oroville Facilities as requested by other work groups as part of their studies.

Scope/Methodology/Results: The physical scope of the study area will include both Statewide and local operations modeling. The Statewide simulations will focus on the major facilities of the USBR CVP and the DWR SWP. Simulations considering local conditions will include the Feather River Basin, from the upstream boundary of Lake Oroville to the confluence with the Sacramento River. To develop and carry out the simulation modeling, work group representatives will meet with modelers to develop and design the assumptions and parameters of the study. A request for running the study will be submitted to the Plenary Group through the appropriate Resource Area Manager (RAM) for approval and coordination. The results of the various simulations will be used to evaluate impacts or to supplement additional modeling or technical analysis.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-E3 - EVALUATE THE POTENTIAL FOR ADDITIONAL HYDROPOWER GENERATION AT OROVILLE

Type of Study: ¸ Desktop Study 1 Field Study

Start Date:

Need for Study: The Federal Power Act directs FERC to consider whether a project will be operated "in a manner most likely to provide efficient and reliable electric service."

Objective: The objective of this study is to identify and evaluate ways to generate additional hydropower or enhance power generation efficiency at the Oroville Facilities.

Scope/Methodology/Results: The study scope is the Oroville Facilities within the FERC boundary. This study will include an evaluation of economic and engineering constraints such as water supply limitations, projected market conditions, and current technology. Impacts on water supply, environmental and recreation resources, and flood protection will also be considered. The study will review existing literature on the Oroville Facilities as well as in-progress hydropower studies and will update/refine the data where useful. New concepts for hydropower generation will also be evaluated. The results of the study will be summarized in a report that will identify options for additional hydropower generation at the Oroville Facilities and will include a quantitative and qualitative assessment of the significance and feasibility of each option.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-E4 - FLOOD MANAGEMENT STUDY

Type of Study: ¸ Desktop Study 1 Field Study

Start Date:

Need for Study: A comprehensive plan for developing the waterway for beneficial public use, including flood control, is required by FERC.

Objective: This objective of this study is to document current flood control requirements, analyze flood management under current operations, and identify opportunities for future improvements in flood management.

Scope/Methodology/Results: The physical scope of the study area includes the FERC Project 2100 boundary and the Feather River upstream of Oroville Dam, which forms the Oroville River Watershed (Lake Oroville Watershed) and downstream to the confluence with the Yuba River. The study scope focuses on updating existing studies to reflect current conditions and technology relevant to flood forecasting and control. The methodology followed will be to review the existing literature, update studies and/or conduct new studies where relevant, establish a workable system of water agency coordination, and develop a report identifying and evaluating flood control alternatives. Results will include flood mapping, measures for improving flood protection, and evaluation of various impacts of flood protection measures.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-E6 - DOWNSTREAM EXTENT OF REASONABLE CONTROL OF FEATHER RIVER TEMPERATURE BY OROVILLE THERMALITO

Type of Study: ¸ Desktop Study 1 Field Study

Start Date: 2003

Need for Study: During the relicensing process, questions regarding the management of water temperatures in the Feather River downstream of the Oroville-Thermalito Complex have been raised. It is necessary to evaluate how far downstream temperature effects, particularly on fisheries, can be controlled by project operations.

Objective: The objective of this study is to define the ability of the Oroville-Thermalito Complex to control temperatures in the Feather River downstream of the project under a variety of operational and climatic conditions.

Scope/Methodology/Results: The study scope is the Feather River downstream of the Oroville-Thermalito Complex to the confluence with the Sacramento River; however, the study area may be extended if temperature effects are noted further than expected. The study will use an existing temperature computer model and input varied assumptions as they apply to the Oroville-Thermalito Complex, and will include a sensitivity analysis. The results of this study will be included in a report that will document the procedures and results of the evaluation and present findings on using the Oroville-Thermalito Complex to control downstream water temperature.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-E7 - OROVILLE RESERVOIR COLD WATER POOL EVALUATION

Type of Study: ¸ Desktop Study 1 Field Study

Start Date: 2003

Need for Study: To control temperatures downstream, particularly for fishery requirements, it is necessary to evaluate how much cold water is available in Lake Oroville and to identify management options for the Oroville-Thermalito Complex that will minimize impacts on fisheries and the coldwater pool.

Objective: The objective of this study is to quantify the availability of the coldwater pool in Lake Oroville to control downstream water temperatures in the Feather River under a variety of operational and climactic conditions.

Scope/Methodology/Results: The study area is Lake Oroville. The study will use the existing 1-D monthly time step USBR Lake Oroville temperature model, with any modifications needed, to evaluate the availability of cold water, both seasonally and annually, in Lake Oroville under varied hydrologic and climatic conditions. The results will be analyzed and a report will be developed documenting the procedures and findings of the evaluation. The report will include statistical, tabular, and graphical representation for the available coldwater pool at different times of the year under varied conditions.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-E8 - TEMPERATURE IMPACTS OF PUMPBACK OPERATION ON OROVILLE RESERVOIR COLD WATER POOL

Type of Study: 1 Desktop Study , Field Study

Start Date: 2003

Need for Study: To control temperatures downstream, particularly for fishery requirements, it is necessary to evaluate how much cold water is available in Lake Oroville and to identify management options for the Oroville-Thermalito Complex that will minimize impacts on fisheries and the coldwater pool. This study is needed to understand the role of pump-back operations in coldwater pool availability.

Objective: The objective of this study is to quantify the effects of pumping warm water back into the Lake Oroville coldwater pool following power generation. It is intended that information from this study will determine whether the impacts are significant enough to be included into the Oroville temperature model development.

Scope/Methodology/Results: The physical scope of the study area is Lake Oroville and the Thermalito Forebay–Afterbay complex. This study will include a review of existing data and the installation of required temperature and/or reservoir sensors. Pump-back tests will be performed and data will be collected profiling release and pump-back flows and temperatures as well as coldwater pool temperatures. A report will be compiled that will provide information on impacts on the coldwater pool and temperature of project operations. This information will be used both for Oroville temperature model development and for performance of alternative operational simulations.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-G1 - EFFECTS OF PROJECT OPERATIONS ON GEOMORPHIC PROCESSES UPSTREAM OF OROVILLE DAM

Type of Study: 1 Desktop Study ¸ Field Study

Start Date: March 2002

Need for Study: Stakeholders have identified altered sediment routing and reservoir drawdown caused by project operations as potentially affecting resources within the Feather River and tributaries above Lake Oroville. Understanding geomorphic processes upstream of Oroville Dam is critical to support evaluations of ongoing project effects on riparian resources, water quality, and fish and wildlife needed for National Environmental Policy Act (NEPA)/CEQA compliance.

Objective: The objective of this study is to determine ongoing project operation effects (primarily seasonal water level changes) on reservoir sedimentation, mass wasting, shoreline erosion, channel geomorphology, and sediment transport in the Feather River in and above Lake Oroville.

Scope/Methodology/Results: The study area includes the reservoir and its tributaries that are influenced by drawdown of Lake Oroville. Specific upstream extent of the study area will be based on initial survey results of the reservoir shoreline exposed during low-water conditions. This study will involve reviewing existing data, field mapping of channel resources in tributaries, re-surveying reservoir cross sections to determine sediment storage, and tributary cross section monitoring to determine changes in river geomorphic, sediment transport, and hydraulic parameters that have occurred in the tributaries and reservoir above Oroville Dam using FLUVIAL-12 as a modeling tool. The results will be provided to other studies to be used in their evaluations of ongoing project effects on riparian resources, water quality, and fish and wildlife.

Progress Report, April 2003 – Abstract: The objective of this study is to determine the ongoing effects of project operations (primarily seasonal water level changes) on reservoir sedimentation, mass wasting, shoreline erosion, channel geomorphology, and sediment transport in the Feather River in and above Lake Oroville.

Dams affect upriver geomorphic processes, including physical attributes and functions such as channel shape, channel stability, sediment transport and deposition, and bedload recruitment. These effects are caused by the reservoir formed by the dam, which changes the local base level. As the reservoir level changes from day to day and from year to year, the upstream channel responds with channel aggradation or degradation. This creates a highly dynamic reach immediately upstream of the reservoir that can affect riparian vegetation, fish, aquatic invertebrates, and other

resources. In addition, a fluctuating base level also affects substrate scour or deposition, mobilization of sediment, and turbidity levels in the reservoir and its drawdown zone. When reservoir levels are high, sediment is deposited in the upper reaches of the reservoir. Sediment is subsequently eroded in the spring and summer when reservoir levels are lower, causing large amounts of sediment to move. High turbidity and sediment movement affects the reservoir's benthic invertebrates, riparian vegetation, and fish.

A study of reservoir cross sections was initiated in 1971, and 17 of the cross sections were resurveyed in 1994 to determine sedimentation rates. Data collection is ongoing. Standard topographic maps were used for creation of a GIS-based study base map. A geologic base map was created in 1975 and digitized for use in the current GIS-based study.

DWR is currently in the process of mapping the channel resources in the tributaries above Oroville Dam, resurveying the reservoir cross sections and determining sediment in storage, performing cross section monitoring, and determining changes in the Feather River’s geomorphic and hydraulic parameters.

Analysis is ongoing and results will be presented in the Final Report.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-G2 - EFFECTS OF PROJECT OPERATIONS ON GEOMORPHIC PROCESSES DOWNSTREAM OF OROVILLE DAM

Type of Study: 1 Desktop Study ¸ Field Study

Start Date: March 2002

Need for Study: Understanding geomorphic processes downstream of Oroville Dam is critical to support evaluations of ongoing project effects on riparian resources, water quality, and fish and wildlife needed for NEPA/CEQA compliance and compliance with beneficial uses as defined in the Basin Plan.

Objective: The objective of this study is to determine the effects of altered downstream hydrology and sediment retention in Lake Oroville on channel geomorphology and sediment transport below Lake Oroville.

Scope/Methodology/Results: The study area includes the Feather River below Oroville Dam. This study will involve existing data review, field mapping of channel resources in the Feather River, establishment of photo points and cross sections to monitor sediment transport and erosion, modeling, and data analysis to determine changes in river geomorphic, sediment transport, and hydraulic parameters that have occurred downstream of Oroville Dam using FLUVIAL-12 as a modeling tool. The results will be provided to other studies to be used in their evaluations of ongoing project effects on riparian resources, water quality, and fish and wildlife.

Draft Interim Report, April 2003 – Abstract: Dams affect downstream geomorphic processes, mainly because the primary function of the dam is to store high flows in winter and release them for irrigation and water supply during the summer. The result includes changes in yearly, monthly, and daily streamflow distribution, bankfull discharge, flow exceedance, peak flows, and other geomorphic parameters. The reservoir also captures up to 97 percent of the clay, silt, sand, and gravel transported by the river from the watershed. Changes in sediment transport and discharge alter physical attributes and functions such as channel shape, channel stability, sediment transport and deposition, bedload recruitment, and woody debris recruitment. Altered river processes may affect biological processes as well.

The objective of this study is to determine the effects of altered downstream hydrology and sediment retention in Lake Oroville on channel geomorphology and sediment transport below Lake Oroville. Specific tasks include the following: obtain, review, and summarize existing resource data; map and characterize spawning riffles; evaluate changes to the channel morphology by reestablishing historic cross section surveys; assess current channel characteristics and monitor selected cross sections for

significant changes to those characteristics; determine project effects on river geomorphic and hydraulic parameters; establish bank erosion monitoring sites; and model sediment transport and channel hydraulics.

Work to date has focused on researching and collecting references and data sets, performing sieve analyses of sediment samples, documenting field surveys, and preparing maps, charts, and figures. This work has been focused on providing data for development of the FLUVIAL-12 sediment transport model. Field work has concentrated on finding and resurveying historic cross sections, collecting bulk and sediment samples, and classifying river habitat.

A detailed description of the physiographic setting, including maps and descriptions of precipitation, geology, soils, topography, vegetation, and other watershed characteristics, was developed.

Spawning riffle mapping was completed using aerial photos. Identification of the physical characteristics of spawning habitats is under way. Gravel and surface sampling at the riffles has been performed and analysis is ongoing. An assessment of locations and volumes of withdrawals and return flows to the Feather River is currently under way (Section 6).

Locating and resurveying historic cross section locations in the Feather River below Oroville Dam, gravel sampling at representative cross sections, and intergravel permeability measurements and analysis are ongoing.

A representative number of cross section locations are being monitored periodically to measure hydraulic and sediment transport conditions at a variety of flow conditions. In addition, a determination of physical characteristics of sediment, channels, banks, tributaries, and vegetation is ongoing. Project effects on geomorphically significant flows are being investigated through hydrologic analysis (Section 9).

In areas where bank erosion is occurring, monitoring sites have been established to determine erosion rates and the nature of the material eroded. Data are being collected and analysis is under way.

DWR is in the process of using hydrologic modeling to estimate sediment transport and channel hydraulics. Of particular interest is determining at which flows a gravel bed begins to mobilize, which is critical in determining flow conditions that degrade spawning riffles. This information is also important in designing spawning gravel rehabilitation measures.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-W1 – PROJECT EFFECTS ON WATER QUALITY DESIGNATED BENEFICIAL USES FOR SURFACE WATERS

Type of Study: 1 Desktop Study , Field Study

Start Date: February 2002

Need for Study: Relicensing of the Oroville Facilities by FERC requires certification from the SWRCB that the project complies with §401 of the federal Clean Water Act. Information required by the SWRCB for certification includes evidence of compliance with appropriate requirements in the Basin Plan.

Objective: The objective of this study is to evaluate the physical, chemical, and biological integrity of water quality within project-affected waters for compliance with the Basin Plan.

Scope/Methodology/Results: The study area includes Lake Oroville, its main tributaries, the Thermalito Diversion Pool, Thermalito Forebay and Thermalito Afterbay, the OWA ponds, and the Feather River downstream to the confluence with the Sacramento River for project-related effects. Monitoring stations will collect data on water temperature, dissolved oxygen, conductivity, pH, and turbidity. Water samples will be analyzed for minerals, nutrients, metals, oil, grease, pesticides, and bacteria. Organic constituents sampled from project-affected waters will be described and the aquatic macroinvertebrate communities will be assessed. Project-affected waters will also be tested for aquatic toxicity to identify parameters that may be adversely affecting aquatic life. Results of the study will be used to determine whether project-affected waters meet the numerical and narrative Basin Plan objectives and are protective of beneficial uses designated in the Basin Plan.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-W2 - CONTAMINANT ACCUMULATION IN FISH, SEDIMENTS AND THE AQUATIC FOOD CHAIN

Type of Study: 1 Desktop Study , Field Study

Start Date: Spring 2002

Need for Study: Relicensing of the Oroville Facilities by FERC requires certification from the SWRCB that the project complies with §401 of the federal Clean Water Act. Information required by the SWRCB for certification includes evidence of compliance with appropriate requirements in the Basin Plan. Analysis of the presence of mercury and other contaminants is necessary in order to determine this.

Objective: The objectives of this study are to evaluate: (1) levels of metals and organic contaminants in sediments impounded within project waters; (2) potential effects of contaminated sediments on the food web in the project area; and (3) effects of project features, operations, and maintenance on sediment contamination and bioaccumulation in aquatic organisms.

Scope/Methodology/Results: The study area includes the North, Middle, and South Forks of the Feather River and the West Branch and the Concow Creek just above their confluences with the reservoir; Lake Oroville; the Thermalito Diversion Pool; Thermalito Forebay and Thermalito Afterbay, the Feather River from Oroville Dam to downstream of the Thermalito Afterbay outlet; and the OWA ponds. This study will involve the analysis of metals and organic contaminants in fish and crayfish in the project area and, if detected at levels greater than the criteria for protection of human health or fish and crayfish predators, the evaluation of metals and organic contaminants in sediments, fish, and crayfish in tributaries to the reservoir. Results from this study will be used to evaluate the effects of the project and project operations in sediments and bioaccumulation of contaminants in fish and crayfish.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-W3 - RECREATIONAL FACILITIES AND OPERATIONS EFFECTS ON WATER QUALITY

Type of Study: 1 Desktop Study , Field Study

Start Date: February 2002

Need for Study: Relicensing of the Oroville Facilities by FERC requires certification from the SWRCB that the project complies with §401 of the federal Clean Water Act. Analysis of the effects of recreational facilities is required by FERC, and is also one of the inputs required to obtain the water quality certification from the SWRCB.

Objective: The objective of the study is to evaluate the potential effects from recreational facilities, operations, and activities on the physical, chemical, and biological integrity of project waters.

Scope/Methodology/Results: The study area is generally within the FERC Project boundary, but also includes adjacent lands and waterways for effects on project waters, and downstream for project effects in the Feather River. Interviews and field surveys will be conducted, and recreation facilities will be reviewed, monitored, and evaluated. The study will focus on evaluating the potential for current and potential future recreation facilities, operations, and activities to affect water quality, and monitoring to determine current contamination. Information derived from this study will be compared to water quality goals and criteria for protection of beneficial uses to determine whether recreational facilities, operations, and activities adversely affect the physical, chemical, and biological integrity of project waters.

Interim Report, October 2002 – Abstract: The objective of this study is to evaluate the potential effects of recreational facilities, operations, and activities associated with the Oroville Facilities on the physical, chemical, and biological integrity of project waters. Effects of facilities and operations on the integrity of project waters, as well as general water quality conditions, are evaluated in SP-W1, Project Effects on Water Quality Designated Beneficial Uses for Surface Waters. This study evaluates localized effects on water quality from specific recreational facilities and activities. Task 1 of this study is to evaluate the potential for recreation facilities to affect water quality in the project area and develop appropriate monitoring. This Interim Report presents the results of that task.

Information from recreation study plans was obtained as necessary to evaluate potential contamination and its sources from recreation facilities, operations, and activities. The current LOSRA map was reviewed for completeness and updated to ensure that all recreational facilities and activities have been identified. Potential types of

contamination associated with each type of recreational facility and activity were identified. Field surveys were conducted to determine potential sources of contamination from recreation facilities and activities. Operators of recreation facilities were contacted, recreation facilities visited, and recreational activities reviewed to determine potential for contamination to project waters. Interviews and field visits were conducted to identify potential sources of contamination, potential contaminants, source pathways, and operations and management that may contribute to contamination. Specific monitoring was developed following determination of the potential for each type of recreational facility and activity to contaminate project waters. The contribution of contaminants from wildlife will also be investigated where appropriate, such as waterfowl contribution to bacterial levels at swim areas. The monitoring program was designed to target specific recreational facilities and activities with potential to introduce contaminants into project waters.

Parameters proposed for monitoring include turbidity; sediments; microbiological indicator organisms (i.e., coliform and enterococcus bacteria); petroleum byproducts (e.g., polycyclic aromatic hydrocarbons [PAHs], methyl tertiary butyl ether [MTBE], oil, and grease); nutrients; pesticides; paints; and vessel cleaning products. Weekly and event-based (e.g., holiday weekends, recreation or fishing tournaments, spills) collection of water quality data is proposed during the recreation season or the particular event. Monthly or other appropriately timed monitoring is proposed to determine effects from activities that occur throughout the year.

Information derived from the first phase of this study was used to determine whether recreational facilities, operations, and activities could adversely affect the physical, chemical, or biological integrity of project waters. Each of the facilities within or adjacent to the boundary of the Oroville Facilities was inventoried and assessed for potential impacts. The Interim Report identifies types of facilities and potential contaminants, as well as potential sources of contamination, source pathways, operations, and management that may contribute to contamination. It then evaluates the effectiveness of the facility or operations in preventing contamination. The report further contains a detailed discussion of each recreation facility, possible contamination concerns, and proposed monitoring.

The Interim Report also contains a list of 23 proposed sampling sites among 26 recreational facilities. Water quality analyses will include bacteria, nutrients, pesticides, and PAHs. Potential erosion will be monitored through visual assessments. Physical parameters measured will include dissolved oxygen, conductivity, pH, temperature, and turbidity. All of the water samples will be taken at the surface.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-W5 - PROJECT EFFECTS ON GROUNDWATER

Type of Study: 1 Desktop Study , Field Study

Start Date: February 2002

Need for Study: The study is necessary to obtain the SWRCB water quality certification required by FERC. Information required by the SWRCB for certification includes evidence of compliance with appropriate requirements in the Basin Plan.

Objective: The objective of the study is to evaluate the effects of project features and operations of Thermalito Forebay, Thermalito Afterbay, and the Feather River in the project area on groundwater quality and levels, and the effects of subsurface movement on the hyporheic zone and its connectivity with ponds in OWA.

Scope/Methodology/Results: The study area is generally down gradient from Thermalito Forebay, Thermalito Afterbay, the Feather River, and ponds within OWA. Groundwater quality information from the study area will be compared with surface water quality information collected in SP-W1 to assess effects of the project. Groundwater levels will be monitored to determine effects of the project on area groundwater levels and pond levels in OWA. Surface water quality and groundwater elevation data obtained in this study will be compared to applicable numerical and narrative water quality objectives and goals. Suitable wells will be identified (or constructed, if necessary) to collect groundwater quality information. The findings will be used to evaluate project effects on beneficial uses for groundwater in the project area as defined in the Basin Plan.

Interim Report, May 2003 – Abstract: The purpose of this study plan is to identify possible effects on groundwater levels and quality from Oroville Facilities operations. Task 1 of the study plan included determining whether existing data are sufficient to evaluate potential effects on groundwater. The Interim Report presents the results of the evaluation of existing data and need to collect additional information.

Local geology essentially eliminates potential effects on groundwater from Lake Oroville, which is underlain by relatively impermeable Mesozoic-era igneous and metamorphic bedrock. Thermalito Forebay and Thermalito Afterbay, however, are underlain by younger and more permeable volcaniclastic and consolidated alluvial sediments where groundwater recharge occurs, thus potentially affecting local groundwater.

Wells previously monitored in the vicinity of Thermalito Forebay show that project operation raised the groundwater level about 10 feet. However, no groundwater quality data are available from this area.

There are numerous wells in the vicinity of Thermalito Afterbay, with most of these being private, active pumping wells. DWR monitors several wells in the vicinity of the afterbay, but most of these are too far from the project area to be useful for determination of site-specific project effects. However, groundwater levels in Butte County are monitored through an extensive groundwater level monitoring network, and there is little concern about groundwater levels. In addition, some previously monitored wells nearer the project area were located and have been added to the DWR groundwater level monitoring grid.

Only two wells near the project area have been monitored for water quality, but the depth from which one well draws water is unknown and the other well is more than a mile from Thermalito Afterbay. Thus, little information is available concerning groundwater quality near the Oroville Facilities. Several parameters have been identified at elevated levels in project waters that could affect groundwater quality. In addition, groundwater quality is a major concern for Butte County. Therefore, existing wells near Thermalito Forebay and Thermalito Afterbay will be monitored to determine potential effects on groundwater quality from project features.

Surface water quality from Thermalito Forebay, Thermalito Afterbay, and the Feather River were reviewed to identify any constituents that may be elevated and hence could result in degradation of groundwater quality. Organic contaminants at levels greater than the minimum detection levels have not been found from the surface waters. Aluminum and mercury were the only metal constituents found in the surface waters that exceed water quality criteria. Nutrients have been found in the surface waters at very low levels and are less than those found in area groundwater. Minerals, particularly calcium, magnesium, chloride, and hardness, are present in surface waters at concentrations that are significantly less than those found previously in area groundwater.

Additional groundwater quality data will be collected in the vicinity of both Thermalito Forebay and Thermalito Afterbay. The proposed monitoring for water quality will include the 11 wells currently monitored semiannually for groundwater levels, 2 wells currently monitored monthly for groundwater levels, and 12 piezometers originally used to evaluate seepage from the afterbay following construction. Attempts will be made to identify several additional existing shallow wells to include in the monitoring program to enhance coverage of the shallow aquifer. Groundwater quality will be measured during the spring and fall from the existing monitoring wells, piezometers, and domestic wells included in the study. Groundwater samples collected for additional monitoring will be 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 will enable the ionic composition and physical

characteristics of the groundwater to be compared with those of the surface waters collected in SP-W1 to provide an indication of connectivity. Aluminum and mercury will be analyzed to provide information on levels in the groundwater and possible link to surface water.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-W7 - LAND AND WATERSHED MANAGEMENT

Type of Study: 1 Desktop Study , Field Study

Start Date: March 2002

Need for Study: FERC requires a report on land management to determine project conformance and compatibility with local and regional land uses and plans. In addition, SWRCB water quality certification, which is required by FERC as part of the licensing process, must take into account effects of project-related land use and management.

Objective: The study will evaluate existing and future project-related land and watershed activities that have the potential to affect water quality.

Scope/Methodology/Results: The study area includes lands within the FERC Project boundary and adjacent lands for effects on resources within the project boundary. The study will evaluate both existing and potential future effects on water quality from physical, chemical, and biological land uses and management within and adjacent to the project boundary. Parameters that may be monitored to determine effects from the various land use and management activities may include turbidity, erosion, nutrients, minerals, metals, pesticides, bacteria, and dissolved oxygen, among others. The first phase of the study will rely on information derived from SP-L1 and SP-L2. The second phase of the study will be undertaken as proposed changes to land use and management activities become formulated. Information derived from this study will be used to evaluate effects on water quality of existing and future land and watershed use and management activities adjacent to and within the project boundary.

