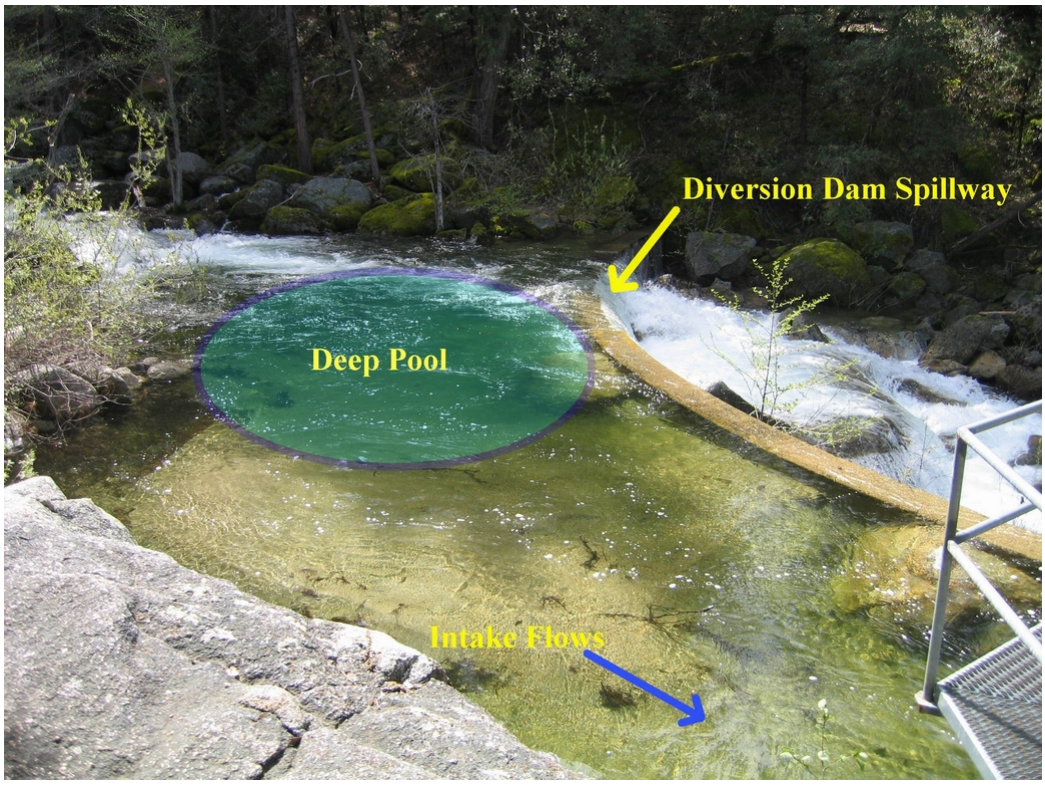
Appendix A

General Sampling Photo Appendix



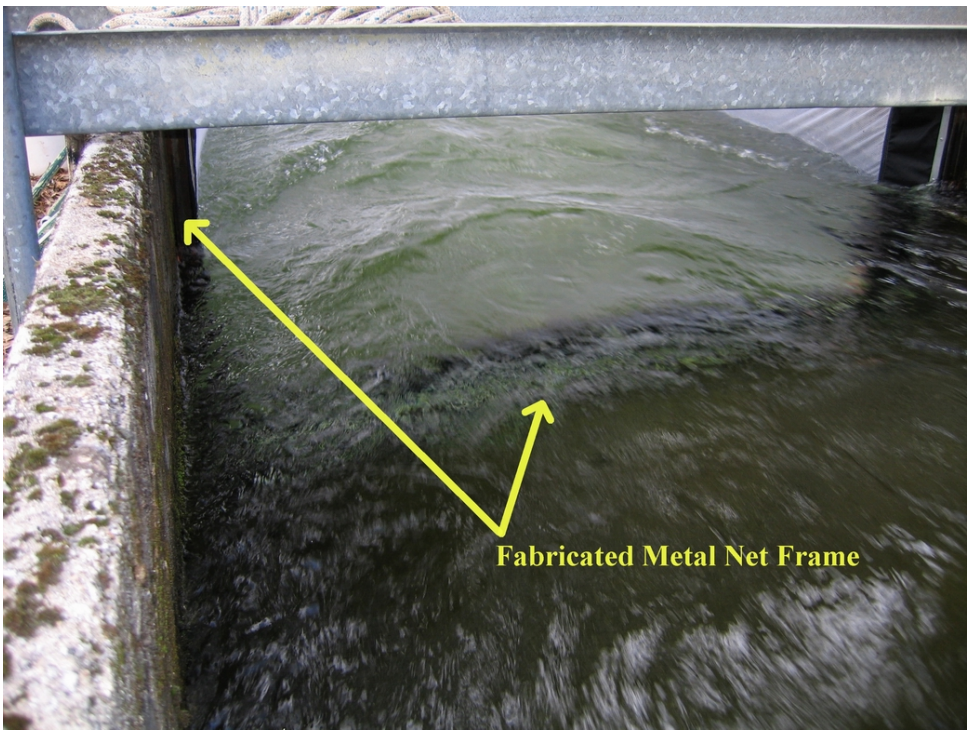
Habitat area Upstream of diversion dam.

Upstream side of water intake structure.

Onset of sampling activity (January).

First sample set in January.

