Water Quality Report

Kaw Lake
Oklahoma
1996

US Army Corps of Engineers **April 2001**
Southwestern Division
Tulsa District
Planning, Environmental, and Regulatory Division

EXECUTIVE SUMMARY

Water quality data were collected from eight main channel locations and one tailwater location at Kaw Lake, Oklahoma, between April and November 1996. The purposes of the study were to collect sufficient water quality data to define existing limnological conditions and to provide a basis for future water quality investigations.

Kaw Lake exhibited thermal stratification only at the near dam sampling station (OKN0096). However, vertical thermal gradients were observed at all stations located within riverine transition and lacustrine zones of the reservoir. Additional vertical gradients were observed at these same stations in dissolved oxygen and specific conductance, and hypolimnetic oxygen depletion was observed between June and August at all lacustrine stations.

Nutrient concentrations in Kaw Lake were high relative to the range expected in unpolluted surface waters, this was especially true of total phosphorus. Trophic classification of Kaw Lake using epilimnetic total phosphorus concentrations resulted in Kaw Lake being classified as hyper-eutrophic. Because phosphorus has a high affinity to sorb to suspended particulates (especially clays) this trophic state classification may be an overestimate given the short retention time (176 days) and relatively high turbidity of the reservoir.

Iron and manganese were also found in relatively high concentrations. These elements are of aesthetic concern rather than risks to human health. During times of oxygen depletion in the hypolimnion water users could experience staining problems as a result of sediment releases. Analysis of other metals indicated no need for concern at this time.

In summary, water quality in Kaw Lake is acceptable for municipal and industrial water supply and recreation purposes. Agricultural activities in the watershed do not appear to have substantially affected water quality in the reservoir at this time. Awareness is needed for nutrients, iron, and manganese. The reservoir is turbid, which affects recreation uses, aesthetics, and potentially, water supply users because of treatment costs and potential health effects (excluding iron and manganese).

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INTRODUCTION

Between 30 April 1996 and 5 November 1996, a water quality study of Kaw Lake was undertaken by Tulsa District personnel. The primary objective of the Tulsa District's water quality program is to identify existing and potential water quality problems, and evaluate water quality trends. Additionally, this study builds upon historical water quality data (Appendix A) collected in 1978, further increasing the Tulsa District's efforts to provide timely, relevant, and scientifically sound data in support of operational and environmental missions.

DESCRIPTION OF THE STUDY AREA

Kaw Lake is located 8 miles east of Ponca City, Kay County, Oklahoma, within the Northern Limestone Cuesta Plains (Curtis and Ham, 1972). Dominant soils in the project area include the Yahola-Lincoln association in the pre-impoundment floodplain areas. In upland areas the dominant soils include the Shellabarger-Dougherty-Eufaula, Newtonia-Summit-Sogn, and the Sogn-Summit-Labette associations. The soils within the historic floodplain of the Arkansas River are generally deep, sandy soils. The soil series associated with upland areas around the reservoir range from deep, gently sloping, mostly loamy soils to deep to very shallow, level to rolling soils either underlain by limestone or with limestone escarpments (USDA, 1967).

The Kaw Lake dam is located at river mile 653.7 on the Arkansas River (Figure 1 inset). Construction of Kaw Lake was authorized by the 1962 Flood Control Act (PL 87-874), Senate Document (SD) 143, 87th Congress, 2nd Session for the purposes of flood control, hydropower, navigation, water supply, water quality, recreation, and wildlife conservation. Construction of Kaw Dam began in June 1966. Diversion of the Arkansas River began in November 1974, final storage began in April 1976, and the project was placed into useful operation in May 1976 (USACE, 1995). The conservation pool became permanently filled in May 1977.

Kaw Dam is a rolled earthfill embankment rising 125 feet (38.1 meters) above the streambed. The gate-controlled concrete valley spillway is an ogee weir and includes a stilling basin and outlet works. Flow over the spillway is controlled by eight 50 foot by 47 foot tainter gates with a design capacity of 616,200 cfs. Low flow facilities consist of

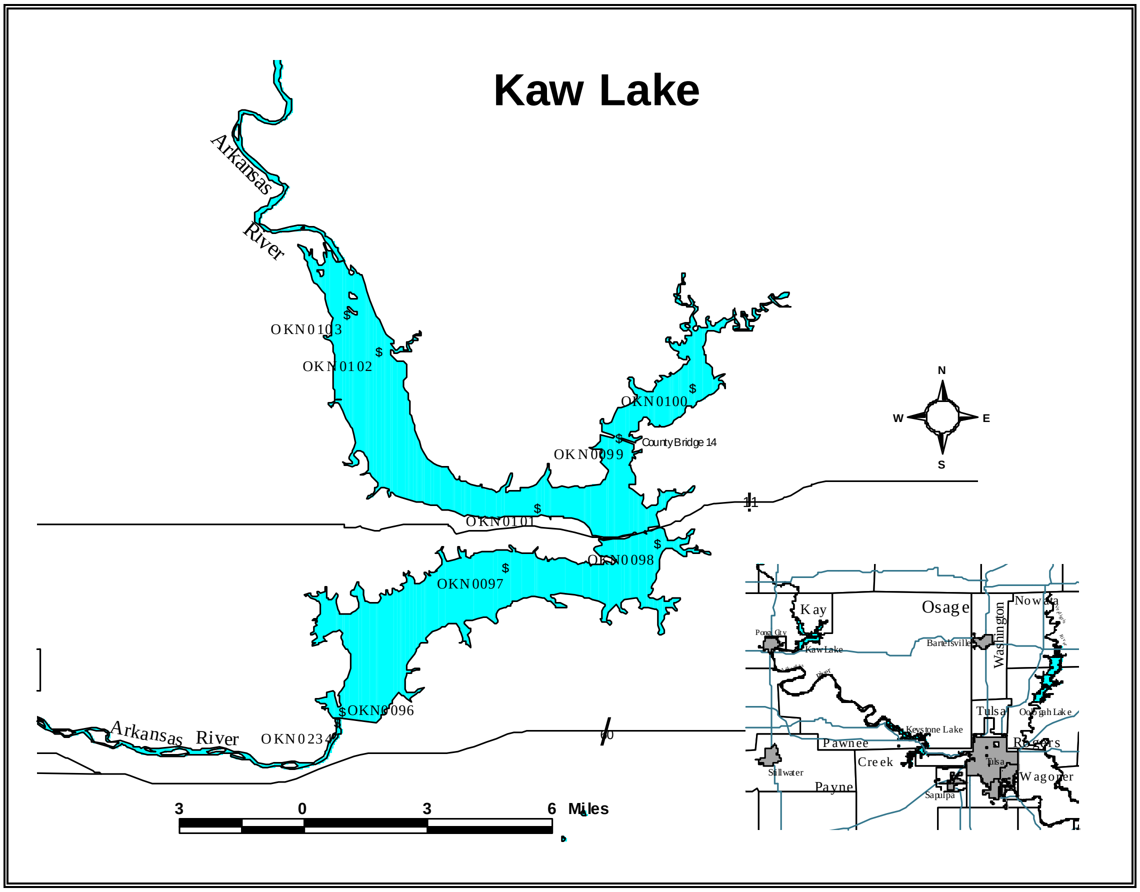

Figure 1. Sampling stations Kaw Lake, Oklahoma, 1996.

two 5.6 foot by 10 foot sluices located through two intermediate piers. A powerhouse substructure, intake monolith, and penstock were incorporated into the original construction of the spillway, however construction of generating facilities did not begin until August 1987. Power generation began in August 1989 under the auspices of the Oklahoma Municipal Power Authority (OMPA) following the installation of a 37 megawatt unit operated by run of river (USACE, 1993 and 1995).

Conservation storage at Kaw Lake is 330,175 acre-feet which includes 171,200 acre-feet for water supply (167 mgd yield), 31,800 acre-feet for water quality control (39 mgd yield), and 140,500 acre-feet for sediment storage (USACE, 1993). Current contracts for water supply from the reservoir include 9,150 acre-feet of present water supply storage and 30,200 acre-feet of future storage with Oklahoma Gas & Electric, and 6,662 acre-feet of present water supply storage and 44,788 acre-feet of future storage with the Stillwater Utility Authority (USACE, 1995). Descriptive characteristics for the lake at conservation pool elevation are listed in Table 1.

Table 1. Descriptive characteristics of Kaw Lake, Oklahoma, at conservation pool elevation.

Conservation Pool Elevation	1010.0 Feet (MSL)
Lake Surface Area	16,750 acres (6778.7 ha)
Lake Volume	406,540 acre-feet (501.6×10^6 m^3)
Drainage Area	6,652 square miles (1.72×10^4 km^2)
Mean Depth (Lake Volume/Surface Area)	61.1 feet (18.6 m)
Shoreline Length	186 mi (299 km)
Total Inflow (1996)	1,727,364 acre-feet (2131.5×10^6 m^3)
Lake Residence Time (Lake Volume/Total Inflow)	176 days

MATERIALS AND METHODS

Water quality samples were collected on eight occasions at Kaw Lake, Oklahoma from 30 April 1996 through 5 November 1996. Eight main channel stations within the reservoir and one tailwater station (Figure 1) were sampled on each sampling date with the exception of stations OKN0103 on 16 July 1996 and OKN0100 on 5 November 1996. Table 2 lists the primary station identification codes and a brief description of each site.

Samples were collected between 0900 and 1500 hours. Field measured parameters collected at each sampling station included depth profiles of water temperature (^oC), dissolved oxygen (DO) (mg/L), pH (standard units), and specific conductance (μS/cm), Secchi depth (m), and turbidity (NTU).

Depth profiles were measured beginning at 0.5 meter intervals at the surface (0.5 and 1 meter depths) and in 1 meter intervals from 1 meter below the surface to approximately 1 meter above the bottom with a Hydrolab Datasonde 3. Turbidity samples were obtained from a depth of approximately 0.5 meters and measured with an Orbeco-Hellige portable turbidity meter. Secchi depth (transparency) was measured at each lake sampling station with a standard Secchi disk following methods described in Lind (1979).

