3.3.2 Water Resources

The discussion of water resources is divided into five sections. The affected environment is discussed in Section 3.3.2.1. Environmental effects of the proposed Project are discussed in Section 3.3.2.2. Cumulative effects are described in Section 3.3.2.3. Proposed environmental conditions are presented in Section 3.3.2.4, and unavoidable adverse effects are addressed in Section 3.3.2.5.

Where existing, relevant, and reasonably available information from YCWA's PAD was not sufficient to determine the potential effects of the Project or proposed Project on water resources, YCWA conducted six studies: 1) Study 2.1, *Hydrologic Alteration*; 2) Study 2.2, *Water Balance/Operations Model*; 3) Study 2.3, *Water Quality*; 4) Study 2.4, *Bioaccumulation*; 5) Study 2.5, *Water Temperature Monitoring*; and 6) Study 2.6, *Water Temperature Models*. The studies are complete (Table 1.4-3), and a technical memorandum for each study is included in Appendix E6.

3.3.2.1 Affected Environment

This section describes existing water resources conditions in two general areas – water quantity and water quality – for waters affected by the Project.[1, 2]

3.3.2.1.1 Water Quantity

This section describes: 1) the use of YCWA's relicensing Operations Model in Exhibit E; 2) the development of Project hydrologic datasets; 3) the Project's storage and flows; 4) the existing and proposed uses of Project waters; and 5) existing and proposed water rights that might affect or be affected by the Project.

YCWA's Water Balance and Operations Model[3]

In 2011 and 2012, as part of the FERC-approved Study 2.2, YCWA developed an Operations Model to simulate operations of YCWA's Project. The Operations Model is used to simulated current and future operations of the Project using historical hydrology to define a representative range of hydrological conditions.

The Operations Model simulates Project operations on a daily timestep for a user-designated period of record. Using historic hydrology, the model simulates user-defined operations using a consistent set of operational and physical constraints to determine the Project's response to a

1 Refer to Section 3.1 for a description of the Yuba River basin from its headwaters to the confluence with the Feather River, a description of the Feather River basin from the Yuba River to the Sacramento River; and for information regarding the drainage area and the hydraulic retention time (i.e., flushing rate) of New Bullards Bar reservoir.

2 Refer to Table 2.1-2 for information regarding the volume, surface area, depth and shoreline length of New Bullards Bar Reservoir, Our House Diversion Dam impoundment and Log Cabin Diversion Dam impoundment. The substrate in each reservoir is composed of bolder, cobble, gravel, sand and silt.

3 Refer to Technical Memorandum 2-2, *Water Balance/Operations Model*, in Appendix E6 for a full description of the model, including development, validation and Base Case (i.e., No Action Alternative) Scenario.

wide range of hydrology. The Operations Model platform is Microsoft® Excel, with almost all of the logic and computations written in Microsoft® Visual Basic for Applications. The Operations Model uses the United States Army Corps of Engineers' (USACE's) Hydrologic Engineering Center Data Storage System (HEC-DSS) as a platform for input and output timeseries storage and management. The model has the capability to simulate time periods from as long as 41 years of hydrology (i.e., WYs 1970 through 2010) to as short as a single day.

The Operations Model's lower geographic boundary is the Yuba River confluence with the Feather River. The model's upper geographic boundaries are the NMWSEs of New Bullards Bar Reservoir on the North Yuba River, Log Cabin Diversion Dam on Oregon Creek, Our House Diversion Dam on the Middle Yuba River, and Englebright Reservoir on the South Yuba River.

Modeled Project facilities include the New Bullards Bar Dam and Reservoir, Log Cabin and Our House diversion dams, New Colgate Powerhouse and Narrows 2 Powerhouse. In addition, the following non-Project facilities and features are modeled: 1) Englebright Dam and Reservoir; 2) PG&E's Narrows 1 Powerhouse; and 3) agricultural diversions from the Yuba River near Daguerre Point Dam.[4]

Input hydrology to the Operations Model is a combination of historic gaged flow and synthesized hydrology. Model output includes flows on the North Yuba River, Middle Yuba River, Oregon Creek, and Yuba River downstream of Project facilities. Output also includes reservoir storage and elevation for New Bullards Bar and Englebright reservoirs,[5] generation from the New Colgate, Narrows 1, and Narrows 2 powerhouses, and agricultural deliveries to YCWA's Member Units.[6]

After developing, calibrating and validating the model, YCWA developed a No Action Alternative. The No Action Alternative includes a representation of the regulatory requirements affecting Project operations. The No Action Alternative also includes a representation of current agricultural irrigation demands served by the Project, and hydrology that results from the current operations of facilities owned and operated by others upstream from the Project. Lastly, the No Action Alternative includes a representation of Project operational practices such as New Bullards Bar Reservoir Target Operating Line operations, New Bullards Bar Reservoir carryover storage operations, New Colgate Powerhouse operations, and Englebright Reservoir operations – all of which are current operating practices in the watershed.[7]

[4] All daily deliveries are aggregated into a single daily diversion within the model.
[5] The model does not output storage of Our House and Log Cabin diversion dams since these impoundments are small and do not store water.
[6] Refer to Exhibit B, Table 5.2-2, for a list of YCWA's member units and their contract irrigation delivery quantities.
[7] Refer to Exhibit B for a full description of Project operations.

Hydrologic Datasets

To support the relicensing, YCWA compiled five hydrologic datasets: 1) a Historical Hydrology dataset; 2) a Without-Project Hydrology dataset; 3) a With-Project Hydrology dataset (i.e., No Action Alternative); 4) YCWA's Proposed Project (Existing) Hydrology dataset; and 5) YCWA's Proposed Project (Future) Hydrology dataset. Each hydrologic dataset is briefly described below.[8]

- Historical Hydrology (i.e., gaged flows). The Historical Hydrology dataset contains the measured (i.e., gaged) mean daily hydrology. This dataset is primarily composed of the measured hydrology from WYs 1970 through 2010 for the geographic area from just upstream of the Project to the United States Geological Survey's (USGS') Marysville streamflow gage, which is located on the Yuba River upstream of the Feather River. In addition, this dataset includes data from as early as 1900 for several gages. The Historical Hydrology dataset for locations downstream of Project facilities is representative of Project operations throughout its history.[9]
- Without-Project Hydrology. The Without-Project Hydrology dataset includes mean daily hydrology as if the Project had not been constructed (i.e., no Project facilities in place), but all other water projects in the basin are operating.[10] This dataset is comprised of measured hydrology and synthesized hydrology from WYs 1970 through 2010 for the geographic area from just upstream of the Project to USGS' Yuba River near Marysville gage. The Without-Project Hydrology for areas upstream from the Project is the measured hydrology from the Historical Hydrology dataset (i.e., inflow to the Project). The Without-Project Hydrology downstream of Project facilities is calculated from synthesized accretions for locations downstream from where inflows are measured plus the measured tributary inflows.
- With-Project Hydrology (i.e., No Action Alternative). The With-Project Hydrology dataset reflects current conditions, i.e., with the Project in operation). This dataset is comprised of mean daily hydrology for the geographic area from just upstream of the Project to USGS' Yuba River near Marysville gage for WYs 1970 through 2010. The measured inflows and synthesized accretions used in the Without-Project Hydrology are used as inputs to the Operations Model. The With-Project Hydrology dataset is the output from the No Action Alternative of the model.
- YCWA's Proposed Project (Existing) Hydrology. This dataset reflects conditions under YCWA's proposed Project with the existing level-of-development irrigation demands. This dataset is comprised of historical mean daily hydrology for the geographic area

[8] Refer to Appendix E6 for a full description of the hydrologic datasets.
[9] A significant shift in the Historical Hydrology occurred in 2006. From WY 1970 through WY 2005, the Project was operated under either the existing FERC license minimum flow requirements or the SWRCB's Revised Decision 1644 (RD-1644). Beginning in WY 2006, the Project was operated under the Yuba River Accord flow requirements, which are higher than the flow requirements in the existing FERC license.
[10] YCWA has not evaluated a Yuba basin "unimpaired flow" dataset for the relicensing because it would have no meaning for the relicensing. Other water projects, including SFWPA's South Feather Power Project, NID's Yuba-Bear Hydroelectric Project, and PG&E's Drum-Spaulding Project affect flow into YCWA's Yuba River Development Project. These upstream Projects are in various stages of relicensing. YCWA used the upstream historic regulated flows in the model.

immediately upstream from the Project to USGS' Yuba River near Marysville gage for WYs 1970 through 2010. The measured inflows and synthesized accretions used in the Without-Project and With-Project Hydrology datasets are used as inflows to the Operations Model. The YCWA Proposed Project (Existing) Hydrology is the output from the Operations Model. It is a simulation of the Project operations under YCWA's proposed Project conditions.

- YCWA's Proposed Project (Future) Hydrology. This dataset reflects conditions under YCWA's proposed Project with conditions in 2062. This dataset is comprised of synthetic mean daily hydrology for the geographic area immediately upstream from the Project, including new license conditions and water delivery demands for projects upstream from the Project, to USGS' Yuba River near Marysville gage for WYs 1975 through 2008. The synthetic flows resulting from simulations of the upstream projects are used as inflows to the Project, along with future irrigation demands from the Yuba River near Daguerre Point Dam. The YCWA's Proposed Project (Future) Hydrology is the output from the Operations Model is simulation of the Project operations under YCWA's proposed Project conditions with future-level inflows and water demands.

Table 3.3.2-1 lists the USGS- and YCWA-maintained gages within the Yuba River Basin that were used to develop the five hydrologic datasets.

Table 3.3.2-1. Streamflow gages and Project tunnel, powerhouse and reservoir gages.

USGS Gage Number	Name	Elevation (ft)	Drainage (sq mi)	Period of Record	
				Start	End
STREAMFLOW GAGES					
11408850	Middle Yuba River Near Camptonville	NA[1]	136	8/1/1967	9/30/1989
11408880[2]	Middle Yuba River Below Our House Diversion Dam, Near Camptonville	1,957.51	145	10/1/1968	Present
11409300	Oregon Creek At Camptonville	2,230	23	10/1/1967	9/30/2000
11409400[2]	Oregon Creek Below Log Cabin Diversion Dam, Near Camptonville	1,912.73	29.1	9/1 1968	Present
11413000	North Yuba River Below Goodyears Bar	2,453	250	10/1/1930	Present
11413300	Slate Creek Below SFWPA's Slate Creek Diversion Dam, Near Strawberry Valley	3,570	49.4	10/1/1960	Present
11413320	Deadwood Creek near Strawberry, CA	3,275	3.16	10/1/1994	Present
11413520	North Yuba River Below New Bullards Bar Dam, Near North San Juan	1,350	490	8/13/1966	9/30/2004
11413517[2]	North Yuba River Low Flow Release Below New Bullards Bar Dam	--	--	10/1/2003	Present
11417500	South Yuba River at Jones Bar, Near Grass Valley	1,060	308	10/1/1940	Present
11418000[2]	Yuba River Below USACE's Englebright Dam, Near Smartsville	278.68	1,108	10/1/1941	Present
11418500	Deer Creek Near Smartsville	630	84.6	10/1/1935	Present
11421000[2]	Yuba River Near Marysville	-2.95[3]	1,339	10/1/1943	Present
11420700	Dry Creek near Browns Valley	NA	87	8/1/1964	10/03/1980
TUNNEL FLOW/DIVERSION GAGES					
11408870	Lohman Ridge Diversion Tunnel At Intake, Near Camptonville	2,014.77	--	10/1/1988	Present
11409350	Camptonville Diversion Tunnel At Intake, Near Camptonville	1,952.00	--	10/1/1988	Present
11413250	Slate Creek Tunnel near Strawberry Valley, CA	NA	--	10/1/1962	Present
11420750	Browns Valley Irrigation Ditch near Browns Valley, CA	NA	--	3/25/1988	Present

Table 3.3.2-1 (continued)

USGS Gage Number	Name	Elevation (ft)	Drainage (sq mi)	Period of Record	
				Start	End
TUNNEL FLOW/DIVERSION GAGES (continued)					
11420760	Brophy South Canal near Marysville, CA	NA	--	10/1/1994	Present
11420770	Hallwood-Cordua Irrigation District Canal near Marysville, CA	NA	--	10/1/1987	Present
POWERHOUSE FLOW GAGES					
11417980	Narrows Powerhouse No. 2 Below USACE's Englebright Dam	--	--	10/1/1970	9/30/2006
11413510	New Colgate Powerplant Near French Corral	--	--	10/1/1966	Present
11417970	Narrows No. 1 Powerhouse at USACE's Englebright Dam (PG&E)	--	--	10/01/1974	9/30/2006
RESERVOIR STORAGE GAGES					
11413515	New Bullards Bar Reservoir Near North San Juan	1,965	489	1/1/1969	Present

Notes: Elevation and drainage per USGS records. (USGS 2004. Water Resources Data, California, Water Year 2004)
[1] NA = Not available
[2] These gages are used by YCWA to document compliance with the minimum flow requirements in the existing FERC license.
[3] This negative value was confirmed with USGS.

Figure 3.3.2-1 shows the location of each gage in the watershed.

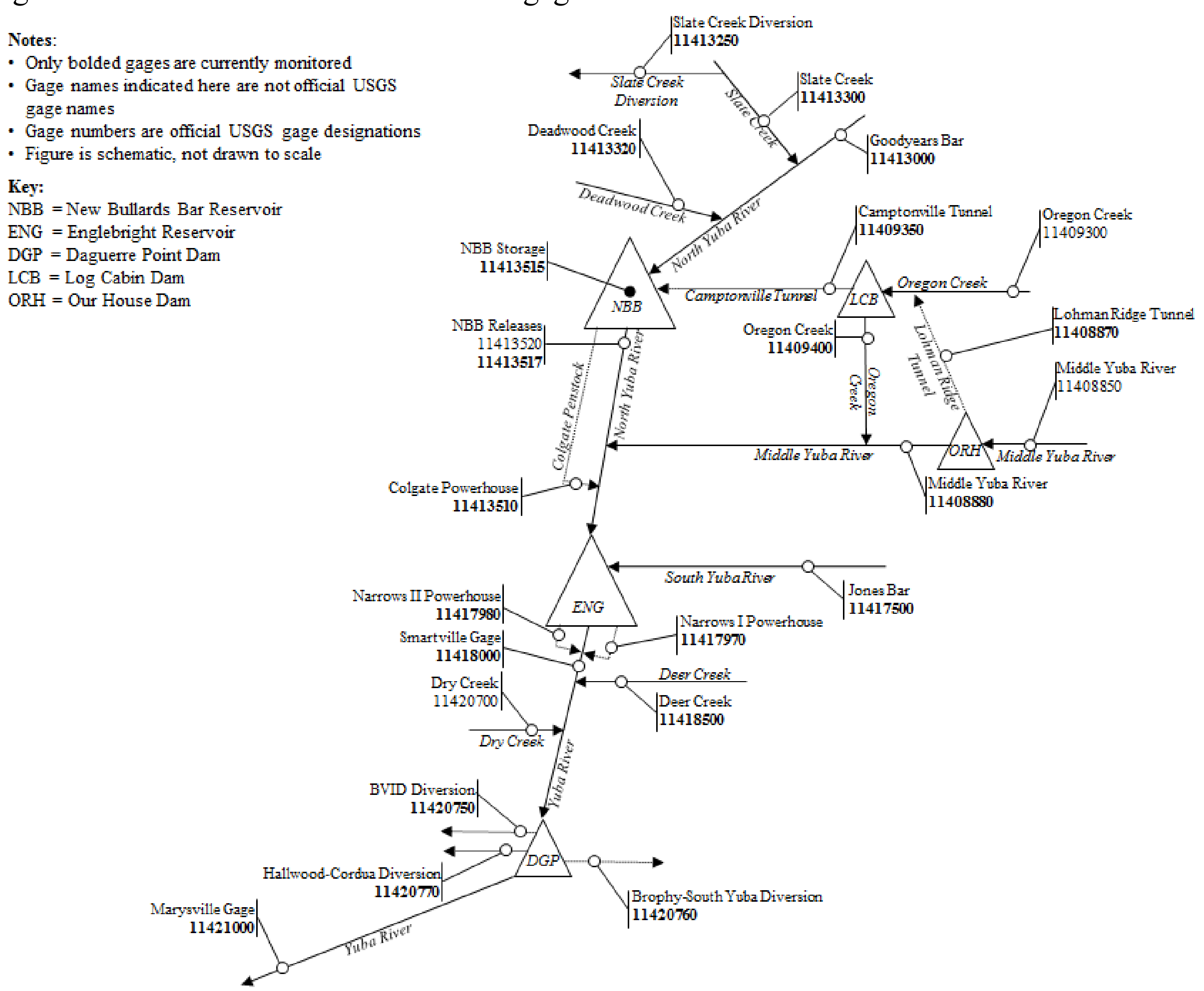

Figure 3.3.2-1. Schematic of the Project Vicinity, including USGS gage identification numbers.

Measured historical gage data were available from the following locations:

- North Yuba River below Goodyears Bar
- Slate Creek below SFWPA's South Feather Power Project's Slate Creek Diversion Dam
- Oregon Creek above Log Cabin Diversion Dam
- Oregon Creek below Log Cabin Diversion Dam
- Camptonville Tunnel
- Middle Yuba River above Our House Dam
- Middle Yuba River below Our House Dam
- Lohman Ridge Tunnel
- South Yuba River above Jones Bar
- Deer Creek below Nevada Irrigation District's Lake Wildwood Dam
- Dry Creek near its confluence with the Yuba River

When measured data were unavailable, historical accretions were synthesized using regressions relating watershed area, average annual precipitation, and hydrologic characteristics to historical gaged data from gages representing unimpaired watersheds. YCWA developed synthesized historical accretions for the following locations:[11]

- Canyon Creek inflow to the North Yuba River
- Accretions to Slate Creek below SFWPA's South Feather Power Project's Slate Creek Diversion Dam
- Accretions to the North Yuba River between Goodyears Bar and New Bullards Bar Reservoir
- Accretions to the North Yuba River between Slate Creek and New Bullards Bar Dam
- Accretions to Oregon Creek below the Log Cabin Diversion Dam
- Accretions to the Middle Yuba River between Our House Dam and the Middle Yuba River's confluence with Oregon Creek
- Accretions to the Middle Yuba River between its confluence with Oregon Creek and its confluence with the North Yuba River
- Accretions to the North Yuba and Yuba rivers between New Bullards Bar Dam and Colgate Powerhouse
- Accretions to the Yuba River between the Colgate Powerhouse and Englebright Dam

[11] The accretions were not calculated for specific locations in each reach, but are distributed accretions across the entire reach.

- Accretions to the South Yuba River below Jones Bar
- Dry Creek inflow to the Yuba River

The With-Project and YCWA's Proposed Project (Existing) Hydrology datasets also included a synthetic representation of agricultural water supply demands from Daguerre Point Dam. These demands were developed using 2005 irrigated land use within Yuba County and DWR-derived applied water rates.[12] The dataset of YCWA's Proposed Project (Future) Hydrology assumed a full build-out of YCWA's service area surface water irrigation demand.

YCWA Proposed Project (Future) Hydrology dataset relied on simulated inflows into the Project from the upstream projects - NID's Yuba-Bear Hydroelectric Project and PG&E's Drum-Spaulding Projects – assuming their new license flows, rather than historical flows.[13] Modeled Middle Yuba River flows below NID's Milton Diversion Dam from the upstream relicensing's' L061812-PBFSC Alternative run of NID's and PG&E's Yuba-Bear Water Balance/Operations model, reflecting both new FERC license conditions and 2062-level demands for both NID and for PCWA, were combined with accretions between the Milton Diversion Dam and the Our House Diversion Dam to develop an inflow timeseries for Middle Yuba River flow above Our House Diversion Dam. Similarly, modeled South Yuba River flow below Lake Spaulding, and Canyon Creek flows below Bowman-Spaulding Diversion Dam from NID's and PG&E's Yuba-Bear Water Balance/Operations model were combined with accretions between those points and Jones Bar to develop an inflow timeseries for the South Yuba River. An inflow timeseries for Slate Creek flow below SFWPA's Slate Creek Diversion Dam was developed using historical hydrology above the Slate Creek Diversion Dam, and a combination of water rights and the SFWPA pending FERC license. Within the Project area, the accretions described above were used in a consistent manner with the No Action, YCWA's Proposed Project (Existing), and Without-Project hydrology data sets. Each dataset is provided in Appendix E6 of this Exhibit E.

Project Flows and Storages

YCWA currently operates the Project is to meet New Bullards Bar Reservoir storage targets, USACE flood control requirements, FERC-required flow requirements, agricultural water supply demands, and YCWA's water rights. A complete description of the current Project operations is provided in Section 2, and a description of the Operations Model's representation of Project operations under the No Action Alternative can be found in Technical Memorandum 2-2, Appendix 2-2C, *Base Case Scenario Report,* in Appendix E6.

Table 3.3.2-2 provides, for Project flows and storages, the 0 percent (i.e., maximum), 10 percent (wet), 50 percent (median), 90 percent (dry) and 100 percent (minimum) exceedance values for the No Action Alternative model run. The average is also provided in the table.

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[12] In comparison, the Without-Project Hydrology dataset assumed only senior water right holders would receive agricultural surface water supply.
[13] Historical flows are used in the YCWA's Proposed Project (Existing) Hydrology dataset.

Table 3.3.2-2. No Action Alternative flows and storage by month from YCWA's With-Project Hydrology dataset.

Value	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
NEW BULLARDS BAR RESERVOIR STORAGE (ac-ft)												
0%	680,402	789,140	834,548	891,340	852,155	800,535	896,000	966,000	966,000	966,000	886,204	714,641
10%	655,319	643,181	711,758	792,891	791,607	796,000	842,680	938,411	966,000	901,326	773,750	691,745
50%	630,460	605,715	598,883	611,228	637,846	708,197	787,860	853,100	856,765	790,006	708,243	664,796
90%	493,486	467,449	477,745	506,801	540,882	611,012	681,030	735,478	697,285	630,132	565,788	525,819
100%	214,296	197,936	188,997	273,705	306,469	291,077	290,979	297,768	291,631	265,594	246,649	241,956
Average	*591,489*	*574,031*	*586,189*	*620,171*	*649,680*	*700,514*	*768,835*	*834,542*	*838,861*	*767,084*	*680,458*	*625,635*
NEW BULLARDS BAR RESERVOIR WATER-SURFACE ELEVATION (ft)												
0%	1,890	1,917	1,927	1,940	1,931	1,919	1,941	1,956	1,956	1,956	1,939	1,898
10%	1,883	1,880	1,898	1,918	1,917	1,918	1,929	1,950	1,956	1,942	1,913	1,892
50%	1,876	1,869	1,867	1,871	1,878	1,897	1,916	1,931	1,932	1,917	1,897	1,885
90%	1,836	1,827	1,830	1,840	1,850	1,871	1,890	1,904	1,894	1,876	1,858	1,846
100%	1,721	1,712	1,707	1,752	1,767	1,760	1,760	1,763	1,760	1,748	1,739	1,736
Average	*1,864*	*1,858*	*1,862*	*1,872*	*1,880*	*1,894*	*1,911*	*1,926*	*1,926*	*1,909*	*1,888*	*1,873*
NEW BULLARDS BAR MINIMUM FLOW POWERHOUSE RELEASE (RM 2.4) (cfs)												
0%	4	4	4	4	4	4	4	3	4	4	4	4
10%	4	4	4	4	4	4	3	3	3	3	4	4
50%	4	4	4	4	4	3	3	2	2	3	3	4
90%	3	3	3	3	3	2	2	2	2	2	3	3
100%	3	3	2	2	2	2	2	2	2	2	2	3
Average	*4*	*4*	*4*	*4*	*3*	*3*	*3*	*3*	*2*	*3*	*3*	*4*
NORTH YUBA RIVER BELOW NEW BULLARDS BAR RESERVOIR FLOW (RM 2.4) (cfs)												
0%	7	7	34,683	62,992	50,000	25,327	20,312	24,193	5,152	1,110	7	7
10%	7	7	7	7	7	1,032	7	473	511	7	7	7
50%	7	7	7	7	7	7	7	7	7	7	7	7
90%	6	6	6	6	6	6	6	6	6	6	6	6
100%	6	6	6	6	6	6	6	6	6	6	6	6
Average	*7*	*7*	*245*	*601*	*361*	*466*	*162*	*320*	*211*	*11*	*7*	*7*
MIDDLE YUBA RIVER FLOW BELOW OUR HOUSE DIVERSION DAM FLOW (RM 12.6) (cfs)												
0%	302	4,460	12,673	20,141	17,052	7,040	6,091	7,709	1,869	313	33	33
10%	33	33	33	259	186	270	146	398	53	33	33	33
50%	33	33	33	33	33	33	38	53	38	33	33	33
90%	24	24	24	24	24	24	29	38	29	24	23	22
100%	15	19	22	24	24	24	24	38	24	12	12	13
Average	*30*	*60*	*137*	*222*	*160*	*153*	*118*	*170*	*80*	*32*	*30*	*30*
LOHMAN RIDGE TUNNEL DIVERSION FLOW (cfs)												
0%	860	860	860	860	860	860	860	860	860	860	93	197
10%	33	244	617	860	860	860	860	860	815	137	31	17
50%	5	18	72	185	295	413	424	433	115	25	6	3
90%	0	3	7	22	56	167	175	92	21	4	0	0
100%	0	0	0	0	0	14	21	17	1	0	0	0
Average	*17*	*88*	*186*	*304*	*359*	*467*	*466*	*456*	*259*	*62*	*12*	*7*

Table 3.3.2-2. (continued)

Value	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
MIDDLE YUBA RIVER FLOW ABOVE OREGON CREEK FLOW (RM 4.75) (cfs)												
0%	396	5,156	14,050	22,136	19,131	7,628	7,313	8,231	1,905	323	39	69
10%	38	71	149	485	384	464	256	483	104	40	36	35
50%	35	36	42	66	86	104	100	80	47	36	34	34
90%	25	27	34	37	43	62	49	50	34	25	24	23
100%	16	20	23	26	26	28	29	42	25	12	12	13
Average	*34*	*78*	*187*	*311*	*255*	*255*	*188*	*212*	*93*	*36*	*32*	*32*
OREGON CREEK FLOW BELOW LOG CABIN DIVERSION DAM FLOW (RM4.3) (cfs)												
0%	9	1,114	2,822	4,479	3,809	1,633	2,139	1,076	13	9	9	9
10%	9	9	9	142	115	123	13	13	13	9	9	9
50%	8	9	9	9	9	9	9	13	9	9	8	6
90%	2	6	7	7	7	7	8	9	8	7	2	1
100%	1	1	3	4	4	7	7	9	3	1	1	1
Average	*6*	*16*	*44*	*79*	*64*	*53*	*27*	*18*	*10*	*8*	*6*	*5*
CAMPTONVILLE TUNNEL DIVERSIONS FLOW (cfs)												
0%	1,034	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,000	876	106	259
10%	33	309	836	1,100	1,100	1,100	1,061	1,001	855	141	29	13
50%	0	16	85	250	405	556	542	484	119	22	1	0
90%	0	0	4	23	67	219	207	98	19	0	0	0
100%	0	0	0	0	0	16	16	16	0	0	0	0
Average	*16*	*106*	*240*	*399*	*480*	*614*	*574*	*519*	*274*	*60*	*9*	*5*
OREGON CREEK FLOW ABOVE ITS CONFLUENCE WITH THE MIDDLE YUBA RIVER FLOW (RM 01) (cfs)												
0%	43	1,362	3,382	5,343	4,550	1,975	2,574	1,317	54	22	11	22
10%	11	23	49	212	186	190	56	48	23	11	10	10
50%	9	10	12	21	28	34	31	22	13	10	9	6
90%	2	7	9	10	13	19	14	13	9	7	2	2
100%	1	1	3	4	4	8	8	11	3	1	1	1
Average	*7*	*22*	*62*	*111*	*97*	*89*	*52*	*33*	*15*	*9*	*7*	*6*
MIDDLE YUBA RIVER FLOW BELOW OREGON CREEK FLOW (RM 4.65) (cfs)												
0%	439	6,517	16,982	26,718	23,681	9,530	9,887	9,194	1,930	335	51	91
10%	49	94	200	701	583	688	309	532	132	51	46	45
50%	43	46	54	87	114	138	132	102	61	46	43	40
90%	28	34	42	47	56	81	64	63	43	32	26	25
100%	17	22	27	32	33	36	37	53	29	13	13	14
Average	*41*	*100*	*249*	*422*	*352*	*344*	*239*	*244*	*108*	*45*	*39*	*38*
MIDDLE YUBA RIVER FLOW ABOVE ITS CONFLUENCE WITH THE NORTH YUBA RIVER FLOW (RM 0.1) (cfs)												
0%	507	7,017	17,972	28,461	25,176	10,221	10,766	9,570	1,955	342	56	118
10%	54	122	281	886	733	812	407	590	162	56	48	47
50%	45	48	62	112	154	190	173	123	69	48	44	41
90%	29	35	45	51	64	101	76	68	43	33	27	25
100%	18	23	28	34	35	39	41	55	29	14	14	15
Average	*43*	*113*	*285*	*486*	*420*	*418*	*289*	*274*	*118*	*48*	*41*	*39*

Table 3.3.2-2. (continued)

Value	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
YUBA RIVER FLOW BELOW THE CONFLUENCE OF THE NORTH YUBA AND MIDDLE YUBA RIVERS FLOW (RM 40.0) (cfs)												
0%	514	7,023	42,067	90,917	64,807	35,548	31,077	33,497	7,107	1,332	62	125
10%	61	129	293	1,357	1,126	1,921	431	1,082	645	63	55	54
50%	52	55	69	118	161	199	180	130	76	55	51	48
90%	34	41	51	58	71	108	82	74	50	39	33	31
100%	23	28	34	39	40	44	46	61	35	19	19	20
Average	*50*	*119*	*530*	*1,087*	*781*	*884*	*452*	*595*	*329*	*59*	*47*	*46*
YUBA RIVER FLOW ABOVE THE NEW COLGATE POWERHOUSE FLOW (RM 34.2) (cfs)												
0%	590	7,588	43,344	92,537	66,231	36,329	32,069	33,921	7,136	1,343	72	154
10%	66	160	391	1,568	1,310	2,038	541	1,138	680	68	58	56
50%	53	58	79	147	206	258	225	152	83	57	52	50
90%	35	43	54	62	80	132	96	79	50	40	33	31
100%	24	29	35	41	42	48	50	64	36	20	20	21
Average	*52*	*134*	*570*	*1,159*	*858*	*967*	*508*	*628*	*340*	*62*	*49*	*47*
NEW COLGATE POWERHOUSE RELEASE (cfs)												
0%	1,089	3,430	3,430	3,430	3,430	3,430	3,430	3,430	3,430	3,430	3,430	2,209
10%	858	931	3,410	3,430	3,430	3,430	3,430	3,430	3,430	3,430	2,178	966
50%	746	720	589	1,047	1,420	1,486	1,176	2,246	2,230	1,576	1,368	793
90%	596	505	245	155	196	142	366	1,098	1,124	1,281	946	612
100%	0	0	0	0	0	0	0	0	406	500	241	0
Average	*733*	*798*	*955*	*1,428*	*1,771*	*1,770*	*1,529*	*2,195*	*2,259*	*1,933*	*1,522*	*770*
YUBA RIVER FLOW BELOW THE NEW COLGATE POWERHOUSE FLOW (RM 34.0) (cfs)												
0%	1,171	11,018	43,344	92,537	66,231	36,329	32,069	33,921	10,566	4,773	3,497	2,281
10%	909	1,093	3,630	4,302	4,481	5,301	3,816	4,554	4,110	3,495	2,236	1,018
50%	797	776	660	1,267	1,835	1,900	1,400	2,447	2,307	1,633	1,423	841
90%	653	577	433	408	407	384	474	1,197	1,189	1,322	989	659
100%	227	130	107	139	141	154	146	384	591	524	263	136
Average	*785*	*931*	*1,526*	*2,587*	*2,629*	*2,737*	*2,037*	*2,823*	*2,599*	*1,995*	*1,571*	*817*
NARROWS 2 POWERHOUSE RELEASE (cfs)												
0%	1,475	3,400	3,400	3,400	3,400	3,400	3,400	3,400	3,400	3,400	2,873	1,650
10%	900	900	3,400	3,400	3,400	3,400	3,400	3,400	3,400	2,896	1,575	900
50%	119	124	59	900	1,923	2,070	1,323	2,223	1,660	968	900	128
90%	0	49	0	0	0	0	0	900	900	900	900	0
100%	0	0	0	0	0	0	0	0	0	0	0	0
Average	*353*	*383*	*798*	*1,531*	*1,893*	*1,958*	*1,681*	*2,077*	*1,915*	*1,375*	*1,044*	*402*
YUBA RIVER FLOW NEAR SMARTSVILLE FLOW (RM 23.9) (cfs)												
0%	2,205	24,828	66,396	130,044	93,168	54,292	46,179	48,203	15,384	8,080	3,603	2,380
10%	965	1,475	4,279	6,214	6,313	7,532	5,220	6,756	6,123	3,637	2,305	1,065
50%	852	856	790	1,596	2,695	2,919	2,073	3,147	2,443	1,703	1,459	881
90%	700	806	700	700	700	812	860	1,353	1,262	1,353	1,025	700
100%	528	600	550	550	550	700	250	573	639	530	271	149
Average	*852*	*1,185*	*2,117*	*3,635*	*3,718*	*3,899*	*2,928*	*3,741*	*3,243*	*2,135*	*1,619*	*863*

Table 3.3.2-2. (continued)

Value	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
YUBA RIVER FLOW BELOW DEER CREEK FLOW (RM 23.1) (cfs)												
0%	2,526	26,108	73,646	137,694	99,838	56,622	49,519	49,723	15,423	8,095	3,616	2,386
10%	975	1,540	4,549	7,043	7,194	8,011	5,574	6,888	6,157	3,646	2,307	1,073
50%	892	869	808	1,746	2,875	3,141	2,192	3,187	2,452	1,707	1,462	888
90%	761	822	706	709	758	836	921	1,360	1,266	1,354	1,027	703
100%	529	602	603	582	578	706	256	575	639	530	272	150
Average	*886*	*1,235*	*2,259*	*3,901*	*4,038*	*4,201*	*3,087*	*3,807*	*3,260*	*2,140*	*1,623*	*869*
YUBA RIVER FLOW BELOW DRY CREEK FLOW (RM 13.4) (cfs)												
0%	2,558	26,300	75,027	143,085	104,722	58,999	52,340	50,219	15,432	8,103	3,622	2,393
10%	983	1,543	4,587	7,520	7,558	8,487	5,951	6,955	6,165	3,654	2,314	1,079
50%	899	873	825	1,801	3,007	3,341	2,290	3,192	2,459	1,715	1,469	894
90%	767	824	719	716	796	862	943	1,364	1,273	1,361	1,034	710
100%	534	603	616	605	599	712	262	576	646	536	279	156
Average	*894*	*1,244*	*2,298*	*4,088*	*4,273*	*4,509*	*3,221*	*3,829*	*3,267*	*2,148*	*1,630*	*876*
AGRICULTURAL DIVERSIONS FROM THE DAGUERRE POINT DIVERSION DAM DIVERSION (cfs)												
0%	483	415	338	160	46	36	656	830	1,007	1,092	1,057	623
10%	468	388	320	151	28	26	495	792	956	1,056	1,035	435
50%	370	363	209	69	8	9	85	702	848	1,002	774	278
90%	271	324	168	48	5	5	8	427	760	954	536	196
100%	134	203	129	11	4	4	7	278	401	466	209	86
Average	*374*	*357*	*230*	*92*	*13*	*14*	*183*	*654*	*850*	*991*	*788*	*303*
YUBA RIVER FLOW BELOW THE DAGUERRE POINT DIVERSION DAM FLOW (RM 11.6) (cfs)												
0%	2,108	25,963	74,839	142,961	104,715	58,993	52,332	49,508	14,653	7,093	2,899	1,770
10%	652	1,171	4,374	7,464	7,551	8,478	5,932	6,325	5,330	2,628	1,376	747
50%	500	500	593	1,695	2,992	3,319	2,093	2,576	1,518	700	600	567
90%	400	500	500	575	776	844	686	600	400	400	400	408
100%	400	400	400	500	561	684	245	245	245	70	70	70
Average	*520*	*887*	*2,068*	*3,996*	*4,260*	*4,495*	*3,038*	*3,176*	*2,418*	*1,157*	*842*	*573*
YUBA RIVER FLOW NEAR MARYSVILLE FLOW (RM 6.2) (cfs)												
0%	2,108	25,963	74,839	142,961	104,715	58,993	52,332	49,508	14,653	7,093	2,899	1,770
10%	652	1,171	4,374	7,464	7,551	8,478	5,932	6,325	5,330	2,628	1,376	747
50%	500	500	593	1,695	2,992	3,319	2,093	2,576	1,518	700	600	567
90%	400	500	500	575	776	844	686	600	400	400	400	408
100%	400	400	400	500	561	684	245	245	245	70	70	70
Average	*520*	*887*	*2,068*	*3,996*	*4,260*	*4,495*	*3,038*	*3,176*	*2,418*	*1,157*	*842*	*573*

YCWA uses in its Application for New License the With-Project Hydrology dataset, rather than the Historical Hydrology dataset, to describe the No Action Alternative conditions for two reasons. First, as described above, since 2006 the Project has been operated in accordance with the Yuba Accord flow schedule, which is significantly higher than the FERC flow requirements to which the Project operated from about 1970 through 2005. Therefore, the Historical Hydrology dataset would understate existing hydrology conditions. Second, the Yuba Accord flows have only been in effect since 2006. The With-Project Hydrology dataset incorporates 41 years of hydrology, rather than 5 years.

Existing Beneficial Uses of Project Waters

Table 1.3-2 lists the existing designated beneficial uses of water in the Project Vicinity, as specified in the Basin Plan (CVRWQCB 1998). These beneficial uses include: 1) municipal and domestic water supply; 2) agricultural water supply (irrigation); 3) industrial process supply; 4) industrial service supply (power generation); 5) water contact recreation; 6) non-water contact recreation; 7) warm freshwater habitat; 8) cold freshwater habitat; 9) migration of aquatic organisms; 10) spawning; and 11) wildlife habitat.

Information on Existing and Proposed Water Rights that Might Affect or be Affected by the Project

Table 2.1-6 provides a list of water rights held by YCWA for power generation. Provided below is a description of other existing or proposed water rights potentially affecting or affected by the Project.

Numerous water rights holders divert and store waters upstream of the Project Area. The upstream projects with significant impacts on inflows to the Project include SFWPA's South Feather Power Project, NID's Yuba-Bear Hydroelectric Project, and PG&E's Drum-Spaulding Project. These projects are described in Sections 3.1.1.2, 3.1.1.4 and 3.1.1.6, respectively. Tables 3.3.2-3, 3.3.2-4, 3.3.2-5 and 3.3.2-6 show the historic average upstream-of-the-Project diversions in cfs and total annual diversions in ac-ft for each of these three projects in representative dry, normal and wet WYs.

Table 3.3.2-3. North Yuba River sub-basin diversions by SFWPA's South Feather Power Project - Slate Creek Diversion Dam diversions for representative WY types.

Year Type	Representative Water Year (WY)	Average Diversion (cfs)	Annual Diversion (ac-ft)
Dry	2001	68	48,995
Normal	2003	141	102,108
Wet	1995	209	151,075

Source: USGS Gage 11413250, Slate C Tunnel Nr Strawberry Valley CA. http://waterdata.usgs.gov/nwis/dv/?referred_module=sw

Table 3.3.2-4. Middle Yuba River sub-basin diversions by NID's Yuba-Bear Hydroelectric Project – Milton Diversion Dam diversions for representative WY types.

Year Type	Representative Water Year (WY)	Average Diversion (cfs)	Annual Diversion (ac-ft)
Dry	2001	52	37,376
Normal	2003	93	67,420
Wet	1995	59	42,718

Source: USGS Gage 11408000, Milton-Bowman Tunnel Outlet Nr Graniteville CA. http://waterdata.usgs.gov/nwis/dv/?referred_module=sw.
Note: These values should be considered estimates, as tunnel gage statistics do not take into account changes in upstream storage.

Table 3.3.2-5. South Yuba River sub-basin diversions by NID's Yuba-Bear Hydroelectric Project – Bowman-Spaulding Diversion Conduit diversions for representative WY types.

Year Type	Representative Water Year (WY)	Average Diversion (cfs)	Annual Diversion (ac-ft)
Dry	2001	165	119,573
Normal	2003	245	177,507
Wet	1995	235	169,860

Source: USGS Gage 11416100 – Bowman Spaulding Canal at Jordan Canal Siphon, CA.
http://waterdata.usgs.gov/nwis/dv/?referred_module=sw. Note: These values should be considered estimates, as tunnel gage statistics do not take into account changes in upstream storage.

Table 3.3.2-6. South Yuba River sub-basin diversions by PG&E's Drum-Spaulding Project – Spaulding Dam diversions for representative WY types.

Year Type	Representative Water Year (WY)	Average Diversion (cfs)	Annual Diversion (ac-ft)
Dry	2001	403	291,647
Normal	2003	634	458,644
Wet	1995	698	505,271

Source: USGS Gage 11414170, Drum Canal at Tunnel Outlet near Emigrant Gap, CA
USGS Gage 11414200, South Yuba Canal near Emigrant Gap, CA. http://waterdata.usgs.gov/nwis/dv/?referred_module=sw.
Note: These values should be considered estimates, as tunnel gage statistics do not take into account changes in upstream storage.

Water Rights within the Project Area

YCWA holds pre-1914 appropriative rights dating from 1897 and post-1914 appropriative rights confirmed by water right licenses, for the purpose of operating the Project for water supply purposes. Several of these water rights also allow for the diversion or storage of water, in addition to generation, from the North Yuba River, Middle Yuba River, Oregon Creek, and the Yuba River. These water rights are listed, with their date of priority, source, amount and place of diversion or storage, season of applicability, and their place of beneficial use in Table 2.1-6.

Water Rights Downstream of the Project Area Affected by the Project

Several entities, including YCWA, hold water rights for diversion from the Yuba River downstream from the Project. Those water rights holders include: YCWA, PG&E, BVID, CID, the HIC, several mining companies within the Yuba Goldfields, and several diverters with riparian rights downstream from the Daguerre Point Dam. This section provides a summary of water rights downstream of the Project area, potentially affected by the Project.

YCWA has post-1914 appropriative rights to store water in New Bullards Bar Reservoir for later re-diversion that were amended in 2003 by the SWRCB in Revised Decision 1644 (RD-1644) to include Daguerre Point Dam as a place of re-diversion. Those rights, Permits 15026, 15027, and 15030, are used to provide agricultural water supply to YCWA's member units.

PG&E has a post-1914 appropriative right, License 6388, to divert up to 700 cfs year around of Yuba River water through the Narrows 1 Powerhouse at Englebright Dam, and up to 45,000 ac-ft to storage in Englebright Reservoir between about October 1 to about March 1 of the succeeding year.

BVID holds a pre-1914 water right for agricultural use that was also amended by RD-1644 for a total of 24,462 ac-ft per year. BVID diverts from the Yuba River approximately 0.9 mi upstream of Daguerre Point Dam from its Pumpline Diversion Facility.

CID holds a pre-1914 water right for a diversion of 200 cfs of agricultural water use and two post-1914 appropriative rights, Licenses 3984 and 3985, for diversion of 40 cfs and 50 cfs, respectively. CID diverts from the Yuba River at the north abutment of Daguerre Point Dam into the Cordua-Hallwood Canal.

HIC holds an un-finalized pre-1914 water right for diversion of 150 cfs, and a post-1914 appropriative right, License 4443, for diversion of 100 cfs from April 1 through November 1 for agricultural water use. HIC diverts from the Yuba River at the north abutment of Daguerre Point Dam into the Cordua-Hallwood Canal.

Within the Yuba Goldfields, several mining companies, including the Yuba Goldfield Development Company, Western Water Company, and Western Aggregates, Inc. claim both riparian and pre-1914 appropriative water rights.

There are several diverters who claim riparian water rights within the Dantoni Area along the Yuba River downstream from Daguerre Point Dam.

3.3.2.1.2 Water Quality

This section first describes the regulatory context of water quality in the basins and sub-basins, and then describes existing water quality conditions in five areas: 1) general water quality, including results of synoptic dissolved oxygen sampling (DO); 2) water temperature and DO conditions in reservoirs; 3) water temperature conditions in streams; 4) YCWA's water temperature models; and 5) the CWA Section 303(d) constituent mercury and existing conditions regarding mercury bioaccumulation in fish.

Regulatory Context

Basin Plan

As described in Section 1.3, the Basin Plan establishes water quality standards for the Yuba River Basin. The standards are composed of designated existing and potential beneficial uses and water quality objectives to protect the beneficial uses. Water Quality Objectives (WQOs) that correlate with the designated beneficial uses listed in Table 1.3-2, are repeated below in

Table 3.3.2-7. The objectives are primarily narrative, incorporating California's numeric Title 22 drinking water standards by reference.

Table 3.3.2-7. Water quality objectives to support beneficial uses in the vicinity of the Project as designated by the CVRWQCB and listed in the Basin Plan.

Water Quality Objective	Description
Bacteria	In terms of fecal coliform. Less than a geometric average of 200/100 ml on five samples collected in any 30-day period and less than 400/100 ml on ten percent of all samples taken in a 30-day period.
Biostimulatory Substances	Water shall not contain biostimulatory substances that promote aquatic growth in concentrations that cause nuisance or adversely affect beneficial uses.
Chemical Constituents	Waters shall not contain chemical constituents in concentrations that adversely affect beneficial uses. Specific trace element levels are given for certain surface waters, none of which include the waters in the vicinity of the Project. Electrical conductivity (at 77 ºF) shall not exceed 150 micromhos (µmhos)/cm (90 percentile) in well-mixed waters of the Feather River from the Fish Barrier Dam at Oroville to Sacramento River. Other limits for organic, inorganic and trace metals are provided for surface waters that are designated for domestic or municipal water supply. In addition, waters designated for municipal or domestic use must comply with portions of Title 22 of the California Code of Regulations. For protection of aquatic life, surface water in California must also comply with the California Toxics Rule (40 C.F.R. Part 131).
Color	Water shall be free of discoloration that causes a nuisance or adversely affects beneficial uses.
Dissolved Oxygen (DO)	Monthly median of the average daily dissolved oxygen concentration shall not fall below 85 percent of saturation in the main water mass, and the 95 percent concentration shall not fall below 75 percent of saturation. Minimum level of 7 mg/L. Specific DO water quality objectives below Oroville dam are 8.0 mg/L from September 1 to May 31, for Feather River from Fish Barrier Dam at Oroville to Honcut Creek (surface water body #40). When natural conditions lower dissolved oxygen below this level, the concentrations shall be maintained at or above 95 percent of saturation.
Floating Material	Water shall not contain floating material in amounts that cause a nuisance or adversely affect beneficial uses.
Oil & Grease	Water shall not contain oils, greases, waxes or other material in concentrations that cause a nuisance, result in visible film or coating on the surface of the water or on objects in the water, or otherwise adversely affect beneficial uses.
PH	The pH of surface waters will remain between 6.5 and 8.5, and cause changes of less than 0.5 in receiving water bodies.
Pesticides	Waters shall not contain pesticides or a combination of pesticides in concentrations that adversely affect beneficial uses. Other limits established as well.
Radioactivity	Radionuclides shall not be present in concentrations that are harmful to human, plant, animal or aquatic life nor that result in the accumulation of radionuclides in the food web to an extent that presents a hazard to human, plant, animal or aquatic life.
Sediment	The suspended sediment load and suspended-sediment discharge rate of surface waters shall not be altered in such a manner as to cause a nuisance or adversely affect beneficial uses.
Settleable Material	Waters shall not contain substances in concentrations that result in the deposition of material that causes a nuisance or adversely affects beneficial uses.
Suspended Material	Waters shall not contain suspended material in concentrations that cause a nuisance or adversely affect beneficial uses.
Tastes and Odor	Water shall not contain taste- or odor-producing substances in concentrations that impart undesirable tastes and odors to domestic or municipal water supplies or to fish flesh or other edible products of aquatic origin, or that cause nuisance, or otherwise adversely affect beneficial uses.
Temperature	The natural receiving water temperature of interstate waters shall not be altered unless it can be demonstrated to the satisfaction of the Regional Water Quality Control Board that such alteration in temperature does not adversely affect beneficial uses. Increases in water temperatures must be less than 5 ºF above natural receiving-water temperature.
Toxicity	All waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life. Compliance with this objective will be determined by analyses of indicator organisms, species diversity, population density, growth anomalies, and biotoxicity tests as specified by the Regional Water Quality Control Board.

Table 3.3.2-7. (continued)

Water Quality Objective	Description
Turbidity	In terms of changes in turbidity (NTU) in the receiving water body: where natural turbidity is 0 to 5 NTUs, increases shall not exceed 1 NTU; where 5 to 50 NTUs, increases shall not exceed 20 percent; where 50 to 100 NTUs, increases shall not exceed 10 NTUs; and where natural turbidity is greater than 100 NTUs, increase shall not exceed 10 percent.

Source: CVRWQCB 1998.

[1] Methylmercury objectives in the Basin Plan are waterbody-specific and do not apply to waterbodies in the Project Area or Vicinity. The radioactivity and suspended material objectives do not apply to the Project. Project O&M does not contribute radioactive or suspended material into the Yuba River or its impoundments.

[2] There is no waterbody specific salinity objective that applies to the Project Vicinity. Salinity is therefore addressed thorough the chemical constituents objective.

[3] Table 3.3.2-8 lists numeric standards, criteria, and benchmarks for water quality constituents that do not have numeric Basin Plan objectives.

[4] Tastes and Odors limits for drinking water are provided as secondary MCLs in Title 22 of the California Code of Regulations.

Two of the Basin Plan WQOs, Temperature and Turbidity, include, at least in part, a criterion limiting changes to receiving water. The Temperature objective states that "natural receiving waters" should not be warmed by more than 5 degrees Fahrenheit (°F), while the Turbidity objective provides restrictions for percentage increases in turbidity. These objectives are difficult to apply to a hydroelectric project because one cannot easily identify "natural receiving waters" or ambient conditions as one could with, for instance, a point-source discharge. The analysis in this section makes a good faith effort to apply the intent of the Basin Plan's Temperature and Turbidity objectives.

Similarly, application of the Basin Plan's Temperature and DO objectives to the Project's New Bullards Bar Reservoir is difficult due to seasonal reservoir stratification. For instance, a reservoir may comply entirely with the Basin Plan's DO objective throughout the entire water column except in the thin layer of water near the bottom, which may have no effect on designated beneficial uses. Again, the analysis in this document makes a good faith effort to apply the intent of the Basin Plan's Temperature and DO objectives to New Bullards Bar Reservoir.

Surface Water Quality Protective Standards, Criteria and Benchmarks

When Basin Plan WQOs are not numeric, values excerpted from other regulations and/or literature sources can assist with data interpretation. For example, the California Toxics Rule (CTR) specifies aquatic toxicity criteria for several constituents, including metals (USEPA 2000). Table 3.3.2-8 lists water quality guidelines, criteria and benchmark values used by YCWA in Technical Memorandum 2-3, *Water Quality*, and Technical Memorandum 2-4, *Water Temperature*, which are located in Appendix E6, to help interpret water quality measurements.

Table 3.3.2-8. Water quality standards, criteria and benchmark values used for evaluating the protection of designated beneficial uses in the vicinity of the Yuba River Development Project.[1]

Analyte	Symbol or Abbreviation	Standard, Criteria or Benchmark Value	Reference	Notes
BACTERIA (MUN, REC-1)				
Total coliform	--	< 10,000 MPN per 100 mL < 240 MPN per 100 mL (geometric mean)	USEPA 2003a	Water contact recreation, single-day sample; Water contact recreation, 30-day geometric mean

Table 3.3.2-8. (continued)

Analyte	Symbol or Abbreviation	Standard, Criteria or Benchmark Value	Reference	Notes
BACTERIA (MUN, REC-1) (continued)				
Fecal coliform	--	< 200 MPN per 100 mL (geometric mean); < 10% of samples > 400 MPN per 100 mL	CVRWQCB 1998	Water contact recreation, 30-day geometric mean; with individual samples not > 400 MPN/100 mL
Escherichia coli	*E. coli*	< 126 MPN per 100 mL (geometric mean) < 235 MPN per 100 mL in any single sample	CVRWQCB 2002; USEPA 2003a	Water contact recreation, 30-day geometric mean
BIOSTIMULATORY SUBSTANCES (COLD, SPAWN)				
Total Kjeldahl Nitrogen	TKN	None	--	--
Total Phosphorous	TP	None	--	--
CHEMICAL CONSTITUENTS (AGR, COLD, MUN, REC-1)				
Alkalinity	--	20 mg/L	Marshack 2008	USEPA AWQC; can affect water treatment
Arsenic	As	0.010 mg/L	CDPH 2010 cited in CVRWQCB 1998	Title 22 Primary MCL[2]
Cadmium	Cd	5 µ/L	CDPH 2010 cited in CVRWQCB 1998	Title 22 Primary MCL[2]
Calcium	Ca	None	--	--
Chloride	Cl	250 mg/L	CDPH 2010 cited in CVRWQCB 1998	Title 22 Secondary MCL[2]
CHEMICAL CONSTITUENTS (AGR, COLD, MUN, REC-1) (cont.)				
Chromium (total)	Cr (total)	50 µg/L	CDPH 2010 cited in CVRWQCB 1998	Title 22 Primary MCL[2]
Copper	Cu	1 mg/L	CDPH 2010 cited in CVRWQCB 1998	Title 22 Secondary MCL[2]
Lead	Pb	15 µg/L	CDPH 2010 cited in CVRWQCB 1998	Title 22 Primary MCL[2]
Mercury (inorganic)	Hg	0.002 mg/L	CDPH 2010 cited in CVRWQCB 1998	Title 22 Primary MCL[2]
Methylmercury		0.07-0.44 mg/L wet-weight in edible fish tissue	Klasing and Brodberg 2008	OEHHA Advisory Tissue Level
Nickel	Ni	0.1 mg/L	CDPH 2010 cited in CVRWQCB 1998	Title 22 Primary MCL[2]
Nitrate	NO_3	45 mg/L	CDPH 2010 cited in CVRWQCB 1998	Title 22 Primary MCL[2]
Nitrite	NO_2	1 mg/L	CDPH 2010 cited in CVRWQCB 1998	Title 22 Primary MCL[2]
Nitrate + Nitrite	$NO_3 + NO_2$	10 mg/L (combined total)	CDPH 2010 cited in CVRWQCB 1998	Title 22 Primary MCL[2]
Potassium	K	None	--	--
Selenium	Se	0.05 mg/L	CDPH 2010 cited in CVRWQCB 1998	Title 22 Primary MCL[2]
Sodium	Na	20 mg/L	Marshack 2008	Sodium Restricted Diet[3]
Specific conductance	--	150 µmhos	CVRWQCB 1998	Aquatic Life Protection
Zinc	Zn	5 mg/L	CDPH 2010 cited in CVRWQCB 1998	Title 22 Secondary MCL[2]
DISSOLVED OXYGEN (COLD, SPAWN)				
Dissolved Oxygen	DO	> 7 mg/L (minimum)	CVRWQCB 1998	Aquatic life protection
FLOATING MATERIAL (REC-1, REC-2)				
Floating Material	--	Narrative Criteria	CVRWQCB 1998	Aesthetics – Absent by visual observation
OIL & GREASE (REC-1, REC-2)				
Oil & Grease	--	Narrative	CVRWQCB 1998	Aesthetics – Absent by visual observation
Total Petroleum Hydrocarbons	TPH	None	--	--
pH (MUN, COLD, SPAWN, WILD)				
pH	--	6.5-8.5	CVRWQCB 1998	Aquatic life protection

Table 3.3.2-8. (continued)

Analyte	Symbol or Abbreviation	Standard, Criteria or Benchmark Value	Reference	Notes
SEDIMENT AND SETTLEABLE SOLIDS (REC-2, SPAWN, WILD)				
Sediment	--	Narrative	CVRWQCB 1998	See Geology and Soil Resources
TASTES & ODOR (MUN)				
Aluminum	Al	0.2 mg/L	CDPH 2010 cited in CVRWQCB 1998	22 CCR §64449 Secondary MCL
Chloride	Cl	250 mg/L	CDPH 2010 cited in CVRWQCB 1998	22 CCR §64449 Secondary MCL
Copper	Cu	1.0 mg/L	CDPH 2010 cited in CVRWQCB 1998	22 CCR §64449 Secondary MCL
Iron	Fe	0.3 mg/L	CDPH 2010 cited in CVRWQCB 1998	22 CCR §64449 Secondary MCL
Silver	Ag	0.1 mg/L	CDPH 2010 cited in CVRWQCB 1998	22 CCR §64449 Secondary MCL
Specific conductance	--	900 µS/cm	CDPH 2010 cited in CVRWQCB 1998	22 CCR §64449 Secondary MCL
Sulfate	SO_4^{2-}	250 mg/L	CDPH 2010 cited in CVRWQCB 1998	22 CCR §64449 Secondary MCL
Total Dissolved Solids	TDS	500 mg/L	CDPH 2010 cited in CVRWQCB 1998	22 CCR §64449 Secondary MCL
Zinc	Zn	5 mg/L	CDPH 2010 cited in CVRWQCB 1998	22 CCR §64449 Secondary MCL
TEMPERATURE (COLD, SPAWN)				
Temperature	--	20ºC	USEPA 2003b	See Technical Memorandum 2-5, Water Temperature Monitoring
TOXICITY (COLD, SPAWN, MUN)				
Alkalinity	--	20 mg/L	Marshack 2008	USEPA AWQC; buffering capacity
Aluminum	Al	0.087 µg/L	Marshack 2008	USEPA AWQC; aquatic life protective[3]
Ammonia as N (pH and Temp dependent)	NH_3-N	24.1 mg/L (CMC); 4.1-5.9 mg/L (CCC)	USEPA 2000	CTR criteria over 0-20ºC assuming pH 7.0
		5.6 mg/L (CMC); 1.7-2.4 mg/L (CCC)	USEPA 2000	CTR criteria over 0-20ºC assuming pH 8.0
		0.9 mg/L (CMC); 0.3-0.5 mg/L (CCC)	USEPA 2000	CTR criteria over 0-20ºC assuming pH 9.0
Arsenic	As	0.34 mg/L (CMC); 0.15 mg/L (CCC)	USEPA 2000	CTR criteria
Cadmium (hardness dependent)	Cd	0.16 µg/L (CMC); 0.25 µg/L (CCC)	USEPA 2000	CTR for dissolved sample assuming hardness of 5 mg/L as $CaCO_3$
		0.35 µg/L (CMC); 0.41 µg/L (CCC)	USEPA 2000	CTR for dissolved sample assuming hardness of 10 mg/L as $CaCO_3$
		0.54 µg/L (CMC); 0.56 µg/L (CCC)	USEPA 2000	CTR for dissolved sample assuming hardness of 15 mg/L as $CaCO_3$
		0.95 µg/L (CMC); 0.81 µg/L (CCC)	USEPA 2000	CTR for dissolved sample assuming hardness of 25 mg/L as $CaCO_3$
Chloride	Cl-	860 mg/L (CMC); 230 mg/L (CCC)	Marshack 2008	USEPA AWQC; aquatic life protective

Table 3.3.2-8. (continued)

Analyte	Symbol or Abbreviation	Standard, Criteria or Benchmark Value	Reference	Notes
TOXICITY (COLD, SPAWN, MUN) (continued)				
Chromium (hardness dependent)	Cr	47.19 µg/L (CMC); 15.31 µg/L (CCC)	USEPA 2000	CTR for dissolved sample assuming hardness of 5 mg/L as $CaCO_3$
		83.25 µg/L (CMC); 27.0 µg/L (CCC)	USEPA 2000	CTR for dissolved sample assuming hardness of 10 mg/L as $CaCO_3$
		116.03 µg/L (CMC); 37.64 µg/L (CCC)	USEPA 2000	CTR for dissolved sample assuming hardness of 15 mg/L as $CaCO_3$
		176.31 µg/L (CMC); 57.19 µg/L (CCC)	USEPA 2000	CTR for dissolved sample assuming hardness of 25 mg/L as $CaCO_3$
Copper (hardness dependent)	Cu	0.8 µg/L (CMC); 0.69 µg/L (CCC)	USEPA 2000	CTR for dissolved sample assuming hardness of 5 mg/L as $CaCO_3$
		1.54 µg/L (CMC); 1.25 µg/L (CCC)	USEPA 2000	CTR for dissolved sample assuming hardness of 10 mg/L as $CaCO_3$
		2.25 µg/L (CMC); 1.77 µg/L (CCC)	USEPA 2000	CTR for dissolved sample assuming hardness of 15 mg/L as $CaCO_3$
		3.64 µg/L (CMC); 2.74 µg/L (CCC)	USEPA 2000	CTR for dissolved sample assuming hardness of 25 mg/L as $CaCO_3$
Iron	Fe	1 mg/L (CCC)	Marshack 2008	USEPA AWQC; aquatic life protective
Mercury (total)	Hg	0.050 µg/L	USEPA 2000 40 C.F.R. 131.38	CTR/Federal Register. 5/18/00
Nickel (hardness dependent)	Ni	37.2 µg/L (CMC); 4.1 µg/L (CCC)	USEPA 2000	CTR for dissolved sample assuming hardness of 5 mg/L as $CaCO_3$
		66.9 µg/L (CMC); 7.4 µg/L (CCC)	USEPA 2000	CTR for dissolved sample assuming hardness of 10 mg/L as $CaCO_3$
		94.3 µg/L (CMC); 10.5 µg/L (CCC)	USEPA 2000	CTR for dissolved sample assuming hardness of 15 mg/L as $CaCO_3$
		145.2 µg/L (CMC); 16.1 µg/L (CCC)	USEPA 2000	CTR for dissolved sample assuming hardness of 25 mg/L as $CaCO_3$
Selenium (total)	Se	20 µg/L (CMC); 5 µg/L (CCC)	Marshack 2008	USEPA AWQC; aquatic life protective
Silver (hardness dependent)	Ag	0.02 µg/L (CMC) Instantaneous	USEPA 2000	CTR for dissolved sample assuming hardness of 5 mg/L as $CaCO_3$
		0.07 µg/L (CMC) instantaneous	USEPA 2000	CTR for dissolved sample assuming hardness of 10 mg/L as $CaCO_3$
	Ag	0.13 µg/L (CMC) instantaneous	USEPA 2000	CTR for dissolved sample assuming hardness of 15 mg/L as $CaCO_3$
		0.32 µg/L (CMC) instantaneous	USEPA 2000	CTR for dissolved sample assuming hardness of 25 mg/L as $CaCO_3$

Table 3.3.2-8. (continued)

Analyte	Symbol or Abbreviation	Standard, Criteria or Benchmark Value	Reference	Notes
TOXICITY (COLD, SPAWN, MUN) (continued)				
Lead (hardness dependent)	Pb	2 µg/L (CMC); 0.086 µg/L (CCC)	USEPA 2000	CTR for dissolved sample assuming hardness of 5 mg/L as $CaCO_3$
		5 µg/L (CMC); 0.191 µg/L (CCC)	USEPA 2000	CTR for dissolved sample assuming hardness of 10 mg/L as $CaCO_3$
		8 µg/L (CMC); 0.303 µg/L (CCC)	USEPA 2000	CTR for dissolved sample assuming hardness of 15 mg/L as $CaCO_3$
		14 µg/L (CMC); 0.54 µg/L (CCC)	USEPA 2000	CTR for dissolved sample assuming hardness of 25 mg/L as $CaCO_3$
Specific conductance	--	150 µmhos	CVRWQCB 1998	Aquatic Life Protection[4]
Zinc (hardness dependent)	Zn	9.26 µg/L (CMC); 9.33 µg/L (CCC)	USEPA 2000	CTR for dissolved sample assuming hardness of 5 mg/L as $CaCO_3$
		16.66 µg/L (CMC); 16.79 µg/L (CCC)	USEPA 2000	CTR for dissolved sample assuming hardness of 10 mg/L as $CaCO_3$
		23.48 µg/L (CMC); 23.68 µg/L (CCC)	USEPA 2000	CTR for dissolved sample assuming hardness of 15 mg/L as $CaCO_3$
		36.20 µg/L (CMC); 36.50 µg/L (CCC)	USEPA 2000	CTR for dissolved sample assuming hardness of 25 mg/L as $CaCO_3$
Turbidity	NTU	increase < 1 NTU for 1-5 NTU background; increase < 20% for 5-50 NTU background; increase < 10 NTU for 50-100 NTU background	CVRWQCB 1998	Aesthetics, disinfection

Key: AWQC = Ambient Water Quality Criteria; USEPA = United States Environmental Protection Agency
$CaCO_3$ = Calcium carbonate; CDPH = California Department of Public Health
CMC = Criterion Maximum Concentration (1-hour acute exposure) for aquatic toxicity as defined by USEPA (2000)
CCC = Criterion Continuous Concentration (4-day chronic exposure) for aquatic toxicity as defined by USEPA (2000)
CTR = California Toxics Rule; MCL = Maximum Contaminant Level; µmhos = micromhos
µg/L = micrograms per liter; mg/L = milligrams per liter; mL = milliliter
MPN = Most Probable Number; µS/cm – microSiemens per centimeter; NTU = Nephelometric turbidity units
SM = Standard Method; su = standard unit

1 Note: a constituent may be listed under more than one beneficial use.
2 Sodium level is a guidance level to protect those individuals restricted to a total sodium intake of 500 mg/day (Marshack 2008).
3 Aquatic life protective aluminum benchmark is likely overly protective, as USEPA is aware of field data indicating that many high quality waters in the U.S. contain more than 0.087 µg aluminum/L, when either total recoverable or dissolved is measured (Marshack 2008).
4 Applies to Sacramento River (CVRWQCB 1998). Converted from µmhos to µSiemens for comparisons.

