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**LAKE ELSINORE/CANYON
LAKE NUTRIENT TMDL
MONITORING PROGRAM
REPORT
FOR YEAR 2000/2001**

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**Lake Elsinore/Canyon Lake Nutrient TMDL Monitoring Program
Report for the Year 2000/2001**

Santa Ana Regional Water Quality Control Board (Regional Board) staff initiated water quality monitoring in Lake Elsinore and Canyon Lake in June 2000, focusing on the nutrients (nitrogen and phosphorus), algal biomass and dissolved oxygen. Based on the review of past studies, three monitoring stations on Lake Elsinore were selected (Fig. 1); four stations were selected for Canyon Lake. At each sampling station, water samples were collected from top (0-6 ft depth) and bottom (one foot above sediment). When the lake water is over 20 feet deep, a sample from the mid-depth was taken. At the time of sampling, physical parameters such as water depth and Secchi Depth were measured. At three feet interval, other parameters such as water temperature, dissolved oxygen (DO), pH, turbidity, conductivity, and oxidation reduction potential (ORP) were measured to construct the depth profile. The constituents analyzed by the Associated Laboratories include total dissolved solid (TDS), hardness as CaCO₃, chlorophyll a, total phosphate as P, soluble phosphate as P, total nitrogen, nitrate, nitrite, ammonium, organic nitrogen, Kjeldahl nitrogen, biological oxygen demand (BOD), chemical oxygen demand (COD), turbidity, and total suspended solid. Samples were collected biweekly in the summer and monthly in other seasons.

This report will summarize the data collected for May 2000 till May 2001.

Lake Elsinore

The summary of Lake Elsinore monitoring results is listed in Table 1.

Table 1. Lake Elsinore Nutrient TMDL Monitoring Data Summary (2000 - 2001)

	TP (mg/L)	TKN (mg/L)	Chlorophyll a (ug/L)	DO (mg/L)	Secchi Depth (in)
Mean	0.13	2.50	43.48	6.94	24.63
Standard Error	0.01	0.07	4.61	0.21	1.31
Median	0.12	2.50	38.05	6.71	24.00
Mode	0.11	2.50	20.60	4.60	30.00
Standard Deviation	0.08	0.83	27.65	3.01	8.62
Sample Variance	0.01	0.68	764.37	9.04	74.24
Range	0.86	6.00	119.10	13.96	39.00
Minimum	0.04	0.60	4.90	0.27	6.00
Maximum	0.90	6.60	124.00	14.23	45.00
Sum	15.28	322.78	1565.20	1430.06	1059.00
Count	122.00	129.00	36.00	206.00	43.00

The nutrient concentrations of Lake Elsinore are high, with the mean of total Phosphate as P as 130 ug/L. The total nitrogen has a mean of 2.5 mg/L. The ratio of TN over TP of

22 indicate that the lake is phosphorus limited at the time. Chlorophyll a concentration has a range of 4.9 ug/L to 124 ug/L. Episodes of algal blooms were observed on the Lake in the summer. The lake is mostly well mixed. However, anoxic conditions were observed in the hyperlimnion (DO near zero). The epilimnion is oxygenated, as a result of wind action and algal photosynthesis. The turbidity of Lake Elsinore is high, with the mean of Secchi depth reading as 2 feet.

The observed seasonal trend of TP and TKN in relation to chlorophyll a is shown in Figure 1 and Figure 2. It appears that the TP decreased from the late spring till the fall when the algal biomass peaked. Then the storm in the winter and spring washed new source of TP into the lake, and the TP concentration increased. Same trend holds true for TKN.

Canyon Lake

Table 2 and Table 3 show the summary of Canyon Lake Nutrient TMDL monitoring data for the year 2000 and 2001. Canyon Lake is much deeper than Lake Elsinore and has a better transparency as well (Table 2). As a result, Canyon Lake was stratified in the summer into three layers, with the top layer being warm (temperature as high as 30°C), light and saturated with oxygen. This top layer is called epilimnion, where photosynthesis occurs and algal productivity is high. The bottom layer is colder (15°C), denser and dark. The bottom layer is called hypolimnion. Due to the absence of light and low temperatures, the algal productivity is minimal in the hypolimnion, although the senescent and decomposing algal cells may settle there. In between the epilimnion and hypolimnion is the thermocline where temperature and dissolved oxygen decrease dramatically. Canyon Lake turns over in the fall and stays mixed in the summer.

Table 2. Canyon Lake Water Depth and Secchi Depth *

Sample site	Location Description	Total Depth (ft)	Secchi Depth (in)
CL-07	At Dam	50.00	38
CL-08	North Channel	27.00	48
CL-09	Canyon Bay	19.25	33
CL-10	East Bay	8.65	30

* The numbers listed are the mean of all measurement for each site as of November 2000.

The concentration of TP in Canyon Lake is greater than in Lake Elsinore, with a median of 450 ug/L. But the TKN concentration is less than Lake Elsinore. The median of TN/TP ratio of 7.8 indicates the nitrogen limitation.

The thermal stratification of Canyon Lake has caused chemical stratification as well. The chemical stratification prevents nutrients getting into the photic zone. Algal blooms in Canyon Lake occur when the lake turns over.

Table 3. Canyon Lake Nutrient Water Quality Data
 Summary
 (Regional Water Quality Control Board, May 2000 through May
 2001)

	Ortho-P (mg/L)	Total P (mg/L)	Chlorophyll a (ug/L)	TKN (mg/L)	Nitrate as N (mg/L)	Nitrite as N (mg/L)	Ammonium-N (mg/L)	TKN/TTP ratio
Minimum	ND	0.06	ND	ND	ND	ND	ND	2
Maximum	1.61	1.9	180	7	0.38	ND	5.4	15.7
Median	0.18	0.25	17.6	1.1	ND	ND	0.14	7.8
Mean	NA	0.46	NA	NA	NA	NA	NA	7.97
Std. Dev.	NA	0.59	NA	NA	NA	NA	NA	4.2
25 percentile	0.02	0.12	8.28	0.9	ND	ND	ND	4.4
75 percentile	0.61	0.59	35	1.8	ND	ND	0.4	10
# of data points	116	129	64	139	139	130	143	46
D.L.	0.02	0.02	1	0.5	0.1	0.1	0.1	
Eutrophic Lakes*	>0.02		>10					

ND = Non-detectable

NA = Not applicable

TKN = Total Kjeldahl Nitrogen, a sum of ammonia-N and organic N.

* According to
 USEPA (2000)