Water samples for laboratory measured parameters were collected in 1-liter clear polyethylene bottles and immediately placed on ice. Laboratory measured parameters (Table 3) were collected from the surface (0.5 meter) at every sampling station during each sampling event and from depth (approximately 1 meter above the bottom) at stations which exhibited oxygen depletion (DO < 2.0 mg/l) in the hypolimnion. As indicated in Table 3, analyses of total alkalinity, chloride, total hardness, total phosphorus, and sulfate were performed by Tulsa District personnel. The remaining laboratory parameters were analyzed by Reclamation Services, Inc., Central City, Kentucky.

Table 2. Station identification code and location of active sampling stations, Kaw Lake, Oklahoma, 1996.

STATION IDENTIFICATION NUMBER*	STATION LOCATION
OKN0234	Stilling Basin
OKN0096	Dam Site
OKN0097	Midlake SW. of Kaw City
OKN0098	Lake Channel S. of HWY 11
OKN0099	County Bridge 14 – Beaver Creek Arm
OKN0100	Otter Creek
OKN0101	Lake Channel N. of Kaw City
OKN0102	Mouth of Bear Creek Cove
OKN0103	Upper Lake W. of Three Islands

* Primary station code of EPA STORET and CESWT DASLER water quality database management systems

Physicochemical data were analyzed for statistical differences using MINITAB 13 (Minitab, Inc., 2000). Differences were considered statistically significant at $\alpha \leq 0.05$. Analyses were performed to determine if the data deviated significantly from that of a normal distribution using the Anderson-Darling normality test. Analysis of Variance (ANOVA) was used to determine spatial and temporal differences between sampling events. When differences between the means (or medians if the distribution of the data was not normally distributed) were detected, Tukey's multiple comparison test was utilized to determine which means/medians were different. The t-test (normally distributed data) or Mann-Whitney U test (non-normally distributed data) was used for comparisons between surface and bottom parameter concentrations.

Table 3. Laboratory measured water quality parameters and associated analytical methodologies (1996 Kaw Lake water quality survey).

PARAMETER	METHOD[4, 5]	PARAMETER	METHOD[3, 4]
Alkalinity, Total (mg/l as $CaCO_3$)[1]	SM 2320 B	Nickel, Total (mg/l)[2]	EPA 249.1
Arsenic, Total (mg/l)[2]	EPA 206.3	Nitrogen, Ammonia (mg/l)[2]	EPA 350.3
Cadmium, Total (mg/l)[2]	EPA 213.1	Nitrogen, Organic, Total (mg/l)[2]	EPA 351.4
Carbon, Organic, Total (mg/l)[2]	EPA 415.2	Nitrogen, Nitrate (mg/l)[2]	EPA 353.3
Chloride (mg/l)[1]	SM 4500 Cl C	Nitrogen, Nitrate (mg/l)[2]	EPA 354.1
Mercury, Total (mg/l)[2]	EPA 245.1	Phosphorus, Total (mg/l)[1]	SM 4500-P C
Chromium, Total (mg/l)[2]	EPA 218.1	Selenium, Total (mg/l)[2]	EPA 270.3
Copper, Total (mg/l)[2]	EPA 220.1	Solids, Dissolved, Total (mg/l)[2]	EPA 160.1
Hardness, Total (mg/l as $CaCO_3$)[1]	SM 2340 C	Solids, Suspended, Total (mg/l)[2]	EPA 160.2
Iron, Total (mg/l)[2]	EPA 236.1	Sulfate (mg/l)[1]	SM 4500 SO_4^- F
Lead, Total (mg/l)[2]	EPA 239.1	Zinc, Total (mg/l)[2]	EPA 289.1
Manganese, Total (mg/l)[2]	EPA 243.1		

1 analyses performed by Tulsa District personnel.
2 analyses performed by Reclamation Services, Inc., Central City, Kentucky
3 SM refers to Standard Methods for the Examination of Water and Wastewater (APHA, 1992)
4 EPA refers to Methods for the Analysis of Water and Wastes (USEPA, 1979)

RESULTS

Summary statistics for laboratory measured water quality parameters are presented in Table 4. All raw data related to laboratory measured water quality parameters is presented in Appendix B. Vertical profiles of water temperature (^{o}C), dissolved oxygen (mg/l), pH (standard units), and specific conductance (uS/cm) for select sampling stations are found in Appendix C. Hydrolab data (i.e. vertical profile data) for all stations and dates are presented in Appendix D, Tables D-1 through D-9.

Table 4. Descriptive statistics for selected water quality parameters, all sites and depths, Kaw Lake, Oklahoma, 1996.

Parameter	Median	Mean	Min[2]	Max	No. Obs.
Alkalinity, Total (mg/l as CaCO)	120.0	129.3	84.0	216.0	97
Arsenic, Total (mg/l)			< 0.01		82
Cadmium, Total (mg/l)			< 0.01		82
Carbon, Organic, Total (mg/l)	4.35	4.94	2.7	4.6	81
Chloride (mg/l)	210.0	190.5	60.0	310.0	97
Chromium, Total (mg/l)			< 0.01		82
Copper, Total (mg/l)			< 0.01		82
Hardness, Total (mg/l as CaCO)	192.0	198.4	82.0	312.0	97
Iron, Total (mg/l)	0.350[1]	0.959[1]	< 0.01	10.57	82
Lead, Total (mg/l)			< 0.01		82
Manganese, Total (mg/l)	0.070[1]	0.156[1]	< 0.01	1.49	82
Mercury, Total (mg/l)			< 0.02		82
Nickel, Total (mg/l)			< 0.01		82
Nitrogen, Ammonia (mg/l)	0.138	0.203	0.015	1.01	82
Nitrogen, Organic, Total (mg/l)	0.650	0.725	0.020	4.60	82
Nitrogen, Nitrate (mg/l)	0.820	0.881	0.01	6.00	82
Nitrogen, Nitrite (mg/l)	0.020[1]	0.031[1]	< 0.005	0.20	82
Phosphorus, Total (mg/l)	0.167	0.193	0.07	0.914	97
Secchi Depth (m)	0.30	0.41	0.01	1.20	13
Selenium, Total (mg/l)			< 0.01		82
Solids, Dissolved, Total (mg/l)	590.0	667.3	150.0	5430.0	73
Solids, Suspended, Total (mg/l)	25.0	58.5	1.0	1346.0	82
Sulfate (mg/l)	28.8	27.5	3.9	119.2	97
Turbidity (NTU)	34.9	60.5	5.5	765.0	69
Zinc, Total (mg/l)	0.03[1]	0.03[1]	<0.01	0.09	82

1 reported values for mean and median are were calculated with values that were above the practical quantitation limit

2 when only a minimum value is reported concentrations in all samples were below the practical quantitation limit

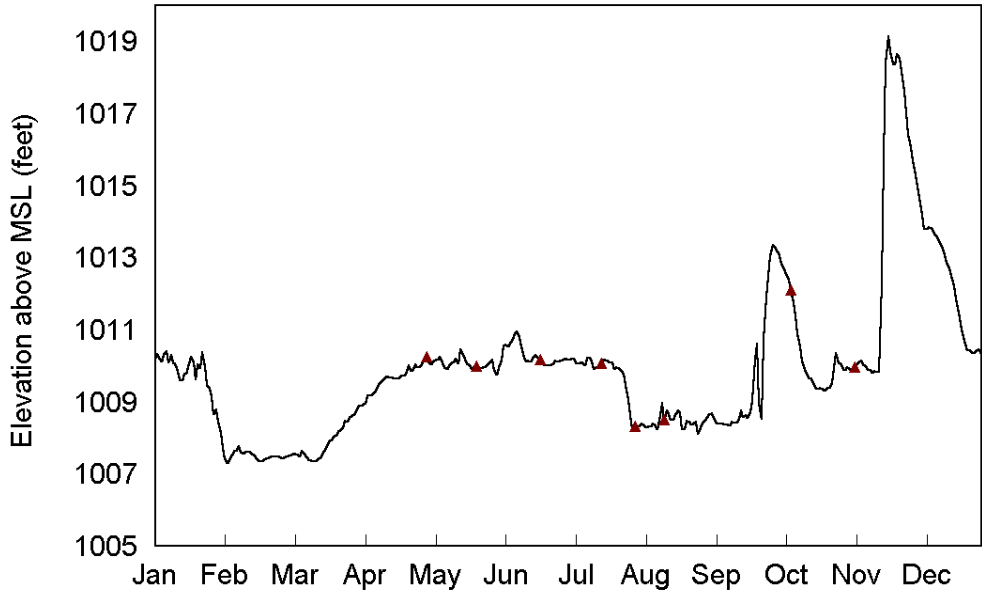

Figure 2. Daily lake elevation (feet above MSL) at 0800 hours, Kaw Lake, Oklahoma, 1996 (triangles represent individual sampling dates).

Lake elevation relative to individual sampling events is illustrated in Figure 2 and monthly charts of pertinent reservoir data (e.g. elevation, inflow, rainfall, etc...) are provided in Appendix E.

Vertical Profiles - Water Temperature

Vertical profiles of Kaw Lake during the course of this water quality survey are typical to those of other turbid reservoirs within the Tulsa District. To some extent, thermal gradients were observed at all sampling stations, however, due to the shallow nature of upper portions of the reservoir (OKN0102 and OKN0103) only minor differences between surface and bottom water temperatures were observed (generally not less than 1 ^{o}C). Thermal stratification (i.e. a change in water temperature greater than 1 ^{o}C per meter (Wetzel, 1983)) was observed at only one station (Station OKN0096). Across all sampling sites and dates surface water temperatures ranged from a minimum of 10.05 ^{o}C (Station OKN0102 on 5 November 1996) to a maximum of 30.20 ^{o}C (Station OKN0103 on 31 July 1996) with an average of 22.34 ^{o}C. The spatial and temporal water temperature dynamics observed throughout this study at

OKN0098 (Figure 3) are generally representative of the vertical water temperature distribution throughout the reservoir.

