

BUTTE CREEK
SPRING-RUN CHINOOK SALMON, *ONCORHYNCHUS TSHAWYTSCHA*
PRE-SPAWN MORTALITY EVALUATION
2004^{1/}
by

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ABSTRACT

This is the second report assessing pre-spawning mortalities among spring-run Chinook salmon (SRCS) (*Oncorhynchus tshawytscha*) in Butte Creek affected by the Pacific Gas and Electric (PG&E) DeSabra Centerville Project (Project). Project is located on Butte Creek near Chico, in Butte County California. There were an estimated 418 SRCS that died prior to spawning in 2004 out of a total estimated population of 10,639. Although no fish were examined by a Department pathologist, based upon the protracted time (June 15 – September 24, 2004) and low numbers, we conclude mortalities were likely normal attrition for holding in fresh water since early spring. In contrast during 2003, there were an estimated 11,231 SRCS that died prior to spawning out of a total estimated population of 17,294. Pre-spawn mortalities during 2003 were the result of large numbers of fish concentrated in limited holding pools, high water temperature, and an outbreak of two pathogens, *Flavobacterium columnare* (columnaris) and the protozoan *Ichthyophthirius multophilis* (Ich). During the 2004 summer holding period approximately 68% of the fish held above the Centerville Powerhouse (CVPH) and 32% below, while mortalities were more evenly divided with 51% above and 49% below. An estimated 10,221 fish survived to spawn with approximately 54% spawning above the CVPH and 46% below. PG&E voluntarily increased Project flows to 60 cfs, above that required by the Federal Energy Regulatory Commission License of 40 cfs, in the reach above the CVPH at spawning onset during late September to increase usable spawning gravel. In spite of the increase, spawning habitat was again over-utilized above the CVPH and under-utilized below.

Air and water temperatures during the key summer holding period were generally lower during 2004 than during 2002-2003, while Butte Creek flows were generally somewhat higher.

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INTRODUCTION

This is the second report prepared under a grant from Pacific Gas and Electric Company (PG&E) to assess pre-spawning mortalities among spring-run Chinook salmon (SRCS), *Oncorhynchus tshawytscha*, in Butte Creek within and below its' DeSabra-Centerville Project, (Federal Energy Regulatory Commission (FERC) Project #803). Specifically, the grant required the following:

- Develop an accurate estimate of pre-spawning mortalities among Butte Creek SRCS,
- Assess causal relationship of SRCS pre-spawning mortalities with operation of the PG&E DeSabra Centerville Hydro-power Project.
- Recover coded-wire tags (CWT) from previously marked Butte Creek SRCS.
- Monitor and document holding distribution of Butte Creek SRCS.

Salmon in Butte Creek

Butte Creek is one of several Central Valley streams that continue to harbor a sustaining population of the threatened SRCS. The first somewhat systematic effort to generate a Butte Creek SRCS population estimate was done in 1954 (Table 1) (CDFG, 1998). However, inconsistent methods of evaluation used during the intervening years have made it difficult to assess population trends.

Table 1. Butte Creek SRCS spawning escapement estimates for the period 1954 through 2004.

Year	Run Size	Year	Run Size	Year	Run Size	Year	Run Size	
1954	830	1969	830	1984	23	1999	3679*	
1955	400	1970	285	1985	254	2000	4118*	
1956	3000	1971	470	1986	1371		Snorkel	Spawn
1957	2195	1972	150	1987	14	2001	9605*	18312**
1958	1100	1973	300	1988	1300	2002	8785*	12597
1959	500	1974	150	1989	1300*	2003	4398*	6063
1960	8700	1975	650	1990	100*	2004	7390*	10221
1961	3100	1976	46	1991	100*			
1962	1750	1977	100	1992	730*			
1963	6100	1978	128	1993	650*			
1964	600	1979	10	1994	474*			
1965	1000	1980	226	1995	7500*			
1966	80	1981	250	1996	1413*			
1967	180	1982	534	1997	635*			
1968	280	1983	50	1998	20212*			

* Surveys prior to 1989 used various methods of varying precision. Snorkel surveys used since 1989 are thought to significantly underestimate actual population size and are used as an index. Spawning survey results for 2001- 2004 generated by a Schaefer Model carcass survey. Neither snorkel survey nor spawning survey estimates include pre-spawn mortalities.

** Number as reported in 2003 (22,744) in error (Ward et al., 2004b).

The SRCS over-summer holding reach of Butte Creek is approximately 11 miles in length, extending from the Quartz Bowl Pool downstream to the Centerville Covered Bridge (Figures 1 and 2). Flows in this reach are controlled by PG&E for power generation at the DeSabra (DSPH) and Centerville (CVPH) powerhouses. Within the 11 mile SRCS holding/spawning reach, the area with the most deep holding pools and which is most isolated is located in the uppermost 3 miles between the Quartz Bowl and Pool 4, while the majority of spawning gravel is located in the 5 miles below the CVPH (Figures 1 and 2; Appendix C, Figures 1-5). With the recent increased populations of Butte Creek SRCS, there were reports and observations of significant mortalities during the summer holding period prior to spawning. This was partially documented during 2002 when there were an estimated 3,431 pre-spawning mortalities out of a total estimated population of 16,328 (Ward et al., 2004a) and systematically documented during 2003 when there were an estimated 11,231 pre-spawn mortalities out of a total estimated population of 17,294 (Ward et al., 2004b). It was concluded that the high mortalities during 2003 were primarily due to large numbers of fish concentrated in limited holding pools, high water temperatures, and an outbreak of two pathogens, *Flavobacterium columnare* (columnaris) and the protozoan *Ichthyophthirius multifiliis* (Ich) (Ward et al., 2004b). It was also noted that maximum daily air temperatures during the last two weeks of July exceeded 37.6°C (100°F) a total of 10 days as measured at the nearby California Department of Forestry Cohasset Fire Station. This protracted period of high air temperatures was within the top 10 percent of temperatures for the period of record (1984-2002). Additionally, during the same 2-week period water temperatures at key sites in the holding reaches above the CVPH were also higher than seen during the previous 2 years. It was further concluded that mortalities during 2002 and 2003 appeared to coincide with sustained daily average water temperatures above 19°C, as measured at the Quartz Bowl Pool (Figure 1).

Temperature Contingency Plan

Review of flow and temperature data for the various sources of input to the holding reach including upper Butte Creek and the West Branch of the Feather River (WBFR) suggested that there was the potential to affect water temperatures by selectively managing flows from the WBFR. Based upon that analysis, PG&E in consultation with the California Department of Fish and Game (CDFG), National Oceanographic and Atmospheric Administration (NOAA Fisheries), and United States Fish and Wildlife Service (USFWS), agreed to the following contingency plan during 2004 (PG&E 2004):

1. "Starting on June 14, PG&E will prepare a weather forecast for the DeSabra-Centerville Project Area by noon each Monday and Thursday. The weather forecast will be based on information from USFS weather stations at Cohasset and Chester. PG&E will provide an email copy of the forecasts to NOAA Fish, CDF&G and FWS. If air temperatures in excess of 105°F for two or more days during the next seven day period are forecasted at Cohasset, with the potential for compression heating at higher elevations as confirmed by data from the Chester location, PG&E will send an e-mail to the individuals at the Resource Agencies identified in paragraph 5 below advising them that an extreme heat event is forecasted. If the next forecast confirms that an extreme heat event has started or is imminent within the next two days, and is expected to continue for over two days, PG&E will send a second e-mail and will initiate efforts to modify Project operations as discussed in paragraphs 2-4 below. If action is taken, a fax will also be sent to CDF&G and NOAA Fish."
2. "If releases are being made from Round Valley Reservoir at the time of the second forecast confirming an extreme heat event, the releases from Round Valley Reservoir will be reduced by approximately 50% and the release valve at Philbrook Reservoir will be opened to provide a total release of up to 35 cfs if determined to be appropriate."

3. "The actual amount of water released from Philbrook Reservoir during a confirmed extreme heat event will depend on PG&E's assessment of then existing conditions and recommendations and comments received from the Resource Agencies in response to the e-mails."
4. "At the next forecast date, if temperature forecasts have returned to normal levels, PG&E will reduce the releases at Philbrook Reservoir to the pre-event level and assess the quantity of water available for the remainder of the season. If temperatures forecasts have not returned to normal, PG&E will consult with the Resource Agencies regarding whether to continue or adjust the releases based on the then-existing conditions."

Additionally, PG&E in coordination with CDFG, NOAA Fisheries, and USFWS, proposed a study plan to develop a water temperature model (PG&E, 2004b). The goal of the study is to develop a "model that can be used to evaluate the range of operational alternatives for managing stream temperatures in Butte Creek during the summer months (June through September) between DeSabra Powerhouse and immediately upstream of Centerville Powerhouse". Implementation of various components, including increased flow, temperature, and meteorological measurement stations was initiated during 2004.

Flow Increase for Spawning

Based upon the previous evaluation which provided an estimate of available spawning gravel (Gard et al., 2003; Ward et al., 2004b) PG&E agreed to consider increased flows above the minimum 40 cfs, in the reach above the CVPH during the spawning period (PG&E, 2004a) as follows:

"Changing or increasing the releases to Butte Creek at the Lower Centerville Diversion Dam (LCDD) or from the Lower Centerville Canal downstream of the LCDD will continue to be considered. Current data does not support increasing flows below LCDD during the summer months, due to the potential adverse impacts such releases may have on the water temperatures below Centerville Powerhouse. However, increased releases below LCDD during the spawning period (i.e., after approximately mid-September) may provide additional spawning habitat in the reach below LCDD. Accordingly, PG&E will consult with the Resource Agencies over the course of the summer to determine whether releases below LCDD during the spawning period can be implemented without adversely impacting water temperatures below Centerville Powerhouse. This consultation will include, prior to September 1, a water temperature analyses for bypass flows of up to 80 cfs beginning on September 15, based on the best information available at the time."

A subsequent analysis by CDFG recommended that PG&E consider increasing flows to a maximum of 80 cfs during the last week of September and maintain that level through December (Ward, 2004). It was further recommended that flow increases be modified based upon water-year type, runoff forecasts, field observations of number of spawners in the reach above the CVPH, onset of spawning, and proportion of spawning by the end of September. Based upon a forecast of early October natural flows in Butte Creek, PG&E with concurrence of CDFG, NOAA Fisheries and USFWS, provided a spawning flow of 60 cfs during 2004.

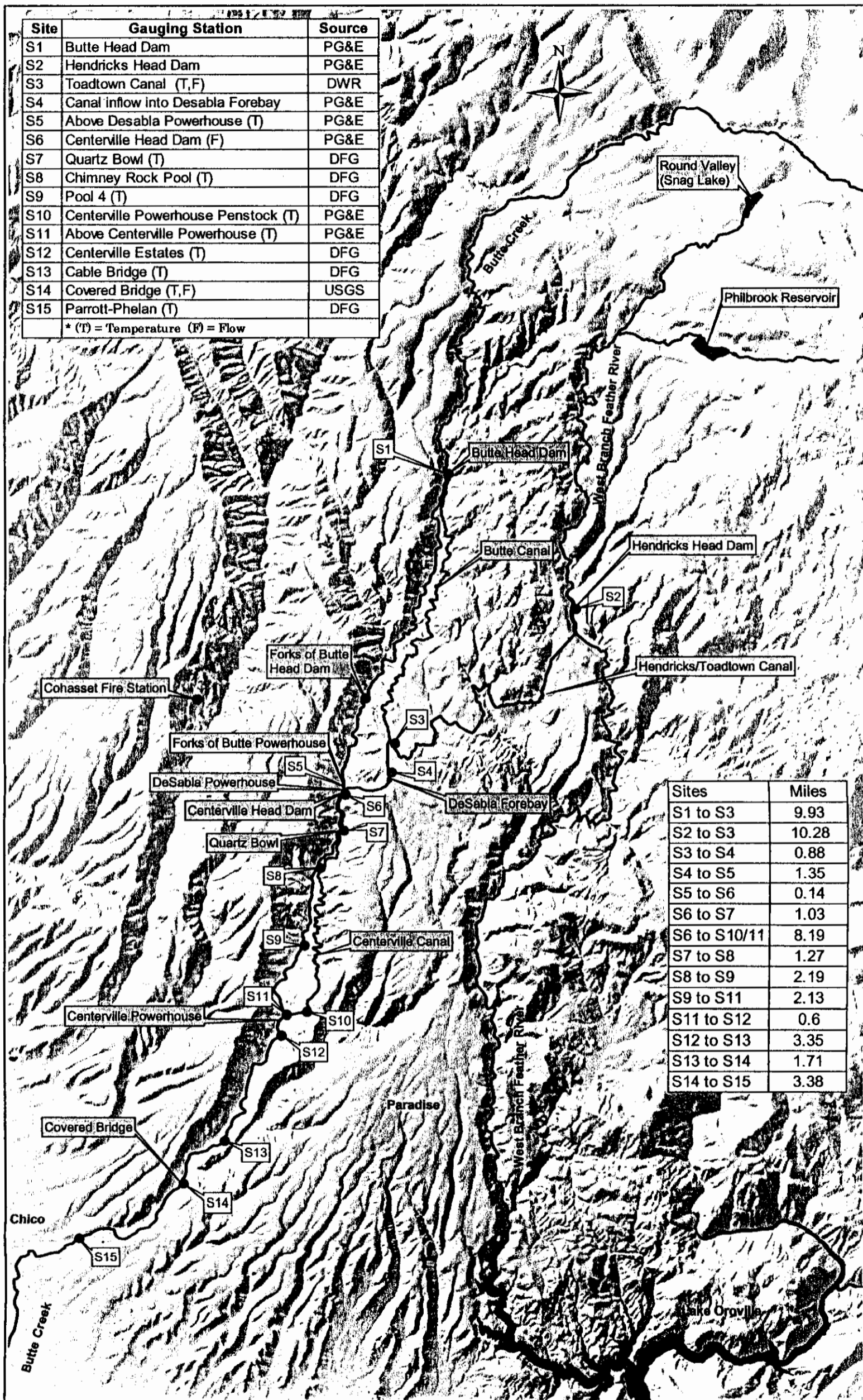


Figure 1. Map showing reaches of Butte Creek and West Branch of the Feather River controlled by Pacific Gas and Electric Company affecting Butte Creek spring-run Chinook salmon, including temperature and flow gage locations and distances.

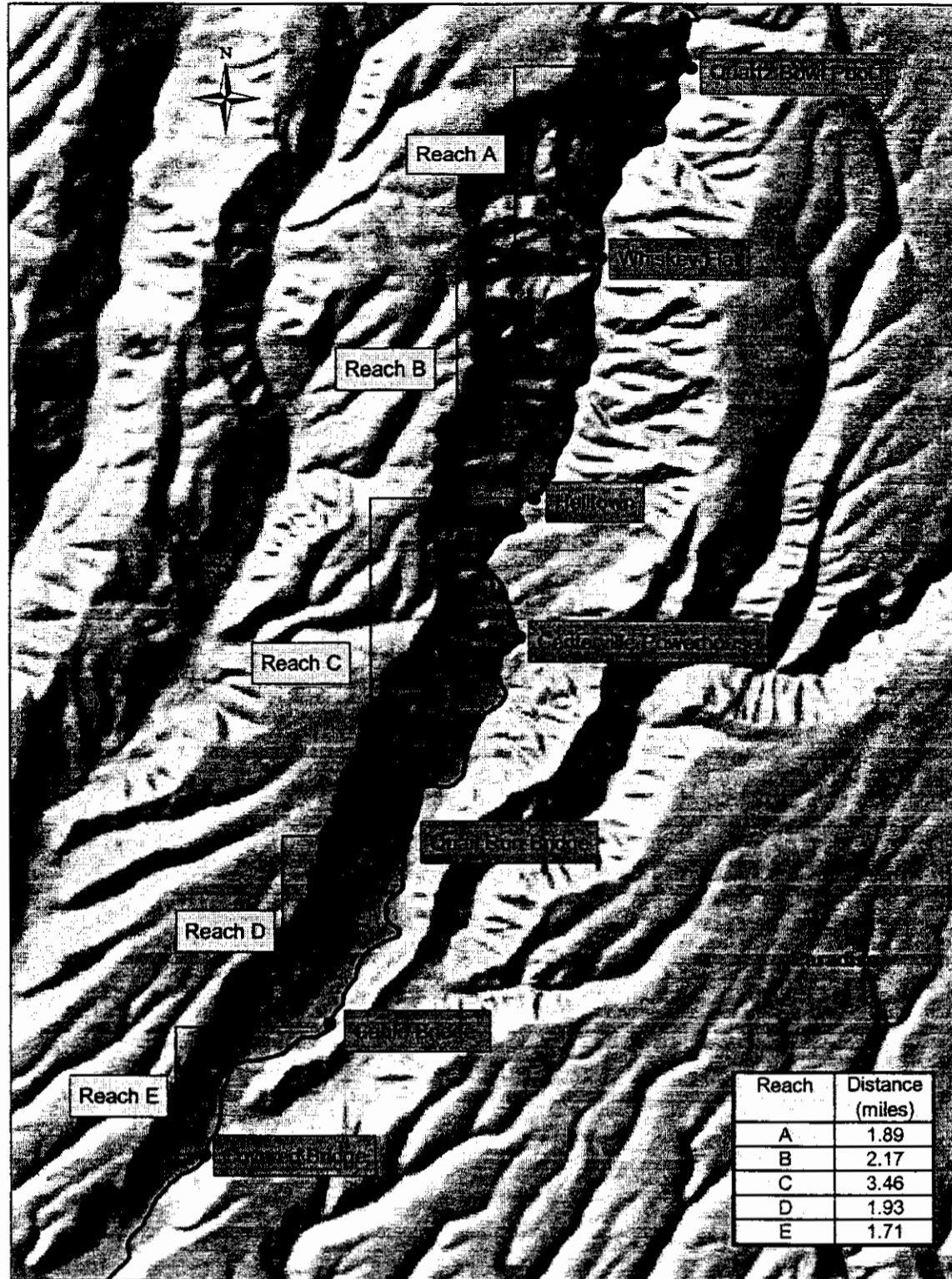


Figure 2. Map of Butte Creek from Quartz Bowl Pool to Covered Bridge showing spring-run Chinook salmon holding and spawning reaches and distances.

MATERIALS AND METHODS

Adult Escapement

CDFG calculates an adult SRCS escapement estimate each summer by conducting a swimming-snorkel survey. Adults SRCS are counted while holding prior to spawning. On Butte Creek, the swimming-snorkel survey extends from the Quartz Bowl Pool to the Covered Bridge (Figure 1 and 2). Each pool was observed only once by each surveyor, with each of the individual independent estimates recorded. If subsequent analysis of the entire data set revealed significant outliers, such outliers were excluded from the calculation of the population estimate. In such instances, the average for the pool reflected only the remaining recorded observations. Individual estimates were then averaged for each pool with the annual total escapement estimate calculated by summing the averages for all survey reaches.

Adult Pre-spawning Mortality Survey

Since all Pacific salmon die after spawning, a standard technique employed in California for estimating population size is the carcass (mark-recapture) survey. This technique employs a physical count of all carcasses during the entire period and develops an expansion factor for carcasses not encountered during the physical count. Fresh carcasses (clear eyed/pink gills) encountered were externally marked and returned to the water near the spot encountered. All other carcasses were tallied and chopped in half to avoid being counted more than once. During subsequent surveys, the proportion of previously marked carcasses encountered was used to develop an expansion factor to account for carcasses that went unseen. This methodology required a short duration between surveys, in general no longer than weekly.

A survey to identify pre-spawning mortalities was conducted during the period June 15, until the onset of spawning on September 22, 2004. The survey extended from the Quartz Bowl Pool to the Covered Bridge (Figure 1 & 2; Appendix C, Figures 1-5). The approximately 17.7 km (11 mi.) long stream section was divided into five reaches with each reach surveyed weekly. Two to four crew members walked downstream covering both sides of the creek. All carcasses were examined for an adipose fin-clip, and then chopped in half to avoid counting during subsequent trips. Carcasses classified as fresh (clear eye, firm flesh, red gills) were sexed and measured to the nearest mm fork length (FL). Heads were removed from adipose fin-clipped carcasses and returned to the office for recovery of the coded-wire tag (CWT).

The estimation method employed utilized a modification of the Schaefer Model (Schaefer 1951) as follows:

$$E = N_{ij} = R_{ij}(T_i C_j / R_i R_j) - T_i$$

Where:

E = Total run size

N_{ij} = Population size in tagging period i recovery period j,

R_{ij} = number of carcasses tagged in the ith tagging period and recaptured in the jth recovery period,

T_i = number of carcasses tagged in the ith tagging period,

C_j = number of carcasses recovered and examined in the jth recovery period,

R_i = total recaptures of carcasses tagged in the ith tagging period, and

R_j = total recaptures of tagged carcasses in the jth recovery period.

Water Temperature

Onset, model WTA032, temperature data loggers calibrated to ± 0.2 ° Celsius (C) set for 1-hour interval recordings were deployed in pools at five sites within the SRCS spawning habitat (Figure 1). Each data logger was placed in a 4.2cm x 12.8cm long galvanized steel pipe and suspended by 0.5cm steel cable.

RESULTS AND DISCUSSION

RESULTS

Pre-spawn Mortalities

During the entire pre-spawn sampling period from June 15, through September 24, 2004 there was a total of 201 carcasses encountered with an estimated total pre-spawn mortality of 418 (Table 2).

Table 2. Summary of Butte Creek SRCS pre-spawn mortalities during period June 15, 2004 through September 24, 2004.

Week	Date	Total Carcasses Encountered					Weekly Total	Schafer Model Expanded Total*
		Reach						
		A	B	C	D	E		
1	6/15	1	2	-	-	-	5	10
	6/17	-	-	2	0	0		
2	6/22	1	1	-	-	-	2	4
	6/24	-	-	0	0	0		
3	6/29	1	1	-	-	-	5	10
	7/1	-	-	2	1	0		
4	7/6	0	1	-	-	-	6	12
	7/8	-	-	3	1	1		
5	7/15	1	1	-	-	-	10	21
	7/13	-	-	4	3	1		
6	7/20	0	3	-	-	-	8	17
	7/22	-	-	2	0	3		
7	7/27	2	5	-	-	-	24	50
	7/29	-	-	15	0	2		
8	8/3	6	3	-	-	-	22	46
	8/5	-	-	11	2	0		
9	8/10	3	6	-	-	-	13	27
	8/12	-	-	4	0	0		
10	8/17	1	2	-	-	-	4	8
	8/19	-	-	1	0	0		
11	8/24	3	0	-	-	-	8	17
	8/26	-	-	4	1	0		
12	8/31	2	3	-	-	-	16	33
	9/2	-	-	9	1	1		
13	9/7	2	0	-	-	-	14	29
	9/9	-	-	8	3	1		
14	9/14	12	4	-	-	-	27	56
	9/16	-	-	8	1	2		
15	9/21	7	4	-	-	-	37	77
	9/24	-	-	17	7	2		
1-15	TOTAL	42	36	90	20	13	201	418

* Note: No expansion factor generated from pre-carcass survey due to low number of carcasses and low mark/recovery. Expansion factor of 2.08 applied based upon subsequent spawning survey.

Due to the low number of mortalities spread over the entire period it was not possible to generate a Schaefer Model estimate of total pre-spawn mortality. Instead, an expansion factor generated from the subsequent Schaefer Model estimate of spawning was applied. That expansion factor was 2.08 and was based upon the Schaefer estimate for the number of fish spawning divided by the number of carcasses examined (10,221/4,906). Spawning onset was first documented on September 22, 2004 and overlapped the pre-spawn mortality period which extended until September 24, 2004. All carcasses examined during the overlapping period were allocated as pre-spawn mortality or spawned based upon examination of egg retention. The subsequent spawning survey from September 22, through November 4, 2004 encountered a total of 4,906 carcasses with an estimated spawning population of 10,221. The previous swimming-snorkel survey conducted July 12-16, 2004 resulted in an estimate of 7,390 fish. The 2004 snorkel survey was moved to early July to develop a better estimate prior to any significant pre-spawn mortalities. There were still an estimated 28 pre-spawn mortalities prior to the snorkel survey (Table 2).

