



Friends of Corte Madera Creek Watershed

P.O. Box 415 • Larkspur • California 94977

info@friendsofcortemaderacreek.org (415) 456-5052 www.friendsofcortemaderacreek.org

September 27, 2008

Ed Schulze, Chair
Wildlife & Fisheries Advisory Committee
Cooperative Extension
1682 Novato Boulevard, Suite 150B
Novato CA 94947

Cc: Mike Swezy

RE: Final Report for Grant FY 2007-2008

Dear Ed,

Friends of Corte Madera Creek Watershed, in cooperation with Marin Municipal Water District and four local property owners, has completed the first year of monitoring at Phoenix Lake and Ross Creek. Temperatures were monitored with continuously recording temperature loggers manufactured by Onset Corporation (model HOBO U22 Water Temp Pro loggers v2). We have spent \$2,313.99 for the permit from MMWD, equipment, and the repair and calibration of the Hydrolab. Approximately 200 volunteer-hours have been spent installing and maintaining equipment, downloading loggers, using the Hydrolab to gather additional data and to calibrate the loggers, and analyzing data. A table of expenditures is attached.

Ross Creek

MMWD gave permission to deploy loggers in the upstream portions of the creek and three private property owners allow us to access the creek below Glenwood Avenue. The loggers were placed at five locations along Ross Creek, also shown on Figure 1. The most upstream location is just below Phoenix Dam (RC1); the next downstream station is near the bridge at Glenwood Ave. (RC2); the next downstream is located at the end of Southwood Avenue, adjacent to the Branson School Campus (RC3); the most downstream station is located near Shady Lane, just upstream of the confluence with Corte Madera Creek (RC4).

Logger Installation and Data Gathering: The temperature loggers were designed for long term deployment. Although the loggers are relatively robust, each was enclosed in a section of pipe which was then cabled to a root, rock, or tree. A photograph of one deployment, the logger at station RC4, is shown in Figure 2.

All loggers were set to record data points at ten-minute intervals. The accuracy of the device is 0.2°C over the range of 0°C to 50°C. In order to ensure that all loggers were operating correctly, a calibration measurement was taken using the Hydrolab on each service occasion.

Once deployed in the pipe, the loggers are inconspicuous and no one appears to have tampered with any of them. We attempted to locate sites with relatively deep, moving water; the deepest pools were not selected, because we wanted to measure the temperature of water moving in the creek. Stagnant pools out of the current were avoided due to concern that they could possibly be stratified. The Ross Creek loggers were installed on March 28, in the four locations shown on Figure 1. A fifth logger was placed in a pool downstream of the low-release outlet on April 30.

Loggers were downloaded at approximately 2-week intervals. The three downstream loggers were removed in mid-May when the creek dried, but the upper two, on MMWD land upstream of Natalie Coffin Green Park remain in place.

