164 This is not the complete report.

Fs#2663

BEFORE THE FEDERAL ENERGY REGULATORY COMMISSION

CRANE VALLEY PROJECT
FERC NO. 1354

AMENDED APPLICATION FOR NEW LICENSE

FINAL: JUNE 2001

VOLUME I

INITIAL STATEMENT
EXECUTIVE SUMMARY
EXHIBITS: A, B, C, D, E
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PG&E

CRANE VALLEY HYDROELECTRIC PROJECT
(FERC NO. 1354)
AMENDED APPLICATION FOR NEW LICENSE

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E2.3.1.3 Sedimentation

According to Brown and Thorp (1947), total sediment volume deposited in Bass Lake by 1946 was 382 acre-feet. Assuming that deposition continued at the same annual rate, the sediment volume in 1984 would have been about 700 acre-feet, equal to 1.5 percent of the active storage volume of Bass Lake. Sand deposits have formed at the NFWC inflow to Bass Lake, near the Falls Day Use Area. The grain size of this sediment varies widely, from coarse silt to gravel.

E2.3.2 Crane Valley Project Waters Below Bass Lake

E2.3.2.1 1984 Water Temperature Data

Stream temperature studies conducted in 1984 by Woodward-Clyde Consultants are detailed in Bozeman et al. (1985). Water temperatures were recorded continuously at 12 stations (Figure E2.3-1) in the existing Project system downstream of Bass Lake during the summer of 1984. These data were utilized, along with meteorological and flow data, to calibrate and validate the USFWS stream temperature model for selected stream segments. This model was used to simulate daily mean and maximum stream temperatures for a range of potential release flows. Temperatures were simulated for both normal and extreme meteorological and hydrological conditions in July, August, and September. Project streams were divided into four hydrologically-defined sections for simulation: (1) NFWC below Bass Lake; (2) NFWC below Manzanita Lake; (3) SFWC below Browns Creek Diversion Dam; and (4) Willow Creek below the confluence of

SFWC and NFWC. The model was also used to simulate temperatures in Manzanita Lake to estimate downstream release temperatures.

The most critical season for both water quality and fisheries in existing Project waterways is summer, when temperatures are highest and flows are lowest. Daily mean and maximum temperatures in existing Project reservoirs and waterways during summer and early fall 1984 are summarized in Table E2.3-3 and Figures E2.3-4a and E2.3-4b. Meteorological data indicate that 1984 air temperatures were higher than normal. NFWC water temperatures were measured downstream of Bass Lake, upstream and immediately downstream of Manzanita Lake, at the downstream end of Manzanita Lake, and upstream of the NFWC Diversion Dam.

TABLE E2.3-2 (Continued)
Ranges of Water Quality Parameter Values for Waterways Below Bass Lake[1]

Station No.	Location	Temperature (°C)	Oxygen Dissolved (mg/l)	Oxygen Saturation (%)	Alkalinity (as $CaCO_3$) (mg/l)	Hardness (as $CaCO_3$) (mg/l)	Oil and Grease (mg/l
6	NFWC below Bass Lake	0.2 - 21.0	8.1 - 10.2	93 - 106	16.0 - 19.5	10.0 - 18.3	0.5 - 5.5
8	NFWC above Manzanita Lake	1.0 - 21.9	7.5 - 11.3	90 - 100	11.0 - 23.0	11.4 - 17.2	<0.1 - 1.0
9	Manzanita Lake	1.5 - 25.0	7.6 - 10.5	85 - 96	1.75 - 15.0	8.5 - 13.7	<0.1 - 4.5
16	NFWC above No. 1 Conduit	2.0 - 26.5	8.6 - 10.7	96 - 108	33.0 - 93.0	21.0 - 45.5	0.4 - 2.5
13	Willow Creek above San Joaquin River	2.0 - 29.0	8.7 - 11.6	95 - 112	18.0 - 21.0	11.4 - 25.7	<0.1 - 2.5
5	SFWC above Browns Creek Diversion Dam	1.5 - 20.0	8.8 - 12.6	96 - 102	10.0 - 13.0	5.2 - 8.6	<0.1 - 2.5
17	SFWC above No. 1 Conduit	0.5 - 25.0	7.8 - 10.4	86 - 98	19.8 - 62.0	12.9 - 17.1	0.9 - 3.5
12	No. 1 Conduit downstream of San Joaquin No. 2 Powerhouse tailrace	*	8.1 - 10.8	94 - 99	6.5 - 40.0	10.4 - 18.1	0.5 - 4.0
7	No. 3 Forebay	*	7.0 - 10.3	84 - 98	7.5 - 13.0	9.0 -10.2	0.6 - <1.0
11	No. 2 Forebay	*	7.8 - 9.3	94 - 104	4.5 - 22.0	9.0 - 14.0	1.1 - 3.0
15	Corrine Lake	*	9.0 - 10.2	99 - 111	7.0 - 47.0	10.2 - 17.0	0.3 - 4.0
14	Kerckhoff Lake (FERC No. 96)	*	9.3 – 11.6	94 - 104	5.0 – 43.0	7.2 – 12.5	<0.1 – 3.5
	Water Quality Criteria[2]	---	3.0 - 9.5 (min)[3]	---	20 (min)	---	---

1 Source: Bowie, 1985.
2 Water quality criteria from Central Valley Basin Plan and USEPA Ambient Water Quality Criteria– maximum or range of maximum values are shown unless otherwise noted.
3 All June 1984 samples for Cu were below the detection limit of 0.05 mg/l; therefore, the numbers listed here are from August 1984 and March 1985 sampling periods.
--- Not applicable.
* No data available.

In addition, a temperature recorder was placed in the Crane Valley Powerhouse tailrace, because this location is a source of potential release flows to NFWC. The tailrace and Manzanita Lake temperatures are controlled (usually cooled) largely by Bass Lake discharge water temperatures when the existing Project is in operation.

Bass Lake discharge temperatures tend to be low during early summer, when the existing Project intake draws from the hypolimnion. As summer progresses, discharge temperatures increase gradually through mid-summer due to heating of lake waters, followed by a fairly rapid increase during August and September, when the thermocline reaches the bottom of the intake tower.

Temperatures in the Crane Valley Powerhouse tailrace and Manzanita Lake reflected temperatures in Bass Lake, and increased throughout the summer of 1984, reaching daily means of about 20.5°C (68.9°F) and 22.0°C (71.6°F), respectively, during mid-September. Daily maximum water temperatures were only slightly higher, and were generally within 1.5°C of the daily means. During powerhouse outages, however, temperatures at both locations rose sharply, due to heating of water at both locations and reduced inflows of cool water from Bass Lake to the Crane Valley Powerhouse intake and Manzanita Lake.

TABLE E2.3-3

Ranges in Daily Maximum and Mean Temperatures in Project Waters

June - October 1984[1]

Station	Daily Maximum Temperatures (Degrees C)	Daily Mean Temperatures (Degrees C)
1. SFWC Above Browns Creek Diversion Dam	5.8-20.0	5.3-18.7
2. SFWC Below Browns Creek Diversion Dam	8.0-22.5	7.7-21.1
3. SFWC Above SFWC Diversion Dam	9.8-25.0	8.0-24.3
4. Crane Valley Powerhouse Tailrace	8.0-25.5[2]	8.0-20.6
5. NFWC 0.2 km Below Bass Lake	11.7-21.0	11.6-20.8
6. NFWC Above Manzanita Lake	9.2-21.9[3]	8.6-21.0[3]
7. Manzanita Lake	12.0-24.5[2]	11.7-23.7[2]
8. NFWC Below Manzanita Lake	11.3-25.5	11.1-24.2
9. NFWC Above NFWC Diversion Dam	10.0-26.5	9.5-24.1
10. Willow Creek Below NFWC-SFWC Confluence at Licensee Gauge W-26	9.4-27.5	8.7-26.9
11. Whisky Creek Above Confluence with Willow Creek	10.1-25.9	9.3-23.9
12. Willow Creek Above San Joaquin at USGS Gauge No. 2465	21.0-29.0[4]	19.4-26.3[4]

[1] Source: Bozeman et al., 1985
[2] Higher temperature occurred during powerhouse outage.
[3] Based on partial record. Instrument stolen prior to August 1984.
[4] Based on partial record. Instrument malfunctioned July 31, 1984.

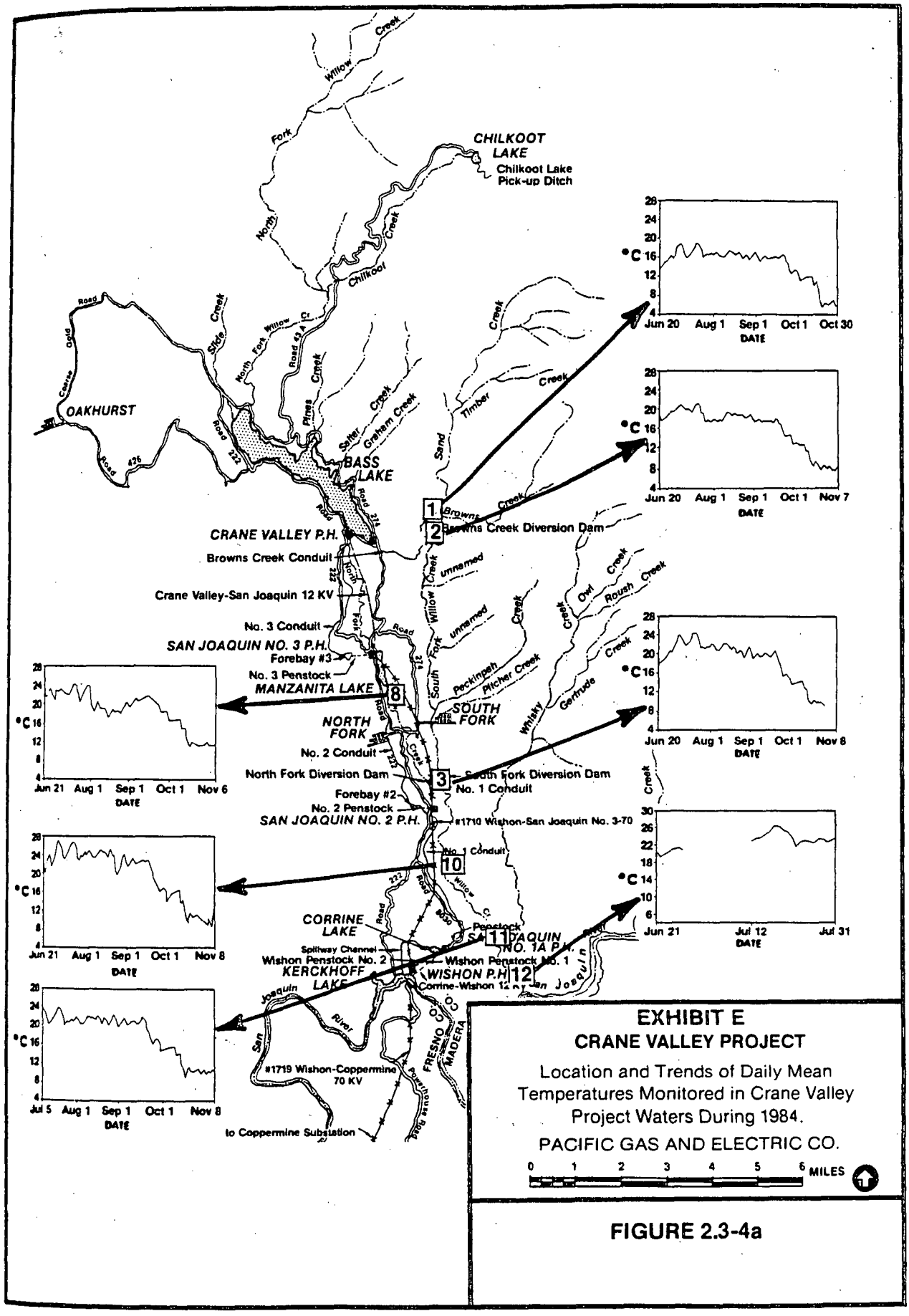

FIGURE 2.3-4a

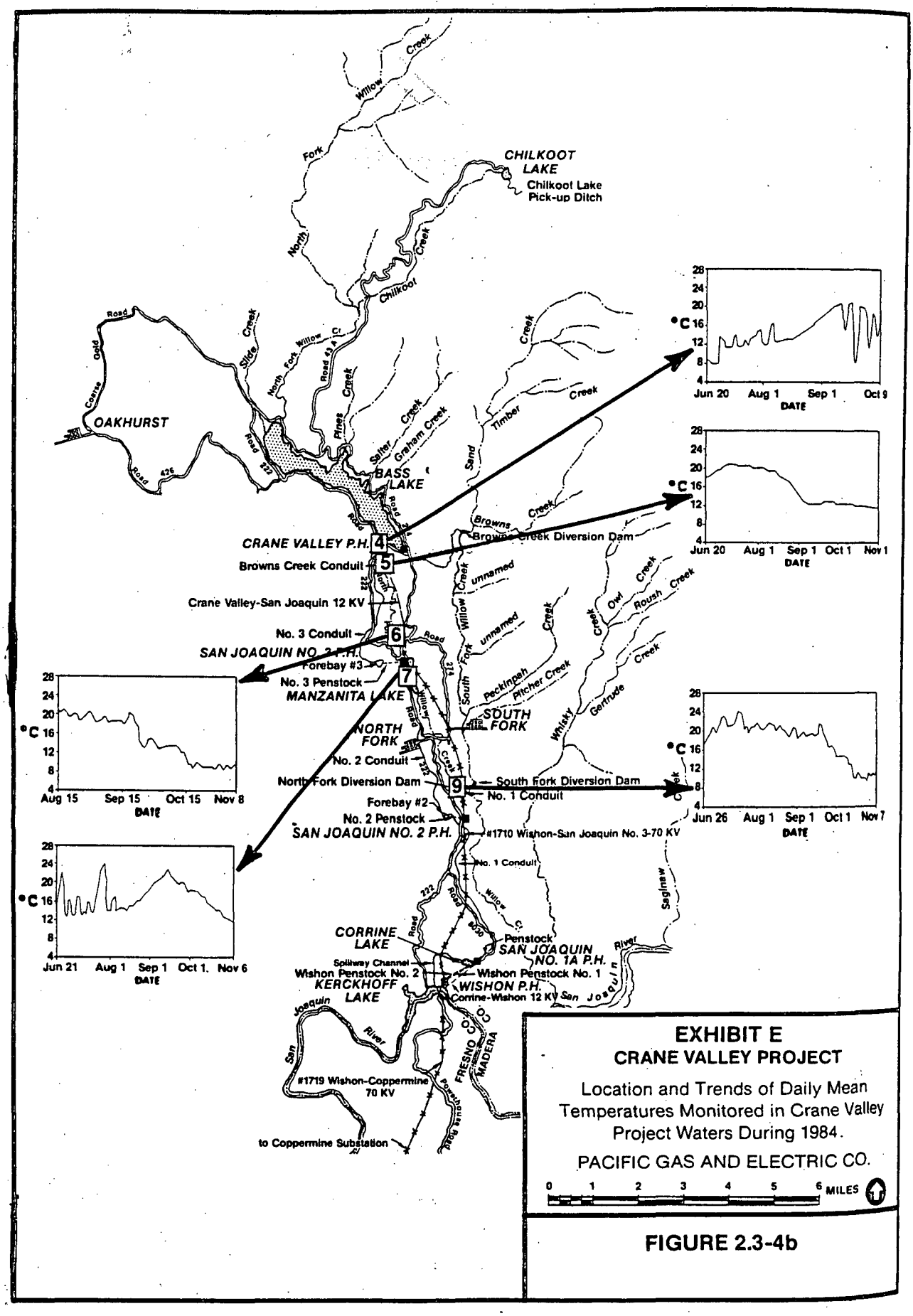

EXHIBIT E
CRANE VALLEY PROJECT

Location and Trends of Daily Mean Temperatures Monitored in Crane Valley Project Waters During 1984.

PACIFIC GAS AND ELECTRIC CO.

FIGURE 2.3-4b

Summer flows in NFWC between Bass Lake and Manzanita Lake originate primarily as seepage from Crane Valley Dam, with some accretion downstream. Flows are typically low and constant and, during summer 1984, were on the order of 1 to 2 cfs or less. Temperatures at the upstream end of the reach were fairly constant, with daily means slightly above 20°C (68°F) during most of July, and dropping somewhat through August. NFWC waters were heated as they moved downstream during most of the summer, typically increasing 2°C to 4°C by the time they reached Manzanita Lake. Temperatures dropped as the stream entered Manzanita Lake and mixed with cooler flows discharged through San Joaquin No. 3 Powerhouse tailrace.

Summer flows in the reach of NFWC below Manzanita Lake are usually extremely low. They originate primarily as seepage from Manzanita Lake Dam, with some accretion and local area runoff. From July to September 1984, mean monthly flows ranged from 0.2 cfs to 0.4 cfs. The low flows resulted in warm temperatures, with maximum daily means of over 24°C (75.2°F) in July 1984 at both ends of the stream reach. Temperatures reached daily maximums of 25.5°C (77.9°F) to 26.5°C (79.7°F). These maximums were within 1.5°C of the daily means of the upstream station (below Manzanita Lake), and were about 2°C to 3°C warmer than daily means at the downstream station (above the confluence with SFWC). In August 1984, under normal operating conditions, temperatures were also consistently higher at the downstream station. The thermal model of this portion of NFWC indicates that temperatures increase rapidly over the first half of the reach. Due to

additional shading and cool groundwater accretion, temperatures in the downstream half of the reach level off and vary only slightly.

During the summer of 1984, daily mean temperatures in SFWC were coolest upstream of Browns Creek Diversion Dam, increased rapidly just below the diversion, and continued to increase downstream to its confluence with Peckinpah Creek, where cooling water tended to reduce temperatures. Below Browns Creek Diversion Dam, low flows result in a rapid temperature increase. In 1984, mean monthly flows ranged from 0.2 to 1.9 cfs during most of the summer, including flow releases by Licensee (Pacific Gas and Electric, unpublished data). Model simulations show that temperatures increase rapidly for the first 2.2 miles below Browns Creek Diversion Dam, and gradually decrease over the next 2.5 miles due to shading. A sudden drop in temperature occurs 4.7 miles below Browns Creek Diversion Dam, as cool water enters from Peckinpah Creek. A marked decrease in shading 0.6 miles further downstream, however, again causes temperatures to increase rapidly. Maximum temperatures recorded during 1984 ranged from 20°C (68.0°F) to 25°C (77.0°F), and daily means were as high as 18.7°C (65.6°F) to 24.3°C (75.7°F). Daily maximum temperatures were generally within 1.5°C of daily mean temperatures.

Willow Creek is the warmest of the Project stream sections during the summer. High temperatures result from warm upstream temperatures, low flows, and a relative lack of shading. Flows in upper Willow Creek were 0.3 cfs or less during summer 1984. Based

on model simulations of low flows, water temperatures respond rapidly to solar heating and increase quickly with distance downstream. Willow Creek temperatures change at its confluence with Whisky Creek, where 2.0 to 3.2 cfs of water enter the stream in the summer. Whisky Creek is the main source of flow in the lower portion of Willow Creek during the summer. After decreasing at the Whisky Creek confluence, temperatures increase downstream to the end of Willow Creek. Maximum temperatures recorded in 1984 in Willow Creek ranged from 27.5°C (81.5°F) at Gauge W-26 about one mile below the NFWC-SFWC confluence, to 29°C (84.2°F) near the confluence with the San Joaquin River. The maximum 1984 temperature measured in Whisky Creek above the confluence with Willow Creek was 25.9°C (78.6°F). Daily means at Gauge W-26, Whisky Creek, and Willow Creek above the San Joaquin confluence were as high as 26.9°C (80.4°F), 23.9°C (72.2°F), and 26.3°C (79.3°F), respectively. Daily mean temperatures were greater than 20°C (68°F) at all three monitoring stations throughout most of the summer. Maximum daily temperatures were within 1.5°C of daily means in upper Willow Creek, but were 2°C greater in Whisky Creek upstream of its confluence with Willow Creek, and were 2°C to 4°C greater in lower Willow Creek.

E2.3.2.2 1985-1996 Water Temperature Data

This section presents stream flow and temperature data collected and simulated from 1985 to 1996 for Project waters downstream of Bass Lake. It includes methods of data collection, and an overview of the findings. The data were used to develop stream

segment-specific predictions and hypotheses that were tested under altered flow study conditions from 1993 to 1996 (Studley et al, unpublished data).

Stream flow data were collected at several continuous recording stations and staff gages operated by the Licensee. Gages used in this study included W-1 (Browns Creek conduit), W-3 (NFWC below Bass Lake), and W-28 at SFWC below Browns Diversion.