Progress Report, January 2003 – Abstract: This study evaluates the potential effects of land and watershed management activities on the physical, chemical, and biological integrity of project waters. Effects of Oroville Facilities operations on the integrity of project waters, as well as general water quality conditions, are evaluated in SP-W1, Project Effects on Water Quality Designated Beneficial Uses for Surface Waters. This study identifies potential localized effects on water quality from specific land and watershed management activities. This Interim Report presents the results of Task 1 of this study, which was to identify effects from ongoing land uses and management.

Information from land use plans was obtained, as necessary, from other agencies to evaluate potential contamination and their sources from land use activities. Information on land and watershed management on adjacent lands was obtained from the County Assessor's Office, Plumas National Forest, the City, and BLM. The County Assessor's Office provided parcel land use and ownership data of the entire county. The data were imported into ArcView GIS for analysis. Specific proposed monitoring was developed

following determination of the potential for each type of land use activity to affect project waters. The monitoring program is designed to target specific land use activities with potential to introduce contaminants into project waters.

Information derived from the first phase of this study was used to determine whether land and water use activities could affect the physical, chemical, or biological integrity of project waters. Each of the land use types within or adjacent to the project boundary (within 0.5 mile) was inventoried and assessed for potential impacts. This information identified types of land use activities, as well as potential sources of contamination, source pathways, and operations and management, that may contribute to contamination, and effectiveness of the facility or operations in preventing contamination.

Land uses within 0.5 mile of the project boundary fall into several broad categories, including agriculture, commercial, industrial, railroad, residential, roads and streets, and miscellaneous, which includes lands under jurisdiction of State or federal entities. Potential contaminants identified from these land uses and management activities include pesticides, sediments, bacteria, petroleum byproducts, metals, and nutrients. Adequate controls exist that would preclude potential contaminants from most land uses from affecting project waters. Several land uses or management activities, though, may affect project waters.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-W9 - PROJECT EFFECTS ON NATURAL PROTECTIVE PROCESSES

Type of Study: 1 Desktop Study , Field Study

Start Date: Early 2002

Need for Study: USFWS and the National Oceanic and Atmospheric Administration (NOAA) Fisheries require information to determine project effects on the habitat of listed species, including salmon and steelhead for Endangered Species Act (ESA) compliance.

Objective: The study objective is to determine the effect of the project on natural protective processes of those special areas adjacent to, and under the influence of, project waters that impact water quality. The goal is to eliminate, reduce, or control project-related effects to maintain and enhance the viability and sustainability of ecosystems along the Feather River.

Scope/Methodology/Results: The study area will include waters and lands within the project boundary, and along the Feather River within the levee system, if present, or the extent of the riparian/wetland vegetation, whichever is greater, downstream to the Sacramento River. The study will compare historical riparian and wetland maps, including riffle areas, to current maps to assess the amount and type of change that may have occurred to riparian and wetland areas as a result of project-related activities, and survey and track large woody debris to determine the extent of downstream migration. These data will be analyzed to determine whether there is any net loss of functionality with respect to their protective processes in the project-affected waters of the Feather River system.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-T1 – EFFECTS OF PROJECT FEATURES AND OPERATION ON WILDLIFE AND WILDLIFE HABITAT

Type of Study: ¸ Desktop Study 1 Field Study

Start Date: April 2002

Need for Study: Identification and quantification of project effects on wildlife and wildlife habitat has been raised as an issue by relicensing stakeholders including stakeholders with mandatory conditioning authority and is a FERC requirement. Evaluation of project effects on wildlife is also required for CEQA/NEPA compliance.

Objective: The objective of this study is to identify current and future project effects on wildlife and wildlife habitat, including band-tailed pigeon, black bear, waterfowl, black-tailed deer, special-emphasis species, harvest species, and species biodiversity.

Scope/Methodology/Results: The study area is generally within the FERC Project boundary but also includes the Feather River downstream to the confluence with the Sacramento River. This study will use information and results from the other wildlife-related studies to analyze effects of project features and operation, recreation facilities and use, and land management activities on wildlife and wildlife habitat. Results will be incorporated into a Wildlife Management Plan for submittal to FERC as part of the license application.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-T2 – PROJECT EFFECTS ON SPECIAL STATUS SPECIES

Type of Study: 1 Desktop Study , Field Study

Start Date: April 2002

Need for Study: The federal Endangered Species Act (FESA) requires evaluation and consultation to avoid take of listed species or adverse modification of their habitats. The California Endangered Species Act (CESA) also requires assessment of the proposed project's impact on listed species. Both CEQA and NEPA require assessment of a project's impacts on State listed and federally listed species and their habitats. In addition, CEQA requires an evaluation of species that have not been listed under FESA or CESA, but meet the definition of threatened and endangered as listed in CESA. CEQA requires evaluation of project impacts on State and federal species of concern. This study is needed to provide sufficient information for these consultations and CEQA/NEPA documentation.

Objective: The objective of this study is to provide information on special-status species occurrence and distribution within the study area and potential project effects on those species sufficient for use in consultation with State and federal wildlife management agencies

Scope/Methodology/Results: The study area includes the FERC Project boundary and the Feather River downstream to the confluence with the Sacramento River and lands outside the boundary as appropriate. Scopes for surveys focused on protected species will be determined on a species-by-species basis in consultation with appropriate management agencies. This study includes field inventories and data analyses to determine status of occurrence and project effects on special-status animals and plants within the study area. Opportunities for special-status species' habitat protection and enhancement will be identified. Results will form the basis for a Biological Assessment and NEPA/CEQA documentation.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-T3/5 – RIPARIAN RESOURCES, WETLANDS, AND ASSOCIATED FLOODPLAINS

Type of Study: 1 Desktop Study ¸ Field Study

Start Date: May 2002

Need for Study: This study will describe existing conditions for wetland and riparian vegetation and project effects as required under both NEPA and CEQA. This information is also required for license review under the Federal Power Act.

Objective: The objectives of this study are to assess the effects of project-water operations on wetland and riparian habitats and to assess the effects of project operations on isolated wetland habitats within the FERC Project boundary.

Scope/Methodology/Results: The study area includes all areas within the FERC Project boundary and downstream Feather River floodplain to the confluence with the Sacramento River. This study includes field inventories, mapping, and data analyses to determine status of occurrence, riparian recruitment, and project effects on wetland and riparian vegetation within the study area. Opportunities for wetland and riparian habitat protection and enhancement will be identified. Results will provide GIS layers for use with other studies and provide information for a Biological Assessment and NEPA/CEQA documentation.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-T4 – BIODIVERSITY, VEGETATION COMMUNITIES AND WILDLIFE HABITAT MAPPING

Type of Study: 1 Desktop Study ¸ Field Study

Start Date: April 2002

Need for Study: This study will provide information to develop a vegetation cover map describing the botanical resources of the project area to be included in the license application. These vegetation cover and habitat maps will be used with other studies to assess issues of CEQA, NEPA, and FERC regulatory concern including extent and acreages of plant communities and wildlife habitat, including endangered or threatened species habitat and riparian and wetland habitat.

Objective: The objectives of this study are to complete plant community and wildlife habitat mapping for use in evaluating project-related effects on biological resources consistent with the CEQA, NEPA, and FERC regulatory framework.

Scope/Methodology/Results: The study area includes all areas within 0.5 mile of the FERC Project boundary and downstream Feather River floodplain to the confluence with the Sacramento River. This study includes aerial photography review, field inventories, mapping, and data analyses to determine plant communities within the study area and then to convert these vegetation cover maps to wildlife habitat classes. Culturally significant plant communities important to local Native Americans will also be mapped. Results will provide GIS layers for use with other studies and to develop management options, and provide information for NEPA/CEQA documentation.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-T6 – INTERAGENCY WILDLIFE MANAGEMENT COORDINATION AND WILDLIFE MANAGEMENT PLAN DEVELOPMENT

Type of Study: ¸ Desktop Study 1 Field Study

Start Date: April 2002

Need for Study: Several land management agencies actively manage wildlife resources within the project boundary. Stakeholders have suggested that opportunities exist to improve interagency coordination, management, and planning related to wildlife resources. This study is important to the development of a Wildlife Management Plan as required by FERC.

Objective: The objectives of this study are to identify opportunities to enhance interagency coordination, management, and planning and develop a coordinated, interagency terrestrial Wildlife Management Plan for the project area.

Scope/Methodology/Results: The study area includes all lands within the FERC Project boundary. This study will collect and analyze current land management mandates and practices to develop an interagency Wildlife Management Plan, identifying how interagency coordination will occur in the future and guidelines for wildlife management, plus an evaluation of current wildlife management and opportunities for interagency habitat improvements.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-T7 – PROJECT EFFECTS ON NOXIOUS TERRESTRIAL AND AQUATIC PLANT SPECIES

Type of Study: 1 Desktop Study ¸ Field Study

Start Date: April 2002

Need for Study: Noxious terrestrial and aquatic plant species can adversely affect native species, including State and federal special-status species. State and federal agencies must comply with applicable State and federal noxious weed legislation.

Objective: The objectives of this study are to provide sufficient information for State and federal noxious weed legislation compliance; to allow for habitat analysis consistent with ESA; and to address concerns of stakeholders related to infestation and spread of noxious terrestrial and aquatic plant species as a result of project operations and maintenance activities.

Scope/Methodology/Results: The study area includes all areas within 0.5 mile of the FERC Project boundary, downstream irrigation canals, and downstream Feather River levees to the confluence with the Yuba River. This study will include literature surveys, field species surveys, and data collection relative to dispersal mechanisms to assess effects of project-related land use practices and project operations on occurrence and spread of noxious terrestrial and aquatic plant species.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-T8 – PROJECT EFFECTS ON NON-NATIVE WILDLIFE

Type of Study: ¸ Desktop Study 1 Field Study

Start Date: April 2002

Need for Study: Non-native wildlife species can adversely affect native wildlife, including State and federal special-status species. Further, NEPA requires an assessment of public health impacts and several of the undesirable non-native species that may carry or transmit disease to humans may be attracted to currently developed project recreation facilities.

Objective: The objective of this study is to identify potential changes in project operations, land use, features and management practices that could serve to reduce the potential impact of seven identified undesirable non-native wildlife species.

Scope/Methodology/Results: The study area includes all areas within the FERC Project boundary, and downstream within the Feather River floodplain to the confluence with the Yuba River as well as areas outside the project boundary as appropriate. This study will include a literature review and desktop evaluation to identify general management guidelines within the study area that serve to limit the occurrence of the seven identified undesirable non-native wildlife species: house sparrow, rock dove, European starling, black rat, Norway rat, house mouse, and red fox.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-T9 – RECREATION AND WILDLIFE

Type of Study: ¸ Desktop Study 1 Field Study

Start Date: April 2002

Need for Study: Both direct and indirect impacts on wildlife and the plant communities that support them may occur as a result of the high level of recreational use in the project area. The results of this study are required for both CEQA and NEPA compliance.

Objective: The objectives of this study are to identify current and future recreation-related direct and indirect impacts on wildlife and plant communities and identify opportunities to reduce or eliminate those impacts.

Scope/Methodology/Results: The study area includes all areas within the FERC project boundary and other areas potentially affected by project recreation facilities and use. This study will use information from other studies, including wildlife habitat/plant community map, ESA surveys, and recreational development and use surveys to map existing and potential areas of opportunities and areas of constraints associated with recreational use and wildlife conflicts. Results will identify recreation/wildlife conflicts with recommendations for areawide and site-specific avoidance or remediation actions.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-T10 – EFFECTS OF PROJECT FEATURES, OPERATION AND MAINTENANCE ON UPLAND PLANT COMMUNITIES

Type of Study: ¸ Desktop Study 1 Field Study

Start Date: April 2002

Need for Study: Stakeholders have identified project-related facilities, operations, maintenance, and recreation facilities and associated activities as having potential effects on upland plant communities. An evaluation of project effects on botanical resources is required for both CEQA and NEPA compliance.

Objective: The objectives of this study are to identify direct and indirect impacts of project features on upland vegetation communities including rare or unique plant communities.

Scope/Methodology/Results: The study area includes all areas within the FERC Project boundary and other areas potentially affected by project recreation facilities and use. This study will use existing literature and information from other studies, including vegetation community mapping, ESA surveys, noxious weed surveys, and project-related facilities operation and maintenance data, to evaluate the status of upland plant communities in the study area and map project-related effects. This qualitative assessment will include current vegetation patterns, project-related effects, enhancement opportunities, and proposed guidelines for future development of facilities or land use that will minimize impacts on local native upland plant communities.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-T11 – EFFECTS OF FUEL LOAD MANAGEMENT AND FIRE PREVENTION ON WILDLIFE AND PLANT COMMUNITIES

Type of Study: ¸ Desktop Study 1 Field Study

Start Date: April 2002

Need for Study: CEQA requires evaluation of potential project impacts related to safety including increased risk of wildfire. Stakeholders have expressed concern that historical land management and fire prevention activities within the FERC Project boundary have resulted in increased fuel loading, which has led to an increased risk of destructive wildfire.

Objective: The objective of this study is to provide information to the Land Use, Land Management and Aesthetics Work Group that will allow assessment of the effects of historical and potential future fuels management activities on biological resources within the project boundary.

Scope/Methodology/Results: The study scope includes all terrestrial plant communities and wildlife habitats present within the FERC Project boundary. This study will involve a literature review and evaluation of habitat mapping information from SP-T4 to develop predictions of ecological effects of historic and current fire prevention practices on major plant communities and wildlife habitat within the study area. The study will also evaluate effects of fuels management options on those plant communities and wildlife habitats. This study will provide information to the Land Use, Land Management and Aesthetics Work Group.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-F1 – EVALUATION OF PROJECT EFFECTS ON NON-FISH AQUATIC RESOURCES

Type of Study: [1] Desktop Study , Field Study

Start Date: Spring 2002

Need for Study: Relicensing of the Oroville Facilities by FERC requires certification from the SWRCB that the project complies with §401 of the federal Clean Water Act. Information required by the SWRCB for certification includes evidence of compliance with appropriate requirements in the Basin Plan. Additionally, this study is needed to provide sufficient information for CEQA/NEPA documentation.

Objective: The objectives of this study are to identify the macroinvertebrates and their available habitat present within project waters and to evaluate the effects of project features, operations, and maintenance on these resources, using macroinvertebrate and plankton assemblages as indicators.

Scope/Methodology/Results: The study area includes waters within the FERC project boundary. This study will involve a literature review and, using aerial photos, mapping data, and field verification, will develop and base maps depicting areas of potential habitat within the project area. Representative habitat locations will be identified and specific sampling protocol developed. Samples will be analyzed and findings presented. The results will define the existing condition of aquatic macroinvertebrate and plankton resources and will assess the potential of operational changes to affect these resources within project waters.

Draft Initial Progress Report, April 2003 – Abstract: This study qualitatively evaluates the effects of the project on macroinvertebrate and plankton communities. Aquatic macroinvertebrate and plankton communities are important components of the biological food web in project waters. They are an important food source for fish species found within the Oroville Facilities and their community structure can provide general information on ecosystem health.

The study focuses specifically on macroinvertebrates and plankton, as they are indicators of overall water quality and the prey base for fish. The objectives of the study are to: (1) document the status of existing macroinvertebrate and plankton communities and provide a description of the potential effects on these resources based on a review of the existing literature (Task 1); and (2) evaluate the 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).

A review of existing literature, field studies, and project data was conducted. The initial progress report describes the condition of aquatic macroinvertebrate and plankton communities present in both the impounded and free-flowing freshwater habitats associated with the Oroville Facilities. It also contains synthesized information on the effects of environmental and operational changes on macroinvertebrate and plankton abundance, distribution, and community structure in other aquatic systems.

Data from ongoing validation and enumeration efforts, in addition to future results from related studies, will provide additional information on environmental conditions that will be used to further evaluate the potential project effects on non-fish aquatic resources in project-affected waters. Results from Task 2 will be incorporated into a final study report scheduled for completion by June 2004.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-F2 – EVALUATION OF PROJECT EFFECTS ON FISH DISEASES

Type of Study: ¸ Desktop Study 1 Field Study

Start Date: Spring 2002

Need for Study: FERC regulations require an application for relicensing to include a discussion of the fish, wildlife, and botanical resources in the vicinity of the project and the ongoing and potential future project-related impacts on those resources. Evaluations of ongoing project effects on fish populations, endangered species, and their habitat are also needed for NEPA/CEQA compliance.

Objective: The objective of this study is to evaluate the effects of ongoing and future project operations (pump-back operations, hatchery production, water temperature, etc.) on the establishment, transmission, extent, and control of infectious hematopoetic necrosis (IHN), bacterial kidney disease (BKD), and other significant fish diseases within project-affected waters.

Scope/Methodology/Results: The study area encompasses waters within the Feather River basin, including waters within the FERC Project boundary, tributaries upstream to the current upper migratory limit, and the Feather River downstream to the Sacramento–San Joaquin Delta (Delta) and San Francisco Bay. This study will involve a literature review and evaluation of project and hatchery operations to analyze how these operations, including hatchery release practices, might affect the establishment, extent, and control of diseases. If necessary, the study will be augmented with field investigations. Results will be presented in a report and will include recommendations for minimizing potential project impacts on the establishment and transmission of fish diseases in the Feather River basin.

The study plan will be coordinated with SP-4 (Evaluation of Project Effects on Fish Passage Upstream of Lake Oroville) and SP-15 (Evaluation of the Feasibility to Provide Passage for Anadromous Salmonids Past Oroville Facility Dams).

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-F3.1 – EVALUATION OF PROJECT EFFECTS ON FISH AND THEIR HABITAT WITHIN LAKE OROVILLE, ITS UPSTREAM TRIBUTARIES, THE THERMALITO COMPLEX AND THE OROVILLE WILDLIFE AREA

Type of Study: ¸ Desktop Study 1 Field Study

Start Date: Spring 2002

Need for Study: FERC regulations require an application for relicensing to include a discussion of the fish, wildlife, and botanical resources in the vicinity of the project and the ongoing and potential future project-related impacts on those resources. Evaluations of ongoing project effects on fish populations, endangered species, and their habitat are also needed for ESA consultation and NEPA/CEQA compliance.

Objective: The objective of this study is to evaluate the ongoing and potential future project effects on resident coldwater and warmwater fish and their habitat within project waters. This study does not evaluate project effects on anadromous salmonids.

Scope/Methodology/Results: The study area includes Lake Oroville, its upstream tributaries, and the Thermalito Complex. This study will involve a literature and data review and evaluation of project operations to analyze how these operations affect resident fish species and their habitat requirements. Distribution of resident fish species within the study area, species' life history, habitat requirements, and habitat conditions within the study area will be determined. Findings will be presented in a report with accompanying tabular information and GIS-based map products.

F-3.1 (Task 2A, 3A), Interim Report June 2003 – Abstract: This study identifies the composition of fish species in Lake Oroville, the Thermalito Diversion Pool, and Thermalito Forebay. Information from this study will be used in the analysis of the effect of the Oroville Facilities' resident fisheries on upstream tributary fish and downstream special-status fish, and on the development of a recreational fishery management plan and other potential PM&E measures for the project.

The study is based upon data collected from several different evaluations over the last decade, using a variety of sampling methods and levels of intensity. The study provides a description of the existing Oroville Facilities and current operational constraints. A listing of the fish species is presented along with a general perspective as to the relative abundance of these species. In addition, the relationship of these fish species compositions to fishery management programs is also discussed.

Fish species occur in Lake Oroville and Thermalito Forebay as a result of the impoundment of Feather River species captured when Oroville Dam and the Thermalito

Diversion Dam were constructed in the early 1960s. Such species included rainbow trout, Chinook salmon, Sacramento pikeminnow, and smallmouth bass. Other species were introduced intentionally (e.g., brown trout, various strains of rainbow trout, Chinook salmon, largemouth bass, spotted bass) and unintentionally (e.g., wakasagi). Illegal introductions have no doubt occurred as well. Movement of fish (e.g., rainbow trout) into Lake Oroville from the tributaries occurs on a regular basis. All species occurring in Lake Oroville could potentially exist in Thermalito Forebay and the Thermalito Diversion Pool because they could move down through the power plant and/or via the spillway during high-water events.

The Lake Oroville warmwater fishery is composed of species such as spotted bass, largemouth bass, and catfish, and is sustained primarily through natural reproduction in the reservoir. The largemouth population is supplemented periodically by stocking Florida-strain largemouth bass. The coldwater fishery is supported almost entirely by hatchery stocking. A small amount (less than 2 percent) of rainbow trout was recorded in the angler survey. The primary forage fish, wakasagi, is self-sustaining.

The most frequently observed fish in Thermalito Forebay and the Thermalito Diversion Pool are rainbow trout and brook trout; these species are stocked in the Forebay on a regular basis. About 40,000–50,000 salmonids are stocked annually, supporting a popular put-and-take fishery.

Evaluation of the Ability of Lake Oroville's Coldwater Pool to Support Salmonid Stocking Recommendations, F-3.1 (Task 2B), Final Report, March 2003 – Abstract: This task is related to the FERC Relicensing of the Oroville Facilities because the amount of cold water present in Lake Oroville is determined in part by project operations and in part by external factors such as air temperature and precipitation. As such, the coldwater pool in Lake Oroville is influenced, in part, by project operations. In addition, the conclusions from this analysis may be used as the basis for suggesting potential PM&E measures relating to coldwater pool habitat for salmonids in Lake Oroville.

The objective of this study is to evaluate whether there is sufficient cold water in Lake Oroville to support current annual salmonid stocking goals of 170,000 yearling-equivalent salmon. For the purpose of this analysis, the usable coldwater habitat was defined as any zone in Lake Oroville in which both the water temperature criterion of less than 18˚C and the dissolved oxygen criterion of greater than or equal to 6.5 milligrams per liter (mg/L) were met. Water temperature and dissolved oxygen profiles were collected for 51 months at as many as 8 different sampling locations in Lake Oroville, then these profiles were analyzed. For each month of the period of record, the volume of usable coldwater habitat at each location for which data was available was calculated. Because of the variability in the volume of usable coldwater habitat between locations, the average volume was calculated for each month and year of the period of record.

Results suggest that even in the months and years with the lowest calculated average volume of usable coldwater habitat in Lake Oroville, the volume available per fish far exceeds the volume of water provided for fish in settings such as hatcheries and experimental and commercial net-pen operations. The assumptions used in calculating the average volume of usable coldwater habitat in Lake Oroville are highly conservative, almost certainly resulting in an underestimation of the actual volume available. Additionally, available information regarding depth distribution of forage base suggests that forage base is present in Lake Oroville in the zones in which usable coldwater habitat exists. Therefore, continued operation of the Oroville Facilities in a manner consistent with current operations would be expected to result in a sufficient volume of usable coldwater habitat to support current salmonid stocking recommendations in Lake Oroville.

Management Practices and Monitoring Studies for White Sturgeon, F-3.1 (Task 2D), Final Report, December 2002 – Abstract: The purpose of this study is to summarize information regarding management practices at reservoirs that are actively managed for sturgeon, evaluate potential project effects, and provide baseline information useful for future evaluations and development of potential PM&E measures. This study is also needed to determine whether Lake Oroville and its upper river tributaries have suitable habitat to maintain a sturgeon population, which includes spawning and adult holding habitat.

A literature review was completed that summarized management activities and the results of monitoring studies designed to evaluate the effectiveness of various management activities. The purpose of the review was to provide a mechanism for developing a potential sturgeon management plan and evaluating the likelihood of success of such a program in Lake Oroville. Lake Shasta management policies, monitoring and tagging studies, and progress reports have been reviewed and summarized for their potential applicability to Lake Oroville. Similar information from other reservoirs in the western United States that are managed for sturgeon also has been reviewed and summarized for its applicability to Lake Oroville. The literature review was also completed to assess habitat preferences of white sturgeon for spawning, as well as for adult holding. The literature review assessed the status of sturgeon populations above hydroelectric facilities and identified potential management practices for continuing to maintain healthy sturgeon populations for sport harvest.

Presently, it is believed that a self-sustaining population of white sturgeon does not occur in Lake Oroville. It was determined that small portions of the North and Middle Forks of the Feather River may provide suitable spawning habitat for white sturgeon; however, it has not been determined how much or under what hydrologic conditions habitat may be available. Because white sturgeon have not been stocked since 1998, the lack of any substantial reported catches indicate that Lake Oroville did not achieve a self-sustaining population. White sturgeon spawning habitat may be available within the Thermalito Diversion Pool, but it is unlikely that the amount of this habitat would support a self-sustaining population.

Characterization of Coldwater Pool Availability in Thermalito Afterbay, F.3-1 (Task 4B), Draft Report, October 2003 – Abstract: This study is needed to fulfill a portion of the FERC application requirements by characterizing coldwater pool availability in Thermalito Afterbay. Water temperature is an important factor influencing the availability of habitat for various species of fish in Thermalito Afterbay; this study evaluates potential project effects on habitat available to coldwater fish species in the afterbay.