Due to differences in acute and chronic toxicity to aquatic organisms of the many elements and compounds as well as variations with ambient water quality such as pH or hardness, several entries in Table 3.3.2-8 have multiple values. Criteria for several metals are shown in 5 milligrams per liter (mg/L) increments of hardness since the level at which each of these metals is reportedly toxic to aquatic life is a function of hardness levels. Similarly, the Criterion Maximum Concentrations (CMC) and Criterion Continuous Concentrations (CCC) levels for ammonia are a function of both pH and temperature and are presented over a range of 0º to 20º Celsius (C) in pH increments.[14]

California List of Impaired Waters

Based on a review of the most current CWA Section 303(d) list and its associated TMDL Priority Schedule, the following Project waters have been identified by the SWRCB as State Impaired (SWRCB 2010):

- Mercury - New Bullards Bar Reservoir, the North Fork Yuba River between New Bullards Bar and Englebright Reservoir, the Middle Yuba River, the South Yuba River from Lake Spaulding to Englebright Reservoir, Englebright Reservoir, and the Lower Yuba River from Englebright Reservoir to the Feather River.

TMDL development for these waterbodies is scheduled to be complete by 2019 or 2021; however, there are currently no approved TMDL plans for the Yuba River.

Fish Ingestion Advisories

Using available fish tissue data and risk-based methodologies, the California Office of Environmental Health Hazard Assessment (OEHHA) has issued species-specific fish ingestion advisories for trout, sunfish and bass caught in Englebright Reservoir (OEHHA 2003, OEHHA 2009). Fish ingestion advisories previously issued for Deer Creek, a tributary to the Yuba River, were retracted due to an insufficient quantity of data (OHHEA 2009). In 2011, YCWA collected fish tissue of the quantity and quality required by OEHHA's risk assessors to assess the need for fish ingestion advisories in New Bullards Bar Reservoir, Log Cabin Diversion Dam impoundment, and Our House Diversion Dam impoundment (YCWA 2012). OEHHA has not issued any fish advisories based on these data.

General Water Quality

Water quality data from the 1950s through 2009 in the Project Area is available from the following sources:

- YCWA's own data
- OEHHA fish ingestion advisories
- DWR
- NID's Yuba-Bear Hydroelectric Project relicensing water quality and water temperature studies
- PG&E's Drum-Spaulding Project relicensing water quality and water temperature studies
- Sacramento River Watershed Program regional monitoring data

[14] Section 131.38 of 40 C.F.R. establishes CMC as the highest concentration to which aquatic life can be exposed for a short period (i.e., 1 hour) without deleterious effects and must be based on extended sample collection and 1-hour averaging. The CCC is defined as the highest concentration to which aquatic life can be exposed for an extended period of time (i.e., 4 days) without deleterious effects.

- USGS' California Water Science Center Investigations
- USGS' National Water Information System Reports
- USEPA's Storage and Retrieval Reports
- Yuba River Temperature Monitoring Project performed by the USFWS
- Upper Yuba River Studies Program's technical reports
- Water quality data from the SYRCL
- Water quality data from the Friends of Deer Creek

A review of these data (YCWA 2010) show surface water of the Project Area generally meets Basin Plan Objectives. However, the vast majority of the data are 10 years old or more, much of the data had been collected near the mouth of the Yuba River and YCWA's 2009 data was collected only in one season – summer low flow period (YCWA 2010). Hence, to supplement the historical data regarding general water quality conditions, YCWA undertook the FERC-approved Study 2.3, *Water Quality*.[15] The study consisted of three parts:

- A water quality element that determined whether surface water in the Project Area is consistent with the Basin Plan.
- A recreation element of the study where bacteria and total petroleum hydrocarbon samplings were conducted at some near-shore locations adjacent to unmanaged and low-managed recreation facilities. Each site sampled was identified by the recreation facility condition reconnaissance survey as having the potential to affect water quality.
- A turbidity-associated mercury element, triggered by high flows, whereby powerhouse tailrace samples were collected and sent to the laboratory for mercury analyses.

YCWA's study data were consistent with historic studies; within and between seasons general water quality in the Project Area is high. YCWA found that most analytes were reported at non-detect to just above reporting limit concentrations. The water is generally clear (i.e., average turbidity of <36 NTU), and near saturation with DO. Alkalinity is low (<100 mg/L in all samples) and pH is near neutral. Fecal coliform bacteria are not found near potential sources. The nutrients nitrogen and phosphorous exhibit concentrations generally less than 1 mg/L and algae blooms are not observed. The shoreline of New Bullards Bar Reservoir has no residential or commercial development that would contribute nutrients to the reservoir, and recreation development covers less than 1 percent of the shoreline. These nutrient concentrations and lack of development, with Secchi disc measurements (i.e., 6 meters [m] in spring for both reservoirs), indicate that New Bullards Bar and Englebright reservoirs are mesotrophic to oligotrophic, which is consistent with other lower elevation Sierra reservoirs. Nutrients, hardness (i.e., 24 to 76 mg/L in spring; 26 to 81 mg/L in summer; 32 mg/L in fall), and turbidity (i.e., 0 to 46 NTU in

[15] Refer to Technical Memorandum 2-3, *Water Quality*, in Appendix E6, for the full results of the study. Water temperature was not addressed by Study 2.3, but in two separate FERC-approved studies: Study 2.5, *Water Temperature Monitoring*, and Study 2.6, *Water Temperature Modeling*. Additionally, consistency of water quality with methylmercury fish tissue objectives was addressed in Study 2.4, *Bioaccumulation*.

spring;[16] 0 to 22 NTU in summer)[17] values remain constant and/or decrease as water flows downstream through the Project, suggesting that water quality is essentially maintained.[18] Further, YCWA did not observe a pattern of increasing or decreasing chemical concentrations from upstream to downstream of Project reservoirs (YCWA 2013d).

Consistency with Basin Plan Water Quality Objectives

YCWA's general water quality and recreation element data were evaluated with 14 applicable Basin Plan WQOs. When numeric WQOs were not available, data were examined in context with other relevant guidelines and benchmarks, including the USEPA's (USEPA 2000) CTR (Table 3.3.2-8). Turbidity-associated mercury data were evaluated in the context of ambient and hydrological information.

YCWA found no inconsistencies for 10 of the 14 Basin Plan WQOs for both reservoir and stream reaches. These included: 1) Biostimulatory Substances, 2) Color, 3) Floating Material, 4) Oil and Grease, 5) Pesticides, 6) pH, 7) Sediment and Settleable Material, 8) Taste and Odor, and 9) Chemical Constituents. Some inconsistencies were observed for four objectives in reservoirs: 1) Bacteria, 2) DO, 3) Turbidity, and 4) Toxicity. No inconsistencies were observed in stream reaches. The 14th objective, temperature, is evaluated separately below. Observations inconsistent with Basin Plan Objectives are discussed below.

Bacteria. The Basin Plan includes a WQO (< 200 MPN per 100 mL) for fecal coliform in waters designated for contact recreation. In 2012, all six sites sampled had fecal coliform counts below the WQO for both the time surrounding and including the Independence Day holiday as well as the time surrounding and including the Labor Day holiday.

The Basin Plan does not have WQOs for total coliform or *E. coli*, and other benchmarks were selected for the evaluation. Over the Independence Day holiday 2012 interval, five of six locations had mean total coliform counts above the USEPA (2003a) benchmark of 240 MPN/100 mL, and over the Labor Day holiday interval, six out of six locations had mean total coliform counts above the benchmark of 240 MPN/100 mL. However, *E. coli* counts were below the recommended numeric criteria in all samples associated with each holiday. *E. coli* counts are a subset of total coliform counts and are thought to be better indicators of human impacts (USEPA 2003a).

Dissolved Oxygen. The general DO WQO of 7.0 mg/L applies to the Yuba River and its tributaries. Both New Bullards Bar and Englebright reservoirs stratify in summer months, which oftentimes results in low DO conditions at the bottom of reservoirs (YCWA 2010). DO concentrations measured in spring 2012 ranged from 6.90 to 13.1 mg/L in the 31 samples collected, and only two of the sites had concentrations less than the WQO of 7.0 mg/L. New

[16] Range is for 29 of 31 samples. The other two samples were: 1) in spring 2012, turbidity in surface samples collected in Englebright Reservoir's upper reservoir sample was 550 NTU; and 2) in New Bullards Bar Reservoir's Madrone Cove sample was 336 NTU.

[17] Range is for 30 of 31 samples. The other sample was taken in summer 2012 when turbidity in the surface sample collected in Englebright Reservoir's upper reservoir sample was 159.6 NTU.

[18] Even during the high flow sampling events of March 16 and 19, turbidity downstream of Project reservoirs was less than 100 NTU during the sampling period.

Bullards Bar Reservoir near Madrone Cove had a DO concentration of 6.96 mg/L in its surface sample, which could be consistent with the objective, as it is within the measuring instrument's measurement error of ± 0.5 mg/L. New Bullards Bar Reservoir near the dam had a DO concentration of 6.90 mg/L in the hypolimnion, which could also be consistent with the objective, as it is within the instruments error of ± 0.5 mg/L.

DO concentrations measured in summer 2012 ranged from 5.14 to 12.1 mg/L in the 31 samples collected and only three of the samples had concentrations less than the WQO of 7.0 mg/L. New Bullards Bar Reservoir near Madrone Cove had a DO concentration of 5.14 mg/L in its hypolimnion sample. New Bullards Bar Reservoir near the dam had a DO concentration of 6.16 mg/L in its hypolimnion sample. Englebright Reservoir mid-reservoir had a concentration of 6.79 mg/L in its hypolimnion sample. These results were not unexpected since large, deep reservoirs/lakes generally form strong thermoclines with oxygen poor hypolimnions in the late summer/fall period.

Turbidity. The Basin Plan requires that waters be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. This objective is expressed in terms of changes in turbidity in the receiving water body where natural turbidity is 0 to 5 NTUs, increases shall not exceed 1 NTU; where 5 to 50 NTUs, increases shall not exceed 20 percent; where 50 to 100 NTUs, increases shall not exceed 10 NTUs; and where natural turbidity is greater than 100 NTUs, increase shall not exceed 10 percent.

Spatial upstream-to-downstream turbidity trends are best seen in the data as they are presented in YCWA's Technical Memorandum 2-3, *Water Quality*, Attachment 2-3C, in Appendix E6, which provides sample results by location (YCWA 2013d). For spring 2012 sampling, these data show that turbidity was high in surface samples collected in Englebright Reservoir's upper reservoir sample (550 NTU) and New Bullards Bar Reservoir's Madrone Cove sample (335.6 NTU), but low everywhere else. Turbidity in the other 29 samples ranged from 0 to 46 NTU and the subset of samples collected from the Yuba River downstream of the Project ranged from 0 to 11.9 NTU. For summer 2012 sampling, these data show that turbidity was high in surface samples collected in Englebright Reservoir's upper reservoir sample (159.6 NTU), but low everywhere else. Turbidity in the other 30 samples ranged from 0 to 20 NTU and the subset of samples collected from Yuba River downstream of the Project ranged from 0.3 to 20 NTU. YCWA is unaware of any reports that turbidity causes a nuisance or adversely affects beneficial uses in the study area or immediately downstream of the Project.

Toxicity. The Basin Plan requires that waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal or aquatic life.

The FERC-approved study states that study water quality data would be compared to the aquatic life protective benchmarks from the USEPA (2000) CTR or benchmarks excerpted from Marshack (2008), *A Compilation of Water Quality Goals* (See Table 3.3.2-8). At the low hardness levels found in the study (i.e., 2.4 mg/L to 46 mg/L in spring and 26 mg/L to 81 mg/L in the summer), sample specific dissolved cadmium, copper, lead, silver, and zinc CTR criteria were calculated (Attachment 2-3C of Technical Memorandum 2-3). In spring 2012, dissolved copper, nickel, and silver concentrations were greater than each sample specific CTR in Englebright Reservoir's surface samples. At the Englebright Reservoir's mid-reservoir location, copper was essentially equivalent[19] to the CTR criteria (0.39 µg/L; CTR= 0.37 µg/L) and the silver reporting limit was greater than the CTR criteria (<0.02 µg/L; CTR 0.01 µg/L). At Englebright Reservoir's upper-reservoir location, nickel was essentially equivalent to the CTR criteria (27.7 µg/L; CTR= 18.8 µg/L). In summer 2012, dissolved copper concentrations were greater than the CTR criteria in each of the six hypolimnion samples. Upstream to downstream, in New Bullards Bar, the dissolved copper hypolimnion concentrations were 9.13 µg/L (CTR=2.83 µg/L), 5.86 µg/L (CTR=2.93 µg/L), and 5.01 µg/L (CTR=3.11 µg/L); while upstream to downstream in Englebright Reservoir, dissolved copper concentrations were 5.32 µg/L (CTR=3.47 µg/L), 7.57 µg/L (CTR=3.02 µg/L), and 3.84 µg/L (CTR=3.11 µg/L). YCWA is unaware of any Project operation and maintenance (O&M) activity that may affect toxicity in Project reservoirs and downstream.

The FERC-approved study states that one surface water quality sample would be collected each from the New Colgate Powerhouse tailrace and the Narrows No. 2 Powerhouse tailrace when the powerhouses are in operation during a single period expected to be of high turbidity in 2012. A flow of 5,000 cfs, as measured at the Smartsville gage, when flows as measured at Smartsville have increased by at least 100 percent in the previous 7 days, will trigger the sampling event. Water samples were analyzed for turbidity, total suspended sediment, total dissolved sediment, total mercury and methylmercury (YCWA 2013d). YCWA compared the samples collected from the powerhouse tailraces to ambient levels of total mercury and methylmercury, as determined by YCWA's sampling at other locations and seasons, as well as regional studies performed by others. Methylmercury and mercury concentrations measured downstream of powerhouses were consistent with ambient conditions; travel through the powerhouses did not appear to affect methylmercury or mercury concentrations (YCWA 2013d).

Water Temperature Condition in Reservoirs

Data collected by YCWA are the most recent and complete source of water temperature information for New Bullards Bar Reservoir and Englebright Reservoir. Reservoir profiles were taken at New Bullards Bar and the Englebright reservoirs at a target frequency of about once every 2 weeks year-round from August 1989 to October 2012. Profiles were collected at one location near the dam in New Bullards Bar Reservoir. In Englebright Reservoir, profiles were collected at one location near the dam, and beginning in April 2011, at an additional location approximately 3.3 miles upstream of the dam. DO monitoring began in October 2010 at both reservoirs. Details regarding the location and frequency of reservoir profiles are provided in Table 3.3.2-9.

[19] At the trace and low metals and hardness concentrations observed by YCWA's Study 2.3, *Water Quality*, metals quantification and CTR criteria are highly uncertain. Comparisons between metals concentrations measured by USEPA Method 1638 and CTR criteria account for the uncertainties in the both the laboratory method and the criteria. At the trace and low metals and hardness concentrations observed by this study, concentrations found of the same order of magnitude and within two times of each other were considered essentially equivalent.

Table 3.3.2-9. Temperature and DO concentrations found in YCWA's routine reservoir profile locations by reservoir.

Reservoir	Location	Designation for Site	River Mile	Latitude	Longitude	Period of Record
New Bullards Bar Reservoir	Approximately 0.5 miles upstream of center point of main dam	NY2.T455	NYR 2.3	39.397148	-121.135863	About every 2 weeks from August 1989 through October 2012
Englebright Reservoir	Approximately 500 feet upstream of center point of main dam	NY14.T455	YR 24.0	39.240959	-121.268811	About every 2 weeks from January 1990 through October 2012

Water temperature profiles at New Bullards Bar Reservoir show a consistent pattern from year to year. In general, there is no stratification during the winter months and beginning in the spring, a thermocline develops. The strongest thermoclines exist from June through August and begin to weaken in the fall. During summer, the thermocline generally occurs from 20 to 60 ft deep. Water temperatures in New Bullards Bar Reservoir are consistent with warm monomictic (i.e., mixes once per year during turnover) lakes (Wetzel 1983) – temperatures do not drop below approximately 5°C, the reservoir circulates freely in winter, and stratifies in summer. Ice does not form on the reservoir, and the reservoir mixes once in winter.

Figure 3.3.2-2 provides an example of the water temperature plots generated.[20] For each year, water temperature on each sample day was plotted versus elevation and the maximum water surface elevation, intake elevation and low-level outlet elevations were shown.

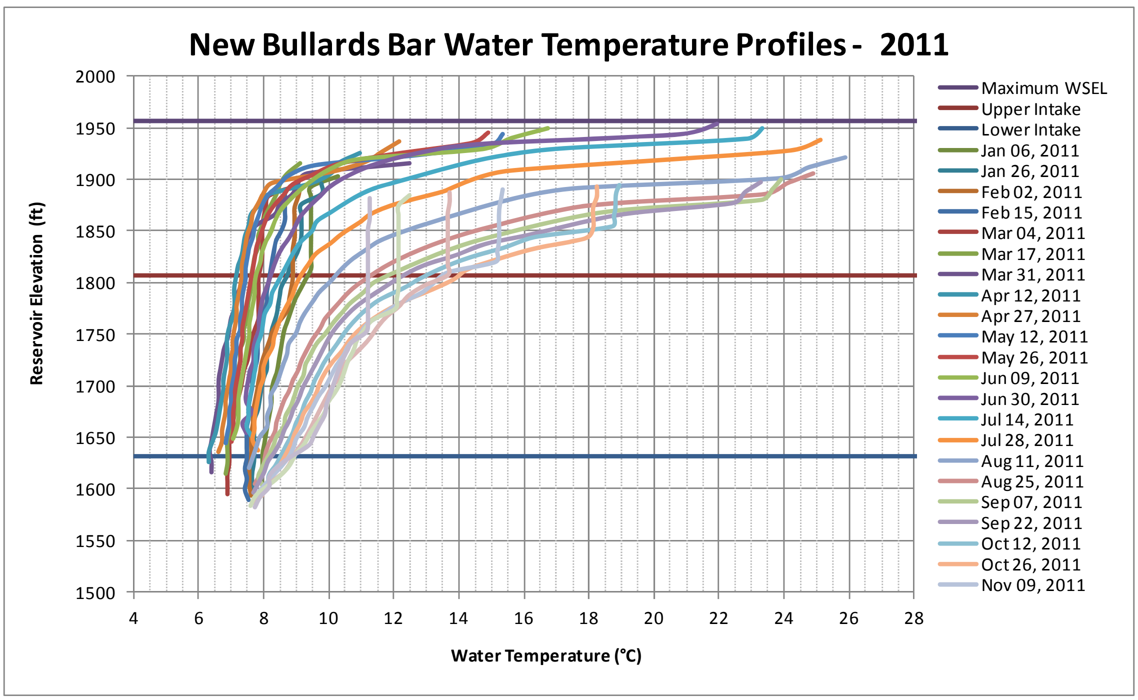


Figure 3.3.2-2. Water temperature profiles in New Bullards Bar Reservoir near the dam in 2011.

[20] Refer to Technical Memorandum 2-5, *Water Temperature Monitoring*, in Appendix E6, for the full results of the study. Reservoir water temperature profiles for each year of the entire monitoring period are available in Attachment 2-5C of the technical memorandum.

Water temperature profiles in Englebright Reservoir show a consistent pattern from year to year. In general, there is no to weak stratification during the spring months and beginning in the summer, a thermocline develops. The strongest thermoclines usually exist from August through January; the reservoir turns-over in winter, and then begins to weakly set up in the spring likely during the runoff period. During summer, the thermocline generally occurs from 10 to 30 ft deep. Water temperatures in Englebright Reservoir are also consistent with warm monomictic lakes (Wetzel 1983) - temperatures do not drop below approximately 6ºC, the reservoir circulates freely in winter, and stratifies in summer. Ice does not form on the reservoir, and the reservoir mixes once in winter

The water temperature profiles taken in Englebright Reservoir at the upstream location showed similar characteristics to those near Englebright Dam. In most instances, the thermocline seemed less established] which could be caused from the increased water velocity at the upstream location, closer to the Yuba River and South Yuba River inflows. Thermoclines were strongest in summer and early fall, which were consistent with the periods of highest air temperatures.

Figures 3.3.2-3 and 3.3.2-4 show water temperature plots in Englebright Reservoir in 2011.

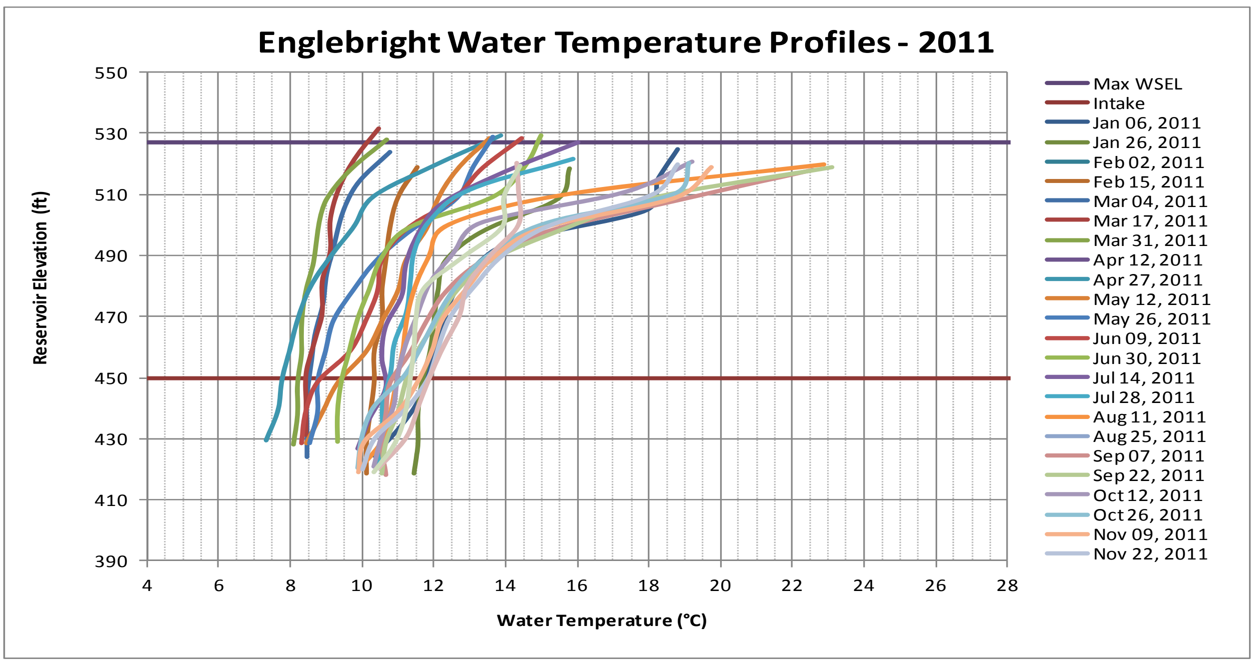


Figure 3.3.2-3. Water temperature profiles in Englebright Reservoir near the dam in 2011.

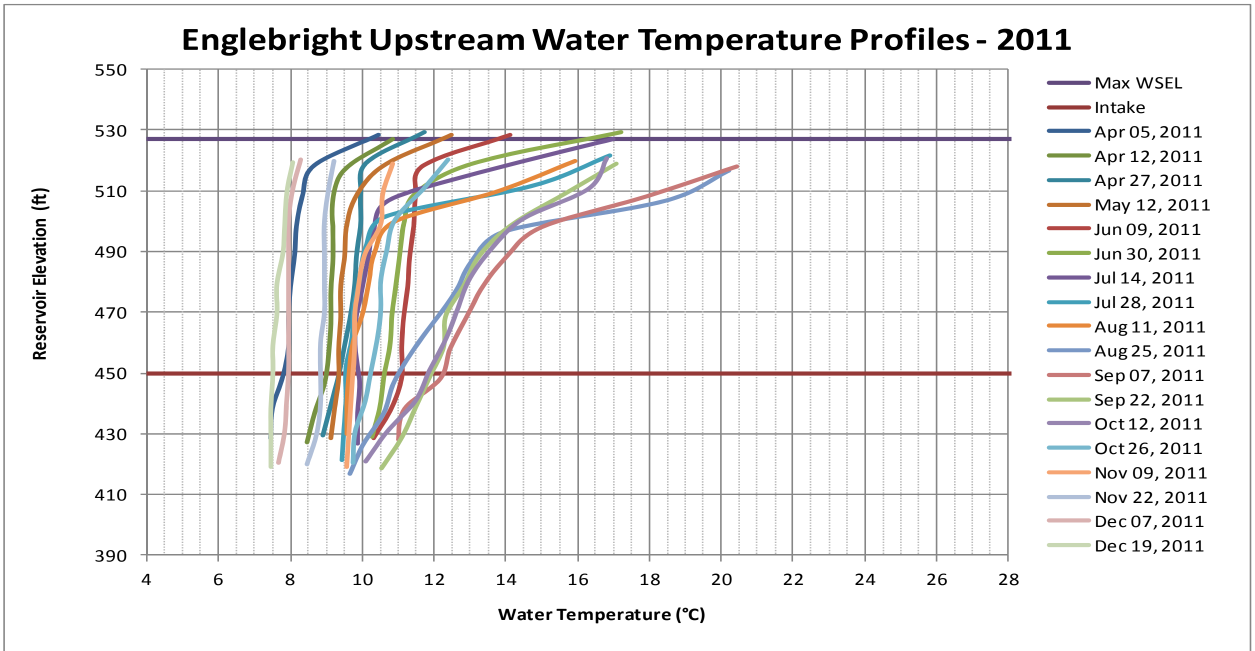


Figure 3.3.2-4. Water temperature profiles in Englebright Reservoir 3.3 mi upstream of the dam in 2011.

DO Concentration Condition in Reservoirs

Data collected by YCWA are the most recent and complete source of DO concentration information for New Bullards Bar and Englebright reservoirs. Along with temperature profiles, DO concentration profiles were collected in New Bullards Bar Reservoir each month since November 2010 at the location shown in Table 3.3.2-9.

Monthly minimum, average, and maximum DO concentrations for New Bullards Bar are summarized in Table 3.3.2-10. These data show that almost all DO concentration measurements are greater than 7.00 mg/L. However, in July and August 2012, DO concentration was observed at levels less than the Basin Plan Objective of 7.0 mg/L. During each of these months, a strong thermocline was observed from 40 to 60 ft, and the lower DO concentrations were observed well into the hypolimnion from 70 to 300 ft.

Table 3.3.2-10. Monthly minimum, average and maximum DO concentrations in New Bullards Bar Reservoir near the dam from November 2010 through August 2012.

Month	Minimum DO (mg/L)	Average DO (mg/L)	Maximum DO (mg/L)
2010			
November	8.22	8.93	9.34
December	8.37	9.51	10.19
2011			
January	8.66	9.55	10.22
February	9.42	9.96	10.65
March	9.97	10.43	11.30
April	10.16	10.43	11.05
May	9.91	10.33	11.23
June	8.67	10.24	11.16

Table 3.3.2-10. (continued)

Month	Minimum DO (mg/L)	Average DO (mg/L)	Maximum DO (mg/L)
2011 (continued)			
July	8.32	10.03	10.45
August	8.20	9.84	10.30
September	8.24	9.44	10.01
October	8.01	9.19	9.79
November	8.39	9.11	9.59
December	8.57	9.14	9.64
2012			
January	8.28	9.20	10.16
February	8.24	9.41	10.54
March	8.17	9.36	10.51
April	9.46	9.98	10.73
May	9.00	9.74	10.49
June	8.70	9.59	10.25
July	6.99	8.16	8.85
August	6.79	8.01	8.64

DO concentrations in New Bullards Bar Reservoir are consistent with what would be expected in oligotrophic and mesotrophic reservoirs in inland northern California. The profile is a positive heterograde curve indicating a metalimnetic oxygen maximum. This occurs whenever a reservoir is stratified, but most strongly in the summer. Increasing temperatures in the epilimnion result in decreased solubility while typical oxygen consumption in the hypolimnion also results in a decrease in DO concentration with depth. These metalimnetic DO concentration maxima are usually caused by the reservoir's algal populations producing oxygen in the metalimnion faster than they sink into the hypolimnion. The depth at which this occurs is often directly related to the transparency of water (Wetzel 1983). Based on summertime Secchi disk readings in New Bullards Bar Reservoir, the photic zone (i.e., the depth from the surface to where light dims to about 1%, and therefore a region of net oxygen production) extends to about 13 ft.[21] Figure 3.3.2-5 shows four reservoir DO concentration profiles in New Bullards Bar Reservoir. In the March, June and August 2011 profiles, when the reservoir was stratified, the metalimnetic DO concentration maxima are evident. Figure 3.3.2-6 provides the corresponding water temperature profiles.

[21] Secchi disc readings are usually about one-third of the depth of the photic zone (Horne and Goldman 1994)..

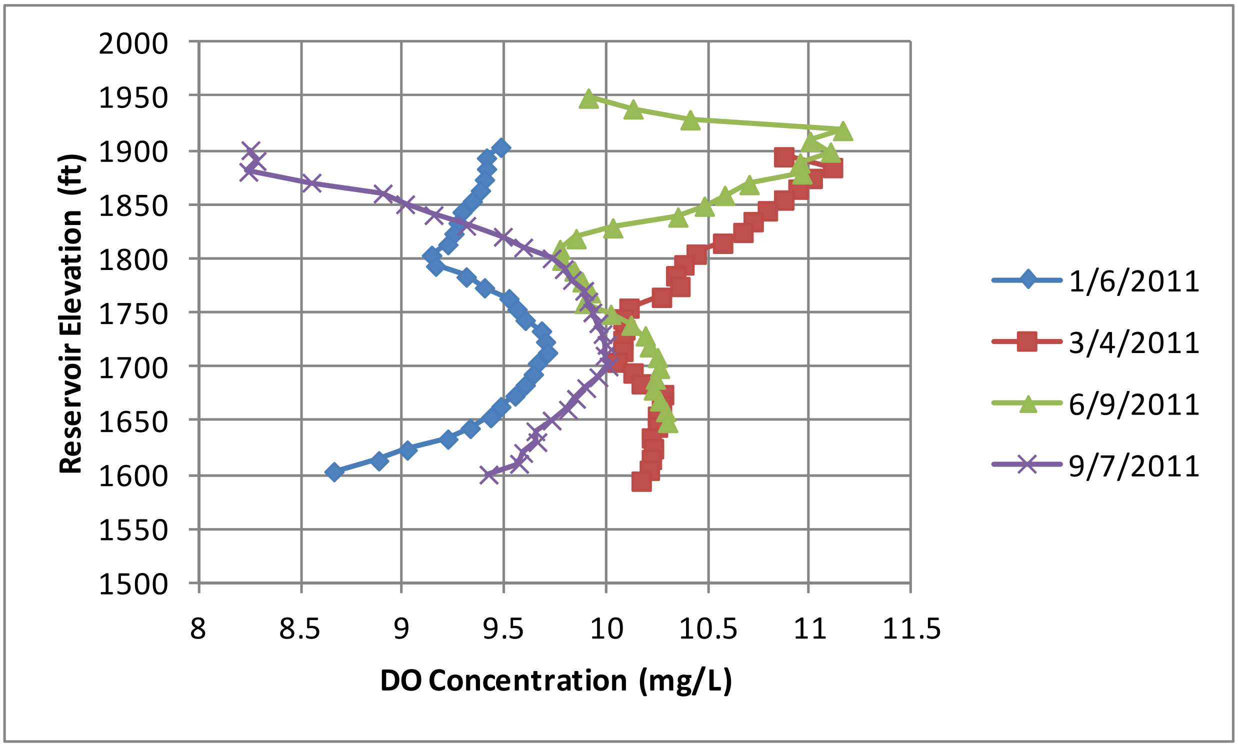


Figure 3.3.2-5. New Bullards Bar Reservoir DO concentration profiles at four dates in 2011.

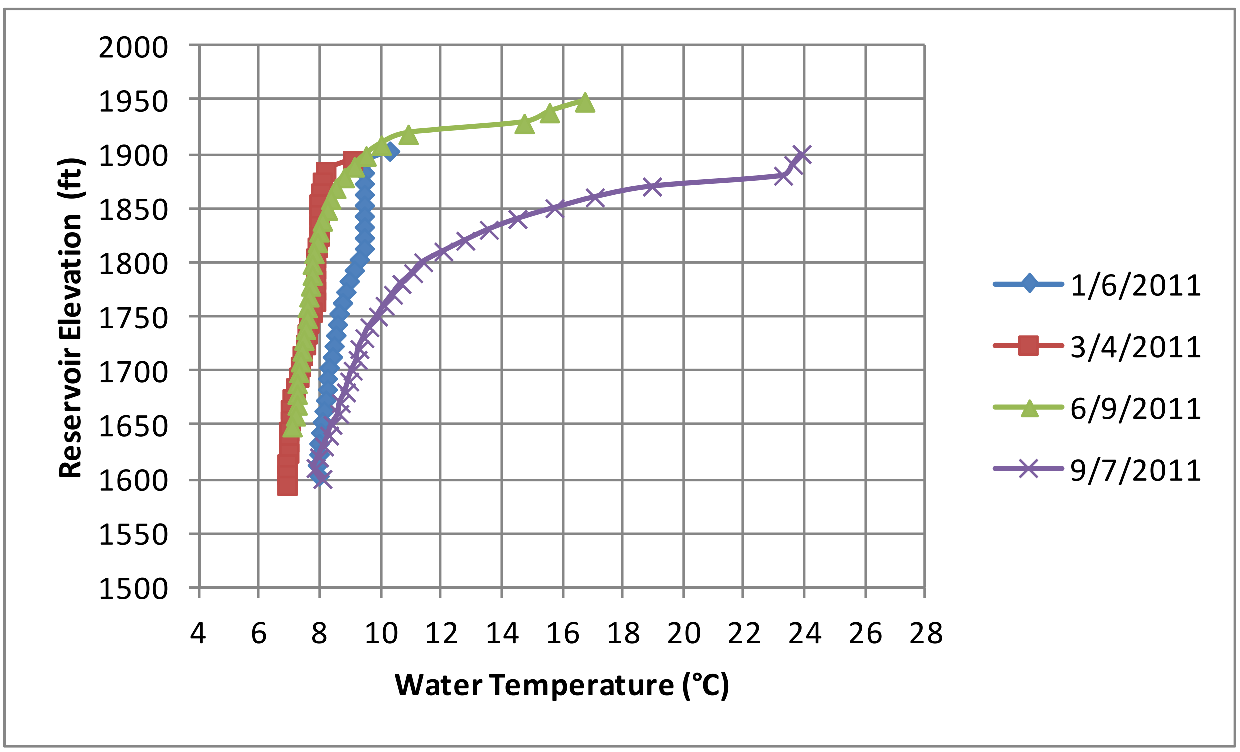


Figure 3.3.2-6. New Bullards Bar Reservoir water temperature profiles at four dates in 2011.

Along with temperature profiles, DO concentration profiles have been collected in Englebright Reservoir near the dam each month since November 2010 and mid-reservoir since April 2011 at the location shown in Table 3.3.2-9.

The monthly minimum, average, and maximum DO concentrations for Englebright Reservoir are summarized in Tables 3.3.2-11 and 3.3.2-12. As with New Bullards Bar, there are only a few cases where DO concentrations were inconsistent with the WQO. In November 2010, DO level was observed at concentrations less than the Basin Plan WQO of 7.0 mg/L near the dam. During this month, a strong thermocline was observed from 10 to 30 ft, and the lower DO concentrations were observed well into the hypolimnion from 40 to 100 ft. Profiles collected from the middle of Englebright Reservoir since April 2011 was all consistent with the Basin Plan Objective.

Table 3.3.2-11. Monthly minimum, average and maximum DO concentrations in Englebright Reservoir near the dam from November 2010 through August 2012.

Month	Minimum DO (mg/L)	Average DO (mg/L)	Maximum DO (mg/L)
2010			
November	6.52	9.21	10.38
December	10.33	10.45	10.55
2011			
January	10.36	10.93	11.44
February	11.27	11.58	11.84
March	11.82	12.00	12.16
April	11.66	11.87	12.06
May	11.36	11.59	11.85
June	10.84	11.41	11.89
July	9.94	11.00	11.72
August	9.80	10.98	11.92
September	9.38	10.25	11.01
October	9.41	9.88	10.37
November	8.02	9.45	10.85
December	10.74	10.96	11.38
2012			
January	10.86	11.26	11.96
February	9.25	10.45	11.89
March	11.06	11.43	11.67
April	10.66	11.25	11.55
May	9.67	10.79	11.24
June	9.97	10.62	11.01
July	8.46	9.33	10.00
August	7.97	8.97	9.98

Table 3.3.2-12. Monthly minimum, average and maximum DO concentrations in Englebright Reservoir 3.3 mi upstream of the dam from April 2011 through August 2012.

Month	Minimum DO (mg/L)	Average DO (mg/L)	Maximum DO (mg/L)
2011			
April	11.49	11.97	12.40
May	11.08	11.64	11.86
June	10.77	11.41	11.81
July	9.77	11.40	12.44
August	10.48	11.38	12.00
September	9.31	10.29	10.89
October	7.11	9.83	10.53
November	10.62	10.86	11.06
December	11.00	11.17	11.43

Table 3.3.2-12. (continued)

Month	Minimum DO (mg/L)	Average DO (mg/L)	Maximum DO (mg/L)
2012			
January	10.49	11.19	11.42
February	9.44	10.42	11.44
March	11.44	11.78	11.85
April	10.71	11.40	11.65
May	10.20	11.25	11.72
June	9.87	10.82	11.22
July	7.87	9.22	10.12
August	8.70	9.95	10.39

Englebright Reservoir at the dam does not show a DO pattern similar to that of New Bullards Bar Reservoir. Figures 3.3.2-7 and 3.3.2-8 show the DO and water temperature profiles for four monitoring events. In the March and June 2011 sampling events, there is little to no stratification present and DO concentrations reflect that pattern. The January 2011 sampling shows a thermocline; however, the DO values do not show an oxygen maxima pattern. Based on summertime Secchi disk readings in Englebright Reservoir, the photic zone extends to a depth of about 15 ft.[22] In September, there is a weak thermocline present and DO concentrations show characteristics close to the metalimnetic oxygen maxima described above.

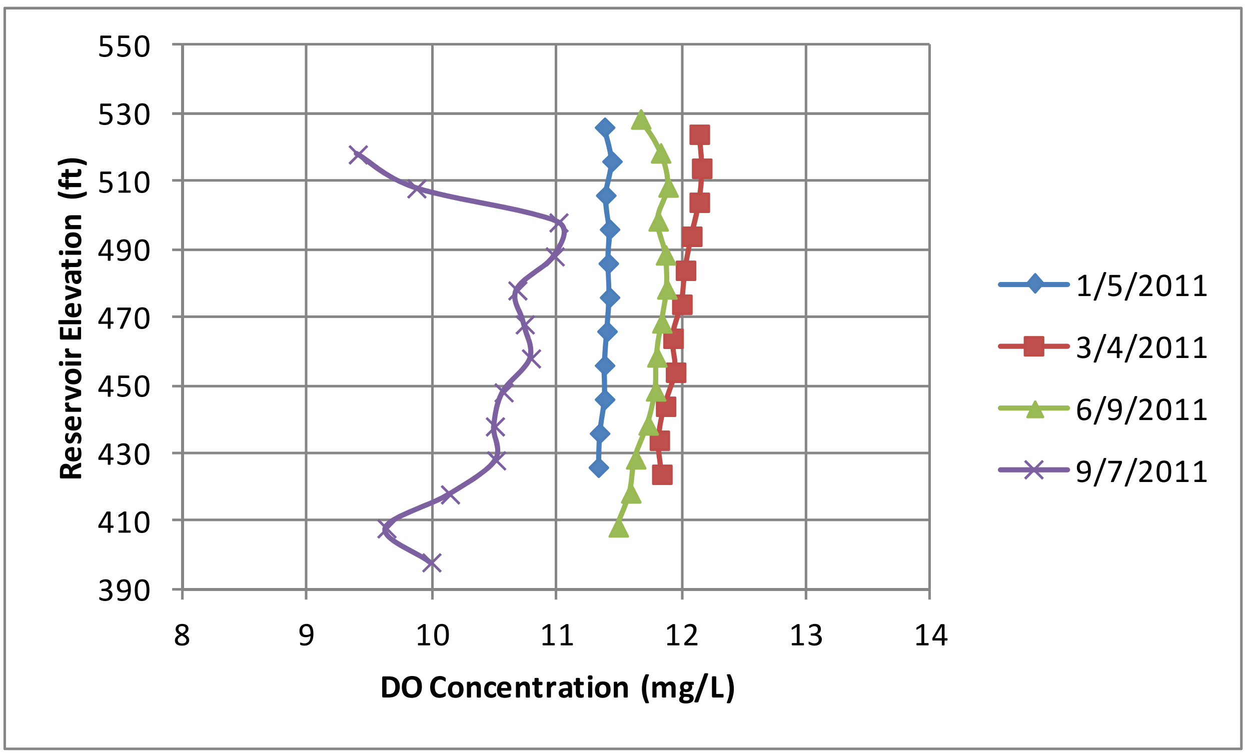


Figure 3.3.2-7. Englebright Reservoir DO concentration profiles at four dates in 2011.

[22] Secchi disc readings are usually about one-third of the depth of the photic zone (Horne and Goldman 1994).

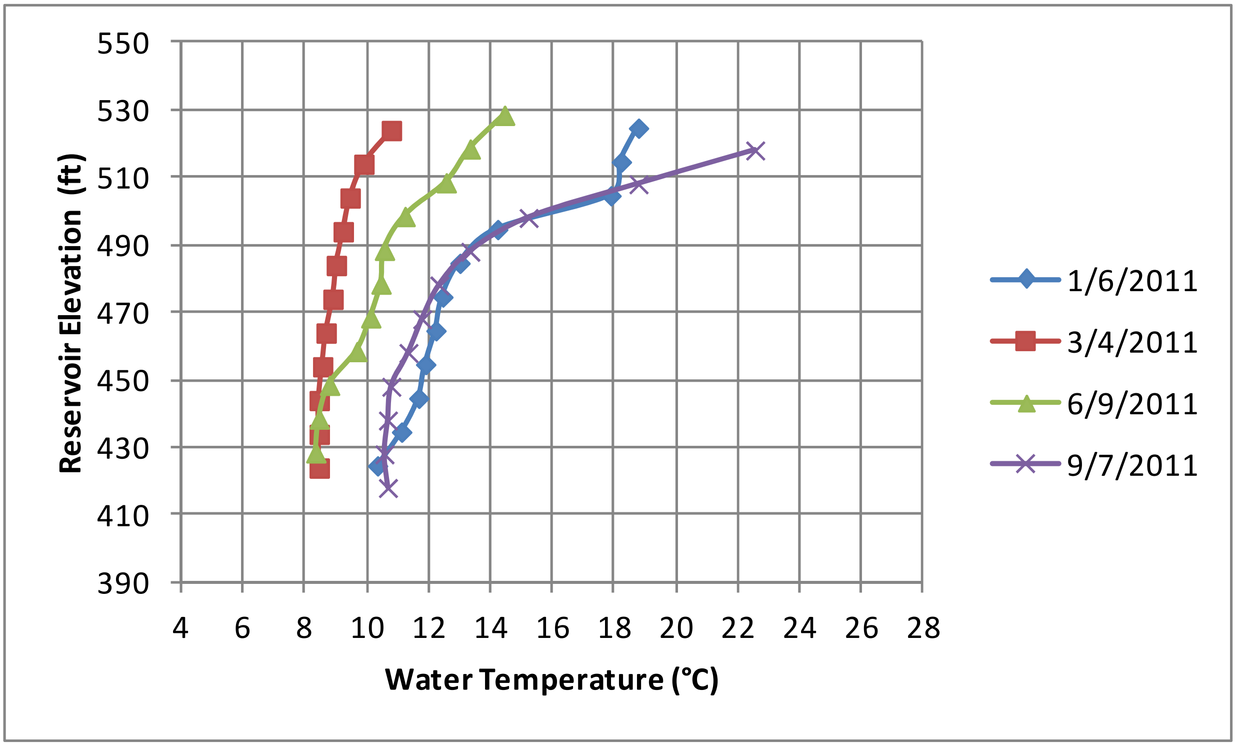


Figure 3.3.2-8. Englebright Reservoir temperature profiles at four dates in 2011.

DO concentrations in New Bullards Bar and Englebright reservoirs are consistently above the SWRCB's Basin Plan Objective of 7 mg/L. In the few instances where concentrations are below 7 mg/L, it is near the bottom of the reservoir where little biological activity occurs.

Water Temperature Conditions in Streams

Stream temperature data collected by YCWA is the most current and complete source of water temperature information in the areas potentially affected by the Project. YCWA collected data at some locations since 2003 but the majority of monitoring began in 2008. Details regarding the water temperature monitoring locations are provided in Table 3.3.2-13.

Table 3.3.2-13. Continuous stream water temperature monitoring location information.

Project Reach	Location	Designation for Recorders	River Mile	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Data Available	Streamflow Gage, if Co-Located
MIDDLE YUBA RIVER							
Non-Project	Upstream of Our House Diversion Dam Impoundment	T10a T10b	MYR 12.9	39.413015	-120.994590	3/28/09-10/15/12	--
Our House Diversion Dam Reach	At Intake to Lohman Ridge Diversion Tunnel	T20	MYR 12.7	39.411910	-120.997427	7/3/08-10/15/12	USGS 11408870 (PG&E NY17)
	Downstream of Our House Diversion Dam	T30	MYR 12.6	39.410661	-120.998604	10/24/08-10/15/12	USGS 11408880 (PG&E NY18)
Oregon Creek Reach	Upstream of North Yuba River	T90a T90b	MYR 0.0	39.368639	-121.135658	8/19/08-10/15/12	--

Table 3.3.2-13. (continued)

Project Reach	Location	Designation for Recorders	River Mile	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Data Available	Streamflow Gage, if Co-Located
OREGON CREEK							
Non-Project	Upstream of Log Cabin Diversion Dam Impoundment	T40	OC 4.5	39.440146	-121.056149	7/8/08-10/15/12	USGS 11409300 (PG&E NY19)
Log Cabin Diversion Dam Reach	At Intake to Camptonville Diversion Tunnel	T50	OC 4.3	39.440491	-121.058746	7/8/08-10/15/12	USGS 11409350 (PG&E NY30)
	Downstream of Log Cabin Diversion Dam	T60	OC 4.3	39.439455	-121.059264	8/30/08-10/15/12	USGS 11409400 (PG&E NY20)
	Upstream of confluence with Middle Yuba River	OC1	OC 0.2	39.396080	-121.082880	3/29/11-10/15/12	--
NORTH YUBA RIVER							
Non-Project	Upstream of New Bullards Bar Reservoir	T65a T65b	NYR 16.1	39.523728	-121.090972	1/1/08-10/15/12	--
New Bullards Bar Dam Reach	At Low Flow Releases from New Bullards Bar Dam	T70a T70b	NYR 2.3	39.392348	-121.141584	7/18/08-10/15/12	USGS 11413517 (PG&E NY23)
	Upstream of Middle Yuba River	T80a T80b	NYR 0.1	39.368694	-121.136793	8/19/08 - 10/15/12	--
SOUTH YUBA RIVER							
Non-Project	At Jones Bar (data collected on 1-hr interval)	Jones Bar a Jones Bar b Jones Bar c	SYR 7.4	39.292222	-121.103610	5/16/08 - 10/15/12	USGS 11417500 (PG&E NY29)
DOBBINS CREEK							
Non-Project	At Lake Francis Outlet[2]	T140a T140b	DC 2.7	39.359171	-121.205168	4/2/09 - 10/15/12	--
Non-Project	Upstream of Yuba River	T145a T145b	DC 0.1	39.329735	-121.197641	4/2/09 - 10/15/12	--
DRY CREEK							
Non-Project	Upstream of Yuba River	T185a T185b	DryC 0.7	39.228930	-121.402270	4/1/09 - 10/15/12	--
DEER CREEK							
Non-Project	Upstream of Yuba River	T175a T175b	DeerC 0.9	39.224091	-121.269866	2/3/09-10/15/12	--
YUBA RIVER							
Middle/ North Yuba River Reach	Downstream of Confluence of North Yuba River and Middle Yuba River	T100a T100b	YR 40.0	39.367839	-121.136655	8/19/08-10/15/12	--
	Upstream of New Colgate Powerhouse	T110a T110b	YR 34.4	39.330602	-121.187675	8/19/08-10/15/12	--
New Colgate Powerhouse Reach	In Colgate Powerhouse Penstock	T120	YR 34.2	39.330824	-121.191565	1/1/08-10/15/12	--
	Downstream of New Colgate Powerhouse	T130a T130b	YR 34.1	39.330260	-121.193169	8/19/08-10/15/12	--
	Downstream of Dobbins Creek	T150a T150b	YR 33.9	39.328398	-121.196162	3/28/09-10/15/12	--
	In Narrows #2 Powerhouse Penstock	T160a T160b	YR 24.2	39.238911	-121.270034	5/5/09-10/15/12	(PG&E NY24)
	Downstream of Narrows #2 Powerhouse at Smartsville	T170	YR 24.0	39.235799	-121.272688	4/15/09-10/15/12	USGS 11419000 (PG&E NY28)

Table 3.3.2-13. (continued)

Project Reach	Location	Designation for Recorders	River Mile	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Data Available	Streamflow Gage, if Co-Located
YUBA RIVER (continued)							
New Colgate Powerhouse Reach (continued)	Downstream of Narrows #2 Powerhouse at Smartsville (data collected on 1-hr interval)	Smartsville a Smartsville b Smartsville c	YR 24.0	39.235799	-121.272688	WY2003 - 2007	USGS 11419000 (PG&E NY28)
	Downstream of Deer Creek	T180a T180b	YR 23.1	39.230047	-121.285165	11/8/08-10/15/12	--
	At Parks Bar (data collected on 1-hr interval)	Parks Bar a Parks Bar b Parks Bar c	YR 17.7	39.219612	-121.346980	6/14/04 – 10/15/12	--
	At Long Bar (data collected on 1-hr interval)	Longs Bar a Longs Bar b Longs Bar c	YR 16.0	39.218503	-121.369961	4/8/04 – 10/15/12	--
	Downstream of Dry Creek	T190a T190b	YR 13.2	39.219611	-121.415128	11/8/08-3/9/09[1]	--
	Upstream of USACE's Daguerre Point Dam	T200a Y200b	YR 11.6	39.208009	-121.443116	11/8/08-10/15/12	--
USACE's Daguerre Point Dam Reach	At USACE's Daguerre Point Dam Fish Ladder	T210a T210b	YR 11.6	39.207853	-121.443529	11/18/08-10/15/12	--
	At USACE's Daguerre Point Dam Fish Ladder (data collected on 1-hr interval)	Daguerre a Daguerre b Daguerre c	YR 11.6	39.208009	-121.443116	WY2003 – 2007	--
	At Walnut Avenue (Near Western Extent of Yuba Goldfields)	T220a T220b	YR 8.3	39.188220	-121.495307	8/28/08-10/15/12	--
	At Marysville Gage (data collected on 1-hr interval)	Marysville a Marysville b Marysville c	YR 6.2	39.176164	-121.524386	WY2003 – 2007, 1/1/08 – 10/15/12	USGS 11421000
USACE's Daguerre Point Dam Reach (cont.)	Upstream of Simpson Lane (Between Yuba Goldfields and Marysville)	T230a T230b	YR 5.0	39.165328	-121.541350	8/28/08-10/15/12	--
	At Marysville (Downstream of Highway 70 Bridge	T240a T240b	YR 0.7	39.134510	-121.590720	8/21/08-10/15/12	--
FEATHER RIVER							
Non-Project	Upstream of Yuba River	T250a T250b	--	39.139425	-121.607282	8/15/08-10/15/12	--
Non-Project	Downstream of Yuba River on Right Bank	T260a T260b	--	39.108603	-121.603149	8/15/08-10/15/12	--
Non-Project	Downstream of Yuba River on Left Bank	T270a T270b	--	39.108594	-121.604663	8/19/08-10/15/12	--

[1] The water temperature logger at Station T190, Downstream of Dry Creek, was installed on November 8, 2008 and removed on March 9, 2009 at the request of the land owner.

Table 3.3.2-14 provides a summary of the minimum and maximum daily mean temperatures by month at each of the stream monitoring sites for WYs 2009 to 2012. Daily minimum or maximum water temperatures greater than 20°C[23] are shaded. Locations with an asterisk indicate sites that are upstream of Project-affected reaches.

[23] Benchmark values used for evaluating relicensing water temperature data are provided in Table 3.3.2-8.

Table 3.3.2-14. WYs 2009 through 2012 minimum and maximum daily average stream temperatures (°C) by month. Shaded cells indicate values over 20°C. An * indicates a site above the Project (i.e., not affected by the Project).

