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Rock Creek-Cresta 2009 Water Temperature Monitoring Results

(ERC Review Draft)

Rock Creek-Cresta Hydroelectric Project

FERC Project No. 1962

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1 INTRODUCTION

1.1 BACKGROUND

North Fork Feather River (NFFR) water temperatures in the Rock Creek and Cresta (RCC) reaches reflect a combination of the water temperature delivered from the upstream Upper NFFR Project (Federal Energy Regulatory Commission [FERC] 2105), flows from the unregulated East Branch of NFFR (EBNFFR) and other tributaries, flow released from Bucks Creek Project (FERC 619), and the diversions within the reaches of the Rock Creek-Cresta Project (Project). The temperature of water from FERC 2105 is primarily determined by conditions at the non-selective Prattville Intake in Lake Almanor. Pursuant to FERC Condition 4C of the Project License (issued October 24, 2001), temperature monitoring is required during the summer months to determine if and to what extent the 20°C daily mean temperature level can be met with reasonable control measures.

The RCC Hydroelectric Project FERC License No. 1962 required Pacific Gas and Electric Company (PG&E or Licensee) to file a water temperature monitoring plan with FERC, which described the implementation (including a schedule for implementation) of the water temperature monitoring program described in Condition No. 4C of the Project License. The RCC water temperature monitoring plan was prepared in consultation with the RCC Ecological Resource Committee (ERC) and the Forest Service (FS) and was

implemented in June 2002. The 2009 monitoring effort was the 8th year (or the third year as defined in the 2nd 5-year minimum flow period) after the issuance of FERC 1962 License (issued October 24, 2001).

The objective of the water temperature monitoring program is to:

1. *Document summer water temperatures and flows in the Rock Creek and Cresta reaches as well as in upstream drainages tributary to the Project.*
2. *Install and monitor continuous temperature recorders at two telemetry stations installed at flow gaging stations in the Rock Creek and Cresta reaches.*
3. *Determine if mean daily water temperatures of 20°C or less can be met in the Rock Creek and Cresta reaches to the extent that Licensee can reasonably control such temperatures, particularly if a modified Prattville Intake is implemented.*

This report documents the results and subsequent analysis of the 2009 monitoring program.

1.2 PROJECT SETTING

The Licensee's NFFR Projects (FERC 2105 and FERC 1962) are located on the NFFR watershed in northeastern California (see Figure 1-1). The monitoring area comprises the Upper NFFR and RCC Projects and is located in Plumas and Butte counties, approximately 90 miles northeast of Oroville, California, and encompasses approximately 40 river-miles of the upper NFFR. The Upper NFFR Project is located on lands owned by Licensee and the National Forest Service Lands and is currently operated by the Licensee under FERC License 2105.

The NFFR is part of the greater Sacramento River watershed and drains a large portion of the eastern Sierra-Cascade geomorphic area in California. The NFFR watershed extends from its headwater area on the southeastern slope of Mount Lassen to Lake Oroville, traversing lands in Lassen, Plumas, and Butte counties. The main stem of the Feather River is formed downstream of Lake Oroville; the North, Middle, and South forks of the Feather River are impounded behind Oroville Dam which was completed in 1967.

The monitoring program involved collecting data from facilities associated with the Licensee's Upper NFFR Project (FERC 2105) and RCC Project (FERC 1962). Both Projects are part of a series of major hydroelectric generation projects that utilize the water resources of the NFFR and its tributaries for hydroelectric power generation. Downstream of these Projects is the Poe Project (FERC 2107) operated by the Licensee, and the Oroville Project (FERC 2100) owned by the State of California Department of Water Resources (DWR). Delivering water to the NFFR upstream of Licensee's Rock Creek Powerhouse is the Licensee's Bucks Creek Project (FERC 619).

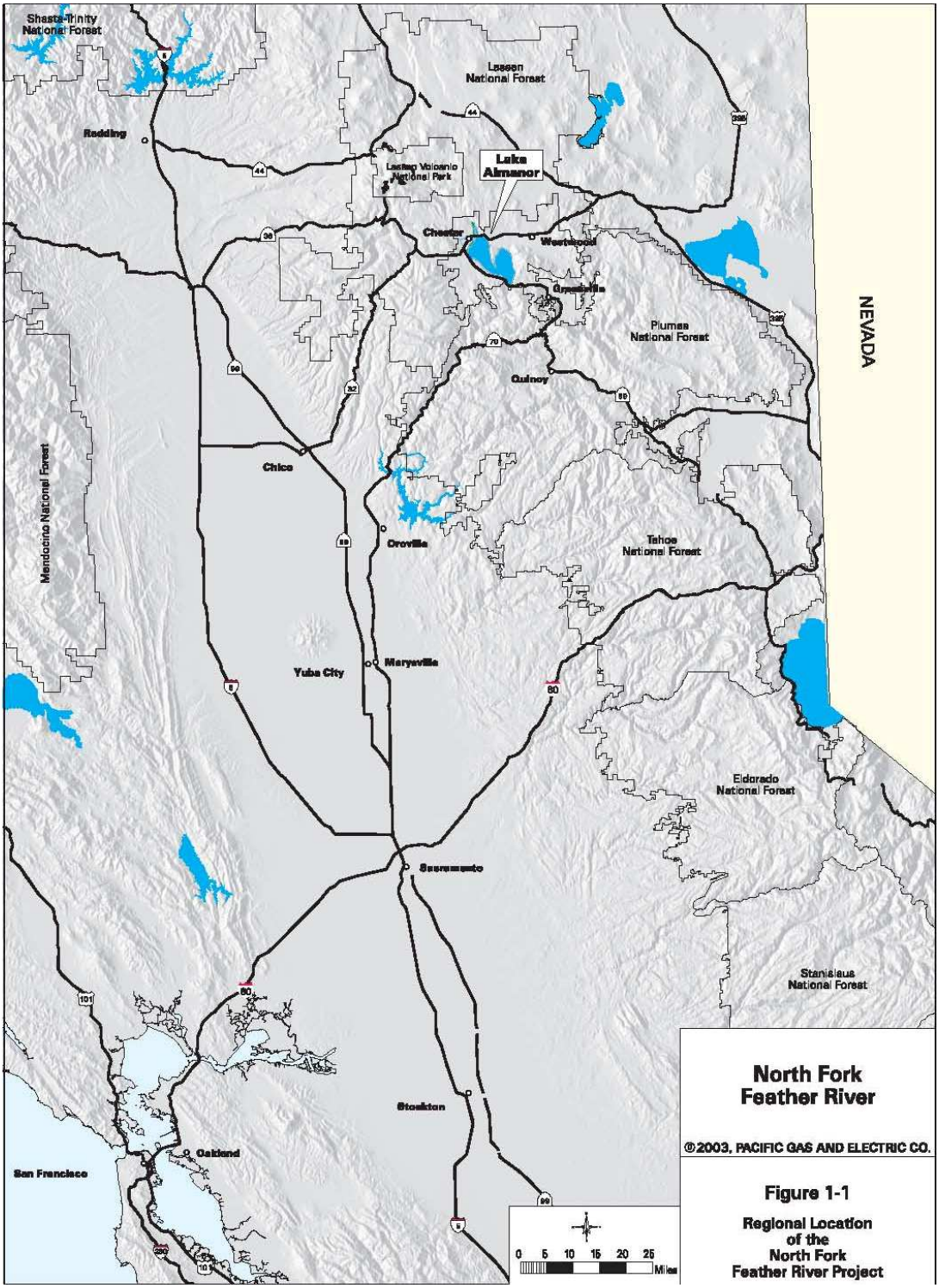


Figure 1-1. Regional Location of Study Area.

2 STUDY DESIGN

2.1 MONITORING PROGRAM

2.1.1 Monitoring Network

An eighth year of compliance water resource monitoring was initiated in June 2009, and continued through September 2009. The monitoring program consisted of monitoring continuous stream flow, local meteorological, and water temperature data from selected locations. All monitoring activities were conducted by staff or contract personnel from the Licensee's Technical & Scientific Support (TSS) under Land & Environmental Management Department.

A map of the system (Figure 2-1) depicts monitoring stations in relation to the major Project features such as powerhouses, reservoirs and bypass reaches. Station identification, location, and monitoring activity are shown in Table 2-1. Results of the 2009 water resource monitoring effort are discussed in Section 3.

2.2 METHODOLOGY

2.2.1 Flow Monitoring

Stream flow was monitored at eight stations (NF1, HB1, NF4, BC3, YC1, MR1, BUCK1, and GR1) located throughout the Project area in 2009. Flow data were also obtained from permanent stream flow gages and powerhouses associated with the Project through Pacific Gas and Electric Company's Hydroelectric Generation Department. Flow monitoring locations are shown on Figure 2-1 and described in Table 2-1.

Table 2-1

Description of NFFR Water Resource Monitoring Locations

Station ID	Alternate Station Identification	Station Location	Monitoring Activity [1]
NF1	----	NFFR above Chester, CA.	F, TR
HB1	----	Hamilton Branch of NFFR at HWY bridge	TR, F
NF-83	----	Hamilton Branch Powerhouse	F
HB2	----	Hamilton Branch Powerhouse – canal head-works	TR
LA1-S	----	Lake Almanor near Canyon Dam - Epilimnion	TR - buoy
LA1-B	----	Lake Almanor near Canyon Dam - Hypolimnion	TR - buoy
LA – P1	----	Lake Almanor near Canyon Dam – near intake	IS-P
LA – P2	----	Lake Almanor - Offshore of Prattville Intake (LA2)	IS-P
LA – P3	----	Lake Almanor – middle of Eastern lobe (LA8)	IS-P
LA – P4	----	Lake Almanor – middle of Western lobe (LA6)	IS-P
LA-MET	----	Meteorological station on Prattville Intake	M
NF-1	11-399000	Lake Almanor near Prattville	Lake storage
NF2	----	NFFR below Canyon Dam	TR,
NF-2	11-399500	NFFR below Canyon Dam	F
NF3	----	NFFR at Seneca	TR
NF4	NF-47 (PG&E)	NFFR above Caribou No.1 Powerhouse	TR F
BV1		Butt Valley Powerhouse Tailrace	TR
NF-71	11-400600	Butt Valley Powerhouse	F
BV2_S	----	BVR near Caribou No.1 Intake - Epilimnion	TR - buoy
BV2_B	----	BVR near Caribou No.1 Intake - Hypolimnion	TR - buoy
BV-P1	----	BVR at Caribou No. 1 Intake	IS-P
BV-P2	----	BVR near Cool Springs Campground	IS-P
BV-P3	----	BVR near boat ramp	IS-P
BV-P4A	----	BVR near Caribou No.2 intake channel	IS-P (special)
BV-P4B	----	BVR at mouth of Caribou No.2 intake channel	IS-P (special)
NF-8	11-401050	Butt Valley Reservoir near Caribou (at dam)	Lake storage
CARB1	----	Caribou No. 1 Powerhouse (internal)	TR
NF-63	11-401110	Caribou No. 1 Powerhouse	F
CARB2	----	Caribou No. 2 Powerhouse tailrace (internal)	TR
CARB2B	----	Caribou No. 2 Intake channel bottom at structure	TR
NF-263	11-401109	Caribou No. 2 Powerhouse	F
BC1	----	Butt Creek upstream of Butt Valley Reservoir	TR
NF-4	11-400500	Butt Creek below ABC tunnel, near BVR	F
BC2	----	Butt Creek downstream of Butt Valley Reservoir	TR
BC3	----	Butt Creek near confluence with NFFR	TR, F
BD1	----	Belden Reservoir at powerhouse intake	TR
NF-67	11-403050	Belden Reservoir	Lake storage
NF-103	----	Oak Flat Powerhouse	F
NF5	---	NFFR below Belden Dam	TR
NF-70	11-401112	NFFR below Belden Dam	F
MC1	----	Mosquito Creek near mouth	TR, F
NF6	----	NFFR near Queen Lily Campground	TR

Table 2-1 Continued

Station ID	Alternate Station Identification	Station Location	Monitoring Activity [1]
NF7	----	NFFR near Gansner Bar	TR
EB1	----	East Branch of NFFR above confluence	TR
NF-51	11403000	East Branch of NFFR above confluence	F
NF8	----	NFFR at Belden Town Bridge	TR
BD2	----	Belden Powerhouse (internal)	TR
NF-74	11-403050	Belden Powerhouse	F
YC1	----	Yellow Creek near mouth	TR, F
RCK-MET	----	Meteorological station on Rock Creek Dam	M
CHIP	----	Chips Creek near mouth	TR, S
NF9	----	NFFR below Rock Creek Dam	TR
NF10	----	NFFR below Rock Creek Dam at NF-57	TR
NF-57	11-403200	NFFR downstream of Rock Creek Dam	F
MR1	----	Milk Ranch Creek near mouth	TR, F
CHAM	----	Chambers Creek near mouth	TR, S
NF11	----	NFFR below Granite Creek	TR
JC1	----	Jackass Creek near mouth	TR
NF12	----	NFFR above confluence with Bucks Creek	TR
BUCK1	11-403700	Bucks Creek near mouth	TR, F
NF-20	----	Bucks Creek Powerhouse	F
BUCK2	----	Bucks Creek Powerhouse tailrace	TR
NF13	----	NFFR above Rock Creek Powerhouse	TR
RC1	11-403800	Rock Creek Powerhouse (internal)	TR
NF-64	----	Rock Creek Powerhouse	F
RC2	----	Rock Creek near mouth	TR, S
NF14	----	NFFR below Cresta Dam	TR
GR1	----	Grizzly Creek near mouth	TR, F
NF15	----	NFFR downstream of Grizzly Creek at NF-56	TR
NF-56	11-404330	NFFR downstream of Grizzly Creek	F
NF16	----	NFFR upstream of Cresta Powerhouse	TR
CR1	----	Cresta Powerhouse (internal)	TR
NF-62	11-404360	Cresta Powerhouse	F
MB1	----	Middle Fork Feather River at Milsap Bar	TR

F = Flow

TR = Temperature Recorder, TR-buoy = Temp Recorders attached to buoy

IS-P = *In Situ* Profile

S = Staff gage

M = Meteorological station data

Each of the temporary flow monitoring stations consisted of a Campbell CR510 digital recorder, associated 5 psi pressure transducer and a stage-pin. The stage-pin and pressure transducer were placed in-stream, while the digital recorder was located on the stream bank in a locked enclosure. The digital recorders were programmed to record instantaneous readings every 15 minutes, and store these data as hourly average transducer values in non-volatile memory. During routine site visits, stream stage was recorded, and the stored hourly average transducer data were downloaded to computer.

A simple linear regression was used to define the relationship between transducer readings and the associated stream stage (stage pin readings) measurements at each station. Average hourly transducer readings were then converted into average hourly stream stage readings using the resultant regression equation. The conversion to a stage value based on a fixed reference (stage pin) facilitated year to year comparison of flow measurements and allowed for correction of errors associated with transducer drift or changes in stream channel morphology.

Stream flow measurements were made at each gaging station during routine site visits. Measurements were made at transects located near each station. Measurements were made using U. S. Geological Survey (USGS) approved stream flow measurement techniques (Buchanan 1980). All measurements were made using a Price AA-type flow meter and a 5-foot top-setting wading rod. The error associated with measurements was estimated to range from 5 to greater than 10% depending on the suitability of the transect.

The primary objective of the routine flow measurements was to cover the range of observed flows in order to develop a stage-flow rating equation.

The relationship of stream stage to stream flow (stage-flow rating) was developed using flow measurements and the associated stage pin readings collected during routine site visits. The resultant stage-flow rating was used to convert average hourly stage readings into average hourly flow. The rating is only applicable to flow within the defined range of stage and is also subject to changes in the hydraulic control (high flows, debris accumulation). All instrumentation installed *in situ* was removed during months when seasonal high flows could damage the equipment.

Daily flow at four secondary tributary streams (Mosquito, Chambers, Chips, and Rock creeks) was estimated based on periodic flow measurements. A linear decay between measurements was assumed to generate a daily flow value. A stage pin was installed at each of these stations to periodically measure stream stage. A total of at least four measurements were made at each station between June and September.

Stream flow and reservoir storage data from the permanent stations operated by the Licensee were collected, compiled, and provided by the Licensee's Hydro Generation Department.

2.2.2 Meteorological Monitoring

Local meteorology was monitored to define the climatic influence on water temperature in the Project area. Two temporary meteorological stations were placed in the Project area. One station was located on the Prattville Intake at Lake Almanor; another was located on Rock Creek Dam. These stations effectively represented conditions in the upper and middle portion of the Project. Parameters that were measured included average wind speed and direction, air temperature, relative humidity, and solar radiation. These parameters were monitored continuously using a Campbell Scientific Model CR10 data logger. Data were collected at 1-second intervals and were reduced to hourly average readings.

2.2.3 Temperature Monitoring

The temperature-monitoring program used recorders from three different manufactures to monitor temperature during the 2009 effort. The bulk of the data loggers deployed in the system were Vemco Model Minilog 12T recorders. Starmon mini recorders manufactured by Star-Oddi were utilized at select stations. Both of these temperature-only units recorded continuous temperature data based on readings taken at 20-minute intervals. Campbell Scientific was the third manufacture utilized during the 2009 monitoring effort. Two different data loggers were used from Campbell Scientific; these include the Model CR510 and CR200 data loggers. The CR510 recorders were used at eight stations to monitor temperature as well as continuous stream stage (flow) (Table 2-1). The CR200 recorders were deployed at five Project powerhouses (Caribou No. 1,

Caribou No. 2, Belden, Rock Creek, and Cresta). The tailrace characteristics of these facilities dictated that the temperature sensors be installed internally in the powerhouse. Both of the Campbell data loggers recorded continuous data as hourly averages based on readings taken at 15-minute intervals. All interval data were later reduced to hourly average.

Water temperature sensors were typically deployed in well-mixed areas with elevated velocity and turbulent flow to ensure representative measurements. Various recorders were used depending on deployment conditions. In general, continuous monitoring of temperature covered the period from June 1 through September 30, 2009.

During the period May through September 2009, vertical temperature profiles were collected from four locations on Lake Almanor and from three locations on Butt Valley Reservoir to determine the magnitude and seasonal development of thermal gradients. Temperature profiles were defined using 1-meter vertical spacing from the surface to the bottom.

In addition to the synoptic profiles collected at the two primary Project reservoirs, vertical temperatures at two depths in Lake Almanor and Butt Valley were continuously monitored from June through September 2009. A thermistor array consisting of Starr-Oddi Starmon Mini recorders were positioned at two depths (near the surface [1.0 meter below surface] and near the bottom [2 meters above bottom to resting on bottom

depending on lake elevation]) at each location. The thermistor array was suspended from a buoy so that each recorder was maintained at a fixed depth below the surface. Continuous temperatures were monitored at a single station near the dam to define the temperature of the release from each reservoir (Figure 2-1).

To verify the operation and accuracy of the temperature recorders, the units were calibrated using an American Society for Testing and Materials (ASTM) reference thermometer, both prior to and following removal from the *in situ* deployment. Typical instrument error is approximately ±0.1°C.

Temperature records from instruments placed internally or in the tailrace of the various project powerhouses were corrected to reflect periods of powerhouse operation. This process was done on an hourly basis by comparing powerhouse load records with temperature recorder data. This process helped eliminate periods when there was little or no flow through the powerhouse and temperatures would reflect stagnate conditions in the penstock.

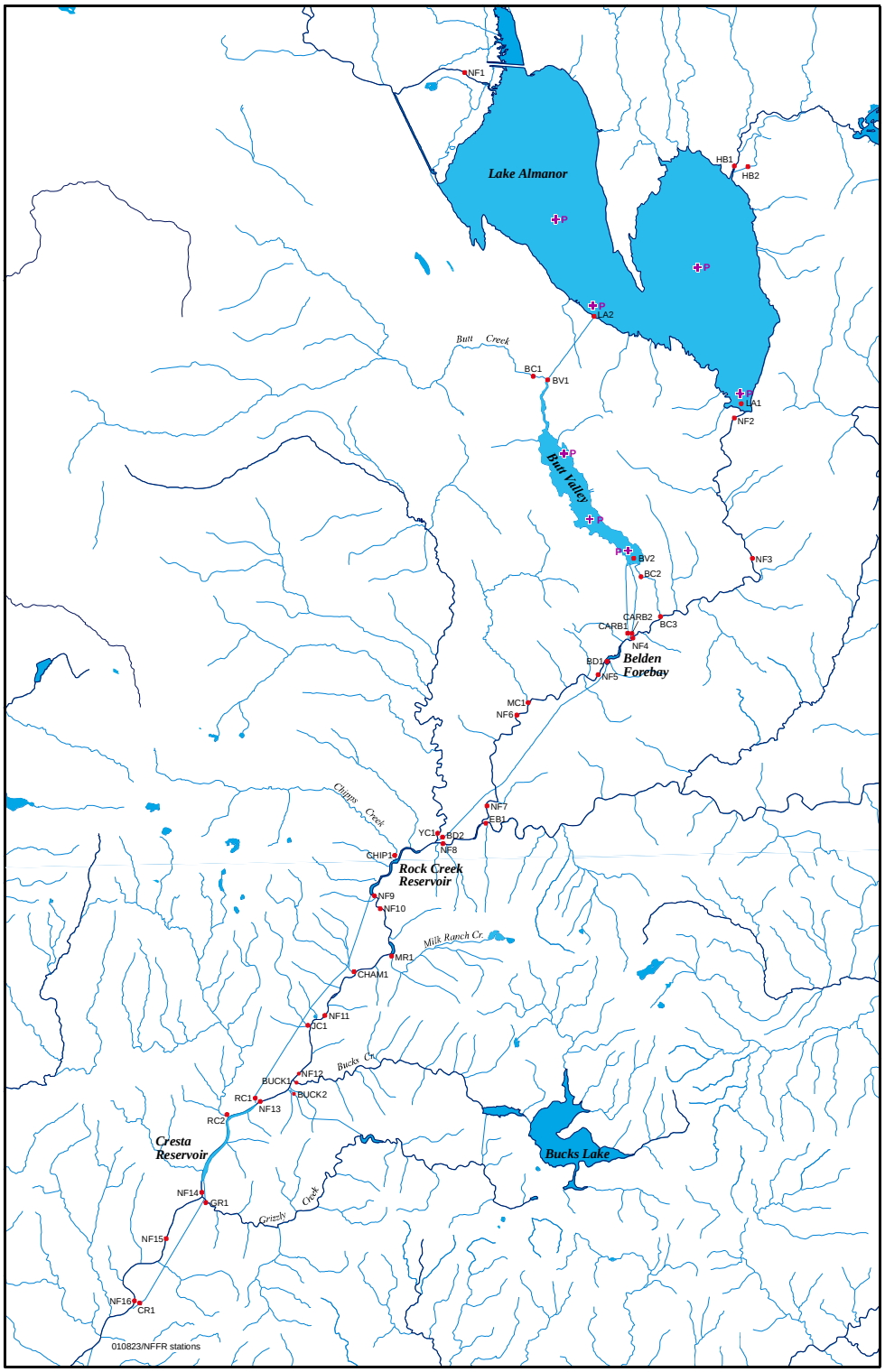


Figure 2-1. Map of Station Locations Used During the 2009 Monitoring Program.

3 MONITORING RESULTS - 2009

3.1 HYDROLOGY AND METEOROLOGY

3.1.1 Stream-flow and Reservoir Operation

The Licensee's Upper NFFR Project (FERC 2105) encompasses the water resources and aquatic habitats of the upper NFFR drainage basin (from Lake Almanor to the NFFR confluence with Yellow Creek [headwaters of Rock Creek Reservoir]). The majority of flow entering the Project originates from water first stored in Lake Almanor. While Licensee operates and maintains the minimum instream flow as stipulated in the license for all by-passed reaches, majority of the water is passed downstream through a series of powerhouses and associated forebays. The Licensee's RCC Project (FERC 1962) encompasses the water resources of the middle portion of the NFFR basin, extending from the confluence of Yellow Creek to the headwaters of Poe Reservoir. In accordance with FERC 1962 License Condition 5 (River Flow Management), 2009 was classified as a Dry Year, Licensee operated all minimum river flow releases in Rock Creek and Cresta reaches to meet required minimum flow conditions.

In addition to the permanent flow monitoring stations, the Licensee installed a series of temporary flow monitoring gages. These gages provided supplemental information in support of the temperature modeling effort. Table 3-1 summarizes stream flow data from all flow-monitoring stations. Stream discharge measurements that were collected in 2009 at each of the temporary stations are summarized in Appendix A, with stage discharge ratings and applied shifts summarized in Appendix B. Data are discussed for the period

Table 3-1

Summary of 2009 Stream Flow Data from Permanent and Temporary Monitoring Stations.

Station	Year	Month	Daily Average Flow [1] (cfs) max	min	mean	Powerhouse Operation [2]	Data Days
NFFR near	2009	June	363	148	253	--	30
Chester (NF1)	2009	July	140	98.0	117	--	29
[Temporary]	2009	Aug	119	52.0	89.3	--	31
	2009	Sept	122	62.2	79.3	--	30
Hamilton Branch	2009	June	77.0	68.4	74.6	--	30
near Road A13	2009	July	76.6	68.6	72.7	--	31
Bridge (HB1)	2009	Aug	92.7	72.6	86.5	--	31
[Temporary]	2009	Sept	91.6	74.9	86.5	--	30
Hamilton Branch	2009	June	0.0	0.0	0.0	0%	30
Powerhouse	2009	July	47.5	0.0	6.56	23%	31
(NF-83) [3]	2009	Aug	49.3	0.0	7.82	23%	31
[Permanent]	2009	Sept	72.8	0.0	32.2	64%	30
Butt Valley	2009	June	683	14	153	10%	30
Powerhouse	2009	July	1,379	758	1,147	78%	31
(NF-71) [3]	2009	Aug	1,667	1,300	1,485	96%	31
[Permanent]	2009	Sept	1,532	814	1,084	75%	30
Butt Creek at ABC	2009	June	70	48.0	56.0	--	30
Tunnel (at BC1) [3]	2009	July	51	41	45	--	31
[NF-4 Permanent]	2009	Aug	44	36.0	39	--	31
	2009	Sept	38.0	35.0	36.2	--	30
NFFR below	2009	June	39.0	37.0	38.2	--	30
Canyon Dam	2009	July	39.0	38.0	38.9	--	31
(NF-2) [3]	2009	Aug	39.0	38.0	38.6	--	31
[Permanent]	2009	Sept	38.0	37.0	37.4	--	30
Butt Creek at	2009	June	13.8	11.7	12.7	--	30
Mouth	2009	July	11.7	11.1	11.3	--	31
(BC3)	2009	Aug	11.3	10.9	11.1	--	31
[Temporary]	2009	Sept	11.8	11.0	11.2	--	30
NFFR above	2009	June	65.6	57.0	59.8	--	30
Caribou PH	2009	July	58.8	54.9	57.0	--	31
(NF4)	2009	Aug	59.1	52.8	56.5	--	31
[Temporary]	2009	Sept	59.6	51.0	57.1	--	30
Caribou No. 1	2009	June	137	59	78	5%	30
Powerhouse	2009	July	962	76	499	57%	31
(NF-63) [3]	2009	Aug	596	264	533	71%	31
[Permanent]	2009	Sept	490	100	310	44%	30

Table 3-1 (Continued)

Station	Year	Month	Daily Average Flow [1] (cfs) max	min	mean	Powerhouse Operation [2]	Data Days
Caribou No. 2	2009	June	564	6.0	171	22%	30
Powerhouse	2009	July	1,267	5.8	693	61%	31
(NF-263) [3]	2009	Aug	1,444	397	911	72%	31
[Permanent]	2009	Sept	1,398	459	755	74%	30
Belden	2009	June	600	60	181	15%	30
Powerhouse	2009	July	1,436	779	1,114	80%	31
(NF-74) [3]	2009	Aug	1,724	637	1,382	68%	31
[Permanent]	2009	Sept	1,544	605	1,066	68%	30
Oak Flat	2009	June	116	0.0	97	--	30
Powerhouse	2009	July	117	0.0	108	--	31
(NF-103) [3]	2009	Aug	116	0.0	97	--	31
[Permanent]	2009	Sept	114	2.2	64	--	30
NFFR below	2009	June	161	146	149	--	30
Belden Dam	2009	July	153	149	151	--	31
(NF-70) [3]	2009	Aug	152	141	143	--	31
[Permanent]	2009	Sept	143	61.0	80.1	--	30
Mosquito Creek	2009	June	7.3	5.2	6.2	--	30
At mouth	2009	July	5.1	3.5	4.2	--	31
(MC1)	2009	Aug	3.5	2.8	3.1	--	31
[Estimate]	2009	Sept	2.8	2.5	2.6	--	30
East Branch	2009	June	504	148	294	--	30
NFFR near NFFR	2009	July	144.0	61.0	86.5	--	31
(NF-51) [3]	2009	Aug	65.0	43.5	54.2	--	31
[Permanent]	2009	Sept	58.2	45.1	52.0	--	30
Yellow Creek	2009	June	150	77.4	106	--	30
Near mouth	2009	July	76.7	63.1	68.8	--	31
(YC1)	2009	Aug	66.3	57.4	60.6	--	31
[Temporary]	2009	Sept	59.7	55.0	57.5	--	30
Chips Creek	2009	June	106	36.8	64.3	--	30
Near mouth	2009	July	35.6	18.2	25.0	--	31
(CHIP)	2009	Aug	17.9	14.0	15.5	--	31
[Estimate]	2009	Sept	14.0	13.1	13.5	--	30
NFFR below	2009	June	303	254	269	--	30
Rock Creek Dam	2009	July	465	246	276	--	31
(NF-57) [3]	2009	Aug	641	277	309	--	31
[Permanent]	2009	Sept	649	259	303	--	30

Table 3-1 (Continued)

Station	Year	Month	Daily Average Flow [1] (cfs) max	min	mean	Powerhouse Operation [2]	Data Days
Milk Ranch Creek	2009	June	29.1	10.9	19.5	--	30
Near mouth	2009	July	10.4	5.29	7.46	--	31
(MR1)	2009	Aug	5.72	4.08	4.74	--	31
[Temporary]	2009	Sept	4.58	3.59	3.88	--	30
Chambers Creek	2009	June	22.6	6.92	13.0	--	30
Near mouth	2009	July	6.69	3.20	4.52	--	31
(CHAM)	2009	Aug	3.15	2.47	2.73	--	31
[Estimate]	2009	Sept	2.46	2.33	2.38	--	30
Bucks Creek	2009	June	41.8	24.6	31.8	--	30
Near Mouth	2009	July	23.1	15.4	17.2	--	31
(BUCK1)	2009	Aug	16.8	13.9	15.1	--	31
[Temporary]	2009	Sept	14.5	12.8	13.8	--	30
Bucks Creek	2009	June	152	7.18	58.7	51%	30
Powerhouse	2009	July	172	2.70	104	35%	31
(NF-20) [3]	2009	Aug	176	67.2	125	43%	31
[Permanent]	2009	Sept	200	26.5	108	36%	30
Rock Creek	2009	June	853	431	618	68%	30
Powerhouse	2009	July	1,529	853	1,195	77%	31
(NF-64) [3]	2009	Aug	1,490	723	1,359	68%	31
[Permanent]	2009	Sept	1,241	516	978	73%	30
Rock Creek	2009	June	73.8	11.2	30.9	--	30
Near mouth	2009	July	10.7	4.79	6.97	--	31
(RC2)	2009	Aug	4.71	3.33	3.90	--	31
[Estimate]	2009	Sept	3.31	2.80	3.02	--	30
Grizzly Creek	2009	June	65.4	40.2	51.7	--	30
Near mouth	2009	July	39.6	17.1	26.4	--	31
(GR1)	2009	Aug	17.7	11.4	13.9	--	31
[Temporary]	2009	Sept	12.6	9.49	11.0	--	30
NFFR below	2009	June	546	472	505	-----	30
Grizzly Creek	2009	July	457	328	346	-----	31
(NF-56) [3]	2009	Aug	337	307	320	-----	31
[Permanent]	2009	Sept	381	309	353	-----	30
Cresta	2009	June	1,020	370	619	67%	30
Powerhouse	2009	July	1,671	901	1,328	73%	31
(NF-62) [3]	2009	Aug	2,008	754	1,534	68%	31
[Permanent]	2009	Sept	1,629	509	1,139	76%	30

1. Daily values are based on hourly average data, monthly statistics represent the maximum, minimum, and mean based on these hourly average flows.

2. Percent powerhouse operation is based on hourly generation data.

3. Source - Pacific Gas and Electric Company, 2009.

June 1 through September 30 (referred to as the monitoring period) unless stated otherwise.

3.1.1.1 Lake Almanor and tributaries

The major tributaries feeding into Lake Almanor are the NFFR at Chester with an historic average annual flow of approximately 335 cubic feet per second (cfs), the Hamilton Branch with an historic average flow of 190 cfs, and a number of minor tributaries including Benner, Last Chance, and Bailey creeks.

Flow in the NFFR upstream of Lake Almanor (which provides an estimated 50 percent of the annual inflow to Lake Almanor) is derived from headwaters on the slopes of Mount Lassen. During the 2009 monitoring program, flow in the NFFR upstream of Lake Almanor was measured at a temporary stream gage (NF1) located upstream of the city of Chester, California. The stream gaging system was installed on May 20th. Stream flow measurements at this location in 2009 recorded hourly average flows ranging from 89.3 to 376 cfs. These measurements indicated that NF1_R2007 rating was representative of channel conditions; stage shifts ranging from 0.15 to 0.39 ft were utilized to adjust the rating to measured conditions. Based on the NF1_R2007 rating, flows over 414 cfs are beyond the 10 % range acceptable for extrapolating a rating and were not estimated (given a value of greater than 414). Based on the limits of NF1_R2007 stage-discharge rating, daily average flow at NF1 for the period June 1 through September 30, 2009 ranged from 52.0 to 363 cfs, with an average of 135 cfs. A maximum hourly average

flow of 381 cfs was calculated based on the maximum hourly average stage (2.12 ft). Figure 3.1 compares daily average flow from NF1 with two other stations tributary to Lake Almanor.

Flow in the Hamilton Branch (which provides 20 to 25 percent of the annual inflow to Lake Almanor) originates from the Licensee's Mountain Meadows Project. During the 2009 monitoring program, flow in the Hamilton Branch was measured upstream of Lake Almanor at a temporary stream gage (HB1). This station is located downstream of a series of small diversion facilities that diverts flow into a canal that supplies the Licensee's Hamilton Branch Powerhouse. Stream flow measurements made in 2009 at the HB1 location recorded flows ranging from 68.4 to 83.3 cfs. These measurements supported the existing R2003_HB1 rating. Based on this rating, flows over 166 cfs are beyond the 10 % range acceptable for extrapolating a rating and were not estimated (given a value of greater than 166). Based on the limits of the HB1_R2003 stage-discharge rating, daily average flow at HB1 for the period June 1 through September 30, 2009 ranged from 68.4 to 92.7 cfs, with an average of 80.1 cfs. A maximum hourly average flow of 99.8 cfs was calculated based on the maximum recorded hourly average stage (2.52 ft). Figure 3.1 compares daily average flow from HB1, with two other stations tributary to Lake Almanor.

The second location used for monitoring flow from Mountain Meadows Reservoir as inflow to Lake Almanor was the Licensee's Hamilton Branch Powerhouse (NF-83). This

facility is located at the mouth of the Hamilton Branch River and discharges directly into Lake Almanor (Figure 2-1). During the June-September 2009 monitoring period, daily average flows at the Hamilton Branch Powerhouse averaged 11.7 cfs and ranged from 0 to 72.8 cfs (Pacific Gas and Electric Company 2009). The facility was shut down for a number of extended periods during the 2009 monitoring effort, only operating on a consistent basis after September 11 through the remainder of the monitoring period. Figure 3-1 compares daily average flow from HB2 with two other stations tributary to Lake Almanor.

Lake Almanor is the primary storage reservoir for the Upper NFFR Project. It is located about 90 miles upstream of the city of Oroville. Lake Almanor was created by the construction of a hydraulic fill dam now referred to as Canyon Dam. Canyon Dam was completed in various phases between 1913 and 1927. Lake Almanor has a normal maximum water surface elevation of 4504 ft (USGS datum) and a storage capacity of 1,142,00 acre-ft. The average residence time in Lake Almanor is approximately 291 days. Lake outlets are the Canyon Dam Intake, which releases water to the NFFR downstream of Lake Almanor, and the Prattville Intake that diverts water to Butt Valley Reservoir through Butt Valley Powerhouse. Figure 3-2 presents daily average reservoir storage and elevation for Lake Almanor for the monitoring period.

Releases from the Prattville Intake to Butt Valley Reservoir represent the greatest portion of water released from Lake Almanor. The maximum flow through the intake is 2200

cfs. The Prattville Intake is a high-Froude number structure; as a result, water is drawn from the entire water column regardless of thermal stratification conditions. The tunnel invert is situated at the bottom of a narrow steep-sided trough that connects the relatively shallow intake channel with the deeper areas of the reservoir. The invert of the Prattville Intake is located at an elevation of 4420 ft. (USGS datum). However, access to the deeper areas of Lake Almanor is restricted by the shallow approach channel that has a base elevation of 4,432 ft (USGS datum). Thus, the water withdrawn by the Prattville Intake is primarily from the warmer layers in the lake due to the restriction of the approach channel.

3.1.1.2 Butt Valley Reservoir and tributaries

The main source of inflow to Butt Valley Reservoir is the discharge from Butt Valley Powerhouse (NF-71), which draws water from Lake Almanor at Prattville Intake. During the June-September 2009 monitoring period, daily average flows in Butt Valley Powerhouse averaged 967 cfs and ranged from 14 to 1667 cfs (Pacific Gas and Electric Company 2009). Figure 3-3 compares daily average flow through Butt Valley Powerhouse with those from the other powerhouses associated with the Upper NFFR Project.

Butt Creek is the only significant natural tributary entering Butt Valley Reservoir. During the 2009 monitoring period, daily average flows in Butt Creek (BC1 at NF-4

gage) ranged from 35.0 to 70.0 cfs, with an average flow of 44.0 cfs (Pacific Gas and Electric Company 2009) (Figure 3-3A).

On an annual basis, the Butt Valley Reservoir water surface elevations fluctuate by about 10 to 15 feet from the maximum water surface elevation of 4142 ft. (USGS datum). Under normal operating conditions, daily changes in elevation are typically less than 1 foot. The retention time for water traveling through the reservoir is 14 to 32 days depending on operating conditions. Figure 3-4 presents daily average storage and elevation for Butt Valley Reservoir for the June through September 2009 monitoring period.

The primary outflow from the Butt Valley Reservoir is through the intakes for Caribou No. 1 and No. 2 powerhouses. The Caribou No. 1 Intake has a capacity of about 1,100 cfs and is located in the deepest area of Butt Valley Reservoir near the dam. The Caribou No. 1 Intake tunnel invert elevation is at 4077 ft. (USGS datum). The actual Caribou No. 1 Intake structure is located in a small depression zone. The most recent bathymetric surveys (April 1996) indicated that the main approach channel has an elevation of 4095 ft. (USGS datum). Caribou No. 2 Intake has a larger capacity (1460 cfs) and is more efficient than the Caribou No. 1 Intake, and is located in a shallow channel with an entrance elevation (channel invert) of 4110 ft. (USGS datum). Because of the higher invert elevation, the Caribou No. 2 Intake withdraws warmer surface water from the reservoir.

No controlled minimum release is made from Butt Valley Dam to the Butt Creek channel downstream of the reservoir. The reservoir rarely spills due to the large combined outflow capability of Caribou No. 1 and No. 2 powerhouses (a combined total of 2560 cfs). The Licensee has monitored leakage flows in Butt Creek below Butt Valley Dam since 1997 to ensure that leakage flows were not reduced after seismic restoration work on the dam was completed in 1997. The average annual leakage flow is about 0.07 cfs (32 gallons per minute). Flow conditions in Butt Creek below Butt Valley Dam will be discussed in the following Section.

3.1.1.3 Seneca Reach of the NFFR and tributaries

The Seneca bypass reach (Seneca Reach) consists of a 10.8-mile section of the NFFR extending from Canyon Dam to Caribou No. 1 Powerhouse. A seasonally constant minimum of 35 cfs is released from Canyon Dam to the NFFR in accordance with Article 26 of FERC License 2105. Flows are measured by the Licensee in cooperation with the USGS at a permanent gaging station (NF-2) located approximately 0.5 miles downstream of the release structure. During the 2009 monitoring period, daily average flows in NFFR below Canyon Dam (NF-2) ranged from 37.0 to 39.0 cfs, and averaged 38.3 cfs (Pacific Gas and Electric Company 2009).

Butt Creek enters the NFFR approximately 1.25 miles upstream of Belden Forebay. Butt Creek is the largest of the NFFR tributaries in the Seneca Reach. There are no minimum flow requirements for Butt Creek below Butt Valley Reservoir. Flows in Butt Creek

downstream of Butt Valley Dam consist primarily of spring flow accretion, supplemented with leakage from the Butt Valley Dam, and tributary inflow from Benner Creek. The temporary stream gage located near the mouth of Butt Creek (BC3) was installed on May 20, 2009. Stream flow measurements at this location in 2009 recorded hourly average flows ranging from 11.0 to 12.0 cfs. These measurements supported the existing BC3_R2008. Based on this rating, flows over 15.1 cfs are beyond the 10 % range acceptable for extrapolating a rating and were not estimated (given a value of greater than 15.1). Based on the limits of the BC3_R2008 stage-discharge rating, mean daily flow at BC3 for the period June 1 through September 30, 2009 ranged from 10.9 to 13.8 cfs, with an average of 11.6 cfs.

The monitoring station located on the NFFR above Caribou Powerhouse (NF4 temperature station) is also the site of a discontinued permanent gage (NF-47). This station captures the total flow entering Belden Forebay from the Seneca Reach. Stream flow measurements at NF4 in 2009 recorded hourly average flows ranging from 59.9 to 67.4 cfs. These measurements supported the existing NF4_R2005 rating. Based on this rating, flows over 148 cfs are beyond the 10 % range acceptable for extrapolating a rating and were not estimated (given a value of greater than 148). Based on the limits of this stage-discharge rating, daily average flow at NF4 for the period June 1 through September 30, 2009 ranged from 51.0 to 65.6 cfs, with an average of 57.6 cfs. A maximum hourly average flow of 68.7 cfs was calculated based on the maximum recorded hourly average stage (2.60 ft).

The total mean daily tributary and lateral accretion flows were calculated for the entire Seneca Reach. For the June 1 through September 30, 2009 period, tributary flows ranged from 13.8 to 26.6 cfs, and averaged 19.3 cfs. The measured range of accretion exclusive of Butt Creek ranged from 2.2 to 12.8 cfs, averaging 7.7 cfs.

3.1.1.4 Belden Forebay and Caribou Powerhouse complex

Belden Reservoir is located on the NFFR approximately 10.8 miles downstream of Canyon Dam. Belden Forebay forms the afterbay for the Caribou Powerhouses, and is the forebay for Belden Powerhouse. The forebay was created by a rock-filled dam in 1958 and has a maximum water surface elevation of 2985 ft. (USGS datum) and a theoretical usable storage capacity of 2477 acre-ft. Under normal operation, the water surface elevation fluctuates between 2960 ft. and 2973 ft (USGS datum) depending on power operations. Lake Almanor and Butt Valley Reservoir control the majority of upstream run-off; as a result, spill events at Belden Dam are rare. Belden Forebay has limited storage capability and therefore the operation of the Caribou powerhouses is closely coordinated with the operation of Belden Powerhouse as well as Licensee's other downstream powerhouses. The average residence time in Belden Reservoir is estimated at approximately 0.5 to 1.0 days.

The majority of flow entering Belden Forebay originates from Butt Valley Reservoir and is discharged through the Caribou No. 1 and No. 2 powerhouses. These powerhouses have average annual flow rates of 615 and 674 cfs, respectively (Pacific Gas and Electric

Company 1999). Additional inflow is received from the Seneca Reach of the NFFR; the average annual inflow from this source is approximately 125 cfs (NF-47 1970-1988 PG&E archive). Caribou No. 1 was completed in 1921 and Caribou No. 2 was completed in 1958. Depending on water availability and power requirements, one or both powerhouses may be used. The generating units at Caribou No. 2 are more efficient than those at Caribou No. 1, and their operation is favored.

During the 2009 monitoring period, daily average flows at Caribou No. 1 Powerhouse (NF-63) ranged from 59 to 962 cfs, and averaged 355 cfs (Pacific Gas and Electric Company 2009). Flow through the Caribou No. 2 Powerhouse (NF-263) during 2009 ranged from 6 to 1444 cfs, and averaged 633 cfs (Pacific Gas and Electric Company 2009). Figure 3-3 compares daily average flow through the Caribou No. 1 and No. 2 powerhouses with those from the other powerhouses associated with the Upper NFFR Project.

The primary outflow from Belden Forebay is through an intake structure located on the left bank (looking downstream) near Belden Dam. This intake provides flows of up to 2610 cfs to Belden Powerhouse, which is located on Yellow Creek immediately upstream of the confluence of Yellow Creek with the NFFR. Water released from Belden Powerhouse enters the NFFR at its confluence with Yellow Creek; this flow enters the Licensee's Rock Creek Reservoir immediately downstream. During the 2009 monitoring period, daily average flow at Belden Powerhouse (NF-74) ranged from 60 to 1724 cfs,

and averaged 936 cfs (Pacific Gas and Electric Company 2009). Figure 3-3 compares daily average flow through Belden Powerhouse with those from the other powerhouses associated with the Upper NFFR Project.

3.1.1.5 Belden Reach of the NFFR and tributaries

The Belden bypass reach (Belden Reach) is a 9.3-mile section of the NFFR extending from Belden Dam to the confluence of the NFFR and Yellow Creek. Prior to July 1985, releases from Belden Forebay to the NFFR immediately downstream of the Belden Dam were made from a low-level release in the dam or its upper spillway gates. Oak Flat Powerhouse was completed in 1985 and operates on the instream flow release made at the base of Belden Forebay Dam. To accommodate the two flow rates, the turbine has a high flow and a low flow runner. These runners are changed in the spring and fall. This change-out takes a few days and during this time the instream flow is met by releasing water through the pressure release valve at the end of the outlet pipe so that a continuous release is maintained. During the 2009 monitoring period, daily average flows through Oak Flat Powerhouse (NF-103) ranged from 0 to 117 cfs, and averaged 91.4 cfs (Pacific Gas and Electric Company 2009).

Under the terms of FERC License 2105 and the California Department of Fish and Game (CDFG) agreement, the Licensee releases a minimum of 140 cfs from the last Saturday in April to Labor Day and 60 cfs during the rest of the year to the NFFR downstream of Belden Dam (Belden Reach of the NFFR) for the maintenance of fish life. The instream

flow releases from Belden Dam are measured at a compliance stream gage located approximately 0.5 miles downstream of the Belden Dam-Oak Flat Powerhouse complex. During the 2009 monitoring period, daily average flows in the NFFR below Belden Dam (NF-70) ranged from 61.0 to 161 cfs, and averaged 131 cfs (Pacific Gas and Electric Company 2009).

Mosquito Creek is the largest tributary to the NFFR between Belden Forebay and the NFFR confluence with the EBNFFR. Flows in Mosquito Creek (MC1) typically range from 2 to 10 cfs during the period June through September (Pacific Gas and Electric Company 1987). Flows in Mosquito Creek were estimated based on periodic flow measurements and a curvilinear regression estimating the runoff decay between measurements. Based on this estimation, daily average flows during the June 1 through September 30, 2009 period ranged from 2.5 to 7.3 cfs, averaging 4.0 cfs.

The EBNFFR is a large unregulated tributary of the NFFR with an average annual flow of 1,031 cfs (Pacific Gas and Electric Company 1999). The EBNFFR and the NFFR merge approximately 1.75 miles upstream of the confluence with Yellow Creek. Winter and spring flows in the EBNFFR are sufficient under most conditions to allow the Licensee to operate the Upper NFFR Project such that water is stored in Lake Almanor until required by the downstream production facilities. During the 2009 monitoring period, daily average flows in EBNFFR (NF-51) ranged from 43.5 to 504 cfs, with an average of 122 cfs (Pacific Gas and Electric Company 2009).

Yellow Creek is one of the larger tributary streams contributing to the NFFR downstream of the confluence with the EBNFFR. Typical flows in Yellow Creek (YC1) range from 40 to 170 cfs during the June through September period (Pacific Gas and Electric Company 1986, 1987). Flows were calculated based on hourly average stage data using a rating curve developed with periodic flow measurements. Stream flow measurements at this location in 2009 recorded hourly average flows ranging from 47.3 to 152 cfs. These measurements supported the existing YC1_R2006r2 rating. Based on this rating, flows over 248 cfs are beyond the 10 % range acceptable for extrapolating a rating and were not estimated (given of value of greater than 248). Based on the limits of YC1_R2006r2 stage-discharge rating, daily average flow at YC1 for the period June 1 through September 30, 2009 ranged from 55.0 to 150 cfs, with an average of 73.1 cfs. A maximum hourly average flow of 167 cfs was calculated based on the maximum recorded hourly average stage and shift correction.

3.1.1.6 Rock Creek Reach of the NFFR and tributaries

Rock Creek Dam is located on the NFFR approximately 3.0 miles downstream of Belden Powerhouse. Rock Creek Reservoir forms the afterbay for Belden Powerhouse, and is the forebay for Rock Creek Powerhouse. The forebay was created by a concrete dam in 1950 and has a maximum water surface elevation of 2216.2 ft. (USGS datum). Rock Creek Reservoir's original operating capacity of 4400 acre-feet at 2216.2 ft. has been significantly reduced (greater than 50%) by sediment accumulation (PG&E, 2004).

Chips Creek is a major tributary of the NFFR, discharging directly into Rock Creek Reservoir. Flows in Chips Creek (CHIP) were estimated based on periodic flow measurements and a curvilinear regression estimating the runoff decay between measurements. Based on this estimation, daily average flows during the June 1 through September 30, 2009 period ranged from 13.1 to 106 cfs, averaging 29.4 cfs.

The Rock Creek bypass reach (Rock Creek Reach) is an 8.4-mile section of the NFFR extending from Rock Creek Dam to the tailrace of Rock Creek Powerhouse. Under the terms of the FERC License (Dated October 24, 2001), the Licensee is required to release a minimum of 210 cfs in the June-September period. Run-off conditions in 2009 were classified as a dry year.

The instream flow releases from Rock Creek Dam to the Rock Creek Reach of the NFFR are measured at a stream gage located approximately 1.5 miles downstream of the dam. During the 2009 monitoring period, daily average flows in the NFFR below Rock Creek Dam (NF-57) ranged from 246 to 649 cfs, and averaged 289 cfs (Pacific Gas and Electric Company 2009). All instream releases were higher than the 210 cfs minimum required to ensure the flow is in compliance. Three pulse flow events were made in the Rock Creek Reach to accommodate recreational user per license requirement.

Milk Ranch Creek is one of several tributaries to the Rock Creek Reach of the NFFR. Flows in Milk Ranch Creek were monitored using a temporary flow monitoring gage

installed near the mouth (MR1). Flows were calculated based on hourly average stage data, and a rating developed using periodic flow measurements. Stream flow measurements at this location in 2009 captured flows ranging from 2.34 to 35.6 cfs. These measurements indicated that a new rating was necessary; as a result rating MR1_R2009 was developed. Based on this rating, flows over 39.2 cfs are beyond the 10 % range acceptable for extrapolating a rating and were not estimated (given a value of greater than 39.2). Based on the limits of this stage-discharge rating, daily average flow at MR1 for the period June 1 through September 30, 2009 ranged from 2.45 to 17.2 cfs, with an average of 4.89 cfs. A maximum hourly average flow of 24.5 cfs was calculated based on the maximum recorded hourly average stage.