Daily mean stream flows for each stream segment were computed in the following manner: SFWC above Browns Diversion (W-1 plus W-28), SFWC below Browns Diversion (W-28), and NFWC below Bass Lake (W-3). Daily mean stream flows for each stream segment were used to compute the following low-flow values for two time periods (April-June and July-September), for use in a correlation analysis with fish populations and habitats: minimum, mean, median, 5-day minimum (i.e., the highest flow during the lowest consecutive 5-day, low-flow period), 10-day minimum, and 21-day minimum. The high-flow values computed from daily mean flows on an annual basis were maximum flow, and 3- and 5-day maximum (i.e., the lowest flow during the highest 3- and 5-day, high-flow periods). Daily mean flows were also used to compute monthly mean and median or seasonal flows. At most locations, stream flow data were recorded every 15 minutes and mean daily flows were calculated. Flows were then determined for various time steps, and mean daily flows were also used with stream and air temperature data to simulate missing stream temperature data.

In the uncontrolled stream segment SFWC above Browns Diversion Dam (historical flows are from Owusu 1985 and Trihey 1985b), median monthly flows in 1985 were relatively equal to historical median flows (historical flows based on 1968-1984 water years; see PG&E 1986a. In 1986, median monthly flows were higher than historical median flows in 10 of 12 months, and were higher than 10% exceedance flows in 4 of 12 months (February-May). Ten percent exceedance flows are relatively high flows that are equaled or exceeded 10% of the time. Conversely, median monthly flows for 1987-1992 water years exceeded historical median monthly flows in only 4 of 72 months.

Tables E2.3.2a1 through 6 present additional flow data for each stream segment including (1) tables of historical mean and median monthly flows for each stream segment; (2) tables of mean and median monthly flow data; (3) tables of mean daily flows; and (4) tables of flow data based on different hydrologic time steps (minimum, mean, median, and maximum seasonal flow; 5-, 10-, and 21-day annual minimum flow; and 3- and 5-day annual maximum flows).

Temperatures

Stream temperatures were monitored with Omnidata Model 112 temperature recorders at several locations. Monitoring occurred in all years from 1984 to 1992, except 1985, when no temperature data were collected. Specially made Omnidata program chips were used to allow temperatures to be measured to the nearest 0.1°C (Bozeman 1986a, 1986b).

Stream temperature was monitored at the following locations in each stream segment: SFWC below Browns Diversion (SfW 10.0), SFWC below Forest Service Road (SfW 5.8 and 7.7), and NFWC below Bass Lake (NfW 6.4 during 3 years; NfW 11.0 in all years except 1984, when only the seepage from Crane Valley Dam was monitored). Additional stream temperature data were collected in San Joaquin Ditch #3 to monitor temperatures at the water source that would be used for increased instream flow studies in the stream segment NFWC below Bass Lake.

Stream flow and temperature data are summarized in Tables E2.3.2b-2 and E2.3.2b-3. The data was collected on a daily basis at different times of the day. The temperatures recorded exceeded 20°C for more than 13 days in 1989, 1990, and 1995 at NfW 11. For SfW 5.8 & 7.7, which is a combination of data collected at both sites, the temperature exceeded 20° C for more than 15 days thru the years 1987 to 1990, and also in 1992, 1994, and 1996. The warmest and most 20 degree exceedance temperatures were recorded in 1988.

annual max. = 21.0 °C

TABLE E2.3.2b-2

NFWC below Bass Lake (NfW 11) (1986-1996)

N.F.

Year	Min. Flow (cfs)	Max. Flow (cfs)	Min. Temperature (°C)	Max Temperature (°C)	Days over 20 °C
1986	0.16	2100	4.7	20.6	1
1987	0.16	3.8	3.6	20	1
1988	0.24	2.8	4.38	20.6	2
1989	0.01	1.5	4.3	20.8	16
1990	0.17	2.2	3.4	22	34
1991	0.15	2.6	3.9	20	2
1992	0.19	3.3	4.63	19.8	0
1993	0.49	493	3.86	18.69	0
1994	3.9	152	5.27	17.86	0
1995	3.1	2200	4.94	22.55	14
1996	3.2	423	5.33	16.93	0

would not list

Source: Studley et al., unpublished data.

2/11

TABLE E2.3.2b-3

would list this segment

SFWC below Forest Service Road (SfW 5.8 & 7.7) (1986-1996)

Year	Min Flow (cfs)	Max Flow (cfs)	Min Temperature (°C)	Max Temperature (°C)	Days over 20 °C
1986	0.5	1200	3.6	20.36	4
1987	0.4	190	4.54	22	16
1988	0.2	25	4.17	23.01	54
1989	0.2	90	3.07	21.8	18
1990	0.3	13.8	4.15	22.5	32
1991	0.2	282	3.54	21.8	12
1992	0.21	28	3.51	22.4	27
1993	1.2	204	1.52	20.63	6
1994	0.39	53	1.29	21.29	28
1995	2.6	524	2.36	20.22	5
1996	1.8	598	2.36	22.03	21

2/11

Source: Studley et al., unpublished data.

Several stream temperature statistics were calculated for each stream segment from 1986 to 1992, for use in the correlation analysis with biological variables: number of days over 20.0°C by year; number of degree days over 20.0°C by year; number of degree days over 0°C by year; and mean, median, and maximum temperatures for April through June and

July through September (degree days were computed for a given year by subtracting 20 from the daily mean temperatures and then summing the non-negative values). Since all monitoring site data sets within a stream segment were not necessarily complete, missing values were simulated.

Synthesis of Missing Temperature Records

Missing values in the temperature records were replaced with synthesized values. Missing temperature data resulted from instruments not being deployed at all times at some sites, instruments being vandalized or out of service, operator error, and temperatures below the 5°C minimum read by some Omnidata program chips. The percent of measured daily temperature data for the 2,557 days (1986-1992) is summarized in Table E2.3.2b-4.

TABLE E2.3.2b-4

Number and Percent of Measured Daily Temperature Data

	Number of Measured Daily Temperature Values (Percent of Total Days)		
Station	**April-June**	**July-September**	**October-March**
SFWC RK 7.7	288 (45%)	541 (84%)	553 (43%)
SFWC RK 5.8	246 (39%)	447 (69%)	189 (15%)
NFWC RK 11.0	353 (55%)	573 (89%)	512 (40%)

Source: Studley et al., 1995.

Missing temperature values were synthesized using regression against other measured variables. At each station, regression models were determined using the measured mean daily temperatures, and then used to synthesize the missing temperature values.

At NfW 11.0 (below Bass Lake), the regression models were incapable of estimating temperatures with adequate accuracy during periods in 1986, when spillage from Bass Lake occurred. Spill flows occur rarely, but when they do occur, the flow rate increases by several orders of magnitude, with obvious effects on temperature. For March 1 through April 1 1986, stream temperature was estimated to increase at a steady rate from the value simulated for February 28 to the value simulated for April 2. For June 1-12, 1986, the temperature was estimated to be 18°C.

Air temperatures were available from several sources. U.S. Weather Service values of daily maximum, mean, and minimum air temperatures were obtained from the three stations nearest Crane Valley (Kern River Powerhouse, Ash Mountain, and Yosemite Park Headquarters). The best air temperature record to use was determined by which air temperatures correlated best with water temperatures at the study sites. A correlation of the Ash Mountain and Yosemite data with water temperatures at SFWC SfW 5.8 and 7.7 showed that the Yosemite Park daily mean air temperatures were the best predictors of water temperatures at the Crane Valley sites (Table E2.3.2b-5).

TABLE E2.3.2d-1

SFWC Below Forest Svc. Rd.

Water Quality Data for SfW 7.7 (1986-1996)

DATE	Air Temp.	TIME	H_2O Temp.	pH	CND	D.O.
7/9/1986	-	1030	19.0	-	35	8.4
10/21/1986	15.0	1035	9.5	7.2	18	10.4
12/17/1986	5.0	0930	5.5	7.7	25	11.5
1/31/1987	20.0	1030	5.5	-	-	11.0
4/13/1987	-	1230	11.5	6.7	35	-
6/18/1987	-	-	19.0	7.7	25	9.0
9/11/1987	-	-	17.5	-	30	7.5
12/11/1987	10.0	-	8.5	8.0	50	8.8
2/27/1988	14.5	1500	10.5	8.5	70	9.2
4/18/1988	19.0	1950	15.5	7.4	70	9.4
6/15/1988	28.0	1530	19.0	7.8	50	5.7
10/8/1988	18.2	0930	8.1	8.1	43	8.6
12/18/1988	4.0	1450	6.0	-	30	11.6
2/21/1989	13.0	1300	9.0	6.8	-	10.2
4/17/1989	23.0	1700	20.5	6.7	47	8.9
6/4/1989	-	-	17.0	-	50	8.3
10/24/1989	13.6	-	11.2	6.8	22	8.1
12/13/1989	9.8	1410	6.0	7.1	18	10.7
2/10/1990	9.5	1400	7.5	7.0	15	10.8
4/23/1990	20.0	-	13.0	6.8	30	8.8
6/11/1990	24.0	1330	23.0	7.2	30	-
10/20/1990	12.0	1130	11.4	6.8	20	8.3
2/23/1991	16.0	1310	10.0	7.2	20	10.0
4/21/1991	16.0	-	9.0	6.8	15	10.7
6/7/1991	24.0	-	17.0	6.5	100	7.5
10/20/1991	17.1	1130	14.0	7.0	28	6.4
2/23/1992	15.5	1300	8.0	6.9	20	-
4/15/1992	18.0	1135	9.8	7.1	15	-
6/12/1992	17.0	0930	17.0	6.8	25	-
10/11/1992	23.0	1130	15.0	6.8	27	7.4
2/20/1993	1.0	0930	2.0	7.2	11	11.2
4/29/1993	20.0	0910	5.5	7.3	10	10.6
6/27/1993	30.0	1340	18.9	7.1	22	-
10/2/1993	17.5	0925	14.0	7.5	22	8.6
3/1/1994	16.0	1300	6.0	7.0	20	11.4
4/15/1994	19.5	1620	14.5	7.1	20	8.4
6/6/1994	18.5	1115	14.0	7.7	20	8.6
9/24/1994	23.0	1600	18.0	6.6	30	7.1
4/11/1995	10.0	1030	5.5	7.1	12	10.4
8/8/1995	23.8	1219	18.3	7.4	23	8.8
10/20/1995	25.5	1430	18.0	7.4	20	10.2
4/14/1996	15.0	1400	8.0	7.3	12	10.5
6/22/1996	20.0	1430	17.0	7.1	20	8.8
10/3/1996	24.0	1530	15.5	7.3	21	8.6

Source: Studley et al., unpublished data.

NFWC below Bass Lake

TABLE E2.3.2d-2

Water Quality Data for NFW 11.0 (1986-1996)

DATE	AIR Temp.	TIME	H2O Temp.	pH	CND	D.O.
7/10/1986	-	1555	21.5	-	25	8.2
10/20/1986	-	0900	9.5	7.6	30	7.5
12/16/1986	-	1450	6.5	6.9	35	10.0
2/1/1987	6.0	1600	7.5	-	-	9.4
4/12/1987	-	1800	12.5	6.7	35	-
6/18/1987	-	-	20.0	7.7	30	9.6
9/11/1987	-	-	15.5	-	35	8.9
12/12/1987	5.0	-	7.5	7.5	255	-
2/27/1988	7.5	1000	9.0	8.5	318	11.3
4/18/1988	8.4	1130	9.8	7.7	115	9.8
6/16/1988	22.0	1239	19.8	7.4	42	9.0
10/8/1988	-	-	18.0	7.5	45	8.4
12/19/1988	5.0	1000	7.0	-	40	8.0
2/22/1989	13.0	0920	8.0	6.8	-	8.7
4/18/1989	20.8	1100	14.5	5.5	130	9.9
6/5/1989	17.0	1220	15.0	-	29	8.7
10/19/1989	12.2	1522	12.2	6.7	42	9.2
12/12/1989	7.0	-	5.5	7.3	35	10.2
2/9/1990	8.5	1340	6.0	7.0	32	10.0
4/22/1990	21.0	1430	16.0	7.2	30	10.2
6/12/1990	24.0	1445	18.0	6.9	30	7.9
10/19/1990	21.0	1715	13.4	7.4	40	9.3
2/23/1991	16.0	1530	10.0	7.3	40	9.8
4/21/1991	14.0	-	11.0	7.0	30	10.2
6/7/1991	26.0	-	17.0	7.0	30	10.4
10/20/1991	18.9	1350	14.0	7.1	40	8.3
2/23/1992	14.0	1545	9.5	6.9	55	-
4/15/1992	13.5	1230	9.5	7.5	70	-
6/11/1992	21.0	-	21.5	7.1	35	-
10/11/1992	28.9	1500	22.0	7.0	43	7.4
2/20/1993	7.0	1300	5.0	7.4	20	10.6
4/29/1993	19.4	1045	11.7	7.3	22	8.6
6/27/1993	26.7	1610	14.4	7.4	22	-
10/1/1993	12.0	0750	8.0	7.3	23	9.8
3/1/1994	6.0	0845	5.5	7.2	21	10.8
4/16/1994	24.0	1110	10.5	7.3	22	10.0
6/5/1994	26.0	1615	12.0	7.2	23	8.8
9/24/1994	23.0	1415	12.5	7.0	30	9.8
4/11/1995	-	-	-	-	-	-
8/8/1995	27.8	1530	16.7	7.3	20	8.2
10/20/1995	19.0	1200	16.0	7.4	23	9.0
4/14/1996	17.5	1630	7.5	7.3	19	11.0
6/22/1996	19.0	1600	17.0	7.2	18	8.0
10/3/1996	30.0	1330	11.0	7.2	21	8.8

Source: Studley et al., unpublished data.

TABLE E2.3.2b-5 Air/Water Temperature Models

Station	Variables in Model	RMSE (°C)[1]	Number of Values Synthesized
SfW 7.7	Air temperature at Yosemite, log(flow)	0.4-1.3	1015
SfW 5.8	Air temperature at Yosemite, log(flow)	0.7-1.2	661 (May-Nov)
NfW 11.0	Air temperature at Yosemite, log(flow) (flow not included in all months)	0.7-1.5	1004

[1] Root mean square error (standard deviation) of regression residuals. This is a measure of the average error in predicted temperatures. The lowest value is for the month with the lowest RSME. The highest value is for the month with the highest RSME.

Source: Studley et al., 1995.

Stream Temperature Model Analysis

During relicensing studies, the stream network water temperature model (SNTEMP) was used to analyze downstream temperature changes with alternative operations (release flows) at diversion dams associated with Licensee's Crane Valley project (Bozeman et al. 1985a, 1985b). The model predicts longitudinal, cross-section averaged, daily mean, and daily maximum temperatures throughout a stream network. A complete description of SNTEMP is provided by Theurer et al. (1984).

Stream Temperature Model Predictions

Plots of stream temperature data (mean, minimum, and maximum daily values for measured data; mean values for simulated data) and air temperature data (maximum daily) collected from 1984 to 1992 are provided in Appendix 3C. Stream temperature data were collected during relicensing studies in 1984, but not in 1985. Stream temperature data

collection resumed in 1986 (the data recorders were often at different locations than in 1984) and continued through 1992 (data recorder locations varied little during this period). Data collection varied between years in the number of days and locations sampled. Consequently, daily minimum, mean, and maximum stream temperatures are not necessarily available for all stream segments or for all months of a given year.

E2.3.2.3 1984-1985 Water Quality Data

Water quality data for existing Project waterways below Bass Lake are summarized in Table E2.3-2. Data are drawn primarily from water samples taken during 1984 and 1985 at 12 locations in Project streams, conduits, forebays, and reservoirs (Figure E2.3-1). Little additional historical information is available for these waterways.

Samples were taken during three seasons, reflecting: (1) late-spring conditions, before the main recreation season; (2)-late-summer, peak-recreation conditions; and (3) late-winter, high-flow conditions. All samples were analyzed at the nearest state-certified water quality laboratory (Twining Laboratories), located in Fresno, in accordance with USEPA guidelines.

Water quality samples were taken a short distance upstream of the various diversion dams, where they represent conditions both in the streams and at the upstream end of each diversion conduit. Forebay samples reflect conditions at the downstream ends of the conduits. Project reservoirs below Bass Lake are small and have short residence times.

proposed Project operation practices. Current background levels of hazardous materials (e.g., oil and grease) are low, even during peak recreation use of Bass Lake.

Pesticide Use

Licensee recognizes and observes the current USFS moratorium on herbicide use on USFS lands. Licensee applies herbicides on Licensee's land in its switchyards at Wishon Powerhouse, San Joaquin No. 2 Powerhouse, and San Joaquin No. 3 Powerhouse. Although small amounts of herbicide could enter Project waters, the lethal dose for fish and other animals is at least an order of magnitude greater than what is expected to result from standard applications. Rodenticide (bait) is not expected to enter Project waters. No net impact on aquatic fauna is expected.

Temperature

Temperatures in NFWC and SFWC will be reduced below previous project conditions by the increased flow releases proposed in E2.4.3. However, low flows and the unavailability of cool release water in September will result in stream temperatures in portions of Willow Creek above those needed for long-term trout growth and reproduction, and occasionally will result in temperatures above upper incipient lethal limits. Simulated daily maximum temperatures in Willow Creek, at the flows proposed in Exhibit E3, Section 3.3.1, range from 9.9°C (48.9°F) to 27.5°C (81.5°F), and simulated daily means range from 8.7°C (47.7°F) to 26.9°C (80.4°F). The biological significance of these temperatures is discussed in detail in Exhibit E3.

Based on these surveys, species composition, distribution, and relative abundance were summarized for each stream segment. Trout length-frequency distributions were calculated in ten millimeter (0.4 inch) increments, and fish densities (number per hectare) and biomass (kilogram per hectare) were computed for Browns Creek Conduit Spill Channel.

Studley et al., (1995) sampled at 10 electrofishing stations. The sampling was conducted over an eight year period from 1985 to 1992 located within four stream segments (Figures E3.1-2 and E3.1-3). Three electrofishing stations are located upstream of Browns Diversion Dam, five electrofishing stations are located in two segments below Browns Diversion Dam, and two stations are located in the NFWC. Price, (2000) conducted quantitative electrofishing surveys of 4 stations in Willow and Whisky creeks using a multiple pass removal method in October 2000 to determine the status of sensitive hardhead in these areas. The term "sensitive" is a Forest Service designation indicating that the hardhead is recognized as a sensitive species by the Pacific Southwest Region of the U.S. Forest Service.

Temperature Studies

Water temperatures in the existing Project system were studied in detail because of their importance in limiting fish populations in the Willow Creek drainage. Detailed water temperature monitoring and simulation results are presented in Bozeman et al., (1985) and are discussed in Report E2 of this amended application. The effects of stream temperature on rainbow and brown trout were analyzed.

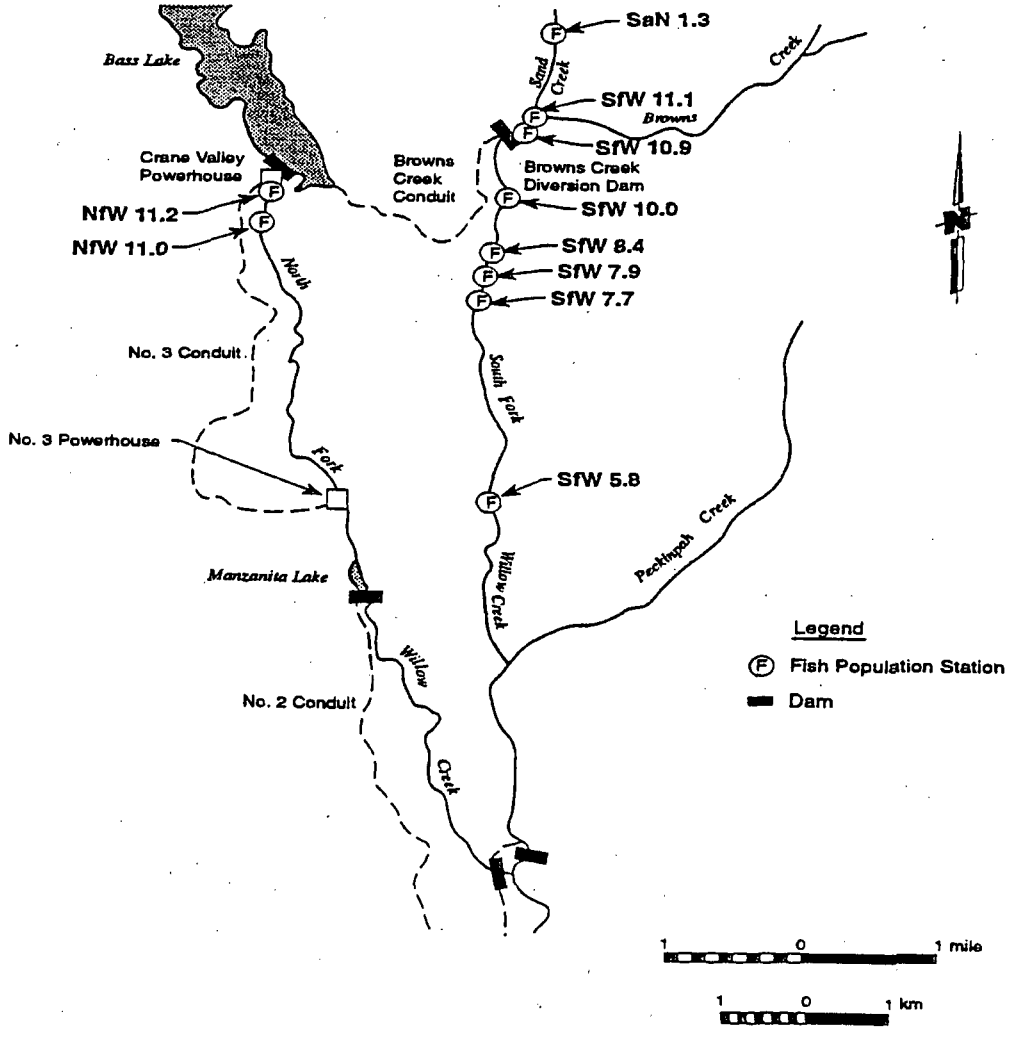

FIGURE E3.1-2
Altered flows study fish sampling locations at the Crane Valley Project.