Sex and Age Composition

There was a total of 111 carcasses measured and identified by sex during this survey, of which 75% were female and 25% male (Table 3). The average lengths of both females and males during this survey were significantly smaller than observed during 2003 (Table 3; Appendix A, Figures 1-3). There were no CWT fish recovered during the pre-spawn mortality survey. Based upon subsequent recoveries of CWT's during the spawning survey adjusted for release group size, it is estimated that approximately 86% of the population was age-3 and 14 % age-4. This estimate is supported by the significantly shorter average lengths.

Table 3. Fork lengths of subsample of Butte Creek SRCS pre-spawn mortalities during 2002- 2004.

Year	Female					Male				
	Carcasses		FL (MM)			Carcasses		FL (MM)		
	Total	Percent	Max	Min	Mean	Total	Percent	Max	Min	Mean
2004	83	75%	928	601	737	28	25%	1064	486	778
2003	596	62%	961	473	823	368	38%	1110	452	879
2002	393	65%	931	514	725	213	35%	1048	400	757

Holding and Spawning Distribution

For the purposes of providing a comparative basis for holding, pre-spawn mortality, and spawning, the swimming--snorkel estimate for holding was adjusted to reflect the total carcass estimate for the combined pre-spawn mortality and spawning. The adjusted holding estimate was based upon the combined carcass estimate (pre-spawn and spawn) allocated by the percentages observed in each reach/subreach during the swimming-snorkel survey. During the 4-year period 2001-2004, approximately 65% of the fish counted held above the CVPH and 35% below, while approximately 53% of the fish spawned above the CVPH and 47% below (Appendix B, Figure 3-5). For the 2001-2004 period based upon the various survey methods, 89% of the mortalities occurred above the CVPH and 11% below. During 2004, it appears that approximately 1,416 (20% of the total) fish holding above the CVPH moved to spawn below (Table 4; Appendix B, Figure 1&2).

Table 4. Summary of Butte Creek SRCS distribution by reach, above and below PG&E CVPH for snorkel, pre-spawn, and spawn survey during 2001-2004.

Year 2004							
Reach	Snorkel Survey			Pre-Spawn Survey		Spawn Survey	
	Actual	Estimated	Percent	Actual	Percent	Actual	Percent
A	3072	4427	41.6%	87	20.9%	964	9.4%
B	1518	2187	20.6%	75	17.9%	2617	25.6%
C1-5	408	588	5.5%	52	12.4%	1991	19.5%
C6-12	2041	2942	27.6%	133	31.8%	2201	21.5%
D	284	409	3.8%	44	10.4%	1734	17.0%
E	60	86	0.8%	27	6.5%	714	7.0%
Total	7384	10639	100.0%	418	100.0%	10221	100.0%
Total Above Powerhouse	4999	7202	67.7%	214	51.2%	5572	54.5%
Total Below Powerhouse	2385	3437	32.3%	204	48.8%	4649	45.5%

Year 2003							
Reach	Snorkel Survey			Pre-Spawn Survey		Spawn Survey	
	Actual	Estimated	Percent	Actual	Percent	Actual	Percent
A	1421	5584	32.3%	5056	45.0%	160	2.6%
B	671	2637	15.2%	3481	31.0%	635	10.5%
C1-5	82	322	1.9%	1578	14.0%	732	12.1%
C6-12	2097	8240	47.6%	718	6.4%	2536	41.8%
D	120	472	2.7%	305	2.7%	1664	27.5%
E	10	39	0.2%	93	0.8%	336	5.5%
Total	4401	17294	100%	11231	100%	6063	100%
Total Above Powerhouse	2174	8543	49.4%	10115	90%	1527	25.2%
Total Below Powerhouse	2227	8751	50.6%	1116	10%	4536	74.8%

Year 2002							
Reach	Snorkel Survey			Pre-Spawn Survey		Spawn Survey	
	Actual	Estimated	Percent	Actual	Percent	Actual	Percent
A	5284	9821	60.1%	2077	60.5%	1530	11.9%
B	1101	2046	12.5%	841	24.5%	3773	29.3%
C1-5	280	519	3.2%	164	4.8%	1857	14.4%
C6-12	2053	3816	23.4%	232	6.8%	3592	27.9%
D	65	121	0.7%	86	2.5%	1917	14.9%
E	2	4	0.02%	31	0.9%	228	1.8%
Total	8785	16328	100%	3431	100%	12897	100%
Total Above Powerhouse	6665	12386	75.9%	3082	90%	7161	55.5%
Total Below Powerhouse	2120	3941	24.1%	349	10%	5737	44.5%

Year-2001							
Reach	Snorkel Survey			Pre-Spawn Survey		Spawn Survey	
	Actual	Estimated	Percent	Actual	Percent	Actual	Percent
A	4598	8762	47.8%	ns	ns	2834	15.5%
B	1643	3130	17.1%	ns	ns	5433	29.7%
C1-5	376	716	3.9%	ns	ns	2620	14.3%
C6-12	2141	4079	22.3%	ns	ns	2809	15.3%
D	685	1305	7.1%	ns	ns	3504	19.1%
E	168	320	1.8%	ns	ns	1112	6.1%
Total	9611	18312	100%	193*	ns	18312	100%
Total Above Powerhouse	6617	12608	68.8%	ns	ns	10887	59.5%
Total Below Powerhouse	2994	5704	31.2%	ns	ns	7425	40.5%

* Sporadic surveys conducted beginning week of June 14, through September 6.

Estimates for available spawning habitat and maximum spawners accommodated at various flows were developed and discussed in the 2003 review (Ward et al. 2004b; Gard 2003). It was concluded that based upon the historic flow record (1930-2003) at the maximum sustainable flow (approximately 130 cfs), approximately 18% of useable spawning gravel is located above the CVPH and 82% below. It was estimated that the reach of Butte Creek above the CVPH would support 152-1,316 spawners at 40 cfs, and 270-2,352 spawners at 130 cfs, while the reach below the CVPH would support an estimated 1,262-10,976 spawners at 130 cfs. During the three-year period 2001-2003, it was estimated that 10,887, 7,161, 1,527, fish respectively spawned above the CVPH (Table 4) at the required minimum release flow of 40 cfs. During 2004, PG&E in coordination with CDFG and NOAA Fisheries voluntarily increased the flow above the CVPH from the required 40 cfs to 60 cfs, to provide additional habitat for the 5,572 fish that survived to spawn in that reach. Estimated usable spawning gravel increased approximately 26% when flows increased from 40 to 60 cfs, with estimated spawners supported increasing to 191 – 1661 (Ward et al. 2004b; Gard 2003). During the four-year period, there were 7,425, 5,737, 4,536, and 4,649 fish spawning respectively in the reach below the powerhouse at the average flow of approximately 130 cfs. Thus, in each of the years it appears that fish surviving to spawn in the reach above the CVPH significantly exceeded the capacity and underutilized that below the CVPH.

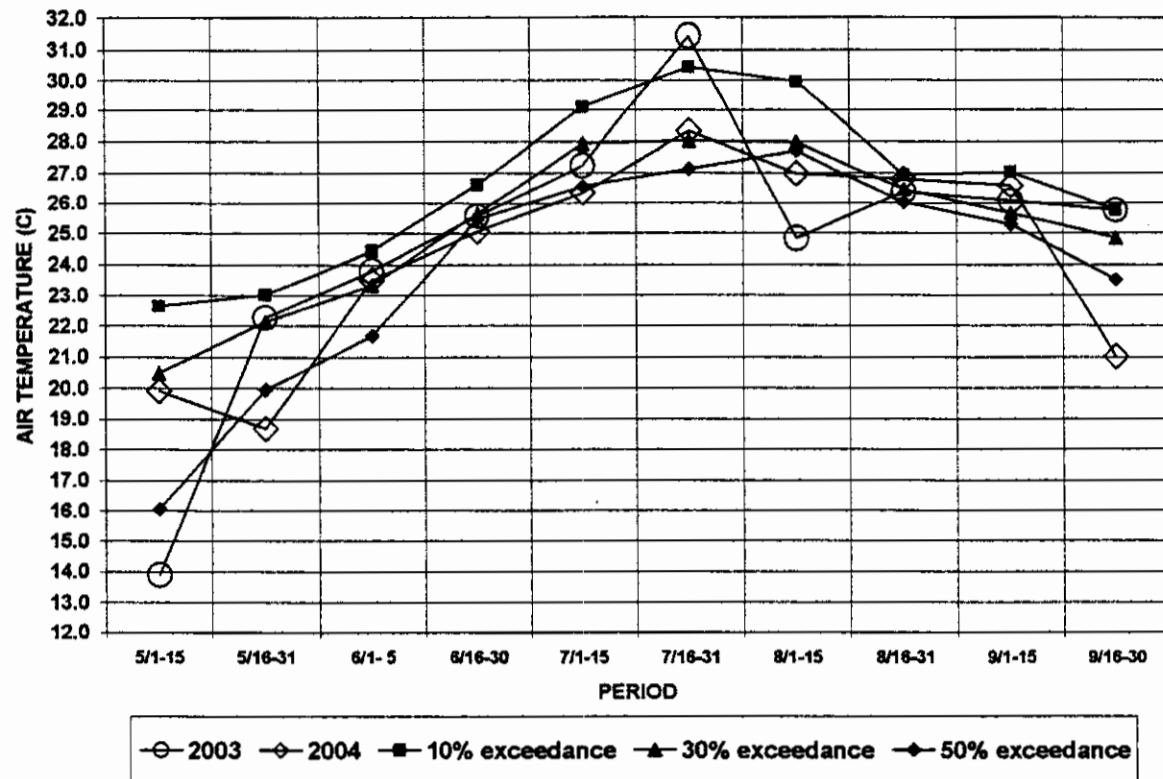
Air Temperatures

Air temperatures measured at the California Department of Forestry Cohasset Fire Station (Figure 1) were once again monitored to assess resultant stream temperatures and pre-spawn mortalities. Air temperatures during 2004 for the period June – August were generally lower than during 2003, and near the 1984-2003 average (Table 5, Figure 3) (CDWR, 2004). Maximum daily air temperatures exceeded 37.6° C (100° F) on 3 days during July 2004, as compared to 11 days during 2003. For the 17 years since 1985 where there are complete records, the average number of days in which maximum air temperatures exceeded 37.6° C was one day, with the maximum of 13 days during 1988.

Table 5. Average daily air temperatures (C) as measured at the California Department of Forestry Cohasset Fire Station for the bi-monthly periods June through September 1998-2004.

Period	Year							Avg. 1998-03
	1998	1999	2000	2001	2002	2003	2004	
June 1-15	18.1	18.3	23.0	23.3	24.3	23.8	23.5	22.0
June 16-30	21.3	26.6	28.0	25.5	25.5	25.6	25.1	25.4
July 1-15	26.2	27.5	22.7	28.0	29.3	27.2	26.4	26.8
July 16-31	27.9	23.1	27.2	25.1	27.1	31.4	28.3	27.2
Aug. 1-15	30.9	21.9	28.1	27.7	27.8	24.8	27.0	26.9
Aug. 16-31	26.0	27.2	25.0	26.8	26.0	26.4	26.8	26.3
Sept. 1-15	28.1	25.3	22.2	25.3	25.7	26.1	26.6	25.6
Sept. 16-30	19.1	25.7	24.7	23.5	24.8	25.1	21.0	23.4

Figure 3. Average daily air temperature exceedance for period 1984-2002 compared to 2003 and 2004, California Department of Forestry Cohasset Fire Station.



Water Temperatures and Flows

Average daily water temperatures began to rise in early July, peaking at the Quartz Bowl on July 7, 2004 at 20.2°C, then remaining under 20°C for the rest of year (Figure 4; Appendix E, Table 1). Average daily water temperatures at Quartz Bowl exceeded 19.5°C a total of 2 days during July 2004. Pre-spawning mortalities during 2002 and 2003 coincided with peak water temperatures at Quartz Bowl during mid-July in which average daily water temperatures exceeded 19.5°C a total of 11 days and 9 days, respectively. During 2001, there were no days during July in which water temperatures exceeded 19.5°C. While the estimated number of holding adult SRCS was similar for 2001, 2002, and 2003, being 18,312, 16,328, and 17,294, respectively, the estimate for 2004 was significantly lower at 10,637. Average daily flows in the Quartz Bowl to Centerville Powerhouse reach for each of the years were always above the required 40 cfs (Appendix G, Table 1).

The DeSabra Forebay continues to be a significant heat source with average daily heating through the Forebay exceeding 1°C during the entire period June 15, - September 30, 2004 (Figure 5, Tables 6&7) (Sagraves, 2004). This was partially documented during 2003 (Ward et al., 2004b) and during previous evaluations conducted by PG&E (PG&E, 1993). PG&E also concluded that to keep temperature increases through the forebay less than 1°C would require a flow of 108 cfs or greater.

Figure 4. Average daily water temperature (C) at Quartz Bowl July through September 2001-2004.

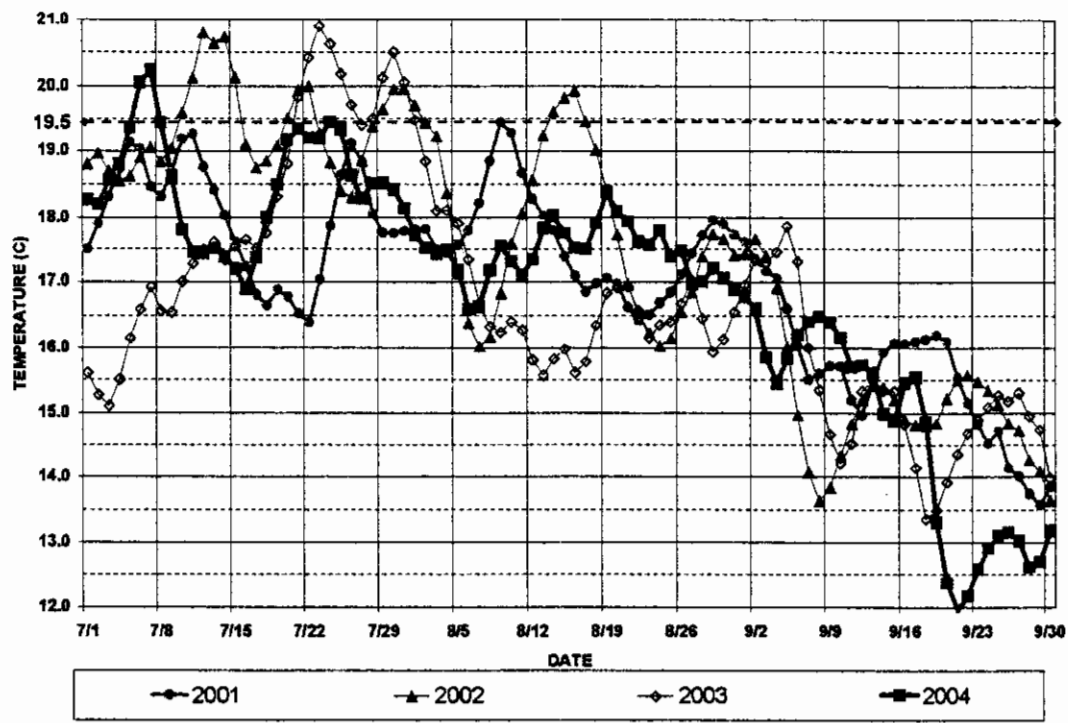
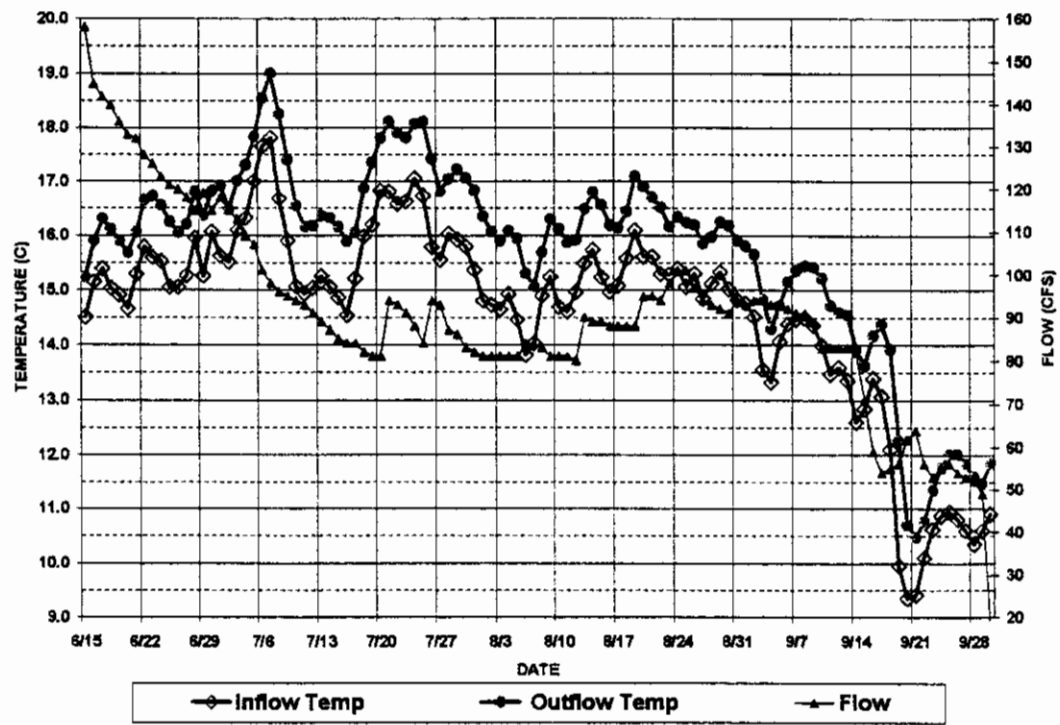


Figure 5. Average daily water temperature (C) at DeSabra Forebay inflow and DeSabra Powerhouse outflow compared to average daily flows (cfs) June 15- September 30, 2004.



As was demonstrated during 2003 additional sources of heating continue to be evident within the channel of Butte Creek between the DSPH discharge and the CVHD and between the CVHD and the CVPH (Tables 6 & 7) (Bundy, 2004; Sagraves, 2004). Heating in the reach from the CVHD to immediately above the CVPH ranged from 2.9°C to 3.9°C during July and August 2004, compared to 1.7°C to 4.3°C for the same period in 2003. This reach is affected by the minimum flow release of 40 cfs and the limited ability of flows above 40 cfs to reduce heating (PG&E 1993). Flows conveyed via the Centerville Canal to the CVPH continued to be significantly cooler due to the short conveyance time and shading, with increases in temperature ranging from 0.56°C to 0.89°C during July-August 2004, and from 0.40°C to 0.86°C during the same period in 2003.

Table 6. Bi-monthly average water temperature increase (C) at key locations within the PG&E DeSabra Centerville Project conveying water into and within Butte Creek, July through September.

Site and Distance*		July 1-15		July 16-31		Aug. 1-15		Aug. 16-31		Sept. 1-15		Sept. 16-30	
		T o t a l	P M e i t e	T o t a l	P M e i t e	T o t a l	P M e i t e	T o t a l	P M e i t e	T o t a l	P M e i t e	T o t a l	P M e i t e
Hendricks Head Dam to Toadtown Canal Gage - 2003 (Site S2 to S3, 10.28 miles)	2004	0.62	0.06	0.77	0.07	0.74	0.07	0.43	0.04	0.36	0.04	0.53	0.05
	2003	0.73	0.07	0.95	0.09	0.93	0.09	0.79	0.08	0.69	0.07	1.14	0.11
Toadtown Canal Gage to DeSabra Forebay - 2003 (Site S3 to S4, 0.88 miles)	2004	-0.01	-0.01	0.25	0.29	0.33	0.38	-0.14	-0.16	-0.37	-0.42	-0.43	-0.49
	2003	-0.22	-0.25	-0.30	-0.34	ND	ND	-0.14	-0.16	-0.55	-0.63	-0.51	-0.57
DeSabra Forebay to DeSabra Powerhouse Outfall - 2003 (Site S4 to S5, 1.35 miles)	2004	1.17	0.87	1.21	0.89	1.21	0.9	1.04	0.77	1.04	0.77	1.17	0.86
	2003	1.37	1.01	1.59	1.18	ND	ND	0.87	0.65	0.79	0.59	1.05	0.78
DeSabra Powerhouse Outflow to Centerville Head Dam - 2003 (Site S5 to S6, 0.14 miles)	2004	0.6	4.31	0.59	4.19	0.63	4.52	0.5	3.59	0.39	2.78	0.65	4.66
	2003	0.21	1.51	0.54	3.87	0.71	5.08	0.51	3.64	0.41	2.90	0.50	3.58
Centerville Head Dam via Centerville Canal to Centerville Powerhouse Outflow - 2003 (Site S6 to S10/11, 3.19 miles)	2004	0.67	0.08	0.77	0.09	0.75	0.09	0.65	0.08	0.61	0.08	0.82	0.10
	2003	0.71	0.09	0.65	0.08	0.55	0.07	0.52	0.06	0.48	0.06	0.63	0.08
Centerville Head Dam via Creek to immediately above Centerville Powerhouse Outflow - 2003 (Site S6 to S11, 6.62 miles)	2004	3.45	0.52	3.40	0.51	3.37	0.51	3.16	0.48	2.94	0.44	2.50	0.38
	2003	2.13	0.32	3.33	0.50	3.77	0.57	3.45	0.52	3.11	0.47	2.86	0.43
Centerville Head Dam to Quartz Bowl Pool - 2003 (Map site S6 to S7, 1.03 miles)	2004	0.72	0.70	0.70	0.68	0.71	0.69	0.70	0.68	0.66	0.64	0.57	0.56
	2003	0.45	0.44	0.65	0.63	0.81	0.78	0.67	0.65	0.63	0.62	0.59	0.57
Quartz Bowl Pool to Chimney Rock (Site S7 to S8, 1.27 miles)	2004	0.63	0.49	0.60	0.48	0.61	0.48	0.57	0.45	0.52	0.41	0.44	0.35
	2003	0.46	0.36	0.70	0.55	0.82	0.65	0.73	0.58	0.61	0.48	0.59	0.47
	2002	0.60	0.47	0.63	0.50	0.55	0.43	0.50	0.39	0.45	0.35	0.40	0.31
	2001	0.56	0.44	0.65	0.51	0.55	0.43	0.52	0.41	0.51	0.40	0.49	0.39
	Avg.	0.56	0.44	0.65	0.51	0.63	0.50	0.58	0.46	0.52	0.41	0.48	0.38
Chimney Rock to Pool 4 (Site S8 to S9, 2.19 miles)	2004	0.95	0.44	0.94	0.43	0.92	0.42	0.85	0.39	0.79	0.36	0.69	0.31
	2003	0.71	0.33	1.03	0.47	1.06	0.48	1.04	0.48	0.93	0.45	0.89	0.41
	2002	0.71	0.32	0.73	0.34	0.72	0.33	0.68	0.31	0.69	0.32	0.64	0.29
	2001	1.08	0.50	1.14	0.52	1.05	0.48	1.03	0.47	0.95	0.43	0.95	0.43
	Avg.	0.87	0.40	0.96	0.44	0.94	0.43	0.90	0.41	0.84	0.38	0.79	0.36
Pool 4 to immediately above Centerville Powerhouse Outflow - 2003 (Site S9 to S11, 2.13 miles)	2004	1.15	0.54	1.15	0.54	1.13	0.53	1.03	0.48	0.96	0.45	0.80	0.38
	2003	0.51	0.24	0.94	0.44	0.97	0.45	1.02	0.48	0.93	0.44	0.79	0.37

* See Figure 1.