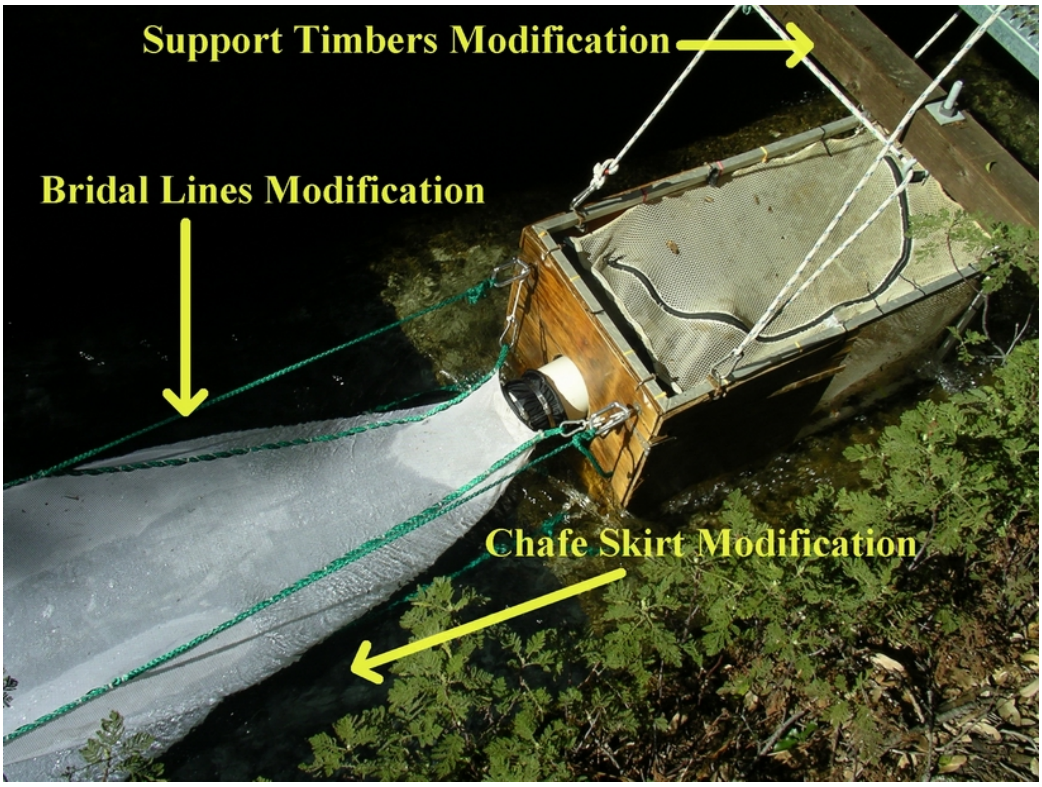
Effects of debris load on entrainment sampling (January).



Close-up of net mouth while sampling (January).

Typical debris load after a sample period in January (3 to 5 five-gallon buckets).

Dewatered conduit during March sample event.



Gear modifications following January net failure.

Entrainment sampling at full operating capacity (March).

Initiation of March sample event.

Debris accumulation in entrainment net (April).

Checking the live car contents (April).

Removal of net contents following sample period in April.

Newt captured in livecar (April).

Garter snake captured in livecar (June).

Entrainment Sampling in July.

Livecar apparatus detached from sampling net.

Downstream view of sampling apparatus.

Appendix B

Data Appendix

Date	set #	start time	finish time	temp (˚C)	DO (mg/L)	cond (µS)	pH	species	TL (mm)	FL (mm)	SL (mm)	weight (g)	physical con	debris (5 gal buckets)
1/24/2005	1	1115	1630	4.9	13.6	15.7	-	-	-	-	-	-	-	1
1/24/2005	2	1505	830	-	-	-	-	-	-	-	-	-	-	0.75
1/25/2005	3	850	1600	5.6	11.2	14.3	-	Newt	-	-	-	-	good	
1/26/2005	4	850	1145	4.1	12.7	13.7	-	-	-	-	-	-	-	blow out
3/29/2005	1	1030	1430	4.8	13.36	18.6	8.5	newt	-	-	-	-	good	5
3/30/2005	2	920	1540	5.8	12.33	11.6	8.2	-	-	-	-	-	-	0.75
3/31/2005	3	855	1555	7.7	11.5	12.4	8.4	-	-	-	-	-	-	0.75
4/1/2005	4	900	1600	7.9	11.65	12.1	8.2	-	-	-	-	-	-	0.75
4/25/2005	1	1000	1630	6.6	10.8	17.2	8.6	Newt	-	-	-	-	-	-
4/26/2005	2	900	1620	9.2	9.8	17.5	8.7	-	-	-	-	-	-	1.75
4/27/2005	3	900	1615	7.3	10.4	16.6	8.8	-	-	-	-	-	-	1
4/28/2005	4	920	1615	5.6	10.4	15.7	9.3	-	-	-	-	-	-	-
4/29/2005	5	1215	1620	6.3	10.2	17.2	-	-	-	-	-	-	-	1
6/20/2005	1	1040	1615	13.1	8.27	19.6	-	BRT	179	169	150	50	minor fin fray	-
6/20/2005	1	1040	1615	13.1	8.27	19.6	-	garter snake	-	-	-	-	excellent	-
6/21/2005	2	1630	835	9.7	6.21	13.7	-	BRT	235	230	209	140	excellent	1.25
6/21/2005	3	840	1605	13.2	6.5	19.5	-	-	-	-	-	-	-	-
6/22/2005	4	1615	840	9.8	7.8	19.7	-	garter snake	-	-	-	-	excellent	1.5
6/22/2005	5	850	1605	13.9	4.9	19.9	-	-	-	-	-	-	-	0.75
6/23/2005	6	1615	838	10.2	10.31	19.9	-	-	-	-	-	-	-	2
6/23/2005	7	850	1607	13.8	9.41	20.1	-	-	-	-	-	-	-	0.75
6/24/2005	8	1618	830	10.8	10.38	20.2	-	-	-	-	-	-	-	1.25
6/24/2005	9	843	1602	13.9	9.56	20.4	-	-	-	-	-	-	-	0.5
7/25/2005	1	1030	1630	-	-	-	-	-	-	-	-	-	-	3
7/26/2005	2	1650	855	-	-	-	-	-	-	-	-	-	-	1.5
7/26/2005	3	900	1600	-	-	-	-	-	-	-	-	-	-	1
7/27/2005	4	1630	855	-	-	-	-	RBT	147	142	-	30	caudal fin br	1.5
7/27/2005	5	910	1601	-	-	-	-	-	-	-	-	-	-	0.5
7/28/2005	6	1620	900	-	-	-	-	-	-	-	-	-	-	1.5
7/28/2005	7	915	1606	-	-	-	-	-	-	-	-	-	-	0.5
7/29/2005	8	1615	855	-	-	-	-	garter snake	25-26 in	-	-	-	good	0.75
7/29/2005	9	900	1600	-	-	-	-	-	-	-	-	-	-	0.12

