

Appendix A
Mokelumne River Project, FERC 137,
Supplemental Water Quality Monitoring Study Plan
March 18, 2002

FINAL

**Mokelumne River Project
FERC 137**

**Supplemental Water Quality Monitoring
Study Plan
March 18, 2002**

Objective

The objective of this monitoring is to supplement dissolved copper data currently being collected for the Project according to the May 14, 2001 *Water Quality Monitoring Study Plan*. That 2001 study plan was developed in accordance with the *Settlement Agreement*, and provides data by which the Ecological Resources Committee (ERC) and U.S. Forest Service (FS) can assess water quality impacts in Project-affected stream reaches resulting from Project operations, and evaluate any changes in water quality parameters resulting from changes in the streamflow regime. This supplemental monitoring will provide data that the ERC and FS can use to better delineate potential sources of dissolved copper upstream of the outflow from Lower Bear River Reservoir.

Rationale

Dissolved copper was one of 14 parameters analyzed for 61 samples taken from eight different locations in 2001, in accordance with the 2001 study plan. Of those 61 samples, 44 had dissolved copper concentrations less than or equal to 1.0 µg/L; 15 had concentrations greater than 1.0 and less than or equal to 10 µg/L; and two had concentrations greater than 10 and less than or equal to 23 µg/L. Twelve of the samples had concentrations that exceeded aquatic life criteria for water, as specified in the California Toxics Rule, which are based on a formula that factors in the sample's hardness. Seven of those 12 samples that did not meet the criteria were collected from Bear River below Lower Bear River Reservoir (BR1). Additionally, the dissolved copper concentrations of two of those seven BR1 samples, taken on March 15 and May 30, 2001, measured 23 and 20 µg/L, respectively. These two concentrations also exceeded a range of 1-10 µg/L that, according to a citation in EPA's 1985 *Ambient Water Quality Criteria*, is usually reported for unpolluted surface waters of the United States. The other 10 of 12 samples that exceeded the criteria had concentrations less than 10 µg/L.

Pacific Gas and Electric Company presented these results at the February 13 and 14, 2002 ERC meeting and a subsequent meeting on March 4. Discussions regarding the 20 and 23 µg/L concentrations caused some ERC members to request that additional water samples and sediment samples be collected from locations above BR1, to determine potential sources of copper. Specifically, these members requested that water and sediment samples be collected from Lower Bear Reservoir and that water samples be collected from tributaries to Upper and Lower Bear River reservoirs. ERC members also requested that the frequency of sampling be increased to monthly during the March - May period, because concentrations were highest during that period.

This supplemental water quality monitoring study plan outlines Pacific Gas and Electric Company's proposal for conducting that sampling. The plan focuses on determining dissolved copper concentrations within Upper and Lower Bear River reservoirs and their tributaries as a means of identifying potential copper sources. This plan was approved by the ERC and FS during the March 13, 2002 ERC meeting. The plan could be modified pending review of the data by the ERC and FS, and agreement on further actions.

Monitoring Stations and Schedule

Unless otherwise stated below, samples will be collected from BR1 and six additional locations each month from March through September 2002, during December 2002, and after the first significant winter storm of the season, if that storm occurs in 2002. Additionally, samples will be collected from other tributaries of Upper and Lower Bear River reservoirs if such tributaries are discovered during sampling.

Access to some or all stations during December, and after the first significant winter storm, may be hindered by snow. Sampling will be cancelled if it is unsafe or impracticable.

Lower Bear River Reservoir: Provided a boat can be safely launched in Lower Bear River Reservoir, water samples will be collected from one location near the dam (LBRR1). This location is representative of both Lower Bear River Reservoir as a whole, and of waters being passed downstream to Bear River. If Lower Bear River Reservoir is stratified, samples will be collected from the epilimnion, metalimnion, and hypolimnion; otherwise, samples will be collected from near the surface and approximately 5 feet off the bottom.

Streams: Provided these stations can be safely accessed by foot, helicopter, or boat, samples will be collected from: Bear River below Lower Bear River Reservoir (BR1); Little Bear River on the northwest shore of Lower Bear River Reservoir (LBR1); Sugar Pine Creek on the northwest shore of Lower Bear River Reservoir (SPC1); Upper Bear River Reservoir outflow to Lower Bear River Reservoir (BR3); an unnamed tributary entering midway up the west shore of Upper Bear River Reservoir (UNT1); and Bear River above Upper Bear River Reservoir (BR4), below its confluence with Tragedy Creek.

Methods

Water samples will be collected and analyzed according to the procedures described in the May 14, 2001 *Water Quality Monitoring Study Plan*, but with limited parameters being tested. Field parameters will include water temperature and dissolved oxygen profiles in Lower Bear River Reservoir, to determine if the reservoir is stratified, and thus the depth at which samples will be collected. Additionally, pH will be determined at each station. Laboratory analytes will include dissolved copper and total hardness (criteria in the EPA California Toxics Rule are based on a formula using hardness). Dissolved copper samples will be field-filtered and acidified on-site. A duplicate dissolved copper sample will be collected from BR1 on each sampling event and sent to California Department of Fish and Game's laboratory for QA/QC confirmation. Flow will be estimated for each tributary sampled, so that future estimates can be made of that tributary's total copper load, if desired.

Field Documentation and Quality Assurance / Quality Control Procedures

The procedures described in the May 14, 2001 *Water Quality Monitoring Study Plan* will be followed. As previously described, the duplicate samples from BR1 will provide additional QA/QC.

Products

All data will be incorporated into the 2002 annual water quality report. Data will also be made available to the ERC, FS, and others as appropriate, on a periodic basis throughout the monitoring period. The ERC and FS can use the data to evaluate potential sources of dissolved copper and to evaluate whether additional monitoring is recommended to achieve the objectives of the *Settlement Agreement* and the May 14, 2001 *Water Quality Monitoring Study Plan*.