The objective of this study is to evaluate whether sufficient cold water exists in Thermalito Afterbay to support a year-round coldwater fishery. The two potential types of coldwater fishery that this study was designed to assess are a put-and-grow salmonid trophy fishery and a put-and-take salmonid sport fishery. Because residence times of stocked salmonids potentially would be different for put-and-grow or put-and-take fisheries, two thermal regimes were analyzed. Based on the reported thermal tolerances of coho salmon (*Oncorhynchus kisutch*), water temperatures less than or equal to 18°C (64.4°F) year-round were used as an index representing appropriate water temperatures for a put-and-grow salmonid fishery. A range of 18.1–23.9°C (64.6–75.0°F) was used as an index representing appropriate water temperatures for a put-and-take salmonid fishery. During preliminary examination of the available water temperature data collected from Thermalito Afterbay, it was determined that, during most of the year, sufficient cold water exists to sustain a salmonid fishery.

Water temperature and dissolved oxygen profiles were collected over an 11-month period at 5 point locations and across 4 transects in Thermalito Afterbay. Detailed analysis of the data was conducted for each of the three warmest months of the year (June, July, and August) because the water temperature profiles during those months were the warmest, most heterogeneous, and most dynamic of the water temperatures observed during the year. Based on analysis of available data, in the summer months in 2002 when water temperatures in Thermalito Afterbay were highest and surface water elevations fluctuated the most, water temperatures for both put-and-grow and put-and-take salmonid fishery management were suitable at the locations sampled. Therefore, continued operation of the Thermalito Complex facilities in a manner consistent with current operations would be expected to result in availability of usable coldwater habitat to support salmonid management goals in Thermalito Afterbay.

One-mile Pond Fish Species Composition, F-3.1 (Task 5A) – Abstract: This study is needed because ongoing project operations affect Feather River stage elevations, which can have an effect on the surface elevation, temperature, and fish habitat of the ponds in OWA.

The objective of this study is to describe the composition of fish species at OWA from fish sampling conducted during 2002 and 2003 in One-mile Pond. One-mile Pond was selected for sampling to represent the general habitat and hydrologic function of the entire area. Sampling data from Robinson's Pond is also included. Composition of fish species at OWA is based on boat electrofishing conducted in November 2002,

April 2003, and June 2003. Anecdotal information from hook-and-line sampling, direct observation, and angler interviews is also included. A listing of the fish species is presented along with a general perspective as to the relative abundance of these species; the relationship of these fish species compositions to existing fishery management programs is also discussed.

Warmwater game fish dominate the OWA fishery, with bluegill, redear sunfish, and largemouth bass comprising 39 percent, 26 percent, and 24 percent of the catch, respectively. Warmouth, black crappie, and green sunfish made up another 8 percent, and other species accounted for less than 2 percent of the catch. The number of carp was estimated at 5–10% of the fish observed. Channel catfish have also been observed. Sacramento blackfish were likely introduced during a flooding event in the late 1990s. Juvenile salmonids also have been observed in OWA ponds.

Characterization of Fish Habitat in One-mile Pond, F.3-1 (Task 5B), Draft Report, November 2003 (DWR Report) – Abstract: The objective of this study is to collect baseline information about habitat character to serve as a foundation for future evaluations and development of potential PM&E measures designed to continue to provide an attractive fishery in the OWA ponds. The habitat suitability analysis conducted in this report was based on a literature review of the water temperatures, dissolved oxygen concentrations, substrates, cover types, and depths reported as suitable, preferred, or optimal for each of the species with the potential to exist in One-mile Pond. Habitat suitability was determined based on available literature for each life stage of each species with the potential to occur in OWA.

Most native species identified as having the potential to exist in the Lower Feather River below the Thermalito Afterbay outlet were generally suited to habitat conditions found within One-mile Pond. However, some exceptions are Pacific lamprey, tule perch, green sturgeon, white sturgeon, and riffle sculpin. Although these exceptions may be found in One-mile Pond during certain life stages, the life history of the fish and the habitat types reportedly required likely preclude year-round residence. The introduced species identified as having the potential to exist in the lower Feather River below the Thermalito Afterbay outlet are generally all well suited for existing habitat within One-mile Pond, with the exception of three species, for which only seasonal habitat may exist. These three species are American shad, striped bass, and spotted bass.

The most significant issue affecting OWA fisheries in the last decade has been the invasion of water primrose (*Ludwigia peploides*) in OWA on the east side of the Feather River. High abundance of aquatic plants can have negative impacts on recreational fisheries through reduced angler access and effectiveness, as well as declines in largemouth bass foraging success and population skewing toward smaller fish.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-F3.2 – EVALUATION OF PROJECT EFFECTS ON NON-SALMONID FISH IN THE FEATHER RIVER DOWNSTREAM OF THE THERMALITO DIVERSION DAM

Type of Study: ¸ Desktop Study 1 Field Study

Start Date: Spring 2002

Need for Study: FERC regulations require an application for relicensing to include a discussion of the fish, wildlife, and botanical resources in the vicinity of the project and the ongoing and potential future project-related impacts on those resources. Evaluations of ongoing project effects on fish populations, endangered species, and their habitat are also needed for ESA consultation and NEPA/CEQA compliance.

Objective: The objective of this study is to evaluate the ongoing and potential future project effects on resident coldwater and warm water fish and their habitat within project-affected waters downstream of the project facilities. This study does not evaluate project effects on anadromous salmonids.

Scope/Methodology/Results: The study area includes the Feather River low-flow channel downstream of the Fish Barrier Dam to the Thermalito Afterbay outlet, the Feather River downstream to its confluence with the Yuba River, and tributary waters within the FERC boundary. This study will involve a literature and data review and evaluation of project operations to analyze how these operations affect resident fish species and their habitat requirements. Distribution of resident fish species within the study area, species' life history, habitat requirements, and habitat conditions within the study area will be determined. Findings will be presented in a report with accompanying tabular information and GIS-based map products.

Fish Distribution in the Feather River below Thermalito Diversion Dam to the Confluence with the Sacramento River, F-3.2 (Task 1) and F-21 (Task 2), Draft Report, January 2003 – Abstract: The purpose of this study is to establish an informational baseline describing the current knowledge of fish distribution in the Feather River. This study fulfills a portion of the FERC application requirements by detailing the distribution of fish species of special regulatory status and fish species of primary management concern.

The objective of this study is to document the distribution of non-salmonid and primary predator and prey fish species observed in the Feather River from Thermalito Diversion Dam to the confluence with the Sacramento River.

Information regarding fish distribution in the Feather River was collected from a variety of sources, including snorkel surveys, beach seine surveys, rotary screw trap surveys, and creel surveys. The distribution of fish species was represented using maps delineating the geographic distribution of each species or class of species. As appropriate, temporal distributions of fish species were described using life stage pinwheel diagrams. The fish distribution maps and life stage pinwheel diagrams were generalized to those geographic and temporal distributions that are considered "typical," accounting for seasonal, annual, and water year–type variations.

Assimilation of the existing fish distribution information has the potential to affect the design and implementation of future fisheries studies and field data collection efforts. As this fish distribution information is finalized using information from ongoing FERC relicensing studies, fish distribution information will be compared to the location and distribution of fish habitat requirements by species. This comparison will contribute to the evaluation of potential effects of Oroville Facilities operations on fish habitat availability, suitability, and use, and species interactions.

Literature Review of Life History and Habitat Requirements for Feather River Fish Species, F-3.2 (Task 2) and F-21 (Task 1), Interim Report, January 2003 – Abstract: The purpose of this report is to assemble and summarize information regarding fish species' life history characteristics and habitat requirements. This study fulfills a portion of the FERC application requirements by detailing the life history characteristics and habitat requirements of fish species of special regulatory status, native fish species, and sport fish species.

Operations of the Oroville Facilities can potentially affect, both directly and indirectly, the quality, quantity, and distribution of fish habitat components in the Feather River. Developing a profile of fish life stage characteristics and habitat requirements establishes the basis for developing an understanding of the potential effects of Oroville Facilities operations on these fish resources. The purpose of this report is to provide an information base regarding life stage characteristics and habitat requirements of the fish species within the Feather River, which is intended to support other FERC Relicensing study plan tasks.

Twenty-four species of special regulatory status and management concern are characterized, with respect to as many as 94 separate elements or characteristics of fish life stages and habitat requirements for each species.

Information extracted from the literature review sources is integrated into the fish matrix, a searchable and readily manipulatable database of fish characteristics. The fish matrix currently consists of a separate table for each fish species. These tables will be eventually merged into one master fish matrix that will function as a database to support other study plans and reports.

Final Assessment of Potential Sturgeon Passage Impediments, F-3.2 (Task 3A), September 2003 – Abstract: The purpose of this study is to document and communicate the findings of the field investigations of Feather River sturgeon passage for the range of flow observations visually evaluated during the representative low-flow and high-flow periods. The sturgeon passage assessment fulfills a portion of the FERC application requirements by detailing the potential passage impediments associated with the Oroville Facilities Relicensing Project area for green sturgeon, which is a species of special regulatory status, and white sturgeon, which is a species of primary management concern.

Operations of the Oroville Facilities may influence the ability of both green sturgeon and white sturgeon to upmigrate past potential passage impediments by influencing flows within the Feather River; therefore, this study was developed to evaluate the degree to which migration impediments may contribute to the relatively low number and inconsistent observations of sturgeon in the Feather River. Three potential physical barriers to upstream migration for sturgeon in the Feather River were identified: Shanghai Bench, Sunset Pumps, and Steep Riffle (located 2 miles upstream of the Thermalito Afterbay outlet). These potential physical barriers were field evaluated by a team of selected sturgeon passage experts during representative low-flow conditions (November 2002, approximately 2,074 cubic feet per second [cfs]) and high-flow conditions (July 2003, approximately 9,998 cfs).

At the observed representative low flow, Shanghai Bench is likely a barrier to sturgeon passage because of the height of its waterfalls, the water velocities of the midchannel chute, and the lack of attraction flow within the potentially passable side channel. These potential passage impediments virtually disappear at relatively higher flows, and Shanghai Bench is likely passable for sturgeon during the representative high-flow conditions.

At the observed representative low-flow conditions, Sunset Pumps is likely a barrier to sturgeon passage because of the height of its waterfalls and the water velocities of the midchannel chute. The passage of Sunset Pumps by sturgeon during the representative high-flow conditions is unlikely, although a potential passage opportunity may exist within a river-left cascade/willow bar complex.

Of the potential barriers assessed, Steep Riffle represents the most reasonably passable potential barrier during representative low-flow conditions, and sturgeon could likely ascend the riffle without complication. Steep Riffle was removed from evaluation during representative high-flow conditions because the expert team deemed that it is likely passable during most river stages. Passage determinations at each of the potential passage barriers in the lower Feather River will continue to be speculative without a greater understanding of sturgeon migration patterns and physiologic limitations.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-F4 – EVALUATION OF PROJECT EFFECTS ON FISH PASSAGE UPSTREAM OF LAKE OROVILLE

Type of Study: ¸ Desktop Study 1 Field Study

Start Date: Spring 2002

Need for Study: FERC regulations require an application for relicensing to include a discussion of the fish, wildlife, and botanical resources in the vicinity of the project and the ongoing and potential future project-related impacts on those resources. Evaluations of ongoing project effects on fish populations, endangered species, and their habitat are also needed for ESA consultations and NEPA/CEQA compliance.

Objective: The objective of this study is to evaluate the ongoing and potential future project effects (e.g., inundation, water level fluctuations) on the ability of Lake Oroville resident salmonids to migrate into upper Feather River tributaries.

Scope/Methodology/Results: The study area includes waters within the FERC Project boundary whose surface water elevation may be affected by Oroville Facilities operations and where surface water elevation fluctuation could potentially affect passage of resident salmonids to upper Feather River tributaries. This study will involve a literature and data review and evaluation of project operations to analyze how these operations affect the passage of resident salmonids to and from available fish habitat upstream of Lake Oroville. Availability and use of resident salmonid habitat, habitat requirements, and habitat conditions, including barriers, relevant to passage within the study area will be determined. Findings will be presented in a report with accompanying tabular information and GIS-based map products.

This study plan and SP-15, Evaluation of the Feasibility to Provide Passage for Anadromous Salmonids Past Oroville Facility Dams, may be combined into one study plan to deal comprehensively with passage issues. Specific areas that will be expanded include additional detail on how results will be used in the relicensing process as tools to evaluate future potential operational scenarios.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-F5/7 –EVALUATION OF FISHERIES MANAGEMENT ON PROJECT FISHERIES

Type of Study: ¸ Desktop Study 1 Field Study

Start Date: Spring 2002

Need for Study: Warmwater and coldwater fisheries are important facets of recreation at the Oroville Facilities. Under the existing FERC license, the licensee has been required to implement fish management projects that benefit both fisheries at the Oroville Facilities. It is anticipated that as part of relicensing, FERC will require a Fisheries Management Plan that benefits recreational fishing while balancing warmwater and coldwater fisheries in Lake Oroville and project-affected waters.

Objective: The objective of this study is to evaluate the effect of ongoing and proposed fishery management activities and plans on the goal of a balanced warmwater and coldwater fishery at the project facilities and within project-affected waters and to evaluate the effect of Oroville Facilities fisheries on upstream tributary fish.

Scope/Methodology/Results: The study area includes project-affected waters within the FERC boundary, tributaries upstream to the current migratory limit, and the Feather River downstream to the confluence with the Sacramento River. This study will involve a literature and data review and evaluation of existing and proposed fish management plans and activities to analyze effects on fisheries within the study area. This information will be used to evaluate effects of project fisheries on the tributary fisheries. Relationship of management activities on balanced fishery goals, including constraints or inconsistencies with FERC-related and other management plans, will be described. Findings will be presented in a report that evaluates the effects of fisheries management plans and activities on fisheries within project-affected waters. Results will be presented in a summary report.

Potential Effects of Fish Management Activities on ESA-listed Fish Species, F-5/7 (Task 1), November 2003 - Abstract: Components of the coldwater and warmwater reservoir fisheries management program have the potential to interact with species listed under the FESA and/or CESA and species of special concern in the Feather River. This study evaluates the effects of fisheries stocking and management practices on listed fish species. This study fulfills a portion of the FERC application requirements by identifying and categorizing those fisheries management activities that may affect fish species of concern in the Feather River.

The objectives for this study are to evaluate the effects of fisheries management activities on fish species listed under FESA and/or CESA and species of special

concern in the Feather River. Management activities are divided into two categories, fish stocking activities and nonstocking activities. Current fish stocking activities in the project area include the stocking of coho salmon (*Oncorhynchus kisutch*) in Lake Oroville and rainbow trout and brook trout (*Salvelinus fontinalis*) in Thermalito Forebay. Potential interactions among stocked fish and FESA and/or CESA listed salmonids in the Feather River include competition for resources, predation, disease transmission, and genetic introgression. Nonstocking fisheries management activities in the project area include habitat enhancements and genetic enhancements to warmwater fish species promoting growth and longevity. These interactions and activities are evaluated to determine potential detrimental effects on fish species of concern in the Feather River.

Very few stocked fish escape from the reservoirs in which they are planted. The potential for competitive or predatory interactions with fish species of concern in the Feather River is minimal. Current stocking practices minimize the likelihood of significant emigration of stocked fish from the reservoirs. In addition, there is little evidence of disease transmission between hatchery fish and wild fish.

Evidence of hybridization between coho salmon and Chinook salmon is weak, and there are no documented cases of fertile offspring. The possibility of stocked rainbow trout mating with wild steelhead is not a likely scenario. Additionally, those few spawning events that may occur are not likely to affect the overall genetic makeup of the wild steelhead population.

Nonstocking management activities in the project area, including construction of habitat structures providing cover for juvenile black bass and the construction of catfish spawning structures, are confined to Lake Oroville and specifically target the warmwater fishery. It is unlikely that activities promoting growth and longevity of warmwater sport fish related to genetic enhancements to the populations would have any impact on special-status fish species in the Feather River.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-F8 –TRANSFER OF ENERGY AND NUTRIENTS BY ANADROMOUS FISH MIGRATIONS

Type of Study: ¸ Desktop Study 1 Field Study

Start Date: Spring 2002

Need for Study: FERC regulations require an application for relicensing to include a discussion of the fish, wildlife, and botanical resources in the vicinity of the project and the ongoing and potential future project-related impacts on those resources. Evaluations of ongoing project effects on endangered species and their habitat are also needed for ESA consultations and NEPA/CEQA compliance.

Objective: The objective of this study is to evaluate the effect of ongoing and proposed project operations on energy/nutrient conditions upstream of project facilities.

Scope/Methodology/Results: The study area includes the FERC Project waters and tributaries upstream to the pre-project upper migratory limits for fall-run and spring-run chinook salmon and steelhead. This study will estimate fish biomass using literature and data review to estimate currently available spawning habitat in the accessible stream reaches upstream of the reservoir. Habitat mapping will be obtained from results of SP-F15, Evaluation of the Feasibility to Provide Passage for Anadromous Salmonids Past Oroville Facility Dams. If nutrient losses are potentially significant to the nutrient and energy conditions of the upper basin, quantitative modeling and field sampling will be used to quantify the net changes of energy and nutrients to the streams and describe the ecological significance of that change. Results will be presented in a summary report.

Draft Report, August 2003 – Abstract: Project facilities currently prevent the upstream movement of anadromous fish stocks and therefore potentially affect the transfer of marine-derived nutrients and organic matter to the tributaries upstream of Lake Oroville. The potential influence on the nutrient transfer may contribute to a general decrease in productivity in the aquatic and terrestrial ecosystems of the upstream tributary basins. The potential loss of ecological productivity resulting from the elimination of the anadromous Chinook salmon and steelhead runs from the Feather River Basin upstream of Oroville Dam represents a continuing impact of the project on the biological resources of the area. This study fulfills a portion of the FERC application requirements by evaluating the effect of ongoing blockage of the upstream transfer of salmonid-derived nutrients and organic matter to the upstream tributaries.

The principal objectives of this study are to determine the amount of nutrients and organic matter lost from the upstream tributaries as a result of the elimination of

Chinook salmon and steelhead, to evaluate the effect of the losses on productivity of the tributaries, and to assess the need for nutrient mitigation or enhancement measures and potential approaches for implementing such measures.

Historical transfers of nutrients and organic matter are estimated from escapement estimates for the upstream tributaries and estimates of salmonid nutrient and organic matter content derived from previous studies. Historical escapement surveys for the upstream tributaries were reviewed to provide estimates of the number of salmon contributing to the upstream transfer of nutrients and organic matter before the construction of the Oroville Facilities. Potential escapement estimates were developed based on the current available salmonid spawning habitat in the upstream tributaries and observed Chinook salmon spawning densities in the spawning grounds of several rivers, including the Feather River downstream of Lake Oroville.

The estimated potential losses of nutrients and organic matter are substantial, but the significance of the losses was difficult to evaluate because of limitations in the available information. The estimates for potential spawning densities were too imprecise, and detection levels for measured nutrient concentrations in the upstream tributaries were insufficiently low. In spite of these limitations, the study provides useful information for guiding any future efforts to assess the significance of the nutrient and organic matter losses and for developing conservative target levels for potential future PM&E measures addressing nutrient conditions in the upstream tributaries.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-F9 –EVALUATION OF THE FEATHER RIVER HATCHERY EFFECTS ON NATURALLY SPAWNING SALMONIDS

Type of Study: 1 Desktop Study , Field Study

Start Date: Fall 2002

Need for Study: FERC regulations require an application for relicensing to include a discussion of the fish, wildlife, and botanical resources in the vicinity of the project and the ongoing and potential future project-related impacts on those resources. Evaluations of ongoing project effects on fish populations, endangered species, and their habitat are also needed for ESA consultation and NEPA/CEQA compliance.

Objective: The objective of this study is to analyze the effects of the Feather River Hatchery on naturally spawning salmonids in the Feather River specifically and in general for Central Valley streams, using a combination of literature review, analysis of studies conducted previously, and new field and laboratory studies,.

Scope/Methodology/Results: The study area includes the Feather River Fish Hatchery, waters of the project, and the Feather River to the confluence with the Sacramento River through to the Delta and San Francisco Bay. It also includes significant tributaries and Central Valley rivers and streams. The study will include a combination of literature review, analysis of studies conducted previously, and new field and laboratory studies as appropriate. The report will be completed by June 30, 2004. Some tasks may continue through the license application deadline and provide supplemental information postapplication.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-F10 – EVALUATION OF PROJECT EFFECTS ON SALMONIDS AND THEIR HABITAT IN THE FEATHER RIVER BELOW THE FISH BARRIER DAM

Type of Study: 1 Desktop Study , Field Study

Start Date: Spring 2002

Need for Study: FERC regulations require an application for relicensing to include a discussion of the fish, wildlife, and botanical resources in the vicinity of the project and the ongoing and potential future project-related impacts on those resources. Evaluations of ongoing project effects on fish populations, endangered species, and their habitat are also needed for ESA consultations and NEPA/CEQA compliance.

Objective: The objective of this study is to evaluate the ongoing and potential future project effects on fall-run Chinook salmon, spring-run Chinook salmon, and steelhead and their habitat in the Feather River below the Fish Barrier Dam.

Scope/Methodology/Results: The study area includes the Feather River from the Fish Barrier Dam to the confluence with the Sacramento River. Because the study plan addresses different salmonid life stages, the study area boundaries vary among specific tasks. This study will use literature review and field investigations to evaluate project effects on: (1) the upstream migration of adult anadromous salmonids in the study area; (2) spawning, incubation, initial and juvenile rearing period of anadromous salmonids in the Feather River; and (3) emigration of juvenile anadromous salmonids in the Feather River. Results will be used to develop PM&E measures for anadromous salmonid populations in the study area. Findings will be presented in a report with accompanying tabular information, graphical representations, and GIS-based map products.

Flow-related Physical Impediments in the Feather River Below the Fish Barrier Dam, F-10 (Task 1C), Interim Report, January 2003 – Abstract: This study evaluates potential relationships between flow and flow-related physical passage impediments to adult salmonid immigration in the Feather River. Adequate flows are necessary to allow fish passage past potential physical impediments to upstream migration. The flow regime associated with the ongoing operation of the Oroville Facilities has the potential to impede the passage of salmonids migrating to upstream spawning areas in the Feather River. To evaluate the potential relationships between project operations and FESA and/or CESA–listed spring-run Chinook salmon and steelhead, as well as candidate fall-run Chinook salmon, it is desirable to evaluate the potential for flow-related physical passage impediments to adult salmonid immigration in the Feather River. This study fulfills a portion of the FERC application requirements by evaluating the potential for flow-related physical passage impediments to adult salmonid immigration in the Feather River below the Fish Barrier Dam.

The purpose of this study is to evaluate potential relationships between flow and flow-related physical passage impediments to adult salmonid immigration in the Feather River. Anadromous salmonids that use the Feather River as a migration corridor include steelhead (*Oncorhynchus mykiss*) and Chinook salmon (*O. tshawytscha*).

Various statistical analyses were conducted to identify any consistent temporal pattern among flow and escapement that might suggest potential flow-related physical impediments to upstream passage. A linear regression approach was used to evaluate potential relationships between the estimate of total Chinook salmon escapement and various flow rate variables based on defined regulatory or flow-level thresholds. In addition, an analysis of variance (ANOVA) approach compared two series of estimates of adult Chinook salmon escapement, which were separated and grouped based on a defined regulatory or flow-level threshold. The statistical examinations indicate that no statistically significant difference exists between adult Chinook salmon spawning escapement in dryer, lower flow years and such escapement in wetter, higher flow years. Flow-related physical passage impediments to adult salmonid upstream migration are not apparent in the Feather River.

Spring-run Chinook Salmon Holding Habitat Characteristics, F-10 (Task 1E), Interim Report, April 2003 – Abstract: Oroville Facilities operations affect Feather River flows, water temperatures, and channel morphology below Oroville Dam in a manner that may affect fish habitat. This study fulfills a portion of the FERC application requirements by identifying and characterizing holding habitat for adult spring-run Chinook salmon, including physical habitat components such as water temperature, dissolved oxygen, and substrate, within pools in the Feather River below Thermalito Diversion Dam. In addition, the conclusions from this analysis may be used as the basis for developing or evaluating potential PM&E measures focused on adult spring-run Chinook salmon holding habitat in the Feather River.

The purpose of this study is to identify and characterize holding habitat for adult spring-run Chinook salmon (*Oncorhynchus tshawytscha*) in the Feather River below Thermalito Diversion Dam. Ongoing operation of the Oroville Facilities influences flows and water temperatures in the Feather River downstream of Thermalito Diversion Dam. Water temperatures and flow are both important factors influencing the ability of adult salmonids to migrate upstream and hold in natal streams until spawning occurs.

A literature review was conducted to determine suitable water temperature, dissolved oxygen concentration, depth, substrate, and water velocity for the holding habitat of adult spring-run Chinook salmon. An analysis was conducted to determine the existence, location, and distribution of suitable holding habitat in the Feather River below Oroville Dam. Sixteen pools were sampled in four reaches of the Feather River to collect water temperature, dissolved oxygen concentration, and depth data to which published parameters could be compared.