Approximate locations of Phoenix Lake and Ross Creek temperature loggers

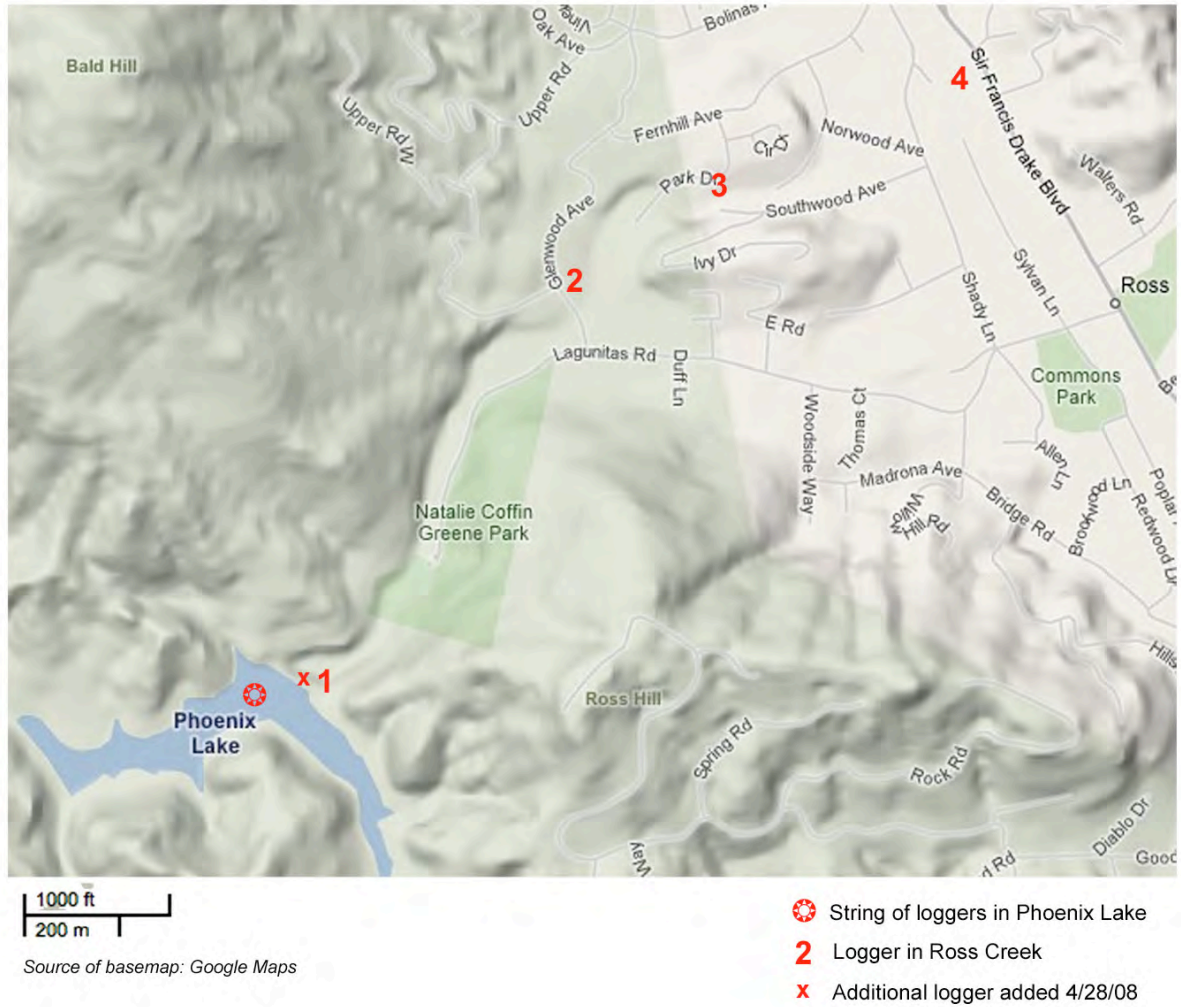


Figure 1. Deployment locations of continuously recording temperature loggers in Ross Creek, Summer 2008 field season.



Figure 2. Continuously recording temperature logger deployed at Ross Creek near Shady Lane (RC4). The site is just upstream of the confluence with Corte Madera Creek. Logger is indicated by the red circle.

Water Temperatures in Ross Creek

One objective of this monitoring project was to determine if temperatures in Ross Creek could support steelhead. Steelhead generally need summer rearing habitat in the range of 12°C to 17°C.

Graphs of temperature time series for loggers deployed in Ross Creek are included as Figures 3 through 6. Each graph is a record of water temperature at a particular location. Figure 3 includes measurements beginning in March and concluding in September, 2008. Figures 4 through 6 also begin in March, 2008 but conclude in May, 2008 when the creek dried and loggers were de-watered.

Graph 3 is a record of temperatures just below the dam. Notice that the temperature abruptly decreases in early May. Flow no longer passed over the spillway after early May. After this time, temperatures at the location at Natalie Coffin Greene (RC1) decreased because the majority of the flow was from the reservoirs lower level outlets.

Graph 4 is a record of temperatures at the next downstream location, at the Glenwood Ave Bridge (RC2). The stream dried by early May; however, during the time that flow was maintained, temperatures were appropriate for salmonids.

Graph 5 is a record of temperatures at the next downstream location, at Southwood Avenue (RC3). In this location, the stream dried later, in mid-May. Additional flow may be attributed to groundwater inflow between the two sites. Temperature of groundwater would be cooler than stream temperatures during early spring and summer. During the time that flow was maintained, temperatures were appropriate for salmonids.