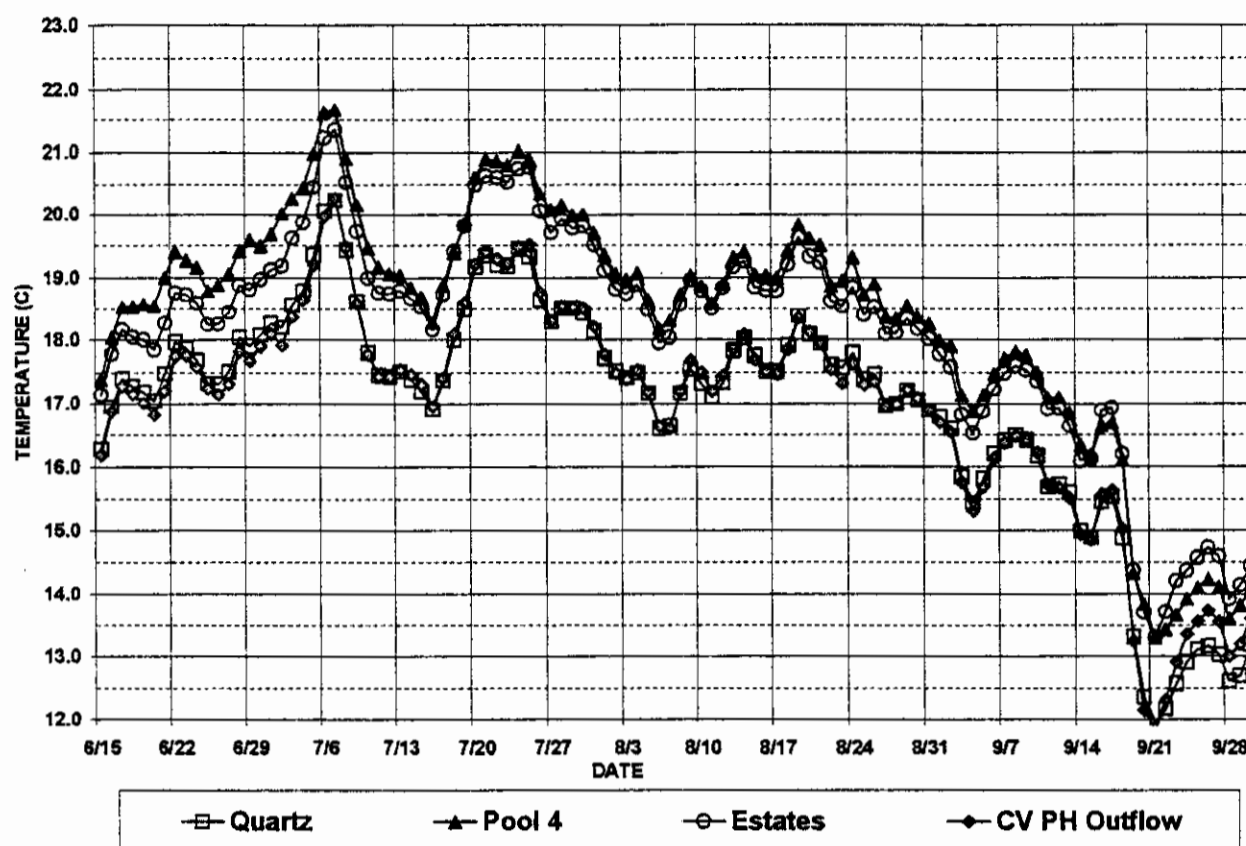
Table 7. Bi-monthly average daily flows (cfs) and water temperature (C) for key sites within PG&E DeSabra Centerville Project affecting Butte Creek SRCS holding and spawning.

Locations*		July 1-15		July 16-31		Aug. 1-15		Aug. 16-31		Sept. 1-15		Sept. 16-30	
		Flow	Temp	Flow	Temp	Flow	Temp	Flow	Temp	Flow	Temp	Flow	Temp
Hendricks Head Dam (Site S2)	2004	17	15.3	17	15.0	18	13.7	18	15.0	18	13.9	19	10.8
	2003	nr	14.0	nr	16.5	nr	13.6	nr	13.7	nr	14.1	nr	11.8
Toadtown Canal Above Butte Canal (Site S3)	2004	55	15.9	50	15.8	50	14.5	62	15.4	58	14.2	26	11.3
	2003	84	14.8	59	17.4	59	14.6	66	14.5	64	14.8	33	12.9
	1998-2002	69	15.8	67	15.1	64	15.1	57	14.7	58	13.8	43	12.9
DeSabra Forebay Inflow (Site S4)	2004	99	15.9	87	16.1	83	14.8	94	15.3	88	13.9	53	10.9
	2003	86	14.5	96	14.9	102	nr	101	14.3	98	14.2	64	12.4
	1998-2002	121	nr	113	nr	109	nr	103	nr	96	nr	80	nr
Butte Creek Above DeSabra Ph Discharge, PG&E temporary gage 2004 (Site S5)	2004	36	19.2	33	19.3	31	18.2	30	18.2	29	16.3	30	13.6
	2003	121	nr	57	nr	44	nr	41	nr	40	nr	37	nr
	1998-2002	42	nr	39	nr	39	nr	36	nr	35	nr	35	nr
DeSabra PH Discharge (Below site S5)	2004	99	17.1	87	17.3	83	16.0	94	16.3	88	14.9	53	12.0
	2003	86	15.9	96	18.3	102	15.6	101	15.2	98	15.0	64	13.5
	1998-2002	121	nr	113	nr	109	nr	103	nr	96	nr	80	nr
Below Centerville Head Dam (Site S6)	2004	45	17.7	45	17.9	44	16.7	45	16.8	45	15.3	52	12.7
	2003	nr	16.1	52	18.8	45	16.3	44	15.7	44	15.4	44	14.0
	1998-2002	48	nr	47	nr	48	nr	46	nr	46	nr	46	nr
Quartz Bowl (Site S7)	2004	45	18.4	45	18.6	44	17.4	45	17.5	45	15.9	52	13.3
	2003	nr	16.6	52	19.5	45	17.0	44	16.4	44	16.0	44	14.5
	2002	47	19.4	47	19.2	47	18.1	47	17.5	47	15.5	46	14.9
	2001	48	18.5	47	17.5	47	18.1	47	17.1	47	16.1	47	15.0
Chimney Rock (Site S8)	2004	45	19.0	45	19.2	44	18.0	45	18.1	45	16.5	52	13.7
	2003	nr	17.0	52	20.2	45	17.8	44	17.1	44	16.6	44	15.1
	2002	47	20.0	47	19.9	47	18.7	47	18.0	47	15.9	46	15.3
	2001	48	19.1	47	18.2	47	18.7	47	17.6	47	16.6	47	15.5
Pool 4 (Site S9)	2004	45	20.0	45	20.1	44	18.9	45	18.9	45	17.3	52	14.4
	2003	nr	17.7	52	21.2	45	18.9	44	18.2	44	17.6	44	16.0
	2002	47	20.7	47	20.6	47	19.4	47	18.7	47	16.6	46	15.9
	2001	49	20.1	47	19.3	47	19.7	47	18.7	47	17.6	47	16.4
Butte Creek above Centerville PH Discharge (Site S11)	2004	45	21.2	45	21.3	44	20.0	45	20.0	45	18.2	52	15.2
	2003	nr	18.3	52	22.1	45	20.0	44	19.2	44	18.5	44	16.8
Centerville PH Discharge (Site S10)	2004	119	18.4	108	18.6	100	17.4	103	17.5	105	15.9	52	13.5
	2003	116	16.8	130	19.5	116	16.8	117	16.3	112	15.9	76	14.6
	1998-2002	118	nr	105	nr	101	nr	95	nr	93	nr	77	nr
Centerville Estates (Site S12)	2004	192	19.6	171	19.9	179	18.7	160	18.7	146	17.0	110	14.7
	2003	194	18.1	133	20.9	132	18.3	147	17.7	147	17.6	109	nr
	2002	120	20.9	113	20.9	118	19.7	118	19.0	117	16.9	81	16.5
	2001	143	19.9	136	19.0	127	19.7	118	18.7	115	17.6	106	16.5
Cable Bridge (Site S13)	2004	192	20.4	171	20.8	179	19.8	160	19.4	146	17.8	110	15.3
	2003	194	18.7	133	21.7	132	19.1	147	18.3	147	17.9	109	nr
	2002	120	22.0	113	21.9	118	20.7	118	19.9	117	17.7	81	17.4
	2001	143	nr	136	20.9	127	20.6	118	19.7	115	18.5	106	17.4
Covered Bridge (Site S14)	2004	176	21.1	171	21.6	179	20.5	160	20.3	146	18.6	110	16.3
	2003	194	19.6	133	22.6	132	20.1	147	19.3	147	18.6	109	17.4
	2002	120	22.9	113	22.7	118	21.5	118	20.6	117	18.4	81	18.0
	2001	143	21.6	136	20.9	127	21.4	118	20.5	115	19.2	106	18.0

* See Figure 1.

As observed during 2003 water temperatures at Pool 4 and Estates Pool (Figures 1 & 6) provide graphic evidence of the effects of the diversion through the CVPH and the related effect upon SRCS holding and spawning distribution. Flows diverted through the CVPH as measured approximately 0.6 miles downstream at the Estates Pool are generally close to temperatures at Pool 4 for those flows remaining in Butte Creek (Figure 6) and reflect the impacts of the cooler CVPH discharge.

Figure 6. Average daily water temperatures (C) at select SRCS holding pools in Butte Creek from June 15 through September 30, 2004.



DISCUSSION

Flow and temperatures within the SRCS holding and spawning reach of Butte Creek are directly affected by the PG&E DeSabra-Centerville Project (FERC-803). At issue is whether the project as currently operated negatively impacts SRCS survival and spawning success. As concluded during 2003, current operations seem to benefit both holding and spawning for Butte Creek SRCS (Ward et al., 2004b). As previously observed, flows discharged at the CVPH are generally significantly cooler during the key summer holding period than the flows in Butte Creek above the CVPH. During 2004, as was previously observed, the cooler water below the CVPH provided more SRCS holding habitat and significantly enhanced the spawning distribution allowing better utilization of the majority of the spawning gravel below the powerhouse. The flow-temperature evaluation conducted by (PG&E, 1993) showed that increased flows would not materially reduce the temperatures above the CVPH and would significantly

increase water temperatures below. Evaluation of holding and spawning since 2001 continues to show a net downstream movement of SRCS from holding pools to spawning areas. However, in general the downstream movement is limited, with little net movement from above the CVPH to the reach below. During 2004 approximately 1,416 fish holding above the CVPH (20% of the total) moved to spawn below (Table 4; Appendix B, Figures 1-5). However, even with significant pre-spawning mortalities during 2002 and 2003, use of estimated spawning gravel above the CVPH was exceeded in all four years, and significantly underutilized in the reach below the CVPH.

The previous evaluation suggested that an extended period of average daily temperatures above 19.4°C during July as measured at the Quartz Bowl preceded the onset of significant pre-spawn mortalities (Ward et al., 2004b). During 2002, temperatures exceeded 19.4°C a total of 16 days with a maximum of 20.8°C on July 12. During 2003, temperatures exceed 19.4°C a total of 11 days with a maximum of 20.9°C on July 23. However during 2001 when there were minimal pre-spawn mortalities, maximum daily average water temperature at Quartz Bowl never exceeded 19.4 °C. During 2004, maximum daily water temperatures exceeded 19.4°C on only 2 days in early July, with a maximum of 20.2°C on July 7, followed by a significant cooling period (Appendix E, Table 1). The limited pre-spawn mortalities during 2004 continue to support the previous conclusion that pre-spawn mortalities seem to occur when there are sustained water temperatures at Quartz Bowl above 19.0°C. Additionally, during 2004 the estimated total population was significantly smaller at 10,637, than during the previous three years 17,294, 16,328, 18,312, respectively.

The PG&E contingency plan to regulate WBFR flows to reduce Butte Creek temperatures was never implemented since air temperature thresholds as established in the plan were never exceeded. PG&E meteorologists did provide twice-weekly forecasts for the entire period beginning on June 14. At the onset of spawning and at the recommendation of the CDFG and NOAA Fisheries, PG&E voluntarily increased flows in the reach above the CVPH from the FERC requirement of 40 cfs to 60 cfs. It is estimated that the increased flows provided access to approximately 26% more spawning gravel, increasing the estimated maximum number of spawners accommodated from 1,316 to 1,661.

CONCLUSIONS AND RECOMMENDATIONS

There were approximately 418 SRCS that died prior to spawning during 2004, of which 214 were in the reach above the Centerville Powerhouse and 204 below. Mortalities were fairly evenly spread over the entire pre-spawn period from June 15, through September 24, 2004. Due to the low number of mortalities none was examined by a CDFG pathologist. We conclude that all were likely normal attrition among a population of fish holding in fresh water since early spring. Pre-spawn mortalities consisted of approximately 75% female and 25% male. Although there were no CWT's recovered from pre-spawn mortalities, based upon recovery of 13 CWT's during the subsequent spawning survey, we estimate that there were approximately 86% age-3 and 14% age-4.

Air temperatures and resultant water temperatures were lower in 2004, than during the previous two years in which there were significant pre-spawn mortalities. Additionally, the total population during 2004 was significantly smaller at 10,637 than during 2003 and 2002 which were 17,294, 16,328, respectively. The 2004 results continue to support the conclusion that the 1991 FERC requirement that PG&E maintain a minimum release of 40 cfs from June 1 through September 14, below the Centerville Head Dam, appears to have maximized survival and spawning success. Increased flows in the reach below the CVHD at onset of spawning increased the available spawning habitat, although spawning habitat was again significantly over-utilized above the CVPH and under-utilized below the CVPH.

As previously demonstrated, diversions through the CVPH significantly decreased temperatures in Butte Creek below the CVPH, providing important holding habitat during the summer, and ultimately contributing to more efficient usage of spawning habitat.

While current PG&E project operations appear to provide a net benefit to Butte Creek SRCS, we recommend that PG&E consider the following:

- Investigate and implement alternatives to reduce or eliminate heating through the DeSabra Forebay.
- Continue to investigate other means to reduce sources of heating.
- Continue to schedule maintenance operations for periods after SRCS have spawned.
- Continue development of a predictive model to better manage flows from the WBFR.
- Continue to increase flows up to 80 cfs, in the reach above the CVPH at onset of SRCS spawning to maximize available spawning gravel.

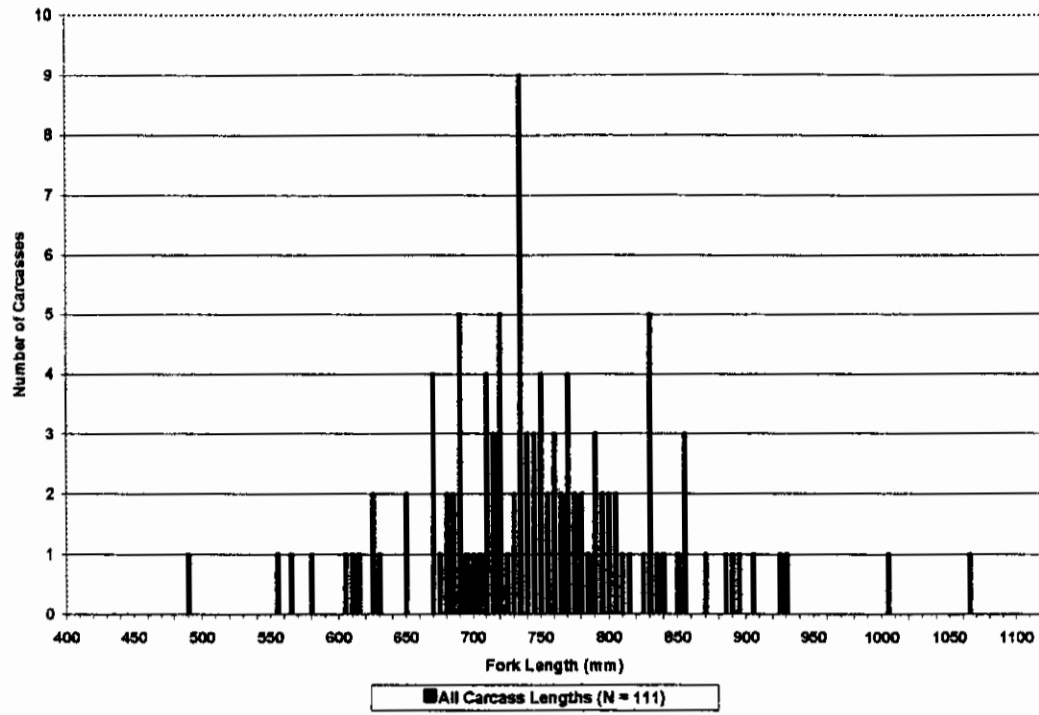
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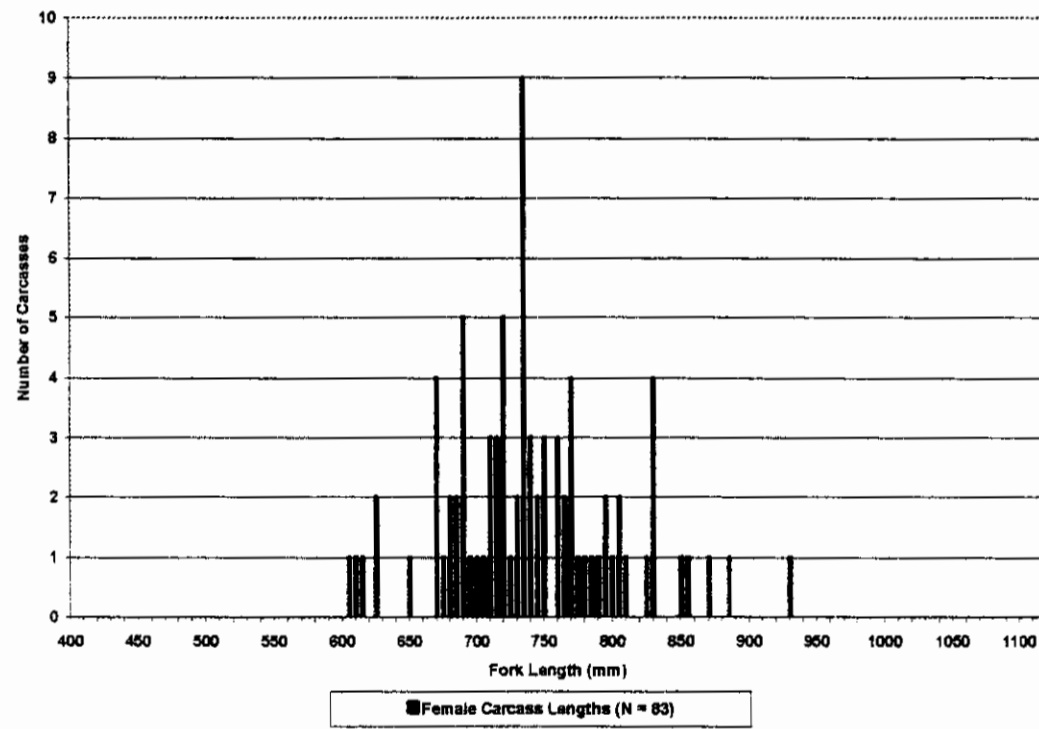
APPENDIX A

**FIGURES 1-3
LENGTH FREQUENCY DISTRIBUTION OF ADULT
BUTTE CREEK SPRING-RUN CHINOOK SALMON**

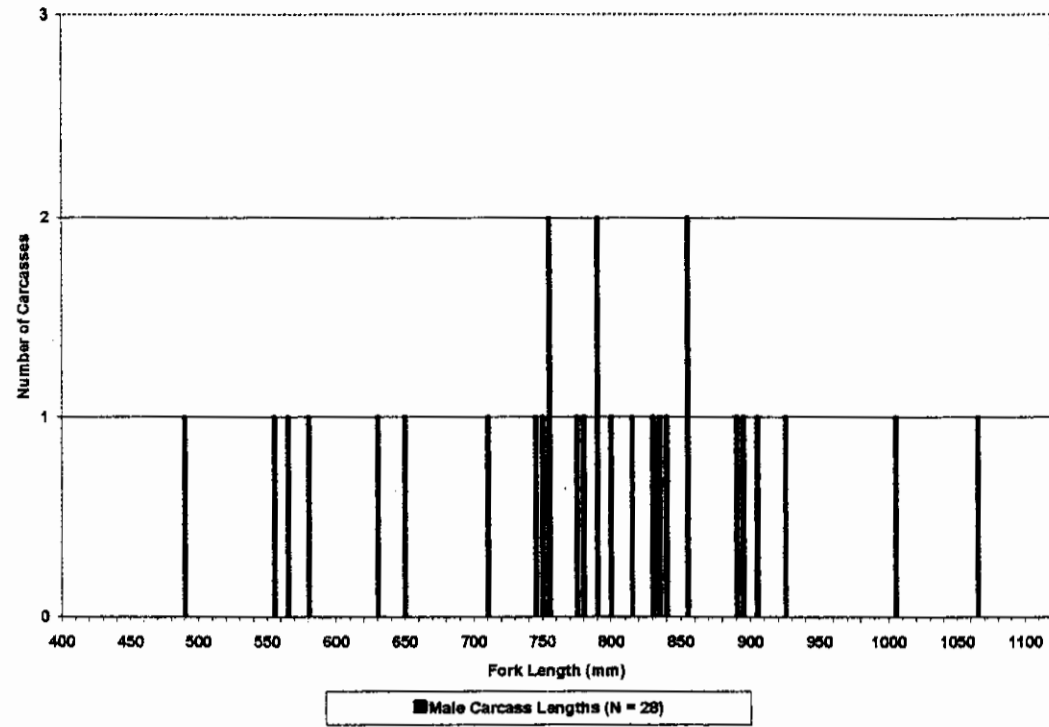
APPENDIX A, Figure 1. Length frequency distribution of 111 adult SRCS carcasses measured and marked for abundance estimate between June 15, 2004 and September 23, 2004.



APPENDIX A, Figure 2. Length frequency distribution of 83 adult female SRCS carcasses measured and marked for abundance estimate between June 15, 2004 and September 23, 2004.



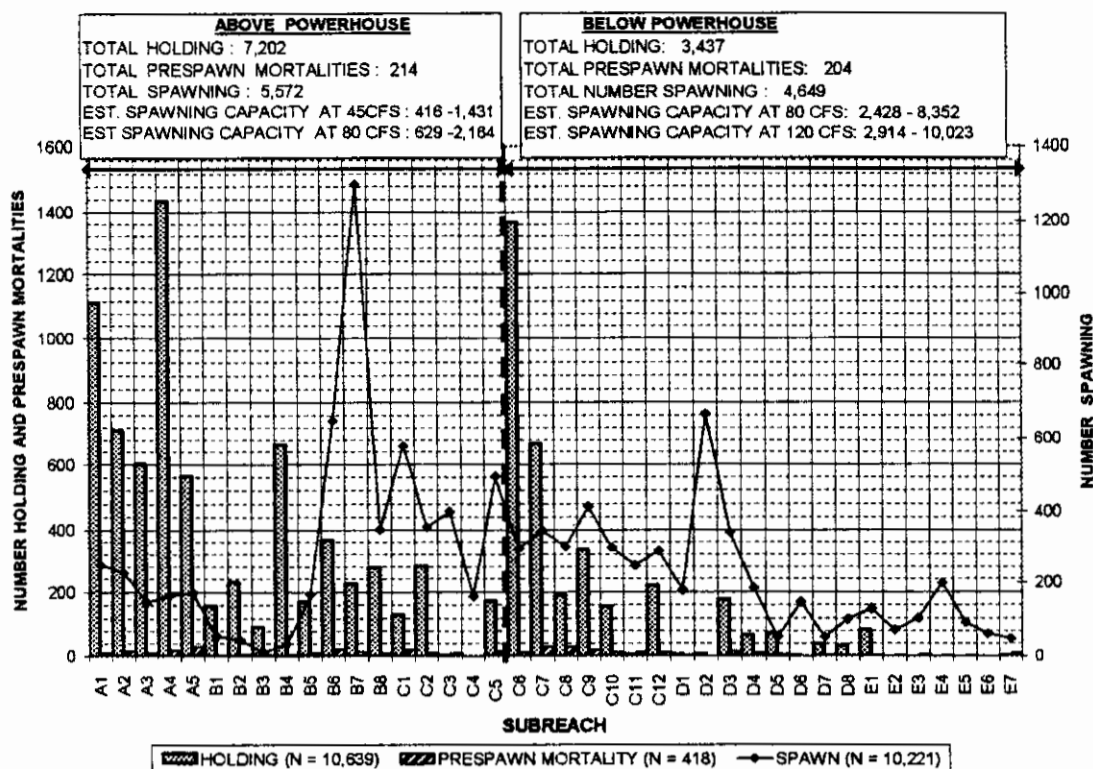
APPENDIX A, Figure 3. Length frequency distribution of 28 male adult SRCS carcasses measured and marked for abundance estimate between June 15, 2004 and September 23, 2004.



