
Coho and Steelhead Restoration Project

Annual Section 10 Permit Data Report June 30, 1997 – July 1, 1998



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1997-98 COHO SALMON SECTION 10 PERMIT DATA REPORT PERMIT #1046

GOAL / PURPOSE OF SAMPLING

The National Park Service (NPS) implemented a long term watershed restoration project in response to the Federal Endangered Species Act listing of coho salmon (*Oncorhynchus kisutch*) and steelhead trout (*O. mykiss*) along the central California coast. The Coho and Steelhead Restoration Project (CSRP) is a five year cooperative effort between Golden Gate National Recreation Area, Muir Woods National Monument, and Point Reyes National Seashore in western Marin County. The objectives of the CSRP are to:

- Collect baseline data on the abundance and distribution of threatened juvenile, outmigrant, and adult salmonids;
- collect baseline watershed and habitat data;
- identify and implement habitat restoration projects; and
- develop and implement long term habitat and fish abundance monitoring programs.

The Coho and Steelhead Restoration Project (CSRP) is monitoring trends in fish abundance and distribution to prioritize and assess restoration efforts in the Olema, Lagunitas, Pine Gulch, and Redwood Creek watersheds (Figure 1). Field sampling began in summer 1997 and covered select areas in each watershed (Table 1). To date our efforts have focused both on filling gaps in current knowledge and extending existing data sets. In general, adult spawner surveys are conducted during the fall and winter, juvenile abundance is estimated during summer, and fish distribution is assessed year round in large portions of each watershed. At a select number of sites, smolt emigration is quantified in the spring. Various physical habitat measurements, including water quality and hydrologic characteristics, are collected in conjunction with each survey. In addition, interviews with long time residents and searches in archives have been conducted in an attempt to establish historical trends. Intensive fish sampling will continue for the next two years and a long term monitoring plan will be developed based on the results.

This report presents data from sampling pursuant to permit #1046 for threatened coho salmon. The CSRP has applied to the National Marine Fisheries Service (NMFS) for a section 10 permit to take threatened steelhead trout and this report includes data for both species. The format of the report follows a NMFS document attached to permit #1046 dated August 1, 1997.