Water temperatures did not exhibit a high degree of variability between surface and bottom values in the early spring and late fall indicating total mixing of the water column. An increase in surface water temperature and development of a vertical temperature gradient was observed throughout the late spring, summer and early fall. The extent of the vertical gradient was directly related to station depth with near dam stations exhibiting greater temperature gradients and, at Station OKN0096, thermal stratification. The spatial and temporal dynamics in water temperature strongly influence the rates of chemical and metabolic reactions and can prevent the circulation of water between the epilimnion and hypolimnion for extended periods of time, ultimately affecting the distribution of fish and macroinvertebrates.

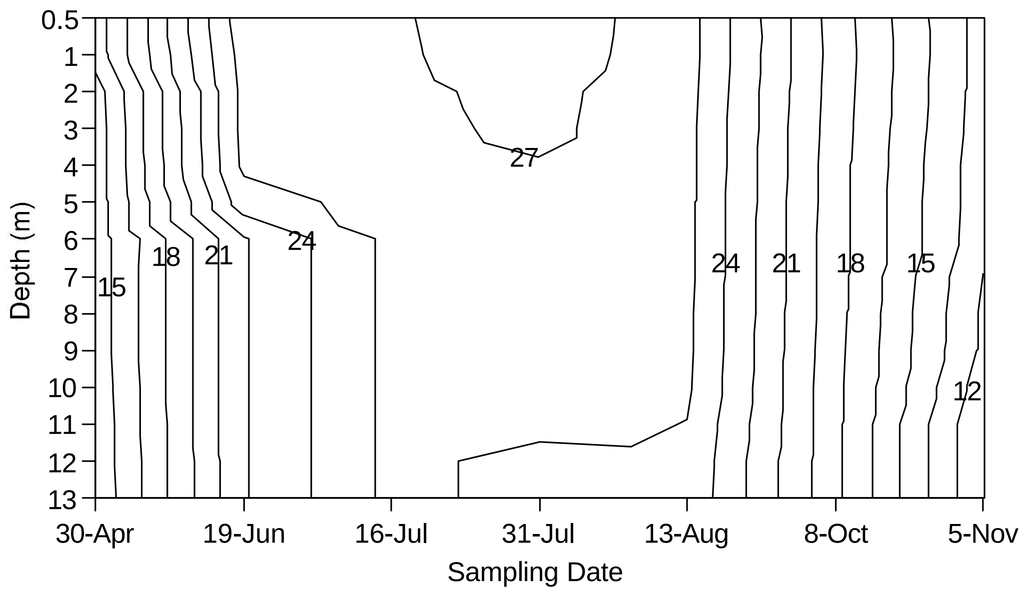

Figure 3. Depth-time diagram of temperature (°C) isopleths at Station OKN0098, 30 April 1996 through 5 November 1996, Kaw Lake, Oklahoma.

Vertical Profiles - Dissolved Oxygen

Dissolved oxygen in water is principally due to the rate of diffusion from the atmosphere, turbulence, oxidation, photosynthesis, and the rate of biotic respiration. During this study, surface concentrations of dissolved oxygen ranged from 3.69 mg/l (Station OKN0098 on 13 August 1996) to 12.21 mg/l (Station OKN0103 on 5

November 1996) with an average concentration of 7.69 mg/l (7.37 mg/l median). Dissolved oxygen concentrations at depth (approximately 1 meter above the bottom) ranged from 0.15 mg/l (Station OKN0099 on 31 July 1996) to 9.73 mg/l (Station OKN0101 on 5 November 1996) with an average concentration of 3.07 mg/l (0.52 mg/l median). The depth-time isopleth of dissolved oxygen concentrations at Station OKN0097 (Figure 4) is typical of the dissolved oxygen dynamics observed during this study at down-reservoir sampling stations. At these stations (OKN0096, OKN0097, OKN0098, and OKN0101), dissolved oxygen concentrations below 2 mg/l were consistently encountered from late May through July in the hypolimnion. The riverine sampling stations (OKN0099, OKN0100, OKN0102, and OKN0103) exhibited either intermittent occurrences of dissolved oxygen concentrations below 2 mg/l (Figure 5), or did not exhibit any dissolved oxygen concentrations below 2 mg/l. Spatial and temporal changes in dissolved oxygen concentrations can greatly affect the distribution of fish and macroinvertebrates in the water column. Levels of dissolved oxygen present in the water column are closely tied to water temperature and salinity through an inverse function, thus as temperature and/or salinity increase the dissolved oxygen concentration will decrease.

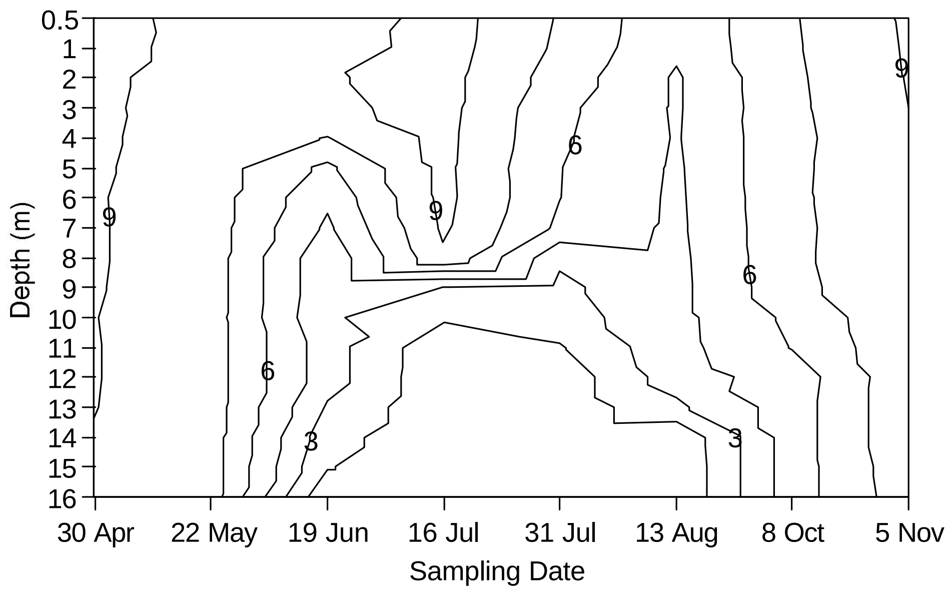

Figure 4. Depth-time diagram of dissolved oxygen (mg/l) isopleths at Station OKN0097, 30 April 1996 through 5 November 1996, Kaw Lake, Oklahoma.

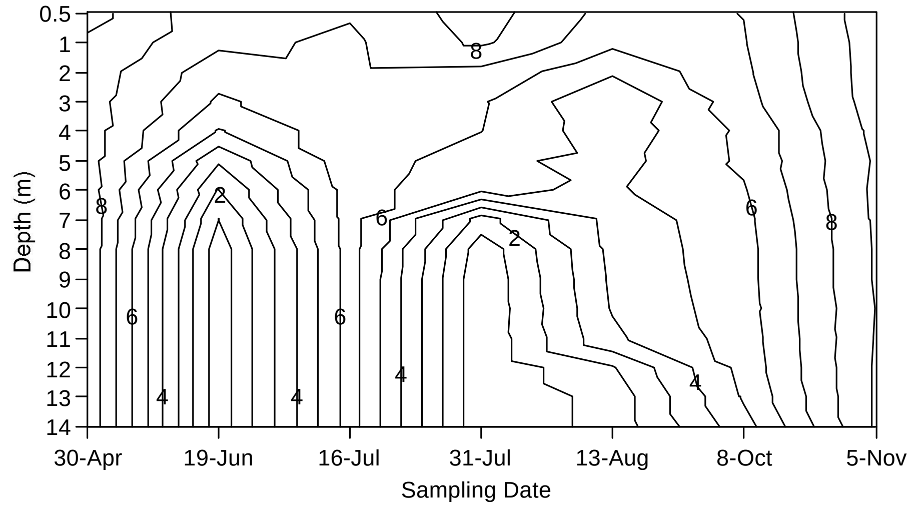

Figure 5. Depth-time diagram of dissolved oxygen (mg/l) isopleths at Station OKN0099, 30 April 1996 through 5 November 1996, Kaw Lake, Oklahoma.

Vertical Profiles – Specific Conductance and Salinity

Specific conductance is a measure of the electrical conductivity of lake water and is directly affected by increases in water temperature and ionic content. This measurement is similar to conductivity however, unlike conductivity, specific conductance is referenced to a standard temperature of 25 ^{o}C allowing for spatial and temporal comparisons. Specific conductance and total dissolved solids are often used as surrogate measures for salinity, but these parameters do not by themselves adequately describe what ions are responsible for the salinity within a given body of water. Salinity and total dissolved solids in fresh water is attributed to four major cations (Ca^{++}, Mg^{++}, Na^{+}, K^{+}) and four major anions (HCO_3^-, $CO_3^=$, SO_4^-, Cl^-) (Wetzel, 1983). Additional surrogate measures used to asses the salinity of a water body are hardness, an indirect measure of Ca^{++} and Mg^{++}, and alkalinity, an indirect measure of HCO_3^- and $CO_3^=$, both of which are important measures of the buffering capacity of aquatic systems.

Sulfur and chlorine are both important micronutrients in aquatic systems. Sulfur is important in protein structure and cell division, but rarely limits the growth or distribution of aquatic biota (Horne & Goldman, 1994). In aquatic systems sulfate (SO_4) is the predominant form of sulfur. Its predominance is a result of bacterial oxidation of hydrogen sulfide (H_2S) released from highly organic anoxic sediments. Nearly all assimilation of sulfur in aquatic systems is as sulfate (Wetzel, 1983). Although chlorine is the most abundant halogen, in most fresh water systems the chloride ion does not typically dominate. The chloride ion is required in photosynthesis, ATP formation, and other phosphorylation reactions and due to its ease of measurement is often used to identify water bodies affected by chlorinated wastes (e.g. road salt and municipal waste).