**NOTE-7-25/26 set times not recorded on data sheets, so they are estimated

Catch Per Unit Effort (Fish/Hour) for Fish Captured in Brown'sCreek Conduit Livecar, 2005.

Set #	Sample Period	End Date	Time (hours)	Number of Fish Captured	Fish Captured Per Hour
1	Day	24-Jan-05	5.25	0	0
2	Night	25-Jan-05	17.42	0	0
3	Day	25-Jan-05	7.12	0	0
4	Day	26-Jan-05	3.92	0	0
1	Day	29-Mar-05	4.00	0	0
2	Day	30-Mar-05	6.33	0	0
3	Day	31-Mar-05	7.00	0	0
4	Day	1-Apr-05	7.00	0	0
1	Day	25-Apr-05	6.50	0	0
2	Day	26-Apr-05	7.33	0	0
3	Day	27-Apr-05	7.25	0	0
4	Day	28-Apr-05	5.58	0	0
5	Day	29-Apr-05	4.08	0	0
1	Day	20-Jun-05	5.92	1	0.19
2	Night	21-Jun-05	16.08	1	0.06
3	Day	21-Jun-05	7.75	0	0
4	Night	22-Jun-05	16.50	0	0
5	Day	22-Jun-05	7.25	0	0
6	Night	23-Jun-05	16.38	0	0
7	Day	23-Jun-05	7.28	0	0
8	Night	24-Jun-05	16.20	0	0
9	Day	24-Jun-05	7.32	0	0
1	Day	25-Jul-05	6.00	0	0
2	Night	26-Jul-05	16.10	0	0
3	Day	26-Jul-05	7.00	0	0
4	Night	27-Jul-05	16.42	1	0.06
5	Day	27-Jul-05	6.85	0	0
6	Night	28-Jul-05	16.67	0	0
7	Day	28-Jul-05	6.85	0	0
8	Night	29-Jul-05	16.67	0	0
9	Day	29-Jul-05	7.00	0	0

APPENDIX B

Daily Mean Discharge in Cubic feet/second Water Year Oct 2004 to Sep 2005
Sampling dates marked by boxes.

Site: W1 Browns Creek Diversion Canal
USGS #: 11243300
Beginning Date: 10/01/2004
Ending Date: 09/30/2005