Appendix B

Mokelumne River Project Photographs of Stations Below Lower Bear River Reservoir Dam Taken During the Supplemental Water Quality Monitoring Program

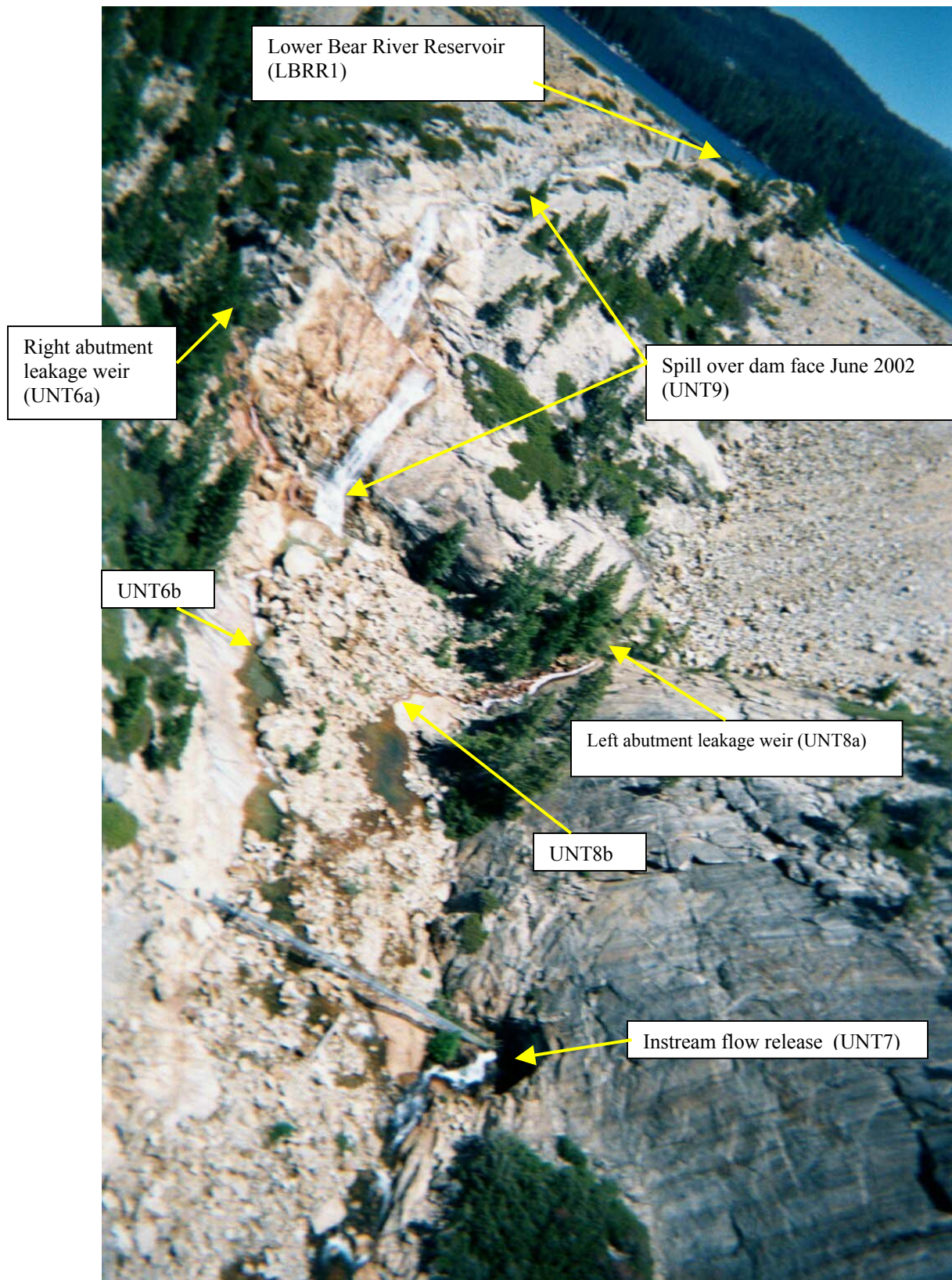


Photo 1. View of right and left abutment leakage weirs, instream flow release pipe, and spill over dam face below Lower Bear River Reservoir (June 2002)



Photo 2. View of spill channel below Lower Bear River Reservoir Dam (June 2002)



Photo 3. Left abutment leakage weir source (UNT8a) at dam face above the gage (June 2002)



Photo 4. View of the quarry located adjacent to the Lower Bear River Reservoir



Photo 5. Right abutment leakage weir (UNT6) flow and bottom of spill flow at point of convergence (June 2002)

Appendix C

Mokelumne River Project Supplemental Water Quality Monitoring Results for the Period March 2002-September 2003

Table 1. Mokelumne River Supplemental Water Quality Monitoring Results for the Period March 2002-September 2003

Station	Location of Station	Date	Estimated Flow (cfs)	Temperature (°C)	DO (mg/L)	pH (units)	Hardness (mg/L)	Dissolved Copper (µg/L)	Flag	Dissolved Copper (µg/L)	Hardness based criteria for CTR and USEPA		Comments/Special Notes
								Sewern Trent Laboratory (STL)		WPCL & MPSL, Department of Fish and Game	CCC	CMC	
BR4	Bear River above Upper Bear River Res., below its confluence with Tragedy Creel Latitude (38° 34.40 N) Longitude (120° 12.56 W)	3/27/2002	200	3.6	10.5	6.9	3.9	1.8	J	---	0.56	0.63	
		4/23/2002	150	2.0	12.0	6.0	3.5	0.38	J	---	0.51	0.57	
		5/15/2002	100	3.8	10.6	6.8	4.0	<0.3		---	0.57	0.65	
		6/11/02 ^[1]	50	8.1	9.3	6.2	4.4	1.9	J	---	0.62	0.71	
		7/17/2002	<5	17.6	6.2	6.2	6.3	0.5	J	---	0.84	0.99	
UNT5	Unnamed tributary entering midway up the west shore of Upper Bear River Reservoir Latitude (38° 33.90 N) Longitude (120° 13.23 W)	3/27/2002	---	---	---	---	---	---		---			
		4/23/2002	50	3.8	11.4	6.8	7.6	0.58	J	---	0.99	1.19	
		5/15/2002	50	5.1	10.3	7.7	7.4	3.3	J	---	0.97	1.16	
		6/11/02 ^[1]	40	9.8	9.2	6.7	7.4	1.7	J	---	0.97	1.16	
		7/17/2002	DRY	---	---	---	---	---		---	---	---	
BR3	Upper Bear River Reservoir outflow to Lower Bear River Reservoir Latitude (38° 33.44 N) Longitude (120° 12.89 W)	3/27/2002	7	1.2	11.0	6.7	4.4	1.5	J	---	0.62	0.71	
		4/23/2002	5	4.7	11.3	6.8	3.6	<0.3		---	0.52	0.59	
		5/15/2002	<5	7.3	---	7.3	3.4	<0.3		---	0.50	0.56	
		6/11/02 ^{[1], b}	15	12.6	8.6	6.4	3.8	9.9		---	0.55	0.62	
		7/17/2002	8	10.8	10.7	6.3	3.7	1.1	J	---	0.54	0.60	
UNT1	Unnamed tributary on the upper west shore of Lower Bear River Reservoir (due to snowmelt) Latitude (38° 33.23 N) Longitude (120° 13.30 W)	3/27/2002	<5	8.4	9.7	7.0	2.3	1.7	J	---	0.36	0.38	
		4/23/2002	DRY	---	---	---	---	---		---	---	---	
										---	---	---	
UNT2	Unnamed tributary on the upper west shore of Lower Bear River Reservoir (due to snowmelt) Latitude (38° 33.21 N) Longitude (120° 13.32 W)	3/27/2002	<1	5.5	10.7	7.1	1.7	2.1	J	---	0.28	0.29	
		4/23/2002	DRY	---	---	---	---	---		---	---	---	
										---	---	---	
UNT4	Small tributary flow from snowmelt near Sugar Pine Creek, northwest shore of Lower Bear River Reservoir Latitude (38° 32.81 N) Longitude (120° 14.36 W)	3/27/2002	---	---	---	---	---	---		---			
		4/23/2002	2	14.0	7.6	6.5	1.4	0.75	J	---	0.23	0.24	
		5/15/2002	DRY	---	---	---	---	---		---	---	---	