Location	River Mile	Water Year	October		November		December		January		February		March		April		May		June		July		August		September	
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
MIDDLE YUBA RIVER																										
MYR upstream of Our House Diversion Dam Impoundment *	MYR 12.9	2009	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	7.1	8.7	6.8	11.5	7.9	16.4	13.9	22.1	20.4	24.9	20.0	24.5	15.2	21.3
		2010	7.7	14.4	8.6	10.2	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	3.6	9.6	6.9	10.5	9.3	18.7	17.5	23.5	17.6	22.4	15.8	20.0
		2011	8.2	17.3	2.8	10.5	3.7	7.2	2.7	6.3	1.0	6.0	3.5	8.4	5.2	8.8	5.5	9.7	7.6	13.4	13.6	21.6	19.6	21.7	16.7	19.7
		2012	8.8	16.7	5.7	8.7	0.3	4.5	0.3	5.5	2.5	6.3	2.4	8.0	5.0	10.4	9.0	16.6	13.4	20.8	20.8	23.5	20.2	24.5	17.4	21.0
MYR at intake to Lohman Ridge Diversion Tunnel	MYR 12.7	2009	9.1	16.5	6.4	11.4	0.9	6.6	2.2	6.6	2.4	6.4	4.8	8.7	6.8	11.6	8.0	16.5	14.0	22.1	20.4	24.9	19.7	24.6	No Data	No Data
		2010	9.7	13.8	4.4	12.4	1.0	5.6	3.7	7.0	5.1	7.2	4.9	8.6	5.2	9.6	6.9	10.6	9.4	18.8	17.6	23.5	17.9	22.1	16.3	20.1
		2011	8.4	16.2	3.0	10.7	3.7	7.2	3.0	6.4	1.2	6.1	3.5	7.4	5.1	7.8	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
		2012	No Data	No Data	No Data	No Data	0.5	4.5	0.8	5.5	2.9	6.3	2.4	8.0	4.9	10.4	8.9	16.6	13.5	20.6	20.6	23.3	19.0	24.3	No Data	No Data
MYR downstream of Our House Diversion Dam	MYR 12.6	2009	10.2	11.0	6.3	11.4	1.0	6.4	2.2	6.7	2.4	6.4	4.8	8.8	6.8	11.6	8.0	16.6	14.0	21.9	20.2	24.6	20.1	24.3	15.8	21.2
		2010	8.3	14.9	3.9	10.2	0.7	5.6	3.7	7.0	5.1	7.2	4.8	8.6	5.2	9.6	6.9	10.6	9.5	18.8	17.5	23.3	17.6	21.9	16.0	19.8
		2011	8.3	17.4	2.9	10.7	3.7	7.2	2.9	6.5	1.2	6.1	3.5	7.5	5.0	9.0	5.6	9.8	7.6	13.5	13.7	21.5	19.4	21.6	16.8	19.8
		2012	9.1	16.8	5.0	9.1	0.5	4.5	0.6	5.5	2.9	6.3	2.4	8.1	4.9	10.5	9.0	16.7	13.5	20.7	20.6	23.2	20.3	24.2	17.6	20.8
MYR upstream of North Yuba River	MYR 0.0	2009	9.1	18.0	6.4	12.6	1.4	6.7	No Data	No Data	No Data	No Data	10.4	11.8	9.7	16.9	9.2	21.6	17.6	24.4	21.5	25.9	20.5	25.5	15.2	21.5
		2010	8.1	15.2	8.5	11.3	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	6.8	13.5	10.2	15.6	13.8	23.9	21.7	26.0	18.7	23.3	16.3	20.7
		2011	9.3	18.3	3.5	11.6	3.9	8.7	3.7	7.5	2.9	6.8	4.5	10.4	6.4	12.8	6.6	14.2	10.0	17.7	17.3	24.1	20.9	24.0	17.6	20.9
		2012	9.6	17.6	7.5	9.9	0.3	5.1	0.6	6.6	3.5	7.5	4.9	10.3	7.5	14.6	11.9	19.3	16.7	23.2	21.7	24.4	20.0	25.1	17.3	21.1
OREGON CREEK																										
Oregon Creek upstream of Log Cabin Diversion Dam Impoundment *	OC 4.5	2009	7.4	15.6	6.1	11.1	0.4	6.6	1.4	6.1	1.0	6.1	4.5	7.8	5.7	11.8	8.3	17.2	13.4	19.6	17.3	21.6	16.9	21.2	12.3	17.9
		2010	6.7	12.9	4.1	9.8	0.5	5.4	3.6	6.7	4.5	6.7	4.5	7.8	4.4	9.0	6.9	10.8	11.0	18.8	16.7	21.1	14.8	18.9	12.7	16.6
		2011	7.2	15.5	2.3	10.3	3.3	7.1	3.1	6.6	0.5	6.3	3.2	7.0	5.1	8.1	5.8	10.6	7.4	15.9	15.2	19.6	16.8	19.6	14.4	17.0
		2012	9.4	14.4	5.9	9.6	2.2	5.5	1.9	5.7	1.4	5.7	1.1	7.6	4.3	10.5	8.9	15.4	12.5	18.6	17.5	20.2	16.3	21.1	14.6	17.5
Oregon Creek at intake to Camptonville Diversion Tunnel	OC 4.3	2009	9.3	16.5	7.3	11.8	2.0	7.6	2.2	6.5	2.3	6.4	4.8	8.6	6.7	11.6	8.2	16.5	14.0	21.3	19.6	22.5	No Data	No Data	No Data	No Data
		2010	11.0	13.3	5.2	9.0	2.4	5.7	3.8	7.0	5.1	7.1	4.9	8.4	5.1	9.5	6.9	10.6	9.6	18.7	17.4	22.9	17.4	20.8	16.6	18.4
		2011	8.3	15.2	3.0	10.8	3.7	7.2	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
		2012	No Data	No Data	No Data	No Data	2.0	5.1	2.4	5.6	3.2	6.4	2.5	8.0	4.9	10.6	9.2	16.3	13.5	20.3	19.8	21.7	20.7	21.6	No Data	No Data
Oregon Creek downstream of Log Cabin Diversion Dam	OC 4.3	2009	9.3	16.6	7.4	11.9	2.3	7.7	2.4	6.7	2.5	6.6	4.9	8.9	7.0	12.0	8.4	16.9	14.4	21.5	19.7	22.5	18.5	21.8	14.7	18.7
		2010	9.1	14.2	5.2	11.0	2.5	5.8	3.9	7.2	5.2	7.3	5.1	8.6	5.4	9.8	7.1	11.0	10.1	19.0	17.7	23.0	17.4	20.8	14.8	18.4
		2011	8.5	15.9	3.2	10.9	3.8	7.4	3.1	6.7	1.3	6.2	3.6	7.7	5.3	9.3	5.8	10.3	7.8	13.9	14.0	21.3	19.2	21.4	16.4	19.2
		2012	9.6	16.4	8.9	9.7	No Data	No Data	No Data	No Data	No Data	No Data	7.6	9.6	7.1	13.5	10.5	16.4	14.4	19.8	17.8	20.6	17.5	21.2	15.6	17.9
Oregon Creek upstream of confluence with Middle Yuba River	OC 0.2	2009	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
		2010	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
		2011	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	9.8	10.2	6.6	11.7	7.7	12.8	9.4	17.0	15.6	20.2	17.5	20.1	15.7	18.4
		2012	9.6	15.8	6.0	10.0	1.9	6.1	1.5	7.3	4.2	7.4	7.6	9.6	7.1	13.5	10.5	16.4	13.7	19.8	17.8	20.6	16.1	20.9	14.8	17.6
NORTH YUBA RIVER																										
NYR upstream of New Bullards Bar Reservoir *	NYR 16.1	2009	8.8	17.0	7.5	12.9	0.2	8.0	2.1	6.0	1.6	6.4	4.8	8.2	6.0	10.1	7.0	14.8	11.9	20.4	18.7	23.5	18.3	23.0	12.7	19.9
		2010	7.0	13.4	3.5	10.0	0.1	5.4	3.6	6.6	4.7	7.0	4.8	8.1	4.5	9.1	6.4	10.0	7.8	16.3	15.0	21.2	16.1	20.7	14.3	18.5
		2011	7.6	16.2	2.4	10.3	3.3	6.8	3.1	6.2	0.9	6.4	3.6	7.2	5.2	8.4	5.6	9.4	7.1	10.5	11.4	18.7	16.8	18.8	14.8	17.5
		2012	7.8	15.2	4.4	8.4	0.9	5.8	0.7	5.2	2.4	6.4	2.0	7.5	3.3	9.2	7.8	15.1	11.5	19.1	19.0	21.9	18.5	22.9	15.9	19.6
NYR at Low Flow Releases from New Bullards Bar Dam	NYR 2.3	2009	8.0	8.9	8.7	9.5	8.6	9.6	8.4	9.1	7.8	8.8	7.5	8.4	7.6	9.2	8.0	10.0	8.8	10.1	9.6	10.1	No Data	No Data	No Data	No Data
		2010	7.7	8.9	7.4	8.0	6.5	7.6	7.4	7.9	7.6	8.1	7.7	8.8	7.7	9.4	8.7	9.6	9.4	10.6	10.3	10.9	10.0	10.7	9.5	10.3
		2011	8.7	9.9	7.6	8.9	7.7	9.3	7.5	8.1	7.0	8.0	7.4	8.4	7.4	8.5	7.4	8.6	7.6	9.1	8.9	9.8	9.4	9.7	8.7	9.5
		2012	7.8	8.8	7.2	7.8	6.7	7.3	6.7	7.6	7.1	7.9	7.2	8.8	7.3	9.4	8.6	9.8	9.0	10.4	9.9	10.5	9.7	10.5	9.2	9.9
NYR upstream of Middle Yuba River	NYR 0.0	2009	8.1	13.6	8.7	9.6	9.1	9.6	No Data	No Data	No Data	No Data	10.7	11.7	10.4	16.0	10.3	20.7	17.2	22.5	20.2	23.8	8.3	23.5	15.1	19.8
		2010	7.4	14.0	7.8	9.3	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	8.1	14.1	11.2	16.1	13.8	22.3	20.7	23.9	18.0	22.5	15.9	19.5
		2011	10.3	17.2	10.1	11.8	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	19.7	22.5	20.2	22.5	17.1	20.0
		2012	10.0	17.1	8.2	10.2	2.2	5.6	2.9	7.3	5.0	8.1	6.3	10.6	8.4	14.8	11.7	18.3	16.2	21.3	20.2	22.0	18.6	22.4	16.4	19.3

Table 3.3.2-14. (continued)

Location	River Mile	Water Year	October		November		December		January		February		March		April		May		June		July		August		September	
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
SOUTH YUBA RIVER																										
SYR at Jones Bar *	SYR 7.4	2009	10.2	18.5	6.9	12.9	3.3	7.3	No Data	No Data	4.1	7.9	6.1	10.7	8.9	15.8	9.6	18.3	16.7	24.3	21.5	26.0	21.3	25.7	16.1	21.8
		2010	8.7	15.6	4.5	11.3	0.3	6.5	4.6	8.3	6.6	8.7	6.6	10.5	6.6	12.2	9.0	12.9	11.1	19.2	18.3	25.8	19.2	23.6	17.1	21.2
		2011	9.6	19.1	3.4	12.1	3.8	8.5	3.4	7.5	2.9	7.0	4.6	8.7	6.1	11.0	7.4	11.9	9.1	13.3	13.1	23.6	21.3	23.8	18.3	21.5
		2012	10.4	18.4	6.7	10.8	1.0	6.7	0.9	6.8	4.2	7.8	4.9	9.7	7.2	13.8	10.3	18.5	15.4	23.2	22.4	24.8	20.7	25.6	18.3	21.8
YUBA RIVER																										
Yuba River downstream of Confluence of North Yuba River and Middle Yuba River	YR 40.0	2009	8.6	15.1	8.0	11.4	4.8	8.3	No Data	No Data	No Data	No Data	10.5	11.8	9.9	16.9	9.4	21.5	17.5	23.9	21.2	25.4	11.5	25.0	15.5	21.0
		2010	9.2	14.3	8.6	10.2	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	6.9	13.6	10.3	15.7	13.9	23.5	21.5	25.4	18.6	22.8	16.3	20.4
		2011	9.6	18.1	9.6	11.8	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	20.1	23.7	20.7	23.6	17.6	20.8
		2012	9.7	17.6	7.5	10.0	No Data	No Data	No Data	No Data	No Data	No Data	5.9	10.3	7.7	14.7	12.0	18.6	16.7	23.0	21.8	24.1	20.1	24.4	17.5	20.9
Yuba River upstream of New Colgate Powerhouse	YR 34.4	2009	8.4	18.2	9.1	10.8	7.8	9.6	No Data	No Data	No Data	No Data	11.8	12.8	11.2	18.1	10.0	22.7	18.9	24.5	21.6	25.9	9.6	25.7	17.0	21.8
		2010	8.0	16.0	8.9	10.7	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	7.8	14.6	11.8	16.9	14.8	24.6	22.5	26.4	19.8	23.9	17.6	21.5
		2011	10.9	19.2	4.7	13.0	4.7	10.5	4.6	8.3	4.9	7.8	5.9	11.4	8.2	13.3	9.9	12.7	11.3	14.8	14.3	24.9	20.8	24.9	18.9	22.0
		2012	11.0	19.0	5.9	11.2	0.4	5.2	1.0	6.3	4.0	7.5	5.1	10.3	7.5	15.3	12.2	19.8	17.5	22.6	21.3	23.5	19.6	24.2	17.5	20.8
In Colgate Powerhouse Penstock	YR 34.2	2009	10.0	16.7	15.1	17.1	8.7	17.2	9.7	11.0	9.9	10.7	8.6	9.9	7.9	8.9	8.0	8.5	7.7	8.4	8.1	8.5	8.4	9.7	9.1	10.0
		2010	9.1	10.0	9.4	10.1	10.0	10.7	10.1	11.4	8.8	10.2	8.8	10.3	8.4	9.4	8.4	9.1	8.6	9.2	9.0	9.5	9.4	9.7	No Data	No Data
		2011	No Data	No Data	No Data	No Data	9.3	10.2	8.5	9.5	8.2	9.1	7.3	8.7	7.2	8.1	7.5	8.2	7.6	8.1	8.1	8.6	8.5	9.0	9.0	9.4
		2012	9.2	10.4	9.3	10.2	10.1	10.5	9.0	10.3	8.7	9.8	7.9	9.5	8.0	8.7	8.2	8.9	8.4	9.3	8.7	9.1	9.0	9.9	9.2	10.1
Yuba River downstream of New Colgate Powerhouse	YR 34.1	2009	8.4	13.7	9.0	10.8	7.8	9.6	No Data	No Data	No Data	No Data	7.5	9.8	7.1	9.3	7.7	8.6	7.3	8.1	7.6	7.9	7.9	11.7	8.4	12.0
		2010	8.7	9.1	9.0	9.0	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	7.9	8.4	7.9	8.2	8.2	8.5	8.5	8.8	8.8	9.4	10.0	16.5
		2011	9.5	14.5	8.1	10.6	8.1	9.8	7.8	8.4	7.3	7.8	6.7	7.4	6.7	7.1	6.9	7.4	7.2	7.6	7.5	7.8	7.8	9.1	8.6	11.7
		2012	8.7	11.1	8.8	9.2	7.4	9.1	8.2	9.2	8.0	8.6	7.4	8.6	7.4	8.1	7.6	9.7	8.3	11.4	8.1	10.5	8.7	10.7	9.6	14.0
Dobbins Creek at Lake Francis Outlet	DC 2.4	2009	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	13.1	20.7	15.0	23.7	15.6	21.1	16.8	20.2	16.5	20.0	12.3	17.7
		2010	8.7	14.7	9.8	14.5	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	9.8	18.0	14.9	20.0	18.5	23.3	15.9	17.9	14.3	16.5	13.6	15.8
		2011	9.1	16.7	10.3	14.9	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	12.3	16.5	15.2	19.9	15.9	25.8	17.1	25.7	9.9	17.6	14.0	16.0
		2012	10.3	18.7	9.2	11.1	6.6	9.7	5.6	9.2	6.9	10.8	7.7	11.1	11.0	21.7	17.6	22.9	14.1	23.7	15.3	17.3	15.2	17.5	14.5	16.0
Dobbins Creek upstream of Yuba River	DC 0.1	2009	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	10.0	17.1	12.8	20.2	16.9	21.5	19.5	21.6	No Data	No Data	No Data	No Data
		2010	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	8.5	14.8	12.1	17.0	17.4	22.6	20.6	24.3	19.0	22.0	17.0	20.5
		2011	10.3	19.0	10.4	15.2	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	10.2	15.4	12.6	17.2	13.2	22.0	19.5	22.5	11.2	22.5	18.2	21.1
		2012	11.7	18.3	8.6	13.0	4.0	8.2	3.8	8.4	4.5	10.1	6.8	15.3	9.9	18.6	14.7	18.7	15.9	20.5	No Data	No Data	19.7	23.5	19.1	20.5
Yuba River downstream of Dobbins Creek	YR 33.9	2009	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	8.0	8.7	7.7	8.5	8.0	10.7	7.8	9.2	8.0	8.4	8.3	11.9	8.8	11.3
		2010	8.8	10.1	9.0	10.3	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	8.1	9.5	8.3	9.9	8.5	9.2	8.7	9.1	9.1	9.8	9.9	14.1
		2011	9.7	13.4	10.1	11.1	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	6.8	9.0	7.6	9.4	7.6	10.5	7.8	9.4	8.1	9.6	9.4	11.4
		2012	8.9	12.6	8.9	13.0	7.7	9.0	7.8	8.8	7.5	8.6	7.4	9.2	7.6	9.7	7.9	9.4	8.3	10.4	8.4	10.2	8.9	10.3	9.7	10.9
In Narrows #2 Powerhouse Penstock	YR 24.2	2009	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	10.7	12.4	11.3	12.4	11.4	11.9	11.2	11.7	11.2	19.1
		2010	11.3	12.5	10.2	11.4	8.8	10.2	8.4	9.0	8.5	9.5	9.1	10.7	9.9	11.5	10.9	11.9	11.4	12.4	11.6	12.8	11.5	11.7	No Data	No Data
		2011	No Data	No Data	No Data	No Data	8.8	9.8	7.8	8.7	7.6	8.3	7.5	8.7	8.6	10.2	9.6	10.8	9.3	12.3	10.9	12.6	10.8	11.3	11.3	19.1
		2012	12.4	13.7	10.1	12.4	7.8	10.1	7.9	8.3	8.1	8.7	8.6	9.4	9.2	11.7	10.0	13.1	11.6	12.8	11.7	12.3	11.3	11.8	11.5	12.3
Yuba River downstream of Narrows #2 Powerhouse at Smartsville	YR 24.0	2009	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	10.0	10.9	10.5	12.2	11.0	12.3	11.1	11.6	10.9	11.4	11.4	12.2
		2010	11.0	12.0	9.7	11.1	8.4	9.6	8.2	8.8	8.3	9.3	8.8	10.3	9.6	11.1	10.4	11.4	11.4	12.4	11.4	12.6	11.2	11.9	11.7	12.6
		2011	12.0	13.3	9.9	12.1	8.4	9.8	7.4	8.2	7.2	8.0	7.2	8.7	8.3	9.8	9.5	10.8	9.2	12.5	10.7	13.2	10.6	11.1	10.9	12.5
		2012	12.1	13.6	9.8	12.1	7.5	9.9	7.5	7.9	7.9	8.5	8.4	9.5	8.9	12.1	9.9	12.9	11.6	12.5	11.4	12.0	11.0	11.5	11.1	12.1
Deer Creek upstream of Yuba River *	DeerC 0.9	2009	No Data	No Data	No Data	No Data	5.1	7.1	4.2	10.7	5.9	10.5	8.8	14.4	12.1	21.3	15.0	24.7	19.8	26.8	23.1	27.4	21.7	26.2	16.5	23.0
		2010	10.0	17.1	7.0	14.0	3.0	9.2	6.5	10.5	8.8	11.4	9.1	13.6	10.3	15.7	13.2	18.6	19.0	27.0	23.5	27.3	20.8	25.0	18.3	23.1
		2011	12.7	20.7	13.8	14.3	No Data	No Data	7.5	8.2	6.6	10.0	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	22.3	23.8	19.2	23.4
		2012	14.3	19.8	8.1	14.0	2.2	8.0	2.4	6.1	No Data	No Data	No Data	No Data	No Data	No Data	16.7	22.4	19.5	26.2	No Data	No Data	No Data	No Data	19.8	20.9

Table 3.3.2-14. (continued)

Location	River Mile	Water Year	October		November		December		January		February		March		April		May		June		July		August		September	
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
YUBA RIVER (continued)																										
Yuba River downstream of Deer Creek	YR 23.1	2009	No Data	No Data	10.4	11.0	8.2	10.4	8.1	8.6	8.0	9.0	8.4	10.5	10.2	11.2	11.0	12.5	11.3	12.5	11.4	11.8	11.2	11.8	11.8	12.8
		2010	11.1	12.7	9.6	11.2	8.2	9.5	8.2	8.8	8.4	9.4	9.0	11.0	10.0	11.7	10.8	11.7	11.6	12.7	11.7	12.8	11.5	12.2	12.3	13.1
		2011	12.2	13.6	9.6	12.3	8.3	9.8	7.3	8.3	7.0	8.1	7.4	9.0	8.6	10.0	9.7	11.0	9.4	12.7	10.9	13.3	10.8	11.6	11.6	13.3
		2012	12.4	14.4	9.7	12.2	7.4	9.8	7.2	8.2	7.9	8.7	8.5	10.1	9.2	12.1	10.2	13.0	11.7	12.6	11.7	12.2	11.3	11.9	11.7	12.6
Yuba River at Parks Bar	YR 17.7	2009	11.6	12.9	10.4	11.9	8.1	10.4	8.0	8.8	8.0	9.2	8.5	10.6	10.3	11.4	11.1	12.7	11.7	12.7	11.8	12.2	11.5	12.2	12.2	13.3
		2010	11.1	12.9	9.6	11.4	8.1	9.4	8.2	8.9	8.4	9.6	9.2	11.1	10.0	11.9	10.9	11.8	11.8	12.9	11.9	13.0	11.7	12.5	12.7	13.5
		2011	12.3	13.8	9.6	12.5	8.3	9.9	7.3	8.3	7.1	8.1	7.4	9.1	8.7	10.2	9.8	11.1	9.4	12.8	11.2	13.5	11.0	11.9	12.1	13.5
		2012	12.6	14.4	9.8	12.2	7.4	9.7	7.1	8.3	8.0	8.9	8.5	10.1	9.3	12.0	10.4	13.3	11.9	13.0	12.1	12.7	11.7	12.3	12.1	12.8
Yuba River at Long Bar	YR 16.0	2009	11.7	13.1	10.4	12.0	8.1	10.4	7.9	8.9	8.0	9.2	8.6	10.7	10.3	11.6	11.2	12.9	11.8	12.9	12.0	12.5	11.7	12.5	12.5	13.6
		2010	11.1	13.1	9.6	11.5	8.1	9.4	8.1	9.0	8.4	9.6	9.2	11.3	10.0	12.0	11.0	12.0	11.9	12.9	12.1	13.2	12.0	12.8	13.0	13.7
		2011	12.4	13.8	9.5	12.6	8.3	9.9	7.2	8.3	7.1	8.2	7.5	9.2	8.8	10.2	9.8	11.1	9.5	12.8	11.9	13.6	11.2	12.1	12.4	13.8
		2012	12.7	14.5	9.8	12.3	7.2	9.7	6.9	8.4	8.0	9.0	8.5	10.0	9.4	12.1	10.4	13.4	12.0	13.2	12.2	12.9	11.8	12.5	12.3	13.1
Dry Creek upstream of Yuba River *	DryC 0.7	2009	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	14.3	21.5	15.2	24.7	19.8	26.0	22.4	25.9	20.6	24.5	18.2	22.5
		2010	12.0	18.4	8.5	14.0	4.0	9.8	8.5	10.4	7.5	12.9	10.5	14.4	11.4	16.7	13.1	19.5	19.5	24.2	21.3	24.7	19.4	21.8	18.0	20.2
		2011	12.2	20.0	6.5	14.6	6.7	12.9	6.6	9.5	7.9	11.0	8.3	12.5	10.6	14.0	13.0	19.4	15.7	20.7	20.9	24.8	22.1	23.9	19.4	23.3
		2012	12.8	19.8	8.8	13.3	4.6	9.3	No Data	No Data	No Data	No Data	No Data	No Data	14.1	20.3	13.6	23.4	20.6	26.8	23.4	26.5	21.6	26.2	20.7	22.2
Yuba River upstream of USACE's Daguerre Point Dam	YR 11.6	2009	No Data	No Data	10.9	12.1	8.2	10.9	8.1	9.4	8.3	9.9	9.2	10.1	11.1	12.9	11.7	14.0	12.9	13.9	13.2	14.0	12.6	14.0	13.6	15.2
		2010	11.6	14.0	9.8	12.3	7.9	9.6	8.3	9.6	8.7	10.1	9.4	12.1	10.3	12.7	11.4	12.7	12.6	13.6	13.1	14.2	12.9	14.0	14.4	15.0
		2011	12.7	15.0	9.6	13.3	8.5	10.4	7.5	8.6	7.4	8.5	7.9	9.6	9.2	10.6	10.1	11.6	9.9	13.4	12.0	14.2	11.7	12.5	13.1	14.7
		2012	13.0	14.8	10.1	12.7	7.2	9.7	7.1	8.8	8.4	9.8	9.0	11.0	10.1	12.5	11.1	14.2	12.9	14.2	13.3	14.1	12.4	13.4	13.0	13.9
Yuba River at USACE's Daguerre Point Dam Fish Ladder	YR 11.6	2009	No Data	No Data	11.2	12.2	8.3	11.2	8.4	9.5	8.3	10.0	9.1	11.7	11.0	12.8	11.6	14.0	13.0	14.4	13.3	13.9	12.8	14.6	13.5	15.0
		2010	11.6	14.1	9.9	12.3	7.2	11.0	8.3	12.0	8.8	10.2	9.5	12.0	10.2	12.6	11.4	12.6	12.4	13.5	12.9	13.9	12.8	13.7	14.2	14.9
		2011	12.8	14.8	9.6	15.2	8.6	10.5	7.6	8.7	7.8	8.7	8.0	9.7	9.4	10.5	10.3	11.5	10.1	13.1	12.3	13.9	12.0	14.3	14.0	15.9
		2012	13.4	15.0	10.3	13.2	7.4	10.1	7.1	8.8	8.4	9.7	8.8	10.4	10.1	12.1	11.0	14.1	12.6	14.6	13.1	14.0	12.7	14.2	13.8	14.4
Yuba River at Walnut Avenue (Near Western Extent of Yuba Goldfields)	YR 8.3	2009	13.0	15.8	11.4	13.7	8.5	11.5	8.4	9.9	8.5	10.3	9.4	12.3	11.2	13.5	11.9	14.4	13.6	15.1	14.1	14.8	13.3	14.5	14.7	16.3
		2010	12.4	15.2	10.3	13.3	8.4	10.1	8.6	10.1	9.0	10.4	9.7	12.4	10.4	13.0	11.7	13.3	12.9	14.1	13.8	14.7	13.7	14.9	15.3	16.2
		2011	13.8	15.9	9.9	14.2	8.5	10.8	7.5	8.6	7.7	8.8	8.2	9.9	9.4	10.9	10.3	11.9	10.1	13.6	12.9	14.5	12.6	14.6	14.9	16.3
		2012	14.0	15.7	10.7	13.5	8.1	10.3	7.3	9.2	8.9	10.3	9.2	11.2	10.2	12.7	11.1	14.6	13.2	15.8	14.0	15.1	13.5	15.1	14.6	15.4
Yuba River at Marysville Gage	YR 6.2	2009	13.8	16.7	11.9	14.7	8.7	11.9	8.6	10.5	9.0	11.0	9.9	13.0	11.8	14.3	12.5	15.3	14.3	16.2	14.8	15.8	14.3	16.1	15.4	17.4
		2010	12.9	16.0	10.6	13.9	8.8	10.5	9.1	10.6	9.6	11.2	10.4	13.3	11.2	13.8	12.4	14.2	13.4	15.0	10.9	15.5	13.9	14.8	No Data	No Data
		2011	No Data	No Data	No Data	No Data	9.0	10.4	7.9	9.1	8.1	9.4	8.8	10.6	10.2	11.5	10.8	12.5	10.8	14.2	13.6	15.3	13.3	15.4	16.0	17.3
		2012	15.0	17.2	11.7	14.8	8.5	10.9	8.0	10.5	9.9	11.6	9.5	12.4	10.4	13.3	11.4	16.2	14.7	18.5	15.4	17.3	14.9	18.3	16.6	17.8
Yuba River upstream of Simpson Lane (Between Yuba Goldfields and Marysville)	YR 5.0	2009	13.9	16.7	11.9	14.2	8.4	12.0	8.5	10.4	8.6	10.7	9.5	13.3	11.6	14.6	12.0	15.0	14.1	16.5	14.8	15.7	13.9	17.2	15.6	18.8
		2010	12.7	16.8	10.3	14.0	8.2	10.5	8.5	10.8	9.4	10.9	10.0	13.0	10.6	13.5	11.9	14.0	13.2	14.7	14.2	15.2	14.3	15.9	16.3	17.7
		2011	14.1	16.8	9.8	15.0	8.5	11.1	7.5	8.7	7.7	9.1	8.3	10.1	9.6	11.1	10.4	12.1	10.3	13.9	13.5	15.0	13.2	16.9	16.8	19.2
		2012	15.0	17.2	11.7	14.8	8.5	10.9	8.0	10.5	9.9	11.6	9.5	12.4	10.4	13.3	11.4	16.2	14.7	18.5	15.4	17.3	14.9	18.3	16.6	17.8
FEATHER RIVER																										
Yuba River at Marysville (Downstream of Highway 70 Bridge	YR 0.7	2009	13.9	17.4	11.9	14.3	8.6	12.3	8.8	10.7	8.7	10.8	9.6	13.6	11.9	15.1	12.2	15.7	14.5	16.8	15.2	16.2	14.3	16.5	15.5	17.9
		2010	12.7	16.4	10.6	14.0	8.2	10.7	8.7	10.9	9.5	11.3	10.0	13.6	11.2	13.7	12.2	14.4	13.4	14.9	14.4	15.4	14.5	16.0	16.4	18.0
		2011	14.0	17.0	11.5	15.7	8.5	12.9	7.6	8.8	8.0	9.2	8.4	10.3	9.8	11.2	10.7	12.3	11.1	13.9	13.7	15.0	13.4	16.2	16.4	18.3
		2012	14.2	16.7	10.8	13.9	7.8	10.4	6.9	9.5	9.1	10.8	9.5	11.8	10.4	13.5	11.5	16.1	14.5	18.1	15.3	17.0	14.8	17.2	15.8	17.4

Table 3.3.2-14. (continued)

Location	River Mile	Water Year	October		November		December		January		February		March		April		May		June		July		August		September	
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
FEATHER RIVER (continued)																										
Feather River upstream of Yuba River *	--	2009	14.1	19.6	11.5	15.0	6.5	11.9	7.3	10.8	8.6	13.0	11.4	16.7	13.9	19.6	13.6	23.9	19.0	23.4	18.9	21.2	19.6	23.7	17.5	22.5
		2010	12.9	17.8	10.2	14.6	7.5	10.3	8.2	10.3	10.0	13.1	11.1	14.9	11.8	18.9	16.2	21.0	20.3	25.9	20.0	23.4	17.9	20.6	16.3	18.8
		2011	13.8	17.4	8.6	15.0	8.2	12.2	7.2	10.0	7.9	11.4	9.7	10.3	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
		2012	14.3	15.8	11.2	14.4	8.0	10.7	7.5	9.9	9.8	11.4	9.9	13.7	13.0	20.4	17.8	21.9	16.5	22.9	18.6	20.8	17.3	20.4	16.3	19.0
Feather River downstream of Yuba River on Right Bank	--	2009	13.4	18.4	11.2	14.4	7.0	11.7	7.6	10.5	8.6	10.9	9.6	14.2	11.9	16.7	12.5	17.5	15.4	20.9	17.3	19.2	15.9	19.3	16.0	20.4
		2010	12.7	17.1	9.7	14.1	7.2	10.2	8.5	10.5	9.4	11.5	10.1	14.1	11.0	14.8	13.0	16.8	14.0	16.5	14.9	16.2	15.5	17.0	16.7	18.9
		2011	13.6	17.4	9.0	15.2	8.4	11.4	7.2	8.8	7.7	9.4	8.4	10.3	9.9	11.2	10.8	12.3	10.9	13.9	13.7	15.3	14.3	18.8	16.2	19.9
		2012	14.1	16.7	11.0	13.8	7.8	9.9	7.3	9.9	9.5	11.1	9.5	12.3	10.5	14.4	12.0	17.5	15.7	19.6	16.8	19.5	16.3	17.8	16.3	18.2
Feather River downstream of Yuba River on Left Bank	--	2009	14.1	19.6	11.6	15.1	6.6	12.0	7.2	10.8	8.5	13.0	11.2	15.1	14.0	19.0	13.8	20.4	18.0	22.9	19.1	21.5	18.5	21.2	17.7	21.4
		2010	13.2	17.9	10.3	14.6	7.4	10.4	8.2	10.4	10.1	13.2	11.1	14.8	11.9	15.4	13.9	17.0	16.1	18.9	19.1	21.7	18.0	20.9	16.5	19.0
		2011	13.9	17.6	8.5	15.2	8.1	12.4	7.3	10.0	8.0	11.4	8.3	13.1	11.4	14.2	12.1	15.5	13.9	19.4	18.2	21.3	18.2	21.4	16.1	21.1
		2012	13.5	16.8	11.1	14.3	7.9	10.6	7.4	10.0	9.8	11.5	9.9	13.8	13.0	20.6	17.4	22.3	16.2	23.3	18.6	21.6	17.4	20.8	16.5	18.5

In general, water temperatures in stream reaches increased in May or June through August and early September, before declining in late September and October. This temperature trend is consistent with the Mediterranean climate patterns of inland northern California.

On a daily scale, monitoring locations showed a widely varying amount of diurnal influence as seen in the plots found in YCWA Technical Memorandum 2-5, *Water Temperature Monitoring*, Attachment 2-5 (YCWA 2013e) in Attachment E6. Diurnal variance was increasingly evident in locations with lower flows and/or increasing distance from low-level reservoir outlets. In addition, the trends in the water temperature data tended to closely follow trends seen in mean daily air temperatures observed regionally; this trend was also stronger at those locations with lower flows or increased distance from reservoir outlets as water temperatures began to approach equilibrium with the surrounding environment.

Monitoring locations directly downstream of Project facilities or in Project conduits did not necessarily follow these trends. These locations exhibited less daily fluctuations in temperature and were not correlated as closely to air temperatures in the area. However, water temperatures were affected by changes in flow releases from the nearby upstream facilities. In addition, water temperatures at monitoring locations downstream of reservoirs tended to increase as water temperatures in the contributing Reservoir increased.

Margin Water Temperature Conditions in Streams

Margin stream temperature data collected by YCWA is the most comprehensive source of margin temperature information in the areas potentially affected by the Project. YCWA collected data at four locations from July 2012 to September 2014. Details regarding the margin water temperature monitoring locations are provided in Table 3.3.2-15.

Table 3.3.2-15. Margin water temperature station information.

Site Location	Coordinates (Decimal Degrees)		Logger Location							
	Latitude	Longitude	Micro-habitat	Install Depth (ft)	Micro-habitat	Install Depth (ft)	Micro-habitat	Install Depth (ft)	Micro-habitat	Install Depth (ft)
Middle Yuba River downstream of Our House Diversion Dam (M01)	39.409195	-121.000992	A - RB, Edgewater	0.7	B - RB, Backwater	0.7	C - Thalweg, Pool	6.8	D - LB, Edgewater	0.9
Middle Yuba River upstream of Oregon Creek Confluence (M02)	39.393987	-121.082559	A - RB, Backwater	0.8	B - Thalweg, Run	2.8	C - LB, Run	1.8	D - LB, Edgewater	0.35
Middle Yuba River downstream of Oregon Creek Confluence (M03)	39.390960	-121.085380	A - RB, Edgewater w/ shade	0.55	B - RB, Edgewater w/o shade	0.52	C - Thalweg, Run	1.0	D - LB, Edgewater	0.42
Oregon Creek near Celestial Valley (M04)	39.413796	-121.068437	A - RB, Edgewater	0.6	B - Thalweg, Pool	1.8	C - LB, Run	0.55	D - LB, Backwater	0.75

Key: LB = left bank RB = right bank

Water temperatures observed at the four margin water temperature sites were generally consistent between the individual stations at each location. Where differences did occur it was generally during the summer months when flows were low and air and water temperatures were higher. In most cases, when a station's maximum temperatures were higher compared to those at the other three stations, it was a shallow, backwater area that received little shade and, hence, was likely to be subjected to effects of solar radiation. Temperature dynamics are difficult to predict between thalweg and edgewater locations in many streams due to the complexity of longitudinal and lateral mixing in the stream channel, which can also vary significantly at varying flow rates.

Figures 3.3.2-9 through 3.3.2-12 show the daily maximum water temperatures at each of the four monitoring locations. The y-axis has been focused, generally between 20°C and 25°C, to show the differences in temperatures between sites. Plots for the minimum and average daily water temperatures can be seen in Technical Memorandum 2-5, *Water Temperature Monitoring,* in Appendix E6.

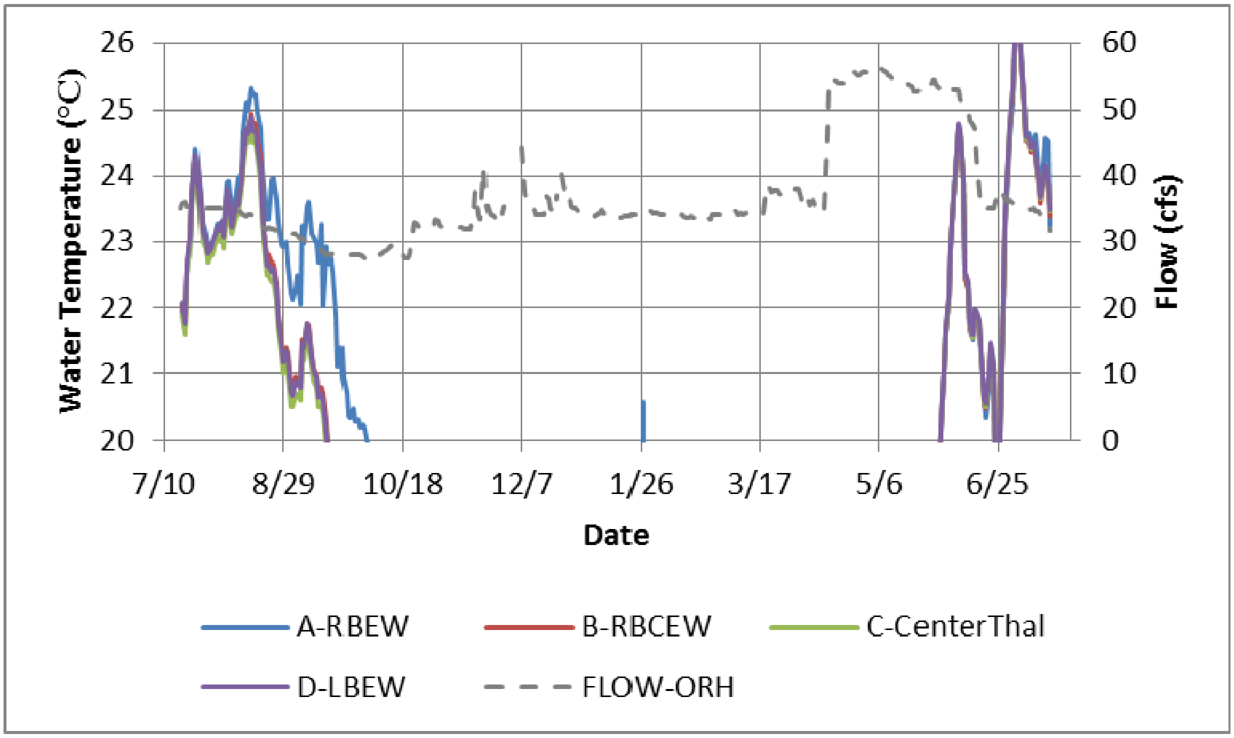


Figure 3.3.2-9. Daily maximum water temperatures in the Middle Yuba River downstream of Our House Diversion Dam (Site M01, loggers A – D).

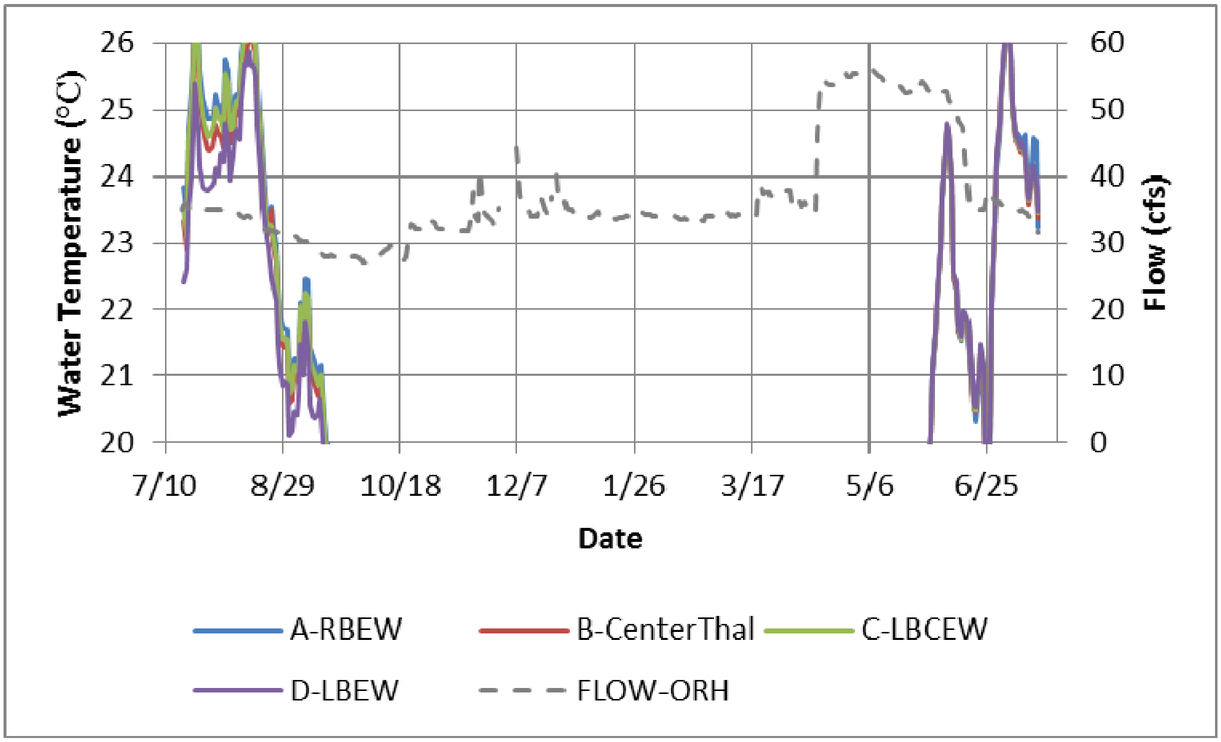


Figure 3.3.2-10. Daily maximum water temperatures in the Middle Yuba River upstream of the confluence with Oregon Creek (Site M02, loggers A – D).

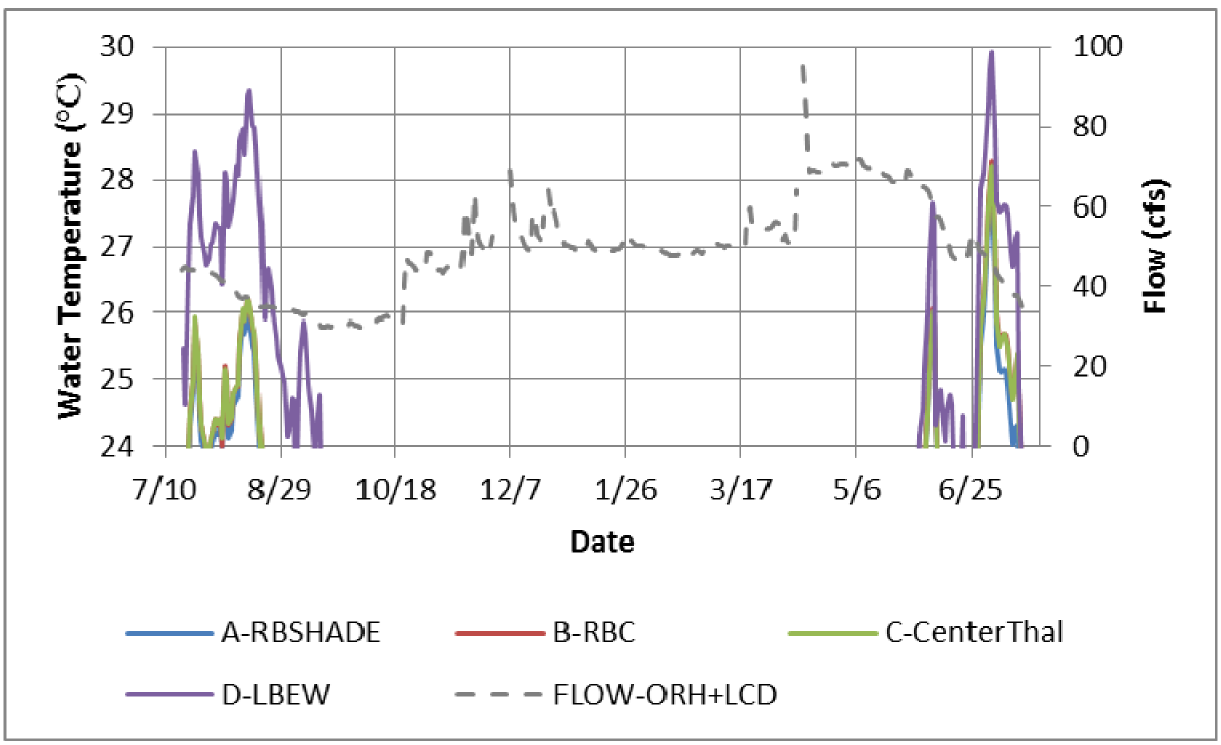


Figure 3.3.2-11. Daily maximum water temperatures in the Middle Yuba River downstream of the confluence with Oregon Creek (Site M03, loggers A – D).

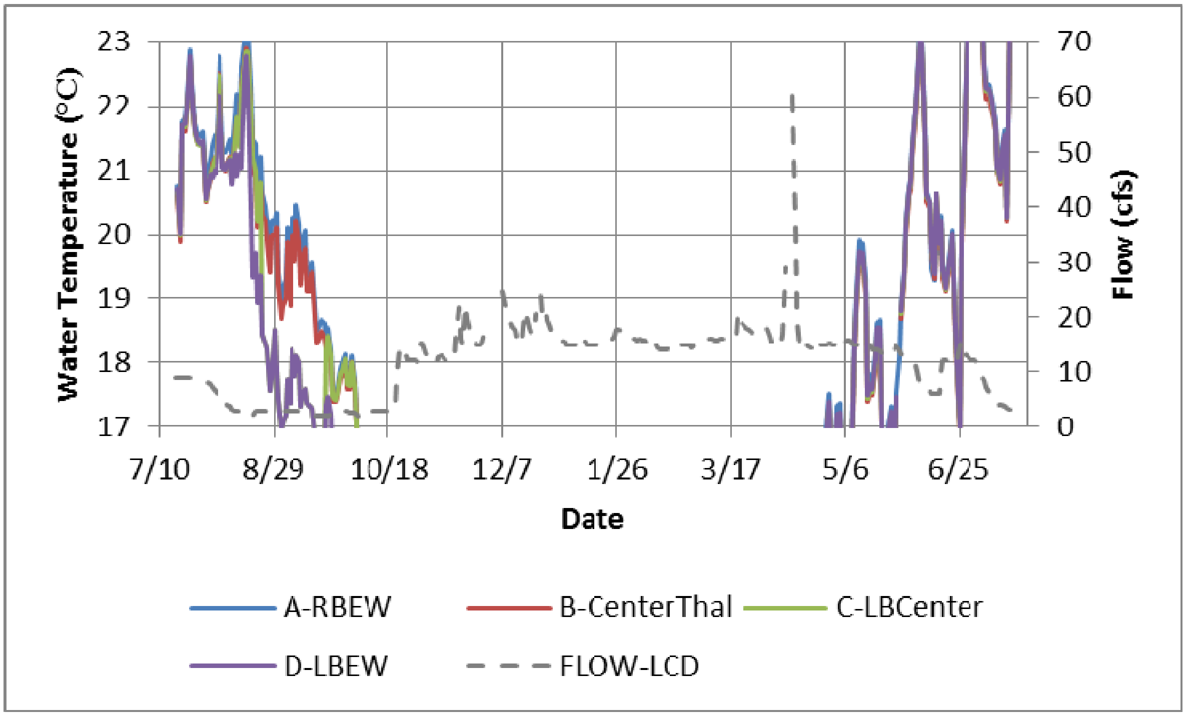


Figure 3.3.2-12. Daily maximum water temperatures in Oregon Creek near Celestial Valley (Site M04, loggers A – D).

YCWA's Relicensing Water Temperature Models

While a substantial quantity of water temperature data was collected throughout the Project area, the available data was limited to a few years, and generally at readily accessible locations and regulatory compliance points. Analysis of Project effects is greatly enhanced through the examination of a longer period-of-record of data than was historically available, representing a wide range of hydrologic and meteorological conditions. Accordingly, a suite of water temperature models were developed with the capability of simulating water temperatures throughout the Project area, for a period of record matching that of the Operations Model, WYs 1970 through 2010. YCWA relicensing Technical Memorandum 2-6, *Water Temperature Models,* in Appendix E6 provides a detailed description of the various modeling platforms used in the development of the water temperature models, but a summary is presented here.

The Temperature Models consist of three separate models that are run in series to simulate water temperatures from upstream to downstream. The Temperature Model consisted of: 1) the Upper Temperature Model; 2) the Englebright Temperature Model; and 3) the Lower Temperature Model. Each of these models is summarized below.

- Upper Temperature Model. This model uses the USACE's HEC model, HEC-5Q, to simulate Project water temperatures upstream of Englebright Reservoir. The model uses hydrologic output from the Operations Model; a historically-based synthetic timeseries for water temperatures on the Middle Yuba River above Our House Diversion Dam, on

Oregon Creek above Log Cabin Diversion Dam, and on the North Yuba River above New Bullards Bar Dam; accretions below each of the Project dams; and a historically-based synthetic timeseries of meteorological conditions to simulate Project effects on water temperatures. The model extents include a vertically-segmented one-dimension representation of New Bullards Bar Reservoir, the Middle Yuba River from Our House Diversion Dam to its confluence with the North Yuba River, Oregon Creek from Log Cabin Diversion Dam to its confluence with the Middle Yuba River, the North Yuba River from New Bullards Bar Dam to its confluence with the Middle Yuba River, and the Yuba River from its headwaters at the confluence of the North Yuba and Middle Yuba rivers to where the Yuba River reaches the NMWSE of Englebright Reservoir.

- Englebright Temperature Model. This model uses the USACE's CE-QUAL-W2 model to simulate water temperatures in Englebright Reservoir. The models uses hydrologic output from the Operations Model, simulated water temperatures on the Yuba River below the New Colgate Powerhouse from the Upper Temperature Model; a historically-based synthetic timeseries of water temperatures in the South Yuba River near Jones Bar; accretions to Englebright Reservoir; and historically-based synthetic meteorological conditions to simulate Project effects on Englebright Reservoir water temperatures. The model provides a two-dimensional representation of Englebright Reservoir, including flows through both of the powerhouses at Englebright Dam.
- Lower Temperature Model. This model uses the USACE's HEC-5Q to simulate water temperatures in the Yuba River from Englebright Dam to the Yuba River's confluence with the Feather River. The model uses hydrologic output from the Operations Model; simulated Yuba River water temperatures below Englebright Dam from the Englebright Temperature Model; a historically-based timeseries of water temperatures in Deer Creek near its confluence with the Yuba River and Dry Creek near its confluence with the Yuba River; and historically-based meteorological conditions to simulate Project effects on the Yuba River below Englebright Dam.

The models were developed using available information about the physical reservoir and river channel geometry, and then the historically-measured data described above was used to calibrate each water temperature model. All models calibrated extremely well, and the model output is extremely reasonable and valid for use in comparing alternatives. After calibration, each model was validated using a different period of hydrology than was used for the calibration. In each phase, the simulated output was compared against historical model to see if refinement to the calibration was required. After each of the models was calibrated and validated, they were run to simulate the No Action Alternative, described as the Base Case Scenario in Technical Memorandum 2-6, YCWA's Proposed Project Alternative, YCWA's Proposed Project (Future) Alternative, and the Without Project Alternative. All of the alternatives use the same meteorological and input water temperature conditions, but the hydrological conditions for each model come from their respective Operations Model runs.

The No Action, YCWA's Proposed Project (Existing), and YCWA's Proposed Project (Future) Hydrology datasets also include identical physical configurations, but the Without Project alternative assumes there are no YRDP Project facilities (i.e., no New Bullards Bar, Our House Diversion, and Log Cabin Diversion dams) or diversion structures (i.e., Lohman Ridge Tunnel, Log Cabin Tunnel, New Colgate Penstock) and no powerhouses (i.e., New Colgate, New Bullards Bar Minimum Flow and Narrows 2). The geometry for the North Yuba River below New Bullards Bar Dam was extended along the North Yuba River thalweg within the New Bullards Bar Reservoir to above the normal mean water surface elevation to represent the North Yuba River in the Without Project Alternative.

Model output from the three water temperature models includes mean daily water temperatures for WYs 1970 through 2010 for the following river reaches for all alternatives. The models are capable of producing output at virtually any location within each reach, but the typical output locations are listed below:

- Middle Yuba River
  - Middle Yuba River, Our House Diversion Dam Reach (HEC-5Q)
    - Middle Yuba River downstream of Our House Diversion Dam
    - Middle Yuba River upstream of Oregon Creek confluence
  - Middle Yuba River, Oregon Creek Reach (HEC-5Q)
    - Middle Yuba River downstream of Oregon Creek confluence
    - Middle Yuba River upstream of North Yuba River confluence
- Oregon Creek
  - Oregon Creek, Log Cabin Diversion Dam Reach (HEC-5Q)
    - Oregon Creek downstream of Log Cabin Diversion Dam
    - Oregon Creek upstream of Middle Yuba River confluence
- North Yuba River
  - New Bullards Bar Reservoir (HEC-5Q)
  - North Yuba River, North/Middle Yuba River Reach (HEC-5Q)
    - North Yuba River downstream of New Bullards Bar Dam
    - North Yuba River upstream of Middle Yuba River confluence
- Yuba River
  - Yuba River-North/Middle Yuba River Reach (HEC-5Q)
    - Yuba River downstream of Middle Yuba-North Yuba rivers confluence
    - Yuba River upstream of New Colgate Powerhouse
  - Yuba River, Colgate Powerhouse Reach (HEC-5Q)
    - Yuba River downstream of New Colgate Powerhouse
    - Yuba River upstream of Deer Creek confluence
    - Yuba River downstream of Deer Creek confluence

  - Yuba River near Parks Bar
  - Yuba River downstream of Dry Creek confluence
  - Yuba River upstream of Daguerre Point Dam
- Yuba River, Colgate Powerhouse Reach (CE-QUAL-W2)
  - Englebright Reservoir
  - Yuba River near Smartsville
- Yuba River USACE's Daguerre Point Dam Reach(HEC-5Q)
  - Yuba River downstream of Daguerre Point Dam
  - Yuba River near Marysville
  - Yuba River upstream of Feather River confluenceC-5Q)

Results of the water temperature models under the No Action Alternative (i.e., existing conditions) are presented below for three represented WYs: 1998 (wet hydrology); 2005 (normal hydrology); and 2001 (dry hydrology). To demonstrate simulated water temperature changes along each river, each figure shows mean daily water temperatures for each WY at several locations, sometimes spanning reaches and at other times splitting reaches into multiple segments. The three water years show peak mean daily water temperatures in June and July can be slightly cooler in the representative dry year (2001) than in either the representative wet (1998) or normal (2005) years; this is indicative of water temperatures within a reach being responsive to more than just the volume of flow in the river. Meteorology and the assumption of input water temperature at the upstream end of a reach can both play a role in the amount of heating and cooling occurring in a river, overcoming water temperature differences due to differences in flow.

Figure 3.3.2-13, 3.3.2-14, and 3.3.2-15 show simulated mean daily water temperatures along the Middle Yuba River. In all three WY types, water temperatures throughout the reach exceed 20°C for most of the June through August period. Simulated water temperatures throughout the year are very similar between years for the respective locations; there is little warming from upstream to downstream until the late spring, regardless of hydrology, and temperatures throughout the river reconverge in the fall, indicating there is minimal warming as flow travels downstream.

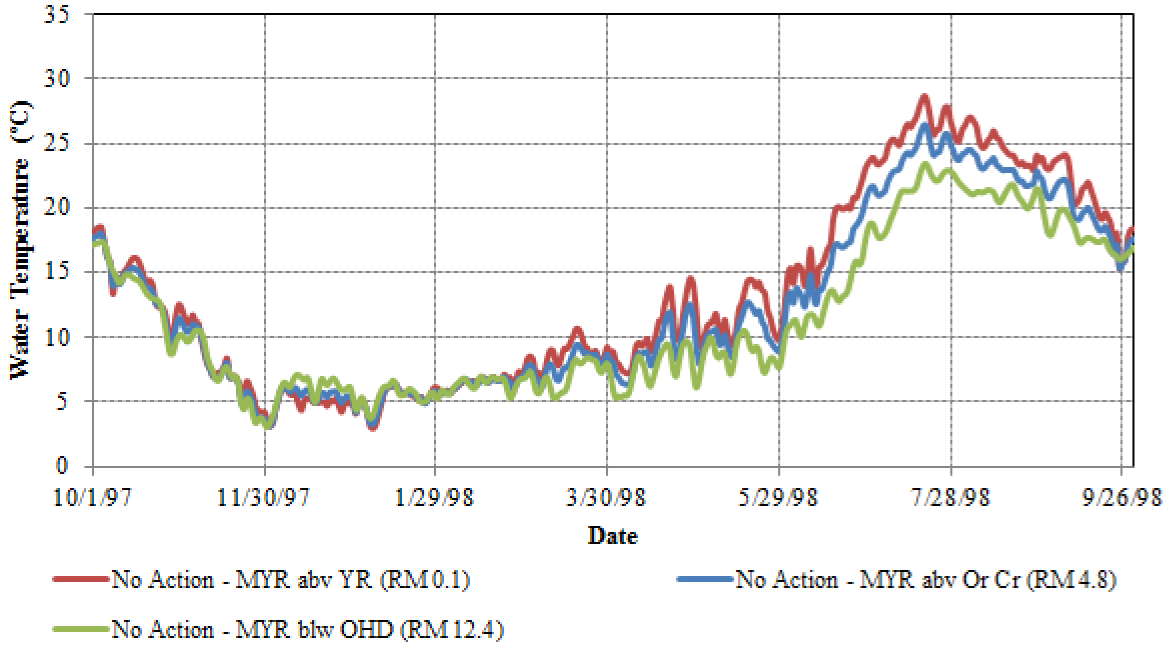


Figure 3.3.2-13. Simulated daily water temperatures for a representative wet WY (1998) at various locations along the Middle Yuba River.

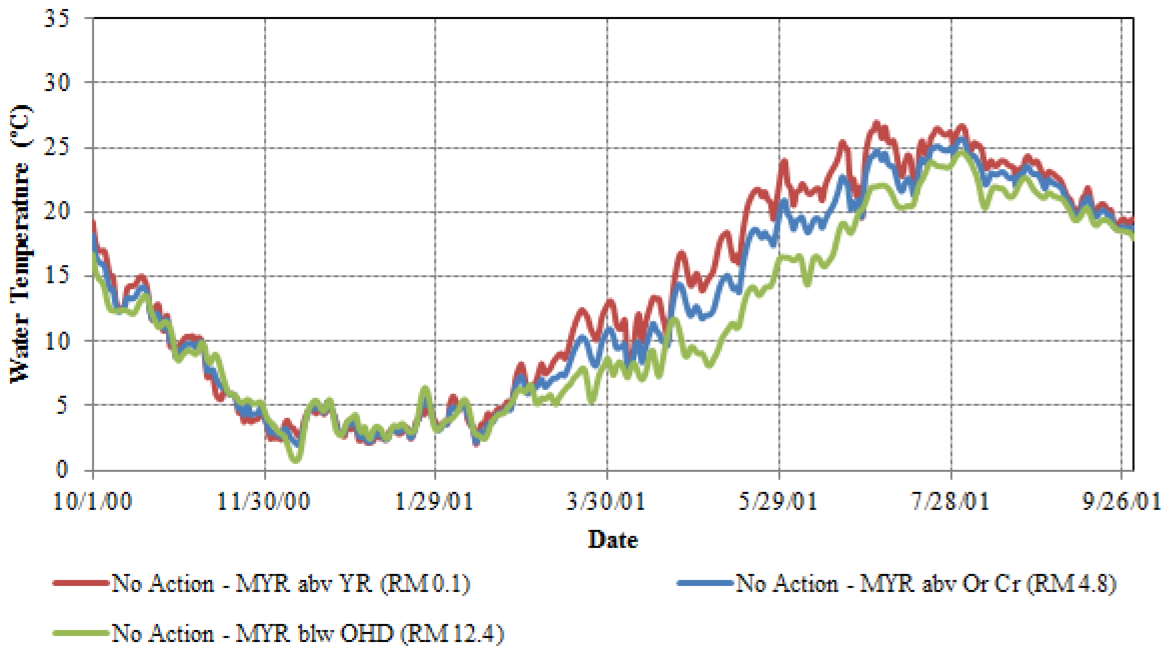


Figure 3.3.2-14. Simulated daily water temperatures for a representative dry WY (2001) at various locations along the Middle Yuba River.

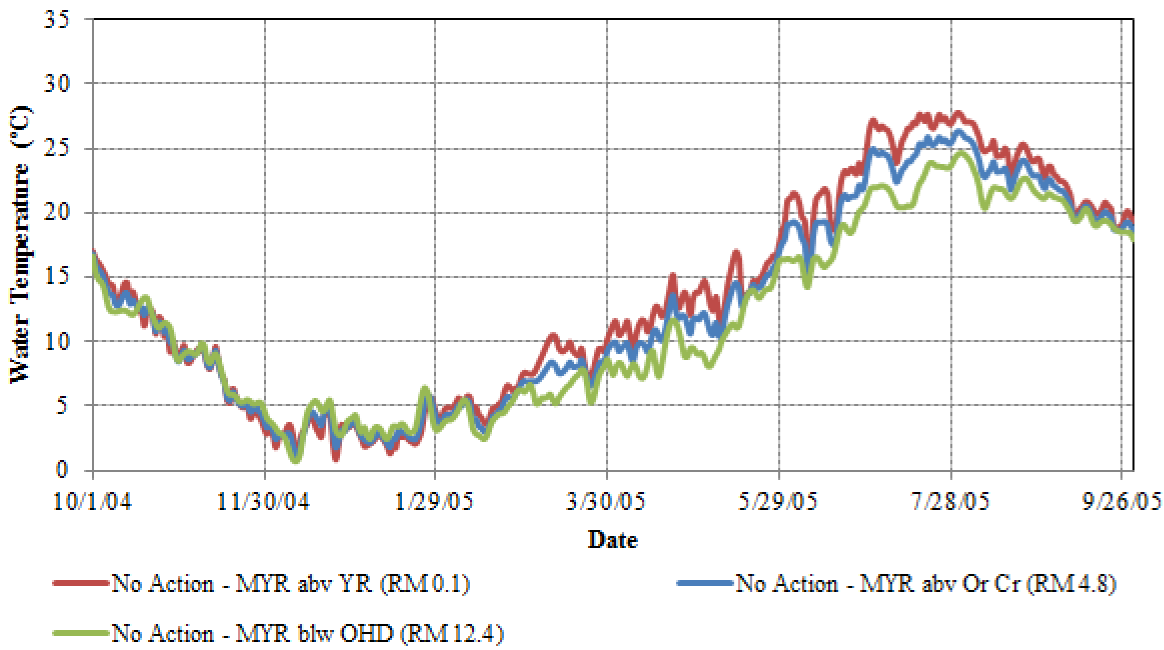


Figure 3.3.2-15. Simulated daily water temperatures for a normal WY (2005) at various locations along the Middle Yuba River.

Model calibration results for the Middle Yuba River show that the model slightly over-predicts water temperature in the July through October time period (Technical Memorandum 2-6, Attachment 2-6C).

Figure 3.3.2-16, 3.3.2-17 and 3.3.2-18 show similar plots for water temperatures along Oregon Creek for the No Action Alternative. In all three WY types, water temperatures below the dam exceed 20°C for major portions of the summer and water temperatures at the downstream end of the reach exceed 20°C for most of the May through September period. Like the Middle Yuba River, Oregon Creek warms up as flow moved downstream from Log Cabin Diversion Dam. The greatest heat gain is in the summer months in all WYs, generally corresponding to periods of both warmest ambient conditions and lowest flows. In all three years, there is some cooling in Oregon Creek in the winter months, as ambient conditions cool off and the water is not warmed by solar radiation.

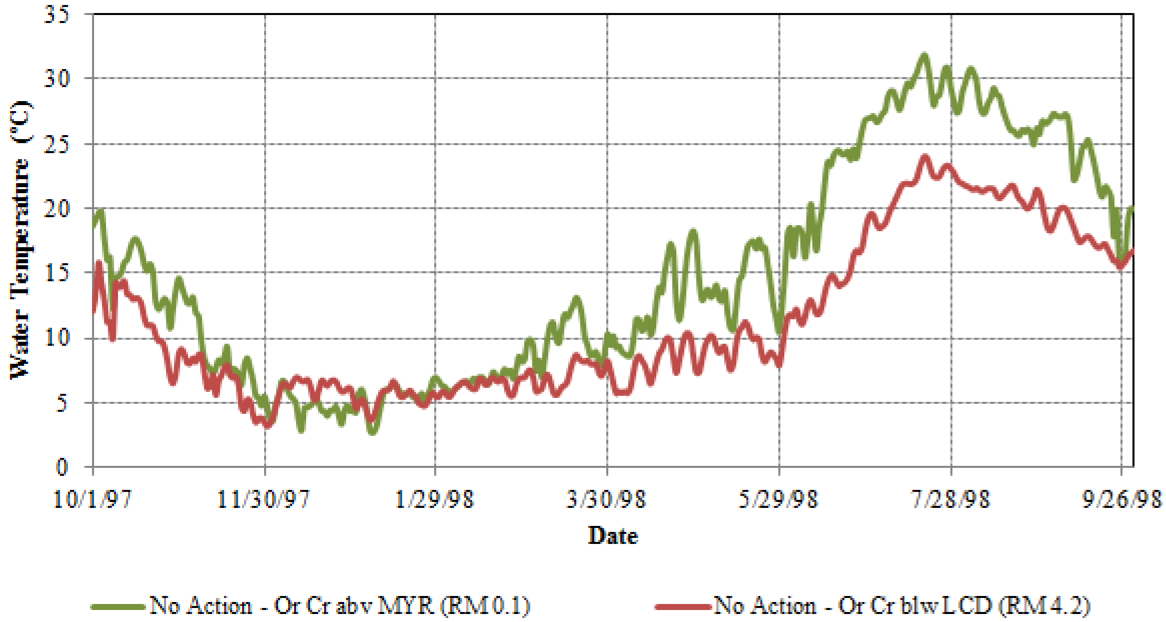


Figure 3.3.2-16. Simulated daily water temperatures for a representative wet WY (1998) at various locations along Oregon Creek.

