

## APPENDIX E6

# YCWA'S OPERATIONS AND WATER TEMPERATURE MODELS, HYDROLOGY AND WATER TEMPERATURE DATA, TECHNICAL MEMORANDA, PROJECT VIDEO AND MAPS

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Appendix E6 includes maps, historical hydrological and water temperature data, modeled hydrological and water temperature data from YCWA's Water Balance/Operations Model and Water Temperature models, technical memoranda, and YCWA's helicopter Project video.<sup>1, 2</sup> Specifically, the material in Appendix E6 includes:

- Detailed 1:24,000 scale maps of the Project extending from the confluence of the Yuba River with the Feather River upstream to and including the most upstream Project facilities and features. Each map shows: elevation contours; county borders; rivers and streams including river miles in tenths of a mile; dams, diversions and other non-Project facilities; cities and towns; roads; stream flow and reservoir storage gages; railroads and transmission lines; and other major landmarks. Each map also shows land ownership (e.g., federal by land management agency, State of California, YCWA and others) (Disc #1).
- Historical and modeled hydrologic and water temperature data (Disc #2) including the following:
  - Historical Hydrology. HEC-DSS files with historically-measured flow data from USGS gages within and nearby the Project Area for the available period of record at each gage. The period of record for historically-measured data varies by gage, but most empirical data are available from 1970 through 2016.
  - Historical Water Temperature Data. HEC-DSS files with historically-measured water temperature data for locations throughout the Project Area. The period of record for historically-measured data varies by station, but most empirical data are from 2008 through 2016. Reservoir water temperature data are provided in Microsoft<sup>TM</sup> Excel format for New Bullards Bar and Englebright reservoirs for the period of record from 1989 to 2016. Raw meteorological data are provided in HEC-DSS format for four stations within the Project Area.

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<sup>1</sup> Due to the number of CDs and DVDs in Appendix E6, a compilation of Appendix E6 CDs and DVDs is provided in a separate binder named Exhibit E, Appendix E6, *Yuba County Water Agency's Operations and Water Temperature Models, Hydrology and Water Temperature Data, Technical Memoranda and Project Video and Maps*.

<sup>2</sup> YCWA has not filed each technical memorandum with the Amended FLA since they are already in the docket and on file with FERC.

- Unimpaired Flow Data. A HEC-DSS file with computed unimpaired flow information at several key locations. The period of record for unimpaired flow data is 1975 through 2008.
- Existing Without-Project and With-Project Hydrology. HEC-DSS files with hydrology from the simulated No Action Alternative (Operations Model Base Case Scenario), YCWA's Proposed Project Alternative, YCWA's Future Proposed Project Alternative and the Without-Project Alternative for the period of record from WY 1970 through WY 2010, for locations throughout the Project Area, including flows at multiple locations on the Middle Yuba River, North Yuba River, Yuba River, and Oregon Creek.

The Disc #2 includes the following Water Balance/Operations Model output data for the Without-Project, No Action, YCWA Proposed Project and YCWA Future Proposed Project alternatives:

- ✓ New Bullards Bar and Englebright reservoir storage and water-surface elevations
  - ✓ In-basin diversions through the Camptonville Diversion Tunnel, Lohman Ridge Diversion Tunnel, New Colgate Penstock, and Narrows 2 Penstock
  - ✓ Agricultural water supply diversions from Yuba River near Daguerre Point Diversion Dam
  - ✓ Hydroelectric generation for the New Colgate, Narrows 2, and New Bullards Bar Minimum Flow powerhouses
- Simulated Temperature Data. HEC-DSS files with modeled water temperature data for the No Action Alternative, YCWA's Proposed Project Alternative, YCWA's Future Proposed Project Alternative and the Without-Project Alternative for the period from WY 1970 through WY 2010.
  - YCWA's Water Balance/Operations Model and Hydrologic Model Input and Output Files. The Disc #2 includes the latest version of the Water Balance/Operations Model, version 1.45, setup to run the No Action Alternative, YCWA's Proposed Project Alternative, YCWA's Future Proposed Project Alternative and the Without-Project Alternative for the period of record from WY 1970 through 2010. The disc also includes the USACE HEC-DSS Microsoft™ Excel Add-in, which is required to be installed on the user's computer to run the Water Balance/Operations Model. Output from the Water Balance/Operations Model is also included as part of the hydrologic data sets described above.
- YCWA's Water Temperature Models and model input and output files (Disc #2). YCWA's Water Temperature Models are included for four alternatives: 1) the No Action Alternative; 2) YCWA's Proposed Project Alternative; 3) YCWA's Future Proposed Project Alternative; and 4) the Without-Project Alternative. A temperature model graphical user interface (GUI) combines the three models needed to run each alternative: 1) the Upper Temp Model, which simulates water temperatures resulting from Project facilities upstream of Englebright Reservoir; 2) the Englebright Temp Model, which simulates water temperatures within Englebright Reservoir; and 3) the Lower Temp Model, which simulates Yuba River water temperatures downstream of Englebright Dam.

Each model is capable of simulating the full period of record from WY 1970 through 2010. Outputs from the models are also included within the water temperature data set described above. YCWA’s revised Habitat Time Series Charting Program (i.e., includes Water Balance/Operations Model Base Case Scenario and YCWA’s proposed Project) for all of the study reaches upstream of Englebright Reservoir (Disc #3)

Besides the above three discs, this Appendix E6 includes three discs. YCWA previously filed Yuba River Development Project - *Helicopter Video* (Discs #4 and #4A as listed in Table E6-1). FERC has not posted these to the ELibrary with an accession number, therefore, these three discs are included Appendix E6 for ease of reference.

Table E6-1 lists the contents of this appendix, including file type and total file size.

**Table E6-1. Contents of Appendix E6.**

Name	File Type(s) on Disc	Total File Size (MB)	Disc #
<b>MAPS</b>			
Yuba River Development Project 1:24k Quadrangle Maps	1 compact disc (CD)	11MB on CD	1
<b>DATA AND MODELS</b>			
Existing Without-Project and With-Project Hydrology	6 DSS files	27 MB on DVD	2
Existing Without-Project and With-Project Water Temperature Data	5 folders with executable data	110MB on DVD	2
Yuba River Development Project Operations Model	3 folders with executable data	46 MB on DVD	2
Yuba River Development Project Water Temperature Models	4 folders with executable data	924 MB on DVD	2
Yuba River Development Project Habitat Time Series Charting Program Upstream of Englebright Dam	Executable folders with data	132 MB on CD	3
<b>HELICOPTER VIDEO</b>			
Yuba River Development Project - Helicopter Video	1 digital versatile disc (DVD) (Disc 1 of 2) Media files	7.5 GB on DVD	4
Yuba River Development Project - Helicopter Video	1 compact disc (CD) (Disc 2 of 2) 14 jpeg files, 2 Adobe pdf files and 1 Microsoft Word file	65 MB on CD	4A
<b>Total</b>			<b>5</b>

In addition, this Appendix E6 includes, by reference, 53 files that have been previously been filed with FERC and are available on ELibrary. YCWA conducted 50 studies over the course of the relicensing, and filed with FERC a technical memorandum, and in some cases an addendum, for each completed study. Each technical memorandum included an executive summary; a description of study goals and objectives; methods and results; a discussion of study results; a description of study-specific consultation and collaboration undertaken by YCWA; a list of variances to the FERC-approved study; a list of attachments to the technical memorandum; and references. Table E6-2 lists each of these studies and associated technical memorandum, including for each technical memorandum and addendum, the date YCWA filed the material with FERC and the associated accession number on FERC’s ELibrary. These technical memoranda and addenda are included by reference in this Amended FLA.