Table 1. Mokelumne River Supplemental Water Quality Monitoring Results for the Period March 2002-September 2003

Station	Location of Station	Date	Estimated Flow (cfs)	Temperature (°C)	DO (mg/L)	pH (units)	Hardness (mg/L)	Dissolved Copper (µg/L)	Flag	Dissolved Copper (µg/L)	Hardness based criteria for CTR and USEPA		Comments/Special Notes
								Severn Trent Laboratory (STL)		WPCL & MPSL, Department of Fish and Game	CCC	CMC	
SPC1	Sugar Pine Creek on the northwest shore of Lower Bear River Reservoir												
	Latitude (38° 32.74 N)	3/27/2002	20	6.7	9.8	6.8	4.9	2.7	J	---	0.68	0.78	
	Longitude (120° 14.43 W)	4/23/2002	15	7.0	10.2	6.6	5.0	0.47	J	---	0.69	0.80	
		5/15/02 ^a	---	---	---	---	---	---	---	---	---	---	
		6/11/02 ^[1]	15	11.3	8.3	6.1	5.4	2.0	J	---	0.74	0.86	
		7/17/02 ^[2]	0	---	---	---	---	---	---	---	---	---	
LBR1	Little Bear River on the northwest shore of Lower Bear River Reservoir												
	Latitude (38° 33.57 N)	3/27/2002	40	6.5	9.9	6.9	11.0	<0.3		---	1.36	1.68	
	Longitude (120° 14.86 W)	4/23/2002	30	7.5	10.7	7.0	7.5	0.36	J	---	0.98	1.17	
		5/15/2002	20	7.3	9.8	7.3	8.8	<0.3		---	1.12	1.36	
		6/11/02 ^[1]	15	14.1	7.7	6.8	9.1	0.52	J	---	1.16	1.40	
		7/17/02 ^[2]	<1	---	---	---	---	---	---	---	---	---	
LBRR1-top	Lower Bear River Reservoir sample collected near the dam from the epilimnion												
	Latitude (38° 32.365 N)	3/27/2002 ^a	---	NS	NS	NS	NS	NS		---			Reservoir frozen, unable to sample
	Longitude (120° 15.162 W)	4/23/2002	---	6.1	10.2	6.7	4.0	0.31	J	---	0.57	0.65	
		5/16/2002	---	11.2	8.2	6.9	5.0	0.77	J	---	0.69	0.80	
		6/19/2002	---	19.0	7.4	7.0	3.6	<0.3		---	0.52	0.59	
		7/17/2002	---	22.3	6.7	7.1	3.6	<0.3		---	0.52	0.59	
		8/28/2002	---	19.5	6.8	6.7	3.9	3.7	J	1.6	0.56	0.63	
		9/25/2002	---	17.8	7.2	6.8	3.8	<0.3		<0.3	0.55	0.62	
		10/23/2002	---	13.8	7.3	6.6	3.7	1.0	J	0.3	0.54	0.60	
		11/13/02 ^{[7], a}	---	NS	NS	NS	NS	NS		---	---	---	Snow storm, ice at edges of lake, no safe access
		12/11/02 ^[8]	---	5.4	8.4	6.5	11.0	1.2	J	---	1.36	1.68	
		1/29/03 ^{[10], a}	---	NS	NS	NS	NS	NS		---	---	---	Reservoir frozen, unable to sample
		2/26/2003 ^a	---	NS	NS	NS	NS	---		NS	---	---	Reservoir frozen, unable to sample
		3/12/2003 ^a	---	NS	NS	NS	NS	---		NS	---	---	Reservoir frozen, unable to sample
		4/15/2003 ^a	---	NS	NS	NS	NS	---		NS	---	---	Lot of snow on ground down to reservoir, no safe access
		5/5/2003	---	6.2	10.1	6.7	4.4	---		0.09	0.62	0.71	
		6/3/2003	---	16.0	7.7	7.0	4.0	---		0.122	0.57	0.65	
		7/10/2003	---	19.9	6.6	6.9	3.8	---		0.112	0.55	0.62	
		8/21/2003	---	21.2	6.3	7.0	6.3	---		0.10	0.84	0.99	Thunder showers during reservoir sampling
		9/9/2003	---	19.4	6.5	6.6	4.8	---		0.13	0.67	0.77	