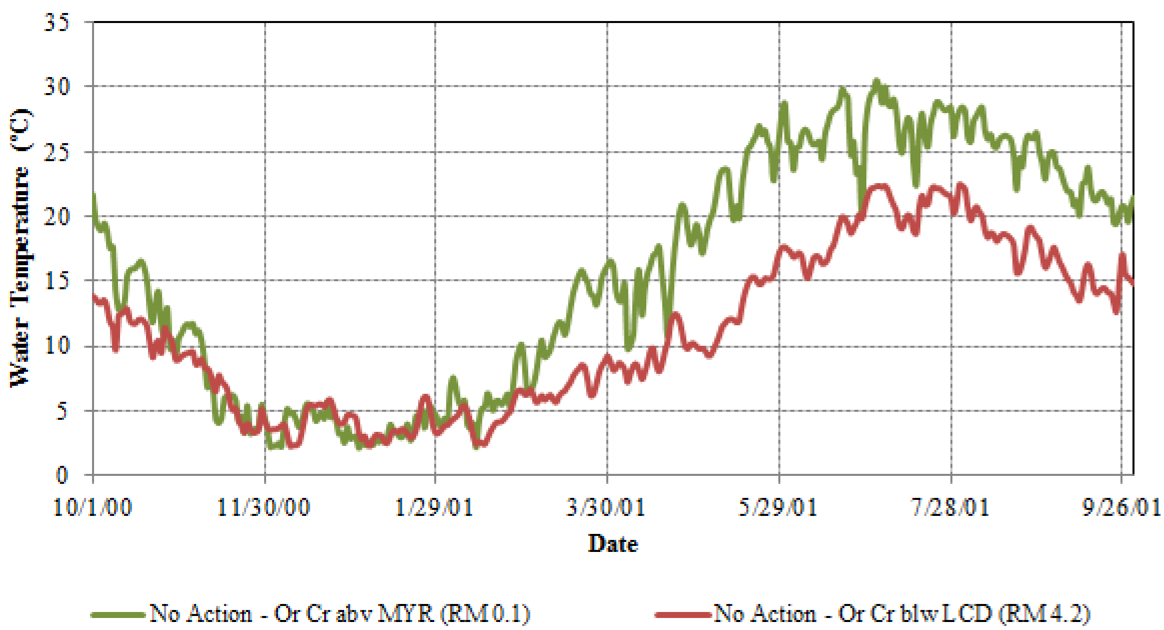


Figure 3.3.2-17. Simulated daily water temperatures for a representative dry WY (2001) at various locations along Oregon Creek.

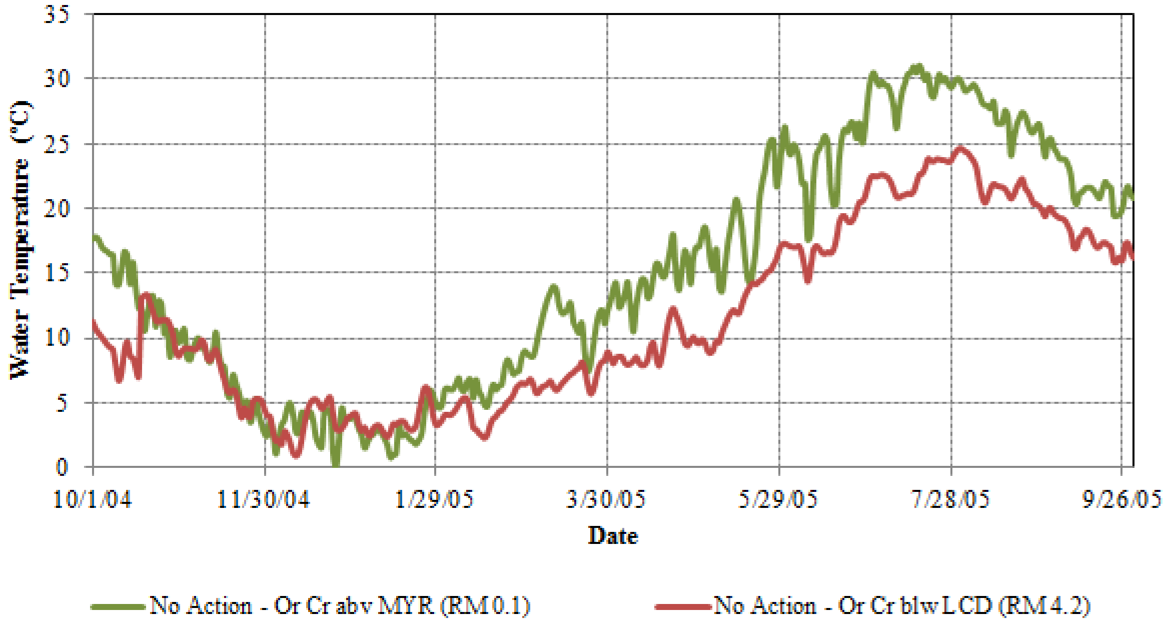


Figure 3.3.2-18. Simulated daily water temperatures for a representative normal WY (2005) at various locations along Oregon Creek.

Model calibration results for Oregon Creek show that the model under-predicts water temperature in fall months, but simulated peak temperatures were very similar to historical peak temperatures (Technical Memorandum 2-6, Attachment 2-6C).

Figure 3.3.2-19, 3.3.2-20 and 3.3.2-21 show simulated water temperatures along the North Yuba River for the No Action Alternative. In all three WY types, water temperatures in the reach are generally below 20°C. Water temperatures at the base of New Bullards Bar Dam exhibit minimal variability throughout the year; the primary source of temperature variation below New Bullards Bar Dam is due to spills through the New Bullards Bar Dam spillway. Otherwise, water temperatures in the North Yuba River downstream of New Bullards Bar Dam reflect water temperatures near the bottom of New Bullards Bar Reservoir.

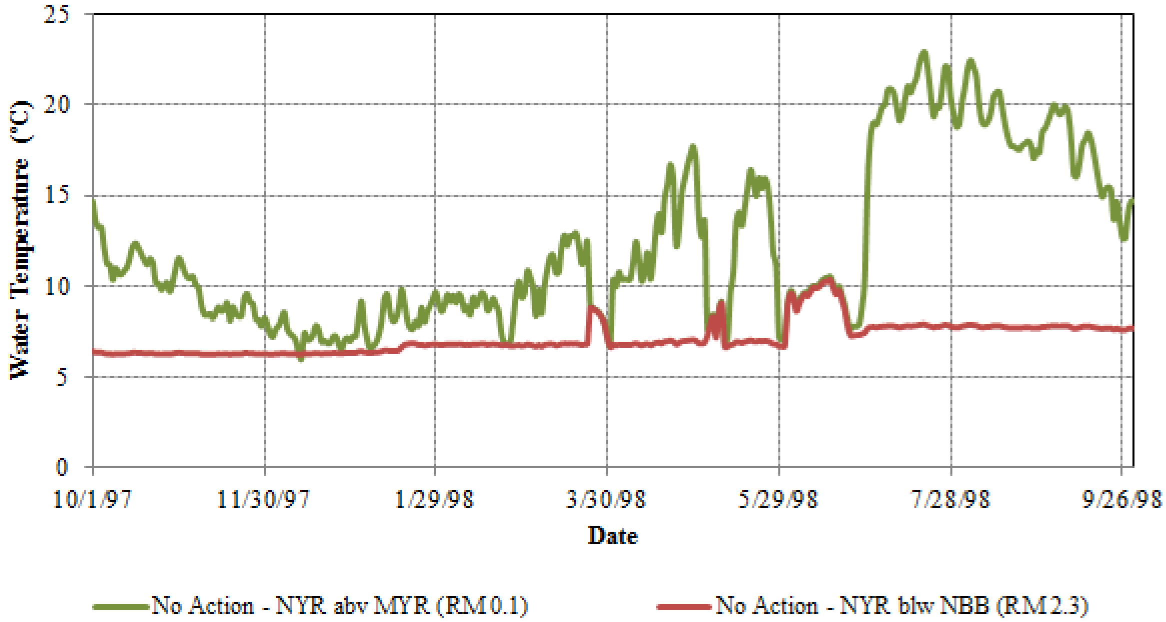


Figure 3.3.2-19. Simulated daily water temperatures for a representative wet WY (1998) at various locations along the North Yuba River.

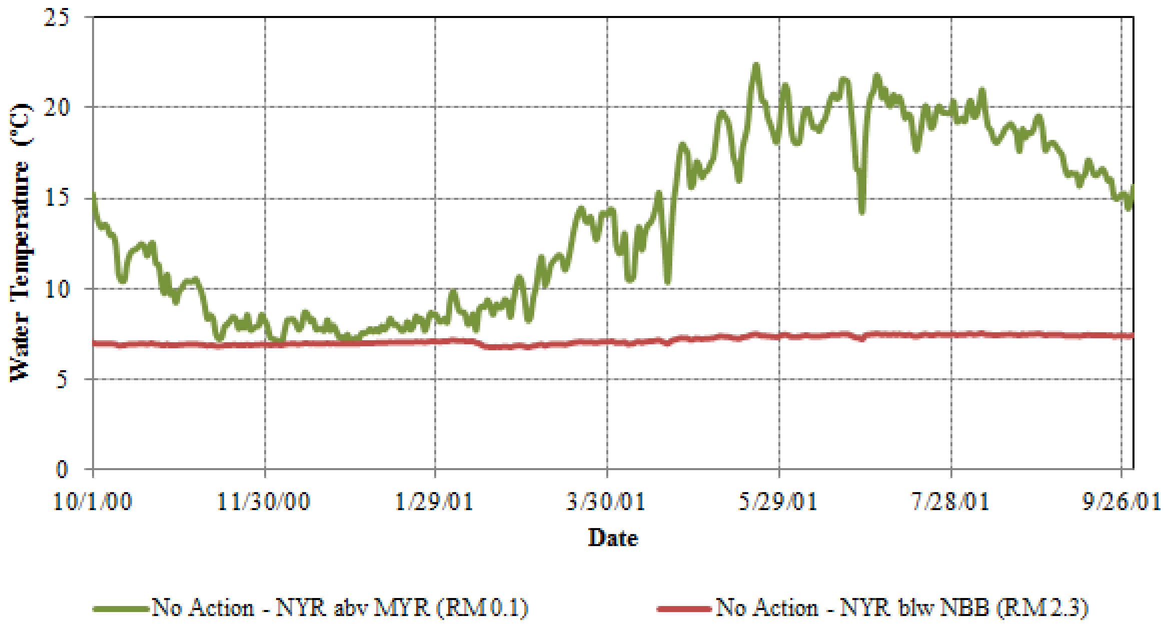


Figure 3.3.2-20. Simulated daily water temperatures for a representative dry WY (2001) at various locations along the North Yuba River.

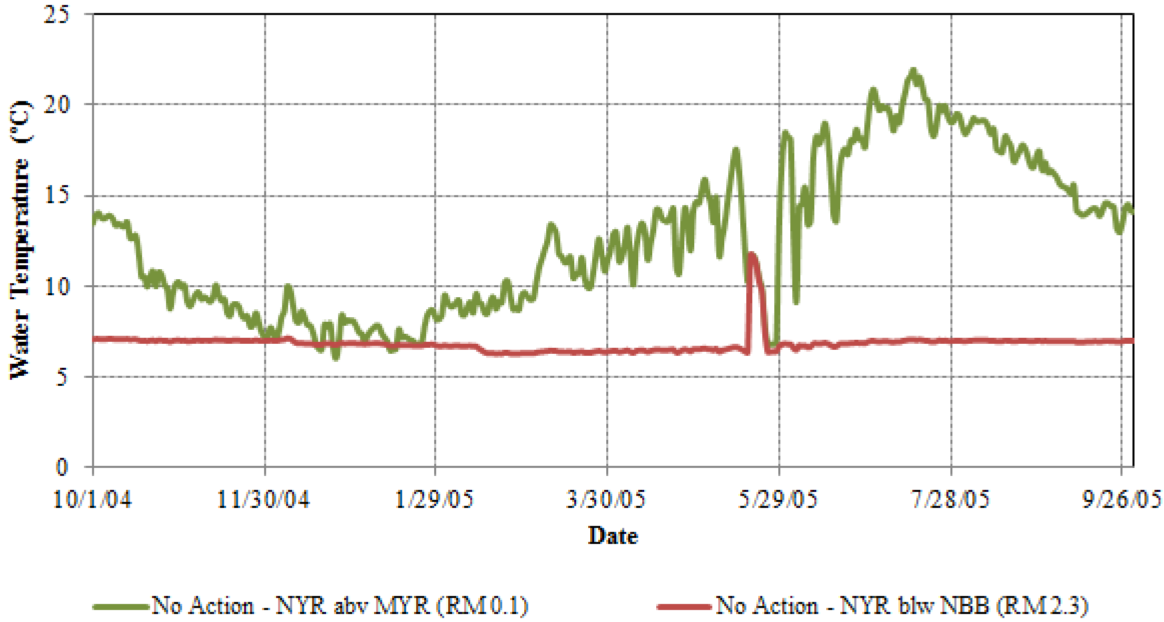


Figure 3.3.2-21. Simulated daily water temperatures for a representative normal WY (2005) at various locations along the North Yuba River.

Physical characteristics of this reach were very challenging to represent in the water temperature model. Figure 3.3.2-22 shows a picture of the North Yuba River downstream of New Bullards Bar Dam. Also, there was minimal data available for water temperatures when flows were greater than the minimum flow, or approximately 6 cfs, to calibrate the model against. As a result, the model did not initially calibrate well, especially during winter and spring (Technical Memorandum 2-6, Attachment 2-6C). However after flow tests on the North Yuba River in August of 2013, the North Yuba River calibration was improved to reasonably represent flows of up to 130 cfs. The model remains more responsive to changes in flow and meteorological conditions than historical measurements indicate, likely due to the insulating characteristics of the substrate in the reach not being well represented in the model.

Figure 3.3.2-22. North Yuba River downstream of New Bullards Bar Dam.

Figure 3.3.2-23, 3.3.2-24, and 3.3.2-25 show simulated water temperatures along the Yuba River upstream of Englebright Reservoir for the No Action Alternative. Similar to the Middle Yuba River and downstream end of Oregon Creek, which flow into the Yuba River, water temperatures upstream of New Colgate Powerhouse exceed 20°C for most of the June through August period. These figures demonstrate water temperatures in the Yuba River below the North Yuba and Middle Yuba rivers' confluence has little variation from upstream to downstream, above the New Colgate Powerhouse. Downstream of the New Colgate Powerhouse, Yuba River water temperatures are dominated by release water temperatures from the New Colgate Powerhouse. During spill events, water temperatures downstream of New Colgate Powerhouse indicate a response through a short-term change in water temperature, but after the spill is over, water temperatures return to a very consistent temperature.

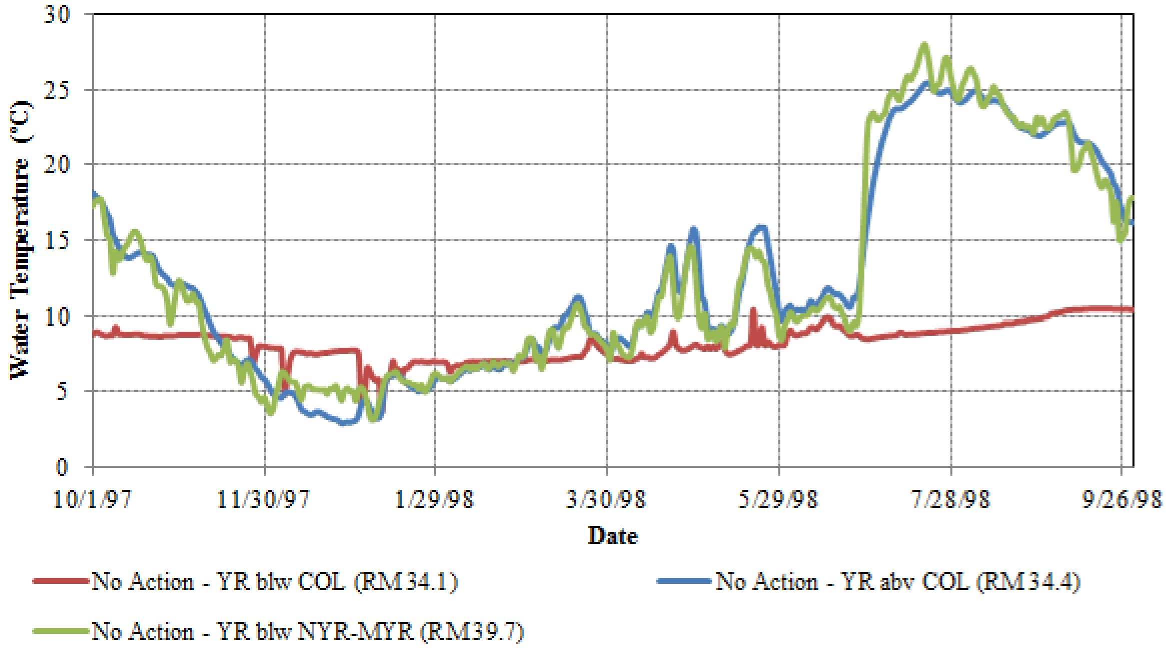


Figure 3.3.2-23. Simulated daily water temperatures for a representative wet WY (1998) at various locations along the Yuba River upstream of Englebright Reservoir.

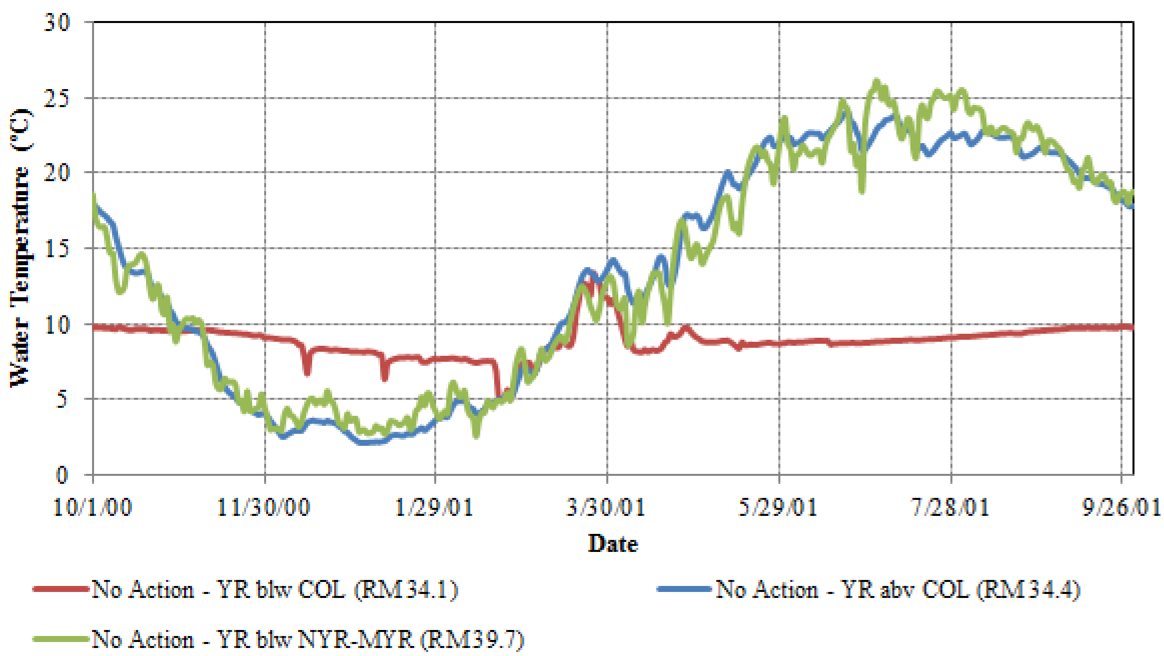


Figure 3.3.2-24. Simulated daily water temperatures for a representative dry WY (2001) at various locations along the Yuba River upstream of Englebright Reservoir.

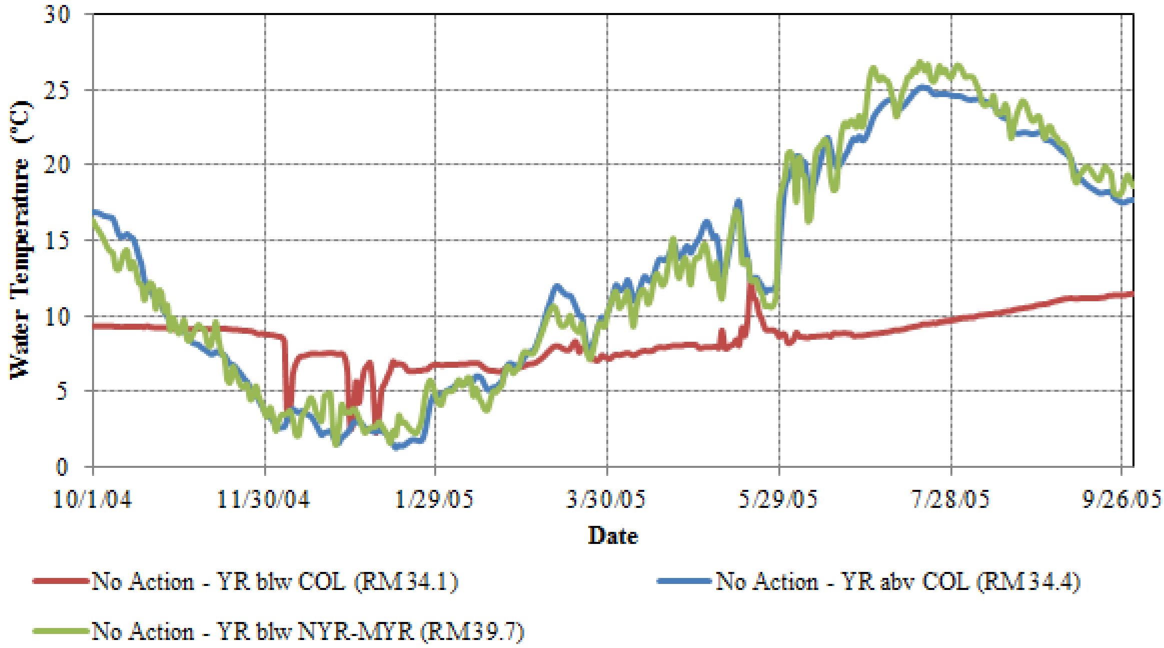


Figure 3.3.2-25. Simulated daily water temperatures for a representative normal WY (2005) at various locations along the Yuba River upstream of Englebright Reservoir.

Model calibration results for the Yuba River show that the model predicts water temperature well in the July through October time period (Technical Memorandum 2-6, Attachment 2-6C).

Last, figure 3.3.2-26, 3.3.2-27, and 3.3.2-28 show simulated water temperatures along the Yuba River downstream of the Narrows 2 Powerhouse for the No Action Alternative. In all three WY types, water temperatures in the reach are well below 20°C. These figures show water temperatures near Smartsville are relatively consistent throughout the year, reflecting the influence of the New Colgate Powerhouse upstream of Englebright Reservoir. The amount of warming downstream of Smartsville is heavily influence by hydrology; water temperatures in the wet WY indicate minimal warming between Smartsville and Marysville, but in the dry WY there is a substantial amount of warming as the flow moves downstream. And, corresponding to its "normal" condition, changes in water temperatures from upstream to downstream in 2005 were less than those in 2001, but more than those in 1998.

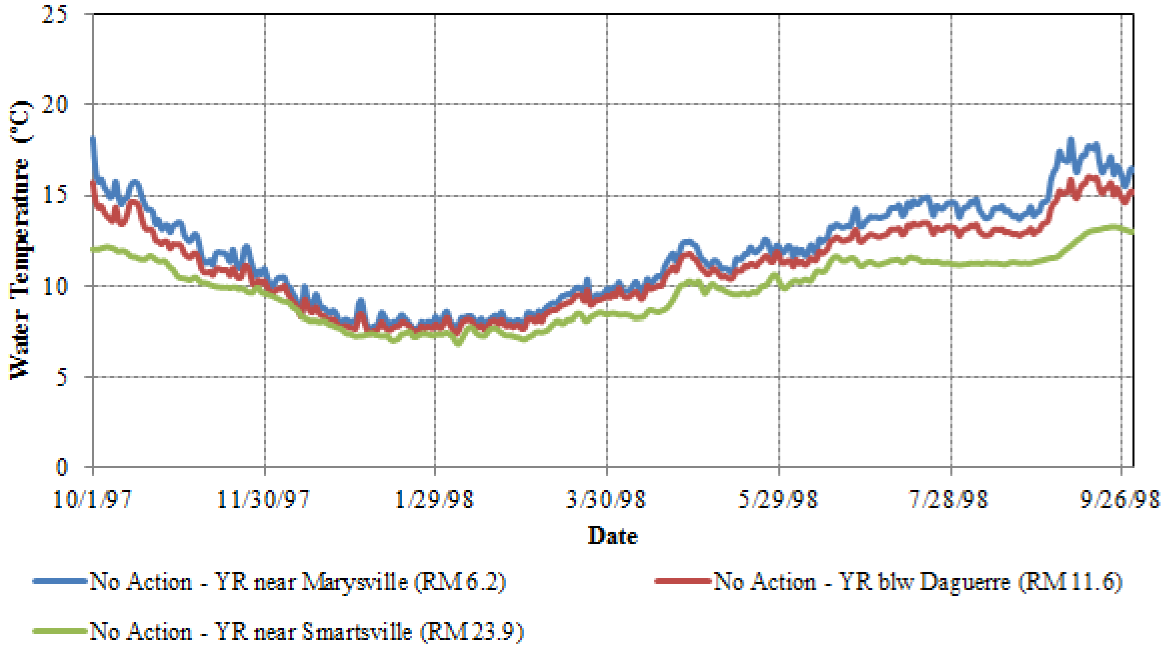


Figure 3.3.2-26. Simulated daily water temperatures for a representative wet WY (1998) at various locations along the Yuba River downstream of the Narrows 2 Powerhouse.

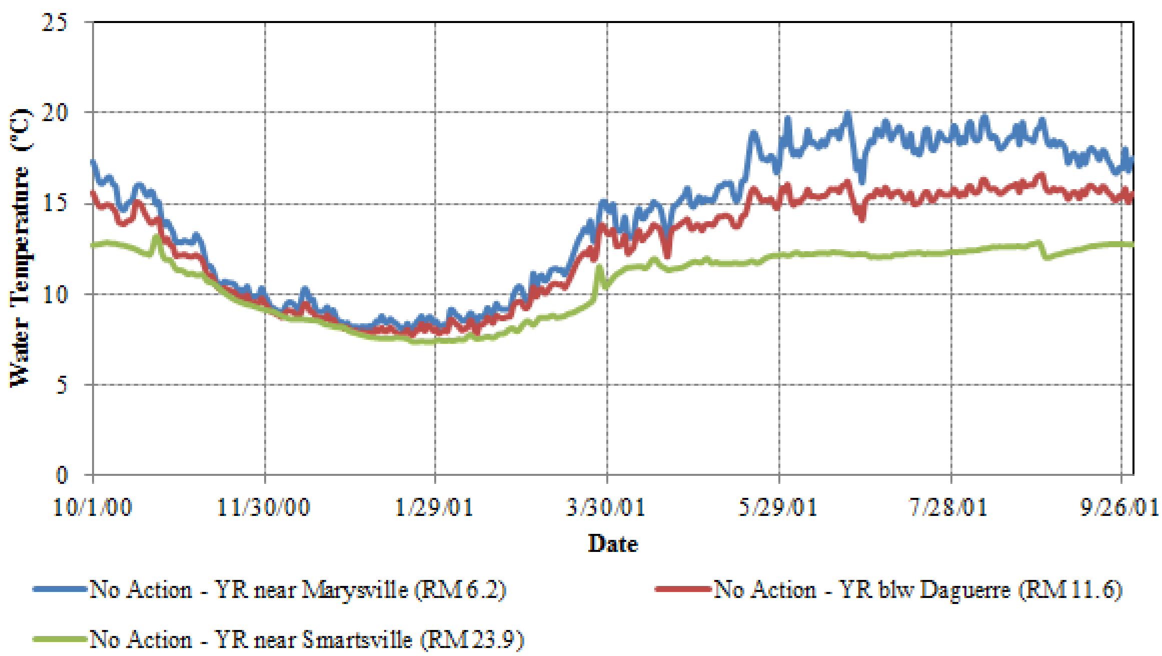


Figure 3.3.2-27. Simulated daily water temperatures for a representative dry WY (2001) at various locations along the Yuba River downstream of the Narrows 2 Powerhouse.

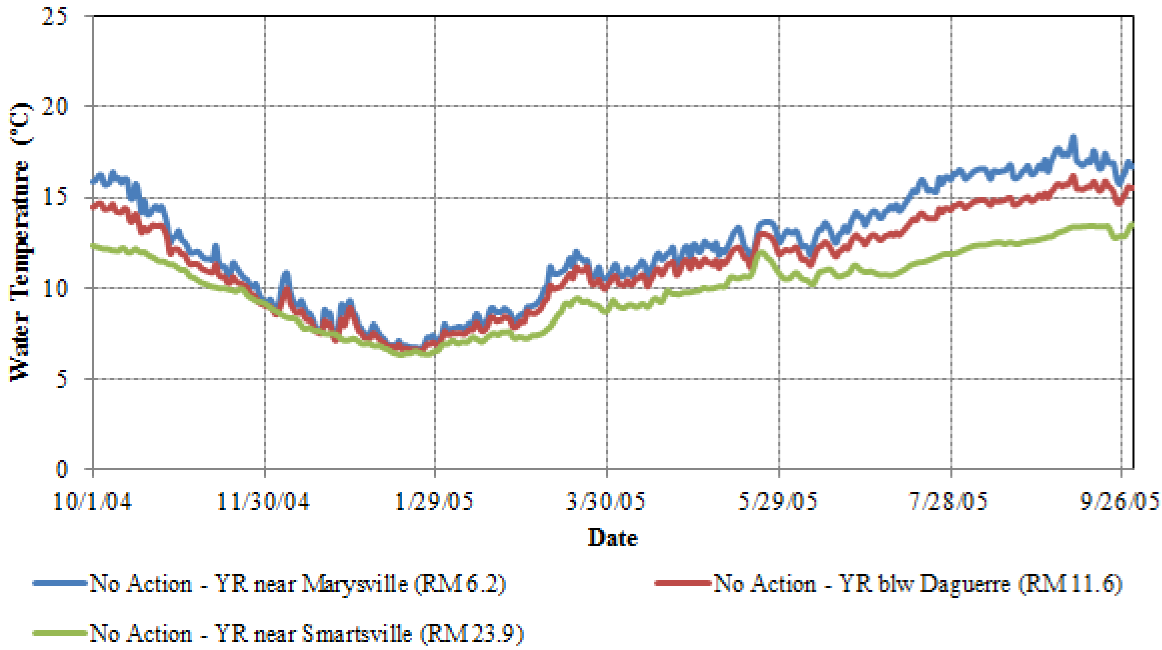


Figure 3.3.2-28. Simulated daily water temperatures for a representative normal WY (2005) at various locations along the Yuba River downstream of the Narrows 2 Powerhouse.

Model calibration results for the Yuba River show that the model predicts water temperature very well in all months of the year (Technical Memorandum 2-6, Attachment 2-6C).

CWA Section 303(d) constituent - Mercury

Mercury contamination is common in California aquatic food webs, affecting both the fishing and aquatic life beneficial uses in many areas of the state, with long-term trends indicating little change over the past few decades (Davis et al. 2007). In the Yuba watershed, local sources of mercury and, hence, methylmercury are a legacy of historic gold mining practices on the river, which used mercury amalgamation in the gold recovery process, much of which was lost to the environment (Alpers et al. 2005; Hunerlach et al. 1999; May et al. 2000; Slotton et al. 1995 *IN* May et al. 2000). Regional and global atmospheric sources of mercury also substantially contribute to mercury impacts to the Sacramento–San Joaquin River system (Davis et al. 2009).

Mercury has been comprehensively studied in Englebright Reservoir sediments (Alpers et al 2002). Mercury is presumed to be present in Our House and Log Cabin impoundment sediments at trace quantities, despite having not been detected in Our House Diversion impoundment sediment samples collected in 2006 or Log Cabin Diversion sediment samples collected in 2013 (YCWA 2006; YCWA pers. comm.).

YCWA detected mercury at almost all surface water locations in spring and summer 2012 surface water sampling (YCWA 2013d). The mercury concentrations ranged between 0.27

(estimated[24]) and 3.58 nanograms per Liter (ng/L) in spring, and between 0.31 (estimated[6]) and 15.9 ng/L in summer samples. These total mercury concentrations are far less than the MCL of 0.002 mg/L (2,000 ng/L) indicating that drinking water beneficial use is being met everywhere in the Project Area for mercury. In addition, the samples were below the CTR benchmark of 50 ng/L.

YCWA detected dissolved and total methyl mercury at about half of the surface water locations sampled in spring and summer 2012 surface water sampling (YCWA 2013d). Total methylmercury was detected in 17 of 31 spring 2012 samples, ranging in concentration from 0.29 (estimated) and 1.08 ng/L, and in 17 of 31 summer 2012 samples, ranging in concentration from 0.31 (estimated) to 15.9 ng/L. Dissolved methylmercury was detected in 31 of 31 spring 2012 samples, ranging in concentration from 0.033 (estimated) and 0.091 ng/L, and in 12 of 31 summer 2012 samples, ranging in concentration from 0.032 (estimated) 0.522 ng/L. The presence of methylmercury in surface water suggests that it may be bioaccumulating, as methylmercury is thought to be mercury's most bioavailable form.

In addition to the seasonal synoptic sampling, in 2012, samples were also collected downstream of the New Colgate and Narrows 2 powerhouses at a time of high turbidity. Below New Colgate Powerhouse, mercury concentrations were 7.2 mg/L on March 16 and 0.689 mg/L on March 19. Below Narrows 2 Powerhouse, mercury concentrations were 9.66 mg/L on March 16 and 19.4 mg/L on March 19 (YCWA 2013d). Total Dissolved Solids ranged between 54 and 68 mg/L in all four samples. Hydrological characteristics on the sampling days affected results, which were found to be consistent with ambient conditions (YCWA 2013d).

OEHHA's Advisory Tissue Levels (ATLs) are California's current screening values for determining the potential impairment of a body of water due to the presence of mercury in fish tissue (Davis et al. 2009; Klasing and Brodberg 2008). ATLs are published guidelines to help public health managers determine whether or not they should pursue fish ingestion advisory development for a water body under their jurisdiction (Klasing and Brodberg 2008). At this time, the most protective ATL is 0.070 parts per million (ppm) mercury wet-weight in fish tissue. This is the concentration at which OEHHA would begin to consider advising children and women of child-bearing age to limit consumption to fewer than eight meals per month. For comparison, USEPA's Tissue Residue Criterion is 0.3 ppm in fish tissue (USEPA 2001).

Since the early 1990's, more than 362 individual and composite fish fillets from 14 different species have been collected in the Project Vicinity and analyzed for mercury[25] by the University of California, Davis, the USGS, YCWA and others (Alpers et al. 2005; Holmberg et al. 2011; Hunerlach et al. 1999; May et al. 2000; Slotton et al. 1995 *IN* May et al. 2000; Slotton et al., in preparation *IN* OEHHA 2009; and YCWA 2012). Forty-seven of the 362 fish were collected from the three Project impoundments in support of YCWA's relicensing Study 2.4, Bioaccumulation (YCWA 2012). Table 3.3.2-16 summarizes the results from these

[24] Estimated value. Concentration is between the method detection and reporting limits.
[25] Of the total amount of mercury found in fish muscle tissue, methylmercury comprises more than 95 percent (ATSDR 1999; Bloom 1992).

investigations. The table shows that even reference sites have measured fish tissue concentrations near or greater than the most protective ATL.

Table 3.3.2-16. Range of mercury concentrations in fish tissue by location and species.

Sample Location	Species	Number of Fish Sampled	Concentration Range (ppm wet-weight)[1]	Total Length (mm)[2]	Reference
REFERENCE SITES[3]					
South Yuba River Near Emigrant Gap	Brown trout	6	0.04–0.06	--[4]	May et al. 2000
Bear River at Highway 20 (SR 20)	Brown trout	3	0.05–0.1	--	May et al. 2000
UPSTREAM OF THE PROJECT AREA					
North Yuba River near Canyon Creek	Rainbow Trout	5	0.19-0.14 (avg.[5] 0.11)	236 – 311	Slotton et al. 1997
Middle Yuba River 1 mile upstream of Plumbago Road	Rainbow Trout	5	0.05-0.19 (avg. 0.11)	292 – 415	Slotton et al. 1997 *IN* CVRWQCB 2009
Middle Yuba River upstream of Kanaka Creek (1 mile upstream of Tyler Foote Crossing)	Rainbow Trout	9	0.10-0.24 (avg. 0.16)	210 - 387	
UPSTREAM OF THE PROJECT AREA					
Middle Yuba River just upstream of Oregon Creek and Highway 49	Rainbow Trout	3	0.15-0.21 (avg. 0.18)	204 – 278	
	Sacramento Pikeminnow	2	0.56 and 0.81	321 - 339	
Middle Yuba River 1 mile downstream of the Highway 49 Crossing	Sacramento Pikeminnow	4 (composite)	0.64	≥150[6]	SWRCB 2002 *IN* CVRWQCB 2009
South Yuba River below Lake Spaulding	Brown Trout	2	0.07 and 0.07	224 – 249	Slotton et al. 1997 *IN* CVRWQCB 2009
	Rainbow Trout	3	0.06-0.11 (avg. 0.080)	180 - 228	
South Yuba River at Washington	Rainbow Trout	13	0.10-0.30 (avg. 0.15)	183 – 345	Slotton et al. 1997 *IN* CVRWQCB 2009
South Yuba River just downstream of Edwards Crossing	Rainbow Trout	2	0.09 and 0.15	182 – 270	May et al. 2000 *IN* CVRWQCB 2009
South Yuba River near Bridgeport	Smallmouth Bass	3 (composite)	0.069	≥150	SWRCB 2002 *IN* CVRWQCB 2009
IN THE PROJECT AREA					
Middle Yuba River at Log Cabin Diversion Dam Impoundment	Rainbow Trout	9	0.073-0.161 (avg 0.115)	214-326	YCWA 2012
Oregon Creek at Our House Diversion Dam Impoundment	Rainbow Trout	9	0.062-0.113 (avg 0.081)	235-276	YCWA 2012
New Bullards Bar Reservoir – East Arm near its confluence with the West Arm	Smallmouth Bass	13	0.22-0.68 (avg. 0.39)	≥150	SWRCB 2002 *IN* CVRWQCB 2009
New Bullards Bar Reservoir--East Arm near its confluence with the West Arm	Smallmouth Bass	13	0.22 - 0.68 avg 0.39	≥ 150	CVRWQCB 2009
New Bullards Bar Reservoir--East Arm near the Willow Creek inlet	Bluegill	3	0.12-0.39 (avg 0.21)	≥ 150	Melwani et al. 2007 *IN* CVRWQCB 2009
	Carp	11	0.34-0.83 (avg 0.52)	≥ 150	
	Largemouth Bass	1	0.61	≥ 150	
	Smallmouth Bass	10	0.29-0.72 (avg 0.48)	≥ 150	
	Carp	6 (composite)	0.61	≥ 150	CVRWQCB 2009
	Smallmouth Bass	5 (composite)	0.63	≥ 150	

Table 3.3.2-16. (continued)

Sample Location	Species	Number of Fish Sampled	Concentration Range (ppm wet-weight)[1]	Total Length (mm)[2]	Reference
IN THE PROJECT AREA (continued)					
New Bullards Bar Reservoir – East Arm near the Willow Creek inlet	Rainbow trout	9	0.068-0.143 (avg 0.105)	306-370	YCWA 2012
	Kokanee Salmon	10	0.075-0.167 (avg 0.112)	214-326	
New Bullards Bar Reservoir – North Arm near the North Yuba River inflow	Smallmouth Bass	10	0.446-0.807 (avg 0.620)	235-276	YCWA 2012
New Colgate Powerhouse Reach, approximately 1.3 miles upstream of USACE's Englebright Reservoir	Smallmouth Bass	5	0.27 - 0.56 avg of 0.38	≥ 150	CVRWQCB 2009
USACE's Englebright Reservoir—South Yuba Arm, Hogsback Ravine Arm, and mid-section.	largemouth smallmouth and spotted bass	56	0.45 (mean)	338 (mean)	May et al. 2000 and Slotton et al. 1997 *IN* CVRWQCB 2001; Slotton et al. in press *IN* OEHHA 2009
	Bluegill and green sunfish	31	0.30 (mean)	161 (mean)	
	Rainbow trout	49	0.08 (mean)	290 (mean)	
	Carp	1	0.88	440	Slotton et al. 1997
USACE's Englebright Reservoir—South Yuba Arm, Hogsback Ravine Arm, and mid-section. (cont.)	Hardhead	1	0.47	540	Slotton et al. 1997
	Sacramento sucker	5	0.41-0.89	410-523	
USACE's Englebright Reservoir	Largemouth Bass	Individual fish	0.2 - 1	--	Holmberg et al. 2011[7]
	Largemouth Bass	composite	0.82 (mean)	--	
	Redear Sunfish	composite	0.25 (mean)	--	
	Black Crappie	composite	0.25 (mean)	--	
Narrows 2 Powerhouse Reach, Lower Yuba River, approximately 2.2 miles downstream of Englebright Dam	Rainbow Trout	9	0.07 - 0.13 avg 0.10	≥ 150	Slotton et al. 1997 in CVRWQCB 2009
Little Deer Creek at Pioneer Park, less than one mile from the confluence with Deer Creek (tributary to Yuba River)	Brown trout	6	0.23 - 0.39 avg 0.32	≥ 150	May et al. 2000; CVRWQCB 2009
DOWNSTREAM OF THE PROJECT AREA[8]					
Daguerre Point Dam Reach, Lower Yuba River approximately 0.9 mile upstream of its confluence with the Feather River	Rainbow trout	1	0.02	≥150	SWRCB 2002 *IN* CVRWQCB 2009
	Sacramento pikeminnow	1	0.46		
	Sacramento sucker	2	0.22 and 0.38		
	Smallmouth bass	4	0.26-0.72 (avg. 0.43)		
Lower Yuba River, approximately 3.6 miles upstream of its confluence with the Feather River	Sacramento pikeminnow	2	0.31 and 1.43	≥150	Davis et al. 2002 *IN* CVRWQCB 2009
	Sacramento sucker	5 (composite)	0.39		
	Rainbow trout	3	0.08-0.10 (avg. 0.09)	310 (avg.)	Grenier at al. 2007 *IN* CVRWQCB 2009

Table 3.3.2-16. (continued)

Sample Location	Species	Number of Fish Sampled	Concentration Range (ppm wet-weight)[1]	Total Length (mm)[2]	Reference
DOWNSTREAM OF THE PROJECT AREA (continued)					
Lower Yuba River, approximately 3.6 miles upstream of its confluence with the Feather River (cont.)	Sacramento pikeminnow	5	0.19-1.58 (avg. 0.84)	≥ 150	
	Sacramento sucker	3	0.11-0.73 (avg. 0.26)	420 (avg.)	

[1] All results are in parts per million (ppm) wet-weight or were assumed to be in wet-weight.
[2] mm indicates millimeters
[3] Identified by the USGS as reference sites in May et al 2000 because location is upstream of mining influences.
[4] -- indicates no data available
[5] avg. indicates average
[6] ≤ indicates less than or equal to
[7] USACE has been collecting fish tissue composite samples and analyzing them for mercury since 2003. When composite sample results exceed USEPA guidelines, individual fish are analyzed. Individual fish concentrations are available for largemouth bass. See Figure 5 of Holmberg et al. 2011.
[8] Additional fish tissue data are available for areas downstream of the Project.

Based on data collected before 2009, the SWRCB identified most waters in the Project Vicinity as CWA (§) 303(d) State Impaired for mercury, citing fish tissue concentrations, not surface water concentrations, to support their listing (SWRCB 2010). YCWA's Bioaccumulation Study results were consistent with the previous findings and the SWRCB's listing rationale. These data indicate that mercury is bioaccumulating in fish residing within, upstream and downstream of Project.

Data collected in support of Study 2.4, *Bioaccumulation*, are of suitable quality and quantity for OEHHA to develop fish ingestion advisories for Project impoundments, the study's primary goal. These data are provided in Appendix E6.

3.3.2.2 Environmental Effects

This section includes a description of the anticipated effects of YCWA's proposed Project, which is described in Section 2.2. The section below is divided into the following areas: 1) effects on water quantity and use, 3.3.2.2.1; 2) effects on reservoir water quality, 3.3.2.2.2; 3) effects on stream reach water quality, 3.3.2.2.3; 4) effects on CWA Section 303(d) constituent – Mercury, 3.3.2.2.4; 5) effects of operations and maintenance activities, 3.3.2.2.5; and 6) effects of construction-related activities, 3.3.2.2.6.

3.3.2.2.1 Effects on Water Quantity and Use

Under YCWA's proposed Project, water quantity and use could potentially change, as compared to the No Action Alternative. This section discusses effects of YCWA's proposed Project on: 1) Project flows and storages; 2) water supply; and 3) water rights.

Project Flows and Storages

Several of YCWA's proposed Project conditions would affect Project flows and storage. Those conditions include the following:

- Gen7: Develop and Implement a Coordinated Operations Plan for Yuba River Development Project and Narrows Project
- Gen8: Right to Use Englebright Dam and Reservoir
- WR2: Determine Water Year-Types for Conditions Pertaining to Our House Diversion Dam, Log Cabin Diversion Dam, and New Bullards Bar Dam
- WR3: Determine Water Year-Types for Conditions Pertaining to Narrows 2 Powerhouse and Narrows 2 Full Bypass
- WR4: Implement Streamflow and Reservoir Level Monitoring Plan
- WR5: Maintain New Bullards Bar Reservoir Minimum Pool
- WR6: Operate New Bullards Bar Reservoir for Flood Control
- AR1: Maintain Minimum Streamflows below Our House Diversion Dam, Log Cabin Diversion Dam, and New Bullards Bar Dam
- AR2: Control Project Spills at Our House Diversion Dam
- AR3: Maintain Minimum Streamflows at Narrows 2 Powerhouse and Narrows 2 Full Bypass
- AR4: Control Project Spills at New Bullards Bar Dam
- TE4: Control Project Ramping and Flow Fluctuations Downstream of Englebright Dam

Project flows and storages are directly affected by all of the conditions; the water year-types defined in WR2 and WR3 determine the minimum flows in AR1 and AR3. The minimum flows in AR1 either affect inflows through the Lohman Ridge and Camptonville diversion tunnels (AR1), or releases from New Bullards Bar Dam (AR1) or Narrows 2 powerhouses (AR3). Similarly, conditions AR2 and AR4 will require increased releases from the Our House Diversion Dam and New Bullards Bar Dam when flows would otherwise have been stored in New Bullards Bar Reservoir. Conversely, increased flows on the Middle Yuba and North Yuba rivers and Oregon Creek from conditions AR1, AR2, and AR4 will generally result in a corresponding decrease in releases through the New Colgate Powerhouse. The minimum flows in AR3 and the ramping and flow fluctuation rates of TE4 are very similar to the corresponding minimum flows and ramping and fluctuation rates in the No Action Alternative, so overall Project releases would not substantially change. While conditions WR5 and WR6 are essentially the same as conditions in YCWA's existing FERC license, they each provide restrictions on quantities of water either stored or released from New Bullards Bar Reservoir. Conditions Gen7 and Gen8 will allow YCWA to continue its current operational agreements with the USACE for the use of Englebright Reservoir and with PG&E for the coordinated operations to meet minimum flows downstream from Englebright Dam. WR4 will allow YCWA to ensure compliance with all of the conditions affecting Project flows and storages.

Table 3.3.2-17 provides Project flows and storages exceedance values for the Proposed Project Alternative similar to those provided in Table 3.3.2-2 for the No Action Alternative. The average is also provided in the table.

Table 3.3.2-17. YCWA's proposed Project flows and storage from YCWA's Proposed Project (Existing) Hydrology dataset.

Value	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
NEW BULLARDS BAR RESERVOIR STORAGE (ac-ft)												
0%	676,429	788,191	796,000	796,000	796,000	796,000	896,000	966,000	966,000	966,000	883,366	710,282
10%	655,633	646,392	711,472	792,407	791,221	796,000	842,667	936,954	966,000	898,077	772,740	691,906
50%	633,698	608,404	601,645	612,757	636,605	706,952	787,261	856,821	861,505	794,635	712,449	667,637
90%	491,708	464,754	475,726	505,674	539,933	608,418	678,302	732,903	696,244	628,327	564,267	524,283
100%	184,328	169,966	163,216	248,444	306,191	290,800	290,140	292,233	286,124	255,194	231,366	209,167
Average	*592,652*	*574,965*	*585,994*	*619,160*	*648,481*	*699,478*	*768,070*	*834,191*	*839,391*	*768,677*	*682,501*	*627,325*
NEW BULLARDS BAR RESERVOIR WATER-SURFACE ELEVATION (ft)												
0%	1,888	1,916	1,918	1,918	1,918	1,918	1,941	1,956	1,956	1,956	1,938	1,897
10%	1,883	1,880	1,898	1,917	1,917	1,918	1,929	1,950	1,956	1,941	1,913	1,893
50%	1,877	1,870	1,868	1,871	1,878	1,896	1,916	1,932	1,933	1,918	1,898	1,886
90%	1,835	1,826	1,830	1,839	1,850	1,870	1,889	1,903	1,894	1,876	1,857	1,845
100%	1,704	1,695	1,690	1,739	1,766	1,760	1,759	1,760	1,757	1,743	1,731	1,719
Average	*1,864*	*1,858*	*1,861*	*1,871*	*1,880*	*1,893*	*1,910*	*1,926*	*1,926*	*1,910*	*1,888*	*1,874*
NEW BULLARDS BAR MINIMUM FLOW POWERHOUSE RELEASE (RM 2.4) (cfs)												
0%	5	5	5	5	5	5	5	5	5	5	5	5
10%	5	5	5	5	5	5	4	3	4	5	5	5
50%	5	5	5	5	5	5	3	3	3	5	5	5
90%	5	5	5	5	5	5	3	2	2	5	5	5
100%	5	5	5	4	4	3	2	2	2	5	5	5
Average	*5*	*5*	*5*	*5*	*5*	*5*	*3*	*3*	*3*	*5*	*5*	*5*
NORTH YUBA RIVER BELOW NEW BULLARDS BAR RESERVOIR FLOW (RM 2.4) (cfs)												
0%	15	15	41,048	63,307	45,621	24,183	18,120	20,763	5,133	775	15	15
10%	15	15	15	15	15	996	7	838	484	15	15	15
50%	15	15	15	15	15	14	7	7	7	14	14	14
90%	15	15	15	15	15	13	7	7	7	13	13	13
100%	7	7	7	7	7	7	7	7	7	7	7	7
Average	*14*	*14*	*264*	*541*	*339*	*451*	*158*	*321*	*204*	*16*	*14*	*14*
MIDDLE YUBA RIVER FLOW BELOW OUR HOUSE DIVERSION DAM FLOW (RM 12.6) (cfs)												
0%	302	4,460	12,673	20,141	17,052	7,040	6,091	7,709	1,869	516	83	83
10%	60	60	60	259	186	270	146	473	287	83	64	50
50%	37	48	60	60	60	69	69	69	69	55	38	35
90%	24	31	37	38	38	52	52	52	42	31	23	22
100%	15	19	22	24	24	24	24	24	24	12	12	13
Average	*39*	*75*	*157*	*242*	*181*	*181*	*137*	*201*	*127*	*64*	*42*	*36*
LOHMAN RIDGE TUNNEL DIVERSION FLOW (cfs)												
0%	860	860	860	860	860	860	860	860	860	657	75	147
10%	6	223	590	860	860	860	860	860	667	93	0	0
50%	0	0	48	159	268	378	403	393	86	0	0	0
90%	0	0	0	0	30	132	166	86	3	0	0	0
100%	0	0	0	0	0	0	25	3	0	0	0	0
Average	*8*	*73*	*167*	*284*	*338*	*439*	*448*	*424*	*212*	*30*	*0*	*1*

Table 3.3.2-17. (continued)

Value	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
MIDDLE YUBA RIVER FLOW ABOVE OREGON CREEK FLOW (RM 4.75) (cfs)												
0%	396	5,156	14,050	22,136	19,131	7,628	7,313	8,231	1,905	529	89	119
10%	64	98	175	485	384	464	258	569	314	89	67	53
50%	39	51	68	91	111	138	122	96	75	58	40	37
90%	25	33	42	57	68	93	62	54	45	32	24	23
100%	16	20	23	28	29	42	27	29	25	12	12	13
Average	*42*	*93*	*207*	*331*	*276*	*283*	*206*	*243*	*140*	*67*	*44*	*38*
OREGON CREEK FLOW BELOW LOG CABIN DIVERSION DAM FLOW (RM4.3) (cfs)												
0%	14	1,114	2,822	4,479	3,809	1,633	2,139	1,076	32	14	14	14
10%	9	9	9	136	111	122	32	32	32	14	6	5
50%	4	7	9	9	9	11	27	27	26	6	3	3
90%	2	3	5	7	7	7	19	19	7	2	1	1
100%	1	1	2	4	4	7	7	7	2	1	1	1
Average	*4*	*14*	*43*	*78*	*63*	*54*	*39*	*29*	*22*	*7*	*4*	*3*
CAMPTONVILLE TUNNEL DIVERSIONS FLOW (cfs)												
0%	1,029	1,100	1,100	1,100	1,100	1,100	1,100	1,100	977	692	92	204
10%	9	282	814	1,100	1,100	1,100	1,036	936	707	92	0	0
50%	0	0	60	225	381	519	508	433	76	0	0	0
90%	0	0	0	1	42	182	186	87	0	0	0	0
100%	0	0	0	0	0	1	30	0	0	0	0	0
Average	*10*	*93*	*221*	*379*	*460*	*585*	*544*	*477*	*216*	*30*	*0*	*1*
OREGON CREEK FLOW ABOVE ITS CONFLUENCE WITH THE MIDDLE YUBA RIVER FLOW (RM 01) (cfs)												
0%	48	1,362	3,382	5,343	4,550	1,975	2,574	1,317	71	27	16	27
10%	11	22	49	205	176	190	75	65	40	16	7	6
50%	4	8	12	21	28	36	45	35	29	7	4	3
90%	2	4	6	10	12	21	22	19	8	3	2	2
100%	1	1	2	4	4	8	8	9	2	1	1	1
Average	*6*	*20*	*61*	*110*	*97*	*90*	*64*	*44*	*27*	*8*	*4*	*4*
MIDDLE YUBA RIVER FLOW BELOW OREGON CREEK FLOW (RM 4.65) (cfs)												
0%	444	6,517	16,982	26,718	23,681	9,530	9,887	9,194	1,949	548	106	146
10%	76	120	224	701	583	688	334	637	349	105	74	58
50%	44	59	80	111	139	173	167	133	104	66	44	40
90%	28	38	48	67	81	115	85	73	56	35	26	25
100%	17	22	27	32	33	50	35	38	29	13	13	14
Average	*47*	*113*	*268*	*441*	*372*	*373*	*270*	*287*	*167*	*75*	*48*	*41*
MIDDLE YUBA RIVER FLOW ABOVE ITS CONFLUENCE WITH THE NORTH YUBA RIVER FLOW (RM 0.1) (cfs)												
0%	512	7,017	17,972	28,461	25,176	10,221	10,766	9,570	1,974	557	110	173
10%	80	149	306	886	733	812	430	694	367	109	76	60
50%	45	62	87	136	178	224	209	153	109	68	45	41
90%	29	39	50	70	89	139	97	80	59	36	27	25
100%	18	23	28	34	35	53	36	42	29	14	14	15
Average	*50*	*126*	*304*	*506*	*441*	*447*	*320*	*317*	*176*	*78*	*49*	*43*

Table 3.3.2-17. (continued)

Value	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
YUBA RIVER FLOW BELOW THE CONFLUENCE OF THE NORTH YUBA AND MIDDLE YUBA RIVERS FLOW (RM 40.0) (cfs)												
0%	527	7,032	55,252	91,768	66,824	34,404	28,886	30,067	7,107	1,332	123	186
10%	95	164	328	1,365	1,129	1,857	459	1,536	769	122	90	73
50%	60	76	102	150	192	242	216	160	116	83	59	56
90%	39	53	65	85	103	153	104	87	66	48	40	39
100%	25	30	38	43	44	62	43	49	36	21	21	22
Average	*64*	*140*	*568*	*1,047*	*779*	*897*	*478*	*637*	*380*	*94*	*63*	*56*
YUBA RIVER FLOW ABOVE THE NEW COLGATE POWERHOUSE FLOW (RM 34.2) (cfs)												
0%	603	7,596	56,449	93,735	68,511	35,185	29,877	30,491	7,136	1,343	128	215
10%	99	195	424	1,576	1,304	2,038	561	1,598	779	127	92	76
50%	62	79	111	178	236	300	261	184	122	85	61	57
90%	40	54	67	89	112	178	118	93	69	49	41	39
100%	25	31	39	44	45	66	46	54	37	21	21	22
Average	*66*	*155*	*608*	*1,119*	*856*	*980*	*534*	*671*	*391*	*97*	*64*	*58*
NEW COLGATE POWERHOUSE RELEASE (cfs)												
0%	1,034	3,430	3,430	3,430	3,430	3,430	3,430	3,430	3,430	3,430	3,430	1,887
10%	847	995	3,430	3,430	3,430	3,430	3,430	3,430	3,430	3,430	2,100	948
50%	739	705	581	1,062	1,405	1,473	1,139	2,117	2,123	1,545	1,375	790
90%	580	488	234	160	197	127	353	1,093	1,108	1,272	930	608
100%	0	0	0	0	0	0	0	0	506	578	320	0
Average	*720*	*791*	*959*	*1,450*	*1,770*	*1,760*	*1,497*	*2,138*	*2,184*	*1,891*	*1,505*	*772*
YUBA RIVER FLOW BELOW THE NEW COLGATE POWERHOUSE FLOW (RM 34.0) (cfs)												
0%	1,180	11,026	59,879	97,165	71,941	38,615	33,307	33,921	10,566	4,773	3,558	2,007
10%	908	1,161	3,665	4,296	4,438	5,234	3,873	4,468	4,048	3,543	2,189	1,019
50%	802	780	668	1,273	1,789	1,891	1,389	2,361	2,252	1,633	1,435	848
90%	653	599	436	409	422	399	463	1,197	1,189	1,323	988	661
100%	257	165	142	164	166	181	195	392	591	604	343	215
Average	*786*	*945*	*1,567*	*2,569*	*2,627*	*2,740*	*2,031*	*2,810*	*2,575*	*1,988*	*1,569*	*829*
NARROWS 2 POWERHOUSE RELEASE (cfs)												
0%	1,488	3,400	3,400	3,400	3,400	3,400	3,400	3,400	3,400	3,400	2,934	1,377
10%	900	900	3,400	3,400	3,400	3,400	3,400	3,400	3,400	2,945	1,526	900
50%	123	126	62	900	1,834	2,051	1,308	2,127	1,579	968	900	146
90%	0	63	0	0	0	12	0	900	900	900	900	0
100%	0	0	0	0	0	0	0	0	0	0	0	0
Average	*371*	*403*	*815*	*1,536*	*1,885*	*1,958*	*1,673*	*2,058*	*1,897*	*1,368*	*1,034*	*426*
YUBA RIVER FLOW NEAR SMARTSVILLE FLOW (RM 23.9) (cfs)												
0%	2,218	24,837	85,243	136,222	93,617	55,981	47,417	48,203	15,384	8,080	3,664	2,107
10%	966	1,523	4,258	6,217	6,261	7,506	5,271	6,586	6,060	3,691	2,256	1,067
50%	856	858	794	1,698	2,648	2,891	2,068	3,114	2,423	1,702	1,478	892
90%	700	808	700	700	700	793	837	1,353	1,262	1,353	1,024	700
100%	500	550	550	550	550	700	481	573	639	610	351	500
Average	*853*	*1,199*	*2,159*	*3,619*	*3,717*	*3,894*	*2,926*	*3,726*	*3,226*	*2,125*	*1,615*	*876*

Table 3.3.2-17. (continued)

Value	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
YUBA RIVER FLOW BELOW DEER CREEK FLOW (RM 23.1) (cfs)												
0%	2,539	26,117	92,493	143,502	103,817	58,311	50,757	49,723	15,423	8,095	3,677	2,113
10%	978	1,588	4,555	7,051	7,074	7,961	5,632	6,854	6,098	3,697	2,261	1,072
50%	896	870	811	1,782	2,798	3,145	2,189	3,149	2,431	1,706	1,483	898
90%	761	822	706	710	759	834	860	1,360	1,266	1,354	1,027	703
100%	500	552	553	582	578	706	483	575	639	610	352	500
Average	*887*	*1,249*	*2,301*	*3,885*	*4,037*	*4,196*	*3,084*	*3,793*	*3,242*	*2,131*	*1,620*	*882*
YUBA RIVER FLOW BELOW DRY CREEK FLOW (RM 13.4) (cfs)												
0%	2,571	26,308	93,874	148,633	111,285	60,688	53,578	50,219	15,432	8,103	3,683	2,119
10%	989	1,598	4,595	7,520	7,543	8,486	6,000	6,939	6,106	3,705	2,267	1,079
50%	902	874	831	1,827	2,953	3,333	2,276	3,174	2,438	1,713	1,490	904
90%	767	826	720	719	794	868	876	1,364	1,273	1,361	1,034	710
100%	506	553	566	605	599	712	484	576	646	616	359	507
Average	*895*	*1,258*	*2,340*	*4,072*	*4,271*	*4,504*	*3,218*	*3,815*	*3,249*	*2,138*	*1,626*	*889*
AGRICULTURAL DIVERSIONS FROM THE DAGUERRE POINT DIVERSION DAM DIVERSION (cfs)												
0%	483	415	338	160	46	36	656	830	1,007	1,092	1,057	623
10%	468	388	320	151	28	26	495	792	956	1,056	1,035	435
50%	370	363	209	69	8	9	85	702	848	1,002	774	287
90%	271	324	168	48	5	5	8	427	760	954	536	196
100%	156	203	129	11	4	4	7	278	401	466	209	172
Average	*374*	*357*	*230*	*92*	*13*	*14*	*183*	*654*	*850*	*991*	*788*	*306*
YUBA RIVER FLOW BELOW THE DAGUERRE POINT DIVERSION DAM FLOW (RM 11.6) (cfs)												
0%	2,121	25,972	93,685	148,497	111,279	60,681	53,570	49,508	14,653	7,093	2,889	1,496
10%	658	1,226	4,389	7,464	7,536	8,478	5,958	6,325	5,230	2,677	1,347	743
50%	500	500	611	1,756	2,944	3,315	2,088	2,555	1,500	700	600	584
90%	400	500	500	576	771	850	686	600	400	400	400	408
100%	350	350	350	500	561	684	245	245	245	150	150	150
Average	*522*	*901*	*2,110*	*3,980*	*4,258*	*4,491*	*3,035*	*3,162*	*2,400*	*1,147*	*838*	*582*
YUBA RIVER FLOW NEAR MARYSVILLE FLOW (RM 6.2) (cfs)												
0%	2,121	25,972	93,685	148,497	111,279	60,681	53,570	49,508	14,653	7,093	2,889	1,496
10%	658	1,226	4,389	7,464	7,536	8,478	5,958	6,325	5,230	2,677	1,347	743
50%	500	500	611	1,756	2,944	3,315	2,088	2,555	1,500	700	600	584
90%	400	500	500	576	771	850	686	600	400	400	400	408
100%	350	350	350	500	561	684	245	245	245	150	150	150
Average	*522*	*901*	*2,110*	*3,980*	*4,258*	*4,491*	*3,035*	*3,162*	*2,400*	*1,147*	*838*	*582*

Under the Proposed Project Alternative, there are two indices used to classify the WY type for operational purposes. The Smartsville Index, as described in YCWA's proposed Condition WR2, is based on annual forecasted and actual unimpaired Yuba River unimpaired flow at Smartsville. It provides an overall classification of the hydrology of the basin for the water year and is completely independent of operations. It essentially replaces the existing FERC license's year-type classification, which is also based on unimpaired flow at Smartsville, but focuses on the years with less than 50% of normal runoff; all of the years meeting this classification are grouped as Dry, Critical, or Extremely Critical under the Smartsville Index. The North Yuba Index, as described in YCWA's proposed Condition WR3, uses a combination of end-of-September New Bullards Bar Reservoir storage and forecasted and actual inflow to New Bullards Bar Reservoir to provide an index of available water available for release from New Bullards Bar Reservoir for the water year. Due to the inclusion of the New Bullards Bar Reservoir storage component, the North Yuba Index is affected by Project operations; releases in one year will affect the end-of-September storage and consequently the following year's classification. Table 3.3.2-18 shows a comparison of occurrences of each North Yuba Index water-year type for YCWA's Proposed Project Alternative and No Action Alternative, along with a comparison to the Existing FERC license and Smartsville Index years corresponding to the North Yuba Index schedules.