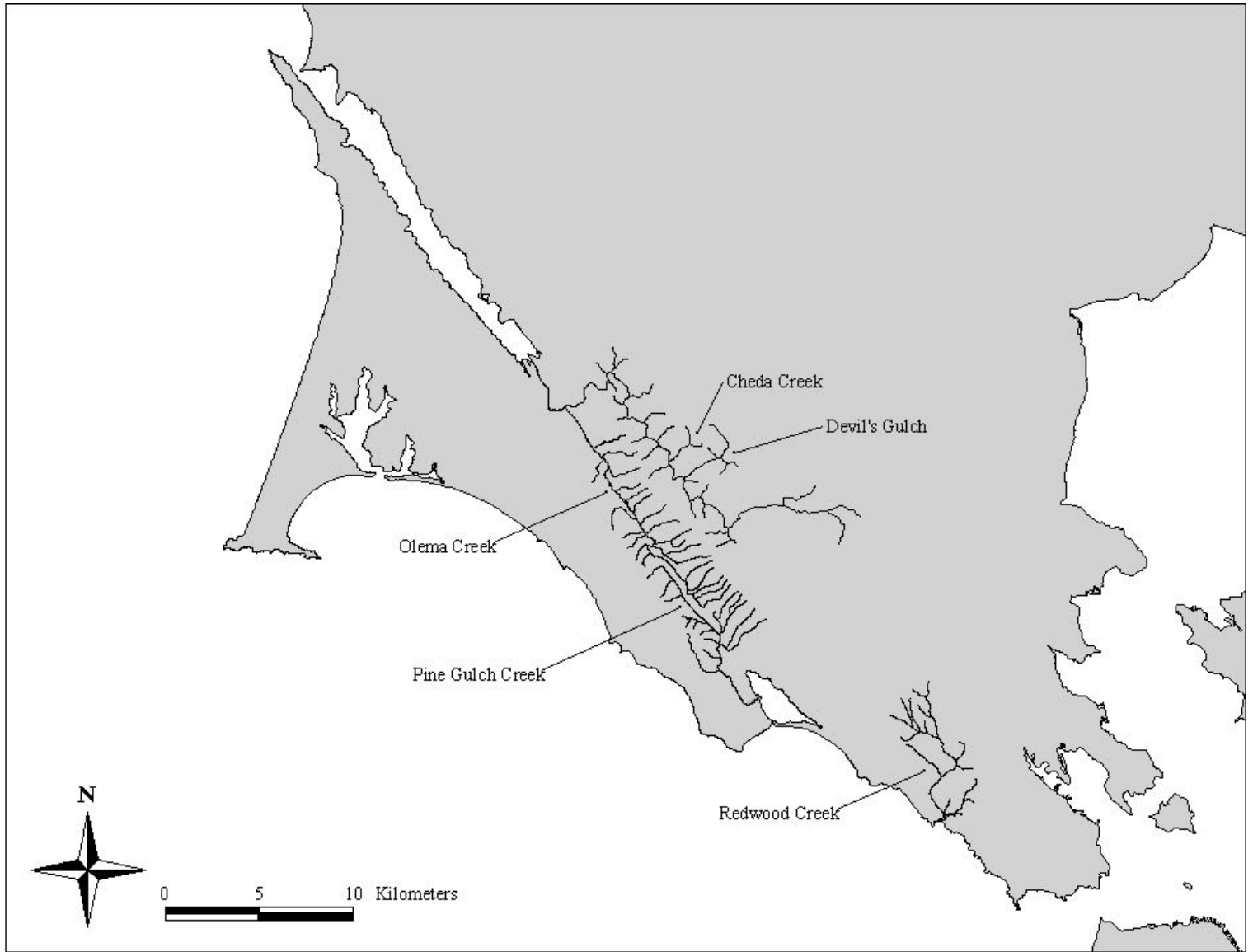


Figure1. Coho and Steelhead Restoration Project watersheds. Marin County, CA.

SAMPLING ACTIVITIES

Spawner and Carcass Surveys

Coho salmon spawner surveys were conducted between October 1997 and February 1998 in the Lagunitas, Olema, and Redwood Creek watersheds. In addition, one survey was conducted on Pine Gulch in March 1998. Occasional steelhead adults were observed and counted incidental to coho observations. Surveys on Redwood Creek occurred every 7-14 days depending upon weather conditions, with less frequent surveys on other creeks. Surveys were conducted using trained volunteers and NPS staff. Survey protocol involves walking upstream along creek margins and banks where possible, looking for carcasses or live fish. Typically, teams of 2 people surveyed reaches of 2-4 km in length. Live fish were identified to species and assigned to approximate size classes. Salmonid carcasses were handled to collect length, weight, and sex. When possible, scales and tissues from the operculum were collected for future genetic work. Take during spawner surveys consisted of occasional disturbance of adult fish. Particular care was taken not to disturb redds or actively spawning adults. Results of the 1997-98 spawner surveys are presented in Manning et al, 1999.

Smolt Trapping Surveys

Smolt yield was measured on Blue Line Creek, a tributary to Olema Creek, using a pipe-style downstream migrant trap from March-August, 1998. Pipe traps operate by impounding water behind a weir constructed of 6 to 13 mm square-mesh metal screen, fence posts, rocks, and sand bags that span the entire width of the stream. Flow is directed into a series of 6.2 m long, 20 cm diameter PVC pipes. The smolt trap is specially designed to minimize impingement under high flows and in-trap predation on young-of-the-year fish. To decrease water velocity, the pipes empty onto a slanted, perforated metal ramp. The ramp is connected to a 125 x 74 x 50 cm live box constructed of wood and 3 mm metal mesh screen. The live box contains a baffle to further slow velocity. Rocks, vegetation, and plastic containers with small mesh were added to the live box to provide cover and refugia for fry. In addition, the weir contains a notch that allows adult steelhead to migrate upstream unimpeded.

The trap was operated 24 hours per day, flow permitting, and checked once daily. We were primarily interested in salmonid smolts, parr, and fry but the numbers and lengths of all fish were recorded. Stream temperature and stage were recorded once daily from a staff gage. Mark-recapture methods were used to estimate trap efficiency and smolt population size. Daily, no more than 30 smolts of each species (coho and steelhead) were anesthetized with carbon dioxide and marked with small but identifiable fin clips. Marked smolts were released at a predetermined site no more than 200 m above the trap site. Mark combinations were alternated weekly. All recaptured smolts, adults, parr, and fry were released immediately after measurement in low velocity areas below the trap. Anesthetized fish were allowed to recover fully in an aerated "recovery bucket" before release.