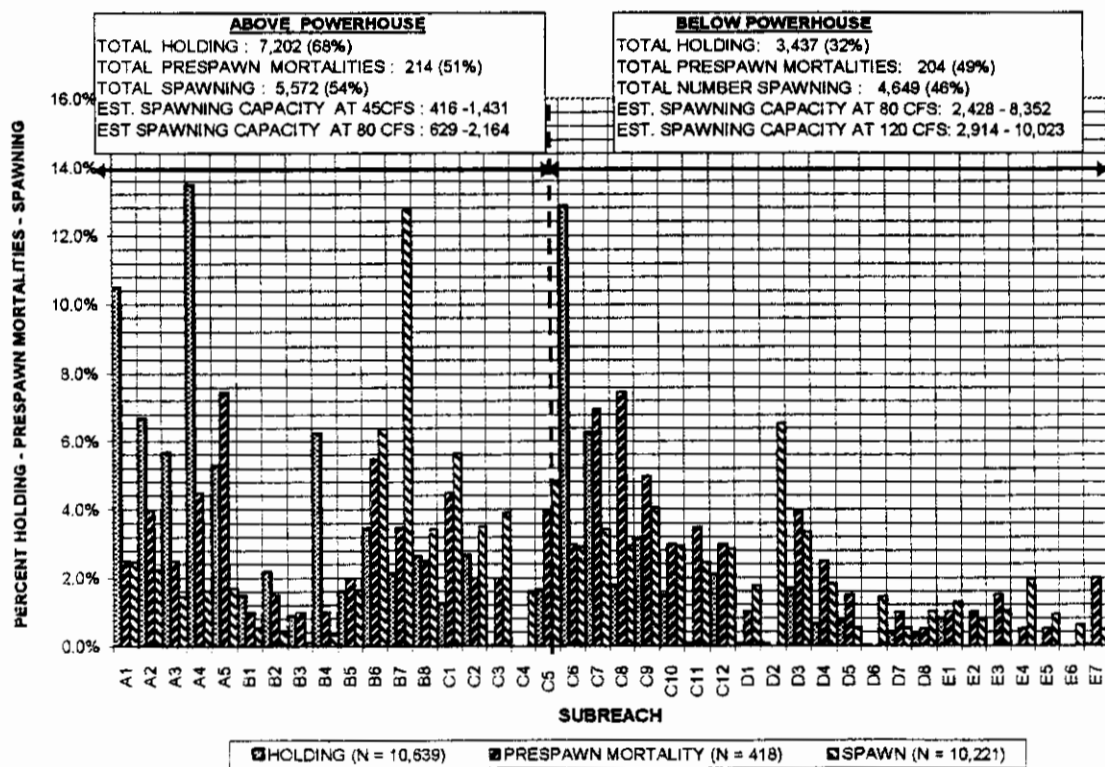
APPENDIX B

**FIGURES 1-5
HOLDING, PRE-SPAWN MORTALITY AND SPAWNING
DISTRIBUTION OF BUTTE CREEK SPRING-RUN CHINOOK SALMON**

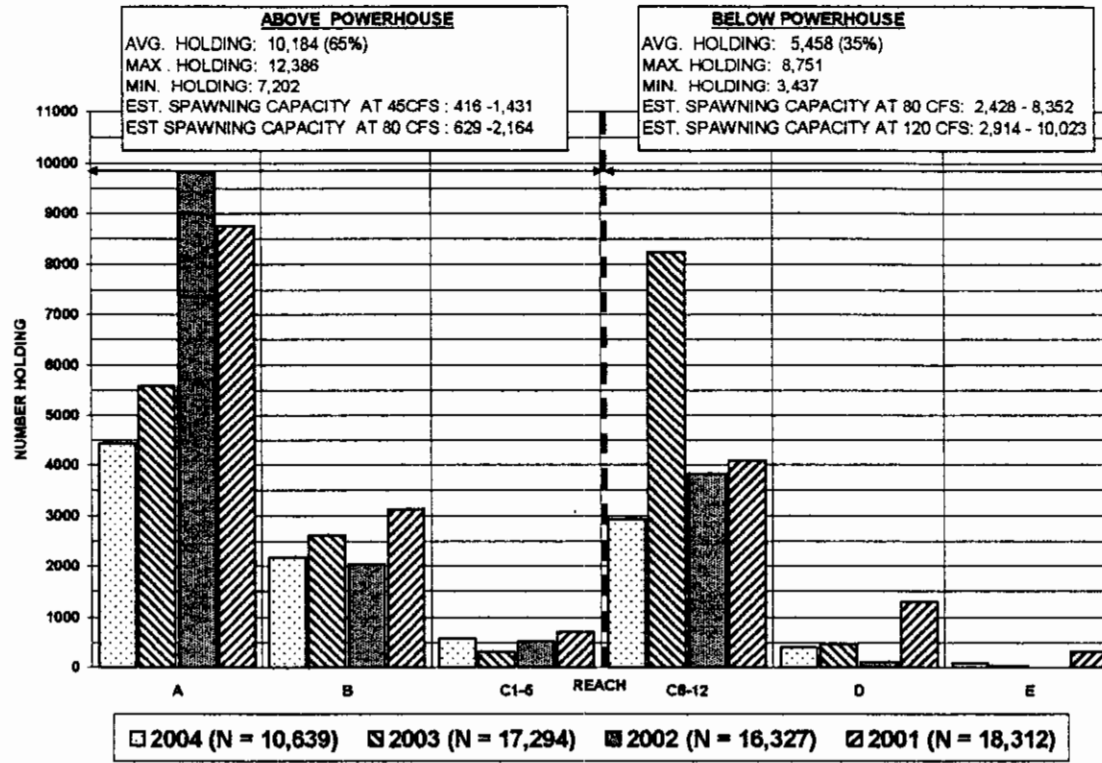
APPENDIX B, Figure 1. Distribution by sub-reach of the number of Butte Creek SRCS holding, pre-spawn mortalities, and spawning during 2004.



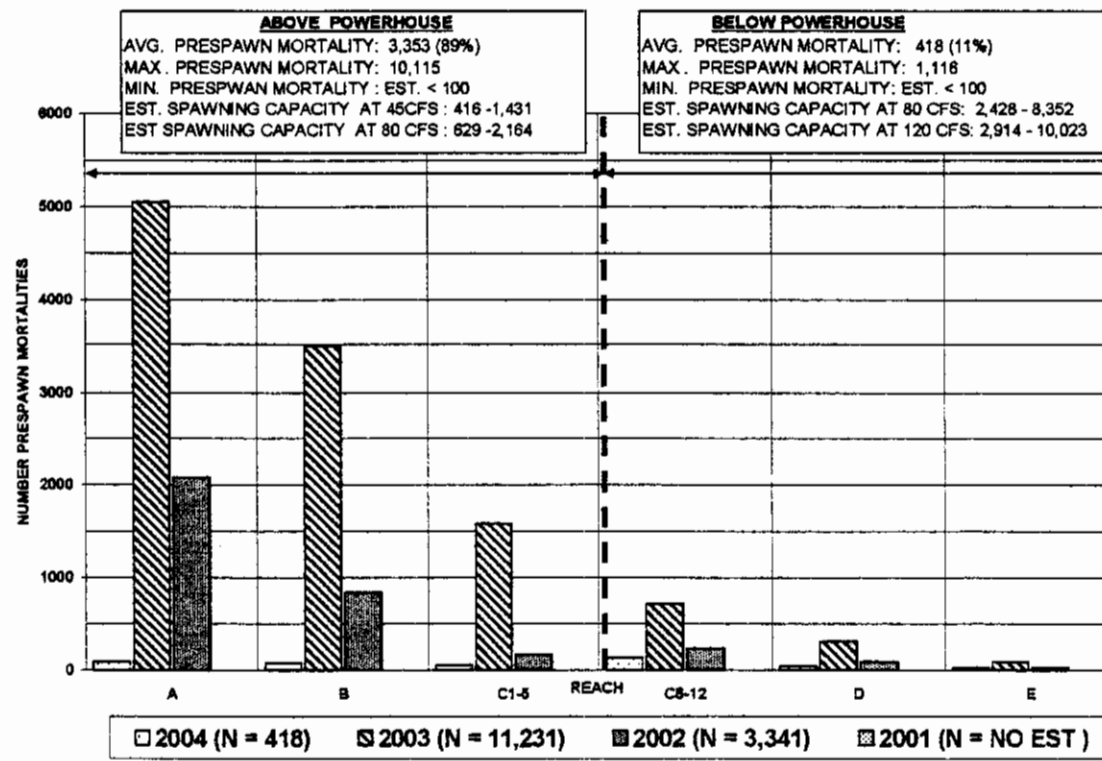
APPENDIX B, Figure 2. Distribution by sub-reach of the percent of Butte Creek SRCS holding, pre-spawn mortalities, and spawning during 2004.



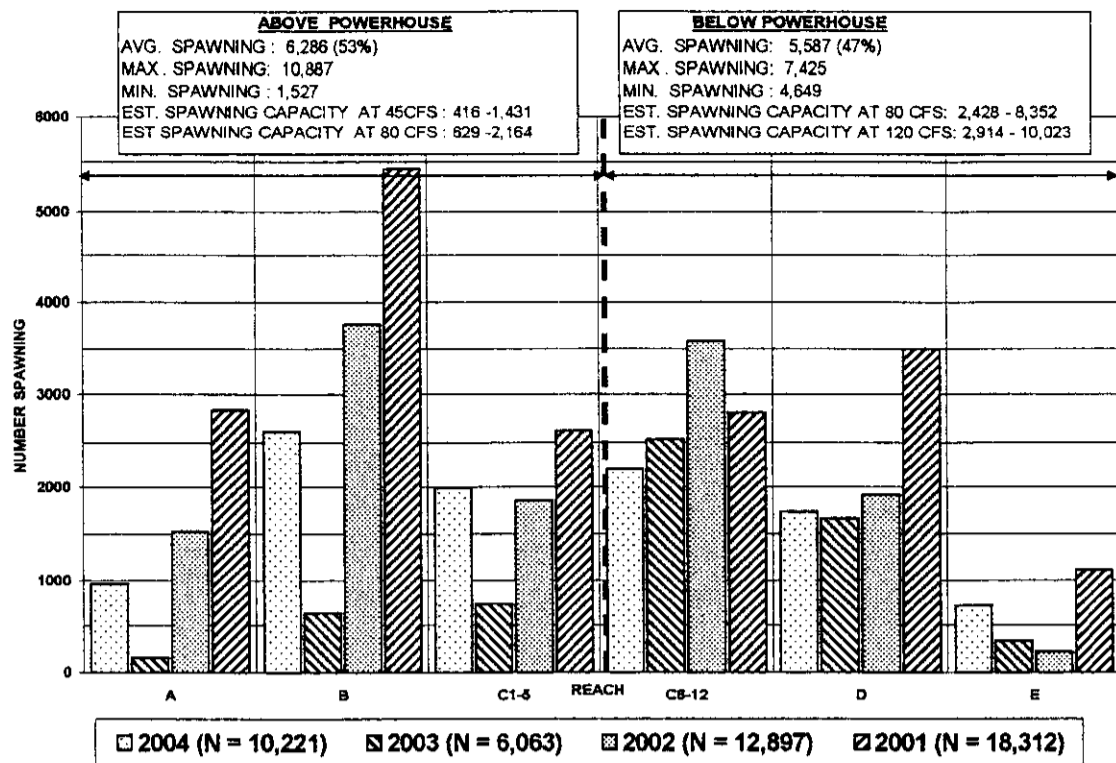
APPENDIX B, Figure 3. Distribution by reach of the number of Butte Creek SRCS holding, during 2001-2004.



APPENDIX B, Figure 4. Distribution by reach of the number of Butte Creek SRCS prespawn mortalities during 2001-2004.

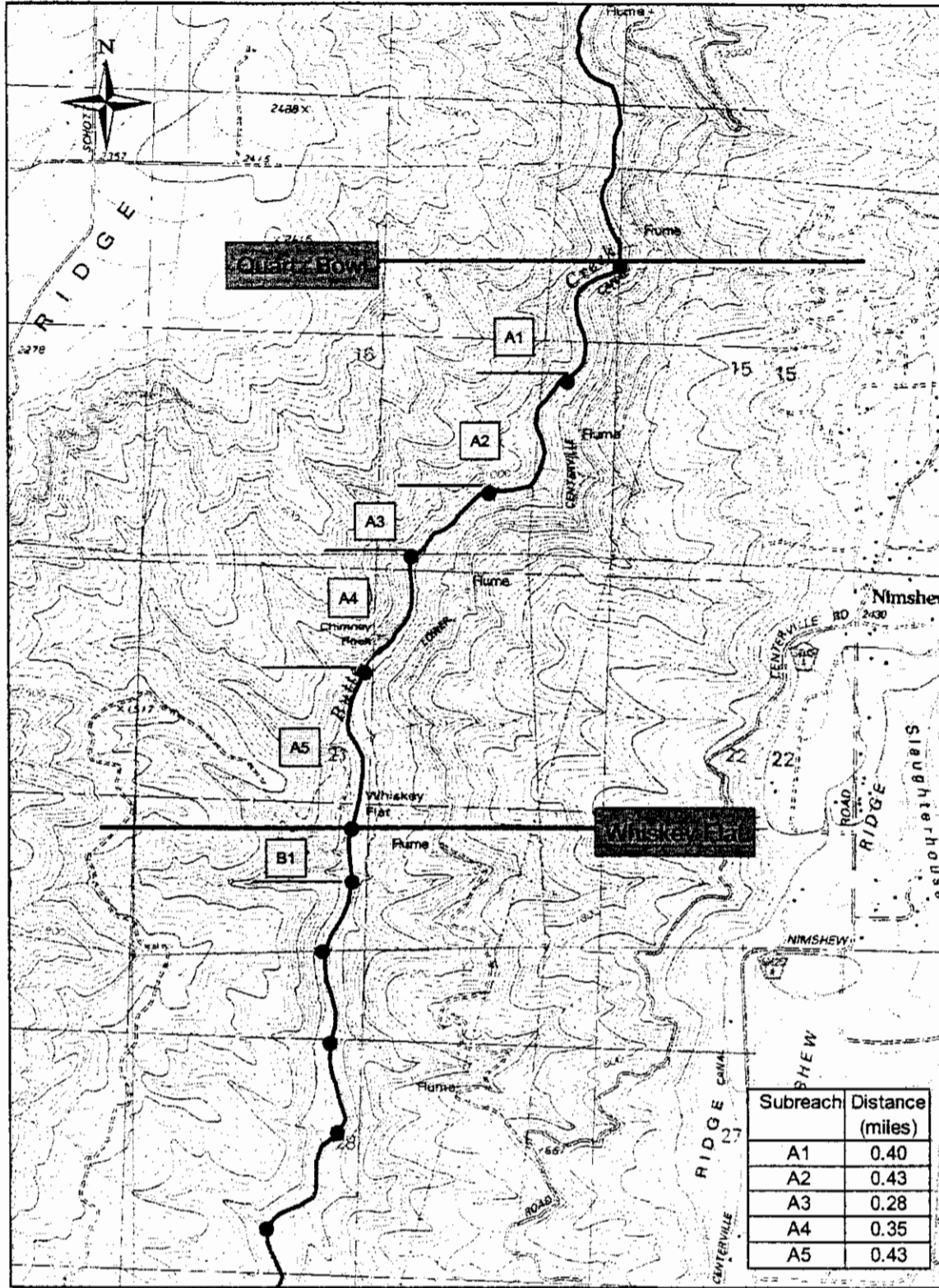


APPENDIX B, Figure 5. Distribution by reach of the number of Butte Creek SRCS spawning during 2001-2004.