Chambers Creek is another tributary to the Rock Creek Reach of the NFFR. Flows in Chambers Creek (CHAM) were estimated based on periodic flow measurements and a curvilinear regression estimating the runoff decay between measurements. Based on this estimation, daily average flows during the June 1 through September 30, 2009 period ranged from 2.33 to 22.6 cfs, and averaged 5.63 cfs.

Flows in Bucks Creek were monitored using a temporary flow monitoring gage installed near the mouth (BUCK1). Flow in Bucks Creek originates from Lower Bucks Reservoir. Flows were calculated based on hourly average stage data, and a rating developed using periodic flow measurements. Stream flow measurements at this location in 2009 captured flows ranging from 12.2 to 45.5 cfs. These measurements supported the

existing BUCK1 _R2008 rating. Based on this rating, flows over 49.8 cfs are beyond the 10 % range acceptable for extrapolating a rating and were not estimated (given a value of greater than 49.8). Based on the limits of this stage-discharge rating, daily average flow at BUCK1 for the period June 1 through September 30, 2009 ranged from 12.8 to 41.8 cfs, an averaged 19.5 cfs. A maximum hourly average flow of 47.8 cfs was calculated based on the maximum recorded hourly average stage (1.38 ft).

The source of flow to Bucks Powerhouse is Grizzly Forebay, which receives diversion flow from Bucks Lake through Lower Bucks Lake. Bucks Powerhouse has a maximum capacity of 340 cfs; flows are released to the NFFR immediately upstream of Rock Creek Powerhouse. During the 2009 monitoring period, daily average flow at Bucks Powerhouse (NF-20) ranged from 2.70 to 200 cfs, and averaged 99.1 cfs (Figure 3-5) (Pacific Gas and Electric Company 2009).

The primary outflow from Rock Creek Reservoir is through an intake structure located on the right bank (looking downstream) near Rock Creek Dam. This intake provides flows of up to 2880 cfs to Rock Creek Powerhouse, which is located on the NFFR upstream Cresta Reservoir. During the 2009 monitoring period, daily average flow at Rock Creek Powerhouse (NF-64) ranged from 431 to 1529 cfs, and averaged 1038 cfs (Pacific Gas and Electric Company 2009). Figure 3-5 compares daily average flow through Rock Creek Powerhouse with those from the other powerhouses associated with the RCC Project.

3.1.1.7 Cresta Reach of the NFFR and tributaries

Cresta Reservoir is located on the NFFR immediately downstream of Rock Creek Powerhouse. Cresta Reservoir forms the afterbay for Rock Creek Powerhouse, and is the forebay for Cresta Powerhouse. The forebay created by a concrete dam build in 1949 has a maximum water surface elevation of 1681.20 ft (USGS datum). The original capacity of 4410 acre-feet has been significantly reduced to half of the original capacity by accumulated sediments (PG&E, 2004).

Rock Creek flows enter the NFFR at the upper end of Cresta Reservoir. Flows in Rock Creek (RC2) were estimated based on periodic flow measurements and a curvilinear regression estimating the runoff decay between measurements. Based on this estimation, daily average flows during the June 1 through September 30, 2009 period ranged from 2.80 to 73.8 cfs, averaging 11.1 cfs.

The Cresta bypass reach (Cresta Reach) is a 4.9-mile section of the NFFR extending from Cresta Dam to the tailrace of Cresta Powerhouse. Under the terms of the FERC License (Dated October 24, 2001), the Licensee was required to release a minimum of 260 cfs in the June-September period. In 2009 the Cresta Reach MIF release was revised to compensate for lost recreational opportunities during the summer period. The June MIF was raised to 400 cfs; with 260 cfs released during the period July through September. This revision was approved and endorsed by the Rock Creek ERC in August 2008

Flows in Grizzly Creek were monitored using a temporary flow monitoring gage installed near the mouth (GR1). Flows were calculated based on hourly average stage data, and a rating developed using periodic flow measurements. Stream flow measurements at this location in 2009 captured flows ranging from 12.6 to 75.5 cfs. These measurements supported the existing GR1_R2008 rating. Based on this rating, flows over 102 cfs are beyond the 10 % range acceptable for extrapolating a rating and were not estimated (given a value of greater than 102). Based on the limits of the GR1_R2008 stage-discharge rating, daily average flow at GR1 for the period June 1 through September 30, 2009 ranged from 9.49 to 65.4 cfs, an averaged 25.7 cfs. A maximum hourly average flow of 75.1 cfs was calculated based on the maximum recorded hourly average stage.

The instream flow releases from Cresta Dam to the Cresta Reach of the NFFR are measured at a permanent stream gage located approximately 2.8 miles downstream of the dam, and 2.4 miles downstream of Grizzly Creek. During the 2009 monitoring period, daily average flows in the NFFR below Grizzly Creek (NF-56) ranged from 307 to 546 cfs, and averaged 381 cfs (PG&E, 2009). All instream releases were higher than the minimum required to ensure compliance with the minimum instream flow requirement. Unlike Rock Creek Reach, there were no recreational flows in Cresta Reach during the July-August period.

The primary outflow from Cresta Reservoir is through an intake structure located on the left bank (looking downstream) near Cresta Dam. This intake provides flows of up to 3560 cfs to Cresta Powerhouse, which is located on the NFFR upstream of Poe Reservoir. During the 2009 monitoring period, daily average flow at Cresta Powerhouse (NF-62) ranged from 370 to 2008 cfs, and averaged 1155 cfs (Pacific Gas and Electric Company 2009). Figure 3-5 compares daily average flow through Cresta Powerhouse with those from the other powerhouses associated with the RCC Project.

3.1.2 Meteorology

3.1.2.1 2009 Regional Precipitation

Mean annual precipitation in the upper NFFR watersheds ranges from a low of 20 inches (in eastern portions of the EBNFFR watershed) to a high of 90 inches in the northwestern part of the watershed near Mount Lassen (California Data Exchange Center [CDEC] 2009). Most of the precipitation in the basin occurs from October through May, with maximum storm intensities occurring December through March. Winter precipitation at higher elevations usually occurs as snow, although warm winter storms can produce rain up to the 10,000-ft level. The typical April 1 snow accumulations range from 6 inches of water at an elevation of 5000 ft, to 27 inches of water at 7000 ft. (CDEC 2009). Larger snow accumulations occur on Mount Lassen, with an average April 1 snow-water-equivalent of 80 inches.

The mean annual precipitation within the Project area ranges from about 30 to 40 inches (CDEC 2009). Table 3-2 summarizes precipitation data from select stations in the Project area. The data from the four stations presented in Table 3-2 broadly define conditions in the upstream watersheds and immediate Project area. Total precipitation during the 2009 water year (October 2007 to September 2009) averaged 89% of normal for these four stations (CDEC 2009). Table 3-3 summarizes snow survey data from select stations in the upper NFFR watershed. As indicated, April 1 water equivalents at all but one station were below normal.

3.1.2.2 2009 Monitoring at Prattville Intake and Rock Creek Dam

Two temporary meteorological stations were installed in the Project vicinity during the 2009 monitoring period. One station was located at the Prattville Intake on Lake Almanor; another station was located on Rock Creek Dam. The data collected at these meteorological stations in 2009 are summarized in Table 3-4.

Table 3-2

Summary of 2009 Precipitation Data from Meteorological Stations in the NFFR Watershed.

		Water Year* (inches)												Annual
Station	**YEAR**	**Oct.**	**Nov.**	**Dec.**	**Jan.**	**Feb.**	**Mar.**	**Apr.**	**May**	**Jun.**	**Jul.**	**Aug.**	**Sept.**	**Total**
Chester	2009	1.71	3.99	3.31	1.34	6.85	4.82	0.68	2.98	1.06	0.40	0.17	0.00	27.31
4525 ft.	% of Normal	85%	107%	63%	22%	131%	120%	31%	204%	114%	174%	61%	0%	86%
(CHS)	Average	2.01	3.73	5.24	6.00	5.24	4.02	2.18	1.46	0.93	0.23	0.28	0.60	31.92
Canyon Dam	2009	2.00	8.31	4.01	1.83	8.94	6.08	0.97	3.01	1.05	0.00	0.15	0.01	36.36
4560 ft.	% of Normal	88%	187%	62%	24%	142%	119%	35%	182%	135%	0%	52%	2%	95%
(CNY)	Average	2.28	4.44	6.49	7.58	6.30	5.11	2.76	1.65	0.78	0.18	0.29	0.58	38.44
Greenville	2009	1.94	4.14	3.92	2.17	6.94	6.61	0.51	3.38	1.00	--	--	--	30.61
3570 ft.	% of Normal	76%	77%	63%	30%	111%	124%	19%	218%	128%	--	--	--	78%
(GNV)	Average	2.55	5.35	6.26	7.22	6.26	5.35	2.68	1.55	0.78	0.26	0.36	0.78	39.40
DeSabla	2009	4.49	5.37	8.18	4.68	22.84	7.47	0.94	5.98	0.76	0.00	0.00	0.96	61.67
3710 ft.	% of Normal	117%	71%	75%	38%	218%	89%	18%	277%	80%	0%	0%	132%	98%
(DSB)	Average	3.85	7.61	10.94	12.29	10.47	8.39	5.11	2.16	0.95	0.10	0.23	0.73	62.83

Data Source – CDEC 2009.

* Water year is period October 1 through September 30

Table 3-3 Continued.

Summary of 2009 Snow Survey Data from the Upper NFFR Watershed

Station	Elevation (ft. USGS)	2009 April 1 Water Equivalents (inches)	Average April 1 Water Equivalents (inches)
Lower Lassen Peak	8250	66.5	80.2
Mount Dyer 1	7100	26.7	25.9
Mount Dyer 2	6050	13.5	16.6
Harkness Flat	6200	16.6	28.5
Mount Stover	5600	5.9	14.7
Feather River Meadows	5400	15.8	23.1
Warner Creek	5100	6.3	14.7
Humbug Summit 2	4850	9.0	14.3
Chester Flat	4600	0.0	6.1

Data Source – CDEC 2009

Table 3-4

Summary of 2009 Meteorological Data from Prattville and Rock Creek Dam Stations

Prattville Intake Station

Station	Units	Year	Month	Daily Average [1] Max	Min	Mean	Data Days
Air Temperature	(°C)	2009	June	20.4	8.6	14.2	30
			July	23.0	14.5	19.3	31
			Aug	22.1	11.8	18.0	31
			Sept	19.8	8.2	16.3	30
Relative Humidity	(%)	2009	June	87.8	38.4	63.4	30
			July	51.4	31.8	41.6	31
			Aug	75.0	32.3	43.4	31
			Sept	72.6	25.9	43.6	30
Solar Radiation	(watts/m^2)	2009	June	525	100	390	30
			July	518	372	477	31
			Aug	472	250	430	31
			Sept	436	213	369	30
Wind Speed	(m/s)	2009	June	1.77	0.52	1.13	30
			July	1.31	0.95	1.11	31
			Aug	1.42	0.90	1.12	31
			Sept	2.90	0.90	1.19	30

Rock Creek Dam Station

Station	Units	Year	Month	Daily Average [1] Max	Min	Mean	Data Days
Air Temperature	(°C)	2009	June	26.0	13.2	19.4	30
			July	28.9	19.2	24.3	31
			Aug	27.1	15.8	23.1	31
			Sept	25.5	13.4	21.7	30
Relative Humidity	(%)	2009	June	78.0	27.5	48.8	30
			July	53.7	28.1	33.2	31
			Aug	63.7	26.1	35.5	31
			Sept	61.4	16.1	34.0	30
Solar Radiation	(watts/m^2)	2009	June	490	132	404	30
			July	484	339	458	31
			Aug	446	249	412	31
			Sept	412	219	349	30
Wind Speed	(m/s)	2009	June	3.45	1.66	2.69	30
			July	3.35	2.23	2.71	31
			Aug	3.28	2.20	2.69	31
			Sept	4.15	2.29	2.92	30

1= Based on hourly average data.

3.2 WATER TEMPERATURE

3.2.1 2009 Monitoring

As discussed in Section 2, water temperatures were continuously monitored during the summer of 2009. Due to the voluminous nature of these data, the information presented in the following section will summarize the data collected during the monitoring effort. Appendix C presents a summary of hourly average temperature data. Furthermore, in accordance with FERC 1962 License Condition 4C (Water Temperature Monitoring), the Licensee is required to provide a more frequent report of monitoring results. After issuance of the license, the Licensee is to provide weekly or bi-weekly reports depending on water year type for 9 of the first 15 years monitoring years. During the 2007 and 2008 critical dry years, the Licensee provided weekly data reports from seven stations including: NFFR below Rock Creek Dam (NF9), NFFR at the NF 57 gage (telemetered station NF57 [water temp]), NFFR above Bucks Creek (NF12), NFFR above Rock Creek Powerhouse (NF13), NFFR below Cresta Dam (NF14), NFFR at the NF 56 gage (telemetered station NF56 [water temp]) and NFFR above Cresta Powerhouse (NF16). In 2009, classified as a dry year, the licensee provided weekly data reports from the two telemetered stations; NF-57 [water temp] in the Rock Creek Reach and NF-56 [water temp] in the Cresta Reach.

For consistency with the temperature level specified for the Licensee's Rock Creek Cresta Project (FERC 1962), daily average data are used throughout this document unless

otherwise specified. Table 3-5 summarizes the daily average water temperature data collected during the 2009 program.

3.2.1.1 Lake Almanor and Tributaries

Summer water temperatures in the NFFR upstream of Lake Almanor (near Chester) (NF1) were monitored in 2009 by the Licensee. This station was located in the NFFR upstream of the town of Chester and about 0.25 miles downstream of the Army Corp. of Engineers flood diversion dam. During the 2009 program, daily average temperatures at station NF1 ranged from 7.3 to 16.6°C, and averaged 13.0°C. The diel fluctuation in temperature ranged from 1.6 to 7.6°C, and averaged 5.4°C in 2009.

Under the Rock Creek-Cresta Relicensing Settlement Agreement (Pacific Gas and Electric Company 2009), a daily average water temperature of 20°C or less is specified as the desired water temperature level. As part of the license, to the extent that can reasonably be controlled, the Licensee shall try to maintain conditions at or below this temperature level. For this reason, a comparison to this level was made at applicable locations. At Station NF1, which defines the water temperature regime upstream of the PG&E project, the daily average temperatures were not above 20°C during the 2009 June through September period. The maximum hourly average temperature recorded at this station during the 2009 monitoring program was 19.4°C on July 19th (Appendix C).

Table 3-5

Summary of 2009 Daily Average Water Temperatures from NFFR Watershed Stations

Station	Year	Month	Mean Daily Temperature [1] Maximum	Minimum	Mean	Diel Fluctuation [2] Maximum	Minimum	Mean	Data Days
NFFR at	2009	June	15.1	8.6	11.9	7.4	1.6	5.4	30
Chester	2009	July	16.1	12.8	14.7	7.6	4.6	6.6	31
(NF1)	2009	Aug	16.6	12.3	13.8	6.2	3.6	5.4	31
	2009	Sept	13.0	7.3	11.6	5.0	2.4	4.1	30
Hamilton	2009	June	12.1	9.4	11.1	5.3	0.8	3.9	30
Branch at	2009	July	12.9	11.0	12.1	5.0	3.8	4.6	31
Road bridge	2009	Aug	13.1	10.8	11.6	4.4	1.6	3.8	31
(HB1)	2009	Sept	11.8	9.7	11.0	3.9	1.8	3.2	30
Hamilton	2009	June	--	--	--	--	--	--	0
Branch	2009	July	19.1	15.4	17.0	6.4	1.0	4.5	16
Powerhouse	2009	Aug	17.7	14.7	16.6	6.3	2.1	4.8	8
(HB2)	2009	Sept	15.9	13.5	15.4	3.5	1.4	2.9	20
Lake Almanor	2009	June	21.9	16.9	18.9	2.9	0.5	1.3	30
at Canyon Dam	2009	July	25.0	20.1	22.2	2.8	0.3	1.4	31
near surface	2009	Aug	24.3	21.3	22.6	1.6	0.3	1.0	31
(LA1-S)	2009	Sept	21.1	18.4	20.3	1.9	0.3	1.1	30
Lake Almanor	2009	June	9.7	8.6	9.3	1.1	0.1	0.5	30
at Canyon Dam	2009	July	10.6	9.4	10.0	0.5	0.0	0.2	31
near bottom	2009	Aug	11.0	10.3	10.7	0.5	0.0	0.2	31
(LA1-B)	2009	Sept	11.2	10.8	11.1	0.4	0.1	0.2	30
Butt Valley	2009	June	17.5	14.2	15.9	2.3	0.8	1.5	9
Powerhouse	2009	July	20.8	16.9	18.8	2.4	0.6	1.6	31
[Corrected]	2009	Aug	21.4	20.3	20.8	2.5	0.3	1.1	31
(BV1)	2009	Sept	20.2	18.0	19.5	2.0	0.4	0.9	30
Butt Creek above	2009	June	14.1	9.9	12.3	6.4	0.9	4.6	30
Butt Valley	2009	July	14.4	11.9	13.4	6.2	4.5	5.7	31
Reservoir	2009	Aug	14.5	11.6	12.6	5.7	2.8	5.0	31
(BC1)	2009	Sept	12.2	8.4	11.1	4.7	2.4	3.9	30
Butt Valley Res.	2009	June	22.1	17.7	19.6	2.4	0.5	1.1	30
at Caribou Intake	2009	July	24.1	20.4	22.0	3.2	0.6	1.4	31
Near surface	2009	Aug	23.3	21.3	22.1	1.7	0.5	1.0	31
(BV2-S)	2009	Sept	21.3	18.7	20.3	2.3	0.4	1.0	30
Butt Valley Res.	2009	June	12.6	10.6	11.5	1.4	0.4	0.9	30
at Caribou Intake	2009	July	18.8	12.9	15.8	2.4	0.5	1.3	31
Near bottom	2009	Aug	20.1	18.9	19.7	1.0	0.4	0.6	31
(BV2-B)	2009	Sept	19.8	18.4	19.2	1.3	0.2	0.6	30

Table 3-5 (Continued)

Station	Year	Month	Mean Daily Temperature [1] Maximum	Minimum	Mean	Diel Fluctuation [2] Maximum	Minimum	Mean	Data Days
NFFR below	2009	June	11.8	10.9	11.3	2.2	0.7	1.3	30
Canyon Dam	2009	July	13.2	11.8	12.6	2.0	1.0	1.5	31
(NF2)	2009	Aug	13.3	13.1	13.2	1.9	0.6	1.4	31
	2009	Sept	13.6	13.1	13.4	1.9	0.6	1.4	30
NFFR at	2009	June	14.0	10.9	12.6	4.4	0.8	3.2	30
Seneca Bridge	2009	July	15.2	13.1	14.2	4.1	3.1	3.7	31
(NF3)	2009	Aug	15.3	13.4	14.2	3.5	2.1	3.0	31
	2009	Sept	14.1	11.2	13.4	2.8	1.4	2.3	30
NFFR above	2009	June	14.8	11.1	13.0	4.2	0.7	2.9	30
Caribou PH	2009	July	15.8	13.4	14.7	4.0	2.3	3.4	31
(NF4)	2009	Aug	15.9	13.4	14.5	3.3	1.6	2.8	31
	2009	Sept	14.3	10.6	13.3	2.9	1.2	2.1	30
Butt Creek below	2009	June	Monitoring not required since 2007						
Butt Valley	2009	July	--	--	--	--	--	--	--
Reservoir	2009	Aug	--	--	--	--	--	--	--
(BC2)	2009	Sept	--	--	--	--	--	--	--
Butt Creek at	2009	June	12.0	10.6	11.3	2.7	0.4	2.0	30
Mouth	2009	July	12.7	11.4	12.1	2.6	1.9	2.3	31
(BC3)	2009	Aug	12.6	11.6	12.2	2.3	1.3	2.0	31
	2009	Sept	12.4	10.6	12.0	2.0	0.9	1.6	30
Caribou No. 1	2009	June	13.9	10.9	12.3	1.6	0.0	0.8	27
Powerhouse	2009	July	21.4	14.1	18.5	4.0	0.7	2.0	31
[corrected]	2009	Aug	21.0	19.2	19.8	3.7	0.6	2.5	31
(CARB1)	2009	Sept	19.8	16.8	18.5	3.2	1.0	2.3	30
Caribou No. 2	2009	June	21.3	16.9	19.1	2.1	0.2	1.0	27
Powerhouse	2009	July	23.2	20.2	21.7	1.9	0.0	1.1	25
[corrected]	2009	Aug	22.9	21.3	22.0	1.3	0.3	0.7	31
(CARB2)	2009	Sept	21.3	18.7	20.3	1.1	0.2	0.6	30
Belden Reservoir	2009	June	19.2	14.4	16.0	2.3	0.3	1.0	30
At Intake	2009	July	22.2	17.6	20.2	2.9	0.4	0.7	31
(BD1)	2009	Aug	22.0	21.0	21.4	0.7	0.2	0.4	31
	2009	Sept	20.9	18.5	19.9	0.8	0.1	0.4	30
Belden	2009	June	19.9	15.5	17.7	1.9	0.3	0.7	17
Powerhouse	2009	July	22.3	17.8	20.3	2.4	0.3	0.6	31
(BD2)	2009	Aug	22.1	21.0	21.5	0.5	0.2	0.3	31
	2009	Sept	20.9	18.6	19.9	0.5	0.2	0.3	30

Table 3-5 (Continued)

Station	Year	Month	Mean Daily Temperature [1] Maximum	Minimum	Mean	Diel Fluctuation [2] Maximum	Minimum	Mean	Data Days
NFFR below	2009	June	17.3	14.0	15.0	0.8	0.2	0.5	30
Belden Dam	2009	July	21.2	17.3	19.2	1.7	0.3	0.6	31
(NF5)	2009	Aug	21.3	19.4	20.6	1.6	0.3	0.6	31
	2009	Sept	20.3	18.2	19.1	0.9	0.3	0.5	30
Mosquito Creek	2009	June	13.6	11.1	12.3	2.1	0.3	1.6	30
At mouth	2009	July	14.7	12.5	13.6	2.0	1.6	1.9	31
(MC1)	2009	Aug	14.8	12.8	13.5	1.8	1.1	1.6	31
	2009	Sept	13.2	10.5	12.4	1.5	0.7	1.3	30
NFFR near	2009	June	17.3	14.1	15.1	3.4	0.7	2.5	30
Queen Lily	2009	July	21.0	17.1	19.1	3.4	2.2	2.9	31
Campground	2009	Aug	20.9	19.2	20.1	3.5	1.6	2.5	31
(NF6)	2009	Sept	19.9	16.1	18.2	4.0	1.6	3.0	30
NFFR near	2009	June	17.6	14.2	15.5	5.1	0.9	3.9	22
Gansner Bar	2009	July	21.0	17.1	19.1	5.3	3.6	4.7	31
(NF7)	2009	Aug	21.0	19.1	19.9	4.8	2.7	4.0	31
	2009	Sept	19.7	15.1	18.0	5.0	2.1	3.9	30
NFFR at Belden	2009	June	20.3	15.0	17.7	4.9	0.7	3.6	30
Town Bridge	2009	July	22.5	18.8	20.7	5.1	3.3	4.4	31
(NF8)	2009	Aug	22.4	19.6	20.7	4.8	2.5	4.1	31
	2009	Sept	20.1	14.9	18.5	4.1	1.8	3.3	30
East Branch	2009	June	22.5	15.1	18.8	4.3	0.9	3.1	30
NFFR at mouth	2009	July	24.9	20.6	22.7	4.1	1.6	2.9	31
(EB1)	2009	Aug	24.2	20.1	21.8	3.3	1.2	2.3	31
	2009	Sept	20.7	14.6	19.0	2.7	1.0	1.9	30
Yellow Creek	2009	June	16.4	11.0	13.7	4.1	0.6	3.0	30
Near mouth	2009	July	17.6	14.3	16.1	4.2	2.8	3.8	31
(YC1)	2009	Aug	17.6	13.8	15.3	3.8	1.8	3.3	31
	2009	Sept	14.6	9.7	13.2	3.1	1.4	2.4	30
Chips Creek	2009	June	15.0	10.1	12.4	4.7	0.8	3.4	30
Near mouth	2009	July	17.0	13.7	15.3	4.9	3.9	4.5	31
(CHIP)	2009	Aug	17.1	13.9	15.2	4.6	2.5	4.1	31
	2009	Sept	14.9	10.9	13.8	4.1	1.9	3.5	30
NFFR below Rock	2009	June	19.9	14.3	17.1	1.3	0.3	0.9	30
Creek Dam	2009	July	22.2	18.0	20.3	1.4	0.4	0.7	31
(NF9)	2009	Aug	22.0	20.5	21.1	0.8	0.4	0.6	31
	2009	Sept	20.5	17.7	19.4	0.9	0.3	0.6	30

Table 3-5 (Continued)

Station	Year	Month	Mean Daily Temperature [1] Maximum	Minimum	Mean	Diel Fluctuation [2] Maximum	Minimum	Mean	Data Days
NFFR at NF-57	2009	June	--	--	--	--	--	--	0
(NF10)	2009	July	22.2	21.1	21.6	1.4	0.9	1.2	10
	2009	Aug	22.0	20.4	21.0	1.3	0.5	1.0	31
	2009	Sept	20.5	17.6	19.4	1.3	0.6	1.0	30
Milk Ranch Creek	2009	June	14.8	10.7	12.7	4.4	0.9	3.3	30
Near mouth	2009	July	17.1	12.8	14.8	4.1	2.8	3.7	31
(MR1)	2009	Aug	16.7	13.5	14.7	3.1	1.5	2.7	31
	2009	Sept	14.4	10.3	13.3	2.3	1.1	1.8	30
Chambers Creek	2009	June	15.6	10.5	13.1	5.3	0.9	3.7	30
Near mouth	2009	July	18.1	13.1	15.5	4.6	2.7	4.0	31
(CHAM)	2009	Aug	17.3	13.6	15.3	4.2	1.6	3.6	31
	2009	Sept	15.6	10.6	14.4	3.8	1.8	3.2	30
NFFR near Tobin	2009	June	20.2	14.4	17.2	4.6	1.0	3.3	30
below Granite	2009	July	22.5	18.3	20.5	3.9	2.9	3.4	31
Creek (NF11)	2009	Aug	22.3	20.0	20.9	3.5	1.4	2.8	31
	2009	Sept	20.5	17.1	19.3	3.0	0.8	2.4	30
Jackass Creek	2009	June	16.0	11.0	13.6	5.9	1.0	4.4	30
Near mouth	2009	July	19.1	13.7	16.2	5.0	3.0	4.2	31
(JC1)	2009	Aug	18.3	14.6	16.4	3.2	1.6	2.7	31
	2009	Sept	16.6	12.2	15.5	2.5	1.0	2.0	30
NFFR abv Bucks	2009	June	20.3	14.5	17.3	4.3	1.1	3.1	30
Creek	2009	July	22.7	18.4	20.6	3.7	2.6	3.2	31
(NF12)	2009	Aug	22.3	20.0	21.0	3.3	1.7	2.7	31
	2009	Sept	20.5	16.9	19.3	2.9	1.1	2.3	30
Bucks Creek	2009	June	16.3	11.1	13.7	5.5	0.9	4.1	30
Near Mouth	2009	July	19.2	14.0	16.5	5.7	3.9	4.9	31
(BUCK1)	2009	Aug	18.3	14.1	16.0	4.7	2.4	3.9	31
	2009	Sept	15.9	10.0	14.2	3.8	1.7	2.9	30
Bucks Creek	2009	June	14.1	12.0	13.2	2.3	0.2	0.7	29
Powerhouse	2009	July	16.1	13.6	14.2	2.3	0.2	0.6	23
(BUCK2)	2009	Aug	13.6	12.6	13.2	1.9	0.2	0.4	31
	2009	Sept	13.2	12.0	12.6	3.0	0.0	0.3	30
NFFR abv Rock	2009	June	19.9	14.1	16.7	4.5	1.0	2.3	30
Creek Powerhouse	2009	July	21.0	17.5	19.3	4.3	1.6	3.1	31
(NF13)	2009	Aug	20.5	17.8	19.2	4.4	2.5	3.8	31
	2009	Sept	19.8	15.6	17.9	4.1	2.0	3.3	30

Table 3-5 (Continued)

Station	Year	Month	Mean Daily Temperature [1] Maximum	Minimum	Mean	Diel Fluctuation [2] Maximum	Minimum	Mean	Data Days
Rock Creek Powerhouse (RC1)	2009	June	19.9	14.4	17.1	1.7	0.4	1.0	30
	2009	July	22.5	18.4	20.7	2.0	0.6	1.0	31
	2009	Aug	22.4	21.0	21.5	1.5	0.6	1.2	31
	2009	Sept	20.9	18.4	19.8	1.6	0.4	0.9	30
Rock Creek Near mouth (RC2)	2009	June	16.7	11.6	14.1	2.7	0.6	1.8	30
	2009	July	19.2	14.6	16.8	2.5	1.8	2.2	31
	2009	Aug	18.9	15.4	16.7	2.1	0.9	1.7	31
	2009	Sept	16.3	12.7	15.4	1.8	0.8	1.3	30
NFFR abv Grizzly Creek (NF14)	2009	June	19.7	14.4	17.0	1.2	0.4	0.7	30
	2009	July	21.7	18.2	20.0	1.4	0.5	1.1	31
	2009	Aug	21.5	19.8	20.5	1.7	0.6	1.1	31
	2009	Sept	20.2	16.9	18.8	1.4	0.4	0.9	30
Grizzly Creek Near mouth (GR1)	2009	June	17.4	11.9	14.5	4.0	0.6	3.0	30
	2009	July	20.4	15.6	17.9	4.0	3.1	3.5	31
	2009	Aug	19.9	15.9	17.6	3.2	1.6	2.7	31
	2009	Sept	17.0	12.5	15.7	2.7	1.3	2.0	30
NFFR at NF-56 (NF15)	2009	June	--	--	--	--	--	--	0
	2009	July	--	--	--	--	--	--	0
	2009	Aug	21.0	19.6	20.3	2.7	1.4	2.2	18
	2009	Sept	20.1	16.6	18.8	2.1	0.8	1.7	30
NFFR abv Cresta Powerhouse (NF16)	2009	June	19.6	14.9	17.2	3.1	0.8	2.4	30
	2009	July	22.3	18.4	20.4	3.2	2.3	2.9	31
	2009	Aug	22.0	19.7	20.6	2.8	1.7	2.5	31
	2009	Sept	20.1	16.5	18.9	2.5	1.1	1.8	30
Cresta Powerhouse (CR1)	2009	June	19.8	14.4	17.1	1.3	0.2	0.6	30
	2009	July	22.0	18.6	20.3	1.5	0.6	0.9	31
	2009	Aug	21.8	20.3	20.9	1.6	0.3	0.8	31
	2009	Sept	21.0	17.3	19.8	1.6	0.1	0.6	30
NFFR below Poe Dam (NF17A)	2009	June	19.7	15.1	17.3	1.3	0.5	0.8	30
	2009	July	22.6	18.7	20.6	1.4	0.7	1.0	31
	2009	Aug	22.2	20.1	21.0	1.1	0.5	0.7	31
	2009	Sept	20.6	17.2	19.2	1.2	0.5	0.9	30

Table 3-5 (Continued)

Station	Year	Month	Mean Daily Temperature [1] Maximum	Minimum	Mean	Diel Fluctuation [2] Maximum	Minimum	Mean	Data Days
NFFR above	2009	June	21.9	16.8	19.3	3.9	1.1	2.9	30
Poe Powerhouse	2009	July	24.3	20.0	22.3	3.8	2.6	3.3	31
(NF18)	2009	Aug	24.0	20.3	21.9	3.3	1.5	2.7	31
	2009	Sept	21.2	17.0	19.9	3.0	1.2	2.2	30
Middle Fork	2009	June	--	--	--	--	--	--	0
Feather River	2009	July	23.0	21.8	22.6	3.1	2.6	2.9	5
At Milsap Bar	2009	Aug	22.7	18.3	20.2	2.9	1.7	2.5	31
(MB1)	2009	Sept	19.4	14.5	17.9	2.6	1.1	2.0	30

1. Daily values are based on hourly average data. Monthly statistics represent the maximum, minimum, and mean based on these daily average temperatures. For example, the maximum June temperature represents the maximum daily average measured in June. See Appendix C for a summary of hourly data.

2. Diel Fluctuation is calculated based on the daily maximum temperature minus the daily minimum temperature. Monthly statistics are based on these daily range values.

Table 3-6 compares daily average temperatures from each station with the 20°C level. Figure 3-6 compares the daily average temperature from the NFFR with other stations tributary to Lake Almanor.

Water temperatures in the Hamilton Branch of the NFFR (Hamilton Branch) are primarily a function of conditions in Mountain Meadows Reservoir and the significant accretion that occurs along its entire length. Temperatures in the Hamilton Branch tend to be less variable and slightly cooler than those measured in the NFFR upstream of Lake Almanor (NF1). The Hamilton Branch station (HB1) was located in the river below the Peninsula Road Bridge; this station was positioned to be upstream of any backwater effect associated with Lake Almanor.

During the 2009 program, daily average temperatures at station HB1 ranged from 9.4 to 13.1°C, and averaged 11.5°C. The diel fluctuation in temperature ranged from 0.8 to 5.3°C, and averaged 3.8°C in 2009. Figure 3-6 compares the daily average temperature from HB1 with other stations tributary to Lake Almanor. The maximum hourly average temperature recorded at this station during the 2009 monitoring program was 16.5°C on July 17th (Appendix C). At station HB1, daily average temperatures were not above 20°C during the June-September 2009 period (Table 3-6).

Table 3-6

Comparison of 2009Daily Average Water Temperature with the 20°C Threshold.

Station	Year	Month	Days Greater 20°C	Total Data Days	Percent Above 20°C Limit
NFFR at	2009	June	0	30	0%
Chester	2009	July	0	31	0%
(NF1)	2009	Aug	0	31	0%
	2009	Sept	0	30	0%
Hamilton	2009	June	0	30	0%
Branch at	2009	July	0	31	0%
Road bridge	2009	Aug	0	31	0%
(HB1)	2009	Sept	0	30	0%
Hamilton	2009	June	--	--	--
Branch	2009	July	0	16	0%
Powerhouse	2009	Aug	0	8	0%
(HB2)	2009	Sept	0	20	0%
Lake Almanor	2009	June	4	30	13%
At Canyon Dam	2009	July	31	31	100%
near surface	2009	Aug	31	31	100%
(LA1-S)	2009	Sept	25	30	83%
Lake Almanor	2009	June	0	30	0%
At Canyon Dam	2009	July	0	31	0%
near bottom	2009	Aug	0	31	0%
(LA1-B)	2009	Sept	0	30	0%
Butt Valley	2009	June	0	9	0%
Powerhouse	2009	July	7	31	23%
[Corrected]	2009	Aug	31	31	100%
(BV1)	2009	Sept	3	30	10%
Butt Creek above	2009	June	0	30	0%
Butt Valley	2009	July	0	31	0%
Reservoir	2009	Aug	0	20	0%
(BC1)	2009	Sept	0	30	0%
Butt Valley Res.	2009	June	9	30	30%
at Caribou Intake	2009	July	31	31	100%
Near surface	2009	Aug	31	31	100%
(BV2-S)	2009	Sept	23	30	77%
Butt Valley Res.	2009	June	0	30	0%
at Caribou Intake	2009	July	0	31	0%
Near bottom	2009	Aug	0	31	0%
(BV2-B)	2009	Sept	0	30	0%

Table 3-6 (Continued)

Station	Year	Month	Days Greater 20°C	Total Data Days	Percent Above 20°C Limit
NFFR below	2009	June	0	30	0%
Canyon Dam	2009	July	0	31	0%
(NF2)	2009	Aug	0	31	0%
	2009	Sept	0	30	0%
NFFR at	2009	June	0	30	0%
Seneca Bridge	2009	July	0	31	0%
(NF3)	2009	Aug	0	31	0%
	2009	Sept	0	30	0%
NFFR above	2009	June	0	30	0%
Caribou PH	2009	July	0	31	0%
(NF4)	2009	Aug	0	31	0%
	2009	Sept	0	30	0%
Butt Creek below	2009	June	Monitoring not required since 2007		
Butt Valley	2009	July	--	--	--
Reservoir	2009	Aug	--	--	--
(BC2)	2009	Sept	--	--	--
Butt Creek at	2009	June	0	30	0%
Mouth	2009	July	0	31	0%
(BC3)	2009	Aug	0	31	0%
	2009	Sept	0	30	0%
Caribou No. 1	2009	June	0	12	0%
Powerhouse	2009	July	10	28	36%
[corrected]	2009	Aug	16	31	52%
(CARB1)	2009	Sept	2	30	7%
Caribou No. 2	2009	June	7	27	26%
Powerhouse	2009	July	25	25	100%
[corrected]	2009	Aug	31	31	100%
(CARB2)	2009	Sept	21	30	70%
Belden Reservoir	2009	June	0	30	0%
At Intake	2009	July	21	31	68%
(BD1)	2009	Aug	31	31	100%
	2009	Sept	12	30	40%
NFFR below	2009	June	0	30	0%
Belden Dam	2009	July	10	31	32%
(NF5)	2009	Aug	28	31	90%
	2009	Sept	3	30	10%

Table 3-6 (Continued)

Station	Year	Month	Days Greater 20°C	Total Data Days	Percent Above 20°C Limit
Mosquito Creek	2009	June	0	30	0%
At mouth	2009	July	0	31	0%
(MC1)	2009	Aug	0	31	0%
	2009	Sept	0	30	0%
NFFR near	2009	June	0	30	0%
Queen Lily	2009	July	8	31	26%
Campground	2009	Aug	17	31	55%
(NF6)	2009	Sept	0	30	0%
NFFR near	2009	June	0	22	0%
Gansner Bar	2009	July	9	31	29%
(NF7)	2009	Aug	10	31	32%
	2009	Sept	0	30	0%
East Branch	2009	June	9	30	30%
NFFR at mouth	2009	July	31	31	100%
(EB1)	2009	Aug	31	31	100%
	2009	Sept	6	30	20%
NFFR at Belden	2009	June	3	30	10%
Town Bridge	2009	July	21	31	68%
(NF8)	2009	Aug	25	31	81%
	2009	Sept	1	30	3%
Belden	2009	June	0	17	0%
Powerhouse	2009	July	21	31	68%
(BD2)	2009	Aug	31	31	100%
	2009	Sept	12	30	40%
Yellow Creek	2009	June	0	30	0%
Near mouth	2009	July	0	31	0%
(YC1)	2009	Aug	0	31	0%
	2009	Sept	0	30	0%
Chips Creek	2009	June	0	30	0%
Near mouth	2009	July	0	31	0%
(CHIP)	2009	Aug	0	31	0%
	2009	Sept	0	30	0%
NFFR below Rock	2009	June	0	30	0%
Creek Dam	2009	July	20	31	65%
(NF9)	2009	Aug	31	31	100%
	2009	Sept	4	30	13%

Table 3-6 (Continued)

Station	Year	Month	Days Greater 20°C	Total Data Days	Percent Above 20°C Limit
NFFR at NF-57	2009	June	--	--	--
(NF110)	2009	July	10	10	100%
	2009	Aug	31	31	100%
	2009	Sept	5	30	17%
Milk Ranch Creek	2009	June	0	30	0%
Near mouth	2009	July	0	31	0%
(MR1)	2009	Aug	0	31	0%
	2009	Sept	0	30	0%
Chambers Creek	2009	June	0	30	0%
Near mouth	2009	July	0	31	0%
(CHAM)	2009	Aug	0	31	0%
	2009	Sept	0	30	0%
NFFR near Tobin	2009	June	1	30	3%
below Granite Crk	2009	July	22	31	71%
(NF11)	2009	Aug	31	31	100%
	2009	Sept	5	30	17%
Jackass Creek	2009	June	0	30	0%
Near mouth	2009	July	0	31	0%
(JC1)	2009	Aug	0	31	0%
	2009	Sept	0	30	0%
NFFR above	2009	June	2	30	7%
Bucks Creek	2009	July	22	31	71%
(NF12)	2009	Aug	31	31	100%
	2009	Sept	6	30	20%
Bucks Creek	2009	June	0	30	0%
Near Mouth	2009	July	0	31	0%
(BUCK1)	2009	Aug	0	31	0%
	2009	Sept	0	30	0%
Bucks Creek	2009	June	0	29	0%
Powerhouse	2009	July	0	23	0%
(BUCK2)	2009	Aug	0	31	0%
	2009	Sept	0	30	0%
NFFR abv Rock	2009	June	0	30	0%
Creek Powerhouse	2009	July	10	31	32%
(NF13)	2009	Aug	4	31	13%
	2009	Sept	0	30	0%
Rock Creek	2009	June	0	30	0%
Powerhouse	2009	July	21	31	68%
(RC1)	2009	Aug	31	31	100%
	2009	Sept	13	30	43%

Table 3-6 (Continued)

Station	Year	Month	Days Greater 20°C	Total Data Days	Percent Above 20°C Limit
Rock Creek	2009	June	0	30	0%
Near mouth	2009	July	0	31	0%
(RC2)	2009	Aug	0	31	0%
	2009	Sept	0	30	0%
NFFR abv Grizzly	2009	June	0	30	0%
Creek	2009	July	19	31	61%
(NF14)	2009	Aug	25	31	81%
	2009	Sept	1	30	3%
Grizzly Creek	2009	June	0	30	0%
Near mouth	2009	July	2	31	6%
(GR1)	2009	Aug	0	31	0%
	2009	Sept	0	30	0%
NFFR at NF-56	2009	June	--	--	--
(NF15)	2009	July	--	--	--
	2009	Aug	11	18	61%
	2009	Sept	1	30	3%
NFFR abv Cresta	2009	June	0	30	0%
Powerhouse	2009	July	21	31	68%
(NF16)	2009	Aug	24	31	77%
	2009	Sept	3	30	10%
Cresta	2009	June	0	30	0%
Powerhouse	2009	July	21	31	68%
(CR1)	2009	Aug	31	31	100%
	2009	Sept	15	30	50%
Middle Fork	2009	June	--	--	--%
Feather River	2009	July	5	5	100%
At Milsap Bar	2009	Aug	16	31	52%
(MB1)	2009	Sept	0	30	0%

Water temperatures associated with flow through Hamilton Branch Powerhouse are a function of conditions in Mountain Meadows Reservoir. The Hamilton Branch Powerhouse station (HB2) was located in the diversion canal immediately upstream of the head-works control structure. The powerhouse discharges directly into Lake Almanor from an elevated tailrace. Daily average temperatures at station HB2 for the period ranged from 13.5 to 19.1°C, and averaged 16.3°C. The diel fluctuation in temperature ranged from 1.0 to 6.4°C, and averaged 4.1°C in 2009. Figure 3-6 compares the daily average temperature from HB2 with other stations tributary to Lake Almanor. The operation of Hamilton Branch Powerhouse was minimal during the 2009 period with only 44 days of operation during the period June through September; of these 44 days, only 27 days were operated for 20 hours or more. The maximum hourly average temperature recorded at this station during the 2009 monitoring program was 20.8°C on July 21 (Appendix C). Daily average temperatures did not exceed 20°C on any of the 44 operational days (0%) during the June-September, 2009 period.

As discussed earlier, Lake Almanor is the primary storage reservoir on the NFFR. Lake Almanor has a very large surface area with relatively moderate depths. Resource monitoring indicates that near the Canyon Dam and Prattville intakes, Lake Almanor undergoes thermal stratification (CDFG 1988; DWR 1999; Pacific Gas and Electric Company 1982, 1984, 1986, 1987, 2002). Thermal gradients typically begin to develop relatively early in Lake Almanor (April-May). During June, the development of

temperature stratification is well underway. By July, a fully developed thermal structure is present, including a well-developed epilimnion, thermocline, and hypolimnion. The stratification is persistent throughout the summer, with the epilimnion growing downward throughout the period and with turnover usually occurring during the period between late September and October.

The general pattern of temperature stratification near the Canyon Dam Intake was continuously measured by a submerged array of digital recorders deployed in 2009. The temperature recorders were set up on a cable attached to a buoy. As a result, the top sensor remained approximately 0.5 meters below the surface, while the bottom sensor was typically 0 to 2 meters off of the bottom depending on lake elevation. Data from 2009 indicated that daily average temperatures at the lake surface (LA1-S) ranged from 16.9 to 25.0°C during the June through September period. Daily average temperatures near the bottom (LA1-B) ranged from 8.6 to 11.2°C during the same period. The daily average temperatures at station LA1-S were above 20°C on 91 of 122 days (75%) during the 2009 June through September period (Table 3-6). Figure 3-7 compares mean daily temperatures from the epilimnion and hypolimnion for 2009.

Summer temperature profiles in Lake Almanor show that a warm upper layer (epilimnion) extends to a depth of about 9 meters and that a colder bottom layer (hypolimnion) typically exists below a depth of 12 meters. The seasonal characteristics of the 2009 Lake Almanor thermocline were defined using monthly vertical profiles. Figure 3-8 compares monthly

profiles from Lake Almanor near the Canyon Dam Intake (LA-P1) for the period May through September 2009. All profile data from Lake Almanor is presented in Appendix D.

Vertical temperature profiles were measured at four locations, covering the main body near Canyon Dam, the Prattville Intake area, and two longitudinal axes of Lake Almanor (see Figure 2-1). Figure 3-9 compares monthly profiles from each of the four profile stations. This figure illustrates the limited lateral thermal variation present in Lake Almanor in 2009. As illustrated by these figures, temperature profiles indicate that colder water is present only in stations located in the deeper portions of the lake, particularly near Canyon Dam (Pacific Gas and Electric Company 2002).

3.2.1.2 Butt Valley Reservoir and tributaries

Butt Valley Reservoir is a long, narrow water body of moderate depth. The deepest areas of the reservoir occur near the dam. Water temperature in Butt Valley Reservoir is essentially driven by conditions in Lake Almanor and the physical configuration of the Prattville Intake. The operations of Butt Valley Powerhouse and the Caribou No. 1 and No. 2 powerhouses are the primary controlling influences on the water resources entering and leaving Butt Valley Reservoir. Under typical conditions, only a limited volume of cold water is available in Butt Valley Reservoir during the summer. Contributions from Butt Creek are seasonally variable, but typically remain a relatively small portion of the total inflow to the reservoir. The thermal structure of Butt Valley Reservoir is driven

largely by the physical configuration of the reservoir and the location and operation of the two Caribou intakes.

Although perennial flow is present in Butt Creek upstream of Butt Valley Reservoir, the primary source of flow into the reservoir is through Butt Valley Powerhouse. Temperatures in the tailrace are representative of temperatures withdrawn from the Prattville Intake in Lake Almanor (Pacific Gas and Electric Company 1986). The Butt Valley Powerhouse station (BV1) was located in the tailrace estuary downstream of the powerhouse. The tailrace discharges directly into the original Butt Creek channel; however, depending on lake elevation this area can exhibit flow characteristics ranging from riverine to lacustrine. The Butt Valley Powerhouse was shut down for maintenance during the period June 1 through August 12, 2009. During the 2009 program, daily average temperatures at station BV1 ranged from 14.2 to 21.4°C, and averaged 18.8°C. The diel fluctuation in temperature ranged from 0.3 to 2.5°C, and averaged 1.3°C in 2009. The maximum hourly average temperature recorded at this station during the 2009 monitoring program was 22.0°C on August 20 (Appendix C). The daily average temperatures at station BV1 exceeded 20°C on 41 of the 101 operational days (41%) during the 2009 June through September period. Figure 3-10 compares daily average temperatures from station BV1 with other stations tributary to Butt Valley Reservoir.

Temperatures in Butt Creek (BC1) were monitored upstream of the backwater effect from Butt Valley Reservoir during the 2009 period. During the 2009 program, daily average

temperatures at station BC1 ranged from 8.4 to 14.5°C, and averaged 12.4°C. The diel fluctuation in temperature ranged from 0.9 to 6.4°C, and averaged 4.8°C in 2009. The maximum hourly average temperature recorded at this station during the 2009 monitoring program was 17.4°C on July 20th (Appendix C). The daily average temperatures at station BC1 did not exceed 20°C during the 2009 June through September period (Table 3-6).

A moderately pronounced thermal gradient does develop in Butt Valley Reservoir in the late spring and early summer. However, as a result of the relatively short retention time, and depending on the frequency of usage of the Caribou No. 1 Intake (located in the deeper portion of the lake), the limited cold water volume can be consumed in a few weeks. In general, an identifiable thermocline was present in June and persisted through July. By early August, after a few weeks of operation at Caribou No. 1 Powerhouse, a well-defined hypolimnion and epilimnion were no longer present (Pacific Gas and Electric Company 2002).

The seasonal characteristics of the Butt Valley Reservoir thermocline in 2009 were defined using monthly vertical profiles. Figure 3-11 compares monthly profiles from the Butt Valley Reservoir near Caribou No. 1 Intake (BV-P1) for the period May through September 2009. As indicated by these data Butt Valley Reservoir was essentially isothermal by August 2009. All profile data from Butt Valley Reservoir are presented in Appendix D.

Vertical temperature profiles were measured at three locations (BV-P1, BV-P2, BV-P3), covering the longitudinal axis of Butt Valley Reservoir. Profiles measured from June through September 2009 indicated little difference in thermal structure along the longitude of the reservoir. Figure 3-12 illustrates the longitudinal thermal structure present in Butt Valley Reservoir in 2009 by comparing monthly temperature profiles from the three profile stations located in the reservoir. As illustrated by these figures, the general thermal structure is well established in the upper portion of the reservoir. The data also indicate that the only area with a cool-water zone is located near the dam.

The development of temperature stratification near the Caribou No. 1 Intake was measured continuously by a submerged array of digital recorders deployed in 2009. The temperature recorders were set up on a cable attached to a buoy. As a result, the top sensor remained approximately 0.5 meters below the surface, while the bottom sensor was typically 0.5 to 5 meters off the bottom. Daily average temperatures recorded in the epilimnion (BV2-S) of Butt Valley Reservoir near the Caribou No. 1 Intake averaged 21.0°C, and ranged from 17.7 to 24.1°C for the period June through September in 2009. The daily average temperatures at station BV2-S were above 20°C on 94 of 122 days (77%) during the 2009 June through September period (Table 3-6). Daily average temperatures from the hypolimnion (BV2-B) ranged from 10.6 to 20.1°C, with an average of 16.5°C during the same period (Table 3-5). The daily average temperatures at station BV2-B were above 20°C on 5 of 122 days (4%) during the 2009 (Table 3-6). Figure 3-13 compares mean daily temperatures from the epilimnion and hypolimnion of Butt Valley Reservoir for

2009. As indicated by the data in this figure, the reservoir became nearly isothermal (less than 3°C difference between top and bottom recorders) by late August.

3.2.1.3 Seneca Reach of NFFR

Water temperature in the NFFR below Canyon Dam is largely determined by the level at which water is released from the lake through the Canyon Dam Intake tower. At present, the Licensee preferentially utilizes the lower gates as the source of fishwater releases. The lower gates in combination with the upper gates are used during periods that require high flow releases. In 2009, the Licensee utilized the lower gate for fishwater release throughout the year.

Water temperatures in the NFFR downstream of Canyon Dam (NF2) were monitored approximately 0.25 miles downstream of the release structure during the 2009 monitoring effort. This station represents the initial conditions in the Seneca Reach and corresponded with the location of the Licensees NF-2 permanent flow monitoring station. During the 2009 program, daily average temperatures at station NF2 ranged from 10.9 to 13.6°C, and averaged 12.6°C. The diel fluctuation in temperature ranged from 0.6 to 2.2°C, and averaged 1.4°C in 2009. The maximum hourly average temperature recorded at this station during the 2009 monitoring program was 14.7°C on September 4th (Appendix C). The daily average temperatures at station NF2 did not exceed 20°C during the 2009 June through September period (Table 3-6).