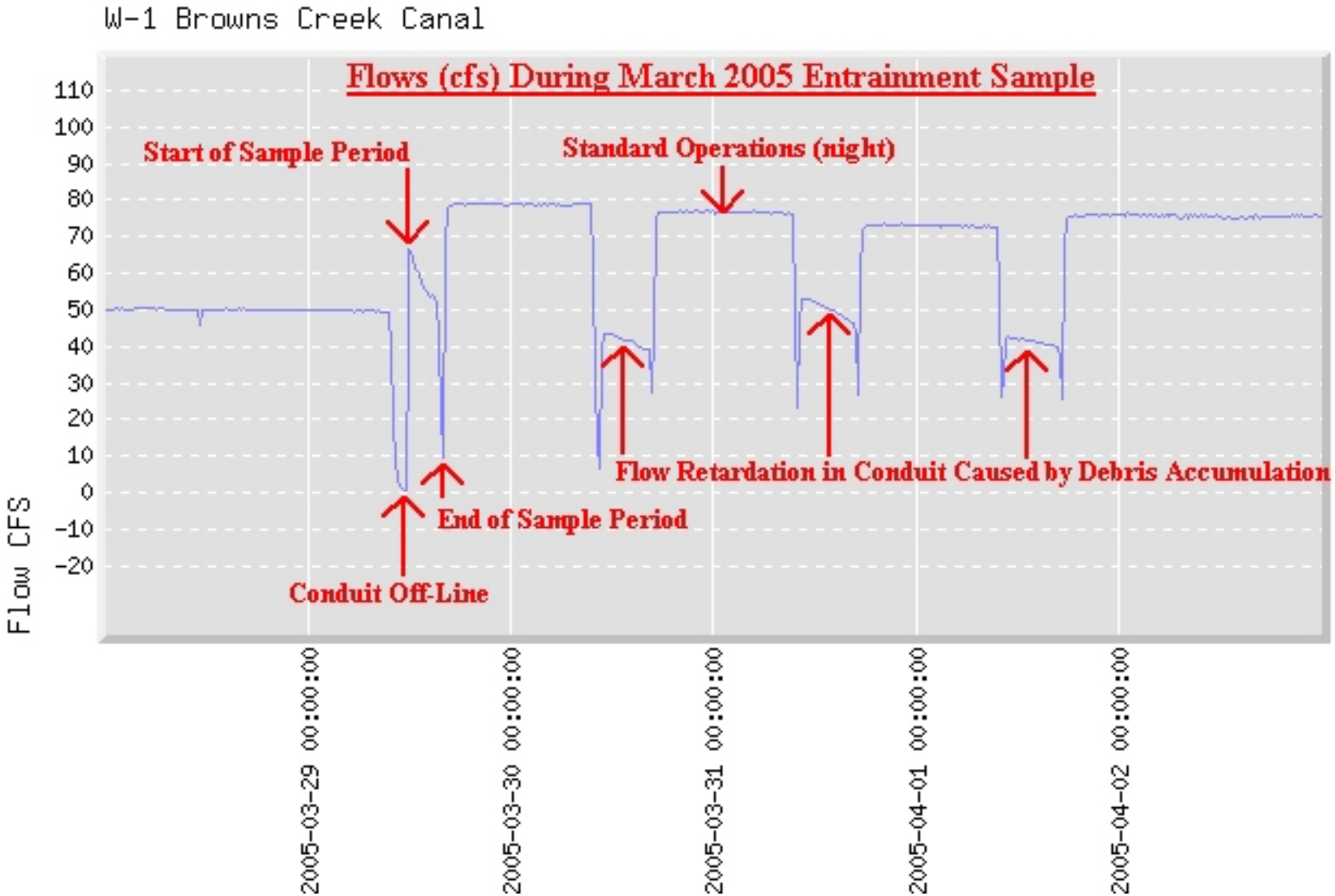
Day	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0	0	11	40	72	66	68	56	0	47	0	0
2	0	0	10	32	72	77	80	55	43	45	0	0
3	0	0	9.8	29	68	71	74	55	71	44	0	0
4	0	.01	9.7	26	67	66	59	55	70	40	0	0
5	0	0	9.4	24	67	75	50	58	62	35	0	0
6	0	0	9.3	22	67	78	71	59	53	33	0	0
7	0	0	11	36	55	80	54	58	52	32	0	0
8	0	.06	17	52	58	80	53	57	23	31	0	0
9	0	.05	19	54	56	81	53	60	.07	30	0	0
10	0	.02	21	58	57	81	53	56	.03	29	0	0
11	0	.02	22	56	63	80	53	53	0	28	4.2	0
12	0	.02	25	53	75	78	53	52	0	27	4.9	0
13	0	0	23	50	65	78	53	53	0	11	3.4	0
14	0	0	21	48	50	78	53	54	0	0	2.2	0
15	0	.01	19	53	50	77	53	54	0	0	1.4	0
16	0	8.4	18	63	54	78	54	54	0	0	.82	0
17	.31	15	17	67	53	77	54	17	0	0	.39	0
18	.44	14	16	68	53	70	54	.07	0	0	.03	0
19	.41	14	15	73	53	61	54	.07	28	0	0	0
20	.36	13	15	80	53	60	53	.07	41	0	0	0
21	0	11	14	80	53	54	53	.07	40	0	0	0
22	0	10	13	80	52	32	53	.04	39	0	0	0
23	0	10	12	80	58	7.3	53	0	39	0	0	0
24	.10	10	11	58	70	14	54	0	41	10	0	0
25	.03	10	11	45	70	13	51	0	27	16	0	0
26	.31	9.9	11	51	72	13	57	0	29	16	0	0
27	.07	23	15	61	63	32	57	0	51	16	0	
28	0	20	25	67	52	57	50	0	53	15	0	
29	0	13	21	69	------	62	56	0	51	10	0	
30	0	12	26	70	------	70	57	0	48	.02	0	
31	0	------	49	70	------	71	------	0	------	0	0	------
Total	2.03	193.49	526.2	1715	1698	1917.3	1690	906.32	861.10	515.02	17.34	0
Mean	.065	6.45	17.0	55.3	60.6	61.8	56.3	29.2	28.7	16.6	.56	0
Max	.44	23	49	80	75	81	80	60	71	47	4.9	0
Min	0	0	9.3	22	50	7.3	50	0	0	0	0	0
Acre-Ft	4.0	384	1040	3400	3370	3800	3350	1800	1710	1020	34	0

Wtr Year 2005	Total	10041.80	Mean	27.8	Max	81	Min	0	Acre-Ft	19920
Cal Year 2004	Total	6784.82	Mean	18.5	Max	85	Min	0	Acre-Ft	13460

Water velocities (f/s) at Browns Creek Conduit during sampling periods.

Sampling Date	Depth: Top			Depth: 6/10ths			Depth: Bottom			Daily Mean	Sampling Period Mean
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max		
24-Jan-05	0.79	-0.30	1.38	0.82	-0.26	1.25	0.26	-0.07	1.05	0.62	
25-Jan-05	0.39	-0.07	0.95	0.36	-0.07	0.95	0.20	-0.13	0.69	0.33	
26-Jan-05*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.48
29-Mar-05**	1.08	0.36	1.57	0.75	0.10	1.44	0.16	-0.20	0.43	0.66	
30-Mar-05	0.85	0.26	1.48	0.89	0.20	1.74	0.16	-0.39	0.62	0.62	
31-Mar-05	0.95	0.16	1.35	0.62	-0.46	1.28	0.16	-0.56	0.85	0.56	
1-Apr-05	0.89	-0.23	1.12	0.56	0.20	0.89	0.16	-0.20	0.49	0.49	0.58
25-Apr-05	0.95	0.03	2.13	0.98	0.07	1.44	0.46	0.07	0.82	0.79	
26-Apr-05	1.18	-0.33	2.40	1.05	-0.16	2.07	0.49	-0.10	0.92	0.92	
27-Apr-05	1.28	0.26	1.84	1.05	-0.59	2.00	0.59	0.23	1.15	0.98	
28-Apr-05	0.75	0.30	1.15	0.56	0.26	1.15	0.23	-0.26	0.79	0.52	
29-Apr-05	1.25	0.33	1.97	0.82	-0.23	1.38	0.72	0.13	1.67	0.92	0.84
20-Jun-05	0.46	-0.30	1.12	0.72	-0.13	1.48	0.49	-0.30	1.87	0.56	
21-Jun-05	0.98	-0.23	1.74	0.36	-1.38	1.54	0.26	-0.33	1.08	0.56	
22-Jun-05	0.82	0.20	1.38	0.66	-0.20	1.44	0.26	-0.20	0.82	0.59	
23-Jun-05	0.62	-0.30	1.38	0.49	-0.10	1.21	0.62	0.07	1.28	0.59	
24-Jun-05	0.59	-0.89	1.41	0.72	-0.20	1.80	0.43	0.07	0.82	0.56	0.57
25-Jul-05	0.98	0.33	1.41	0.72	0.26	1.25	0.36	-0.07	0.49	0.69	
26-Jul-05	0.79	-0.10	1.38	0.62	-0.07	1.12	0.10	-0.20	0.33	0.49	
27-Jul-05***	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
28-Jul-05	0.56	-0.03	1.25	0.52	-0.03	1.25	0.13	-0.03	0.33	0.39	
29-Jul-05	0.39	0.20	0.56	0.49	0.30	0.62	0.13	-0.16	0.46	0.33	0.48