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Station	Location of Station	Date	Estimated Flow (cfs)	Temperature (°C)	DO (mg/L)	pH (units)	Hardness (mg/L)	Dissolved Copper (µg/L)	Flag	Dissolved Copper (µg/L)	Hardness based criteria for CTR and USEPA	Comments/Special Notes
								Severn Trent Laboratory (STL)		WPCL & MPSL, Department of Fish and Game	CCC	CMC
LBRR1-middle	Lower Bear River Reservoir sample collected near the dam from the metalimnion											
	Latitude (38° 32.365 N)	3/27/2002 ^a	---	NS	NS	NS	NS	NS		---	---	Reservoir frozen, unable to sample
	Longitude (120° 15.162 W)	4/23/2002	---	NS	NS	NS	NS	NS		---	---	Reservoir not stratified, no sample collected
		5/16/2002	---	5.2	9.4	6.6	4.0	0.9	J	---	0.57	0.65
		6/19/2002	---	6.3	10.7	6.6	3.7	<0.3		---	0.54	0.60
		7/17/2002	---	7.2	10.3	6.5	5.4	<0.3		---	0.74	0.86
		8/28/2002	---	10.3	9.4	6.3	3.9	19 ^[6]		19.1	0.56	0.63
		9/25/2002	---	17.2	7.0	6.5	3.7	0.91	J	0.3	0.54	0.60
		10/23/2002	---	9.2	8.3	6.5	3.4	1.2	J	<0.3	0.50	0.56
		11/13/02 ^[7]	---	NS	NS	NS	NS	NS		---	---	
		12/11/02 ^[8]	---	NS	NS	NS	NS	NS		---	---	
		1/29/03 ^[10]	---	NS	NS	NS	NS	NS		---	---	Reservoir frozen, unable to sample
		2/26/2003	---	NS	NS	NS	NS	---		NS	---	Reservoir frozen, unable to sample
		3/12/2003	---	NS	NS	NS	NS	---		NS	---	Reservoir frozen, unable to sample
		4/15/2003	---	NS	NS	NS	NS	---		NS	---	Lot of snow on ground down to reservoir, no safe access
		5/5/2003	---	NS	NS	NS	NS	---		NS	---	Reservoir not stratified, no sample collected
		6/3/2003	---	NS	NS	NS	NS	---		NS	---	Reservoir not stratified, no sample collected
		7/10/2003	---	7.7	8.8	7.4	3.8	---		0.187	0.55	0.62
		8/21/2003	---	12.0	8.7	6.5	7.4	---		0.13	0.97	1.16
		9/9/2003	---	13.2	7.1	6.1	4.8	---		0.29	0.67	0.77
LBRR1-bottom	Lower Bear River Reservoir sample collected near the dam from the hypolimnion											
	Latitude (38° 32.365 N)	3/27/2002 ^a	---	NS	NS	NS	NS	NS		---	---	Reservoir frozen, unable to sample
	Longitude (120° 15.162 W)	4/23/2002	---	4.1	10.1	6.5	4.7	0.68	J	---	0.66	0.75
		5/16/2002	---	4.7	8.8	6.5	4.0	1.2	J	---	0.57	0.65
		6/19/2002	---	5.3	6.2	6.9	3.8	<0.3		---	0.55	0.62
		7/17/2002	---	5.4	9.7	6.3	4.8	1.3	J	---	0.67	0.77
		8/28/2002	---	5.6	8.7	6.1	4.0	1.6	J	<0.3	0.57	0.65
		9/25/2002	---	5.7	6.9	6.3	3.7	<0.3		<0.3	0.54	0.60
		10/23/2002	---	5.8	6.9	6.2	3.7	1.0	J	<0.3	0.54	0.60
		11/13/02 ^[7]	---	NS	NS	NS	NS	NS		---	---	
		12/11/02 ^[8]	---	5.1	8.6	6.5	11.0	1.1	J	---	1.36	1.68
		1/29/03 ^[10]	---	NS	NS	NS	NS	NS		---	---	Reservoir frozen, unable to sample
		2/26/2003	---	NS	NS	NS	NS	---		NS	---	Reservoir frozen, unable to sample
		3/12/2003	---	NS	NS	NS	NS	---		NS	---	Reservoir frozen, unable to sample
		4/15/2003	---	NS	NS	NS	NS	---		NS	---	Lot of snow on ground down to reservoir, no safe access
		5/5/2003	---	4.5	10.5	6.8	4.2	---		0.15	0.60	0.68
		6/3/2003	---	5.0	10.6	6.7	4.0	---		0.145	0.57	0.65
		7/10/2003	---	5.2	8.7	7.7	3.8	---		0.376	0.55	0.62
		8/21/2003	---	5.2	6.5	6.5	8.4	---		0.13	1.08	1.30
		9/9/2003	---	5.5	7.4	6.2	4.6	---		0.19	0.64	0.74