Data collected during spring, summer, and early fall 2002 indicate generally suitable water temperatures for adult spring-run Chinook salmon holding from the Fish Barrier Dam to Mathews Riffle (River Mile [RM] 67 to RM 64). Water temperatures increased to reported sublethal and incipient lethal levels with increased distance downstream. At all sample sites, the dissolved oxygen concentration was suitable for holding adult spring-run Chinook salmon on all sample dates. Pools of suitable depth are available during the holding period; however, not all pools sampled were of suitable depth throughout the entire holding period. Initial results suggest that a larger temperature data set is needed to accurately draw conclusions about the availability, location, and distribution of suitable spring-run Chinook salmon holding habitat within the Feather River.

Steelhead Spawning Methods, May 2003, and 2003 Lower Feather River Steelhead (*Oncorhynchus Mykiss*) Redd Survey, F-10 (Task 2B), Interim Report, July 2003 – Abstract: Ongoing operation of the Oroville Facilities affects flows, water temperatures, and supply of gravel, which in turn may affect spawning, incubation, and initial rearing of salmonids. Flow, water temperature, and gravel quality are important factors influencing the spawning, incubation, and initial rearing lifestages of salmonids. This study evaluates potential relationships between project operations and FESA-listed steelhead. Therefore, it is desirable to collect data regarding steelhead spawning locations and the relative abundance of spawning steelhead. This study fulfills a portion of the FERC application requirements by providing a literature review that summarizes and evaluates potential methods of surveying spawning steelhead, as well as detailed information regarding spawning steelhead in the Feather River.

The purpose of this study is to summarize and evaluate potential methodologies for observing and measuring steelhead spawning and to obtain detailed information on spawning steelhead in the Feather River. This study includes a literature review designed to evaluate the types of methods that could be used to survey spawning steelhead and the applicability of each method to the Feather River. In addition, steelhead redd surveys were conducted to identify the location, timing, and magnitude (if possible) of steelhead spawning in the Feather River between the Fish Barrier Dam and Honcut Creek.

The objective of the literature review and evaluation is to identify opportunities for improvement in the methods used to quantify steelhead spawning in the Feather River. A review was conducted of available literature describing devices and methods that could be used to enumerate migrating or spawning salmonids. Potential survey methods for spawning steelhead combined with consideration of the physical characteristics of the Feather River reveal that a combination of methods including bank, snorkel, and boat surveys are best suited for surveying spawning steelhead in the Feather River.

The objectives of the study related to steelhead spawning are to:

- Obtain detailed information on the distribution of spawning steelhead;
- Obtain basic data on the physical characteristics of steelhead redds; and
- Provide a basis for the development of a long-term plan to monitor the abundance and distribution of steelhead spawning in the Feather River.

Thirteen weekly redd surveys were performed between January 6 and April 3, 2003. A total of 108 steelhead and 75 redds were observed during the sampling period. Redd construction likely began sometime in late December, peaked in late January, and was essentially complete by the end of March. In the months of January, February, and March, steelhead constructed, at a minimum, 45, 26, and 4 redds, respectively. The surveys revealed that nearly half (48 percent) of all redds were constructed in the uppermost mile of river (between RM 66 and RM 67), between the Table Mountain Bicycle Bridge and Lower Auditorium Riffle. This section of river maintained 36 redds per mile, more than 10 times as many redds per mile than in any other section of river. Hatchery Ditch alone had 26 redds constructed within it, 5 times more redds than were constructed in any other location.

Assuming one female per redd and a male-to-female ratio of 1.2:1, the minimum number of males and females expected to have spawned was 88 and 75, respectively, for a total of 163 steelhead during the 2002–2003 spawning season. Physical characteristics of constructed redds in both the high-flow channel and the low-flow channel appeared suitable for successful spawning and egg incubation. A weir or other counting mechanism would be necessary to accurately determine the number of steelhead spawning in the Feather River.

Steelhead Rearing Temperatures, F-10 (Task 3B), Interim Report, July 2003 – Abstract: Ongoing operation of the Oroville Facilities affects flows, and consequently water temperatures, in the Lower Feather River, which in turn may affect the rearing success of salmonids. This study summarizes the water temperatures reported to be suitable for rearing juvenile steelhead and the effects of increased water temperatures on their physiology and behavior. This study fulfills a portion of the FERC application requirements by providing a literature review that summarizes suitable water temperatures for rearing steelhead and evaluates potential effects of increased water temperatures on rearing juvenile steelhead.

The objective of this literature review and evaluation is to identify temperature ranges that are suitable for steelhead fry and juvenile rearing, and to provide a basis from which PM&Es could be developed to improve habitat conditions in the Lower Feather River. Reported suitable rearing temperatures for steelhead fry and juveniles in laboratory and field settings are identified. The report includes a brief description of the types of studies from which suitable water temperature ranges for rearing steelhead were derived, as well as the effects of exposure to water temperatures outside the

reportedly suitable water temperature range. Average water temperatures in the reach of the Feather River where juvenile steelhead are reported to rear are compared to reported suitable water temperature ranges. The analysis revealed that in the low-flow channel of the Feather River, water temperatures are suitable for steelhead fry and juvenile rearing during all months of the year.

Redd Dewatering and Juvenile Steelhead and Chinook Salmon Stranding in the Lower Feather River, 2002–2003, F-10 (Task 3C), Interim Report, June 2003 (DWR Report) – Abstract: This study consists of two major components over a 2-year (2002–2003) period: aerial and ground surveys to locate spawning riffles and potential stranding areas and biological observations to estimate the incidence of juvenile stranding and redd dewatering. The results of the study will serve as a basis for establishing long-term ramping rate criteria to minimize the potential for stranding juvenile salmonids.

The incidence of redd dewatering was compared with the estimated number of salmon redds from the 2002 spawning season to determine redd losses as a proportion of the total in the Feather River. Also, the incidence of stranding was compared with emigration estimates from rotary screw trap operations to determine the stranding losses relative to the population of juvenile spring-run salmon in the river.

The study summarizes activities from the 2002–2003 sampling season. Since 2001, DWR has conducted a redd dewatering and juvenile stranding study on Chinook salmon and steelhead in the lower Feather River. The objectives of the study are to determine the number of redds dewatered by reductions in flow; identify potential ponding areas; determine the relative abundance of stranded salmonids; and determine the biological significance of stranding/redd dewatering losses to the existing population of salmonids in the river.

Only 14 dewatered redds were discovered, as compared to an estimated 23,308 female spawning Chinook. Empirical observations and historical aerial photos led to the identification of more than 30 areas that have the potential to strand juvenile salmonids. Sampling of these areas revealed that relatively few juvenile salmon and steelhead become isolated. Furthermore, the proportion of stranded salmonids represents a very small percentage (less than 1 percent) of the estimated number of emigrants. The major flow fluctuation occurred in late February, which probably reduced the potential stranding impact on rearing salmonids. The peak of emigration for Chinook salmon occurred several weeks before this event. Also, more than 75 percent of the early rearing of steelhead takes place in the low-flow channel, suggesting that flow fluctuations in early spring have a very limited potential impact on juvenile steelhead in the high-flow channel.

Literature Review of Devices Used for Enumeration of Juvenile Steelhead (*Oncorhynchus mykiss*) Outmigrants, F-10 (Task 4A), Interim Report, January 2003 – Abstract: This study evaluates the types of devices that could be used to

enumerate outmigrating juvenile steelhead (*Oncorhynchus mykiss*), and the applicability of each device to the Feather River. This study fulfills a portion of the FERC application requirements by providing a literature review that supports evaluations of potential project effects on juvenile salmonids. The conclusions drawn from this literature review may be used as the basis for suggesting potential PM&E measures designed to increase trap efficiencies and provide a more rigorous estimate of the number of outmigrating juvenile steelhead.

The purpose of this literature review is to evaluate the current juvenile steelhead enumeration program and determine whether there are opportunities for improvement that would increase the accuracy and precision of estimates of the number of outmigrating juvenile steelhead in the Feather River. Devices used to enumerate outmigrating juvenile steelhead, including acoustic devices, camera monitoring, electric fish counters, fyke nets, inclined plane traps, inclined screen traps, rotary screw traps (RSTs), seining, snorkel surveys, and trawls, are researched through a review of published peer-reviewed journal articles, government agency reports, and consultant literature. A brief description of each device, a list of advantages and disadvantages associated with the device, a summary of several case studies involving use of the device, and conclusions regarding the applicability of the device for use in enumerating outmigrant juvenile steelhead in the Feather River are provided. The literature review concluded that RSTs were the most suitable method for enumerating outmigrant juvenile steelhead in the Feather River.

Through a literature review, RST efficiencies and site conditions in the Feather River are compared to those in other comparable rivers to determine whether the respective efficiencies are similar. Feather River RST efficiencies are determined to be as high as, and in many cases higher than, RST efficiencies in other large rivers. Modifications to RSTs that have the potential to improve trap efficiencies, including diversion wings, ganged RSTs, multiple RSTs, and the use of behavioral modifications such as light and sound, are researched through a literature review. A description of the modification, a list of advantages and disadvantages of the modification, and a summary of case studies in which the modification had been applied is provided. The literature review concluded that no modifications to the existing RSTs for next year's field studies are recommended.

Timing, Thermal Tolerance Ranges, and Potential Water Temperature Effects on Emigrating Juvenile Salmonids in the Lower Feather River, F-10 (Task 4B), September 2003 – Abstract: Ongoing operation of the Oroville Facilities influences flows and water temperatures in the Feather River downstream of Thermalito Diversion Dam. Water temperature and flow are important factors influencing the emigration of juvenile salmonids in the Lower Feather River. Flow and water temperature manipulations resulting from operation of the Oroville Facilities may affect emigration of juvenile salmonids in the Feather River. This study fulfills a portion of the FERC application requirements by describing the relationship between water temperature and juvenile salmonid emigration patterns, and evaluating the potential project effects on

juvenile salmonid emigration in the Feather River downstream of the Fish Barrier Dam. In addition, the conclusions from this analysis may be used as the basis for developing or evaluating potential PM&E measures focused on providing appropriate water temperature regimes in the Feather River for emigrating juvenile salmonids.

The purpose of this study is to describe the relationship between water temperature and juvenile salmonid emigration patterns, and evaluate potential project effects on juvenile salmonid emigration in the Feather River downstream of the Fish Barrier Dam. A literature review was conducted 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. Upon completion of the literature review, spatial and temporal water temperature distributions in the lower Feather River were determined. Water temperature distributions were then combined with emigration dates to determine the potential impacts on emigrating juvenile salmonids from thermal stress loading.

Elevated water temperatures in the Lower Feather River may affect emigrating juvenile steelhead more than emigrating juvenile Chinook salmon. Water temperatures in the low-flow channel are more conducive to emigrating salmonids than are water temperatures in the high-flow channel. However, the project's ability to manipulate water temperature through flow releases decreases with downstream distance from Oroville Dam. In the high-flow channel during the warmest months of the year, inflow of cold water from the Yuba River may provide localized thermal refugia.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-F15 – EVALUATION OF THE FEASIBILITY TO PROVIDE PASSAGE FOR TARGETED SPECIES OF MIGRATORY AND ANADROMOUS FISH PAST OROVILLE FACILITY DAMS

Type of Study: ¸ Desktop Study 1 Field Study

Start Date: Spring 2002

Need for Study: FERC regulations require an application for relicensing to include a discussion of the fish, wildlife, and botanical resources in the vicinity of the project and the ongoing and potential future project-related impacts on those resources. Evaluations of ongoing project effects on fish populations, endangered species, and their habitat are also needed for ESA consultations and NEPA/CEQA compliance.

Objective: The objective of this study is to evaluate the feasibility of restoring passage for anadromous salmonids to areas upstream of the Fish Barrier Dam, including the area between the Fish Barrier Dam and Thermalito Diversion Dam and upstream of Oroville Dam to the next salmonid migration barrier.

Scope/Methodology/Results: The study area includes the FERC Project waters upstream of the Fish Barrier Dam, including Lake Oroville and its upstream tributaries. This includes areas of the Upper Feather River watershed within the fluctuation zone of Lake Oroville. This study will review and assess available information, including information from SP-F10 and SP-F3, regarding life history and habitat requirements of Feather River anadromous salmonids and potential habitat availability upstream of the Fish Barrier Dam and Lake Oroville. The study will also evaluate alternative fish passage facilities, methods for passage, and the overall feasibility for successful fish passage at the Oroville Facilities. If feasible, more detailed hydrologic, hydraulic, and design considerations will be developed. Results will be presented in a report with accompanying tabular information, graphical representations, and GIS-based map products.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-F16 – EVALUATION OF PROJECT EFFECTS ON INSTREAM FLOWS AND FISH HABITAT (PHABSIM)

Type of Study: ¸ Desktop Study 1 Field Study

Start Date: Spring 2002

Need for Study: Resource agencies participating in FERC relicensing processes commonly rely on information generated from PHABSIM instream flow studies to develop recommended instream flow regimes. FERC also uses these results during their resource balancing deliberations.

Objective: The objective of this study is to analyze flow-habitat relationships to evaluate potential project effects on anadromous salmonid spawning and rearing habitat within the study area.

Scope/Methodology/Results: The study area includes the Feather River from the Fish Barrier Dam to the confluence with Honcut Creek, near Live Oak. This study will review and evaluate existing information, including hydraulic and habitat suitability data, and perform habitat simulations to determine relationships between streamflow and habitat suitability. Results will be presented in a report describing output from habitat/flow relationship simulations, methodology used, and interpretation of results. A second phase of this study would lead to the Instream Flow Incremental Methodology (IFIM) process.

Draft Phase 1 Report, July 2002 – Abstract: This study analyzes flow-habitat relationships and evaluates potential project effects on anadromous salmonid spawning and rearing habitat within the study area. The objective of Phase 1 is to examine existing PHABSIM (physical habitat simulation) studies for their applicability to the needs of the FERC Oroville Facilities Relicensing Project. PHABSIM computer models create indices that describe the physical habitat suitability of alternative instream flow releases. Phase I includes an evaluation of the changes in the Feather River since the PHABSIM studies were completed, as those changes apply to determination of the amount of available habitat. Additionally, the Phase 1 evaluation includes an assessment of the habitat suitability criteria generated in previous PHABSIM studies, as well as recent habitat utilization data collected by DWR. The objective of Phase 2 is to collect additional hydraulic or biological data to supplement existing data for direct applicability to the FERC Oroville Facilities Relicensing Project. Phase 2 will also establish tools to evaluate future potential operational scenarios and other PM&E measures.

The general approach of the Phase 1 assessment is to review and evaluate existing information and conduct additional analyses of existing data (site-specific or generic) using recent modeling and analytical techniques. This approach is intended to reduce uncertainty associated with previous PHABSIM analyses. The review of existing information and supplemental analyses is intended to identify whether additional data are needed to further refine flow-habitat relationships in the study area, and if additional data are required, to specify required data collection efforts.

The instream flow studies conducted by DWR provide a significant and useful tool for evaluating potential flow management strategies. The IFIM process used by DWR remains the most defensible method available for identifying and establishing environmental flows and is considered state-of-the-art internationally for in depth studies of flow and instream biota interactions. The studies are strong in terms of general river representation and the acquisition and use of site-specific habitat criteria data for the target fish species (Chinook salmon and steelhead).

Two general areas of the DWR studies were identified as needing to be addressed to bring them to the highest acceptable standards. First, additional river study sites should be selected for supplemental hydraulic data collection using improved measurement and modeling techniques. At least 12 one-dimensional transects are recommended, along with 2 two-dimensional sites, after which all hydraulic data should be recalibrated. Second, supplemental biological data should be collected (much of which is currently being acquired by DWR). Following completion of this data collection effort, all data should be pooled together and new final habitat suitability criteria created and linked with the hydraulic data to create new flow suitability indices.

Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

ABSTRACT: SP-F21 –PROJECT EFFECTS ON PREDATION OF FEATHER RIVER JUVENILE ANADROMOUS SALMONIDS

Type of Study: 1 Desktop Study , Field Study

Start Date: Spring 2002

Need for Study: FERC regulations require an application for relicensing to include a discussion of the fish, wildlife, and botanical resources in the vicinity of the project and the ongoing and potential future project-related impacts on those resources. Evaluations of ongoing project effects on fish populations, endangered species, and their habitat are also needed for ESA consultations and NEPA/CEQA compliance.

Objective: The objective of this study is to evaluate the ongoing and potential future project effects on predation of Feather River juvenile anadromous salmonids.

Scope/Methodology/Results: The study area includes those waters within the Oroville Facilities FERC Project boundary that contain anadromous salmonids and the section of the Lower Feather River potentially affected by project operations. This study will include a literature review to gather information on potential predators, life histories, distribution and predator-habit characteristics. It will also characterize the study area's environmental components, estimate juvenile salmonid losses to predation since project construction, and review alternative for predator control and management. Results will be used to develop PM&E measures for anadromous salmonid populations in the study area. Findings will be presented in a report with accompanying tabular information, graphical representations, and GIS-based map products.

Predation PM&E Literature Review, F-21 (Task 4), Interim Report, February 2003 – Abstract: This study summarizes previously conducted predation management and monitoring plans designed to decrease predation on juvenile anadromous salmonids and assesses their potential applicability to the Feather River and the Oroville Facilities.

The purpose of this study is to compile and summarize PM&E measures designed to reduce predation or control predatory fish, and to evaluate the success of such measures, as well as the potential applicability of such measures to the Feather River and the Oroville Facilities. This study is designed to support the identification of potential PM&E measures by summarizing previously implemented PM&E measures to reduce predation on juvenile anadromous salmonids from other river systems, and assessing their potential applicability to the Feather River and the Oroville Facilities. Applicability of PM&E measures conducted in other river basins to the Feather River was evaluated qualitatively, and the degree of applicability was used to conceptually

evaluate the potential value associated with implementing a similar PM&E measure in the Feather River.

Of the literature reviewed, it appeared that most of the management plans could conceptually be applied to the conditions at the Oroville Facilities and the Feather River. Most of the predation management literature reviewed did not use rigorous scientific methods of sampling or monitoring, nor did they document pre- and postmanagement implementation conditions. Most of these studies provided only qualitative and subjective interpretation of their results. As a result, the specific potential benefits of implementing any of these plans are not readily quantifiable.

APPENDIX F

POTENTIAL RESOURCE ACTIONS/PM&E MEASURES

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APPENDIX F
POTENTIAL RESOURCE ACTIONS/PM&E MEASURES

All potential resource actions (RAs)/protection, mitigation, and enhancement (PM&E) measures that were submitted to DWR (and/or the Work Groups) by January 2004 were captured in the master list provided on the following pages. However, if a specific RA/PM&E measure is not found or recognized, please contact Kim Cotto at (916) 653-6700 or kcotto@water.ca.gov.

KEY TO COLUMN HEADINGS OF RA/PM&E MASTER LIST

- A unique **RA/PM&E number** is given and used by DWR to identify all separate RAs/PM&E measures. For general overview they are organized by resource area. Each resource area has its own thousand-series: 1001+ identify Cultural Resources RAs/ PM&E measures, 2001+ = Engineering and Operations, 3001+ = Environmental Resources, 4001+ = Aesthetics, Land Use and Management RAs/PM&E measures, and 5001+ describe Recreation and Socioeconomics related RAs/PM&E measures. The 6001+ ones identify U.S. Forest Service submitted RAs/PM&E measures and the 7001+ capture PM&E measures that have been submitted to DWR, but haven't been reconciled within a Work Group.

- The **RAIF Stakeholder ID** identifies a Resource Action Identification Form (RAIF) and the stakeholder that submitted it. (The letters in the code are in most cases representative of the stakeholder's name, e.g., "BCCFG-01" is the first PM&E measure submitted by Butte County Citizens for Fair Government.)

- The **Work Group number** identifies the RAs/PM&E measures that were worked on in the Technical Work Groups. Codes identify the resource area (e.g., "CWG" = Cultural Work Group, "EWG" = Environmental Work Group), and in the case of Recreation PM&E measures, the location of the PM&E (e.g., "RWG-OR-01" describes PM&E measure 01 of the Recreation Work Group in the Oroville area). For a list of all Work Group codes, see below.

- **Descriptions** of PM&E measures sometimes appear very similar. Measures may have a different intent, which only becomes visible in the details (of approach), especially if submitted by different stakeholders. Some PM&E measures have changed in description since they have been submitted, as they were discussed in the Work Groups (in some cases with and in other cases without the stakeholders that submitted them).

- The **Proponent** column lists the stakeholders, resource agencies, and organizations that proposed the original PM&E measure and/or endorsed it.

- The **Work Group Forum** column lists the Work Group that primarily addressed and discussed a RA/PM&E measure. It may also list the proponents and stakeholders that were part of the discussion. Work Group meetings were open to the public.

Table F-1. Key terms used in the master list of potential PM&E measures.

Acronym or Abbreviation	Definition
ADA	Americans with Disabilities Act
AF	deleted the one reference I found for AF and replaced it with 'afterbay'
BBAC	Black Bass Action Committee
BC	Butte County
BCCFFG	Butte County Citizens for Fair Government
BCCFG#	Butte County Citizens for Fair Government number supplied by Kearns and West
BIC	Boat-in Camp
BLM	U.S. Bureau of Land Management
BSC	Butte Sailing Club
Caltrans	California Department of Transportation
CDF	California Department of Forestry and Fire Protection
CFER	Citizens for Fair and Equitable Recreation
cfs	cubic feet per second
CG	Campground
CTC	County Transportation Commission
CWA	California Waterfowl Association
CWG	Cultural Work Group
CRWG#	Cultural Work Group ID
DFG	California Department of Fish and Game
DPR	California Department of Parks and Recreation
DWR	California Department of Water Resources
DU	Ducks Unlimited
EOWG	Engineering and Operations Work Group
EOWG#	Engineering and Operations Work Group ID
EWG	Environmental Work Group
EWG#	Environmental Work Group ID
F.R. LFCA	Feather River Low Flow Collaborative Alliance - it's often listed as seen.
FRRPD	Feather River Recreation and Parks District
IHN	infectious hemapoetic necrosis
LFCA	Low Flow Collaborative Alliance
LOBO	Lake Oroville Bicyclist Organization
LOJPA	Lake Oroville Joint Powers Authority
LOOC	Lake Oroville Oversight Committee
LOSRA	Lake Oroville State Recreation Area
LSIC	Lime Saddle Interested Citizens
LUWG	Land Use, Land Management, & Aesthetics Work Group
LWG#	Land Use, Land Management, & Aesthetics Work Group ID
MET	MWH-EDAW Team (Consultants)
Mph	miles per hour
N/A	Not available
NOAA	National Oceanic and Atmospheric Administration
NMFS	National Marine Fisheries Service
O&M	operations and maintenance

Table F-1. Key terms used in the master list of potential PM&E measures.

Acronym or Abbreviation	Definition
OFD	Oroville Field Division
OHV	off-highway vehicle
ORAC	Oroville Recreation Advisory Committee
ORDA	Oroville Redevelopment Authority
OWA	Oroville Wildlife Area
PG&E	Pacific Gas and Electric Company
PM&E	protection, mitigation, and/or enhancement (also called “resource action”)
RAIF	Resource Action Identification Form
RDA	Also called the ORDA - Oroville Redevelopment Authority
RV	recreational vehicle
RWG	Recreation (and Socioeconomics) Work Group
RWG-S/#	(Recreation and) Socioeconomics Work Group ID
RWG#	Recreation (and Socioeconomics) Work Group ID
RWQCB	Regional Water Quality Control Board
SP-	Study Plan
SR	State Route (Highway)
SRA	State Recreation Area
SVRA	State Vehicular Recreation Area
SWP	State Water Project
SWRI	Surface Water Resources, Inc. (Consultants)
TBD	to be determined
TCD	Temperature Control Device
TCP	Traditional Cultural Property
TEA	Transport Efficiency Act of 1991
UPRR	Union Pacific Railroad
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
VELB	valley elderberry longhorn beetle
WCB	Wildlife Conservation Board
WG#	Work Group ID as assigned by Work Group (Example: EWG-5 is Environmental Work Group PM&E measure no. 5)

Source: Information provided by DWR.

The next step in this process will be the evaluation of the potential RAs/PM&E measures. PM&E measures that pass the initial evaluation (having the ability to achieve a specific resource goal and having a nexus to the project) will be carried forward into a more detailed evaluation. For more information, see Section 3.5 in the PDEA Progress Summary.