Water temperatures in the NFFR at Seneca (NF3) were monitored approximately 60 meters downstream of the Seneca Road Bridge during the 2009 monitoring effort. This station represents conditions present in the middle of the Seneca Reach. During the 2009 program, daily average temperatures at station NF3 ranged from 10.9 to 15.3°C, and averaged 13.6°C. The diel fluctuation in temperature ranged from 0.8 to 4.4°C, and averaged 3.0°C in 2009. The maximum hourly average temperature recorded at this station during the 2009 monitoring program was 16.7°C on July 30 (Appendix C). The daily average temperatures at station NF3 did not exceed 20°C during the 2009 June through September period (Table 3-6).

Water temperatures were monitored in the NFFR approximately 0.5 miles upstream of Caribou Powerhouse (NF4) during the 2009 monitoring effort. This station represents conditions at the end of the Seneca Reach. During the 2009 program, daily average temperatures at station NF4 ranged from 10.6 to 15.9°C, and averaged 13.9°C. The diel fluctuation in temperature ranged from 0.7 to 4.2°C, and averaged 2.8°C in 2009. The maximum hourly average temperature recorded at this station during the 2009 monitoring program was 17.5°C on July 28 (Appendix C). The daily average temperatures at station NF4 did not exceed 20°C during the 2009 June through September period (Table 3-6).

The magnitude of temperature changes that occur in the Seneca Reach depends on several factors including which release gates are used, the magnitude of the release flow, the magnitude of tributary inflows, physical characteristics of the stream channel, topographic

and riparian shading and meteorological conditions. To compare the relative change in temperature occurring through the entire bypass reach, the daily average temperature from station NF2 was compared with the daily average temperatures at station NF4. Temperatures were only evaluated for the period when releases were made from the low-level gate at the Canyon Dam Intake. Releases were made from the same gate for the entire period in 2009. For the period June through September, the daily average temperatures at station NF4 (upstream of Caribou Powerhouse) averaged 1.3°C warmer in 2009, than at station NF2 (below Canyon Dam). These values represent the average heating occurring through the entire Seneca Reach and calculate to a less than 0.1°C per mile increase in temperature for 2009. Figure 3-14 compares the daily average temperatures at the three stations located in the Seneca Reach in 2009.

3.2.1.4 Lower Butt Creek

No release is made from Butt Valley Reservoir to the lower Butt Creek channel. As a result, flows in lower Butt Creek are derived from various sources of tributary and accretion inflows. Water temperature was measured at two locations in Butt Creek downstream of Butt Valley Dam.

The first station in lower Butt Creek was located approximately 0.3 miles below the dam (BC2). This station captured inflow from Benner Creek, leakage flows from Butt Valley Dam, and the spring inflow that arises in the Butt Creek channel downstream of the Benner Creek confluence. During the 2002-2006 period water temperatures were monitored at this

station, temperatures were typically stable with little diel variation, having daily average values varying from 10.6 to 10.8°C. Because of its relative constant values and dangerous access, this station was discontinued in 2007 as per agreement with the Rock Creek-Cresta ERC (ERC meeting on April 18, 2007) decision.

The second station in lower Butt Creek (BC3) is located about 300 ft above the confluence with the NFFR. This station defines the quality of inflow to the NFFR from the largest tributary in the Seneca Reach. During the 2009 program, daily average temperatures at station BC3 ranged from 10.6 to 12.7°C, and averaged 11.9°C. The diel fluctuation in temperature ranged from 0.4 to 2.7°C, and averaged 2.0°C in 2009. The maximum hourly average temperature recorded at this station during the 2009 monitoring program was 14.0°C on July 30 (Appendix C). The daily average temperatures at station BC3 did not exceed 20°C during the 2009 June through September period (Table 3-6). Figure 3-15 presents the daily average water temperatures from this lower Butt Creek station in 2009.

3.2.1.5 Belden Forebay and Caribou Powerhouse complex

Water temperature in Belden Forebay is primarily the result of the combined flows from Caribou No. 1 and No. 2 powerhouses. Other inflows to Belden Forebay originate from the Seneca Reach of the NFFR. All three-inflow sources enter through the same channel in the upper portion of Belden Forebay.

Water temperatures at Caribou No. 1 Powerhouse (CARB1) were monitored at an internal location due to the configuration of the tailrace at this facility. Water temperature data were processed to remove data for periods when the powerhouse was not operating and when water within the penstock was static and no discharge to the NFFR was being made. During the 2009 program, daily average temperatures at station CARB1 ranged from 10.9 to 21.4°C, and averaged 17.3°C. The diel fluctuation in temperature ranged from 0.0 to 4.0°C, and averaged 1.9°C in 2009. The maximum hourly average temperature recorded at this station during the 2009 monitoring program was 22.8°C on July 31 (Appendix C). The daily average temperatures at station CARB1 exceeded 20°C on 16 of 119 operational days (13%) in the 2009 June through September period (Table 3-6).

Water temperatures at Caribou No. 2 Powerhouse (CARB2) were monitored directly from the penstock at the main valve house. This location was chosen due to the configuration of the tailrace at this facility, which is submerged by Belden Forebay. Water temperature data were processed to remove data for periods when the powerhouse was not operating and when water within the penstock was static and no discharge to the NFFR was being made. During the 2009 program, daily average temperatures at station CARB2 ranged from 16.9 to 23.2°C, and averaged 20.8°C. The diel fluctuation in temperature ranged from 0.0 to 2.1°C, and averaged 0.8°C in 2009. The maximum hourly average temperature recorded at this station during the 2009 monitoring program was 23.9°C on July 28 (Appendix C). The daily average temperatures at station CARB2 were above 20°C on 84 of 113 operating days (74%) during the 2009. PG&E initiated temperature mitigation

operations at the Caribou Complex on July 4, preferentially utilizing Caribou No. 1 Powerhouse through July 10 in an effort to reduce water temperatures in the NFFR. The results of this effort are discussed in detail in Section 3.2.2.1.

Water temperature was monitored in Belden Forebay near the Belden Powerhouse Intake at a fixed depth. During the 2009 program, daily average temperatures at station BD1 ranged from 14.4 to 22.2°C, and averaged 19.4°C. The diel fluctuation in temperature ranged from 0.1 to 2.9°C, and averaged 0.7°C in 2009. The maximum hourly average temperature recorded at this station during the 2009 monitoring program was 22.5°C on July 30 (Appendix C). The daily average temperatures at station BD1 exceeded 20°C on 64 of 122 days (52%) during the 2009 June through September period (Table 3-6).

Temperatures at Belden Powerhouse (BD2) are essentially the same as those present in Belden Forebay as measured at the powerhouse intake (BD1) and primarily reflect the temperature of Butt Valley Reservoir water as released by the Caribou powerhouses, with some minor modification due to mixing and heat exchange in Belden Forebay. Water temperatures at Belden Powerhouse were monitored at an internal location due to the configuration of the tailrace at this facility. Water temperature data were then processed to remove data from periods when the powerhouse was not operating and when water within the penstock was static and no discharge to the NFFR was being made. During the 2009 program, daily average temperatures at station BD2 ranged from 15.5 to 22.3 °C, and averaged 19.9°C. The diel fluctuation in temperature ranged from 0.2 to 2.4°C, and averaged 0.5°C in 2009. The maximum hourly average temperature recorded at this

station during the 2009 monitoring program was 22.5°C on July 30 (Appendix C). The daily average temperatures at station BD2 exceeded 20°C on 64 days during the 109 operational days (59%) in the 2009 June through September period (Table 3-6). Figure 3-16 compares the daily average temperatures at the four stations associated with the Caribou Powerhouse-Belden Forebay complex in 2009.

3.2.1.6 Belden Reach of the NFFR and tributaries

Water temperatures were recorded in the NFFR downstream of Belden Dam (NF5) throughout the 2009 sampling season. This station represents initial conditions in the Belden Reach and corresponds with the location of the permanent flow monitoring station (NF-70). During the 2009 program, daily average temperatures at station NF5 ranged from 14.0 to 21.3°C, and averaged 18.5°C. The diel fluctuation in temperature ranged from 0.2 to 1.7°C, and averaged 0.6°C in 2009. The maximum hourly average temperature recorded at this station during the 2009 monitoring program was 21.7°C on August 23 (Appendix C). The daily average temperatures at station NF5 exceeded 20°C on 41 of 122 days (34%) during the 2009 June through September period (Table 3-6).

Water temperatures were recorded in Mosquito Creek near its confluence with the NFFR (MC1). Temperatures were comparatively cool with a relatively stable flow regime suggesting a strong groundwater supply during non-runoff periods. Mosquito Creek provides a cooling influence in the Belden Reach. Daily average temperatures at station MC1 ranged from 10.5 to 14.8°C, and averaged 13.0°C. The diel fluctuation in

temperature ranged from 0.3 to 2.1°C, and averaged 1.6°C in 2009. The maximum hourly average temperature recorded at this station during the available 2009 monitoring period was 15.8°C on August 2 (Appendix C). The daily average temperatures at station MC1 did not exceed 20°C during the 2009 June through September period (Table 3-6).

The station located near the Queen Lily Campground (NF6) represents conditions in the middle section of the Belden Reach and defines conditions downstream of the largest tributary in the reach. During the 2009 program, daily average temperatures at station NF6 ranged from 14.1 to 21.0°C, and averaged 18.1°C. The diel fluctuation in temperature ranged from 0.7 to 4.0°C, and averaged 2.8°C in 2009. The maximum hourly average temperature recorded at this station during the 2009 monitoring program was 22.9°C on July 30 (Appendix C). The daily average temperatures at station NF6 exceeded 20°C on 25 of 122 day (20%) during the 2009 June through September period (Table 3-6).

Station NF7 represents conditions in the NFFR at the end of the upper Belden Reach. This station is also upstream of the confluence with the EBNFFR. During the 2009 program, daily average temperatures at station NF7 ranged from 14.2 to 21.0°C, and averaged 18.1°C. The diel fluctuation in temperature ranged from 0.9 to 5.3°C, and averaged 4.1°C in 2009. The maximum hourly average temperature recorded at this station during the 2009 monitoring program was 23.6°C on July 30 (Appendix C). The daily average temperatures at station NF7 exceeded 20°C on 19 of 114 monitored days (17%) during the 2009 June through September period (Table 3-6).

The total change in daily average temperature in the upper Belden Reach was measured as the difference between the NFFR at the confluence with the EBNFFR (NF7) and below Belden Dam (NF5). The change in temperature between stations NF5 and NF7 was evaluated for the period June-September. The total daily average temperature at station NF7 averaged 0.4°C cooler in 2009 than at station NF5. This value calculates to a 0.07°C per mile decrease in temperature in the upper Belden Reach. Figure 3-17 compares the daily average temperatures at the four stations located in the upper Belden Reach in 2009.

The temperature station in the NFFR upstream of Yellow Creek (NF8), was located immediately upstream of the Belden Town bridge. This station is approximately 1.75 miles downstream of the confluence of the EBNFFR with the NFFR. Temperatures at this location were warmer than those measured in the NFFR upstream of the EBNFFR (NF7), but cooler than in the EBNFFR. This station represents conditions in the NFFR at the end of the Belden bypass reach. During the 2009 program, daily average temperatures at station NF8 ranged from 14.9 to 22.5°C, and averaged 19.4°C. The diel fluctuation in temperature ranged from 0.7 to 5.1°C, and averaged 3.8°C in 2009. The maximum hourly average temperature recorded at this station during the 2009 monitoring program was 25.0°C on July 28 (Appendix C). The daily average temperatures at station NF8 were above 20°C on 50 of 122 days (41%) during the 2009 June through September period.

The daily average change in temperature in the NFFR between the NFFR at the confluence with the EBNFFR (NF7) and Belden Town Bridge (NF8) was evaluated for the period June through September. The daily average temperatures at station NF8 in 2009 averaged 1.2°C warmer than at station NF7. This value calculates to a 0.6°C per mile increase in temperature in this section of the NFFR. This increase is attributable to the contribution from the EBNFFR.

Temperatures were recorded in the EBNFFR upstream of the confluence with the NFFR (EB1) during the 2009 sampling season. During the 2009 program, daily average temperatures at station EB1 ranged from 14.6 to 24.9°C, and averaged 20.6°C. The diel fluctuation in temperature ranged from 0.9 to 4.3°C, and averaged 2.6°C in 2009. The maximum hourly average temperature recorded at this station during the 2009 monitoring program was 26.0°C on July 28 (Appendix C). This was the highest hourly average temperature recorded during the 2009 monitoring program. The daily average temperatures at station EB1 were above 20°C on 77 of 122 days (63%) during the 2009 June through September period.

Temperatures were monitored in Yellow Creek (YC1) 0.5 miles upstream of its confluence with the NFFR during the 2009 sampling season. This station represents conditions at the mouth of Yellow Creek upstream of the confluence with the NFFR. During the 2009 program, daily average temperatures at station YC1 ranged from 9.7 to 17.6°C, and averaged 14.6°C. The diel fluctuation in temperature ranged from 0.6 to 4.2°C, and

averaged 3.1°C in 2009. The maximum hourly average temperature recorded at this station during the 2009 monitoring program was 19.6°C on August 2 (Appendix C). The daily average temperatures at Station YC1 did not exceed 20°C during the June through September period in 2009 (Table 3-6). Figure 3-18 compares the daily average temperatures from several stations in the lower Belden Reach.

Temperatures were monitored in Chips Creek (CHIP) 0.2 miles upstream of its confluence with the NFFR (Rock Creek Reservoir) during the 2009 sampling season. Chips Creek discharges directly into Rock Creek Reservoir. During the 2009 program, daily average temperatures at station CHIP ranged from 10.1 to 17.1°C, and averaged 14.2°C (Figure 3-19). The diel fluctuation in temperature ranged from 0.8 to 4.9°C, and averaged 3.9°C in 2009. The maximum hourly average temperature recorded at this station during the 2009 monitoring program was 19.7°C on July 30 (Appendix C). The daily average temperatures at station CHIP did not exceed 20°C during the June through September period in 2009 (Table 3-6).

3.2.1.7 Rock Creek Reach of the NFFR and tributaries

The first temperature station in the NFFR downstream of Rock Creek Dam (NF9) is located immediately below the dam. During the 2009 program, daily average temperatures at station NF9 ranged from 14.3 to 22.2°C, and averaged 19.5°C. The diel fluctuation in temperature ranged from 0.3 to 1.4°C, and averaged 0.7°C in 2009. The maximum hourly average temperature recorded at this station during the 2009 monitoring program was

22.5°C on July 30 (Appendix C). The daily average temperatures at Station NF9 exceeded 20°C on 55 of 122 days (45%) during the June through September period in 2009 (Table 3-6). Figure 3-19 compares the 2009 daily average temperatures from NF9 with five other river stations located in the Rock Creek Reach.

The temperature station (NF10) in the NFFR near the NF-57 gaging station, is located approximately 1.5 miles downstream of Rock Creek Dam. The recorder deployed at this station used as a backup for the telemetered station (NF57 [water Temp]) as discussed in Section 3.2.2.2. The NF10 recorder was deployed late in July 2009 to verify performance of the NF57 sensor, as a result only a partial data set was available. Figure 3-19 compares the 2009 daily average temperatures from Station NF10 with five other river stations located in the Rock Creek Reach. As indicated in Figure 3-19, water temperatures at this location are typically very similar to those measured at NF9.

Temperatures were monitored in Milk Ranch Creek (MR1) 0.25 miles upstream of its confluence with the NFFR during the 2009 sampling season. This station represents conditions at the mouth upstream of the influence from the NFFR. During the 2009 program, daily average temperatures at station MR1 ranged from 10.3 to 17.1°C, and averaged 13.9°C. The diel fluctuation in temperature ranged from 0.9 to 4.4°C, and averaged 2.9°C in 2009. The maximum hourly average temperature recorded at this station during the 2009 monitoring program was 19.0°C on July 29 (Appendix C). The daily average temperatures at station MR1 did not exceed 20°C during the June through

September period in 2009 (Table 3-6). Figure 3-19 compares 2009 daily average temperatures from MR1 with other stations tributary to the NFFR in the Rock Creek Reach.

Temperatures were monitored in Chambers Creek (CHAM) 0.2 miles upstream of its confluence with the NFFR during the 2009 sampling season. This station represents conditions near the mouth upstream of any influence from the NFFR. During the 2009 program, daily average temperatures at station CHAM ranged from 10.5 to 18.1°C, and averaged 14.6°C. The diel fluctuation in temperature ranged from 0.9 to 5.3°C, and averaged 3.6°C in 2009. The maximum hourly average temperature recorded at this station during the 2009 monitoring program was 20.2°C on July 29 (Appendix C). The daily average temperatures at station CHAM did not exceed 20°C during the June through September period in 2009 (Table 3-6). Figure 3-19 compares 2009 daily average temperatures from CHAM with other stations tributary to the NFFR in the Rock Creek Reach.

The station located on the NFFR below Granite Creek (NF11) represents conditions in the middle section of the Rock Creek Reach and defines conditions downstream of several tributaries. During the 2009 program, daily average temperatures at station NF11 ranged from 14.4 to 22.5°C, and averaged 19.5°C. The diel fluctuation in temperature ranged from 0.8 to 4.6°C, and averaged 3.0°C in 2009. The maximum hourly average temperature recorded at this station during the 2009 monitoring program was 24.1°C on July 29

(Appendix C). The daily average temperatures at station NF11 were above 20°C on 59 of 122 days (48%) during the 2009 June through September period. Figure 3-19 compares the 2009 daily average temperatures from NF11 with four other river stations located in the Rock Creek Reach.

Temperatures were monitored in Jackass Creek (JC1) 0.2 miles upstream of its confluence with the NFFR during the 2009 sampling season. This station represents conditions near the mouth upstream of any influence from the NFFR. The data from this station for the period September 1 through September 30 were lost; as a result the data discussed covers the period June 1 to August 31. During the 2009 program, daily average temperatures at station JC1 ranged from 11.0 to 19.1°C, and averaged 15.4°C. The diel fluctuation in temperature ranged from 1.0 to 5.9°C, and averaged 3.3°C in 2009. The maximum hourly average temperature recorded at this station during the 2009 monitoring program was 20.9°C on July 29 (Appendix C). The daily average temperatures at station JC1 did not exceed 20°C during the June through August period in 2009 (Table 3-6). Figure 3-19 compares 2009 daily average temperatures from JC1 with other stations tributary to the NFFR in the Rock Creek Reach.

The NFFR station located upstream of the Bucks Creek confluence (NF12) represents conditions at the end of the Rock Creek Reach and defines conditions prior to inflow from Bucks Creek and Bucks Creek Powerhouse. During the 2009 program, daily average temperatures at station NF12 ranged from 14.5 to 22.7°C, and averaged 19.5°C. The diel

fluctuation in temperature ranged from 1.1 to 4.3°C, and averaged 2.8°C in 2009. The maximum hourly average temperature recorded at this station during the 2009 monitoring program was 24.1°C on July 29 (Appendix C). The daily average temperatures at station NF12 were above 20°C on 61 of 122 days (50%) during the 2009 June through September period. Figure 3-20 compares the 2009 daily average temperatures from NF12 with four other river stations located in the Rock Creek Reach.

The daily average change in temperature in the Rock Creek Reach (NFFR between Rock Creek Dam [NF9] and above Bucks Creek [NF12]) was evaluated for the period June 1 through September 30. The daily average temperatures at station NF12 in 2009 averaged 0.1°C warmer than at station NF9. This value calculates to a 0.01°C per mile increase in water temperature in this section of the NFFR.

Temperatures were monitored in Bucks Creek (BUCK1) 0.04 miles upstream of its confluence with the NFFR during the 2009 sampling season. During the 2009 program, daily average temperatures at station BUCK1 ranged from 10.0 to 19.2°C, and averaged 15.1°C. The diel fluctuation in temperature ranged from 0.9 to 5.7°C, and averaged 4.0°C in 2009. The maximum hourly average temperature recorded at this station during the 2009 monitoring program was 21.7°C on July 30 (Appendix C). The daily average temperatures at station BUCK1 did not exceed 20°C during the June through September period in 2009 (Table 3-6). Figure 3-20 compares 2009 daily average temperatures from BUCK1 with other stations tributary to the NFFR in the Rock Creek Reach.

Temperatures at Bucks Creek Powerhouse (BUCK2) are essentially the same as those present in Lower Bucks Creek Reservoir. Water temperatures at Bucks Creek Powerhouse were monitored in the tailrace at this facility. Water temperature data were then processed to remove data from periods when the powerhouse was not operating and when water within the penstock was static and no discharge to the NFFR was being made. During the 2009 program, daily average temperatures at station BUCK2 ranged from 12.0 to 16.1°C, and averaged 13.4°C. The diel fluctuation in temperature ranged from 0.0 to 3.7°C, and averaged 1.1°C in 2009. The maximum hourly average temperature recorded at this station during the 2009 monitoring program was 16.7°C on July 10 (Appendix C). The recorder at this station is located in the tailrace, which a high energy non-pool configuration. As a result, the maximum recorded water temperatures at this location are influenced by the highly variable operational conditions present at this location and may not accurately represent true maximum values (actual values are probably lower). The daily average temperatures at station BUCK2 did not exceed 20°C during the 113 operational days monitored in the 2009 June through September period. Figure 3-20 compares 2009 daily average temperatures from BUCK2 with other stations tributary to the NFFR in the Rock Creek Reach. The influence of Bucks Creek Powerhouse releases on water temperatures in the Rock Creek reach is illustrated during the period June 30 through July 9, when the powerhouse was off-line. As illustrated in Figure 3-20, mean daily water temperature during this period are the same at Stations NF12 and NF13. After July 9, Bucks Creek powerhouse is on-line and temperatures at NF13 are cooler than those measured at NF12.

The NFFR station located upstream of Rock Creek Powerhouse (NF13) represents conditions at the end of the Rock Creek Reach and defines conditions prior to receiving diversion flow from Rock Creek Powerhouse. During the 2009 program, daily average temperatures at station NF13 ranged from 14.1 to 21.0°C, and averaged 18.3°C. The diel fluctuation in temperature ranged from 1.0 to 4.5°C, and averaged 3.1°C in 2009. The maximum hourly average temperature recorded at this station during the 2009 monitoring program was 22.8°C on July 30 (Appendix C). The daily average temperatures at station NF13 exceeded 20°C on 14 of 122 (11%) during the 2009 June through September period. Figure 3-20 compares the 2009 daily average temperatures from NF13 with four other river stations located in the Rock Creek Reach.

The daily average change in temperature in the Rock Creek Reach (NFFR between Rock Creek Dam [NF9] and above Rock Creek Powerhouse [NF13]) was evaluated for the period June 1 through September 30. The daily average temperature at station NF13 averaged 1.2°C cooler in 2009 than at station NF9. The cooling occurs between stations NF12 and NF13 and is entirely related to the contribution from Bucks Creek and Bucks Creek Powerhouse.

Temperatures at Rock Creek Powerhouse (RC1) are essentially the same as those present in Rock Creek Reservoir. Water temperatures at Rock Creek Powerhouse were monitored at an internal location due to the configuration of the tailrace at this facility. Water

temperature data were then processed to remove data from periods when the powerhouse was not operating and when water within the penstock was static and no discharge to the NFFR was being made. During the 2009 program, daily average temperatures at station RC1 ranged from 14.4 to 22.5°C, and averaged 19.8°C. The diel fluctuation in temperature ranged from 0.4 to 2.0°C, and averaged 1.0°C in 2009. The maximum hourly average temperature recorded at this station during the 2009 monitoring program was 23.1°C on July 30 (Appendix C). The daily average temperatures at station RC1 exceeded 20°C on 65 of 122 days (53%) during the 2009 June through September period. Figure 3-20 compares the 2009 daily average temperatures from RC1 with four other river stations located in the Rock Creek Reach.

3.2.1.8 Cresta Reach of the NFFR and tributaries

Temperatures were monitored in Rock Creek (RC2) 0.2 miles upstream of its confluence with the NFFR during the 2009 sampling season. Rock Creek discharges directly into Cresta Reservoir approximately 0.75 miles downstream of Rock Creek Powerhouse. During the 2009 program, daily average temperatures at station RC2 ranged from 11.6 to 19.2°C, and averaged 15.8°C. The diel fluctuation in temperature ranged from 0.6 to 2.7°C, and averaged 1.8°C in 2009. The maximum hourly average temperature recorded at this station during the 2009 monitoring program was 20.4°C on July 29 (Appendix C). The daily average temperatures at station RC2 did not exceed 20°C during the 2009 June through September period. Figure 3-22 compares daily average temperatures from RC2 with another station tributary to the NFFR in the Cresta Reach in 2009.

The first temperature station in the NFFR downstream of Cresta Dam (NF14) is located upstream of the confluence with Grizzly Creek. This station is approximately 0.4 miles downstream of the dam. During the 2009 program, daily average temperatures at station NF14 ranged from 14.4 to 21.7°C, and averaged 19.1°C. The diel fluctuation in temperature ranged from 0.4 to 1.7°C, and averaged 0.9°C in 2009. The maximum hourly average temperature recorded at this station during the 2009 monitoring program was 22.4°C on July 29 (Appendix C). The daily average temperatures at station NF14 were above 20°C on 45 of 122 days (37%) during the 2009 June through September period. Figure 3-21 compares the 2009 daily average temperatures at NF14 with three other river stations located in the Cresta Reach.

Temperatures were monitored in Grizzly Creek (GR1) 0.5 miles upstream of its confluence with the NFFR during the 2009 sampling season. During the 2009 program, daily average temperatures at station GR1 ranged from 11.9 to 20.4°C, and averaged 16.4°C. The diel fluctuation in temperature ranged from 0.6 to 4.0°C, and averaged 2.8°C in 2009. The maximum hourly average temperature recorded at this station during the 2009 monitoring program was 22.2°C on July 30 (Appendix C). The daily average temperatures at station GR1 were above 20°C on 3 of 122 days (2%) during the June through September period in 2009 (Table 3-6). Figure 3-22 compares daily average temperatures from GR1 with another station tributary to the NFFR in the Cresta Reach in 2009.

The temperature station in the NFFR downstream of Grizzly Creek (NF15) was located near the NF-56 gaging station. This station is approximately 2.5 miles downstream of the dam, and is the site of the compliance telemetered sensor (NF56 [Water Temp] as discussed in Section 3.2.2.2. During routine review of data from the NF56 [Water Temp] temperature sensor, and comparison with the upstream NF57 [Water Temp] sensor, a system failure of some type was suspected. A field inspection verified a sensor error and remedial action was taken to install a backup sensor in situ and schedule repair of the telemetry system. A complete repair of the telemetry system was made on September 28 2009. A stand alone *in situ* recorder was deployed at this station (NF15) in late August to serve as a backup for the telemetered station. Figure 3-21 compares the 2009 daily average temperatures at Station NF15 with three other river stations located in the Cresta Reach. As indicated in Figure 3-21, water temperatures at this location are typically very similar to those measured at NF14.

The NFFR station located upstream of Cresta Powerhouse (NF16) represents conditions at the end of the Cresta Reach and defines conditions prior to receiving diversion flow from Cresta Powerhouse. During the 2009 program, daily average temperatures at station NF16 ranged from 14.9 to 22.3°C, and averaged 19.3°C. The diel fluctuation in temperature ranged from 0.8 to 3.2°C, and averaged 2.4°C in 2009. The maximum hourly average temperature recorded at this station during the 2009 monitoring program was 23.6°C on August 16 (Appendix C). The daily average temperatures at station NF16 were above 20°C on 48 of 122 days (39%) during the 2009 June through September period. Figure 3-

21 compares the 2009 daily average temperatures at NF16 with three other river stations located in the Cresta Reach.

The daily average change in temperature in the Cresta Reach (NFFR between Cresta Dam [NF14] and above Cresta Powerhouse [NF16]) was evaluated for the period June-September. The daily average temperature at station NF16 averaged 0.2°C warmer than station NF14 in 2009. This value calculates to a warming trend of 0.04°C per mile in this section of the Cresta Reach.

Temperatures at Cresta Powerhouse (CR1) are essentially the same as those present in Cresta Reservoir. Water temperatures at Cresta Powerhouse were monitored at an internal location due to the configuration of the tailrace at this facility. Water temperature data were then processed to remove data from periods when the powerhouse was not operating and when water within the penstock was static and no discharge to the NFFR was being made. During the 2009 program, daily average temperatures at station CR1 ranged from 14.4 to 22.0°C, and averaged 19.5°C. The diel fluctuation in temperature ranged from 0.1 to 1.6°C, and averaged 0.7°C in 2009. The maximum hourly average temperature recorded at this station during the 2009 monitoring program was 22.7°C on July 30 (Appendix C). The daily average temperatures at station CR1 were above 20°C on 67 of 122 operational days (55%) during the 2009 June through September period. Figure 3-21 compares the 2009 daily average temperatures at CR1 with three other river stations located in the Cresta Reach.

3.2.1.9 Middle Fork Feather River

The Licensee collected temperature data in 2009 from a station in the Middle Fork of the Feather River (MFFR) at Milsap Bar (MB1). These data were collected in order to compare temperature conditions in the NFFR with those in the lower portion of the unregulated MFFR. This station exhibits large changes in stage during the spring runoff, and installation of in situ recorders can be hampered by high flow. As a result of these conditions, the recorder at this location was out of the water for most of the period from June through early July 2009. During the 2009 program, daily average temperatures from station MB1 ranged from 14.5 to 23.0°C, and averaged 20.2°C. The diel fluctuation in temperature ranged from 1.1 to 3.2°C, and averaged 2.5°C in 2009. The maximum hourly average temperature recorded at this station during the 2009 monitoring program was 24.6°C on July 29 (Appendix C). The daily average temperatures at station MB1 were above 20°C on 21 of 66 days (32%) during the 2009 June through September period. (effectively July through September) Figure 3-23 compares the 2009 daily average temperatures at MB1 with river stations located in the Rock Creek and Cresta reaches of the NFFR.

As indicated in Figure 3-23, temperatures in the NFFR were similar in value and trend to measured temperatures in the MFFR at Milsap Bar (unregulated) through August. From September through October, NFFR temperatures were similar in value and trend to those observed in the EBNFFR. Temperatures in the EBNFFR (unregulated) were warmer than

those in the MFFR during the entire monitoring period. All stations were above the 20°C level from late June through early September 2009.

3.2.2 Special Evaluations

This section presents the results of various special field tests and data analyses conducted on the 2009 data. Typically this section contains the results of tests and evaluations conducted in response to specific requests by the ERC or implemented by the Licensee to improve monitoring methods or to identify potential mitigation sources.

3.2.2.1 Temperature mitigation Operations at Caribou Complex Powerhouses.

As part of the FERC license agreement, Licensee is required to monitor real time temperature in the NFFR below Rock Creek and Cresta Dams. During periods of sustained elevated temperature when the daily average temperatures at NF57 and NF56 exceeded 20°C consecutively for two days, Licensee is required to attempt temperature mitigation through operational changes. During the period July 4 through July 10, 2009, the Licensee initiated temperature-based operational changes at the Caribou Powerhouse Complex in order to mitigate temperatures downstream. During this period the Licensee curtailed or eliminated the use of Caribou No. 2 and passed flow preferentially through Caribou No. 1, with flow through Caribou No.2 reduced to less than 100 cfs. Prior to the start of the mitigation effort (hereafter referred to as the “test period” or “test”), Caribou No.1 had been operated at low idle flows through May and June. As a result, the pool of cool water in Butt Valley Reservoir had been utilized to some degree. However, starting

temperatures were still comparatively low, with mean daily temperatures at Caribou No.1 being about 14°C in the days prior to the start of the test. Table 3-7 summarizes the results of data from the test period. Figure 3-24 compares daily average temperatures from the Caribou powerhouse complex, with selected stations in the NFFR during the test period.

As indicated in Figure 3-24A, the operational mitigation test did generate lower temperatures in the Belden Reach of the system. However, the affect of the mitigation test on river reaches further downstream was less pronounced and occurred in concert with reduced air temperatures observed during the same period. The magnitude of change in water temperature resulting from the test is estimated in the following discussion.

Determining what affect the mitigation effort had on temperatures downstream of Belden Forebay is made difficult by changing ambient conditions during the same period. As stated, the mitigation test occurred July 4 through July 10. Peak water temperatures during this period in the lower NFFR as well as greater regional area occurred on or about July 1, 2009. The fact that air temperatures peaked before the event indicates that ambient meteorological conditions were probably trending downward during the test. As a result, it is nearly impossible to determine the absolute affect of operational changes on temperatures downstream. Average daily temperatures during the test where compared with a static value equal to the mean daily temperature at each station the day prior to the test (Delta-T). This assumes that temperatures at each location would not have changed significantly over the course of the seven day test period had the test not been conducted.

This method does not necessarily generate a reliable estimate of the actual change in temperature related to the mitigation effort. However, it does illustrate the deflection of temperatures as a result of the mitigation efforts.

As indicated in Table 3-7, release temperatures from the Caribou Powerhouse complex were approximately 21°C before the event began. Once Caribou No. 1 came into full utilization and Caribou No. 2 utilization ended, temperatures from the complex dropped to approximately 17°C. This decrease in temperature (Delta-T) of 4.1°C represents the maximum change measured at any station during the test (Figure 3-24A). The maximum Delta-T as well as the lowest release temperature occurred on the first day of the test. Temperatures at this location increased in a progressive manner as the pool of cool water were depleted, reaching approximately 18.0°C by the end of the test.

The BD1 monitoring station represents temperatures in the upper layers of the forebay that are passed through Belden Powerhouse. The NF5 station represents temperatures in the lower layers of the forebay, as well as initial temperatures in the Belden Reach. To evaluate the effect of operational changes on temperatures, each transport pathway will be discussed separately.

During the test, temperatures in Belden Forebay (BD1) exhibited a maximum decrease in Delta-T of 3.5°C, which was recorded on the third day of the test (Figure 3-24A). During

Table 3-7

Summary of Water Temperature Data from Select Stations during 2009 Caribou Complex Mitigation Test.

Date	Butt Valley PH Temperature (°C)	Butt Valley PH Flow (cfs)	Caribou No. 1 Temperature (°C)	Caribou No. 1 Flow (cfs)	Caribou No. 2 Temperature (°C)	Caribou No. 2 Flow (cfs)	Resultant Caribou Complex [1] (°C)	Belden PH Temperature (°C)	Belden PH Flow (cfs)	Remarks
06/27/09	16.5	518	13.4	67	21.0	371	20.4	19.1	359	Pre-Test
06/28/09	16.4	518	13.5	67	21.1	382	20.1	19.5	361	Pre-Test
06/29/09	16.6	517	13.7	68	21.3	374	20.7	19.8	379	Pre-Test
06/30/09	17.5	700	13.9	115	20.9	557	17.7	19.9	600	Pre-Test
07/01/09	17.5	1030	14.1	78	21.0	1120	20.3	20.1	1144	Pre-Test
07/02/09	17.0	1109	14.1	76	21.8	1089	21.0	20.8	1101	Pre-Test
07/03/09	16.9	911	14.2	77	21.6	1209	20.9	21.1	1278	Pre-Test
07/04/09	17.2	1041	16.6	924	21.7	65	16.9	19.9	922	Test
07/05/09	17.5	778	17.2	962		0	17.2	18.1	897	Test
07/06/09	17.6	848	17.2	961		0	17.2	17.8	897	Test
07/07/09	17.7	848	17.4	962		0	17.4	17.9	878	Test
07/08/09	18.0	975	17.7	962		6	17.7	18.0	922	Test
07/09/09	17.9	1177	17.9	961		0	17.9	18.3	915	Test
07/10/09	18.1	1180	18.0	961		11	18.0	18.4	850	Test
07/11/09	18.1	1050	18.3	278	20.4	654	19.6	18.9	844	Post Test
07/12/09	17.7	1051	18.3	198	20.2	643	19.7	19.5	779	Post Test
07/13/09	18.2	1054	18.4	232	20.6	681	19.9	19.6	839	Post Test
07/14/09	18.5	1046	18.5	225	21.0	667	20.6	20.1	848	Post Test
07/15/09	18.5	1040	19.1	267	20.9	812	20.5	20.3	1033	Post Test
07/16/09	18.8	1046	18.5	388	21.1	699	19.7	20.3	1009	Post Test
07/17/09	19.0	1289	19.1	496	21.1	846	20.1	20.4	1255	Post Test

[1] Based on mass balance calculations.

Table 3-7

(Continued)

Date	Belden Forebay (BD1) (°C)	NFFR below Belden Dam (NF5) (°C)	NFFR above Yellow Creek (NF8) (°C)		NFFR below Rock Creek Dam (NF9) (°C)		NFFR below Cresta Dam (NF14) (°C)		East Branch Above NFFR (EB1) (°C)	Remarks
06/27/09	18.5	16.3	19.9		19.0		18.6		21.9	Pre-Test
06/28/09	18.9	16.7	20.2		19.6		18.8		22.4	Pre-Test
06/29/09	19.2	17.0	20.3		19.9		19.3		22.5	Pre-Test
06/30/09	19.0	17.3	20.1		19.9		19.7		22.3	Pre-Test
07/01/09	20.0	17.5	20.5		19.9		20.0		22.7	Pre-Test
07/02/09	20.8	18.2	20.6		20.4		20.2		22.7	Pre-Test
07/03/09	21.1	19.4	20.9		20.8		20.5		22.5	Pre-Test
07/04/09	19.2	18.7	20.6		20.6		20.9		22.0	Test
07/05/09	17.8	17.6	20.0		19.4		20.6		21.9	Test
07/06/09	17.6	17.3	19.4		18.5		19.3		21.6	Test
07/07/09	17.7	17.4	18.8		18.0		18.6		20.9	Test
07/08/09	17.9	17.5	18.9		18.1		18.3		20.7	Test
07/09/09	18.2	17.6	18.9		18.3		18.4		20.6	Test
07/10/09	18.4	17.9	19.0		18.4		18.4		20.6	Test
07/11/09	18.8	18.0	19.0		18.6		18.2		20.7	Post Test
07/12/09	19.4	18.1	19.4		19.0		18.3		21.3	Post Test
07/13/09	19.6	18.2	19.2		19.1		18.7		20.7	Post Test
07/14/09	20.0	18.5	19.9		19.7		18.9		21.6	Post Test
07/15/09	20.2	19.0	20.4		20.2		19.5		22.2	Post Test
07/16/09	20.2	19.2	20.8		20.4		19.8		22.6	Post Test
07/17/09	20.3	19.2	20.8		20.4		20.0		22.8	Post Test

the test, temperatures in the lower portion of Belden Forebay as measured by NF5 were somewhat less responsive to changes in operation. The maximum Delta-T decrease was 2.0°C, which was also recorded on day three of the test (Figure 3-24A).

Station NF8 is located immediately upstream of the confluence with Yellow Creek and downstream of the East Branch NFFR confluence. This Station closely followed temperature trends measured in the East Branch, and the temperature indices reflected the diminishing influence of the mitigation test (Figure 3-24B). The maximum Delta-T decrease was 2.1°C, which was recorded on the fourth day of the test.

The stations below Rock Creek Dam and Cresta Dam (NF9 and NF14, respectively), were used to detect the downstream effect from the mitigation test. It was assumed that these stations would be the least affected by tributary inflow and ambient conditions. Temperatures at the beginning of the Rock Creek Reach (NF9) had a maximum Delta-T decrease of 2.8°C, which was recorded on the fourth day of the test (Figure 3-24B). Temperatures at the beginning of the Cresta Reach (NF14) had a maximum Delta-T decrease of 2.3°C, which was recorded on the first day after the test was completed (Figure 3-24B). The large discrepancy between the occurrence of the two indices and their small values indicates that the influence of operational mitigation on temperatures in the Cresta Reach was probably not significant and that these values reflected the change in ambient conditions as much as operational changes at Caribou.

The observed rate of change in release temperatures at Caribou No. 1 supports preceding assertions that the pool of cool water is of limited volume. The day before the beginning of the test, Caribou No.1 release temperatures measured 14.2°C, by the end of the seven day test period release temperatures had increased to 18.0°C. Mean daily temperatures remained above 19°C for the period July 17 through September 11, 2009.

3.2.2.2 Performance of Telemetry Stations

Real-time temperature (telemetry) systems were installed in the gaging stations located at NF-56 and NF-57. To distinguish these stations from the corresponding flow stations, the temperature stations are termed NF-56 [Water Temp] and NF-57 [Water Temp]. Temperatures were measured approximately at 5-minute intervals and stored locally on a data logger as well as being transmitted through SCADA to the Rock Creek and Caribou Powerhouse Switching Centers. The temperature data is processed for the daily average value, mid-night to mid-night, and if temperature levels are above 20°C on two consecutive days, a signal alerts operators and temperature conditions are reported to the ERC and USFS. An appropriate course of action is then developed in order to try and maintain daily average temperatures below 20°C at NF-56 [Water Temp] and/or NF-57 [Water Temp]. Both telemetry sensors are tested once a year before the monitoring season. In 2009, the calibration process indicated that both station had sensor errors over their range of less than 0.1 °C.

Both telemetry sensors are calibration checked twice a year. In 2009, the pre-season calibration process indicated that both stations had sensor errors within the acceptable range of less than 0.1°C. However, during the early part of the monitoring period a sensor error was detected at the NF-56 [Water Temp] station a subsequent accuracy check and corrective action were taken. After the sensor error was detected, *in situ* recorders were installed near each gage station as a check on the accuracy of each sensor and to provide a redundant data set from these locations.

Figure 3-25A compares daily average temperatures from station NF-57 [Water Temp] with the NF10 in-situ data logger. The in-situ recorder at NF10 was located in a riffle approximately 100 feet downstream of the NF-57 gaging pool. Data from NF10 is representative of the well mixed conditions in the main river channel, whereas data from the NF-57 [Water Temp] telemetry sensor measures temperatures in a relatively static pool approximately 8 feet below water surface. On average, for the period July 22 through September 30, 2009 there was no difference between sensors (difference was less than the defined 0.1°C accuracy of the in situ instrument), the maximum absolute difference was never greater than ±0.5°C.

Figure 3-25B compares daily average temperatures from station NF-56 [Water Temp] with the NF15 *in-situ* data logger. The in-situ recorder at NF-15 was located in the same pool as telemetry sensor. Comparison between instantaneous readings from NF-57 [Water Temp] indicated some degree of error at either one or both sensors. A field investigation

indicated that the sensor at NF-56 at failed and a replacement procedure was conducted. Prior to the replacement being completed, an in situ recorder was also placed at this location. The NF-56 [Water Temp] sensor is placed approximately 5 feet below water surface, while the NF-10 *in situ* recorder is placed on the stream bottom in about 12 feet of water. An evaluation of the degree to which the telemetry system at this location differed from the in-situ data loggers was not performed for this station due to the know sensor error during the period. The NF-56 [Water Temp] sensor was repaired on September 28, 2009.

Another stipulation of the FERC 4C Condition was that, "*Temperatures at NF-57 and at NF-56 are to be monitored and telemetered, from June 1 through October 31, for the term of the Project License. If temperatures from the telemetered stations demonstrate that mean daily water temperatures regularly exceed 20°C in October, the entire monitoring program will be expanded to include October*". This stipulation was incorporated into the monitoring program presented in the Water Temperature Monitoring Plan. The telemetered stations were continuously operated throughout the entire year. Recorded at five-minute intervals, the instantaneous water temperatures at NF-56 [Water Temp] and at NF-57 [Water Temp] never exceeded 20 °C in October.

3.2.3 Summary of MWAT and MWMT Calculations.

Three different indices were used to characterize the water temperature regime observed during the 2009 monitoring program. The first index value was simply the daily maximum (DM) temperature, and was derived from the maximum hourly average value.

The second value utilized was the maximum weekly maximum temperature (MWMT) value. The MWMT is generated by evaluating the daily maximum temperatures from each station averaged over a 7-day period (moving average for the entire period) and then selecting the maximum averaged value for the monitoring period. The third value is the maximum weekly average temperature (MWAT) value. The MWAT is generated by evaluating the daily average temperatures from each station averaged over a 7-day period (moving average for the entire period) and then selecting the maximum averaged value for the monitoring period. The DM, MWMT, and MWAT indices were selected to summarize the water temperature regime in the Project area at the request of the ERC.

Table 3-8 summarizes the three indices for the period June through September from six key stations in the lower NFFR (Rock Creek-Cresta and Poe projects) and one station from the Middle Fork Feather River. As indicated, the maximum value for each index occurred in August at Station EB1, the East Branch Feather River. The coolest values for the three indices where observed in June at several stations (Station NF7, NF12, and NF16).