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Station	Location of Station	Date	Estimated Flow (cfs)	Temperature (°C)	DO (mg/L)	pH (units)	Hardness (mg/L)	Dissolved Copper (µg/L)	Flag	Dissolved Copper (µg/L)	Hardness based criteria for CTR and USEPA	Comments/Special Notes
								Severn Trent Laboratory (STL)		WPCL & MPSL, Department of Fish and Game	CCC CMC	
UNT6a	Leakage flow from the right abutment of the Lower Bear River Res. Dam collected at the weir											
	Latitude (38° 32.30 N)	6/11/02 ^[1]	0.44	7.3	9.5	6.0	7.7	38		---	1.00 1.20	Lower Bear Reservoir spilling during sampling event
	Longitude (120° 15.48 W)	7/17/2002	0.27	9.8	10.0	6.4	9.6	49		---	1.21 1.48	
		8/29/2002	0.14	9.0	9.1	6.7	11.0	38		---	1.36 1.68	
		9/25/2002	0.09	9.1	8.3	6.9	12.0	31		---	1.46 1.82	
		10/23/2002	0.04	7.8	8.1	6.8	12.0	32		---	1.46 1.82	
		11/13/02 ^[7]	0.10	5.9	8.9	4.7	23.0	280		300	2.55 3.37	
		12/11/02 ^[8]	0.03	4.4	8.9	5.5	12.0	110		103	1.46 1.82	
		1/29/03 ^[10]	0.12	3.2	10.1	4.9	30.0	500		440	3.20 4.32	
		2/26/2003	0.05	3.1	9.6	5.3	29.0	---		362	3.11 4.19	
		3/12/2003	0.06	3.7	9.1	5.8	30.0	---		355	3.20 4.32	
		4/15/2003 ^[11]	NS	NS	NS	NS	NS	---		NS	---	Snow/ice covering rocks, no safe access to site
		5/5/2003	0.05	3.6	8.7	4.7	29.0	---		617	3.11 4.19	
		6/2/2003	0.51	6.5	9.6	6.4	10.9	---		68.3	1.35 1.67	Lower Bear Reservoir spilling during sampling event
		7/1/2003	0.33	8.3	9.3	6.8	9.5	---		49.1	1.20 1.46	
		8/19/2003	0.19	10.4	7.9	6.5	14.7	---		48.6	1.74 2.21	
		9/9/2003	0.10	8.9	8.7	6.2	19.2	---		52.0	2.19 2.84	
UNT6b	Leakage flow from the right abutment of the Lower Bear River Res. Dam collected below the weir, below the spillway confluence											
	Latitude (38° 32.23 N)	3/27/2002	---	---	---	---	---	---		---	---	
	Longitude (120° 15.44 W)	4/23/2002	---	---	---	---	---	---		---	---	
		5/15/2002	0.42	---	---	5.9	11.0	79		---	1.36 1.68	
		6/11/02 ^[1]	0.44	15.8	7.5	7.0	3.4	4.3	J	---	0.50 0.56	Lower Bear Reservoir spilling during sampling event
		7/17/2002	0.27	16.7	8.6	6.3	10.0	31		---	1.25 1.54	
		8/29/2002	0.14	10.1	8.6	7.3	11.0	22		---	1.36 1.68	
		9/25/2002	0.09	15.3	6.9	6.9	12.0	15		---	1.46 1.82	
		10/23/2002	0.04	11.6	7.7	7.0	14.0	18		---	1.67 2.11	
		11/13/02 ^[7]	0.10	8.4	8.9	4.8	27.0	260		---	2.93 3.91	
		12/11/02 ^[8]	0.03	3.4	9.4	5.4	10.0	100		---	1.25 1.54	
		1/29/03 ^[10]	0.12	1.9	10.7	5.3	31.0	420		---	3.29 4.46	
		2/26/2003	0.05	1.5	9.4	5.4	34.0	---		292	3.56 4.86	
		3/12/2003	0.06	4.8	7.6	5.5	33.0	---		308	3.47 4.73	
		4/15/2003 ^[11]	NS	2.4	11.0	5.7	25.0	---		449	2.74 3.64	Sample collected above outlet, combined flow from UNT6b+UNT8b
		5/5/2003	0.05	4.7	6.3	4.8	34.0	---		471	3.56 4.86	
		6/2/2003	0.51	15.0	7.4	6.7	4.0	---		0.378	0.57 0.65	Lower Bear Reservoir spilling during sampling event
		7/1/2003	0.33	13.6	8.6	6.9	6.7	---		15.4	0.89 1.05	
		8/19/2003	0.19	16.2	7.5	6.6	16.8	---		28.8	1.95 2.50	
		9/9/2003	0.10	10.1	8.8	6.6	15.8	---		33.1	1.85 2.36	

Table 1. Mokelumne River Supplemental Water Quality Monitoring Results for the Period March 2002-September 2003

Station	Location of Station	Date	Estimated Flow (cfs)	Temperature (°C)	DO (mg/L)	pH (units)	Hardness (mg/L)	Dissolved Copper (µg/L)	Flag	Dissolved Copper (µg/L)	Hardness based criteria for CTR and USEPA	Comments/Special Notes
								Severn Trent Laboratory (STL)		WPCL & MPSL, Department of Fish and Game	CCC CMC	
UNT7	Outflow from the instream flow release pipe below Lower Bear River Res. upstream of station BR1											
	Latitude (38° 32.21 N)	3/27/2002	---	---	---	---	---	---		---	---	
	Longitude (120° 15.40 W)	4/23/2002	---	---	---	---	---	---		---	---	
		5/15/2002	6	---	---	6.9	3.8	<0.3		---	0.55	0.62
		6/11/02 ^[1]	7	5.8	10.3	6.0	3.5	1.1	J	---	0.51	0.57
		7/17/2002	4	6.6	11.0	5.9	4.5	1.5	J	---	0.63	0.72
		8/29/2002	3	5.8	9.9	7.4	3.7	<0.3		---	0.54	0.60
		9/25/2002	3	6.1	9.3	6.8	3.8	<0.3		---	0.55	0.62
		10/23/2002	5	6.0	9.3	6.9	3.8	<0.7		---	0.55	0.62
		11/13/02 ^[7]	5	6.1	9.4	6.6	4.2	<0.7		---	0.60	0.68
		12/11/02 ^[8]	4	5.5	9.5	6.5	12.0	1.3	J	---	1.46	1.82
		1/29/03 ^[10]	6	3.7	10.3	6.5	4.2	2.3	J	---	0.60	0.68
		2/26/2003	6	3.8	10.4	7.0	4.9	---		0.115	0.68	0.78
		3/12/2003	6	4.0	9.2	7.1	5.5	---		0.136	0.75	0.87
		4/15/2003	6	4.5	11.0	7.7	4.0	---		0.097	0.57	0.65
		5/5/2003	7	4.6	9.1	6.9	4.2	---		0.09	0.60	0.68
		6/2/2003	7	5.4	9.4	7.3	4.0	---		0.117	0.57	0.65
		7/1/2003	6	5.5	10.3	7.5	3.8	---		0.14	0.55	0.62
		8/19/2003	5	5.9	9.1	6.6	5.2	---		0.11	0.72	0.83
		9/9/2003	4	5.8	9.6	6.8	4.8	---		0.13	0.67	0.77
UNT8a	Leakage flow from left abutment below Lower Bear River Res. Dam collected at the weir											
	Latitude (38° 32.26 N)	6/11/02 ^[1]	1.2	6.0	9.6	6.2	6.1	32		---	0.82	0.96
	Longitude (120° 15.41 W)	7/17/2002	0.91 ^[9]	6.8	11.4	6.2	7.4	42		---	0.97	1.16
		8/29/2002	0.64	8.3	9.3	6.9	7.4	29		---	0.97	1.16
		9/25/2002	0.50	12.6	7.7	6.9	7.8	20		---	1.01	1.21
		10/23/2002	0.31	10.1	8.2	6.9	7.9	19		---	1.02	1.23
		11/13/02 ^[7]	0.23	6.3	9.3	4.8	22.0	330		---	2.46	3.23
		12/11/02 ^[8]	0.07	5.1	9.7	6.4	10.0	54		---	1.25	1.54
		1/29/03 ^[10]	0.18	2.3	10.5	5.6	29.0	600		---	3.11	4.19
		2/26/2003	0.11	2.4	10.2	5.9	19.0	---		235	2.17	2.81
		3/12/2003	0.09	2.8	9.7	6.2	21.0	---		218	2.36	3.09
		4/15/2003 ^[11]	NS	NS	NS	NS	NS	---		NS	---	---
		5/5/2003	0.37	2.4	10.1	4.8	36.0	---		798	3.74	5.13
		6/3/2003	1.28	5.6	9.7	7.1	9.9	---		60.3	1.24	1.52
		7/1/2003	2.04	7.8	9.8	7.3	7.1	---		22.4	0.93	1.11
		8/19/2003	1.03	10.6	8.3	6.7	10.0	---		22.3	1.25	1.54
		9/9/2003	0.71	11.7	8.2	6.8	6.7	---		22.5	0.89	1.05