Table F-2. RA/PM&E Master List

Resource Action / PM&E No.	Stakeholder ID No.	Work Group No.	Description	Proponent (initial stakeholder)	Work Group Forum
(Unique Identifier ID [1001+=Cultural Resources; 2001+= Engineering & Operations; etc.])	*(Code from Resource Action/PM&E Measure Identification Forms - only where applicable)*	*(Code assigned by Work Groups)*	*(Short description and location)*	*(Resource agency*, or Work Group, organization)* *[*In some cases the resource agency was part of the Work Group]*	*(Work Groups in which the potential PM&E measures were discussed and developed further. In a few cases, single stakeholders developed their potential PM&E measures further.)*
1001		CRWG01	Relocate Car-Top Boat Ramp (Foreman Creek)	CWG	CWG
1002		CRWG02	Site Stabilization (Foreman Creek)	CWG	CWG
1003		CRWG03	Boat Ramp Extension (Enterprise)	CWG	CWG
1004		CRWG04	Signage Program - Protection	CWG	CWG
1005		CRWG04	Signage Program - Enhancement	CWG	CWG
1006		CRWG05	Closure (Foreman Creek)	CWG	CWG
1007	CRWG-01	CRWG06	Expansion of Site Stewardship Program with Full-Time Archaeologist	CWG	CWG
1008	CRWG-02	CRWG07	Public Education Program	CWG	CWG
1009	CRWG-03	CRWG08	Data Recovery	CWG	CWG
1010	CRWG-04	CRWG09	Display Enhancement for LOSRA Visitor Center	CWG	CWG
1011		CRWG10	Boat-in Campground Access Restrictions	CWG	CWG
1012		CRWG11	Artifact Amnesty Program	CWG	CWG
1013	BCCFG-01	CRWG12	Natural Springs Restoration and Maintenance	BCCFFG	CWG
1014		CRWG13	Relocate Mortar Cupules (Fish Hatchery)	CWG	CWG
1015		CRWG14	Funding of Associate State Park Archaeologist	CWG	CWG
1016		CRWG15	Additional State Park Ranger Positions	CWG	CWG
1017		CRWG16	Develop Publications and Brochures for Cultural Awareness Education - Protection	CWG	CWG
1018		CRWG16	Develop Publications and Brochures for Cultural Awareness Education - Mitigation	CWG	CWG
1019		CRWG17	Return/Donation of Local Cultural Materials	CWG	CWG
1020		CRWG18	State Park Interpreter I at LOSRA Visitor Center	CWG	CWG
1021		CRWG19	Site Stabilization (Project-wide)	CWG	CWG
1022		CRWG20	Historic Education Program	CWG	CWG
1023	BC-E-MR-01	CRWG21	Surcharge for all electric power sold outside the Feather River Watershed	Tribes	CWG
1024	BC-E-MR-02	CRWG22	Surcharge for all water sold outside the Feather River Watershed	Tribes	CWG
1025	BC-E-MR-03	CRWG23	Protection of Sacred Ancestral Sites at Foreman Creek - Relocate Car-Top Boat Ramp	Tribes	CWG
1026	CRWG-05	CRWG24	Traditional Planting Areas	CWG	CWG
1027		CRWG25	Restriction of OHV Access to Culturally Sensitive Areas	CWG	CWG
1028		CRWG26	Cultural Resources Curation Facility	CWG	CWG
1029		CRWG27	Support Existing Local Native American Festivals	CWG	CWG
1030		CRWG28	Modify Wildlife Habitat Management Program	CWG	CWG
1031	CRWG-06	CRWG29	Reconfigure present use of Foreman Creek area for repatriation/burial site, hiking/biking trailhead, and educational complex and/or Maidu Cultural Interpretation Center	CWG	CWG
1032		CRWG30	Native American Cultural Complex	CWG	CWG
1033	MAC-01	CRWG31	Protection, preservation, and access for Maidu Practioners on Stringtown Mountain - a Traditional Cultural Property (TCP)	Maidu Advisory Council	CWG
2001	BC PM&E #3	EO1	Thermalito Afterbay Water Temperature Improvements: construct facilities to convey cold water directly to Thermalito Afterbay Outlet facility	Butte County	EOWG
2002	BC PM&E #3	EO2	Thermalito Afterbay Water Temperature Improvements: curtail pump-back and peaking during 4-week rice planting season	Butte County	EOWG
2003	BC PM&E #3	EO3	Thermalito Afterbay Water Temperature Improvements: Operate Lake Oroville TCD to optimize for recreation, rice production, and fisheries needs	Butte County	EOWG

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2004	BC PM&E #3	EO4	Thermalito Afterbay Water Temperature Improvements: construct canal to allow river diverters to take water from afterbay	Butte County	EOWG
2005	BC PM&E #6	EO5	Lake Oroville Oversight Committee	Butte County	EOWG - related to LWG-23 and RWG-SO-8
2006	LFCA PM&E #17	EO6	Lake Oroville Oversight Committee	LFCA	EOWG - related to LWG-23 and RWG-SO-8
2007	BC PM&E #10	EO7	Develop an early-warning system to convey important information during flood events	Butte County	EOWG
2008	BC PM&E #10	EO8	Provide specific information on inundation, flood travel times, and flow/stage relationships at key locations along the Feather River	Butte County	EOWG
2009	DWRC - 01 (BC PM&E #11)	EO9	Develop a watershed protection plan to reduce intensity of wildfires and improve water quality and quantity	Butte County	EOWG
2010	BC PME #8	EO10	Develop and implement measures and programs to rectify past, present, and future Lake Oroville Facilities and operational impacts on local government services and infrastructures	Butte County	EOWG - related to RWG-SO-14
3001		EWG-1	Open Fish Barrier Pool to fish passage and allow the pool to be used as a spring Chinook salmon holding area. Requires the addition of a fish ladder to the Fish Barrier Dam and modifying the existing ladder with a branch to the Fish Barrier Pool	N/A	EWG
3002		EWG-2A	Install a weir at or a size-exclusion device in the low-flow section (from July 1st to November 15th) to selectively pass desired fish species into the low-flow channel. Currently, fishes in the Feather River are allowed free access into the upper portions of the low-flow channel. This Resource Action would address concerns about high salmonid spawning densities in the low-flow channel and provide an opportunity to segregate the spring and fall runs of Chinook salmon in the Feather River	N/A	EWG
3003	NMFS-02	EWG-101	Install a barrier weir at or a size-exclusion device in the low-flow section to selectively pass spring-run Chinook salmon, with the goal to spatially separate the spring- and fall-run. Studies have indicated that recent genetic studies have determined that fish hybridization (spring- and fall-run) is occurring, due to reduced spatial spawning separation. This Resource Action would potentially address concerns about high salmonid spawning densities in the low-flow channel and provide an opportunity to segregate the spring and fall runs of Chinook salmon in the Feather River	N/A	NOAA
3004		EWG-88	Increase flows in the low-flow reach of the Feather River reach to increase available spawning habitat. This Resource Action would increase flows above current levels (600 cfs) during peak Chinook and steelhead spawning to increase the quantity of habitat available for salmonids	N/A	EWG

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3005	NMFS-06	EWG-100	This Resource Action proposes to simulate aspects of historic flow regimes through periodic increases of flows in the low-flow channel to encourage outmigration of juvenile salmonids. This Resource Action would periodically increase flows above current levels (600 cfs) to serve as migratory cues.	NOAA	EWG
3006		EWG-4A	Provide pulse flows from the Thermalito Afterbay Outlet or the Thermalito Diversion Dam to the high flow section of the Feather River to facilitate upstream migration of adult sturgeon (February-June) and shad (May-June) to potentially reduce holding time below Shanghai Bench and Sunset Pumps. Under this Resource Action, the same acre-footage of water would be released over the upstream migration time period, but the regime would be altered so that the flow pattern would include pulses that would not have previously existed.	NOAA	EWG
3007		EWG-4B	Provide high-flow pulses in winter-spring (February-May) that will serve as attraction flows primarily for shad (May-June), sturgeon (February-June), and splittail (January-April). Secondarily, pulse flows would serve as attraction flows for spring-run Chinook salmon and steelhead	NOAA	EWG
3008		EWG-5	Under low-flow conditions, Shanghai Bench and Sunset Pumps may be impassable for sturgeon and/or American shad due to high water velocities in some areas and/or a vertical height barrier. Structurally modify the Sunset Pumps and/or Shanghai Bench areas to aid passage of sturgeon, and shad. This Resource Action would provide physical changes to these areas to aid anadromous fish passage. Options for physical changes include: - Blast a section of Shanghai Bench to turn it into a chute; - Add a ladder at Sunset Pumps; - Change channel configuration to increase the depth and proportion of flow in the existing side channel; and - Change channel configuration to create a low velocity side channel at Sunset Pumps	NOAA	EWG
3009	NMFS-03	EWG-97A	This Resource Action proposes to evaluate providing upstream passage of anadromous fish (Central Valley spring-run Chinook and steelhead) to the upstream tributaries of Lake Oroville to high up into their historical spawning areas. One potential methodology proposed for upstream passage could be achieved through a "trap and haul" program. Downstream migrants could be captured in the tributaries using positive barrier screens during low flows, and surface collection devices (“gulpers”) during high flows	NOAA	EWG
3010	NMFS-03	EWG-97B	Provide upstream passage of adult anadromous fish through "trap and transport" program. Passage would be to upstream tributaries of Lake Oroville to the first fish barrier (e.g., Big Bend Dam)	NOAA	EWG

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3011	NMFS-01	EWG-13A	Add woody debris in the Feather River. Large woody debris would be anchored or inserted into the river at target locations to provide increased habitat complexity. Source areas for woody debris are upstream of Lake Oroville	NOAA/USFWS	EWG
3012		EWG-13B	Provide additional salmonid rearing habitat within the existing main channel of the low-flow channel by creating additional cover, edge, and flow complexity. This could be accomplished through the addition of large woody debris, boulders, and other objects, and by the creation of midchannel gravel islands. The goal of these main channel enhancements would be to provide instream cover, but also to increase the area of shallow-edge habitats within existing riffles and glides. The primary target for this Resource Action would be rearing steelhead and a secondary target would be rearing Chinook salmon	USFWS	EWG
3013		EWG-15A	Incrementally increase flows in the low-flow channel from relatively low flows (for example, 400-600 cfs or 600-800 cfs) to relatively high flows (for example, 800-1,000 cfs or 1,000-1,200 cfs) throughout the Chinook salmon spawning season (for example, September 1- December 1 or September 1-December 15) in order to change the lateral spawning habitat distribution from the center of the river channel during the early portion of the spawning season to the margins of the river channel in the later portion of the spawning season. Flows would be increased by some relatively consistent interval each week (for example, 25, 50, or 75 cfs/week) in order to increase usable spawning habitat and reduce superimposition of Chinook salmon redds. Once flows reach the high-flow target, the high-flow target would be maintained through May 30 in order to avoid dewatering steelhead redds through the incubation period.	N/A	EWG
3014		EWG-15B	Provide relatively low flows (for example, 400-800 cfs) in the low-flow channel from the beginning of Chinook salmon spawning season (for example, September 1-October 7 or September 1-October 15) until spring-run Chinook salmon are believed to have spawned and then change flows to a relatively high flow (for example, 800-1,200 cfs from October 8-December 1 or October 16-December 15) in order to change the lateral spawning habitat distribution from the center of the river channel during the early portion of the spawning season to the margins of the river channel in the later portion of the spawning season. Flows would be increased once during the season in order to increase usable spawning habitat and reduce superimposition of spring-run Chinook salmon redds. Once flows reach the high-flow target, the high-flow target would be maintained through May 30 in order to avoid dewatering steelhead redds through the incubation period.	N/A	EWG

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3015		EWG-16A	Create side-channel habitat adjacent to the low-flow reach in the Feather River. DWR studies have found that juvenile steelhead trout strongly select shallow riffle/glide and nearshore habitats with abundant riparian and instream cover. Habitats meeting these criteria are most often found in side channels. Currently preferred habitats of juvenile steelhead are not common in the low-flow channel. To expand availability of preferred rearing habitat, side channels should be constructed at various suitable areas within the low-flow channel. Potential sites for side-channel creation in the low-flow channel include (from upstream to downstream): Aleck Riffle; Great Western Riffle; Robinson Riffle/Borrow Pond; Steep Riffle, between Eye and Gateway Riffles; and the Oroville Wildlife Area southeast of the Thermalito Afterbay Outlet	N/A	EWG
3016		EWG-16B	Restore and/or improve side-channel habitat adjacent to the low-flow reach in the Feather River. The two existing side channels at the upstream end of the low-flow channel, Hatchery Ditch and Moe's Ditch, would benefit from habitat and flow enhancements. Hatchery Ditch, a primary steelhead spawning and rearing reach, is currently fed solely by seepage from the Feather River Fish Hatchery settling pond. Discharge in Hatchery Ditch is directly related to water use in the hatchery. Hatchery Ditch requires its own water source so that it can function independently. This need is particularly pressing since the Feather River Fish Hatchery water system is overdue for a major overhaul, which requires shutting down the hatchery water supply for several months. Moe's Ditch is a manmade spawning channel adjacent to Hatchery Ditch. Currently Moe's Ditch suffers from a lack of flow (due to upstream changes in bed morphology) and a lack of cover and channel sinuosity	N/A	EWG
3017		EWG-92	Gravel replacement on spawning riffles found to be of poor spawning substrate quality	N/A	EWG
3018		EWG-18	In areas where armoring has occurred, selected sections of the low-flow reach of the Feather River would be ripped with the goal of improving spawning gravel quality for Chinook salmon and steelhead. This Resource Action is not specific to location at this time; results from ongoing geomorphology studies (SP-G2) will be used to better define ripping and target locations in the low-flow reach	N/A	EWG
3019		EWG-19A	Modify existing or build vegetated "benches" at various stage elevations in the lower Feather River (i.e., near Verona) to enhance splittail spawning habitat and Chinook salmon rearing habitat	N/A	EWG

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3020		EWG-104	This Resource Action proposes mechanical or hydraulic changes to increase the connectivity between the lower Feather River channel and its floodplain habitats (including low-elevation terraces) to increase/enhance the spawning and rearing habitat for splittail and salmonids. This could be accomplished by setting back levees to create/enhance habitats for Chinook salmon, splittail, and steelhead, or by providing increased flows (higher and longer duration) in the winter and spring. Lands utilized for this Resource Action could be on existing State owned lands or, if feasible, on newly purchased areas. One potential source for the increased flows could be the Thermalito Afterbay Outlet	N/A	EWG
3021		EWG-26	Provide habitat enhancement in areas without weeds, primarily through added structure, for warmwater or other target species (i.e., black bass)	N/A	EWG
3022		EWG-28	Manage water levels in Thermalito Afterbay to provide increased nesting and initial rearing habitat for nesting warmwater species	N/A	EWG
3023		EWG-29	Control aquatic weeds to enhance fish habitat in the OWA ponds. Aquatic weed control could be accomplished using various methods, including but not limited to mechanical control, chemicals, or altering the flows	N/A	EWG
3024		EWG-103	Use brood ponds as nursery habitat for warmwater species (i.e., black bass) in Thermalito Afterbay	N/A	EWG
3025		EWG-31	Continue/maintain habitat enhancement program for fish rearing/refuge in Lake Oroville through the placement of woody debris, Christmas tree reefs, or other, yet to be determined, methods. This Resource Action could include enhancement of spawning and nesting shelters for resident fish (bass and catfish) in the shallow areas of Lake Oroville. Habitat enhancement may incorporate the addition of riprap, concrete, or weighted pipes, or by adding artificial reefs in the shallow areas of Lake Oroville. This Resource Action is related to drawdown because selecting areas for habitat improvement will need to take into account seasonal fluctuations of the reservoir	DPR	EWG
3026	NMFS-07	EWG-98	Create or enhance spawning and rearing habitat in the tributaries of the lower Feather River. The Resource Action proposes to engineer new habitat or enhance underutilized habitats in the lower Feather River with year-round water supplies (derived from the project water - Feather River, Oroville Dam releases, etc.). Water supplies could be delivered to these habitats through conduits constructed from the project waters, to supply the habitats with year-round cold water for the benefit of anadromous fishes. The goal of the Resource Action is to create third-order stream habitats, similar to that in higher elevations (upstream of Oroville Dam)	NOAA	EWG

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3027	NMFS-04	EWG-99	Create or enhance side-channel habitats, within existing levees, to enhance spawning and rearing habitat for spring Chinook and steelhead. The proposed channel locations for enhancement could include any project waters from the low-flow or high-flow channel, down to lower Honcut Creek. Water supplies could be delivered to these habitats through conduits constructed from the project waters	NOAA	EWG
3028		EWG-35A	Reduce water temperatures at the Thermalito Afterbay Outlet to reduce the feeding rates of juvenile salmonid predators on rearing and emigrating juvenile salmonids in the Feather River	DFG	EWG
3029		EWG-35B	Reduce water temperatures in particular areas of the Feather River to exclude predators of rearing and emigrating juvenile salmonids	DFG	EWG
3030		EWG-42	Release hatchery steelhead at a smaller size or alter release timing (release them earlier) to reduce their impacts on salmonid survival (as predators)	DFG	EWG
3031		EWG-36	Operate the Oroville Facilities in a manner that would provide additional cold water in the low-flow channel of the Feather River for benefit of Chinook salmon and steelhead. This Resource Action would likely be implemented during the early fall (September and October), during the early spawning period for fall-run Chinook salmon (spawning and incubation period)	N/A	EWG
3032	NMFS-05	EWG-102	Provide water temperatures in the lower Feather River that mimic historic (pre-Oroville Dam) to help maintain the genetic integrity of the spring-run Chinook salmon. This Resource Action could also benefit other fish species in the Feather River system (i.e., steelhead, sturgeon, and splittail)	NOAA	EWG
3033		EWG-37	Operate the Oroville Facilities in a manner that would provide additional cold water in the high-flow channel of the Feather River for benefit of Chinook salmon and steelhead	N/A	EWG
3034		EWG-38	Manage withdrawals from Lake Oroville to minimize reduction of the coldwater pool	N/A	EWG
3035		EWG-40	Decrease hatchery production of salmon so that there is less crowding and competition for limited spawning habitat in the low-flow section of the Feather River	N/A	EWG
3036		EWG-44	Screen all stocked fish for fish diseases. (action) Evaluate current rainbow trout stocking program in forebay to look at angler preferences and to prevent the spread of fish diseases (C. Shasta or IHN). Potentially cease fish planting in Thermalito Forebay to prevent disease transmission to fishes in the Feather River	DFG	EWG
3037		EWG-45	Create trophy salmonid stocking program in Thermalito Afterbay similar to trophy program in Lake Oroville. This would use a Feather River strain of steelhead (to reduce disease concerns)	N/A	EWG
3038		EWG-47	Create trout stocking program in suitable OWA ponds (without weed issues). The program would operate seasonally and all stocked fish would be screened for disease	N/A	EWG

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3039		EWG-48	Stock warmwater species (e.g., Florida strain bass) in selected OWA ponds to create trophy angling areas	N/A	EWG
3040		EWG-50	Continue or maintain the coldwater fishery in Lake Oroville. This Resource Action would involve continuing the management protocols for the coldwater fishery upstream of Lake Oroville as well as in the reservoir	N/A	EWG
3041	LFCA PM&E #20	EWG-105	The PM&E measure was originally introduced to the EWG with a goal of mitigating for the dewatering of Ruddy Creek. This measure proposes to re-water Ruddy Creek by utilizing the Thermalito Afterbay seepage valves, and enhance historic wetlands. The EWG initially looked at the measure to potentially providing salmonid spawning and rearing habitat in a tributary of the Feather River; however, a secondary option would be provide habitat for warmwater species or enhance the OWA by adding additional waters	Butte County (Mike Pierce)	EWG
3042		EWG-56	Construct and maintain additional brood ponds to accommodate brooding waterfowl in Thermalito Afterbay	USFWS, CWA, DU	EWG
3043		EWG-57A	Enhance upland nesting cover in the vicinity of Thermalito Afterbay for the benefit of nesting waterfowl. Resource Actions could include the use of various species (e.g., DFG seedmix [wheatgrass/ vetch/barley, etc.])	USFWS, CWA, DU	EWG
3044		EWG-57B [formerly EWG-69]	Enhance upland food (approximately 60 acres) in the vicinity of Thermalito Afterbay for the benefit of wintering waterfowl and upland gamebirds. Resource Actions could include the use of various species (e.g., DFG seedmix [milo, barley, safflower, etc.])	USFWS, CWA, DU	EWG
3045		EWG-58	Install wood duck nest boxes in OWA. Need to determine a target goal for the number of duck boxes	CWA, DU	EWG
3046		EWG-59	Modify recreational use patterns in Feather River, OWA, and Thermalito reach to minimize impacts on sensitive species.	DPR, USFWS	EWG
3047		EWG-61	Develop a hydrologic flow regime (management protocols) to support natural regeneration of riparian recruitment along the Feather River. An option to this measure would be to determine project-related imapcts and develop offsite mitigation measures	N/A	EWG
3048		EWG-62	Implement vegetation or restoration activities to enhance or restore native plant communities in the Lake Oroville upland areas	N/A	EWG
3049		EWG-65	Implement measures to reduce recreational disturbances (i.e., trespass and grading) on wildlife populations as needed based on the results of Study Plan SP-T9	USFWS	EWG
3050		EWG-66	Develop a hydrologic flow regime to support natural regeneration of riparian vegetation along the Feather River. An option to this measure would be to determine project-related imapcts and develop offsite mitigation measures	N/A	EWG
3051		EWG-67	Initiate active vegetation plantings in the Thermalito Afterbay area	N/A	EWG

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3052		EWG-68A	Recharge brood ponds at 3-week intervals for the brooding periods (April 15 to June 31, with the possibility to extend this until June 1)	N/A	EWG
3053		EWG-68B	Build or enhance riparian habitat in the fluctuation zone of Lake Oroville	N/A	EWG
3054		EWG-70	Eliminate noxious plants via biological control, herbicidal treatment, or mechanical control and replant with native species	N/A	EWG
3055		EWG-73	Control non-native and undesirable plant species (e.g., purple loose-strife) in the Thermalito Complex	N/A	EWG
3056		EWG-74A	Eliminate noxious plants via biological control, herbicidal treatment, or mechanical control and replant with native species	N/A	EWG
3057		EWG-74B	Eliminate noxious plants via biological control, herbicidal treatment, or mechanical control and replant with native species	N/A	EWG
3058		EWG-75	Develop management protocols to control primrose (in OWA ponds)	N/A	EWG
3059		EWG-78A	Develop maintenance and recreational management actions to avoid impacts on special-status species within the project area	USFWS	EWG
3060		EWG-78B	Develop operational management actions to avoid impacts on special-status species within the project area. Specific measures associated with this Resource Action are not identified at this time	USFWS	EWG
3061		EWG-79	Enhance riparian habitat. One component of the measure will be a VELB Management Plan; other plant species may be included in this (from Gail).	USFWS	EWG
3062		EWG-80	Develop maintenance and recreational management actions to avoid impacts on special-status species within the project area	USFWS	EWG
3063		EWG-82	Develop protection and avoidance actions for sensitive plant populations in the Lake Oroville area	USFWS	EWG
3064		EWG-83	Operate the Thermalito Complex to provide colder water to the lower Feather River for the benefit of salmonids	N/A	EWG
3065		EWG-84A	The settling ponds associated with the Feather River Fish Hatchery are designed to hold effluent until evaporation occurs, but there is high connectivity between the ponds and the Feather River. Leaching occurs from the settling ponds to the Feather River. The ponds' gravel bottom provides some unknown level of filtration. This Resource Action would construct new settling ponds at the existing location or in a different area that would prevent leaching and/or enhance evaporation	RWQCB	EWG
3066		EWG-84B	Line existing holding pond with impermeable barrier to prevent leaching	RWQCB	EWG
3067		EWG-86A	Develop educational signage program for public awareness of water supply uses and sources	RWQCB	EWG
3068		EWG-86B	Develop Water Quality Signage Program. The program could include signage such as "Don't Eat The Fish" or "No Swimming"	RWQCB	EWG

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3069		EWG-87	Operate or modify the Oroville Complex in a manner to provide suitable warm water for agricultural and recreational purposes, while providing adequate coldwater releases at the Thermalito Afterbay Outlet	N/A	EWG
3070		EWG-89	Create levee setbacks to increase meandering nature of river and improve gravel composition in critical spawning reaches of the low-flow reach. This could be introduced into the south area (of the low-flow section)	N/A	EWG
3071		EWG-93A	Mechanical or hydraulic changes to areas in the low-flow reach have been suggested to improve fish habitat. This Resource Action could include several options, such as leveling off selected gravel bars so they are inundated at particular flows and digging side channels that provide suitable velocity and cover for juvenile fishes	N/A	EWG
3072		EWG-93B	Regrade the high-flow channel, using similar methods as above (EWG-93A). This could include reconfiguring selected sections of the stream channel to establish additional inundated benches to provide suitable splittail spawning habitat	N/A	EWG
3073		EWG-3	This Resource Action would increase flows during critical upstream passage periods for sturgeon at Steep Riffle. Currently, flows in the low-flow reach are maintained at 600 cfs, except during flood events or occasional temporary changes in project operations	NOAA	EWG
3074		EWG-7	Assist in field calibration of sturgeon passage information from University of California, Davis, studies (conducted in lab in 2003)	N/A	EWG
3075		EWG-8	Conduct field-tracking studies to determine timing and movement patterns of sturgeon in Feather River (i.e., field-verify whether sturgeon can migrate past Sunset pumps and Shanghai Bench)	N/A	EWG
3076		EWG-10A	Provide resident fish with access to the upstream tributaries by removing sediment plugs that block access to the upstream tributaries of Lake Oroville to increase the quantity and quality of available salmonid spawning habitat	USFS	EWG
3077		EWG-10B	Provide resident fish with access to the upstream tributaries by removing boulders and manmade barriers. This Resource Action could include the removal of Big Bend Dam or the construction/repair of fish passage facilities at this site to open up the Poe Reach	USFS	EWG
3078		EWG-11	Prevent downstream passage of rainbow trout from the Thermalito Complex into the Feather River. Currently rainbow trout are stocked in Thermalito Forebay for a "put and take" fishery. This Resource Action will address concerns about hatchery-origin trout interacting with natural steelhead in the Feather River. Opportunities to prevent downstream passage of rainbow trout include changing the species that are stocked in the forebay (i.e., stock steelhead, Chinook salmon, Coho salmon, or brown trout instead of rainbow trout) or eliminating stocking in the forebay	N/A	EWG