Table 3.3.2-18. Comparison between the Existing FERC License, Smartsville Index and North Yuba Index for WYs 1970 through 2010 for the Proposed Project and No Action Alternative.

Existing FERC License			Smartsville Index			North Yuba Index			
Water Year Classification	**Index Value (Units = ac-ft)**	**Count (Number of WYs)**	**Water Year Classification**	**Index Value (Units = ac-ft)**	**Count (Number of WYs)**	**Water Year Classification**	**Index Value (No Units)**	**Count (Number of WYs)**	
								No Action Alternative	**Proposed Project Alternative**
Normal	>50% of Normal (≥2,329)	33 (1970, 1971, 1972, 1973, 1974, 1975, 1978, 1979, 1982, 1983, 1984, 1985, 1986, 1989, 1990, 1991, 1993, 1995, 1996, 1997, 1998, 1999, 2000, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010)	Wet	≥3,240	9 (1974, 1980, 1982, 1983, 1986, 1995, 1997, 1998, 2006)	Schedule 1	≥1,400	23 (1970, 1971, 1972, 1973, 1974, 1975, 1978, 1980, 1982, 1983, 1984, 1986, 1989, 1993, 1995, 1996, 1997, 1998, 1999, 2000, 2003, 2005, 2006)	21 (1970, 1971, 1973, 1974, 1975, 1978, 1980, 1982, 1983, 1984, 1986, 1993, 1995, 1996, 1997, 1998, 1999, 2000, 2003, 2005, 2006)
NA	>45% of Normal (>1,048)	1 (1981)	Above Normal	≥2,191	11 (1970, 1971, 1973, 1975, 1978, 1984, 1989, 1993, 1996, 1999, 2000)	Schedule 2	≥1,040	8 (1979, 1981, 1985, 2002, 2004, 2007, 2009, 2010)	10 (1972, 1979, 1985, 1989, 1990, 2002, 2004, 2007, 2009, 2010)
NA	>40% of Normal (>932)	0	Below Normal	≥1,461	9 (1972, 1979, 1985, 2002, 2003, 2004, 2005, 2009, 2010)	Schedule 3	≥920	2 (1990, 1991)	2 (1981, 1991)
NA	≤40% of Normal (≤932)	7 (1976, 1977, 1987, 1988, 1992, 1994, 2001)	Dry	≥901	9 (1981, 1987, 1990, 1991, 1992, 1994, 2001, 2007, 2008)	Schedule 4	≥820	6 (1976, 1987, 1992, 1994, 2001, 2008)	6 (1976,1987, 1992, 1994, 2001, 2008)
--	--	--	Critically Dry	≥616	2 (1976,1988)	Schedule 5	≥693	1 (1988)	1 (1988)
--	--	--	Extreme Critically Dry	<616	1 (1977)	Schedule 6	≥500	0	0
--	--	--	--	--	--	Conference Year	<500	1 (1977)	1 (1977)
4 Classifications		**41 WYs**	**6 Classifications**	--	**41 WYs**	**7 Classifications**	--	**41 WYs**	**41 WYs**

Key: NA= Not applicable. The existing FERC license does not classify the year-types other than normal.

Changes in minimum streamflows in the Middle Yuba and North Yuba rivers, and Oregon Creek from the proposed Project, described in Condition AR1, compared to the No Action Alternative, result in increased flows in the Middle Yuba River, North Yuba River, Oregon Creek, and Yuba River above the New Colgate Powerhouse.

The difference in minimum flows under YCWA's proposed Project for the Yuba River below the Narrows 2 Powerhouse and the Narrows 2 Full Bypass, contained in Condition AR3, are only different from corresponding No Action Alternative minimum flows in conference (i.e., the very driest) years.[26] Similarly, Condition TE4's limits on ramping and flow fluctuation below Englebright Dam are identical to those in the No Action Alternative. Instead, changes in simulated flow in the Yuba River below the Narrows 2 Powerhouse and Narrows 2 Bypass are typically a result of changes in hydrologic year-type classification. Increases in minimum flows on the Middle Yuba River and Oregon Creek result in decreased flow through the Lohman Ridge, and Camptonville tunnels, respectively, and a corresponding decrease in inflow to New Bullards Bar Reservoir.

Other than during flood-management or storage-management periods, New Bullards Bar Reservoir releases through the New Colgate Powerhouse augment flows from the North Yuba, Middle Yuba and South Yuba rivers and Oregon Creek to meet minimum required flows on the Yuba River below the Narrows 2 Powerhouse and Narrows 2 Bypass. The increase in North Yuba River, Middle Yuba River, and Oregon Creek flow would be directly offset by a decrease in required releases from New Bullards Bar Reservoir through the New Colgate Powerhouse, and a corresponding increase in storage, directly offsetting the decrease in reservoir inflow through the Camptonville Tunnel. The net result of YCWA's proposed Project would be an increase in flows on the North Yuba and Middle Yuba rivers and Oregon Creek, but a decrease in flow through the New Colgate Powerhouse, slight differences in New Bullards Bar Reservoir storage, and slight differences in Yuba River flow below the Narrows 2 Powerhouse and Narrows 2 Bypass.

Table 3.3.2-19 shows: 1) the differences in Project flows and storages for the same locations and exceedance values shown in Tables 3.3.2-2 and 3.3.2-17 resulting from: 1) the With-Project Hydrology less YCWA's Proposed Project (Existing) Hydrology; and 2) the percent change, shown in parentheses.

[26] In the relicensing period of record (WYs 1970 through 2010) used in the Operations Model, there is only one Conference Year – WY 1977.

Table 3.3.2-19. Changes in Project flows and storage from No Action Alternative to YCWA's Proposed Project (Existing) Alterative.

Value	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
NEW BULLARDS BAR RESERVOIR STORAGE (ac-ft)												
0%	-3,973 (-0.6%)	-949 (-0.1%)	-38,548 (-4.6%)	-95,340 (-10.7%)	-56,155 (-6.6%)	-4,535 (-0.6%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	-2,838 (-0.3%)	-4,359 (-0.6%)
10%	314 (0.0%)	3,210 (0.5%)	-286 (0.0%)	-484 (-0.1%)	-386 (0.0%)	0 (0.0%)	-13 (0.0%)	-1,458 (-0.2%)	0 (0.0%)	-3,249 (-0.4%)	-1,010 (-0.1%)	161 (0.0%)
50%	3,238 (0.5%)	2,689 (0.4%)	2,762 (0.5%)	1,529 (0.3%)	-1,242 (-0.2%)	-1,245 (-0.2%)	-599 (-0.1%)	3,721 (0.4%)	4,741 (0.6%)	4,629 (0.6%)	4,205 (0.6%)	2,841 (0.4%)
90%	-1,778 (-0.4%)	-2,695 (-0.6%)	-2,019 (-0.4%)	-1,128 (-0.2%)	-949 (-0.2%)	-2,594 (-0.4%)	-2,729 (-0.4%)	-2,575 (-0.4%)	-1,041 (-0.1%)	-1,805 (-0.3%)	-1,521 (-0.3%)	-1,536 (-0.3%)
100%	-29,968 (-14.0%)	-27,970 (-14.1%)	-25,781 (-13.6%)	-25,260 (-9.2%)	-277 (-0.1%)	-277 (-0.1%)	-838 (-0.3%)	-5,535 (-1.9%)	-5,506 (-1.9%)	-10,400 (-3.9%)	-15,283 (-6.2%)	-32,790 (-13.6%)
Average	1,163 (0.2%)	934 (0.2%)	-196 (0.0%)	-1,010 (-0.2%)	-1,200 (-0.2%)	-1,036 (-0.1%)	-765 (-0.1%)	-351 (0.0%)	530 (0.1%)	1,593 (0.2%)	2,043 (0.3%)	1,691 (0.3%)
NEW BULLARDS BAR RESERVOIR WATER-SURFACE ELEVATION (ft)												
0%	-1 (-0.1%)	0 (0.0%)	-9 (-0.5%)	-22 (-1.1%)	-13 (-0.7%)	-1 (-0.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	-1 (0.0%)	-1 (-0.1%)
10%	0 (0.0%)	1 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	-1 (0.0%)	0 (0.0%)	0 (0.0%)
50%	1 (0.0%)	1 (0.0%)	1 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.0%)	1 (0.1%)	1 (0.1%)	1 (0.1%)	1 (0.0%)
90%	-1 (0.0%)	-1 (0.0%)	-1 (0.0%)	0 (0.0%)	0 (0.0%)	-1 (0.0%)	-1 (0.0%)	-1 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
100%	-18 (-1.0%)	-17 (-1.0%)	-16 (-1.0%)	-12 (-0.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	-2 (-0.1%)	-3 (-0.1%)	-5 (-0.3%)	-8 (-0.5%)	-18 (-1.0%)
Average	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
NEW BULLARDS BAR MINIMUM FLOW POWERHOUSE RELEASE (RM 2.4) (cfs)												
0%	1 (14.1%)	1 (14.1%)	1 (14.1%)	1 (14.2%)	1 (16.3%)	1 (16.4%)	1 (25.6%)	1 (36.7%)	1 (33.4%)	1 (27.8%)	1 (19.8%)	1 (16.9%)
10%	1 (23.3%)	1 (20.9%)	1 (20.1%)	1 (20.0%)	1 (22.2%)	1 (28.6%)	0 (10.5%)	0 (10.9%)	0 (14.5%)	2 (43.4%)	1 (31.8%)	1 (27.2%)
50%	1 (29.9%)	1 (26.8%)	1 (27.9%)	1 (29.7%)	1 (37.4%)	2 (46.2%)	0 (4.7%)	0 (10.6%)	0 (14.6%)	2 (70.9%)	2 (45.7%)	1 (35.0%)
90%	2 (68.3%)	2 (67.1%)	2 (72.7%)	2 (81.0%)	2 (98.7%)	3 (125.6%)	1 (25.2%)	0 (10.0%)	0 (0.0%)	3 (121.2%)	2 (87.4%)	2 (73.5%)
100%	2 (77.3%)	2 (89.9%)	3 (122.2%)	3 (162.6%)	2 (139.3%)	2 (105.8%)	1 (49.2%)	0 (16.0%)	0 (2.0%)	3 (149.8%)	2 (97.3%)	2 (83.4%)
Average	1 (34.2%)	1 (32.2%)	1 (34.1%)	1 (38.7%)	1 (42.9%)	2 (51.8%)	0 (10.1%)	0 (11.7%)	0 (11.8%)	2 (73.0%)	2 (49.1%)	1 (39.0%)

Table 3.3.2-19. (continued)

Value	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
NORTH YUBA RIVER BELOW NEW BULLARDS BAR RESERVOIR FLOW (RM 2.4) (cfs)												
0%	8 (114.3%)	8 (114.3%)	6,365 (18.4%)	315 (0.5%)	-4,379 (-8.8%)	-1,144 (-4.5%)	-2,191 (-10.8%)	-3,430 (-14.2%)	-19 (-0.4%)	-335 (-30.2%)	8 (114.3%)	8 (114.3%)
10%	8 (114.3%)	8 (114.3%)	8 (114.3%)	8 (114.3%)	8 (114.3%)	-35 (-3.4%)	0 (0.0%)	365 (77.2%)	-27 (-5.3%)	8 (114.3%)	8 (114.3%)	8 (114.3%)
50%	8 (114.3%)	8 (114.3%)	8 (114.3%)	8 (114.3%)	8 (114.3%)	7 (100.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	7 (100.0%)	7 (100.0%)	7 (100.0%)
90%	10 (172.7%)	10 (172.7%)	10 (172.7%)	10 (172.7%)	10 (172.7%)	8 (136.4%)	2 (27.3%)	2 (27.3%)	2 (27.3%)	8 (136.4%)	8 (136.4%)	8 (136.4%)
100%	2 (27.3%)	2 (27.3%)	2 (27.3%)	2 (27.3%)	2 (27.3%)	2 (27.3%)	2 (27.3%)	2 (27.3%)	2 (27.3%)	2 (27.3%)	2 (27.3%)	2 (27.3%)
Average	8 (114.2%)	8 (114.2%)	19 (7.7%)	-60 (-9.9%)	-22 (-6.2%)	-15 (-3.3%)	-4 (-2.6%)	0 (0.1%)	-8 (-3.5%)	5 (47.2%)	7 (102.9%)	7 (102.9%)
MIDDLE YUBA RIVER FLOW BELOW OUR HOUSE DIVERSION DAM FLOW (RM 12.6) (cfs)												
0%	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	203 (65.0%)	50 (151.5%)	50 (151.5%)
10%	27 (81.8%)	27 (81.8%)	27 (81.8%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	75 (18.7%)	234 (441.4%)	50 (151.5%)	31 (93.9%)	17 (51.8%)
50%	4 (13.1%)	15 (45.4%)	27 (81.8%)	27 (81.8%)	27 (81.8%)	36 (109.1%)	31 (81.6%)	16 (30.2%)	31 (81.6%)	22 (66.7%)	5 (16.3%)	2 (6.7%)
90%	0 (0.0%)	7 (29.2%)	13 (55.5%)	14 (58.3%)	14 (58.3%)	28 (116.7%)	24 (82.5%)	14 (36.8%)	14 (48.8%)	7 (28.8%)	0 (0.0%)	0 (0.0%)
100%	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	-14 (-36.8%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Average	8 (27.1%)	15 (25.1%)	20 (14.3%)	20 (9.1%)	21 (13.2%)	28 (18.4%)	18 (15.5%)	31 (18.5%)	47 (58.2%)	32 (98.3%)	11 (37.1%)	6 (20.5%)
LOHMAN RIDGE TUNNEL DIVERSION FLOW (cfs)												
0%	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	-203 (-23.7%)	-18 (-19.2%)	-50 (-25.3%)
10%	-27 (-81.6%)	-21 (-8.8%)	-27 (-4.4%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	-148 (-18.2%)	-44 (-32.1%)	-31 (-100.0%)	-17 (-100.0%)
50%	-5 (-100.0%)	-18 (-100.0%)	-24 (-33.8%)	-26 (-14.1%)	-27 (-9.0%)	-35 (-8.5%)	-21 (-4.9%)	-40 (-9.3%)	-29 (-25.0%)	-25 (-100.0%)	-6 (-100.0%)	-3 (-100.0%)
90%	0 (0.0%)	-3 (-100.0%)	-7 (-100.0%)	-22 (-100.0%)	-26 (-46.7%)	-35 (-21.2%)	-9 (-5.3%)	-6 (-6.7%)	-19 (-87.6%)	-4 (-100.0%)	0 (0.0%)	0 (0.0%)
100%	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	-14 (-97.3%)	4 (21.3%)	-14 (-80.9%)	-1 (-100.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Average	-8 (-49.4%)	-15 (-17.3%)	-20 (-10.5%)	-20 (-6.7%)	-21 (-5.9%)	-28 (-6.0%)	-18 (-3.9%)	-31 (-6.9%)	-47 (-18.0%)	-32 (-51.2%)	-11 (-96.0%)	-6 (-88.9%)

Table 3.3.2-19. (continued)

Value	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
MIDDLE YUBA RIVER FLOW ABOVE OREGON CREEK FLOW (RM 4.75) (cfs)												
0%	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	207 (64.1%)	50 (127.2%)	50 (72.1%)
10%	26 (67.8%)	26 (37.0%)	25 (17.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.6%)	86 (17.8%)	210 (202.3%)	49 (124.1%)	31 (85.5%)	17 (48.5%)
50%	4 (12.8%)	15 (42.0%)	26 (61.1%)	25 (37.3%)	25 (28.6%)	34 (32.5%)	22 (22.2%)	17 (20.9%)	28 (59.0%)	23 (63.0%)	6 (17.1%)	3 (8.3%)
90%	0 (0.4%)	6 (24.3%)	8 (22.3%)	20 (54.8%)	25 (58.6%)	31 (50.3%)	13 (26.7%)	4 (8.8%)	11 (33.5%)	7 (27.2%)	0 (0.0%)	0 (0.0%)
100%	0 (0.0%)	0 (0.0%)	0 (0.0%)	2 (6.4%)	3 (10.2%)	14 (49.9%)	-2 (-8.3%)	-13 (-29.8%)	0 (1.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Average	8 (24.7%)	15 (19.4%)	20 (10.5%)	20 (6.5%)	21 (8.3%)	28 (11.0%)	18 (9.8%)	31 (14.8%)	47 (50.1%)	32 (88.4%)	11 (35.0%)	6 (19.4%)
OREGON CREEK FLOW BELOW LOG CABIN DIVERSION DAM FLOW (RM4.3) (cfs)												
0%	5 (55.6%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	19 (146.2%)	5 (55.6%)	5 (55.6%)	5 (55.6%)
10%	0 (0.0%)	0 (0.0%)	0 (0.0%)	-6 (-4.5%)	-4 (-3.9%)	-1 (-1.0%)	19 (146.2%)	19 (146.2%)	19 (146.2%)	5 (55.6%)	-3 (-33.9%)	-4 (-43.8%)
50%	-4 (-54.1%)	-2 (-25.5%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	2 (22.2%)	18 (187.2%)	14 (107.7%)	17 (183.8%)	-3 (-33.9%)	-5 (-63.4%)	-3 (-55.4%)
90%	0 (-0.1%)	-3 (-50.9%)	-1 (-19.5%)	0 (6.1%)	0 (6.1%)	0 (6.1%)	11 (143.6%)	9 (98.0%)	-1 (-10.3%)	-4 (-65.5%)	0 (-13.0%)	0 (0.0%)
100%	0 (0.0%)	0 (-21.0%)	-1 (-31.2%)	0 (0.0%)	0 (0.0%)	0 (6.1%)	0 (6.1%)	-2 (-25.5%)	-1 (-34.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Average	-2 (-28.5%)	-2 (-11.1%)	-1 (-1.3%)	-1 (-0.7%)	-1 (-1.0%)	1 (1.2%)	12 (45.2%)	11 (62.3%)	12 (114.0%)	-1 (-15.1%)	-3 (-44.4%)	-2 (-41.7%)
CAMPTONVILLE TUNNEL DIVERSIONS FLOW (cfs)												
0%	-5 (-0.5%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	-23 (-2.3%)	-184 (-21.0%)	-14 (-13.5%)	-55 (-21.2%)
10%	-23 (-71.3%)	-27 (-8.7%)	-23 (-2.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	-25 (-2.4%)	-65 (-6.5%)	-148 (-17.3%)	-49 (-35.0%)	-29 (-100.0%)	-13 (-100.0%)
50%	0 (0.0%)	-16 (-100.0%)	-25 (-29.6%)	-25 (-10.0%)	-25 (-6.1%)	-37 (-6.7%)	-34 (-6.3%)	-51 (-10.5%)	-43 (-36.3%)	-22 (-100.0%)	-1 (-100.0%)	0 (0.0%)
90%	0 (0.0%)	0 (0.0%)	-4 (-100.0%)	-22 (-96.3%)	-25 (-37.4%)	-37 (-16.7%)	-21 (-10.0%)	-11 (-11.5%)	-19 (-100.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
100%	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	-14 (-92.1%)	13 (81.3%)	-16 (-100.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Average	-6 (-39.6%)	-13 (-12.6%)	-19 (-8.0%)	-20 (-4.9%)	-20 (-4.3%)	-29 (-4.7%)	-31 (-5.3%)	-42 (-8.2%)	-59 (-21.4%)	-30 (-50.2%)	-8 (-96.1%)	-4 (-81.4%)

Table 3.3.2-19. (continued)

Value	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
OREGON CREEK FLOW ABOVE ITS CONFLUENCE WITH THE MIDDLE YUBA RIVER FLOW (RM 01) (cfs)												
0%	5 (11.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	17 (30.9%)	5 (23.0%)	5 (44.5%)	5 (22.8%)
10%	0 (3.1%)	0 (-0.9%)	0 (0.0%)	-7 (-3.5%)	-10 (-5.2%)	0 (0.0%)	19 (33.9%)	18 (36.8%)	17 (74.8%)	5 (39.9%)	-3 (-30.3%)	-4 (-39.4%)
50%	-5 (-53.7%)	-2 (-23.1%)	0 (-1.0%)	0 (-1.1%)	0 (-0.6%)	1 (4.2%)	14 (46.5%)	13 (60.4%)	16 (119.6%)	-3 (-29.6%)	-5 (-59.9%)	-3 (-51.0%)
90%	0 (-0.1%)	-3 (-46.9%)	-3 (-32.9%)	-1 (-6.5%)	0 (-1.8%)	2 (10.4%)	8 (53.6%)	6 (45.5%)	-1 (-8.6%)	-4 (-61.0%)	0 (-13.0%)	0 (0.0%)
100%	0 (0.0%)	0 (-21.0%)	-1 (-31.2%)	0 (0.0%)	0 (0.0%)	0 (5.0%)	0 (-5.4%)	-2 (-17.3%)	-1 (-32.9%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Average	-2 (-24.3%)	-2 (-8.0%)	-1 (-0.9%)	-1 (-0.5%)	-1 (-0.7%)	1 (0.7%)	12 (23.6%)	11 (33.9%)	12 (78.9%)	-1 (-13.1%)	-3 (-40.4%)	-2 (-37.6%)
MIDDLE YUBA RIVER FLOW BELOW OREGON CREEK FLOW (RM 4.65) (cfs)												
0%	5 (1.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	19 (1.0%)	213 (63.5%)	55 (108.8%)	55 (60.2%)
10%	27 (54.6%)	26 (27.9%)	24 (12.2%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	25 (7.9%)	105 (19.8%)	217 (164.5%)	54 (105.7%)	28 (60.1%)	13 (27.8%)
50%	1 (1.3%)	13 (27.8%)	26 (47.3%)	25 (28.2%)	24 (21.2%)	35 (25.2%)	35 (26.9%)	30 (29.7%)	43 (69.4%)	20 (43.5%)	1 (1.7%)	0 (0.0%)
90%	0 (0.0%)	4 (11.1%)	6 (14.7%)	20 (42.3%)	25 (45.5%)	34 (42.7%)	21 (32.6%)	9 (14.6%)	14 (32.0%)	3 (8.2%)	0 (0.0%)	0 (0.0%)
100%	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	14 (39.9%)	-3 (-7.7%)	-14 (-27.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Average	6 (15.9%)	13 (13.4%)	19 (7.7%)	20 (4.7%)	20 (5.8%)	29 (8.3%)	31 (12.8%)	42 (17.4%)	59 (54.1%)	30 (67.2%)	8 (21.5%)	4 (10.2%)
MIDDLE YUBA RIVER FLOW ABOVE ITS CONFLUENCE WITH THE NORTH YUBA RIVER FLOW (RM 0.1) (cfs)												
0%	5 (1.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	19 (1.0%)	215 (62.9%)	54 (95.8%)	55 (46.8%)
10%	26 (47.9%)	27 (22.2%)	26 (9.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	23 (5.6%)	103 (17.5%)	205 (126.4%)	53 (95.6%)	28 (57.4%)	13 (26.6%)
50%	1 (1.5%)	13 (27.4%)	25 (40.0%)	24 (21.7%)	24 (15.4%)	33 (17.6%)	36 (20.9%)	30 (24.5%)	40 (58.1%)	20 (42.6%)	1 (2.0%)	0 (0.0%)
90%	0 (0.0%)	4 (10.8%)	5 (11.0%)	20 (38.3%)	26 (40.3%)	38 (37.5%)	21 (27.9%)	12 (17.6%)	16 (37.1%)	3 (7.9%)	0 (0.0%)	0 (0.0%)
100%	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	14 (37.0%)	-5 (-11.2%)	-13 (-24.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Average	6 (15.0%)	13 (11.9%)	19 (6.7%)	20 (4.1%)	20 (4.9%)	29 (6.9%)	31 (10.6%)	42 (15.5%)	59 (49.8%)	30 (63.6%)	8 (20.8%)	4 (9.9%)

Table 3.3.2-19. (continued)

Value	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
YUBA RIVER FLOW BELOW THE CONFLUENCE OF THE NORTH YUBA AND MIDDLE YUBA RIVERS FLOW (RM 40.0) (cfs)												
0%	13 (2.5%)	9 (0.1%)	13,185 (31.3%)	850 (0.9%)	2,017 (3.1%)	-1,144 (-3.2%)	-2,191 (-7.1%)	-3,430 (-10.2%)	0 (0.0%)	0 (0.0%)	61 (98.3%)	61 (49.0%)
10%	34 (55.5%)	35 (27.2%)	35 (11.9%)	8 (0.6%)	3 (0.2%)	-65 (-3.4%)	28 (6.5%)	454 (42.0%)	124 (19.3%)	59 (94.5%)	34 (61.8%)	19 (34.4%)
50%	9 (16.8%)	21 (37.8%)	32 (46.7%)	32 (27.0%)	31 (19.3%)	43 (21.9%)	36 (20.1%)	30 (23.1%)	40 (52.7%)	28 (50.8%)	8 (15.8%)	7 (15.3%)
90%	5 (15.4%)	11 (27.1%)	14 (27.2%)	28 (47.9%)	33 (46.2%)	45 (41.4%)	22 (26.8%)	12 (16.8%)	16 (31.9%)	9 (22.9%)	8 (23.2%)	8 (26.0%)
100%	2 (6.5%)	2 (7.1%)	4 (10.2%)	4 (8.9%)	4 (8.7%)	18 (40.3%)	-3 (-6.6%)	-12 (-19.3%)	2 (4.3%)	2 (7.8%)	2 (7.8%)	2 (7.4%)
Average	14 (28.4%)	21 (17.6%)	38 (7.1%)	-40 (-3.7%)	-2 (-0.2%)	13 (1.5%)	26 (5.8%)	43 (7.2%)	51 (15.5%)	36 (60.5%)	15 (32.4%)	11 (23.6%)
YUBA RIVER FLOW ABOVE THE NEW COLGATE POWERHOUSE FLOW (RM 34.2) (cfs)												
0%	13 (2.2%)	9 (0.1%)	13,106 (30.2%)	1,199 (1.3%)	2,281 (3.4%)	-1,144 (-3.1%)	-2,191 (-6.8%)	-3,430 (-10.1%)	0 (0.0%)	0 (0.0%)	56 (78.7%)	61 (39.6%)
10%	33 (49.6%)	35 (21.9%)	33 (8.4%)	8 (0.5%)	-6 (-0.5%)	-1 (0.0%)	20 (3.7%)	460 (40.4%)	98 (14.5%)	59 (86.1%)	34 (58.9%)	19 (34.5%)
50%	9 (16.1%)	21 (35.8%)	32 (40.7%)	31 (21.3%)	31 (15.0%)	42 (16.4%)	36 (15.8%)	32 (21.1%)	39 (47.1%)	28 (49.4%)	8 (16.1%)	7 (14.9%)
90%	5 (15.1%)	11 (25.1%)	13 (24.3%)	27 (44.1%)	32 (40.6%)	46 (35.0%)	22 (22.8%)	14 (18.0%)	18 (36.6%)	9 (22.2%)	8 (23.2%)	8 (25.2%)
100%	2 (6.4%)	2 (8.0%)	4 (9.9%)	4 (8.6%)	4 (8.4%)	18 (37.5%)	-5 (-9.9%)	-11 (-16.5%)	2 (4.2%)	2 (7.6%)	2 (7.6%)	2 (7.2%)
Average	14 (27.1%)	21 (15.7%)	38 (6.6%)	-40 (-3.5%)	-2 (-0.2%)	13 (1.4%)	26 (5.2%)	43 (6.8%)	51 (15.0%)	36 (57.7%)	15 (31.5%)	11 (22.9%)
NEW COLGATE POWERHOUSE RELEASE (cfs)												
0%	-54 (-5.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	-322 (-14.6%)
10%	-10 (-1.2%)	64 (6.9%)	20 (0.6%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	-78 (-3.6%)	-18 (-1.9%)
50%	-6 (-0.9%)	-16 (-2.2%)	-8 (-1.3%)	15 (1.4%)	-15 (-1.1%)	-13 (-0.9%)	-37 (-3.2%)	-128 (-5.7%)	-106 (-4.8%)	-31 (-1.9%)	6 (0.5%)	-3 (-0.4%)
90%	-16 (-2.7%)	-17 (-3.3%)	-11 (-4.5%)	5 (3.4%)	2 (0.9%)	-15 (-10.6%)	-13 (-3.6%)	-5 (-0.5%)	-16 (-1.4%)	-9 (-0.7%)	-16 (-1.7%)	-4 (-0.6%)
100%	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	100 (24.7%)	79 (15.7%)	79 (32.6%)	0 (0.0%)
Average	-13 (-1.7%)	-7 (-0.9%)	4 (0.4%)	22 (1.5%)	-1 (0.0%)	-11 (-0.6%)	-32 (-2.1%)	-56 (-2.6%)	-75 (-3.3%)	-43 (-2.2%)	-17 (-1.1%)	2 (0.3%)

Table 3.3.2-19. (continued)

Value	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
YUBA RIVER FLOW BELOW THE NEW COLGATE POWERHOUSE FLOW (RM 34.0) (cfs)												
0%	9 (0.8%)	9 (0.1%)	16,536 (38.2%)	4,629 (5.0%)	5,711 (8.6%)	2,286 (6.3%)	1,239 (3.9%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	61 (1.7%)	-273 (-12.0%)
10%	-1 (-0.1%)	67 (6.2%)	35 (1.0%)	-5 (-0.1%)	-43 (-1.0%)	-67 (-1.3%)	57 (1.5%)	-86 (-1.9%)	-62 (-1.5%)	47 (1.4%)	-47 (-2.1%)	1 (0.1%)
50%	4 (0.5%)	4 (0.5%)	8 (1.3%)	6 (0.5%)	-46 (-2.5%)	-9 (-0.5%)	-11 (-0.8%)	-86 (-3.5%)	-55 (-2.4%)	0 (0.0%)	12 (0.9%)	7 (0.8%)
90%	0 (0.0%)	22 (3.8%)	3 (0.7%)	2 (0.4%)	15 (3.7%)	15 (3.9%)	-11 (-2.4%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	-1 (-0.1%)	2 (0.3%)
100%	30 (13.0%)	35 (27.0%)	35 (32.7%)	25 (17.9%)	25 (17.5%)	27 (17.3%)	49 (33.5%)	7 (1.9%)	0 (0.0%)	80 (15.3%)	80 (30.4%)	79 (58.1%)
Average	1 (0.2%)	14 (1.5%)	42 (2.7%)	-19 (-0.7%)	-3 (-0.1%)	3 (0.1%)	-6 (-0.3%)	-13 (-0.5%)	-24 (-0.9%)	-7 (-0.4%)	-2 (-0.1%)	13 (1.6%)
NARROWS 2 POWERHOUSE RELEASE (cfs)												
0%	13 (0.9%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	61 (2.1%)	-273 (-16.6%)
10%	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	50 (1.7%)	-49 (-3.1%)	0 (0.0%)
50%	3 (2.9%)	1 (1.2%)	3 (4.6%)	0 (0.0%)	-89 (-4.6%)	-19 (-0.9%)	-14 (-1.1%)	-96 (-4.3%)	-82 (-4.9%)	0 (0.0%)	0 (0.0%)	17 (13.6%)
90%	0 (0.0%)	14 (28.9%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	12 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
100%	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Average	17 (4.8%)	20 (5.2%)	17 (2.1%)	5 (0.3%)	-7 (-0.4%)	0 (0.0%)	-8 (-0.5%)	-19 (-0.9%)	-17 (-0.9%)	-7 (-0.5%)	-10 (-1.0%)	23 (5.8%)
YUBA RIVER FLOW NEAR SMARTSVILLE FLOW (RM 23.9) (cfs)												
0%	13 (0.6%)	9 (0.0%)	18,847 (28.4%)	6,178 (4.8%)	449 (0.5%)	1,689 (3.1%)	1,239 (2.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	61 (1.7%)	-273 (-11.5%)
10%	2 (0.2%)	49 (3.3%)	-21 (-0.5%)	4 (0.1%)	-52 (-0.8%)	-26 (-0.3%)	51 (1.0%)	-170 (-2.5%)	-63 (-1.0%)	54 (1.5%)	-49 (-2.1%)	2 (0.1%)
50%	4 (0.5%)	2 (0.2%)	4 (0.5%)	101 (6.3%)	-47 (-1.7%)	-28 (-1.0%)	-6 (-0.3%)	-33 (-1.0%)	-20 (-0.8%)	0 (0.0%)	19 (1.3%)	11 (1.3%)
90%	0 (0.0%)	2 (0.2%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	-19 (-2.3%)	-23 (-2.6%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	-1 (-0.1%)	0 (0.0%)
100%	-28 (-5.3%)	-50 (-8.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	231 (92.6%)	0 (0.0%)	0 (0.0%)	80 (15.1%)	80 (29.5%)	351 (235.9%)
Average	1 (0.2%)	14 (1.2%)	42 (2.0%)	-16 (-0.4%)	-1 (0.0%)	-4 (-0.1%)	-3 (-0.1%)	-14 (-0.4%)	-18 (-0.5%)	-10 (-0.5%)	-4 (-0.2%)	13 (1.5%)

Table 3.3.2-19. (continued)

Value	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
YUBA RIVER FLOW BELOW DEER CREEK FLOW (RM 23.1) (cfs)												
0%	13 (0.5%)	9 (0.0%)	18,847 (25.6%)	5,808 (4.2%)	3,979 (4.0%)	1,689 (3.0%)	1,239 (2.5%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	61 (1.7%)	-273 (-11.5%)
10%	3 (0.3%)	47 (3.1%)	5 (0.1%)	8 (0.1%)	-120 (-1.7%)	-51 (-0.6%)	57 (1.0%)	-34 (-0.5%)	-59 (-1.0%)	51 (1.4%)	-46 (-2.0%)	0 (0.0%)
50%	4 (0.5%)	1 (0.1%)	3 (0.4%)	37 (2.1%)	-77 (-2.7%)	4 (0.1%)	-3 (-0.1%)	-38 (-1.2%)	-21 (-0.8%)	0 (0.0%)	21 (1.4%)	10 (1.2%)
90%	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.1%)	1 (0.1%)	-2 (-0.2%)	-61 (-6.6%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
100%	-28 (-5.3%)	-50 (-8.3%)	-50 (-8.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	226 (88.4%)	0 (0.0%)	0 (0.0%)	80 (15.1%)	80 (29.5%)	351 (234.1%)
Average	1 (0.2%)	14 (1.1%)	42 (1.8%)	-16 (-0.4%)	-1 (0.0%)	-4 (-0.1%)	-3 (-0.1%)	-14 (-0.4%)	-18 (-0.5%)	-10 (-0.5%)	-4 (-0.2%)	13 (1.5%)
YUBA RIVER FLOW BELOW DRY CREEK FLOW (RM 13.4) (cfs)												
0%	13 (0.5%)	9 (0.0%)	18,847 (25.1%)	5,547 (3.9%)	6,564 (6.3%)	1,689 (2.9%)	1,239 (2.4%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	61 (1.7%)	-273 (-11.4%)
10%	6 (0.6%)	55 (3.5%)	8 (0.2%)	0 (0.0%)	-15 (-0.2%)	-2 (0.0%)	49 (0.8%)	-16 (-0.2%)	-59 (-1.0%)	52 (1.4%)	-46 (-2.0%)	0 (0.0%)
50%	3 (0.3%)	0 (0.0%)	7 (0.8%)	25 (1.4%)	-55 (-1.8%)	-9 (-0.3%)	-14 (-0.6%)	-19 (-0.6%)	-21 (-0.9%)	-2 (-0.1%)	21 (1.4%)	10 (1.2%)
90%	0 (0.0%)	2 (0.2%)	0 (0.0%)	2 (0.3%)	-1 (-0.2%)	7 (0.8%)	-67 (-7.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
100%	-28 (-5.3%)	-50 (-8.3%)	-50 (-8.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	222 (85.0%)	0 (0.0%)	0 (0.0%)	80 (14.9%)	80 (28.7%)	351 (224.5%)
Average	1 (0.2%)	14 (1.1%)	42 (1.8%)	-16 (-0.4%)	-1 (0.0%)	-4 (-0.1%)	-3 (-0.1%)	-14 (-0.4%)	-18 (-0.5%)	-10 (-0.5%)	-4 (-0.2%)	13 (1.5%)
AGRICULTURAL DIVERSIONS FROM THE DAGUERRE POINT DIVERSION DAM DIVERSION (cfs)												
0%	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
10%	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
50%	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	10 (3.5%)
90%	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
100%	22 (16.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	86 (100.0%)
Average	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	3 (1.0%)

Table 3.3.2-19. (continued)

Value	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
YUBA RIVER FLOW BELOW THE DAGUERRE POINT DIVERSION DAM FLOW (RM 11.6) (cfs)												
0%	13 (0.6%)	9 (0.0%)	18,847 (25.2%)	5,536 (3.9%)	6,564 (6.3%)	1,689 (2.9%)	1,239 (2.4%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	-10 (-0.4%)	-273 (-15.5%)
10%	6 (1.0%)	56 (4.8%)	15 (0.3%)	0 (0.0%)	-15 (-0.2%)	0 (0.0%)	27 (0.4%)	0 (0.0%)	-101 (-1.9%)	50 (1.9%)	-29 (-2.1%)	-5 (-0.6%)
50%	0 (0.0%)	0 (0.0%)	18 (3.0%)	61 (3.6%)	-49 (-1.6%)	-4 (-0.1%)	-5 (-0.2%)	-21 (-0.8%)	-18 (-1.2%)	0 (0.0%)	0 (0.0%)	17 (2.9%)
90%	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.1%)	-5 (-0.6%)	6 (0.8%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
100%	-50 (-12.5%)	-50 (-12.5%)	-50 (-12.5%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	80 (114.3%)	80 (114.3%)	80 (114.3%)
Average	1 (0.3%)	14 (1.6%)	42 (2.0%)	-16 (-0.4%)	-1 (0.0%)	-4 (-0.1%)	-3 (-0.1%)	-14 (-0.4%)	-18 (-0.7%)	-10 (-0.9%)	-4 (-0.4%)	10 (1.7%)
YUBA RIVER FLOW NEAR MARYSVILLE FLOW (RM 6.2) (cfs)												
0%	13 (0.6%)	9 (0.0%)	18,847 (25.2%)	5,536 (3.9%)	6,564 (6.3%)	1,689 (2.9%)	1,239 (2.4%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	-10 (-0.4%)	-273 (-15.5%)
10%	6 (1.0%)	56 (4.8%)	15 (0.3%)	0 (0.0%)	-15 (-0.2%)	0 (0.0%)	27 (0.4%)	0 (0.0%)	-101 (-1.9%)	50 (1.9%)	-29 (-2.1%)	-5 (-0.6%)
50%	0 (0.0%)	0 (0.0%)	18 (3.0%)	61 (3.6%)	-49 (-1.6%)	-4 (-0.1%)	-5 (-0.2%)	-21 (-0.8%)	-18 (-1.2%)	0 (0.0%)	0 (0.0%)	17 (2.9%)
90%	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.1%)	-5 (-0.6%)	6 (0.8%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
100%	-50 (-12.5%)	-50 (-12.5%)	-50 (-12.5%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	80 (114.3%)	80 (114.3%)	80 (114.3%)
Average	1 (0.3%)	14 (1.6%)	42 (2.0%)	-16 (-0.4%)	-1 (0.0%)	-4 (-0.1%)	-3 (-0.1%)	-14 (-0.4%)	-18 (-0.7%)	-10 (-0.9%)	-4 (-0.4%)	10 (1.7%)

Effects on Reservoir Releases

New Bullards Bar Reservoir

As previously mentioned, the change in minimum flows on the Middle Yuba River and Oregon Creek due to condition AR1 reduces the quantity of inflow to New Bullards Bar Dam from the Middle Yuba River and Oregon Creek. While the reduction in inflow due to an increase in flows on the Middle Yuba River and Oregon Creek is generally offset by a decrease in releases through the New Colgate Powerhouse by a roughly equivalent amount, the change in reservoir inflow can have an affect on the North Yuba Index year-type, as shown in Table 3.3.2.2-18. The change in year-type, in turn, affects the minimum flow below the Narrows 2 Powerhouse, which has a corresponding effect on the quantity of water released from New Bullards Bar Reservoir and a change in New Bullards Bar Reservoir water surface elevation and storage. These changes in water surface elevation and storage are relatively minor, but occur, nonetheless. Simulated daily New Bullards Bar Reservoir water surface elevations are presented in Figure 3.3.2-29 for the No Action and YCWA's Proposed Project alternatives for representative wet, dry and normal WYs.

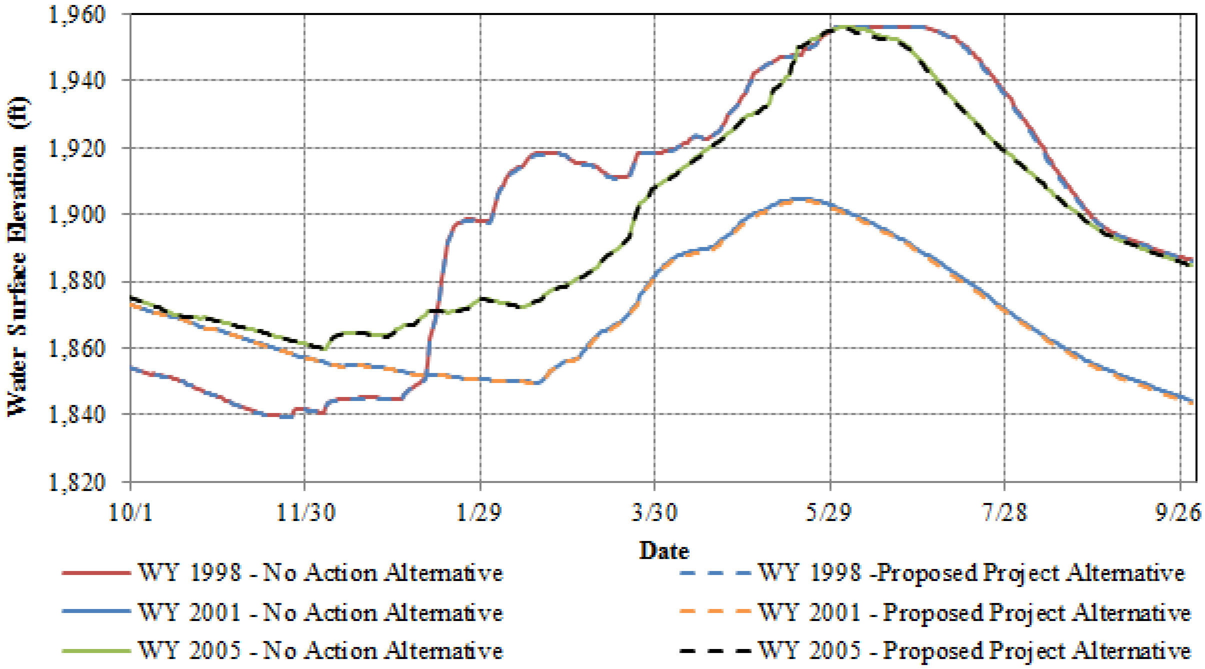


Figure 3.3.2-29. Simulated daily New Bullards Bar Reservoir water surface elevation for the No Action and YCWA's Proposed Project (Existing) alternatives for representative wet (1998), dry (2001) and normal (2005) WYs.

Simulated bi-weekly isotherms, showing elevations of constant temperature within New Bullards Bar Reservoir are shown in Figures 3.3.2-30, 3.3.2-31, and 3.3.2-32, for representative wet (1998), dry (2001) and normal (2005) WYs, respectively, and the elevations of the two inlets to the New Colgate Powerhouse tunnel. These figures show YCWA's proposed Project has little effect on cold water availability within New Bullard Bar Reservoir, and water temperatures throughout the year are always less than 15°C at the currently used, lower intake, and are almost always 10°C.

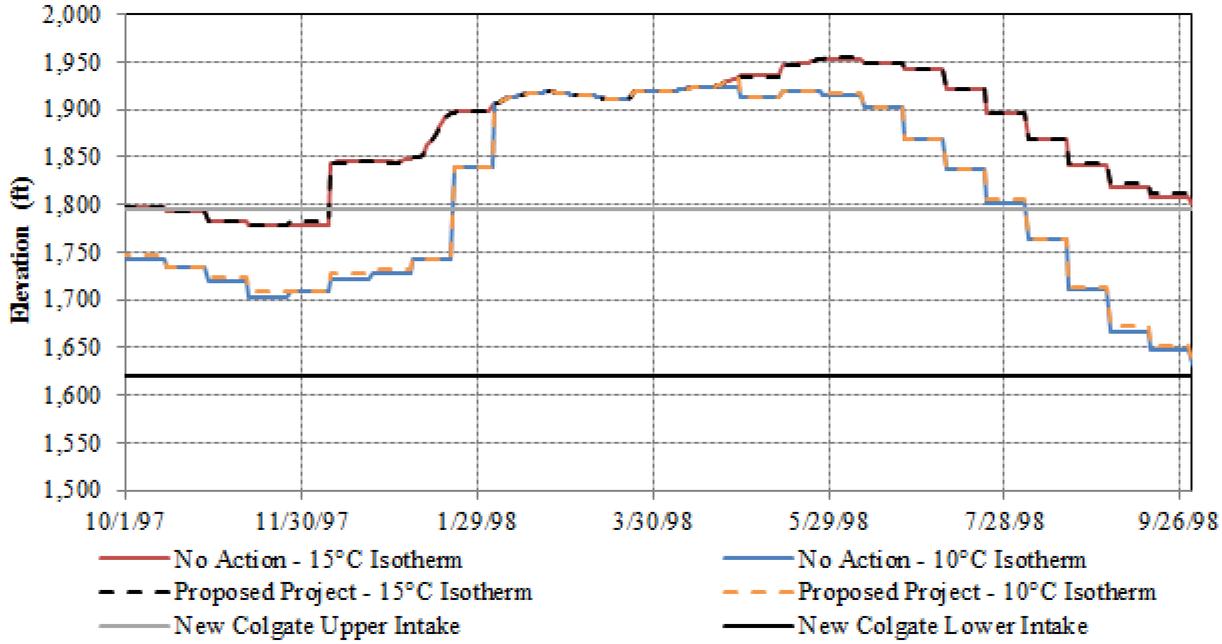


Figure 3.3.2-30. Simulated bi-weekly New Bullards Bar Reservoir 10°C and 15°C isotherm elevations for the No Action and YCWA's Proposed Project (Existing) alternatives for a representative wet (1998) WY. The elevation of the New Colgate Power Tunnel upper and lower intakes is shown.

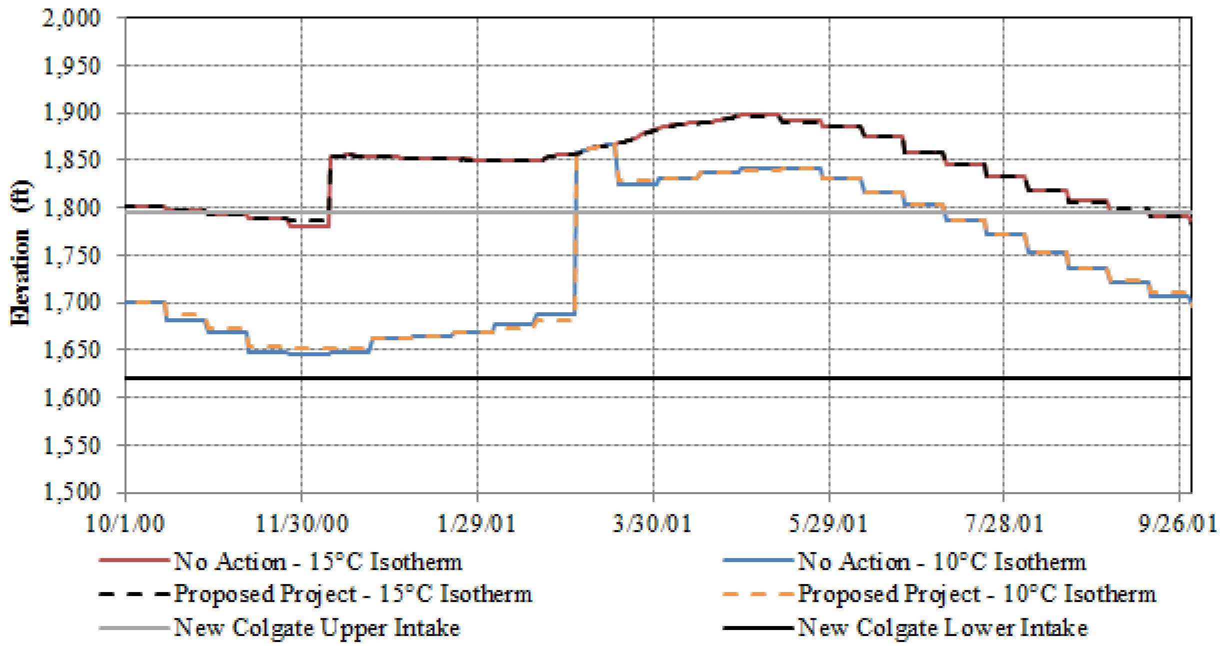


Figure 3.3.2-31. Simulated bi-weekly New Bullards Bar Reservoir 10°C and 15°C isotherm elevations for the No Action and YCWA's Proposed Project (Existing) alternatives for a representative dry (2001) WY. The elevation of the New Colgate Power Tunnel upper and lower intakes is shown.

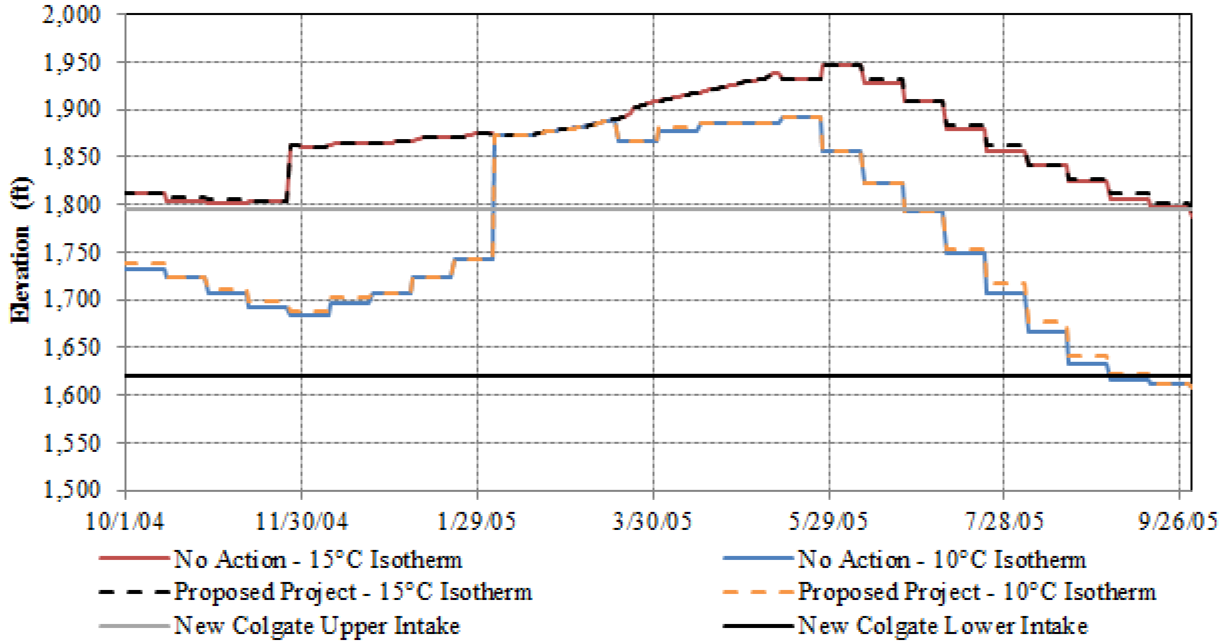
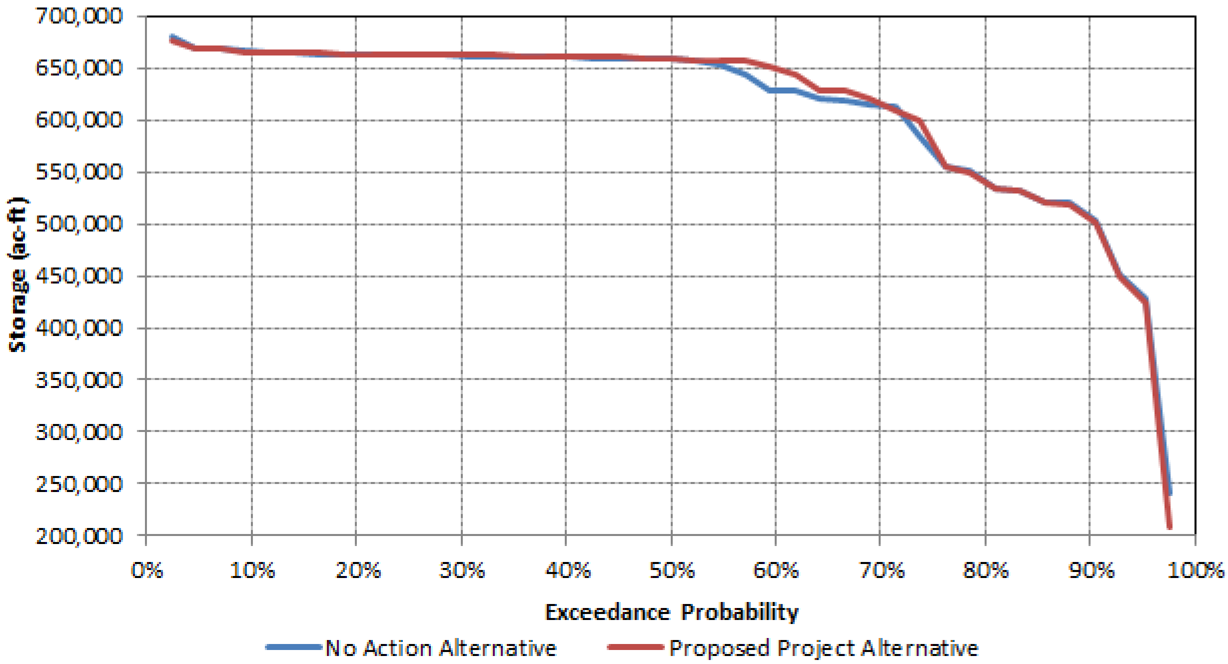


Figure 3.3.2-32. Simulated bi-weekly New Bullards Bar Reservoir 10°C and 15°C isotherm elevations for the No Action and YCWA's Proposed Project (Existing) alternatives for a representative normal (2005) WY. The elevation of the New Colgate Power Tunnel upper and lower intakes is shown.

The end of September is used as a metric for changes in operations for several reasons: 1) it reflects the end of the WY's operations and reservoir operations generally include an end-of-September storage target, simulated New Bullards Bar Reservoir operations under the No Action and Proposed Project (Existing) Alternatives use an end-of-September storage of 650,000 ac-ft; 2) reservoir releases in September are generally at a base flow level and are consistent from year to year; 3) annual inflows to the reservoir have typically not increased due to precipitation or snowmelt; and 4) flood management activities do not control New Bullards Bar Reservoir storage in September, meaning reservoir storage does not have a regulatory constraint. The exceedance probability of simulated end-of-September New Bullards Bar Reservoir storage from the full period of record of WYs 1970 through 2010, for the No Action and YCWA's Proposed Project (Existing) alternatives is presented in Figure 3.3.2.2-33.



Note: the No Action Alternative line (blue) is hidden behind the proposed Project line (red).

Figure 3.3.2-33. Simulated exceedance probability of end-of-September New Bullards Bar Reservoir storage for the No Action and YCWA's Proposed Project (Existing) alternatives for WYs 1970 through 2010

Englebright Reservoir

Changes in upstream flows will have negligible effect on Englebright Reservoir pool elevation. Simulated daily Englebright Reservoir water surface elevations are presented in Figure 3.3.2-34 for the No Action and YCWA's Proposed Project alternatives for representative wet, dry and normal WYs. Changes in water surface elevation occur in the representative wet water year (1998) and in the representative normal water year (2005) in response to high flow events. Water surface elevations in the representative dry water year (2001) do not change. The water surface elevation changes in the wet and normal water year can be due to Englebright Reservoir spill avoidance operations, where New Colgate Powerhouse releases are curtailed in advance of a high flows from the Middle Yuba or South Yuba rivers to create storage space within Englebright Reservoir to reduce spills. Englebright Reservoir water surface elevations could also change in response to spill events from New Bullards Bar Reservoir. The Operations Model allows Englebright Reservoir water surface elevations to fluctuate between 516 ft and 527 ft.