Table 1. Mokelumne River Supplemental Water Quality Monitoring Results for the Period March 2002-September 2003

Station	Location of Station	Date	Estimated Flow (cfs)	Temperature (°C)	DO (mg/L)	pH (units)	Hardness (mg/L)	Dissolved Copper (µg/L)	Flag	Dissolved Copper (µg/L)	Hardness based criteria for CTR and USEPA	Comments/Special Notes
								Severn Trent Laboratory (STL)		WPCL & MPSL, Department of Fish and Game	CCC CMC	
UNT8b	Leakage flow from left abutment below Lower Bear River Res. Dam collected below the weir											
	Latitude (38° 32.23 N)	6/11/02 ^[1]	1.2	6.6	9.4	6.4	6.5	27		---	0.87 1.02	Lower Bear Reservoir spilling during sampling event
	Longitude (120° 15.42W)	7/17/2002	0.91 ^[9]	7.9	11.0	6.2	7.2	36		---	0.95 1.13	
		8/29/2002	0.64	8.5	9.5	7.1	7.7	23		---	1.00 1.20	
		9/25/2002	0.50	13.4	7.5	6.9	7.8	16		---	1.01 1.21	
		10/23/2002	0.31	10.6	8.0	6.9	8.0	15		---	1.03 1.24	
		11/13/02 ^[7]	0.23	6.9	9.1	4.8	20.0	300		---	2.26 2.95	
		12/11/02 ^[8]	0.07	5.0	9.6	6.4	12.0	40		---	1.46 1.82	
		1/29/03 ^[10]	0.18	2.4	10.3	5.5	28.0	580		---	3.02 4.05	Sample collected above outlet, combined flow from UNT6b+UNT8b
		2/26/2003	0.11	2.2	10.4	6.0	18.0	---		215	2.07 2.67	
		3/12/2003	0.09	4.2	9.2	6.0	21.0	---		202	2.36 3.09	
		4/15/2003 ^[11]	NS	2.4	11.0	5.7	25.0	---		449	2.74 3.64	
		5/5/2003	0.37	2.8	10.3	4.9	33.0	---		729	3.47 4.73	
		6/2/2003	1.28	14.9	7.8	6.7	5.0	---		0.948	0.69 0.80	
		7/1/2003	2.04	8.6	9.2	7.3	7.1	---		22	0.93 1.11	
		8/19/2003	1.03	11.1	8.6	6.8	11.6	---		21	1.42 1.77	Lower Bear Reservoir spilling during sampling event
		9/9/2003	0.71	11.6	8.3	6.9	8.6	---		20.6	1.10 1.33	
UNT9 ^[4]	Spill over Lower Bear River Res. during one sampling event only											
	Latitude (38° 32.26 N)	6/11/02 ^[1]	12	15.8	7.3	6.6	3.7	8.7		---	0.54 0.60	
	Longitude (120° 15.44 W)	6/3/2003	356	15.1	7.6	6.7	4.0	---		0.154	0.57 0.65	
BR1	Bear River below Lower Bear River Reservoir											
	Latitude (38° 32.14 N)	3/27/2002	8	5.4	8.7	7.0	7.2	19		22.4	0.95 1.13	Lower Bear Reservoir spilling during sampling event
	Longitude (120° 15.48W)	4/23/2002	8	7.0	10.3	6.9	5.8	16		19.2	0.79 0.92	
		5/15/2002	6	7.0	8.7	7.1	5.1	12		12.2	0.70 0.81	
		6/11/02 ^[1]	21	11.8	8.8	6.3	3.9	5.8		4.16	0.56 0.63	
		7/17/02 ^[3]	5	9.1	9.9	6.6	4.6	8.7		6.3	0.64 0.74	
		8/29/2002	4	6.6	9.5	7.4	4.5	3.5	J	3.5	0.63 0.72	
		9/25/2002	4	8.5	9.0	7.1	4.4	1.8	J	2.0	0.62 0.71	
		10/24/2002	5	7.2	8.8	7.1	3.8	1.7	J	1.1	0.55 0.62	
		11/13/02 ^[7]	5	6.8	9.3	6.6	6.0	15		12.3	0.81 0.95	
		12/11/02 ^[8]	4	5.5	9.5	6.5	11.0	3.6	J	2.2	1.36 1.68	
		1/29/03 ^[10]	6	3.3	10.6	6.0	7.4	35		33.1	0.97 1.16	Lower Bear Reservoir spilling during sampling event
		2/26/2003	6	3.9	9.9	6.8	5.8	---		11.7 (11.3)	0.79 0.92	
		3/12/2003	6	5.2	9.0	7.0	6.7	---		10.1 (9.53)	0.89 1.05	
		4/15/2003	6	4.4	10.8	6.7	7.0	---		39.9 (39.8)	0.92 1.10	
		5/5/2003	7	5.4	8.8	5.7	9.0	---		93.8 (93.7)	1.14 1.39	
		6/2/2003	365	14.9	7.5	6.8	5.0	---		0.610 (0.570)	0.69 0.80	
		7/1/2003	8	8.6	9.7	7.1	5.7	---		8.17 (7.99)	0.77 0.90	
		8/19/2003	6	8.9	8.7	6.7	8.4	---		4.33 (4.30)	1.08 1.30	Lower Bear Reservoir spilling during sampling event
		9/9/2003	5	7.3	9.2	6.9	6.2	---		2.97 (3.09)	0.83 0.98	