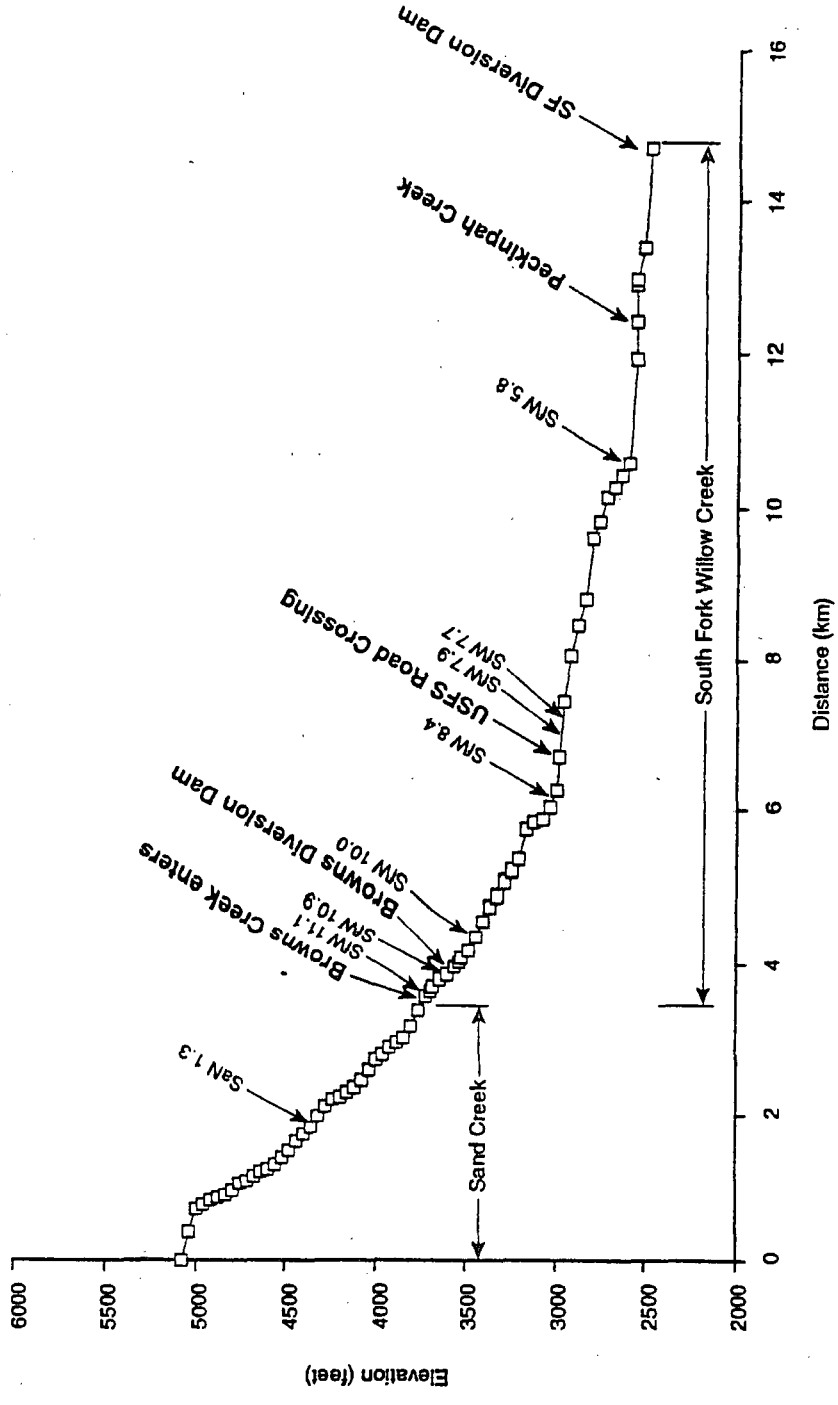

FIGURE E3.1-3
Longitudinal Profile of Sand Creek and South Fork Willow Creek, Madera County, California.

Longitudinal stream temperatures for each stream segment were simulated and compared to criteria for long-term exposure and growth and to upper incipient lethal temperatures for brown and rainbow trout. These criteria were used to develop estimates of the percentage of each stream segment length with usable water temperatures. A stream length (0.1 kilometer section) was considered to be unusable if its daily maximum temperature reached or exceeded 25°C (77°F) (the upper incipient lethal temperature for rainbow trout) or if daily mean temperatures reached or exceeded 20°C (68°F) (the long-term exposure and growth criterion).

A wide range of potential release flows were evaluated using simulated temperature forecasts. Both normal hydrologic and meteorologic conditions and extreme (hot and dry) conditions were analyzed. Stream temperatures were evaluated for flows ranging from 0 to 50 cfs. A major assumption made in forecasting temperatures for NFWC and Willow Creek was that the temperature of the water discharged from Bass Lake would be the same as that observed in 1984.

Instream Flow Studies

Instream flow study results describe habitat availability (weighted usable-area) as a function of streamflow by assessing its response to variation in flow-dependent variables. Studies were conducted in portions of the Willow Creek drainage affected by existing Project operations. Methodologies and applications were selected during scoping

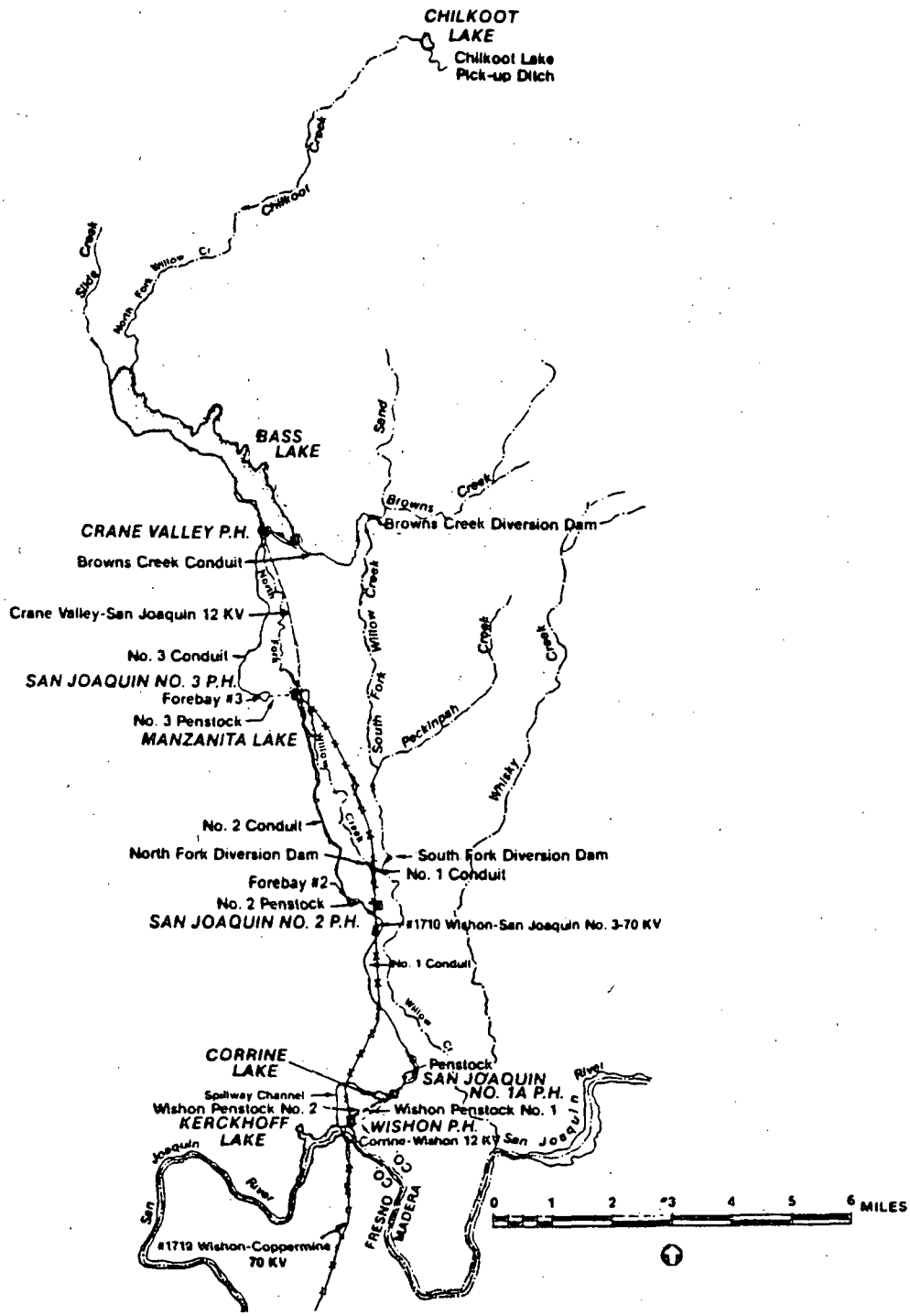

FIGURE E1.2-2

Crane Valley Project Facilities

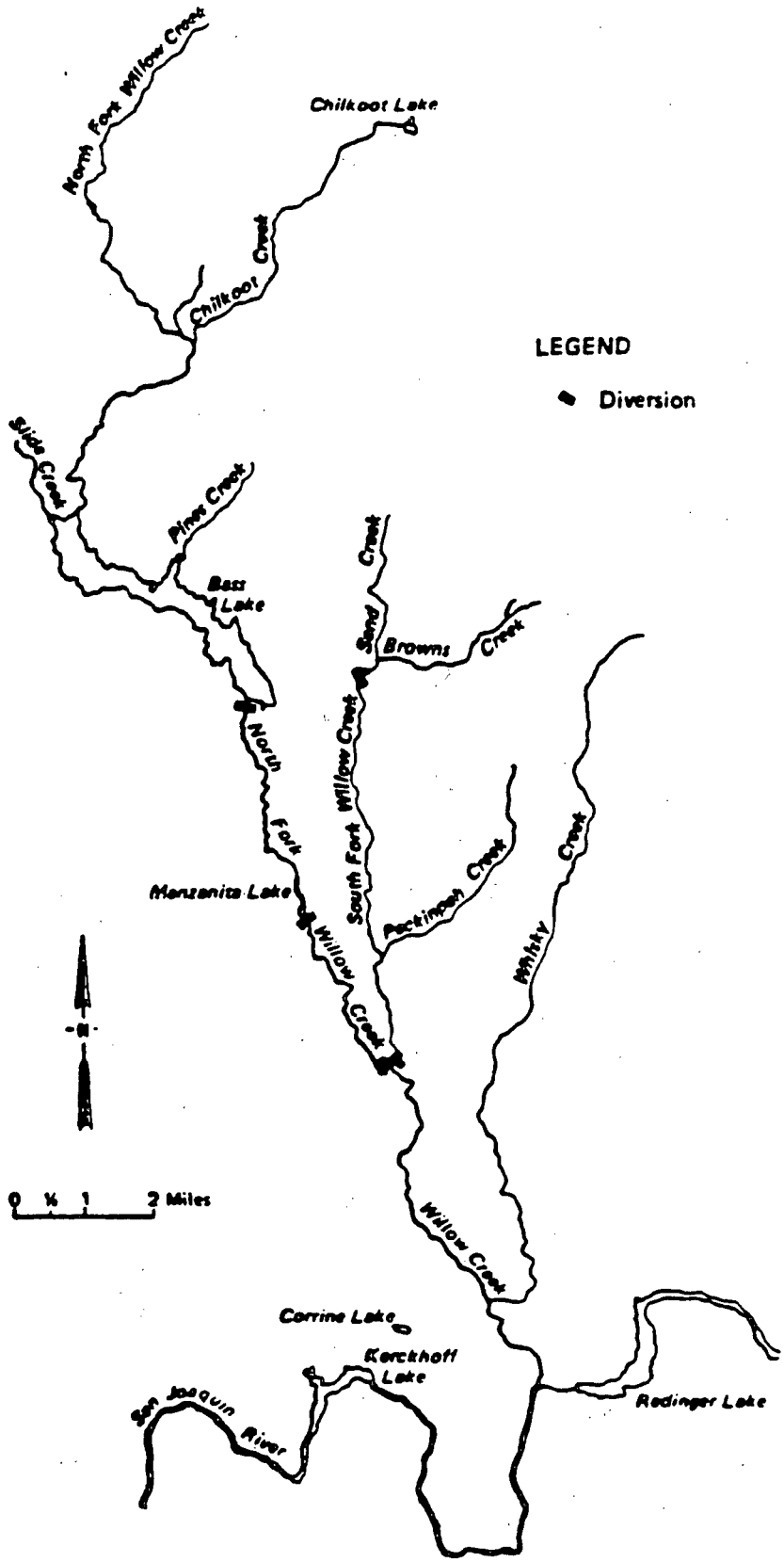

FIGURE E1.2-1

Primary Components of the Willow Creek Drainage System

Crane Valley Project
FERC 1354

PG&E

Pacific Gas and Electric Company Land

United States Forest Service Land

FERC Boundary

0 1 2 3 Miles

CHILKOOT LAKE

Yosemite Forks

Slide Creek

Willow Cr. N Fk

ROAD 222

Central Camp

ROAD 432

Pines Creek

Bass Lake

Sailor Creek

Browns Creek

Sand Creek

ROAD 274

CRANE VALLEY PH

Whisky R

ROAD 223

ROAD 222

ROAD 275

Willow Cr. S Fk

SAN JOAQUIN PH #3

Peckinpah Creek

HWY 221

Willow Cr. N Fk

ROAD 225

South Fork

North Fork

Willow Cr. S Fk

HWY 222

SAN JOAQUIN PH #2

Willow Cr.

HWY 222

SAN JOAQUIN PH #1A

S. WISHON PH

San Joaquin R.

FIGURE E1-1

PROJECT LOCATION

E1-3
Crane Valley Project, FERC 1354

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This is not the complete report

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Final Report

Crane Valley Project Supplemental Data to Fisheries Technical Report

Prepared for

Pacific Gas and Electric Company
Department of Engineering Research
San Ramon, California

Prepared by

M.A. Bozeman, W.S. Lifton,
J.E. Baldrige, K.A. Voos, and
R.A. Sanford

August 1985

Woodward-Clyde Consultants
100 Pringle Ave., One Walnut Creek Center, Walnut Creek, CA 94596

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and the outflows of each stream reach. Meteorology data were collected onsite at San Joaquin No. 3 Powerhouse and at PGandE Gage W-26, so that the data used would be representative of the study area. Stream geometry and structure data were collected onsite utilizing both ground-level and aerial data collection. All parameters necessary for calibration of the USFWS stream temperature model (SNTEMP) were collected in and near each of the stream reaches to provide accurate modeling of stream temperatures.

A3.2.2 STREAM TEMPERATURES

Temperature data were collected by means of Omnidata Model 112 temperature recorders installed in underwater housings and placed in armored steel casings to reduce vandalism and theft. The steel casings were chained and locked to steel plates that were epoxied to large boulders or bedrock. At initial deployment the units contained the standard Omnidata temperature recording program, which rounds the measured temperature to the nearest 0.5°C, providing an accuracy of ± 0.25°C. That program was subsequently replaced in order to record temperatures to the nearest 0.1°C. Prior to and during installation, and at each subsequent service date, all units were checked for calibration with an ASTM standard thermometer certified traceable to the National Bureau of Standards.

The temperature recorders stored information on data storage modules (DSMs) which have erasable, programmable, read-only memories (EPROMs). These DSMs are nonvolatile; that is, they retain the storage of information even if the recorder is shut off. The location, date, and time of installation and removal were recorded on a label affixed to each DSM. In addition, each DSM was accompanied by a printed data sheet showing that information, as well as the serial number of the recorder, the recording period, and the unit diagnostics. These data were also recorded in waterproof field notebooks used by the field team which installed and serviced the units.

Upon removal, DSMs were shipped to PGandE for data translation. PGandE provided the translated information to WCC on magnetic tape. These data were then subjected to a series of quality control checks. The data translated for the period of August through October 1984 were found to have been incorrectly translated and were retranslated by WCC. Data were then reduced to daily mean, minimum, and maximum temperatures.

As stated above, temperature recorders were used to define conditions within each stream reach for temperature monitoring and for temperature model calibration. Additional units were deployed to monitor the water temperatures of potential sources of flow releases. Such sources included the Crane Valley Powerhouse tailrace, Manzanita Lake, and Browns Creek Diversion Dam. Potential diversion release temperatures were measured with units installed in the water backed up by the dams. Recorders were installed downstream of the dams to measure seepage temperatures. Whisky Creek in the Willow Creek drainage was also monitored, due to its importance to flow and stream temperature within that reach. Each recorder location is listed for each of the stream reaches studied in Table A3-1. Each of the temperature recorder locations is also shown in Figure A3-1. In the stream temperature simulations, stream section distances are in river kilometers (RK) to comply with stream temperature model requirements.

Sufficient data were gathered from these instruments to allow calibration of the stream temperature model. Data were incomplete for three of the instruments. The unit in the Crane Valley Powerhouse was damaged shortly after initial installation by the high turbulence in the tailrace and had to be remounted. This resulted in a data loss of several days during June. The unit upstream of Manzanita Lake in NFWC was stolen prior to its scheduled service during August 1984. This resulted in the loss of all data collected during June and July. The unit located in Willow Creek at USGS Gage 2465 had a partial malfunction in early July and failed completely in August. Data from the August period were unrecoverable.

Table A3-1

INSTRUMENT LOCATIONS USED FOR CRANE VALLEY PROJECT TEMPERATURE MONITORING, 1984

Stream Reach	Location[a]	Purpose
NFWC downstream of Bass Lake	Crane Valley Powerhouse tailrace, RK 11.48	Release water temperature
NFWC downstream of Bass Lake	RK 11.58	Start of stream reach
NFWC downstream of Bass Lake	Upstream of Manzanita Lake, RK 7.08	End of stream reach
NFWC downstream of Manzanita Lake	Manzanita Lake at diversion	Release water temperature
NFWC downstream of Manzanita Lake	RK 4.83	Start of stream reach
NFWC downstream of Manzanita Lake	Upstream of North Fork Diversion Dam, RK 0.40	End of stream reach[b]
Willow Creek	At Gage W-26, RK 6.92	Start of stream reach
Willow Creek	Mouth of Whisky Creek, RK 2.90	Major tributary
Willow Creek	At USGS Gage 2465, RK 0.60	End of stream reach
SFWC	Upstream of Browns Creek Diversion Dam, RK 10.60	Release water temperature
SFWC	Downstream of Browns Creek Diversion Dam, RK 10.46	Start of stream reach
SFWC	Upstream of South Fork Diversion Dam, RK 0.16	End of stream reach

[a]NFWC and SFWC locations are river kilometers (RK) upstream of the NFWC-SFWC confluence. Willow Creek locations are river kilometers upstream of the Willow Creek - San Joaquin River confluence.

[b]Release water source for Willow Creek.