Graph 6 is a record of temperatures at the most downstream location, at Shady Lane (RC4). In this location, the stream dried in early May. Up until late March, temperatures were appropriate for salmonids.

Temperatures in the three downstream locations (RC 2, RC3, and R4) were consistently within the appropriate range for steelhead, but the stream dried by mid-May. This is early for young salmonids. If Phoenix Lake could be operated to ensure that Ross Creek had flow into June, it may be possible to improve conditions for young salmonids.

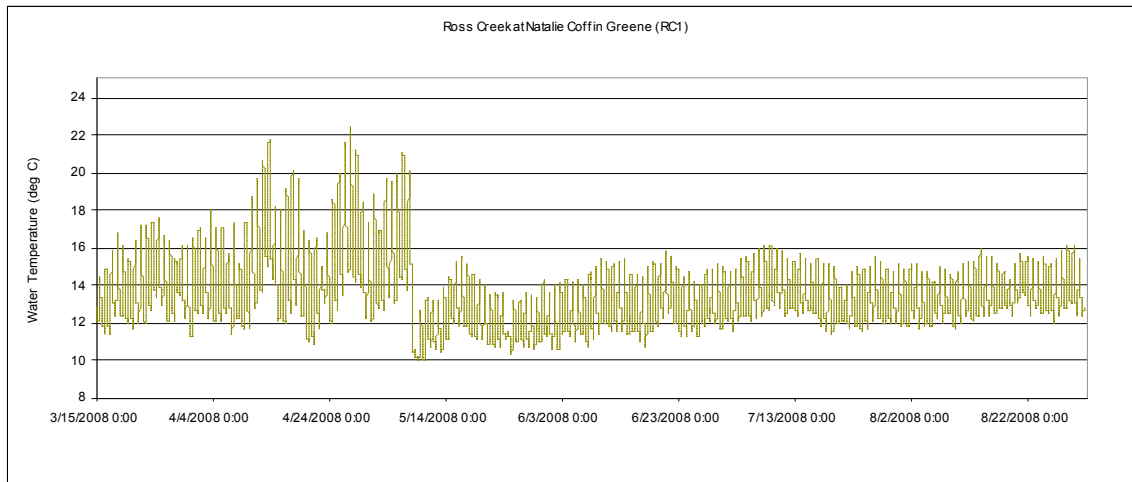


Figure 3. Temperatures recorded in Ross Creek at station RC1 (below Phoenix Dam).

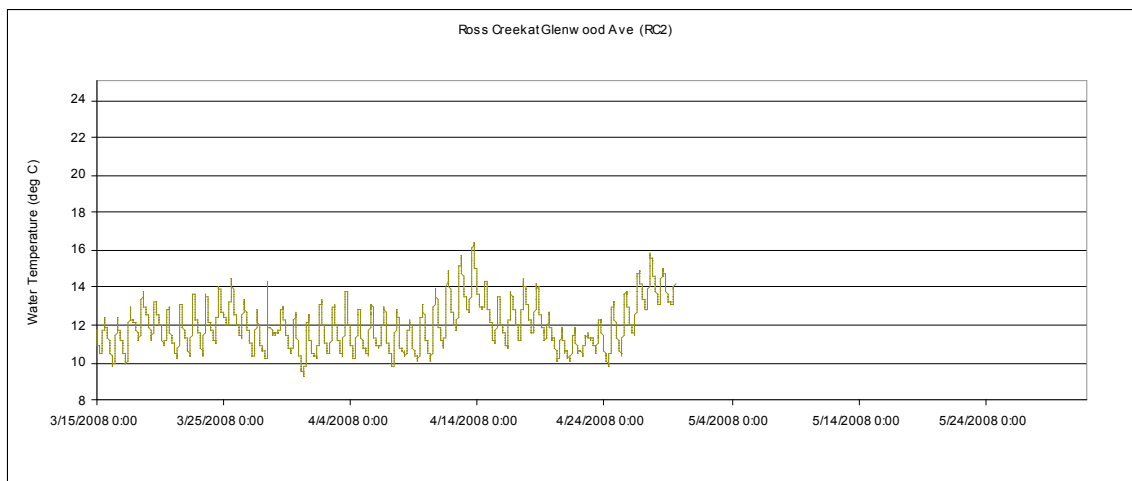


Figure 4. Temperatures recorded in Ross Creek at station RC2 (near the bridge at Glenwood Ave).