**Table E6-2. List of studies and associated technical memorandum and addendum conducted by YCWA in support of the relicensing, the date YCWA filed the material with FERC, and the corresponding accession number for the material in FERC’s ELibrary.**

Study No.	Study Description / Technical Memorandum Name	Date YCWA Filed Final Technical Memorandum with FERC	Corresponding Accession Number on FERC’s ELibrary
<b>GEOLOGY AND SOILS</b>			
1.1	Channel Morphology Upstream of Englebright Reservoir	April 28, 2014	20140429-4048
1.2	Channel Morphology Downstream of Englebright Dam	April 28, 2014	20140429-4050
<b>WATER RESOURCES</b>			
2.1	Hydrologic Alteration	April 28, 2014	20140429-4052
2.2	Water Balance/Operations Model	April 28, 2014 and modified on November 25, 2014	20141217-0109
2.3	Water Quality	April 28, 2014	20140429-4057
2.4	Bioaccumulation	April 28, 2014	20140429-4058
2.5	Water Temperature Monitoring	April 28, 2014	20140429-4059
2.6	Water Temperature Model	April 28, 2014	20140429-4062
<b>AQUATIC RESOURCES</b>			
3.1	Aquatic Macroinvertebrates Upstream of Englebright Reservoir	April 28, 2014	20140429-4063
3.2	Aquatic Macroinvertebrates Downstream of Englebright Dam	April 28, 2014	20140429-4064
3.3	Special-Status Aquatic Mollusks	April 28, 2014	20140429-4065
3.4	Special-Status Amphibians – Foothill Yellow-Legged Frog Surveys	April 28, 2014	20140429-4066
3.5	Special-Status Amphibians – Foothill Yellow-Legged Frog Habitat Modeling	April 28, 2014	20140429-4067
3.6	Special-Status Turtles – Western Pond Turtle	April 28, 2014	20140429-4068
3.7	Reservoir Fish Populations	April 28, 2014	20140429-4069
3.8	Stream Fish Populations Upstream of Englebright Reservoir	April 28, 2014	20140429-4070
3.9	Non-ESA-Listed Fish Populations Downstream of Englebright Dam	April 28, 2014	20140429-4071
3.10	Instream Flow Upstream of Englebright Reservoir	April 28, 2014	20140429-4075
3.11	Entrainment	April 28, 2014, and modified on May 14, 2015	20140429-4076 20150514-5181
3.12	New Colgate Powerhouse Ramping	April 28, 2014	20140429-4077
3.13	Focused 2013 Foothill Yellow-legged Frog Surveys	April 28, 2014	20140429-4078
3.14	Focused 2013 Western Pond Turtle Surveys	April 28, 2014	20140429-4027
<b>WILDLIFE RESOURCES</b>			
4.1	Special-Status Wildlife – California Wildlife Habitat Relationships	April 28, 2014	20140429-4028
4.2	Special-Status Wildlife – Bats	April 28, 2014	20140429-4030
<b>BOTANICAL RESOURCES</b>			
5.1	Special-Status Plants	April 28, 2014	20140429-4031
5.2	Supplemental Botanical and Valley Elderberry Longhorn Beetle Surveys for Construction of the Proposed New Flood Control Outlet at New Bullards Bar Dam	October 27, 2015	20151028-5078
<b>RIPARIAN, WETLANDS AND LITTORAL HABITATS</b>			
6.1	Riparian Habitat Upstream of Englebright Reservoir	April 28, 2014	20140429-4032
--	Addendum to Technical Memorandum 6-1, Riparian Habitat Above Englebright – Additional Analysis	April 28, 2014	20140429-4023
6.2	Riparian Habitat Downstream of Englebright Dam	April 28, 2014	20140429-4034
--	Addendum to Technical Memorandum 6-2, Riparian Habitat Downstream of Englebright Dam – Additional Analysis	April 28, 2014	20140429-4024
6.3	Wetlands	April 28, 2014	20140429-4035
<b>THREATENED, ENDANGERED AND FULLY PROTECTED SPECIES</b>			
7.1	ESA-Listed Plants	April 28, 2014	20140429-4036
7.2	Narrows 2 Powerhouse Intake Extension	April 28, 2014	20140429-4037