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3079		EWG-12	Install a fish-counting and identification device at the Thermalito Afterbay Outlet and Diversion Dam	N/A	EWG
3080		EWG-27	Isolate, modify, fill, or reclaim Robinson Riffle borrow pond (used for gravel extraction) to reduce predator habitat	N/A	EWG
3081		EWG-30	Regulate reservoir drawdowns to less than 9 feet/month to reduce bass nest dewatering and subsequent mortality	N/A	EWG
3082		EWG-32	This Resource Action would supplement tributaries to Lake Oroville with salmon carcasses or carcass analogs (chemicals) to increase levels of marine-derived nutrients (assuming nutrient supplementation is desired)	USFS	EWG
3083		EWG-33	Provide resident salmonids with access to the upstream tributaries by removing sediment plugs, boulders, and manmade barriers. This Resource Action could include the removal of Big Bend Dam or the construction/repair of fish passage facilities at this site to open up the Poe Reach	USFS	EWG
3084		EWG-39	Evaluate all proposed management actions for relevance to fish disease concerns	DFG	EWG
3085		EWG-52	Modify recreational use patterns in Feather River to minimize impacts on important terrestrial species	N/A	EWG
3086		EWG-53	Provide improved vegetation cover and improved recreational screening within important migration corridors	N/A	EWG
3087		EWG-54	Modify recreational use patterns in the Thermalito Complex to minimize impacts on important terrestrial species (exact measures dependent on analysis in upcoming report)	N/A	EWG
3088		EWG-55	Provide improved vegetation cover and improved screening within important corridors	N/A	EWG
3089		EWG-60	Provide improved vegetation cover and screening within important corridors or nursery areas within OWA	N/A	EWG
3090		EWG-63	Retrofit or modify existing Lake Oroville recreational facilities to remove potential food sources, nesting sites, and rodent refuge areas for nuisance or pest species. This could also include implementing measures to reduce populations of nuisance non-native wildlife in the Lake Oroville areas (this is to include EWG-64)	DPR	EWG
3091		EWG-71	Develop flow regime to control establishment of noxious species below the Thermalito Afterbay Outlet	N/A	EWG
3092		EWG-72	Develop construction and recreational management protocols to control the spread of noxious species	N/A	EWG
3093		EWG-77	Enhance or add riparian habitat for threatened and endangered species in the low-flow section of the Feather River	N/A	EWG
3094		EWG-95	Stabilize target stream and reservoir banks to prevent mass wasting. The appropriate bank stabilization method is unknown at this time	N/A	EWG
3095		EWG-96	Stabilize hill slope near Black Canyon (aka Dark Canyon) and remove sediment barrier. Related to fish passage Resource Actions associated with sediment plugs	N/A	EWG

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3096		EWG-2B	Install a size exclusion device such as a lattice grating near Bedrock Park from July 1st to November 15th in order to provide spatial separation of holding and spawning habitat for spring-run and fall-run Chinook salmon. The latticed grate would be designed to block movement of adult salmonids but not juveniles	N/A	EWG
3097		EWG-6	Recondition the existing benches along the lower Feather River reach to improve fisheries habitat	N/A	EWG
3098		EWG-9	Provide increase flows to allow fish passage over barriers in the lower Feather River	N/A	EWG
3099		EWG-14	Create deep pools in the low-flow reach of the Feather River to provide holding habitat for spring-run Chinook salmon. Deep pools would be created in reaches where water temperatures are expected to be cool enough to provide summer habitat for spring-run Chinook salmon	N/A	EWG
3100		EWG-17	Enhance riparian vegetation (including trees) along banks for shading and increased habitat complexity. This could include the use of cottonwoods or alders	N/A	EWG
3101		EWG-19B	Increase the operational flexibility to allow for decreases in water temperatures downstream of the Thermalito Afterbay Outlet to encourage gravel utilization downstream of the Thermalito Afterbay Outlet	N/A	EWG
3102	NMFS-01	EWG-20	Add woody debris in the Feather River. Large woody debris would be anchored or inserted into the river at target locations to provide increased habitat complexity	NOAA/USFWS	EWG
3103		EWG-21	Increase the quantity of shallow-water rearing habitat for juvenile salmonids in the high-flow section of the Feather River by releasing higher flows	N/A	EWG
3104		EWG-22	Increase connectivity between river channel and floodplain habitats (including low-elevation terraces) in the lower Feather River by setting back levees to create seasonal habitats for Chinook salmon, splittail, and steelhead	N/A	EWG
3105		EWG-23	Provide higher and longer duration flows in winter/spring. Provide flow in the high-flow channel to inundate floodplains to provide high quality rearing habitat. This Resource Action would provide higher flows, which would increase quantity of fish habitat (splittail spawning and rearing and Chinook rearing habitat)	N/A	EWG
3106		EWG-24	Construct or create permanent juvenile fish rearing areas for steelhead and Chinook on existing State owned lands or on newly purchased areas (for floodplains and side channels)	N/A	EWG
3107		EWG-25	Use flow releases from the Thermalito Afterbay Outlet to provide additional floodplain habitats adjacent to the river channel	N/A	EWG
3108		EWG-34	Exclusionary devices (e.g., weirs) placed at the lower part of the low-flow section would have a potential benefit of reducing predation on salmonids in the low- flow section of the Feather River	N/A	EWG

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3109		EWG-41	Use a weir to monitor and restrict access of returning adult Chinook salmon to the low-flow section of the Feather River. This Resource Action potentially would reduce genetic introgression between Chinook races and between hatchery/wild salmonids. This Resource Action also would potentially reduce crowding and competition for limited spawning habitat	N/A	EWG
3110		EWG-43	Evaluate all proposed management actions for relevance to fish disease concerns	DFG	EWG
3111		EWG-46	Evaluate all proposed management actions for relevance to fish disease concerns	DFG	EWG
3112		EWG-49	Evaluate all proposed management actions for relevance to fish disease concerns	DFG	EWG
3113		EWG-51	Enhance riparian vegetation and trees along banks for shading and increased habitat complexity	N/A	EWG
3114		EWG-64	Implement measures to reduce populations of nuisance non-native wildlife in the Lake Oroville area	N/A	EWG
3115		EWG-76	Develop a variety of control measures, including hydrologic regime, to support and protect native riparian vegetation in OWA	N/A	EWG
3116		EWG-81	Develop disturbance avoidance plans in the vicinity of nest sites during the nesting season of bald eagles and peregrine falcons	N/A	EWG
3117		EWG-90	Rip sections of the low-flow reach to improve spawning gravel composition for Chinook salmon and steelhead. This Resource Action is not specific to location at this time; results from ongoing geomorphology studies (SP-G2) will be used to better define ripping and target locations in the low-flow reach	N/A	EWG
3118		EWG-91	Supplement the low-flow reach with suitable spawning gravel to increase productivity (i.e., # fish produced per unit area)	N/A	EWG
3119		EWG-94	Increase floodplain connectivity between OWA and the mainstream Feather River with the goal of increasing inflow to selected OWA ponds during higher flows	N/A	EWG
4001		LWG-2A1	Use of native low-water-consuming plants for landscaping. Encourage the use of native plantings around project facilities to limit water use including but not limited to the Feather River Fish Hatchery, State Parks Headquarters/OFD, Spillway Launch facility, and trails (coordinate with EWG)	LUWG	LUWG
4002		LWG-3	Screen-remove dump areas. Dump and storage areas used by DWR need to be removed or screened (AE5)	Members of the general public during scoping	LUWG
4003		LWG-4	Transfer of federal lands (BLM) within or nearby the project boundary to the State with assistance from DWR and DPR	DPR/BLM	LUWG
4004		LWG-7	Provide an emergency fire and rescue boat for CDF	CDF	CDF

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4005		LWG-8	Establish regular, routine trash type debris collection program for public access areas, shorelines, and camping areas using volunteers, DWR staff, etc. To augment budget for the Program. ("Adopt a shoreline Program") Develop a debris and trash collection program withDPR, DFG and other interested parties. The program will involve collecting debris and trash from the waters andlands of the project with a focus on camping and public use areas.	Members of the general public during scoping	LUWG
4006		LWG-17	Plant vegetation along SR 99. Plant appropriate vegetation including trees at intervals along the highway easement east of SR 99 and west of the Afterbay levee to break up the visual impact created by the levee as viewed from hwy 99. Groups of appropriate vegetationincluding trees would be randomly planted between the toe of the levee and the edge of the Hwy 99 right of way. Appropriate vegetation including trees would help visually break up the long, lineal, horizontal form of the levee. The appropriate vegetation including trees would have to be sited and maintained so that htye would not impact vernal pools or other sensitive areas.	N/A	LUWG
4007		LWG-18	Remove the existing billboards east of SR 99 (west of the Thermalito Afterbay levee) that are on DWR managed lands to improve the visual quality	N/A	LUWG
4008	CDPR - 26	LWG-19	Fuel Load Management Plan Vegetation Management Plans and implementation to reduce biomass on wildlands adjacent and in the vicinity of urban areas: Develop and implement a vegetation management plan to reduce fuels along the vicinity of the wildland/urban interface of Lake Oroville Project. Actions will be consisten with State Parks goals for management of natural resources at LO SRA and incorporate management techniques on large enough areas to duplicate the effects of natural process such as periodic wildfire.	DPR	LUWG
4009		LWG-2B	Develop a program to evaluate future development proposals within the project area to ensure preservation and protection of open space when possible. Require a greenbelt area as a component of any new development within the project area	Members of the general public during scoping	LUWG
4010		LWG-5	Potential for DWR to sell, for private development, some lands currently held by the State. This would get the land back on tax rolls	Members of the general public during scoping	LUWG
4011		LWG-13	Camouflage the power line towers. Paint the towers within the project boundary complementary colors such as brown and green so as to better blend into their surroundings	Members of the general public during scoping	LUWG
4012	LFCA PM&E #10	LWG-26	The creating of a Joint Powers Authority lake water district utilizing the State Water Project area of origin entitlement of 27,500 acre-feet with the suggested share based upon the weight of the current vote of the agency presently sitting on the LOJPA	LFCA	LUWG

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4013	LFCA PM&E #16	LWG-27	A dollar amount will be negotiated for any sales of the Butte County water entitlement and set aside in a mitigation water bank fund for watershed modeling and resource conservation planning and any PM&E measure as a result of these studies	LFCA	LUWG
4014	LFCA PM&E #18	LWG-29	During drought season and/or when the Lake Oroville water capacity falls below acceptable levels deemed appropriate by the LOJPA, the SWP contractors shall enforce water conservation methods to prevent further decline to the reservoir. Contractors shall be charged a higher rate once Lake Oroville falls below LOJPA levels	LFCA	LUWG
4015	BC PM&E #11	LWG-21	Watershed approach to reduce the intensity of wildfire and improve quality and quantity of useable runoff from the Feather River watershed by removal of ladder fuels in overstocked forest stands and restoring floodplain function to degraded meadows and streams in the Feather River basin	Dept. of Water and Resource Conservation (Butte County)	LUWG
4016		LWG-16	Transfer administration of grazing lease from DWR to DPR when the current 5-year lease terminates on 9/30/04. As appropriate, grazing practices will be modified to mitigate (yet to be determined) adverse impacts on natural, cultural, and recreational resources: including monthly stocking rates, annual presence, and fencing of boundary and sensitive resource areas	DPR	LUWG
4017	LFCA PM&E #8	LWG-24	Centralized facility is needed for law enforcement and fire/rescue protection in the highly visible low-flow recreation area. With the increased usage, there is a need for a facility that is central to the Thermalito Afterbay Outlet, OWA, and Low Flow Recreation Area	LFCA	N/A
4018	BSC-01	LWG-31	Protect and enhance the forebay wildlife resources. Campbell Hills must be purchased and included in the Thermalito Forebay SRA to protect the biological integrity of the area. A management plan for elimination of noxious plants must be developed and carried out	Butte Sailing Club	LUWG
4019		LWG-2A	Develop a Vegetation Management Program and replacement schedule/plan for specific identified developed areas at project facilities that have landscaped areas. Would include an integrated pest management approach and encourage the use of native plantings and removal of lawns to limit water use and decrease maintenance	LWG	LUWG- (coordination with EWG)
4020		LWG-1	Increase communication on issues relating to present DWR land usage around the lake area so it shifts from unused to recreational or appropriate public use	LWG	LUWG - Transferred to RWG-OR86
4021	Butte-02 (BC PM&E #4)	LWG-20	Provide catch-up funding to DFG, enhance wildlife area, fund road and sign construction and maintenance, provide adequate security, and encourage organization cooperation	Butte County	LUWG - resubmitted as BC PM&E #4a (LWG-20a) and BC PM&E #4b (LWG-20b)
4022	LFCA PM&E #9	LWG-25	Bedrock Park Renovation. A renovation of Bedrock Park River corridor by updating the 1977 Feather River Enhancement Project	LFCA	Transfer to RWG-LF8

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4023	LFCA PM&E #19	LWG-30+	Requesting that Matthews Ready Mix property leased to Matthews by the Department of Wildlife Conservation Board and DFG be put into a public trust for accessibility by all	LFCA	Transfer to RWG-LF44
4024	BC PM&E #6	LWG-23	Lake Oroville Oversight Committee	Butte County	Related to EOWG-EO5-6/RWG-SO-8
4025		LWG-24	Public Safety Center	LFCA	Transfer to RWG-LF41
4026	F.R.LFCA	LWG-30	Historic Matthews Riffle Fishing Access (LWG-30) - Coordinate with DFG/WCB to acquire easement on portion of Matthews Ready Mix property to allow for river users to access streamside areas that have been recently fenced	F.R.LFCA	Transfer to RWG-LF44
5001		RWG-DP1	Lakeland Blvd. Access: Acquire authorization to use existing road or build new road to old railroad grade. Provide limited facilities (parking, tables, pole stoves, restroom, access to water's edge for hikers and cartop boats) to facilitate use	ORAC, Butte County	RWG
5002		RWG-DP2	Equestrian trailhead improvements: Extend water line to trailhead and adjacent area. Provide additional horse tethering facilities and permanent restrooms. Gravel surfacing of dirt road	C. Hodges	RWG
5003		RWG-DP3	Camping improvements: Provide a few initial primitive camping facilities in the vicinity of the trailhead; more expansive development contingent upon DP5 below	C. Hodges	RWG
5004		RWG-DP4	Equestrian trail head parking improvements: Included in DP2 above	C. Hodges	RWG
5005		RWG-DP5	Acquire adjacent land for expansion: Acquire 80-acre parcel adjacent to (downstream of) Lakeland Blvd. Trailhead from PG&E. Use for development of overnight facilities and additional trail and park development	City of Oroville	RWG
5006		RWG-DP6	Day use sites for trail users and boaters: In addition to DP1 above, develop spur trails and boat-landing areas with picnic tables, pole stoves, and trash cans at remote points along north and south shores of the Diversion Pool; requires shoreline access for maintenance	LOJPA	RWG
5007		RWG-DP7	Clean up area/remove exotic plants: More frequent routine maintenance of public use areas (similar to other LOSRA developed areas), and develop a native vegetation management plan in coordination with DPR; provide screening of adjacent maintenance area (IP)	N/A	RWG
5008		RWG-DP8	Opportunities for nature interpretation: Develop interpretive sites at Lakeland trailhead, and numbered stations along existing trail(s) for use with a trail brochure. Coordinate opportunities for guided walks with the Feather River Nature Center and/or Lake Oroville Visitor Center	DPR	RWG

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5009		RWG-DP9	Open Diversion Pool Dam to trail linkage use: Construct any modifications necessary to safely allow public crossing (foot, bicycle, walked-mount) of Diversion Dam; alternatively, create a new crossing near Diversion Pool (in addition to DP-11, which is upstream	LOJPA	RWG
5010		RWG-DP10	Safe crossing of railroad tracks and river for users and connection to trail system: Obtain UPRR authorization to develop trail access under south abutment of railroad bridge, or permission to construct pedestrian bridge over tracks	LOJPA	RWG
5011		RWG-DP11	Multiuse loop trail around Diversion Pool: In addition to DP9 above, add a second (probably suspension) footbridge (including short connecting trails) at the head of the Diversion Pool, to connect Burma Rd. with the old RR grade	LOJPA	RWG
5012		RWG-DP12	Seasonal pontoon bridge or other crossing over the Diversion Pool: Covered in DP9 and/or DP11 above	LOJPA	RWG
5013		RWG-DP13	Paved Bike Trail on Railroad Grade from Diversion Dam to Oroville Dam	LOBO	RWG
5014		RWG-DP14	Demonstration mountain bike loop trail: Develop a trail parallel to the Dan Beebe Trail for separation of equestrian and bicycle use, including special technical features designed in conjunction with local enthusiasts	C Hodges	RWG
5015		RWG-DP15	Paved bike trail - Nature Center, across Diversion Pool and down river: In conjunction with DP9 above, pave trail through Nature Center property to connect to city streets; also pave trail connection from Diversion Dam to fish hatchery	FRRPD	RWG
5016		RWG-DP16	Acquisition of 83 acres for regional park and connection to trails system: same as DP5 above	City of Oroville	RWG
5017		RWG-DP17	Use of DWR property next to Diversion Dam for multiuse center: Additional development at "staging area" Interim Project (arena, fencing, delineated parking, water, restrooms, small concession/office building, grandstand seating)	City of Oroville	RWG
5018		RWG-DP18	Easement/acquisition of PG&E land adjacent to the Diversion Pool: Same as DP5 and DP16 above	City of Oroville	RWG
5019	DP-01	RWG-DP19**	Oroville Dam Blvd. Bike Lane Extension -- Extend connection of bike lane from Orange Ave. up Oroville Dam Blvd. To Canyon Dr. (near Oroville Dam; add blacktop, widen as needed)	Dave Phillips	RWG
5020		RWG-DP19**	Oroville Dam Blvd. Bike Lane Extension -- Extend connection of bike lane from Orange Ave. up Oroville Dam Blvd. To Canyon Dr. (near Oroville Dam; add blacktop, widen as needed)	Cathy Hodges	RWG
5021	CDPR-04	RWG-TF1	Safe, warmwater swimming w/sand beaches -- Modify circulation, provide pumped water, or investigate subimpoundment to allow more warming of swim cove and enhance safety at North Forebay; perhaps a "play feature" (shallow "stream," smooth boulders) and landscaping	DPR	RWG

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5022	CDPR-02	RWG-TF2	Expand day-use facilities at South Forebay -- Develop sand beach, grass and/or trees, additional tables and pole stoves, fish cleaning station, paved parking. Fencing (barbed-wire) to protect vernal pools	DPR	RWG
5023		RWG-TF3	Acquire Campbell Hills property, ~100 ac.: Purchase parcel overlooking the N side of the North Forebay, if willing seller. Allow public access from expanded North Forebay parking lot, any development must be consistent with natural resource values; manage/remove noxious plants	BSC	RWG
5024		RWG-TF4	Lakefront resort: Allow and encourage concession for development of commercial lodging and amenities on the north shore of the forebay; provide required expansion of utilities and infrastructure (parking, boat docks, etc.)	LOJPA	RWG
5025	LOJPA-09(7(f))	RWG-TF5	Golf course -- 18-hole course just north of the forebay, proposed as public/private partnership operated by lease. Eventually, possibly part of a recreational complex, including a lakefront resort, warmwater swimming, boating/special events area, and an expanded aquatics center	LOJPA	RWG
5026		RWG-TF6	Utilities/infrastructure to area: This is not a stand-alone project, but an element necessary for the additional developments described in TF4 and TF5	LOJPA	RWG
5027		RWG-TF7	Expand boating aquatics center: Provide additional covered storage and utilities at existing North Forebay "Boat Storage Facility"; make use of facilities available to active groups	DPR	RWG
5028	CDPR-06	RWG-TF8**	Boating events venue and support facilities -- DPR: Develop a Boating Information and Safety Center, with 120-person multipurpose room, 4 classrooms, men's/women's locker rooms and showers, docks, landscaping	DPR	RWG
5029	LOJPA-10(7(i))	RWG-TF8**	Boating events venue and support facilities -- LOJPA: possibly as part of recreational complex (golf, resort);	LOJPA	RWG
5030	LOJPA-11(7(j))	RWG-TF9	Expand day-use facilities at North Forebay -- Add shade ramadas and expand parking at existing recreation area	LOJPA	RWG
5031		RWG-TF10	New DPR visitors center: Construct a visitors center similar in size and to generally replace the Lake Oroville Visitor Center, close to one of the SR 70 exits	City of Oroville	RWG
5032		RWG-TF11	SR 70/Diversion Canal bridge connection (ALSO SEE TA-16): Additional/pedestrian access route to the North Forebay recreation area; possible candidate for TEA grant (requires matching funds and coordination with CTC and Caltrans)	City of Oroville	RWG
5033		RWG-TF12	Fishing access: Create additional shoreline access points around the North Forebay; may include some removal of aquatic vegetation and a disabled-access fishing pier	N/A	RWG

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5034	CDPR-08	RWG-TF13	Develop DPR maintenance facility -- Construct equipment yard and staffing space in the vicinity of the forebay, allowing more direct attention to maintenance needs of the North and South Forebay recreation areas' existing and new facilities	DPR	RWG
5035	BSC-02	RWG-TF14	Enhance wildlife values at the forebay, AND protect resource for nonmotorized recreation -- Enhance opportunity with paddleboat, etc., rentals (concessionaire space) coordinated with expansion of boat storage facility	BSC	RWG
5036		RWG-TF15	Cost share with Utility District on upsizing of lines to site, to support additional development: Variation of TF6, intended as part of development/cluster described in TF-4	LOJPA	RWG
5037		RWG-TF16	SAME AS TA-11 -- North Forebay/Sports Complex Bridge over canal: Construct a pedestrian access bridge and associated connecting trail segment(s) to connect these two recreational areas (FRRPD has not filled out form, but has provided additional information).	FRRPD	RWG
5038		RWG-TF17	Loop trail around the entire forebay and afterbay: Improve existing trail and create several hundred feet of new trail, connecting existing segments of the Brad Freeman Trail, to allow multiple-use nonmotorized access around margin of these water bodies	LOJPA	RWG
5039	AWW-01	RWG-TF18	White Water Recreation Park: Create a competition-style public artificial channel near the outlet of the forebay that flows to the afterbay, with support facilities (parking, stairs, restrooms, grandstand); periodically divert 400-1,000 cfs through channel	American Whitewater/ Paddleheads	RWG
5040	CDPR-05	RWG-TF19	Additional North Forebay Enroute Camping -- Develop 25 additional campspurs with tables, ramadas, and a combination shower/restroom building; landscaping, overlooking Power Canal.	DPR	RWG
5041	CDPR-07	RWG-TF20	Expand the Accessible Fishing Pier -- Enlarge existing fishing platform and add shade structure	DPR	RWG
5042	FRRPD-02	RWG-TF21	Deed ~44 acres of DWR land to FRRPD (currently under FRRPD lease) for development of a soccer complex and protection of some onsite and adjoining wetlands	FRRPD	RWG
5043		RWG-TA1	Expand existing day-use facility: More beach and sand, more picnic sites, add shade trees and ramadas, and more parking for boaters, at Monument Hill	City of Gridley, LOJPA	RWG
5044		RWG-TA2~	Add launch ramp at existing facility: Either add additional lanes at Monument Hill (with commensurate additional parking), or upgrade the car-top ramp at Larkin Road to a two-lane conventional ramp with new (commensurate) boat-trailer parking	City of Gridley, LOJPA	RWG
5045		RWG-TA3~	Add boat-in improvements: More boat-in picnic sites, and perhaps primitive boat-in campsites, at remote shoreline or island areas of the afterbay	City of Gridley, LOJPA	RWG