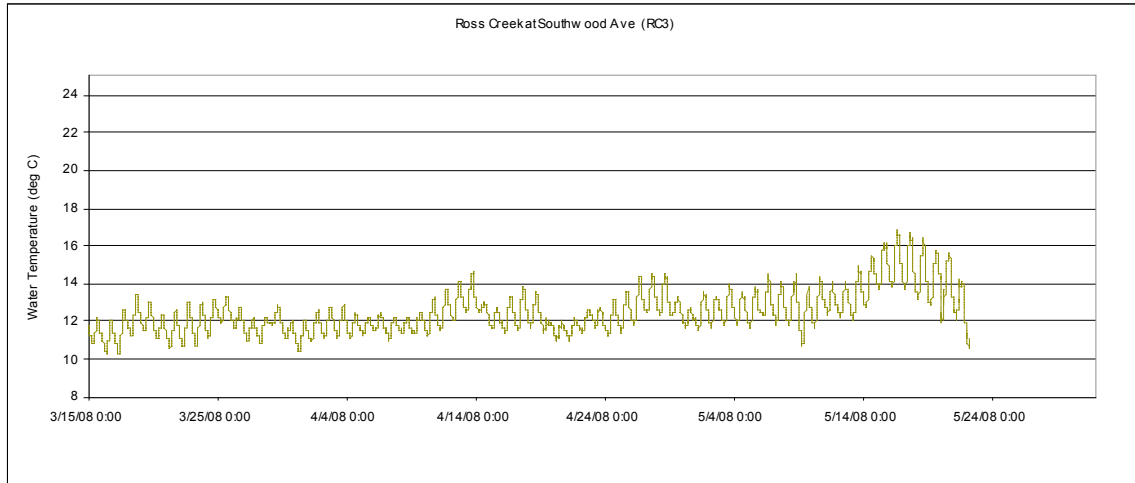


Figure 5. Temperatures recorded in Ross Creek at station RC3 (end of Southwood Ave).

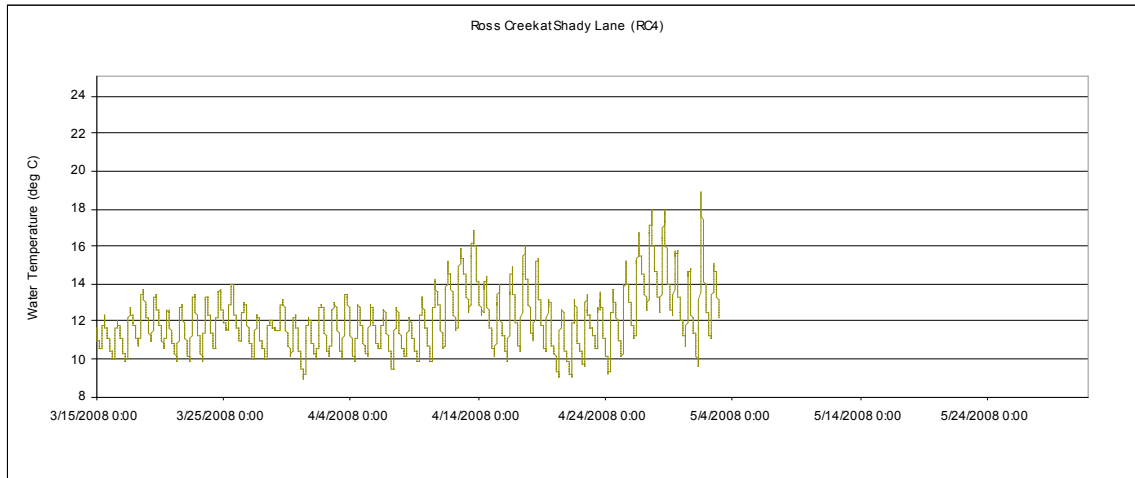


Figure 6. Temperatures recorded in Ross Creek at station RC4 (near Shady Lane).