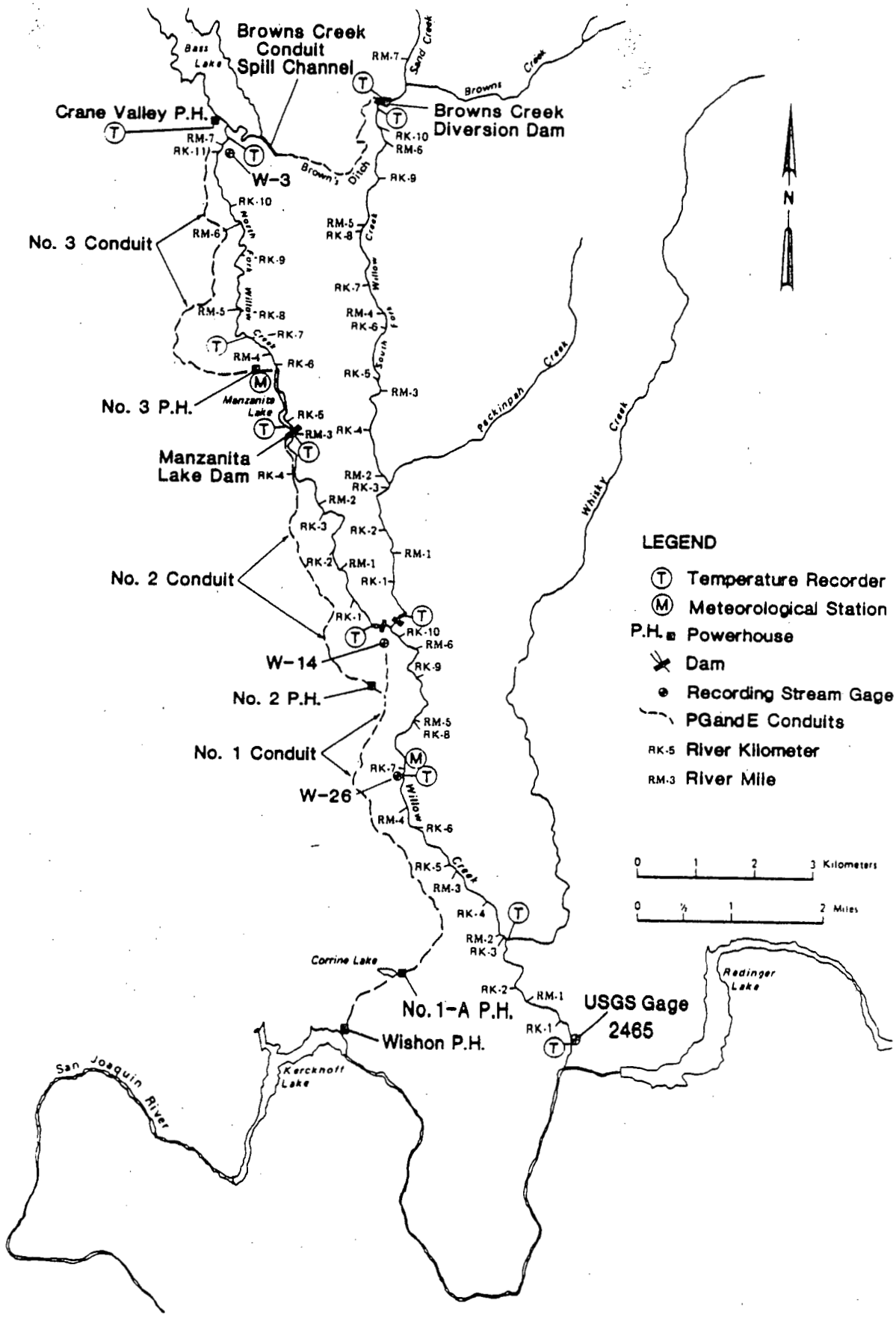


Figure A3-1. Temperature Data Collection Sites in Willow Creek Drainage

A3.2.3 HYDROLOGY

Hydrology data were collected by PGandE using their existing system of recorders and staff gages. Additional information was supplied by USGS for stations either operated by USGS or whose data reduction was provided by USGS. Hydrology data provided by PGandE were reanalyzed and summarized by PGandE (unpublished data), including the synthesis of local-area runoff for stream sections or time periods not provided or of insufficient accuracy to be used in the stream temperature model. Flow duration analyses were used in the stream temperature model. Flow duration analyses were prepared of the flow records (PGandE unpublished data) for analysis of median and extreme flow events. Data from these sources were provided to WCC on magnetic tape. Data on median facility operations were summarized for use in the stream temperature model (PGandE unpublished data).

A3.2.4 METEOROLOGY

Three meteorological stations were installed by PGandE at Big Creek, San Joaquin No. 3 Powerhouse, and Rex Ranch in order to provide the necessary meteorological data to calibrate the stream temperature model. The meteorological stations used were Teledyne model Micromets. The station instrumentation at all sites consisted of a thermistor (temperature), relative humidity element, and wind speed and wind direction detectors. Solar radiation was measured at Big Creek and Rex Ranch to provide a local measure of actual sunshine received in the study area. Quality assurance checks were carried out by PGandE meteorologists on a quarterly basis throughout the study. Data obtained from the meteorological network were reduced by PGandE and provided to WCC on magnetic tape.

A3.2.5 SHADE ANALYSIS

Shading data were collected at regular intervals along each stream to characterize vegetative shading and to provide ground-truth information to substantiate data obtained from topographic maps and photographs. The data collected were those required for the solar shade component of the USFWS Stream Temperature Model (Theurer, Voos, and Miller 1984). The

data represented a combination of both topographic and riparian vegetation shading factors for both sides of the stream.

As explained by Theurer et al. (1984), topographic shading dominates the shading effects because it determines the local time of sunrise and sunset. Riparian vegetation is an important shading component only if it casts a shadow on the water surface.

Topographic shading is a function of a variety of factors. These include the following:

- Time of year
- Stream reach latitude
- General stream reach azimuth
- Topographic altitude angle

Riparian vegetation shading is a combination of both topographic shade factors and parameters directly related to the riparian vegetation. These include the following:

- Height of vegetation
- Crown measurement
- Vegetation offset
- Vegetation density

With the exception of latitude, which must be derived from maps, all of the above factors were measured onsite. Stream reach azimuth was ground-truthed by means of an engineering compass at streamside. Topographic angle was measured on each side of the stream by means of a hand level. Vegetation height was calculated from measurements taken with a hand level and tape. Crown measurements were taken by means of a tape or optical range finder. As specified by Theurer et al. (1984), the crown radius was used for softwoods. The vegetation density and the

7day $\bar{x}$ is 17.0°C

TABLE C-289. SOUTH FORK WILLOW CREEK
UPSTREAM OF BROWN'S DIVERSION
(10.60 KM UPSTREAM OF SOUTH FORK DIVERSION)
1984 MEAN, MINIMUM, AND MAXIMUM TEMPERATURES

DATE	MEAN TEMPERATURE (C)	MINIMUM TEMPERATURE (C)	MAXIMUM TEMPERATURE (C)
6/20	14.36	13.50	14.50
6/21	13.63	12.50	14.50
6/22	13.98	12.50	15.50
6/23	14.50	13.00	16.00
6/24	14.98	13.50	16.00
6/25	14.94	13.50	16.00
6/26	15.17	14.00	16.00
6/27	15.75	14.50	17.00
6/28	16.40	15.50	17.50
6/29	16.21	15.50	17.00
6/30	15.63	14.50	16.50
7/ 1	15.98	14.50	17.50
7/ 2	16.98	16.00	18.00
7/ 3	17.94	17.00	19.00
7/ 4	18.27	17.50	19.50
7/ 5	18.46	17.50	19.50
7/ 6	18.67	18.00	19.50
7/ 7	18.02	17.00	19.00
7/ 8	16.83	16.00	18.00
7/ 9	15.88	15.00	17.00
7/10	15.69	14.50	17.00
7/11	16.02	15.00	17.00
7/12	16.23	15.00	17.50
7/13	16.77	16.00	18.00
7/14	17.17	16.50	18.00
7/15	17.65	17.00	18.50
7/16	17.92	17.00	19.00
7/17	18.65	18.00	20.00
7/18	18.56	17.50	19.50
7/19	18.33	17.50	19.50
7/20	17.75	17.00	18.50
7/21	17.21	16.50	18.00
7/22	15.88	15.50	16.50
7/23	16.29	15.50	17.50
7/24	16.50	15.50	18.00
7/25	16.48	15.50	18.00
7/26	16.44	15.00	18.00
7/27	16.79	16.00	18.00
7/28	16.75	16.00	18.00
7/29	16.23	15.00	17.50
7/30	16.44	15.50	18.00
7/31	16.73	16.00	18.00
8/ 1	16.88	16.00	18.50
8/ 2	16.58	15.50	18.00

7day $\bar{x}$ = 15.58

7day $\bar{x}$ = 17.76

annual max. 21.0°C

TABLE C-289 (CONT.) SOUTH FORK WILLOW CREEK
UPSTREAM OF BROWN'S DIVERSION
(10.60 KM UPSTREAM OF SOUTH FORK DIVERSION)
1984 MEAN, MINIMUM, AND MAXIMUM TEMPERATURES

DATE	MEAN TEMPERATURE (C)	MINIMUM TEMPERATURE (C)	MAXIMUM TEMPERATURE (C)
8/ 3	16.08	15.00	17.50
8/ 4	16.02	15.00	17.50
8/ 5	15.94	15.00	17.50
8/ 6	15.94	14.50	17.50
8/ 7	16.17	15.00	17.50
8/ 8	16.48	15.50	18.00
8/ 9	16.81	15.50	18.00
8/10	17.29	16.50	18.50
8/11	17.21	16.00	18.50
8/12	16.98	16.00	18.00
8/13	16.85	16.00	19.40
8/14	16.51	15.40	17.70
8/15	16.59	16.20	16.90
8/16	16.71	15.60	18.20
8/17	17.02	15.90	18.50
8/18	16.95	16.00	18.30
8/19	16.30	15.20	17.70
8/20	15.58	14.30	16.90
8/21	15.89	14.70	17.30
8/22	16.30	15.50	17.20
8/23	16.43	15.60	17.70
8/24	16.02	15.10	17.20
8/25	15.40	14.40	16.40
8/26	15.85	14.70	17.30
8/27	16.27	15.20	17.70
8/28	16.65	15.50	18.00
8/29	17.14	16.10	18.60
8/30	16.91	16.10	17.80
8/31	16.07	15.10	17.20
9/ 1	15.25	14.00	16.60
9/ 2	15.13	13.90	16.50
9/ 3	15.50	14.30	16.90
9/ 4	15.86	14.70	17.30
9/ 5	16.33	15.40	17.50
9/ 6	16.20	15.40	17.30
9/ 7	15.56	14.40	16.80
9/ 8	15.72	14.70	17.00
9/ 9	15.81	14.90	16.80
9/10	15.71	14.70	16.90
9/11	15.90	15.20	16.70
9/12	16.04	15.30	17.00
9/13	16.01	15.20	17.20
9/14	15.85	14.90	17.00
9/15	15.66	14.70	16.90

7day X = 16.87

TABLE C-289 (CONT.) SOUTH FORK WILLOW CREEK
UPSTREAM OF BROWN'S DIVERSION
(10.60 KM UPSTREAM OF SOUTH FORK DIVERSION)
1984 MEAN, MINIMUM, AND MAXIMUM TEMPERATURES

DATE	MEAN TEMPERATURE (C)	MINIMUM TEMPERATURE (C)	MAXIMUM TEMPERATURE (C)
9/16	15.92	15.00	17.20
9/17	16.11	15.10	17.30
9/18	16.58	15.80	17.60
9/19	16.56	15.70	17.50
9/20	16.26	15.70	16.80
9/21	15.16	14.20	16.20
9/22	15.00	14.20	15.90
9/23	13.91	13.30	14.70
9/24	13.23	12.60	14.00
9/25	12.45	11.50	13.60
9/26	12.95	12.20	14.20
9/27	13.34	12.50	14.40
9/28	13.41	12.60	14.40
9/29	13.30	12.40	14.40
9/30	12.75	12.20	13.40
10/ 1	11.57	11.20	12.00
10/ 2	11.18	10.40	12.00
10/ 3	11.39	10.50	12.30
10/ 4	11.55	10.80	12.40
10/ 5	11.80	11.10	12.60
10/ 6	11.85	11.00	12.90
10/ 7	11.93	11.10	13.00
10/ 8	12.06	11.20	13.00
10/ 9	12.07	11.30	13.00
10/10	12.07	11.30	13.00
10/11	11.62	10.80	12.20
10/12	10.31	9.60	11.00
10/13	10.87	10.10	11.90
10/14	11.10	10.30	11.60
10/15	8.89	8.20	10.10
10/16	7.24	6.60	8.20
10/17	5.71	5.10	6.30
10/18	5.30	5.00	5.80
10/19	6.32	5.90	6.80
10/20	6.62	6.30	6.90
10/21	6.26	5.70	6.60
10/22	6.02	5.30	6.80
10/23	6.08	5.30	6.90
10/24	6.31	5.60	7.20
10/25	6.65	6.10	7.50
10/26	6.91	6.50	7.50
10/27	6.58	6.10	7.10
10/28	5.75	5.00	6.50
10/29	5.99	5.30	6.90
10/30	5.43	5.00	5.80

7day X = 14.13

TABLE C-290. SOUTH FORK WILLOW CREEK
DOWNSTREAM OF BROWN'S DIVERSION
(10.46 KM UPSTREAM OF SOUTH FORK DIVERSION)
1984 MEAN, MINIMUM, AND MAXIMUM TEMPERATURES

DATE	MEAN TEMPERATURE (C)	MINIMUM TEMPERATURE (C)	MAXIMUM TEMPERATURE (C)
6/20	18.40	18.00	19.00
6/21	17.56	16.50	19.00
6/22	17.65	16.50	19.00
6/23	17.79	16.50	19.00
6/24	18.08	17.00	19.50
6/25	18.23	17.00	19.50
6/26	18.46	17.50	20.00
6/27	18.71	17.50	20.50
6/28	19.06	18.00	20.50
6/29	19.38	18.50	21.00
6/30	19.33	18.00	21.00
7/ 1	19.40	18.50	21.00
7/ 2	19.69	18.50	21.50
7/ 3	19.94	19.00	21.50
7/ 4	20.19	19.00	22.00
7/ 5	20.54	19.50	22.00
7/ 6	20.81	19.50	22.50
7/ 7	20.90	19.50	22.50
7/ 8	20.60	19.00	22.00
7/ 9	20.08	19.00	21.50
7/10	19.85	18.50	21.00
7/11	19.67	18.50	21.00
7/12	19.63	18.50	21.00
7/13	19.75	19.00	21.00
7/14	19.35	19.00	20.50
7/15	19.17	18.50	20.00
7/16	19.75	18.50	21.50
7/17	20.48	19.50	22.00
7/18	20.83	19.50	22.00
7/19	21.08	20.00	22.50
7/20	20.92	20.00	22.00
7/21	20.44	19.50	21.00
7/22	19.25	19.00	20.00
7/23	19.08	18.00	20.50
7/24	19.23	18.00	21.00
7/25	17.54	16.50	19.00
7/26	17.31	16.00	19.00
7/27	17.69	16.50	19.50
7/28	17.71	16.50	19.50
7/29	17.23	16.00	19.00
7/30	17.31	16.00	18.50
7/31	17.54	16.50	18.50
8/ 1	17.85	17.00	19.00
8/ 2	17.77	16.50	19.00

TABLE C-290 (CONT.) SOUTH FORK WILLOW CREEK
DOWNSTREAM OF BROWN'S DIVERSION
(10.46 KM UPSTREAM OF SOUTH FORK DIVERSION)
1984 MEAN, MINIMUM, AND MAXIMUM TEMPERATURES

DATE	MEAN TEMPERATURE (C)	MINIMUM TEMPERATURE (C)	MAXIMUM TEMPERATURE (C)
8/ 3	17.48	16.50	18.50
8/ 4	17.19	16.00	18.50
8/ 5	17.42	16.50	18.50
8/ 6	17.56	16.50	18.50
8/ 7	17.27	16.00	18.50
8/ 8	17.50	16.50	18.50
8/ 9	18.13	17.50	19.00
8/10	18.63	18.00	19.50
8/11	18.98	18.50	20.00
8/12	19.02	18.50	19.50
8/13	19.10	18.50	20.50
8/14	18.94	18.50	19.50
8/15	18.64	18.30	18.90
8/16	18.50	17.70	19.30
8/17	18.85	18.20	19.60
8/18	19.02	18.40	19.60
8/19	18.89	18.20	19.50
8/20	18.53	17.70	19.10
8/21	18.61	17.90	19.20
8/22	18.66	18.20	19.20
8/23	18.62	18.00	19.20
8/24	18.45	17.90	18.90
8/25	18.24	17.60	18.70
8/26	18.12	17.40	18.60
8/27	18.27	17.70	18.70
8/28	18.36	17.80	18.90
8/29	18.53	18.10	19.10
8/30	18.62	18.20	19.10
8/31	18.33	17.80	18.70
9/ 1	17.69	17.10	18.10
9/ 2	17.35	16.70	17.70
9/ 3	17.36	16.80	17.70
9/ 4	17.47	16.90	17.80
9/ 5	17.73	17.30	18.20
9/ 6	17.74	17.30	18.10
9/ 7	17.37	16.80	17.60
9/ 8	17.25	16.80	17.60
9/ 9	17.34	16.80	17.80
9/10	17.20	16.80	17.50
9/11	17.32	17.10	17.60
9/12	17.30	17.00	17.60
9/13	17.29	16.90	17.70
9/14	17.21	16.80	17.40
9/15	17.04	16.70	17.30

TABLE C-290 (CONT.) SOUTH FORK WILLOW CREEK
DOWNSTREAM OF BROWN'S DIVERSION
(10.46 KM UPSTREAM OF SOUTH FORK DIVERSION)
1984 MEAN, MINIMUM, AND MAXIMUM TEMPERATURES

DATE	MEAN TEMPERATURE (C)	MINIMUM TEMPERATURE (C)	MAXIMUM TEMPERATURE (C)
9/16	17.06	16.80	17.30
9/17	17.15	16.80	17.50
9/18	17.48	17.10	17.90
9/19	17.55	17.30	17.90
9/20	17.53	17.30	17.80
9/21	16.81	16.40	17.20
9/22	16.58	16.20	16.80
9/23	15.90	15.60	16.30
9/24	15.26	14.80	15.70
9/25	14.26	13.80	14.70
9/26	14.22	13.90	14.60
9/27	14.29	13.90	14.60
9/28	14.22	13.90	14.50
9/29	14.25	13.90	14.60
9/30	14.12	13.80	14.40
10/ 1	13.39	13.10	13.70
10/ 2	12.75	12.30	13.00
10/ 3	12.55	12.20	12.80
10/ 4	12.60	12.20	12.90
10/ 5	12.73	12.40	13.00
10/ 6	12.58	12.30	12.80
10/ 7	12.46	12.20	12.70
10/ 8	12.40	12.10	12.60
10/ 9	12.35	12.10	12.60
10/10	12.37	12.10	12.60
10/11	12.51	12.10	12.70
10/12	11.53	11.20	12.00
10/13	11.32	11.00	11.60
10/14	11.61	11.30	11.90
10/15	10.50	10.10	11.10
10/16	9.58	9.20	10.10
10/17	9.38	9.00	9.70
10/18	8.52	8.10	8.90
10/19	9.05	8.70	9.40
10/20	9.34	9.10	9.50
10/21	9.05	8.70	9.40
10/22	8.51	8.30	8.90
10/23	8.11	7.80	8.40
10/24	8.12	7.90	8.30
10/25	8.03	7.80	8.30
10/26	8.45	8.00	8.90
10/27	8.73	8.40	9.10
10/28	8.26	7.90	8.60
10/29	8.17	7.90	8.40

TABLE C-290 (CONT.) SOUTH FORK WILLOW CREEK
DOWNSTREAM OF BROWN'S DIVERSION
(10.46 KM UPSTREAM OF SOUTH FORK DIVERSION)
1984 MEAN, MINIMUM, AND MAXIMUM TEMPERATURES

DATE	MEAN TEMPERATURE (C)	MINIMUM TEMPERATURE (C)	MAXIMUM TEMPERATURE (C)
10/30	8.47	8.10	8.80
10/31	8.43	8.10	8.60
11/ 1	7.91	7.70	8.30
11/ 2	7.80	7.40	8.20
11/ 3	8.19	8.00	8.30
11/ 4	7.75	7.50	8.00
11/ 5	7.70	7.20	8.10
11/ 6	8.22	7.90	8.50
11/ 7	8.42	8.30	8.60

TABLE C-291. SOUTH FORK WILLOW CREEK
UPSTREAM OF SOUTH FORK DIVERSION
(0.16 KM UPSTREAM OF SOUTH FORK DIVERSION)
1984 MEAN, MINIMUM, AND MAXIMUM TEMPERATURES