In 1996, specific conductance values in Kaw Lake ranged from 433 μS/cm to 1503 μS/cm, with a mean of 1044 μS/cm and total dissolved solids ranged from 150 mg/l to 5430 mg/l, with a mean of 667.3 mg/l. As shown in Figure 6, specific conductance showed no clear trend in spatial distribution. Total dissolved solids tended to increase slightly, on average, with depth at stations in the main stem of the Arkansas River (Figure 7). Conversely, in the Beaver Creek arm of the reservoir specific conductance values and total dissolved solids concentrations decreased with depth. One-way Analysis of Variance (ANOVA) failed to detect a significant difference in concentrations of specific conductance, total dissolved solids, chloride, and sulfate between individual sampling stations and the Mann-Whitney U test did not detect significant differences between surface and bottom concentrations. Significant differences were found between sampling dates for all four parameters ($F = 8.99$, $p < 0.001$ for specific conductance and $F = 11.79$, $p < 0.001$ for total dissolved solids, $F = 23.03$, $p < 0.001$ for chloride, and $F = 61.13$, $p < 0.001$ for sulfate). Significant temporal differences were detected among median concentrations of specific conductance and total dissolved solids with concentrations on 8 October 1996 determined to be statistically different from those on all other sampling dates (Figures 8 and 9). This difference corresponded with a rainfall event on 26 September 1996 (Figure 2).

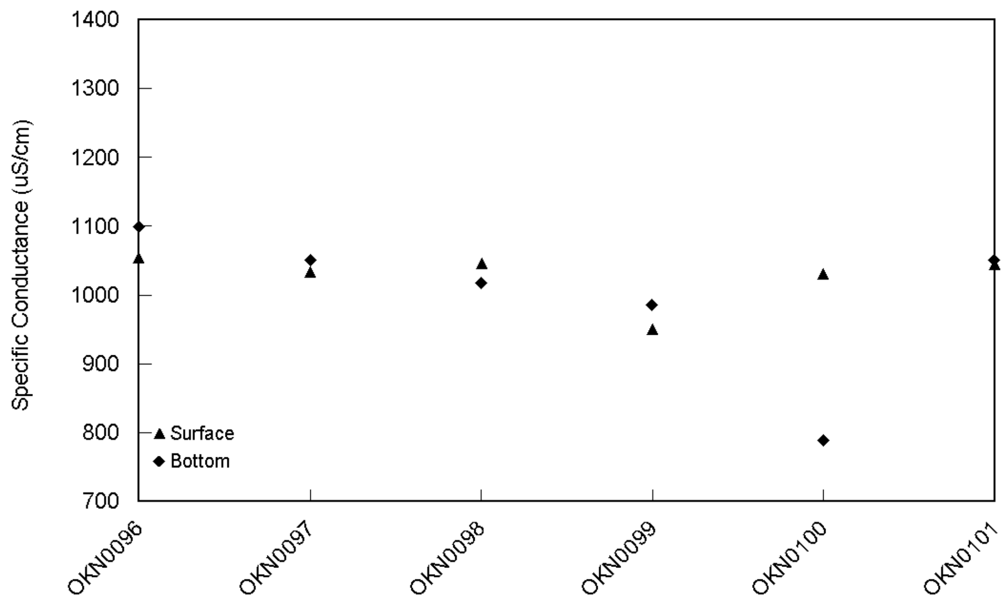

Figure 6. Mean surface and bottom values of specific conductance (µS/cm) by station, Kaw Lake, Oklahoma, 1996.

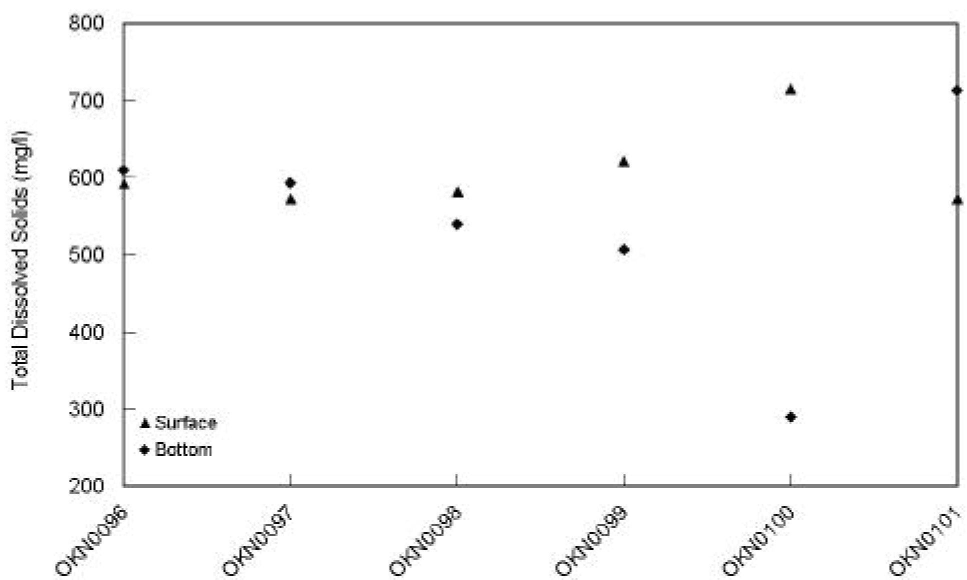

Figure 7. Mean surface and bottom concentrations of total dissolved solids (mg/l) by station, Kaw Lake, Oklahoma, 1996.

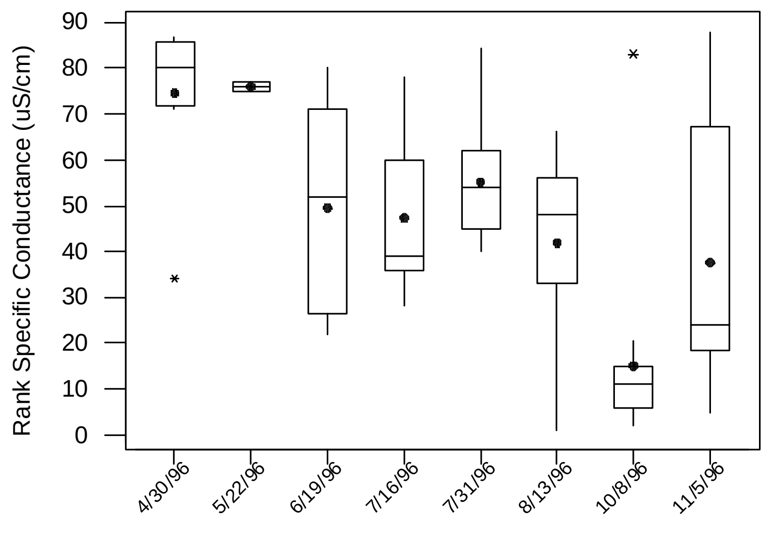

Figure 8. Specific conductance (μS/cm) variability (ranked data), Kaw Lake, Oklahoma, 1996.

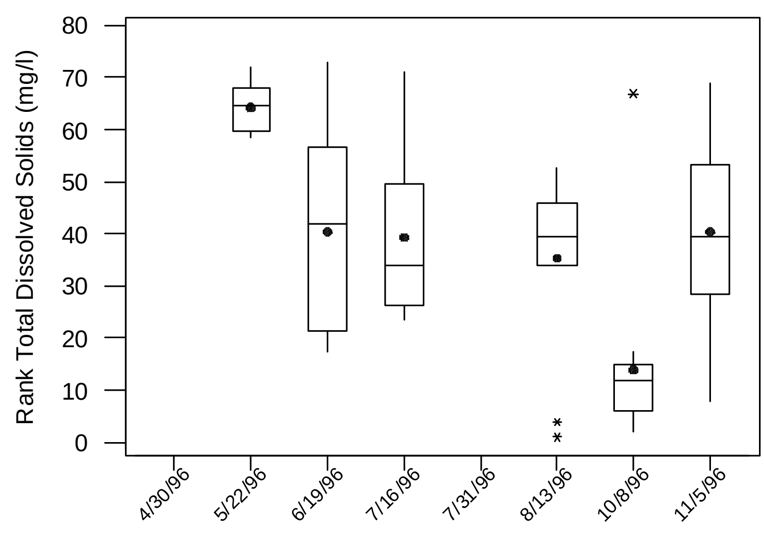

Figure 9. Total dissolved solids (mg/l) variability (ranked data), Kaw Lake, Oklahoma, 1996 (TDS was not sampled on 31 July 1996).

Temporal differences in chloride concentrations within the reservoir were greater in the spring and summer, and then decreased following the rainfall events in September when, as a result of greater inflows, total loadings into the reservoir would have increased but concentrations would have decreased. Tukey's multiple comparison test ($\alpha = 0.05$) separated chloride concentrations into three groups as follows:

$$\text{May} \leq \text{Apr} \leq \text{31 Jul} \neq \text{16 Jul} \leq \text{Jun} \leq \text{Aug} \neq \text{Nov} \leq \text{Oct}$$

Temporal differences in sulfate concentrations are opposite those exhibited by chlorides with lower concentrations present in the spring, and increases in sulfate concentrations through the summer and into the fall (Figure 10). The increase in concentrations observed from July and into November corresponds, at least in part, with a decrease in hypolimnetic oxygen concentrations and are likely related to internal sulfur loadings from the release and subsequent oxidation of hydrogen sulfide from the sediment.

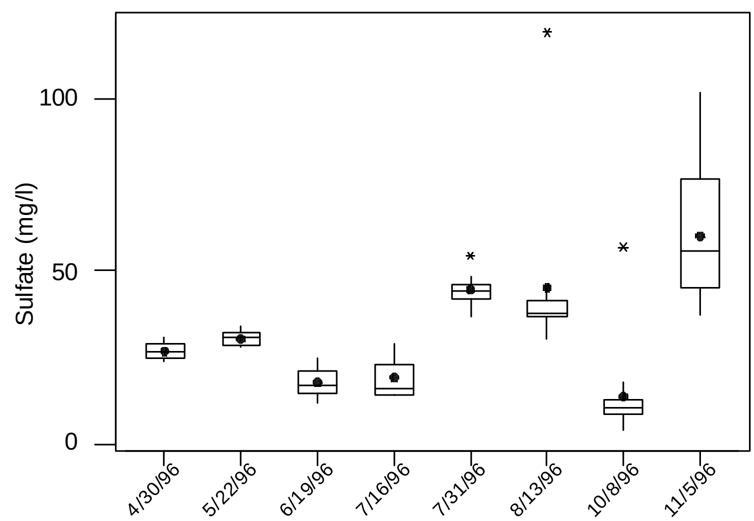

Figure 10. Sulfate (mg/l) variability between sampling dates, Kaw Lake, Oklahoma, 1996.