Phoenix Lake

In order to better understand the temperature dynamics of Phoenix Lake, loggers were deployed in Phoenix Lake. Figure 1 shows the approximate location of the string of loggers. MMWD provided essential logistical support in both the deployment and ongoing maintenance of our equipment. Eric Ettlinger drives us to the lake from Sky Oaks Ranger Station, and assists us in reaching our deployment in a MMWD boat. He has helped us install the loggers, and download them. This project would not be possible without his help and the support of the resources staff, particularly Mike Swezy.

Logger Installation and Data Gathering: A string of six loggers was installed in Phoenix Lake on March 21, 2008. The loggers are attached to a rope with an 8-lb anchor at the bottom and three floats on the top. Loggers are attached at 2 ft, 8 ft, 14 ft, 20 ft, 26 ft, 30 ft, and 36 ft elevation measured from the bottom of the lake. To download the loggers, the rope is lifted from the lake into the boat, each logger is connected to the data shuttle, which reads and then empties the logger memory. After all six loggers are downloaded, the string is replaced at approximately the same

location. The loggers have been downloaded six times, on April 21, May 16, June 14, July 11, August 8, and September 4, 2008. Because MMWD staff is fully committed to conducting salmonid surveys in Lagunitas Creek until mid-October, we plan to do the next download in late October.

Results: Figure 7 is a graph of seven temperature profiles derived from logger data. Each profile is a snapshot in time of temperatures at six depths. The reservoir was weakly stratified at the beginning of our field season, and becomes more strongly stratified as time continues into the summer months.

We are interested in temperatures suitable for steelhead, which generally need summer rearing habitat with water in the range of 12° C to 17°C. From our field observations in Ross Creek, we now understand that when water is present in Ross Creek, temperatures are generally within this suitability range. However, during times when the flow in Ross Creek is not suitable for steelhead, it would need to be augmented by releases from Phoenix Lake. In order to sustain suitable habitat, these additional releases would have to come from lower lake elevations.

Returning once again to Figure 7, profiles indicate that surface temperatures are between 12°C and 17°C until early May when surface layers begin to warm significantly. During the critical months of May and June, water would have to be released from the lower levels of Phoenix Lake if suitable habitat were to be maintained in Ross Creek.

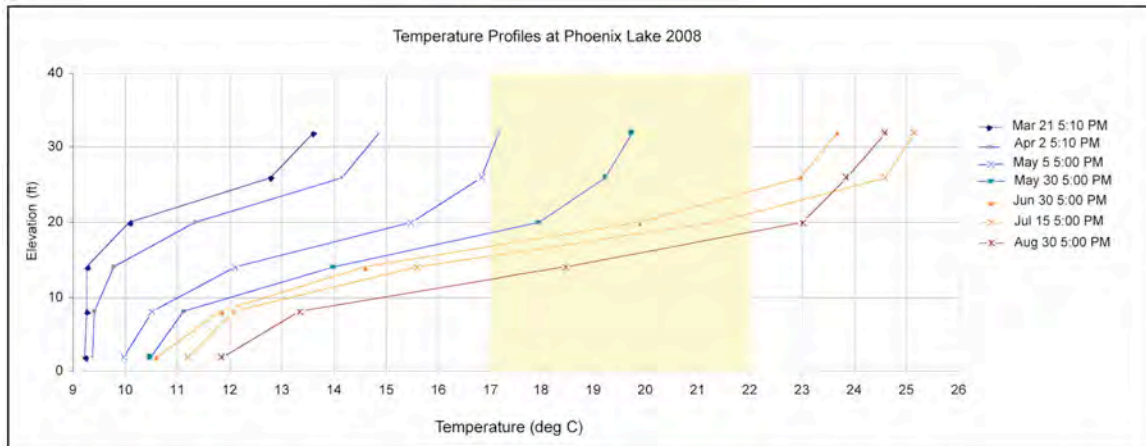


Figure 7. Temperature profiles in Phoenix Lake at seven times during the 2008 deployment period. The yellow highlight indicates the general range of temperature suitable for summer rearing habitat.

Figure 8 is another way of looking at this lake data. Time series plot of temperatures at all six elevations are shown. The figure suggests that if water were released from the dam at an elevation of 14 feet or lower, it is possible that cold temperatures could be maintained in Ross Creek.

In order to determine if such an approach is feasible it will be necessary to first determine the volume of water contained in the reservoir at these (lower) elevations. Current bathymetry was not available during our field season.