3.3 COMPARISON OF ANNUAL RESULTS

3.3.1 Comparative Summary of Monitoring Results

In order to facilitate evaluation of current results with previous year's data, a comparative summary of the data is presented in Table 3-9. As indicated by these data, average 2009

Table 3-8

Evaluation of 2009 Data from Select Stations Using Three Water Temperature Indices

Station	June	July	August	September	Period (7/1-8/31)
Max Instantaneous Temperature (DM)[1]					
NF7	20.6	23.6	23.2	21.8	23.6
EB1	24.5	26.0	25.1	21.7	26.0
NF8	22.8	25.0	24.6	22.2	25.0
NF12	21.8	24.1	23.5	21.7	24.1
NF16	21.4	23.6	23.3	21.3	23.6
NFFR above Poe PH	23.9	25.9	25.6	22.7	25.9
MFFR1	--	24.6	24.1	20.9	21.2
Max Weekly Average Temperature (MWAT)					
NF7	17.0	20.7	20.9	19.6	20.9
EB1	21.6	24.1	24.3	20.7	24.3
NF8	19.7	22.1	22.3	20.1	22.3
NF12	19.4	22.0	22.3	20.5	22.3
NF16	18.9	21.7	22.0	20.1	22.0
NFFR above Poe PH	21.1	23.6	24.0	21.0	24.0
MFFR1	--	22.6	20.6	17.2	20.6
Max Weekly Maximum Temperature (MWMT)					
NF7	20.0	23.3	23.4	21.8	23.4
EB1	23.6	25.2	25.4	21.8	25.4
NF8	22.1	24.5	24.6	22.1	24.6
NF12	21.0	23.5	23.6	21.6	23.6
NF16	20.6	23.1	23.3	21.2	23.3
NFFR above Poe PH	23.1	25.4	25.6	22.5	25.6
MFFR1	--	24.2	22.1	18.3	22.1

Table 3-9

Comparison of 2009 Water Resource Data with Results from 2002-2008 Monitoring Efforts

Station	Year	Average Temperature (°C)	July 1 through August 31 Daily Average Exceedance of 20°C (% of days)	Maximum Hourly Temperature (°C)	Average Flow (cfs)
River Stations					
NF1	2002	14.9	0%	20.1	148
	2003	13.9	0%	19.9	225
	2004	14.3	0%	19.1	160
	2005	14.1	0%	19.3	200
	2006	12.8	0%	18.1	283
	2007	14.5	0%	20.4	95
	2008	14.4	0%	19.3	109
	2009	14.3	0%	19.4	102
HB1	2002	11.9	0%	17.1	75
	2003	11.5	0%	14.9	89
	2004	11.9	0%	15.5	29
	2005	11.5	0%	14.7	84
	2006	11.6	0%	15.6	125
	2007	11.6	0%	15.6	80
	2008	11.5	0%	15.1	76
	2009	11.9	0%	14.6	80
BC1	2002	13.9	0%	18.9	44
	2003	13.7	0%	19.0	65
	2004	13.4	0%	18.1	50
	2005	13.9	0%	18.4	58
	2006	15.7	0%	17.6	70
	2007	13.2	0%	18.1	75
	2008	16.9	0%	20.6	381
	2009	13.0	0%	17.4	42
NF2	2002	12.9	0%	14.0	36
	2003	11.9	0%	12.8	36
	2004	21.1	98%	23.0	36
	2005	13.6	2%	21.5	37
	2006	9.2	0%	16.7	57
	2007	12.3	0%	14.3	40
	2008	13.4	0%	15.8	37
	2009	12.9	0%	14.7	39

Table 3-9
(Continued)

Station	Year	Average Temperature (^{o}C)	July 1 through August 31 Daily Average Exceedance of 20°C (% of days)	Maximum Hourly Temperature (^{o}C)	Average Flow (cfs)
River Stations					
NF3	2002	14.7	0%	17.4	--
	2003	13.9	0%	17.2	--
	2004	18.4	0%	21.4	--
	2005	14.9	0%	20.6	--
	2006	11.7	0%	18.3	--
	2007	14.0	0%	16.7	--
	2008	14.6	0%	17.0	--
	2009	14.2	0%	16.7	--
NF4	2002	15.4	0%	18.4	75
	2003	14.8	0%	18.8	70
	2004	16.8	0%	20.1	64
	2005	15.1	0%	19.0	71
	2006	13.2	0%	18.6	101
	2007	14.6	0%	17.7	64
	2008	14.8	0%	17.5	59
	2009	14.6	0%	17.5	57
BD1	2002	21.7	95%	23.0	--
	2003	20.0	65%	22.0	--
	2004	21.2	90%	22.4	--
	2005	20.6	79%	22.2	--
	2006	18.1	0%	19.8	--
	2007	20.5	85%	21.7	--
	2008	21.0	89%	23.0	--
	2009	20.8	84%	22.5	--
NF5	2002	20.1	61%	21.5	143
	2003	19.1	23%	21.0	143
	2004	20.8	79%	22.1	145
	2005	19.8	55%	21.9	147
	2006	17.2	0%	19.6	143
	2007	19.9	66%	21.5	146
	2008	19.6	35%	21.7	150
	2009	19.9	61%	21.7	147

Table 3-9

(Continued)

Station	Year	Average Temperature (°C)	July 1 through August 31 Daily Average Exceedance of 20°C (% of days)	Maximum Hourly Temperature (°C)	Average Flow (cfs)
NF6	2002	19.9	48%	22.9	--
	2003	18.9	8%	22.4	--
	2004	20.4	77%	23.2	--
	2005	19.4	45%	22.9	--
	2006	17.2	0%	20.4	--
	2007	19.7	48%	22.7	--
	2008	19.4	31%	22.7	--
	2009	19.6	40%	22.9	--
NF7	2002	19.9	50%	24.0	--
	2003	19.1	10%	23.6	--
	2004	20.3	76%	23.9	--
	2005	19.5	40%	23.3	--
	2006	17.5	0%	21.3	--
	2007	19.6	35%	23.5	--
	2008	19.6	34%	23.9	--
	2009	19.5	31%	23.6	--
NF8	2002	21.1	87%	25.2	--
	2003	20.7	73%	25.4	--
	2004	21.3	100%	25.5	--
	2005	21.1	97%	25.3	--
	2006	19.9	37%	24.1	--
	2007	20.7	87%	24.8	--
	2008	20.8	87%	24.9	--
	2009	20.7	74%	25.0	--
EB1	2002	22.8	97%	26.5	66
	2003	22.3	100%	27.4	128
	2004	22.3	100%	26.6	76
	2005	22.4	97%	26.6	147
	2006	21.4	82%	26.5	197
	2007	22.4	100%	26.0	72
	2008	22.6	100%	25.6	63
	2009	22.2	100%	26.0	70

Table 3-9
(Continued)

Station	Year	Average Temperature (°C)	July 1 through August 31 Daily Average Exceedance of 20°C (% of days)	Maximum Hourly Temperature (°C)	Average Flow (cfs)
NF9	2002	--	--	--	--
	2003	20.0	58%	22.2	--
	2004	21.1	92%	22.2	--
	2005	20.7	81%	22.0	--
	2006	18.7	0%	20.3	--
	2007	20.5	85%	21.6	--
	2008	20.7	85%	22.8	--
	2009	20.7	82%	22.5	--
NF10	2002	21.3	97%	23.4	213
	2003	20.1	65%	22.8	214
	2004	21.1	92%	22.5	272
	2005	20.7	81%	22.6	265
	2006	18.7	3%	20.8	282
	2007	20.5	85%	22.4	248
	2008	--	--	--	253
	2009	21.2	Partial	23.0	293
NF11	2002	21.3	93%	24.0	--
	2003	20.3	68%	24.3	--
	2004	21.1	95%	23.9	--
	2005	20.7	82%	24.1	--
	2006	19.2	15%	22.9	--
	2007	20.8	92%	23.7	--
	2008	20.5	81%	23.9	--
	2009	20.7	85%	24.1	--
NF12	2002	21.3	95%	24.0	--
	2003	20.3	66%	23.9	--
	2004	21.2	97%	23.6	--
	2005	20.8	84%	23.9	--
	2006	19.4	23%	22.7	--
	2007	20.8	94%	23.4	--
	2008	20.7	85%	23.8	--
	2009	20.8	85%	24.1	--

Table 3-9
(Continued)

Station	Year	Average Temperature (°C)	July 1 through August 31 Daily Average Exceedance of 20°C (% of days)	Maximum Hourly Temperature (°C)	Average Flow (cfs)
River Stations					
NF13	2002	20.0	58%	24.1	--
	2003	18.5	18%	24.2	--
	2004	18.8	10%	22.8	--
	2005	17.9	0%	22.7	--
	2006	16.6	0%	21.2	--
	2007	19.6	35%	23.6	--
	2008	19.7	39%	23.0	--
	2009	19.3	23%	22.8	--
NF14	2002	20.9	94%	22.8	--
	2003	19.8	34%	22.9	--
	2004	20.7	87%	22.2	--
	2005	20.7	73%	22.1	--
	2006	18.4	3%	20.9	--
	2007	20.3	71%	22.5	--
	2008	20.3	60%	22.4	--
	2009	20.3	71%	22.4	--
NF15	2002	20.9	92%	23.5	263
	2003	19.9	42%	23.9	291
	2004	20.7	85%	23.3	273
	2005	20.2	66%	23.3	301
	2006	18.5	6%	22.2	289
	2007	20.4	71%	23.6	242
	2008	--	--	--	216
	2009	20.3	Partial	22.3	333
NF16	2002	21.3	95%	23.9	--
	2003	20.1	50%	23.9	--
	2004	21.0	95%	23.4	--
	2005	20.5	77%	23.4	--
	2006	18.8	8%	22.2	--
	2007	20.8	87%	23.6	--
	2008	20.8	89%	23.5	--
	2009	20.5	73%	23.6	--

Table 3-9
(Continued)

Station	Year	Average Temperature (°C)	July 1 through August 31 Daily Average Exceedance of 20°C (% of days)	Maximum Hourly Temperature (°C)	Average Flow (cfs)
Tributary Stations					
BC2	2002	10.7	0%	11.2	--
	2003	10.8	0%	11.9	--
	2004	10.7	0%	11.2	--
	2005	10.8	0%	11.4	--
	2006	10.9	0%	11.7	--
	2007		Not Deployed in 2007		
	2008		Not Deployed in 2008		
	2009		Not Deployed in 2009		
BC3	2002	12.4	0%	14.0	14.0
	2003	12.3	0%	14.3	15.1
	2004	12.6	0%	14.5	15.1
	2005	12.4	0%	14.3	14.4
	2006	12.1	0%	14.2	14.8
	2007	12.1	0%	13.9	12.9
	2008	12.1	0%	13.9	11.4
	2009	12.1	0%	14.0	11.2
MC1	2002	14.3	0%	16.7	4.3
	2003	13.5	0%	NA	6.4
	2004	14.0	0%	16.2	5.6
	2005	14.0	0%	16.4	6.7
	2006	13.5	0%	16.3	9.4
	2007	13.7	0%	15.8	4.7
	2008	13.7	0%	15.5	3.7
	2009	13.6	0%	15.8	3.7
YC1	2002	16.4	0%	20.1	55
	2003	15.7	0%	20.1	81
	2004	15.7	0%	18.1	64
	2005	15.8	0%	19.1	105
	2006	15.0	0%	19.2	99
	2007	15.9	0%	20.3	55
	2008	15.9	0%	19.7	56
	2009	15.7	0%	19.6	65

Table 3-9
(Continued)

Station	Year	Average Temperature (°C)	July 1 through August 31 Daily Average Exceedance of 20°C (% of days)	Maximum Hourly Temperature (°C)	Average Flow (cfs)
Tributary Stations					
CHIP	2002	16.3	0%	21.0	21
	2003	15.4	0%	20.7	30
	2004	15.6	0%	19.5	21
	2005	15.1	0%	19.1	43
	2006	14.9	0%	19.7	33
	2007	16.1	0%	20.0	18
	2008	15.7	0%	20.2	18
	2009	15.3	0%	19.7	20
MR1	2002	15.7	0%	20.4	4.3
	2003	15.4	0%	21.1	11.7
	2004	15.5	0%	20.2	6.1
	2005	15.5	0%	19.8	9.2
	2006	14.9	0%	19.9	8.3
	2007	15.5	0%	19.2	3.4
	2008	15.4	0%	18.6	3.5
	2009	14.7	0%	19.0	6.1
CHAM	2002	16.3	0%	21.4	5.3
	2003	15.7	0%	22.2	10.1
	2004	16.0	0%	20.9	4.4
	2005	15.9	0%	21.4	11.9
	2006	15.2	0%	21.1	7.6
	2007	15.9	0%	20.4	2.8
	2008	16.0	0%	19.9	3.0
	2009	15.4	0%	20.2	3.6
JC1	2002	16.5	0%	21.2	--
	2003	16.4	2%	22.8	--
	2004	16.5	0%	21.4	--
	2005	16.6	0%	21.9	--
	2006	16.1	0%	21.9	--
	2007	16.5	0%	20.2	--
	2008	16.6	0%	19.7	--
	2009	16.3	0%	20.9	--

Table 3-9
(Continued)

Station	Year	Average Temperature (°C)	July 1 through August 31 Daily Average Exceedance of 20°C (% of days)	Maximum Hourly Temperature (°C)	Average Flow (cfs)
Tributary Stations					
BUCK1	2002	17.7	3%	23.5	14
	2003	17.0	8%	23.5	25
	2004	17.3	0%	23.2	15
	2005	17.0	0%	22.7	20
	2006	16.4	0%	22.6	21
	2007	16.8	0%	22.5	13
	2008	16.6	0%	21.0	17
	2009	16.3	0%	21.7	16
RC2	2002	17.6	0%	20.7	4
	2003	17.9	19%	22.7	5.5
	2004	17.4	0%	20.5	3.9
	2005	17.3	0%	20.9	16.3
	2006	16.8	3%	21.3	6.9
	2007	17.3	0%	20.3	3.5
	2008	17.2	0%	20.0	3.6
	2009	16.8	0%	20.4	5.4
GR1	2002	18.7	19%	22.7	21
	2003	17.8	13%	22.7	27
	2004	18.4	3%	22.3	20
	2005	18.0	3%	22.3	30
	2006	17.5	8%	22.5	29
	2007	18.4	11%	22.1	16
	2008	18.4	5%	22.0	16
	2009	17.6	3%	21.9	20
MB1	2002	21.1	76%	25.3	--
	2003	20.5	42%	24.6	--
	2004	20.7	76%	24.1	--
	2005	20.6	70%	23.4	--
	2006	19.9	39%	24.5	--
	2007	21.0	73%	24.8	--
	2008	20.9	89%	24.3	--
	2009	20.5	Partial period	24.6	--

Table 3-9
(Continued)

Station	Year	Average Temperature (°C)	July 1 through August 31 Daily Average Exceedance of 20°C (% of days)	Maximum Hourly Temperature (°C)	Average Flow (cfs)
Powerhouse Stations					
HB2	2002	15.4	0%	21.6	51
	2003	15.6	0%	21.2	89
	2004	14.7	0%	19.4	23
	2005	15.2	0%	19.8	18
	2006	15.4	0%	20.3	36
	2007	16.5	0%	20.9	21
	2008	12.6	0%	17.8	4.0
	2009	16.9	0%	20.8	7.2
BV1	2002	20.7	85%	22.6	865
	2003	18.6	15%	20.8	1,281
	2004	20.4	69%	22.1	1,445
	2005	19.6	56%	21.6	1,547
	2006	15.7	0%	19.2	1,354
	2007	19.9	54%	21.5	1,126
	2008	21.4	95%	22.9	415
	2009	19.8	61%	22.0	1.316
CARB1	2002	20.4	68%	22.2	401
	2003	18.8	0%	20.3	406
	2004	20.6	74%	22.1	542
	2005	19.2	50%	21.7	496
	2006	16.2	0%	18.8	398
	2007	19.3	45%	21.4	289
	2008	19.6	56%	21.1	68
	2009	19.2	26%	22.8	516
CARB2	2002	22.9	100%	24.7	408
	2003	20.9	80%	24.1	873
	2004	22.0	100%	23.4	841
	2005	21.8	88%	23.9	996
	2006	19.2	6%	20.9	971
	2007	21.5	100%	22.9	842
	2008	21.9	100%	23.6	565
	2009	21.9	100%	23.9	802

Table 3-9
(Continued)

Station	Year	Average Temperature (°C)	July 1 through August 31 Daily Average Exceedance of 20°C (% of days)	Maximum Hourly Temperature (°C)	Average Flow (cfs)
Powerhouse Stations					
BD2	2002	21.5	93%	22.8	759
	2003	20.0	65%	21.8	1,195
	2004	21.3	92%	22.3	1,283
	2005	20.7	79%	22.2	1,435
	2006	18.4	0%	19.7	1,321
	2007	20.7	89%	21.8	1,082
	2008	21.3	98%	22.9	526
	2009	20.9	84%	22.5	1.248
BUCK2	2002	15.5	0%	20.0	98
	2003	13.4	0%	20.1	125
	2004	13.6	0%	15.9	164
	2005	12.5	0%	18.6	190
	2006	11.8	0%	18.5	209
	2007	15.1	0%	21.2	106
	2008	16.1	0%	19.5	91
	2009	13.7	0%	16.7	115
RC1	2002	21.5	97%	22.8	925
	2003	20.5	77%	22.7	1,478
	2004	21.6	97%	22.7	1,455
	2005	21.0	81%	22.5	1,687
	2006	18.5	0%	20.0	1,634
	2007	21.0	92%	22.3	1,191
	2008	20.6	77%	22.8	565
	2009	21.1	84%	23.1	1.277
CR1	2002	21.2	100%	22.8	977
	2003	19.9	47%	22.7	1,581
	2004	20.7	89%	21.9	1,627
	2005	20.2	73%	21.6	1,852
	2006	18.5	2%	20.4	1,909
	2007	20.7	90%	22.3	1,290
	2008	20.5	69%	22.5	770
	2009	20.6	84%	22.7	1.431

Table 3-9

(Continued)

Station	Year	Elevation (ft PGE datum)	July 1 - August 31 Average Water Temperature Epilimnion (° C)		Hypolimnion (° C)
Lake	2002	4483.7	23.3		10.4
Almanor	2003	4487.6	23.0	Partial	10.1
	2004	4485.8	22.7		12.2
	2005	4486.8	23.3		10.8
	2006	4490.7	23.0		7.4
	2007	4494.0	22.0	Partial	10.3
	2008	4484.0	22.1		11.4
	2009	4484.1	22.4		10.3
Butt	2002	4128.1	23.0		17.5
Valley	2003	4130.2	21.6		16.0
Reservoir	2004	4129.9	22.5		20.2
	2005	4130.2	22.3		16.9
	2006	4127.9	20.5		16.4
	2007	4135.1	22.0		17.3
	2008	4122.3	22.3		16.7
	2009	4124.6	22.1		17.7

water temperatures throughout the watershed were similar to or slightly cooler than those measured in 2008. Ambient meteorological and regional runoff conditions were similar to those measured in 2008, with the exception that September 2009 air temperatures were hotter than normal (3% exceedance).

During the 2009 period, runoff into Lake Oroville was recorded at levels higher than 2008, but significantly less than the levels observed in 2002-2007 (Table 3-10). Precipitation in the watershed averaged 89% of normal (Table 3-10). The available state indices all listed 2009 as Dry with regard to precipitation and runoff. For the NFFR drainage, the 2009 water year was classified as Dry based on annual inflow forecasts to Lake Oroville per FERC 1962 License Condition No. 5B. The 2009 monitoring effort was the third consecutive below normal (dry and critical dry) water year. Air temperature conditions were comparatively mild, with only September exhibiting extreme temperature conditions (Table 3-10).

Table 3-10

Comparison of 2009 Meteorological Conditions with Conditions Observed in 2002-2008

Classification	2002	2003	2004	2005	2006	2007	2008	2009
Watershed Runoff								
Water Year classification	Dry	Above Norm	Below Norm	Above Norm	Wet	Dry	Critically Dry	Dry
State Runoff Index	6.4	8.2	7.5	8.5	13.1	6.2	5.4	5.5
Watershed Precipitation[1]	72%	110%	82%	104%	153%	66%	70%	89%
Total Annual Inflow to Lake Oroville[2]	2,689,314	4,008,511	3,332,018	3,490,846	7,376,285	2,143,199	1,887,727	2,736,961
Water Year Type – Feather River[3]	Dry	Normal	Normal	Normal	Wet	Critically Dry	Critically Dry	Dry
Air Temperature Exceedance								
Canyon Dam June Ranking	16%	4%	17%	---	5%	40%	38%	62%
Canyon Dam July Ranking	2%	5%	30%	3%	12%	20%	37%	25%
Canyon Dam August Ranking	23%	38%	25%	20%	43%	28%	2%	48%
Canyon Dam Sept. Ranking	25%	5%	51%	80%	35%	72%	13%	8%

1. Average based on four stations within the watershed.
2. Recorded inflow for period Oct 2009 through May 2009 (CDEC – 2009).
3. Forecast based on definition outlined in Rock Creek-Cresta Settlement Agreement.

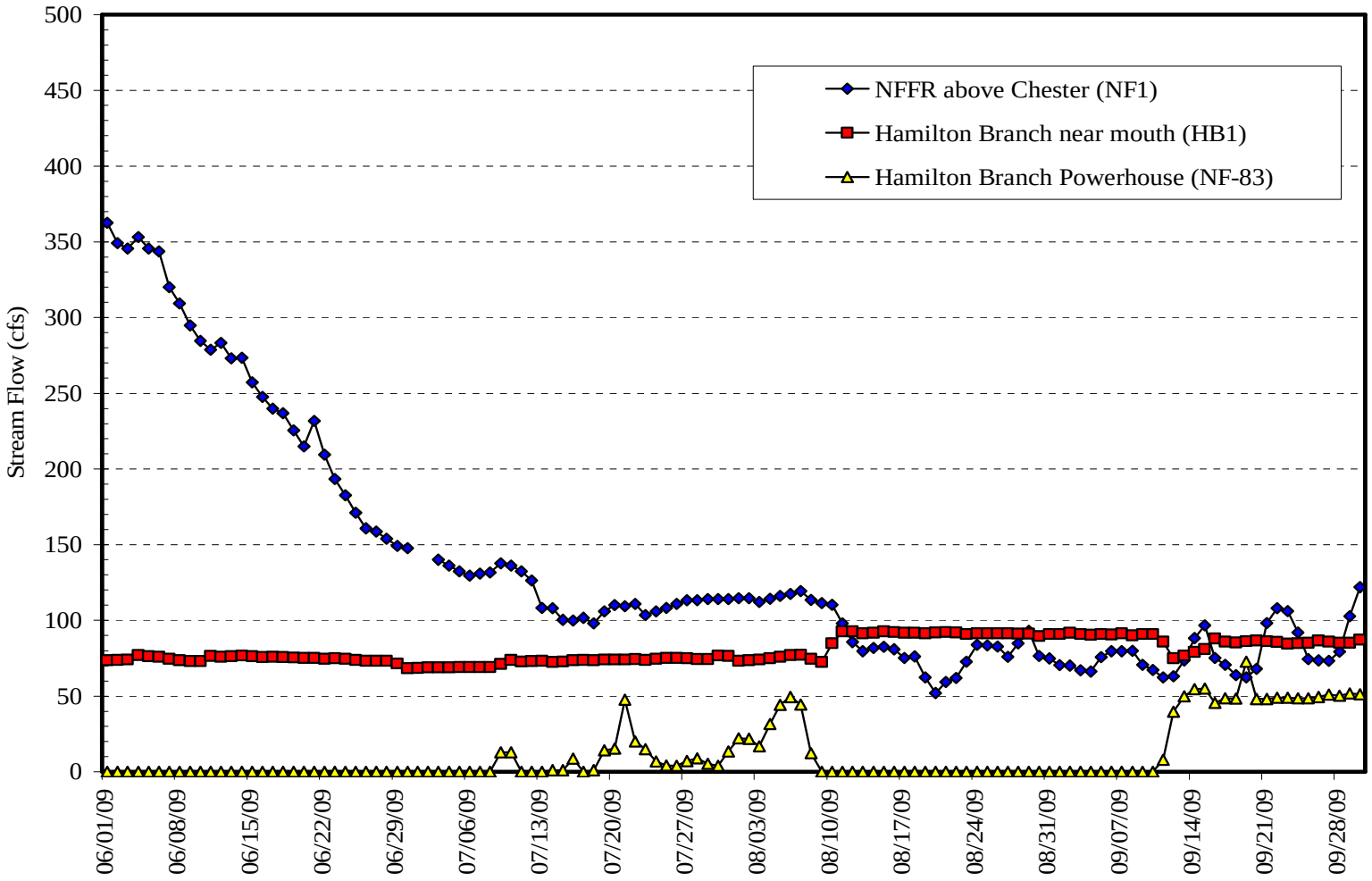


Figure 3-1. Comparison of daily average flow at stations tributary to Lake Almanor – 2009

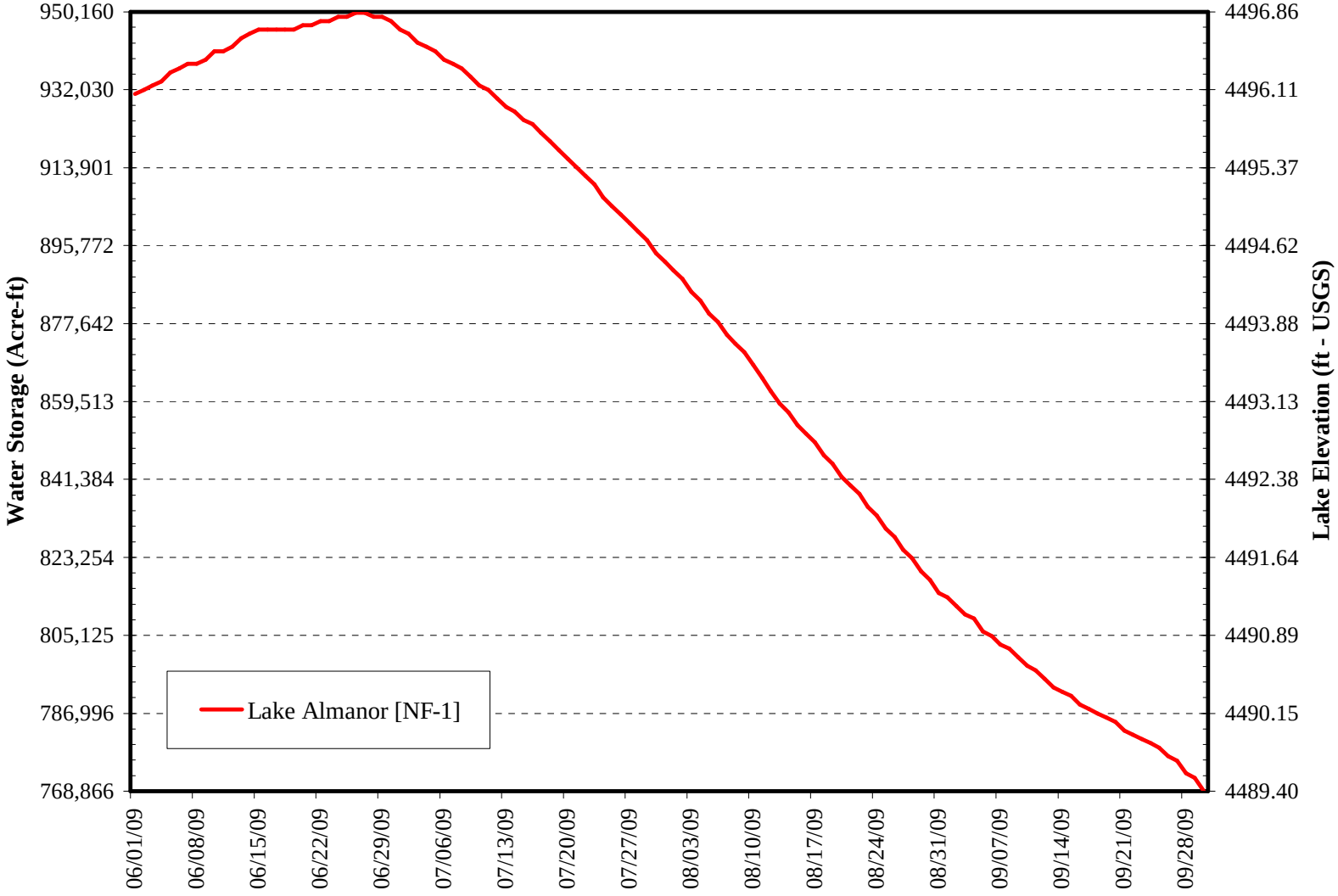
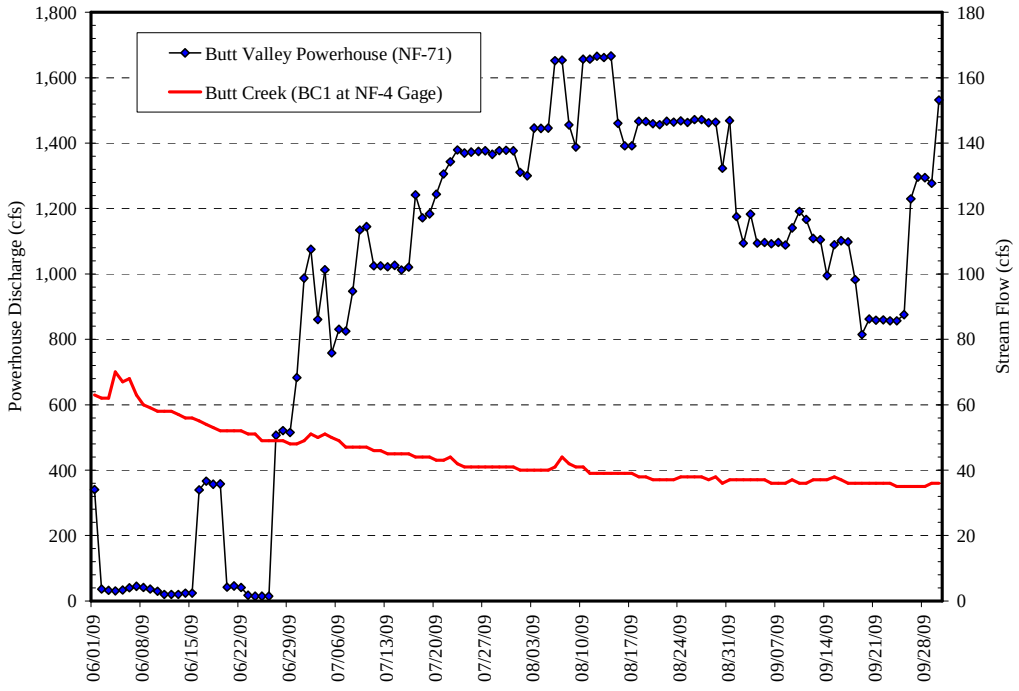
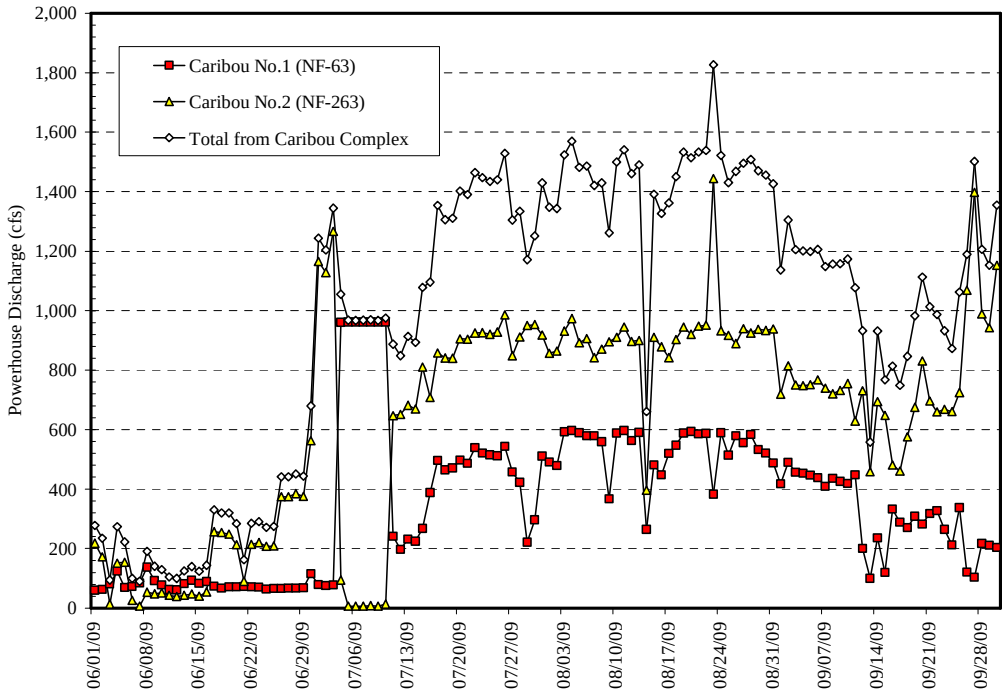

950,160
932,030
913,901
895,772
877,642
859,513
841,384
823,254
805,125
786,996
768,866
Water Storage (Acre-ft)
4496.86
4496.11
4495.37
4494.62
4493.88
4493.13
4492.38
4491.64
4490.89
4490.15
4489.40
Lake Elevation (ft - USGS)
Lake Almanor [NF-1]
06/01/09
06/08/09
06/15/09
06/22/09
06/29/09
07/06/09
07/13/09
07/20/09
07/27/09
08/03/09
08/10/09
08/17/09
08/24/09
08/31/09
09/07/09
09/14/09
09/21/09
09/28/09

Figure 3-2. Lake Almanor daily average storage and elevation – 2009

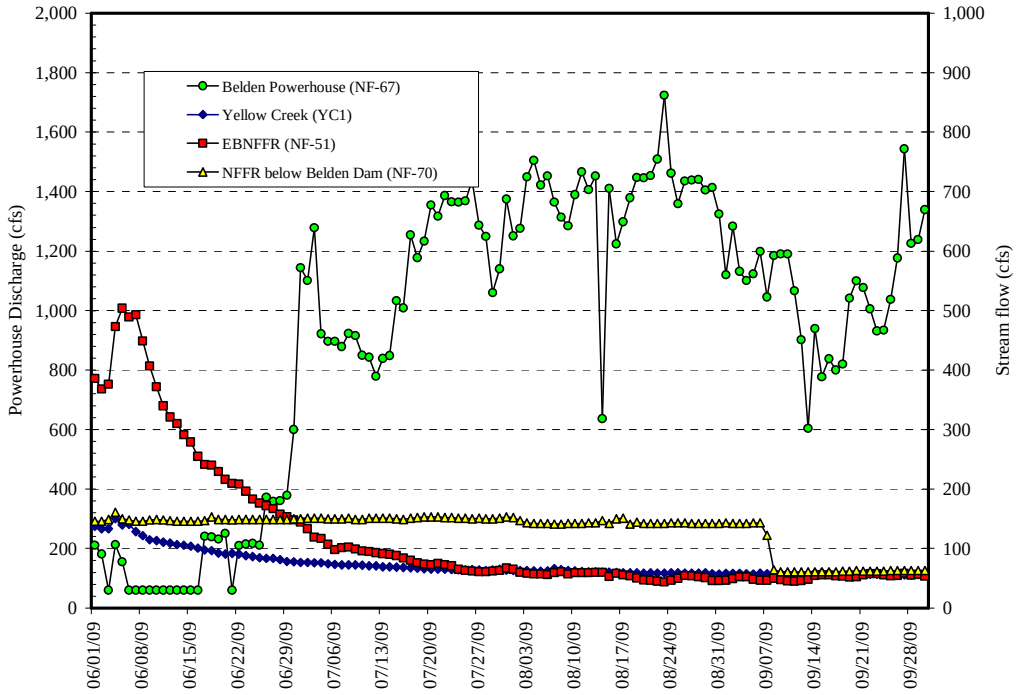


A. Butt Valley Powerhouse and Butt Creek.

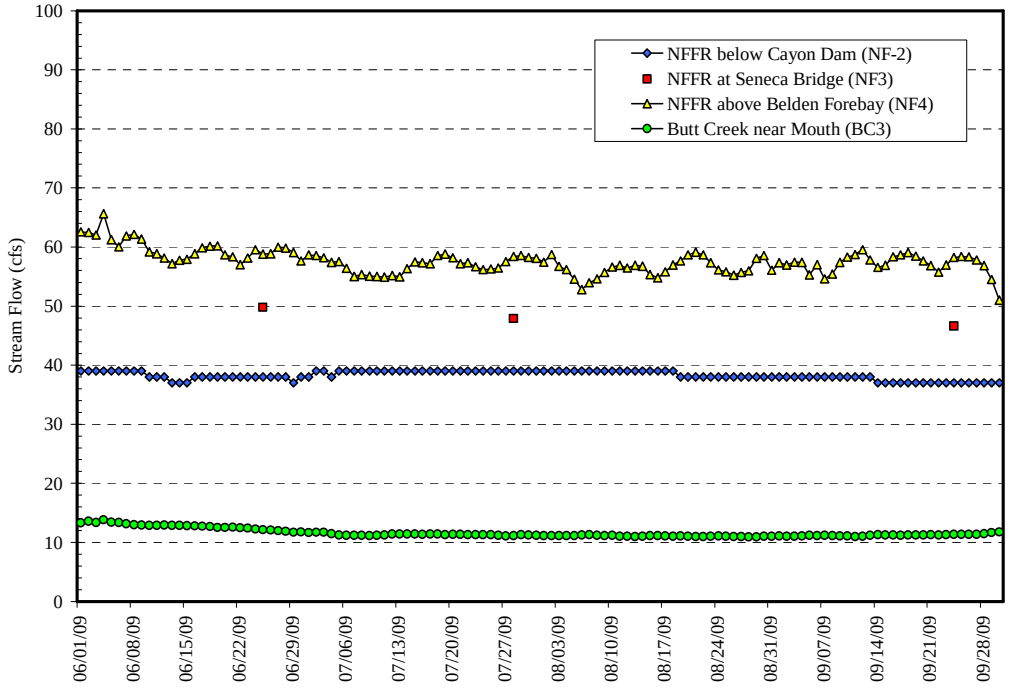


B. Caribou No.1 and Caribou No.2 powerhouses.

Figure 3-3. Comparison of daily average flow from select stations in the upper NFFR Project – 2009



C. Belden Reach.



D. Seneca Reach.

Figure 3-3 (continued).

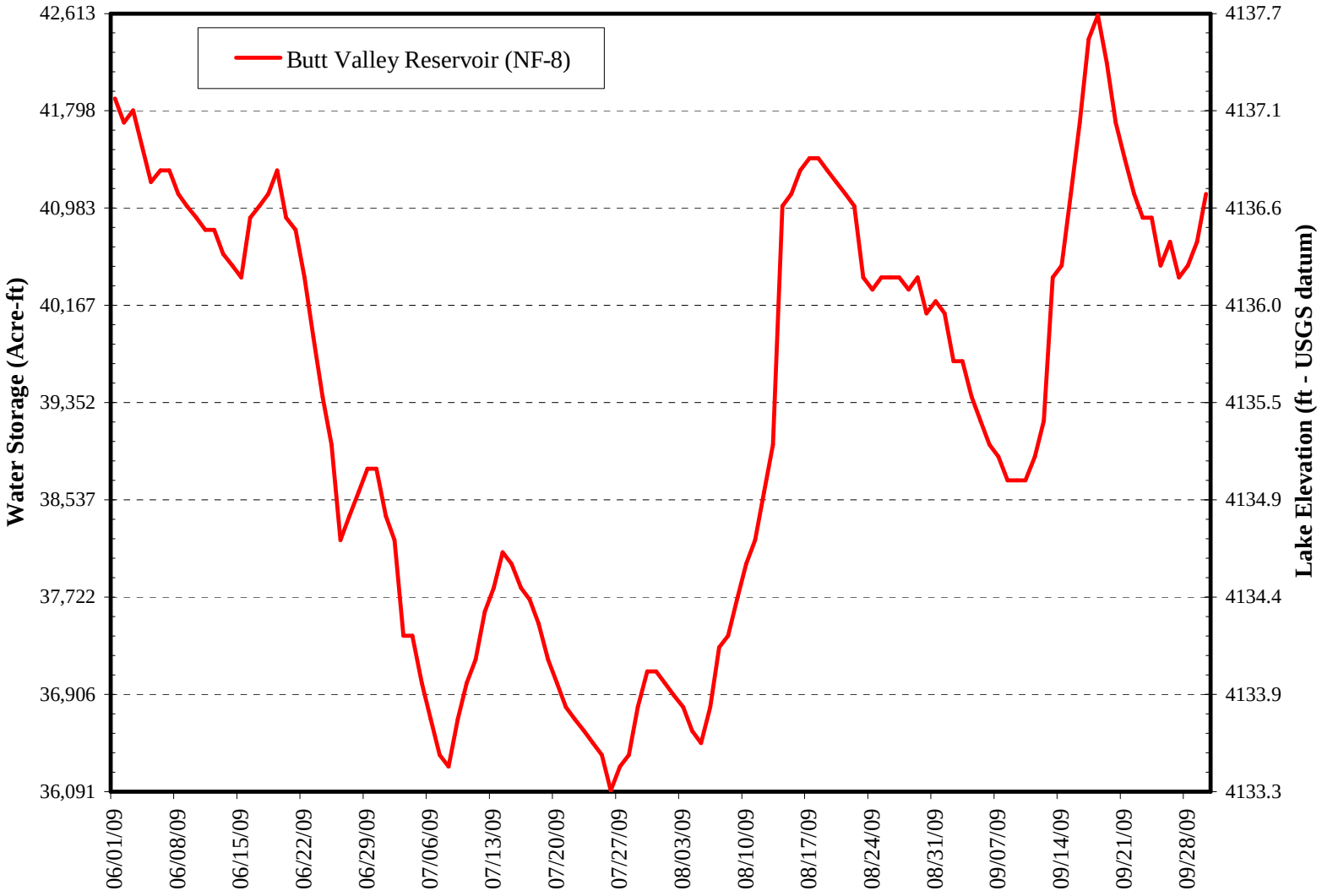
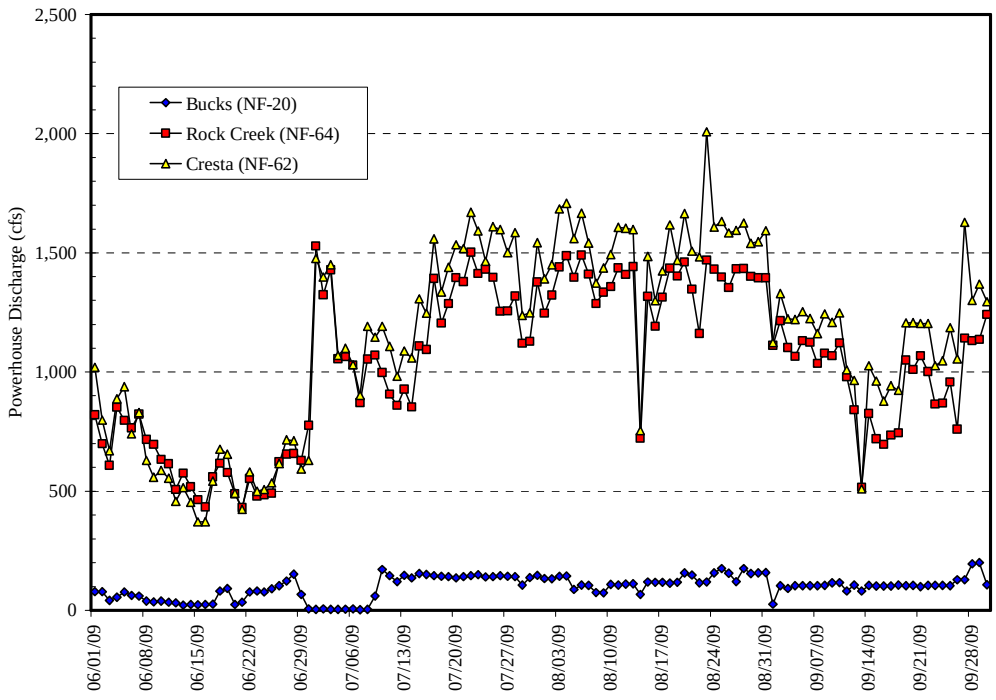
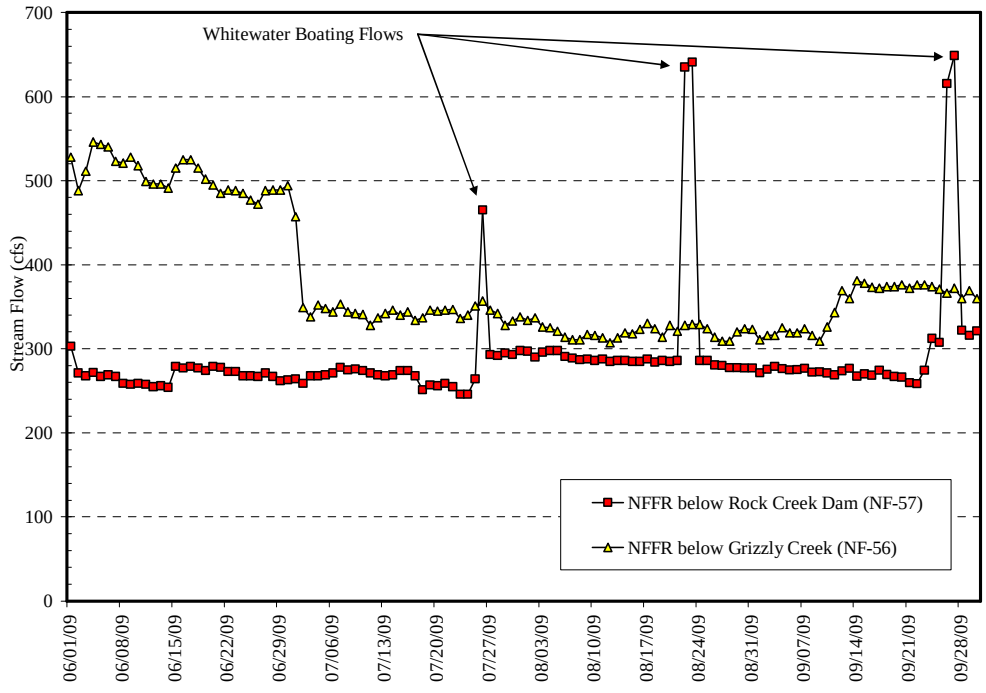

Butt Valley Reservoir (NF-8)
Water Storage (Acre-ft)
Lake Elevation (ft - USGS datum)
42,613
41,798
40,983
40,167
39,352
38,537
37,722
36,906
36,091
4137.7
4137.1
4136.6
4136.0
4135.5
4134.9
4134.4
4133.9
4133.3
06/01/09
06/08/09
06/15/09
06/22/09
06/29/09
07/06/09
07/13/09
07/20/09
07/27/09
08/03/09
08/10/09
08/17/09
08/24/09
08/31/09
09/07/09
09/14/09
09/21/09
09/28/09

Figure 3-4. Butt Valley Reservoir average daily storage and elevation – 2009



A. Bucks, Rock Creek and Cresta Powerhouse.



B. Rock Creek and Cresta Reach.

Figure 3-5. Comparison of daily average flow in Rock Creek-Cresta reaches – 2009

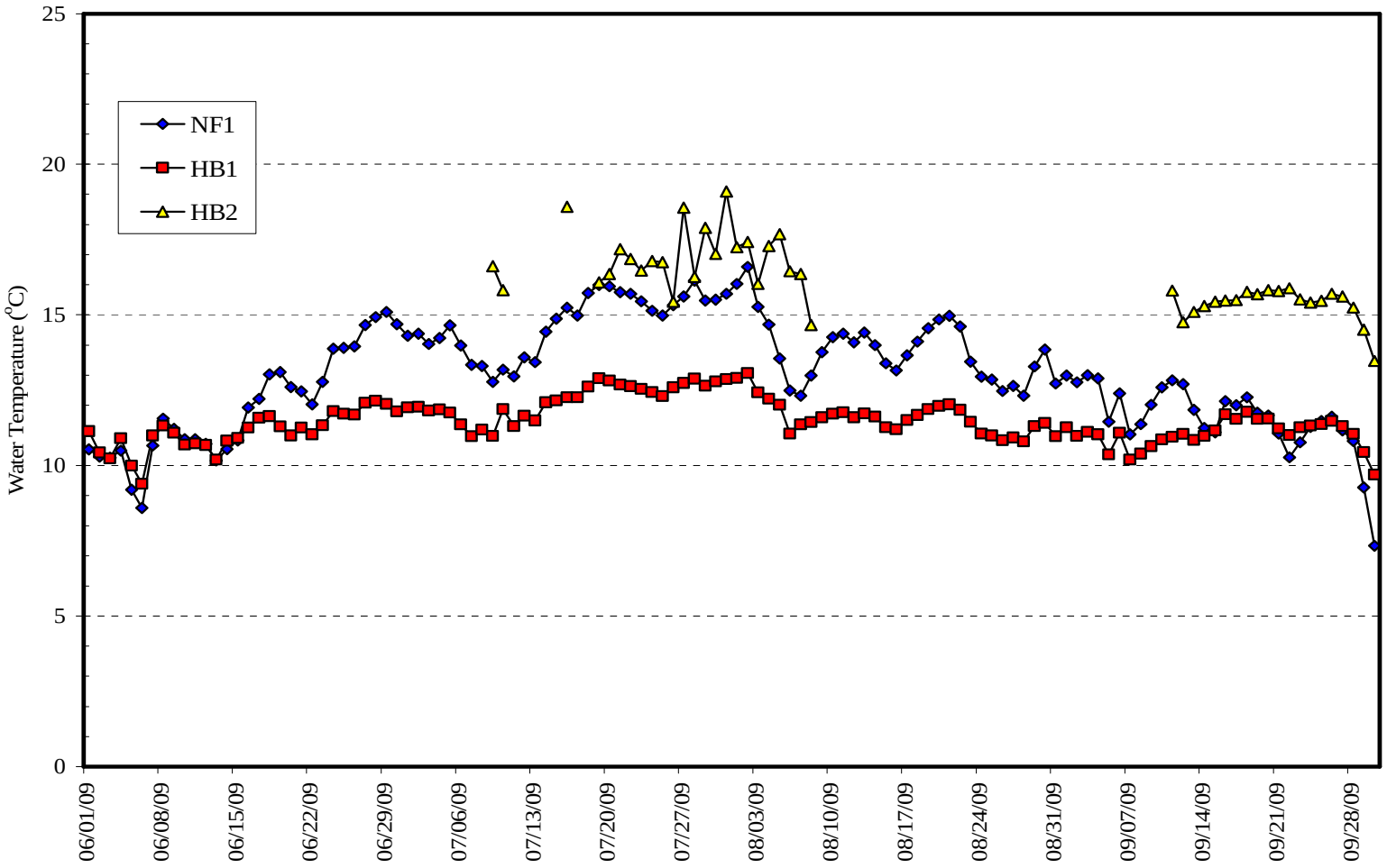


Figure 3-6. Comparison of daily average water temperature from stations tributary to Lake Almanor – 2009

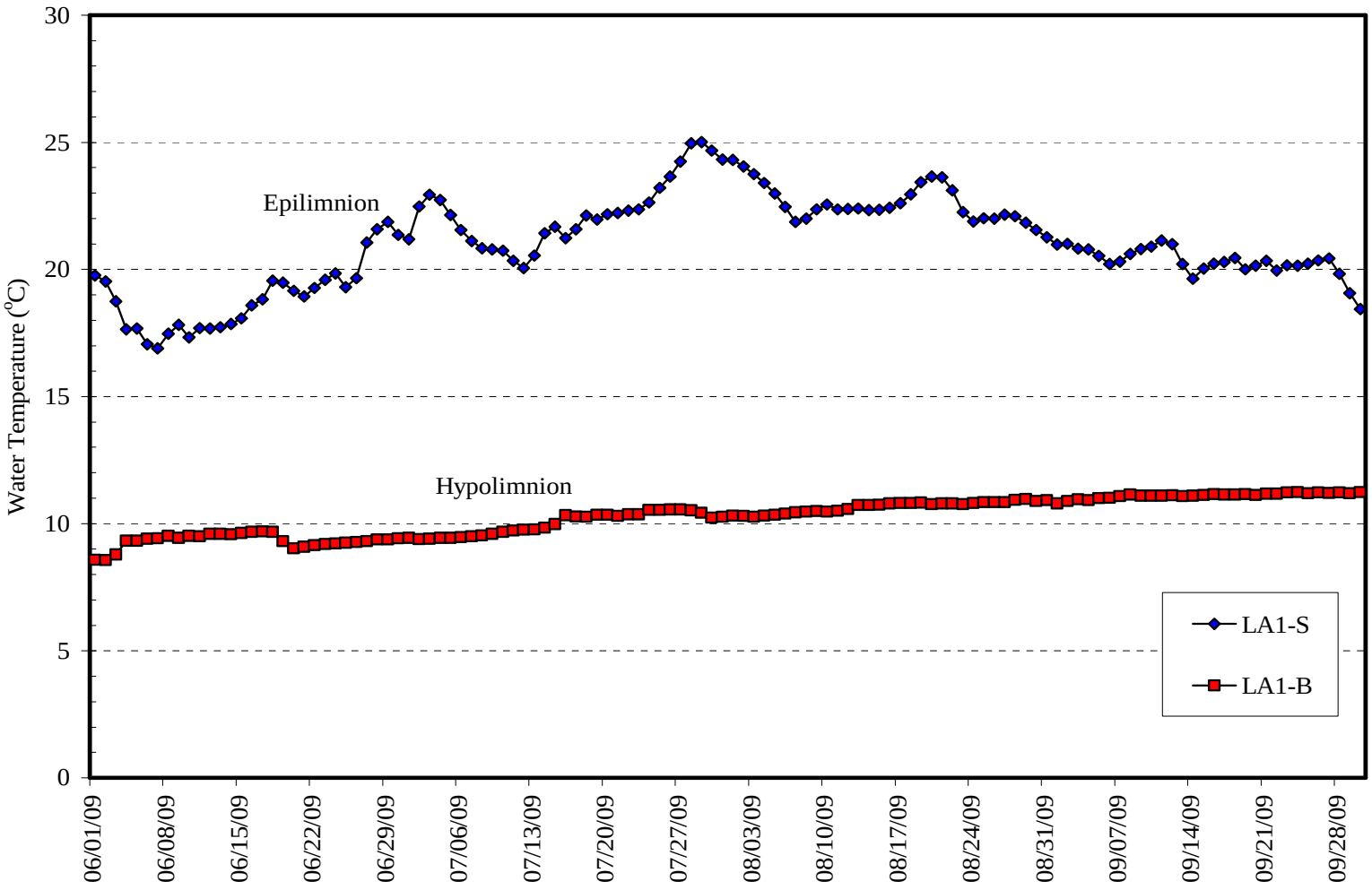


Figure 3-7. Comparison of daily average water temperature from two depths in Lake Almanor near Canyon Dam Intake – 2009

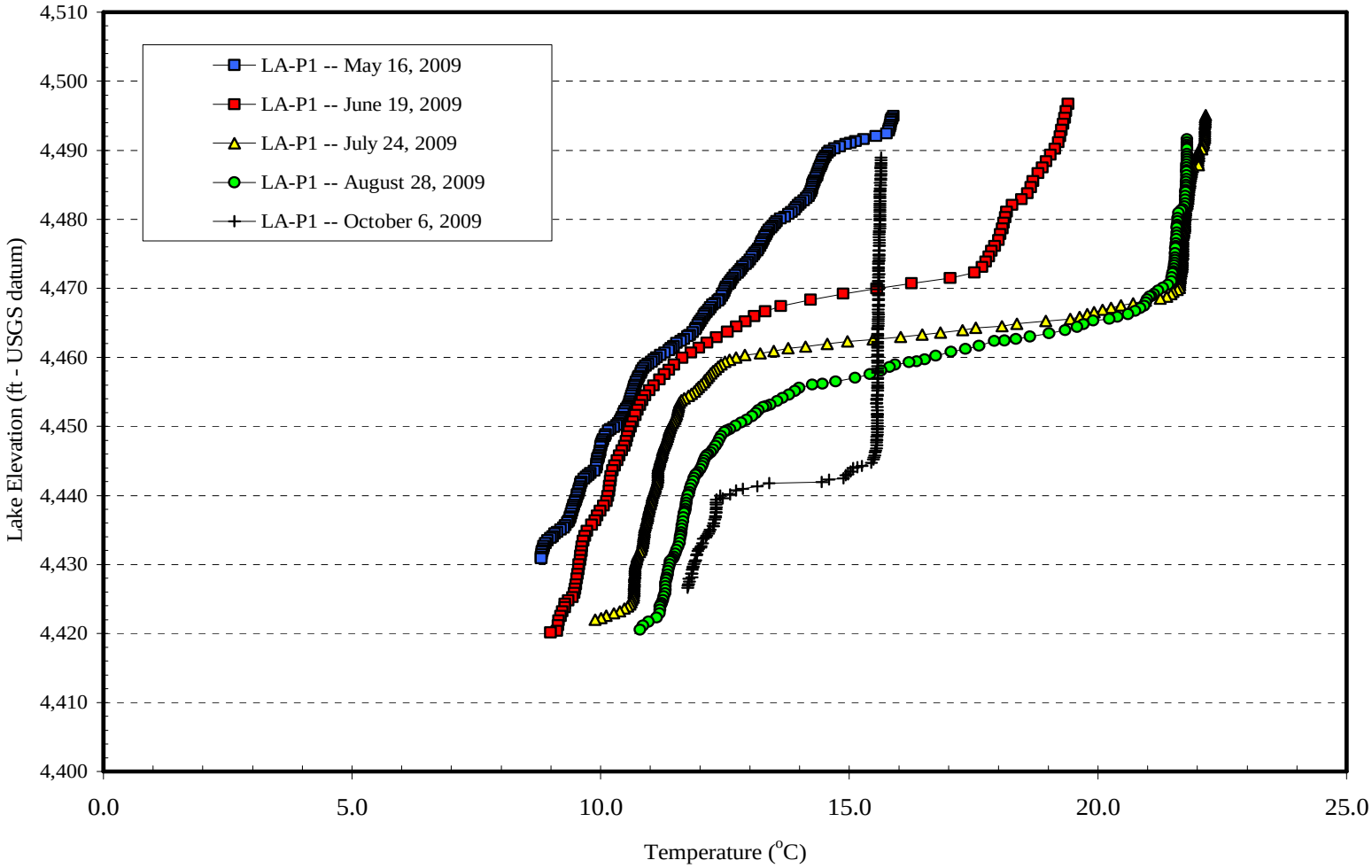
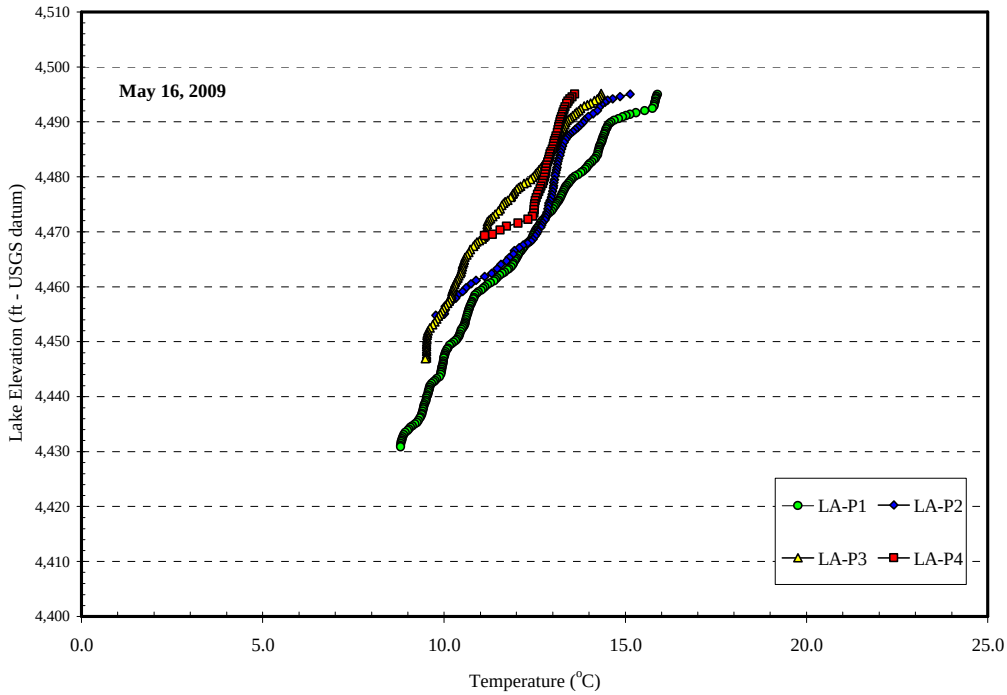
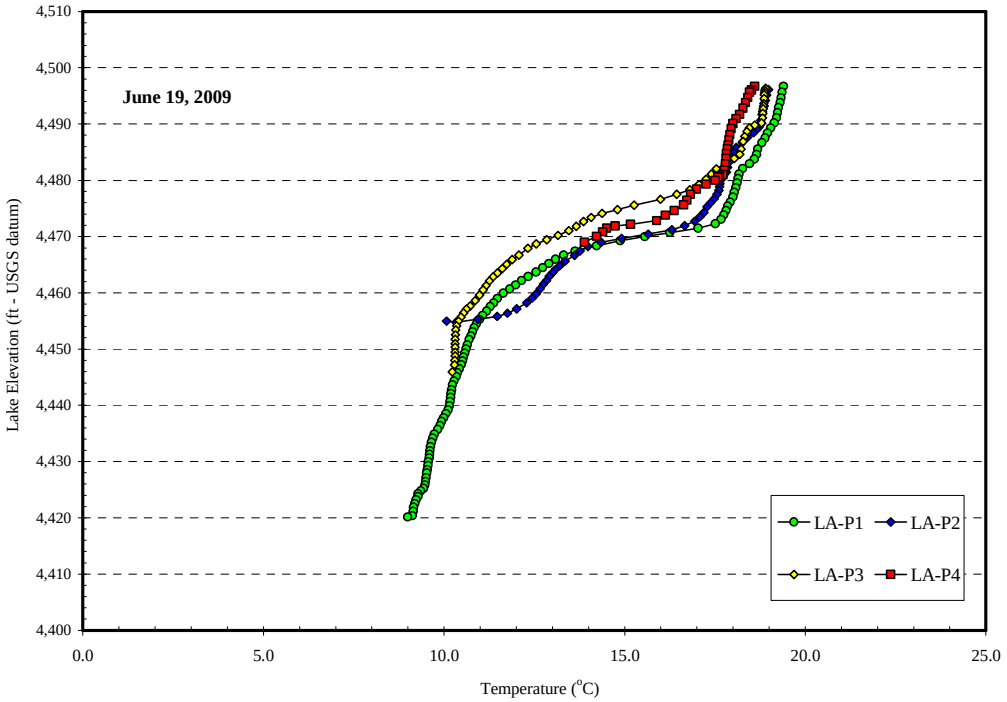