*Velocity not measured; high flow and turbidity; unsafe for wading.
** Only 15 of 45 point velocities taken. Gates closed due to sediment accumulation in net.
******* Data excluded due to sampling equipment failure.


W-1 Browns Creek Canal
Flows (cfs) During March 2005 Entrainment Sample
Start of Sample Period
Standard Operations (night)
Flow Retardation in Conduit Caused by Debris Accumulation
End of Sample Period
Conduit Off-Line
Flow CFS
110
100
90
80
70
60
50
40
30
20
10
0
-10
-20
2005-03-29 00:00:00
2005-03-30 00:00:00
2005-03-31 00:00:00
2005-04-01 00:00:00
2005-04-02 00:00:00

Appendix C

Rainbow and Brown Trout Life History Information

Appendix C

Rainbow and Brown Trout Life History Information

The following life history characteristics for rainbow and brown trout have been derived from descriptions outlined by Moyle (2002).

Rainbow Trout

Typically, rainbow trout are found in cool, clear, fast-flowing permanent streams and rivers where riffle habitat predominates over pools and where cover in the form of riparian vegetation or instream structure exists. Thermal regimes are crucial to rainbow trout persistence. Tolerable temperature regimes, depending on population specific acclimation, are being between 0° to 26-27°C, while optimal growth temperature ranges from 15-18°C. High temperatures, 24 to 27°C, for extended periods are invariably lethal to rainbow trout. In rivers different life stages tend to select different habitat types as defined by depth, velocity, substrate and cover. Fry (<50mm SL) typically concentrate shallow water (<50 cm) along the rivers edge where velocities are low (1-25 cm/sec). Juveniles (50-100 cm SL) can be found in deeper waters (50-100 cm) with faster velocities (10-30 cm/sec). Adult fish can be found in a variety of habitats including deep pools, fast riffles and runs, and are typically situated adjacent to fast moving water areas for optimal foraging efficiency. Most rainbow trout reach sexual maturation in their second or third year, but time of first maturity varies between the first and fifth year. Mature trout spawn in the spring, from February to June, depending on water seasonal water temperatures. Spawning mainly occurs in course gravels (1-13 cm diameter) at the tail of a pool or in a riffle. Water velocities at spawning locations (redds) are typically 20-155 cm/sec and depths are 10-150 cm.

Brown Trout

Brown trout prefer clear streams with swift riffles and large, deep pools but are found in all typical trout waters from spring-fed creeks to lakes and reservoirs. Temperature regimes greatly influence brown trout distribution. They can survive for short periods of time in temperatures up to 28-29°C, but prefer temperatures ranging from 12-20°C. Optimal temperatures for growth are 17-18°C, although high growth rates occur between 12-18°C. Generally, brown trout will avoid water bodies in which temperatures do not exceed 13°C for extended periods of time. Different life stages of brown trout select different combinations of depth, velocity and cover. Fry (<50 cm TL) typically inhabit water less than 30 cm deep, with low velocities. Juvenile select deeper water (50-75 cm) with higher velocities (0.1)-0.4 cm/sec) associated with structural habitat (logs, large rocks, overhanging vegetation). Adult fish are largely bottom oriented pool dwellers, typically found in water 0.7-3.5 meters deep, and associated with heavy cover and low velocities. Brown trout usually mature in their second or third year, with few fish waiting as long as 7 or 8 years. Spawning takes place in the fall or winter, commonly in November and December in California. Preferred spawning substrates are pea- to walnut-sized gravel. The most suitable spawning locations are at the tails of pools where the water is deeper and less turbulent, with nearby cover. Spawning depths are generally 12-18 cm with water velocities of 24-37 cm/sec.

Appendix D

Resource Agency Comments & PG&E Response to Comments

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825-1846

In reply refer to:
FERC No. 1354-035

DEC 02 2005

Mr. Donald G. Price, Senior Aquatic Biologist
Technical & Ecological Services
Pacific Gas & Electric Company
3400 Crow Canyon Road
San Ramon, California 94583

Subject: U.S. Fish and Wildlife Service's Comments on Pacific Gas and Electric Company's (PG&E) Report, "Entrainment Sampling at Browns Creek Conduit Intake Structure," for the Crane Valley Hydroelectric Project, Federal Energy Regulatory Commission (FERC) Project No. 1354-035

Dear Mr. Price:

The U.S. Fish and Wildlife Service (Service) has reviewed the Crane Valley Hydroelectric Project's Draft Report, "Entrainment Sampling at Browns Creek Conduit Intake Structure," and we have conferred with the U.S. Forest Service (FS) and with the California Department of Fish and Game (DFG).

The Service concurs with the comments made by the FS regarding this Draft Report (see Attachment). The Service also supports an additional year of entrainment sampling to establish that fish and wildlife entrainment is limited at the Browns Creek Conduit Intake Structure over two water years. The Service has no further comments at this time, but would like to receive a copy of the Final Report that PG&E submits to FERC.