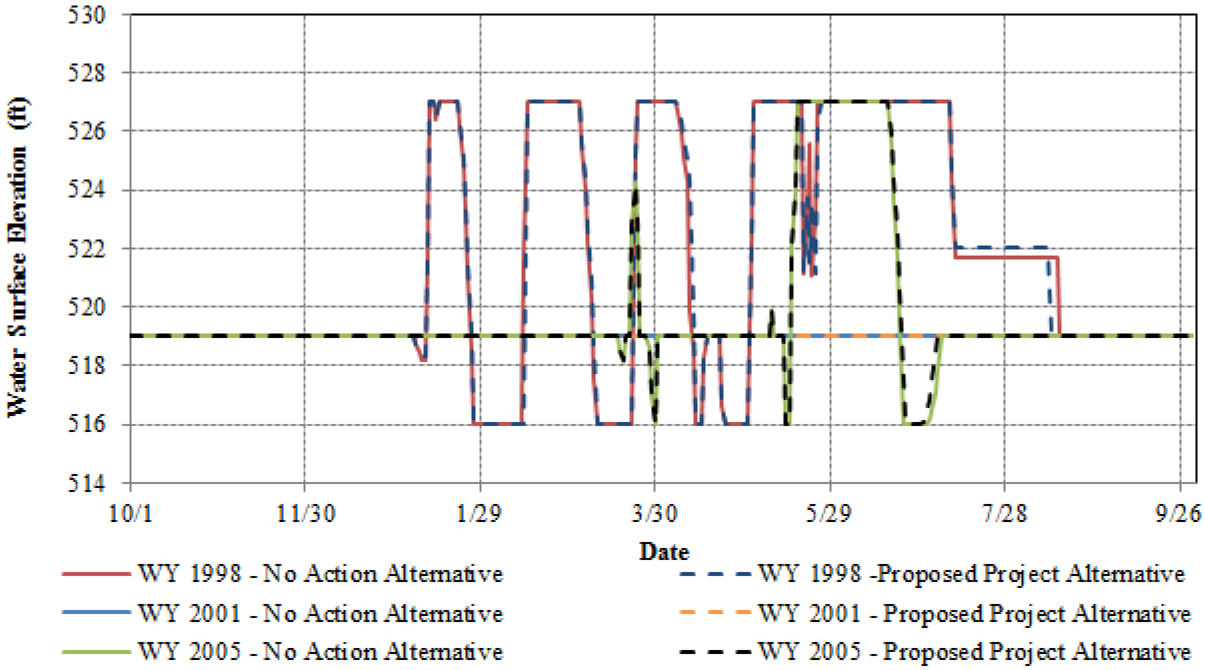


Figure 3.3.2-34. Simulated daily Englebright Reservoir water surface elevation for the No Action and YCWA's Proposed Project (Existing) alternatives for representative wet (1998), dry (2001) and normal (2005) WYs.

Simulated bi-weekly isotherms, showing elevations of constant temperature within Englebright Reservoir are shown in Figures 3.3.2-35, 3.3.2-36, and 3.3.2-37, for representative wet (1998), dry (2001) and normal (2005) WYs, respectively, and the elevations of the Narrows 2 Power Tunnel intake. These figures show YCWA's proposed Project has little effect on cold water availability within Englebright Reservoir, and water temperatures throughout the year are always less than 15°C at the intake, and are almost always less than 10°C. Interestingly, May 2005 shows the effect of a large flood event of nearly 50,000 cfs that spilled Englebright Reservoir and replaced the volume of cold water in Englebright Reservoir with the flood flow. Releases from New Colgate Powerhouse restored the cold water volume within Englebright Reservoir within a few days after the spill, indicating the coldwater volume of Englebright Reservoir is driven by New Colgate Powerhouse releases.

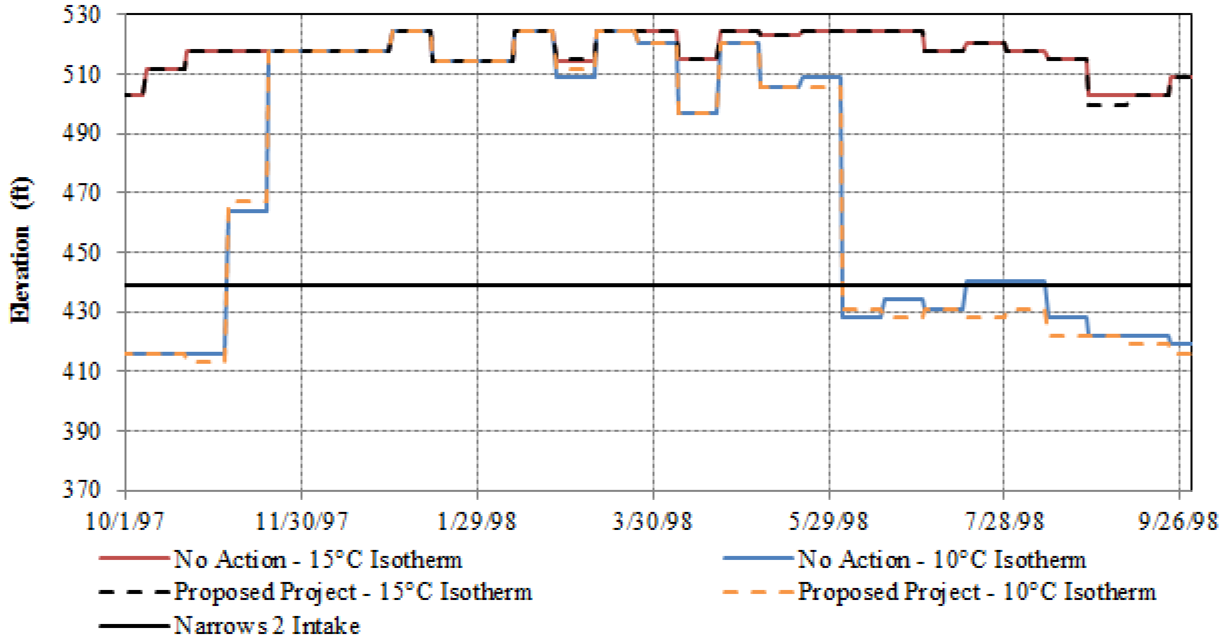


Figure 3.3.2-35. Simulated bi-weekly Englebright Reservoir 10°C and 15°C isotherm elevations for the No Action and YCWA's Proposed Project (Existing) alternatives for a representative wet (1998) WY. The elevation of the Narrows 2 Power Tunnel intake is shown.

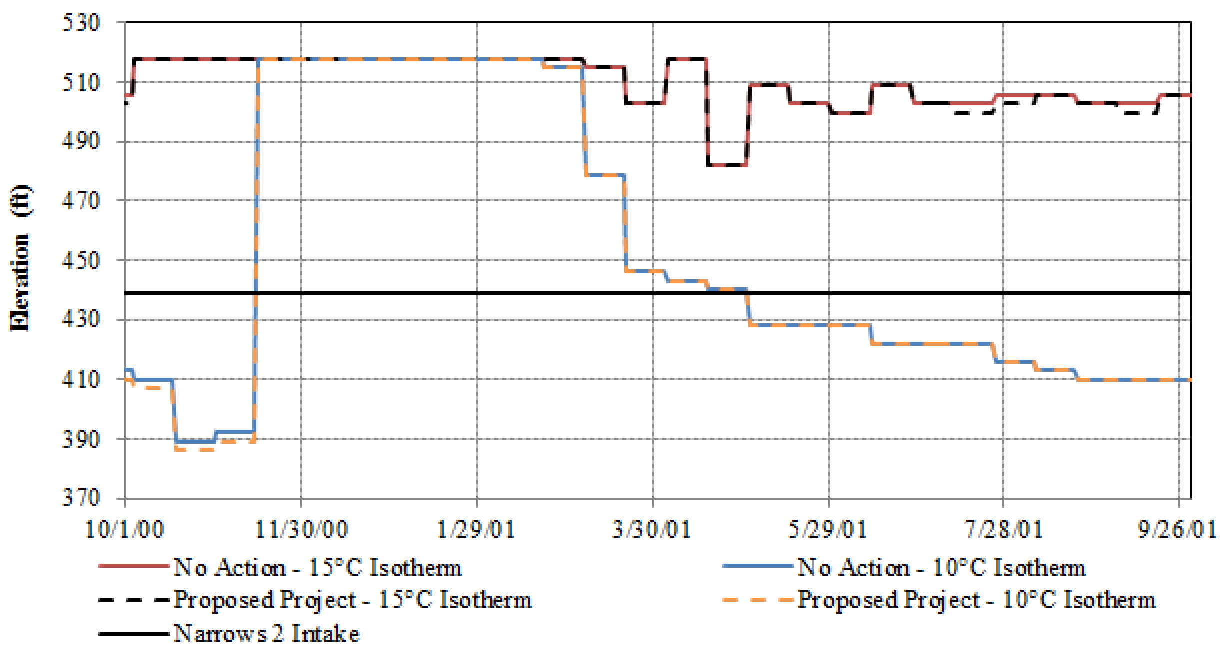


Figure 3.3.2-36. Simulated bi-weekly Englebright Reservoir 10°C and 15°C isotherm elevations for the No Action and YCWA's Proposed Project (Existing) alternatives for a representative dry (2001) WY. The elevation of the Narrows 2 Power Tunnel intake is shown.

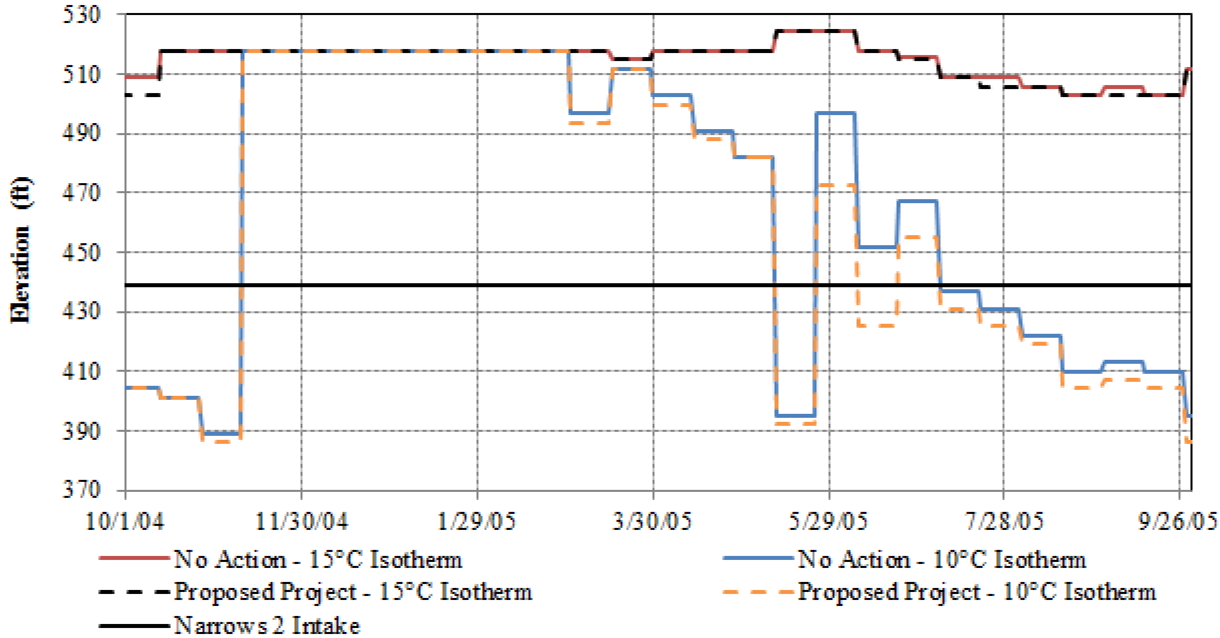


Figure 3.3.2-37. Simulated bi-weekly Englebright Reservoir 10°C and 15°C isotherm elevations for the No Action and YCWA's Proposed Project (Existing) alternatives for a representative normal (2005) WY. The elevation of the Narrows 2 Power Tunnel intake is shown.

Figure 3.3.2-38 shows simulated daily Narrows 2 Powerhouse release temperatures for the three representative water years, 1998 (Wet), 2001 (Dry), and 2005 (Normal). Periods without data in the figure correspond with times when all releases are made through PG&E's Narrows 1 Powerhouse. The figure shows release water temperatures from the Narrows 2 Powerhouse are consistently under 14°C in all three water year types, under both the No Action and YCWA's Proposed Project. The figures all show a very slight warming of water temperatures under the proposed Project, as compared to the No Action Alternative. This is due to the slight differences in flows on the Middle Yuba River and Oregon Creek, and the water temperature differences primarily due to corresponding decreased releases from New Colgate Powerhouse.

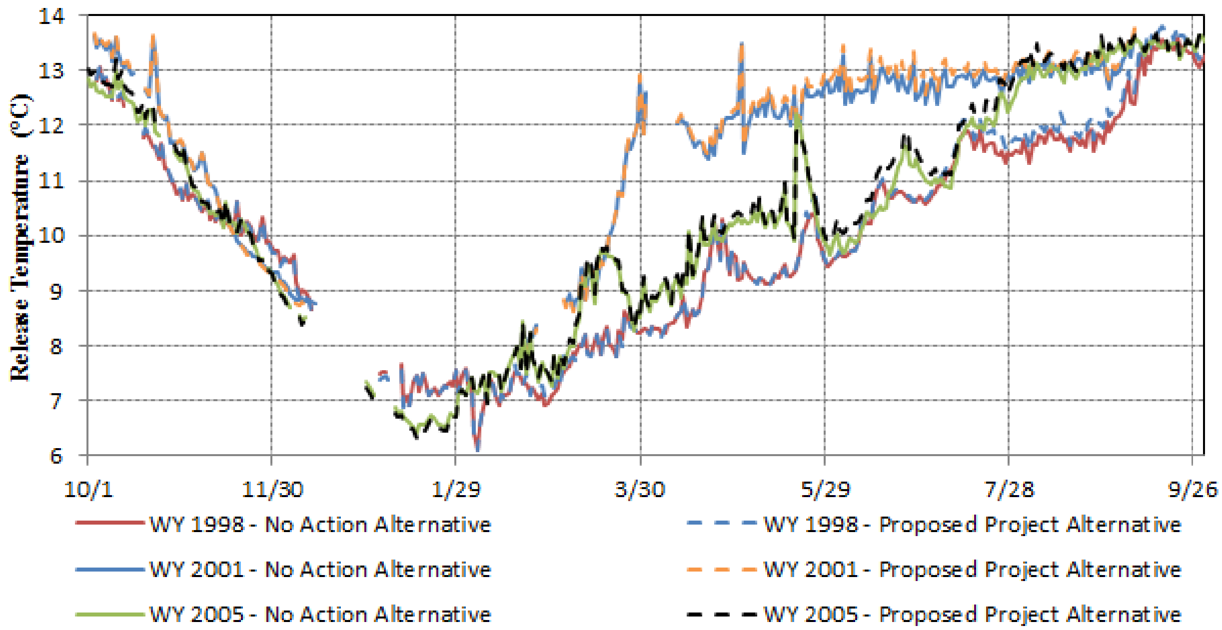
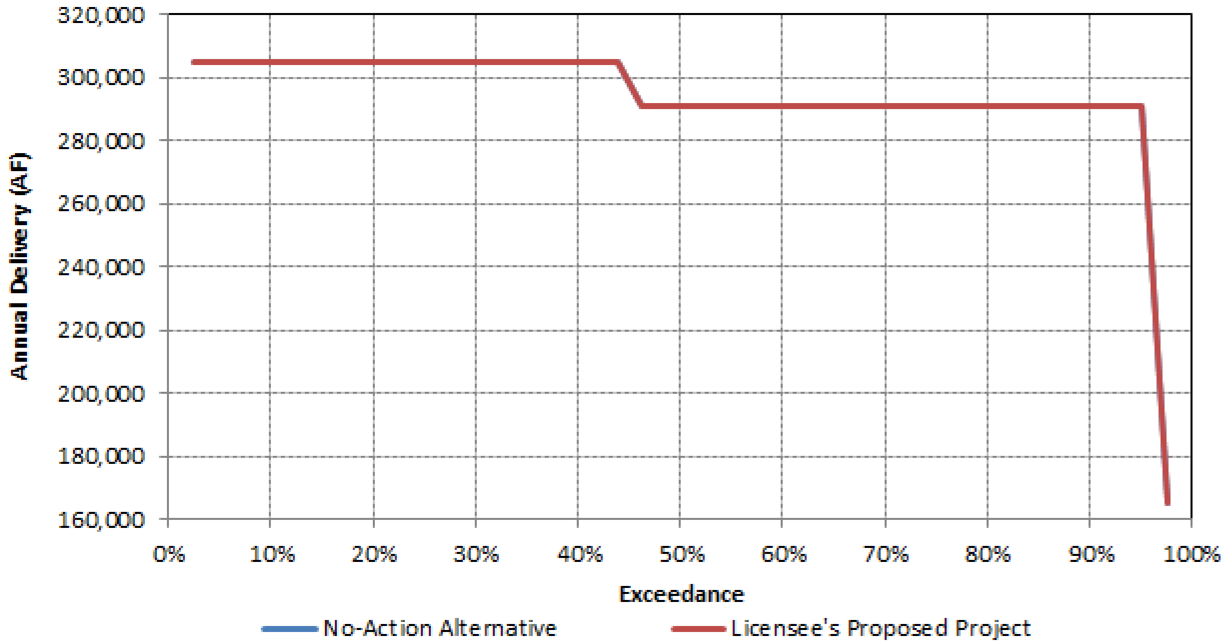


Figure 3.3.2-38. Simulated daily Narrows 2 Powerhouse release water temperatures for representative wet (1998), dry (2001), and normal (2005) water years

Water Supply

Under YCWA's proposed Project (Existing), irrigation deliveries to YCWA Member Units would continue similarly to the No Action Alternative. A comparison of existing irrigation deliveries to YCWA Member Units under the No Action and YCWA's proposed Project (Existing) alternatives is presented in Figure 3.3.2-39.



Note: the No Action Alternative line (blue) is hidden behind the proposed Project line (red).

Figure 3.3.2-39. Exceedance curves of modeled annual irrigation deliveries to YCWA Member Units for the No Action and YCWA's proposed Project (Existing) alternatives for WYs 1970 through 2010.

Water Rights

Under YCWA's proposed Project, there would be very little effect on flows downstream from the Project, as compared to the No Action Alternative, as shown in Table 3.3.2-19. Without any changes in flows, there would not be expected to be any effects on water rights holders either downstream or within the Project Area. One possible exception to this is PG&E, with its Narrows 1 Powerhouse appropriative water right; however, with YCWA's proposed Condition Gen7, YCWA will ensure coordination with PG&E for meeting the minimum flows described in Condition AR3.

3.3.2.2.2 Effects on Reservoir Water Quality

Under YCWA's proposed Project, changes in New Bullards Bar Reservoir water surface elevation and storage occur, but are relatively minor; the maximum reservoir level differences in any year type under typical operations would result in changes of less than 5 feet (Figure 3.3.2-28). These changes would not substantially change the size or stability of the epilimnion or hypolimnion, or encroach upon the intake structures. Since YCWA would not substantially alter the stratification or where water is withdrawn, there is no mechanism to affect water quality in New Bullards Bar Reservoir.

Since YCWA's proposed minimum flow regime and reservoir operation restrictions are not likely to impair most water quality parameters, the discussion below focuses on Basin Plan water quality objectives not met under the No Action Alternative, as well as parameters affected by the Project.

Bacteria. In 2012, bacteria samples were collected adjacent from six reservoir recreation sites. At each site, the Basin Plan WQO for fecal coliform in waters designated for contact recreation was met for both the time surrounding and including Independence Day holiday as well as the time surrounding and including Labor Day holiday. However, the total coliform counts were greater than their benchmark. Since the E. coli counts are well below the benchmark and very low, human impacts are not suggested; it is likely that non-humans are the source of total coliform counts.

Under YCWA's Proposed Project, the Project's minimum flow provisions and operation restrictions would not increase fecal or total coliform anywhere in the Project Area. Further, YCWA's Proposed Project includes installation or modernization, enhancement or rehabilitation of a number of restrooms and leach fields, which would further protect surface water from fecal coliform and total coliform (Table 3.3.2-20; See Condition RR1, *Implement Recreation Facilities Plan*, in Appendix E2). Designated beneficial uses would not be adversely affected.

Table 3.3.2-20. Proposed recreation-related rehabilitation and enhancements with the potential to effect water quality.

Recreation Facility	Manager	Land Ownership	Restrooms		Other/Notes
			Replace	Add	
NEW BULLARDS BAR RESEROVIR					
Schoolhouse Campground	USFS	NFS	X	X	--
Dark Day Campground	USFS	NFS	X	--	--
Hornswoggle Group Campground	USFS	NFS	X	X	--
Cottage Creek Campground	USFS	NFS and YCWA	--	X	--
Garden Point Boat-In Campground	USFS	NFS	--	X	--
Madrone Cove Boat-In Campground	USFS	YCWA	--	--	--
Frenchy Point Boat-In Campground	USFS	YCWA	--	--	--
Dark Day Picnic Area	USFS	NFS	X	--	--
Moran Road Day Use Area	USFS	NFS	--	--	--
Cottage Creek Boat Launch	YCWA	YCWA	--	--	--
Dark Day Boat Launch	USFS	NFS	--	--	--
Bullards Bar Trail	USFS	NFS/ YCWA	--	--	--
Schoolhouse Trail	USFS	NFS	--	--	--
Floating Comfort Stations	YCWA	N/A	--	--	--
Moran Road Day Use Area	USFS	NFS	--	--	--
PROJECT RELATED FACILTIES					
Sunset Vista	USFS	NFS	X[1]	X[1]	--
Dam Overlook	USFS	YCWA	--	--	--
Water Supply System	YCWA	YCWA	--	--	No change to chlorination system
PROJECT IMPOUNDMENTS					
Our House Diversion Dam	--	NFS	--	--	--
Log Cabin Diversion Dam	--	NFS	--	--	--

[1] Included for completeness. Site is not located near Project waters.

Toxicity. In the Yuba watershed, mercury is addressed under the toxicity objective; because mercury is a CWA Section 303(d) constituent of interest, mercury is discussed under its own heading here – other metals are discussed in this section.

In summer 2012, samples collected upstream, downstream, and within New Bullards Bar Reservoir had copper concentrations greater than each sample's hardness-specific CTR criteria for copper. In spring 2012, samples collected from Englebright Reservoir had copper, nickel, and silver concentrations greater than each sample's hardness-specific respective CTR criteria.

YCWA does not release any substances into surface waters that contain copper or any metal, and is unaware of any other party that releases materials with copper or any metal to surface waters. Therefore, the source of copper and metals is likely a result of natural conditions (e.g., copper minerals in the geology of the watershed). In addition, YCWA is unaware of any indications or reports that would indicate toxicity in aquatic life in New Bullards Bar or Englebright reservoirs. Last, the copper, nickel, and silver CTR criteria are likely overly protective, as each is extrapolated to the low-hardness conditions found within the Project area from toxicity tests performed at higher hardness levels, and many waters with higher copper, nickel, and silver concentrations support thriving aquatic populations. Under YCWA's proposed Project, the Project's minimum flow provisions and operation restrictions would not increase metals concentrations. Thus, for the reasons stated above, this inconsistency with the Basin Plan's Toxicity objective is considered less than significant. Designated beneficial uses would not be adversely affected.

Turbidity. Spatial upstream-to-downstream turbidity trends are best seen in the data as they are presented in YCWA's Technical Memorandum 2-3, Water Quality, Attachment 2-3C, which provides sample results by location. As pointed out above, New Bullards Bar Reservoir's Madrone Cove sample exhibited high turbidity (335.6 NTU) in spring 2012, while Englebright Reservoir's upper reservoir samples exhibited high turbidity (550 NTU; 159.6 NTU) in spring and summer 2012 However, in the Yuba River downstream of the Project, turbidity ranged from 0 to 11.9 NTU in the spring and 0.3 to 20 NTU in the summer. YCWA is unaware of any reports that turbidity causes a nuisance or adversely affects beneficial uses in the study area or immediately downstream of the Project. Under YCWA's proposed Project, the Project's minimum flow provisions and operation restrictions would not increase turbidity anywhere in the Project area. This inconsistency with the Basin Plan's turbidity objective is considered less than significant. Designated beneficial uses would not be adversely affected.

Water Temperature

Reservoir water temperatures typically exceeded 20.0°C during June through September, at depths of up to 50 feet below the New Bullards Bar Reservoir surface (1989-2012). However, water temperatures near the upper New Colgate Power Tunnel Intake only exceeded 20°C for short periods in 5 out of the 24-year period of record. Water temperatures near the lower intake never exceeded 13°C in the 24-year period of record. Since 1994, all releases have been made through the lower intake.

Under YCWA's proposed Project, modified inflows to and outflows from New Bullards Bar Reservoir are not anticipated to significantly affect either seasonal storage or seasonal stratification, as compared to the No Action Alternative. Table 3.3.2-21 depicts thermal conditions in New Bullards Bar Reservoir under these two scenarios.

Table 3.3.2-21. Average usable storage in New Bullards Bar Reservoir at the 10°C and 15°C isotherms for the modeled period of record (WYs 1970 through 2010) based on Operations Model and HEC-5Q temperature model results.

Operations Scenario	Average Usable Storage below 15°C Isotherm (ac-ft)		Average Usable Storage below 10°C Isotherm (ac-ft)	
	July 1	October 15	July 1	October 15
No Action Alternative	673,216	371,367	453,271	165,816
YCWA's Proposed Project (Existing)	677,818	375,421	458,706	171,601

Under most WY types, water levels would not change appreciably in New Bullards Bar Reservoir. However, in the summer months of Dry and Critically Dry WYs, water level changes would range up to, at most, 5 ft (Figure 3.3.2-28). This minor amount of water level change would not substantially change the size or stability of the epilimnion or hypolimnion, or encroach upon the intake structures. For this reason, YCWA's proposed Project's effect on reservoir temperatures is considered less than significant, and designated beneficial uses would not be adversely affected.

Dissolved Oxygen

In 2012, the instantaneous Basin Plan objective for DO concentrations was not met in the hypolimnion of New Bullards Bar and Englebright reservoirs, while the reservoir was stratified.

YCWA is unaware of any DO-related problems in the Project reservoirs or in streams below the reservoirs that affect designated beneficial uses. A low DO reading at the bottom of a stratified reservoir is a common occurrence. Most fish and aquatic organisms utilize the upper portions of the reservoir, where low DO levels are typically not prevalent. Diurnal DO concentration patterns of variation in reservoirs and stream reaches are also a common occurrence. Under most WY types, water levels would not change New Bullards Bar Reservoir. However, in the summer months of Dry and Critically Dry WYs, water level changes would range up to, at most, 5 ft (Figure 3.3.2-28). This minor amount of water level change would not substantially change the size or stability of the epilimnion or hypolimnion, or the likelihood that the epilimnion would encroach upon the intake structures. Since YCWA does not propose a significant change in the size of the epilimnion or hypolimnion, or to change from the current exclusive use of the lower of the intake structures, these current DO conditions may be expected to continue to occur with YCWA's proposed Project; however, YCWA's proposed Project is not expected to cause DO concentrations to be lower than under existing conditions. For the reasons stated above, these existing inconsistencies with the Basin Plan's DO objective (should they occur with YCWA's proposed Project) is considered less than significant, and designated beneficial uses would not be adversely affected.

3.3.2.2.3 Effects on Water Quality in Stream Reaches

Water Quality

Simulated daily New Bullards Bar Reservoir water surface elevations are presented for YCWA's proposal in Figure 3.3.2-28 for the No Action and Proposed Project (Existing) alternatives. Under YCWA's proposal, changes in water surface elevation and storage occur, but are relatively minor; the maximum reservoir level differences in any year type would be at most 5 ft. These changes would not substantially change the size or stability of the epilimnion or hypolimnion, or cause the epilimnion to encroach upon the intake structures. The existing condition of water quality in YCWA's Project Area was described above in the Affected Environment (Section 3.3.2.1). As pointed out above, water quality in Project affected stream reaches meets or exceeds WQOs (YCWA 2013d). Since YCWA would not substantially alter the stratification or where water is withdrawn, and DO concentrations met or exceeded WQOs, likely due to mixing at the New Colgate Powerhouse, there is no mechanism to adversely affect water quality downstream of New Bullards Bar reservoir and designated beneficial uses would not be adversely affected by YCWA's proposed Project flows.

YCWA's proposed Project also includes changing minimum-required flows in the Middle Yuba and North Yuba rivers, and Oregon Creek from YCWA's proposed Project (AR1 in Appendix E2); changing flows downstream of Narrows 2 in the driest years (AR3); changing ramping rates downstream of Englebright Dam (TE4); and adopting a spill cessation schedule at Our House Diversion Dam and New Bullards Bar Dam (AR2 and AR4). The modulating spills and ramping rates are designed to enhance amphibian and aquatic habitat. The existing condition of water quality in YCWA's Project Area was described above in the Affected Environment (Section 3.3.2.1). As pointed out above, water quality in Project affected stream reaches meets or exceeds WQOs (YCWA 2013d). Gradual release of downstream flows would not impair downstream water quality, and may reduce turbidity; therefore, designated beneficial uses would not be adversely affected by YCWA's proposed Project's spill control and reduced ramping rates.

Water Temperature

As shown above in Table 3.3.2-19, YCWA's Proposed Project (Existing) Alternative would result in relatively minor changes in flow throughout the Project Area. These changes would primarily be due to the following:

- YCWA proposed condition AR1: Maintain minimum streamflows below Our House Diversion Dam, Log Cabin Diversion Dam, and New Bullards Bar Dam
- YCWA proposed condition AR3: Maintain minimum streamflows at Narrows 2 Powerhouse and Narrows 2 Full Bypass

Other proposed conditions, such as the following, would also have an effect on flow, but the change would be relatively minor, compared to the previous two:

- YCWA proposed Condition AR2: Control Project spills at Our House Diversion Dam
- YCWA proposed Condition AR4: Control Project spills at New Bullards Bar Dam

Changes in flow, and changes in New Bullards Bar Reservoir storage, have a corresponding effect on water temperatures. The Water Temperature Models described above were used to simulate the effects of YCWA's proposed Project on water temperatures throughout the Project.

Simulated water temperatures for the No Action Alternative and YCWA's Proposed Project (Existing) Alternative for locations along the Middle Yuba River, Oregon Creek, North Yuba River, and Yuba River are presented below. To demonstrate simulated water temperature changes along each river, each figure shows water temperatures for each WY at several locations, sometimes spanning reaches and at other times splitting reaches into multiple segments.

Figures 3.3.2-40, 3.3.2-41, and 3.3.2-42 show simulated water temperatures along the Middle Yuba River. All three representative WYs show water temperatures increasing from upstream to downstream, particularly in the spring and summer. Additionally, the effect of the increased minimum flows is evident in the reduction of warming for the Proposed Project Alternative; water temperatures at the downstream end of the Middle Yuba River are slightly cooler under the Proposed Project Alternative as compared to the No Action Alternative, despite temperatures at the upstream end being essentially identical.

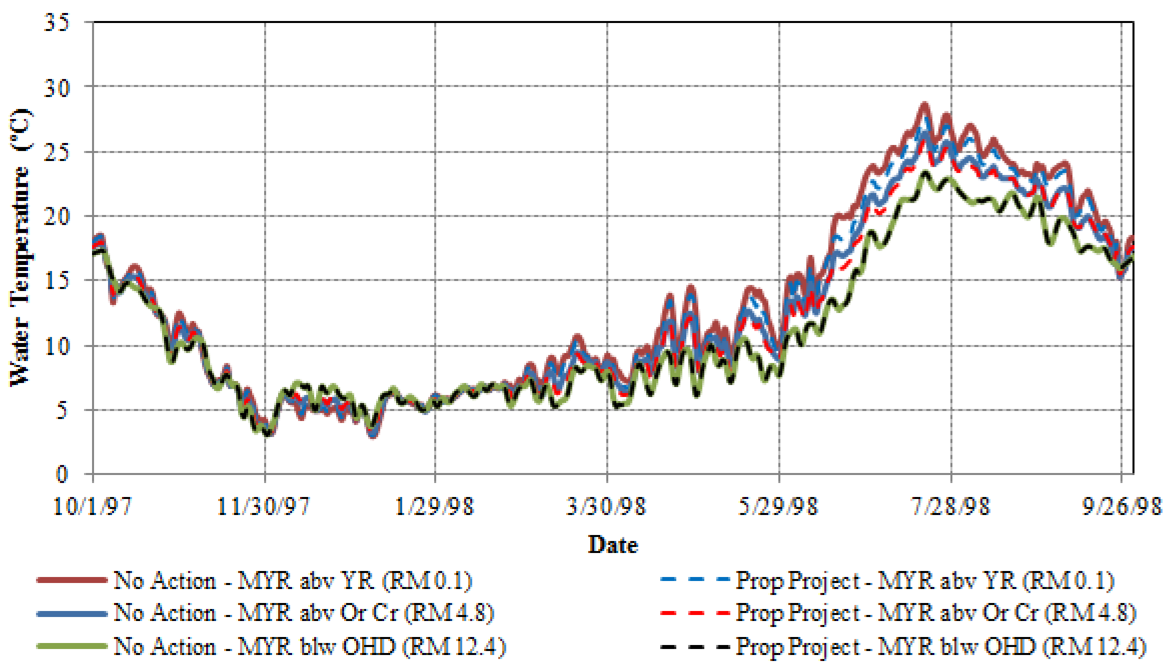


Figure 3.3.2-40. Simulated daily water temperatures for a representative wet WY (1998) at various locations along the Middle Yuba River.

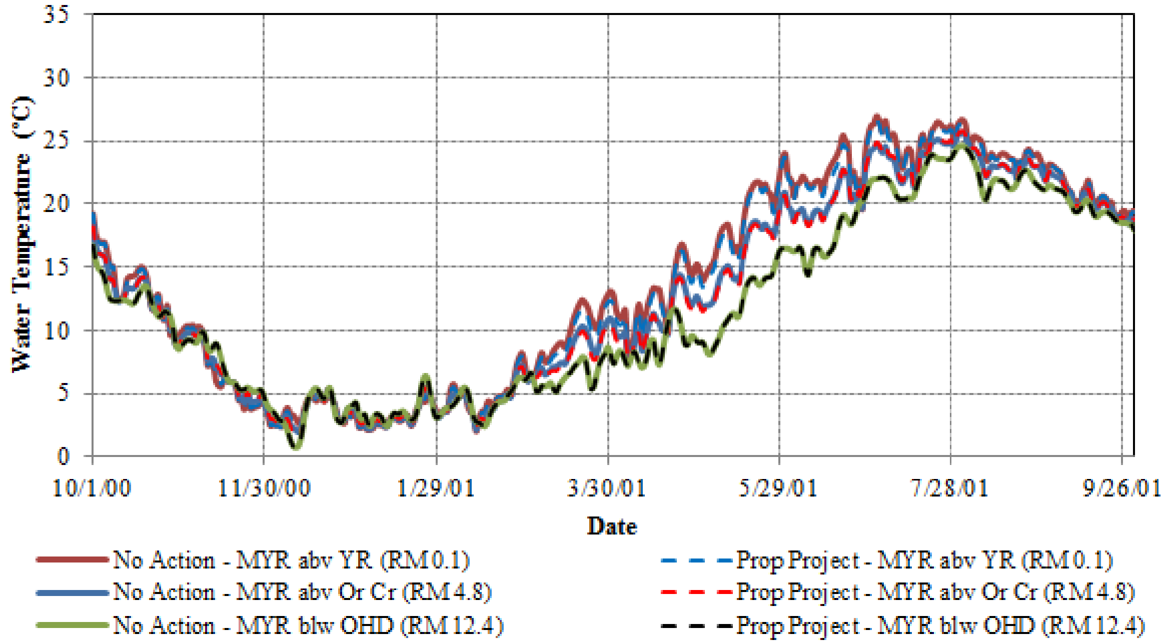


Figure 3.3.2-41. Simulated daily water temperatures for a representative dry WY (2001) at various locations along the Middle Yuba River.

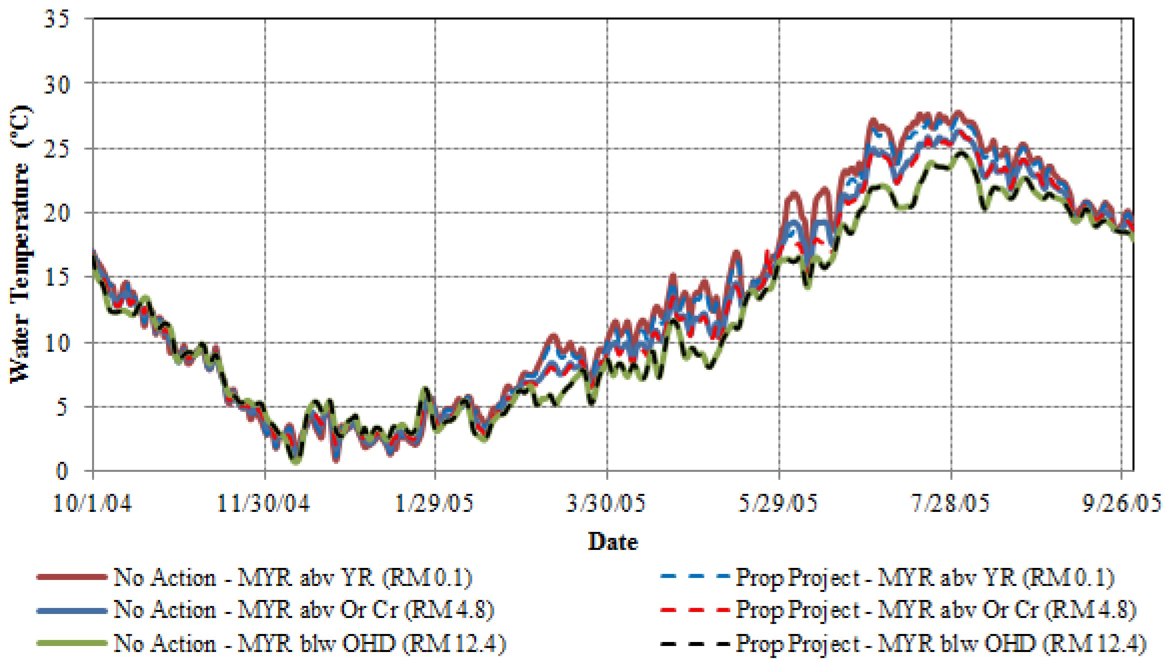


Figure 3.3.2-42. Simulated daily water temperatures for a representative normal WY (2005) at various locations along the Middle Yuba River

Figures 3.3.2-43, 3.3.2-44 and 3.3.2-45 show simulated water temperatures along Oregon Creek both below the Log Cabin Diversion Dam. In all three WYs in both alternatives, there is substantial warming between the upstream and downstream ends of Oregon Creek. Water temperatures in the summer, however, do not show a substantial benefit due to the increased minimum flows; in all three years, there is a difference in water temperatures at the upstream end in July and August, but that difference is greatly reduced or non-existent at the downstream end. During this period, Oregon Creek inflow to Log Cabin Dam are typically very low, so water temperature differences at the upstream end are likely due to the influence of flow (or lack thereof) from the Middle Yuba River through the Lohman Ridge Tunnel. The benefit of the increased minimum flow on water temperature is evident in the spring, when water temperatures below Log Cabin Diversion Dam are the same between the No Action Alternative and the Proposed Project Alternative, but there is a difference in downstream water temperature.

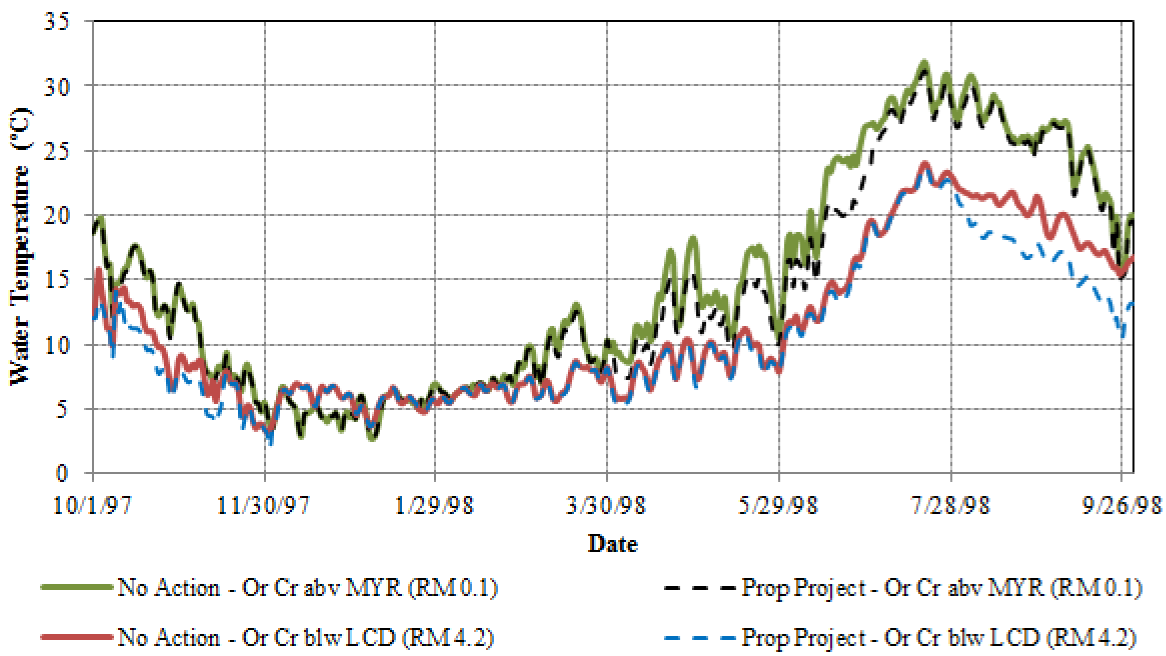


Figure 3.3.2-43. Simulated daily water temperatures for a representative wet WY (1998) at various locations along Oregon Creek.

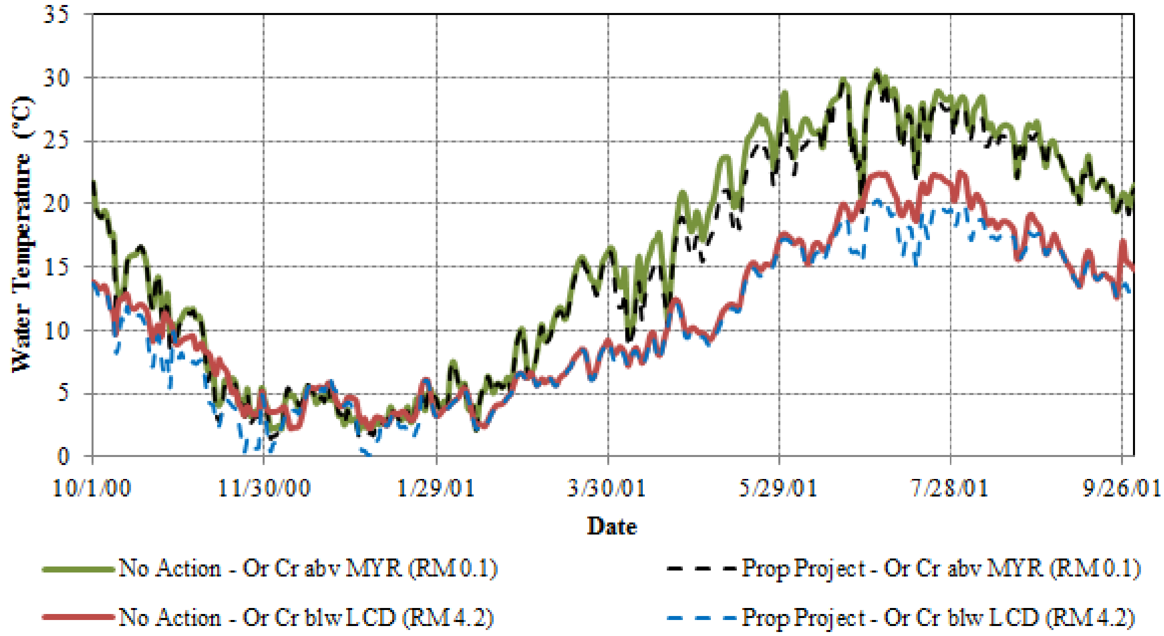


Figure 3.3.2-44. Simulated daily water temperatures for a representative dry WY (2001) at various locations along Oregon Creek.

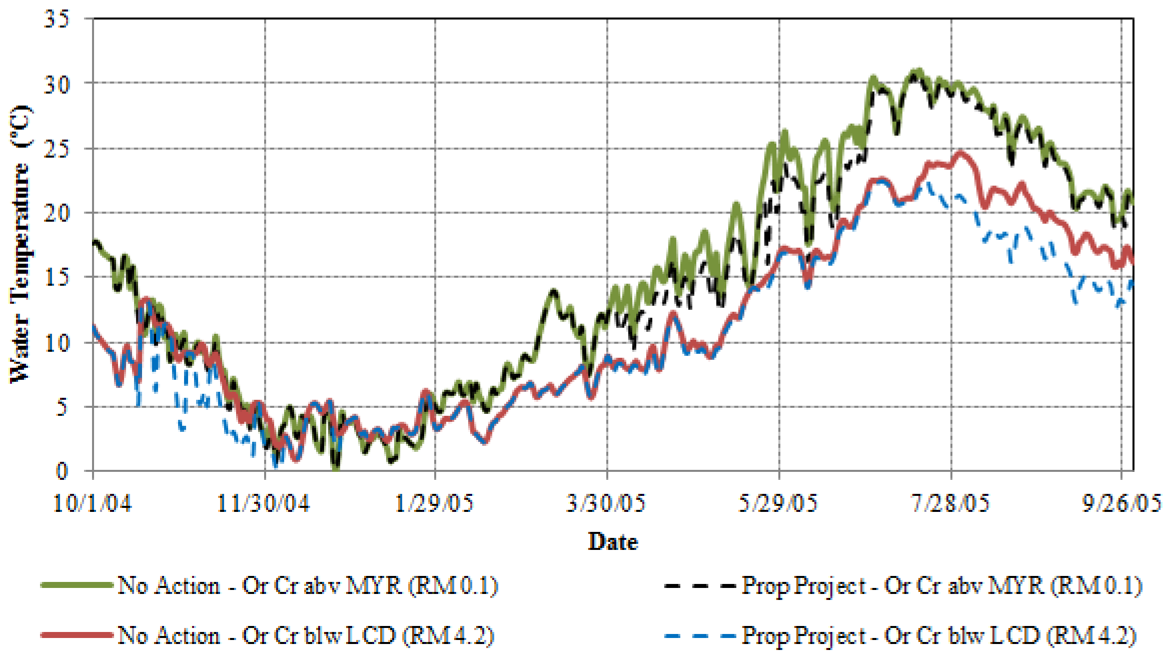


Figure 3.3.2-45. Simulated daily water temperatures for a representative normal WY (2005) at various locations along Oregon Creek.

Figures 3.3.2-46, 3.3.2-47 and 3.3.2-48 show simulated water temperatures along the North Yuba River. The benefit of increased minimum flows on temperature is very evident in July and

August of each year, when water temperatures at the upstream end of the reach are the same under the No Action and Proposed Project alternatives, but there are substantial differences in water temperatures at the downstream end of the reach. During extremely high flows (spills from the New Bullards Bar Dam spillway), water temperatures at the upstream and downstream end of the reach are the same.

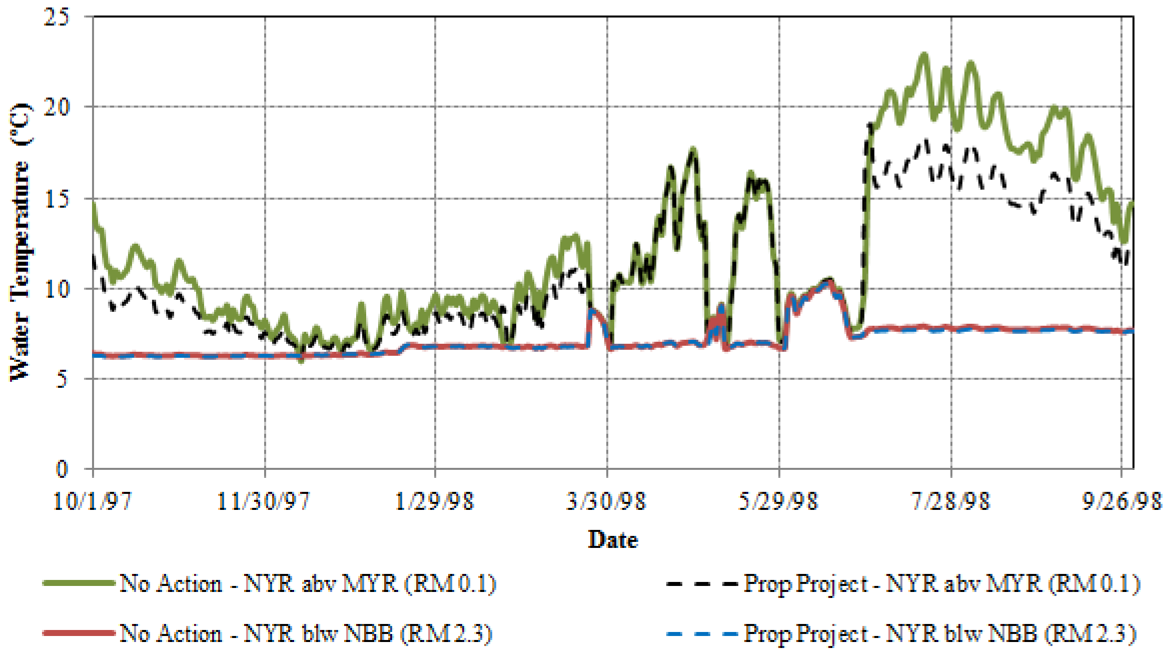


Figure 3.3.2-46. Simulated daily water temperatures for a representative wet WY (1998) at various locations along the North Yuba River.

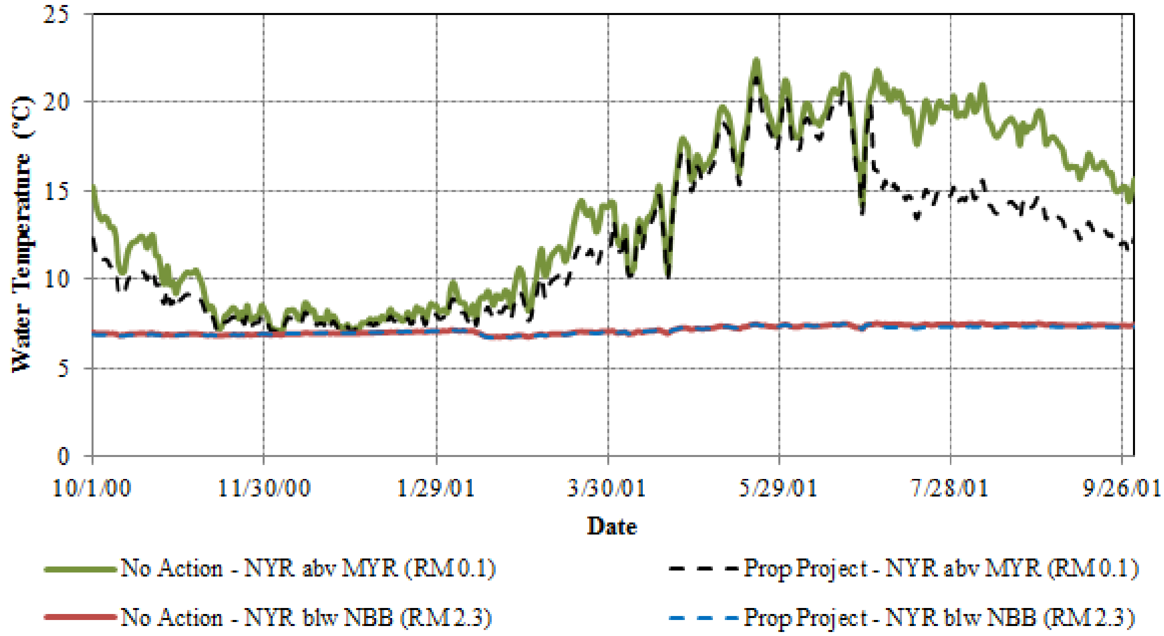


Figure 3.3.2-47. Simulated daily water temperatures for a representative dry WY (2001) at various locations along the North Yuba River.

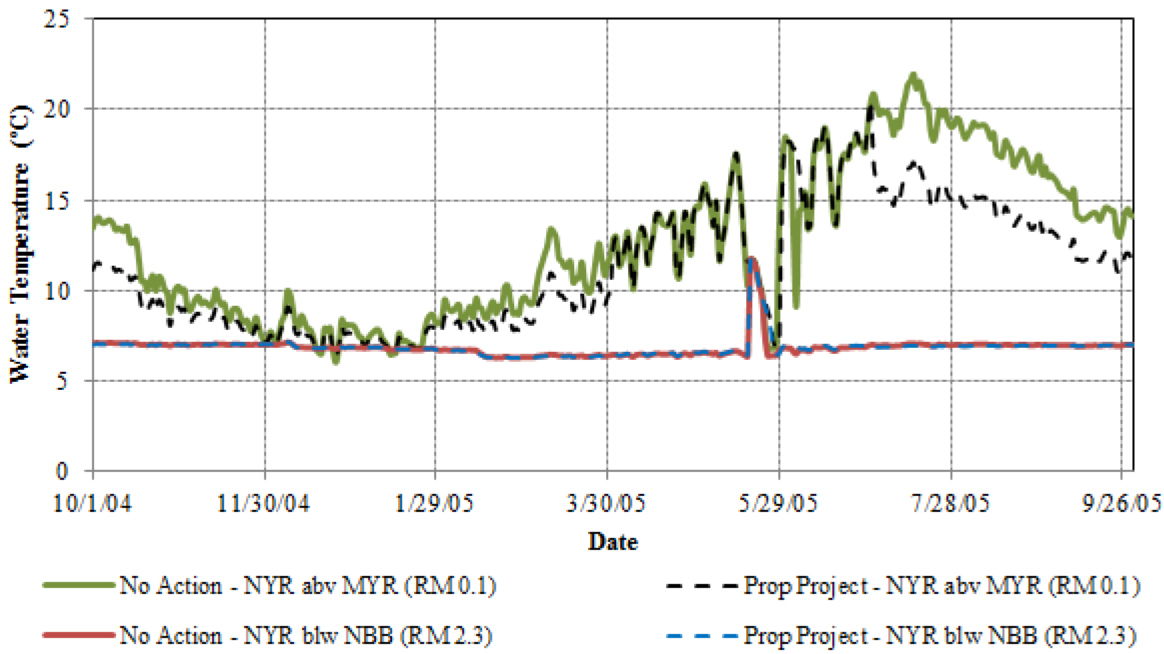


Figure 3.3.2-48. Simulated daily water temperatures for a representative dry WY (2005) at various locations along the North Yuba River.

Figure 3.3.2-49, 3.3.2-50, and 3.3.2-51 show simulated water temperatures along the Yuba River upstream of Englebright Reservoir. These figures show there is some warming between the

Middle Yuba-North Yuba rivers' confluence and immediately upstream of the New Colgate Powerhouse in the summer, but the influence of cold water releases from the New Colgate Powerhouse overwhelms any temperature differences between alternatives and essentially resets water temperatures downstream of the New Colgate Powerhouse between the two alternatives. In the winter, releases from the New Colgate Powerhouse under both alternatives have the effect of warming water temperatures relative to flow upstream of the New Colgate Powerhouse.

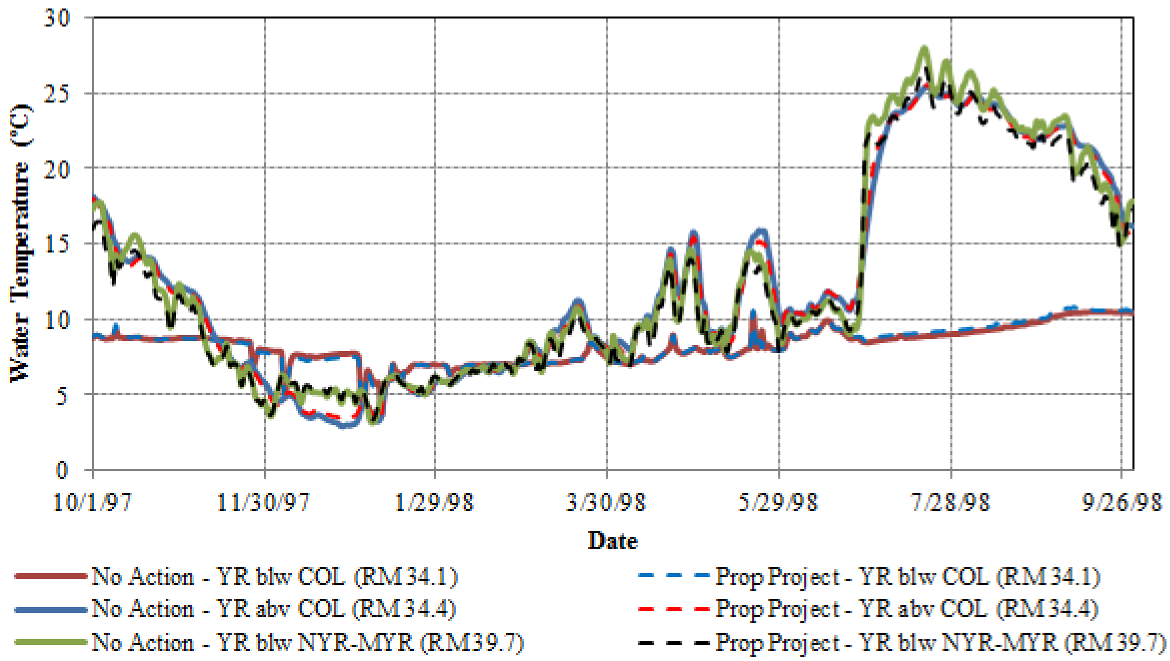


Figure 3.3.2-49. Simulated daily water temperatures for a representative wet WY (1998) at various locations along the Yuba River upstream of Englebright Reservoir.

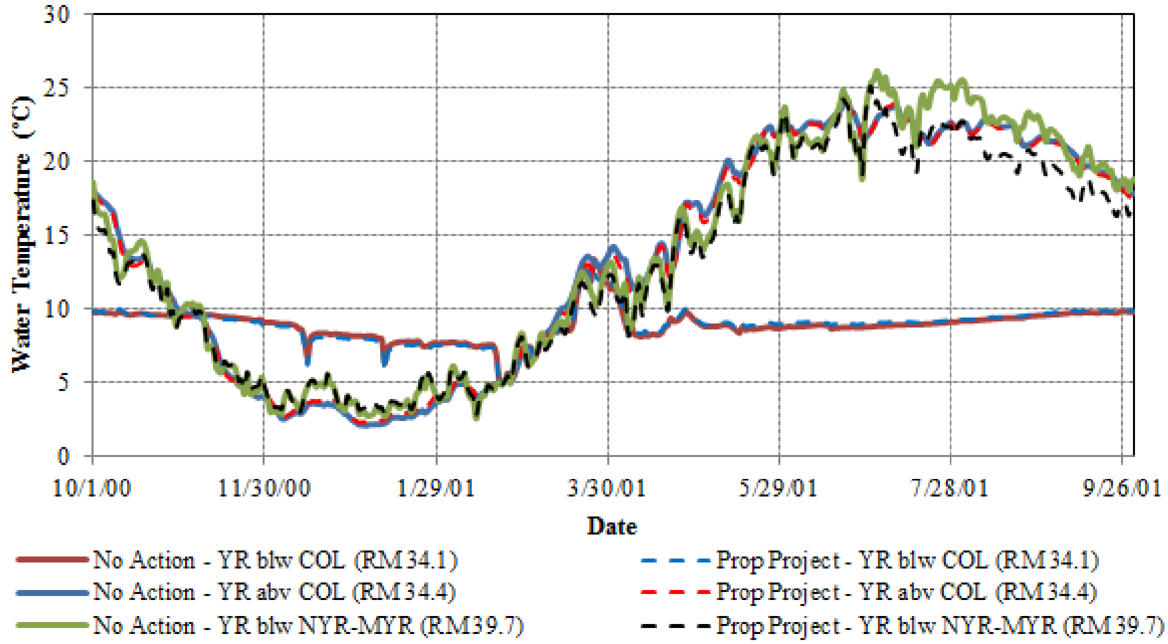


Figure 3.3.2-50. Simulated daily water temperatures for a representative dry WY (2001) at various locations along the Yuba River upstream of Englebright Reservoir.

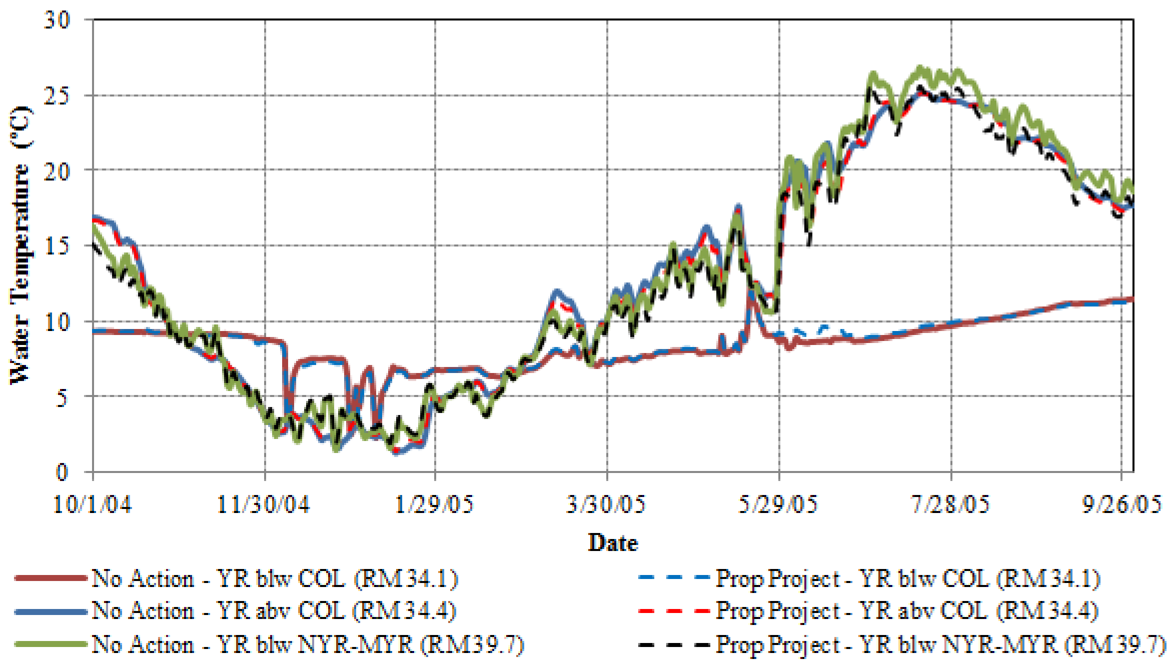


Figure 3.3.2-51. Simulated daily water temperatures for a representative normal WY (2005) at various locations along the Yuba River upstream of Englebright Reservoir.