Figure 3-8. Comparison of monthly water temperature profiles from Lake Almanor (LA1) near Canyon Dam Intake - 2009

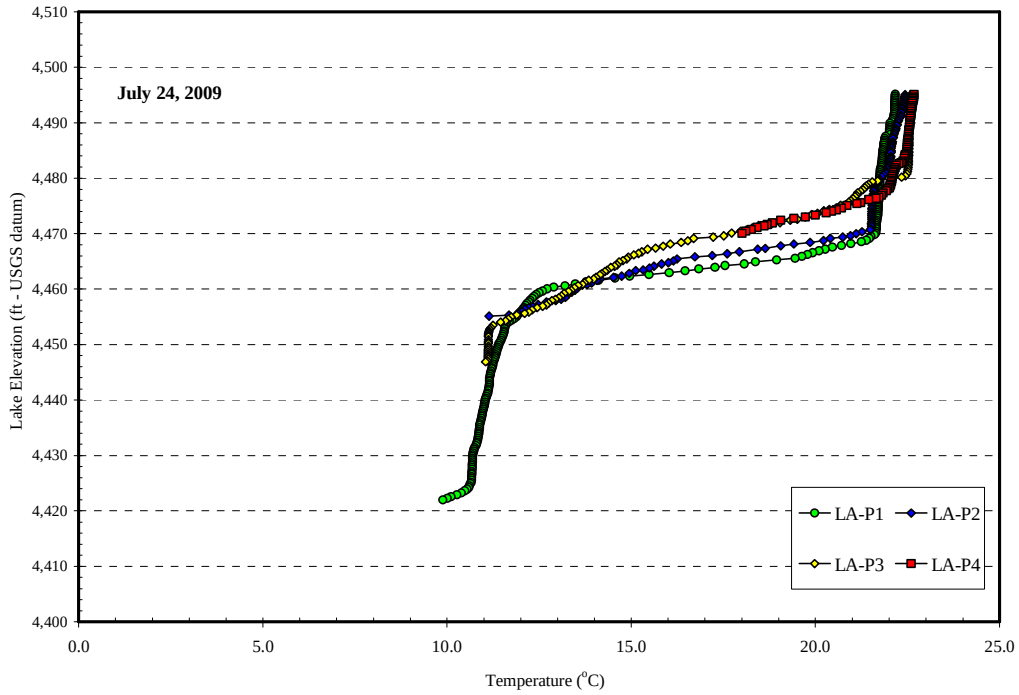


A. May 16, 2009 – Lake Almanor Profiles

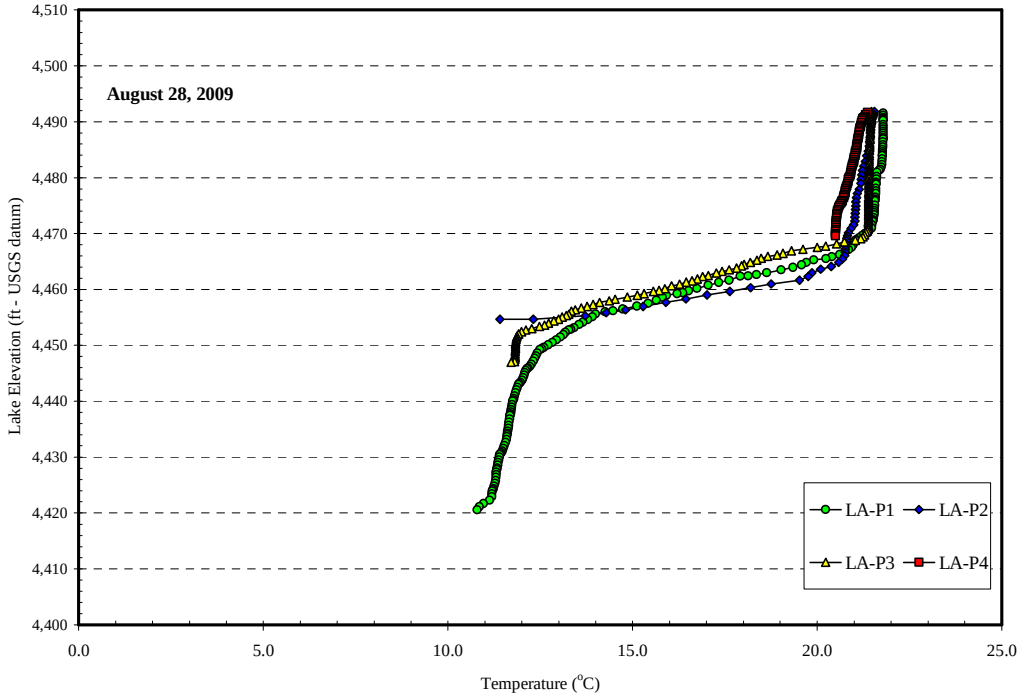


B. June 19, 2009 – Lake Almanor Profiles

Figure 3-9. Longitudinal thermal structure in Lake Almanor based on four profile stations– 2009

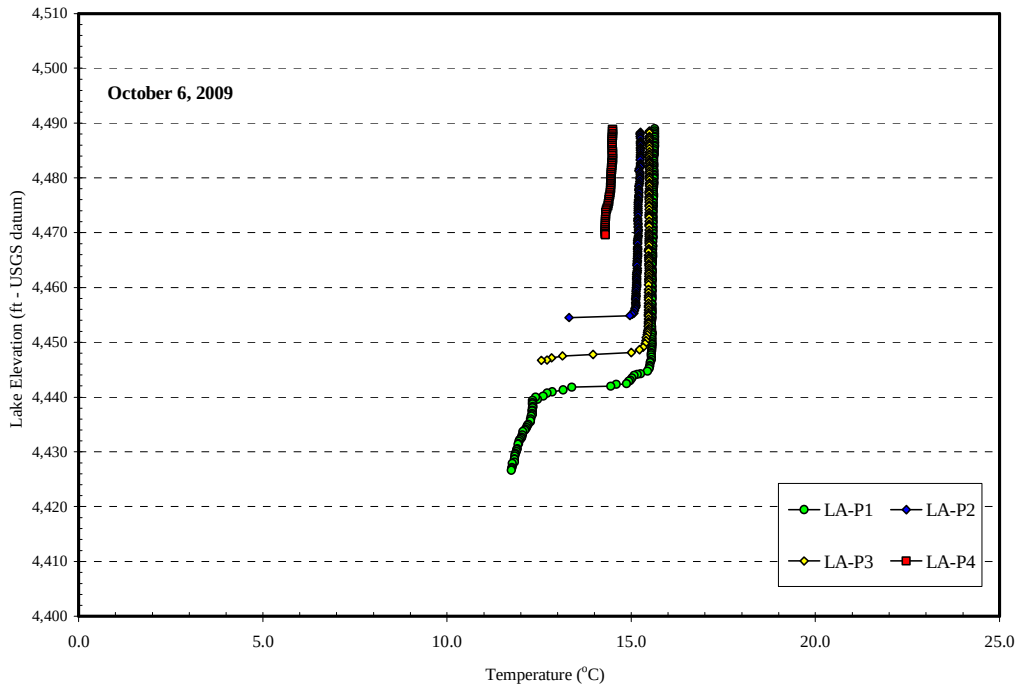


C. July 24, 2009 – Lake Almanor Profiles



D. August 28, 2009 – Lake Almanor Profiles

Figure 3-9. (Continued).



E. October 6, 2009 – Lake Almanor Profiles

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Figure 3-9. (Continued)

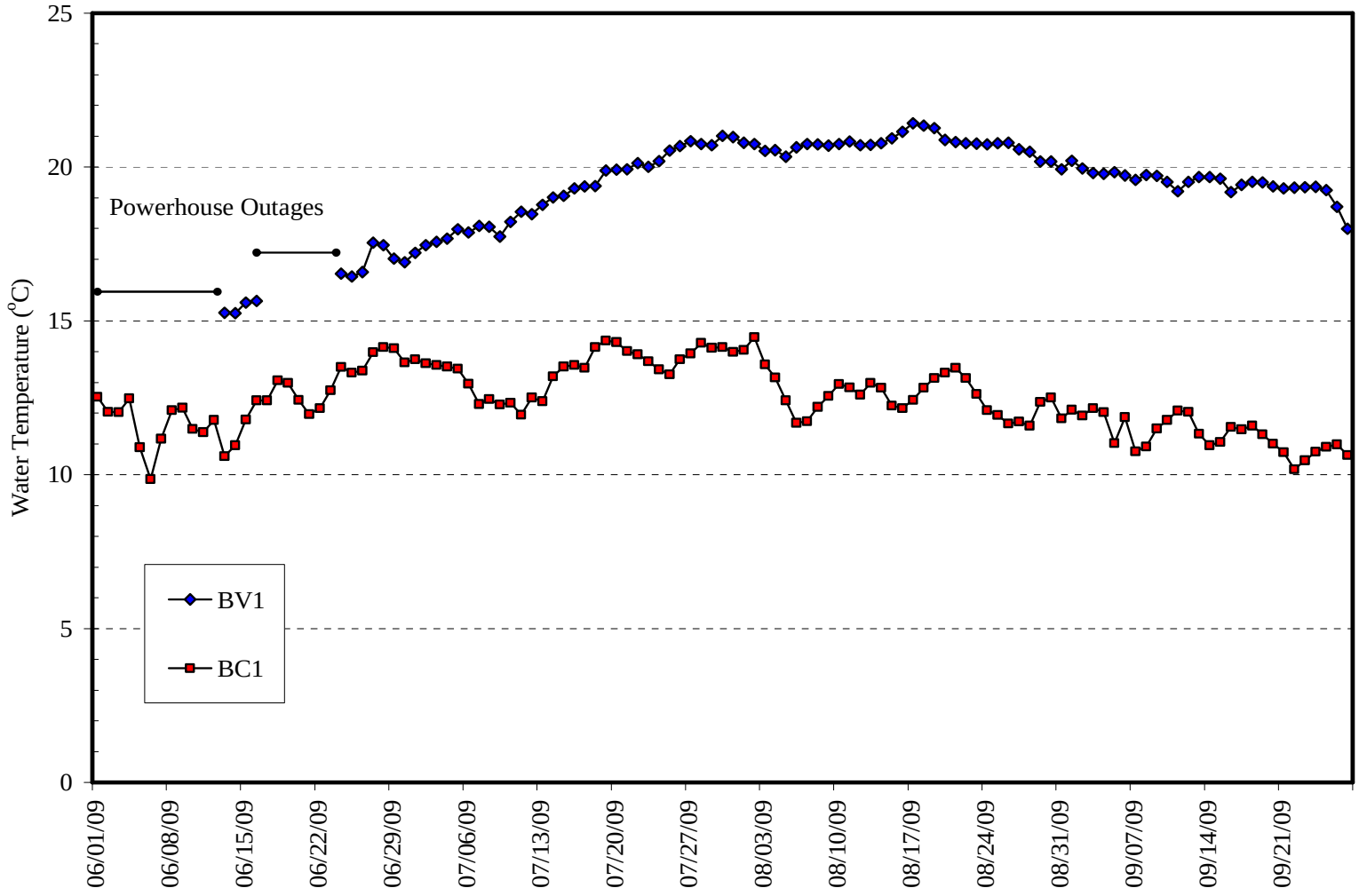


Figure 3-10. Comparison of daily average water temperature from stations tributary to Butt Valley Reservoir – 2009

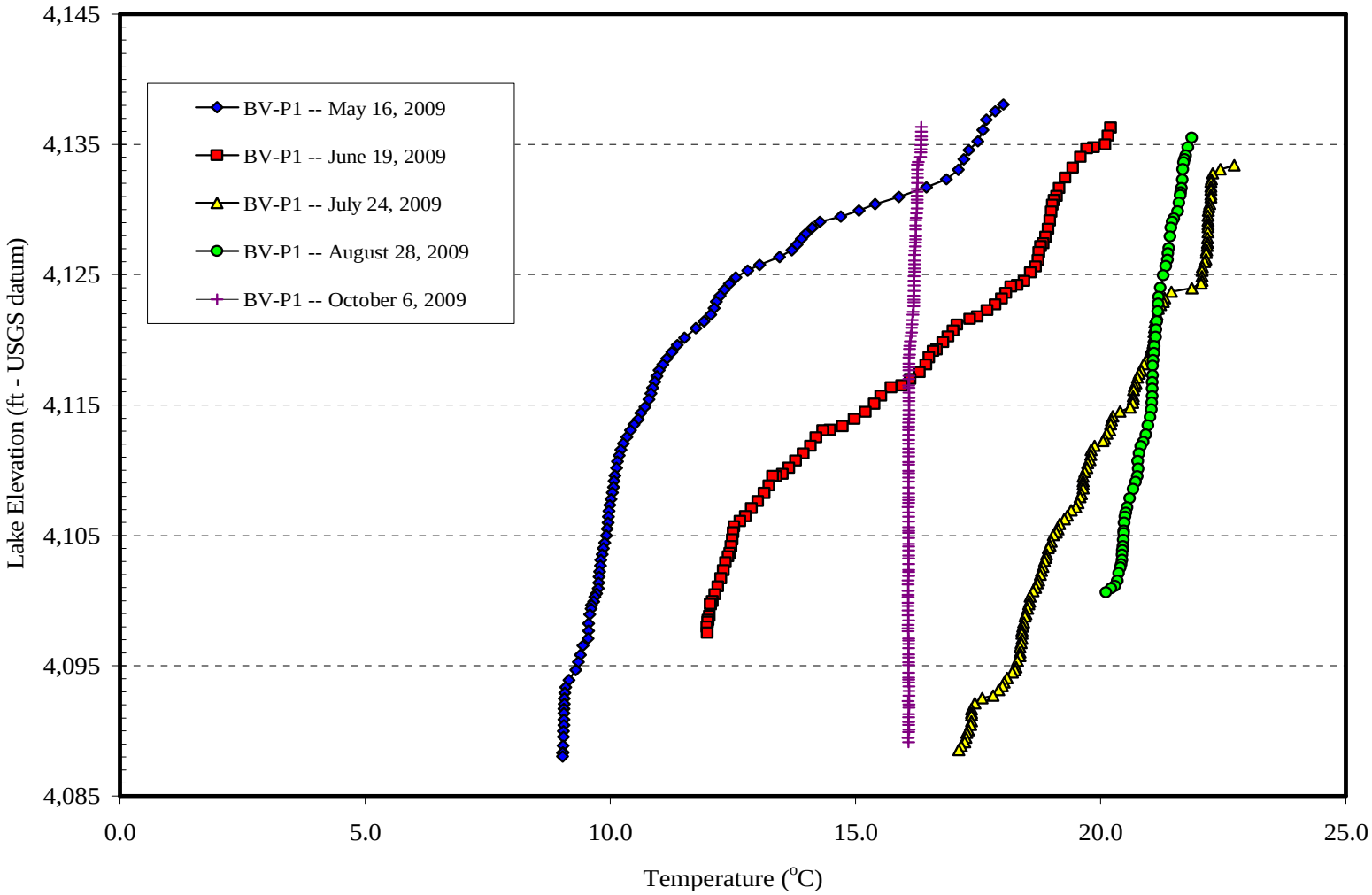
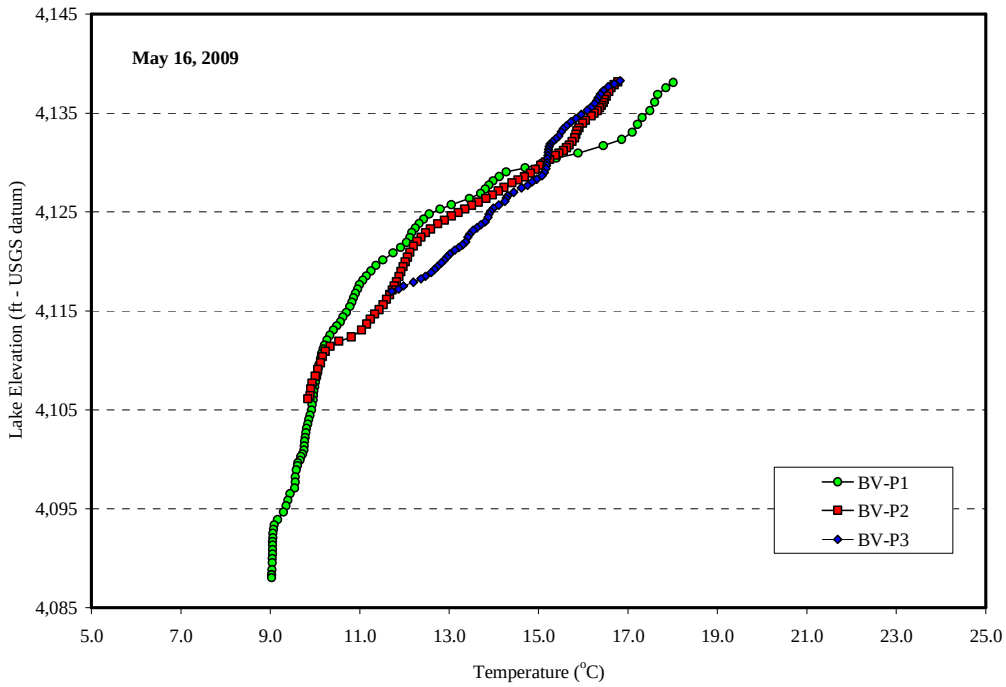
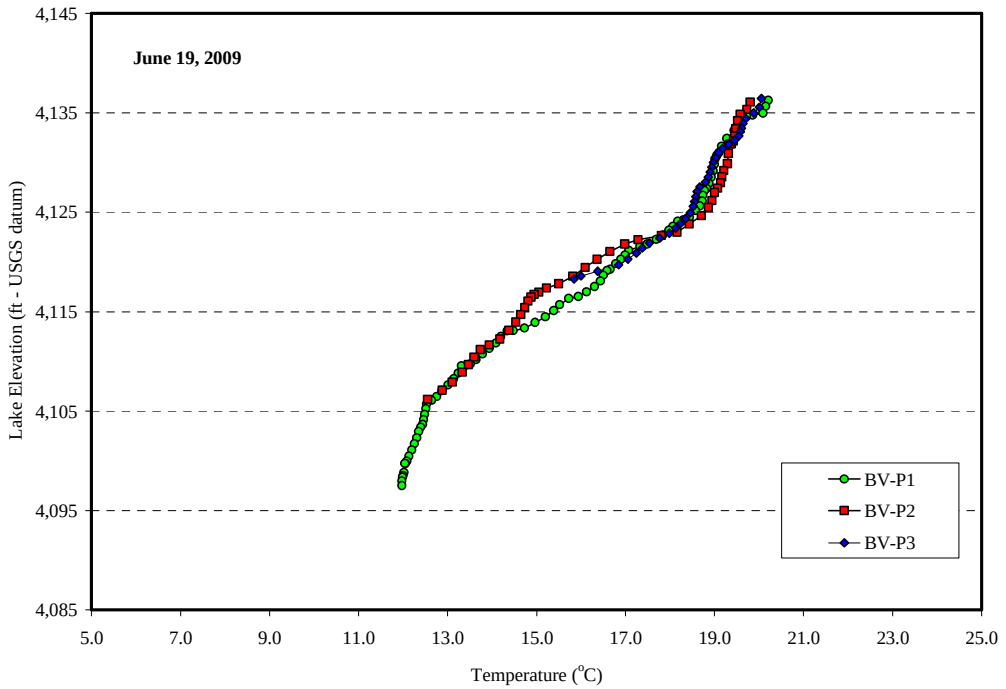


Figure 3-11. Comparison of monthly water temperature profiles from Butt Valley Reservoir (BV2-A) near Caribou No. 1 Intake - 2009

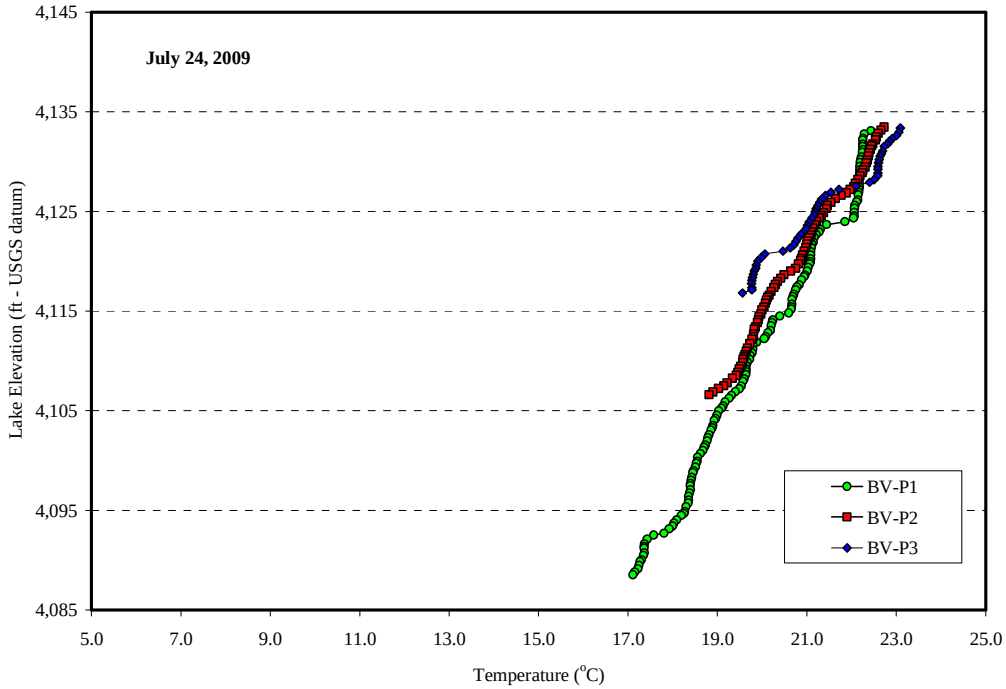


A. May 16, 2009 – Butt Valley Reservoir Profiles

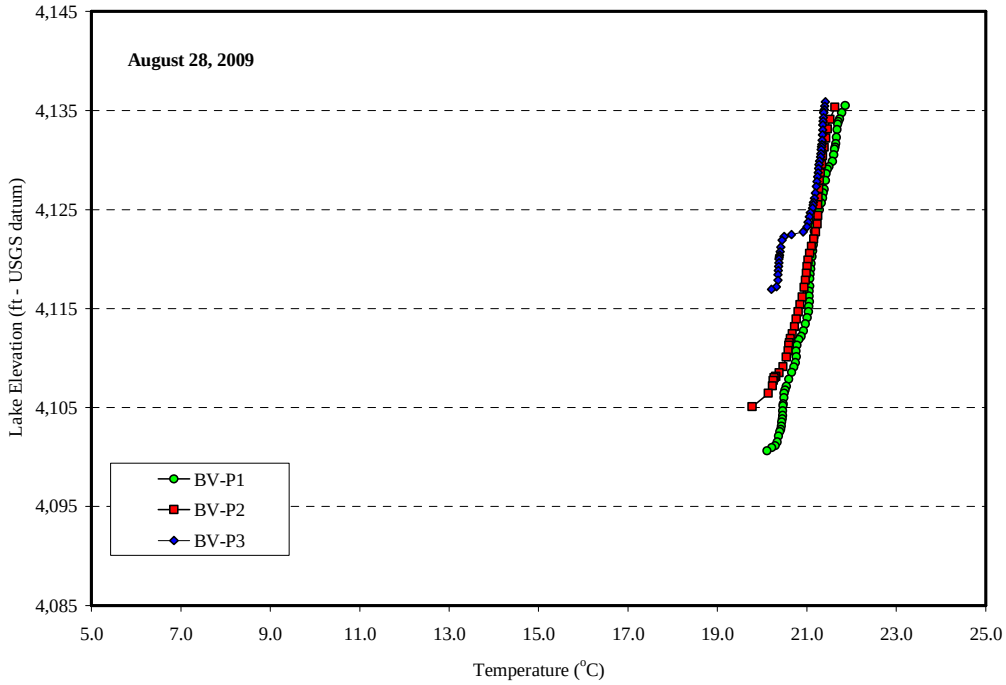


B. June 19, 2009 – Butt Valley Reservoir Profiles

Figure 3-12. Longitudinal thermal structure in Butt Valley Reservoir based on three profile stations– 2009

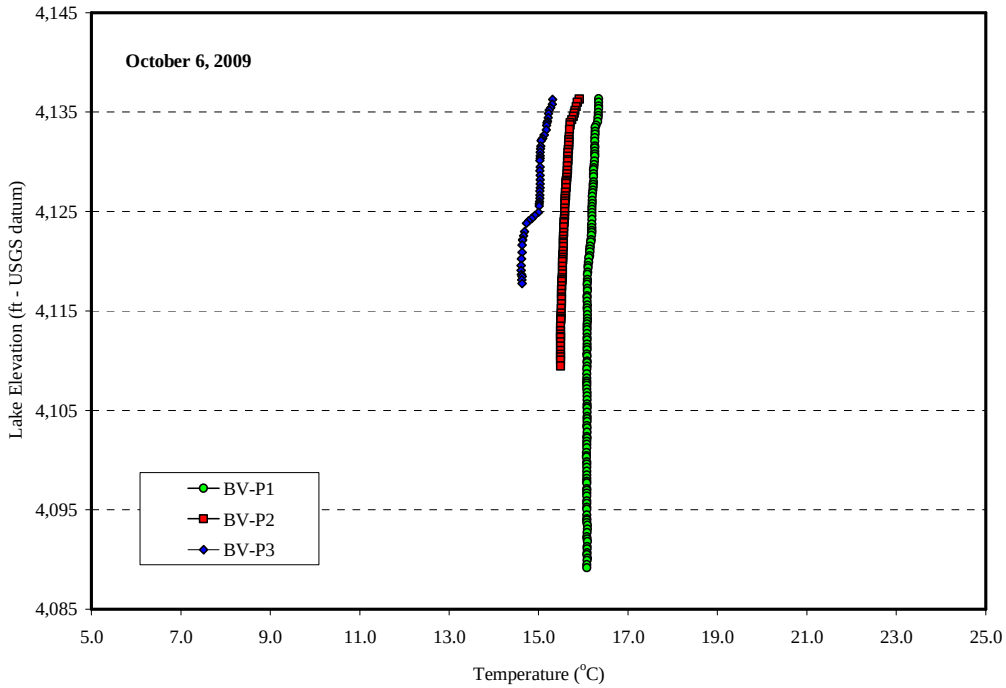


C. July 24, 2009 – Butt Valley Reservoir Profiles



D. August 28, 2009 – Butt Valley Reservoir Profiles

Figure 3-12 (continued).



E. October 6, 2009 – Butt Valley Reservoir Profiles

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Figure 3-12 (continued).

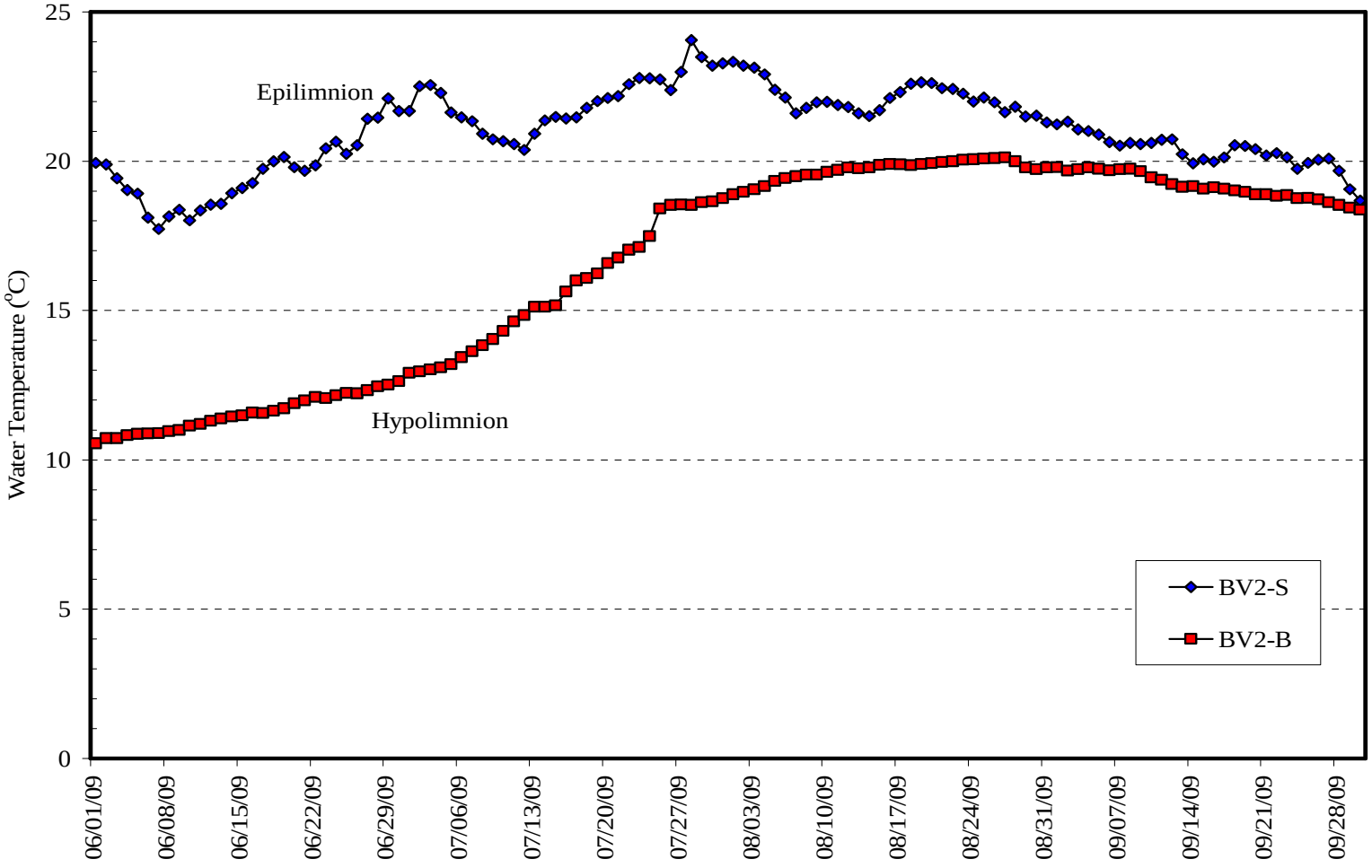


Figure 3-13. Comparison of daily average water temperatures from two depths in Butt Valley Reservoir near Caribou No. 1 Intake – 2009

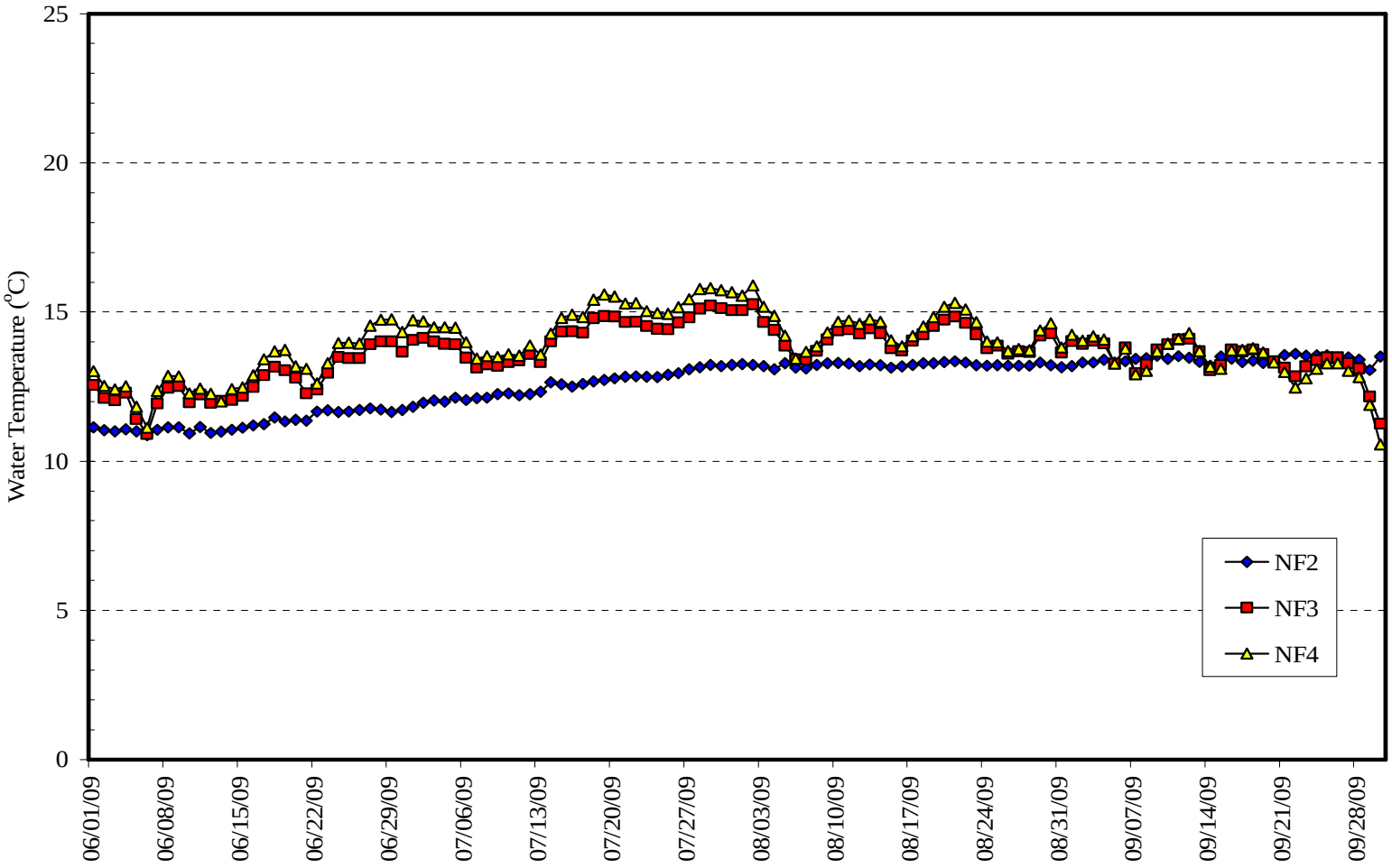


Figure 3-14. Comparison of daily average water temperatures in the Seneca Reach – 2009

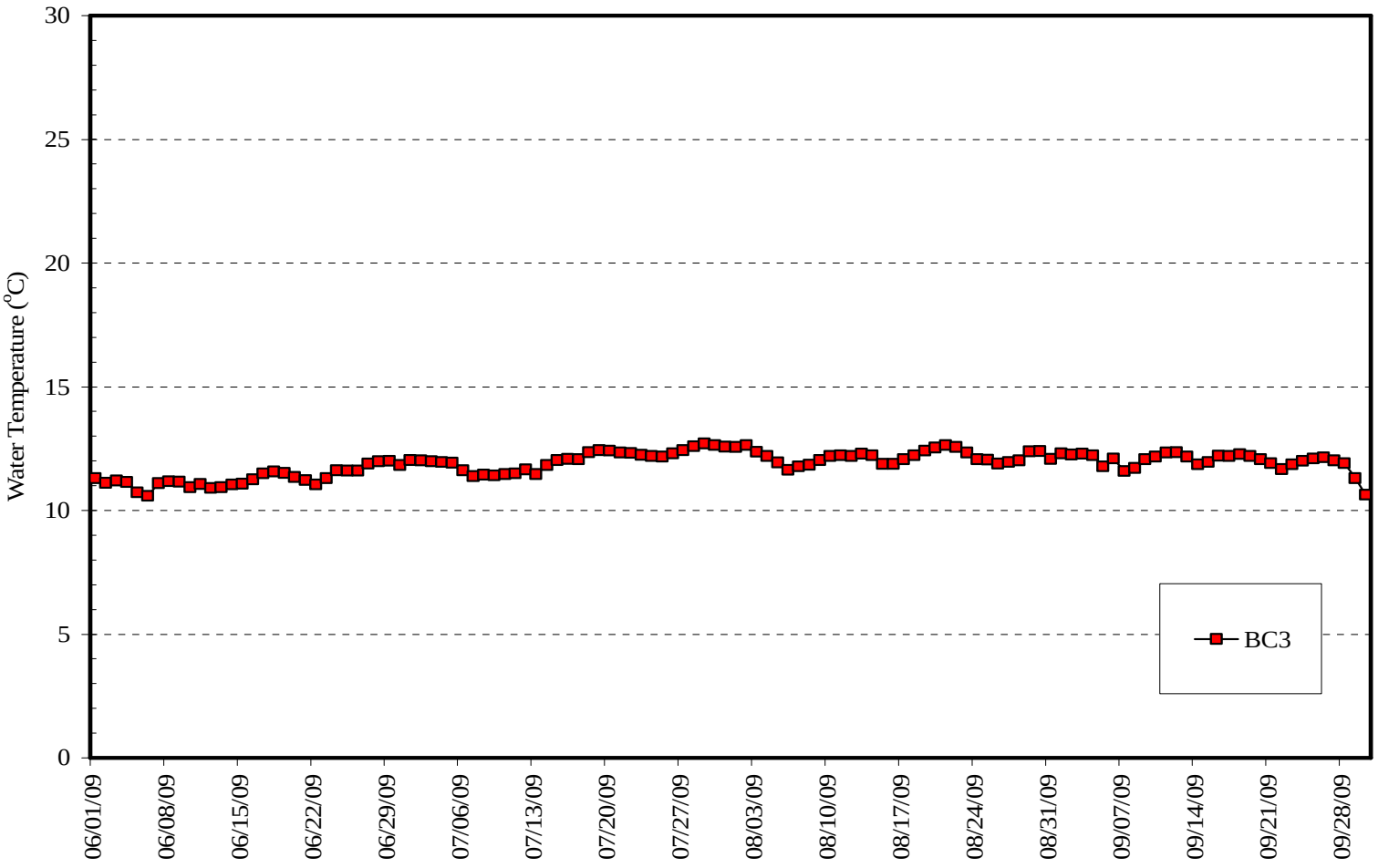


Figure 3-15. Daily average water temperatures in lower Butt Creek near mouth – 2009

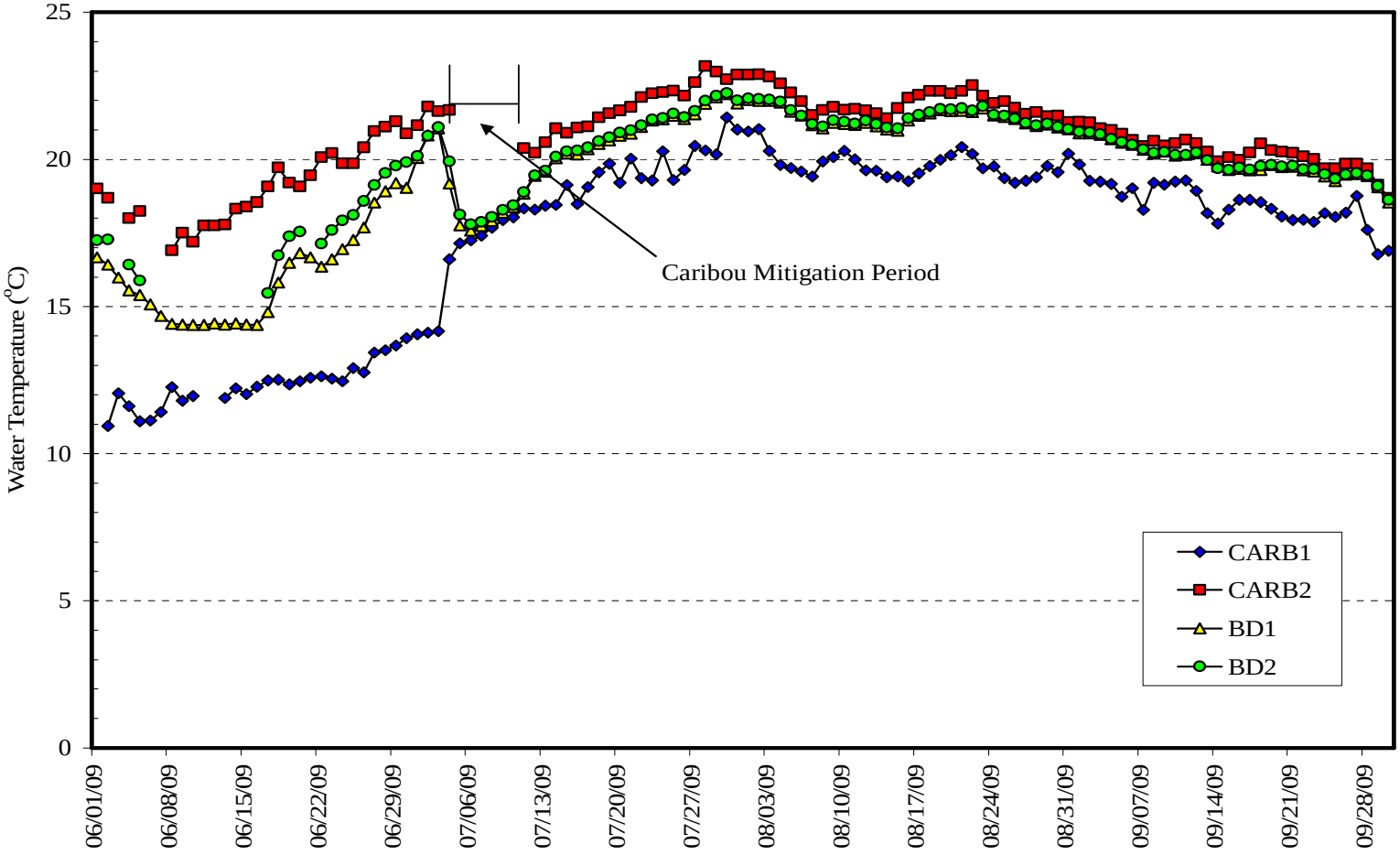


Figure 3-16. Comparison of daily average water temperatures from the Caribou Powerhouse/Belden Forebay complex – 2009

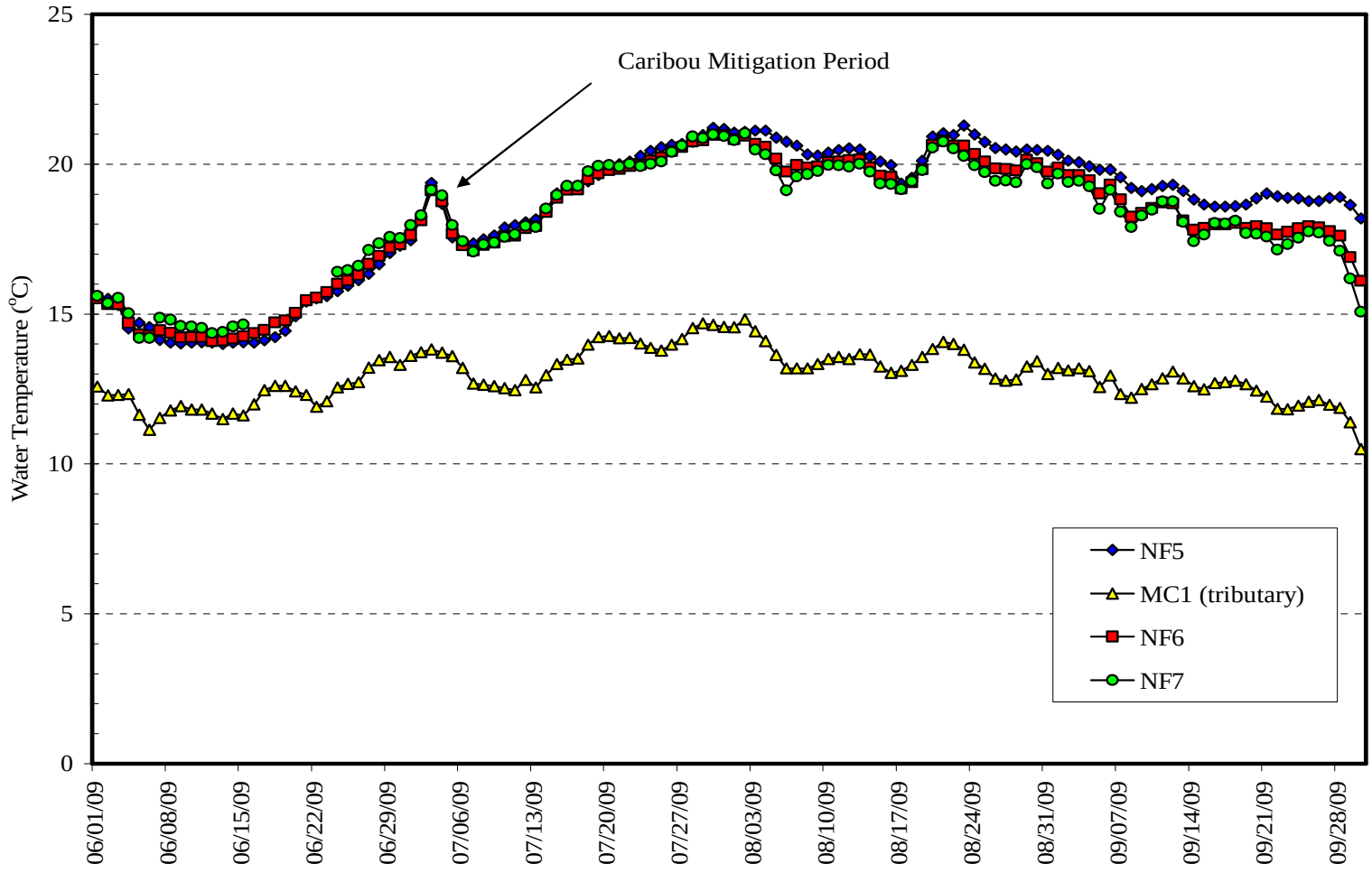


Figure 3-17. Comparison of daily average water temperatures in the upper Belden Reach – 2009

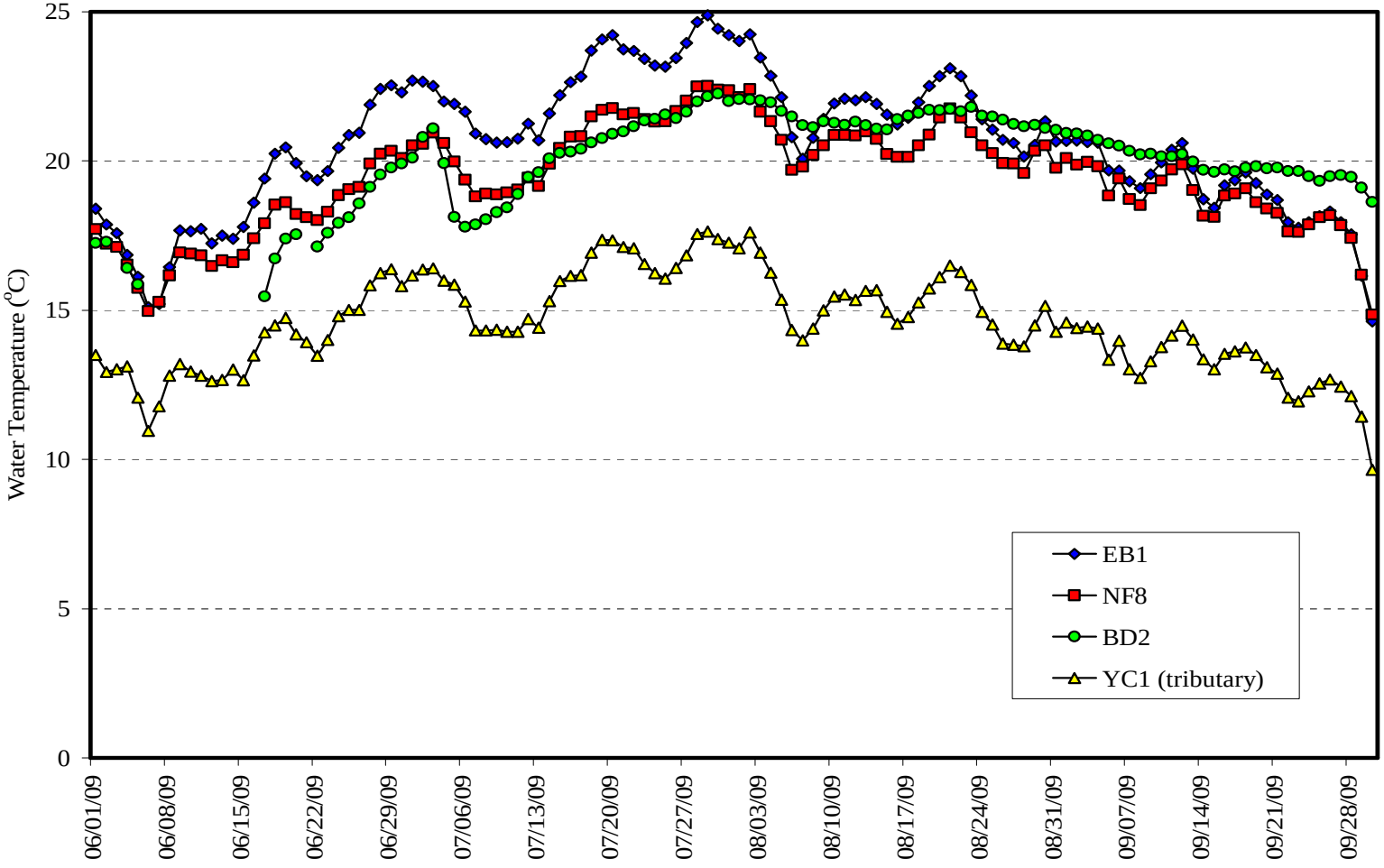


Figure 3-18. Comparison of daily average water temperatures in the lower Belden Reach – 2009