Table 1. Mokelumne River Supplemental Water Quality Monitoring Results for the Period March 2002-September 2003

Station	Location of Station	Date	Estimated Flow (cfs)	Temperature (°C)	DO (mg/L)	pH (units)	Hardness (mg/L)	Dissolved Copper (µg/L)	Flag	Dissolved Copper (µg/L)	Hardness based criteria for CTR and USEPA		Comments/Special Notes
								Severn Trent Laboratory (STL)		WPCL & MPSL, Department of Fish and Game	CCC	CMC	
BR2	Bear River above gaging station	8/29/2002	6	15.2	8.4	7.8	6.2	1.1	J	---	0.83	0.98	
	Latitude (38° 29.604N)	9/25/2002	5	12.0	9.2	7.2	5.7	3.4	J	---	0.77	0.90	
	Longitude (120° 17.304 W)	10/24/2002	5	7.2	9.9	7.2	1.6	1.5	J	---	0.26	0.27	
		11/13/02 ^[7]	8	6.8	10.8	7.2	9.8	2.1	J	---	1.23	1.51	
		12/11/02 ^[8]	6	4.5	11.2	6.5	11.0	2.2	J	---	1.36	1.68	
		1/29/03 ^[10]	35	3.7	10.5	7.0	9.1	4.3	J	---	1.16	1.40	
		2/26/2003	19	4.0	10.8	7.0	10.0	---		1.83	1.25	1.54	
		3/12/2003	14	7.2	9.2	7.3	12.0	---		1.61	1.46	1.82	
		4/15/2003	62	3.4	11.8	7.3	9.6	---		2.32	1.21	1.48	
		5/5/2003	105	7.4	9.1	7.4	9.9	---		4.28	1.24	1.52	
		6/3/2003	423	16.4	8.0	6.6	4.0	---		0.795	0.57	0.65	Lower Bear Reservoir spilling during sampling event
		7/1/2003	9	15.5	8.2	7.2	9.5	---		1.82	1.20	1.46	
		8/19/2003	7	18.4	7.9	7.1	8.4	---		1.59	1.08	1.30	
		9/9/2003	6	14.1	8.7	7.0	9.1	---		1.39	1.16	1.40	
BR-RSC1	Bear River above Confluence with Rattlesnake Creek	8/29/2002	4	11.5	8.7	7.1	4.3	2.4	J	---	0.61	0.69	
		9/25/2002	4	9.9	9.1	7.0	4.4	1.9	J	---	0.62	0.71	
	Latitude (38° 31.145 N)	10/24/2002	5	6.1	9.7	7.2	4.4	2.1	J	---	0.62	0.71	
	Longitude (120° 16.008 W)	11/13/02 ^[7]	5	6.3	10.3	6.6	5.5	7.3		---	0.75	0.87	
		12/11/02 ^[8]	4	3.3	11.4	6.8	9.0	4.4	J	---	1.14	1.39	
		1/29/03 ^[10]	6	3.4	10.7	6.1	8.0	22		---	1.03	1.24	
		2/26/03 ^(a)	NS	NS	NS	NS	NS	---		NS			no access by road, helicopter not available, no samples collected
		3/12/2003	6	5.1	10.8	7.3	7.2	---		6.8	0.95	1.13	
		4/15/2003	6	2.6	11.0	7.0	5.5	---		20.9	0.75	0.87	
		5/6/2003	7	4.7	9.6	5.6	7.0	---		49.5	0.92	1.10	
		6/3/2003	365	15.5	8.6	6.4	6.9	---		0.798	0.91	1.08	Lower Bear Reservoir spilling during sampling event
		7/2/2003	8	9.6	9.7	6.9	4.8	---		5.85	0.67	0.77	
		8/20/2003	6	12.0	7.9	6.8	7.4	---		3.47	0.97	1.16	
		9/9/2003	5	10.6	8.7	6.9	5.3	---		2.49	0.73	0.84	
BR-RSC2	Bear River below Confluence with Rattlesnake Creek	8/29/2002	6	11.8	8.2	7.0	5.0	2.7	J	---	0.69	0.80	
		9/25/2002	5	10.3	8.7	7.0	4.9	1.5	J	---	0.68	0.78	
	Latitude (38° 31.035 N)	10/24/2002	5	6.1	9.4	7.0	4.6	1.9	J	---	0.64	0.74	
	Longitude (120° 16.105 W)	11/13/02 ^[7]	8	5.9	10.4	7.0	7.8	4.6	J	---	1.01	1.21	
		12/11/02 ^[8]	6	2.9	11.2	6.6	8.8	3.7	J	---	1.12	1.36	
		1/29/03 ^[10]	35	4.4	10.0	6.3	8.1	5.8		---	1.05	1.26	
		2/26/03 ^(a)	19	NS	NS	NS	NS	---		NS	---	---	no access by road, helicopter not available, no samples collected
		3/12/2003	14	4.0	11.1	7.4	11.0	---		1.69	1.36	1.68	
		4/15/2003	62	2.5	11.1	6.6	7.3	---		7.61	0.96	1.14	
		5/6/2003	105	4.5	9.4	6.9	7.9	---		17	1.02	1.23	
		6/3/2003	423	15.5	8.3	6.5	4.0	---		0.733	0.57	0.65	Lower Bear Reservoir spilling during sampling event
		7/2/2003	9	9.8	9.2	6.7	6.7	---		4.48	0.89	1.05	
		8/20/2003	7	12.5	8.4	6.8	9.4	---		3	1.19	1.45	
		9/9/2003	6	11.0	8.6	6.9	7.2	---		2.34	0.95	1.13	

Table 1. Mokelumne River Supplemental Water Quality Monitoring Results for the Period March 2002-September 2003