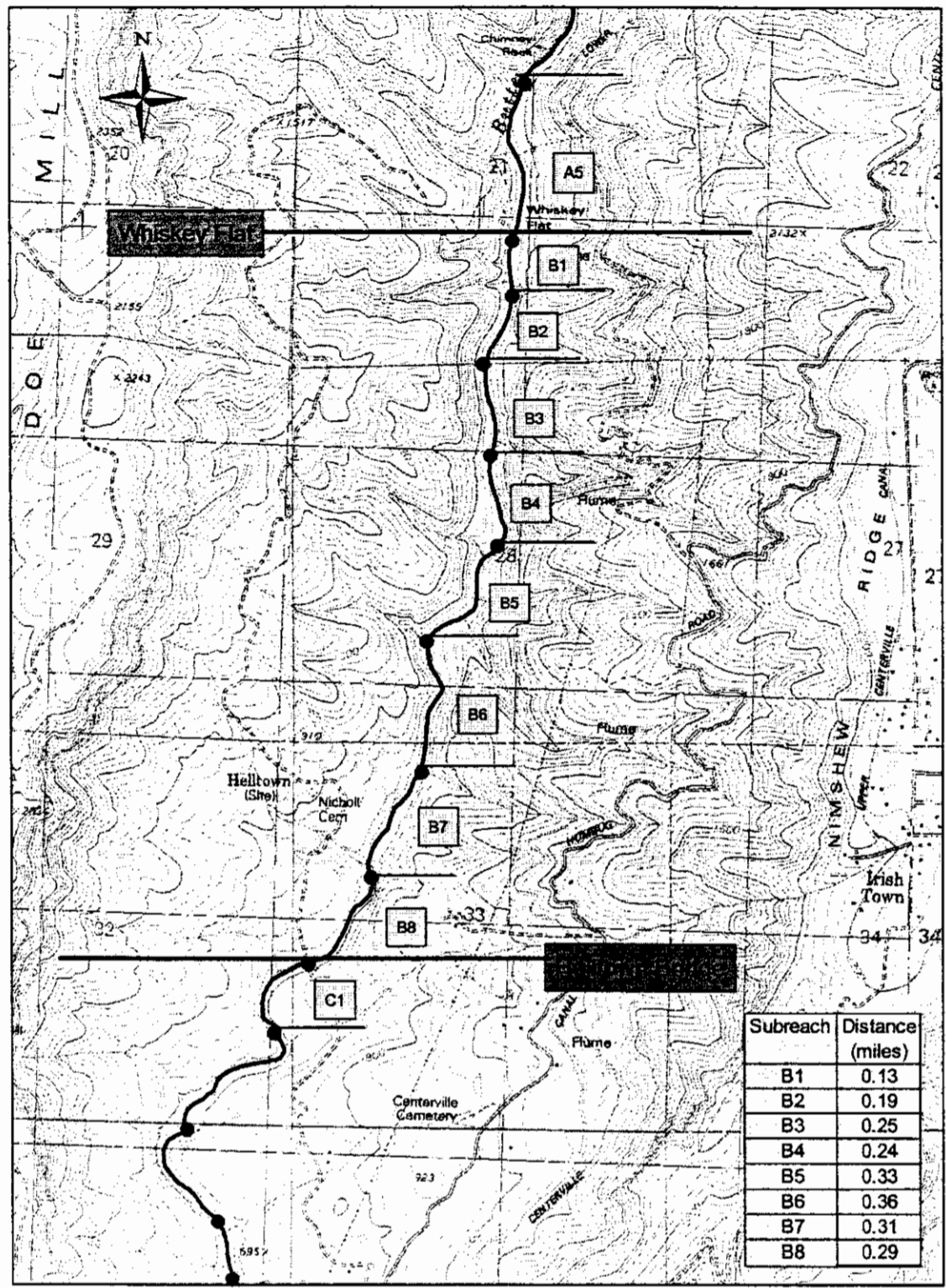


APPENDIX C

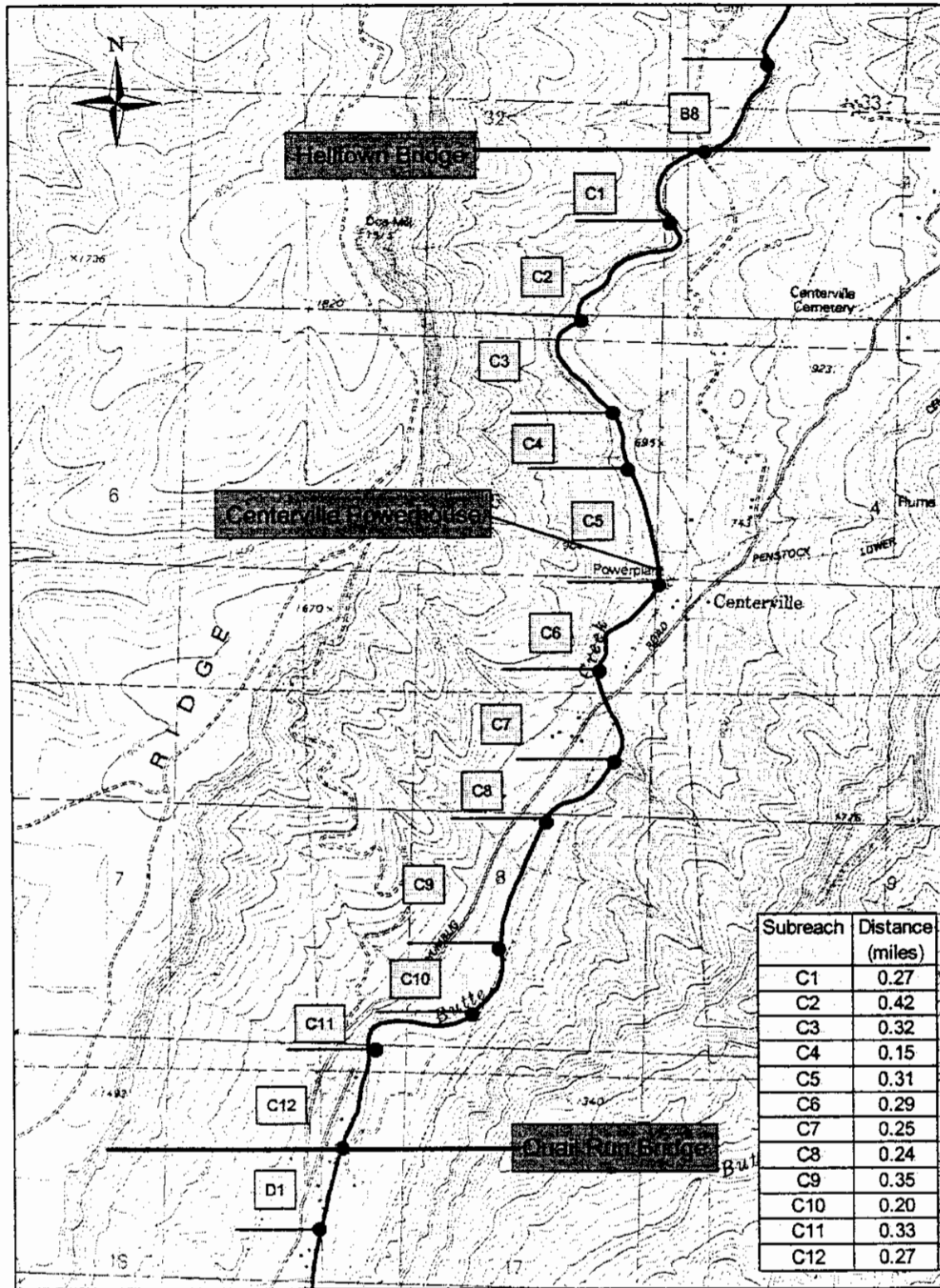
**FIGURES 1-5
MAPS OF BUTTE CREEK HOLDING AND SPAWNING REACHES**



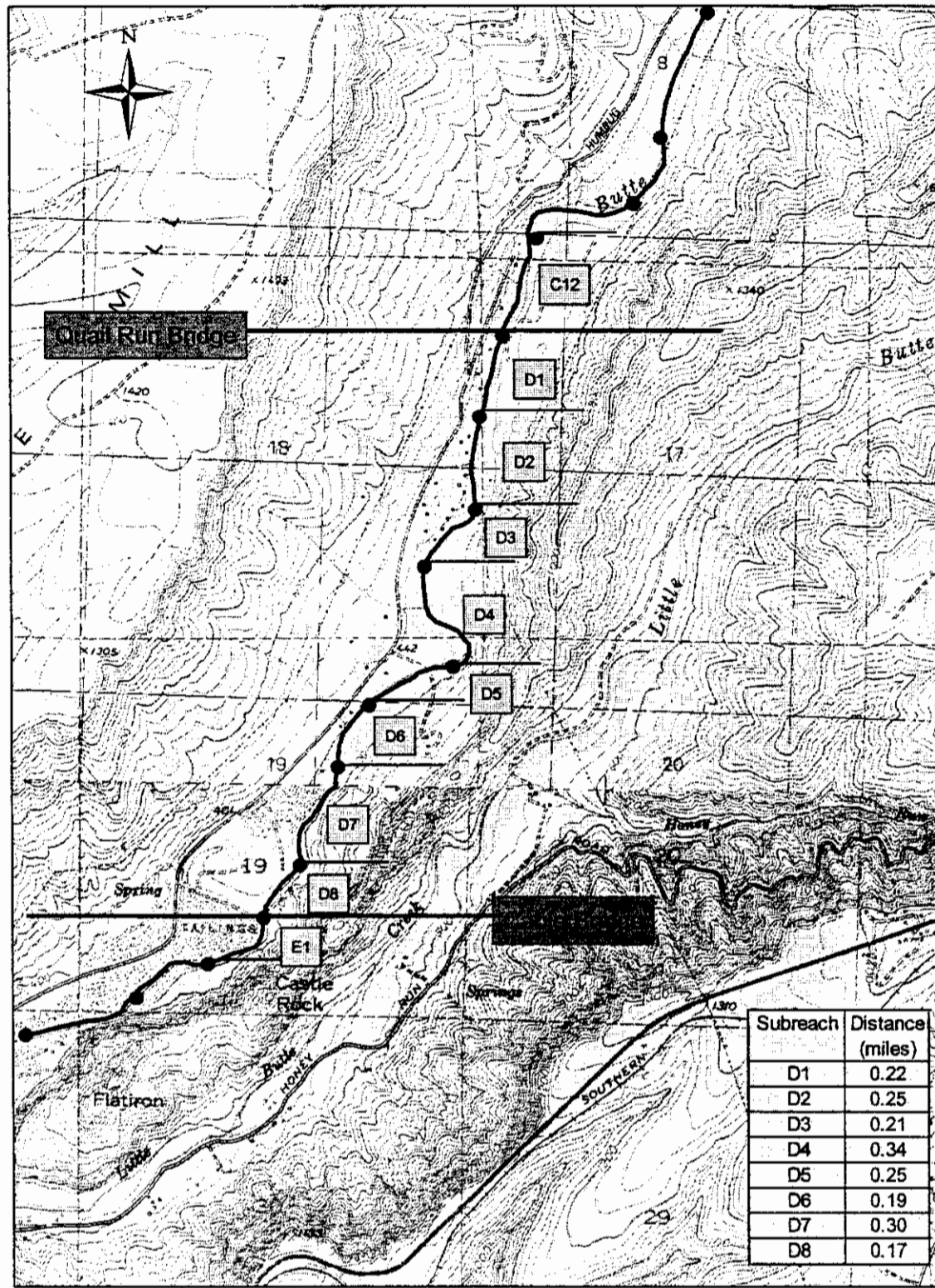
APPENDIX C, Figure 1. Map of Butte Creek spring-run Chinook salmon holding and spawning Reach A, showing sub-reaches and distances.



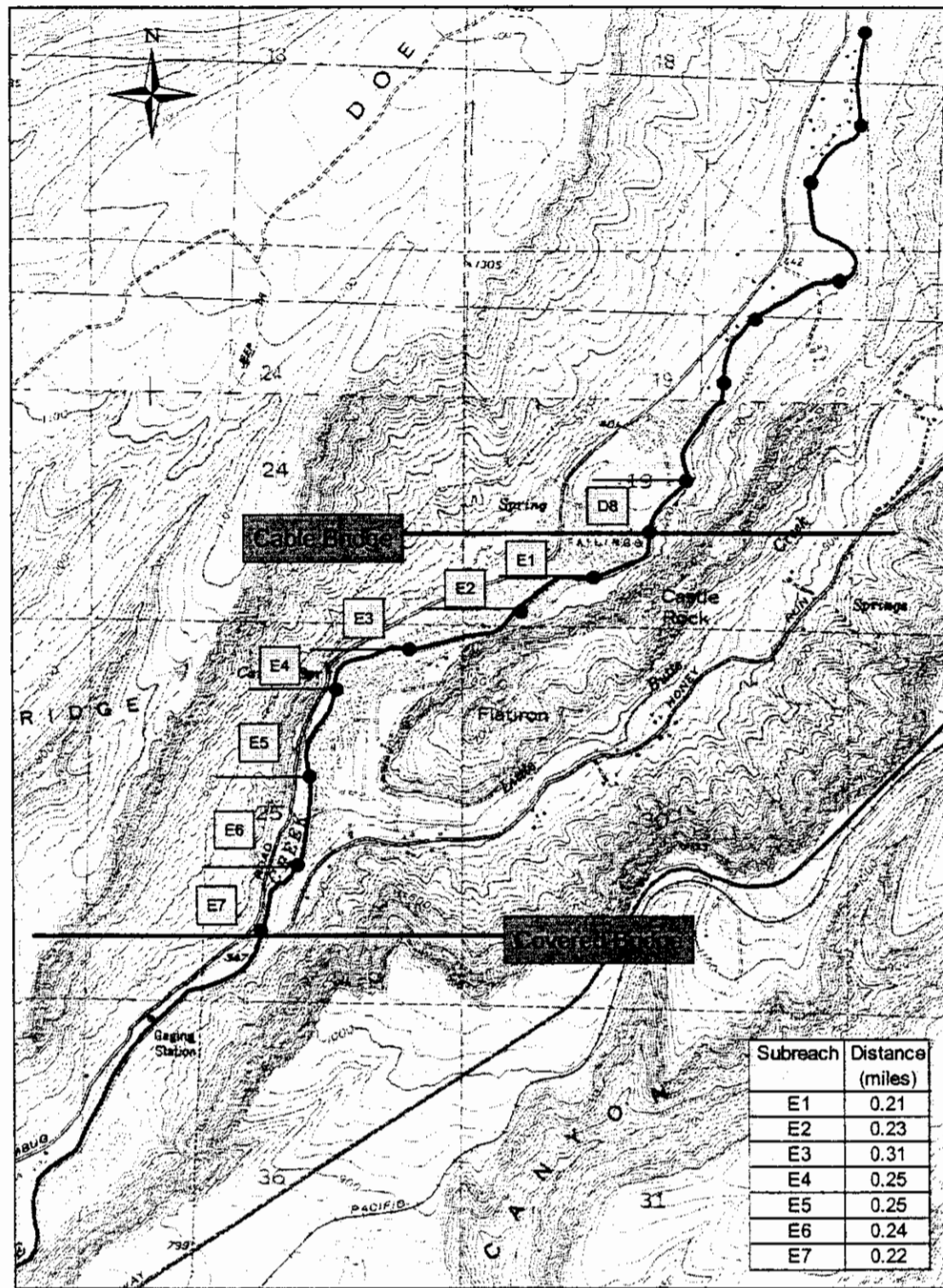
APPENDIX C, Figure 2. Map of Butte Creek spring-run Chinook salmon holding and spawning Reach B, showing sub-reaches and distances.



APPENDIX C, Figure 3. Map of Butte Creek spring-run Chinook salmon holding and spawning Reach C, showing sub-reaches and distances.



APPENDIX C, Figure 4. Map of Butte Creek spring-run Chinook salmon holding and spawning Reach D, showing sub-reaches and distances.



APPENDIX C, Figure 5. Map of Butte Creek spring-run Chinook salmon holding and spawning Reach E, showing sub-reaches and distances.

APPENDIX D

**AIR TEMPERATURES AT COHASSET FIRE STATION
JUNE 1- SEPTEMBER 30, 2004**

APPENDIX D. Air temperature (Celsius) as measured at California Department of Forestry Cohasset Fire Station (CST), Elevation 1600 Feet, Latitude 39.9000° N, Longitude 121.7000° W, for period June 1 through September 30, 2004.

YEAR - 2004							
DAY	MAX	MIN	MEAN	DAY	MAX	MIN	MEAN
6/1	33.3	20.0	26.7	8/1	31.7	20.0	26.0
6/2	33.9	21.1	27.2	8/2	28.9	13.9	20.9
6/3	31.7	16.7	24.9	8/3	32.8	15.0	23.7
6/4	33.3	16.7	25.4	8/4	32.8	20.0	25.8
6/5	31.7	16.1	24.6	8/5	29.4	16.7	23.3
6/6	30.6	16.1	24.1	8/6	31.1	16.1	23.8
6/7	24.4	11.7	18.1	8/7	36.7	20.6	27.9
6/8	22.2	10.0	15.2	8/8	36.7	24.4	29.8
6/9	23.9	10.6	18.1	8/9	37.2	24.4	30.1
6/10	25.6	10.6	18.7	8/10	38.3	22.8	29.9
6/11	28.3	14.4	21.6	8/11	39.4	25.0	32.1
6/12	30.6	16.7	23.9	8/12	40.0	26.1	32.4
6/13	32.8	18.3	25.4	8/13	37.2	21.1	29.5
6/14	36.7	18.9	28.2	8/14	33.3	20.0	26.4
6/15	36.7	23.3	30.6	8/15	32.8	13.3	23.3
6/16	37.2	22.8	29.9	8/16	33.3	18.9	26.2
6/17	31.1	16.7	23.6	8/17	36.1	21.7	28.4
6/18	30.0	14.4	22.8	8/18	37.2	24.4	29.6
6/19	31.1	17.2	23.5	8/19	37.2	22.8	29.0
6/20	32.8	16.1	24.6	8/20	36.1	20.6	28.6
6/21	34.4	18.9	26.3	8/21	36.1	21.7	28.6
6/22	32.2	17.8	25.1	8/22	27.2	17.8	21.7
6/23	32.2	16.7	24.5	8/23	28.9	14.4	21.6
6/24	31.7	14.4	24.1	8/24	29.4	16.1	23.4
6/25	32.8	16.7	25.8	8/25	28.9	13.3	22.0
6/26	33.3	18.3	25.8	8/26	30.6	16.1	23.8
6/27	34.4	17.2	26.4	8/27	34.4	20.0	27.6
6/28	33.3	22.2	27.1	8/28	37.8	23.9	30.1
6/29	31.7	20.0	24.9	8/29	37.2	25.6	30.3
6/30	29.4	15.6	21.9	8/30	36.1	23.3	29.3
7/1	30.6	13.9	23.4	8/31	35.6	22.8	28.8
7/2	34.4	20.0	26.8	9/1	33.9	20.0	26.6
7/3	33.9	21.1	27.5	9/2	30.6	17.2	24.2
7/4	35.0	22.2	28.5	9/3	31.7	16.1	23.4
7/5	37.8	22.2	30.1	9/4	34.4	20.6	27.0
7/6	40.0	22.2	31.0	9/5	34.4	22.2	28.0
7/7	32.8	19.4	25.6	9/6	36.1	24.4	29.6
7/8	30.6	15.6	23.0	9/7	37.8	25.6	30.8
7/9	29.4	16.1	21.7	9/8	37.2	25.0	30.4
7/10	31.1	13.9	22.8	9/9	36.1	24.4	29.7
7/11	33.3	18.3	26.4	9/10	34.4	20.6	27.2
7/12	35.0	21.7	27.9	9/11	36.7	21.7	28.3
7/13	33.9	19.4	26.4	9/12	31.1	18.3	24.9
7/14	33.9	19.4	26.6	9/13	30.0	13.9	21.7
7/15	34.4	20.6	27.4	9/14	31.1	15.0	23.6
7/16	33.9	21.7	27.8	9/15	33.9	21.1	27.1
7/17	35.0	21.7	28.5	9/16	32.8	20.0	25.9
7/18	35.6	22.2	28.7	9/17	30.0	15.6	23.4
7/19	33.9	23.9	28.2	9/18	22.8	11.7	16.4
7/20	34.4	20.6	27.8	9/19	16.1	10.0	12.4
7/21	36.1	22.8	29.7	9/20	23.3	8.9	15.2
7/22	37.8	24.4	30.5	9/21	27.8	13.3	20.7
7/23	36.1	22.8	29.3	9/22	29.4	15.6	22.0
7/24	36.1	19.4	28.0	9/23	31.1	17.8	24.3
7/25	37.2	22.2	29.2	9/24	32.8	20.6	25.7
7/26	37.2	25.0	30.5	9/25	32.2	21.1	25.9
7/27	36.7	23.3	29.8	9/26	32.8	21.1	25.2
7/28	36.1	22.2	28.5	9/27	31.7	18.9	24.6
7/29	33.3	18.3	25.6	9/28	24.4	11.1	17.0
7/30	33.9	20.0	26.5	9/29	24.4	12.8	18.1
7/31	31.1	18.3	24.9	9/30	26.1	12.2	18.4

APPENDIX E

**TABLES 1-6
BUTTE CREEK WATER TEMPERATURES
MAY 1-OCTOBER 31, 2004**

APPENDIX E, Table 1. Butte Creek water temperatures (Celsius) at Quartz Bowl Pool for period May 1 through October 21, 2004.

DATE	MAX	MIN	MEAN	DATE	MAX	MIN	MEAN	DATE	MAX	MIN	MEAN
05/01/04	11.5	10.1	10.8	07/01/04	19.6	17.3	18.3	09/01/04	17.9	16.0	16.8
05/02/04	12.1	10.7	11.4	07/02/04	19.9	17.0	18.2	09/02/04	17.8	15.9	16.6
05/03/04	12.6	11.3	12.0	07/03/04	20.2	17.5	18.6	09/03/04	16.9	15.1	15.8
05/04/04	12.7	11.3	12.1	07/04/04	20.5	17.7	18.8	09/04/04	16.7	14.6	15.5
05/05/04	12.1	10.9	11.6	07/05/04	21.1	18.2	19.4	09/05/04	17.2	14.9	15.8
05/06/04	11.5	10.4	11.1	07/06/04	21.7	18.9	20.1	09/06/04	17.5	15.4	16.2
05/07/04	11.6	10.1	11.0	07/07/04	21.7	19.3	20.2	09/07/04	17.8	15.5	16.4
05/08/04	11.8	10.9	11.4	07/08/04	20.9	18.5	19.4	09/08/04	17.8	15.7	16.5
05/09/04	11.3	9.9	10.8	07/09/04	20.1	17.7	18.6	09/09/04	17.7	15.6	16.4
05/10/04	11.0	10.1	10.6	07/10/04	19.3	16.7	17.8	09/10/04	17.4	15.4	16.2
05/11/04	9.9	8.9	9.4	07/11/04	19.1	16.3	17.5	09/11/04	16.9	14.9	15.7
05/12/04	10.4	8.5	9.5	07/12/04	19.2	16.2	17.4	09/12/04	17.0	15.0	15.7
05/13/04	11.3	9.5	10.4	07/13/04	19.2	16.4	17.5	09/13/04	16.7	14.9	15.6
05/14/04	12.0	10.4	11.2	07/14/04	19.1	16.2	17.4	09/14/04	16.1	14.2	15.0
05/15/04	12.7	11.0	11.9	07/15/04	18.9	16.1	17.2	09/15/04	16.1	14.1	14.9
05/16/04	12.6	11.5	12.1	07/16/04	18.2	15.9	16.9	09/16/04	16.8	14.7	15.5
05/17/04	12.3	11.0	11.8	07/17/04	19.0	16.4	17.4	09/17/04	16.7	14.9	15.5
05/18/04	12.0	11.0	11.4	07/18/04	19.7	17.0	18.0	09/18/04	15.7	14.0	14.9
05/19/04	11.5	9.9	10.9	07/19/04	20.0	17.5	18.5	09/19/04	13.9	12.6	13.3
05/20/04	12.3	10.7	11.6	07/20/04	20.9	18.1	19.2	09/20/04	13.1	11.9	12.4
05/21/04	11.8	10.4	11.2	07/21/04	21.0	18.3	19.3	09/21/04	13.2	11.1	12.0
05/22/04	11.9	10.4	11.2	07/22/04	20.9	18.1	19.2	09/22/04	13.3	11.4	12.2
05/23/04	12.5	11.1	11.9	07/23/04	20.8	18.1	19.2	09/23/04	13.7	11.8	12.6
05/24/04	12.5	11.0	11.9	07/24/04	21.0	18.5	19.4	09/24/04	14.1	12.1	12.9
05/25/04	12.3	11.2	11.9	07/25/04	20.9	18.3	19.3	09/25/04	14.2	12.4	13.1
05/26/04	13.4	11.3	12.3	07/26/04	20.2	17.6	18.6	09/26/04	14.2	12.5	13.2
05/27/04	13.7	13.2	13.5	07/27/04	19.8	17.2	18.3	09/27/04	14.1	12.3	13.0
05/28/04	13.2	11.8	12.6	07/28/04	20.1	17.5	18.5	09/28/04	13.3	12.1	12.6
05/29/04	12.7	10.9	11.9	07/29/04	20.0	17.5	18.5	09/29/04	13.6	12.1	12.7
05/30/04	13.6	11.7	12.8	07/30/04	20.0	17.5	18.4	09/30/04	14.2	12.4	13.2
05/31/04	14.4	12.8	13.7	07/31/04	19.8	17.1	18.1	10/01/04	14.5	13.0	13.5
06/01/04	14.9	13.4	14.2	08/01/04	19.2	16.7	17.7	10/02/04	14.5	13.0	13.5
06/02/04	15.6	14.0	14.7	08/02/04	19.0	16.5	17.5	10/03/04	14.5	13.0	13.6
06/03/04	16.2	14.6	15.2	08/03/04	18.9	16.4	17.4	10/04/04	14.9	13.3	14.0
06/04/04	15.9	14.2	14.9	08/04/04	19.0	16.6	17.5	10/05/04	14.7	13.3	13.9
06/05/04	16.1	14.5	15.2	08/05/04	18.6	16.3	17.2	10/10/04	14.5	13.2	13.7
06/06/04	16.3	14.3	15.2	08/06/04	18.0	15.6	16.6	10/07/04	14.4	12.8	13.5
06/07/04	15.9	14.3	14.9	08/07/04	18.2	15.5	16.6	10/08/04	14.1	12.7	13.3
06/08/04	14.8	12.7	13.6	08/08/04	18.8	16.1	17.2	10/09/04	14.2	12.8	13.5
06/09/04	13.4	11.6	12.5	08/09/04	19.2	16.5	17.5	10/10/04	13.2	11.8	12.3
06/10/04	14.2	12.1	13.1	08/10/04	18.9	16.3	17.3	10/11/04	12.4	11.0	11.6
06/11/04	14.7	12.7	13.6	08/11/04	18.4	16.1	17.1	10/12/04	12.4	10.8	11.5
06/12/04	15.7	13.2	14.3	08/12/04	18.9	16.3	17.3	10/13/04	13.2	11.4	12.1
06/13/04	16.5	14.0	15.1	08/13/04	19.3	16.9	17.8	10/14/04	13.3	11.9	12.5
06/14/04	17.3	14.6	15.8	08/14/04	19.3	17.3	18.0	10/15/04	13.2	11.8	12.4
06/15/04	17.7	15.1	16.3	08/15/04	19.0	16.8	17.7	10/16/04	12.7	11.6	12.0
06/16/04	18.5	15.8	16.9	08/16/04	19.0	16.6	17.5	10/17/04	12.1	11.1	11.9
06/17/04	18.9	16.4	17.4	08/17/04	18.9	16.6	17.5	10/18/04	10.8	9.9	10.3
06/18/04	18.8	16.2	17.3	08/18/04	19.4	16.9	17.9	10/19/04	9.9	9.1	9.5
06/19/04	18.7	16.1	17.2	08/19/04	19.8	17.5	18.4	10/20/04	9.0	8.4	8.7
06/20/04	18.7	15.8	17.0	08/20/04	19.5	17.2	18.1	10/21/04	8.5	7.7	8.0
06/21/04	19.2	16.2	17.5	08/21/04	19.3	17.1	17.9	10/22/04	nr	nr	nr
06/22/04	19.7	16.9	18.0	08/22/04	18.2	17.2	17.6	10/23/04	nr	nr	nr
06/23/04	19.5	16.8	17.9	08/23/04	18.7	16.8	17.6	10/24/04	nr	nr	nr
06/24/04	19.4	16.7	17.7	08/24/04	19.1	17.1	17.8	10/25/04	nr	nr	nr
06/25/04	19.1	16.2	17.3	08/25/04	18.5	16.6	17.4	10/26/04	nr	nr	nr
06/26/04	19.1	16.2	17.3	08/26/04	18.7	16.9	17.5	10/27/04	nr	nr	nr
06/27/04	19.2	16.3	17.5	08/27/04	18.3	16.0	17.0	10/28/04	nr	nr	nr
06/28/04	19.5	17.1	18.0	08/28/04	18.4	16.0	17.0	10/29/04	nr	nr	nr
06/29/04	19.4	16.8	17.9	08/29/04	18.6	16.3	17.2	10/30/04	nr	nr	nr
06/30/04	19.6	17.1	18.1	08/30/04	18.4	16.2	17.1	10/31/04	nr	nr	nr
				08/31/04	18.2	16.0	16.9				

nr = no record

APPENDIX E, Table 2. Butte Creek water temperatures (Celsius) at Chimney Rock Pool for period May 1 through October 21, 2004.