DATE	MEAN TEMPERATURE (C)	MINIMUM TEMPERATURE (C)	MAXIMUM TEMPERATURE (C)
6/21	18.00	18.00	18.00
6/22	18.38	17.50	19.00
6/23	18.48	18.00	19.00
6/24	18.81	18.50	19.00
6/25	18.96	18.50	19.00
6/26	19.00	19.00	19.00
6/27	19.23	19.00	19.50
6/28	19.73	19.50	20.00
6/29	20.31	20.00	20.50
6/30	20.40	20.00	20.50
7/ 1	20.40	20.00	20.50
7/ 2	20.75	20.50	21.00
7/ 3	21.27	21.00	21.50
7/ 4	22.00	21.50	22.50
7/ 5	22.71	22.50	23.00
7/ 6	23.50	23.00	24.00
7/ 7	23.73	23.00	24.50
7/ 8	23.23	22.50	24.00
7/ 9	22.60	22.00	23.50
7/10	22.15	21.50	22.50
7/11	21.79	21.50	22.50
7/12	21.69	20.50	22.50
7/13	21.98	21.00	23.00
7/14	22.33	22.00	23.00
7/15	22.73	22.00	24.00
7/16	23.40	22.50	24.00
7/17	24.21	23.50	25.00
7/18	24.27	23.50	25.00
7/19	24.25	24.00	24.50
7/20	23.81	23.50	24.50
7/21	23.27	23.00	24.00
7/22	22.13	21.50	23.00
7/23	21.10	21.00	21.50
7/24	21.63	21.00	22.50
7/25	21.50	21.00	22.00
7/26	20.96	20.50	21.50
7/27	21.06	20.50	21.50
7/28	21.33	21.00	21.50
7/29	21.27	21.00	21.50
7/30	21.19	20.50	21.50
7/31	21.85	21.00	23.00
8/ 1	22.02	21.00	22.50
8/ 2	21.85	21.00	22.50
8/ 3	21.38	21.00	22.00

TABLE C-291 (CONT.) SOUTH FORK WILLOW CREEK
UPSTREAM OF SOUTH FORK DIVERSION
(0.16 KM UPSTREAM OF SOUTH FORK DIVERSION)
1984 MEAN, MINIMUM, AND MAXIMUM TEMPERATURES

DATE	MEAN TEMPERATURE (C)	MINIMUM TEMPERATURE (C)	MAXIMUM TEMPERATURE (C)
8/ 4	20.92	20.50	21.50
8/ 5	20.85	20.50	21.50
8/ 6	20.77	20.00	21.50
8/ 7	20.67	19.50	21.00
8/ 8	21.19	20.00	22.00
8/ 9	21.65	20.50	22.50
8/10	22.17	21.50	22.50
8/11	22.10	21.50	22.50
8/12	22.00	21.50	22.50
8/13	21.92	21.50	22.50
8/14	21.70	21.00	22.20
8/15	21.30	21.00	21.60
8/16	20.83	20.30	21.20
8/17	21.11	20.40	21.60
8/18	21.48	20.80	22.00
8/19	21.24	20.80	21.60
8/20	20.60	20.10	21.10
8/21	20.32	19.90	20.60
8/22	20.38	19.90	20.80
8/23	20.57	20.10	21.00
8/24	20.42	20.00	20.90
8/25	19.74	19.40	20.30
8/26	19.21	18.70	19.60
8/27	19.72	18.80	20.50
8/28	20.19	19.30	20.90
8/29	20.85	20.10	21.60
8/30	21.15	20.40	21.80
8/31	20.65	20.10	21.10
9/ 1	19.62	19.00	20.00
9/ 2	19.10	18.30	19.80
9/ 3	19.13	18.30	19.80
9/ 4	19.46	18.60	20.50
9/ 5	20.03	19.10	21.10
9/ 6	20.24	19.40	21.10
9/ 7	19.77	19.10	20.10
9/ 8	19.42	18.70	20.00
9/ 9	19.49	18.70	20.50
9/10	19.67	18.70	20.70
9/11	19.88	19.10	20.80
9/12	19.98	19.30	20.80
9/13	19.88	19.20	20.50
9/14	19.71	18.90	20.50
9/15	19.43	18.70	20.40
9/16	19.40	18.60	20.10

TABLE C-291 (CONT.) SOUTH FORK WILLOW CREEK
UPSTREAM OF SOUTH FORK DIVERSION
(0.16 KM UPSTREAM OF SOUTH FORK DIVERSION)
1984 MEAN, MINIMUM, AND MAXIMUM TEMPERATURES

DATE	MEAN TEMPERATURE (C)	MINIMUM TEMPERATURE (C)	MAXIMUM TEMPERATURE (C)
9/17	19.62	18.70	20.70
9/18	20.43	19.50	22.10
9/19	20.52	19.80	21.30
9/20	20.35	20.00	20.80
9/21	19.45	19.10	19.90
9/22	18.52	18.10	19.20
9/23	17.43	17.10	18.20
9/24	16.61	16.20	17.10
9/25	15.50	14.90	16.10
9/26	15.13	14.40	16.10
9/27	15.48	14.70	16.60
9/28	15.75	15.00	16.90
9/29	15.72	15.10	16.80
9/30	15.25	14.90	15.80
10/ 1	14.35	13.90	14.80
10/ 2	13.59	13.20	13.90
10/ 3	13.60	13.00	14.50
10/ 4	13.65	13.10	14.40
10/ 5	13.85	13.30	14.70
10/ 6	13.87	13.40	14.60
10/ 7	13.88	13.40	14.70
10/ 8	14.01	13.40	15.00
10/ 9	14.05	13.50	14.80
10/10	14.03	13.60	14.60
10/11	13.96	13.70	14.30
10/12	13.02	12.60	13.60
10/13	12.58	12.20	13.00
10/14	12.86	12.60	13.10
10/15	11.89	11.50	12.60
10/16	10.60	10.00	11.40
10/17	9.97	9.60	11.10
10/18	9.38	8.80	10.10
10/19	9.73	9.40	10.40
10/20	10.32	10.00	10.80
10/21	10.26	9.90	10.70
10/22	10.12	9.70	11.00
10/23	9.85	9.50	10.50
10/24	9.88	9.40	10.70
10/25	9.88	9.40	10.70
10/26	9.90	9.70	10.40
10/27	9.74	9.50	10.10
10/28	9.48	9.20	9.80
10/29	9.20	8.80	9.80
10/30	9.09	6.10	12.40

TABLE C-291 (CONT.) SOUTH FORK WILLOW CREEK
UPSTREAM OF SOUTH FORK DIVERSION
(0.16 KM UPSTREAM OF SOUTH FORK DIVERSION)
1984 MEAN, MINIMUM, AND MAXIMUM TEMPERATURES

DATE	MEAN TEMPERATURE (C)	MINIMUM TEMPERATURE (C)	MAXIMUM TEMPERATURE (C)
10/31	8.02	5.00	16.80
11/ 1	8.80	5.00	21.00
11/ 2	10.53	5.00	21.50
11/ 3	9.38	5.00	20.40
11/ 4	8.48	5.00	19.20
11/ 5	10.08	5.00	18.30
11/ 6	10.05	5.00	17.80
11/ 7	10.35	10.00	10.70
11/ 8	10.40	10.40	10.40

TABLE C-292. CRANE VALLEY POWERHOUSE TAILRACE
(DITCH NUMBER THREE)
1984 MEAN, MINIMUM, AND MAXIMUM TEMPERATURES

DATE	MEAN TEMPERATURE (C)	MINIMUM TEMPERATURE (C)	MAXIMUM TEMPERATURE (C)
6/20	9.00	9.00	9.00
6/21	8.56	8.50	9.00
6/22	8.35	8.00	8.50
6/23	8.02	8.00	8.50
6/24	8.00	8.00	8.00
6/25	8.00	8.00	8.00
6/26	8.00	8.00	8.00
6/27 [1]	8.00	8.00	8.00
7/ 6	13.67	13.00	14.00
7/ 7	13.06	11.50	17.00
7/ 8	12.81	11.00	17.50
7/ 9	11.25	11.00	11.50
7/10	11.25	11.00	11.50
7/11	11.44	11.00	11.50
7/12	11.35	11.00	11.50
7/13	11.31	11.00	12.00
7/14	13.65	11.00	22.00
7/15	14.15	12.50	17.00
7/16	11.60	11.00	12.50
7/17	11.48	11.00	12.00
7/18	11.65	11.50	12.00
7/19	11.77	11.50	12.00
7/20	13.06	11.50	17.50
7/21	12.50	11.00	16.00
7/22	11.77	10.50	13.00
7/23	12.94	10.50	19.00
7/24	13.52	11.00	20.50
7/25	13.67	11.50	21.00
7/26	13.90	11.50	21.50
7/27	14.63	12.00	23.00
7/28	15.04	12.50	24.50
7/29	15.17	12.00	25.00
7/30	12.29	11.50	13.50
7/31	12.00	11.50	12.50
8/ 1	12.10	12.00	12.50
8/ 2	12.23	11.50	12.50
8/ 3	14.46	12.00	20.50
8/ 4	16.10	12.50	25.50 e
8/ 5	16.54	13.00	25.50
8/ 6	12.77	12.00	14.00
8/ 7	12.52	12.50	13.00
8/ 8	12.58	12.50	13.00

[1] INSTRUMENT MALFUNCTION

TABLE C-292 (CONT.) CRANE VALLEY POWERHOUSE TAILRACE
(DITCH NUMBER THREE)
1984 MEAN, MINIMUM, AND MAXIMUM TEMPERATURES

DATE	MEAN TEMPERATURE (C)	MINIMUM TEMPERATURE (C)	MAXIMUM TEMPERATURE (C)
8/ 9	12.69	12.50	13.00
8/10	12.79	12.50	13.00
8/11	12.98	12.50	13.50
8/12	13.08	12.50	13.50
8/13	13.17	13.00	13.50
8/14	13.07	12.50	13.50
8/15	13.02	12.80	13.30
8/16	13.13	12.90	13.50
8/17	13.32	13.00	13.60
8/18	13.50	13.10	13.80
8/19	13.71	13.30	14.20
8/20	13.99	13.60	14.40
8/21	14.29	14.00	14.70
8/22	14.58	14.20	14.90
8/23	14.82	14.40	15.30
8/24	15.09	14.40	15.60
8/25	15.33	14.90	15.90
8/26	15.63	15.20	16.10
8/27	15.90	15.20	16.50
8/28	16.17	15.70	16.70
8/29	16.56	16.30	16.90
8/30	16.87	16.30	18.00
8/31	17.20	16.50	17.80
9/ 1	17.53	17.20	18.20
9/ 2	17.95	17.50	18.40
9/ 3	18.30	18.00	18.80
9/ 4	18.57	18.10	19.00
9/ 5	18.93	18.50	19.60
9/ 6	19.19	18.80	19.80
9/ 7	19.45	19.10	19.80
9/ 8	19.66	19.20	20.00
9/ 9	19.95	19.70	20.20
9/10	20.10	19.80	20.50
9/11	20.23	19.80	20.60
9/12	20.58	20.30	20.80
9/13	20.50	20.30	20.80
9/14	20.36	15.90	23.80
9/15	15.90	13.30	24.00
9/16	15.08	12.60	22.70
9/17	17.81	12.40	20.70
9/18	20.44	20.30	20.70
9/19	20.62	20.40	20.90
9/20	20.51	20.20	20.80
9/21	14.23	8.30	20.80
9/22	8.26	8.10	8.40

TABLE C-292 (CONT.) CRANE VALLEY POWERHOUSE TAILRACE
(DITCH NUMBER THREE)
1984 MEAN, MINIMUM, AND MAXIMUM TEMPERATURES

DATE	MEAN TEMPERATURE (C)	MINIMUM TEMPERATURE (C)	MAXIMUM TEMPERATURE (C)
9/23	8.20	8.10	8.30
9/24	13.01	8.10	20.10
9/25	19.97	19.90	20.10
9/26	19.83	19.70	20.00
9/27	19.62	19.40	19.80
9/28	19.40	19.30	19.50
9/29	18.15	13.40	22.80
9/30	13.17	8.90	17.60
10/ 1	11.13	8.40	13.60
10/ 2	15.03	8.00	18.60
10/ 3	18.29	18.20	18.50
10/ 4	18.11	17.90	18.20
10/ 5	16.62	11.60	20.30
10/ 6	13.72	10.50	20.60
10/ 7	14.01	10.70	20.50
10/ 8	15.45	10.90	17.90
10/ 9	17.65	17.60	17.70

TABLE C-293. NORTH FORK WILLOW CREEK
DOWNSTREAM OF BASS LAKE
(11.50 KM UPSTREAM OF NORTH FORK DIVERSION)
1984 MEAN, MINIMUM, AND MAXIMUM TEMPERATURES

DATE	MEAN TEMPERATURE (C)	MINIMUM TEMPERATURE (C)	MAXIMUM TEMPERATURE (C)
6/20	18.25	18.00	18.50
6/21	18.10	18.00	18.50
6/22	18.33	18.00	18.50
6/23	18.50	18.50	18.50
6/24	18.50	18.50	18.50
6/25	18.60	18.50	19.00
6/26	18.98	18.50	19.00
6/27	19.00	19.00	19.00
6/28	19.33	19.00	19.50
6/29	19.50	19.50	19.50
6/30	19.50	19.50	19.50
7/ 1	19.50	19.50	19.50
7/ 2	19.85	19.50	20.00
7/ 3	20.04	20.00	20.50
7/ 4	20.42	20.00	20.50
7/ 5	20.50	20.50	20.50
7/ 6	20.50	20.50	20.50
7/ 7	20.58	20.50	21.00
7/ 8	20.67	20.50	21.00
7/ 9	20.83	20.50	21.00
7/10	20.56	20.50	21.00
7/11	20.56	20.50	21.00
7/12	20.58	20.50	21.00
7/13	20.58	20.50	21.00
7/14	20.52	20.50	21.00
7/15	20.50	20.50	20.50
7/16	20.50	20.50	20.50
7/17	20.50	20.50	20.50
7/18	20.50	20.50	20.50
7/19	20.50	20.50	20.50
7/20	20.52	20.50	21.00
7/21	20.52	20.50	21.00
7/22	20.50	20.50	20.50
7/23	20.50	20.50	20.50
7/24	20.27	20.00	20.50
7/25	20.04	20.00	20.50
7/26	20.08	20.00	20.50
7/27	20.06	20.00	20.50
7/28	20.04	20.00	20.50
7/29	20.00	20.00	20.00
7/30	20.04	20.00	20.50
7/31	20.04	20.00	20.50
8/ 1	20.04	20.00	20.50
8/ 2	20.00	20.00	20.00

TABLE C-293 (CONT.) NORTH FORK WILLOW CREEK
DOWNSTREAM OF BASS LAKE
(11.50 KM UPSTREAM OF NORTH FORK DIVERSION)
1984 MEAN, MINIMUM, AND MAXIMUM TEMPERATURES

DATE	MEAN TEMPERATURE (C)	MINIMUM TEMPERATURE (C)	MAXIMUM TEMPERATURE (C)
8/ 3	20.00	20.00	20.00
8/ 4	19.90	19.50	20.00
8/ 5	19.60	19.50	20.00
8/ 6	19.54	19.50	20.00
8/ 7	19.52	19.50	20.00
8/ 8	19.50	19.50	19.50
8/ 9	19.50	19.50	19.50
8/10	19.50	19.50	19.50
8/11	19.50	19.50	19.50
8/12	19.50	19.50	19.50
8/13	19.40	19.00	19.50
8/14	18.99	18.80	19.70
8/15	18.57	18.40	18.80
8/16	18.37	18.30	18.40
8/17	18.16	18.10	18.30
8/18	18.10	18.00	18.20
8/19	17.95	17.80	18.10
8/20	17.76	17.60	17.90
8/21	17.58	17.40	17.60
8/22	17.34	17.20	17.40
8/23	17.08	16.90	17.20
8/24	16.74	16.50	16.90
8/25	16.35	16.20	16.50
8/26	16.06	15.90	16.20
8/27	15.76	15.60	15.80
8/28	15.47	15.30	15.60
8/29	15.15	15.00	15.30
8/30	14.82	14.50	15.00
8/31	14.42	14.20	14.60
9/ 1	14.06	13.90	14.20
9/ 2	13.74	13.60	13.90
9/ 3	13.42	13.20	13.60
9/ 4	13.22	13.10	13.30
9/ 5	13.05	12.90	13.20
9/ 6	12.89	12.80	13.00
9/ 7	12.70	12.50	12.80
9/ 8	12.54	12.50	12.70
9/ 9	12.49	12.40	12.70
9/10	12.46	12.40	12.70
9/11	12.43	12.40	12.50
9/12	12.43	12.40	12.50
9/13	12.45	12.40	12.60
9/14	12.48	12.40	12.70
9/15	12.45	12.40	12.70

TABLE C-293 (CONT.) NORTH FORK WILLOW CREEK
DOWNSTREAM OF BASS LAKE
(11.50 KM UPSTREAM OF NORTH FORK DIVERSION)
1984 MEAN, MINIMUM, AND MAXIMUM TEMPERATURES

DATE	MEAN TEMPERATURE (C)	MINIMUM TEMPERATURE (C)	MAXIMUM TEMPERATURE (C)
9/16	12.45	12.40	12.70
9/17	12.50	12.40	12.70
9/18	12.53	12.40	12.70
9/19	12.54	12.50	12.70
9/20	12.64	12.50	12.80
9/21	12.77	12.70	12.90
9/22	12.84	12.80	12.90
9/23	12.84	12.80	12.90
9/24	12.83	12.80	12.90
9/25	12.80	12.70	12.90
9/26	12.83	12.80	12.90
9/27	12.84	12.80	12.90
9/28	12.76	12.50	12.90
9/29	12.59	12.50	12.80
9/30	12.53	12.40	12.70
10/ 1	12.49	12.40	12.60
10/ 2	12.48	12.40	12.60
10/ 3	12.50	12.40	12.70
10/ 4	12.52	12.40	12.70
10/ 5	12.54	12.50	12.70
10/ 6	12.50	12.40	12.70
10/ 7	12.49	12.40	12.70
10/ 8	12.48	12.40	12.70
10/ 9	12.49	12.40	12.70
10/10	12.49	12.40	12.60
10/11	12.46	12.40	12.50
10/12	12.37	12.30	12.50
10/13	12.39	12.30	12.50
10/14	12.37	12.20	12.50
10/15	12.23	12.10	12.40
10/16	12.09	11.90	12.20
10/17	12.10	12.00	12.20
10/18	12.04	12.00	12.10
10/19	12.08	12.00	12.10
10/20	12.06	12.00	12.10
10/21	11.98	11.90	12.10
10/22	11.92	11.80	12.10
10/23	11.89	11.80	12.00
10/24	11.90	11.80	12.10
10/25	11.87	11.80	12.00
10/26	11.85	11.70	12.00
10/27	11.78	11.70	12.00
10/28	11.75	11.60	12.00
10/29	11.75	11.70	11.90

TABLE C-293 (CONT.) NORTH FORK WILLOW CREEK
DOWNSTREAM OF BASS LAKE
(11.50 KM UPSTREAM OF NORTH FORK DIVERSION)
1984 MEAN, MINIMUM, AND MAXIMUM TEMPERATURES

DATE	MEAN TEMPERATURE (C)	MINIMUM TEMPERATURE (C)	MAXIMUM TEMPERATURE (C)
10/30	11.76	11.70	11.90
10/31	11.68	11.50	11.90
11/ 1	11.66	11.60	11.80
11/ 2	11.66	11.50	11.90
11/ 3	11.66	11.60	11.80
11/ 4	11.64	11.60	11.80
11/ 5	11.60	11.50	11.70
11/ 6	11.60	11.50	11.70
11/ 7	11.57	11.50	11.70

TABLE C-294. NORTH FORK WILLOW CREEK
DOWNSTREAM OF BASS LAKE
(7.08 KM UPSTREAM OF NORTH FORK DIVERSION)
1984 MEAN, MINIMUM, AND MAXIMUM TEMPERATURES