Station	Location of Station	Date	Estimated Flow (cfs)	Temperature (°C)	DO (mg/L)	pH (units)	Hardness (mg/L)	Dissolved Copper (µg/L)	Flag	Dissolved Copper (µg/L)	Hardness based criteria for CTR and USEPA		Comments/Special Notes
								Severn Trent Laboratory (STL)		WPCL & MPSSL, Department of Fish and Game	CCC	CMC	
RSC	Rattlesnake Creek at the Mouth	8/29/2002	1	13.1	7.6	7.0	9.8	<0.3		---	1.23	1.51	
	Latitude (38° 31.089 N)	9/25/2002	<1	11.3	7.5	7.0	10.0	<0.3		---	1.25	1.54	
	Longitude (120° 16.087 W)	10/24/2002	<1	6.2	8.2	7.0	10.0	0.9	J	---	1.25	1.54	
		11/13/02 ^[7]	3	4.5	10.8	7.1	12.0	<0.7		---	1.46	1.82	
		12/11/02 ^[8]	2	1.4	11.6	6.6	10.0	1.3	J	---	1.25	1.54	
		1/29/03 ^[10]	29	4.7	10.1	6.2	8.6	1.0	J	---	1.10	1.33	
		2/26/03 ^(a)	NS	NS	NS	NS	NS	---		NS	---	---	no access by road, helicopter not available, no samples collected
		3/12/2003	9	3.4	11.2	7.7	11.0	---		0.1	1.36	1.68	
		4/15/2003	56	2.4	11.3	6.8	9.2	---		0.06	1.17	1.42	
		5/6/2003	98	3.9	9.4	7.1	9.0	---		0.17	1.14	1.39	
		6/3/2003	58	NS	NS	NS	NS	---		NS	---	---	Lower Bear Reservoir spilling, flow too high to cross Bear River
		7/2/2003	1	10.3	9.1	6.8	11.4	---		0.067	1.40	1.74	
		8/20/2003	1	14.2	7.2	7.0	13.6	---		0.05	1.63	2.05	
		9/9/2003	1	13.0	7.8	6.9	11.5	---		0.07	1.41	1.75	
UNT 10	Field Blank [5]	9/25/2002	---	---	---	---	---	<0.3		---			
		10/23/2002	---	---	---	---	---	1.2	J	---			
UNT 11	Field Blank [5]	9/25/2002	---	---	---	---	---	<0.3		---			
		10/23/2002	---	---	---	---	---	1.1	J	---			
UNT 12	Field Blank [5]	9/25/2002	---	---	---	---	---	<0.3		---			
		10/24/2002	---	---	---	---	---	<0.7		---			
UNT 13	Field Blank [5]	10/24/2002	---	---	---	---	---	<0.7		---			
Field Blank	Field Blank (trace metal clean water provided by Marine Pollution Studies Laboratory)	2/26/2003	---	---	---	---	---	---		<0.003			Started using clean water from MPSSL
		3/12/2003	---	---	---	---	---	---		0.016			Same bottle that was used in February
		4/15/2003	---	---	---	---	---	---		0.019			Same bottle that was used in February
		5/5/2003	---	---	---	---	---	---		0.17			Same bottle that was used in February
		6/3/2003	---	---	---	---	---	---		0.019			Same bottle that was used for another project
		7/1/2003	---	---	---	---	---	---		<0.003			New bottle of clean water from MPSSL, only new bottles to be used from now on for each event
		8/21/2003	---	---	---	---	---	---		<0.003			New bottle of clean water from MPSSL
	9/9/2003	---	---	---	---	---	---		<0.003			New bottle of clean water from MPSSL	

Table 1. Mokelumne River Supplemental Water Quality Monitoring Results for the Period March 2002-September 2003

Station	Location of Station	Date	Estimated Flow (cfs)	Temperature (°C)	DO (mg/L)	pH (units)	Hardness (mg/L)	Dissolved Copper (µg/L)	Flag	Dissolved Copper (µg/L)	Hardness based criteria for CTR and USEPA	Comments/Special Notes
								Severn Trent Laboratory (STL)		WPCL & MPSL, Department of Fish and Game	CCC	CMC
FOOTNOTES: a = could not access during monitoring event b = the Upper Bear Reservoir was spilling during this event, the normal sampling location was not accessible, therefore sample for BR3 was collected from the spillway DRY = Tributary dry, seasonal due to snowmelt NS = No sample collected during this monitoring event Highlited cells for dissolved copper represent concentrations above the recommended criteria for the CTR and USEPA, criteria based on calculation that uses hardness of the sample J = 'J' Flag concentration is an estimated concentration below the reporting limit (5.0µg/L), but above the Method Detection Limit (MDL),(0.30 µg/L) for samples analyzed by STL. STL = Severn Trent Laboratories, samples were analyzed by this lab from March 2002 through January 2003. WPCL = Water Pollution Control Lab, Rancho Cordova CA, Department of Fish and Game, this lab provided QA/QC analysis of copper samples from March 2002 through January 2003. MPSL = Marine Pollution Studies Laboratory, Moss Landing CA, Department of Fish and Game -- analyzed dissolved copper samples using ultraclean method for the remainder of the study, February 2003 through September 2003. CTR = USEPA 40 CFR Part 131, Water Quality Standards; Establishment on Numeric Criteria for Priority Toxic Pollutants for the State of California, California Toxics Rule (CTR) USEPA = US Environmental Protection Agency National Ambient Water Quality Criteria, Freshwater Aquatic Life Protection Recommended Criteria. CCC = Continuous concentration (4-day average) CMC = Maximum concentration (1-hour average) [1] = Upper and Lower Bear River Reservoirs were spilling during this monitoring event. [2] = Tributary not flowing or flow <1 cfs, therefore not sampled during this monitoring event. [3] = Sample collected at temporary diversion dam, approximately 100 meters upstream of old weir (construction of new weir in progress) [4] = Spill over Lower Bear River Reservoir Dam collected at the bottom of the spillway at the confluence with the leakage from the weir on the right abutment of the dam. [5] = Field Blank, collected in the field using de-ionized water filtered into a preserved metals container (field blanks collected prior to first sample station, during sampling, and after last sample station). [6] = Dissolved copper measurement for LBRR1-middle on 8/28/02 questionable, possibly due to sample contamination. [7] = Snow storm occurred prior to and during sampling event, approximately 6-8 inches of snow accumulated on the ground by dam, leakage weir flow increased due to rain/snow precipitation on face of dam during event. [8] = All snow from previous sampling event had melted, no snow on ground, light rain/snow beginning on this day												