DATE	MAX	MIN	MEAN	DATE	MAX	MIN	MEAN	DATE	MAX	MIN	MEAN
05/01/04	11.9	10.3	11.1	07/01/04	20.6	17.6	18.8	09/01/04	18.5	16.2	17.2
05/02/04	12.6	10.9	11.8	07/02/04	20.8	17.6	18.9	09/02/04	18.7	16.2	17.1
05/03/04	13.1	11.5	12.3	07/03/04	21.2	17.9	19.2	09/03/04	17.8	15.4	16.4
05/04/04	13.4	11.7	12.5	07/04/04	21.4	18.0	19.4	09/04/04	17.7	14.9	16.0
05/05/04	12.6	11.2	12.0	07/05/04	22.0	18.5	20.0	09/05/04	18.0	15.2	16.3
05/06/04	11.9	10.8	11.4	07/06/04	22.7	19.2	20.7	09/06/04	18.3	15.6	16.7
05/07/04	12.2	10.3	11.3	07/07/04	22.6	19.6	20.8	09/07/04	18.6	15.7	16.9
05/08/04	12.5	11.2	11.7	07/08/04	21.8	18.8	20.0	09/08/04	18.6	15.9	17.0
05/09/04	11.9	10.3	11.1	07/09/04	21.0	18.1	19.3	09/09/04	18.5	15.9	16.9
05/10/04	11.4	10.5	11.0	07/10/04	20.3	17.2	18.5	09/10/04	18.2	15.7	16.7
05/11/04	10.3	9.2	9.8	07/11/04	20.1	16.7	18.2	09/11/04	17.7	15.1	16.2
05/12/04	10.8	8.8	9.8	07/12/04	20.2	16.5	18.1	09/12/04	17.8	15.3	16.3
05/13/04	11.9	9.7	10.7	07/13/04	20.2	16.7	18.1	09/13/04	17.5	15.2	16.1
05/14/04	12.5	10.6	11.5	07/14/04	20.0	16.5	18.0	09/14/04	17.0	14.5	15.5
05/15/04	13.4	11.4	12.2	07/15/04	19.8	16.3	17.8	09/15/04	16.9	14.3	15.4
05/16/04	13.6	11.7	12.5	07/16/04	18.8	16.1	17.4	09/16/04	17.5	14.9	15.9
05/17/04	12.8	11.4	12.2	07/17/04	19.9	16.7	18.0	09/17/04	17.1	15.1	15.9
05/18/04	12.5	11.4	11.8	07/18/04	20.5	17.2	18.5	09/18/04	16.5	14.3	15.4
05/19/04	12.5	10.3	11.3	07/19/04	20.8	17.6	19.0	09/19/04	14.1	13.0	13.8
05/20/04	13.1	10.9	12.0	07/20/04	21.7	18.4	19.7	09/20/04	13.9	12.3	13.0
05/21/04	12.6	10.8	11.6	07/21/04	21.9	18.6	19.9	09/21/04	13.9	11.4	12.5
05/22/04	12.5	10.6	11.5	07/22/04	21.8	18.4	19.8	09/22/04	14.1	11.7	12.7
05/23/04	13.3	11.2	12.1	07/23/04	21.7	18.4	19.8	09/23/04	14.4	12.1	13.0
05/24/04	13.4	11.2	12.2	07/24/04	21.9	18.8	20.1	09/24/04	14.7	12.3	13.3
05/25/04	13.0	11.5	12.2	07/25/04	21.8	18.7	19.9	09/25/04	14.9	12.6	13.5
05/26/04	14.0	11.5	12.6	07/26/04	21.2	18.0	19.3	09/26/04	14.8	12.8	13.6
05/27/04	14.2	13.2	13.6	07/27/04	20.9	17.6	19.0	09/27/04	14.7	12.5	13.4
05/28/04	13.5	12.1	12.9	07/28/04	21.0	17.8	19.2	09/28/04	13.9	12.3	13.0
05/29/04	13.4	11.1	12.2	07/29/04	20.9	17.8	19.1	09/29/04	14.3	12.5	13.2
05/30/04	14.3	11.9	13.0	07/30/04	21.0	17.8	19.1	09/30/04	14.9	12.6	13.5
06/01/04	15.4	13.0	14.0	07/31/04	20.7	17.4	18.8	10/01/04	15.1	13.2	13.9
06/02/04	16.1	13.6	14.5	08/01/04	20.2	16.9	18.4	10/02/04	15.3	13.4	14.0
06/03/04	17.1	14.7	15.5	08/02/04	19.9	16.9	18.2	10/03/04	15.3	13.4	14.1
06/04/04	17.1	14.3	15.3	08/03/04	19.9	16.7	18.1	10/04/04	15.6	13.7	14.4
06/05/04	17.2	14.6	15.5	08/04/04	20.0	16.9	18.1	10/05/04	15.4	13.7	14.3
06/06/04	17.4	14.5	15.6	08/05/04	19.3	16.7	17.8	10/10/04	15.3	13.5	14.2
06/07/04	16.9	14.4	15.3	08/06/04	19.0	16.0	17.3	10/07/04	15.1	13.2	14.0
06/08/04	15.5	13.1	14.0	08/07/04	19.3	15.9	17.3	10/08/04	14.8	13.1	13.7
06/09/04	14.6	12.0	13.0	08/08/04	19.8	16.4	17.8	10/09/04	14.9	13.2	13.9
06/10/04	15.4	12.3	13.5	08/09/04	20.1	16.7	18.1	10/10/04	13.7	12.2	12.8
06/11/04	15.7	12.9	14.0	08/10/04	19.9	16.5	17.9	10/11/04	13.1	11.4	12.1
06/12/04	16.8	13.4	14.8	08/11/04	19.2	16.4	17.7	10/12/04	13.1	11.2	12.0
06/13/04	17.6	14.2	15.5	08/12/04	19.9	16.5	18.0	10/13/04	13.7	11.8	12.6
06/14/04	18.4	14.8	16.2	08/13/04	20.2	17.1	18.4	10/14/04	13.7	12.2	12.8
06/15/04	18.8	15.2	16.7	08/14/04	20.2	17.5	18.6	10/15/04	13.7	12.2	12.8
06/16/04	19.5	15.9	17.4	08/15/04	19.9	17.0	18.3	10/16/04	13.2	12.0	12.5
06/17/04	19.8	16.6	17.8	08/16/04	19.9	16.9	18.2	10/17/04	12.5	11.5	12.2
06/18/04	19.7	16.5	17.8	08/17/04	19.8	16.8	18.1	10/18/04	11.2	10.3	10.7
06/19/04	19.7	16.4	17.7	08/18/04	20.3	17.2	18.5	10/19/04	10.3	9.4	9.9
06/20/04	19.7	16.1	17.7	08/19/04	20.6	17.8	18.9	10/20/04	9.2	8.6	9.0
06/21/04	20.2	16.6	18.1	08/20/04	20.4	17.4	18.7	10/21/04	8.6	8.0	8.2
06/22/04	20.5	17.1	18.5	08/21/04	20.3	17.4	18.6	10/22/04	nr	nr	nr
06/23/04	20.4	17.0	18.4	08/22/04	19.1	17.5	18.1	10/23/04	nr	nr	nr
06/24/04	20.3	17.0	18.3	08/23/04	19.6	17.1	18.1	10/24/04	nr	nr	nr
06/25/04	20.0	16.4	17.9	08/24/04	20.0	17.4	18.4	10/25/04	nr	nr	nr
06/26/04	20.0	16.5	18.0	08/25/04	19.5	16.8	17.9	10/26/04	nr	nr	nr
06/27/04	20.2	16.6	18.1	08/26/04	19.7	17.2	18.1	10/27/04	nr	nr	nr
06/28/04	20.1	17.4	18.5	08/27/04	19.2	16.3	17.5	10/28/04	nr	nr	nr
06/29/04	20.4	17.2	18.6	08/28/04	19.3	16.2	17.5	10/29/04	nr	nr	nr
06/30/04	20.4	17.3	18.6	08/29/04	19.5	16.6	17.7	10/30/04	nr	nr	nr
				08/30/04	19.2	16.3	17.5	10/31/04	nr	nr	nr
				08/31/04	19.1	16.3	17.4				

nr = no record

APPENDIX E, Table 3. Butte Creek water temperatures (Celsius) at Pool 4 for period May 20 through October 21, 2004.

DATE	MAX	MIN	MEAN	DATE	MAX	MIN	MEAN	DATE	MAX	MIN	MEAN
05/01/04	nr	nr	nr	07/01/04	21.6	17.8	19.7	09/01/04	19.3	16.5	18.0
05/02/04	nr	nr	nr	07/02/04	22.0	18.1	20.0	09/02/04	19.4	16.5	17.9
05/03/04	nr	nr	nr	07/03/04	22.3	18.4	20.3	09/03/04	18.6	15.7	17.1
05/04/04	nr	nr	nr	07/04/04	22.5	18.4	20.4	09/04/04	18.5	15.2	16.9
05/05/04	nr	nr	nr	07/05/04	23.1	18.9	21.0	09/05/04	18.8	15.5	17.1
05/06/04	nr	nr	nr	07/06/04	23.7	19.6	21.6	09/06/04	19.1	16.0	17.5
05/07/04	nr	nr	nr	07/07/04	23.4	20.0	21.7	09/07/04	19.3	16.1	17.7
05/08/04	nr	nr	nr	07/08/04	22.7	19.1	20.9	09/08/04	19.4	16.3	17.8
05/09/04	nr	nr	nr	07/09/04	21.9	18.4	20.2	09/09/04	19.2	16.3	17.8
05/10/04	nr	nr	nr	07/10/04	21.4	17.6	19.5	09/10/04	19.0	16.1	17.5
05/11/04	nr	nr	nr	07/11/04	21.2	17.2	19.2	09/11/04	18.6	15.5	17.1
05/12/04	nr	nr	nr	07/12/04	21.1	17.0	19.1	09/12/04	18.7	15.6	17.1
05/13/04	nr	nr	nr	07/13/04	21.1	17.0	19.0	09/13/04	18.2	15.5	16.9
05/14/04	nr	nr	nr	07/14/04	21.0	16.8	18.8	09/14/04	17.8	14.9	16.3
05/15/04	nr	nr	nr	07/15/04	20.7	16.6	18.7	09/15/04	17.7	14.6	16.2
05/16/04	nr	nr	nr	07/16/04	19.9	16.6	18.3	09/16/04	18.2	15.2	16.6
05/17/04	nr	nr	nr	07/17/04	20.9	17.1	18.9	09/17/04	17.9	15.4	16.7
05/18/04	nr	nr	nr	07/18/04	21.4	17.6	19.4	09/18/04	17.2	15.3	16.1
05/19/04	nr	nr	nr	07/19/04	21.7	18.0	19.8	09/19/04	15.2	13.7	14.3
05/20/04	14.1	12.2	13.1	07/20/04	22.7	18.7	20.6	09/20/04	15.1	12.9	13.8
05/21/04	13.8	11.2	12.2	07/21/04	22.9	18.9	20.9	09/21/04	14.7	11.9	13.3
05/22/04	13.6	10.9	12.0	07/22/04	22.9	18.9	20.9	09/22/04	14.8	12.1	13.4
05/23/04	14.3	11.5	12.5	07/23/04	22.8	18.8	20.8	09/23/04	15.2	12.3	13.7
05/24/04	14.6	11.5	12.7	07/24/04	22.9	19.2	21.0	09/24/04	15.4	12.6	13.9
05/25/04	14.0	11.8	12.7	07/25/04	22.8	19.1	20.9	09/25/04	15.5	12.8	14.1
05/26/04	15.3	11.8	13.1	07/26/04	22.2	18.5	20.3	09/26/04	15.7	13.0	14.2
05/27/04	14.8	13.1	13.9	07/27/04	21.9	18.2	20.1	09/27/04	15.4	12.9	14.1
05/28/04	14.3	12.4	13.4	07/28/04	22.0	18.4	20.2	09/28/04	15.0	11.5	13.6
05/29/04	14.6	11.4	12.7	07/29/04	21.8	18.1	20.0	09/29/04	15.2	12.7	13.8
05/30/04	15.6	12.1	13.5	07/30/04	21.9	18.2	20.0	09/30/04	15.4	12.9	14.1
05/31/04	16.7	13.1	14.5	07/31/04	21.6	17.8	19.7	10/01/04	15.8	13.3	14.5
06/01/04	17.3	13.8	15.1	08/01/04	21.1	17.5	19.4	10/02/04	16.2	13.6	14.8
06/02/04	18.0	14.1	15.6	08/02/04	20.8	17.3	19.1	10/03/04	16.2	13.6	14.8
06/03/04	18.2	14.8	16.0	08/03/04	20.8	17.1	19.0	10/04/04	16.3	14.1	15.1
06/04/04	18.3	14.4	16.0	08/04/04	20.9	17.4	19.1	10/05/04	16.2	14.0	14.9
06/05/04	18.2	14.6	16.0	08/05/04	20.2	17.0	18.6	10/10/04	16.2	13.8	14.9
06/06/04	18.4	14.6	16.2	08/06/04	19.9	16.4	18.2	10/07/04	15.8	13.6	14.7
06/07/04	17.9	14.5	15.8	08/07/04	20.3	16.3	18.3	10/08/04	15.5	13.5	14.5
06/08/04	16.0	13.5	14.5	08/08/04	20.7	16.8	18.7	10/09/04	15.7	14.0	14.6
06/09/04	15.7	12.4	13.8	08/09/04	21.0	17.2	19.0	10/10/04	14.4	12.6	13.4
06/10/04	16.4	12.6	14.2	08/10/04	20.8	16.9	18.9	10/11/04	13.8	11.6	12.7
06/11/04	16.8	13.0	14.7	08/11/04	20.2	16.9	18.6	10/12/04	14.0	11.6	12.7
06/12/04	17.8	13.6	15.5	08/12/04	20.8	17.1	18.9	10/13/04	14.6	12.1	13.2
06/13/04	18.5	14.3	16.3	08/13/04	21.1	17.5	19.3	10/14/04	14.3	12.6	13.4
06/14/04	19.3	14.9	16.9	08/14/04	21.0	17.9	19.4	10/15/04	14.4	12.4	13.3
06/15/04	19.7	15.4	17.4	08/15/04	20.8	17.2	19.0	10/16/04	14.0	12.3	13.0
06/16/04	20.4	16.0	18.0	08/16/04	20.8	17.3	19.0	10/17/04	13.0	11.8	12.7
06/17/04	20.6	16.7	18.5	08/17/04	20.7	17.3	19.0	10/18/04	11.8	10.7	11.3
06/18/04	20.7	16.6	18.5	08/18/04	21.2	17.6	19.4	10/19/04	10.7	9.8	10.3
06/19/04	20.7	16.6	18.6	08/19/04	21.5	18.2	19.8	10/20/04	9.8	9.0	9.5
06/20/04	20.7	16.5	18.5	08/20/04	21.2	17.9	19.6	10/21/04	9.0	8.4	8.6
06/21/04	21.2	16.9	19.0	08/21/04	21.2	17.8	19.5	10/22/04	nr	nr	nr
06/22/04	21.5	17.5	19.4	08/22/04	19.8	17.8	18.9	10/23/04	nr	nr	nr
06/23/04	21.3	17.3	19.3	08/23/04	20.3	17.6	19.0	10/24/04	nr	nr	nr
06/24/04	21.2	17.3	19.2	08/24/04	20.9	17.9	19.3	10/25/04	nr	nr	nr
06/25/04	20.9	16.7	18.8	08/25/04	20.2	17.2	18.7	10/26/04	nr	nr	nr
06/26/04	21.0	16.8	18.9	08/26/04	20.5	17.6	18.9	10/27/04	nr	nr	nr
06/27/04	21.2	16.9	19.1	08/27/04	20.0	16.7	18.4	10/28/04	nr	nr	nr
06/28/04	21.0	17.8	19.4	08/28/04	20.1	16.6	18.4	10/29/04	nr	nr	nr
06/29/04	21.6	17.7	19.6	08/29/04	20.3	16.9	18.6	10/30/04	nr	nr	nr
06/30/04	21.3	17.8	19.5	08/30/04	20.0	16.7	18.4	10/31/04	nr	nr	nr
				08/31/04	19.9	16.6	18.3				

nr = no record

APPENDIX E, Table 4. Butte Creek water temperatures (Celsius) at Estates Pool for period May 1 through October 22, 2004.

DATE	MAX	MIN	MEAN	DATE	MAX	MIN	MEAN	DATE	MAX	MIN	MEAN
05/01/04	12.4	11.0	11.6	07/01/04	20.8	17.8	19.1	09/01/04	19.2	16.6	17.8
05/02/04	13.0	11.5	12.1	07/02/04	21.0	17.7	19.2	09/02/04	19.3	16.4	17.6
05/03/04	13.5	12.1	12.6	07/03/04	21.5	18.2	19.6	09/03/04	18.5	15.7	16.8
05/04/04	13.6	12.4	12.9	07/04/04	21.8	18.4	19.9	09/04/04	18.3	15.2	16.5
05/05/04	13.3	12.3	12.8	07/05/04	22.5	18.9	20.5	09/05/04	18.7	15.5	16.9
05/06/04	12.6	11.6	12.2	07/06/04	23.4	19.7	21.2	09/06/04	18.9	16.0	17.2
05/07/04	12.6	11.3	11.9	07/07/04	23.3	20.1	21.3	09/07/04	19.4	16.2	17.5
05/08/04	12.7	11.6	12.1	07/08/04	22.5	19.2	20.5	09/08/04	19.5	16.3	17.6
05/09/04	12.6	11.2	11.9	07/09/04	21.7	18.4	19.7	09/09/04	19.2	16.3	17.5
05/10/04	12.4	11.3	11.8	07/10/04	21.0	17.5	19.0	09/10/04	19.2	16.1	17.4
05/11/04	11.6	10.4	11.0	07/11/04	20.9	17.2	18.8	09/11/04	18.7	15.6	16.9
05/12/04	11.3	9.8	10.5	07/12/04	21.0	17.1	18.7	09/12/04	18.7	15.7	16.9
05/13/04	12.7	10.2	11.1	07/13/04	21.0	17.2	18.8	09/13/04	18.4	15.4	16.6
05/14/04	13.6	10.9	12.0	07/14/04	21.0	17.0	18.7	09/14/04	17.8	14.9	16.1
05/15/04	14.4	11.5	12.7	07/15/04	20.8	16.8	18.5	09/15/04	18.0	14.6	16.1
05/16/04	14.6	12.1	13.1	07/16/04	19.7	16.8	18.2	09/16/04	19.0	15.4	16.9
05/17/04	14.1	11.8	12.7	07/17/04	21.0	17.2	18.7	09/17/04	18.5	15.7	16.9
05/18/04	13.5	11.6	12.3	07/18/04	21.7	17.9	19.4	09/18/04	17.8	15.0	16.2
05/19/04	13.3	10.6	11.8	07/19/04	21.9	18.3	19.8	09/19/04	15.2	13.5	14.4
05/20/04	14.0	11.2	12.4	07/20/04	22.8	18.9	20.5	09/20/04	15.3	12.8	13.7
05/21/04	13.7	11.2	12.3	07/21/04	22.8	19.1	20.6	09/21/04	15.0	11.9	13.3
05/22/04	13.7	11.0	12.2	07/22/04	22.8	19.0	20.6	09/22/04	15.7	12.1	13.7
05/23/04	14.1	11.6	12.6	07/23/04	22.7	18.9	20.5	09/23/04	16.7	12.5	14.2
05/24/04	14.4	11.5	12.8	07/24/04	22.7	19.3	20.7	09/24/04	16.2	12.8	14.4
05/25/04	13.8	11.8	12.7	07/25/04	23.0	19.2	20.8	09/25/04	16.4	13.1	14.6
05/26/04	14.9	11.7	13.2	07/26/04	22.1	18.5	20.1	09/26/04	16.5	13.4	14.7
05/27/04	14.9	13.2	13.9	07/27/04	21.7	18.2	19.7	09/27/04	16.2	13.1	14.6
05/28/04	14.4	12.5	13.5	07/28/04	22.0	18.4	19.9	09/28/04	14.9	12.8	13.9
05/29/04	14.6	11.5	12.9	07/29/04	21.9	18.3	19.8	09/29/04	15.7	12.8	14.1
05/30/04	15.5	12.1	13.6	07/30/04	22.0	18.3	19.8	09/30/04	16.2	12.9	14.4
05/31/04	16.5	13.1	14.6	07/31/04	21.7	17.9	19.5	10/01/04	16.4	13.4	14.8
06/01/04	16.9	13.8	15.1	08/01/04	21.2	17.5	19.1	10/02/04	16.7	13.8	15.2
06/02/04	17.5	14.1	15.6	08/02/04	20.8	17.4	18.8	10/03/04	16.7	13.7	15.2
06/03/04	17.8	14.8	16.0	08/03/04	20.9	17.2	18.7	10/04/04	17.0	14.3	15.5
06/04/04	17.7	14.5	15.9	08/04/04	21.1	17.5	18.9	10/05/04	16.8	14.0	15.3
06/05/04	17.6	14.7	16.0	08/05/04	20.3	17.1	18.5	10/10/04	16.7	14.0	15.3
06/06/04	17.8	14.7	16.1	08/06/04	20.0	16.4	18.0	10/07/04	16.5	13.8	15.1
06/07/04	17.4	14.6	15.7	08/07/04	20.3	16.4	18.0	10/08/04	16.2	13.5	14.9
06/08/04	15.5	13.5	14.4	08/08/04	20.8	17.0	18.6	10/09/04	16.2	14.0	15.0
06/09/04	15.2	12.3	13.6	08/09/04	21.2	17.4	19.0	10/10/04	14.9	12.5	13.6
06/10/04	15.7	12.6	14.0	08/10/04	21.0	17.2	18.8	10/11/04	14.5	11.7	13.1
06/11/04	16.1	13.0	14.4	08/11/04	20.2	17.0	18.5	10/12/04	14.6	11.8	13.2
06/12/04	16.9	13.6	15.1	08/12/04	21.0	17.2	18.8	10/13/04	15.3	12.5	13.8
06/13/04	17.7	14.4	15.8	08/13/04	21.2	17.7	19.2	10/14/04	14.9	12.8	13.8
06/14/04	18.3	15.0	16.5	08/14/04	21.1	18.0	19.3	10/15/04	15.1	12.5	13.6
06/15/04	19.0	15.6	17.1	08/15/04	20.8	17.3	18.8	10/16/04	14.5	12.1	13.3
06/16/04	19.6	16.2	17.8	08/16/04	20.8	17.3	18.8	10/17/04	13.4	12.1	12.9
06/17/04	19.8	16.8	18.2	08/17/04	20.7	17.3	18.8	10/18/04	12.1	11.2	11.6
06/18/04	19.7	16.8	18.0	08/18/04	21.2	17.7	19.2	10/19/04	11.1	10.0	10.6
06/19/04	19.7	16.7	18.0	08/19/04	21.4	18.3	19.6	10/20/04	10.1	9.2	9.8
06/20/04	19.5	16.5	17.9	08/20/04	21.2	17.8	19.3	10/21/04	10.6	8.3	9.3
06/21/04	20.1	16.9	18.3	08/21/04	21.1	17.8	19.2	10/22/04	9.2	8.4	8.7
06/22/04	20.5	17.4	18.8	08/22/04	19.6	17.9	18.6	10/23/04	nr	nr	nr
06/23/04	20.5	17.4	18.7	08/23/04	20.0	17.5	18.5	10/24/04	nr	nr	nr
06/24/04	20.5	17.3	18.6	08/24/04	20.6	17.7	18.8	10/25/04	nr	nr	nr
06/25/04	20.2	16.8	18.2	08/25/04	20.1	17.2	18.4	10/26/04	nr	nr	nr
06/26/04	20.2	16.8	18.3	08/26/04	20.3	17.6	18.5	10/27/04	nr	nr	nr
06/27/04	20.3	16.9	18.4	08/27/04	19.9	16.8	18.1	10/28/04	nr	nr	nr
06/28/04	20.5	17.8	18.9	08/28/04	20.0	16.7	18.1	10/29/04	nr	nr	nr
06/29/04	20.5	17.5	18.8	08/29/04	20.2	17.0	18.3	10/30/04	nr	nr	nr
06/30/04	20.7	17.7	19.0	08/30/04	19.9	16.8	18.2	10/31/04	nr	nr	nr
				08/31/04	19.8	16.7	18.0				

nr = no record

APPENDIX E, Table 5. Butte Creek water temperatures (Celsius) at Cable Bridge for period May 1 through October 22, 2004.