Sources of mortality included fish becoming stranded on the ramp, predation of fry by larger fish, and general stress and trauma to fry during trapping and handling. The first source was minimized by carefully checking the trap daily and making adjustments as needed to ensure adequate flow across the ramp to prevent stranding. Fry mortality was minimized by providing adequate refugia in the trap box, and by netting, handling, counting, and releasing them as expeditiously as possible. In the interest of returning fry to the stream quickly, we did not attempt to identify species when large numbers were present in the trap box. Most of these were probably steelhead, given the timing of fry emergence for each species and the relative numbers of fry that were identified. Protocols called for suspending trap operations if either smolt or fry mortality exceeded five percent during a one week period. Actual combined steelhead/coho mortality levels were 1.4% for fry and 1.6% for older age classes.

Snorkel Surveys

To assess population levels and characteristics of juvenile coho and steelhead, snorkel surveys were conducted in Redwood Creek, Olema Creek, and Pine Gulch Creek during September and October 1997. Visual surveys typically involved 1 to 2 snorkelers in the water at a given time. Some of the surveys involved calibration using multiple snorkel passes. Standard dive lights were used to search undercut banks and woody debris for fish. Species identification, number, and size class information were recorded. The potential for injury or mortality from snorkel observations and seining is minimal. No handling of fish occurs from snorkel observations, and only minimal disturbance/harassment occurs

Electrofishing Surveys

During September and October 1997, multiple pass depletion electrofishing was conducted on Redwood, Olema, and Pine Gulch Creeks, usually in conjunction with snorkel surveys to establish a Hankin-Reeves index. Attempts were made to minimize injuries during electrofishing activities by using new generation electrofishing equipment, accepted sampling and fish handling protocols, and providing adequate training to personnel. Park biologists used a state of the art programmable waveform backpack electrofisher (Smith-Root Model 12 B-POW). Fish were captured using either pulsed or straight direct current with the minimum voltage, pulse width, and frequency necessary for immobilization. A log was kept of all settings, pertinent environmental conditions, and fish response. Potential sources of mortality or injury included general stress during capture and handling, respiratory failure, and hemorrhaging or spinal injuries associated with shocking. If a pattern of mortality or injury was recognized, techniques were altered to reduce impacts. Captured fish were typically sedated using carbon dioxide, identified to species and age class, measured, and weighed. Some individuals were handled to take fin clips or scale samples for age and/or genetic analysis. Fish were kept in aerated holding buckets before and after handling, and allowed to recover fully before being released. During electrofishing surveys as well as smolt trapping activities, the smaller salmonids were kept in separate buckets from sculpin and other fish to avoid predation.

Table 1. Streams and sampling activities conducted by the National Park Service CSRP during 1997-1998.

Watershed	County	Stream	Activities
Lagunitas	Marin	Devil's Gulch	Spawner survey
		Cheda Creek	Spawner survey
Lagunitas – Olema	Marin	Olema Creek (mainstem)	Spawner survey, snorkel survey, electrofishing
		Blueline Creek	Spawner survey, smolt trapping
		Quarry Gulch	Spawner survey
		Randall Gulch	Spawner survey
		Giacomini Creek	Spawner survey
Redwood	Marin	Redwood Creek (mainstem)	Spawner survey, electrofishing
		Kent Creek	Spawner survey
		Fern Creek	Spawner survey
Pine Gulch	Marin	Pine Gulch (mainstem)	Spawner survey, snorkel survey, electrofishing

Table 2. Annual take of ESA listed central California coast coho salmon by age class, 7/97-6/98 Permit #1046.

Type of Take	Age Class					
	Juvenile		Adult		Carcass	
	Allowable	Actual	Allowable	Actual	Allowable	Actual
Observe/Harass	44,400	43	1,800	515		
Capture/Handle	5,250	749 + 2982*			200	80
Capture/Handle/Mark	2,625	44				
Indirect Mortality	236	9 + 59*				

*unidentified fry from Blueline Creek smolt trap (mostly steelhead.)