Alkalinity, pH, and Hardness

Alkalinity is a measure of the capacity of water to neutralize acids. The measurement refers to the carbon dioxide (CO_2) – bicarbonate (HCO_3^-) – carbonate ($CO_3^=$) equilibrium system and is used to quantify those compounds which can resist changes in pH (hydrogen ion concentration) (Cole, 1994 and Wetzel, 1983). Alkalinity is important for several reasons: 1) it buffers pH (hydrogen ion concentration) changes that occur naturally as a result of photosynthetic activity, which can affect aquatic life, 2) it is used in the interpretation and control of water and wastewater treatment, and 3) it is used to determine the suitability of a water for irrigation. In addition, components of alkalinity will form a complex with some toxic metals and significantly reduce their toxicity. When total alkalinity is at or below 20 mg/l as $CaCO_3$, the water is considered to be poorly buffered (USEPA , 1986).

Hardness in water is a function of divalent, or polyvalent, cations present in the water column and is directly affected by the geologic characteristics of the watershed. Natural sources of hardness are sedimentary rocks and limestone. The two components of total hardness are described as temporary hardness and permanent hardness. Temporary hardness is governed by the content of calcium and magnesium salts combined with bicarbonate and carbonate and is equal to the total alkalinity. Permanent hardness is governed by the content of calcium and magnesium salts combined with sulfates, chlorides, and other anions of mineral acids and is equal to amount of hardness in excess of temporary hardness (alkalinity) (Wetzel, 1983). It is the permanent, or non-carbonate, hardness that is responsible for the scale deposits on cookware and other household items associated with hard water. Like alkalinity, components of hardness will form a complex with some toxic metals and significantly reduce their toxicity.

Total alkalinity in Kaw Lake ranged from 84.0 mg/l as $CaCO_3$ to 216 mg/l as $CaCO_3$, with a mean of 129.3 mg/l as $CaCO_3$, indicating that the lake is well buffered against sudden pH changes. Alkalinity in Kaw Lake does not exceed the raw water maximum criterion for industrial uses associated with electric utilities or petroleum refining. One-way ANOVA detected no significant difference in median concentrations of total alkalinity between sampling stations or between surface and bottom concentrations ($F = 0.36$, $p = 0.940$ and $F = 0.00$, $p = 0.990$ respectively), but did detect significant differences in the median concentrations between sampling dates (F = 16.86, $p < 0.001$). Alkalinity values were lower during periods of higher primary productivity (June through October) when the overall rate of photosynthesis in the reservoir is highest, and values were greater in April, May and November (Figure 11).

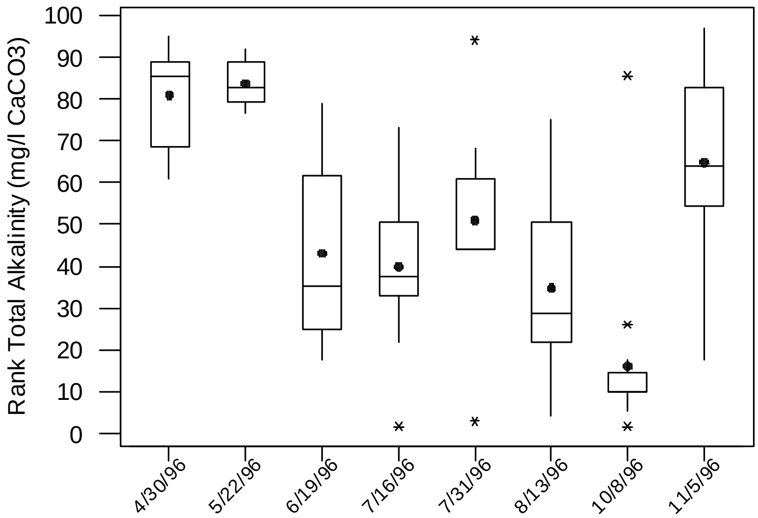

Figure 11. Temporal total alkalinity variability (mg/l as $CaCO_3$) (ranked data), Kaw Lake, 1996.

Hardness values ranged from 82.0 mg/l as $CaCO_3$ to 312.0 mg/l as $CaCO_3$, with a mean of 198.4 mg/l as $CaCO_3$. Water hardness has been classified by the U.S. EPA into the following four categories (USEPA, 1986):

Concentration (mg/l as $CaCO_3$)	Description
0 – 75	Soft
75 – 150	Moderately Hard
150 – 300	Hard
300 and up	Very Hard

Hardness values present in the reservoir during this study indicate that water from Kaw Lake is best classified as hard water based upon the above classification. Although Kaw Lake is classified as a hard water reservoir, hardness values did not exceed the accepted industrial harness levels for raw water sources of 5000 mg/l as $CaCO_3$ for electric utilities and 900 mg/l as $CaCO_3$ for petroleum refining. One-way ANOVA did not detect a significant difference in median hardness concentrations between sampling stations and sampling depth (i.e. top and bottom) ($F = 0.\ 0.31$, $p = 0.960$ and $F = 1.0$, $p = 0.319$ respectively). Differences in median concentrations between sampling dates were found to be significant ($F = 20.75$, $p < 0.001$) and followed the seasonal trend exhibited by total alkalinity (i.e. greater in the spring and fall, lower in the summer).

pH values ranged from 7.81 standard units to 9.89 standard units, with a median of 8.39 standard units. Wetzel (1983) identifies the pH range for most lakes to be between 6 and 9. The pH range in Kaw Lake is reflective of the alkaline nature of prairie soils and is typical of other turbid reservoirs in the Tulsa District.

Water Clarity

Two measures directly associated with water clarity include Secchi disk transparency (meters) and turbidity (NTU). A third measure correlated with water clarity is total suspended solids (mg/l). Secchi disk transparency is the mean depth of the point where a weighted black and white disk, 20 cm in diameter, disappears when viewed from the shaded side of a vessel, and that point where it reappears upon raising it after it has been lowered beyond visibility. It has been calculated that the disk disappears at approximately the region of transmission of 21% full sunlight. Three times the Secchi disk depth roughly approximates the photosynthetic, or photic, zone of the lake where light levels are greater than 1% of full sunlight (Cole, 1994).

Turbidity, measured in Nephelometric Turbidity Units (NTU), can be viewed as a qualitative measure of water clarity which describes the opaqueness produced in water by suspended particulate mater (e.g. clay, silt, plankton). The higher the turbidity value, the more turbid the water.

In contrast, total suspended solids is a quantitative measure of suspended particulate mater and is reported in mg/l, however, the relationship between concentration and turbidity remains the same. The loadings of total suspended solids into a reservoir can impact aquatic organisms in many ways. Because soluble forms of nitrogen and phosphorus have a high affinity to sorb to suspended particles (primarily clays), nutrient availability within a reservoir can be potentially impacted. Increases in turbidity and suspended solids can decrease the photic zone of the reservoir potentially impacting food availability to zooplankton and planktivorous fish. Additional impacts on fish can include growth rate reductions, decreased resistance to disease, modification of natural movements, and prevention of the successful development of fish eggs and larvae, with similar impacts identified for macroinvertebrate populations (USEPA, 1986).

Secchi disk transparency ranged from 0.01 meter to 1.20 meter, with a mean of 0.41 meter. The maximum Secchi depth was observed at OKN0097 SW of Kaw City on 16 July 1996. Within Kaw Lake there is a well defined gradient of decreasing Secchi depth up-reservoir from the dam (Figure 12). One-way ANOVA detected a significant difference in Secchi depth between sampling stations ($F = 11.78$, $p < 0.001$) but failed to detect a significant difference in Secchi depth between sampling dates ($F = 1.94$, $p = 0.085$).

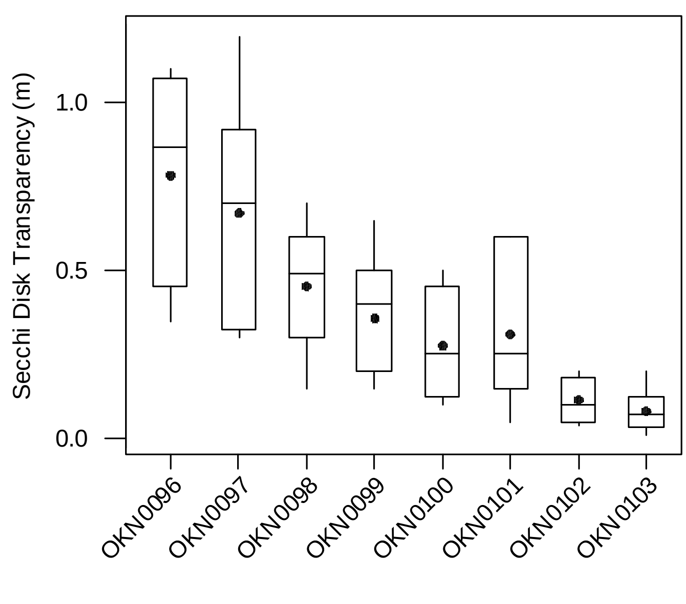

Figure 12. Secchi disk transparency (m) variability at each sampling station 30 April 1996 through 5 November 1996, Kaw Lake, Oklahoma.

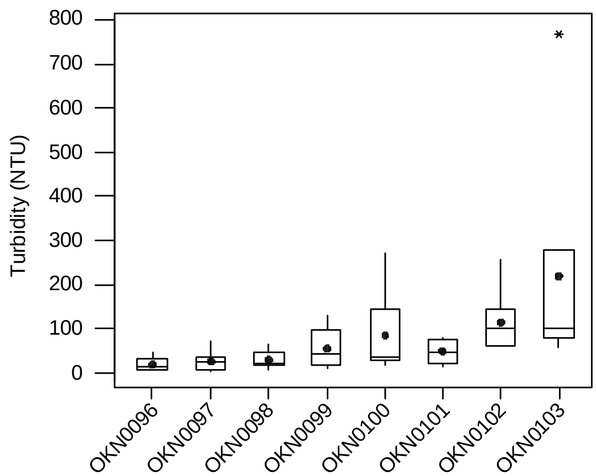

Figure 13. Turbidity (NTU) variability at each station 30 April 1996 through 5 November 1996, Kaw Lake, Oklahoma.