DATE	MEAN TEMPERATURE (C)	MINIMUM TEMPERATURE (C)	MAXIMUM TEMPERATURE (C)
8/15 [1]	20.77	20.40	20.90
8/16	20.36	19.20	21.40
8/17	20.75	19.60	21.90
8/18	20.95	19.90	21.90
8/19	20.46	19.30	21.40
8/20	19.66	18.40	20.70
8/21	19.59	18.30	20.80
8/22	19.98	18.80	21.10
8/23	20.10	18.90	21.10
8/24	19.65	18.60	20.60
8/25	18.87	17.80	19.60
8/26	18.88	17.60	20.10
8/27	19.33	18.10	20.50
8/28	19.74	18.50	21.00
8/29	20.37	19.30	21.50
8/30	20.47	19.50	21.30
8/31	19.58	18.70	20.40
9/ 1	18.57	17.50	19.50
9/ 2	18.29	17.20	19.30
9/ 3	18.41	17.40	19.40
9/ 4	18.69	17.70	19.60
9/ 5	19.28	18.40	20.10
9/ 6	19.38	18.60	20.20
9/ 7	18.58	17.60	19.40
9/ 8	18.39	17.40	19.20
9/ 9	18.64	17.70	19.40
9/10	18.65	17.80	19.40
9/11	18.79	18.00	19.50
9/12	18.75	17.80	19.70
9/13	18.81	17.90	19.80
9/14	18.69	17.80	19.50
9/15	18.40	17.40	19.10
9/16	18.37	17.60	19.00
9/17	18.95	17.80	20.20
9/18	20.29	19.50	21.10 e
9/19	20.03	19.20	20.70
9/20	19.72	19.10	20.40
9/21	18.43	17.80	19.20
9/22	17.71	16.90	18.70
9/23	14.80	14.00	16.70
9/24	13.79	13.20	14.30

[1] INSTRUMENT STOLEN

TABLE C-294 (CONT.) NORTH FORK WILLOW CREEK
DOWNSTREAM OF BASS LAKE
(7.08 KM UPSTREAM OF NORTH FORK DIVERSION)
1984 MEAN, MINIMUM, AND MAXIMUM TEMPERATURES

DATE	MEAN TEMPERATURE (C)	MINIMUM TEMPERATURE (C)	MAXIMUM TEMPERATURE (C)
9/25	13.26	12.20	14.10
9/26	13.82	12.70	15.00
9/27	14.51	13.50	15.50
9/28	14.78	13.80	15.70
9/29	14.73	13.80	15.60
9/30	14.26	13.70	15.00
10/ 1	13.35	12.80	13.90
10/ 2	12.95	12.10	13.70
10/ 3	13.14	12.20	13.90
10/ 4	13.27	12.30	14.00
10/ 5	13.40	12.50	14.10
10/ 6	13.38	12.40	14.20
10/ 7	13.51	12.50	14.40
10/ 8	13.60	12.60	14.40
10/ 9	13.60	12.70	14.30
10/10	13.57	12.70	14.30
10/11	13.21	12.70	13.80
10/12	12.34	11.70	12.80
10/13	12.17	11.30	12.90
10/14	12.55	12.20	12.90
10/15	11.23	10.70	12.10
10/16	9.73	9.30	10.60
10/17	9.76	9.30	10.20
10/18	8.82	8.30	9.20
10/19	9.38	8.90	10.00
10/20	10.02	9.70	10.30
10/21	9.72	9.20	10.10
10/22	9.35	8.60	9.90
10/23	9.17	8.40	9.90
10/24	9.30	8.60	10.00
10/25	9.25	8.50	9.90
10/26	9.30	8.80	9.80
10/27	9.23	8.70	9.60
10/28	8.86	8.30	9.30
10/29	8.82	8.20	9.40
10/30	9.34	8.60	10.20
10/31	9.46	8.90	9.80
11/ 1	8.81	8.20	9.30
11/ 2	8.57	7.80	9.30
11/ 3	9.28	8.70	9.80
11/ 4	9.07	8.50	9.60
11/ 5	8.79	8.20	9.30
11/ 6	9.19	8.60	9.80
11/ 7	9.40	9.00	9.60
11/ 8	8.96	8.70	9.40

TABLE C-295. MANZANITA LAKE AT DIVERSION
(OUTLET TO DITCH NUMBER TWO)
(4.83 KM UPSTREAM OF NORTH FORK DIVERSION)
1984 MEAN, MINIMUM, AND MAXIMUM TEMPERATURES

DATE	MEAN TEMPERATURE (C)	MINIMUM TEMPERATURE (C)	MAXIMUM TEMPERATURE (C)	
6/21	14.38	14.00	14.50	
6/22	14.98	14.50	15.50	
6/23	16.19	15.50	17.50	
6/24	17.88	17.00	19.00	
6/25	20.00	19.00	21.50	
6/26	21.79	21.00	23.00	
6/27	19.21	13.50	22.50	
6/28	13.21	12.00	15.00	
6/29	12.69	11.50	14.00	
6/30	14.19	13.50	15.00	
7/ 1	15.83	15.00	17.00	
7/ 2	16.29	12.50	20.50	
7/ 3	13.02	12.00	14.50	
7/ 4	13.00	12.00	14.50	
7/ 5	12.96	12.00	14.50	
7/ 6	13.54	12.00	15.00	
7/ 7	15.48	15.00	16.00	
7/ 8	16.75	16.00	18.00	
7/ 9	16.88	13.00	19.00	
7/10	13.08	11.50	15.00	
7/11	13.13	11.50	15.00	
7/12	13.40	12.00	15.50	
7/13	13.46	12.00	15.50	
7/14	13.15	12.50	14.00	
7/15	13.98	13.50	14.50	
7/16	15.71	14.00	18.00	
7/17	13.96	13.00	15.50	
7/18	13.63	12.50	15.50	
7/19	13.69	12.50	15.50	
7/20	13.83	12.50	15.00	
7/21	15.48	15.00	16.50	
7/22	16.40	16.00	17.50	
7/23	17.38	16.50	18.50	
7/24	18.52	18.00	19.50	
7/25	20.31	19.50	21.50	
7/26	21.96	21.50	22.50	
7/27	22.83	22.00	23.50	
7/28	23.63	23.00	24.00	
7/29	23.73	23.00	24.50	e
7/30	20.48	14.00	24.50	
7/31	13.98	13.00	15.50	
8/ 1	13.88	12.50	16.00	
8/ 2	13.90	12.50	15.50	
8/ 3	13.94	12.50	15.50	

TABLE C-295 (CONT.) MANZANITA LAKE AT DIVERSION
(OUTLET TO DITCH NUMBER TWO)
(4.83 KM UPSTREAM OF NORTH FORK DIVERSION)
1984 MEAN, MINIMUM, AND MAXIMUM TEMPERATURES

DATE	MEAN TEMPERATURE (C)	MINIMUM TEMPERATURE (C)	MAXIMUM TEMPERATURE (C)
8/ 4	15.81	15.00	16.50
8/ 5	16.94	16.50	18.00
8/ 6	17.08	14.00	19.00
8/ 7	14.10	13.00	16.00
8/ 8	14.10	13.00	16.00
8/ 9	14.35	13.00	16.50
8/10	14.48	13.50	16.00
8/11	14.50	13.50	16.00
8/12	14.40	13.50	16.00
8/13	14.53	13.50	16.80
8/14	14.27	12.90	16.00
8/15	13.96	13.30	14.60
8/16	14.59	13.30	16.30
8/17	14.90	13.60	16.80
8/18	15.06	13.70	17.10
8/19	15.03	13.70	16.80
8/20	15.04	13.70	16.70
8/21	15.40	14.20	16.90
8/22	15.68	14.70	17.20
8/23	15.87	14.70	17.20
8/24	15.98	14.80	17.30
8/25	16.02	15.10	17.10
8/26	16.55	15.40	18.10
8/27	16.88	15.90	18.30
8/28	17.26	16.20	18.70
8/29	17.55	16.40	19.20
8/30	17.78	16.70	19.10
8/31	17.85	16.60	19.40
9/ 1	18.13	16.90	19.70
9/ 2	18.48	17.30	20.10
9/ 3	18.95	17.80	20.30
9/ 4	19.29	18.20	20.80
9/ 5	19.60	18.70	21.00
9/ 6	19.84	19.00	21.00
9/ 7	19.90	18.80	21.30
9/ 8	20.23	19.20	21.60
9/ 9	20.47	19.60	21.70
9/10	20.57	19.60	21.80
9/11	20.70	20.10	21.60
9/12	21.06	20.20	22.30
9/13	21.09	20.20	22.40
9/14	21.48	20.30	22.60
9/15	22.11	21.60	22.90
9/16	22.46	21.80	23.60

TABLE C-295 (CONT.) MANZANITA LAKE AT DIVERSION
(OUTLET TO DITCH NUMBER TWO)
(4.83 KM UPSTREAM OF NORTH FORK DIVERSION)
1984 MEAN, MINIMUM, AND MAXIMUM TEMPERATURES

DATE	MEAN TEMPERATURE (C)	MINIMUM TEMPERATURE (C)	MAXIMUM TEMPERATURE (C)
9/17	22.23	20.90	23.10
9/18	21.21	20.30	22.70
9/19	21.28	20.30	22.60
9/20	20.88	20.30	21.70
9/21	20.45	19.90	21.10
9/22	20.61	20.20	21.20
9/23	20.17	19.80	20.60
9/24	19.48	19.10	20.10
9/25	19.79	18.70	21.20
9/26	20.04	19.10	21.30
9/27	19.95	19.00	21.30
9/28	19.77	18.80	21.10
9/29	19.25	18.70	20.00
9/30	18.99	18.60	19.40
10/ 1	18.19	17.80	18.60
10/ 2	17.94	17.20	18.90
10/ 3	18.47	17.60	19.70
10/ 4	18.32	17.40	19.40
10/ 5	18.30	17.30	19.20
10/ 6	18.47	18.10	18.90
10/ 7	18.26	17.90	18.70
10/ 8	18.25	17.70	19.00
10/ 9	17.91	17.10	19.10
10/10	17.85	17.00	19.10
10/11	17.28	16.90	17.60
10/12	17.13	16.30	17.90
10/13	17.19	16.80	17.70
10/14	17.04	16.60	17.50
10/15	16.16	15.50	16.60
10/16	15.65	15.40	15.90
10/17	15.74	15.10	16.70
10/18	15.25	14.50	16.10
10/19	15.26	14.90	15.70
10/20	15.10	14.90	15.20
10/21	14.62	14.30	14.90
10/22	14.22	13.60	14.90
10/23	14.31	13.50	15.30
10/24	14.28	13.50	15.20
10/25	14.20	13.40	15.20
10/26	13.90	13.60	14.20
10/27	13.51	13.30	13.80
10/28	12.93	12.70	13.20
10/29	12.56	12.30	12.90
10/30	12.57	12.30	13.20

TABLE C-295 (CONT.) MANZANITA LAKE AT DIVERSION
(OUTLET TO DITCH NUMBER TWO)
(4.83 KM UPSTREAM OF NORTH FORK DIVERSION)
1984 MEAN, MINIMUM, AND MAXIMUM TEMPERATURES

DATE	MEAN TEMPERATURE (C)	MINIMUM TEMPERATURE (C)	MAXIMUM TEMPERATURE (C)
10/31	12.53	12.40	12.90
11/ 1	12.20	11.90	12.70
11/ 2	11.99	11.70	12.50
11/ 3	12.13	11.90	12.50
11/ 4	11.93	11.70	12.20
11/ 5	11.69	11.60	12.00
11/ 6	11.71	11.60	12.20

TABLE C-296. NORTH FORK WILLOW CREEK
DOWNSTREAM OF MANZANITA LAKE
(4.82 KM UPSTREAM OF NORTH FORK DIVERSION)
1984 MEAN, MINIMUM, AND MAXIMUM TEMPERATURES

DATE	MEAN TEMPERATURE (C)	MINIMUM TEMPERATURE (C)	MAXIMUM TEMPERATURE (C)	
6/21	22.13	22.00	22.50	
6/22	21.54	20.00	23.00	
6/23	21.52	20.00	22.50	
6/24	21.96	20.50	23.50	
6/25	22.67	21.50	24.00	
6/26	23.31	22.00	24.50	
6/27	22.50	21.50	23.50	
6/28	22.02	20.50	23.50	
6/29	21.83	20.50	23.00	
6/30	20.79	19.50	22.00	
7/ 1	21.23	19.50	23.00	
7/ 2	22.77	21.00	24.50	
7/ 3	22.77	22.00	23.50	
7/ 4	22.60	21.00	24.00	
7/ 5	22.98	21.50	24.00	
7/ 6	23.29	22.00	24.50	
7/ 7	23.13	22.00	24.50	
7/ 8	22.67	21.00	24.00	
7/ 9	22.52	21.00	24.50	
7/10	22.42	20.50	24.00	
7/11	22.13	20.50	23.50	
7/12	22.02	20.50	23.50	
7/13	22.25	20.50	23.50	
7/14	22.42	21.50	23.00	
7/15	22.58	21.50	23.50	
7/16	23.27	22.00	24.50	
7/17	24.17	23.00	25.50	e
7/18	24.17	23.00	25.00	
7/19	23.96	22.50	25.00	
7/20	23.46	22.50	24.50	
7/21	22.31	21.50	23.00	
7/22	20.65	19.50	21.50	
7/23	20.75	19.50	22.50	
7/24	21.75	20.50	23.00	
7/25	22.42	21.00	24.00	
7/26	22.69	21.00	24.00	
7/27	23.46	22.00	25.00	
7/28	23.81	22.50	25.00	
7/29	23.75	22.50	25.00	
7/30	23.92	22.50	25.00	
7/31	22.48	21.50	24.00	
8/ 1	20.15	19.50	21.50	
8/ 2	19.13	18.50	19.50	
8/ 3	18.48	17.50	19.00	

TABLE C-296 (CONT.) NORTH FORK WILLOW CREEK
DOWNSTREAM OF MANZANITA LAKE
(4.82 KM UPSTREAM OF NORTH FORK DIVERSION)
1984 MEAN, MINIMUM, AND MAXIMUM TEMPERATURES

DATE	MEAN TEMPERATURE (C)	MINIMUM TEMPERATURE (C)	MAXIMUM TEMPERATURE (C)
8/ 4	18.63	17.50	19.50
8/ 5	19.69	18.50	21.00
8/ 6	20.48	19.00	22.00
8/ 7	20.02	19.00	21.00
8/ 8	19.15	18.50	19.50
8/ 9	19.08	18.00	20.00
8/10	19.19	18.50	19.50
8/11	18.98	18.50	19.50
8/12	18.67	18.00	19.00
8/13	18.40	18.00	19.10
8/14	17.87	17.00	18.50
8/15	17.38	16.90	17.80
8/16	17.50	16.20	18.70
8/17	18.30	17.20	19.40
8/18	18.74	17.70	19.70
8/19	18.65	17.70	19.40
8/20	18.38	17.30	19.20
8/21	18.42	17.40	19.30
8/22	18.58	17.60	19.70
8/23	18.63	17.60	19.70
8/24	18.47	17.60	19.30
8/25	18.18	17.30	18.90
8/26	18.41	17.20	19.60
8/27	19.04	17.80	20.30
8/28	19.56	18.40	20.80
8/29	20.05	18.90	21.20
8/30	20.22	19.20	21.20
8/31	19.88	18.70	20.90
9/ 1	19.48	18.10	20.50
9/ 2	19.60	18.30	20.70
9/ 3	19.96	18.70	21.00
9/ 4	20.37	19.20	21.30
9/ 5	20.90	19.90	21.80
9/ 6	20.95	19.90	21.90
9/ 7	20.63	19.40	21.50
9/ 8	20.72	19.50	21.60
9/ 9	20.92	19.80	21.80
9/10	21.00	19.80	21.90
9/11	21.11	20.10	21.90
9/12	21.23	20.20	22.30
9/13	21.37	20.40	22.30
9/14	21.33	20.20	22.30
9/15	21.29	20.20	22.20
9/16	21.46	20.30	22.30

TABLE C-296 (CONT.) NORTH FORK WILLOW CREEK
DOWNSTREAM OF MANZANITA LAKE
(4.82 KM UPSTREAM OF NORTH FORK DIVERSION)
1984 MEAN, MINIMUM, AND MAXIMUM TEMPERATURES

DATE	MEAN TEMPERATURE (C)	MINIMUM TEMPERATURE (C)	MAXIMUM TEMPERATURE (C)
9/17	21.22	20.70	22.30
9/18	20.85	20.30	22.00
9/19	20.82	20.20	22.00
9/20	20.59	20.20	21.30
9/21	20.36	19.70	21.20
9/22	19.90	19.10	20.50
9/23	19.55	19.00	20.00
9/24	18.86	18.40	19.50
9/25	18.70	18.20	19.30
9/26	18.41	17.60	19.30
9/27	18.48	17.60	19.30
9/28	18.48	17.60	19.20
9/29	18.22	17.50	18.80
9/30	18.40	18.10	18.70
10/ 1	17.80	17.00	18.30
10/ 2	16.73	15.80	17.40
10/ 3	16.60	15.70	17.40
10/ 4	16.58	15.70	17.30
10/ 5	16.56	15.80	17.30
10/ 6	16.43	15.60	17.20
10/ 7	16.49	15.60	17.20
10/ 8	16.56	15.80	17.20
10/ 9	16.48	15.70	17.20
10/10	16.39	15.50	17.10
10/11	15.81	15.00	16.30
10/12	14.81	14.00	15.50
10/13	14.71	13.80	15.40
10/14	14.90	14.20	15.40
10/15	13.57	12.90	14.20
10/16	12.10	11.50	12.80
10/17	11.78	11.20	12.60
10/18	11.24	10.40	12.00
10/19	11.71	11.20	12.20
10/20	12.08	11.60	12.50
10/21	11.80	11.20	12.20
10/22	11.52	10.80	12.10
10/23	11.36	10.60	11.90
10/24	11.42	10.80	12.00
10/25	11.31	10.60	11.80
10/26	11.35	10.90	11.70
10/27	11.21	10.70	11.60
10/28	11.07	10.70	11.30
10/29	11.46	11.10	11.70
10/30	11.90	11.60	12.20

TABLE C-296 (CONT.) NORTH FORK WILLOW CREEK
DOWNSTREAM OF MANZANITA LAKE
(4.82 KM UPSTREAM OF NORTH FORK DIVERSION)
1984 MEAN, MINIMUM, AND MAXIMUM TEMPERATURES

DATE	MEAN TEMPERATURE (C)	MINIMUM TEMPERATURE (C)	MAXIMUM TEMPERATURE (C)
10/31	11.93	11.60	12.20
11/ 1	11.38	10.90	11.70
11/ 2	11.28	10.90	11.60
11/ 3	11.58	11.20	11.80
11/ 4	11.51	11.10	11.70
11/ 5	11.30	10.90	11.60
11/ 6	11.56	11.20	11.90

TABLE C-297. NORTH FORK WILLOW CREEK
UPSTREAM OF NORTH FORK DIVERSION
(0.40 KM UPSTREAM OF NORTH FORK DIVERSION)
1984 MEAN, MINIMUM, AND MAXIMUM TEMPERATURES

DATE	MEAN TEMPERATURE (C)	MINIMUM TEMPERATURE (C)	MAXIMUM TEMPERATURE (C)
6/21	17.50	17.00	18.00
6/22	17.58	16.00	19.50
6/23	18.23	16.50	20.50
6/24	18.73	17.50	20.50
6/25	19.13	17.50	20.50
6/26	19.50	18.00	21.00
6/27	20.58	18.50	23.00
6/28	20.71	19.50	22.00
6/29	20.19	19.00	22.00
6/30	19.52	18.00	21.50
7/ 1	19.96	18.00	22.00
7/ 2	20.94	19.00	23.00
7/ 3	21.42	20.00	22.50
7/ 4	22.42	21.00	24.00
7/ 5	22.90	21.50	24.50
7/ 6	23.17	21.50	25.00
7/ 7	22.81	21.00	25.00
7/ 8	21.81	19.50	24.00
7/ 9	20.98	18.50	23.50
7/10	21.02	18.50	24.00
7/11	21.17	18.50	24.00
7/12	21.06	18.50	23.50
7/13	21.38	19.00	23.50
7/14	21.40	20.00	22.50
7/15	22.08	20.50	24.00
7/16	23.10	21.00	25.00
7/17	24.06	22.00	26.50 e
7/18	24.08	22.00	26.00
7/19	23.92	22.00	26.00
7/20	23.42	21.50	25.50
7/21	22.17	21.00	23.50
7/22	20.31	19.00	21.50
7/23	20.79	19.00	23.00
7/24	20.77	19.00	23.00
7/25	19.48	18.00	21.50
7/26	19.92	18.00	22.00
7/27	20.73	18.50	23.00
7/28	20.96	19.00	23.00
7/29	20.77	18.50	23.00
7/30	21.21	18.50	23.50
7/31	21.60	19.00	23.50
8/ 1	21.63	19.00	24.00
8/ 2	21.19	19.00	24.00
8/ 3	20.56	18.00	23.00

TABLE C-297 (CONT.) NORTH FORK WILLOW CREEK
UPSTREAM OF NORTH FORK DIVERSION
(0.40 KM UPSTREAM OF NORTH FORK DIVERSION)
1984 MEAN, MINIMUM, AND MAXIMUM TEMPERATURES