Date	Activity	Location	Observe/harass				Capture/handle				Capture/handle/mark		Indirect mortality			
			Coho		Steelhead		Coho		Steelhead		Coho	Steelhead	Coho		Steelhead	
			adult	juv.	adult	juv.	adult	juv.	adult	juv.	juv.	juv.	adult	juv.	adult	juv.
11/6/97	Snorkel survey	Olema mainstem		43		52										
11/6/97	Electrofishing	Olema mainstem						65		56	23					
11/17/97- 1/23/98	Spawner survey	Devil's Gulch (Lag.)	79				9*									
12/11/97	Spawner survey	Cheda Creek (Lag.)	1													
11/18/97- 1/8/98	Spawner survey	Olema mainstem	241				40*									
1/8/98	Spawner survey	Quarry Gulch (Olema)	5													
12/10/97	Spawner survey	Giacomini Cr. (Olema)	3													
12/1/97- 1/28/98	Spawner survey	Blueline Cr. (Olema)	23		7											
12/13/97	Spawner survey	Randall Gulch (Olema)	1				1*									
3/20/98- 8/20/98	Smolt trapping	Blueline Cr. (Olema)						654		4050	21	52		9		42
								Unidentified fry: 2982					Unidentified fry: 59			
Totals:			353	43	7	52	50*	719		4106	44	52	0	9	0	42
							Unidentified fry: 2982						Unidentified fry: 59			

*carcasses

Date	Activity	Location	Observe/harass				Capture/handle				Capture/handle/mark		Indirect mortality			
			Coho		Steelhead		Coho		Steelhead		Coho	Steelhead	Coho		Steelhead	
			adult	juv.	adult	juv.	adult	juv.	adult	juv.	juv.	juv.	adult	juv.	adult	juv.
9/29/97- 9/30/97	Electrofishing	Redwood mainstem						30		58						
11/25/97- 1/23/98	Spawner survey	Redwood mainstem	151				30*									
1/7/98		Kent Creek	2													
1/7/98		Fern Creek	9													
Totals:			162	0	0	0	30*	30	0	58	0	0	0	0	0	0

*carcasses

Table 5. National Park Service CSRP annual take of coho salmon and steelhead trout by stream, sampling activity, and age class on the Pine Gulch; 7/97-6/98.

Date	Activity	Location	Observe/harass				Capture/handle				Capture/handle/mark		Indirect mortality			
			Coho		Steelhead		Coho		Steelhead		Coho	Steelhead	Coho		Steelhead	
			adult	juv.	adult	juv.	adult	juv.	adult	juv.	adult	juv.	adult	juv.	adult	juv.
10/7/97- 11/5/97	Snorkel survey	Pine Gulch mainstem				1575										
10/7/97- 11/5/97	Electrofishing	Pine Gulch mainstem							218							5
3/3/98	Spawner survey	Pine Gulch mainstem			1											
Totals:			0	0	1	1575	0	0	0	218	0	0	0	0	0	5

Coho and Steelhead Restoration Project

Annual Section 10 Permit Electrofishing Log June 30, 1997 – July 1, 1998



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Olema Creek

Unit Number 1

Date	Unit Type	Section Code	Section	Est Flow	Temp	Conductivit	Visibility	Fish Response/Fishing Effectiveness
11/6/1997	SC			1.5	13	358		No injuries, no mortalities
		Pass 1	Pass 2	Pass 3	Pass 4	Pass 5		
Time		323	356	313				
Setting		200-300	200-300	F4				
Volts		F4	F4	200-300				
Pulse Frequency (Hz)		30	30	30				
Pulse Width (ms)		4	4	4				

Olema Creek

Unit Number 2

Date	Unit Type	Section Code	Section	Est Flow	Temp	Conductivit	Visibility	Fish Response/Fishing Effectiveness
11/6/1997	SC				13			No mortalities
		Pass 1	Pass 2	Pass 3	Pass 4	Pass 5		
Time		400						
Setting		F4						
Volts		200-300						
Pulse Frequency (Hz)		30						
Pulse Width (ms)		4						



Olema Creek

Unit Number 3

Date	Unit Type	Section Code	Section	Est Flow	Temp	Conductivit	Visibility	Fish Response/Fishing Effectiveness
11/6/1997	SC							
		Pass 1	Pass 2	Pass 3	Pass 4	Pass 5		
Time		1						
Setting		F4						
Volts		600						
Pulse Frequency (Hz)		30						
Pulse Width (ms)		4						

Olema Creek

Unit Number 4

Date	Unit Type	Section Code	Section	Est Flow	Temp	Conductivit	Visibility	Fish Response/Fishing Effectiveness
11/6/1997	SC							
		Pass 1	Pass 2	Pass 3	Pass 4	Pass 5		
Time								
Setting		F4						
Volts		200-300						
Pulse Frequency (Hz)		30						
Pulse Width (ms)		4						