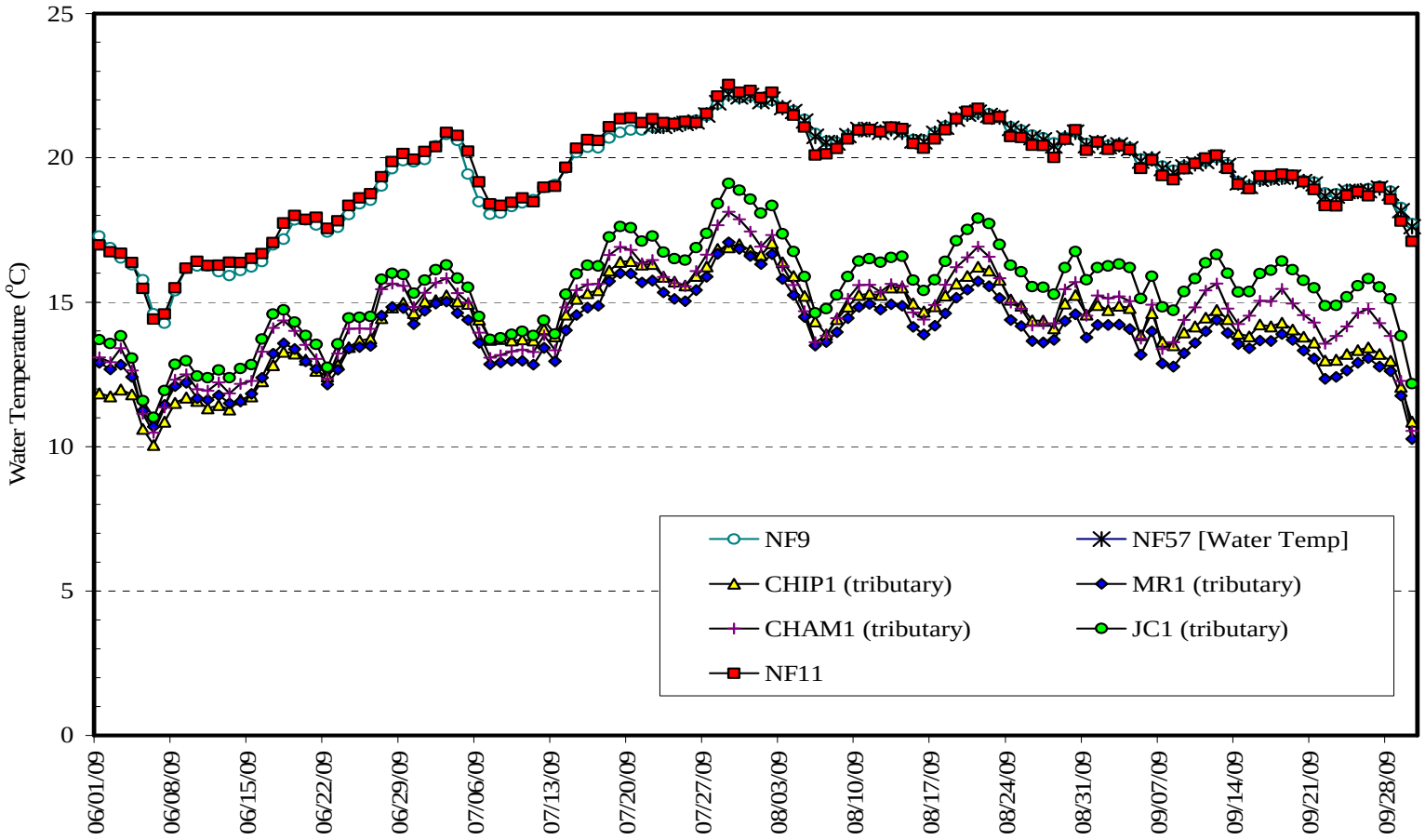


Figure 3-19. Comparison of daily average water temperatures from stations in the upper Rock Creek Reach – 2009

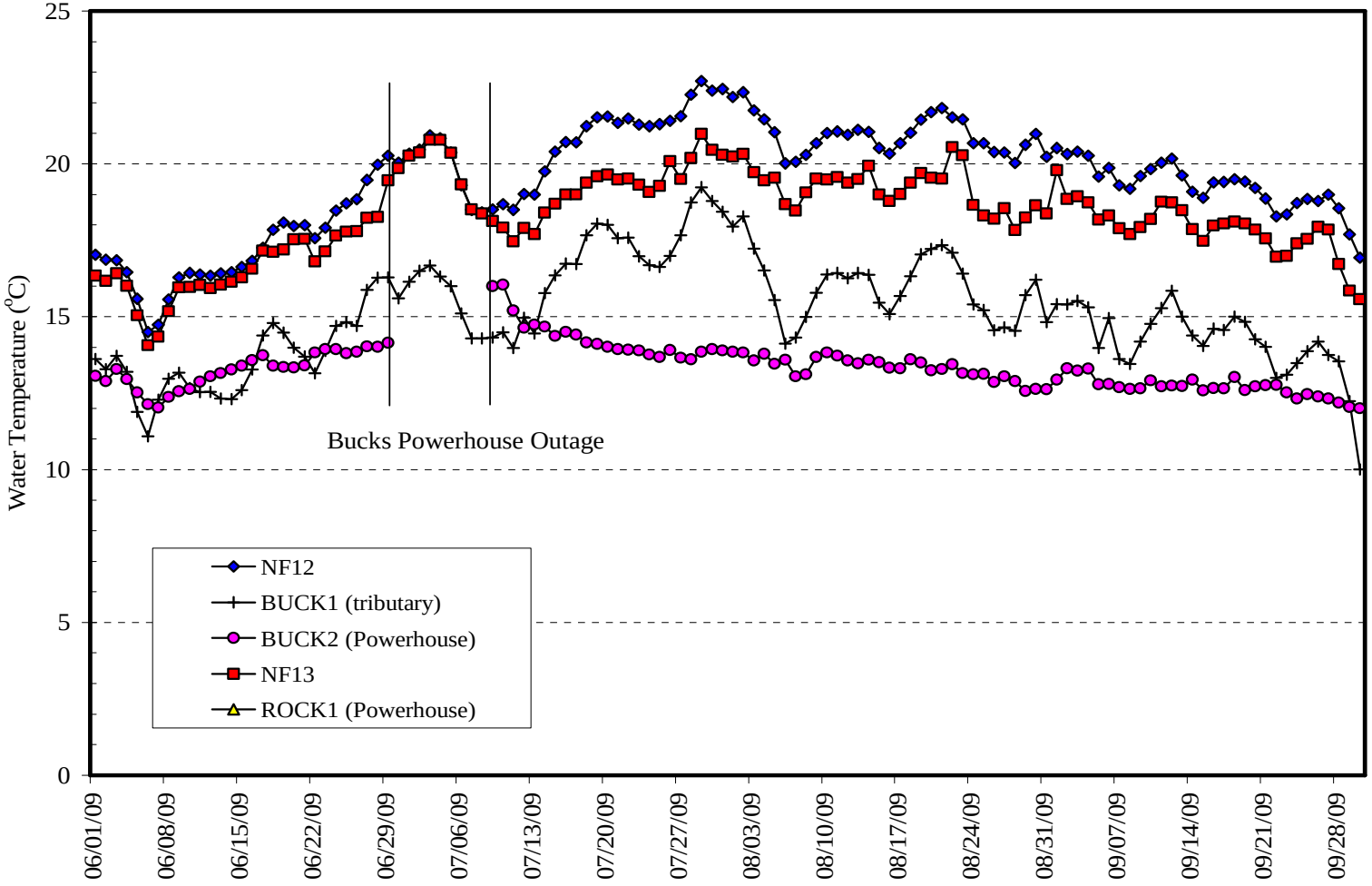


Figure 3-20. Comparison of daily average water temperatures from stations in the lower Rock Creek Reach – 2009

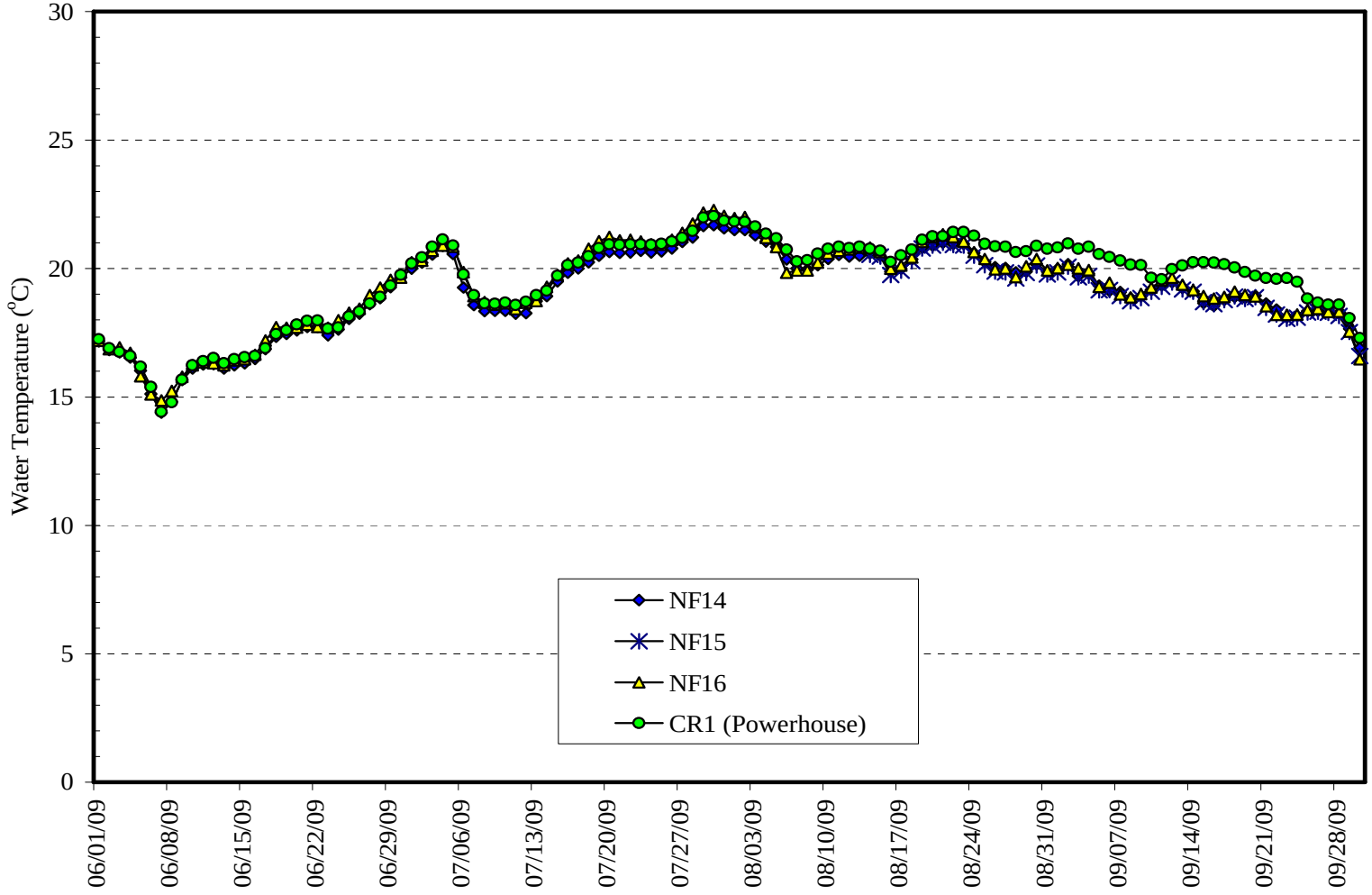


Figure 3-21. Comparison of daily average water temperatures from river stations in the Cresta Reach – 2009

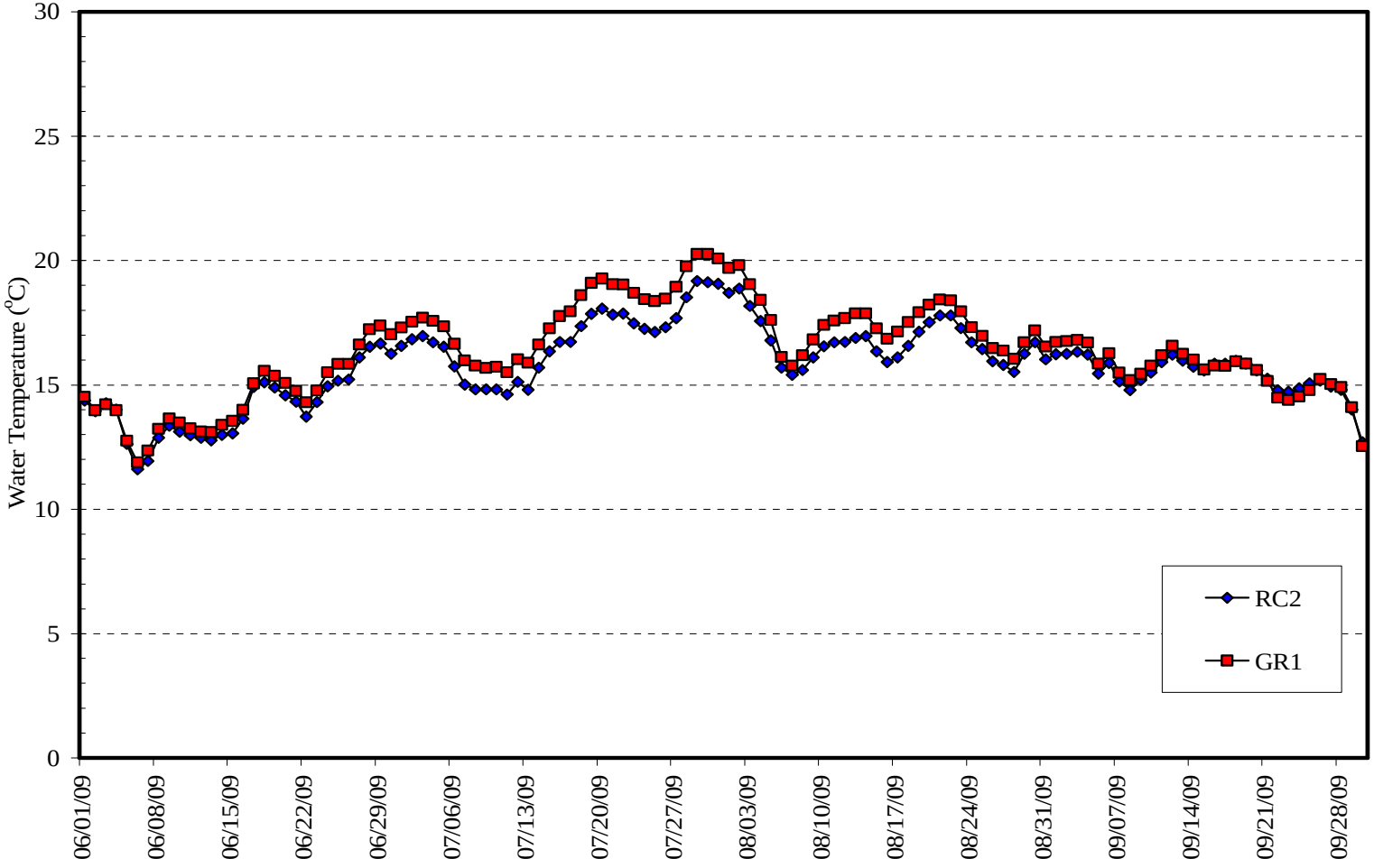


Figure 3-22. Comparison of daily average water temperatures in streams tributary to the Cresta Reach – 2009

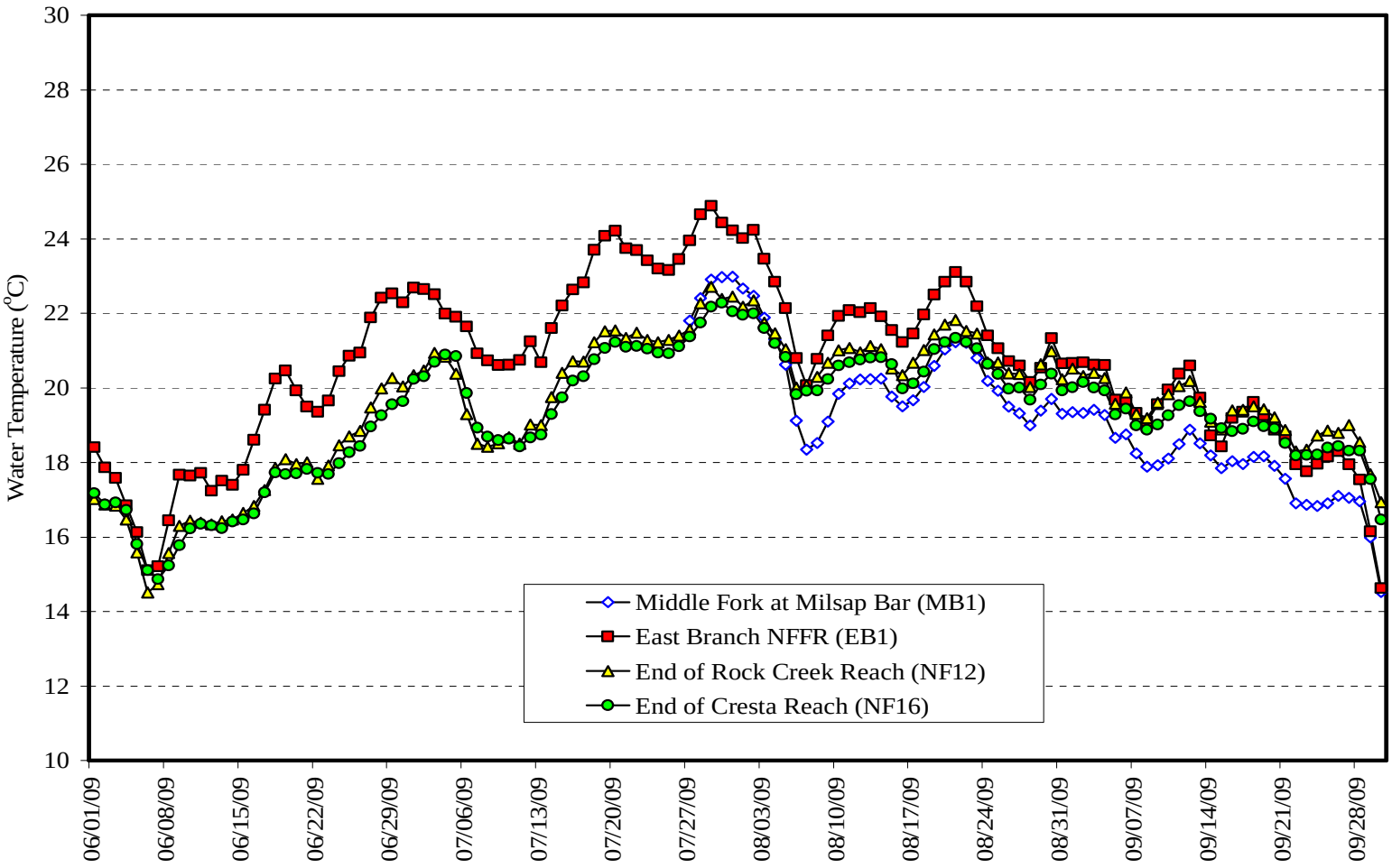
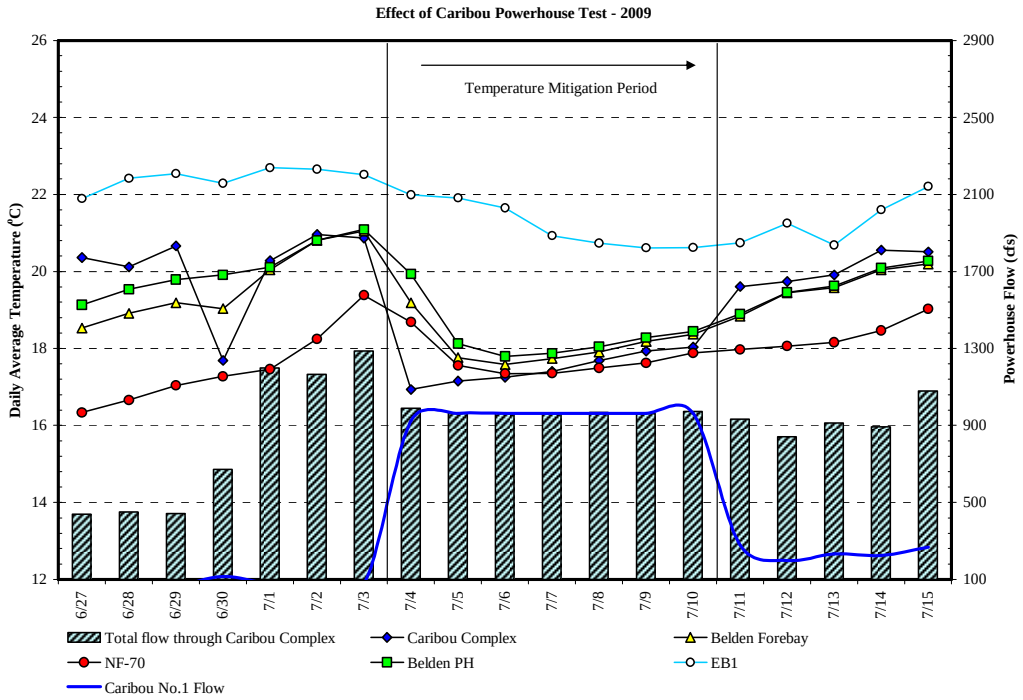
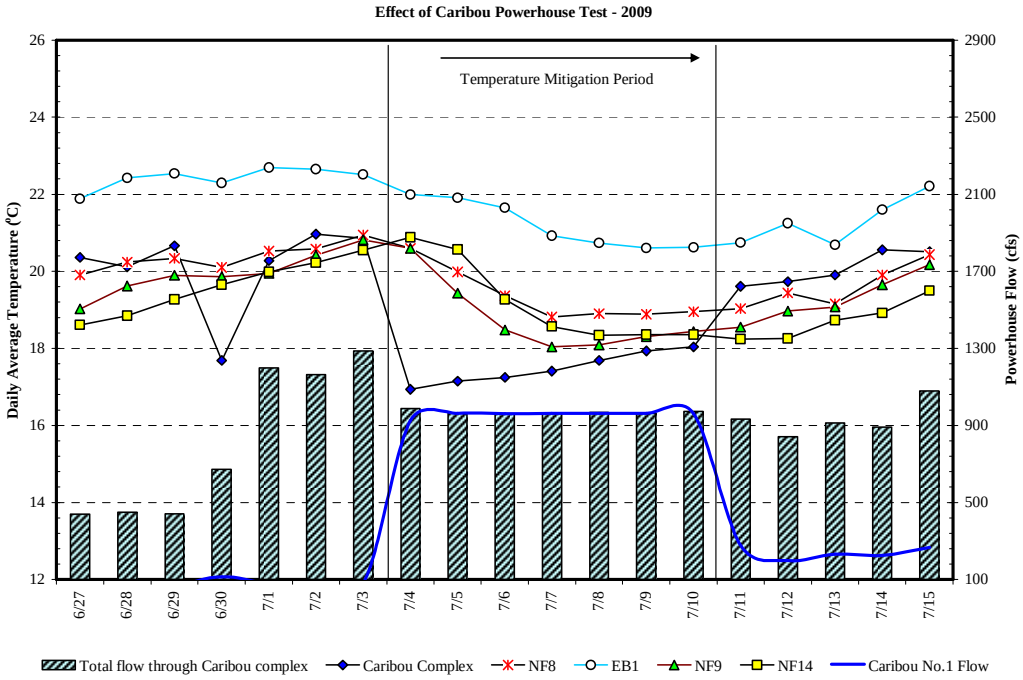


Figure 3-23. Comparison of daily average water temperatures from MFFR at Milsap Bar with selected NFFR stations – 2009

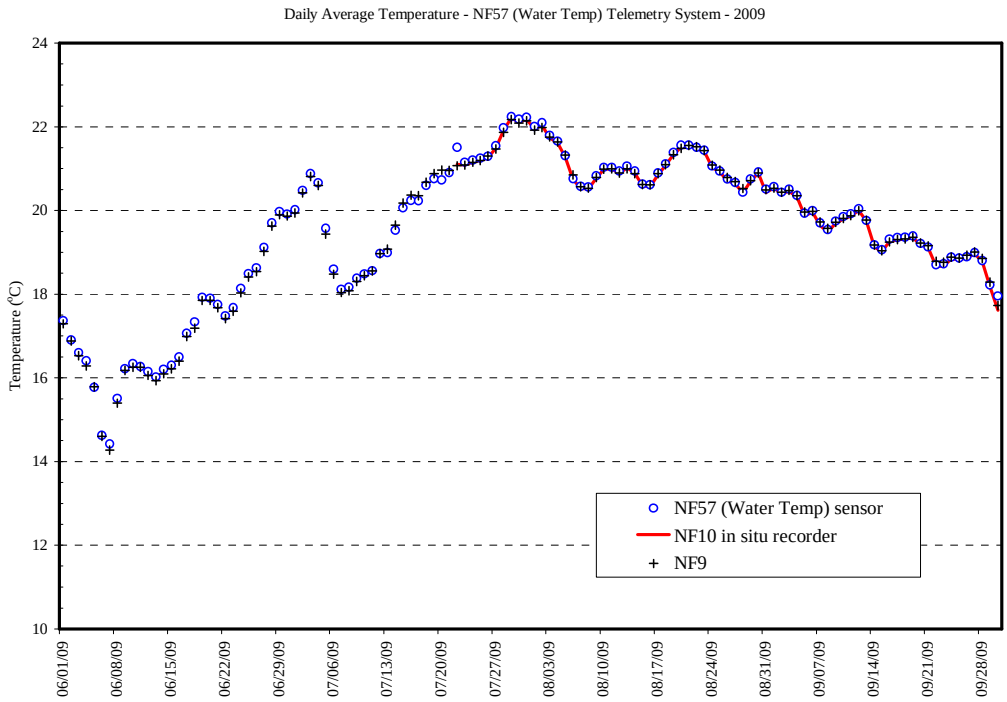


A. Comparison of Caribou complex with Belden Reach stations.

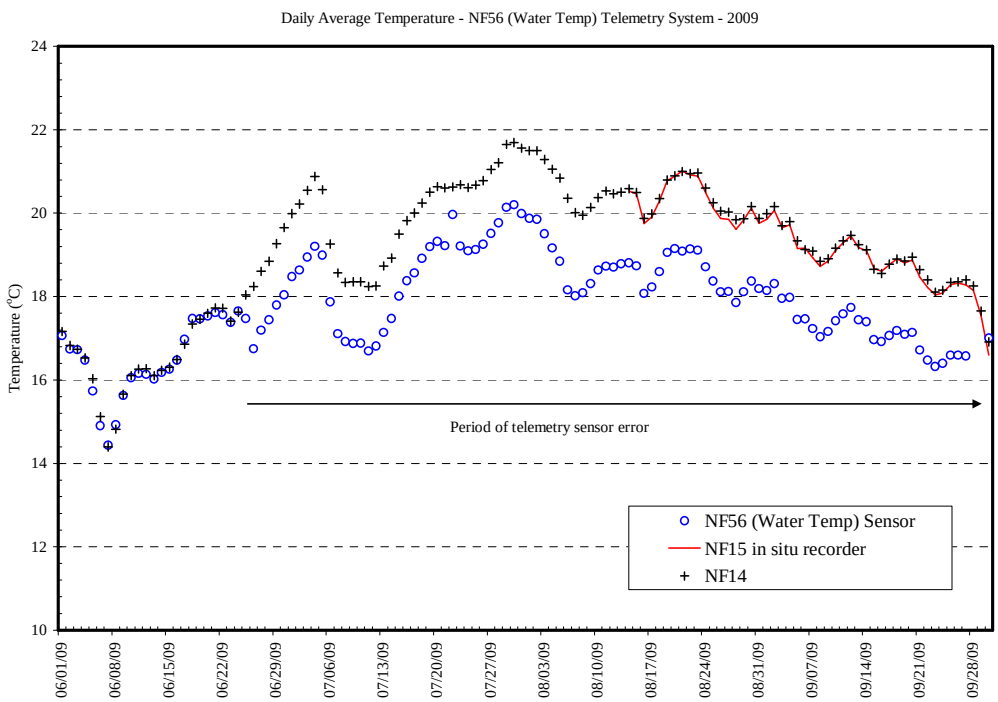


B. Comparison of Caribou complex with lower NFFR reaches.

Figure 3-24. Comparison of daily average water temperatures from select stations during Caribou complex mitigation test – 2009.



A. Station NF-57



A. Station NF-56

Figure 3-25. Comparison of daily average water temperatures from NF-57 and NF-56 telemetry sensors with *in situ* recorders at same locations – 2009.

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5 APPENDIX A

SUMMARY OF DISCHARGE MEASUREMENTS

AT TEMPORARY FLOW STATIONS

Appendix A – Summary of discharge measurement data.

						Cross Section Statistics							
Station	**Date**	**Time**	**Discharge (cfs)**	**GHT (ft)**	**Staff Ref.**	**Width (ft)**	**Area (square ft)**	**Average Depth (ft)**	**Average Velocity (ft/sec)**	**Maximum Velocity (ft/sec)**	**No. of Verticals**	**Msmnt Rating**	**Msmnt by**
NF1	5/29/2009	12:30	376	2.08	-0.25	90.5	129.9	1.41	2.90	3.63	47	Fair - 8%	M. Kossow
	6/26/2009	13:30	175	1.35	-0.98	60.5	116.5	1.95	1.51	2.71	33	Fair - 8%	M. Kossow
	7/31/2009	14:00	115	0.98	-1.35	58.0	83.3	1.45	1.38	2.62	40	Fair - 8%	M. Kossow
	9/25/2009	14:00	89.3	0.80	-1.52	42.0	66.8	1.56	1.34	1.74	43	Fair - 8%	M. Kossow
HB1	5/29/2009	11:00	71.6	2.25	-1.61	37.5	62.9	1.64	1.14	2.58	39	Fair - 8%	M. Kossow
	6/26/2009	11:00	68.4	2.24	-1.62	37.8	62.6	1.64	1.09	2.62	39	Fair - 8%	M. Kossow
	7/31/2009	11:00	76.5	2.33	-1.53	37.6	66.3	1.70	1.15	2.66	40	Fair - 8%	M. Kossow
	9/25/2009	12:00	83.3	2.37	-1.49	37.9	65.9	1.68	1.26	2.71	40	Fair - 8%	M. Kossow
BC3	05/28/09	13:00	12.0	1.17	-1.33	22.8	17.5	0.74	0.69	0.90	32	Fair - 8%	M. Kossow
	06/25/09	12:00	11.8	1.17	-1.33	22.8	17.3	0.73	0.68	0.90	32	Fair - 8%	M. Kossow
	07/28/09	13:30	11.6	1.15	-1.35	22.8	17.1	0.73	0.68	0.94	31	Fair - 8%	M. Kossow
	09/24/09	12:30	11.0	1.14	-1.36	22.8	17.8	0.75	0.62	0.94	32	Fair - 8%	M. Kossow
NF3	05/28/09	11:00	50.7	1.35	-0.65	47.4	55.1	1.12	0.92	1.83	50	Fair - 8%	M. Kossow
	06/25/09	14:30	49.8	1.35	-0.66	47.3	55.0	1.15	0.91	1.69	48	Fair - 8%	M. Kossow
	07/28/09	10:30	47.9	1.34	-0.66	47.3	55.2	1.13	0.90	1.65	49	Fair - 8%	M. Kossow
	09/24/09	15:00	46.6	1.32	-0.68	47.4	54.6	1.10	0.85	1.56	50	Fair - 8%	M. Kossow
NF4	5/27/2009	13:30	66.8	2.59	-1.13	45.0	75.1	1.61	0.89	1.38	32	Good - 5%	M. Kossow
	6/24/2009	12:30	66.2	2.57	-1.15	45.2	76.3	1.62	0.87	1.38	32	Good - 5%	M. Kossow
	7/30/2009	14:15	59.9	2.53	-1.19	45.0	72.5	1.59	0.83	1.25	31	Good - 5%	M. Kossow
	9/23/2009	12:30	61.1	2.52	-1.20	45.0	74.5	1.64	0.82	1.30	31	Good - 5%	M. Kossow

						Cross Section Statistics							
Station	**Date**	**Time**	**Discharge (cfs)**	**GHT (ft)**	**Staff Ref.**	**Width (ft)**	**Area (square ft)**	**Average Depth (ft)**	**Average Velocity (ft/sec)**	**Maximum Velocity (ft/sec)**	**No. of Verticals**	**Msmnt Rating**	**Msmnt by**
MC1	05/27/09	11:30	7.39	2.51	-0.49	21.7	35.9	1.63	0.21	0.55	44	Poor - >10%	M. Kossow
	06/24/09	13:30	6.01	2.42	-0.58	23.0	35.8	1.52	0.17	0.37	31	Poor - >10%	M. Kossow
	07/30/09	13:15	3.24	2.33	-0.67	24.8	40.4	1.54	0.08	0.18	35	Poor - >10%	M. Kossow
	09/23/09	11:00	2.65	2.28	-0.72	25.3	42.3	1.61	0.06	0.13	35	Poor - >10%	M. Kossow
YC1	5/26/2009	12:30	152	0.98	-0.52	34.9	71.7	2.00	2.12	4.12	24	Fair - 8%	M. Kossow
	6/24/2009	10:30	77.8	0.57	-0.93	35.0	56.6	1.48	1.38	3.02	26	Fair - 8%	M. Kossow
	7/29/2009	11:00	52.2	0.39	-1.11	34.4	48.0	1.25	1.09	2.13	26	Fair - 8%	M. Kossow
	9/23/2009	14:30	47.3	0.28	-1.22	32.0	48.8	1.44	0.97	1.74	23	Fair - 8%	M. Kossow

Appendix A – Summary of discharge measurement data.

						Cross Section Statistics							
Station	**Date**	**Time**	**Discharge (cfs)**	**GHT (ft)**	**Staff Ref.**	**Width (ft)**	**Area (square ft)**	**Average Depth (ft)**	**Average Velocity (ft/sec)**	**Maximum Velocity (ft/sec)**	**No. of Verticals**	**Msmnt Rating**	**Msmnt by**
CHIP	05/25/09	15:00	140	17.98	-0.02	30.7	64.7	2.15	2.16	2.88	60	Fair - 8%	M. Kossow
	06/23/09	11:30	45.9	16.94	-1.06	19.5	32.0	1.60	1.43	1.96	60	Fair - 8%	M. Kossow
	07/29/09	12:30	19.7	16.58	-1.42	18.3	22.9	1.23	0.86	1.16	60	Fair - 8%	M. Kossow
	09/22/09	11:15	12.6	16.38	-1.62	18.1	19.9	1.06	0.64	0.94	60	Fair - 8%	M. Kossow
MR1	05/26/09	15:00	35.6	2.70	--	13.4	17.1	1.25	2.09	5.04	28	Poor - >10%	M. Kossow
	06/23/09	15:00	7.83	2.44	--	13.5	10.4	0.75	0.75	2.13	28	Poor - >10%	M. Kossow
	07/29/09	14:15	3.23	2.18	--	10.8	7.9	0.71	0.41	0.94	23	Poor - >10%	M. Kossow
	09/22/09	14:00	2.34	2.08	--	10.3	6.4	0.58	0.37	0.59	22	Poor - >10%	M. Kossow
CHAM	05/26/09	15:00	29.4	2.67	-0.33	15.7	25.1	1.55	1.17	2.09	33	Poor - >10%	M. Kossow
	06/23/09	13:00	8.89	2.14	-0.86	15.0	15.1	0.50	0.59	1.74	60	Poor - >10%	M. Kossow
	07/30/09	11:15	3.47	1.91	-1.09	14.5	10.2	0.34	0.34	0.94	60	Poor - >10%	M. Kossow
	09/22/09	12:45	2.19	1.79	-1.21	12.8	7.9	0.26	0.28	1.08	60	Poor - >10%	M. Kossow
Buck2	05/25/09	12:00	45.5	1.37	-1.63	21.2	28.1	1.28	1.62	3.46	29	Fair - 8%	M. Kossow
	06/22/09	13:30	28.4	1.14	-1.86	20.7	23.6	1.12	1.21	2.44	42	Fair - 8%	M. Kossow
	07/27/09	13:00	17.2	0.86	-2.14	19.7	19.5	0.96	0.88	1.38	40	Fair - 8%	M. Kossow
	09/21/09	13:00	12.2	0.74	-2.26	19.4	17.1	0.86	0.72	1.12	41	Fair - 8%	M. Kossow
ROCK2	06/02/09	12:30	68.9	1.45	-2.55	43.9	20.5	0.44	3.36	4.34	33	Fair - 8%	M. Kossow
	06/22/09	11:30	16.4	1.21	-2.79	42.6	17.2	0.38	0.95	1.52	32	Fair - 8%	M. Kossow
	07/27/09	11:45	5.28	0.99	-3.01	41.7	14.0	0.32	0.38	0.77	31	Fair - 8%	M. Kossow
	09/21/09	11:00	2.81	0.91	-3.09	41.6	12.5	0.28	0.23	0.68	31	Fair - 8%	M. Kossow

						Cross Section Statistics							
Station	**Date**	**Time**	**Discharge (cfs)**	**GHT (ft)**	**Staff Ref.**	**Width (ft)**	**Area (square ft)**	**Average Depth (ft)**	**Average Velocity (ft/sec)**	**Maximum Velocity (ft/sec)**	**No. of Verticals**	**Msmnt Rating**	**Msmnt by**
GR1	05/25/09	10:30	75.5	1.31	-2.55	42.0	78.1	1.78	0.97	1.69	44	Poor - >10%	M. Kossow
	06/22/09	10:00	43.2	0.91	-2.95	41.1	62.9	1.47	0.69	1.21	43	Poor - >10%	M. Kossow
	07/27/09	10:30	19.9	0.51	-3.35	41.0	46.7	1.10	0.43	0.86	43	Poor - >10%	M. Kossow
	09/21/09	9:45	12.6	0.31	-3.55	40.7	37.3	0.89	0.34	0.81	42	Poor - >10%	M. Kossow

6 APPENDIX B

SUMMARY OF STAGE-FLOW RATINGS AND APPLIED SHIFTS

Appendix D – Stage-flow ratings and applied shifts

								Shift Information				
Station	**Date**	**Time**	**Discharge (cfs)**	**GHT (ft)**	**Rating in use**	**Rating Estimate**	**Percent**	**Shifted Gage**	**Shifted Discharge**	**Percent**	**Stage shift**	**Shift Equation**
NF1	5/29/2009	12:30	376	2.08	R2007_NF1	312	21%	2.40	376	0%	0.32	0.32
	6/26/2009	13:30	175	1.35	" "	136	29%	1.50	176	0%	0.15	0.15
	7/31/2009	14:00	115	0.98	" "	20	479%	1.28	115	0%	0.30	0.30
	9/25/2009	14:00	89.3	0.80	" "	-47	-289%	1.19	88.5	1%	0.39	0.39
HB1	5/29/2009	11:00	71.6	2.25	R2003_HB1	74.2	-3%	No Shift	--	--	--	--
	6/26/2009	11:00	68.4	2.24	" "	73.4	-7%	No Shift	--	--	--	--
	7/31/2009	11:00	76.5	2.33	" "	80.9	-5%	No Shift	--	--	--	--
	9/25/2009	12:00	83.3	2.37	" "	84.6	-2%	No Shift	--	--	--	--
BC3	05/28/09	13:00	12.0	1.17	R2007_BC3	12.2	-2%	No Shift	--	--	--	--
	06/25/09	12:00	11.8	1.17	" "	12.2	-3%	No Shift	--	--	--	--
	07/28/09	13:30	11.6	1.15	" "	11.1	5%	No Shift	--	--	--	--
	09/24/09	12:30	11.0	1.14	" "	10.5	5%	No Shift	--	--	--	--
NF3	05/28/09	11:00	50.7	1.35	--	No rating for this station.						
	06/25/09	14:30	49.8	1.35	--	No rating for this station.						
	07/28/09	10:30	47.9	1.34	--	No rating for this station.						
	09/24/09	15:00	46.6	1.32	--	No rating for this station.						
NF4	5/27/2009	13:30	66.8	2.59	R2005_NF4	67.4	-1%	No Shift	--	--	--	--
	6/24/2009	12:30	66.2	2.57	" "	64.6	3%	No Shift	--	--	--	--
	7/30/2009	14:15	59.9	2.53	" "	59.1	1%	No Shift	--	--	--	--
	9/23/2009	12:30	61.1	2.52	" "	57.7	6%	No Shift	--	--	--	--
MC1	05/27/09	11:30	7.39	2.51	--	No rating for this station, curvilinear decay used to estimate daily flow						
	06/24/09	13:30	6.01	2.42	--	No rating for this station, curvilinear decay used to estimate daily flow						
	07/30/09	13:15	3.24	2.33	--	No rating for this station, curvilinear decay used to estimate daily flow						
	09/23/09	11:00	2.65	2.28	--	No rating for this station, curvilinear decay used to estimate daily flow						

								Shift Information				
Station	**Date**	**Time**	**Discharge (cfs)**	**GHT (ft)**	**Rating in use**	**Rating Estimate**	**Percent**	**Shifted Gage**	**Shifted Discharge**	**Percent**	**Stage shift**	**Shift Equation**
YC1	5/26/2009	12:30	152	0.98	R2006_YC1	134	-10%	1.06	151	1%	0.08	0.07
	6/24/2009	10:30	77.8	0.57	" "	67.4	-5%	0.65	77.5	0%	0.08	0.07
	7/29/2009	11:00	52.2	0.39	" "	49.7	3%	0.46	55.8	-6%	0.07	0.07
	9/23/2009	14:30	47.3	0.28	" "	42.3	20%	0.34	46.0	3%	0.06	0.07

Appendix D – Stage-flow ratings and applied shifts

								Shift Information				
Station	**Date**	**Time**	**Discharge (cfs)**	**GHT (ft)**		**Rating Estimate**	**Percent**	**Shifted Gage**	**Shifted Discharge**	**Percent**	**Stage shift**	**Shift Equation**
CHIP	05/25/09	15:00	140	17.98	--	No rating for this station, curvilinear decay used to estimate daily flow						
	06/23/09	11:30	45.9	16.94	--	No rating for this station, curvilinear decay used to estimate daily flow						
	07/29/09	12:30	19.7	16.58	--	No rating for this station, curvilinear decay used to estimate daily flow						
	09/22/09	11:15	12.6	16.38	--	No rating for this station, curvilinear decay used to estimate daily flow						
MR1	05/26/09	15:00	35.6	2.70	R2009_MRC	35.6	0%		No Shift used			--
	06/23/09	15:00	7.83	2.44	" "	7.93	-1%		No Shift used			--
	07/29/09	14:15	3.23	2.18	" "	3.00	8%		No Shift used			--
	09/22/09	14:00	2.34	2.08	" "	2.48	-6%		No Shift used			--
CHAM	05/26/09	15:00	29.4	2.67	--	No rating for this station, curvilinear decay used to estimate daily flow						
	06/23/09	13:00	8.89	2.14	--	No rating for this station, curvilinear decay used to estimate daily flow						
	07/30/09	11:15	3.47	1.91	--	No rating for this station, curvilinear decay used to estimate daily flow						
	09/22/09	12:45	2.19	1.79	--	No rating for this station, curvilinear decay used to estimate daily flow						
Buck2	05/25/09	12:00	45.5	1.37	R2008_Buck1	47.1	-3%		No Shift used			--
	06/22/09	13:30	28.4	1.14	" "	29.2	-3%		No Shift used			--
	07/27/09	13:00	17.2	0.86	" "	16.2	6%		No Shift used			--
	09/21/09	13:00	12.2	0.74	" "	12.8	-5%		No Shift used			--
ROCK2	06/02/09	12:30	68.9	1.45	--	No rating for this station, curvilinear decay used to estimate daily flow						
	06/22/09	11:30	16.4	1.21	--	No rating for this station, curvilinear decay used to estimate daily flow						
	07/27/09	11:45	5.28	0.99	--	No rating for this station, curvilinear decay used to estimate daily flow						
	09/21/09	11:00	2.81	0.91	--	No rating for this station, curvilinear decay used to estimate daily flow						
GR1	05/25/09	10:30	75.5	1.31	R2008_GR1	78.4	-4%	1.27	74.9	1%	-0.04	-0.04
	06/22/09	10:00	43.2	0.91	" "	46.0	-6%	0.87	43.2	0%	-0.04	-0.04
	07/27/09	10:30	19.9	0.51	" "	21.9	-9%	0.47	20.0	0%	-0.04	-0.04
	09/21/09	9:45	12.6	0.31	" "	13.4	-6%	0.27	12.1	4%	-0.04	-0.04

7 APPENDIX C

SUMMARY OF HOURLY TEMPERATURE DATA

Appendix C

Summary of Hourly Average Water Temperatures Data - UNFFR 2009

Station	Year	Month	Hourly Temperatures [1] max	min	mean	Data Days
NFFR at	2009	June	18.8	7.8	11.9	30
Chester	2009	July	19.4	9.7	14.7	31
(NF1)	2009	Aug	19.2	9.3	13.8	31
	2009	Sept	15.1	6.2	11.6	30
Hamilton	2009	June	13.9	8.7	10.8	30
Branch at	2009	July	14.6	8.7	11.7	31
Road bridge	2009	Aug	14.3	8.8	11.3	31
(HB1)	2009	Sept	13.1	8.5	10.8	30
Hamilton	2009	June	--	--	--	0
Branch	2009	July	20.8	12.6	16.9	16
Powerhouse	2009	Aug	20.7	12.7	16.8	8
(HB2)	2009	Sept	18.0	12.6	15.3	20
Lake Almanor	2009	June	22.4	16.6	18.9	30
at Canyon Dam	2009	July	25.8	19.5	22.2	31
near surface	2009	Aug	25.1	21.0	22.6	31
(LA1-S)	2009	Sept	21.9	18.1	20.3	30
Lake Almanor	2009	June	10.1	8.5	9.3	30
at Canyon Dam	2009	July	10.8	9.3	10.0	31
near bottom	2009	Aug	11.2	10.2	10.7	31
(LA1-B)	2009	Sept	11.4	10.7	11.1	30
NFFR below	2009	June	13.2	10.2	11.3	30
Canyon Dam	2009	July	14.5	11.3	12.6	31
(NF2)	2009	Aug	14.6	12.6	13.2	31
	2009	Sept	14.8	12.7	13.4	30
NFFR at	2009	June	15.9	10.3	12.6	30
Seneca Bridge	2009	July	16.7	11.0	14.2	31
(NF3)	2009	Aug	16.6	11.8	14.2	31
	2009	Sept	15.3	10.2	13.4	30
NFFR above	2009	June	16.7	10.6	13.0	30
Caribou PH	2009	July	17.5	11.6	14.7	31
(NF4)	2009	Aug	17.4	12.1	14.5	31
	2009	Sept	15.6	9.9	13.4	30
Butt Valley	2009	June	18.0	13.7	16.1	9
Powerhouse	2009	July	21.4	15.4	19.0	31
[Corrected]	2009	Aug	22.0	18.8	20.8	31
(BV1)	2009	Sept	20.6	17.6	19.5	30

Appendix C (Continued)

Station	Year	Month	Hourly Temperatures [1] max	min	mean	Data Days
Butt Valley Res.	2009	June	22.7	17.4	19.6	30
at Caribou Intake	2009	July	25.1	19.8	22.0	31
Near surface	2009	Aug	24.1	21.1	22.1	31
(BV2-S)	2009	Sept	21.8	18.5	20.3	30
Butt Valley Res.	2009	June	13.2	10.2	11.5	30
at Caribou Intake	2009	July	19.1	12.2	15.8	31
Near bottom	2009	Aug	20.5	18.6	19.7	31
(BV2-B)	2009	Sept	20.2	18.1	19.2	30
Butt Creek above	2009	June	17.3	8.9	12.3	30
Butt Valley	2009	July	17.4	9.3	13.4	31
Reservoir	2009	Aug	17.2	8.9	12.6	31
(BC1 @ NF-4 gage)	2009	Sept	14.6	6.9	11.1	30
Butt Creek below	2009	June	Not deployed since 2007			0
Butt Valley	2009	July	--	--	--	--
Reservoir	2009	Aug	--	--	--	--
(BC2)	2009	Sept	--	--	--	--
Butt Creek at	2009	June	13.6	10.0	11.3	30
Mouth	2009	July	14.0	10.3	12.1	31
(BC3)	2009	Aug	13.9	10.9	12.2	31
	2009	Sept	13.4	10.0	12.0	30
Caribou No. 1	2009	June	14.4	10.8	12.4	27
Powerhouse	2009	July	22.8	13.3	18.2	31
[corrected]	2009	Aug	22.7	17.6	19.8	31
(CARB1)	2009	Sept	20.7	15.6	18.4	30
Caribou No. 2	2009	June	21.5	15.5	19.2	27
Powerhouse	2009	July	23.9	18.8	21.7	25
[corrected]	2009	Aug	23.2	21.0	22.0	31
(CARB2A)	2009	Sept	21.5	18.5	20.2	30
Belden Reservoir	2009	June	20.2	14.2	16.0	30
At Intake	2009	July	22.5	17.3	20.2	31
(BD1)	2009	Aug	22.2	20.6	21.4	31
	2009	Sept	21.1	18.3	19.9	30
NFFR below	2009	June	17.6	13.8	15.0	30
Belden Dam	2009	July	21.5	17.2	19.2	31
(NF5)	2009	Aug	21.7	18.9	20.6	31
	2009	Sept	20.6	17.9	19.1	30

Appendix C (Continued)

Station	Year	Month	Hourly Temperatures [1] max	min	mean	Data Days
Mosquito Creek	2009	June	14.6	10.6	12.3	30
At mouth	2009	July	15.7	11.5	13.6	31
(MC1)	2009	Aug	15.8	12.0	13.5	31
	2009	Sept	14.0	10.0	12.4	30
NFFR near	2009	June	19.4	13.2	15.1	30
Queen Lily	2009	July	22.9	16.0	19.1	31
Campground	2009	Aug	22.5	17.9	20.1	31
(NF6)	2009	Sept	21.2	15.1	18.2	30
NFFR near	2009	June	20.6	12.8	15.5	22
Gansner Bar	2009	July	23.6	15.1	19.1	31
(NF7)	2009	Aug	23.2	17.1	19.9	31
	2009	Sept	21.8	13.4	18.0	30
East Branch	2009	June	24.5	13.6	18.8	30
NFFR at mouth	2009	July	26.0	18.7	22.7	31
(EB1)	2009	Aug	25.1	18.9	21.8	31
	2009	Sept	21.7	14.0	19.0	30
NFFR at Belden	2009	June	22.8	13.7	17.7	30
Town Bridge	2009	July	25.0	16.9	20.7	31
(NF8)	2009	Aug	24.6	17.9	20.7	31
	2009	Sept	22.2	13.4	18.5	30
Belden	2009	June	20.2	14.6	18.1	17
Powerhouse	2009	July	22.5	17.5	20.1	31
(BD2)	2009	Aug	22.2	20.8	21.5	31
	2009	Sept	21.0	18.5	19.8	30
Yellow Creek	2009	June	18.5	10.4	13.7	30
Near mouth	2009	July	19.5	12.3	16.1	31
(YC1)	2009	Aug	19.6	12.2	15.3	31
	2009	Sept	16.3	8.8	13.2	30
Chips Creek	2009	June	17.6	9.4	12.4	30
Near mouth	2009	July	19.7	11.6	15.3	31
(CHIP)	2009	Aug	19.5	12.5	15.2	31
	2009	Sept	17.4	9.7	13.8	30
NFFR below Rock	2009	June	20.4	14.2	17.1	30
Creek Dam	2009	July	22.5	17.8	20.3	31
(NF9)	2009	Aug	22.2	20.1	21.1	31
	2009	Sept	20.8	17.4	19.4	30
NFFR at NF-57	2009	June	--	--	--	0
(NF10)	2009	July	23.0	23.0	21.6	10
	2009	Aug	22.6	22.6	21.0	31
	2009	Sept	21.3	21.3	19.4	30

Appendix C (Continued)

Station	Year	Month	Hourly Temperatures [1] max	Min	mean	Data Days
Milk Ranch Creek	2009	June	17.1	9.8	12.7	30
Near mouth	2009	July	19.0	10.9	14.8	31
(MR1)	2009	Aug	18.3	12.3	14.7	31
	2009	Sept	15.5	9.6	13.3	30
Chambers Creek	2009	June	18.0	9.7	13.1	30
Near mouth	2009	July	20.2	11.2	15.5	31
(CHAM)	2009	Aug	19.3	12.2	15.3	31
	2009	Sept	17.4	9.4	14.4	30
NFFR near Tobin	2009	June	22.1	13.3	17.2	30
blw Granite Crk	2009	July	24.1	16.6	20.5	31
(NF11)	2009	Aug	23.7	18.7	20.9	31
	2009	Sept	22.0	16.1	19.3	30
Jackass Creek	2009	June	18.8	10.0	13.6	30
Near mouth	2009	July	20.9	11.6	16.2	31
(JC1)	2009	Aug	19.8	13.6	16.4	31
	2009	Sept	17.5	11.4	15.5	30
NFFR abv Bucks	2009	June	21.8	13.4	17.3	30
Creek	2009	July	24.1	16.6	20.6	31
(NF12)	2009	Aug	23.5	18.6	21.0	31
	2009	Sept	21.7	15.9	19.3	30
Bucks Creek	2009	June	19.0	10.4	13.7	30
Near Mouth	2009	July	21.7	11.9	16.5	31
(BUCK1)	2009	Aug	20.4	12.6	16.0	31
	2009	Sept	17.4	9.0	14.2	30
Bucks Creek	2009	June	15.8	11.8	13.1	29
Powerhouse	2009	July	16.7	13.4	14.2	23
(BUCK2)	2009	Aug	15.0	12.4	13.2	31
	2009	Sept	15.9	11.9	12.6	30
NFFR abv Rock	2009	June	21.6	13.3	16.7	30
Creek Powerhouse	2009	July	22.8	16.6	19.3	31
(NF13)	2009	Aug	22.6	16.0	19.2	31
	2009	Sept	21.0	14.7	17.9	30
Rock Creek	2009	June	20.4	14.1	17.1	30
Powerhouse	2009	July	23.1	17.9	20.6	31
(RC1)	2009	Aug	22.7	20.0	21.5	31
	2009	Sept	21.2	17.7	19.7	30

Appendix C (Continued)

Station	Year	Month	Hourly Temperatures [1] max	Min	mean	Data Days
Rock Creek	2009	June	17.9	10.9	14.1	30
Near mouth	2009	July	20.4	13.6	16.8	31
(RC2)	2009	Aug	20.0	14.7	16.7	31
	2009	Sept	17.2	12.3	15.4	30
NFFR abv Grizzly	2009	June	20.1	14.2	17.0	30
Creek	2009	July	22.4	17.9	20.0	31
(NF14)	2009	Aug	22.0	19.3	20.5	31
	2009	Sept	20.8	16.3	18.8	30
Grizzly Creek	2009	June	19.5	11.2	14.5	30
Near mouth	2009	July	22.2	14.1	17.9	31
(GR1)	2009	Aug	21.6	14.8	17.6	31
	2009	Sept	18.4	11.9	15.7	30
NFFR at NF-56	2009	June	--	--	--	0
(NF15)	2009	July	--	--	--	0
	2009	Aug	22.3	18.7	20.3	18
	2009	Sept	21.1	15.8	18.8	30
NFFR abov Cresta	2009	June	21.4	14.1	17.2	30
Powerhouse	2009	July	23.6	17.2	20.4	31
(NF16)	2009	Aug	23.3	18.5	20.6	31
	2009	Sept	21.3	15.6	18.9	30
Cresta	2009	June	20.0	14.1	17.0	30
Powerhouse	2009	July	22.7	18.2	20.3	31
(CR1)	2009	Aug	22.2	19.7	21.0	31
	2009	Sept	21.2	16.7	19.6	30
Middle Fork	2009	June	--	--	--	0
Feather River	2009	July	24.6	20.5	22.6	5
At Milsap Bar	2009	Aug	24.1	17.4	20.2	31
(MB1)	2009	Sept	20.9	13.9	17.9	30

1. Values are based on hourly average data, month statistics represent the maximum, minimum, and mean based on these hourly average temperatures. For example, the maximum June temperature represents the maximum hourly average temperature measured in June.