DATE	MEAN TEMPERATURE (C)	MINIMUM TEMPERATURE (C)	MAXIMUM TEMPERATURE (C)
8/ 4	20.40	18.00	23.00
8/ 5	20.33	18.00	23.00
8/ 6	20.29	18.00	22.50
8/ 7	20.65	18.00	23.50
8/ 8	21.04	18.50	23.50
8/ 9	21.33	18.50	24.00
8/10	21.63	19.50	23.50
8/11	21.50	19.50	23.50
8/12	21.06	19.50	22.50
8/13	21.29	19.00	23.50
8/14	20.80	19.00	23.30
8/15	20.29	19.80	20.90
8/16	20.52	18.70	22.40
8/17	20.91	18.90	22.80
8/18	21.18	19.40	23.20
8/19	20.82	18.90	22.80
8/20	20.26	18.30	22.30
8/21	20.36	18.40	22.20
8/22	20.02	18.90	21.00
8/23	19.82	18.60	21.20
8/24	19.43	18.40	20.80
8/25	18.73	17.70	19.80
8/26	18.90	17.50	20.40
8/27	19.57	18.20	21.20
8/28	20.17	18.60	21.80
8/29	20.82	19.30	22.50
8/30	20.65	19.40	21.90
8/31	19.66	18.50	21.10
9/ 1	18.67	17.20	20.20
9/ 2	18.66	16.90	20.30
9/ 3	19.03	17.30	20.80
9/ 4	19.43	17.60	21.20
9/ 5	19.85	18.30	21.40
9/ 6	19.72	18.30	21.30
9/ 7	19.03	17.40	20.70
9/ 8	19.10	17.30	20.80
9/ 9	19.24	17.70	20.50
9/10	19.37	17.80	21.00
9/11	19.47	18.00	20.90
9/12	19.45	18.20	20.80
9/13	19.41	18.20	21.00
9/14	19.21	17.70	20.80
9/15	19.02	17.40	20.60
9/16	19.21	17.60	20.80

TABLE C-297 (CONT.) NORTH FORK WILLOW CREEK
UPSTREAM OF NORTH FORK DIVERSION
(0.40 KM UPSTREAM OF NORTH FORK DIVERSION)
1984 MEAN, MINIMUM, AND MAXIMUM TEMPERATURES

DATE	MEAN TEMPERATURE (C)	MINIMUM TEMPERATURE (C)	MAXIMUM TEMPERATURE (C)
9/17	19.63	17.90	21.30
9/18	21.54	20.70	22.10
9/19	21.42	20.80	21.90
9/20	21.11	20.60	21.60
9/21	19.93	19.30	20.40
9/22	18.92	18.20	19.90
9/23	18.24	17.60	18.90
9/24	17.95	17.30	18.50
9/25	16.81	15.90	17.40
9/26	16.66	15.70	17.70
9/27	17.05	16.00	18.20
9/28	16.89	15.70	17.90
9/29	16.51	15.40	17.70
9/30	15.84	14.90	16.60
10/ 1	15.36	14.90	15.80
10/ 2	14.75	14.00	15.40
10/ 3	14.75	13.90	15.60
10/ 4	14.68	13.80	15.40
10/ 5	14.75	13.90	15.60
10/ 6	14.71	13.80	15.60
10/ 7	14.83	13.80	15.70
10/ 8	14.78	13.80	15.70
10/ 9	14.73	13.80	15.60
10/10	14.60	13.70	15.40
10/11	14.20	13.70	14.60
10/12	13.19	12.50	13.80
10/13	13.05	12.20	13.80
10/14	13.35	12.80	13.80
10/15	11.86	11.20	12.60
10/16	10.48	10.20	11.10
10/17	10.90	10.30	11.50
10/18	10.04	9.40	10.40
10/19	10.70	10.20	11.30
10/20	11.24	10.90	11.70
10/21	10.86	10.30	11.30
10/22	10.40	9.80	10.90
10/23	10.07	9.40	10.70
10/24	10.09	9.50	10.70
10/25	10.10	9.50	10.70
10/26	10.33	9.80	11.00
10/27	10.19	9.70	10.70
10/28	9.54	9.00	10.00
10/29	10.12	9.10	11.10
10/30	11.14	10.30	12.00

TABLE C-297 (CONT.) NORTH FORK WILLOW CREEK
UPSTREAM OF NORTH FORK DIVERSION
(0.40 KM UPSTREAM OF NORTH FORK DIVERSION)
1984 MEAN, MINIMUM, AND MAXIMUM TEMPERATURES

DATE	MEAN TEMPERATURE (C)	MINIMUM TEMPERATURE (C)	MAXIMUM TEMPERATURE (C)
10/31	11.25	10.80	11.70
11/ 1	10.47	9.80	11.10
11/ 2	10.51	9.80	11.30
11/ 3	11.00	10.50	11.40
11/ 4	10.63	10.00	11.20
11/ 5	10.60	9.90	11.30
11/ 6	11.10	10.60	11.60
11/ 7	11.33	10.90	11.60

TABLE C-298. WILLOW CREEK
AT PGandE GAGE W26
(6.92 KM UPSTREAM OF THE SAN JOAQUIN RIVER)
1984 MEAN, MINIMUM, AND MAXIMUM TEMPERATURES

DATE	MEAN TEMPERATURE (C)	MINIMUM TEMPERATURE (C)	MAXIMUM TEMPERATURE (C)
6/21	21.65	21.00	22.00
6/22	19.83	18.50	22.00
6/23	20.77	19.50	21.50
6/24	22.25	21.50	23.00
6/25	23.25	22.50	24.00
6/26	23.90	23.00	24.50
6/27	23.69	23.00	24.50
6/28	21.69	21.00	22.50
6/29	22.40	21.50	23.00
6/30	22.65	21.50	23.50
7/ 1	23.31	22.50	24.00
7/ 2	24.46	24.00	25.00
7/ 3	25.58	25.00	26.50
7/ 4	26.48	26.00	27.00
7/ 5	26.92	26.00	27.50 e
7/ 6	25.98	25.00	27.00
7/ 7	25.96	25.00	26.50
7/ 8	25.00	24.00	26.50
7/ 9	23.79	22.50	25.50
7/10	23.27	22.00	24.50
7/11	23.42	22.00	24.00
7/12	23.83	22.50	24.50
7/13	24.60	24.00	25.00
7/14	25.21	25.00	25.50
7/15	25.60	25.00	26.00
7/16	25.90	25.00	26.50
7/17	26.52	26.00	27.50
7/18	26.67	25.50	27.50
7/19	26.58	25.50	27.50
7/20	26.04	25.00	27.00
7/21	25.65	25.00	27.00
7/22	23.40	22.50	25.00
7/23	22.96	22.00	24.00
7/24	23.79	22.50	25.00
7/25	23.92	22.50	25.00
7/26	23.63	22.50	25.00
7/27	24.33	23.00	25.50
7/28	24.71	23.50	26.00
7/29	24.13	22.50	25.50
7/30	24.25	22.50	25.50
7/31	24.81	23.50	26.00
8/ 1	24.75	23.00	26.00
8/ 2	24.50	23.00	26.00
8/ 3	23.79	22.00	25.50

TABLE C-298 (CONT.) WILLOW CREEK
AT PGandE GAGE W26
(6.92 KM UPSTREAM OF THE SAN JOAQUIN RIVER)
1984 MEAN, MINIMUM, AND MAXIMUM TEMPERATURES

DATE	MEAN TEMPERATURE (C)	MINIMUM TEMPERATURE (C)	MAXIMUM TEMPERATURE (C)
8/ 4	23.65	22.00	25.00
8/ 5	23.71	22.00	25.50
8/ 6	23.54	21.50	25.00
8/ 7	23.94	22.00	26.00
8/ 8	24.48	22.50	26.50
8/ 9	24.98	23.00	26.50
8/10	25.17	24.50	26.50
8/11	24.60	23.00	26.50
8/12	24.73	23.50	26.00
8/13	24.73	23.00	26.50
8/14	24.50	23.00	26.00
8/15	24.08	23.20	25.10
8/16	23.48	21.50	25.70
8/17	24.54	22.60	26.40
8/18	25.12	23.20	27.10
8/19	24.70	22.70	26.80
8/20	23.80	21.60	25.70
8/21	23.95	21.80	25.90
8/22	21.27	18.50	24.40
8/23	19.78	19.30	20.20
8/24	20.57	20.20	21.10
8/25	20.80	20.10	21.20
8/26	20.91	20.20	21.40
8/27	21.77	21.10	22.40
8/28	22.76	21.90	23.30
8/29	23.78	22.80	24.50
8/30	24.12	23.10	24.60
8/31	22.92	21.60	24.10
9/ 1	21.88	20.40	23.00
9/ 2	21.76	20.30	22.60
9/ 3	22.16	20.80	23.00
9/ 4	22.49	21.20	23.10
9/ 5	23.24	22.20	23.90
9/ 6	23.13	21.90	23.90
9/ 7	22.15	20.80	23.20
9/ 8	22.19	20.90	23.10
9/ 9	22.44	21.20	23.20
9/10	22.43	21.10	23.30
9/11	22.66	21.50	23.60
9/12	22.88	21.60	23.70
9/13	22.99	21.80	24.10
9/14	22.72	21.20	23.70
9/15	22.52	20.90	23.60
9/16	22.63	21.10	23.90

TABLE C-298 (CONT.) WILLOW CREEK
AT PGandE GAGE W26
(6.92 KM UPSTREAM OF THE SAN JOAQUIN RIVER)
1984 MEAN, MINIMUM, AND MAXIMUM TEMPERATURES

DATE	MEAN TEMPERATURE (C)	MINIMUM TEMPERATURE (C)	MAXIMUM TEMPERATURE (C)
9/17	23.03	21.40	24.20
9/18	22.02	19.30	24.00
9/19	21.12	19.40	23.30
9/20	20.63	19.30	22.60
9/21	19.15	17.20	20.80
9/22	18.35	17.10	19.30
9/23	17.84	15.70	19.40
9/24	17.05	15.60	18.70
9/25	16.34	13.90	20.00
9/26	16.04	15.30	17.30
9/27	16.51	15.70	17.90
9/28	16.93	16.00	17.80
9/29	16.88	15.90	17.60
9/30	16.40	15.80	17.20
10/ 1	14.07	13.20	15.60
10/ 2	14.44	13.60	15.20
10/ 3	14.82	13.70	15.50
10/ 4	15.30	14.40	15.80
10/ 5	15.64	14.70	16.10
10/ 6	15.69	14.70	16.20
10/ 7	16.00	15.10	16.60
10/ 8	16.13	15.20	16.60
10/ 9	16.20	15.20	16.70
10/10	16.28	15.50	16.90
10/11	16.38	15.50	17.00
10/12	13.81	13.00	15.20
10/13	13.79	13.10	14.20
10/14	14.58	14.20	14.80
10/15	12.67	12.00	14.00
10/16	11.45	10.80	12.60
10/17	10.64	10.10	11.10
10/18	9.56	8.80	10.60
10/19	10.58	9.90	11.20
10/20	11.56	11.20	11.90
10/21	11.15	10.70	12.00
10/22	10.92	10.30	11.40
10/23	10.68	9.90	11.30
10/24	11.03	10.40	11.40
10/25	11.03	10.30	11.40
10/26	11.28	11.00	11.70
10/27	10.75	10.10	11.40
10/28	10.16	9.50	11.10
10/29	10.34	9.50	10.70
10/30	9.98	9.10	11.30

TABLE C-298 (CONT.) WILLOW CREEK
AT PGandE GAGE W26
(6.92 KM UPSTREAM OF THE SAN JOAQUIN RIVER)
1984 MEAN, MINIMUM, AND MAXIMUM TEMPERATURES

DATE	MEAN TEMPERATURE (C)	MINIMUM TEMPERATURE (C)	MAXIMUM TEMPERATURE (C)
10/31	9.63	8.90	10.10
11/ 1	9.59	8.10	11.20
11/ 2	9.20	7.80	10.60
11/ 3	10.41	9.20	11.60
11/ 4	9.31	8.50	11.00
11/ 5	8.66	8.20	9.40
11/ 6	9.87	8.80	11.20
11/ 7	10.98	10.50	11.40
11/ 8	11.40	11.40	11.40

TABLE C-299. WHISKY CREEK
UPSTREAM OF CONFLUENCE WITH WILLOW CREEK
(2.90 KM UPSTREAM OF THE SAN JOAQUIN RIVER)
1984 MEAN, MINIMUM, AND MAXIMUM TEMPERATURES

DATE	MEAN TEMPERATURE (C)	MINIMUM TEMPERATURE (C)	MAXIMUM TEMPERATURE (C)
7/ 5	23.94	23.00	24.80
7/ 6	23.49	21.80	25.40
7/ 7	23.04	21.30	25.10
7/ 8	21.86	19.90	24.10
7/ 9	20.70	18.70	22.90
7/10	20.38	18.20	22.60
7/11	20.61	18.40	22.90
7/12	20.94	18.70	23.10
7/13	21.67	19.60	23.70
7/14	21.86	20.80	23.30
7/15	22.53	21.00	24.50
7/16	23.03	21.30	24.70
7/17	23.88	22.20	25.90 e
7/18	23.85	22.00	25.80
7/19	23.63	22.00	25.50
7/20	23.13	21.40	25.00
7/21	22.05	20.80	23.50
7/22	20.04	18.90	21.00
7/23	20.67	18.90	22.80
7/24	21.03	19.20	23.00
7/25	20.77	18.90	22.80
7/26	20.72	18.50	23.00
7/27	21.42	19.20	23.70
7/28	21.38	19.50	23.40
7/29	20.89	18.70	23.10
7/30	21.20	19.00	23.40
7/31	21.82	19.90	24.00
8/ 1	21.81	19.60	24.00
8/ 2	21.29	19.40	23.40
8/ 3	20.53	18.40	22.70
8/ 4	20.56	18.30	22.80
8/ 5	20.55	18.40	22.80
8/ 6	20.44	18.20	22.80
8/ 7	20.98	18.70	23.40
8/ 8	21.42	18.90	23.90
8/ 9	22.02	19.70	24.40
8/10	22.24	21.00	23.60
8/11	22.04	20.10	24.30
8/12	21.87	20.10	23.80
8/13	21.90	19.90	24.40
8/14	21.67	19.40	23.70
8/15	21.47	20.80	22.80
8/16	21.57	19.60	23.90
8/17	22.03	20.10	24.10

TABLE C-299 (CONT.) WHISKY CREEK
UPSTREAM OF CONFLUENCE WITH WILLOW CREEK
(2.90 KM UPSTREAM OF THE SAN JOAQUIN RIVER)
1984 MEAN, MINIMUM, AND MAXIMUM TEMPERATURES

DATE	MEAN TEMPERATURE (C)	MINIMUM TEMPERATURE (C)	MAXIMUM TEMPERATURE (C)
8/18	22.26	20.40	24.40
8/19	21.56	19.70	23.80
8/20	20.58	18.30	23.00
8/21	20.96	18.70	23.60
8/22	21.72	19.80	24.20
8/23	21.51	19.80	23.10
8/24	20.96	19.20	22.90
8/25	20.17	18.30	22.30
8/26	20.48	18.30	22.90
8/27	21.17	19.10	23.40
8/28	21.81	19.70	24.30
8/29	22.51	20.50	25.00
8/30	22.01	20.50	23.60
8/31	20.56	18.80	22.60
9/ 1	19.77	17.60	22.10
9/ 2	20.02	17.70	22.60
9/ 3	20.48	18.20	23.10
9/ 4	21.00	18.60	23.80
9/ 5	21.63	19.60	24.10
9/ 6	21.10	19.30	23.20
9/ 7	20.13	17.90	22.50
9/ 8	20.55	18.20	23.30
9/ 9	20.89	18.70	23.30
9/10	20.81	18.70	22.90
9/11	21.09	19.30	23.10
9/12	21.05	19.40	23.10
9/13	20.90	19.30	23.10
9/14	20.64	18.70	22.80
9/15	20.39	18.30	22.70
9/16	20.62	18.40	23.10
9/17	21.11	18.90	23.40
9/18	21.83	20.10	23.80
9/19	21.44	19.80	23.20
9/20	21.07	19.80	22.60
9/21	19.45	17.60	21.20
9/22	19.12	17.40	21.00
9/23	17.99	16.40	19.60
9/24	17.25	16.10	18.70
9/25	16.10	14.10	18.20
9/26	16.58	14.80	18.70
9/27	17.10	15.20	19.10
9/28	17.23	15.30	19.30
9/29	17.02	15.20	19.00
9/30	16.35	15.10	17.60

TABLE C-299 (CONT.) WHISKY CREEK
UPSTREAM OF CONFLUENCE WITH WILLOW CREEK
(2.90 KM UPSTREAM OF THE SAN JOAQUIN RIVER)
1984 MEAN, MINIMUM, AND MAXIMUM TEMPERATURES

DATE	MEAN TEMPERATURE (C)	MINIMUM TEMPERATURE (C)	MAXIMUM TEMPERATURE (C)
10/ 1	14.97	13.80	16.00
10/ 2	14.91	13.40	16.40
10/ 3	15.08	13.60	16.60
10/ 4	15.17	13.80	16.70
10/ 5	15.40	14.10	17.00
10/ 6	15.37	14.00	17.00
10/ 7	15.59	14.10	17.30
10/ 8	15.60	14.00	17.30
10/ 9	15.52	14.10	17.00
10/10	15.64	14.20	17.20
10/11	15.12	14.30	15.70
10/12	13.94	12.90	15.00
10/13	14.05	12.80	15.10
10/14	14.30	13.50	14.90
10/15	12.35	11.40	13.20
10/16	11.02	10.60	11.70
10/17	10.74	9.90	11.20
10/18	9.30	8.30	10.10
10/19	10.67	10.00	11.60
10/20	11.15	10.80	11.70
10/21	10.83	10.10	11.40
10/22	10.56	9.60	11.40
10/23	10.31	9.20	11.30
10/24	10.48	9.60	11.40
10/25	10.54	9.70	11.40
10/26	10.90	10.10	11.70
10/27	10.72	9.90	11.40
10/28	10.17	9.30	10.90
10/29	10.06	9.10	10.90
10/30	10.79	9.90	11.80
10/31	10.78	10.10	11.40
11/ 1	10.05	9.10	10.80
11/ 2	9.80	8.80	10.80
11/ 3	10.54	9.70	11.20
11/ 4	10.34	9.60	11.00
11/ 5	10.17	9.20	11.00
11/ 6	10.80	10.10	11.60
11/ 7	11.24	10.60	11.70
11/ 8	10.62	10.10	11.40

TABLE C-300. WILLOW CREEK
AT USGS GAGE 2465
(1.45 KM UPSTREAM OF THE SAN JOAQUIN RIVER)
1984 MEAN, MINIMUM, AND MAXIMUM TEMPERATURES

DATE		MEAN TEMPERATURE (C)	MINIMUM TEMPERATURE (C)	MAXIMUM TEMPERATURE (C)
6/21		20.38	19.00	22.00
6/22		19.42	17.50	21.00
6/23		20.15	18.00	22.00
6/24		20.90	19.00	22.50
6/25		21.00	18.50	23.00
6/26		21.35	19.00	23.50
6/27	1	20.70	17.50	22.50
7/12		22.94	20.50	26.00
7/13		23.56	21.50	26.00
7/14		23.75	22.50	26.00
7/15		24.42	23.00	27.00
7/16		24.94	23.00	27.00
7/17		26.25	24.50	29.00
7/18		26.23	24.50	29.00 e
7/19		25.54	24.00	28.00
7/20		25.00	23.00	27.50
7/21		23.90	22.50	25.50
7/22		21.94	20.50	23.50
7/23		22.56	20.50	25.00
7/24		23.04	21.00	25.50
7/25		22.81	20.50	25.50
7/26		22.63	20.50	25.50
7/27		23.40	21.00	27.00
7/28		23.40	21.50	27.00
7/29		22.90	20.50	26.50
7/30		23.21	21.00	27.00
7/31	1	23.83	21.50	27.50