Figures 3.3.2-52, 3.3.2-53, and 3.3.2-54 show simulated water temperatures in the Yuba River downstream of the Narrows 2 Powerhouse. Releases from the New Colgate Powerhouse overwhelm differences in water temperatures upstream of Englebright Reservoir, essentially resetting the river between the two alternatives, and this normalization between alternatives is reflected in the simulated water temperatures near Smartsville. Flows and water temperatures in this portion of the Yuba River are essentially the same between the two Alternatives for these three years; the minimum flows near Smartsville and Marysville are the same, and agricultural diversions from Daguerre Point Dam are the same. The resulting water temperatures indicate barely measurable differences between alternatives.

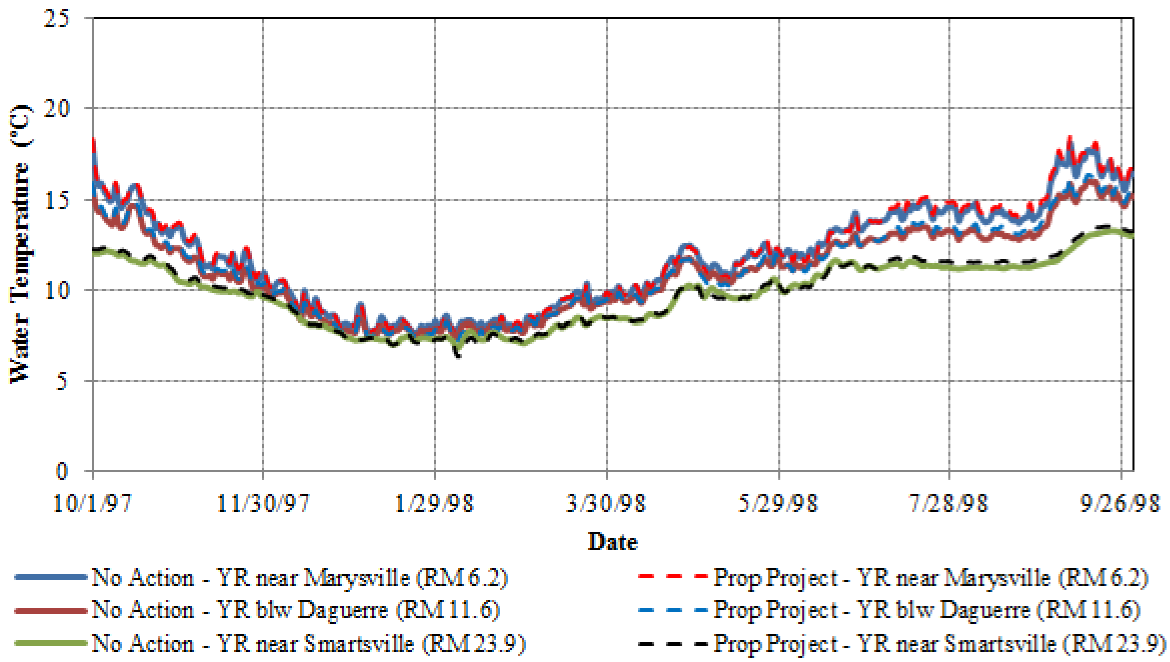


Figure 3.3.2-52. Simulated daily water temperatures for a representative wet WY (1998) at various locations along the Yuba River downstream of the Narrows 2 Powerhouse.

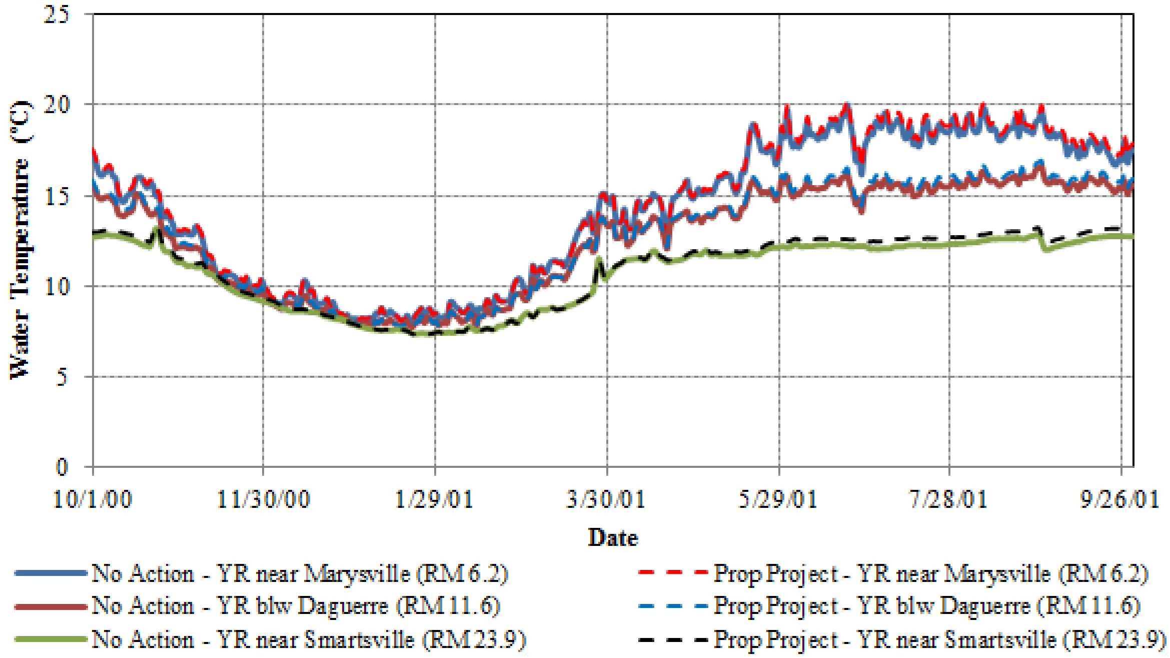


Figure 3.3.2-53. Simulated daily water temperatures for a representative dry WY (2001) at various locations along the Yuba River downstream of the Narrows 2 Powerhouse.

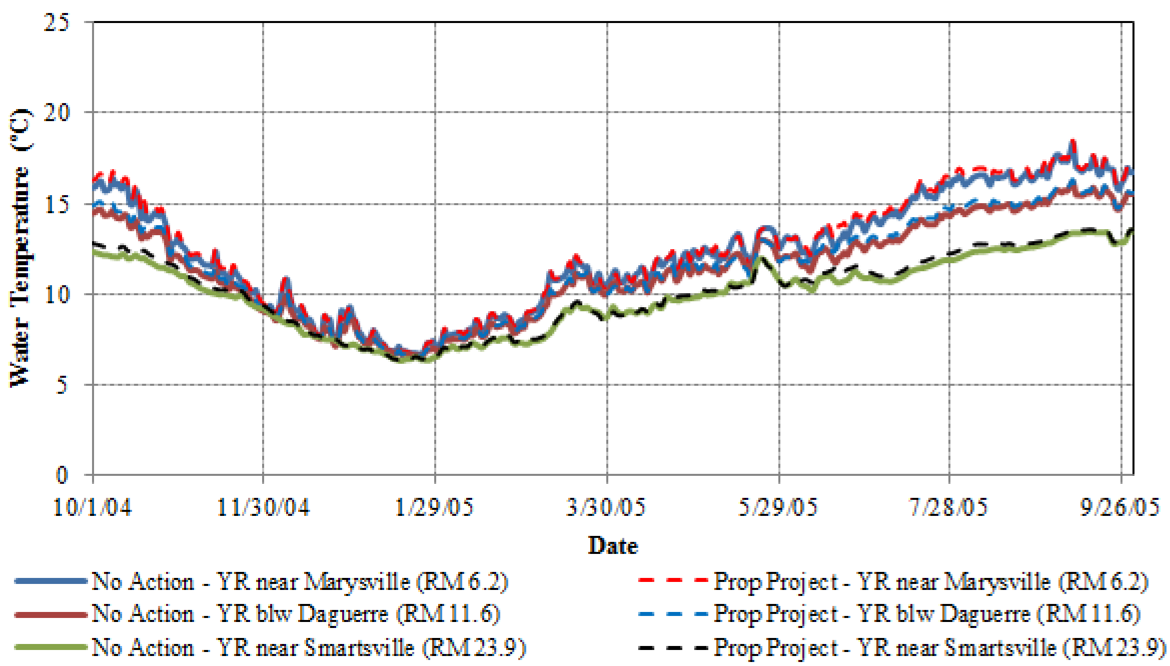


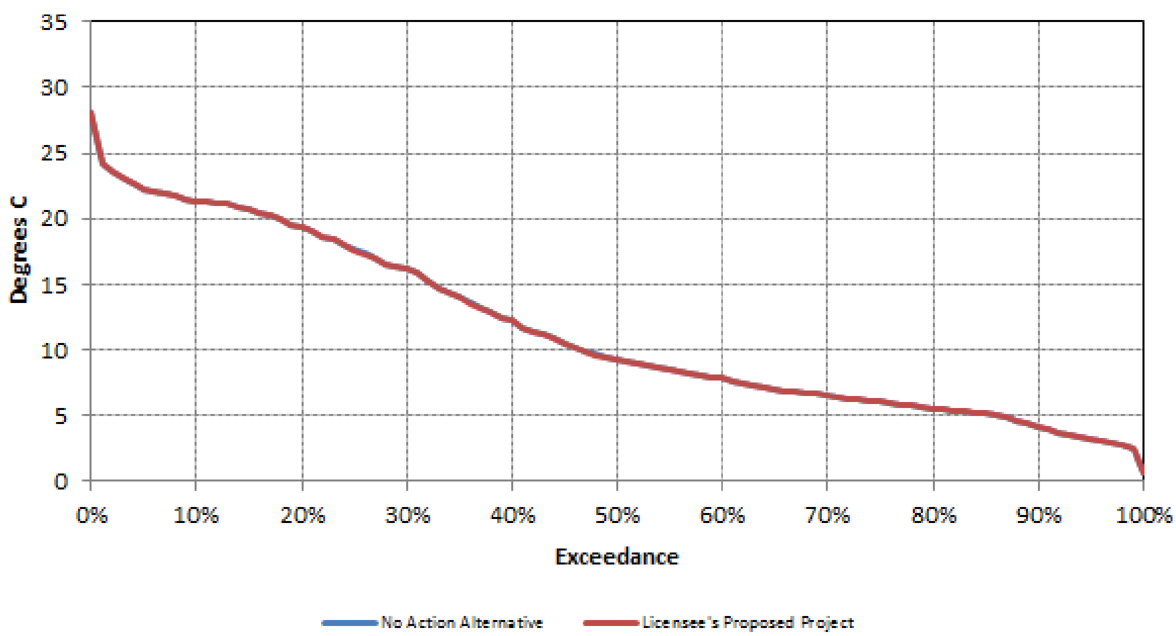
Figure 3.3.2-54. Simulated daily water temperatures for a representative normal WY (2005) at various locations along the Yuba River downstream of the Narrows 2 Powerhouse.

Simulated water temperatures and a brief discussion are statistically presented for the same locations throughout the Project Area for the full period of record (WYs 1970 through 2010), along with additional locations, by river reach.

Middle Yuba River - Our House Diversion Dam Reach

Under the No Action Alternative, both empirical and modeled mean daily water temperatures in the Middle Yuba River downstream of Our House Diversion impoundment can exceed 20.0°C under both the No Action and Proposed Project alternatives in June through September at the upper end of the reach (Table 3.3.2-22), and for May through October at the downstream end of the reach (Table 3.3.2-23). YCWA's proposed Condition AR1 would result in increased minimum flow releases from Our House Diversion Dam into the Middle Yuba River, depending on WY types as defined in YCWA proposed Condition WR2, compared to the No Action Alternative. YCWA proposed Condition AR2 would result in a more gradual spill cessation from Our House Dam and would also increase flows in the Middle Yuba River, as compared to the No Action Alternative. Both proposed Conditions would decrease flows through the Lohman Ridge Tunnel to Oregon Creek.

Increased minimum flows and the implementation of a spill cessation condition are not expected to reduce stream temperature below 20.0°C, and there is no cold water storage in the Our House Diversion Dam impoundment. Figures 3.3.2-55 and 3.3.2-56 present exceedance curves of mean daily water temperatures for the Proposed Project Alternative water temperature model run compared to the No Action Alternative for the Middle Yuba River downstream of Our House Diversion Dam. Tables 3.3.2-22 and 3.3.2-23 present a comparison of simulated monthly water temperatures for the same locations.

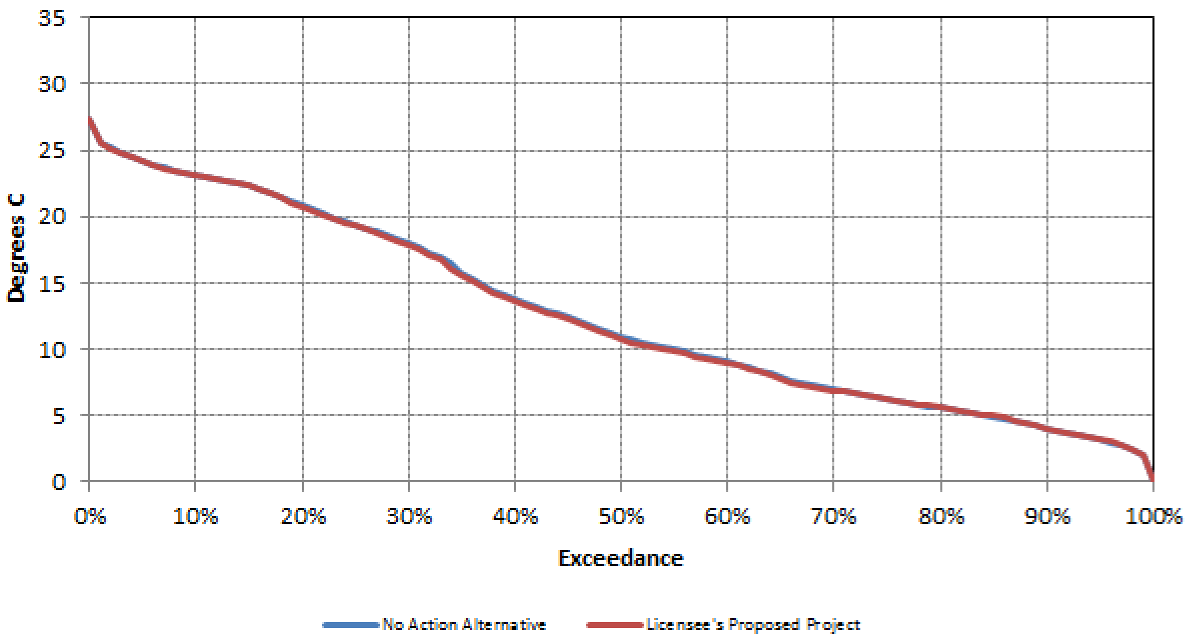


Note: the No Action Alternative line (blue) is hidden behind the Proposed Project Alternative line (red).

Figure 3.3.2-55. Exceedance curves of modeled mean daily water temperatures in the Middle Yuba River downstream of Our House Dam for the No Action Alternative and Proposed Project Alternative for WYs 1970 through 2010.

Table 3.3.2-22. Comparison of simulated mean monthly water temperatures in the Middle Yuba River downstream of Our House Dam for the No Action Alternative and Proposed Project Alternative for WYs 1970 through 2010

Month	No Action Alternative			Proposed Project Alternative			Change		
	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C
October	8.5	13.1	17.4	8.5	13.1	17.4	0.0	0.0	0.0
November	3.3	7.2	10.6	3.3	7.2	10.6	0.0	0.0	0.0
December	0.7	4.6	7.2	0.7	4.6	7.2	0.0	0.0	0.0
January	2.4	4.4	6.7	2.4	4.4	6.7	0.0	0.0	0.0
February	2.4	5.2	7.0	2.4	5.2	7.0	0.0	0.0	0.0
March	5.1	6.7	8.7	5.1	6.7	8.7	0.0	0.0	0.0
April	5.2	8.2	11.7	5.2	8.2	11.7	0.0	0.0	0.0
May	6.7	10.7	16.5	6.7	10.6	16.5	0.0	0.0	0.0
June	10.0	15.6	21.9	10.0	15.6	21.9	0.0	0.0	0.0
July	17.5	21.8	28.1	17.5	21.8	28.1	0.0	0.0	0.0
August	18.0	21.6	27.5	18.0	21.6	27.5	0.0	0.0	0.0
September	16.0	18.8	24.6	16.0	18.8	24.6	0.0	0.0	0.0



Note: the No Action Alternative line (blue) is hidden behind the Proposed Project Alternative line (red).

Figure 3.3.2-56. Exceedance curves of modeled mean daily water temperatures in the Middle Yuba River upstream of Oregon Creek for the No Action Alternative and Proposed Project Alternative for WYs 1970 through 2010.

Table 3.3.2-23. Comparison of simulated mean monthly water temperatures in the Middle Yuba River upstream of Oregon Creek for the No Action Alternative and Proposed Project Alternative for WYs 1970 through 2010.

Month	No Action Alternative			Proposed Project Alternative			Change		
	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C
October	7.4	13.5	21.7	7.4	13.5	21.5	0.0	0.0	-0.2
November	2.7	7.2	11.5	2.8	7.2	11.5	0.1	0.0	0.0
December	0.0	4.2	7.2	0.0	4.2	7.2	0.0	0.0	0.0

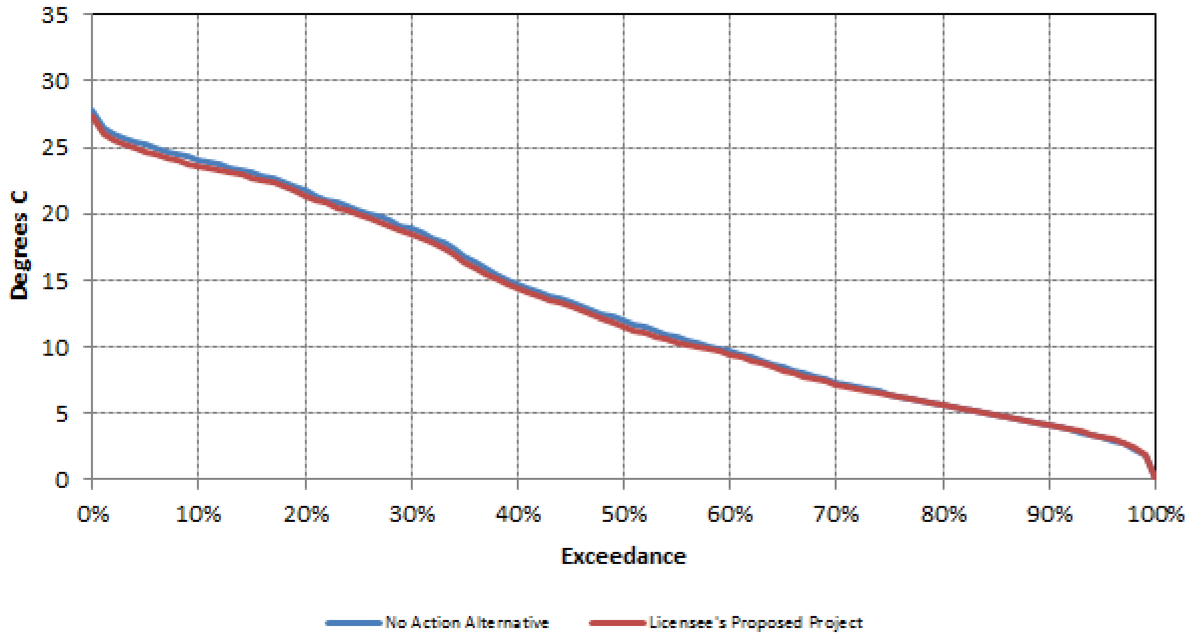
Table 3.3.2-23. (continued)

Month	No Action Alternative			Proposed Project Alternative			Change		
	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C
January	1.3	4.1	6.7	1.3	4.1	6.7	0.0	0.0	0.0
February	1.4	5.6	8.1	1.6	5.6	8.1	0.2	0.0	0.0
March	5.4	7.9	11.0	5.3	7.7	10.6	-0.1	-0.2	-0.4
April	5.5	10.2	15.0	5.5	10.0	14.9	0.0	-0.2	-0.1
May	6.8	13.3	20.9	6.8	13.1	20.7	0.0	-0.2	-0.2
June	10.8	18.6	25.1	10.8	18.3	24.8	0.0	-0.4	-0.2
July	18.4	24.0	27.3	18.3	23.8	27.3	-0.2	-0.1	0.0
August	19.0	22.9	26.5	19.1	22.9	26.6	0.2	0.0	0.0
September	15.3	19.5	23.5	15.6	19.6	23.5	0.3	0.0	0.0

Middle Yuba River – Oregon Creek Reach

Under the No Action Alternative, simulated mean daily water temperatures in the Middle Yuba River downstream of its confluence with Oregon Creek can exceed 20.0°C under both the No Action and Proposed Project alternatives in May through October throughout the entire reach (Tables 3.3.2-24 and 3.3.2-25). YCWA's proposed Condition AR1 would result in increased minimum flows below both the Our House Diversion Dam and Log Cabin Diversion Dam, and YCWA proposed Condition AR2 would result in spill cessation and a corresponding increase in flow below Our House Diversion Dam.

Increases in flow below the two diversion dams has a result of generally reducing water temperatures in the Middle Yuba River below Oregon Creek, as compared to the No Action Alternative. But, flows in the Middle Yuba River below Oregon Creek would not be expected to always be less than 20°C under either alternative, due to the lack of inflows continuously less than 20°C. Figures 3.3.2-57 and 3.3.2-58 present exceedance curves of mean daily water temperatures for the Proposed Project Alternative water temperature model run compared to the No Action Alternative for the Middle Yuba River downstream of Oregon Creek. Tables 3.3.2-24 and 3.3.2-25 present a comparison of simulated monthly water temperatures for the same locations.

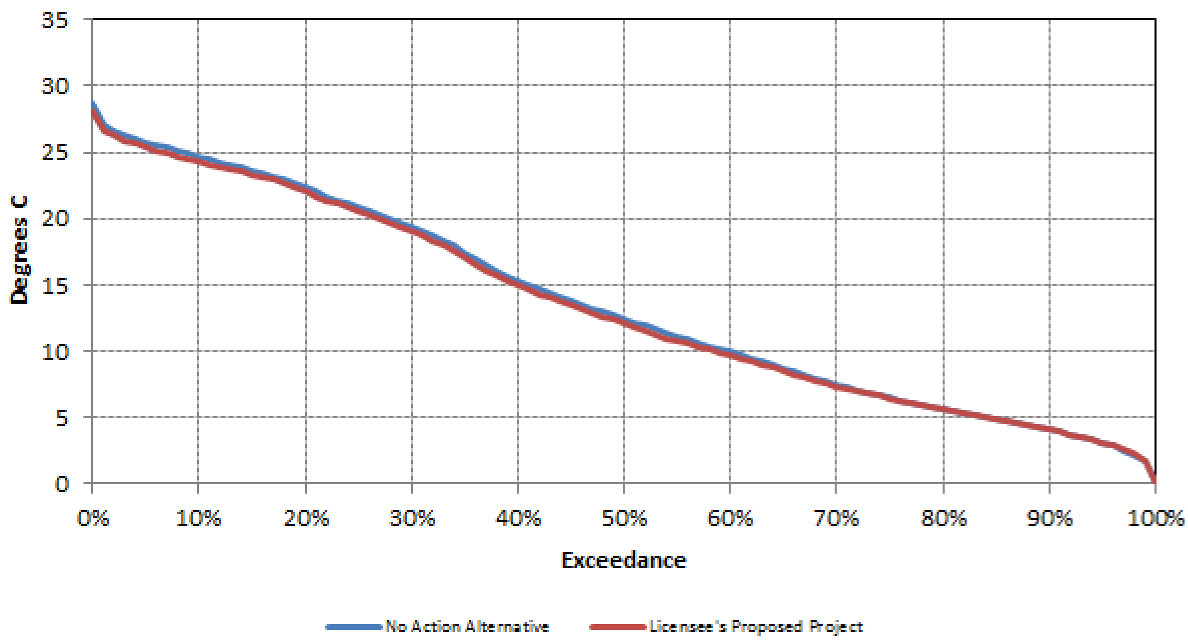


Note: the No Actions Alternative line (blue) is hidden behind the Proposed Project Alternative line (red).

Figure 3.3.2-57. Exceedance curves of modeled mean daily water temperatures in the Middle Yuba River downstream of Oregon Creek for the No Action Alternative and Proposed Project Alternative for WYs 1970 through 2010.

Table 3.3.2-24. Comparison of simulated mean monthly water temperatures in the Middle Yuba River downstream of Oregon Creek for the No Action Alternative and Proposed Project Alternative for WYs 1970 through 2010.

Month	No Action Alternative			Proposed Project Alternative			Change		
	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C
October	7.1	13.8	22.8	7.2	13.7	22.6	0.1	-0.1	-0.2
November	2.6	7.3	12.1	2.6	7.3	11.9	0.0	0.0	-0.2
December	0.0	4.1	7.5	0.0	4.2	7.4	0.0	0.0	-0.1
January	1.0	4.1	6.9	1.1	4.1	6.7	0.1	0.0	-0.1
February	1.2	5.9	9.0	1.4	5.8	8.9	0.2	-0.1	-0.1
March	5.4	8.6	12.6	5.4	8.3	11.9	0.0	-0.3	-0.7
April	5.6	11.3	16.6	5.6	10.9	16.3	0.0	-0.4	-0.3
May	7.0	14.6	22.7	7.0	14.2	22.4	0.0	-0.4	-0.3
June	11.1	20.1	26.5	11.1	19.4	26.0	0.0	-0.7	-0.4
July	19.1	25.0	27.8	18.7	24.4	27.4	-0.4	-0.6	-0.4
August	19.4	23.6	27.5	19.3	23.3	27.0	-0.1	-0.3	-0.5
September	15.3	20.0	24.1	15.5	19.8	23.6	0.2	-0.2	-0.5



Note: the No Action Alternative line (blue) is hidden behind the Proposed Project Alternative line (red).

Figure 3.3.2-58. Exceedance curves of modeled mean daily water temperatures in the Middle Yuba River upstream of the North Yuba River for the No Action Alternative and Proposed Project Alternative for WYs 1970 through 2010.

Table 3.3.2-25. Comparison of simulated mean monthly water temperatures in the Middle Yuba River upstream of the North Yuba River for the No Action Alternative and Proposed Project Alternative for WYs 1970 through 2010.

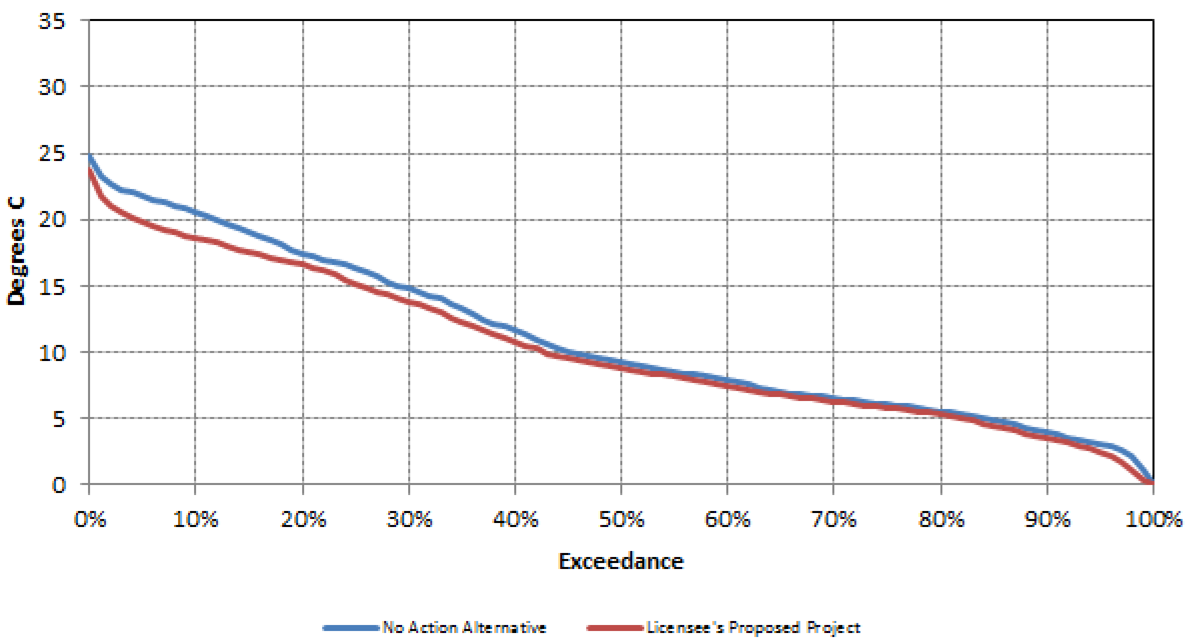
Month	No Action Alternative			Proposed Project Alternative			Change		
	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C
October	6.8	14.0	24.0	6.8	13.9	23.8	0.0	-0.1	-0.2
November	2.4	7.3	12.3	2.5	7.3	12.2	0.1	0.0	-0.2
December	0.0	4.0	7.5	0.0	4.0	7.4	0.0	0.0	0.0
January	0.6	4.0	7.0	0.6	4.0	6.8	0.0	0.0	-0.1
February	0.9	6.0	9.3	1.1	5.9	9.3	0.2	-0.1	0.0
March	5.5	8.9	13.3	5.5	8.6	12.5	0.0	-0.3	-0.8
April	5.7	11.9	17.6	5.7	11.5	17.2	0.0	-0.4	-0.3
May	7.0	15.5	23.9	7.0	15.0	23.6	0.0	-0.5	-0.3
June	11.5	21.0	27.4	11.5	20.3	26.9	0.0	-0.7	-0.4
July	19.4	25.6	28.7	19.0	25.1	28.2	-0.4	-0.5	-0.6
August	19.5	24.0	28.0	19.4	23.8	27.7	-0.1	-0.2	-0.4
September	15.2	20.2	24.7	15.4	20.1	24.3	0.2	-0.1	-0.4

Oregon Creek - Log Cabin Diversion Dam Reach

Under the No Action Alternative, simulated mean daily water temperatures in Oregon Creek downstream of Log Cabin Diversion Impoundment can exceed 20.0°C under both the No Action and Proposed Project alternatives in June through September at its upstream end (Table 3.3.2-26), and from April through October near Oregon Creek's confluence with the Middle Yuba River (Table 3.3.2-27). In Condition AR1, YCWA proposes to increase minimum flows from

Log Cabin Diversion Dam into Oregon Creek from 5.6-12 cfs to 6-31 cfs, depending on water year types described in Condition WR2.

Increased minimum flows are not expected to reduce stream temperature below 20.0°C because historical inflows to Log Cabin Diversion Impoundment are above 20.0°C (Table 3.3.2-14) and there is no cold water storage in the Log Cabin Diversion Impoundment. Historically, minimum flows were supplemented by Middle Yuba River water diverted to Oregon Creek through the Lohman Ridge Tunnel. Increased minimum flows in the Middle Yuba River downstream of Our House Diversion Dam under the Proposed Project Alternative will reduce the quantity of supplemental water from Middle Yuba River to Oregon Creek compared to the No Action Alternative, but the Proposed Project Alternative will result in water temperatures the same, or colder, than under the No action alternative. Figures 3.3.2-59 and 3.3.2-60 present results of the Proposed Project Alternative water temperature model run compared to the No Action Alternative for Oregon Creek downstream of Log Cabin Diversion Dam. Tables 3.3.2-26 and 3.3.2-27 present a comparison of simulated monthly water temperatures for the same locations.



Note: the No Action Alternative line (blue) is hidden behind the Proposed Project Alternative line (red).

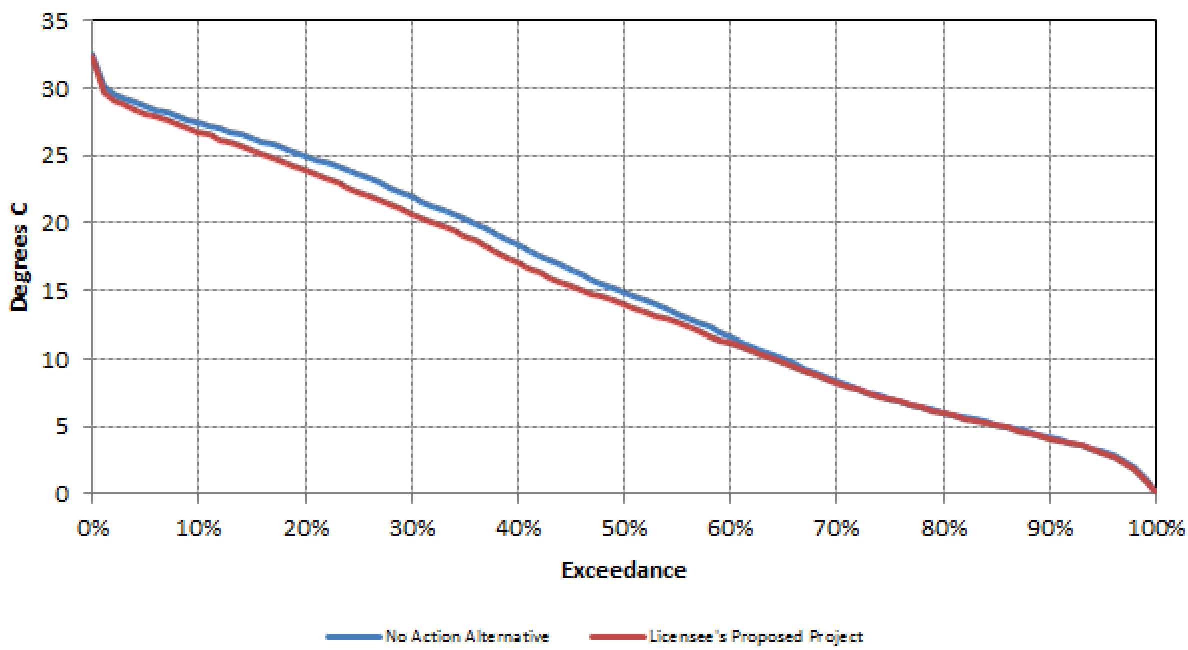
Figure 3.3.2-59. Exceedance curves of modeled mean daily water temperatures in Oregon Creek downstream of Log Cabin Diversion Dam for the No Action Alternative and Proposed Project Alternative for WYs 1970 through 2010.

Table 3.3.2-26. Comparison of simulated mean monthly water temperatures in Oregon Creek downstream of Log Cabin Diversion Dam for the No Action Alternative and Proposed Project Alternative for WYs 1970 through 2010.

Month	No Action Alternative			Proposed Project Alternative			Change		
	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C
October	3.5	11.0	17.2	3.0	9.7	17.4	-0.5	-1.3	0.2
November	0.6	6.4	10.7	0.2	5.3	10.6	-0.4	-1.1	-0.1

Table 3.3.2-26. (continued)

Month	No Action Alternative			Proposed Project Alternative			Change		
	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C
December	0.0	4.4	7.2	0.0	4.0	7.2	0.0	-0.4	-0.1
January	0.0	4.2	6.7	0.0	4.0	6.7	0.0	-0.2	0.1
February	0.7	5.3	7.3	0.4	5.2	7.0	-0.3	-0.1	-0.3
March	4.9	7.1	9.3	4.4	7.0	8.7	-0.5	0.0	-0.7
April	5.3	8.7	12.6	5.3	8.5	11.7	0.0	-0.3	-0.9
May	6.8	11.4	17.6	6.8	11.1	16.5	0.0	-0.3	-1.1
June	10.6	16.3	22.5	10.2	15.7	21.9	-0.4	-0.6	-0.6
July	16.5	21.5	24.8	15.0	19.9	28.1	-1.5	-1.5	3.3
August	13.8	19.6	24.9	13.3	17.7	27.5	-0.4	-1.9	2.7
September	8.1	15.7	20.6	8.1	14.3	24.6	0.0	-1.4	4.0



Note: the No Action Alternative line (blue) is hidden behind the Proposed Project Alternative line (red).

Figure 3.3.2-60. Exceedance curves of modeled mean daily water temperatures in Oregon Creek upstream of the Middle Yuba River for the No Action Alternative and Proposed Project Alternative for WYs 1970 through 2010.

Table 3.3.2-27. Comparison of simulated mean monthly water temperatures in Oregon Creek upstream of the Middle Yuba River for the No Action Alternative and Proposed Project Alternative for WYs 1970 through 2010.

Month	No Action Alternative			Proposed Project Alternative			Change		
	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C
October	5.5	15.1	28.6	5.4	14.9	31.8	-0.1	-0.2	3.2
November	1.4	7.8	14.0	0.4	7.7	14.2	-1.0	-0.1	0.1
December	0.0	3.9	8.7	0.0	3.8	8.7	0.0	-0.1	-0.1
January	0.0	4.1	8.4	0.0	4.0	8.4	0.0	-0.1	0.0
February	0.7	7.0	11.9	0.6	7.0	11.8	0.0	0.0	0.0
March	5.3	10.6	17.0	5.3	10.5	16.5	0.0	-0.1	-0.5
April	5.9	14.7	22.5	5.9	13.2	21.6	0.0	-1.5	-0.9

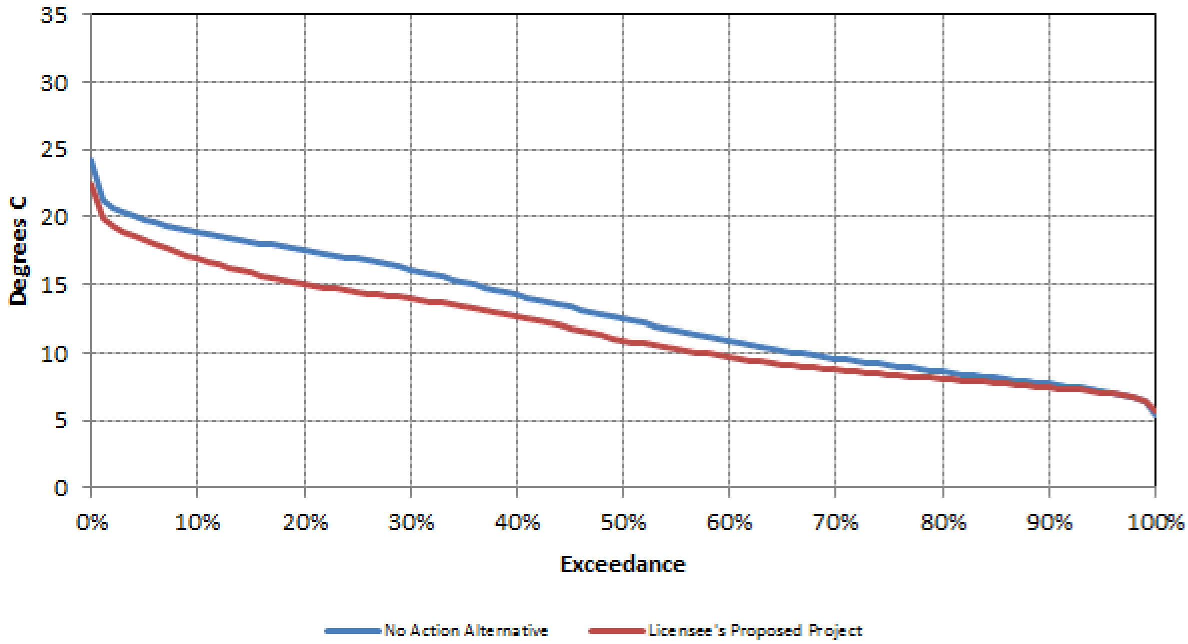
Table 3.3.2-27. (continued)

Month	No Action Alternative			Proposed Project Alternative			Change		
	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C
May	7.4	19.6	28.7	7.4	17.7	27.9	0.0	-1.9	-0.9
June	14.9	25.1	31.1	11.7	22.9	30.2	-3.2	-2.2	-0.8
July	20.7	28.4	32.5	20.1	27.9	32.3	-0.6	-0.4	-0.1
August	19.4	26.0	30.8	19.4	25.6	30.6	0.0	-0.4	-0.2
September	13.6	21.7	27.3	13.6	21.4	27.1	0.0	-0.3	-0.2

North Yuba River – New Bullards Bar Dam Reach

Under the No Action Alternative conditions, simulated mean daily water temperatures in the North Yuba River upstream of the confluence with the Middle Yuba River and above New Colgate Powerhouse can exceed 20.0°C in May through September at its downstream end under the No Action Alternative, and in May through July under the Proposed Project Alternative (Table 3.3.2-28). In YCWA's proposed Condition AR1, minimum flows would be increased from New Bullards Bar Dam into the North Yuba River from 3.5-5 cfs to 5-13 cfs, depending on water year types described in Condition WR2. YCWA's proposed Condition AR4 would provide for a spill cessation operation at New Bullards Bar Reservoir, and would generally provide additional flow to the North Yuba River, as compared to the No Action Alternative.

Figure 3.3.2-61 presents results of the Proposed Project water temperature model run compared to the No Action Alternative for the North Yuba River and The Yuba River downstream of New Bullards Bar Dam. Increased North Yuba River minimum flows focus on providing habitat in the reach between the Yuba River below the North Yuba River's confluence with the Middle Yuba River, and the New Colgate Powerhouse, but a secondary benefit is simulated average daily water temperatures in the North Yuba River below New Bullards Bar Dam are the same or colder under the Proposed Project Alternative than under the No Action Alternative. Table 3.3.2-28 presents a comparison of simulated monthly water temperatures for the same locations.



Note: the No Action Alternative line (blue) is hidden behind the Proposed Project Alternative line (red).

Figure 3.3.2-61. Exceedance curves of modeled mean daily water temperatures in the North Yuba River upstream of the Middle Yuba River for the No Action Alternative and Proposed Project Alternative for WYs 1970 through 2010.

Table 3.3.2-28. Comparison of simulated mean monthly water temperatures in the North Yuba River upstream of the Middle Yuba River for the No Action Alternative and Proposed Project Alternative for WYs 1970 through 2010.

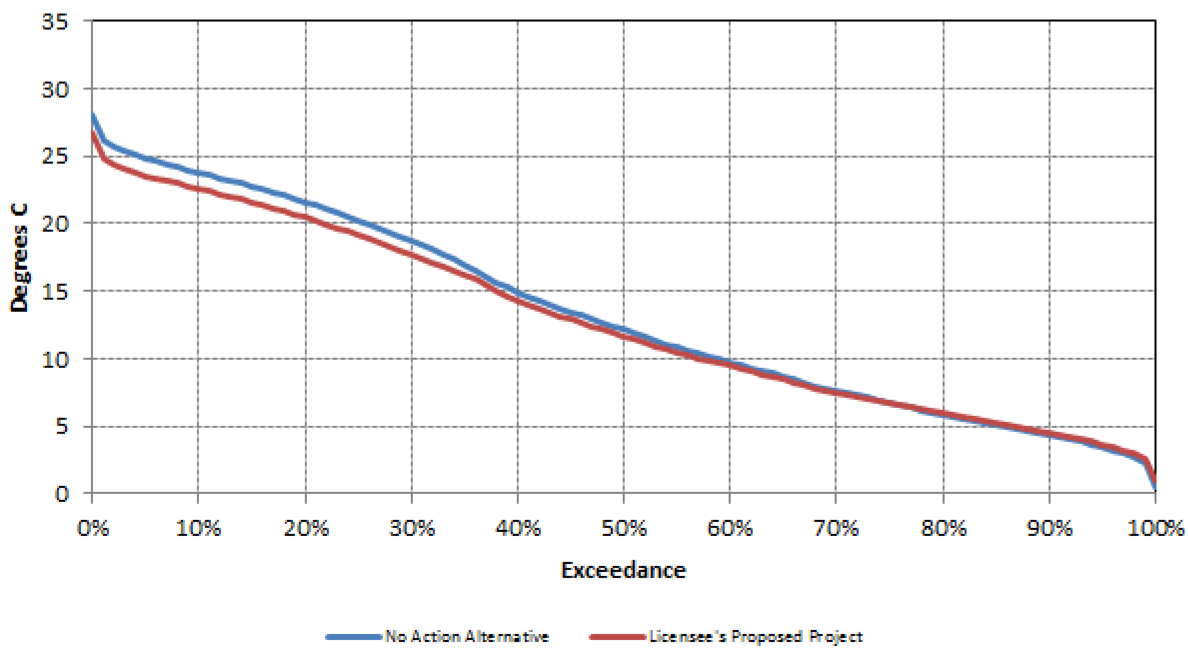
Month	No Action Alternative			Proposed Project Alternative			Change		
	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C
October	7.9	12.2	16.4	7.3	10.4	14.8	-0.6	-1.8	-1.5
November	6.1	9.4	13.2	6.3	8.6	11.7	0.2	-0.8	-1.5
December	5.4	8.0	12.1	5.7	7.7	12.0	0.3	-0.3	-0.2
January	5.6	8.0	12.3	5.7	7.7	11.1	0.1	-0.3	-1.2
February	5.9	9.2	13.0	5.9	8.4	11.3	0.1	-0.8	-1.7
March	6.0	10.7	14.6	6.0	9.5	13.3	0.1	-1.3	-1.4
April	6.2	13.1	18.8	6.3	13.0	18.0	0.0	-0.1	-0.9
May	6.4	15.3	22.4	6.5	15.2	21.8	0.0	-0.1	-0.6
June	6.5	17.2	22.8	6.7	17.1	22.5	0.2	-0.1	-0.3
July	7.6	19.2	24.3	7.6	15.3	21.0	0.0	-3.9	-3.3
August	13.7	17.8	22.5	11.0	14.4	19.7	-2.7	-3.5	-2.8
September	11.1	15.4	20.0	9.5	12.7	18.3	-1.6	-2.7	-1.8

Yuba River – Middle Yuba/North Yuba Confluence Reach

Under the No Action Alternative, simulated mean daily water temperatures in the Yuba River downstream of the confluence of the Middle Yuba and North Yuba rivers can exceed 20.0°C under both the No Action and Proposed Project alternatives in May through October throughout its length (Tables 3.3.2-29 and 3.3.2-30). YCWA's proposed condition AR1 would result in increased minimum flows below the Our House Diversion Dam, Log Cabin Diversion Dam and

New Bullards Bar Dam, and YCWA's proposed Conditions AR2 and AR4 would result in spill cessation measures and a corresponding increase in flow below Our House Diversion Dam and New Bullards Bar Dam, respectively.

An increase in flow below the confluence of the two rivers has a result of generally reducing water temperatures in the Yuba River above the New Colgate Powerhouse, as compared to the No Action Alternative. But, temperatures in the Yuba River below the confluence of the North Yuba and Middle Yuba rivers would not be expected to always be less than 20°C under either alternative, due to the lack of temperatures in the two contributing rivers being continuously less than 20°C. Figures 3.3.2-62 and 3.3.2-63 present exceedance curves of mean daily water temperatures for the Proposed Project Alternative water temperature model run compared to the No Action Alternative for the Yuba River downstream of the confluence of the North Yuba and Middle Yuba rivers. Tables 3.3.2-29 and 3.3.2-30 present a comparison of simulated monthly water temperatures for the same locations. Increased minimum flows from the Middle Yuba and North Yuba rivers and Oregon Creek were designed to provide habitat in the reach between the North Yuba River's confluence with the Middle Yuba River and the New Colgate Powerhouse, and the corresponding result is that simulated average daily water temperatures in the Yuba River above the New Colgate Powerhouse are the same or colder under the Proposed Project Alternative than under the No Action Alternative.

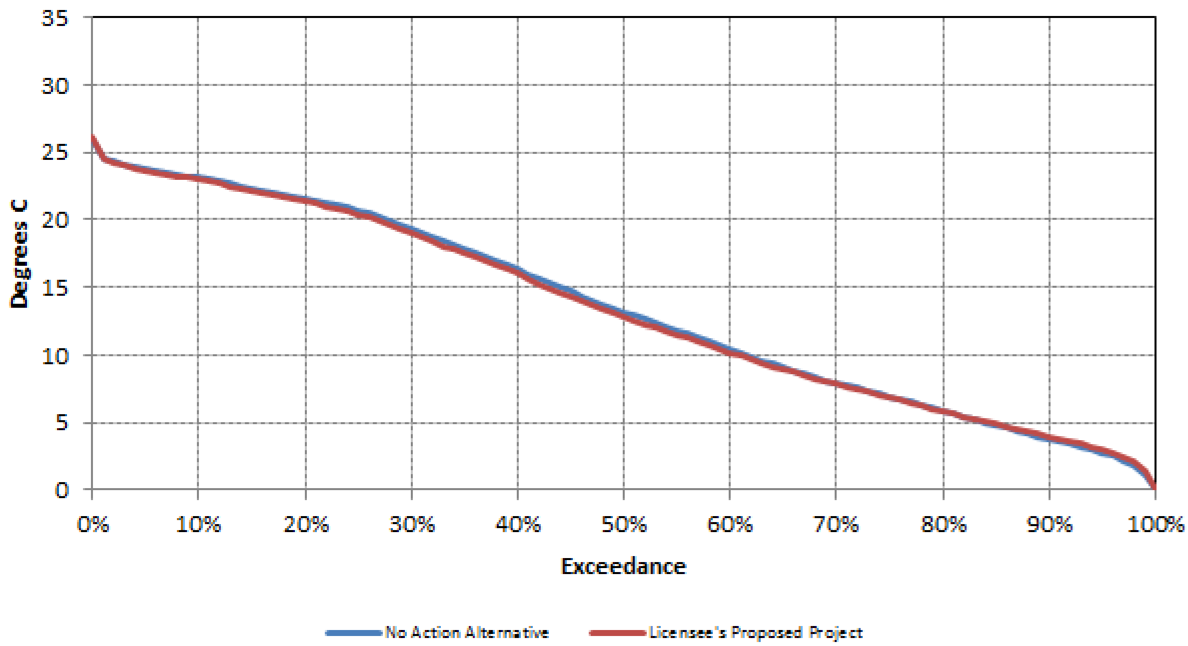


Note: the No Action Alternative line (blue) is hidden behind the Proposed Project Alternative line (red).

Figure 3.3.2-62. Exceedance curves of modeled mean daily water temperatures in the Yuba River downstream of the Middle Yuba River for the No Action Alternative and Proposed Project Alternative for WYs 1970 through 2010.

Table 3.3.2-29. Comparison of simulated mean monthly water temperatures in the Yuba River downstream of the Middle Yuba River for the No Action Alternative and Proposed Project Alternative for WYs 1970 through 2010.

Month	No Action Alternative			Proposed Project Alternative			Change		
	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C
October	6.9	13.7	22.9	6.9	13.0	21.1	0.0	-0.7	-1.7
November	3.0	7.5	12.3	3.2	7.5	11.7	0.3	0.0	-0.5
December	0.5	4.4	10.8	0.9	4.6	10.7	0.4	0.2	-0.1
January	1.3	4.4	9.7	1.8	4.5	9.5	0.6	0.2	-0.1
February	1.2	6.2	9.4	1.6	6.2	9.4	0.3	0.0	-0.1
March	5.6	8.9	13.3	5.6	8.6	12.5	0.0	-0.3	-0.8
April	6.0	11.9	17.6	5.8	11.5	17.3	-0.2	-0.4	-0.3
May	7.8	15.3	23.7	7.6	14.8	23.4	-0.1	-0.4	-0.3
June	8.3	19.9	26.5	7.8	19.5	26.5	-0.5	-0.5	-0.1
July	9.4	24.7	28.0	9.5	23.3	26.8	0.1	-1.4	-1.2
August	18.9	23.1	26.9	17.8	21.5	25.1	-1.1	-1.5	-1.7
September	14.7	19.4	23.7	13.9	18.2	22.5	-0.8	-1.3	-1.2



Note: the No Action Alternative line (blue) is hidden behind the Proposed Project Alternative line (red).

Figure 3.3.2-63. Exceedance curves of modeled mean daily water temperatures in the Yuba River upstream of the New Colgate Powerhouse for the No Action Alternative and Proposed Project Alternative for WYs 1970 through 2010.

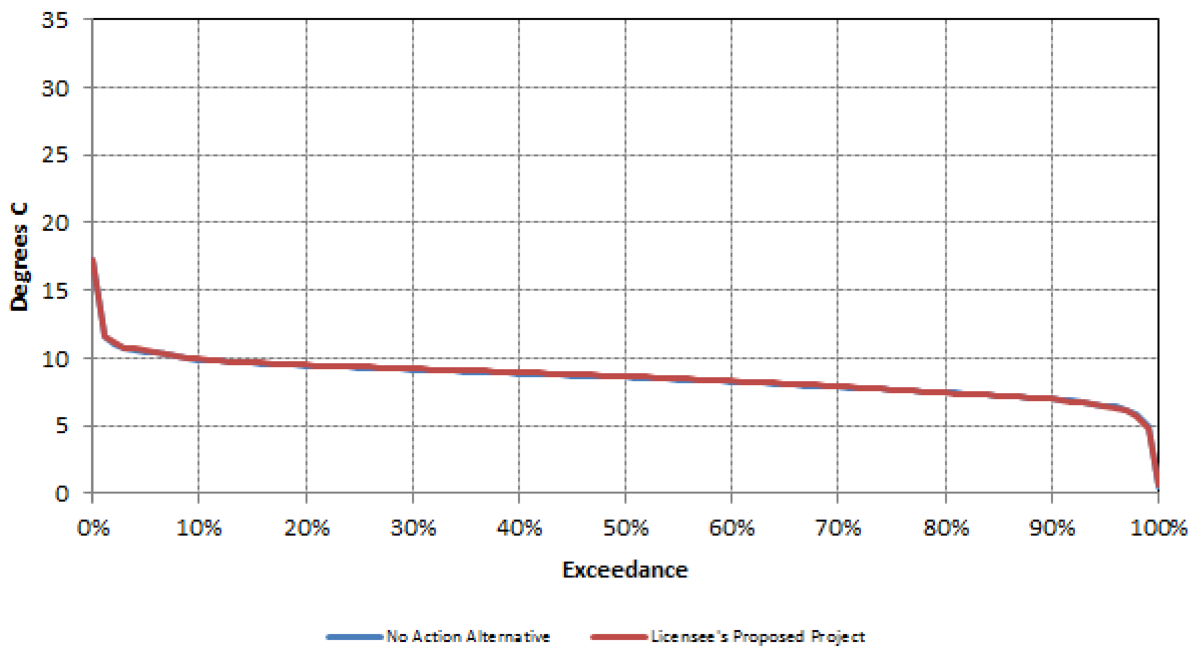
Table 3.3.2-30. Comparison of simulated mean monthly water temperatures in the Yuba River upstream of the New Colgate Powerhouse for the No Action Alternative and Proposed Project Alternative for WYs 1970 through 2010.

Month	No Action Alternative			Proposed Project Alternative			Change		
	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C
October	9.1	14.5	23.1	9.1	14.3	21.5	0.0	-0.2	-1.5
November	2.7	7.9	12.8	2.9	7.8	12.6	0.2	-0.1	-0.2
December	0.0	3.6	10.7	0.0	3.8	10.5	0.0	0.2	-0.1
January	0.1	3.7	9.6	0.3	3.9	9.5	0.2	0.2	-0.1
February	2.2	6.2	9.8	2.5	6.3	9.7	0.3	0.0	-0.1
March	5.5	9.5	14.4	5.6	9.2	13.8	0.1	-0.2	-0.6
April	6.2	13.1	18.5	6.1	12.7	18.4	-0.1	-0.4	-0.1
May	8.4	16.7	22.9	8.4	16.3	22.7	0.0	-0.4	-0.1
June	9.2	20.4	24.5	8.6	20.1	24.5	-0.7	-0.3	0.0
July	10.7	23.4	26.0	11.0	23.4	26.1	0.3	-0.1	0.1
August	19.3	22.5	25.1	19.1	22.3	25.1	-0.2	-0.2	0.0
September	14.8	19.5	22.9	14.6	19.3	22.7	-0.1	-0.2	-0.2

Yuba River – New Colgate Powerhouse Reach

Under both the No Action Alternative and the Proposed Project Alternative, simulated water temperatures in portions of the Yuba River below the New Colgate Powerhouse are almost always below 20°C due to the volume of cold water releases from the New Colgate Powerhouse overwhelming flow and water temperatures from the Yuba River above the New Colgate Powerhouse. While not included in modeling, water temperatures in the Yuba River below the New Colgate Powerhouse during periodic and extended New Colgate Powerhouse outages for maintenance would reflect water temperatures from the North Yuba below New Bullards Bar Reservoir and contributions from the Middle Yuba River if both units were down, however one unit is usually kept online while maintenance outages are performed on the other unit. If there is insufficient Middle Yuba and South Yuba River flow to meet minimum flows below the Narrows 2 Powerhouse during New Colgate Powerhouse maintenance outages, releases from the available generating unit or the low-level outlet at the base of the New Bullards Bar Dam would be increased above the minimum flows to ensure there was adequate flow for release from the Narrows 2 Powerhouse. Increased flows from the base of New Bullards Bar Dam would reflect the water temperature immediately below New Bullards Bar Dam and would generally provide adequate cold water supply so as not to substantially increase water temperatures below the New Colgate Powerhouse. Conversely, the New Colgate Powerhouse often will briefly (less than a day) stop releasing during a day due to hydroelectric peaking operations; during these periods, there would not be an increase in release from the New Bullards Bar Dam low-level outlet, and there would be a measureable temporary increase in Yuba River water temperature below the New Colgate Powerhouse.

Figure 3.3.2-64 presents exceedance curves of mean daily water temperatures for the Proposed Project Alternative water temperature model run compared to the No Action Alternative for the Yuba River downstream the New Colgate Powerhouse. Table 3.3.2-31 presents a comparison of simulated monthly water temperatures for the same location.



Note: the No Action Alternative line (blue) is hidden behind the Proposed Project Alternative line (red).

Figure 3.3.2-64. Exceedance curves of modeled mean daily water temperatures in the Yuba River downstream of the New Colgate Powerhouse for the No Action Alternative and Proposed Project Alternative for WYs 1970 through 2010.

Table 3.3.2-31. Comparison of simulated mean monthly water temperatures in the Yuba River downstream of the New Colgate Powerhouse for the No Action Alternative and Proposed Project Alternative for WYs 1970 through 2010.

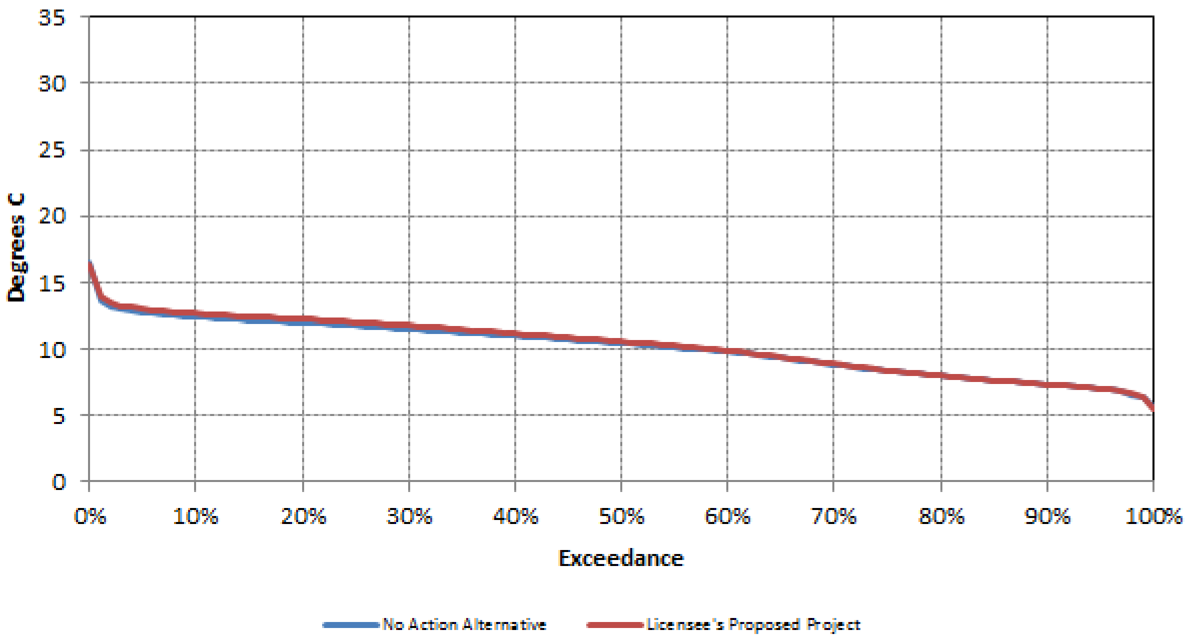
Month	No Action Alternative			Proposed Project Alternative			Change		
	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C
October	8.7	9.8	12.9	8.7	9.9	14.5	0.0	0.1	1.6
November	2.9	9.5	12.9	3.1	9.4	14.1	0.3	-0.1	1.2
December	0.5	7.9	11.4	0.7	7.8	11.7	0.2	-0.2	0.3
January	1.2	7.1	10.2	1.4	7.0	10.1	0.2	-0.1	0.0
February	3.3	7.0	9.7	3.4	7.0	9.7	0.1	0.0	0.0
March	6.0	7.7	13.4	6.1	7.7	12.7	0.0	0.0	-0.7
April	6.2	8.2	15.0	6.2	8.3	14.0	0.0	0.1	-1.0
May	6.9	8.3	17.2	7.0	8.4	17.2	0.1	0.1	0.0
June	7.1	8.5	12.4	7.4	8.7	12.1	0.2	0.2	-0.4
July	7.4	8.8	10.9	7.7	9.0	11.0	0.3	0.2	0.2
August	7.9	9.2	11.8	7.9	9.3	12.2	0.0	0.1	0.4
September	8.5	9.8	14.8	8.5	9.8	14.6	0.0	0.1	-0.1

<u>Yuba River – Narrows 2 Powerhouse Reach</u>

Under both the No Action and Proposed Project Alternatives, simulated water temperatures warm as the Yuba River flows out from the foothills into the valley, and simulated water temperatures begin to occasionally exceed 20°C at times in the Yuba River near Parks Bar.