Olema Creek

Unit Number 5

Date	Unit Type	Section Code	Section	Est Flow	Temp	Conductivit	Visibility	Fish Response/Fishing Effectiveness
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11/6/1997	SC							
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Pass 1	Pass 2	Pass 3	Pass 4	Pass 5
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Time	
Setting	F4
Volts	200-300
Pulse Frequency (Hz)	30
Pulse Width (ms)	4

Olema Creek

Unit Number 6

Date	Unit Type	Section Code	Section	Est Flow	Temp	Conductivit	Visibility	Fish Response/Fishing Effectiveness
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11/6/1997	SC							
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Pass 1	Pass 2	Pass 3	Pass 4	Pass 5
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Time	
Setting	F4
Volts	200-300
Pulse Frequency (Hz)	30
Pulse Width (ms)	4



Olema Creek

Unit Number 7

Date	Unit Type	Section Code	Section	Est Flow	Temp	Conductivit	Visibility	Fish Response/Fishing Effectiveness
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11/6/1997	SC							
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	Pass 1	Pass 2	Pass 3	Pass 4	Pass 5
Time					
Setting	F4				
Volts	200-300				
Pulse Frequency (Hz)	30				
Pulse Width (ms)	4				

Pine Gulch

Unit Number 6

Date	Unit Type	Section Code	Section	Est Flow	Temp	Conductivit	Visibility	Fish Response/Fishing Effectiveness
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10/20/1997	FW	PG-01-1	1	0.5	11.5			No mortalities quick recovery
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	Pass 1	Pass 2	Pass 3	Pass 4	Pass 5
Time	246	200			
Setting	E3	E3			
Volts	200	200			
Pulse Frequency (Hz)	20	20			
Pulse Width (ms)	2	2			



Pine Gulch

Unit Number 10

Date	Unit Type	Section Code	Section	Est Flow	Temp	Conductivit	Visibility	Fish Response/Fishing Effectiveness
10/20/1997	R	PG-01-2	2		11.5			No mortalities

	Pass 1	Pass 2	Pass 3	Pass 4	Pass 5
Time	198				
Setting	E3				
Volts	200				
Pulse Frequency (Hz)	20				
Pulse Width (ms)	2				

Pine Gulch

Unit Number 27

Date	Unit Type	Section Code	Section	Est Flow	Temp	Conductivit	Visibility	Fish Response/Fishing Effectiveness
10/20/1997	R	PG-01-4	4	0.5	12			No mortalities, quick response, quick recovery

	Pass 1	Pass 2	Pass 3	Pass 4	Pass 5
Time	310	295	308	285	
Setting	E2	E2	E2	E2	
Volts	200	200	200	285	
Pulse Frequency (Hz)	20	20	20	20	
Pulse Width (ms)	1	1	1	1	



Pine Gulch

Unit Number 42

Date	Unit Type	Section Code	Section	Est Flow	Temp	Conductivit	Visibility	Fish Response/Fishing Effectiveness
10/20/1997	R	PG-01-8	8		12			No mortalities

	Pass 1	Pass 2	Pass 3	Pass 4	Pass 5
Time	243				
Setting	E3				
Volts	200				
Pulse Frequency (Hz)	20				
Pulse Width (ms)	2				

Pine Gulch

Unit Number 55

Date	Unit Type	Section Code	Section	Est Flow	Temp	Conductivit	Visibility	Fish Response/Fishing Effectiveness
10/20/1997	FW	PG-01-10	10					Dead cottids difficult to net. Fish response the same between 200 and

	Pass 1	Pass 2	Pass 3	Pass 4	Pass 5
Time	875	843	530		
Setting	E3	E3	E3		
Volts	200	300	300		
Pulse Frequency (Hz)	20	20	30		
Pulse Width (ms)	2	2	1		



Pine Gulch

Unit Number 65

Date	Unit Type	Section Code	Section	Est Flow	Temp	Conductivit	Visibility	Fish Response/Fishing Effectiveness
10/21/1997	R	PG-01-11	11	1	11			Good immobilization of fish, no mortalities, no apparent injury
		Pass 1	Pass 2	Pass 3	Pass 4	Pass 5		
Time		588	593	451				
Setting		F3	F3	F3				
Volts		300	300	300				
Pulse Frequency (Hz)		30	30	30				
Pulse Width (ms)		2	2	2				