DATE	MAX	MIN	MEAN	DATE	MAX	MIN	MEAN	DATE	MAX	MIN	MEAN
05/01/04	14.1	10.7	12.1	07/01/04	22.3	18.1	19.9	09/01/04	20.5	16.8	18.5
05/02/04	15.0	11.3	12.8	07/02/04	22.7	18.2	20.1	09/02/04	20.7	16.7	18.3
05/03/04	15.5	12.1	13.4	07/03/04	23.2	18.6	20.5	09/03/04	19.9	15.9	17.5
05/04/04	15.5	12.4	13.7	07/04/04	23.5	18.7	20.7	09/04/04	19.7	15.4	17.3
05/05/04	14.7	11.9	13.1	07/05/04	24.0	19.2	21.3	09/05/04	20.2	15.7	17.6
05/06/04	13.8	11.3	12.4	07/06/04	24.9	20.0	22.0	09/06/04	20.4	16.2	17.9
05/07/04	14.1	11.0	12.3	07/07/04	24.6	20.4	22.0	09/07/04	20.7	16.3	18.2
05/08/04	14.1	11.6	12.6	07/08/04	23.9	19.5	21.2	09/08/04	20.8	16.5	18.3
05/09/04	14.1	11.0	12.3	07/09/04	22.8	18.7	20.4	09/09/04	20.7	16.5	18.3
05/10/04	13.8	11.1	12.1	07/10/04	22.5	17.8	19.8	09/10/04	20.5	16.3	18.1
05/11/04	12.8	10.0	11.2	07/11/04	22.5	17.6	19.6	09/11/04	20.2	15.7	17.7
05/12/04	13.0	9.4	10.9	07/12/04	22.5	17.4	19.6	09/12/04	20.2	16.0	17.7
05/13/04	13.6	10.0	11.6	07/13/04	22.7	17.4	19.6	09/13/04	19.7	15.7	17.3
05/14/04	14.4	11.0	12.4	07/14/04	22.5	17.3	19.4	09/14/04	19.2	15.1	16.8
05/15/04	15.3	11.7	13.2	07/15/04	22.5	17.1	19.3	09/15/04	19.4	14.7	16.8
05/16/04	15.6	12.4	13.6	07/16/04	21.3	17.1	19.0	09/16/04	20.2	15.5	17.5
05/17/04	14.9	12.1	13.3	07/17/04	22.5	17.6	19.6	09/17/04	19.5	15.9	17.6
05/18/04	14.2	12.1	12.9	07/18/04	23.2	18.4	20.2	09/18/04	18.9	15.9	16.9
05/19/04	14.4	11.0	12.5	07/19/04	23.2	18.6	20.6	09/19/04	15.7	14.3	15.0
05/20/04	15.2	11.4	13.0	07/20/04	24.2	19.2	21.2	09/20/04	16.7	13.4	14.6
05/21/04	14.9	11.7	13.0	07/21/04	24.4	19.4	21.5	09/21/04	16.2	12.3	14.1
05/22/04	14.6	11.3	12.7	07/22/04	24.4	19.5	21.5	09/22/04	16.8	12.4	14.4
05/23/04	15.2	11.6	13.1	07/23/04	24.2	19.4	21.4	09/23/04	17.1	12.9	13.5
05/24/04	15.4	11.8	13.3	07/24/04	24.4	19.7	21.5	09/24/04	17.4	13.2	15.1
05/25/04	14.7	12.0	13.2	07/25/04	24.6	19.5	21.6	09/25/04	17.6	13.3	15.3
05/26/04	16.0	12.0	13.7	07/26/04	23.9	19.1	21.1	09/26/04	17.9	13.6	15.6
05/27/04	15.4	13.4	14.3	07/27/04	23.5	18.6	20.7	09/27/04	17.4	13.5	15.4
05/28/04	14.7	13.0	13.9	07/28/04	23.7	18.9	20.8	09/28/04	15.8	13.2	14.6
05/29/04	15.7	11.8	13.5	07/29/04	23.2	18.6	20.6	09/29/04	16.8	13.0	14.8
05/30/04	16.7	12.1	14.1	07/30/04	23.5	18.6	20.7	09/30/04	17.1	13.3	15.1
05/31/04	17.8	13.2	15.1	07/31/04	23.2	18.2	20.4	10/01/04	17.3	13.6	15.3
06/01/04	18.1	14.0	15.7	08/01/04	22.7	17.9	20.0	10/02/04	17.9	14.1	15.9
06/02/04	18.7	14.3	16.2	08/02/04	22.2	17.8	19.7	10/03/04	17.7	14.3	15.9
06/03/04	18.7	14.9	16.5	08/03/04	22.3	17.4	19.6	10/04/04	18.1	14.9	16.2
06/04/04	18.9	14.7	16.6	08/04/04	22.5	17.8	19.8	10/05/04	17.7	14.3	15.9
06/05/04	18.7	14.7	16.5	08/05/04	21.7	17.4	19.4	10/10/04	17.7	14.3	15.9
06/06/04	19.1	14.9	16.7	08/06/04	21.3	16.8	18.9	10/07/04	17.6	14.1	15.8
06/07/04	18.4	14.7	16.3	08/07/04	21.8	16.7	19.0	10/08/04	17.3	14.0	15.6
06/08/04	16.7	13.8	14.9	08/08/04	22.3	17.3	19.5	10/09/04	17.4	14.7	15.8
06/09/04	16.3	12.7	14.4	08/09/04	22.7	17.6	19.9	10/10/04	16.0	12.6	14.1
06/10/04	17.0	12.9	14.7	08/10/04	22.5	17.3	19.7	10/11/04	15.5	12.1	13.6
06/11/04	17.3	13.2	15.1	08/11/04	21.8	17.3	19.4	10/12/04	15.7	12.3	13.8
06/12/04	18.2	13.8	15.7	08/12/04	22.5	17.6	19.8	10/13/04	16.5	12.7	14.4
06/13/04	19.1	14.6	16.5	08/13/04	22.7	17.9	20.0	10/14/04	15.8	13.0	14.4
06/14/04	19.7	15.4	17.2	08/14/04	22.3	18.2	20.0	10/15/04	16.0	12.6	14.1
06/15/04	20.4	15.7	17.7	08/15/04	22.2	17.4	19.6	10/16/04	15.2	12.4	13.8
06/16/04	21.0	16.5	18.4	08/16/04	22.3	17.6	19.6	10/17/04	14.0	12.6	13.4
06/17/04	21.0	17.1	18.8	08/17/04	22.2	17.6	19.6	10/18/04	12.7	11.6	12.1
06/18/04	21.0	17.0	18.7	08/18/04	22.7	17.9	20.0	10/19/04	11.8	10.4	11.1
06/19/04	21.2	17.0	18.7	08/19/04	22.7	18.6	20.4	10/20/04	10.7	9.6	10.3
06/20/04	21.2	16.8	18.6	08/20/04	22.7	18.1	20.2	10/21/04	11.3	8.5	9.8
06/21/04	21.5	17.1	19.0	08/21/04	22.7	18.2	20.1	10/22/04	9.8	8.7	9.1
06/22/04	21.8	17.8	19.4	08/22/04	20.7	18.2	19.3	10/23/04	nr	nr	nr
06/23/04	21.8	17.6	19.4	08/23/04	21.2	17.8	19.3	10/24/04	nr	nr	nr
06/24/04	21.8	17.6	19.3	08/24/04	21.8	18.1	19.7	10/25/04	nr	nr	nr
06/25/04	21.7	17.1	19.0	08/25/04	21.3	17.4	19.1	10/26/04	nr	nr	nr
06/26/04	21.8	17.1	19.1	08/26/04	21.5	17.9	19.3	10/27/04	nr	nr	nr
06/27/04	21.8	17.1	19.2	08/27/04	21.3	17.0	18.8	10/28/04	nr	nr	nr
06/28/04	22.2	18.1	19.6	08/28/04	21.5	16.8	18.8	10/29/04	nr	nr	nr
06/29/04	22.2	17.8	19.6	08/29/04	21.8	17.3	19.1	10/30/04	nr	nr	nr
06/30/04	22.2	17.9	19.6	08/30/04	21.5	17.1	18.9	10/31/04	nr	nr	nr
				08/31/04	21.3	17.0	18.8		nr	nr	nr

nr = no record

APPENDIX E, Table 6. Butte Creek water temperatures (Celsius) at Covered Bridge (USGS Gauge #113900000, Butte Creek near Chico) for period May 1 through October 1, 2004.

DATE	MAX	MIN	MEAN	DATE	MAX	MIN	MEAN	DATE	MAX	MIN	MEAN
05/01/04	14.9	11.2	12.8	07/01/04	22.3	18.9	20.5	09/01/04	21.2	17.6	19.4
05/02/04	15.8	11.8	13.5	07/02/04	22.7	19.2	20.8	09/02/04	20.7	17.5	19.1
05/03/04	16.3	12.5	14.1	07/03/04	22.9	19.5	21.1	09/03/04	19.9	16.7	18.4
05/04/04	16.4	12.9	14.4	07/04/04	23.2	19.7	21.3	09/04/04	20.0	16.3	18.2
05/05/04	15.6	12.5	13.9	07/05/04	23.7	20.1	21.8	09/05/04	20.3	16.5	18.4
05/06/04	14.6	11.9	13.1	07/06/04	24.4	20.8	22.5	09/06/04	20.5	16.9	18.7
05/07/04	14.9	11.6	13.1	07/07/04	24.1	21.2	22.6	09/07/04	20.8	17.1	18.9
05/08/04	14.8	12.2	13.3	07/08/04	23.9	20.5	22.1	09/08/04	20.9	17.3	19.1
05/09/04	15.0	11.6	13.1	07/09/04	23.2	19.4	21.3	09/09/04	20.8	17.3	19.0
05/10/04	14.4	11.8	12.9	07/10/04	22.8	18.7	20.7	09/10/04	20.6	17.1	18.9
05/11/04	13.8	10.8	12.1	07/11/04	22.7	18.6	20.6	09/11/04	20.2	16.7	18.5
05/12/04	13.9	10.0	11.7	07/12/04	22.7	18.4	20.5	09/12/04	20.2	16.8	18.5
05/13/04	14.4	10.6	12.3	07/13/04	22.6	18.4	20.5	09/13/04	19.7	16.6	18.2
05/14/04	15.2	11.5	13.1	07/14/04	22.5	18.2	20.3	09/14/04	19.2	15.9	17.6
05/15/04	16.0	12.3	13.9	07/15/04	22.4	18.1	20.2	09/15/04	19.3	15.7	17.6
05/16/04	16.3	12.8	14.3	07/16/04	21.5	18.2	20.0	09/16/04	19.8	16.4	18.2
05/17/04	15.9	12.7	14.0	07/17/04	22.4	18.6	20.4	09/17/04	19.6	16.8	18.3
05/18/04	15.1	12.6	13.7	07/18/04	23.1	19.2	21.1	09/18/04	19.0	16.8	17.9
05/19/04	15.4	11.7	13.3	07/19/04	23.1	19.6	21.4	09/19/04	16.8	15.4	16.1
05/20/04	15.9	12.1	13.8	07/20/04	24.0	20.1	22.0	09/20/04	17.2	14.5	15.7
05/21/04	15.7	12.3	13.9	07/21/04	24.2	20.3	22.2	09/21/04	16.7	13.5	15.2
05/22/04	15.4	12.0	13.6	07/22/04	24.3	20.5	22.3	09/22/04	16.8	13.6	15.3
05/23/04	15.8	12.2	13.8	07/23/04	24.1	20.4	22.2	09/23/04	17.2	14.0	15.7
05/24/04	16.1	12.5	14.1	07/24/04	24.1	20.6	22.3	09/24/04	17.4	14.3	15.9
05/25/04	15.9	12.5	14.0	07/25/04	24.2	20.6	22.4	09/25/04	17.6	14.4	16.1
05/26/04	16.7	12.6	14.5	07/26/04	23.9	20.1	22.0	09/26/04	17.9	14.8	16.4
05/27/04	15.9	13.8	14.9	07/27/04	23.6	19.8	21.7	09/27/04	17.6	14.7	16.3
05/28/04	15.9	14.0	14.7	07/28/04	23.6	20.0	21.7	09/28/04	16.4	14.5	15.6
05/29/04	16.3	12.6	14.3	07/29/04	23.1	19.8	21.5	09/29/04	16.8	14.2	15.6
05/30/04	17.1	12.8	14.8	07/30/04	23.2	19.8	21.5	09/30/04	17.1	14.5	15.9
06/01/04	18.1	13.8	15.7	07/31/04	22.9	19.7	21.3	10/01/04	17.2	14.6	16.0
06/02/04	18.6	14.6	16.4	08/01/04	22.6	19.4	21.0	10/02/04	nr	nr	nr
06/03/04	19.1	14.9	16.8	08/02/04	22.1	19.2	20.7	10/03/04	nr	nr	nr
06/04/04	19.1	15.5	17.1	08/03/04	22.2	19.0	20.6	10/04/04	nr	nr	nr
06/05/04	19.3	15.4	17.2	08/04/04	22.2	19.2	20.7	10/05/04	nr	nr	nr
06/06/04	19.0	15.6	17.2	08/05/04	21.7	18.9	20.4	10/06/04	nr	nr	nr
06/07/04	19.3	15.7	17.3	08/06/04	21.4	18.4	20.0	10/07/04	nr	nr	nr
06/08/04	18.8	15.7	17.1	08/07/04	21.7	18.3	20.0	10/08/04	nr	nr	nr
06/09/04	17.4	14.8	16.0	08/08/04	22.1	18.7	20.3	10/09/04	nr	nr	nr
06/10/04	16.9	13.8	15.3	08/09/04	22.4	18.9	20.7	10/10/04	nr	nr	nr
06/11/04	17.5	14.0	15.6	08/10/04	22.3	18.8	20.6	10/11/04	nr	nr	nr
06/12/04	17.7	14.3	15.9	08/11/04	21.8	18.8	20.4	10/12/04	nr	nr	nr
06/13/04	18.4	14.7	16.4	08/12/04	22.2	18.9	20.5	10/13/04	nr	nr	nr
06/14/04	19.2	15.4	17.1	08/13/04	22.4	19.3	20.9	10/14/04	nr	nr	nr
06/15/04	19.7	16.1	17.7	08/14/04	22.1	19.5	20.8	10/15/04	nr	nr	nr
06/16/04	20.3	16.4	18.3	08/15/04	21.8	18.9	20.5	10/16/04	nr	nr	nr
06/17/04	21.1	17.1	18.9	08/16/04	21.9	19.0	20.6	10/17/04	nr	nr	nr
06/18/04	21.2	17.8	19.3	08/17/04	21.9	18.9	20.5	10/18/04	nr	nr	nr
06/19/04	21.2	17.7	19.3	08/18/04	22.9	19.2	20.9	10/19/04	nr	nr	nr
06/20/04	21.2	17.7	19.3	08/19/04	22.9	19.3	21.1	10/20/04	nr	nr	nr
06/21/04	21.3	17.7	19.3	08/20/04	22.9	19.0	21.0	10/21/04	nr	nr	nr
06/22/04	21.6	17.9	19.6	08/21/04	22.8	19.0	20.9	10/22/04	nr	nr	nr
06/23/04	21.9	18.4	20.0	08/22/04	21.3	19.1	20.2	10/23/04	nr	nr	nr
06/24/04	21.9	18.4	20.0	08/23/04	21.7	18.5	20.1	10/24/04	nr	nr	nr
06/25/04	21.8	18.4	20.0	08/24/04	22.2	18.9	20.5	10/25/04	nr	nr	nr
06/26/04	21.8	18.0	19.8	08/25/04	21.7	18.2	20.0	10/26/04	nr	nr	nr
06/27/04	21.8	18.1	19.8	08/26/04	21.8	18.7	20.1	10/27/04	nr	nr	nr
06/28/04	21.9	18.1	19.9	08/27/04	21.5	17.6	19.6	10/28/04	nr	nr	nr
06/29/04	22.0	18.8	20.3	08/28/04	21.7	17.5	19.6	10/29/04	nr	nr	nr
06/30/04	22.1	18.8	20.3	08/29/04	21.8	17.9	19.8	10/30/04	nr	nr	nr
06/31/04	21.9	18.8	20.3	08/30/04	21.6	17.8	19.7	10/31/04	nr	nr	nr
				08/31/04	21.4	17.7	19.6		nr	nr	nr

nr = no record

APPENDIX F

**TABLES 1 & 2
PG&E WATER TEMPERATURES AT KEY SITES
WITHIN DESABLA CENTERVILLE PROJECT (FERC 803)
JUNE 1 THROUGH SEPTEMBER 30, 2004**

APPENDIX F, Table 1. Water temperature (C) at key sites within PG&E DeSabra Centerville Project for period June 1, through September 30, 2004 (PG&E preliminary data 2004).

DAY	Hendricks Head Dam		Hendricks/Toadtown Canal at BW12		DeSabra Forebay		Butte Creek Above Desabra Powerhouse	
	MAX	MEAN	MAX	MEAN	MAX	MEAN	MAX	MEAN
6/1	nr	nr	nr	nr	nr	nr	nr	nr
6/2	nr	nr	nr	nr	nr	nr	nr	nr
6/3	nr	nr	nr	nr	nr	nr	nr	nr
6/4	13.8	12.1	nr	nr	14.1	12.9	16.3	15.8
6/5	13.8	12.5	nr	nr	14.2	13.3	16.5	16.1
6/6	14.1	12.6	nr	nr	14.3	13.3	16.8	16.1
6/7	13.3	12.2	nr	nr	13.8	12.9	16.7	15.9
6/8	11.9	10.3	nr	nr	12.7	11.2	15.6	14.8
6/9	10.4	9.5	nr	nr	10.9	10.0	14.0	13.3
6/10	12.1	10.5	nr	nr	12.2	11.0	14.3	13.8
6/11	12.5	11.1	nr	nr	12.8	11.7	15.9	14.7
6/12	13.3	11.7	nr	nr	13.7	12.4	16.8	15.5
6/13	14.0	12.4	nr	nr	14.4	13.1	17.5	16.2
6/14	14.7	13.1	nr	nr	15.1	13.8	18.3	16.9
6/15	15.4	13.7	nr	nr	15.8	14.5	18.7	17.3
6/16	15.9	14.3	nr	nr	16.3	15.1	19.1	17.9
6/17	16.1	14.6	nr	nr	16.5	15.4	19.5	18.4
6/18	15.7	14.3	15.8	14.8	16.1	15.0	19.4	18.3
6/19	15.7	14.2	15.8	14.7	16.0	14.9	19.4	18.2
6/20	15.6	14.0	15.7	14.5	15.9	14.7	19.3	18.0
6/21	16.2	14.6	16.3	15.1	16.6	15.3	19.8	18.6
6/22	16.6	15.1	16.8	15.6	17.1	15.8	20.2	19.0
6/23	16.3	14.9	16.5	15.4	16.7	15.6	19.9	18.8
6/24	16.4	14.9	16.7	15.4	16.8	15.5	19.8	18.6
6/25	15.9	14.5	16.2	14.9	16.3	15.1	19.3	18.0
6/26	16.1	14.6	16.3	15.0	16.5	15.1	19.4	18.1
6/27	16.3	14.8	16.5	15.2	16.7	15.3	19.6	18.4
6/28	16.6	15.3	17.1	15.9	17.1	16.0	19.9	19.0
6/29	16.6	14.9	16.7	15.5	16.7	15.3	20.0	18.9
6/30	17.0	15.6	17.2	16.1	17.3	16.1	20.1	19.2
7/1	15.9	15.1	16.8	15.8	16.4	15.6	20.2	19.2
7/2	16.4	15.0	17.1	15.7	16.9	15.5	20.6	19.4
7/3	16.9	15.4	17.4	16.0	17.4	16.1	20.9	19.8
7/4	17.2	15.7	17.7	16.3	17.8	16.3	21.0	19.8
7/5	17.8	16.3	18.4	16.9	18.6	17.0	21.6	20.4
7/6	18.4	16.9	19.0	17.5	19.2	17.7	22.2	21.0
7/7	18.3	17.0	19.0	17.7	19.0	17.8	22.0	21.2
7/8	17.3	16.0	18.0	16.6	17.9	16.7	21.0	20.1
7/9	16.7	15.4	17.3	15.9	17.1	15.9	20.2	19.3
7/10	16.1	14.6	16.6	15.2	16.5	15.1	19.5	18.5
7/11	15.9	14.5	16.6	15.0	16.5	14.9	19.3	18.1
7/12	16.1	14.5	16.7	15.1	16.7	15.0	19.3	18.1
7/13	16.2	14.7	16.9	15.3	16.9	15.3	19.3	18.1
7/14	16.0	14.5	16.7	15.0	16.6	15.1	19.0	17.8
7/15	15.8	14.3	16.5	14.9	16.5	14.9	18.8	17.6
7/16	15.5	14.0	16.1	14.6	15.8	14.5	18.3	17.3
7/17	16.3	14.7	17.0	15.3	17.0	15.2	19.1	17.9
7/18	16.9	15.3	17.7	15.9	17.7	16.0	19.8	18.5
7/19	16.8	15.4	17.5	16.1	17.7	16.2	20.0	18.9
7/20	17.6	16.0	18.5	16.7	18.5	16.8	21.0	19.8
7/21	17.0	15.9	17.9	16.7	18.1	16.8	21.1	20.0
7/22	16.8	15.5	17.6	16.4	18.0	16.6	21.1	19.9
7/23	16.9	15.6	17.7	16.3	18.1	16.6	21.1	20.0
7/24	17.2	16.0	18.1	16.7	18.4	17.0	21.3	20.3
7/25	16.7	15.5	17.8	16.5	18.1	16.7	21.0	20.0
7/26	15.4	14.4	16.3	15.3	16.9	15.8	20.4	19.3
7/27	15.4	14.3	16.2	15.1	17.0	15.6	20.3	19.2
7/28	16.0	14.7	16.8	15.5	17.5	16.0	20.6	19.5
7/29	15.6	14.6	16.6	15.4	17.2	15.9	20.3	19.4
7/30	15.9	14.6	16.8	15.4	17.3	15.8	20.3	19.3
7/31	15.3	14.1	16.3	15.0	16.7	15.4	20.0	18.9

nr = no record

APPENDIX F, Table 1 (continued). Water temperature (C) at key sites within PG&E DeSabra Centerville Project for period June 1, through September 30, 2004 (PG&E preliminary data 2004).

DAY	Hendricks Head Dam		Hendricks/Toadtown Canal at BW12		DeSabra Forebay Inflow		Butte Creek Above Desabra Powerhouse	
	MAX	MEAN	MAX	MEAN	MAX	MEAN	MAX	MEAN
8/1	14.9	13.7	15.8	14.5	16.2	14.8	19.6	18.5
8/2	14.8	13.7	15.7	14.4	16.1	14.7	19.4	18.4
8/3	14.9	13.7	15.8	14.4	16.2	14.6	19.3	18.3
8/4	15.0	13.9	15.9	14.6	16.3	14.9	19.4	18.4
8/5	14.4	13.3	15.3	14.1	15.6	14.5	18.7	17.8
8/6	13.8	12.8	14.6	13.5	15.0	13.8	18.2	17.3
8/7	14.4	13.1	15.2	13.7	15.7	14.0	18.8	17.5
8/8	15.2	13.9	15.9	14.5	16.5	14.9	19.3	18.1
8/9	15.1	14.0	16.0	14.8	16.6	15.2	19.4	18.3
8/10	14.7	13.5	15.6	14.3	16.1	14.7	19.1	18.0
8/11	14.7	13.6	15.5	14.3	15.9	14.6	18.8	17.8
8/12	15.2	13.9	16.0	14.7	16.6	15.0	19.4	18.1
8/13	15.5	14.4	16.1	15.1	16.8	15.5	19.8	18.8
8/14	15.6	14.7	16.2	15.3	16.9	15.7	19.8	19.0
8/15	15.1	14.2	15.7	14.9	16.2	15.2	19.4	18.5
8/16	15.2	14.1	15.7	14.7	16.2	15.0	19.4	18.4
8/17	15.3	14.3	15.8	14.9	16.3	15.1	19.4	18.4
8/18	16.0	14.8	16.5	15.4	17.0	15.6	19.9	18.8
8/19	16.3	15.3	16.9	16.0	17.2	16.1	20.3	19.3
8/20	16.1	15.0	16.3	15.5	16.7	15.6	19.8	18.9
8/21	16.2	15.2	16.4	15.6	16.7	15.6	19.6	18.7
8/22	15.6	14.9	16.0	15.4	15.9	15.3	18.9	18.4
8/23	16.0	15.2	16.3	15.5	16.4	15.3	19.3	18.5
8/24	16.6	15.4	16.6	15.8	16.5	15.4	19.7	18.9
8/25	15.9	15.0	16.1	15.4	15.9	15.1	18.9	18.2
8/26	16.1	15.4	16.3	15.7	16.2	15.3	19.3	18.3
8/27	16.0	14.9	16.1	15.2	16.0	14.8	18.5	17.6
8/28	16.2	15.1	16.4	15.5	16.3	15.1	18.4	17.4
8/29	16.3	15.3	16.5	15.7	16.4	15.3	18.5	17.6
8/30	15.9	14.9	16.1	15.3	16.0	15.0	18.3	17.3
8/31	15.8	14.7	15.9	15.1	15.9	14.8	18.2	17.3
9/1	15.8	14.7	15.8	15.1	15.6	14.8	18.0	17.1
9/2	15.3	14.5	15.5	14.9	15.2	14.5	17.8	17.0
9/3	14.3	13.7	14.6	14.0	14.3	13.6	17.0	16.4
9/4	14.9	13.6	14.9	13.7	14.6	13.3	17.0	16.0
9/5	15.2	14.2	15.3	14.5	15.2	14.1	17.2	16.3
9/6	15.3	14.4	15.5	14.7	15.4	14.4	17.5	16.6
9/7	15.3	14.4	15.6	14.8	15.5	14.5	17.7	16.7
9/8	15.3	14.4	15.6	14.8	15.5	14.5	17.8	16.9
9/9	15.0	14.2	15.4	14.7	15.3	14.4	17.6	16.8
9/10	14.5	13.8	14.9	14.3	14.9	14.0	17.3	16.5
9/11	14.3	13.4	14.6	13.8	14.5	13.5	16.8	15.9
9/12	14.4	13.6	14.7	14.0	14.6	13.6	17.0	16.1
9/13	14.0	13.3	14.3	13.7	14.1	13.4	16.7	16.0
9/14	13.5	12.7	13.7	13.0	13.5	12.6	16.1	15.3
9/15	13.9	13.0	14.4	13.3	14.2	12.8	16.1	15.2
9/16	14.2	13.2	14.8	13.8	14.5	13.4	16.5	15.7
9/17	13.6	12.8	14.3	13.5	14.0	13.1	16.3	15.6
9/18	12.8	12.0	13.6	12.5	13.0	12.1	15.7	15.2
9/19	10.9	10.0	11.5	10.4	11.0	9.9	14.4	13.5
9/20	10.6	9.7	10.7	9.9	10.3	9.3	13.6	12.9
9/21	10.5	9.6	11.0	9.9	10.7	9.4	13.2	12.4
9/22	11.1	10.1	11.6	10.5	11.4	10.1	13.4	12.5
9/23	11.4	10.5	12.0	11.0	11.9	10.6	13.7	12.9
9/24	11.5	10.6	12.2	11.2	12.1	10.9	14.0	13.1
9/25	11.5	10.6	12.2	11.3	12.0	10.9	14.1	13.3
9/26	11.1	10.4	12.0	11.2	11.7	10.8	14.2	13.4
9/27	11.1	10.3	11.9	11.0	11.7	10.6	14.1	13.3
9/28	11.2	10.3	11.6	10.8	11.3	10.4	13.5	13.0
9/29	11.4	10.6	12.2	11.2	11.7	10.6	13.9	13.2
9/30	11.7	10.8	12.2	11.3	12.0	10.9	14.1	13.4

APPENDIX F, Table 2. Water temperature (C) at key sites within PG&E DeSabra Centerville Project for period June 1, through September 30, 2004 (PG&E preliminary data 2004).