1
INSTRUMENT MALFUNCTION

BEFORE THE FEDERAL ENERGY REGULATORY COMMISSION

164

CRANE VALLEY PROJECT
FERC NO. 1354

AMENDED APPLICATION FOR NEW LICENSE

FINAL: JUNE 2001

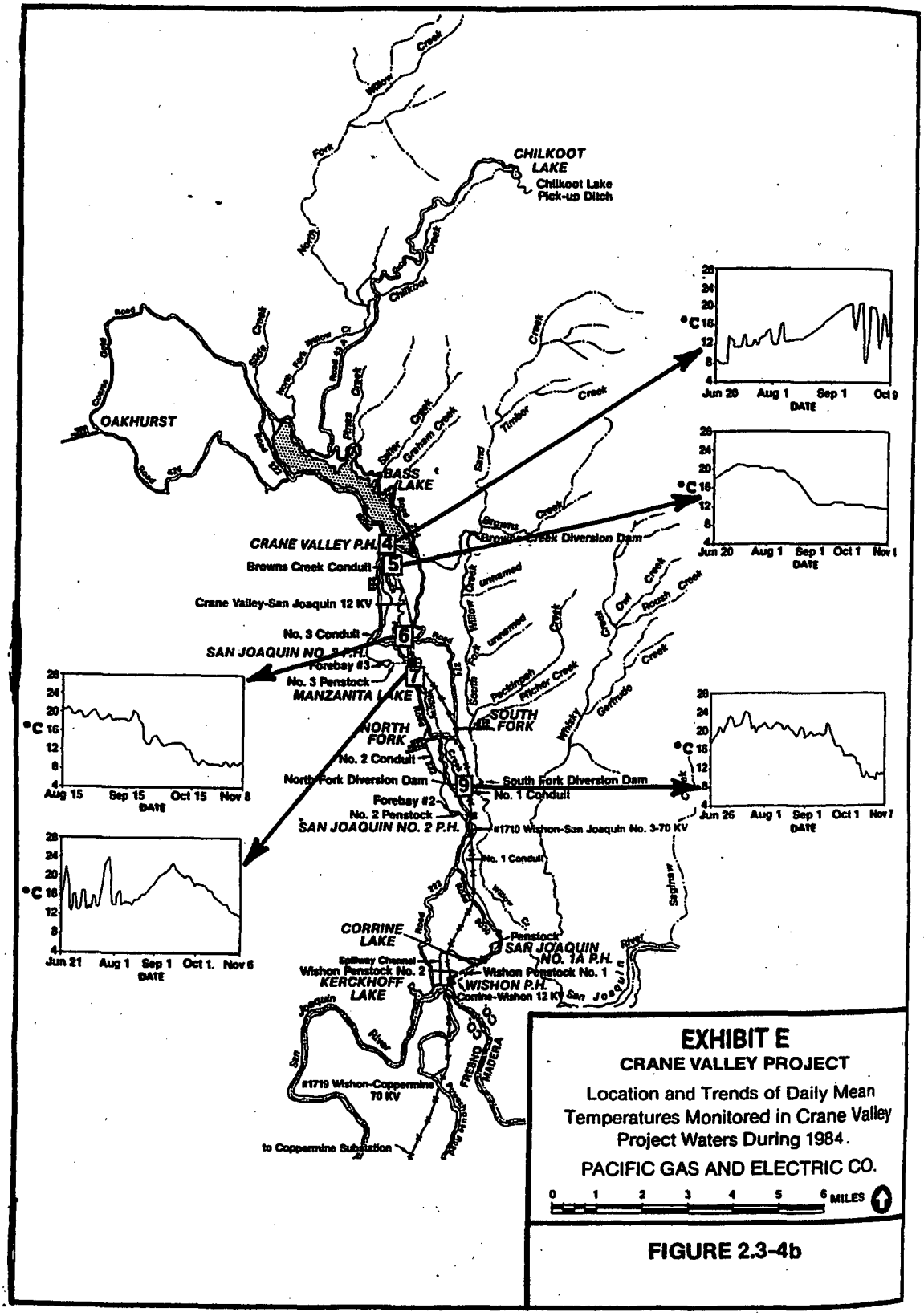
VOLUME I

INITIAL STATEMENT
EXECUTIVE SUMMARY
EXHIBITS: A, B, C, D, E
REPORTS: E1, E2, E3, E4

Russ Kanz manages this 341-5341 14th Floor

Stoner

@



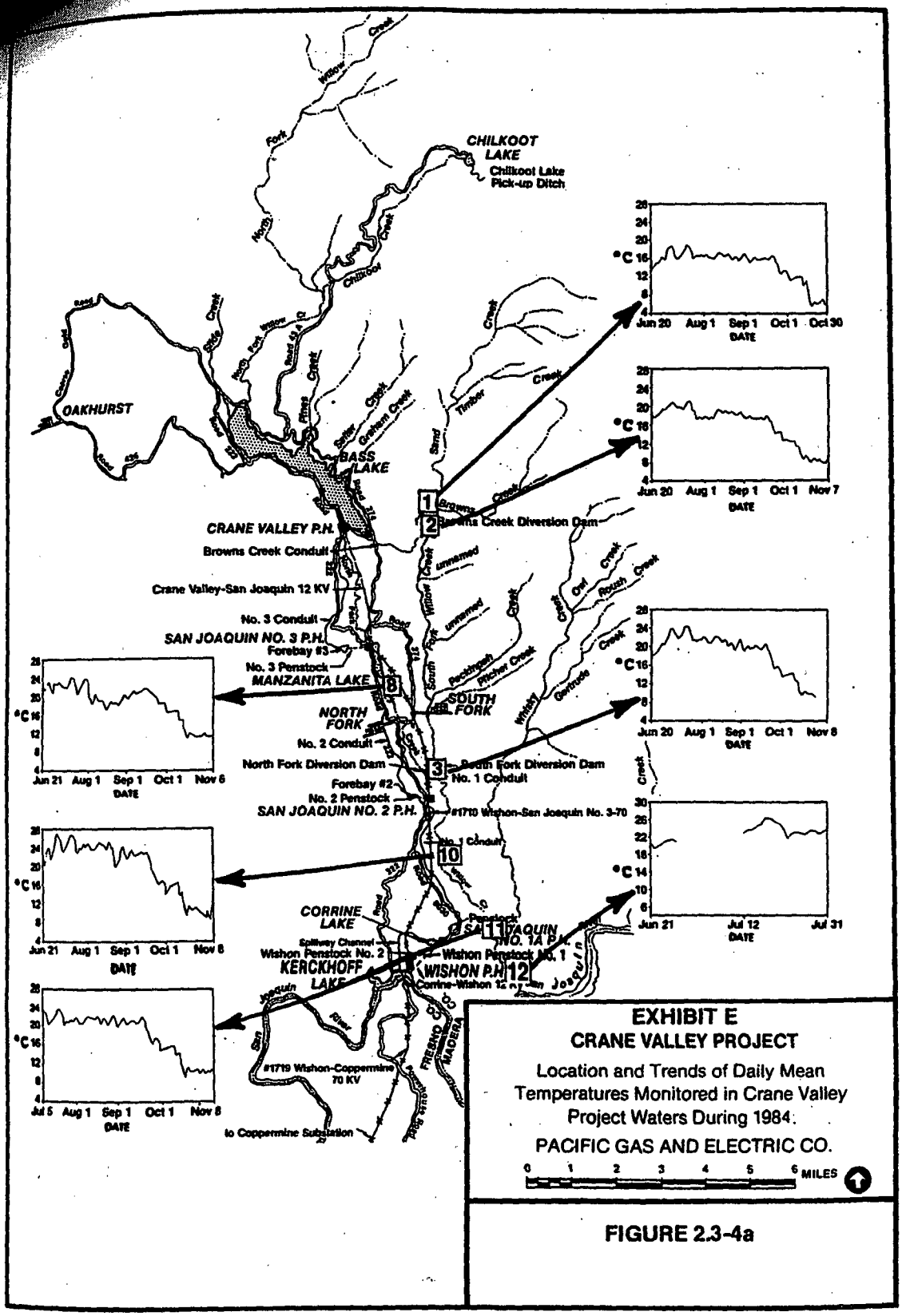


FIGURE 2.3-4a

FS 26604

Temperatures

Stream temperatures were monitored with Omnidata Model 112 temperature recorders at several locations. Monitoring occurred in all years from 1984 to 1992, except 1985, when no temperature data were collected. Specially made Omnidata program chips were used to allow temperatures to be measured to the nearest 0.1°C (Bozeman 1986a, 1986b).

Stream temperature was monitored at the following locations in each stream segment: SFWC below Browns Diversion (SfW 10.0), SFWC below Forest Service Road (SfW 5.8 and 7.7), and NFWC below Bass Lake (NfW 6.4 during 3 years; NfW 11.0 in all years except 1984, when only the seepage from Crane Valley Dam was monitored). Additional stream temperature data were collected in San Joaquin Ditch #3 to monitor temperatures at the water source that would be used for increased instream flow studies in the stream segment NFWC below Bass Lake.

Stream flow and temperature data are summarized in Tables E2.3.2b-2 and E2.3.2b-3. The data was collected on a daily basis at different times of the day. The temperatures recorded exceeded 20°C for more than 13 days in 1989, 1990, and 1995 at NfW 11. For SfW 5.8 & 7.7, which is a combination of data collected at both sites, the temperature exceeded 20° C for more than 15 days thru the years 1987 to 1990, and also in 1992, 1994, and 1996. The warmest and most 20 degree exceedance temperatures were recorded in 1988.

(1)

TABLE E2.3.2b-2

NFWC below Bass Lake (NfW 11) (1986-1996)

Year	Min. Flow (cfs)	Max. Flow (cfs)	Min. Temperature (°C)	Max Temperature (°C)	Days over 20 °C
1986	0.16	2100	4.7	20.6	1
1987	0.16	3.8	3.6	20	1
1988	0.24	2.8	4.38	20.6	2
1989	0.01	1.5	4.3	20.8	16
1990	0.17	2.2	3.4	22	34
1991	0.15	2.6	3.9	20	2
1992	0.19	3.3	4.63	19.8	0
1993	0.49	493	3.86	18.69	0
1994	3.9	152	5.27	17.86	0
1995	3.1	2200	4.94	22.55	14
1996	3.2	423	5.33	16.93	0

Source: Studley et al., unpublished data.

7 / 11 years

TABLE E2.3.2b-3

SFWC below Forest Service Road (SfW 5.8 & 7.7) (1986-1996)

Year	Min Flow (cfs)	Max Flow (cfs)	Min Temperature (°C)	Max Temperature (°C)	Days over 20 °C
1986	0.5	1200	3.6	20.36	4
1987	0.4	190	4.54	22	16
1988	0.2	25	4.17	23.01	54
1989	0.2	90	3.07	21.8	18
1990	0.3	13.8	4.15	22.5	32
1991	0.2	282	3.54	21.8	12
1992	0.21	28	3.51	22.4	27
1993	1.2	204	1.52	20.63	6
1994	0.39	53	1.29	21.29	28
1995	2.6	524	2.36	20.22	5
1996	1.8	598	2.36	22.03	21

Source: Studley et al., unpublished data.

11 / 11

Several stream temperature statistics were calculated for each stream segment from 1986 to 1992, for use in the correlation analysis with biological variables: number of days over 20.0°C by year; number of degree days over 20.0°C by year; number of degree days over 0°C by year; and mean, median, and maximum temperatures for April through June and

Where is entire report? Are this data good enough. Difficult to compare to 14.8°C + 17.0°C

TABLE C-289. SOUTH FORK WILLOW CREEK
UPSTREAM OF BROWN'S DIVERSION
(10.60 KM UPSTREAM OF SOUTH FORK DIVERSION)
1984 MEAN, MINIMUM, AND MAXIMUM TEMPERATURES

only for 1984 is this all the data? missing apgs?

DATE	MEAN TEMPERATURE (C)	MINIMUM TEMPERATURE (C)	MAXIMUM TEMPERATURE (C)
6/20	14.36	13.50	14.50 — 1
6/21	13.63	12.50	14.50 — 2
6/22	13.98	12.50	15.50 — 3
6/23	14.50	13.00	16.00 — 4
6/24	14.98	13.50	16.00 — 5
6/25	14.94	13.50	16.00 — 6
6/26	15.17	14.00	16.00 — 7
6/27	15.75	14.50	17.00 — 8
6/28	16.40	15.50	17.50 — 9
6/29	16.21	15.50	17.00 — 10
6/30	15.63	14.50	16.50 — 11
7/ 1	15.98	14.50	17.50 — 12
7/ 2	16.98	16.00	18.00 — 13
7/ 3	17.94	17.00	19.00 — 14
7/ 4	18.27	17.50	19.50 — 15
7/ 5	18.46	17.50	19.50 — 16
7/ 6	18.67	18.00	19.50 — 17
7/ 7	18.02	17.00	19.00 — 18
7/ 8	16.83	16.00	18.00 — 19
7/ 9	15.88	15.00	17.00 — 20
7/10	15.69 → 17.4	14.50	17.00 — 21
7/11	16.02	15.00	17.00 — 22
7/12	16.23	15.00	17.50 — 23
7/13	16.77	16.00	18.00 — 24
7/14	17.17	16.50	18.00 — 25
7/15	17.65	17.00	18.50 — 26
7/16	17.92	17.00	19.00 — 27
7/17	18.65	18.00	20.00 — 28
7/18	18.56	17.50	19.50 — 29
7/19	18.33	17.50	19.50 — 30
7/20	17.75	17.00	18.50 — 31
7/21	17.21 18.01	16.50	18.00 — 32
7/22	15.88 17.8	15.50	16.50 — 33
7/23	16.29	15.50	17.50 — 34
7/24	16.50	15.50	18.00 — 35
7/25	16.48	15.50	18.00 — 36
7/26	16.44	15.00	18.00 — 37
7/27	16.79	16.00	18.00 — 38
7/28	16.75	16.00	18.00 — 39
7/29	16.23	15.00	17.50 — 40
7/30	16.44	15.50	18.00 — 41
7/31	16.73	16.00	18.00 — 42
8/ 1	16.88	16.00	18.50 — 43
8/ 2	16.58	15.50	18.00 — 44

40 > 14.8°C
13 > 17.0°C
7 > 17.0°C
30 > 17.0°C
13 greater than 17.0°C
43 24 13 36 44

Palma's copy

Final Report

Crane Valley Project Supplemental Data to Fisheries Technical Report

Prepared for

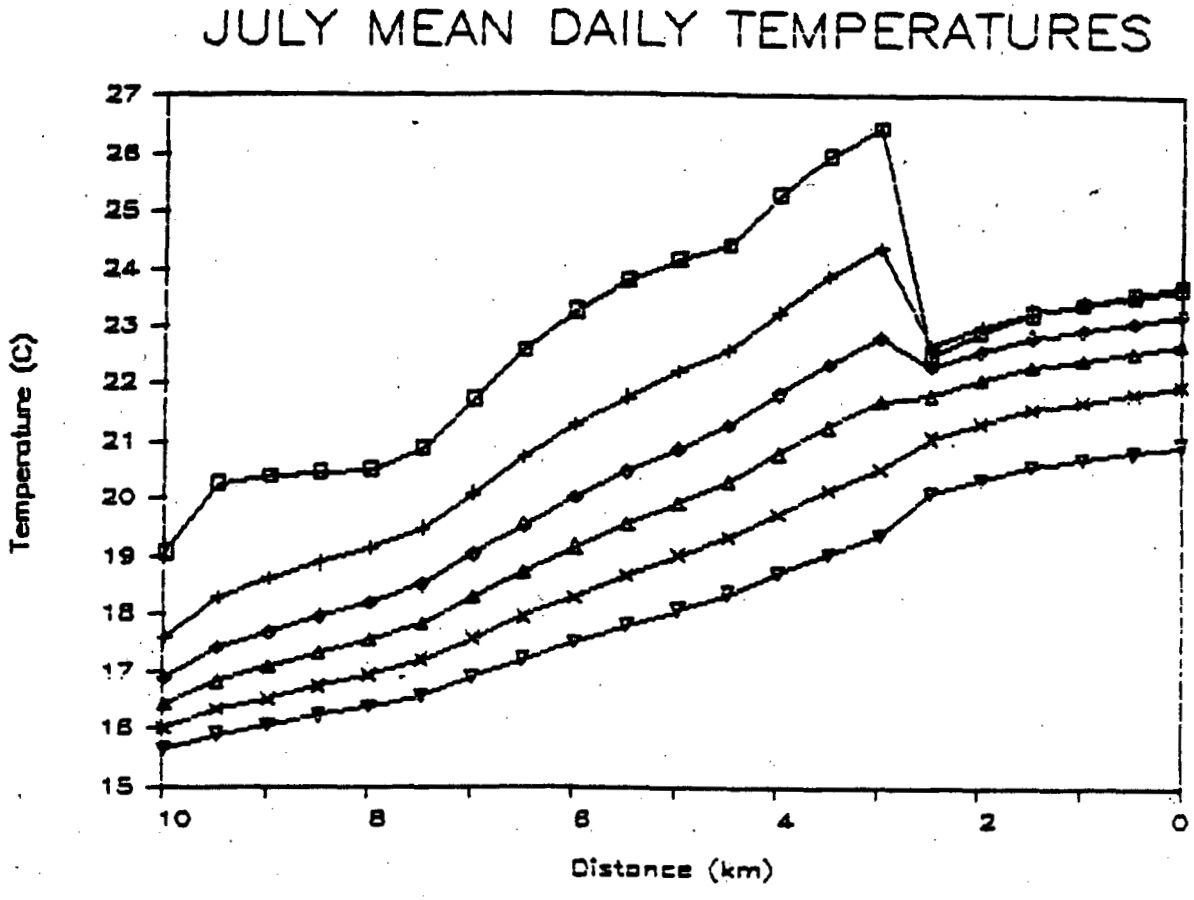
Pacific Gas and Electric Company
Department of Engineering Research
San Ramon, California

Prepared by

M.A. Bozeman, W.S. Lifton,
J.E. Baldrige, K.A. Voos, and
R.A. Sanford

August 1985

Woodward-Clyde Consultants
100 Pringle Ave., One Walnut Creek Center, Walnut Creek, CA 94596



□ = 1 cfs
+ = 3 cfs
◊ = 5 cfs
Δ = 7 cfs
X = 10 cfs
▽ = 15 cfs

CRANE VALLEY PROJECT
DIVERSION effects on
STREAM TEMPERATURE

Figure 4.1-73b. NORMAL JULY DAILY MEAN TEMPERATURES ON WILLOW CREEK, 1 TO 15 CFS RELEASES

Factsheet Details

Waterbody ID: CAR5402105120000216112815
Waterbody Name: Willow Creek (Madera County)
Pollutant Name: Temperature, water
Source Name: Hydromodification
Designated Beneficial Uses : AG - Agricultural Supply
Factsheet ID: 2663
LOE ID: 2929

Reference

Save Reference

Title: Water Quality in the Crane Valley Project - Technical Report - October 1985.

Author: Bowie, G.

Agency: Tetra Tech Inc.

Publication:

Publication Date: (mm/dd/yyyy)

Issue:

Volume:

Pages Cited:

URL:

Record Index:

Select Waterbody ID: CAL5402105020020430105627 - Manzanita Lake (Madera County)

Select Board: Regional Board 5

Select Reference Type: Report

Select Media: Hard Copy

Relevant ?

Comments: (2000 chars max) Prepared for PG&E.

WATER QUALITY
IN THE
CRANE VALLEY PROJECT

-Technical Report-

Prepared for:

Dr. Sheila Byrne
Pacific Gas and Electric Company
Department of Engineering Research
3400 Crow Canyon Road
San Ramon, CA 94583

Prepared by:

George Bowie
Tetra Tech, Inc.
Suite 300
3746 Mt. Diablo Blvd.
Lafayette, CA 94549

October 1985

J-190

Table 3-57. Maximum temperatures in Project waters during 1984 (Woodward-Clyde Consultants 1985).

Station	Maximum temperatures (°C)	Maximum daily mean temperatures (°C)	Difference between daily mean and daily maximum (°C)
N. Fork Willow Creek at Crane Valley Powerhouse	20.7 (25.5 during PH outage)	20.5	0.5 (10.0 during PH outage)
N. Fork Willow Creek 0.2 km below Bass Lake	21.0	20.5	0.2
N. Fork Willow Creek above Manzanita Lake	21.9*	21.0*	1.0*
Manzanita Lake	23.6 (24.5 during PH outage)	22.0 (23.7 during PH outage)	1.5
N. Fork Willow Creek below Manzanita Lake	25.5	24.2	1.5
N. Fork Willow Creek above Ditch No. 1	26.5	24.1	2.0-3.0
S. Fork Willow Creek above Browns Creek Diversion	20.0	18.7	1.5
S. Fork Willow Creek below Browns Creek Diversion	22.5	21.1	1.5
S. Fork Willow Creek above Ditch No. 1	25.0	24.1	0.5-1.0
Willow Creek below confluence of N. and S. Forks at PGandE Gage W-26	27.5	27.0	1.5
Whisky Creek above confluence with Willow Creek	25.9	24.0	2.0
Willow Creek above San Joaquin River	29.0*	26.3*	2.0-4.0*

* Based on partial record.