The Service appreciates being kept informed of this aspect of the project. If you have any further questions, please contact William Foster either by letter to the above address or by telephone (916) 414-6528.

Sincerely,

Michael B. Moore
for David L. Harlow
Acting Field Supervisor

Attachment

TAKE PRIDE IN AMERICA

Attachment

To: Dave Marten, District Ranger, Bass Lake District Gayne Sears, Land and Special Uses Officer, Bass Lake District	Date: 11/30/2005
From: Phil Strand, Fisheries Program Manager, Sierra National Forest Kevin Williams, Fisheries Biologist, Bass Lake District	
Subject: Crane Valley License Conditions, Fish Entrainment Study	

The Forest has reviewed Report 026.11-05.21 (Entrainment Sampling at the Browns Creek Diversion Intake Structure) submitted by Pacific Gas and Electric (PG&E) in November, 2005. We understand the Plan is the result of FERC Article 407 from the Commission's New License Order. In general the plan is well done and pictures in Appendix A provide excellent documentation of the study. It is also encouraging that the results from the 1st year of the study suggest entrainment may be limited at the diversion site. The Forest believes there is value in conducting the additional year of sampling to further establish that entrainment is limited at the site. The Forest is providing several general items for clarification, and comments on measured velocities.

Items for Clarification

Page 6, Table 1: Daily mean flows are provided in Appendix B, however review would be aided if the velocities were included in the table.

Appendix B, first page (Summary table): Under column titled "Flow Gate", there a variety of notes. Some indicate flow in cfs, while others indicate at % or marks. It is unclear what the percentages or the marks represent.

Measured velocities

The study notes on pages 5 and 7 that velocities measurements were taken every 0.25 meters across the face of the intake structure walkway (total 3.5 meters), which would indicate 15 points (if points 0.0 and 3.5 m were measured). Velocity measurements were taken at the water surface, at 6/10 of total depth, and at the substrate interface. This appears to provide 45 velocity points. However, page 7 (5.4 Velocity Measurements) indicates 60 velocity measurement points. It is unclear where the additional 15 velocity points were measured.

Velocities were estimated as noted in section 5.5 (Flow Measurements, p. 8). Averaged velocities are displayed in Table 3 by flow. Of interest, measured water velocities (displayed in Appendix B) appear to indicate actual water velocities are less than estimated, and daily measured means do not seem to necessarily reflect discharge. Higher measured daily mean velocities were maximized at 57 cfs, while maximum mean daily flows (70 and 71 cfs) produced lower velocities. The higher estimated velocities serve as worse case scenario in evaluating entrainment potential.

Page 13 (6.3 Entrainment Potential, 2nd paragraph) indicates the maximum measured point velocity in the water column throughout all sampling dates was 1.6 ft/sec, recorded in July near the water surface. However, review of Appendix B indicates maximum water velocity was

measured at 5.7 ft/sec near the water surface on July 27, 2005. It is possible the report meant to indicate the highest daily mean from the three points of measurement, but again individual maximums provide for a worse case scenario to evaluate entrainment potential. Of interest is that the maximum value occurs on a day when the average daily discharge was one of the lower flows measured (15 cfs), and the maximum recorded for that day is more than double any other maximums measured.

United States Department of Agriculture | Forest Service | Bass Lake Ranger District

57003 Road 225
North Fork, CA 93643
(559) 877-2218
(559) 877-3108 FAX
(800) 735-2929 CA Relay Service

File Code: 2770
Date: December 16, 2005

Nicholas Markevich
Senior License Coordinator
Pacific Gas and Electric Company
Mail Code N11C
P O Box 770000
San Francisco, CA 94177

Dear Nick:

Thank you for submitting Report # 026.11-05.21: Entrainment Sampling at the Browns Creek Diversion Intake Structure (Sampling Results) in November of 2005 for our review. We understand the Sampling Results are a result of FERC Article 407 from the Commission's New License Order. Phil Strand and Kevin Williams, both Sierra National Forest Aquatics biologists, reviewed the Sampling Results and provided the following comments.

In general the Sampling Results are presented well and pictures in Appendix A provide excellent documentation of the study. It is also encouraging that the results from the 1st year of the study suggest entrainment may be limited at the diversion site. The Forest believes there is value in conducting the additional year of sampling to further establish that entrainment is limited at the site. The Forest is providing several general items for clarification, and comments on measured velocities.

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Velocities were estimated as noted in section 5.5 (Flow Measurements, p. 8). Averaged velocities are displayed in Table 3 by flow. Of interest, measured water velocities (displayed in Appendix B) appear to indicate actual water velocities are less than estimated, and daily measured means do not seem to necessarily reflect discharge. Higher measured daily mean

velocities were maximized at 57 cfs, while maximum mean daily flows (70 and 71 cfs) produced lower velocities. The higher estimated velocities serve as worse case scenario in evaluating entrainment potential.

Page 13 (6.3 Entrainment Potential, 2nd paragraph) indicates the maximum measured point velocity in the water column throughout all sampling dates was 1.6 ft/sec, recorded in July near the water surface. However, review of Appendix B indicates maximum water velocity was measured at 5.7 ft/sec near the water surface on July 27, 2005. It is possible the report meant to indicate the highest daily mean from the three points of measurement, but again individual maximums provide for a worse case scenario to evaluate entrainment potential. Of interest is that the maximum value occurs on a day when the average daily discharge was one of the lower flows measured (15 cfs), and the maximum recorded for that day is more than double any other maximums measured.

Gayne Sears received your phone call on December 14, 2005 regarding the need for a second year of monitoring. I am willing to discuss this point with PG&E and our biologists, Please call Gayne at 559-877-2218 ext. 3182 to arrange a meeting or phone conference time and date.