Pine Gulch

Unit Number 74

Date	Unit Type	Section Code	Section	Est Flow	Temp	Conductivit	Visibility	Fish Response/Fishing Effectiveness
10/21/1997	FW	PG-01-12	12	1	11			No mortalities, good immobilization of fish. No change in effectiveness
		Pass 1	Pass 2	Pass 3	Pass 4	Pass 5		
Time		395	397	310				
Setting		F3	F4	F4				
Volts		300	300	300				
Pulse Frequency (Hz)		30	30	30				
Pulse Width (ms)		2	4	4				



Pine Gulch

Unit Number 80

Date	Unit Type	Section Code	Section	Est Flow	Temp	Conductivit	Visibility	Fish Response/Fishing Effectiveness
10/21/1997	R	PG-01-13	13					No mortalities
		Pass 1	Pass 2	Pass 3	Pass 4	Pass 5		
Time		458	391	345				
Setting		F4	F4	F4				
Volts		300	300	300				
Pulse Frequency (Hz)		30	30	30				
Pulse Width (ms)		4	4	4				

Pine Gulch

Unit Number 100

Date	Unit Type	Section Code	Section	Est Flow	Temp	Conductivit	Visibility	Fish Response/Fishing Effectiveness
10/21/1997	R	PG-01-16	16		11			
		Pass 1	Pass 2	Pass 3	Pass 4	Pass 5		
Time		448	375	305				
Setting		F4	F4	F4				
Volts		300	300	300				
Pulse Frequency (Hz)		30	30	30				
Pulse Width (ms)		4	4	4				



Pine Gulch

Unit Number 114

Date	Unit Type	Section Code	Section	Est Flow	Temp	Conductivit	Visibility	Fish Response/Fishing Effectiveness
10/21/1997	R	PG-01-18	18		11			
		Pass 1	Pass 2	Pass 3	Pass 4	Pass 5		
Time		74						
Setting		F3						
Volts		300						
Pulse Frequency (Hz)		30						
Pulse Width (ms)		2						

Pine Gulch

Unit Number 124

Date	Unit Type	Section Code	Section	Est Flow	Temp	Conductivit	Visibility	Fish Response/Fishing Effectiveness
10/21/1997	FW	PG-01-20	20		11			No mortalities or injury.
		Pass 1	Pass 2	Pass 3	Pass 4	Pass 5		
Time		499	482	500				
Setting		F3	F3	F3				
Volts		300	300	300				
Pulse Frequency (Hz)		30	30	30				
Pulse Width (ms)		2	2	2				



Pine Gulch

Unit Number 128

Date	Unit Type	Section Code	Section	Est Flow	Temp	Conductivit	Visibility	Fish Response/Fishing Effectiveness
10/21/1997	R	PG-01-20	20		11			
		Pass 1	Pass 2	Pass 3	Pass 4	Pass 5		
Time		129	99					
Setting		F3	F3					
Volts		300	300					
Pulse Frequency (Hz)		30	30					
Pulse Width (ms)		2	2					

Pine Gulch

Unit Number 140

Date	Unit Type	Section Code	Section	Est Flow	Temp	Conductivit	Visibility	Fish Response/Fishing Effectiveness
10/22/1997	FW	PG-01-22	22		10			No mortalities or injuries.
		Pass 1	Pass 2	Pass 3	Pass 4	Pass 5		
Time		484	393	338				
Setting		F3	F3	F3				
Volts		300	300	300				
Pulse Frequency (Hz)		30	30	30				
Pulse Width (ms)		2	2	2				



Pine Gulch

Unit Number 145

Date	Unit Type	Section Code	Section	Est Flow	Temp	Conductivit	Visibility	Fish Response/Fishing Effectiveness
10/22/1997	R	PG-01-22	22		10	1		No mortalities associated with electrofishing. One steelhead YOY
		Pass 1	Pass 2	Pass 3	Pass 4	Pass 5		
Time		419						
Setting		F3						
Volts		300						
Pulse Frequency (Hz)		30						
Pulse Width (ms)		2						

Pine Gulch

Unit Number 162

Date	Unit Type	Section Code	Section	Est Flow	Temp	Conductivit	Visibility	Fish Response/Fishing Effectiveness
10/22/1997	SC	PG-01-25	25		10			three sh yoy mortalities associated with murky water. Otherwise
		Pass 1	Pass 2	Pass 3	Pass 4	Pass 5		
Time		1304	1273	950				
Setting		F3	F3	F3				
Volts		300	300	300				
Pulse Frequency (Hz)		30	30	30				
Pulse Width (ms)		2	2	2				