Additional analysis is also required to determine if releasing water from lower elevations will affect reservoir stratification. Releasing water from lower level outlets will reduce the volume of the cool water pool and may reduce the ability for the lake to remain stratified through the critical late spring and summer months.

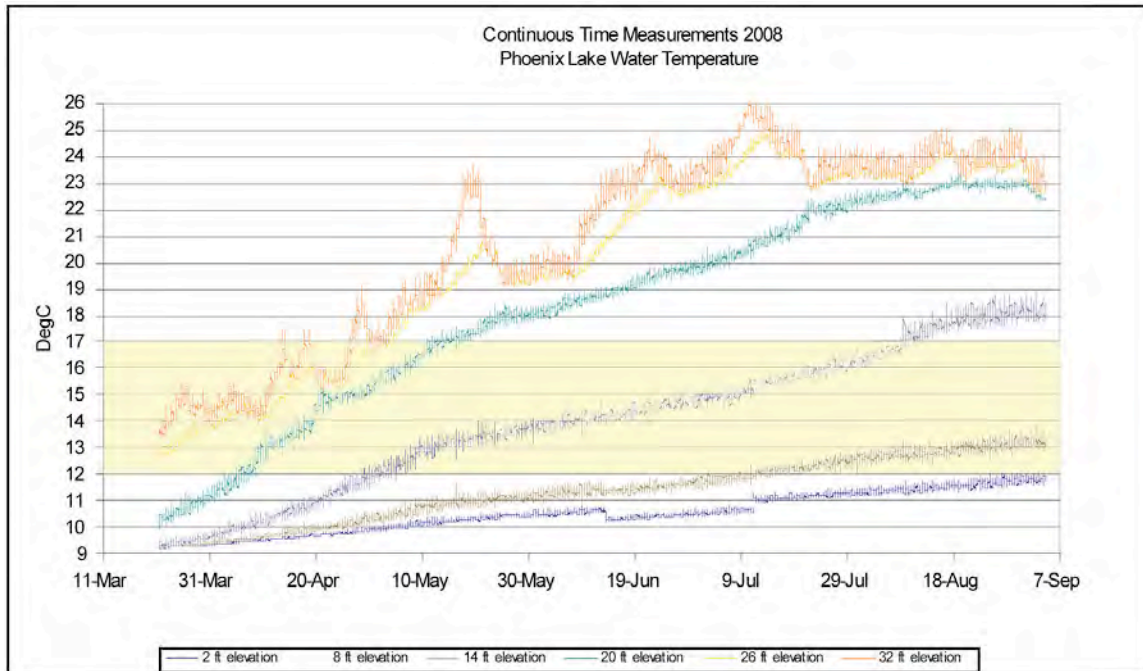


Figure 8. Temperature measurements in Phoenix Lake recorded at six depths during 2008. The yellow highlight indicates the general range of temperature suitable for summer rearing habitat.

We look forward to continuing this project with the equipment we bought with the W&F contribution.

Sincerely,

Cindy Lowney
Project Manager, Friends of Corte Madera Creek Watershed

Expense Report and Accounting

Wildlife and Fisheries Grant FY 2007-2008
Phoenix Lake/Ross Creek Temperature

Name of Organization: Friends of Corte Madera Creek Watershed

Address: P.O. Box 415, Larkspur CA 94977

Program Director: Cindy Lowney

Telephone Number:

Total Grant Award: \$1,500

Period Ending: September 2008

Itemized List of Expenses	
	Cost
Permit (MMWD)	100.00
Hardware (anchors, rope, shackles, fasteners)	294.15
Onset: HOBO Water Temp Pro v2 Loggers (10)	1,020.00
Onset: HOBO Waterproof Shuttle	219.00
Onset: Software (HOBOWare Pro)	99.00
Onset: Shipping and Handling	27.00
Hydrolab Calibration and Repair	554.84
	\$ 2,313.99

Total Paid by W&F	\$1,500.00
Total Paid by Friends	813.99
Total Amount of Reimbursement Requested	0
Funds Remaining in Grant	0

Certification: I certify to the best of my knowledge and belief that this report is correct and complete and that all outlays and obligations are for the purposes set forth in the services agreement.

Signature of Finance Officer

Date