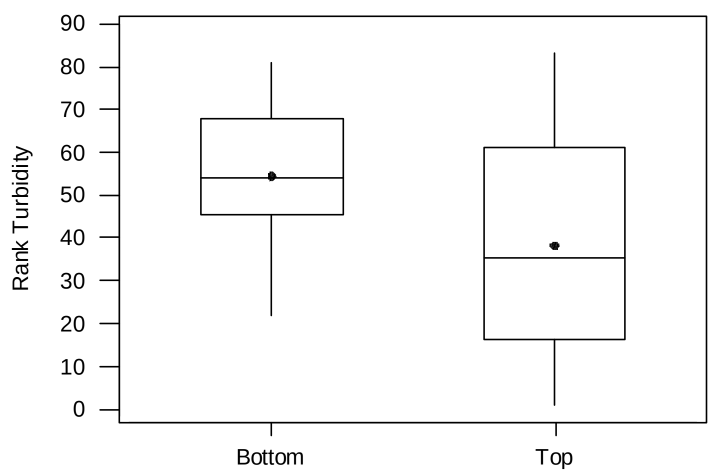

Figure 14. Rank turbidity (NTU) variability at surface and bottom depth 30 April 1996 through 5 November 1996, Kaw Lake, Oklahoma.

Turbidity values ranged from 5.5 NTU to 765 NTU, with a mean of 60.5 NTU (median 34.9 NTU). As might be expected, mean turbidity was lowest at the damsite and greatest in the riverine portion of the reservoir at stations OKN0102 and OKN0103 (Figure 13), and a one-way ANOVA detected a significant difference in median turbidity values between sampling sites ($F = 8.47$, $p < 0.001$). A significant difference was also detected between the surface and bottom turbidity (Mann-Whitney U test, $p = 0.009$) with median values greater at the bottom (Figure 14).

Total suspended solids ranged from 1.0 mg/l to 1346 mg/l, with a mean of 58.5 mg/l (median 25.0 mg/l). The spatial trend exhibited by total suspended solids is similar to that of turbidity with a greater concentration of solids present in the riverine portions of the reservoir. As expected, turbidity and total phosphorus were significantly positively correlated with total suspended solids (Spearman's Rank Correlation $r = 0.923$, $p < 0.001$ and $r = 0.773$, $p < 0.001$ respectively) and Secchi depth was significantly negatively correlated ($r = -0.97$, $p < 0.001$) with total suspended solids. One-way ANOVA did detect a significant difference in median total suspended solids concentrations between individual sampling stations and between individual sampling dates ($F = 9.48$, $p < 0.001$ and $F = 3.17$, $p = 0.001$ respectively). No significant difference was found between surface and bottom concentrations (Mann-Whitney U Test, $p = 0.105$).

Macronutrients

Nitrogen and phosphorus are essential nutrients for growth and development and are the primary factors that determine algal production (biomass) (USEPA, 2000). Water samples in this study were analyzed for the following nutrients: ammonia nitrogen, nitrite, nitrate, organic nitrogen and total phosphorus. In fresh waters, nitrogen is found primarily in two gaseous forms (nitrogen and nitrous oxide) and four combined non-gaseous forms (amino and amide groups, ammonia, nitrite, and nitrate).

<u>Nitrogen Series</u>

Ammonia (NH_3) is released in water from proteinaceous material or urea. Plants easily and rapidly take up ammonia. It is also converted to nitrate via nitrite by soil and water bacteria. The levels of ammonia in unpolluted surface waters generally ranges from 0 to 5 mg/l. In Kaw Lake, ammonia concentrations ranged from 0.015 mg/l to 1.01 mg/l, with a mean of 0.203 mg/l (median 0.138 mg/l). Ammonia was present in all samples above the detection limit and there were no significant spatial or temporal differences in ammonia concentrations between sampling stations, sampling depths, and sampling dates ($p \geq 0.05$).

Nitrite (NO_2) is usually in very low concentrations in fresh waters because it is quickly oxidized to nitrate. Nitrite concentrations are extremely low in unpolluted surface waters and generally range from 0 to 0.01 mg/l. In Kaw Lake, nitrite concentrations ranged from 0.005 mg/l to 0.2 mg/l, with mean concentration of 0.031 mg/l). Nitrate (NO_3) also occurs in small concentrations in unpolluted fresh waters. Under normal conditions, nitrate in solution at any given time is determined by metabolic processes within the waterbody (i.e. production and decomposition of organic matter). Nitrate is easily taken up by green plants, including algae, as a nitrogen source and is extremely important as a nutrient in supplying nitrogen for protein synthesis. In unpolluted fresh waters, nitrate concentrations can range from 0 to 10 mg/l. In Kaw Lake nitrate concentrations ranged from 0.01 mg/l to 6.0 mg/l, with mean of 0.881 mg/l. However, because of the low concentrations of nitrite frequently encountered in fresh waters nitrite and nitrate concentrations are more commonly reported as nitrite + nitrate.

Across all sampling sites, sampling dates, and sampling depths, nitrite + nitrate concentrations in Kaw Lake ranged from 0.01 mg/l to 6.0 mg/l (mean 0.898 mg/l). At the surface nitrite-nitrate ranged from 0.015 mg/l to 6.0 mg/l (mean 0.918 mg/l) and from 0.048 mg/l to 2.20 mg/l (mean 0.835 mg/l) at depth. Nitrite + nitrate concentrations were detected in 100 % of the surface and bottom samples. No significant difference between sampling sites and sampling depths was detected. One-way ANOVA did detect a significant difference between sampling dates ($F = 4.68$ $p < 0.001$).

The synthesis of inorganic substances into plant and animal tissues and the metabolic processes of protoplasm produce various compounds containing nitrogen (organic nitrogen compounds) (Reid, 1965). Examples include animal and plant protein, urea, uric acid, polypeptides, and amino compounds. Total organic nitrogen is calculated from the mass of total nitrogen minus the dissolved fractions of nitrate and ammonia. In Kaw Lake, total organic nitrogen concentrations ranged from 0.02 mg/l to 4.6 mg/l across all sampling sites, depths, and dates, with a mean of 0.725 mg/l. At the surface total organic nitrogen ranged from 0.02 mg/l to 4.6 mg/l (mean 0.742 mg/l) and at depth values ranged from 0.428 mg/l to 1.62 mg/l (mean 0.677 mg/l). One-way ANOVA and Mann-Whitney U test did not detect a significant difference in total organic nitrogen concentrations between sampling sites and depths respectively ($p \geq 0.05$), but at the surface there is a an identifiable trend of organic nitrogen concentrations increasing up-reservoir from the dam (Figure 15). Temporal differences in total organic nitrogen concentrations were significant (one-way ANOVA $F = 5.87$, $p < 0.001$) with concentrations on 30 April 1996 significantly less than concentrations present on all other sampling dates. Taken in concert, all nitrogen species (ammonia, nitrite, nitrate, and total organic nitrogen) can be summed to approximate the total nitrogen content. The ratio of total nitrogen to total phosphorus (discussion below) can then be used to assess general relationships in lake productivity as well as identify which of these two nutrients is potentially limiting primary productivity.

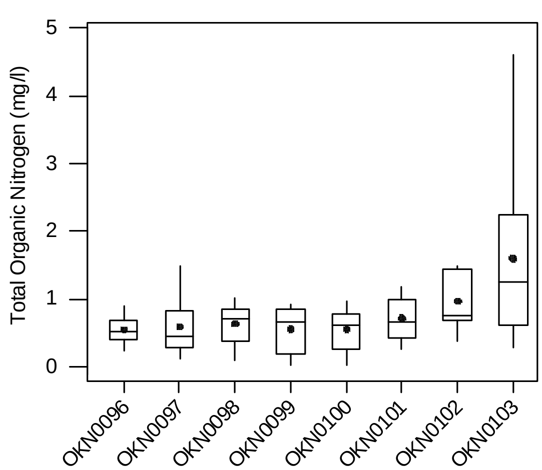

Figure 15. Surface total organic nitrogen (mg/l) variability at each station across all sampling dates, 30 April 1996 through 5 November 1996, Kaw Lake, Oklahoma.

Phosphorus

While phosphorus, in its inorganic state is most commonly present as orthophosphate, more than 90 % of the phosphorus present in fresh waters occurs as organic phosphates and cellular constituents in the biota that are adsorbed to either inorganic or dead particulate organic matter (Wetzel, 1983). Phosphorus has a major role in the metabolism of plants and animals and is a key nutrient stimulating plant growth in lakes. Because phosphorus is less abundant than carbon, nitrogen, oxygen, and sulfur (other nutritional and structural components), it can often limit biological productivity of aquatic ecosystems (Wetzel, 1983), and epilimnetic concentrations can be used to indicate a lake's general trophic status (level of productivity).

The concentrations of total phosphorus encountered in unpolluted surface waters generally ranges from 10 to 50 μg/l (0.01 to 0.05 mg/l). In Kaw Lake, total phosphorus concentrations ranged from 27 μg/l to 914 μg/l (mean 193 μg/l) across all sampling sites, depths, and dates. At the surface, concentrations ranged from 27 μg/l to 914 μg/l (mean 182 μg/l) with bottom concentrations ranging from 83 μg/l to 505 μg/l (mean 221 μg/l). Total phosphorus was present in 100% of both surface ($n = 71$) and bottom ($n = 26$) samples. Total phosphorus concentrations did exhibit both spatial and temporal patterns. One-way ANOVA detected significant differences in the median concentrations between sampling sites and between sampling dates ($F = 2.96$, $p = 0.008$ and $F = 7.78$, $p < 0.001$ respectively). Spatially, concentrations were greater at up-reservoir stations relative to the down-reservoir stations and increased significantly with depth (Mann-Whitney U test, $p = 0.026$). Temporally, the lake wide median concentrations increased sequentially on each sampling trip during the period of this study with one exception. Total phosphorus concentrations (lake-wide median) decreased significantly 31 July 1996 (Tukey's multiple comparison test, $\alpha = 0.05$) and by 13 August 1996 had increased to concentrations greater than those observed on 16 July 1996 prior to the observed decrease (Figure 16).