DAY	DeSabra Powerhouse Discharge		Butte Creek Centerville Head Dam		Butte Creek Above Centerville Powerhouse		Centerville Powerhouse Discharge	
	MAX	MEAN	MAX	MEAN	MAX	MEAN	MAX	MEAN
6/1	nr	nr	nr	nr	nr	nr	nr	nr
6/2	nr	nr	nr	nr	nr	nr	nr	nr
6/3	nr	nr	nr	nr	nr	nr	nr	nr
6/4	14.6	13.8	14.9	14.4	19.0	16.7	16.0	15.0
6/5	14.8	14.1	15.1	14.7	18.8	16.7	16.1	15.1
6/6	14.8	14.2	15.2	14.7	19.1	16.9	16.3	15.2
6/7	14.6	13.9	14.9	14.5	18.6	16.6	15.9	14.9
6/8	13.7	12.4	14.2	13.1	17.1	15.4	14.5	13.6
6/9	11.7	10.9	12.3	11.8	16.6	14.7	13.4	12.4
6/10	12.7	11.7	13.1	12.4	17.3	15.0	14.1	12.8
6/11	13.2	12.4	13.8	13.0	17.6	15.4	14.6	13.4
6/12	14.0	13.0	14.5	13.6	18.6	16.2	15.4	14.1
6/13	14.8	13.8	15.3	14.4	19.4	17.1	16.1	14.8
6/14	15.4	14.5	16.0	15.1	20.1	17.8	16.9	15.6
6/15	16.1	15.2	16.6	15.7	20.4	18.3	17.5	16.2
6/16	16.8	15.9	17.2	16.3	21.1	18.9	18.2	16.9
6/17	17.0	16.3	17.4	16.8	21.5	19.4	18.5	17.3
6/18	16.8	16.1	17.2	16.6	21.7	19.5	18.3	17.1
6/19	16.5	15.9	17.1	16.5	21.8	19.6	18.2	17.0
6/20	16.3	15.7	17.0	16.3	21.8	19.6	18.0	16.8
6/21	17.0	16.1	17.6	16.7	22.4	20.1	18.6	17.2
6/22	17.5	16.7	18.0	17.2	22.7	20.5	19.0	17.8
6/23	17.4	16.7	17.8	17.2	22.5	20.3	19.0	17.8
6/24	17.3	16.6	17.6	17.0	22.5	20.3	18.9	17.6
6/25	17.0	16.2	17.4	16.7	22.3	19.9	18.6	17.2
6/26	16.9	16.1	17.3	16.6	22.4	20.0	18.5	17.1
6/27	17.1	16.2	17.6	16.7	22.5	20.2	18.7	17.3
6/28	17.4	16.8	17.9	17.4	22.7	20.6	18.9	17.8
6/29	17.1	16.4	17.7	17.0	22.8	20.6	18.9	17.7
6/30	17.6	16.8	18.1	17.4	22.5	20.6	19.3	17.9
7/1	17.6	16.9	18.0	17.5	22.7	20.7	19.2	18.1
7/2	17.3	16.5	18.0	17.3	23.5	21.2	19.2	17.9
7/3	17.9	17.0	18.4	17.7	23.7	21.5	19.8	18.4
7/4	18.2	17.3	18.8	18.0	23.8	21.6	20.2	18.6
7/5	18.8	17.8	19.4	18.5	24.4	22.1	20.9	19.2
7/6	19.4	18.6	20.1	19.3	25.0	22.8	21.7	20.0
7/7	19.6	19.0	20.0	19.6	24.8	22.8	21.8	20.3
7/8	19.3	18.3	19.8	18.8	24.1	22.0	20.8	19.5
7/9	18.3	17.4	18.8	18.0	23.3	21.3	20.0	18.6
7/10	17.6	16.5	18.1	17.1	22.8	20.6	19.2	17.8
7/11	16.9	16.2	17.4	16.7	22.7	20.4	19.1	17.4
7/12	16.9	16.2	17.5	16.7	22.6	20.3	19.3	17.4
7/13	17.1	16.4	17.5	16.9	22.5	20.2	19.3	17.6
7/14	17.0	16.3	17.4	16.8	22.3	20.0	19.2	17.5
7/15	16.9	16.2	17.2	16.6	22.2	19.8	19.1	17.3
7/16	16.7	15.9	17.0	16.3	21.4	19.5	18.1	16.9
7/17	17.0	16.1	17.4	16.6	22.3	20.0	19.3	17.4
7/18	17.8	16.9	18.1	17.4	22.8	20.6	20.0	18.1
7/19	18.1	17.4	18.5	17.8	22.8	20.9	20.4	18.6
7/20	18.7	17.8	19.2	18.4	23.9	21.6	21.2	19.2
7/21	18.8	18.1	19.2	18.6	24.2	22.0	21.1	19.4
7/22	18.6	17.9	19.1	18.5	24.3	22.1	21.0	19.3
7/23	18.6	17.8	19.2	18.4	24.1	22.0	21.0	19.2
7/24	18.8	18.1	19.4	18.7	24.1	22.1	21.1	19.5
7/25	18.7	18.1	19.3	18.7	24.2	22.1	21.3	19.5
7/26	18.5	17.4	18.9	18.0	23.7	21.6	20.3	18.8
7/27	17.6	16.8	18.1	17.5	23.4	21.3	19.9	18.3
7/28	17.9	17.0	18.5	17.8	23.5	21.4	20.3	18.6
7/29	17.9	17.2	18.4	17.8	23.1	21.1	20.2	18.5
7/30	17.8	17.1	18.3	17.7	23.3	21.1	20.3	18.5
7/31	17.7	16.8	18.1	17.4	22.9	20.8	20.1	18.2

nr = no record

APPENDIX F, Table 2 (continued). Water temperature (C) at key sites within PG&E DeSabra Centerville Project for period June 1, through September 30, 2004 (PG&E preliminary data 2004).

DAY	DeSabra Powerhouse Discharge		Butte Creek Centerville Head Dam		Butte Creek Above Centerville Powerhouse		Centerville Powerhouse Discharge	
	MAX	MEAN	MAX	MEAN	MAX	MEAN	MAX	MEAN
8/1	17.4	16.3	17.8	17.0	22.5	20.5	19.5	17.8
8/2	16.8	16.1	17.4	16.8	22.1	20.2	19.1	17.5
8/3	16.6	15.9	17.2	16.6	22.1	20.1	19.1	17.4
8/4	16.8	16.1	17.3	16.8	22.3	20.2	19.4	17.5
8/5	16.8	15.9	17.2	16.5	21.6	19.8	18.6	17.2
8/6	16.2	15.3	16.6	15.9	21.3	19.4	18.2	16.6
8/7	15.9	15.1	16.6	15.8	21.7	19.5	18.5	16.6
8/8	16.6	15.7	17.2	16.4	22.0	19.9	19.1	17.2
8/9	17.0	16.3	17.5	16.9	22.3	20.2	19.6	17.7
8/10	17.0	16.1	17.4	16.7	22.1	20.0	19.3	17.5
8/11	16.7	15.9	17.1	16.5	21.5	19.8	18.5	17.2
8/12	16.6	15.9	17.3	16.6	22.1	20.0	19.3	17.5
8/13	17.3	16.5	17.8	17.1	22.3	20.4	19.5	17.9
8/14	17.4	16.8	17.9	17.4	22.1	20.4	19.6	18.1
8/15	17.4	16.6	17.8	17.1	21.9	20.0	19.2	17.7
8/16	16.9	16.2	17.3	16.8	22.0	20.1	19.1	17.5
8/17	16.8	16.1	17.4	16.7	21.9	20.1	19.0	17.5
8/18	17.3	16.4	17.8	17.1	22.4	20.4	19.5	17.9
8/19	17.8	17.1	18.2	17.7	22.5	20.9	20.0	18.4
8/20	17.8	16.9	18.1	17.4	22.5	20.7	19.5	18.1
8/21	17.3	16.7	17.7	17.2	22.4	20.6	19.4	17.9
8/22	17.3	16.5	17.6	17.0	20.7	19.9	18.3	17.5
8/23	16.9	16.2	17.4	16.8	21.4	19.9	18.5	17.3
8/24	16.9	16.3	17.5	17.0	22.0	20.4	19.0	17.6
8/25	16.9	16.2	17.4	16.7	21.3	19.8	18.5	17.3
8/26	16.7	16.2	17.2	16.7	21.6	19.9	18.8	17.3
8/27	16.6	15.9	16.9	16.3	21.1	19.4	18.3	16.9
8/28	16.6	16.0	16.9	16.4	21.2	19.4	18.5	17.0
8/29	16.9	16.2	17.1	16.6	21.4	19.6	18.7	17.2
8/30	16.9	16.2	17.0	16.5	21.1	19.4	18.4	17.1
8/31	16.5	15.9	16.8	16.3	21.0	19.3	18.3	16.9
9/1	16.3	15.8	16.6	16.1	20.6	19.0	17.8	16.7
9/2	16.1	15.7	16.4	16.0	20.4	18.8	17.7	16.5
9/3	15.7	14.8	16.0	15.2	19.6	18.1	17.0	15.8
9/4	14.9	14.3	15.2	14.7	19.5	17.9	16.7	15.3
9/5	15.4	14.7	15.8	15.1	19.8	18.1	17.1	15.7
9/6	15.8	15.2	16.1	15.5	20.1	18.4	17.5	16.1
9/7	16.0	15.4	16.3	15.7	20.4	18.6	17.9	16.4
9/8	16.0	15.4	16.3	15.8	20.4	18.8	17.9	16.5
9/9	16.0	15.4	16.2	15.8	20.3	18.7	17.7	16.4
9/10	15.8	15.2	16.0	15.6	20.1	18.5	17.6	16.2
9/11	15.5	14.7	15.7	15.1	19.7	18.1	17.1	15.7
9/12	15.1	14.6	15.5	15.0	19.7	18.1	17.2	15.7
9/13	15.1	14.5	15.4	15.0	19.2	17.8	16.9	15.5
9/14	14.8	13.9	15.0	14.3	18.8	17.3	16.1	14.9
9/15	14.1	13.6	14.7	14.2	18.7	17.1	16.5	14.9
9/16	14.7	14.2	15.2	14.8	19.2	17.5	17.5	15.6
9/17	14.8	14.4	15.2	14.9	19.0	17.6	17.1	15.6
9/18	14.6	13.9	15.0	14.4	18.0	17.0	16.3	15.0
9/19	13.6	12.3	13.9	12.8	16.1	15.3	13.9	13.2
9/20	11.3	10.7	11.9	11.6	16.1	14.8	13.3	12.2
9/21	10.9	10.5	11.7	11.2	15.8	14.3	13.6	11.8
9/22	11.4	10.8	12.0	11.5	15.9	14.4	14.2	12.3
9/23	11.9	11.3	12.5	12.0	16.1	14.5	14.9	12.9
9/24	12.3	11.8	12.8	12.3	16.3	14.7	15.5	13.4
9/25	12.4	12.0	13.0	12.6	16.4	14.8	15.5	13.6
9/26	12.5	12.0	12.9	12.6	16.7	15.0	15.7	13.7
9/27	12.3	11.8	12.8	12.5	16.3	14.9	15.4	13.6
9/28	12.2	11.6	12.7	12.2	15.1	14.2	14.1	13.0
9/29	11.9	11.5	12.6	12.2	15.8	14.4	15.0	13.2
9/30	12.0	11.9	13.4	12.9	16.0	14.6	15.9	13.6

APPENDIX G

**TABLE 1
FLOWS AT KEY SITES WITHIN
PG&E DESABLA CENTERVILLE PROJECT FERC 803
JUNE 1-SEPTEMBER 30, 2004**

APPENDIX G, Table 1. Average daily flows (cfs) at key sites affecting Butte Creek SRCS for period June 1, through September 30, 2004.

DAY	GAGE								
	Butte Head Dam 1/	Hendricks Head Dam 2/	Butte Creek Above DeSabiá Powerhouse 3/	DeSabiá Powerhouse 4/	Centerville Head Dam 5/	Centerville Powerhouse 6/	Toadtown Canal 7/	Butte Canal 8/	Butte Creek Near Chico 9/
6/1	66	20	nr	159	nr	148	108	51	298
6/2	55	20	nr	167	nr	152	113	55	300
6/3	51	20	nr	169	nr	159	114	55	284
6/4	46	20	nr	169	nr	157	114	56	277
6/5	43	20	nr	168	nr	158	114	55	281
6/6	40	20	nr	168	nr	159	113	55	293
6/7	37	20	nr	168	nr	157	114	55	275
6/8	43	20	nr	163	nr	151	108	56	273
6/9	51	19	nr	150	nr	138	99	52	260
6/10	43	20	nr	157	nr	141	105	52	266
6/11	28	19	nr	156	nr	137	109	48	282
6/12	27	18	nr	158	nr	150	99	59	256
6/13	26	17	nr	155	nr	154	98	57	263
6/14	25	17	nr	147	nr	152	98	49	267
6/15	25	18	nr	158	nr	156	104	54	263
6/16	24	17	nr	145	nr	154	90	55	258
6/17	23	17	nr	142	55	146	88	55	255
6/18	22	17	nr	140	51	149	86	55	251
6/19	22	17	nr	136	51	143	82	54	246
6/20	22	17	nr	133	46	144	80	54	239
6/21	22	17	nr	132	44	148	79	53	258
6/22	22	17	nr	128	44	144	77	52	246
6/23	20	17	nr	126	45	140	74	52	240
6/24	18	17	nr	123	43	137	72	52	233
6/25	18	18	38	121	43	136	70	52	230
6/26	18	18	38	120	43	136	69	52	226
6/27	18	17	38	118	43	136	69	50	226
6/28	18	17	38	115	43	133	67	49	225
6/29	18	17	38	119	44	135	68	52	220
6/30	18	17	38	115	44	129	66	50	198
7/1	19	17	38	118	45	130	65	53	198
7/2	18	17	38	115	45	130	65	50	198
7/3	18	17	37	113	45	127	64	50	197
7/4	18	16	37	109	44	126	62	48	199
7/5	18	15	36	107	44	127	61	47	195
7/6	18	17	35	101	45	128	57	45	157
7/7	19	17	36	98	44	121	55	44	181
7/8	19	17	35	96	44	117	54	43	169
7/9	19	17	35	95	44	113	nr	43	157
7/10	19	17	35	94	44	114	nr	43	156
7/11	19	17	35	93	44	116	nr	43	162
7/12	18	17	35	91	44	114	nr	42	170
7/13	18	17	35	89	46	110	48	41	168
7/14	18	17	34	87	45	109	47	40	165
7/15	18	17	34	85	45	107	46	39	163
7/16	18	17	34	84	45	107	45	39	164
7/17	18	17	34	84	45	109	45	39	165
7/18	18	17	34	82	45	104	44	38	161
7/19	18	17	33	81	44	104	44	38	161
7/20	18	18	33	81	44	109	43	38	161
7/21	18	18	33	94	46	113	57	39	178
7/22	18	18	33	93	46	111	55	38	174
7/23	18	18	32	91	45	109	54	38	175
7/24	18	18	32	88	44	110	51	37	181
7/25	18	18	32	84	45	102	48	36	172
7/26	18	18	32	94	46	112	58	36	172
7/27	18	17	32	93	45	113	58	35	175
7/28	18	17	32	87	45	109	52	35	167
7/29	18	17	32	86	45	107	51	35	169
7/30	18	17	31	83	44	107	47	36	177
7/31	nr	17	31	82	44	105	47	35	178

nr = no record

APPENDIX G, Table 1 (Continued). Average daily flows (cfs) at key sites affecting Butte Creek SRCS for period June 1, through September 30, 2004.

DAY	GAGE								
	Butte Head Dam 1/	Hendricka Head Dam 2/	Butte Creek Above DeSabia Powerhouse 3/	DeSabia Powerhouse 4/	Centerville Head Dam 5/	Centerville Powerhouse 6/	Toadown Canal 7/	Butte Canal 8/	Butte Creek Near Chico 9/
8/1	18	17	31	81	44	103	47	34	177
8/2	18	17	32	81	44	99	47	35	179
8/3	18	17	31	81	44	100	47	34	177
8/4	18	17	32	81	44	102	47	34	173
8/5	18	17	31	81	44	99	48	34	175
8/6	18	17	31	84	45	101	51	33	170
8/7	18	17	31	84	45	105	50	34	186
8/8	18	18	31	83	45	108	49	33	182
8/9	18	18	30	81	44	107	49	32	185
8/10	18	18	30	81	44	101	49	32	174
8/11	18	18	30	81	44	98	49	32	174
8/12	18	18	30	80	44	97	51	31	175
8/13	18	18	30	90	45	95	58	32	184
8/14	18	18	29	89	45	96	58	32	183
8/15	18	18	30	89	45	94	58	32	186
8/16	18	18	30	88	45	94	58	31	187
8/17	18	18	30	88	45	95	57	31	196
8/18	18	18	29	88	43	96	57	31	174
8/19	18	18	29	88	43	94	58	30	149
8/20	18	18	29	95	44	96	65	31	164
8/21	18	18	29	95	44	95	64	31	154
8/22	18	18	29	94	46	95	65	29	150
8/23	19	18	30	98	46	99	67	32	155
8/24	19	18	31	101	46	117	67	34	162
8/25	19	18	31	101	46	111	65	36	156
8/26	19	18	30	97	45	109	65	32	154
8/27	18	18	30	94	45	110	63	31	151
8/28	18	18	29	93	45	111	62	30	147
8/29	18	18	29	92	45	113	62	30	147
8/30	18	18	29	91	45	108	61	30	165
8/31	18	18	29	94	45	109	65	30	148
9/1	18	18	29	93	45	109	64	29	150
9/2	18	18	29	94	45	110	64	30	151
9/3	18	18	29	94	45	107	63	31	177
9/4	18	18	29	93	45	110	63	30	156
9/5	18	18	29	93	45	111	62	30	151
9/6	18	18	29	92	45	113	62	30	149
9/7	18	18	29	91	45	112	62	29	148
9/8	18	18	29	91	45	109	61	30	147
9/9	18	18	28	89	44	107	59	29	145
9/10	18	18	28	83	44	100	54	29	139
9/11	18	18	28	83	44	103	53	30	136
9/12	18	18	29	83	44	103	53	30	137
9/13	18	18	29	83	44	97	54	30	140
9/14	18	18	29	82	44	96	53	29	139
9/15	18	17	29	71	44	92	42	28	128
9/16	18	17	29	59	44	69	30	28	114
9/17	18	18	29	54	46	49	26	28	104
9/18	18	19	29	55	46	52	26	29	106
9/19	18	19	31	56	45	52	26	30	109
9/20	18	19	33	62	44	49	29	33	121
9/21	18	19	32	64	44	48	27	36	122
9/22	18	19	31	56	49	48	26	30	112
9/23	18	19	30	53	54	49	25	28	106
9/24	18	19	30	55	58	49	24	30	108
9/25	18	19	30	56	58	52	25	31	111
9/26	18	19	29	54	58	54	25	30	111
9/27	18	19	29	53	57	50	24	29	108
9/28	18	19	29	52	57	54	24	28	109
9/29	18	24	30	49	58	54	20	27	108
9/30	18	19	30	18	60	53	22	nr	105

nr = no record

APPENDIX G, Table 1 (Continued). Average daily flows (cfs) at key sites affecting Butte Creek SRCS for period June 1, through September 30, 2004.

- ^{1/} PG&E Butte Head Dam discharge for period June 1, through September 30, 2004. USGS gauge #11389720, Latitude 39°58'53", Longitude 121°35'15" NAD27, Drainage area 61.4 square miles, Gage datum 2,840, feet above sea level NGVD29. (Preliminary data received from PG&E 12/04)
- ^{2/} PG&E Hendricks Head Dam discharge for period June 1, through September 30, 2004. USGS gauge #11405200, Latitude 39°56'03", Longitude 121°31'43" Drainage area 46.1 square miles. (Preliminary data received from PG&E 12/04)
- ^{3/} PG&E Butte Creek immediately above DeSabra Powerhouse discharge for period June 25, through September 30, 2004. Temporary gage installed for PG&E flow model development. (Data preliminary per Tim Sagraves, TES. Gage data estimated +-10%)
- ^{4/} PG&E DeSabra Powerhouse discharge for period June 1, through September 30, 2004. USGS gauge #11389750, Latitude 39°52'10", Longitude 121°37'51" NAD27. (Preliminary data received from PG&E 12/04)
- ^{5/} PG&E Centerville Head Dam discharge for period June 1, through September 30, 2004. USGS gauge #11389780, Latitude 39°52'01", Longitude 121°37'58" NAD27, Drainage area 101 square miles, Gage datum 1,130 feet above sea level NGVD29. (Preliminary data received from PG&E 12/04)
- ^{6/} PG&E Centerville Powerhouse discharge for period June 1, through September 30, 2004. USGS gauge #11389775, Latitude 39°47'20", Longitude 121°39'23" NAD27. (Preliminary data received from PG&E 12/04)
- ^{7/} PG&E Toadtown Canal above Butte Canal for period June 1, through September 30, 2004. USGS gauge #11389800, Latitude 39°53'09", Longitude 121°36'35" NAD27. (Preliminary data received from PG&E 12/04)
- ^{8/} PG&E Butte Canal for period June 1, through September 30, 2004. Calculated (DeSabra Powerhouse discharge, USGS 11389750 minus Toadtown Canal above Butte Canal, USGS 11389800). (Preliminary data received from PG&E 12/04)
- ^{9/} USGS gage #11390000 for period June 1, through September 30, 2004, Butte Creek Near Chico. (Preliminary data DWR CDEC)