**Table E6-2. (continued)**

Study No.	Study Description/ Technical Memorandum Name	Date YCWA Filed Final Technical Memorandum with FERC	Corresponding Accession Number on FERC's ELibrary
<b>THREATENED, ENDANGERED AND FULLY PROTECTED SPECIES (cont'd)</b>			
7.3	ESA-Listed Amphibians – California Red-Legged Frog	April 28, 2014	20140429-4038
7.4	ESA-Listed Wildlife – Valley Elderberry Longhorn Beetle	April 28, 2014	20140429-4039
7.5	CESA-Listed Plants	April 28, 2014	20140429-4040
7.6	CESA-Listed and Fully Protected Wildlife – California Wildlife Habitat Relationships	April 28, 2014	20140429-4041
7.7	CESA-Listed and Fully Protected Wildlife – Bald Eagle	April 28, 2014	20140429-4042
7.8	ESA/CESA-Listed Salmonids Downstream of Englebright Dam	April 28, 2014	20140429-4043
7.9	Green Sturgeon Downstream of Englebright Dam	April 28, 2014	20140429-4044
7.10	Instream Flow Downstream of Englebright Dam	April 28, 2014	20140429-4045
--	Addendum to Technical Memorandum 7-10, Instream Flow Downstream of Englebright Dam – Depth and Velocity Summary Tables for In-Channel and for Floodplain	April 28, 2014	20140429-4025
7.11	Fish Behavior and Hydraulics Near Narrows 2 Powerhouse	April 28, 2014 <sup>1</sup> and modified on March 31, 2016 <sup>1</sup>	20140429-4008 20160331-5261
7.11a	Radio Telemetry Study of Spring- and Fall-run Chinook Salmon Downstream of Narrows 2 Powerhouse		
7.12	Evaluation of Project Effects on Daguerre Point Dam and Hallwood-Cordua Fish Facilities	April 28, 2014	20140429-4009
7.13	Fish Stranding Associated with Shutdown of Narrows 2 Powerhouse Partial Bypass	April 28, 2014	20140429-4010
<b>RECREATION RESOURCES</b>			
8.1	Recreation Use and Visitor Surveys	April 28, 2014	20140429-4011-
8.2	Recreational Flow	July 30, 2015	20140429-4013
8.3	Recreational Trail Use	October 27, 2015	20151028-5078
<b>LAND USE</b>			
9.1	Primary Project Roads and Trails	April 28, 2014	20140429-4014
<b>AESTHETIC RESOURCES</b>			
10.1	Visual Quality	April 28, 2014	20140429-4015
<b>SOCIOECONOMIC RESOURCES</b>			
None			
<b>CULTURAL RESOURCES</b>			
12.1	Historic Properties	April 28, 2014	20140429-4016
<b>TRIBAL RESOURCES</b>			
13.1	Native American Traditional Cultural Properties	April 28, 2014	20140429-4017
<b>Total</b>		<b>53 Files</b>	

<sup>1</sup> As provided in the FERC-approved studies, the final technical memoranda for Studies 7.11 and 7.11a were combined into a single final technical memorandum.

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## **Appendix E6**

### **Attachments<sup>3</sup>**

Due to the size and/or format of the material in this appendix, YCWA has filed with FERC these materials on compact disc (CD) and digital versatile disc (DVD) as part of this Amended FLA.

Copies of the material in this appendix on CD and DVD may be obtained upon request by contacting:

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<sup>3</sup> Fifty-three files (see Table E6-2) were previously filed with FERC and are included by reference in this Amended FLA.

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