8 APPENDIX D

SUMMARY OF PROFILE DATA FROM LAKE ALMANOR

AND BUTT VALLEY RESERVOIR

APPENDIX D1 – ROUTINE LAKE PROFILE DATA – LA1-P1

LA1-P1 - Lake Almanor near Canyon Dam Latitude 40° 10.636'N Longitude 121° 05.256'W

Date	Time	Date	Time	Date	Time	Date	Time	Date	Time
05/16/09	10:04	06/19/09	08:35	07/24/09	09:29	08/28/09	09:00	10/06/09	09:04
Elevation		Elevation		Elevation		Elevation		Elevation	
(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)
4495.3	4485.1	4496.7	4486.5	4496.7	4486.5	4491.9	4481.7	4489.0	4478.8
Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)
4495.0	15.9	4496.7	19.4	4495.1	22.2	4491.6	21.8	4488.9	15.6
4494.6	15.9	4495.7	19.4	4494.8	22.2	4491.2	21.8	4488.6	15.6
4494.4	15.8	4494.7	19.3	4494.5	22.2	4490.8	21.8	4488.2	15.6
4494.1	15.8	4493.8	19.3	4494.1	22.2	4490.5	21.8	4487.9	15.6
4493.7	15.8	4492.9	19.3	4493.8	22.2	4490.3	21.8	4487.6	15.6
4493.4	15.8	4492.0	19.2	4493.4	22.2	4490.2	21.8	4487.4	15.6
4493.1	15.8	4491.2	19.2	4493.1	22.2	4489.5	21.8	4487.0	15.6
4492.8	15.8	4490.2	19.1	4492.8	22.1	4489.1	21.8	4486.6	15.6
4492.4	15.8	4489.3	19.0	4492.4	22.1	4488.7	21.8	4486.3	15.6
4492.1	15.5	4488.4	19.0	4492.2	22.1	4488.3	21.8	4485.9	15.6
4491.6	15.3	4487.5	18.9	4491.8	22.1	4487.9	21.8	4485.7	15.6
4491.3	15.1	4486.7	18.8	4491.5	22.1	4487.5	21.8	4485.3	15.6
4491.1	15.0	4485.5	18.7	4491.1	22.1	4487.2	21.8	4484.9	15.6
4490.9	14.9	4484.6	18.7	4490.8	22.1	4487.0	21.8	4484.5	15.6
4490.6	14.8	4483.8	18.6	4490.5	22.1	4486.9	21.8	4484.2	15.6
4490.3	14.7	4482.9	18.5	4490.2	22.1	4486.4	21.8	4484.0	15.6
4490.0	14.6	4482.1	18.3	4489.9	22.0	4485.9	21.8	4483.6	15.6
4489.6	14.6	4481.1	18.2	4489.5	22.0	4485.4	21.8	4483.3	15.6
4489.2	14.5	4480.3	18.1	4489.2	22.0	4485.0	21.8	4483.1	15.6
4488.9	14.5	4479.5	18.1	4488.9	22.0	4484.6	21.8	4482.6	15.6
4488.7	14.5	4478.7	18.1	4488.5	22.0	4484.3	21.8	4482.2	15.6
4488.3	14.5	4477.8	18.0	4488.2	22.0	4484.0	21.8	4482.0	15.6
4488.0	14.4	4477.0	18.0	4487.9	22.0	4483.9	21.8	4481.7	15.6
4487.7	14.4	4476.1	17.9	4487.5	21.9	4483.3	21.8	4481.4	15.6

LA1-P1 - Lake Almanor near Canyon Dam Latitude 40° 10.636'N Longitude 121° 05.256'W

Date	Time	Date	Time	Date	Time	Date	Time	Date	Time
05/16/09	10:04	06/19/09	08:35	07/24/09	09:29	08/28/09	09:00	10/06/09	09:04
Elevation		Elevation		Elevation		Elevation		Elevation	
(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)
4495.3	4485.1	4496.7	4486.5	4496.7	4486.5	4491.9	4481.7	4489.0	4478.8
Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)
4487.3	14.4	4475.4	17.9	4487.2	21.9	4482.8	21.8	4481.0	15.6
4487.0	14.4	4474.6	17.8	4486.8	21.9	4482.3	21.8	4480.6	15.6
4486.6	14.4	4473.8	17.8	4486.5	21.9	4481.9	21.7	4480.4	15.6
4486.3	14.4	4473.1	17.7	4486.2	21.9	4481.5	21.7	4480.0	15.6
4486.0	14.3	4472.3	17.5	4485.9	21.9	4481.3	21.7	4479.8	15.6
4485.6	14.3	4471.5	17.0	4485.5	21.9	4480.9	21.6	4479.3	15.6
4485.4	14.3	4470.7	16.3	4485.2	21.8	4480.2	21.6	4479.0	15.6
4485.0	14.3	4470.0	15.6	4484.9	21.8	4479.7	21.6	4478.7	15.6
4484.7	14.3	4469.2	14.9	4484.6	21.8	4479.2	21.6	4478.3	15.6
4484.4	14.2	4468.4	14.2	4484.2	21.8	4478.9	21.6	4478.1	15.6
4484.0	14.2	4467.4	13.6	4483.9	21.8	4478.8	21.6	4477.8	15.6
4483.7	14.2	4466.7	13.3	4483.6	21.8	4478.1	21.6	4477.4	15.6
4483.4	14.2	4466.0	13.1	4483.3	21.8	4477.6	21.6	4477.0	15.6
4483.1	14.1	4465.2	12.9	4482.9	21.8	4477.2	21.6	4476.6	15.6
4482.7	14.1	4464.4	12.7	4482.6	21.8	4476.5	21.6	4476.2	15.6
4482.4	14.0	4463.7	12.5	4482.3	21.8	4476.1	21.6	4476.2	15.6
4482.1	14.0	4462.9	12.3	4482.0	21.8	4475.9	21.6	4475.5	15.6
4481.7	13.9	4462.2	12.1	4481.6	21.8	4475.8	21.6	4475.5	15.6
4481.4	13.9	4461.4	12.0	4481.3	21.8	4475.1	21.6	4474.9	15.6
4481.0	13.8	4460.7	11.8	4481.0	21.8	4474.5	21.6	4474.7	15.6
4480.8	13.8	4460.0	11.6	4480.6	21.8	4474.1	21.6	4474.4	15.6
4480.4	13.7	4459.0	11.5	4480.3	21.8	4473.7	21.5	4474.0	15.6
4480.1	13.6	4458.2	11.4	4480.0	21.7	4473.3	21.5	4473.8	15.6
4479.7	13.5	4457.5	11.3	4479.7	21.7	4472.8	21.5	4473.6	15.6
4479.4	13.5	4456.8	11.2	4479.3	21.7	4472.5	21.5	4473.1	15.6

LA1-P1 - Lake Almanor near Canyon Dam Latitude 40° 10.636'N Longitude 121° 05.256'W

Date	Time	Date	Time	Date	Time	Date	Time	Date	Time
05/16/09	10:04	06/19/09	08:35	07/24/09	09:29	08/28/09	09:00	10/06/09	09:04
Elevation		Elevation		Elevation		Elevation		Elevation	
(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)
4495.3	4485.1	4496.7	4486.5	4496.7	4486.5	4491.9	4481.7	4489.0	4478.8
Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)
4479.1	13.5	4456.0	11.1	4479.0	21.7	4472.3	21.5	4472.8	15.6
4478.8	13.4	4455.2	11.0	4478.7	21.7	4472.2	21.5	4472.5	15.6
4478.5	13.4	4454.5	10.9	4478.3	21.7	4471.6	21.5	4472.1	15.6
4478.1	13.4	4453.8	10.8	4478.0	21.7	4471.0	21.5	4471.9	15.6
4477.8	13.3	4453.1	10.8	4477.7	21.7	4470.5	21.4	4471.6	15.6
4477.5	13.3	4452.4	10.7	4477.3	21.7	4470.1	21.3	4471.1	15.6
4477.1	13.3	4451.7	10.7	4477.1	21.7	4469.7	21.2	4471.0	15.6
4476.8	13.3	4450.7	10.6	4476.7	21.7	4469.2	21.1	4470.5	15.6
4476.5	13.2	4450.0	10.6	4476.4	21.7	4468.9	21.1	4470.2	15.6
4476.1	13.2	4449.3	10.6	4476.0	21.7	4468.8	21.0	4469.8	15.6
4475.7	13.2	4448.6	10.5	4475.7	21.7	4468.4	21.0	4469.3	15.6
4475.5	13.1	4447.9	10.5	4475.4	21.7	4467.9	21.0	4469.2	15.6
4475.2	13.1	4447.2	10.5	4475.0	21.7	4467.5	20.9	4469.0	15.6
4474.9	13.1	4446.5	10.4	4474.8	21.7	4467.1	20.9	4468.5	15.6
4474.6	13.0	4445.8	10.4	4474.4	21.7	4466.7	20.8	4468.3	15.6
4474.2	13.0	4445.1	10.3	4474.1	21.7	4466.3	20.6	4467.6	15.6
4473.8	13.0	4444.3	10.3	4473.8	21.7	4465.8	20.4	4467.6	15.6
4473.5	12.9	4443.6	10.2	4473.5	21.7	4465.5	20.2	4467.4	15.6
4473.2	12.9	4442.8	10.2	4473.1	21.7	4465.3	19.9	4467.0	15.6
4472.8	12.8	4442.1	10.2	4472.8	21.7	4464.8	19.7	4466.6	15.6
4472.5	12.8	4441.4	10.2	4472.4	21.7	4464.4	19.6	4466.3	15.6
4472.2	12.8	4440.7	10.2	4472.1	21.7	4463.9	19.3	4465.9	15.6
4471.9	12.7	4439.9	10.1	4471.8	21.7	4463.5	19.0	4465.6	15.6
4471.5	12.7	4439.2	10.1	4471.5	21.7	4463.0	18.6	4465.2	15.6
4471.2	12.6	4438.5	10.1	4471.1	21.7	4462.6	18.4	4464.9	15.6

LA1-P1 - Lake Almanor near Canyon Dam Latitude 40° 10.636'N Longitude 121° 05.256'W

Date	Time	Date	Time	Date	Time	Date	Time	Date	Time
05/16/09	10:04	06/19/09	08:35	07/24/09	09:29	08/28/09	09:00	10/06/09	09:04
Elevation		Elevation		Elevation		Elevation		Elevation	
(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)
4495.3	4485.1	4496.7	4486.5	4496.7	4486.5	4491.9	4481.7	4489.0	4478.8
Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)
4470.9	12.6	4437.8	10.0	4470.8	21.6	4462.4	18.1	4464.6	15.6
4470.6	12.6	4437.1	9.9	4470.5	21.6	4462.4	17.9	4464.3	15.6
4470.3	12.5	4436.4	9.9	4470.1	21.6	4461.7	17.6	4464.0	15.6
4469.9	12.5	4435.7	9.8	4469.8	21.6	4461.2	17.3	4463.4	15.6
4469.6	12.5	4434.9	9.7	4469.5	21.5	4460.8	17.0	4463.2	15.6
4469.3	12.5	4434.1	9.7	4469.2	21.5	4460.2	16.7	4463.0	15.6
4468.9	12.4	4433.4	9.6	4468.8	21.4	4459.7	16.5	4462.8	15.6
4468.5	12.4	4432.6	9.6	4468.5	21.3	4459.4	16.4	4462.3	15.6
4468.2	12.4	4431.9	9.6	4468.2	21.0	4459.3	16.2	4461.9	15.6
4467.9	12.3	4431.3	9.6	4467.8	20.7	4459.0	15.9	4461.6	15.6
4467.6	12.3	4430.6	9.6	4467.5	20.5	4458.6	15.8	4461.4	15.6
4467.2	12.2	4430.0	9.6	4467.2	20.3	4458.1	15.6	4460.9	15.6
4466.9	12.2	4429.3	9.6	4466.9	20.1	4457.5	15.4	4460.4	15.6
4466.5	12.1	4428.6	9.5	4466.5	19.9	4457.0	15.1	4460.2	15.6
4466.3	12.1	4428.0	9.5	4466.2	19.8	4456.5	14.7	4460.1	15.6
4466.0	12.1	4427.1	9.5	4465.9	19.6	4456.2	14.5	4459.5	15.6
4465.6	12.0	4426.5	9.5	4465.5	19.4	4456.0	14.3	4459.4	15.6
4465.2	12.0	4425.9	9.5	4465.3	19.0	4455.6	14.0	4459.2	15.6
4465.0	12.0	4425.2	9.4	4464.9	18.4	4455.1	13.9	4458.7	15.6
4464.7	12.0	4424.8	9.4	4464.5	18.1	4454.6	13.8	4458.4	15.6
4464.3	11.9	4424.3	9.3	4464.3	17.5	4454.1	13.7	4458.0	15.6
4464.0	11.9	4423.8	9.3	4463.9	17.3	4453.7	13.5	4457.8	15.6
4463.6	11.9	4423.2	9.2	4463.6	16.8	4453.1	13.4	4457.0	15.6
4463.2	11.8	4422.5	9.2	4463.3	16.5	4452.9	13.3	4456.9	15.6
4463.1	11.8	4421.9	9.2	4462.9	16.0	4452.8	13.3	4456.3	15.6

LA1-P1 - Lake Almanor near Canyon Dam Latitude 40° 10.636'N Longitude 121° 05.256'W

Date	Time	Date	Time	Date	Time	Date	Time	Date	Time
05/16/09	10:04	06/19/09	08:35	07/24/09	09:29	08/28/09	09:00	10/06/09	09:04
Elevation		Elevation		Elevation		Elevation		Elevation	
(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)
4495.3	4485.1	4496.7	4486.5	4496.7	4486.5	4491.9	4481.7	4489.0	4478.8
Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)
4462.7	11.7	4421.2	9.2	4462.6	15.5	4452.3	13.2	4456.0	15.6
4462.4	11.6	4420.4	9.1	4462.3	15.0	4451.9	13.1	4455.7	15.6
4462.1	11.5	4420.2	9.0	4462.0	14.6	4451.5	13.0	4455.5	15.6
4461.6	11.5			4461.6	14.1	4451.0	12.9	4455.2	15.6
4461.3	11.4			4461.3	13.8	4450.5	12.8	4454.6	15.6
4461.0	11.4			4460.9	13.5	4450.1	12.7	4454.4	15.6
4460.7	11.3			4460.6	13.2	4449.6	12.6	4454.0	15.6
4460.4	11.2			4460.3	12.9	4449.4	12.5	4453.8	15.6
4460.0	11.1			4460.0	12.7	4449.2	12.5	4453.4	15.6
4459.7	11.1			4459.6	12.6	4448.6	12.4	4453.3	15.6
4459.4	11.0			4459.3	12.5	4448.1	12.4	4452.8	15.6
4459.0	11.0			4459.0	12.4	4447.7	12.4	4452.3	15.6
4458.8	10.9			4458.7	12.4	4447.2	12.3	4451.8	15.6
4458.5	10.9			4458.3	12.3	4446.6	12.3	4451.6	15.6
4458.1	10.8			4458.0	12.3	4446.2	12.2	4451.7	15.6
4457.7	10.8			4457.6	12.2	4445.9	12.2	4451.4	15.6
4457.3	10.8			4457.3	12.2	4445.8	12.1	4450.9	15.6
4457.1	10.8			4457.0	12.1	4445.5	12.1	4450.5	15.6
4456.8	10.7			4456.7	12.1	4445.1	12.1	4450.1	15.6
4456.5	10.7			4456.4	12.1	4444.7	12.1	4449.7	15.6
4456.1	10.7			4456.1	12.0	4444.2	12.0	4449.5	15.6
4455.8	10.7			4455.7	12.0	4443.8	12.0	4449.1	15.6
4455.4	10.7			4455.4	11.9	4443.4	12.0	4448.8	15.6
4455.1	10.7			4455.1	11.9	4443.1	11.9	4448.5	15.6
4454.8	10.6			4454.7	11.8	4443.0	11.9	4448.1	15.6

LA1-P1 - Lake Almanor near Canyon Dam Latitude 40° 10.636'N Longitude 121° 05.256'W

Date	Time	Date	Time	Date	Time	Date	Time	Date	Time
05/16/09	10:04	06/19/09	08:35	07/24/09	09:29	08/28/09	09:00	10/06/09	09:04
Elevation		Elevation		Elevation		Elevation		Elevation	
(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)
4495.3	4485.1	4496.7	4486.5	4496.7	4486.5	4491.9	4481.7	4489.0	4478.8
Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)
4454.4	10.6			4454.4	11.8	4442.5	11.9	4448.0	15.6
4454.0	10.6			4454.1	11.7	4442.0	11.9	4447.7	15.5
4453.6	10.6			4453.8	11.6	4441.5	11.8	4447.3	15.6
4453.3	10.6			4453.4	11.6	4441.0	11.8	4446.8	15.5
4453.0	10.6			4453.0	11.6	4440.5	11.8	4446.4	15.5
4452.8	10.5			4452.8	11.6	4440.2	11.8	4446.3	15.5
4452.6	10.5			4452.4	11.6	4440.0	11.8	4445.8	15.5
4452.2	10.5			4452.1	11.5	4439.4	11.7	4445.5	15.5
4451.9	10.5			4451.8	11.5	4439.0	11.7	4445.2	15.5
4451.4	10.4			4451.5	11.5	4438.5	11.7	4444.7	15.4
4451.1	10.4			4451.1	11.5	4438.1	11.7	4444.2	15.3
4450.7	10.4			4450.8	11.5	4437.7	11.7	4444.1	15.2
4450.5	10.4			4450.5	11.4	4437.5	11.7	4444.0	15.1
4450.2	10.3			4450.1	11.4	4437.4	11.7	4443.4	15.0
4449.9	10.3			4449.8	11.4	4436.9	11.7	4443.0	15.0
4449.6	10.2			4449.5	11.4	4436.3	11.7	4442.9	14.9
4449.4	10.2			4449.2	11.4	4435.7	11.6	4442.4	14.9
4448.8	10.1			4448.8	11.4	4435.2	11.6	4442.3	14.6
4448.6	10.1			4448.5	11.3	4434.7	11.6	4442.0	14.4
4448.1	10.1			4448.1	11.3	4434.3	11.6	4441.8	13.4
4447.8	10.0			4447.8	11.3	4434.0	11.6	4441.3	13.1
4447.5	10.0			4447.5	11.3	4433.6	11.6	4441.0	12.9
4447.2	10.0			4447.2	11.3	4433.2	11.6	4440.7	12.7
4447.0	10.0			4446.9	11.3	4432.6	11.6	4440.1	12.6
4446.5	10.0			4446.5	11.2	4432.1	11.5	4439.6	12.5

LA1-P1 - Lake Almanor near Canyon Dam Latitude 40° 10.636'N Longitude 121° 05.256'W

Date	Time	Date	Time	Date	Time	Date	Time	Date	Time
05/16/09	10:04	06/19/09	08:35	07/24/09	09:29	08/28/09	09:00	10/06/09	09:04
Elevation		Elevation		Elevation		Elevation		Elevation	
(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)
4495.3	4485.1	4496.7	4486.5	4496.7	4486.5	4491.9	4481.7	4489.0	4478.8
Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)
4446.2	10.0			4446.2	11.2	4431.6	11.5	4440.0	12.4
4445.9	10.0			4445.8	11.2	4431.1	11.5	4439.4	12.3
4445.6	10.0			4445.6	11.2	4430.8	11.5	4439.0	12.3
4445.3	9.9			4445.2	11.2	4430.6	11.4	4438.7	12.3
4445.0	9.9			4444.9	11.2	4430.5	11.4	4438.3	12.3
4444.6	9.9			4444.6	11.2	4430.0	11.4	4438.0	12.3
4444.4	9.9			4444.3	11.2	4429.5	11.4	4437.6	12.3
4444.1	9.9			4443.9	11.2	4429.0	11.4	4437.5	12.3
4443.6	9.9			4443.6	11.2	4428.6	11.3	4437.0	12.3
4443.2	9.8			4443.3	11.2	4428.1	11.3	4436.8	12.3
4442.9	9.8			4442.9	11.2	4427.8	11.3	4436.5	12.3
4442.7	9.7			4442.6	11.2	4427.3	11.3	4436.0	12.3
4442.4	9.7			4442.3	11.1	4426.9	11.3	4435.5	12.3
4442.0	9.6			4441.9	11.1	4426.4	11.3	4435.6	12.3
4441.7	9.6			4441.6	11.1	4425.8	11.3	4435.0	12.2
4441.3	9.6			4441.3	11.1	4425.3	11.3	4434.8	12.2
4441.0	9.6			4440.9	11.1	4424.8	11.3	4434.4	12.2
4440.7	9.6			4440.6	11.1	4424.4	11.2	4434.1	12.1
4440.3	9.5			4440.3	11.1	4424.1	11.2	4433.9	12.1
4440.1	9.5			4440.0	11.0	4423.9	11.2	4433.7	12.1
4439.8	9.5			4439.6	11.0	4423.4	11.2	4433.1	12.0
4439.3	9.5			4439.3	11.0	4422.9	11.2	4432.7	12.0
4439.0	9.5			4438.9	11.0	4422.3	11.1	4432.4	12.0
4438.6	9.5			4438.7	11.0	4421.7	11.0	4432.2	12.0
4438.3	9.5			4438.3	11.0	4421.1	10.9	4431.9	12.0

LA1-P1 - Lake Almanor near Canyon Dam Latitude 40° 10.636'N Longitude 121° 05.256'W

Date	Time	Date	Time	Date	Time	Date	Time	Date	Time
05/16/09	10:04	06/19/09	08:35	07/24/09	09:29	08/28/09	09:00	10/06/09	09:04
Elevation		Elevation		Elevation		Elevation		Elevation	
(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)
4495.3	4485.1	4496.7	4486.5	4496.7	4486.5	4491.9	4481.7	4489.0	4478.8
Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)
4438.1	9.4			4438.0	11.0	4420.6	10.8	4431.5	11.9
4437.8	9.4			4437.7	11.0			4431.4	11.9
4437.4	9.4			4437.3	11.0			4430.6	11.9
4437.0	9.4			4437.0	10.9			4430.4	11.9
4436.7	9.4			4436.7	10.9			4430.1	11.9
4436.3	9.4			4436.3	10.9			4429.7	11.9
4436.1	9.3			4436.0	10.9			4429.6	11.9
4435.7	9.3			4435.7	10.9			4429.2	11.8
4435.3	9.3			4435.4	10.9			4428.7	11.8
4435.0	9.2			4435.0	10.9			4428.6	11.8
4434.7	9.1			4434.7	10.9			4428.1	11.8
4434.4	9.1			4434.3	10.9			4427.5	11.8
4434.1	9.0			4434.1	10.9			4427.9	11.8
4433.9	9.0			4433.8	10.9			4427.1	11.8
4433.5	8.9			4433.4	10.9			4426.9	11.8
4433.1	8.9			4433.1	10.8			4426.6	11.8
4432.7	8.9			4432.7	10.8				
4432.3	8.8			4432.4	10.8				
4432.0	8.8			4432.1	10.8				
4431.8	8.8			4431.8	10.8				
4431.5	8.8			4431.4	10.8				
4431.1	8.8			4431.1	10.7				
4430.9	8.8			4430.8	10.7				
4430.4	8.8			4430.4	10.7				
4430.2	8.8			4430.1	10.7				

LA1-P1 - Lake Almanor near Canyon Dam Latitude 40° 10.636'N Longitude 121° 05.256'W

Date	Time	Date	Time	Date	Time	Date	Time	Date	Time
05/16/09	10:04	06/19/09	08:35	07/24/09	09:29	08/28/09	09:00	10/06/09	09:04
Elevation		Elevation		Elevation		Elevation		Elevation	
(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)
4495.3	4485.1	4496.7	4486.5	4496.7	4486.5	4491.9	4481.7	4489.0	4478.8
Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)
4429.8	8.7			4429.8	10.7				
4429.5	8.6			4429.5	10.7				
4429.3	8.5			4429.2	10.7				
				4428.8	10.7				
				4428.5	10.7				
				4428.2	10.7				
				4427.8	10.7				
				4427.5	10.7				
				4427.1	10.7				
				4426.8	10.7				
				4426.5	10.7				
				4426.1	10.7				
				4425.8	10.7				
				4425.5	10.7				
				4425.2	10.7				
				4424.9	10.6				
				4424.5	10.6				
				4424.2	10.6				
				4423.9	10.5				
				4423.6	10.5				
				4423.2	10.4				
				4422.9	10.3				
				4422.6	10.1				
				4422.2	10.0				
				4422.0	9.9				

APPENDIX D1 – ROUTINE LAKE PROFILE DATA – LA-P2

LA-2 - Prattville Intake Latitude 40° 12.794'N Longitude 121° 09.745'W

Date	Time	Date	Time	Date	Time	Date	Time	Date	Time
05/16/09	12:02	06/19/09	09:53	07/24/09	10:54	08/28/09	11:59	10/06/09	11:24
Elevation		Elevation		Elevation		Elevation		Elevation	
(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)
4495.3	4485.1	4496.7	4486.5	4495.1	4484.9	4491.9	4481.7	4489.0	4478.8

Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)
4495.0	15.1	4496.1	19.0	4495.1	22.4	4491.8	21.6	4488.3	15.2
4494.6	14.9	4495.2	18.9	4494.7	22.4	4491.4	21.5	4488.1	15.2
4494.2	14.7	4494.1	18.9	4494.5	22.4	4491.1	21.5	4487.9	15.2
4493.9	14.5	4493.2	18.9	4494.1	22.4	4490.8	21.5	4487.6	15.2
4493.6	14.4	4492.7	18.8	4493.7	22.4	4490.5	21.5	4487.2	15.2
4493.2	14.3	4492.2	18.8	4493.4	22.4	4490.0	21.5	4486.7	15.2
4492.6	14.3	4491.7	18.8	4493.1	22.4	4489.7	21.5	4486.5	15.2
4492.1	14.2	4490.6	18.8	4492.8	22.3	4489.5	21.5	4486.3	15.2
4491.5	14.1	4489.9	18.8	4492.4	22.3	4489.2	21.5	4486.0	15.2
4491.0	14.0	4489.4	18.7	4492.1	22.3	4488.6	21.5	4485.5	15.2
4490.3	13.9	4489.1	18.7	4491.8	22.3	4488.0	21.4	4485.3	15.3
4489.9	13.8	4488.4	18.6	4491.3	22.3	4487.2	21.4	4485.0	15.2
4489.4	13.8	4487.6	18.4	4491.1	22.3	4486.4	21.4	4484.6	15.2
4489.0	13.7	4486.7	18.2	4490.8	22.3	4485.6	21.4	4484.2	15.2
4488.6	13.6	4485.8	18.1	4490.4	22.3	4484.8	21.4	4483.9	15.2
4488.2	13.6	4484.9	18.0	4490.1	22.2	4483.9	21.3	4483.7	15.2
4487.9	13.5	4484.0	18.0	4489.7	22.2	4482.9	21.3	4483.3	15.2
4487.5	13.4	4483.3	17.9	4489.5	22.2	4482.1	21.3	4482.7	15.2
4487.2	13.4	4482.3	17.9	4489.0	22.2	4481.2	21.2	4482.3	15.2
4486.8	13.4	4481.4	17.8	4488.7	22.2	4480.5	21.2	4482.1	15.2
4486.3	13.3	4480.7	17.7	4488.5	22.2	4479.7	21.2	4482.0	15.2
4485.6	13.3	4480.1	17.7	4488.1	22.1	4479.0	21.2	4481.7	15.2
4485.1	13.2	4479.4	17.6	4487.9	22.1	4477.9	21.1	4481.3	15.2

LA-2 - Prattville Intake Latitude 40° 12.794'N Longitude 121° 09.745'W

Date	Time	Date	Time	Date	Time	Date	Time	Date	Time
05/16/09	12:02	06/19/09	09:53	07/24/09	10:54	08/28/09	11:59	10/06/09	11:24
Elevation		Elevation		Elevation		Elevation		Elevation	
(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)
4495.3	4485.1	4496.7	4486.5	4495.1	4484.9	4491.9	4481.7	4489.0	4478.8

Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)
4484.5	13.2	4478.9	17.6	4487.4	22.1	4477.2	21.1	4481.0	15.2
4483.9	13.2	4478.2	17.6	4487.2	22.1	4476.4	21.1	4480.7	15.2
4483.4	13.2	4477.5	17.6	4486.6	22.1	4475.7	21.0	4480.3	15.2
4482.8	13.1	4476.8	17.5	4486.2	22.1	4475.0	21.0	4479.9	15.2
4482.3	13.1	4476.0	17.4	4486.1	22.1	4474.3	21.0	4479.8	15.2
4481.7	13.1	4475.3	17.3	4485.8	22.1	4473.6	21.0	4479.4	15.2
4481.2	13.1	4474.3	17.2	4485.4	22.1	4472.9	21.0	4479.0	15.2
4480.7	13.1	4473.5	17.1	4485.0	22.1	4472.2	21.0	4478.7	15.2
4480.2	13.1	4472.7	16.9	4484.7	22.0	4471.6	21.0	4478.4	15.2
4479.5	13.0	4471.9	16.7	4484.6	22.0	4470.8	20.9	4478.0	15.2
4479.0	13.0	4471.2	16.3	4483.9	22.0	4470.1	20.8	4477.7	15.2
4478.4	13.0	4470.4	15.7	4483.7	22.0	4469.6	20.8	4477.4	15.2
4477.9	13.0	4469.7	14.9	4483.6	22.0	4469.1	20.8	4476.9	15.2
4477.4	13.0	4469.0	14.3	4483.3	22.0	4468.7	20.8	4476.6	15.2
4476.8	13.0	4468.3	14.0	4482.9	22.0	4468.2	20.8	4476.5	15.2
4476.3	13.0	4467.4	13.8	4482.5	22.0	4467.7	20.8	4476.0	15.2
4475.7	12.9	4466.6	13.6	4482.2	22.0	4467.2	20.8	4475.8	15.2
4475.2	12.9	4465.6	13.3	4481.9	22.0	4466.6	20.8	4475.5	15.2
4474.7	12.9	4464.8	13.2	4481.6	22.0	4466.1	20.7	4475.2	15.2
4474.2	12.9	4464.2	13.1	4481.2	21.9	4465.4	20.7	4474.8	15.2
4473.6	12.8	4463.6	13.0	4480.9	21.9	4464.8	20.6	4474.4	15.2
4473.1	12.8	4463.0	12.9	4480.6	21.9	4464.1	20.4	4474.1	15.2
4472.6	12.8	4462.2	12.8	4480.3	21.8	4463.6	20.1	4473.7	15.2
4472.1	12.8	4461.5	12.7	4479.8	21.7	4463.0	19.9	4473.5	15.2

LA-2 - Prattville Intake Latitude 40° 12.794'N Longitude 121° 09.745'W

Date	Time	Date	Time	Date	Time	Date	Time	Date	Time
05/16/09	12:02	06/19/09	09:53	07/24/09	10:54	08/28/09	11:59	10/06/09	11:24
Elevation		Elevation		Elevation		Elevation		Elevation	
(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)
4495.3	4485.1	4496.7	4486.5	4495.1	4484.9	4491.9	4481.7	4489.0	4478.8

Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)
4471.7	12.7	4460.7	12.7	4479.5	21.7	4462.3	19.8	4473.2	15.2
4471.2	12.7	4459.8	12.5	4479.2	21.7	4461.6	19.5	4472.6	15.2
4470.8	12.7	4459.0	12.4	4478.9	21.6	4461.0	18.8	4472.3	15.2
4470.4	12.6	4458.2	12.3	4478.6	21.6	4460.3	18.2	4472.1	15.2
4470.0	12.6	4457.2	12.0	4478.3	21.6	4459.7	17.6	4471.7	15.2
4469.6	12.6	4456.3	11.8	4477.9	21.6	4459.0	17.0	4471.6	15.2
4469.3	12.5	4455.8	11.5	4477.7	21.6	4458.3	16.4	4471.1	15.2
4468.7	12.5	4455.3	10.9	4477.2	21.6	4457.7	15.9	4470.9	15.2
4468.3	12.4	4454.7	10.3	4476.9	21.6	4456.9	15.3	4470.5	15.2
4467.9	12.3	4455.0	10.1	4476.7	21.5	4456.3	14.8	4470.3	15.2
4467.5	12.2			4476.3	21.5	4455.9	14.3	4469.9	15.2
4467.1	12.1			4475.9	21.5	4455.3	13.7	4469.4	15.2
4466.6	11.9			4475.8	21.5	4454.6	12.3	4469.2	15.2
4466.0	11.9			4475.1	21.5	4454.7	11.4	4469.0	15.2
4465.3	11.8			4474.6	21.5			4468.6	15.2
4464.7	11.7			4474.4	21.5			4468.3	15.2
4464.1	11.6			4474.0	21.5			4468.0	15.2
4463.2	11.5			4473.6	21.5			4467.4	15.2
4462.4	11.3			4473.3	21.5			4467.1	15.2
4461.8	11.1			4473.0	21.5			4466.9	15.2
4461.1	10.9			4472.6	21.5			4466.6	15.2
4460.6	10.7			4472.2	21.5			4466.2	15.2
4459.8	10.6			4471.8	21.5			4465.9	15.2
4459.1	10.5			4471.7	21.5			4465.6	15.2

LA-2 - Prattville Intake Latitude 40° 12.794'N Longitude 121° 09.745'W

Date	Time	Date	Time	Date	Time	Date	Time	Date	Time
05/16/09	12:02	06/19/09	09:53	07/24/09	10:54	08/28/09	11:59	10/06/09	11:24
Elevation		Elevation		Elevation		Elevation		Elevation	
(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)
4495.3	4485.1	4496.7	4486.5	4495.1	4484.9	4491.9	4481.7	4489.0	4478.8

Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)
4458.5	10.4			4471.4	21.5			4465.3	15.2
4457.9	10.3			4470.9	21.5			4464.9	15.2
4457.4	10.2			4470.7	21.5			4464.7	15.2
4456.9	10.1			4470.3	21.3			4464.3	15.2
4456.4	10.0			4470.0	21.1			4464.1	15.2
4455.6	10.0			4469.6	20.9			4463.5	15.2
4455.1	10.0			4469.4	20.7			4463.1	15.2
4454.8	9.8			4469.2	20.4			4462.8	15.2
				4468.7	20.2			4462.7	15.2
				4468.4	19.9			4462.4	15.1
				4468.1	19.4			4462.0	15.1
				4467.8	19.1			4461.7	15.1
				4467.3	18.6			4461.4	15.1
				4467.2	18.4			4460.9	15.1
				4466.7	17.9			4460.6	15.1
				4466.4	17.6			4460.4	15.1
				4466.1	17.2			4460.1	15.1
				4465.8	16.7			4459.7	15.1
				4465.4	16.2			4459.4	15.1
				4465.1	16.1			4458.9	15.1
				4464.7	16.0			4458.6	15.1
				4464.5	15.8			4458.3	15.1
				4464.1	15.6			4458.0	15.1
				4463.8	15.5			4457.8	15.1

LA-2 - Prattville Intake Latitude 40° 12.794'N Longitude 121° 09.745'W

Date	Time	Date	Time	Date	Time	Date	Time	Date	Time
05/16/09	12:02	06/19/09	09:53	07/24/09	10:54	08/28/09	11:59	10/06/09	11:24
Elevation		Elevation		Elevation		Elevation		Elevation	
(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)
4495.3	4485.1	4496.7	4486.5	4495.1	4484.9	4491.9	4481.7	4489.0	4478.8

Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)
				4463.4	15.3			4457.3	15.1
				4463.3	15.1			4457.0	15.1
				4462.8	14.9			4456.7	15.1
				4462.3	14.7			4456.4	15.1
				4462.1	14.5			4456.2	15.1
				4461.8	14.2			4455.8	15.1
				4461.5	14.1			4455.3	15.1
				4461.1	13.9			4455.1	15.0
				4460.8	13.8			4454.8	15.0
				4460.7	13.7			4454.5	13.3
				4460.2	13.5				
				4459.8	13.5				
				4459.5	13.4				
				4459.3	13.3				
				4458.9	13.2				
				4458.5	13.2				
				4458.1	13.1				
				4457.9	13.0				
				4457.7	12.7				
				4457.2	12.5				
				4456.9	12.3				
				4456.6	12.2				
				4456.4	12.1				
				4455.9	12.0				

LA-2 - Prattville Intake				Latitude 40° 12.794'N		Longitude 121° 09.745'W			
Date	Time	Date	Time	Date	Time	Date	Time	Date	Time
05/16/09	12:02	06/19/09	09:53	07/24/09	10:54	08/28/09	11:59	10/06/09	11:24
Elevation		Elevation		Elevation		Elevation		Elevation	
(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)
4495.3	4485.1	4496.7	4486.5	4495.1	4484.9	4491.9	4481.7	4489.0	4478.8
Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)
				4455.6	11.9				
				4455.3	11.7				
				4455.1	11.1				

APPENDIX D1 – ROUTINE LAKE PROFILE DATA – LA-P6

LA1-P6 - Almanor West (P4) Latitude 40°15.445'N Longitude 121°10.807'W

Date	Time	Date	Time	Date	Time	Date	Time	Date	Time
05/16/09	11:35	06/19/09	09:40	07/24/09	10:33	08/28/09	11:47	10/06/09	10:59
Elevation		Elevation		Elevation		Elevation		Elevation	
(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)
4495.3	4485.1	4496.7	4486.5	4495.1	4484.9	4491.9	4481.7	4489.0	4478.8
Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)
4495.0	13.6	4496.7	18.6	4495.0	22.7	4491.7	21.4	4488.8	14.5
4494.5	13.5	4496.0	18.5	4494.6	22.7	4491.3	21.3	4488.5	14.5
4494.2	13.5	4495.7	18.5	4494.4	22.7	4490.9	21.3	4488.0	14.5
4493.7	13.4	4494.7	18.4	4494.1	22.6	4490.7	21.3	4487.7	14.5
4493.3	13.4	4493.8	18.3	4493.9	22.6	4490.5	21.2	4487.3	14.5
4492.7	13.3	4492.8	18.3	4493.5	22.6	4490.2	21.2	4487.0	14.5
4492.3	13.3	4491.7	18.2	4493.0	22.6	4489.8	21.2	4486.7	14.5
4491.8	13.3	4491.0	18.1	4492.7	22.6	4489.4	21.2	4486.3	14.5
4491.3	13.3	4490.1	18.0	4492.5	22.6	4489.1	21.2	4485.9	14.5
4490.9	13.2	4489.2	18.0	4492.1	22.6	4488.9	21.2	4485.6	14.5
4490.4	13.2	4488.1	17.9	4491.7	22.6	4488.6	21.1	4485.2	14.5
4490.0	13.2	4487.2	17.9	4491.3	22.6	4488.2	21.1	4484.8	14.5
4489.6	13.2	4486.2	17.9	4491.1	22.6	4487.7	21.1	4484.4	14.5
4489.1	13.2	4485.6	17.8	4490.8	22.6	4487.4	21.1	4484.0	14.5
4488.5	13.1	4484.8	17.8	4490.3	22.6	4487.1	21.1	4483.6	14.5
4488.1	13.1	4483.9	17.8	4490.0	22.6	4486.9	21.1	4483.2	14.5
4487.5	13.1	4483.0	17.8	4489.6	22.6	4486.6	21.1	4482.8	14.5
4487.0	13.1	4481.8	17.8	4489.5	22.6	4486.2	21.1	4482.6	14.5
4486.5	13.1	4481.0	17.7	4489.2	22.5	4485.8	21.1	4482.2	14.5
4486.1	13.0	4480.7	17.6	4488.8	22.5	4485.6	21.1	4481.8	14.5
4485.6	13.0	4480.6	17.6	4488.5	22.5	4485.3	21.1	4481.4	14.5
4485.0	13.0	4480.0	17.5	4488.1	22.5	4484.9	21.1	4481.0	14.5
4484.6	13.0	4479.3	17.2	4487.9	22.5	4484.6	21.0	4480.6	14.5
4484.1	12.9	4478.4	17.0	4487.5	22.5	4484.3	21.0	4480.3	14.5

LA1-P6 - Almanor West (P4) Latitude 40°15.445'N Longitude 121°10.807'W

Date	Time	Date	Time	Date	Time	Date	Time	Date	Time
05/16/09	11:35	06/19/09	09:40	07/24/09	10:33	08/28/09	11:47	10/06/09	10:59
Elevation		Elevation		Elevation		Elevation		Elevation	
(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)
4495.3	4485.1	4496.7	4486.5	4495.1	4484.9	4491.9	4481.7	4489.0	4478.8
Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)
4483.6	12.9	4477.5	16.8	4487.1	22.5	4483.9	21.0	4479.8	14.5
4483.2	12.9	4476.5	16.7	4486.9	22.5	4483.6	21.0	4479.6	14.4
4482.7	12.9	4475.6	16.6	4486.5	22.5	4483.2	21.0	4479.3	14.4
4482.1	12.8	4474.6	16.4	4486.2	22.5	4482.9	21.0	4479.0	14.4
4481.6	12.8	4473.8	16.1	4485.9	22.5	4482.6	21.0	4478.7	14.4
4481.0	12.8	4472.8	15.9	4485.5	22.5	4482.3	21.0	4478.4	14.4
4480.5	12.8	4472.2	15.2	4485.2	22.5	4482.0	20.9	4478.1	14.4
4479.9	12.8	4471.9	14.7	4484.8	22.5	4481.6	20.9	4477.7	14.4
4479.3	12.7	4471.5	14.5	4484.5	22.5	4481.3	20.9	4477.3	14.4
4478.8	12.7	4470.8	14.4	4484.2	22.4	4480.9	20.9	4476.9	14.4
4478.3	12.7	4470.1	14.2	4484.0	22.4	4480.6	20.9	4476.5	14.4
4477.8	12.7	4469.0	13.9	4483.6	22.4	4480.3	20.9	4476.1	14.4
4477.3	12.6			4483.1	22.4	4480.0	20.9	4475.7	14.4
4476.8	12.6			4482.8	22.3	4479.7	20.8	4475.3	14.4
4476.2	12.5			4482.6	22.3	4479.3	20.8	4474.9	14.4
4475.6	12.5			4482.3	22.2	4479.0	20.8	4474.5	14.3
4475.1	12.5			4481.9	22.2	4478.6	20.8	4474.1	14.3
4474.6	12.5			4481.5	22.1	4478.3	20.8	4473.7	14.3
4474.0	12.5			4481.2	22.1	4478.0	20.8	4473.3	14.3
4473.4	12.5			4481.0	22.1	4477.6	20.8	4472.9	14.3
4472.8	12.4			4480.6	22.1	4477.3	20.8	4472.4	14.3
4472.3	12.3			4480.3	22.1	4476.9	20.7	4472.0	14.3
4471.6	12.0			4479.9	22.1	4476.7	20.7	4471.7	14.3
4471.0	11.7			4479.6	22.1	4476.4	20.7	4471.3	14.3
4470.3	11.6			4479.4	22.1	4475.9	20.7	4470.9	14.3

LA1-P6 - Almanor West (P4) Latitude 40°15.445'N Longitude 121°10.807'W

Date	Time	Date	Time	Date	Time	Date	Time	Date	Time
05/16/09	11:35	06/19/09	09:40	07/24/09	10:33	08/28/09	11:47	10/06/09	10:59
Elevation		Elevation		Elevation		Elevation		Elevation	
(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)
4495.3	4485.1	4496.7	4486.5	4495.1	4484.9	4491.9	4481.7	4489.0	4478.8
Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)
4469.5	11.3			4478.9	22.0	4475.7	20.7	4470.6	14.3
4469.3	11.1			4478.6	22.0	4475.4	20.6	4470.2	14.3
				4478.3	22.0	4475.1	20.6	4469.8	14.3
				4478.0	22.0	4474.8	20.6	4469.6	14.3
				4477.7	21.9	4474.4	20.6		
				4477.3	21.8	4474.0	20.6		
				4476.9	21.8	4473.6	20.5		
				4476.5	21.7	4473.4	20.5		
				4476.4	21.6	4473.1	20.5		
				4476.1	21.5	4472.8	20.5		
				4475.6	21.2	4472.3	20.5		
				4475.4	21.1	4472.0	20.5		
				4475.1	20.9	4471.7	20.5		
				4474.6	20.7	4471.5	20.5		
				4474.3	20.6	4471.1	20.5		
				4474.0	20.4	4470.7	20.5		
				4473.8	20.3	4470.4	20.5		
				4473.3	20.0	4470.0	20.5		
				4473.0	19.7	4469.8	20.5		
				4472.7	19.4	4469.6	20.5		
				4472.4	19.1				
				4471.9	18.8				
				4471.6	18.7				
				4471.4	18.6				
				4471.1	18.4				

LA1-P6 - Almanor West (P4)						Latitude	40°15.445'N	Longitude	121°10.807'W		
Date	Time	Date	Time	Date	Time	Date	Time	Date	Time	Date	Time
05/16/09	11:35	06/19/09	09:40	07/24/09	10:33	08/28/09	11:47	10/06/09	10:59		
Elevation		Elevation		Elevation		Elevation		Elevation			
(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)		
4495.3	4485.1	4496.7	4486.5	4495.1	4484.9	4491.9	4481.7	4489.0	4478.8		
Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)		
				4470.7	18.3						
				4470.5	18.1						
				4470.0	18.0						