YCWA's proposed Condition AR3 results in similar minimum flows downstream from the Narrows 2 Powerhouse and Narrows 2 Bypass as under the No Action Alternative, except for under the driest of years. The water year types defined by YCWA's proposed Condition WR3 are the same as those defining water year-types under the No Action Alternative, but changes in minimum flows below Our House Diversion Dam, Log Cabin Diversion Dam, and New Bullards Bar Dam in YCWA's proposed Condition AR1 and the spill cessation operations in YCWA's proposed Condition AR2 and AR3 result in changes to the water year-types, as shown in Table 3.3.2-18. These changes in water year types result in changes in resulting minimum flows below the Narrows 2 Powerhouse and Narrows 2 Bypass, in spite of the required flows in YCWA's proposed Condition AR3 being virtually identical to corresponding the No Action Alternative requirements. Condition TE4 includes ramping and flow fluctuation constraints on releases from the Narrows 2 Powerhouse and Narrows 2 Bypass that are the same as under the No Action Alternative, so there would not be a difference in flows or temperatures resulting from YCWA's proposed Condition TE4. These changes in simulated flows result in changes in simulated water temperatures, between the No Action Alternative and the Proposed Project Alternative.

Figures 3.3.2-65 through 3.3.2-68 present exceedance curves of mean daily water temperatures for the Proposed Project Alternative water temperature model run compared to the No Action Alternative for the Yuba River downstream of the Narrows 2 Powerhouse. Tables 3.3.2-32 through 3.3.2-35 present a comparison of simulated monthly water temperatures for the same locations.



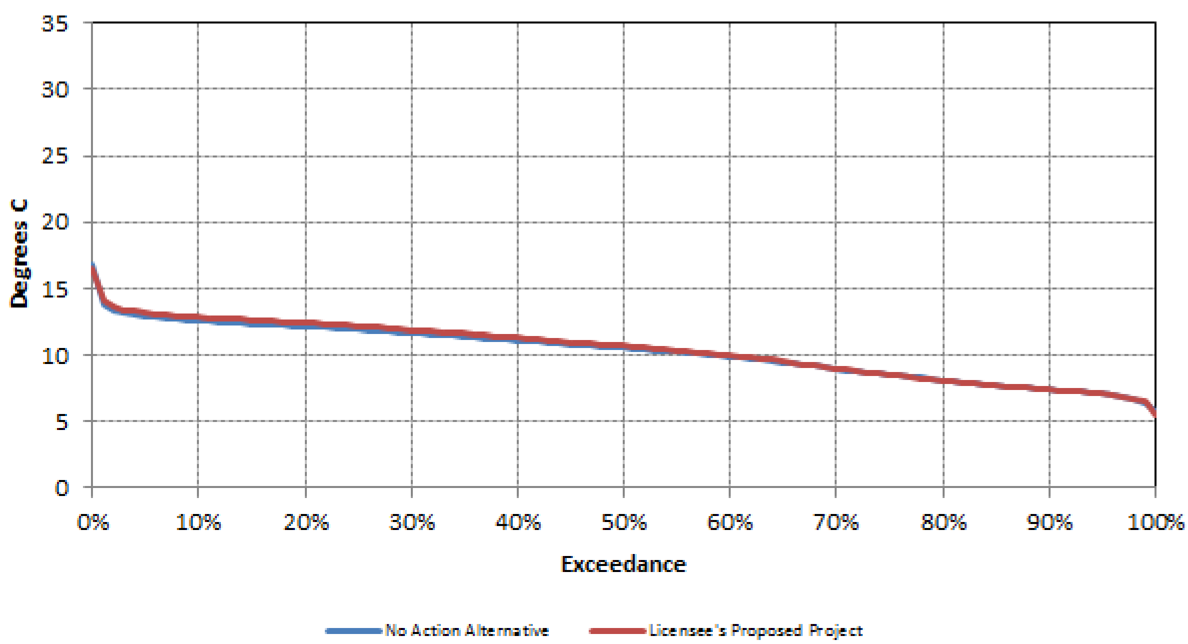
Note: the No Action Alternative line (blue) is hidden behind the Proposed Project Alternative line (red).

Figure 3.3.2-65. Exceedance curves of modeled mean daily water temperatures in the Yuba River near Smartsville for the No Action Alternative and Proposed Project Alternative for WYs 1970 through 2010.

Table 3.3.2-32. Comparison of simulated mean monthly water temperatures in the Yuba River near Smartsville for the No Action Alternative and Proposed Project Alternative for WYs 1970 through 2010.

Month	No Action Alternative			Proposed Project Alternative			Change		
	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C
October	8.6	12.1	16.5	8.6	12.3	16.2	0.0	0.2	-0.3
November	8.0	10.5	13.7	7.7	10.6	15.3	-0.3	0.1	1.6
December	5.8	8.3	11.0	5.5	8.3	12.1	-0.3	0.0	1.0
January	5.6	7.3	8.9	5.7	7.3	8.9	0.1	0.0	0.0
February	5.9	7.5	9.2	6.1	7.5	9.3	0.2	0.0	0.2
March	6.3	8.5	11.5	6.4	8.5	11.5	0.1	0.0	0.0
April	7.1	9.8	12.2	7.2	9.9	12.7	0.2	0.1	0.5
May	8.5	10.5	13.2	8.7	10.6	13.2	0.2	0.1	0.0
June	9.3	11.1	14.5	9.3	11.3	14.6	0.0	0.2	0.1
July	9.5	11.6	15.7	9.5	12.0	15.8	0.0	0.3	0.1
August	10.7	12.1	15.8	11.0	12.3	16.1	0.2	0.3	0.3
September	11.0	12.4	16.4	11.2	12.7	16.3	0.2	0.2	0.0

Deer Creek and Dry Creek are significant tributaries to the lower Yuba River downstream of the Narrows 2 Powerhouse (and also downstream of PG&E's Narrows Powerhouse). They were included in YCWA's temperature model, but their flows are not affected by YRDP's operations. The results of temperature modeling runs and differences in temperatures between YCWA's Proposed Project Alternative and the No Action Alternative for reaches below these tributaries are thus presented below, but are not discussed here.

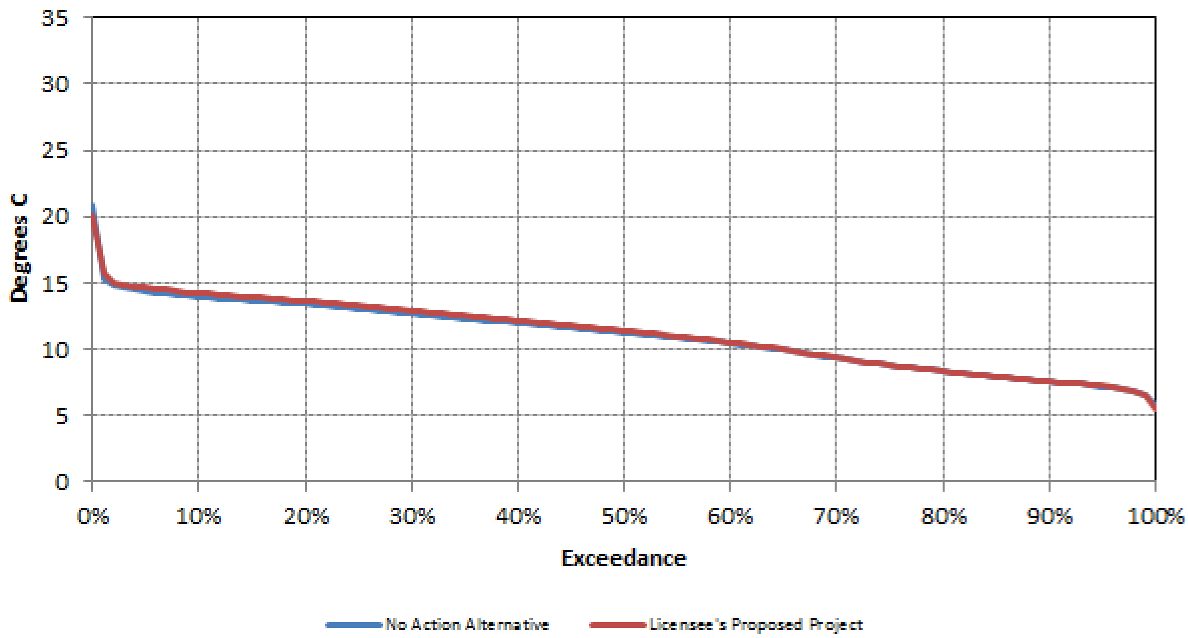


Note: the No Action Alternative line (blue) is hidden behind the Proposed Project Alternative line (red).

Figure 3.3.2-66. Exceedance curves of modeled mean daily water temperatures in the Yuba River downstream of Deer Creek for the No Action Alternative and Proposed Project Alternative for WYs 1970 through 2010.

Table 3.3.2-33. Comparison of simulated mean monthly water temperatures in the Yuba River downstream of Deer Creek for the No Action Alternative and Proposed Project Alternative for WYs 1970 through 2010.

Month	No Action Alternative			Proposed Project Alternative			Change		
	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C
October	8.8	12.2	16.6	8.8	12.4	16.4	0.0	0.2	-0.2
November	8.1	10.5	13.7	7.8	10.7	15.3	-0.3	0.1	1.6
December	5.8	8.3	11.0	5.5	8.3	12.0	-0.3	0.0	0.9
January	5.7	7.3	8.9	5.8	7.3	8.9	0.1	0.0	-0.1
February	6.0	7.6	9.2	6.2	7.6	9.4	0.2	0.0	0.2
March	6.5	8.7	11.6	6.6	8.7	11.6	0.1	0.0	0.0
April	7.8	10.1	12.9	8.0	10.2	13.1	0.1	0.1	0.1
May	8.6	10.6	13.4	8.8	10.7	13.4	0.2	0.1	0.0
June	9.3	11.2	14.8	9.4	11.4	14.9	0.0	0.2	0.1
July	9.6	11.8	16.0	9.6	12.1	16.1	0.0	0.3	0.1
August	10.8	12.2	16.3	11.1	12.5	16.5	0.2	0.3	0.2
September	11.2	12.6	16.8	11.4	12.9	16.6	0.2	0.2	-0.3



Note: the No Action Alternative line (blue) is hidden behind the Proposed Project Alternative line (red).

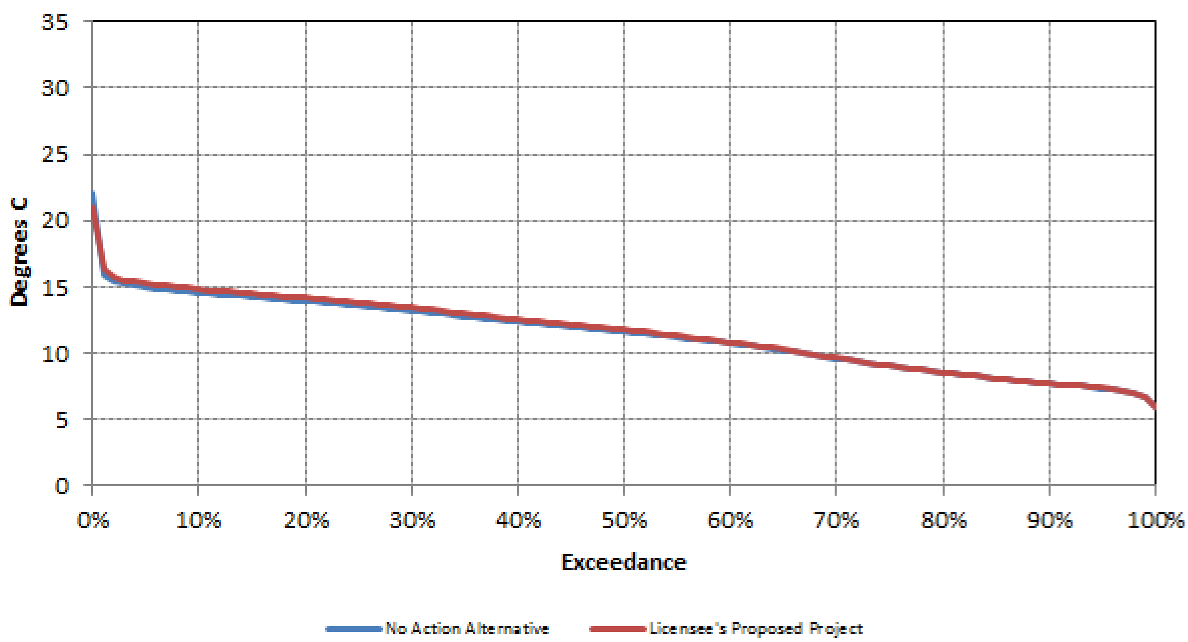
Figure 3.3.2-67. Exceedance curves of modeled mean daily water temperatures in the Yuba River near Parks Bar for the No Action Alternative and Proposed Project Alternative for WYs 1970 through 2010.

Table 3.3.2-34. Comparison of simulated mean monthly water temperatures in the Yuba River near Parks Bar for the No Action Alternative and Proposed Project Alternative for WYs 1970 through 2010.

Month	No Action Alternative			Proposed Project Alternative			Change		
	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C
October	10.1	13.0	18.0	10.1	13.2	17.9	0.0	0.2	-0.1
November	8.2	10.9	14.3	7.8	11.0	15.8	-0.4	0.1	1.5
December	6.0	8.4	11.8	5.5	8.4	12.3	-0.4	0.0	0.4

Table 3.3.2-34. (continued)

Month	No Action Alternative			Proposed Project Alternative			Change		
	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C
January	5.8	7.4	9.0	5.9	7.4	9.1	0.1	0.0	0.1
February	6.1	7.9	10.2	6.3	7.9	10.4	0.2	0.0	0.2
March	6.7	9.2	12.8	6.8	9.2	12.8	0.1	0.0	0.0
April	8.0	10.8	14.3	8.1	10.9	14.2	0.1	0.1	-0.1
May	9.2	11.4	16.0	9.1	11.5	16.0	-0.1	0.1	0.0
June	9.9	12.3	17.7	10.0	12.4	17.7	0.1	0.2	0.0
July	10.4	13.1	19.2	10.4	13.4	19.0	0.0	0.3	-0.2
August	11.5	13.6	20.5	11.7	13.8	20.1	0.2	0.2	-0.4
September	12.3	14.1	20.9	12.5	14.3	19.0	0.3	0.2	-1.9



Note: the No Action Alternative line (blue) is hidden behind the Proposed Project Alternative line (red).

Figure 3.3.2-68. Exceedance curves of modeled mean daily water temperatures in the Yuba River downstream of Dry Creek for the No Action Alternative and Proposed Project Alternative for WYs 1970 through 2010.

Table 3.3.2-35. Comparison of simulated mean monthly water temperatures in the Yuba River downstream of Dry Creek for the No Action Alternative and Proposed Project Alternative for WYs 1970 through 2010.

Month	No Action Alternative			Proposed Project Alternative			Change		
	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C
October	10.5	13.5	18.5	10.5	13.6	18.4	0.0	0.2	-0.1
November	8.2	11.0	14.4	7.8	11.1	15.9	-0.4	0.1	1.5
December	6.0	8.5	12.1	5.9	8.6	12.3	-0.1	0.0	0.2
January	5.9	7.6	9.1	6.0	7.6	9.2	0.1	0.0	0.1
February	6.3	8.1	10.5	6.5	8.1	10.7	0.2	0.0	0.2
March	7.0	9.6	13.3	7.1	9.6	13.3	0.1	0.0	0.0
April	8.7	11.2	14.9	8.8	11.3	14.8	0.1	0.1	-0.1
May	9.5	11.8	16.8	9.4	11.9	16.8	-0.2	0.1	0.0
June	10.2	12.8	18.5	10.3	13.0	18.5	0.1	0.2	0.0

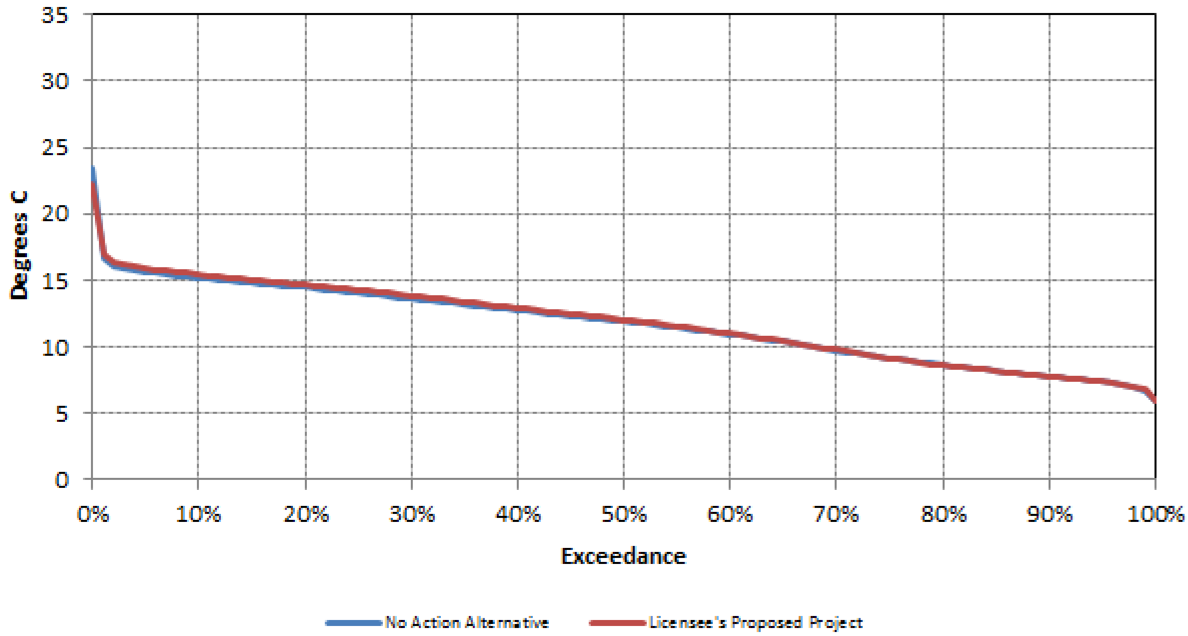
Table 3.3.2-35. (continued)

Month	No Action Alternative			Proposed Project Alternative			Change		
	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C
July	10.8	13.7	20.1	10.8	14.0	19.9	0.0	0.3	-0.3
August	11.9	14.1	21.5	12.1	14.4	21.0	0.2	0.2	-0.5
September	12.6	14.7	22.0	12.9	14.8	19.7	0.3	0.2	-2.3

Yuba River – Daguerre Point Dam Reach

Simulated water temperatures in the Yuba River below the Daguerre Point Dam reflect conditions from upstream of the dam; simulated flows under the No Action and Proposed Project Alternatives and the resulting water temperatures are nearly identical throughout the period of record. Water temperatures occasionally exceed 20°C in July through September with a similar frequency under both alternatives, but are generally less than 20°C. Each of YCWA's proposed conditions directly affecting flow, WR2, WR3, AR1, AR2, AR3, AR4, and TE4 slightly influence Yuba River flows below Daguerre Point Dam, but changes in minimum flows or required releases due to the proposed conditions do not substantially affect water temperatures.

Figures 3.3.2-69 through 3.3.2-71 present exceedance curves of mean daily water temperatures for the Proposed Project Alternative water temperature model run compared to the No Action Alternative for the Yuba River downstream of Daguerre Point Dam. Water temperatures in these reaches are generally under 20°C except for the warmest 1 percent of periods, , corresponding to 1977, when water flows in the Yuba River below the Narrows 2 Powerhouse were the lowest in the period of record for both the No Action Alternative and the Proposed Project Alternative. The highest simulated temperatures exceeded 35°C at the downstream end of the Yuba River, near the Feather River, in the summer months of 1977; no historical information was available to confirm the calibration of the temperature model for flows as low as were simulated in 1977. Tables 3.3.2-36 through 3.3.2-38 present a comparison of simulated monthly water temperatures for the same locations as the figures indicated above.

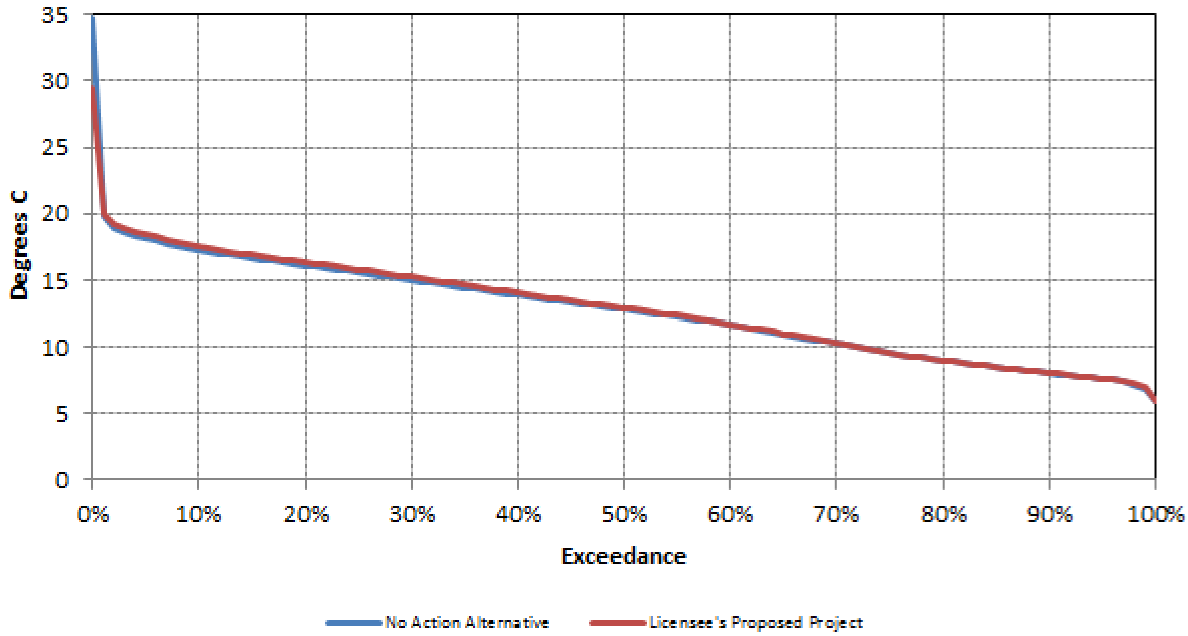


Note: the No Action Alternative line (blue) is hidden behind the Proposed Project Alternative line (red).

Figure 3.3.2-69. Exceedance curves of modeled mean daily water temperatures in the Yuba River downstream of Daguerre Point Dam for the No Action Alternative and Proposed Project Alternative for WYs 1970 through 2010.

Table 3.3.2-36. Comparison of simulated mean monthly water temperatures in the Yuba River downstream of Daguerre Point Dam for the No Action Alternative and Proposed Project Alternative for WYs 1970 through 2010.

Month	No Action Alternative			Proposed Project Alternative			Change		
	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C
October	10.8	13.8	19.0	10.8	14.0	18.9	0.0	0.2	-0.1
November	8.2	11.1	14.6	7.8	11.3	16.1	-0.4	0.1	1.5
December	6.0	8.6	12.4	5.9	8.6	12.5	-0.1	0.0	0.0
January	5.9	7.6	9.2	6.0	7.6	9.3	0.1	0.0	0.1
February	6.3	8.2	10.8	6.5	8.2	11.0	0.2	0.0	0.2
March	7.1	9.7	13.8	7.2	9.7	13.8	0.1	0.0	0.0
April	8.8	11.5	15.7	8.8	11.6	15.6	0.1	0.1	-0.1
May	9.7	12.2	17.7	9.5	12.3	17.7	-0.2	0.1	0.0
June	10.4	13.3	19.6	10.5	13.4	19.7	0.1	0.2	0.0
July	11.0	14.3	21.8	11.2	14.6	21.1	0.2	0.3	-0.7
August	12.2	14.7	23.1	12.4	14.9	22.2	0.2	0.2	-1.0
September	13.0	15.2	23.4	13.2	15.4	20.6	0.3	0.1	-2.8

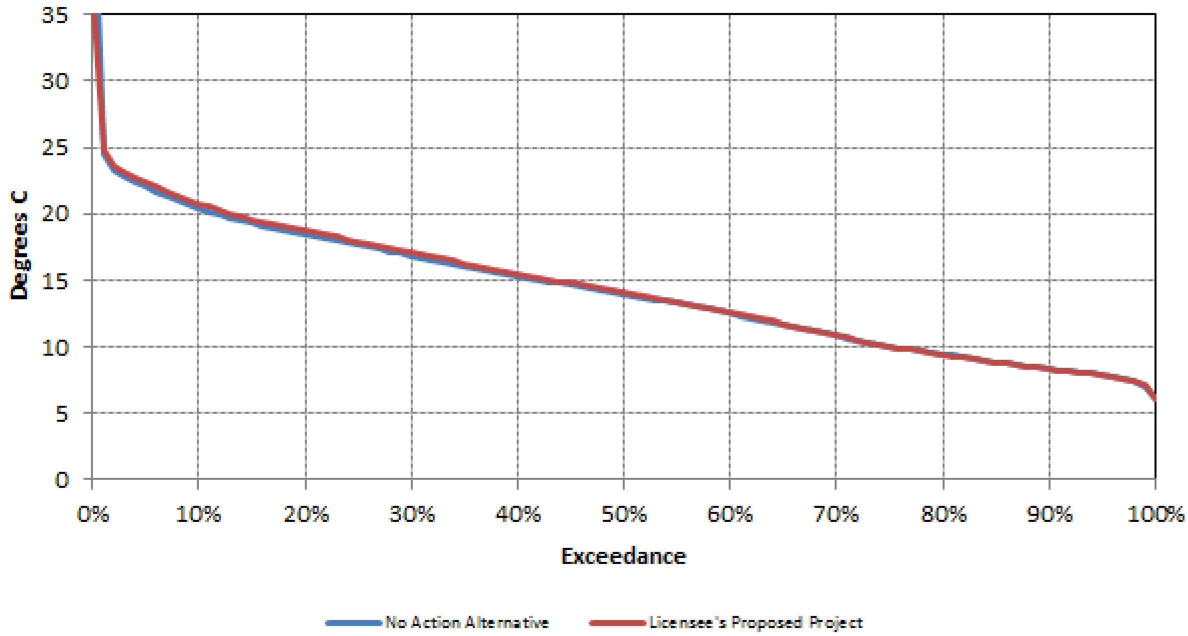


Note: the No Action Alternative line (blue) is hidden behind the Proposed Project Alternative line (red).

Figure 3.3.2-70. Exceedance curves of modeled mean daily water temperatures in the Yuba River near Marysville for the No Action Alternative and Proposed Project Alternative for WYs 1970 through 2010.

Table 3.3.2-37. Comparison of simulated mean monthly water temperatures in the Yuba River near Marysville for the No Action Alternative and Proposed Project Alternative for WYs 1970 through 2010.

Month	No Action Alternative			Proposed Project Alternative			Change		
	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C
October	11.8	14.9	21.3	11.8	15.1	20.7	0.0	0.2	-0.6
November	8.4	11.8	15.5	8.0	11.9	17.1	-0.4	0.1	1.6
December	6.0	8.9	13.7	6.0	8.9	13.6	0.0	0.0	-0.1
January	6.0	7.9	9.9	6.1	7.9	9.9	0.1	0.0	0.0
February	6.5	8.5	11.8	6.7	8.5	12.0	0.2	0.0	0.2
March	7.4	10.3	15.1	7.5	10.3	15.1	0.1	0.0	0.0
April	9.0	12.3	18.9	9.0	12.4	18.8	0.0	0.1	-0.1
May	10.1	13.3	21.5	10.0	13.4	21.5	-0.1	0.1	0.0
June	11.0	14.9	24.8	11.1	15.1	24.9	0.1	0.2	0.0
July	11.7	16.6	34.1	12.1	16.8	28.8	0.4	0.2	-5.2
August	13.1	16.8	34.7	13.3	16.9	29.5	0.2	0.1	-5.2
September	13.9	17.0	31.2	14.2	17.0	25.7	0.3	0.0	-5.5



Note: the No Action Alternative line (blue) is hidden behind the Proposed Project Alternative line (red).

Figure 3.3.2-71. Exceedance curves of modeled mean daily water temperatures in the Yuba River upstream of the Feather River for the No Action Alternative and Proposed Project Alternative for WYs 1970 through 2010.

Table 3.3.2-38. Comparison of simulated mean monthly water temperatures in the Yuba River upstream of the Feather River for the No Action Alternative and Proposed Project Alternative for WYs 1970 through 2010.

Month	No Action Alternative			Proposed Project Alternative			Change		
	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C	Min °C	Mean °C	Max °C
October	12.9	16.7	26.0	13.1	16.8	23.6	0.2	0.2	-2.4
November	8.6	12.6	16.9	8.2	12.8	18.5	-0.4	0.1	1.6
December	6.1	9.3	15.5	6.1	9.3	15.4	0.0	0.0	-0.1
January	6.0	8.2	11.0	6.2	8.2	11.0	0.2	0.0	0.0
February	6.7	9.0	13.1	6.9	9.0	13.2	0.2	0.0	0.2
March	7.7	10.9	17.1	7.8	10.9	17.0	0.1	0.0	-0.1
April	9.1	13.4	22.8	9.1	13.5	22.8	0.0	0.1	-0.1
May	10.4	14.7	26.5	10.3	14.8	26.5	-0.1	0.1	0.0
June	11.6	17.1	31.4	11.7	17.3	31.4	0.1	0.2	0.0
July	12.5	19.7	47.2	13.0	19.8	37.2	0.4	0.2	-10.0
August	14.1	19.7	46.5	14.3	19.8	37.2	0.1	0.0	-9.3
September	15.0	19.6	41.0	15.4	19.5	32.0	0.5	-0.1	-9.0

Dissolved Oxygen in Stream Reaches

YCWA's proposed Project includes adopting or increasing minimum flows below Our House Diversion Dam, Log Cabin Diversion Dam, and New Bullards Bar Dam (AR1 in Appendix E2). The minimum instream flows were developed to provide enhancement for aquatic resources. Water quality under the proposed flows would either remain the same or improve for all constituents, including DO. At most locations, increased minimum flows from the mesotrophic reservoirs and steep gradients downstream of the dams are likely to cause DO to approach oxygen saturation shortly after release.

3.3.2.2.4 Effects on CWA Section 303(d) constituent - Mercury

As pointed out above, based on data collected before 2009, the SWRCB identified most waters in the Project Vicinity as CWA (§) 303(d) State Impaired for mercury, citing fish tissue concentrations, not surface water concentrations, to support their listing (SWRCB 2010).

Currently, YCWA does not perform any Project O&M activity associated with the release or mobilization of mercury (YCWA 2009). In fact, as described above, in 2012, YCWA investigated sediment-associated mercury concentrations upstream and downstream of the powerhouses during a single period expected to be of high turbidity (YCWA 2013d). A flow of 5,000 cfs, as measured at the Smartsville gage, when flows as measured at Smartsville have increased by at least 100 percent in the previous 7 days, triggered the sampling event. Water samples were analyzed for turbidity, total suspended sediment, total dissolved sediment, total mercury and methylmercury. YCWA compared the samples collected from the powerhouse tailraces to ambient levels of total mercury and methylmercury, as determined by YCWA's sampling at other locations and seasons, as well as regional studies performed by others. Methylmercury and mercury concentrations measured downstream of powerhouse were consistent with ambient conditions; travel through the powerhouse did not appear to affect methylmercury or mercury concentrations (YCWA 2013d).

Under YCWA's proposed Project, sediments that accumulate in the Our House and Log Cabin diversion impoundments, would be routinely dredged or passed downstream (GS2 in Appendix E2). Sediment management preserves the beneficial uses of the impounded water for power and fisheries; however, mobilization of sediments also has the potential to introduce mercury sequestered in impoundment sediments to downstream habitats through 1) the removal process; 2) the disposal process; and 3) the downstream sediment passing, for maintenance. Mercury is presumed to be present in impoundment sediments at trace quantities, despite having not been detected in Our House Diversion or Log Cabin Diversion sediment samples collected in 2006 and 2013, respectively (YCWA 2006; YCWA pers. comm.). Gold mining is known to have occurred in the Our House impoundment watershed, but there are no records of gold mining having occurred in the smaller Log Cabin watershed.

To minimize downstream transport of flocculated sediments[27], dredging will be timed and managed, so that there will be no standing water above excavated sediments and no (or minimal) sediment will be transported downstream during dredging (See Sediment Removal Plan in Appendix E3). During the dredge operation, inflow into the impoundment will be intercepted upstream of the planned excavation and diverted downstream of the dam. The pipe will circumvent the area to be dredged and pass over or through the dam via the existing minimum flow release valve, allowing minimum flows in the Middle Yuba River or Oregon Creek to be maintained, per the FERC license.

[27] Flocculated sediments downstream of suction dredge mining have been found to have greater concentrations of reactive mercury (Fleck et al 2011; Marvin-DiPasquale et al 2011).

Excavated sediments will be transported off-site (See Sediment Removal Plan in Appendix E3). In accordance with State and local regulations, chemical analyses will be performed on sediment samples to ensure a proper disposal method is used. If local land-disposal is appropriate, appropriate actions will be taken to prevent sediments from eroding back into local waterways.

Once the accumulated sediment is removed, regular maintenance using the sluice gates can occur. In 2014, YCWA will develop head versus flow rating curves for the Our House and Log Cabin diversion dam Low Level (5-foot diameter) Outlet Valves. From this information operating rules will be developed that will maximize the benefit of having additional sediments available to downstream habitats. Since gold mining is not conducted in the watersheds upstream of Our House and Log Cabin diversion impoundments, it is expected that future sediments deposited in the impoundments will also contain no or non-detectable levels of mercury.

3.3.2.2.5 Effects of Operations and Maintenance Activities

Several of YCWA's proposed Conditions are related to the ongoing O&M of the Project. This section describes effects of those O&M-related conditions on water quantity and water quality.

Coordinated Operations

YCWA's proposed Project includes a Coordinated Operations Plan (GEN7 in Appendix E2) to coordinate operations of the Project with the Narrows Project (FERC Project No. 1403) to assure implementation of flow-related conditions in the two licenses, including maintenance of minimum streamflows during scheduled outages. Development of this plan will ensure maintenance of minimum streamflows and ramping rates from YCWA proposed conditions AR3 and TE4.

Use of Englebright Reservoir

YCWA's Proposed Project Alternative includes the use of Englebright Reservoir (GEN8 in Appendix E2). Through the use of Englebright Reservoir as a buffer to avoid fluctuating flows in the lower Yuba River, YCWA can operate the New Colgate Powerhouse in a manner to provide hydroelectric generation at times when it has more value than if YCWA was unable to use Englebright Reservoir. Similarly, it provides YCWA with the ability to regulate releases from the New Colgate Powerhouse to account for variability in flow on the Middle Yuba River above Our House Dam and from the South Yuba River; without Englebright Reservoir, YCWA would need to operate the New Colgate Powerhouse without consideration for inflow from the Middle Yuba River and South Yuba River, reducing available storage in New Bullards Bar Reservoir, creating greater variability in Yuba River flow below the Narrows 2 Powerhouse and Narrows 2 Bypass, and decreasing the ability of the New Colgate Powerhouse to provide significant regulation and stability for the Northern California power grid.

Our House and Log Cabin Diversion Sediment Passage

YCWA's proposed Project includes a plan to regularly pass sediment downstream from Our House and Log Cabin Diversion dams by opening the low-level outlet valves in each dam (GS3 in Appendix E2) under certain conditions. These operations would require the opening of the low-level outlet valves at times when flows were spilling over the top of the diversion dams, so there would be adequate transport and distribution of sediment below the diversion and no reduction in flow into the Lohman Ridge or Camptonville tunnels.

Streamflow and Reservoir Level Monitoring Plan

YCWA's proposed Project includes the implementation of a streamflow and reservoir monitoring plan to ensure compliance with YCWA's proposed streamflows and reservoir levels (WR4 in Appendix E2). It is not an operational change, and would therefore not affect any of the Project's abilities to meet its flow-related obligations.

Anadromous Fish Ecological Group

YCWA's proposed Project includes the establishment of an Anadromous Fish Ecological Group to assist YCWA with the implementation of the terms and conditions of YCWA's new license, as they pertain to anadromous fish in the Yuba River downstream of the Narrows 2 Powerhouse (TE3 in Appendix E2). This group will discuss conditions of anadromous fisheries in the Yuba River below the Narrows 2 Powerhouse and may provide comments and insight on YCWA operations as they pertain to anadromous fish in the Yuba River downstream of the Narrows 2 Powerhouse. The Anadromous Fish Ecological Group's insights on YCWA's operations and flow change decisions could potentially affect flow and water temperature in the Yuba River downstream of the Narrows 2 Powerhouse. Their recommendations could potentially affect the timing of Project releases by a few weeks, but not the overall volume of releases, and would not affect timing or magnitude of agricultural deliveries.

Recreational Flow Information

YCWA's proposed Project includes the public distribution of Project flow and storage-related information for recreational purposes (RR2 in Appendix E2).). It is not an operational change, and would therefore not affect any of the Project's abilities to meet its flow-related obligations.

Slope Stabilization

YCWA's proposed Project includes an Erosion and Sediment Control Plan under which YCWA would minimize erosion runoff into surface waters, should slopes require stabilization in the future (GS1 in Appendix E2). The Erosion and Sediment Control Plan formalizes actions that YCWA already undertakes to protect water quality; erosion control and slope stabilization will help keep waters in the Project Area clear, protecting the water's beneficial uses.

Sediment Management

This condition was also discussed above, under Section 3.3.2.2.4. YCWA's proposed Project includes an Our House and Log Cabin Diversion Dams Sediment Excavation Plan, to manage sediments that accumulate in diversion impoundments (GS2 in Appendix E2). YCWA's proposed Project also specifies conditions when sediment would be passed through the diversion dams (GS3 in Appendix E). Sediment removal, disposal, and pass-through would be performed in accordance with Federal, State, and local water quality requirements. Sediment management preserves the beneficial uses of the impounded water for power and fisheries.

Use of Hazardous Materials for Operations

Currently, YCWA does not store hazardous materials on NFS land and minimal quantities of hazardous materials, such as gasoline, are brought onto NFS land for specific short-term uses, such as to power the portable engines used for diversion dam outlet operation. The proposed Project includes the Hazardous Materials Management Plan under which YCWA would ensure hazardous materials used for O&M remain segregated from Project waters (WR1 in Appendix E2). The Hazardous Materials Management Plan formalizes actions that YCWA already undertakes to protect water quality; keeping hazardous materials out of Project waters, thereby protecting the water's beneficial uses.

Use of Pesticides[28]

Currently, YCWA does not apply pesticides on NFS land and no pesticides are used in water conduits, or near active streams. YCWA's Integrated Vegetation Management Plan (TR1 in Appendix E3) includes the following guidelines when the use of pesticides on NFS land is proposed: YCWA will acquire the necessary permission from NFS, as appropriate, prior to applying pesticides on NFS land. When permission is obtained, pesticide use will be in compliance with agency requirements. During the Annual Consultation Meeting described in YCWA's proposed Condition GEN4, YCWA shall submit a request for approval of planned uses of pesticides or herbicides on NFS land for the upcoming year. YCWA shall provide information essential for review, including specific locations and timeframes for application, as well as analysis necessary to ensure compliance with the Tahoe National Forest Land and Resource Management Plan (TNF 1990), Plumas National Forest Land and Resource Management Plan (PNF 1988), and any amendments or additional Forest Service requirements.

Temperature Monitoring

YCWA will enhance its water temperature monitoring system to include three locations downstream of Narrows 2 Powerhouse (TE1 in Appendix E2). Measuring temperatures in the Yuba River will not affect designated beneficial uses and may be used improve aquatic resource management in the Yuba River.

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[28] In the Integrated Vegetation Management Plan (TR-1 in Appendix E), the term pesticides is used to mean both pesticides and herbicides.

Road Rehabilitation and Maintenance

YCWA's proposed Project includes a Transportation System Management Plan under which YCWA would maintain all primary project roads in good condition, which would minimize erosion runoff into surface waters from Project roads (LU1 in Appendix E2). Erosion control performed in relationship to this Plan will help keep waters in the Project Area clear, protecting the water's beneficial uses.

3.3.2.2.6 Effects of Construction-Related Activities

YCWA's proposed Project includes the construction of several facilities, including a tailwater depression system at the New Colgate Powerhouse, a new flood control outlet at New Bullards Bar Dam, and the construction of various recreation facilities. This section provides a description of the effects of the construction of these facilities on water quantity and water quality.

New Colgate Powerhouse Tailwater Depression System

YCWA's proposed Project includes the construction of a Tailwater Depression System at New Colgate Powerhouse. The construction period would be expected to last 5 months, and YCWA anticipates the work can be accomplished during planned outages that would not affect the Project's ability to meet downstream requirements.

New Bullards Bar Dam Flood Control Outlet

YCWA's proposed Project includes the construction of a new flood control outlet at New Bullards Bar Dam. The construction period for the new outlet is expected to be approximately 6 years, including the environmental compliance and permitting and procurement and fabrication of key features prior to the actual start of construction. Construction of the new outlet would require excavation in the left abutment area of New Bullards Bar Dam for both a new tunnel on the downstream side of the dam, and a new intake structure on the reservoir-side of the dam. Construction of the new intake structure will require a natural cofferdam until the tunnel and intake structure are complete. Removal of the cofferdam would take place during a low-reservoir storage period. YCWA anticipates the work can be accomplished according to normal operations and would not affect the Project's ability to operate.

Recreation Facilities

YCWA's proposed Project would include upgrades to various recreation facilities, construction of each of which has the potential to affect water quality (RR1 in Appendix E2). YCWA notes, that in some cases, such as the replacement of pit toilets with flush toilets, the threat of recreation-related activities impacting water quality is reduced (See Table 3.3.2-20). YCWA is required to consult with the agencies with authority over public trust resources that may be affected by construction, and to obtain all necessary permits and approvals related to the construction prior to any ground disturbing activities. In addition, YCWA has included in the proposed Project a Hazardous Materials Management Plan (WR1 in Exhibit E), which requires water-quality protective practices be employed, including development and implementation of a Spill Prevention, Control and Countermeasure (SPCC) Plan for construction activities. YCWA has included in the Proposed Alternative Project an Erosion and Sediment Control Plan (GS1 in Appendix E2), which will ensure water quality is protected from ground disturbing construction activities.

3.3.2.3 Cumulative Effects

Water resources in the Yuba River basin have been affected by water and land management practices since the mid 1850s. In fact, many of the Projects' facilities locations and the roads used to construct these facilities trace their origins to this period. The Yuba watershed has been extensively mined and logged (See *Historic Overview* in Section 3.3.8.1.1). Early gold miners panned for gold in stream beds, but within decades, large-scale mining operations replaced individual miners. In 1853, hydraulic mining was introduced to California and became more common by the 1860s. During early 20th century, the California Debris Commission constructed a series of dams in the lower Yuba River to capture hydraulic mining debris and prevent its transport to navigable river reaches on the valley floor. These past activities certainly had profound effects on water quantity and quality in the Yuba River long before the Project received its power licenses and began generating electricity in 1969.

More recently, as California's population increases and spreads into the Sierra Nevada foothills, including the expansion of the Sacramento metropolitan area, the importance of the Yuba River for water supply and to support recreation has substantially increased. Water delivery systems have expanded as have reservoir and stream recreation uses. Currently, Daguerre Point Dam provides hydraulic head for diversions. Water to irrigate crops, a luxury in the late 1800s and early to mid 1900s, is now critical for the continued viability and expansion of Yuba County. This demand at times conflicts with the demands on the water for environmental purposes, which are also increasing.

These past and present actions together with the projects as configured and operated today, have had an effect on water quantity and quality.

3.3.2.3.1 Cumulative Effects to Water Quantity

With regards to water quantity, historical studies have shown that flows in the Middle Yuba River and South Yuba River, and many of their tributaries have experienced re-regulation and diversion of flows since the mid 19th Century. Of particular significance is the history of water diversions from the Middle and South Yuba River basins into the Bear River and American River basins, and from the North Yuba River basin into the Feather River basin; these diversions were originally constructed to provide additional flows for hydraulic mining, and their use was transformed into agricultural and domestic purposes from the late 19th century into the early 20th Century. These upstream projects have recently submitted applications for renewal of their FERC licenses; the issuance of renewed licenses, along with increases in water supply demand, will likely result in substantial changes to inflow to the Project from Slate Creek, the Middle Yuba River, and from the South Yuba River. When coupled with forecasted increases in agricultural water supply demand from the Yuba River due to the addition of the capability for surface water deliveries to portions of the Wheatland Water District, operations under the proposed Project could result in cumulative effects on water quantity.

For the analysis of cumulative effects on water quantity, a With-YCWA Proposed Project (Future) Alternative model run was developed; the model is the same as the Proposed Project (Existing) Alternative with the following exceptions:

- Future-level demands for the Wheatland Water District (approximately 25,000 ac-ft/year of increased demand)
- SFWPA's new FERC license conditions for flows on Slate Creek from the South Feather Project)
- NID's new FERC license conditions for flows for the Yuba-Bear Hydroelectric Project, with NID's year 2062 water deliveries
- PG&E's new FERC license conditions for flows for the Drum-Spaulding Project, with PG&E's year 2062 water deliveries
- PCWA's projected year 2062 water deliveries

Modeling for YCWA's Proposed Project (Future) Alternative was limited by available inflow data from the upstream projects. While YCWA developed a methodology for representing changes in SFWPA's FERC license requirements for the period of record used for the No Action Alternative, modeling of the NID's Yuba Bear Hydroelectric Project and PG&E's Drum-Spaulding Project new licenses and increased PCWA and NID water supply demands only included a period of record of WYs 1975 through 2008, so modeling of the future was limited to WYs 1975 through 2008. Accretions on the Middle Yuba and South Yuba between the upstream projects and Our House Diversion Dam and Englebright Reservoir, respectively, were added to the simulated releases from NID's Yuba Bear Hydroelectric Project and PG&E's Drum-Spaulding Project to get inflows to the Operations Model from the Middle Yuba and South Yuba rivers. The methodology for developing these accretions is discussed in YCWA's Technical Memorandum 2-2, *Water Balance/Operations Model,* Attachment 2-2C in Appendix E6. The future-level demands for the Wheatland Water District were developed using the same methodology as the present-level demands for Wheatland Water District, as described in YCWA's Technical Memorandum 2-2, *Water Balance/Operations Model,* Attachment 2-2A, except the land-use for the Wheatland Water District was updated to reflect surface water deliveries to the full district. Temperature modeling of the Future Proposed Project Alternative assumed identical meteorological and inflow water temperature conditions as under the existing level of development scenarios.

Agricultural water supply for YCWA member units is not expected to change under the Future Proposed Project Alternative, as compared to the No Action Alternative. WY 1977 would remain the sole year with less than full demand water supply availability; and under both alternatives, deliveries to Member Units would be 50 percent of demand in such a hydrologic condition.

3.3.2.3.2 Cumulative Effects to Water Quality

With regards to water quality, YCWA's historical studies have shown that, with the exception of mercury, general water quality in the North and Middle Yuba Rivers and Yuba River is good and meets Basin Plan objectives for the majority of constituents in the majority of locations. The presence of mercury, a legacy from the long history of gold mining, has led to concerns regarding mercury concentrations in edible fish (Section 3.3.2.1.2). However, these concerns occur throughout the watershed (Table 3.3.2-16) as they do in most California streams where gold mining occurred, and the potential to bioaccumulate mercury in fish is not exacerbated by the projects. OEHHA, the California agency responsible for advising the public of health concerns, has issued fish ingestion advisories for New Bullards Bar Reservoir; the Middle Yuba River from Bear Creek to the North Yuba River; the North Yuba River from New Bullards Bar Dam to Englebright Reservoir; the South Yuba River from Lake Spaulding to Englebright Reservoir; Englebright Reservoir, and the Yuba River from Englebright Dam to the Feather River. (See Section 3.3.2.1.2, under the heading CWA Section 303(d) constituent--Mercury).

YCWA's Proposed Project Alternative, in combination with past activities, affects water temperature. Impoundment of water, which has occurred in the basins since the mid 1800s, generally results in higher late spring through early fall temperatures in the surface of the impoundments than would occur in the same reach if the stream was free-flowing. Inflow to the Project from upstream projects on the Middle Yuba and South Yuba rivers is generally warmer than releases from New Bullards Bar Reservoir and the New Colgate Powerhouse. With the increase in inflow from the Middle Yuba and South Yuba rivers under the cumulative condition alternative, relative to the No Action Alternative, there is a potential for increased water temperatures in the Yuba River downstream of the Narrows 2 Powerhouse. These increases in water temperature would be partially ameliorated by increases in releases from New Bullards Bar Reservoir to provide increased agricultural water supply demand from Daguerre Point Dam, but will likely result in warmer Yuba River water temperatures below the Narrows 2 Powerhouse. Figure 3.3.2-72, 3.3.2-73, and 3.3.2-74 show simulated water temperatures along the Yuba River downstream of the Narrows 2 Powerhouse for YCWA's Proposed Project Alternative (Future) compared to the No Action Alternative. Simulated water temperatures are slightly higher the future condition of the Proposed Project Alternative than in the No Action Alternative in the May through November time period, but remain below the 20°C at a similar level to the No Action Alternative.

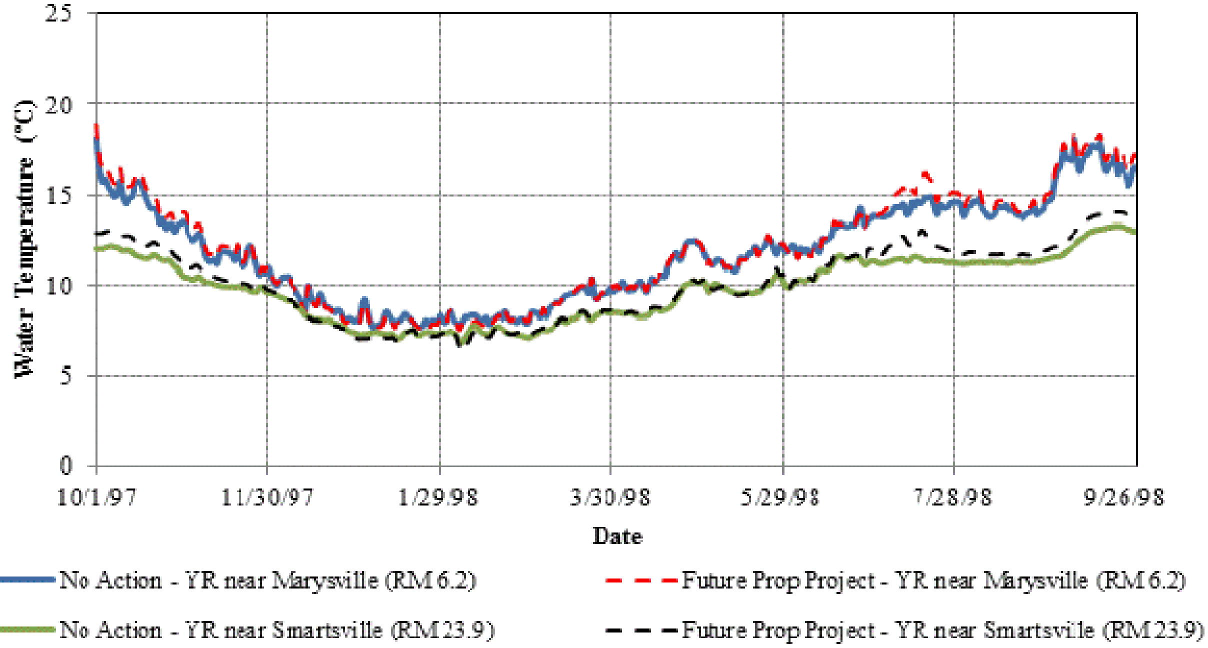

Figure 3.3.2-72. Simulated daily water temperatures for a representative wet WY (1998) at various locations along the Yuba River downstream of the Narrows 2 Powerhouse for the No Action Alternative compared to the Future Proposed Project Alternative.

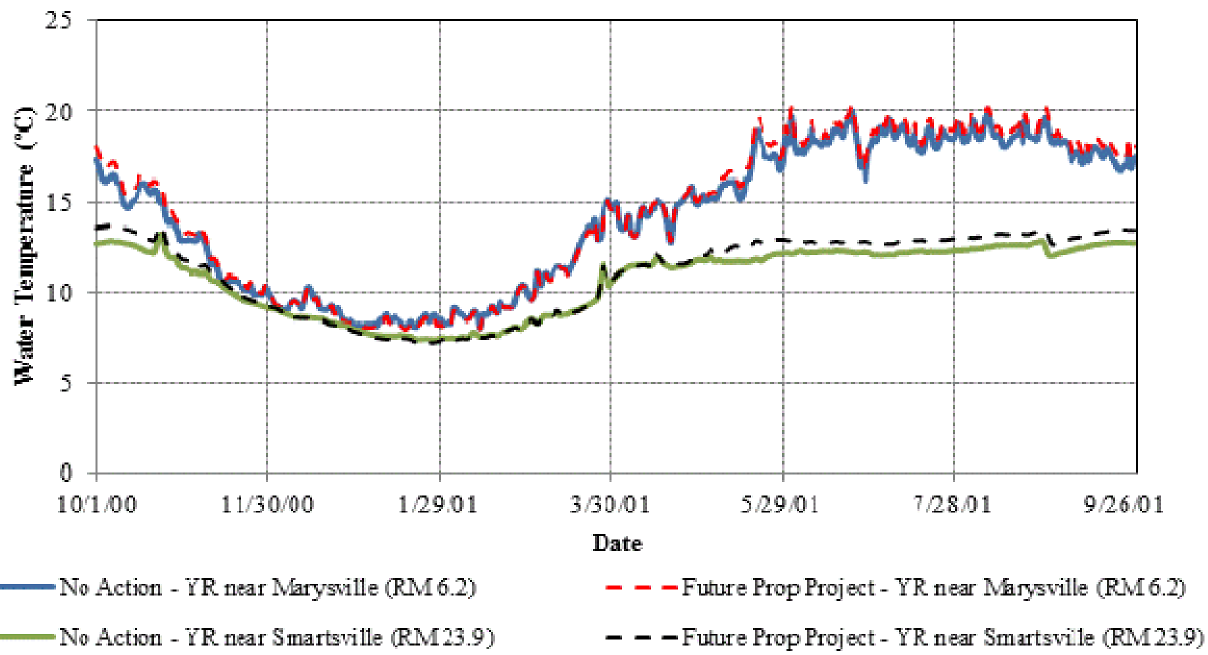

Figure 3.3.2-73. Simulated daily water temperatures for a representative dry WY (2001) at various locations along the Yuba River downstream of the Narrows 2 Powerhouse for the No Action Alternative compared to the Future Proposed Project Alternative.

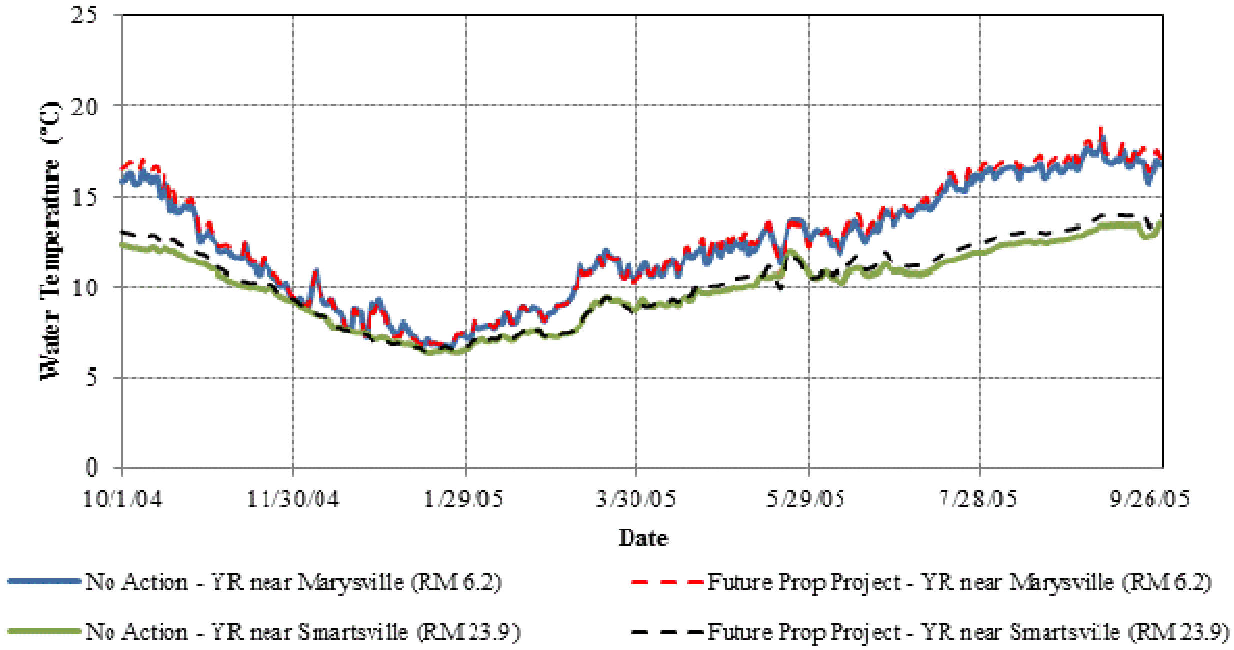

Figure 3.3.2-74. Simulated daily water temperatures for a representative normal WY (2005) at various locations along the Yuba River downstream of the Narrows 2 Powerhouse for the No Action Alternative compared to the Future Proposed Project Alternative.

3.3.2.4 Proposed Environmental Conditions

3.3.2.4.1 Conditions Recommended by YCWA

As described above, YCWA's proposed Project includes 22 conditions related to water resources:

- Proposed Condition GEN7: Develop and Implement a Coordinated Operations Pan for Yuba River Development Project an Narrows Project
- Proposed Condition GEN8: Right to Use Englebright Dam and Reservoir
- Proposed Condition GS1: Implement Erosion and Sediment Control Plan
- Proposed Condition GS2: Implement Our House and Log Cabin Diversion Dams Sediment Excavation Plan
- Proposed Condition GS3: Pass Sediment at Our House and Log Cabin Diversion Dams
- Proposed Condition WR1: Implement Hazardous Materials Management Plan
- Proposed Condition WR2: Determine Water Year-Types for Conditions Pertaining to Our House Diversion Dam, Log Cabin Diversion Dam, and New Bullards Bar Dam.
- Proposed Condition WR3: Determine Water Year-Types for Conditions Pertaining to Narrows 2 Powerhouse and Narrows 2 Full Bypass

- Proposed Condition WR4: Implement Streamflow and Reservoir Level Monitoring Plan
- Proposed Condition WR5: Maintain New Bullards Bar Reservoir Minimum Pool
- Proposed Condition WR6: Operate New Bullards Bar Reservoir for Flood Control
- Proposed Condition AR1: Maintain Minimum Streamflows below Our House Diversion Dam, Log Cabin Diversion Dam, and New Bullards Bar Dam
- Proposed Condition AR2: Control Project Spills at Our House Diversion Dam
- Proposed Condition AR3: Maintain Minimum Streamflows at Narrows 2 Powerhouse and Narrows 2 Full Bypass
- Proposed Condition AR4: Control Project Spills at New Bullards Bar Dam
- Proposed Condition TR1: Implement Integrated Vegetation Management Plan
- Proposed Condition TE1: Monitor Water Temperature Downstream of Narrows 2 Powerhouse
- Proposed Condition TE3: Establish Lower Yuba River Anadromous Fish Ecological Group
- Proposed Condition TE4: Control Project Ramping and Flow Fluctuations Downstream of Englebright Dam
- Proposed Condition RR1: Implement Recreation Facilities Plan
- Proposed Condition RR2: Provide Recreation Flow Information
- Proposed Condition LU1: Implement Transportation System Management Plan

Each proposed condition is provided in full in Appendix E2. Implementation plans are included in Appendix E3.

3.3.2.4.2 Proposed Conditions and Studies Recommended by Agencies or Other Relicensing Participants That Were Not Adopted by YCWA

[Relicensing Participants – This is a placeholder in the Draft License Application. This section will be completed in the Final License Application. YCWA]

3.3.2.5 Unavoidable Adverse Effects

With one exception, operating and maintaining the Project consistent with YCWA's proposed conditions would not create any significant and unavoidable adverse effects. The Yuba River Development Project dams will continue to truncate high spring flows and augment low summertime and fall flows, which will affect water quantity. However, these storages and diversions would occur with or without the Project since the facilities are necessary to meet flood control and downstream consumptive demands now and into the future. For that reason, long-term Project effects on water quantity are considered minor and cumulative.

By storing high flows during the fall, winter, and spring, New Bullards Bar Reservoir develops a cold-water pool which then provides for consistently cold downstream water temperatures year-around. The one exception is the planned maintenance of Our House and Log Cabin diversions, to remove sediments. Despite using best available technologies and practices, it is possible that mercury may be released from sequestered sediments in the dredging or pass-through processes. Implementation of YCWA's Sediment Removal Plan (GS3 in Appendix E2), will minimize the potential effects.

Some Basin Plan Water Quality Objectives are not met now and will not be met in the future. However, excluding water temperature, as discussed above, these inconsistencies with Basin Plan Objectives do not affect designated beneficial uses. For this reason, the inconsistencies are considered minor.

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