The epilimnetic concentration of total phosphorus is often used to estimate lake productivity, or trophic state. Vollenweider showed that the amount of total phosphorus generally increased with lake productivity (Wetzel, 1983). The general relationship of

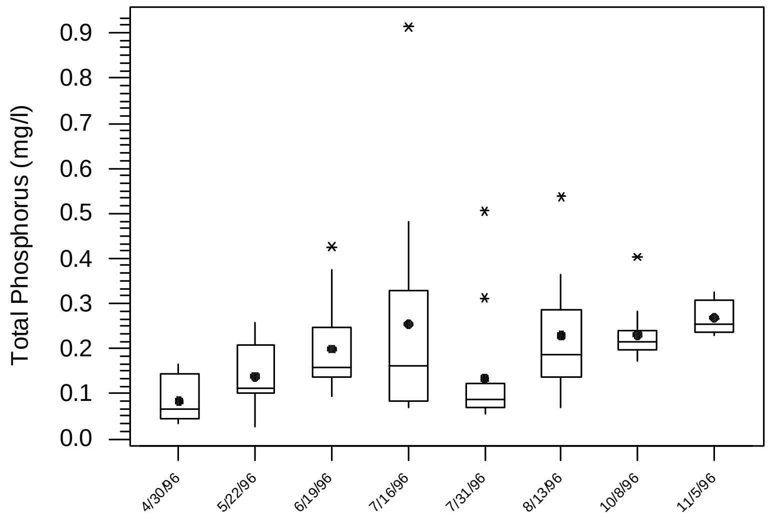

Figure 16. Total phosphorus variability at each station across all sampling dates and depths, 30 April 1996 through 5 November 1996, Kaw Lake, Oklahoma.

lake productivity to average concentrations (μg/l) of epilimnetic total phosphorus is as follows:

Ultra-oligotrophic	< 5
Oligo-mesotrophic	5 – 10
Meso-eutophic	10 – 30
Eutrophic	30 – 100
Hyper-eutrophic	> 100

Based on this approach, Kaw Lake would be considered hyper-eutrophic.

The ratio of total nitrogen to total phosphorus is helpful in exploring nutrient limitation of the phytoplankton in a lake. This ratio is insightful if we assume that total phytoplankton production in the spring and summer are limited by a macronutrient. Generally when the ratio is less than 10, nitrogen is the limiting of the two nutrients. When the ratio is greater than 20, phosphorus is limiting. In Kaw Lake the mean N:P ratio was 7.7 and ranged from 1.02 to 53.31. Spatially no clear trend among the sampling stations is evident. Table 5 details the N:P ratios at individual stations on individual dates. N:P ratios were, on average, greater at OKN0096 and at the sampling stations in Beaver and Otter Creeks (OKN0099 and OKN0100 respectively). Temporally the highest lake-wide mean N:P ratio (19.5) occurred on 22 May 1996 and was never greater than 10 on any other sampling dates indicating Kaw Lake is possibly nitrogen limited with respect to primary productivity. The relatively high concentrations of phosphorus present in Kaw Lake can reasonably be attributed to two factors: 1) the watershed of Kaw Lake is principally agricultural in nature, and 2) increased total phosphorus concentrations with depth indicate internal phosphorus loading occurs as a result of anoxic conditions developing in the hypolimnion.

Metals

Water samples were analyzed for total concentrations of the 11 metals listed in Table 6. These metals were selected for analysis because they are important micronutrients, could be potentially toxic to aquatic organisms or humans, or could affect water supply users. Arsenic, cadmium, chromium, copper, lead, mercury, nickel, and selenium neither exceeded the detection limit, nor exceeded State of Oklahoma water quality numeric criteria, in any sample collected during this study. Metals present in concentrations above the detection limit include iron, present in 90.2 % of samples, manganese, present in 70.7 % of samples, and zinc, present in 10.9 % of samples. Descriptive statistics are for these three metals are presented in Table 6.

Iron is an essential micronutrient of freshwater plants and animals. The typical range of total iron found in oxygenated surface waters of pH 5 to 8 is from 50 μg/l to 200 μg/l (0.05 mg/l to 0.2 mg/l) (Wetzel, 1983). In Kaw Lake, total iron concentrations ranged from < 10 μg/l to 10,507 μg/l (mean 959 μg/l, median 350 μg/l). The highest concentrations were collected in the epilimnion at Stations OKN0102 and OKN0103 and the maximum value encountered during this study occurred 13 August 1996 at OKN0103.

Spatially, median concentrations of total iron were not significantly different between surface and bottom waters (Mann-Whitney U test, $p = 0.367$), but one-way

Table 5. Mean N:P ratios, Kaw Lake, Oklahoma, 1996.

STATION / DATE	30 APRIL	22 MAY	19 JUNE	16 JULY	31 JULY	13 AUGUST	8 OCTOBER	5 NOVEMBER	STATION MEAN
OKN0096	1.7	24.3	9.3	16.1	+	13.0	4.9	4.7	10.6
OKN0097	9.7	9.1	7.9	6.9	+	8.9	6.0	3.9	7.5
OKN0098	8.7	6.8	7.9	1.0	+	7.4	5.5	4.5	5.9
OKN0099	7.9	46.4	10.3	4.6	+	6.8	6.0	4.5	12.4
OKN0100	2.1	53.3	5.5	1.1	+	5.8	5.7	*	12.3
OKN0101	4.0	6.6	1.3	2.4	+	5.9	4.8	4.9	4.2
OKN0102	4.1	4.9	3.0	1.2	+	5.5	4.4	3.6	3.8
OKN0103	4.8	4.6	2.8	*	+	8.4	5.7	5.3	5.2
Date Mean	5.4	19.5	8.2	4.8		6.8	4.8	3.9	

* station not sampled
+ total organic nitrogen, ammonia nitrogen, nitrate, nitrite samples not taken

Table 6. Descriptive statistics for total metals analyses, all sites and depths, Kaw Lake, Oklahoma, 1996.

Parameter	Median	Mean	Min[2]	Max	No. Obs.
Arsenic, Total (mg/l)			< 0.01		0/82
Cadmium, Total (mg/l)			< 0.01		0/82
Chromium, Total (mg/l)			< 0.01		0/82
Copper, Total (mg/l)			< 0.01		0/82
Iron, Total (mg/l)	0.350[1]	0.959[1]	< 0.01	10.57	74/82
Lead, Total (mg/l)			< 0.01		0/82
Manganese, Total (mg/l)	0.070[1]	0.156[1]	< 0.01	1.49	58/82
Mercury, Total (mg/l)			< 0.02		0/82
Nickel, Total (mg/l)			< 0.01		0/82
Selenium, Total (mg/l)			< 0.01		0/82
Zinc, Total (mg/l)	0.03[1]	0.03[1]	<0.01	0.09	9/82

1 reported values for mean and median are were calculated with values that were above the practical quantitation limit
2 when only a minimum value is reported concentrations in all samples were below the practical quantitation limit

ANOVA detected a significant difference in total iron concentrations between individual sampling sites ($F = 4.96$, $p < 0.001$). Total iron was present in greater concentrations in the riverine portions of the reservoir and showed a decrease in mean value in a down-reservoir direction up to the confluence of the Arkansas River with Beaver Creek. Downstream of the confluence of the Arkansas River and Beaver Creek no significant difference in total iron concentrations was detected (Tukey's multiple comparison test, $\alpha = 0.05$). No significant temporal difference in median total iron concentration was detected. High concentrations of iron do not necessarily pose a health threat, however two criteria concerning iron were repeatedly exceeded during this study and include the EPA human health value (200 μg/l) and the EPA aquatic life criterion (1000 μg/l).

The EPA human health value is (water + fish), based on human health criteria that assume a lifetime of exposure to these waters via consumption of drinking water (2 liters per day) and eating contaminated aquatic organisms (6.5 grams per day), was exceeded in 48.7 % of samples (40/82). The EPA aquatic life criterion, based on acute and chronic levels present in the water column, was exceeded in 14.6 % of samples (12/82). Acute levels defined as no unacceptable effects to freshwater organisms and their uses if the one-hour concentration does not exceed this value more than once every three years on average. Chronic levels are defined as no unacceptable effects to freshwater organisms and their uses if the four-day concentration does not exceed this value more than once every three years on average (USEPA, 1986).

Manganese, like iron, is an essential micronutrient for plants and animals. It is necessary for photosynthesis in plants and as a catalyst in enzyme systems of animals. Total manganese in lake surface water typically ranges from 10 μg/l to 850 μg/l, with an average of approximately 35 μg/l (Wetzel, 1983). In Kaw Lake, total manganese concentrations ranged from 20 μg/l to 1490 μg/l, with an average concentration of 155.7 μg/l (median 70 μg/l). Spatially, no significant difference in total manganese concentrations was detected between surface and bottom waters (Mann-Whitney U test), but significant differences were detected in concentrations between individual sampling stations with concentrations greatest in the riverine portion of the reservoir and decreasing in a down-reservoir direction. No significant difference was detected between sampling sites downstream of the confluence of the Arkansas River and Beaver Creek. Temporally, significant differences were found between sampling dates (one-way ANOVA $F = 2.49$, $p = 0.044$), however, no clear seasonal trend was evident.

The EPA criterion of 50 μg/l (USEPA, 1986) is based on objectionable qualities at higher concentrations and not health risks and this value was exceeded in 50 % of samples (41/82).