Sincerely,

Gayne Sea

for DAVID W. MARTIN
District Ranger

Pacific Gas and Electric Company (PG&E) response to Forest Service (USFS) comments regarding year-one results of the Browns Creek Fish Entrainment Study

Items for Clarification

Page 6, Table 1: Mean daily velocity was added to Table 1, page 6.

Appendix B, first page (Summary table): The column titled "Flow Gate" was removed from the summary table, as it contained operational notes that were confusing and did not add to interpretation of the study results. Daily mean discharge can be found in a chart inAppendix B, Page 3. The column titled "total time" was also removed because it did not accurately portray sampling hours. Sample hours can be found in Table 1, page 6 and in Appendix B, page 2.

Measured Velocities:

A total of 45 velocity points were taken for each velocity profile. Page 7 text was amended to read "45" (from "60").

Measured velocities are less than those estimated because they are measurements made across the river channel upstream of the intake structure, and not at the intake opening. Estimated velocities at the intake opening will necessarily be higher as flow is constricted at the two 3'-3" wide by 3'-0" high slide gates. It is important to note that these estimated velocities at the intake openings rely on two assumptions: a) that the gates are all the way open, and b) that the openings are completely covered with water. These assumptions are not always met under actual operating conditions.

Measured velocities from sampling date July 27, 2005 were excluded from the report analyses because of sampling equipment failure. With the exclusion of this date, daily measured mean velocities are more closely aligned with daily mean discharge although the relationship is not straightforward. Several aspects of the non-uniform, dynamic river channel could explain this non-linear relationship. For instance, during high flow events the river right beach and bank above the intake becomes inundated leading to a wider river channel with pockets of slow flow, particularly along the edges and behind the intake structure abutments. Higher flow may also result in additional channel form changes due to the movement of sediment in the channel immediately above the intake structure. The dam on North Fork Willow Creek spills at approximately 70cfs, but overflow also depends on channel shape and size which is altered by discharge.

Page 13 (6.3 Entrainment Potential, 2nd paragraph) was amended to report the individual point velocity maximum in order to reflect the worst case scenario. The maximum measured point velocity in the water column throughout all sampling dates was 2.4 ft/sec, recorded in April near the water surface.

From: Julie Means [JMEANS@dfg.ca.gov]
Sent: Monday, December 19, 2005 4:34 PM
To: Donald Price@pge.com
Subject: Comments on Crane Valley Fish Entrainment Draft Summary Report

The Department has reviewed the above referenced report, which was prepared in compliance with License Article 407 of the new License recently issued by the Federal Energy Regulatory Commission (FERC) for the Crane Valley Hydroelectric Project (FERC No. 1354). Based on our review of the study report, which provides the results of a single year of entrainment monitoring, we note that only a small number of fish were entrained by the Brown's Creek Diversion Intake structure during that sampling effort. However, the Department recommends an additional year of entrainment monitoring for the following reasons:

In Section 6.2 of the report, Sampling Constraints, it is stated that (1) higher than normal flows caused nets to frequently fill with debris during the study, (2) netting was only conducted during day time hours due to safety concerns during high flow periods and (3) sample durations were restricted due to security concerns. Because these various factors may have influenced the sampling results, and because rates of entrainment may vary in response to different water year types, we recommend that the Licensee conduct the additional year of sampling to confirm that entrainment is limited at the site.

Thank you for the opportunity to review the draft summary report.

Julie Means
Environmental Scientist
FERC and Water Rights
California Department of Fish and Game
San Joaquin - Southern Sierra Region
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Pacific Gas and Electric Company (PG&E) response to California Department of Fish and Game (CDFG) comments regarding year-one results of the Browns Creek Fish Entrainment Study

CDFG Comment (summary):

The department recognizes that only a small number of fish were entrained during the sampling effort. However, an additional year of sampling is recommended for the following reasons:

In Section 6.2, Sampling Constraints, it is stated that:

1) Higher than normal flows caused the net to frequently fill with debris
2) Netting was only conducted during day time hours due to safety concerns during high flow periods
3) Sample durations were restricted due to security concerns

Because these various factors may have influenced the sampling results, and because rates of entrainment may vary in response to different water year type, the department recommends that the Licensee conduct the additional year of sampling to confirm that entrainment is limited at the site.

PG&E Response:

The Licensee acknowledges the occurrence of sampling constraints and concurs that such factors reduced the consistency of sample results during the corresponding sample periods (January, March, and April). Specifically, the primary factor influenced by such constraints is sample duration and the ability to regularly conduct night time samples which reduced the total number of hours fished compared to the planned hours. Sampling constraints were not encountered during the months of June and July. Night time sampling was successfully completed eight times during those months. Additionally, one night of sampling was completed during the January sample to determine the feasibility of safely conducting night samples during questionable storm conditions.

Sample constraints, as reported in 2005, are likely to be encountered again in January, March, and April regardless of water-year type due to the rapid flow response to runoff and snow melt typical of this first order stream. Because the study design targets specific seasonal (*I.E. spring freshet flows*) and biological periods (*I.E. spring spawning*), excessive debris accumulation and high flow events will be unavoidable and will continually create challenging sample conditions and/or constraints during the high runoff months. The Licensee feels that additional entrainment sampling during a different water year is problematic, and likely to have the same constraints encountered in 2005.

Security constraints encountered in 2005 were associated with vandalism activity in the Project area. Such constraints are random anomalies and may occur at any given time.

The Licensee agrees that an additional year of sampling would provide more data and potentially greater insight into differing rates of entrainment at Browns Diversion. However, based on the small number of fish entrained relative to the total hours sampled and the intent of study to determine the need for a passive fish bypass structure, the licensee believes that an additional year of sampling is not justified due to high study cost and effort requirements. The Licensee believes that flows sampled in 2005 represent the worst case scenario for entrainment potential at the diversion, where higher than normal flows created higher than normal maximum velocity thresholds relative to fish swimming performance. Sampling below normal flows would lead to reduced velocities at the intake and would reduce the potential for involuntary entrainment. Even with a second year of data, it will be impossible to statistically verify the lack of entrainment at the diversion with so little catch data.