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5046		RWG-TA4~	Plant trees around the afterbay: Plant trees at recreation sites (Monument, Larkin, and boat-in picnic sites) and at other non-levee vista areas. Assume low-maintenance native species or noninvasive domestic-landscaping ornamentals	City of Gridley, L. Gill	RWG
5047		RWG-TA5	Add year-round resort project: Large-scale development at undetermined afterbay-adjacent site to include commercial lodging and camping, special-event and trail-support facilities, "KOA-type" amenities, perhaps (not necessarily) a golf course	M. Kram	RWG
5048		RWG-TA6	Consider afterbay for alternate Equestrian Center site: At a suitable site (likely similar undetermined point as TA5, above), construct the "multiuse center" (equestrian event staging area) described in DP17 (Diversion Pool, previous page)	N/A	RWG
5049		RWG-TA7	Add swimming at existing facility: Designated beach and swim area (new construction/addition = beach sand, shade trees, ramadas) at Larkin Road	LOJPA	RWG
5050	LOJPA-12(9(j))	RWG-TA8	Develop campground at the afterbay (RE9) -- Convert 50 acres from Wildlife Area status to Recreation Area status. Phased development of 200-site campground across the street from Larkin Road car-top boat ramp within OWA *(SEE WA-2)*	LOJPA	RWG
5051		RWG-TA9	Develop facilities (including grandstands, toilets, campground) at forebay/afterbay to support competitive powerboat events (RE28): location likely close to cove designated (afterbay) for water-ski activities, or undetermined site at S. Forebay	LOJPA	RWG
5052		RWG-TA10	Include a marina and launching of boats along with many recreational activities at the afterbay, with the entrance to the facilities off SR 99 (RE29): Construct new marina (includes store, boat rentals, boat storage, infrastructure/utilities)	N/A	RWG
5053		RWG-TA11	Provide additional day-use and camping at South East Afterbay complex (RE137) -- See TA8 above; to support activities at Larkin Road, Afterbay Outlet Fishing Area, and vicinity trails with day-use facilities/area and river access	LOJPA	RWG
5054		RWG-TA12	Site improvements to existing flying site for model airplanes: As initially scoped, most has been completed as Interim Project	Model Airplane Club	RWG
5055		RWG-TA13	Improve OHV Recreation Area (Clay Pit SVRA) at the Oroville complex. Includes but not limited to 4x4 areas for training, safety, but also motor-cross type tracks: (designate areas, add signs/markers)	N/A	RWG
5056		RWG-TA14	Allow seaplane landings on the afterbay, provide minimal facilities for docking near the model airplane flying area, allow access through gate (Wilbur Road) to fuel trucks from local airport	Seaplane Pilots Association	RWG
5057		RWG-WA1	Reestablish boat launch ramp on west side of river in wildlife area: Improve ramp near afterbay outlet (currently dirt, rough); include parking and related minimal amenities (vault toilet)	N/A	RWG

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5058		RWG-WA2*	SAME AS TA-8 -- Add camping at afterbay outlet: Improve and expand existing primitive camping area (additional sanitary facilities; create standard campground including designated individual sites, install tables, provide potable water)	FRLFCA, LOJPA	RWG
5059		RWG-WA3~	Add launch ramp at afterbay outlet: Same as WA1 above.	FRLFCA, LOJPA	RWG
5060		RWG-WA4	Restore natural values of Wildlife Area: Elevate management priority for primary State Wildlife Area purposes -- reduce emphasis on recreation, restore native vegetation, restrict or eliminate high-speed motorized uses	Butte County	RWG
5061		RWG-WA5~	Add fishing ponds for kids: Designate one or two existing ponds for use by anglers age 15 and under; provide special fishery/habitat management, enhance access, and install signage	FRLFCA, D. Macomie	RWG
5062		RWG-WA6	Expand wetlands: Could probably be included in WA4, but otherwise should be referred to other Work Groups (EWG, LWG)	DFG	RWG
5063		RWG-WA7	Increase off-river spawning: Construct side channels for spawning, restrict fishing at these areas (allow "wildlife viewing"); otherwise should be referred to EWG	DFG	RWG
5064		RWG-WA8	Add information center off Larkin Road: Construct easily visible but unstaffed Information Kiosk, with interpretive displays and tourist information, at entrance to Larkin Road car-top ramp area (handful of designated, improved parking spots)	N/A	RWG
5065		RWG-WA9	Add wildlife viewing and interpretation: Install additional interpretive panels at all OWA entrances; designate marked trails (with self-guided literature and markings) for wildlife viewing	DFG	RWG
5066		RWG-WA10~	Add day-use facilities at afterbay outlet: designate area near river but away from camping area and install picnic tables and BBQs	City of Gridley, FRLFCA	RWG
5067		RWG-WA11~	Provide funding for operations and maintenance of Wildlife Area: Increase DFG budget appropriation to restore past levels of service or increase service level; "subsidize" with DWR O&M funds if Legislative/DFG appropriation is reduced	FRRPD, Butte County	RWG
5068		RWG-WA12	Trade to remove 50-100 acres, outlet property from Wildlife Area for campground: Build new, improved campground near site of existing primitive camp area; amend operating agreement for management of this portion of OWA if necessary	LOJPA	RWG
5069		RWG-WA13~	Restore or provide mitigation for dewatering of Ruddy Creek: Divert/pump water into abandoned Ruddy Creek channel to restore fishery and wildlife-viewing values; otherwise should be referred to EWG (Butte County included this as element of S/O-13)	Butte County and F.R. LFCA	RWG
5070		RWG-WA14	Local fish and wildlife improvements: Funding for DFG, appropriate to adequately operate facilities/OWA (Butte County included as element of S/O-13)	Butte County	RWG

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5071		RWG-WA15	Open the River to gold dredging from SR 70 through OWA. Limit to 4" dredge, high banking, sluicing, and panning allowed, establish concession and interpretive building. Open Memorial to Labor Day – establish marketer to buy/sell gold and related items; closed during fish runs	Butte County	RWG
5072		RWG-WA16	Improve water-ski area and/or develop pond in OWA: Existing area already improved (Interim Project); additional/alternative site is a large pond in OWA; construct parking, grandstands, restroom, and upgrade road	Water Ski Club	RWG
5073		RWG-WA17	Clean out the silt of all ponds and remove excess brush around ponds with clear paths to each and plant some warmwater fish in each; dredging, aquatic weed control, trail construction/maintenance, fish-planting	N/A	RWG
5074		RWG-WA18	One-mile Pond, plant with rainbows and brook trout and increase camping sites: manage for coldwater fishery and expand designated (primitive) camping area, perhaps designate individual sites by installing tables	N/A	RWG
5075		RWG-WA19	Restore historic Hamilton Cemetery: Restore fencing and maintain grounds of ~1-acre site; install interpretive panel. (Formerly OR-61)	N/A	RWG
5076		RWG-WA20	Shooting Range: Upgrade facilities at Shooting Area (completed as Interim Project)	N/A	RWG
5077		RWG-LF1	Create a transportation link on the old railroad alignment from Diversion Pool to the Wildlife Area: Acquire title or easement to pre-project railroad grade, develop multiuse (nonmotorized) unpaved trail between Diversion Pool and OWA	Butte County	RWG
5078		RWG-LF2	Restore river natural conditions; remove exotic plants: NOT implying Oroville Dam removal, but vegetation management and flow modifications to restore more natural hydrograph and temperature; otherwise should be referred to other Work Groups (EWG, EOWG, LWG)	FRRPD	RWG
5079		RWG-LF3	Add whitewater park: Create a competition-style public artificial channel on the right bank below the Diversion Pool, with support facilities (parking, stairs, restrooms, grandstand); periodically divert 400-1,000 cfs through that channel	Butte County	RWG
5080		RWG-LF4	Establish Tribal Cultural Center along the river: Construct a special visitor center on public land near downtown or off SR 70, which will be managed by local Tribes for public education, tribal activities, and preservation of local cultural artifacts (CRWG RAs: CWG30, CWG29, CWG26)	City of Oroville	RWG
5081		RWG-LF5	Finish Riverbend Park: In addition to current implementation of Interim Settlement Project, finish additional development of bike trail extension (to SR 162) and visitor information and cultural center, as described in existing environmental documentation	FRRPD	RWG
5082		RWG-LF6	Add DWR Visitor Information Center, as described in LF7 and LF9	FRRPD	RWG

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5083		RWG-LF7	Add interpretive/historic/cultural center: Construct a visitor center, probably in conjunction with "New Visitor Center" (see TF10), on public land (probably close to one of the SR 70 exits), which includes extensive pre/historic interpretation	FRRPD	RWG
5084		RWG-LF8	Modify swimming area, Bedrock Park: Restore side channel/pools to enhance swimming, wading, and help water warm, also modify degraded flow to enhance water quality; improve with waterside turf, concrete, and sand areas; additional support facilities (parking, etc.).	FRRPD	RWG
5085		RWG-LF9	Develop SR 70 gateway to LOSRA: Increase signage and develop significant new visitor/information center near one of the SR 70 exits, probably alternate to that proposed in TF10 or additional project similar to WA8	City of Oroville	RWG
5086		RWG-LF10	Hotel complex (SE side of river): Allow concessionaire to use public land for development of tourism-enhancing recreation-facilitating overnight lodging (perhaps resort-style) development, with conference facilities/capability	City of Oroville	RWG
5087		RWG-LF11	Loop historic cultural trail (funded): Enhance existing and create new multiuse trail with interpretive materials that emphasize cultural resources and history/prehistory of the area; both sides of river from SR 70 bridge to Diversion Dam	City of Oroville	RWG
5088		RWG-LF12	Aquatic center with water ski course - west of hatchery, north side of river: Either in addition to or replacement of existing area on afterbay; designate area with buoys, construct parking, grandstands, restroom, and upgrade road (similar to WA16)	City of Oroville	RWG
5089		RWG-LF13	Add spawning riffle observation/interpretation facility: Create nature trail, either from hatchery or downtown, that leads to viewing platform (new; perhaps also on new constructed side channel) where natural salmonid spawning can be observed	FRRPD	RWG
5090		RWG-LF14	Add improvements to the Nature Center: Additional day-use, trail, and interpretive facilities; these are being implemented as an Interim Project	City of Oroville	RWG
5091		RWG-LF15	Repave Old Ferry Rd. at bathroom: Short segment (<0.25 mile) of resurfacing existing road	City of Oroville	RWG
5092		RWG-LF16	Redevelop Hammond Park: Rehabilitate and upgrade day-use facilities	City of Oroville	RWG
5093		RWG-LF17	Relocate DWR maintenance yard: Move the storage area and other DWR facilities (now upstream of the right abutment of the Diversion Dam) to an undetermined location, to enhance existing/expanded Group Staging Area	City of Oroville	RWG
5094		RWG-LF18	Add swim center: Construct large, indoor competition-capable downtown public swim facility on City land in the center of the existing downtown residential neighborhoods	F.R. LFCA	RWG
5095		RWG-LF19	Acquire land at SR 70 crossing (north and south sides): Expand public land by negotiation with willing sellers, for expansion of existing park areas (Riverbend, Bedrock) and/or new high-visibility visitor/information center (see TF10 and/or LF9)	City of Oroville	RWG

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5096		RWG-LF20	Add RV campground (NE side of river): Build new campground (includes utilities) on public land, exact location TBD	City of Oroville	RWG
5097		RWG-LF21	Provide river access: Clear signage from SR 70 and SR 162 to new and existing developed river access points, such as Riverbend Park, Flash Dam area, Green Bridge, and afterbay outlet; new areas will require creation/upgrading of access roads (OWA) and parking	Butte County	RWG
5098		RWG-LF22	Add event meadow (northeast side of river): At the same (undetermined) site for LF20, provide area and support facilities (parking, sanitary, utilities) for outdoor "festival," "fair," and/or music events	City of Oroville	RWG
5099		RWG-LF23	Add Bedrock Park skate and bike park: Surface existing trails in the vicinity of Bedrock Park and lay out new short trails for beginning skaters; establish signage to convey this is an appropriate staging-point for these activities (FRRPD has not filled out form, but has provided additional information).	FRRPD	RWG
5100		RWG-LF24	Add warmwater swimming and/or play stream and pond: At Bedrock Park, construct new shallow, isolated, very-low-flow side channel to facilitate water use by children and bathers; may include concrete at some pool/poolside areas	F.R. LFCA	RWG
5101	ORA-01	RWG-LF25**	Add Waterfront Linear Park: Multiuse trails on both sides of river, two footbridges, levee road, several stair accesses to river, possible venue for Veteran's Park; generally through downtown from nature center to Riverbend	Oroville RDA	RWG
5102	LFCA PM&E #5	RWG-LF25**	Add Waterfront Linear Park: Multiuse trails on both sides of River, 2 footbridges, levee road, several stair accesses to river, possible venue for Veteran's Park; generally through downtown from Nature Center to Riverbend	F.R. LFCA	RWG
5103	ORA-02	RWG-LF26**	Add Gateway Park: Visitor day-use and information facilities between Riverbend facilities and Bedrock Park (near SR 70 exit and visible from freeway)	ORDA	RWG
5104	LFCA PM&E #7	RWG-LF26**	Add Gateway Park: Visitor day-use and information facilities between Riverbend facilities and Bedrock Park (near SR 70 exit and visible from freeway)	F.R. LFCA	RWG
5105	ORA-03	RWG-LF27**	Add Downtown Riverfront Park: Element of LF25 with river access/trails (both sides); possible site of Cultural Center Museum and amphitheater to accommodate a variety of types of events	ORDA	RWG
5106	LFCA PM&E #4	RWG-LF27**	Add Downtown Riverfront Park: Element of LF25 with river access/trails (both sides); possible site of Cultural Center Museum and amphitheater to accommodate a variety of types of events	F.R. LFCA	RWG
5107	ORA-04	RWG-LF28**	Add Whitewater Park: Same as LF3, except for more downtown location(?)	ORDA	RWG
5108	LFCA PM&E #3	RWG-LF28**	Add Whitewater Park: Same as LF3, except for more downtown location(?)	F.R. LFCA	RWG

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5109	ORA-05	RWG-LF29**	Add flexible event staging/group camping area: Combination of LF20 and LF22; adjacent to the interim project staging area (across/above Power Canal from proposed Whitewater Park, right bank of channel)	ORDA	RWG
5110	LFCA PM&E #2	RWG-LF29**	Add flexible event staging/group camping area: Combination of LF20 and LF22; adjacent to the Interim Project staging area (across/above Power Canal from proposed Whitewater Park, right bank of channel)	F.R. LFCA	RWG
5111	ORA-06	RWG-LF30**	Add equestrian event staging/group camping area: Left bank of channel near Diversion Dam and existing trailhead; similar elements to LF20 and LF22 but Oroville/RDA Information Form specifies location and plan view	ORDA	RWG
5112	LFCA PM&E #1	RWG-LF30**	Add equestrian event staging/group camping area: Left bank of channel near diversion dam and existing trailhead; similar elements to LF20 and LF22 but Oroville/RDA Information Form specifies location and plan view	F.R. LFCA	RWG
5113	ORA-07	RWG-LF31**	Add Neighborhood Park/Aquatic Center/Swim complex: Essentially the same as LF18, with some park-like landscaping (paths, tables, and benches) outside new building	Oroville RDA	RWG
5114	LFCA PM&E #6	RWG-LF31**	Add Neighborhood Park/Aquatic Center/Swim complex: Essentially the same as LF18, with some park-like landscaping (paths, tables, and benches) outside new building	F.R. LFCA	RWG
5115		RWG-LF32	Replace Flash Dam: Restore seasonal placement of the abandoned/removed Western Canal flashboard dam, providing warming backwater for swimming and boating on the river; minimal (primitive) improvements for access, parking, and sanitation	Butte County	RWG
5116		RWG-LF33	Add warmwater swimming area (near Flash Dam): Instead of restoring seasonal operation of flashboards (LF32), construct lower-flow side channel with waterside improvements and access enhancements (parking, seasonal day-use facilities, sanitation)	Butte County	RWG
5117		RWG-LF34	Establish river access (near Flash Dam) for boating and special events: Graded (unsurfaced) access and designated parking, signage from existing facilities and main roads; basic waterside improvements (seasonal day-use facilities, sanitation).	Butte County	RWG
5118		RWG-LF35	Improve appearance of SR 70 corridor: Landscaping of SR 70 viewshed, especially in vicinity of freeway exits and existing parks (Riverbend) and any new visitor facilities (like TF10 and LF6)	Butte County	RWG
5119		RWG-LF36	Acquire property for river access from Caltrans: Negotiate purchase of surplus right-of-way to facilitate recreational use, development, and access to the river from existing recreation areas and proposed SR 70 interchange	City of Oroville	RWG
5120		RWG-LF37	Add historical interpretation of historic gold dredge: At existing recreation area near SR 70 exit (such as Riverbend Park entrance), place historic gold dredging equipment and interpretive exhibits	Butte County	RWG

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5121		RWG-LF38	Remove concrete and construction debris in Feather River including below the Fish Barrier Dam, below the Table Mountain Bridge, and below the SR 70 bridge (RE89)	FRRPD	RWG
5122		RWG-LF39	Replace landscaping at the Feather River Fish Hatchery and adjacent river areas. (RE100): This is being implemented as an Interim Project	N/A	RWG
5123		RWG-LF40	Establish a historic railroad from Flash Dam site to Nature Center: Use existing trail and acquire some additional land to construct a narrow-gauge tourist railway along the river connecting its several parks; includes boarding/station facilities	Butte County	RWG
5124	LFCA PM&E #8	RWG-LF41	Collaborative Public Safety Center: Construct or designate a building for centralized law-enforcement and water-rescue capability; location on public land central to the river, forebay, afterbay, and OWA	F.R. LFCA	RWG
5125		RWG-LF42	Formerly DP-13: Safe/legal passage for bicycles from SR 162 bridge down to trail below: Coordinate development of project proposal with County Transportation Commission and Caltrans -- possible TEA grant requiring matching funds	LOBO	RWG
5126	FRRPD-01	RWG-LF43	O&M Funding for Riverbend Park: Establish recurring allocation of project funds for operation and maintenance of Riverbend Park	FRRPD	RWG
5127	CDPR-14	RWG-OR1	Relocate 50 campsites at Bidwell Canyon: Convert "Big Pine" loop to marina parking; construct new CG loop adjacent to "Gold Flat" loop (retain existing number of sites at relocated campground site)	DPR	RWG
5128	CDPR-14	RWG-OR2	Expand Bidwell Marina parking: Construct new parking lot (requires clearing, grading, paving) on site of half of Bidwell Campground; construct new campground loop (36 sites) adjacent/connected to remaining campground loop	DPR	RWG
5129		RWG-OR3	Upgrade visitors center: New displays and interpretive features; renovation, modernization	DPR	RWG
5130		RWG-OR4	Add Saddle Dam Trailhead improvements: Mostly-completed Interim Project	Community	RWG
5131	LOJPA-01(1(C-1))	RWG-OR5a	Add camp store shell at Bidwell Canyon -- Provide facilities for operation by concessionaire to support expansion of campground activities; ~1,000 sf building with utilities and aisle/shelf space, ~10 parking spaces	LOJPA	RWG
5132	LOJPA-02(1(C-2))	RWG-OR5b	Add camp activity center at Bidwell Canyon -- Provide facilities for operation by concessionaire to support expansion of campground activities, such as 1 acre of turf, shade structures, tables and seats, outdoor games (horseshoes, volleyball court, campfire circle)	LOJPA	RWG
5133		RWG-OR6	Add dry boat storage: Designate one or two areas close to existing marinas for public rental of covered and/or uncovered storage space -- install cyclone fencing, gate, and electronic security; access/operation managed by marina concessionaire(s)	Ron Davis	RWG
5134		RWG-OR7	Add tram to marinas (Lime Saddle, Bidwell): Establish tram service from day-use parking to marinas during low-water periods	LOJPA Public Hearing	RWG

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5135		RWG-OR8	Widen Olive Avenue: Coordinate with Caltrans and County Road Department to convert two-lane section to four or five lanes, from Oroville Dam Blvd. to turnoffs for Bidwell and/or Loafer areas (5 to 7 miles of road with mostly private frontage)	Butte County	RWG
5136		RWG-OR9	Add stable warmwater swimming area and/or water play area at Loafer Creek: Construct 5-acre stable (900') sub impoundment adjacent to lawn/picnic area; needs 30,000 yd3 fill and concrete for dam, plus circulation and probably chlorination system	Butte County	RWG
5137	LOJPA-03(2(2(b))	RWG-OR10	Add group RV camping at Loafer Creek -- New group camp loop including installation/extension of utilities, 50 hookup campsites, 1,500-sf meeting building, 0.25 acre turf, adjacent restroom/shower building	LOJPA	RWG
5138	LOJPA-04(2))	RWG-OR11	Add concession with campground store at Loafer Creek -- Similar to OR5a (above) except near existing Loafer Creek facilities	LOJPA	RWG
5139		RWG-OR12	Add parking for special events and equestrians at Loafer Creek: Clear and grade a new overflow parking area with a capacity of up to 100 vehicles with trailers; probably gravel not paved	C. Hodges	RWG
5140	LOJPA-05(2(e))	RWG-OR13	Add activity center at Loafer Creek -- Similar to OR5b (above) except near existing Loafer Creek facilities	LOJPA	RWG
5141	CDPR-16	RWG-OR14	Extend launch ramp and add low ramp/marina parking -- construct new parking lot(s) in inundation zone for use during low water (DPR submitted form for Bidwell.): Extension of Spillway, Bidwell, Lime Saddle ramps to ~700' completed, plan additional extension for future	DPR	RWG
5142	CDPR-20	RWG-OR15**	Acquire PG&E parcel near Lime Saddle: State purchase of ~5 acre parcel near existing "Parrish Cove" parking for use by marina operations and day use; requires site assessment and negotiation	DPR	RWG
5143	LSIC-07	RWG-OR15**	Acquire PG&E parcel near Lime Saddle: State purchase of ~5 acre parcel near existing "Parrish Cove" parking for use by marina operations and day use; requires site assessment and negotiation	LSIC	RWG
5144	CDPR-23	RWG-OR16**	Expand parking facilities at Lime Saddle, including area of relocated maintenance yard, and low-water parking: New (overflow) lot built in conjunction with CG project (2001); DPR submitted form to construct new parking lot(s) in inundation zone for use during low water	DPR	RWG
5145	LSIC-08	RWG-OR16**	Expand parking facilities at Lime Saddle, including area of relocated maintenance yard, and low-water parking: New (overflow) lot built in conjunction with CG project (2001); DPR submitted form to construct new parking lot(s) in inundation zone for use during low water	LSIC	RWG
5146	CDPR-22	RWG-OR17	Move maintenance yard at Lime Saddle Marina -- Construct shop and storage facility for marina maintenance (screened, near current or PG&E parcel; 500 ft2 office, 2-car garage-shop, covered storage for 2 additional vehicles, 1 acre outside fenced storage).	DPR	RWG

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5147	LSIC-05	RWG-OR18	Add stable warmwater swimming area and/or water play area at Lime Saddle: Construct 2-5 acre stable sub impoundment in ravine west of campground; needs >50K yd3 fill and concrete for jurisdictional dam, plus circulation and probably chlorination, and maintenance area (OR-17)	LSIC	RWG
5148	LSIC-06	RWG-OR19	Add special events meadow at Lime Saddle: Construct a day-use/event parking area (gravel or paved) between CG and marina and designate an open grassy area for special events; requires extension of existing utilities and probably periodic mowing, and maintenance area (OR-17)	LSIC	RWG
5149	LSIC-01	RWG-OR20	Add day-use improvements at Lime Saddle: Designate area and provide grassy area, add covered picnic tables near marina; upgrade landscaping so area is weed-free	LSIC	RWG
5150	CDPR-18	RWG-OR21**	Add 100 individual/family camping sites to Lime Saddle -- Add additional loops to CG, sufficient infrastructure/utilities/maintenance area nearby need to be expanded; proposed in conjunction with OR-25 (50-unit Group Camp). (DPR submitted form for 50-site expansion)	DPR	RWG
5151	LOJPA-07(3(h))&(3(h)(1))	RWG-OR21**	Add 100 individual/family camping sites to Lime Saddle -- Add additional loops to CG, sufficient infrastructure/utilities/maintenance area nearby need to be expanded; proposed in conjunction with OR-25 (50-unit Group Camp). (DPR submitted form for 50-site expansion)	LOJPA	RWG
5152		RWG-OR22	Add camp activity center and store shell at Lime Saddle: Provide facilities for operation by concessionaire to support expansion of campground activities; small building with utilities and aisle/shelf space, outdoor tables and games, and support/maintenance area (OR-17)	LOJPA	RWG
5153	LSIC-02	RWG-OR23	Extend and widen boat launch at Lime Saddle: Add another 1-2 lanes down to at least 800'; extend ramp 10-20 feet below current 700' extension (2002) at next very-low-water period	LSIC	RWG
5154	LOJPA-06(3(0))	RWG-OR24	Add concession improvements infrastructure at Lime Saddle -- Add infrastructure for concession improvements (campground store, restaurant, lodge) to enhance attractiveness of long-term concession lease and coordinate with other enhancements and parking expansion	LOJPA	RWG
5155		RWG-OR25	Add group RV camping at Lime Saddle -- Build new 50-unit group camp loop near existing camps; will include installation/extension of nearby utility services and new maintenance area (OR-17)	LOJPA	RWG
5156	CDPR-10	RWG-OR26	Rehabilitate Lime Saddle Marina, develop complex -- Use reconstruction as an opportunity to improve boat dock capacity; add group picnic facilities, low water shuttle system, and marina store	DPR	RWG