Pine Gulch

Unit Number 165

Date	Unit Type	Section Code	Section	Est Flow	Temp	Conductivit	Visibility	Fish Response/Fishing Effectiveness
10/22/1997	R	PG-01-25	25		10			No mortalities or injuries.
		Pass 1	Pass 2	Pass 3	Pass 4	Pass 5		
Time		262	358					
Setting		F3	F3					
Volts		300	300					
Pulse Frequency (Hz)		30	30					
Pulse Width (ms)		2	2					

Pine Gulch

Unit Number 178

Date	Unit Type	Section Code	Section	Est Flow	Temp	Conductivit	Visibility	Fish Response/Fishing Effectiveness
10/22/1997	R	PG-01-27	27		10			No mortalities or injuries.
		Pass 1	Pass 2	Pass 3	Pass 4	Pass 5		
Time		318						
Setting		F3						
Volts		300						
Pulse Frequency (Hz)		30						
Pulse Width (ms)		2						



Pine Gulch

Unit Number 179

Date	Unit Type	Section Code	Section	Est Flow	Temp	Conductivit	Visibility	Fish Response/Fishing Effectiveness
10/22/1997	PL	PG-01-27	27		10			One sh yoy injured by electrofishing. No other apparent injuries.
		Pass 1	Pass 2	Pass 3	Pass 4	Pass 5		
Time		623	434	416				
Setting		F3	F3	F3				
Volts		300	300	300				
Pulse Frequency (Hz)		30	30	30				
Pulse Width (ms)		2	2	2				

Pine Gulch

Unit Number 184

Date	Unit Type	Section Code	Section	Est Flow	Temp	Conductivit	Visibility	Fish Response/Fishing Effectiveness
10/23/1997	FW	PG-01-28	28					No mortalities or injury.
		Pass 1	Pass 2	Pass 3	Pass 4	Pass 5		
Time		415	260	234				
Setting		F3	F3	F3				
Volts		300	300	300				
Pulse Frequency (Hz)		30	30	30				
Pulse Width (ms)		2	2	2				



Pine Gulch

Unit Number 194

Date	Unit Type	Section Code	Section	Est Flow	Temp	Conductivit	Visibility	Fish Response/Fishing Effectiveness
10/23/1997	R	PG-01-29	29					No mortalities or injury.

	Pass 1	Pass 2	Pass 3	Pass 4	Pass 5
Time	351	263	310		
Setting	F3	F3	F3		
Volts	300	300	300		
Pulse Frequency (Hz)	30	30	30		
Pulse Width (ms)	2	2	2		

Pine Gulch

Unit Number 207

Date	Unit Type	Section Code	Section	Est Flow	Temp	Conductivit	Visibility	Fish Response/Fishing Effectiveness
10/27/1997	MC	PG-01-31	31		10	1		Excellent galvanotaxis, no mortalities or injuries.

	Pass 1	Pass 2	Pass 3	Pass 4	Pass 5
Time	831	860	713		
Setting	F4	F4	F4		
Volts	400	400	400		
Pulse Frequency (Hz)	30	30	30		
Pulse Width (ms)	4	4	4		



Pine Gulch

Unit Number 209

Date	Unit Type	Section Code	Section	Est Flow	Temp	Conductivit	Visibility	Fish Response/Fishing Effectiveness
10/27/1997	R	PG-01-32	32		10			One juvenile sculpin mortality otherwise good fish response.
		Pass 1	Pass 2	Pass 3	Pass 4	Pass 5		
Time		264	239					
Setting		F4	F4					
Volts		300	300					
Pulse Frequency (Hz)		30	30					
Pulse Width (ms)		4	4					

Pine Gulch

Unit Number 213

Date	Unit Type	Section Code	Section	Est Flow	Temp	Conductivit	Visibility	Fish Response/Fishing Effectiveness
10/27/1997	FW	PG-01-32	32					Two sh yoy mortalities. Too much effort -abundant sculpin-should have
		Pass 1	Pass 2	Pass 3	Pass 4	Pass 5		
Time		506	466					
Setting		F4	F4					
Volts		300	200					
Pulse Frequency (Hz)		30	30					
Pulse Width (ms)		4	4					