Appendix E

Entrainment Meeting Minutes 1/20/06

Crane Valley Project (FERC No. 1354) Fish Entrainment Study Meeting

January 20, 2006

The purpose of this meeting was to discuss the draft report and the results of the first year of fish entrainment sampling at the Browns Creek Diversion Dam Intake Structure.

Attendees:

- Julie Means, California Department of Fish and Game
- Philip Strand, Unites States Forest Service
- Nicholas Markevich, PG&E – Hydro Generation
- Don Price, PG&E – Technical and Ecological Services
- Jason Vann, PG&E – Technical and Ecological Services

Absent Invitees:

- William Foster, United States Fish and Wildlife Service
- Gayne Sears, United States Forest Service
- Kevin Williams, United States Forest Service

Meeting Minutes:

- The PG&E representatives presented the first year of entrainment results, highlighted the limited number of fish collected, and questioned the overall value of completing a second year of study *(a second year of entrainment sampling, during a different water-year type, is a component of the FERC order requiring PG&E to analyze potential differences in entrainment under different flow conditions).*
- The Forest Service (FS) and California Department of Fish and Game (CDFG) representatives were willing to discuss the value of a second year of sampling.
- The FS representative noted that they always value additional data as it helps provide them with stronger insights into the ecology of streams impacted by hydroelectric operations, but they also realize that additional data collection is expensive and may not always provide benefits equal to the cost.
- The CDFG representative noted that their primary concern was the number of sampling constraints listed in the report that affected the sampling program and wanted clarification on how these constraints may have reduced the catch of young-of-the-year escapement.
- PG&E's representatives noted that even with a second year of data and a potential increase in sample duration and possible catch, the result of the study was unlikely to change as only 3 fish were collected in 2005. Clearly there is no need for a fish bypass facility at this location.
- PG&E indicated that the runoff sampled in 2005 produced significantly higher than normal flows and such results demonstrate a 'worst case scenario' relative to maximum entrainment potential at the diversion.
- PG&E reiterated that fish that are entrained at the Browns Creek Diversion are not impacted by a powerhouse or other hazards and are transported without barriers to suitable habitat in Bass Lake.

- In order to enhance the groups understanding of the study area, the PG&E biologists provided additional qualitative observations made by them while conducting the entrainment study that suggest limited spawning and rearing habitat availability in the few miles of stream immediately above the diversion dam. Limited habitat supports the low numbers of fish observed above the intake and the limited catch in the net.
- Visual observations also suggest that entrainment was voluntary, as fish observed in the intake vicinity easily avoided entrainment.
- PG&E outlined the resource demands required to do the entrainment sampling, including technical field staff, operational staff from the watershed, and high cost commitment associated with an extensive sampling effort.
- The participants agreed on the high level of effort required to carry out such sampling.

- CDFG's representative asked for clarification on their concern regarding how the sampling constraints presented in the draft report affected the study results.
- PG&E noted that such constraint, aside from vandalism activity, would likely be encountered again during the second year of study and would affect sampling ability during spring months as encountered in 2005.
- PG&E explained that the inherent high flows and debris transport that occur during the winter months are unavoidable and will continually present challenging sampling conditions.
- PG&E also observed that the lack of catch during those months was more likely due to low water temperatures and minimal fish activity rather than any effect due to reduced hours of sampling effort cause by difficult sampling conditions.
- Observations of fish occurrences above the intake were low to nonexistent during the January through April samples and increased in May and June in correlation with increasing water temperatures.
- The USFS representative concurred with the observation that low water temperatures correlate with minimal fish movement and noted that peak spring movement periods for rainbow trout (spawning and young-of-the-year (YOY) emergence), relative to temperatures sampled in 2005, were well represented by the 24 hours samples in June and July.
- Clarification was provided regarding the nature of the vandalism activity reported in the sampling constraints and its occurrence primarily during April.
- CDFG's representative noted that the accurate representation of displacement of YOY in the spring was a primary concern. Based on the additional information provided at this meeting, further discussion of the finding with USFS and PG&E Biologists, and clarification of the timing of the sampling constraints, that CDFG now concur that the 2005 study provides adequate documentation and need not be repeated.
- CDFG recommended that in future reports better clarification be provided relative to the sampling constraints (i.e. time frame and factors affected) to avoid confusion on the validity of key results.
- CDFG encouraged PG&E to report security issues to the district office so the Game Wardens could be aware of the activity and can act as auxiliary support to local law enforcement.
- PG&E indicated they will coordinate with CDFG regarding future incidences of vandalism, should they reoccur.

- PG&E summarized the results of the meeting and asked for concurrence:
    - Given the low numbers of fish collected in 2005, a second year of sampling would provide low value information.
    - The participants agreed that more data collection could provide a clearer picture of rates of entrainment, but that the cost of conducting the study for a second year was greater than the potential benefit.
    - All agreed that PG&E should focus efforts on ‘higher value’ studies such as the deer crossing study, native species management plan, and sediment management plan, rather than expending effort on a second year of entrainment study given the low rate of entrainment observed in 2005.
    - Both the CDFG and USFS representatives agreed that the existing results were satisfactory to document low entrainment at the Browns Creek Diversion and that there was limited value in a second year of data, given the clarification on study constraints and the overall affect they had on the results.
    -Both the CDFG and USFS representatives agreed that a second year of sampling should not be necessary.
    - The CDFG representative indicated that a formal response to this meeting was not necessary and that the minutes should be adequate documentation of the decisions made.
    - The USFS representative indicated they would prepare a recommendation to this effect for approval by the Bass Lake District Ranger and will also communicate the results of this meeting to William Foster of the USFWS who could not attend.

Meeting adjourned