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5157		RWG-OR27	Add dry boat storage at Lime Saddle: Designate area close to marina for public rental of covered and/or uncovered storage space -- install cyclone fencing, gate, and electronic security; access/operation managed by marina concessionaire	R. Davis	RWG
5158		RWG-OR28	Add tournament fishing facilities at Lime Saddle: Build a stage/dais with bleachers or amphitheater-style concrete seating (similar to new facility at Spillway) for public viewing of precision scales and fishing events	LOJPA	RWG
5159	LOJPA-08(3(n))	RWG-OR29	Add water ski tournament area at Lime Saddle -- Designate with buoys and float-line a cove/area, and spectator area, for water ski activity and competition; designate speed restriction (5 mph) for all other vessels not using ski course; restrict use more during events	LOJPA	RWG
5160		RWG-OR30	Add holding tank pump-out station at Lime Saddle: May be part of OR24; develop dump station for discharge and storage of gray and black water from houseboats	LSIC	RWG
5161		RWG-OR31	Replace porta-potties with restrooms at water line at Lime Saddle: Engineer permanent but movable restroom as part of the movable dock/store complex, to replace current "floating" restrooms currently serving marina staff and visitors	LSIC	RWG
5162		RWG-OR32	Add Berry Creek road improvements: Coordinate with USFS and County Road Department to re/surface and improve 1-2 miles of 2-lane road, from SR 162 to LOSRA	J. Edwards	RWG
5163		RWG-OR33	Add Berry Creek camping improvements: Develop a new (primitive: vault toilets, tables, fire pits) campground, probably 10-20 sites, on the North Fork Feather River arm, LOSRA	J. Edwards	RWG
5164		RWG-OR34	Add launch ramp extension at Enterprise: Excavate and fill area at or near the foot of existing ramp (835') to develop a second-stage ramp extending to about 750'	Butte County (Cardoza)	RWG
5165		RWG-OR35	Establish tent camping at Enterprise launch ramp: Develop a new (primitive: vault toilets, tables, fire pits) campground, probably 10-20 sites, near the existing Enterprise lot/area	N/A	RWG
5166		RWG-OR36	Add Craig Saddle road improvements: Increase frequency of road maintenance, resurface with gravel or asphalt to facilitate access to shoreline, old trails, and local private property	N/A	RWG
5167	BCCA-01	RWG-OR37	Add Foreman Creek day-use area: Add basic facilities to existing car-top boat access area -- picnic tables, shade ramadas, vault restrooms, trash containers and pick-up, landscaping (grass lawn and trees), interpretive signage	Loren Gill (Berry Creek Citizen Assoc.)	RWG
5168		RWG-OR38	Preserve and enhance Craig Access park: Associated with OR36; enhance day-use access to Craig Boat-in Campground and adjoing shoreline areas of LOSRA	N/A	RWG
5169		RWG-OR39	Add access at Potters Ravine: Upgrade newly constructed/proposed trail to vehicle access, to provide an additional day-use destination with picnic tables and shoreline access	FRRPD	RWG

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5170		RWG-OR40	Add year-round boat-in campsites east of Loafer Creek: Develop a new boat-in (primitive) campground, probably 6-15 sites, on the South or Middle Fork. Feather River arm, LOSRA	L. Starr	RWG
5171		RWG-OR41	Establish bass tournament areas around lake: Develop Spillway-type amphitheater and staging area to cater to spectators and television at one or more other main boat ramps (Lime Saddle, Bidwell Canyon, Loafer Creek); see OR28	N/A	RWG
5172		RWG-OR42	Provide houseboat anchor sites east of Loafer Creek: Place mooring buoys in coves along the South or Middle Fork Feather River arm, LOSRA, in areas of accessible shoreline	N/A	RWG
5173		RWG-OR43	Establish bank fishing sites around the lake near campgrounds: Develop marked trails from campgrounds (Lime Saddle, Loafer Creek) to lakeshore, sign for "Fishing Access"	N/A	RWG
5174		RWG-OR44	Open spillway road to Potters Ravine for recreation development: same as OR 39; may eventually consider/allow potential for more than just picnic facilities	N/A	RWG
5175		RWG-OR45	Open all closed lake accesses: Allow public vehicular travel on all LOSRA paved and dirt roads that lead to or near the shoreline	N/A	RWG
5176		RWG-OR46	Improve roads around lake: Coordinate maintenance of State, County, and LOSRA internal roads; more frequent grading and graveling of dirt roads, resurfacing of rough roads, conversion to pavement of popular dirt roads	Butte County	RWG
5177		RWG-OR47	Open forks of lake for boating: Create passage-gaps in booms on arms, to allow easier houseboat access to remote reaches of full reservoir	N/A	RWG
5178		RWG-OR48	Add year-round summer resort project east of Loafer Creek: Develop new destination resort (including extension of all utilities) on the South or Middle Fork Feather River; RV camping, lodging, and conference facilities accessed off of Lumpkin Road	M. Kram	RWG
5179		RWG-OR49	Add day use and boat ramp to east side of the North Fork Feather River: Develop new (primitive: vault toilets, tables, fire pits) picnic area near Berry Creek Road or similar area (see OR33); include two-lane ramp (or adapt Foreman BIC for land/vehicle access)	N/A	RWG
5180		RWG-OR50	Add additional floating restrooms and campsites east of Loafer Creek: See OR40 (6-12 unit boat-in campground); includes placement of one additional 2-unit floating restroom on South Fork Feather River	N/A	RWG
5181		RWG-OR51	Add historical interpretive exhibits around lake: Place new interpretive panels and/or defunct historic heavy/mining equipment at 5-10 locations (existing recreation areas and overlooks)	DPR	RWG
5182		RWG-OR52	Add improvements to car top boat launch areas east of Loafer Creek: Add picnic tables and upgrade vault restrooms at Stringtown and Enterprise areas; create better parking and turnaround areas at Stringtown	N/A	RWG

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5183		RWG-OR53	Extend all boat ramps to low pool: Extend all boat ramps to about 640' at the next opportunity; requires substantial fill and excavation	DPR	RWG
5184		RWG-OR54	Add aquatic center on the lake: Create a "boathouse," similar to the facility at North Forebay, at Spillway, or at one of the other established recreation areas, for storage of club/class equipment and coordination of interpretive/safety programs	B. Corkin	RWG
5185		RWG-OR55	Add more restrooms around the lake: Add a floating restroom to each of the arms (about four more); install vault toilets at each vehicular access point (about five more)	K. Marcotte	RWG
5186		RWG-OR56	Remove floating logs from lake/launch ramps: Manually remove large debris that may pose hazard to navigation or interferes with ease of launching.	D. Macomie	RWG
5187		RWG-OR57	Improve whitewater opportunities at Poe Dam area: Coordinate with USFS to improve/develop access (graded dirt road) to the North Fork Feather River and upper reaches of the lake from Big Bend Road and/or French Creek/Four Mile Ridge Roads	Kayak Club	RWG
5188		RWG-OR58	Establish new lake records for fishing and establish a record keeper (group or business): Select local authority to certify and maintain maximum size records for each fish species, publicize succession of new records and report "near-misses"	N/A	RWG
5189		RWG-OR59	Resurvey river and Lake Oroville for depth and mark dangerous areas with buoys. Publish new depth charts and make available to the public: Bathymetric survey of 3,600 acres of reservoir and 12 miles of river	N/A	RWG
5190		RWG-OR60	Construct road and bridge improvements within and adjoining LOSRA: Widen and resurface roads leading to existing recreation areas	N/A	RWG
5191		RWG-OR61	Develop Self-Contained Camping Spaces at Spillway -- Develop camp spurs, with tables and 50-A electrical service; landscaping	DPR	RWG
5192	ETRH-01	RWG-OR62	Preserve Historical Trail Designation and Status: Designate Dan Beebe, Roy Rogers, and Loafer Loop Trails as Historical Equestrian Trails	Equestrian Trail Riders/Cathy Hodges	RWG
5193	LSIC-04	RWG-OR63	Floating Campgrounds: Add new floating campsites in the North Fork and West Branch arms of the lake; about 4-5 new units @ $100,000	LSIC	RWG
5194	LSIC-03	RWG-OR64	Improve car-top boat launch at Nelson Bar: Widen ramp, designate turnaround area(s), create additional parking above 894' (level of lot that is inundated when lake is full)	LSIC	RWG
5195	LSIC-09	RWG-OR65	New Multipurpose Trails in the Lime Saddle Marina Area: Connect existing and proposed facilities (marina, CG, swim area, event meadow, etc.) with loops around vista points	LSIC	RWG
5196	CDPR-15	RWG-OR66	Increase Bidwell Boat Ramp Parking -- New parking for periods of high pool levels, accomplished by excavating a knoll between the ramp and the existing parking lot, and paving/painting more boat-trailer spaces	DPR	RWG

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5197	CDPR-17	RWG-OR67	Increase Lime Saddle Marina Parking -- Expand parking capacity at high water by expanding day-use parking onto knoll near existing access	DPR	RWG
5198	CDPR-19	RWG-OR68	Add fish cleaning station to Lime Saddle Campground -- includes a couple of parking spaces at the existing trailer dump station	DPR	RWG
5199	CDPR-21	RWG-OR69	New maintenance yard at Lime Saddle Campground -- Not a stand-alone project, but element of ANY future Lime Saddle Campground expansion (includes storage facility for maintenance equipment (screened, 2-car garage-shop, 2-car covered storage, 600 ft2 fenced storage)	DPR	RWG
5200	CDPR-24	RWG-OR70	Lime Saddle Campground Campfire Center -- Seating for 100 with stage and screen and A-V setup (near Entrance Station)	DPR	RWG
5201	CDPR-25	RWG-OR71	Two New Group Camps at Loafer Creek -- created by converting southern portion of the day-use area to two new group camp areas	DPR	RWG
5202	CDPR-03	RWG-OR72	Ten New Group Camps at Loafer Creek -- New 25-person sites, including restrooms, parking, ramadas, tables, tent pads, and fire rings; location TBD but near existing campground	DPR	RWG
5203	CDPR-12	RWG-OR73	Enlarge Group Camp Areas at Loafer Creek -- add additional tent and parking spaces at half of existing (six) Loafer Group sites	DPR	RWG
5204	CDPR-13	RWG-OR74	Upgrade Campsites at Loafer Creek -- Convert 75 basic sites to RV sites (extend utilities for hookups, additional paving)	DPR	RWG
5205	CDPR-01	RWG-OR75	Expand Loafer Creek Horse Camp -- construct ten additional sites on the west side of existing equestrian campground	DPR	RWG
5206	CDPR-09	RWG-OR76	Develop a Full-Service Marina at Spillway -- New marina facility including slips and moorings, office, fuel dock, supply store, restrooms, ferry service, and pump-out facility	DPR	RWG
5207	CDPR-11	RWG-OR77	Develop Self-Contained Camping Spaces at Spillway -- Develop camp spurs, with tables and 50-A electrical service; landscaping	DPR	RWG
5208		RWG-OR78	Lake Oroville Overlook Improvement 2 -- Postponed Interim Project: Vegetation clearing, excavation, grading, and paving a parking area adjacent to SR 162, immediately north of Simpson Ranch Rd. near Bidwell Bar Bridge	Butte County	RWG
5209		RWG-OR79	Low Water Boat Ramp Access at Loafer Creek: Create a new road off the point within the Loafer Creek day-use area to allow ~two-lane access during low-water conditions (recognizes existing ramp cannot be lengthened; FRRPD has not filled out form, but has provided additional information)	LOJPA Discussion	RWG
5210		RWG-OR80	Boat Landing Ramp at Lime Saddle Campground: Create a landing ramp and pedestrian access walkway and trail to allow campers with boats to land and more directly access the campground at Lime Saddle	LOJPA Discussion	RWG

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5211		RWG-OR81	Winterize Floating Campsites: Modify enclosure/design of floating campsites to encourage offseason use (dismissed as Interim Project)	S. Brandt	RWG
5212		RWG-OR82	Open Service Roads to Boat-In Campgrounds during Low Water, to Allow Car-Camping: Allow public access to currently closed roads; will probably require grading and gravel surfacing	LOJPA Discussion	RWG
5213		RWG-OR83	Adjustable-Height Swim Dock: Construct a floating platform at existing day-use area (like Loafer Creek or Spillway) to allow swimmers access to deeper water at a range of water levels (dismissed as Interim Project)	S. Brandt	RWG
5214		RWG-OR84	Develop stairs and ADA access at left abutment of Oroville Dam, so Dam walkers and others can access existing parking lot on terrace above	N/A	RWG
5215	TTF-01	RWG-OR85	Consolidated Project Trails Plan -- Consolidation of many of the individual Resource Actions listed herein, synthesized through Collaborative Task Force and submitted by The Dangermond Group 10/30/03	LOJPA	RWG
5216		RWG-FR1	Share in acquisition/development of SR 99 visitor center in Gridley: Coordinate with County, Chamber, and Caltrans to establish and operate Traveler Information Center in or near Gridley (site w/easy access to SR 99), to publicize Oroville recreation	City of Gridley	RWG
5217	LFCA PM&E #21	RWG-FR2	Gridley/Biggs/Oroville Recreation Path: A paved trail connecting these south-county areas; an alternative, safer trail/bicycle route to areas served by Larkin Road, SR 162, SR 99	F.R. LFCA	RWG
5218		RWG-S/O1	Oroville/Lake Oroville JPA Water District -- New local district to administer the 27,500-acre-foot area of origin entitlement:	F.R. LFCA	RWG
5219		RWG-S/O2**	Forebay/Afterbay Recreational Feasibility Study -- Study local agency control of forebay and afterbay recreational facilities, with the objective of providing funding to a local agency for operation of the recreation facilities	Butte County	RWG
5220	LFCA PM&E #11	RWG-S/O2**	Forebay/Afterbay Recreational Feasibility Study -- Study local agency control of forebay and afterbay recreational facilities, with the objective of providing funding to a local agency for operation of the recreation facilities	F.R. LFCA	RWG
5221	LFCA PM&E #12	RWG-S/O3	Marketing Oroville -- Expanded marketing program to promote tourism (TV, radio, billboards, newspaper ads) in all major Northern California/Nevada markets	F.R. LFCA	RWG
5222	LFCA PM&E #13	RWG-S/O4	Art Gallery Cooperative -- Adapt an existing downtown building to showcase local artists of all media, to operate as a cooperative	F.R. LFCA	RWG
5223	LFCA PM&E #14	RWG-S/O5	Agriculture Business Cooperative -- Adapt an existing downtown building to showcase local agricultural products and companies, to operate as a cooperative	F.R. LFCA	RWG
5224	LFCA PM&E #15	RWG-S/O6	Solar Solutions -- Facilitate and support the continued preeminence of Oroville as a renewable energy community, promote development of solar generation at all commercial facilities	F.R. LFCA	RWG

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5225	LFCA PM&E #16	RWG-S/O7	Low-Flow Mitigation Fund -- Develop a mitigation water bank fund to fund resource and watershed conservation planning, based on transfers involving Butte County's entitlement of 27,500 acre-feet	F.R. LFCA	RWG
5226	Butte-03(BC PM&E #6)	RWG-S/O8**	Lake Oroville Oversight Committee: Establish a group of local, State, and Tribal representatives that will coordinate with (or supersede) ORAC, to monitor and reconcile recreation and tourism-related issues. (Two stakeholders submitted forms with slightly different concepts)	Butte County	RWG - Related to LWG-23 and EO5-6
5227	LFCA PM&E #17	RWG-S/O8**	Lake Oroville Oversight Committee: Establish a group of local, State, and Tribal representatives that will coordinate with (or supersede) ORAC, to monitor and reconcile recreation and tourism-related issues. (Two stakeholders submitted Forms with slightly different concepts)	F.R. LFCA	RWG - Related LWG-23 and EO5-6
5228	LFCA PME#18	RWG-S/O9	Lake Oroville Water Conservation Initiative -- Impose restrictions/conservation on State Water Contractors when Lake Oroville drops below certain levels; charge a higher rate for water under those conditions, proceeds to fund local parks and facilities	F.R. LFCA	RWG
5229	LFCA PM&E #22	RWG-S/O10	Thermalito Schools Environmental Education -- Allocate funds to target schoolchildren of local immigrant populations, to build/support a new wildlife day camp, nature path at Poplar Ave. School, recreational outreach and curriculum development	F.R. LFCA	RWG
5230	Butte-01 (BC PM&E #1)	RWG-S/O11	New Master Recreation Plan: Alternative to the Recreation Plan to be developed by DWR and the Relicensing Collaborative, prepared by the LOJPA	Butte County	RWG
5231	Butte-04 (BC PM&E #7)	RWG-S/O12	Measurable Standards to Ensure an Exceptional Recreation Experience and Proper Cultural Resource Protection -- Include recreational performance standards in FERC License, based on annual audit by Oversight Committee; annual expenditure/performance report from agencies	Butte County	RWG
5232		RWG-S/O13	Local Fish and Wildlife Improvements -- Supplement DFG funding for OWA with SWP funds/project revenues; enhance OWA facilities, roads, maintenance, security; restore Ruddy Creek or mitigate for it	Butte County	RWG
5233	Butte-05 (BC PM&E #8)	RWG-S/O14	Measures and Programs to Rectify Past, Present, and Future Lake Oroville Facilities and Operational Impacts on Local Government Services and Infrastructure -- Provide supplemental funds for County road maintenance, pave high-use existing OWA gravel roads, widen SR 162	Butte County	RWG - Related to EO10
5234		RWG-S/O15	Local Economic Development Programs and Projects: Allocate a portion of project revenues to be administered by local agency(s) for infrastructure improvements and local business recruitment and development	Butte County	RWG
5235	ORAC #1	RWG-S/O16**	"SHARE THE WEALTH" Economic benefits to the local economy -- allocate portion of project revenues to provide additional funding for recreation and wildlife enhancement	ORAC	RWG

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5236	CFER-01	RWG-S/O16**	"SHARE THE WEALTH" Economic benefits to the local economy -- allocate portion of project revenues to provide additional funding for recreation and wildlife enhancement	Butte County CFER	RWG
5237	ORAC #2	RWG-S/O17**	"SUSTAINABLE FUNDING" Establish a steady funding stream for resource managing agencies -- additional funding for DFG and DPR activities from project revenues to supplement Legislative appropriations to those agencies (which are variable and unpredictable)	ORAC	RWG
5238	CFER-02	RWG-S/O17**	"SUSTAINABLE FUNDING" Establish a steady funding stream for resource managing agencies -- additional funding for DFG and DPR activities from project revenues to supplement Legislative appropriations to those agencies (which are variable and unpredictable)	Butte Co./CFER	RWG
5239		RWG-S/O18**	"MANAGEMENT STRUCTURE" Establish a better way to manage the resources of the project -- Alternative entities for the management of the economic resources of the should be identified and evaluated to see if they are more responsive to local needs and concerns	Butte County	RWG
5240	ORAC #3	RWG-S/O18**	"MANAGEMENT STRUCTURE" Establish a better way to manage the resources of the project -- Alternative entities for the management of the economic resources of the should be identified and evaluated to see if they are more responsive to local needs and concerns	ORAC	RWG
5241		RWG-S/O19**	"ACCOUNTABILITY" -- A local based "Oversight Committee" with decision making powers to cut through the red tape and buck passing (agency decisions subject to local approval)	Butte County	RWG
5242	ORAC #4	RWG-S/O19**	"ACCOUNTABILITY" -- A local based "Oversight Committee" with decision making powers to cut through the red tape and buck passing (agency decisions subject to local approval)	ORAC	RWG
5243	ORAC #5	RWG-S/O20	[Mitigation for] "LOW LAKE LEVELS" -- Funding agreements to compensate the local economy for impacts of more water withdrawals than anticipated at time of project development	ORAC	RWG
5244	CFER-03	RWG-S/O20	[Mitigation for] "LOW LAKE LEVELS" -- Funding agreements to compensate the local economy for impacts of more water withdrawals than anticipated at time of project development	CFER	RWG
5245	ORAC #6	RWG-S/O21	"LICENSE RE-OPENER" -- A License provision that that allows for additional mitigation to be determined and required when adverse effects are not mitigated properly or arise due to new information	ORAC	RWG
5246		RWG-S/O22	Provide at-cost water and electricity from the project to local industry to facilitate economic development	Mike Kelley	RWG
5247	OACC-01	RWG-S/O23	Project Promotion, Marketing, and Public Relations: Similar to RWG-S/O3, solidify and increase the current year-to-year DWR support of Chamber outreach; new proposed agreement, initially $125,000/year, would increase 4% per year for the term of the License	Chamber of Commerce	RWG

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(Unique Identifier ID [1001+=Cultural Resources; 2001+= Engineering & Operations; etc.])	*(Code from Resource Action/PM&E Measure Identification Forms - only where applicable)*	*(Code assigned by Work Groups)*	*(Short description and location)*	*(Resource agency*, or Work Group, organization)* *[*In some cases the resource agency was part of the Work Group]*	*(Work Groups in which the potential PM&E measures were discussed and developed further. In a few cases, single stakeholders developed their potential PM&E measures further.)*
5248		RWG-S/O24	Funding Coordinator: Hire staff to seek grants for recreation and program development at project and other local facilities and management areas (deferred Interim Project)	N/A	RWG
5249		RWG-S/O25	Add Rangers/Increase LOSRA Security: Hire and support additional (four or five?) staff members to patrol Lake Oroville, Thermalito Diversion Pool, and Thermalito Forebay facilities, to increase frequency of law-enforcement presence and protect resources and visitors	N/A	RWG
5250		RWG-S/O26	Reservation System: Establish locally operated single-source reservation agent to coordinate use of recreation facilities with special events (deferred Interim Project)	N/A	RWG
5251	F.R.LFCA	RWG-LF44	Historic Matthews Riffle Fishing Access (former LWG-30) - Coordinate with DFG/WCB to acquire easement on portion of Matthews Ready Mix property to allow for river users to access streamside areas that have been recently fenced	F.R.LFCA	RWG
5252		RWG-OR86	Increase communication on issues relating to present DWR land usage around the lake area so it shifts from unused to recreational or appropriate public use (LWG-1)	LWG	RWG
5253	BC (PM&E #2)	RWG-S/027	Measurement of the socioeconomic aspects of settlement agreement and new FERC License	Butte County	RWG
6001			Feather Falls Management	USFS	USFS
6002			Floating Debris Management at McCabe Creek	USFS	USFS
6003			Recreation Facility Improvements at Berry and French Creeks	USFS	USFS
6004			Transfer of Energy and Nutrients Upstream of Oroville Dam	USFS	USFS
6005			Coordinate any drawdown zone revegetation on USFS lands with the USFS	USFS	USFS
6006			Ensure that interagency wildlife coordination occurs on at least an annual basis	USFS	USFS
6007			Fuels management - some level of commitment for landscape fuelbreaks	USFS	USFS
The following PM&E measures have not yet been reconciled within a Work Group or Stakeholder Group					
7001	BBAC-01		Continuation of the BBAC Release Boat Program	Black Bass Action Committee	
7002	BBAC-02		Identify sources of funding for the new license agreement and clearly identify who is responsible for providing those funds	Black Bass Action Committee	
7003	BBAC-03		A full-time biologist to implement and coordinate all aspects of new license requrements; to be permanently funded by licensee	Black Bass Action Committee	
7004	BBAC-04		Establish a written management plan for Lake Oroville, the Oroville Wildlife Area, Thermalito Forebay, Thermalito Afterbay, and the Thermalito Diversion Pool	Black Bass Action Committee	
7005	BBAC-05		Establish a warmwater stocking program for Florida bass. This would continue the intent of the original FERC contract that stated, "Lake Oroville would always be managed as a trophy black bass and trout fishery"	Black Bass Action Committee	

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7006	BBAC-06		Establish a permanent willow nursery for Lake Oroville to provide living habitat for fish and wildlife. This could be done in conjunction with local schools and/or colleges. This would not only provide habitat, it would also create hands-on experience for students and employment	Black Bass Action Committee	
7007	BBAC-07		Extend the Loafer Creek Launch Ramp to an elevation that would be equal to all exisiting concrete ramps	Black Bass Action Committee	
7008	BBAC-08		With the advent of a pond smelt forage base, we would recommend studying the feasibiltiy of introducing a good strain of crappie or bluegill as a more catchable fish for the general public	Black Bass Action Committee	
7009	CDPR-27		Identify culturally sensitive areas, both arechaeological and traditional cultural properties, that are in areas with excessive fuel loads. Once areas have been identified, systematically remove the excessive fuel load and then begin a prescribed burn program to maintain the fire safe, resilient landscape	DPR (Leslie Steidl)	
7010	BC PMM&E #4a	related to LWG-20	Local Fish and Wildlife Improvements	Butte County	LWG
7011	BC PMM&E #4b	related to LWG-20	Improve Project Security and Law Enforcement Coordination	Butte County	LWG
7012	BC PM&E #8	related to EO10 and RWG-SO-14	Develop and implement measures and programs to rectify past, present, and future Lake Oroville Facilities and operational impacts on local government services and infrastructures	Butte County	

~Denotes that no RAIF has been submitted but the two proponents appear to agree on the proposed PM&E measure

** Denotes that two groups submitted similar Resource Action Identification Forms and these have been combined and considered one PM&E measure in the Work Group