Pine Gulch

Unit Number 236

Date	Unit Type	Section Code	Section	Est Flow	Temp	Conductivit	Visibility	Fish Response/Fishing Effectiveness
10/27/1997	R	PG-01-36	36					No mortalities or injury.
		Pass 1	Pass 2	Pass 3	Pass 4	Pass 5		
Time		366	373					
Setting		F4	F4					
Volts		200	200					
Pulse Frequency (Hz)		30	30					
Pulse Width (ms)		4	4					

Pine Gulch

Unit Number 256

Date	Unit Type	Section Code	Section	Est Flow	Temp	Conductivit	Visibility	Fish Response/Fishing Effectiveness
10/27/1997	R	PG-01-38	38					No mortalities or injury.
		Pass 1	Pass 2	Pass 3	Pass 4	Pass 5		
Time		413						
Setting		F4						
Volts		200						
Pulse Frequency (Hz)		30						
Pulse Width (ms)		4						



Redwood Creek

Unit Number 1

Date	Unit Type	Section Code	Section	Est Flow	Temp	Conductivit	Visibility	Fish Response/Fishing Effectiveness
9/29/1997	SC			0.05	15	240	.3	E2 100-200 volts cottid and stickleback responded. F3 300 volts
		Pass 1	Pass 2	Pass 3	Pass 4	Pass 5		
Time		828	497	435				
Setting		E2-F3	F3	F3				
Volts		100-300	300	300				
Pulse Frequency (Hz)		20-30	30	30				
Pulse Width (ms)		1-2	2	2				

Redwood Creek

Unit Number 2

Date	Unit Type	Section Code	Section	Est Flow	Temp	Conductivit	Visibility	Fish Response/Fishing Effectiveness
9/29/1997	FW				18.5		.3	Fish recovered rapidly, steelhead were immobilized but no galvanotaxis,
		Pass 1	Pass 2	Pass 3	Pass 4	Pass 5		
Time		865	753	805				
Setting		F3	F3	F3				
Volts		300	300	300				
Pulse Frequency (Hz)		30	30	30				
Pulse Width (ms)		2	2	2				



Redwood Creek

Unit Number 3

Date	Unit Type	Section Code	Section	Est Flow	Temp	Conductivit	Visibility	Fish Response/Fishing Effectiveness
9/29/1997	SC			0.05	18.5	240	.3	Good response with no injuries.
		Pass 1	Pass 2	Pass 3	Pass 4	Pass 5		
Time		1200	1150	1188	800			
Setting		F3	F3	F3	F3			
Volts		300-400	300-400	400	400			
Pulse Frequency (Hz)		30	30	30	30			
Pulse Width (ms)		2	2	2	2			

Redwood Creek

Unit Number 4

Date	Unit Type	Section Code	Section	Est Flow	Temp	Conductivit	Visibility	Fish Response/Fishing Effectiveness
9/30/1997	GLD			0.3	14.8	252		Fish no immobilized for long but good response
		Pass 1	Pass 2	Pass 3	Pass 4	Pass 5		
Time		420	468	353				
Setting		E3	E3	E3				
Volts		300	300	300				
Pulse Frequency (Hz)		20	20	20				
Pulse Width (ms)		2	2	2				



Redwood Creek

Unit Number 5

Date	Unit Type	Section Code	Section	Est Flow	Temp	Conductivit	Visibility	Fish Response/Fishing Effectiveness
9/30/1997	SC			0.3	15.1	252		No difference between 300 and 400 volts. Fish response good with no
		Pass 1	Pass 2	Pass 3	Pass 4	Pass 5		
Time		567	503	450				
Setting		F3	300	F3				
Volts		300-400	300	300				
Pulse Frequency (Hz)		30	30	30				
Pulse Width (ms)		2	2	2				

Redwood Creek

Unit Number 6

Date	Unit Type	Section Code	Section	Est Flow	Temp	Conductivit	Visibility	Fish Response/Fishing Effectiveness
9/30/1997	PL			0.35	15	252		Fish response good. One electrofishing "burn" to steelhead. One cottid
		Pass 1	Pass 2	Pass 3	Pass 4	Pass 5		
Time		440	414	205				
Setting		300-400	300	F3				
Volts		F3	F3	300				
Pulse Frequency (Hz)		30	30	30				
Pulse Width (ms)		2	2	2				