APPENDIX D1 – ROUTINE LAKE PROFILE DATA – LA-P3

LA1-P8 - Green Roof (P3) Latitude 40° 8404'N Longitude 121° 06.8098'W

Date	Time	Date	Time	Date	Time	Date	Time	Date	Time
05/16/09	10:55	06/19/09	09:17	07/24/09	10:08	08/24/07	09:10	10/06/07	09:01
Elevation		Elevation		Elevation		Elevation		Elevation	
(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)
4495.3	4485.1	4496.7	4486.5	4494.4	4484.2	4492.0	4481.8	4490.0	4479.8
Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)
4495.2	14.3	4496.3	18.9	4495.1	22.6	4491.8	21.5	4488.5	15.5
4494.7	14.3	4496.0	18.9	4494.6	22.6	4491.5	21.5	4488.3	15.5
4494.3	14.3	4495.6	18.9	4494.4	22.6	4491.1	21.5	4487.6	15.5
4494.2	14.2	4495.2	18.9	4494.1	22.6	4490.7	21.5	4487.3	15.5
4493.9	14.1	4494.6	18.9	4493.8	22.6	4490.4	21.5	4486.9	15.5
4493.4	14.0	4493.6	18.8	4493.4	22.6	4490.2	21.4	4486.5	15.5
4493.1	14.0	4493.2	18.8	4493.1	22.6	4489.7	21.4	4486.1	15.5
4492.9	13.9	4492.7	18.8	4492.7	22.6	4489.3	21.4	4485.9	15.5
4492.4	13.8	4491.9	18.8	4492.4	22.6	4489.1	21.4	4485.4	15.5
4492.1	13.7	4491.1	18.8	4492.1	22.6	4488.8	21.4	4484.7	15.5
4491.8	13.7	4490.2	18.8	4491.8	22.6	4488.6	21.4	4484.3	15.5
4491.5	13.6	4489.8	18.6	4491.4	22.6	4488.1	21.4	4484.2	15.5
4491.1	13.5	4489.3	18.5	4491.1	22.6	4487.8	21.4	4483.8	15.5
4490.8	13.5	4488.7	18.4	4490.7	22.6	4487.5	21.4	4483.4	15.5
4490.6	13.4	4487.8	18.3	4490.4	22.6	4487.1	21.4	4483.0	15.5
4490.3	13.4	4486.9	18.3	4490.1	22.6	4486.8	21.4	4482.8	15.5
4489.9	13.4	4485.5	18.2	4489.8	22.5	4486.3	21.4	4482.7	15.5
4489.5	13.3	4484.6	18.2	4489.4	22.5	4486.0	21.4	4482.2	15.5
4489.0	13.3	4483.9	18.0	4489.1	22.5	4485.7	21.4	4481.9	15.5
4488.7	13.3	4482.9	17.8	4488.7	22.5	4485.5	21.4	4481.7	15.5
4488.4	13.2	4482.0	17.5	4488.5	22.5	4485.1	21.4	4481.2	15.5
4488.3	13.2	4481.1	17.4	4488.2	22.5	4484.8	21.4	4480.8	15.5
4488.0	13.2	4480.2	17.3	4487.9	22.5	4484.3	21.4	4480.3	15.5
4487.7	13.2	4479.2	17.1	4487.5	22.5	4483.9	21.4	4480.0	15.5

LA1-P8 - Green Roof (P3)										Latitude 40° 8404'N		Longitude 121° 06.8098'W			
Date	Time		Date	Time		Date	Time		Date	Time		Date	Time		Date	Time
05/16/09	10:55		06/19/09	09:17		07/24/09	10:08		08/24/07	09:10		10/06/07	09:01		
Elevation			Elevation			Elevation			Elevation			Elevation			
(USGS)	(PG&E)		(USGS)	(PG&E)		(USGS)	(PG&E)		(USGS)	(PG&E)		(USGS)	(PG&E)		
4495.3	4485.1		4496.7	4486.5		4494.4	4484.2		4492.0	4481.8		4490.0	4479.8		
Elevation (ft.)	Temp. (°C)		Elevation (ft.)	Temp. (°C)		Elevation (ft.)	Temp. (°C)		Elevation (ft.)	Temp. (°C)		Elevation (ft.)	Temp. (°C)		
4487.3	13.1		4478.3	16.8		4487.1	22.5		4483.5	21.4		4479.6	15.5		
4487.0	13.1		4477.5	16.4		4486.9	22.5		4483.2	21.4		4479.1	15.5		
4486.7	13.1		4476.6	16.0		4486.5	22.5		4482.9	21.4		4478.9	15.5		
4486.3	13.1		4475.5	15.3		4486.2	22.5		4482.5	21.4		4478.6	15.5		
4485.9	13.0		4474.8	14.8		4485.9	22.5		4482.4	21.4		4478.0	15.5		
4485.5	13.0		4474.1	14.4		4485.4	22.5		4481.8	21.4		4477.6	15.5		
4485.2	13.0		4473.4	14.1		4485.3	22.5		4481.5	21.4		4477.3	15.5		
4485.0	13.0		4472.7	13.9		4484.8	22.5		4481.3	21.4		4477.1	15.5		
4484.7	12.9		4471.8	13.7		4484.6	22.5		4480.9	21.4		4476.6	15.5		
4484.3	12.9		4471.0	13.5		4484.1	22.5		4480.5	21.4		4476.4	15.5		
4483.9	12.9		4470.2	13.2		4483.9	22.5		4480.2	21.4		4476.0	15.5		
4483.6	12.9		4469.4	12.8		4483.5	22.5		4480.0	21.4		4475.5	15.5		
4483.2	12.9		4468.7	12.6		4483.1	22.5		4479.4	21.4		4475.0	15.5		
4483.0	12.8		4467.9	12.3		4483.0	22.5		4479.1	21.4		4474.8	15.5		
4482.7	12.8		4466.7	12.1		4482.5	22.5		4478.8	21.4		4474.3	15.5		
4482.3	12.7		4465.9	11.9		4482.3	22.5		4478.6	21.4		4473.7	15.5		
4481.9	12.7		4465.1	11.7		4481.9	22.5		4478.3	21.4		4473.3	15.5		
4481.6	12.7		4464.3	11.6		4481.6	22.5		4478.0	21.4		4473.0	15.5		
4481.3	12.6		4463.5	11.5		4481.2	22.5		4477.6	21.4		4472.8	15.5		
4480.9	12.6		4462.8	11.4		4480.8	22.5		4477.3	21.4		4472.1	15.5		
4480.6	12.5		4462.1	11.3		4480.4	22.4		4477.0	21.4		4471.6	15.5		
4480.3	12.5		4461.3	11.2		4480.2	22.3		4476.6	21.4		4471.4	15.5		
4479.9	12.4		4460.5	11.1		4480.0	22.0		4476.4	21.4		4471.2	15.5		
4479.5	12.4		4459.6	11.0		4479.5	21.7		4476.1	21.4		4470.5	15.5		
4479.0	12.3		4458.6	10.9		4479.3	21.5		4475.7	21.4		4470.0	15.5		

LA1-P8 - Green Roof (P3)										Latitude 40° 8404'N		Longitude 121° 06.8098'W			
Date	Time		Date	Time		Date	Time		Date	Time		Date	Time		Date	Time
05/16/09	10:55		06/19/09	09:17		07/24/09	10:08		08/24/07	09:10		10/06/07	09:01		
Elevation			Elevation			Elevation			Elevation			Elevation			
(USGS)	(PG&E)		(USGS)	(PG&E)		(USGS)	(PG&E)		(USGS)	(PG&E)		(USGS)	(PG&E)		
4495.3	4485.1		4496.7	4486.5		4494.4	4484.2		4492.0	4481.8		4490.0	4479.8		
Elevation (ft.)	Temp. (°C)		Elevation (ft.)	Temp. (°C)		Elevation (ft.)	Temp. (°C)		Elevation (ft.)	Temp. (°C)		Elevation (ft.)	Temp. (°C)		
4478.8	12.2		4457.6	10.7		4478.9	21.4		4475.4	21.4		4469.7	15.5		
4478.3	12.1		4457.1	10.6		4478.6	21.4		4475.1	21.4		4469.3	15.5		
4478.1	12.1		4456.4	10.5		4478.3	21.3		4474.7	21.4		4469.0	15.5		
4477.7	12.0		4455.7	10.5		4477.9	21.3		4474.4	21.4		4468.6	15.5		
4477.3	12.0		4455.0	10.4		4477.7	21.2		4474.0	21.4		4468.3	15.5		
4477.0	11.9		4454.1	10.4		4477.4	21.1		4473.6	21.4		4468.1	15.5		
4476.9	11.9		4453.4	10.3		4476.9	21.1		4473.3	21.4		4467.7	15.5		
4476.5	11.9		4452.5	10.3		4476.7	21.1		4473.1	21.4		4467.1	15.5		
4476.2	11.8		4451.8	10.3		4476.3	21.0		4472.7	21.4		4466.9	15.5		
4475.7	11.8		4451.0	10.3		4476.0	21.0		4472.5	21.4		4466.6	15.5		
4475.5	11.7		4450.3	10.3		4475.7	20.9		4472.2	21.4		4465.9	15.5		
4475.2	11.6		4449.5	10.3		4475.2	20.8		4471.9	21.4		4465.5	15.5		
4474.8	11.6		4448.8	10.3		4475.1	20.7		4471.4	21.4		4465.2	15.5		
4474.2	11.5		4448.0	10.3		4474.7	20.6		4471.0	21.4		4464.8	15.5		
4473.8	11.5		4447.2	10.3		4474.3	20.4		4470.7	21.4		4464.3	15.5		
4473.2	11.4		4445.9	10.2		4474.1	20.2		4470.5	21.4		4464.1	15.5		
4472.8	11.3					4473.7	20.1		4470.2	21.3		4464.0	15.5		
4472.4	11.3					4473.4	19.9		4469.8	21.3		4463.5	15.5		
4472.1	11.2					4473.0	19.7		4469.4	21.2		4463.1	15.5		
4471.9	11.2					4472.6	19.5		4469.1	21.2		4462.7	15.5		
4471.3	11.2					4472.4	19.3		4468.8	21.0		4462.5	15.5		
4470.7	11.2					4472.0	19.0		4468.6	20.7		4462.1	15.5		
4470.1	11.2					4471.7	18.8		4468.2	20.5		4461.6	15.5		
4469.7	11.1					4471.5	18.5		4467.7	20.2		4461.3	15.5		
4469.3	11.1					4471.0	18.3		4467.5	20.0		4461.0	15.5		

LA1-P8 - Green Roof (P3)												Latitude 40° 8404'N		Longitude 121° 06.8098'W			
Date	Time		Date	Time		Date	Time		Date	Time		Date	Time		Date	Time	
05/16/09	10:55		06/19/09	09:17		07/24/09	10:08		08/24/07	09:10		10/06/07	09:01				
Elevation			Elevation			Elevation			Elevation			Elevation					
(USGS)	(PG&E)		(USGS)	(PG&E)		(USGS)	(PG&E)		(USGS)	(PG&E)		(USGS)	(PG&E)				
4495.3	4485.1		4496.7	4486.5		4494.4	4484.2		4492.0	4481.8		4490.0	4479.8				
Elevation (ft.)	Temp. (°C)		Elevation (ft.)	Temp. (°C)		Elevation (ft.)	Temp. (°C)		Elevation (ft.)	Temp. (°C)		Elevation (ft.)	Temp. (°C)				
4469.0	11.1					4470.6	18.1		4467.2	19.6		4460.5	15.5				
4468.7	11.0					4470.5	18.0		4466.9	19.3		4459.6	15.5				
4468.4	11.0					4470.1	17.7		4466.5	19.1		4459.1	15.5				
4468.1	10.9					4469.6	17.5		4466.2	18.9		4458.5	15.5				
4467.8	10.9					4469.4	17.2		4465.9	18.7		4458.2	15.5				
4467.4	10.8					4469.2	16.7		4465.6	18.5		4457.8	15.5				
4466.8	10.7					4468.7	16.5		4465.2	18.4		4457.1	15.5				
4466.2	10.7					4468.4	16.4		4464.8	18.2		4456.7	15.5				
4465.8	10.6					4468.1	16.1		4464.4	18.0		4456.4	15.5				
4465.3	10.6					4467.7	15.9		4464.2	18.0		4455.9	15.5				
4464.9	10.6					4467.4	15.7		4463.9	17.8		4455.4	15.5				
4464.4	10.5					4467.2	15.4		4463.5	17.6		4455.1	15.5				
4464.1	10.5					4466.7	15.3		4463.2	17.4		4454.9	15.5				
4463.6	10.5					4466.4	15.2		4462.9	17.3		4454.8	15.5				
4463.2	10.5					4466.1	15.1		4462.5	17.0		4454.3	15.5				
4462.7	10.5					4465.8	14.9		4462.3	16.9		4453.8	15.5				
4462.4	10.4					4465.4	14.9		4461.9	16.8		4453.6	15.5				
4462.0	10.4					4465.1	14.8		4461.6	16.6		4453.4	15.5				
4461.6	10.4					4464.9	14.7		4461.3	16.5		4452.9	15.5				
4461.2	10.4					4464.4	14.6		4460.9	16.3		4452.5	15.5				
4460.9	10.3					4464.1	14.5		4460.6	16.1		4452.2	15.4				
4460.4	10.3					4463.9	14.4		4460.1	15.9		4451.9	15.4				
4460.0	10.3					4463.4	14.3		4459.8	15.7		4451.4	15.4				
4459.5	10.2					4463.2	14.3		4459.7	15.6		4450.8	15.4				
4459.1	10.2					4462.8	14.2		4459.2	15.3		4450.3	15.4				

LA1-P8 - Green Roof (P3)												Latitude 40° 8404'N		Longitude 121° 06.8098'W			
Date	Time		Date	Time		Date	Time		Date	Time		Date	Time		Date	Time	
05/16/09	10:55		06/19/09	09:17		07/24/09	10:08		08/24/07	09:10		10/06/07	09:01				
Elevation			Elevation			Elevation			Elevation			Elevation					
(USGS)	(PG&E)		(USGS)	(PG&E)		(USGS)	(PG&E)		(USGS)	(PG&E)		(USGS)	(PG&E)				
4495.3	4485.1		4496.7	4486.5		4494.4	4484.2		4492.0	4481.8		4490.0	4479.8				
Elevation (ft.)	Temp. (°C)		Elevation (ft.)	Temp. (°C)		Elevation (ft.)	Temp. (°C)		Elevation (ft.)	Temp. (°C)		Elevation (ft.)	Temp. (°C)				
4458.6	10.2					4462.5	14.1		4459.0	15.1		4449.8	15.4				
4458.4	10.2					4462.1	14.0		4458.6	14.9		4449.1	15.3				
4458.0	10.2					4461.8	14.0		4458.2	14.5		4448.6	15.2				
4457.4	10.1					4461.6	13.8		4458.0	14.4		4448.2	15.0				
4457.0	10.1					4461.1	13.7		4457.7	14.1		4447.8	14.0				
4456.5	10.0					4460.9	13.7		4457.3	13.9		4447.5	13.1				
4456.0	10.0					4460.6	13.6		4456.9	13.8		4447.1	12.8				
4455.6	9.9					4460.2	13.5		4456.7	13.6		4446.8	12.7				
4455.0	9.9					4459.8	13.4		4456.3	13.5		4446.7	12.6				
4454.6	9.8					4459.6	13.3		4456.1	13.3							
4454.1	9.8					4459.2	13.2		4455.6	13.3							
4453.6	9.7					4458.8	13.1		4455.3	13.2							
4453.1	9.7					4458.5	13.0		4455.1	13.1							
4452.6	9.6					4458.2	12.9		4454.7	13.0							
4452.0	9.6					4457.9	12.8		4454.4	12.9							
4451.5	9.5					4457.5	12.8		4454.0	12.7							
4451.1	9.5					4457.1	12.7		4453.6	12.6							
4450.6	9.5					4456.9	12.6		4453.4	12.5							
4450.4	9.5					4456.6	12.4		4453.0	12.3							
4450.0	9.5					4456.2	12.3		4452.8	12.1							
4449.5	9.5					4455.9	12.2		4452.4	12.0							
4449.1	9.5					4455.6	12.1		4452.0	11.9							
4448.7	9.5					4455.3	11.9		4451.7	11.9							
4448.3	9.5					4454.9	11.7		4451.4	11.9							
4447.7	9.5					4454.6	11.7		4451.1	11.8							

LA1-P8 - Green Roof (P3)												Latitude 40° 8404'N		Longitude 121° 06.8098'W			
Date	Time		Date	Time		Date	Time		Date	Time		Date	Time		Date	Time	
05/16/09	10:55		06/19/09	09:17		07/24/09	10:08		08/24/07	09:10		10/06/07	09:01				
Elevation			Elevation			Elevation			Elevation			Elevation					
(USGS)	(PG&E)		(USGS)	(PG&E)		(USGS)	(PG&E)		(USGS)	(PG&E)		(USGS)	(PG&E)				
4495.3	4485.1		4496.7	4486.5		4494.4	4484.2		4492.0	4481.8		4490.0	4479.8				
Elevation (ft.)	Temp. (°C)		Elevation (ft.)	Temp. (°C)		Elevation (ft.)	Temp. (°C)		Elevation (ft.)	Temp. (°C)		Elevation (ft.)	Temp. (°C)				
4447.4	9.5					4454.3	11.6		4450.7	11.8							
4447.0	9.5					4454.1	11.5		4450.4	11.8							
4446.9	9.5					4453.5	11.2		4450.1	11.8							
						4453.0	11.2		4449.8	11.8							
						4452.7	11.2		4449.4	11.8							
						4452.4	11.1		4449.1	11.8							
						4452.2	11.1		4448.8	11.8							
						4451.9	11.1		4448.4	11.8							
						4451.6	11.1		4448.1	11.8							
						4451.4	11.1		4447.8	11.8							
						4450.9	11.1		4447.5	11.8							
						4450.6	11.1		4447.1	11.8							
						4450.3	11.1		4447.0	11.7							
						4450.2	11.1										
						4449.7	11.1										
						4449.3	11.1										
						4449.0	11.1										
						4448.7	11.1										
						4448.3	11.1										
						4448.0	11.1										
						4447.7	11.1										
						4447.4	11.1										
						4447.0	11.1										
						4446.9	11.1										

APPENDIX D2 – ROUTINE LAKE PROFILE DATA – BV1-P1

BV1-P1 Butt Valley Reservoir near Caribou 1 intake Latitude 40° 07.032 Longitude 121° 08.694

Date	Time	Date	Time	Date	Time	Date	Time	Date	Time
05/16/09	15:34	06/19/09	12:40	07/24/09	14:27	08/28/09	13:34	10/06/09	14:13
Elevation		Elevation		Elevation		Elevation		Elevation	
(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)
4138.4	4128.2	4136.79	4126.59	4136.79	4126.59	4136.13	4125.93	4136.40	4126.20

Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)
4138.1	18.0	4136.3	20.2	4133.4	22.7	4135.5	21.9	4136.3	16.3
4137.5	17.8	4135.7	20.2	4133.1	22.4	4134.8	21.8	4136.0	16.3
4136.9	17.7	4135.0	20.1	4132.8	22.3	4134.1	21.7	4135.6	16.3
4136.1	17.6	4134.8	19.9	4132.3	22.3	4133.9	21.7	4135.4	16.3
4135.3	17.5	4134.7	19.7	4132.1	22.2	4133.6	21.7	4135.0	16.3
4134.6	17.3	4134.0	19.6	4131.8	22.2	4133.1	21.7	4134.6	16.3
4133.8	17.2	4133.2	19.4	4131.5	22.3	4132.3	21.7	4134.4	16.3
4133.1	17.1	4132.4	19.3	4131.2	22.2	4131.6	21.7	4134.0	16.3
4132.3	16.9	4131.6	19.2	4130.9	22.2	4131.3	21.6	4133.6	16.3
4131.7	16.5	4131.0	19.1	4130.4	22.2	4131.1	21.6	4133.4	16.3
4131.0	15.9	4130.7	19.1	4130.2	22.2	4130.5	21.6	4133.1	16.3
4130.4	15.4	4130.4	19.0	4129.9	22.2	4129.9	21.6	4132.8	16.3
4129.9	15.1	4129.8	19.0	4129.5	22.2	4129.3	21.5	4132.4	16.3
4129.5	14.7	4129.1	19.0	4129.2	22.2	4129.1	21.5	4132.0	16.3
4129.0	14.3	4128.5	18.9	4128.9	22.2	4128.6	21.4	4131.6	16.3
4128.6	14.1	4127.9	18.9	4128.7	22.2	4127.9	21.4	4131.4	16.3
4128.1	14.0	4127.4	18.8	4128.3	22.2	4127.0	21.4	4131.1	16.3
4127.7	13.9	4127.2	18.8	4127.8	22.2	4126.6	21.4	4130.8	16.3
4127.3	13.8	4126.7	18.7	4127.5	22.2	4126.2	21.4	4130.5	16.3
4126.9	13.7	4126.1	18.7	4127.2	22.2	4125.7	21.3	4130.1	16.3
4126.4	13.5	4125.6	18.7	4126.9	22.2	4124.9	21.3	4129.7	16.2
4125.7	13.0	4125.2	18.6	4126.7	22.2	4124.0	21.2	4129.4	16.2
4125.3	12.8	4124.5	18.4	4126.2	22.1	4123.3	21.2	4129.2	16.2

BV1-P1 Butt Valley Reservoir near Caribou 1 intake									
				Latitude 40° 07.032		Longitude 121° 08.694			
Date	Time	Date	Time	Date	Time	Date	Time	Date	Time
05/16/09	15:34	06/19/09	12:40	07/24/09	14:27	08/28/09	13:34	10/06/09	14:13
Elevation		Elevation		Elevation		Elevation		Elevation	
(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)
4138.4	4128.2	4136.79	4126.59	4136.79	4126.59	4136.13	4125.93	4136.40	4126.20
Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)
4124.8	12.6	4124.2	18.3	4126.0	22.1	4122.8	21.2	4128.8	16.2
4124.3	12.4	4124.1	18.2	4125.6	22.1	4122.2	21.2	4128.5	16.2
4123.8	12.3	4123.6	18.1	4125.3	22.1	4121.4	21.1	4128.0	16.2
4123.4	12.2	4123.2	18.0	4124.9	22.1	4120.8	21.1	4127.7	16.2
4122.9	12.2	4122.7	17.8	4124.5	22.1	4120.2	21.1	4127.5	16.2
4122.4	12.1	4122.3	17.7	4124.3	22.0	4119.5	21.1	4127.1	16.2
4121.9	12.0	4121.8	17.5	4124.0	21.9	4119.0	21.1	4126.9	16.2
4121.4	11.9	4121.6	17.3	4123.7	21.4	4118.4	21.1	4126.5	16.2
4120.9	11.7	4121.2	17.1	4123.2	21.3	4118.0	21.1	4126.1	16.2
4120.2	11.5	4120.7	17.0	4122.9	21.3	4117.3	21.1	4125.8	16.2
4119.6	11.4	4120.3	16.9	4122.7	21.2	4116.7	21.1	4125.5	16.2
4119.0	11.3	4119.8	16.8	4122.4	21.2	4116.2	21.1	4125.2	16.2
4118.6	11.1	4119.3	16.7	4121.9	21.1	4115.7	21.1	4124.9	16.2
4118.1	11.1	4119.1	16.6	4121.7	21.1	4115.2	21.0	4124.6	16.2
4117.7	11.0	4118.6	16.5	4121.4	21.1	4114.7	21.0	4124.2	16.2
4117.2	11.0	4118.1	16.4	4121.0	21.1	4114.1	21.0	4123.7	16.2
4116.8	10.9	4117.5	16.3	4120.6	21.1	4113.4	21.0	4123.4	16.2
4116.3	10.9	4117.0	16.1	4120.2	21.1	4112.7	20.9	4123.1	16.2
4115.9	10.8	4116.5	15.9	4119.9	21.1	4112.2	20.9	4122.9	16.2
4115.4	10.8	4116.4	15.7	4119.7	21.1	4111.9	20.8	4122.6	16.2
4114.8	10.7	4115.7	15.5	4119.4	21.0	4111.3	20.8	4122.2	16.2
4114.4	10.6	4115.1	15.4	4119.0	21.0	4110.7	20.8	4121.9	16.2
4113.9	10.6	4114.5	15.2	4118.6	21.0	4110.1	20.8	4121.5	16.2
4113.5	10.5	4113.9	15.0	4118.4	20.9	4109.5	20.7	4121.2	16.2

BV1-P1 Butt Valley Reservoir near Caribou 1 intake																	
								Latitude	40° 07.032			Longitude	121° 08.694				
Date	Time		Date	Time		Date	Time		Date	Time		Date	Time		Date	Time	
05/16/09	15:34		06/19/09	12:40		07/24/09	14:27		08/28/09	13:34		10/06/09	14:13				
Elevation			Elevation			Elevation			Elevation			Elevation					
(USGS)	(PG&E)		(USGS)	(PG&E)		(USGS)	(PG&E)		(USGS)	(PG&E)		(USGS)	(PG&E)				
4138.4	4128.2		4136.79	4126.59		4136.79	4126.59		4136.13	4125.93		4136.40	4126.20				
Elevation (ft.)	Temp. (°C)		Elevation (ft.)	Temp. (°C)		Elevation (ft.)	Temp. (°C)		Elevation (ft.)	Temp. (°C)		Elevation (ft.)	Temp. (°C)				
4113.1	10.4		4113.4	14.7		4118.1	20.9		4109.1	20.7		4120.9	16.1				
4112.5	10.3		4113.1	14.5		4117.6	20.8		4108.5	20.7		4120.6	16.1				
4112.1	10.3		4113.1	14.3		4117.4	20.8		4107.8	20.6		4120.3	16.1				
4111.6	10.2		4112.5	14.2		4117.1	20.7		4107.1	20.5		4119.9	16.1				
4111.1	10.2		4111.9	14.1		4116.7	20.7		4106.7	20.5		4119.5	16.1				
4110.7	10.1		4111.3	13.9		4116.4	20.7		4106.4	20.5		4119.3	16.1				
4110.2	10.1		4110.7	13.8		4116.2	20.7		4106.0	20.5		4118.9	16.1				
4109.6	10.1		4110.2	13.6		4115.7	20.7		4105.4	20.5		4118.7	16.1				
4109.2	10.1		4109.7	13.5		4115.4	20.7		4105.2	20.5		4118.2	16.1				
4108.7	10.1		4109.5	13.4		4115.2	20.7		4104.7	20.5		4117.9	16.1				
4108.3	10.0		4109.6	13.3		4114.8	20.6		4104.2	20.5		4117.7	16.1				
4107.8	10.0		4108.8	13.2		4114.5	20.4		4103.8	20.5		4117.2	16.1				
4107.3	10.0		4108.2	13.1		4114.1	20.2		4103.5	20.4		4117.0	16.1				
4106.9	10.0		4107.6	13.0		4113.8	20.2		4103.1	20.4		4116.5	16.1				
4106.4	10.0		4107.1	12.9		4113.5	20.2		4102.8	20.4		4116.3	16.1				
4106.0	10.0		4106.5	12.8		4113.1	20.2		4102.5	20.4		4116.0	16.1				
4105.5	9.9		4106.1	12.6		4112.8	20.1		4102.1	20.4		4115.6	16.1				
4105.0	9.9		4105.7	12.5		4112.4	20.1		4101.5	20.3		4115.3	16.1				
4104.4	9.9		4105.2	12.5		4112.2	20.1		4101.1	20.3		4115.0	16.1				
4104.0	9.9		4104.7	12.5		4111.9	19.9		4100.9	20.2		4114.6	16.1				
4103.6	9.8		4104.1	12.5		4111.6	19.8		4100.6	20.1		4114.2	16.1				
4103.1	9.8		4103.7	12.4		4111.2	19.8					4114.0	16.1				
4102.7	9.8		4103.4	12.4		4110.8	19.8					4113.7	16.1				
4102.2	9.8		4102.9	12.4		4110.6	19.7					4113.3	16.1				

BV1-P1 Butt Valley Reservoir near Caribou 1 intake																	
								Latitude	40° 07.032			Longitude	121° 08.694				
Date	Time		Date	Time		Date	Time		Date	Time		Date	Time		Date	Time	
05/16/09	15:34		06/19/09	12:40		07/24/09	14:27		08/28/09	13:34		10/06/09	14:13				
Elevation			Elevation			Elevation			Elevation			Elevation					
(USGS)	(PG&E)		(USGS)	(PG&E)		(USGS)	(PG&E)		(USGS)	(PG&E)		(USGS)	(PG&E)				
4138.4	4128.2		4136.79	4126.59		4136.79	4126.59		4136.13	4125.93		4136.40	4126.20				
Elevation (ft.)	Temp. (°C)		Elevation (ft.)	Temp. (°C)		Elevation (ft.)	Temp. (°C)		Elevation (ft.)	Temp. (°C)		Elevation (ft.)	Temp. (°C)				
4101.8	9.8		4102.3	12.3		4110.2	19.7					4113.1	16.1				
4101.4	9.8		4101.7	12.3		4109.9	19.7					4112.7	16.1				
4100.9	9.8		4101.1	12.2		4109.5	19.6					4112.3	16.1				
4100.5	9.7		4100.5	12.1		4109.2	19.6					4112.1	16.1				
4100.3	9.7		4099.9	12.1		4108.9	19.6					4111.7	16.1				
4099.9	9.7		4099.7	12.1		4108.6	19.6					4111.3	16.1				
4099.7	9.6		4099.7	12.0		4108.2	19.6					4111.1	16.1				
4099.4	9.6		4098.8	12.0		4107.9	19.6					4110.6	16.1				
4098.9	9.6		4098.5	12.0		4107.5	19.5					4110.4	16.1				
4098.2	9.6		4098.4	12.0		4107.2	19.5					4110.0	16.1				
4097.7	9.6		4098.0	12.0		4106.9	19.4					4109.8	16.1				
4097.1	9.5		4097.5	12.0		4106.5	19.3					4109.4	16.1				
4096.5	9.4					4106.3	19.3					4109.1	16.1				
4095.8	9.4					4105.9	19.2					4108.7	16.1				
4095.3	9.4					4105.5	19.1					4108.2	16.1				
4094.7	9.3					4105.2	19.1					4107.9	16.1				
4093.9	9.2					4105.0	19.0					4107.7	16.1				
4093.4	9.1					4104.5	19.0					4107.5	16.1				
4092.9	9.1					4104.2	19.0					4107.2	16.1				
4092.5	9.1					4104.0	18.9					4106.8	16.1				
4092.1	9.1					4103.5	18.9					4106.4	16.1				
4091.7	9.1					4103.3	18.9					4106.1	16.1				
4091.4	9.1					4103.0	18.9					4105.6	16.1				
4090.9	9.1					4102.6	18.8					4105.4	16.1				

BV1-P1 Butt Valley Reservoir near Caribou 1 intake																			
								Latitude	40° 07.032			Longitude	121° 08.694						
Date	Time		Date	Time		Date	Time		Date	Time		Date	Time		Date	Time		Date	Time
05/16/09	15:34		06/19/09	12:40		07/24/09	14:27		08/28/09	13:34		10/06/09	14:13						
Elevation			Elevation			Elevation			Elevation			Elevation							
(USGS)	(PG&E)		(USGS)	(PG&E)		(USGS)	(PG&E)		(USGS)	(PG&E)		(USGS)	(PG&E)						
4138.4	4128.2		4136.79	4126.59		4136.79	4126.59		4136.13	4125.93		4136.40	4126.20						
Elevation (ft.)	Temp. (°C)		Elevation (ft.)	Temp. (°C)		Elevation (ft.)	Temp. (°C)		Elevation (ft.)	Temp. (°C)		Elevation (ft.)	Temp. (°C)						
4090.4	9.1					4102.3	18.8					4105.2	16.1						
4090.0	9.0					4102.0	18.8					4104.8	16.1						
4089.5	9.0					4101.5	18.7					4104.3	16.1						
4088.9	9.0					4101.3	18.7					4104.1	16.1						
4088.3	9.0					4101.0	18.7					4103.9	16.1						
4088.3	9.0					4100.7	18.6					4103.5	16.1						
4088.0	9.0					4100.3	18.6					4103.2	16.1						
						4099.9	18.5					4102.8	16.1						
						4099.7	18.5					4102.3	16.1						
						4099.4	18.5					4102.2	16.1						
						4099.0	18.5					4101.9	16.1						
						4098.8	18.5					4101.6	16.1						
						4098.3	18.4					4101.2	16.1						
						4098.0	18.4					4100.7	16.1						
						4097.7	18.4					4100.4	16.1						
						4097.5	18.4					4100.3	16.1						
						4097.1	18.4					4099.8	16.1						
						4096.7	18.4					4099.6	16.1						
						4096.4	18.4					4099.3	16.1						
						4096.0	18.4					4098.9	16.1						
						4095.8	18.3					4098.5	16.1						
						4095.4	18.3					4098.1	16.1						
						4094.9	18.3					4097.9	16.1						
						4094.7	18.3					4097.7	16.1						

BV1-P1 Butt Valley Reservoir near Caribou 1 intake																			
								Latitude	40° 07.032			Longitude	121° 08.694						
Date	Time		Date	Time		Date	Time			Date	Time			Date	Time			Date	Time
05/16/09	15:34		06/19/09	12:40		07/24/09	14:27			08/28/09	13:34			10/06/09	14:13				
Elevation			Elevation			Elevation				Elevation				Elevation					
(USGS)	(PG&E)		(USGS)	(PG&E)		(USGS)	(PG&E)			(USGS)	(PG&E)			(USGS)	(PG&E)				
4138.4	4128.2		4136.79	4126.59		4136.79	4126.59			4136.13	4125.93			4136.40	4126.20				
Elevation (ft.)	Temp. (°C)		Elevation (ft.)	Temp. (°C)		Elevation (ft.)	Temp. (°C)			Elevation (ft.)	Temp. (°C)			Elevation (ft.)	Temp. (°C)				
						4094.5	18.2							4097.1	16.1				
						4094.1	18.1							4096.9	16.1				
						4093.7	18.0							4096.7	16.1				
						4093.4	18.0							4096.4	16.1				
						4093.1	17.9							4095.9	16.1				
						4092.7	17.8							4095.6	16.1				
						4092.5	17.6							4095.3	16.1				
						4092.1	17.4							4095.0	16.1				
						4091.7	17.4							4094.5	16.1				
						4091.4	17.4							4094.1	16.1				
						4091.2	17.4							4093.9	16.1				
						4090.7	17.4							4093.7	16.1				
						4090.5	17.3							4093.4	16.1				
						4090.1	17.3							4093.1	16.1				
						4089.9	17.3							4092.7	16.1				
						4089.5	17.3							4092.3	16.1				
						4089.1	17.2							4092.0	16.1				
						4088.8	17.2							4091.8	16.1				
						4088.5	17.1							4091.3	16.1				
														4091.1	16.1				
														4090.7	16.1				
														4090.5	16.1				
														4090.1	16.1				
														4089.9	16.1				

BV1-P1 Butt Valley Reservoir near Caribou 1 intake												Latitude 40° 07.032		Longitude 121° 08.694			
Date	Time		Date	Time		Date	Time		Date	Time		Date	Time		Date	Time	
05/16/09	15:34		06/19/09	12:40		07/24/09	14:27		08/28/09	13:34		10/06/09	14:13				
Elevation			Elevation			Elevation			Elevation			Elevation					
(USGS)	(PG&E)		(USGS)	(PG&E)		(USGS)	(PG&E)		(USGS)	(PG&E)		(USGS)	(PG&E)				
4138.4	4128.2		4136.79	4126.59		4136.79	4126.59		4136.13	4125.93		4136.40	4126.20				
Elevation (ft.)	Temp. (°C)		Elevation (ft.)	Temp. (°C)		Elevation (ft.)	Temp. (°C)		Elevation (ft.)	Temp. (°C)		Elevation (ft.)	Temp. (°C)				
												4089.5	16.1				
												4089.2	16.1				

APPENDIX D2 – ROUTINE LAKE PROFILE DATA – BV-P2

BV1-P2 Butt Valley Reservoir near Cool Springs Campground Latitude 40° 07.032 Longitude 121° 08.694

Date	Time	Date	Time	Date	Time	Date	Time	Date	Time
05/16/09	15:09	06/19/09	12:24	07/24/09	13:59	08/28/09	15:17	10/06/09	13:48
Elevation		Elevation		Elevation		Elevation		Elevation	
(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)
4138.4	4128.2	4136.79	4126.59	4133.59	4123.39	4136.13	4125.93	4136.40	4126.20

Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)
4138.1	16.8	4136.1	19.8	4133.5	22.7	4135.3	21.6	4136.3	15.9
4137.9	16.7	4135.3	19.7	4133.2	22.7	4134.1	21.5	4136.0	15.9
4137.5	16.6	4134.9	19.6	4132.8	22.6	4133.1	21.5	4135.5	15.8
4137.2	16.6	4134.2	19.5	4132.5	22.6	4132.2	21.4	4135.2	15.8
4136.7	16.5	4133.4	19.5	4132.2	22.5	4131.3	21.4	4134.9	15.8
4136.4	16.5	4132.7	19.5	4131.8	22.5	4130.4	21.4	4134.6	15.8
4136.1	16.4	4132.2	19.4	4131.6	22.5	4129.6	21.3	4134.2	15.7
4135.8	16.4	4131.9	19.4	4131.2	22.4	4128.7	21.3	4133.9	15.7
4135.5	16.4	4131.9	19.3	4130.9	22.4	4127.9	21.3	4133.7	15.7
4135.3	16.3	4130.9	19.3	4130.5	22.4	4127.1	21.3	4133.3	15.7
4135.0	16.2	4129.9	19.3	4130.1	22.4	4126.3	21.3	4132.5	15.7
4134.7	16.2	4129.2	19.2	4129.9	22.3	4125.5	21.2	4132.2	15.7
4134.3	16.1	4128.6	19.2	4129.5	22.3	4124.4	21.2	4132.0	15.7
4134.0	16.0	4128.0	19.1	4129.2	22.3	4123.5	21.2	4131.6	15.7
4133.5	15.9	4127.4	19.1	4128.9	22.2	4122.7	21.2	4131.2	15.7
4133.2	15.9	4127.0	19.0	4128.6	22.2	4122.0	21.2	4130.9	15.7
4132.9	15.8	4126.2	18.9	4128.2	22.1	4121.3	21.1	4130.5	15.7
4132.5	15.8	4125.5	18.9	4127.8	22.1	4120.6	21.1	4130.2	15.7
4132.1	15.8	4124.7	18.7	4127.5	22.1	4119.9	21.0	4130.0	15.7
4131.8	15.7	4123.8	18.4	4127.2	22.0	4119.2	21.0	4129.6	15.6
4131.5	15.6	4123.0	18.2	4126.9	21.9	4118.5	21.0	4129.1	15.6
4131.2	15.6	4122.6	17.8	4126.6	21.8	4117.9	21.0	4128.8	15.6
4131.0	15.5	4122.3	17.3	4126.3	21.6	4117.1	20.9	4128.4	15.6
4130.7	15.4	4121.8	17.0	4125.9	21.5	4116.1	20.9	4128.1	15.6
4130.3	15.3	4121.0	16.6	4125.6	21.5	4115.4	20.9	4128.0	15.6
4130.0	15.2	4120.3	16.4	4125.3	21.4	4114.7	20.8	4127.8	15.6

BV1-P2 Butt Valley Reservoir near Cool Springs Campground Latitude 40° 07.032 Longitude 121° 08.694

Date	Time	Date	Time	Date	Time	Date	Time	Date	Time
05/16/09	15:09	06/19/09	12:24	07/24/09	13:59	08/28/09	15:17	10/06/09	13:48
Elevation		Elevation		Elevation		Elevation		Elevation	
(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)
4138.4	4128.2	4136.79	4126.59	4133.59	4123.39	4136.13	4125.93	4136.40	4126.20

Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)
4129.7	15.0	4119.4	16.1	4124.9	21.4	4114.0	20.8	4127.4	15.6
4129.3	14.9	4118.6	15.8	4124.6	21.3	4113.2	20.7	4126.9	15.6
4128.9	14.8	4117.8	15.5	4124.3	21.3	4112.4	20.7	4126.6	15.6
4128.6	14.7	4117.4	15.2	4124.0	21.2	4112.0	20.6	4126.3	15.6
4128.2	14.5	4117.0	15.1	4123.6	21.2	4111.6	20.6	4126.0	15.6
4127.9	14.4	4116.7	14.9	4123.4	21.1	4111.3	20.6	4125.8	15.6
4127.5	14.2	4116.4	14.9	4122.9	21.1	4110.7	20.6	4125.3	15.6
4127.1	14.1	4116.1	14.8	4122.6	21.1	4110.1	20.5	4125.0	15.6
4126.7	14.0	4115.4	14.7	4122.4	21.1	4109.1	20.5	4124.6	15.6
4126.4	13.8	4114.7	14.7	4122.0	21.0	4108.5	20.4	4124.3	15.6
4126.0	13.7	4114.0	14.5	4121.7	21.0	4108.1	20.3	4124.0	15.6
4125.7	13.5	4113.1	14.4	4121.4	21.0	4108.0	20.3	4123.8	15.6
4125.3	13.3	4112.2	14.2	4121.0	20.9	4107.7	20.3	4123.4	15.6
4124.9	13.2	4111.7	13.9	4120.6	20.9	4107.2	20.2	4122.9	15.6
4124.6	13.0	4111.2	13.7	4120.3	20.9	4106.4	20.1	4122.5	15.6
4124.2	12.9	4110.4	13.6	4120.1	20.9	4105.1	19.8	4122.2	15.6
4123.8	12.7	4109.7	13.5	4119.7	20.8			4121.9	15.6
4123.3	12.6	4108.9	13.3	4119.3	20.8			4121.8	15.6
4122.9	12.5	4107.9	13.1	4119.0	20.6			4121.5	15.6
4122.5	12.4	4107.1	12.9	4118.6	20.5			4121.0	15.5
4122.0	12.3	4106.2	12.6	4118.3	20.4			4120.7	15.5
4121.5	12.2			4118.0	20.3			4120.4	15.5
4120.9	12.1			4117.7	20.3			4120.1	15.5
4120.4	12.1			4117.4	20.3			4120.0	15.5
4120.0	12.0			4117.0	20.2			4119.5	15.5
4119.5	12.0			4116.6	20.2			4119.1	15.5
4119.0	11.9			4116.4	20.1			4118.7	15.5

BV1-P2 Butt Valley Reservoir near Cool Springs Campground Latitude 40° 07.032 Longitude 121° 08.694

Date	Time	Date	Time	Date	Time	Date	Time	Date	Time
05/16/09	15:09	06/19/09	12:24	07/24/09	13:59	08/28/09	15:17	10/06/09	13:48
Elevation		Elevation		Elevation		Elevation		Elevation	
(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)
4138.4	4128.2	4136.79	4126.59	4133.59	4123.39	4136.13	4125.93	4136.40	4126.20

Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)
4118.5	11.9			4116.1	20.1			4118.3	15.5
4117.9	11.8			4115.8	20.1			4118.1	15.5
4117.5	11.8			4115.4	20.0			4118.0	15.5
4117.1	11.7			4115.1	20.0			4117.5	15.5
4116.6	11.7			4114.7	20.0			4117.1	15.5
4116.2	11.6			4114.4	19.9			4116.7	15.5
4115.6	11.5			4114.1	19.9			4116.4	15.5
4115.1	11.4			4113.8	19.9			4116.2	15.5
4114.7	11.3			4113.4	19.9			4115.7	15.5
4114.2	11.2			4113.2	19.8			4115.3	15.5
4113.7	11.2			4112.7	19.8			4114.8	15.5
4113.1	11.0			4112.4	19.8			4114.4	15.5
4112.4	10.8			4112.2	19.8			4114.2	15.5
4111.9	10.5			4111.7	19.7			4114.1	15.5
4111.4	10.3			4111.3	19.7			4113.4	15.5
4110.9	10.2			4111.0	19.6			4113.0	15.5
4110.4	10.2			4110.6	19.6			4112.6	15.5
4109.8	10.1			4110.4	19.6			4112.4	15.5
4109.1	10.1			4110.2	19.6			4112.3	15.5
4108.4	10.0			4109.8	19.6			4111.9	15.5
4107.7	9.9			4109.4	19.5			4111.5	15.5
4107.1	9.9			4109.2	19.5			4111.0	15.5
4106.4	9.9			4108.9	19.5			4110.6	15.5
4106.1	9.8			4108.6	19.4			4110.4	15.5
				4108.3	19.3			4110.1	15.5
				4107.8	19.2			4109.5	15.5
				4107.5	19.1			0.0	0.0

BV1-P2 Butt Valley Reservoir near Cool Springs Campground												Latitude 40° 07.032		Longitude 121° 08.694			
Date	Time		Date	Time		Date	Time		Date	Time		Date	Time		Date	Time	
05/16/09	15:09		06/19/09	12:24		07/24/09	13:59		08/28/09	15:17		10/06/09	13:48				
Elevation			Elevation			Elevation			Elevation			Elevation					
(USGS)	(PG&E)		(USGS)	(PG&E)		(USGS)	(PG&E)		(USGS)	(PG&E)		(USGS)	(PG&E)				
4138.4	4128.2		4136.79	4126.59		4133.59	4123.39		4136.13	4125.93		4136.40	4126.20				
Elevation (ft.)	Temp. (°C)		Elevation (ft.)	Temp. (°C)		Elevation (ft.)	Temp. (°C)		Elevation (ft.)	Temp. (°C)		Elevation (ft.)	Temp. (°C)				
						4107.2	19.0					0.0	0.0				
						4106.9	18.9					0.0	0.0				
						4106.6	18.8										

APPENDIX D2 – ROUTINE LAKE PROFILE DATA – BV-P3

BV1-P3 Butt Valley Reservoir near Alder Creek Boat Ramp		Latitude		Longitude					
Date	Time	Date	Time	Date	Time	Date	Time	Date	Time
05/16/09	14:05	06/19/09	11:52	07/25/08	12:47	08/28/09	13:52	10/06/09	13:18
Elevation		Elevation		Elevation		Elevation		Elevation	
(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)
4138.4	4128.2	4136.79	4126.59	4133.59	4123.39	4136.13	4125.93	4136.40	4126.20
Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)
4138.27	16.8	4136.46	20.1	4133.36	23.1	4135.87	21.4	4136.27	15.3
4137.97	16.7	4135.58	20.0	4132.97	23.1	4135.44	21.4	4135.78	15.3
4137.68	16.6	4135.02	19.9	4132.61	23.0	4135.08	21.4	4135.42	15.3
4137.25	16.4	4134.43	19.7	4132.31	22.9	4134.85	21.4	4135.19	15.2
4136.92	16.4	4133.94	19.6	4132.05	22.8	4134.78	21.4	4134.86	15.2
4136.53	16.3	4133.48	19.6	4131.79	22.8	4134.26	21.4	4134.43	15.2
4136.23	16.3	4133.12	19.6	4131.52	22.7	4133.93	21.4	4134.07	15.2
4135.97	16.3	4132.69	19.5	4131.06	22.7	4133.54	21.4	4133.91	15.2
4135.58	16.2	4132.26	19.5	4130.77	22.7	4133.05	21.4	4133.64	15.2
4135.28	16.1	4131.87	19.3	4130.54	22.6	4132.52	21.4	4133.22	15.2
4134.86	16.0	4131.41	19.2	4130.21	22.6	4132.00	21.3	4132.69	15.1
4134.46	15.8	4131.02	19.1	4129.88	22.6	4131.57	21.3	4132.33	15.1
4134.10	15.7	4130.49	19.0	4129.52	22.6	4131.34	21.3	4132.17	15.1
4133.74	15.6	4130.00	19.0	4129.23	22.6	4131.04	21.3	4132.10	15.1
4133.41	15.5	4129.54	18.9	4128.83	22.6	4130.65	21.3	4131.58	15.0
4133.09	15.5	4129.08	18.9	4128.57	22.6	4130.32	21.3	4131.28	15.0
4132.69	15.5	4128.52	18.9	4128.21	22.5	4129.90	21.3	4130.95	15.0
4132.40	15.4	4128.03	18.8	4127.91	22.4	4129.54	21.3	4130.59	15.0
4132.10	15.3	4127.57	18.7	4127.59	22.1	4129.14	21.3	4130.36	15.0
4131.87	15.3	4127.08	18.6	4127.23	21.7	4128.72	21.3	4130.13	15.0
4131.61	15.2	4126.59	18.6	4126.90	21.5	4128.29	21.2	4129.48	15.0
4131.31	15.2	4126.09	18.6	4126.60	21.4	4127.83	21.2	4129.08	15.0
4131.05	15.2	4125.60	18.5	4126.21	21.3	4127.34	21.2	4128.62	15.0
4130.72	15.2	4124.95	18.5	4125.91	21.3	4126.65	21.2	4128.20	15.0
4130.39	15.2	4124.39	18.3	4125.58	21.2	4126.12	21.2	4127.77	15.0
4130.00	15.2	4123.86	18.2	4125.29	21.2	4125.73	21.2	4127.38	15.0

BV1-P3 Butt Valley Reservoir near Alder Creek Boat Ramp				Latitude		Longitude			
Date	Time	Date	Time	Date	Time	Date	Time	Date	Time
05/16/09	14:05	06/19/09	11:52	07/25/08	12:47	08/28/09	13:52	10/06/09	13:18
Elevation		Elevation		Elevation		Elevation		Elevation	
(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)
4138.4	4128.2	4136.79	4126.59	4133.59	4123.39	4136.13	4125.93	4136.40	4126.20

Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)
4129.71	15.2	4123.40	18.1	4124.96	21.2	4125.47	21.1	4127.05	15.0
4129.41	15.2	4122.91	18.0	4124.67	21.2	4125.14	21.1	4126.66	15.0
4128.98	15.1	4122.39	17.8	4124.34	21.1	4124.68	21.1	4126.33	15.0
4128.69	15.1	4121.90	17.5	4123.94	21.1	4124.25	21.1	4126.00	15.0
4128.33	15.0	4121.40	17.4	4123.58	21.0	4123.73	21.0	4125.77	15.0
4128.03	14.9	4120.88	17.2	4123.32	21.0	4123.27	21.0	4125.54	15.0
4127.70	14.8	4120.29	17.1	4122.89	20.9	4122.74	20.9	4124.92	15.0
4127.44	14.6	4119.73	16.8	4122.70	20.9	4122.45	20.7	4124.59	14.9
4127.02	14.4	4119.07	16.4	4122.34	20.8	4122.29	20.5	4124.29	14.8
4126.65	14.3	4118.61	16.0	4121.98	20.8	4121.89	20.4	4124.03	14.8
4126.39	14.3	4118.29	15.8	4121.65	20.7	4121.20	20.4	4123.80	14.7
4126.10	14.3			4121.32	20.6	4120.74	20.4	4122.98	14.7
4125.70	14.1			4121.02	20.5	4120.38	20.4	4122.56	14.7
4125.38	14.0			4120.73	20.1	4120.19	20.4	4122.19	14.6
4125.08	13.9			4120.37	20.0	4119.99	20.4	4122.10	14.6
4124.78	13.9			4120.01	19.9	4119.63	20.4	4121.60	14.6
4124.49	13.9			4119.61	19.9	4119.23	20.4	4120.88	14.6
4124.00	13.8			4119.29	19.9	4118.84	20.4	4120.23	14.6
4123.70	13.7			4119.06	19.8	4118.41	20.4	4119.57	14.6
4123.41	13.6			4118.70	19.8	4117.86	20.4	4119.08	14.6
4123.14	13.5			4118.40	19.8	4117.20	20.3	4118.65	14.6
4122.75	13.5			4118.07	19.8	4116.94	20.2	4118.49	14.6
4122.46	13.4			4117.74	19.8			4118.13	14.6
4121.96	13.4			4117.35	19.8			4117.77	14.6
4121.70	13.3			4117.12	19.8				
4121.41	13.2			4116.83	19.6				
4121.14	13.1								

BV1-P3 Butt Valley Reservoir near Alder Creek Boat Ramp				Latitude		Longitude			
Date	Time	Date	Time	Date	Time	Date	Time	Date	Time
05/16/09	14:05	06/19/09	11:52	07/25/08	12:47	08/28/09	13:52	10/06/09	13:18
Elevation		Elevation		Elevation		Elevation		Elevation	
(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)	(USGS)	(PG&E)
4138.4	4128.2	4136.79	4126.59	4133.59	4123.39	4136.13	4125.93	4136.40	4126.20
Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)	Elevation (ft.)	Temp. (°C)
4120.75	13.0								
4120.45	13.0								
4120.16	12.9								
4119.86	12.8								
4119.47	12.7								
4119.21	12.7								
4118.88	12.6								
4118.52	12.5								
4118.26	12.4								
4117.90	12.2								
4117.53	12.0								
4117.21	11.9								
4116.98	11.7								