Discussion

Kaw Lake is regionally important as a municipal and industrial water supply source. Results of this study indicate that overall the water in Kaw Lake is of a reasonably good water quality and none of the measured parameters warrant concern at this time (Table 7). The water in Kaw Lake was classified as hard and total hardness did not exceed criteria for municipal or industrial uses (USEPA, 1986). Total alkalinity and pH values suggest that the lake did not experience drastic changes in pH during the study and if such changes were to occur the lake would be well buffered. Thermal stratification was observed at only one station during this study (OKN0096). Although thermal stratification did not occur at any other sampling stations, vertical gradients in pH, temperature, dissolved oxygen, specific conductance, and other parameters were observed. Dissolved oxygen values below 2 mg/l in the hypolimnion were common between June and August. Hypolimnetic anoxia was most pronounced in the lacustrine areas of the lake (OKN0096, OKN0097) and was well entrenched from June through August. In transition zone portions of the lake (OKN0098, OKN0099, OKN0101) hypolimnetic anoxia was more transient.

Two factors directly influence primary productivity in Kaw Lake, nutrient concentrations and light availability. Nutrient concentrations in the reservoir were at times high and quite seasonally variable. During this study, the mean concentration of total phosphorus was 84% greater than total phosphorus concentrations encountered in unpolluted surface waters and trophic classification based on epilimnetic concentrations of total phosphorus indicate the system is hyper-eutrophic. Turbidity values and total suspended solids concentrations exhibited a relatively high degree of variability both spatially and temporally. Mean Secchi depth values indicate that on average the depth of the photic zone (i.e. the portion of the water column where active photosynthesis can take place) was no greater than 1.5 meters. Given its highly turbid nature the high concentrations of total phosphorus in Kaw Lake are the result of phosphorus adsorption to suspended solids (external loading) and phosphorus releases from anoxic sediment during periods of hypolimnetic anoxia (internal loading). The relatively short hydraulic residence time of Kaw Lake (176 days) suggests that both internal and external nutrient loadings are minimized in Kaw Lake due to advective transport of nutrients through the system.

Trace metal concentrations in Kaw Lake do not warrant concern at this time, however concentrations of total iron and total manganese merit some awareness. As discussed in the results section concentrations of total iron, at times, exceeded EPA water quality criteria for aquatic life and human health. Total manganese concentrations in Kaw Lake did not present an aquatic life or human health risk. Concentrations of both iron and manganese were high enough to be of objectionable qualities due to the potential for porcelain and laundry staining and possible bad taste in beverages. The spatial distribution (horizontal and vertical) of iron and manganese in Kaw Lake suggest that loadings are primarily external. Internal loadings can occur as a result releases from anoxic sediments, however advective transport likely its contribution to total concentrations of iron and manganese present in the reservoir.

Table 7. Summary of Kaw Lake, Oklahoma, water quality study, 1996.

PARAMETERS	NO CONCERN	AWARENESS	CONCERN
Temperature and Dissolved Oxygen	X		
Alkalinity, pH, and Hardness	X		
Salinity	X		
Water Clarity	X		
Nutrients		X	
Trace Metals (excluding Iron and Manganese)	X		
Iron and Manganese		X	

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APPENDIX A

WATER QUALITY STUDY

KAW LAKE, 1978

WATER QUALITY STUDY

Kaw Lake
Arkansas River, Oklahoma

by

S.L. Burks
Aquatic Life Consultants, Inc.
1978

US Army Corps of Engineers
Southwestern Division
Tulsa District

FILED ON STORET BY:
(Name) Nolan
(Date)

Final Completion Report
Contract No. DACW56-78-C-0194

Water Quality Study
Kaw Lake, Arkansas River, Oklahoma

for

Tulsa District, Corps of Engineers

by

S. L. BURKS
Aquatic Life Consultants, Inc.

Scope of Project.

Aquatic Life Consultants, Inc. conducted field collections and laboratory analyses of water samples from 11 locations on the Arkansas River and Kaw Lake from June to September, 1978. Interim reports were provided to the Tulsa District, Corps of Engineers' Offices by the 20th day of each month following a collection.

Location of Sampling Stations.

Station A was located on the Arkansas River at the west end of Highway 60 bridge (Figure 1) and (Figure 2a and 2b). Station B was located at the buoy line upstream from the Kaw Lake Dam (Figure 1) and (Figure 3a and 3b). Depth of water at this station was 75 feet (Figure 12). Samples were collected at surface (1M), 11M, 20M and at 22M (bottom) for laboratory analyses.

Station C was located at the mouth of a small cove west of Kaw City (Figure 1) and (Figure 4a and 4b). Depth of water at this station varied from 37 to 55 feet in the deepest channel (Figure 12). Water samples were collected at surface (1M), 11M and bottom.

Station D was located in the deepest portion of the lake northeast of Burbank landing (Figure 1) and (Figure 5a and 5b). Depth of water at this station was 50 feet (Figure 12). Water samples were collected at surface (1M), 11M and bottom.

Station E was located northeast of Washunga Bay beneath a county bridge that crossed the Beaver Creek channel (Figure 1) and (Figure 6a and 6b). Depth of water at this station was 45 feet in the channel (Figure 12). Samples were collected at surface (1M) and bottom.

Station F was located in the upper end of Beaver Creek arm of Kaw Lake (Figure 1) and (Figure 7a and 7b). Depth of water at this station was 39 feet in the channel (Figure 12). Samples were collected at surface (1M) and bottom.

Station G was located north of Kaw City (Figure 1) and (Figure 8a and 8b). Depth of water was 36 to 38 feet (Figure 12). Samples were collected at surface (1M) and bottom.

Station H was located near the mouth of Bear Creek Cove (Figure 1) and (Figure 9a and 9b). Depth of water was only 8 to 15 feet at this location (Figure 12). Samples were collected at surface (1M) and bottom.

Station I was located south of county road bridge due east of Newkirk (Figure 1) and (Figure 10a and 10b). Depth of water at this station was so shallow that only one collection was made by boat, the remainder of the samples were collected from the bridge. Only surface (1M) samples were collected.

Station J was located on the Arkansas River below Highway 77 bridge near Arkansas City, Kansas (Figure 1) and (Figure 11a). Only surface water samples were collected.

Station K was located on Walnut River below Highway 166 bridge near Arkansas City, Kansas (Figure 1) and (Figure 11b). Only surface water samples were collected.

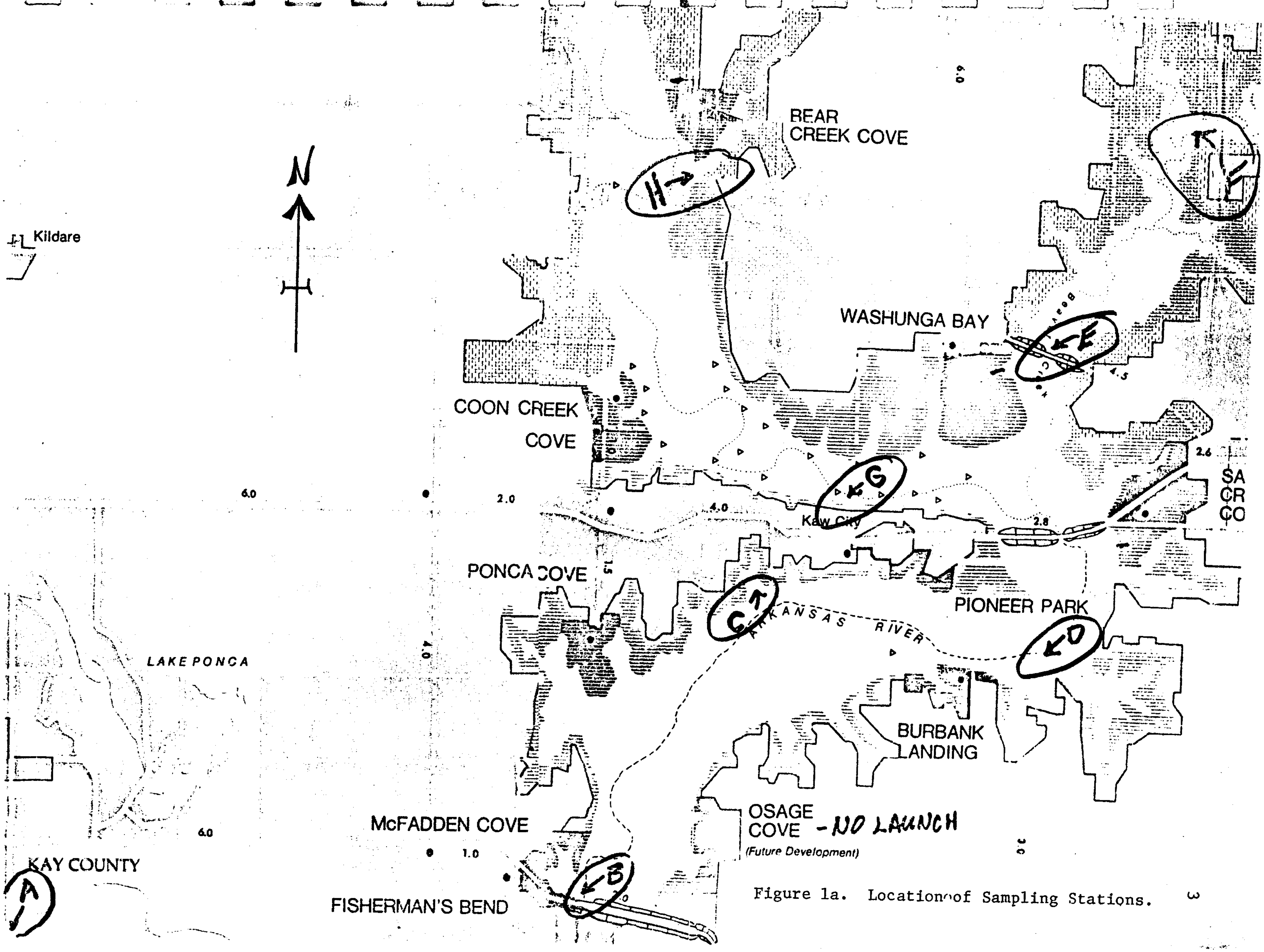

Figure 1a. Location of Sampling Stations.

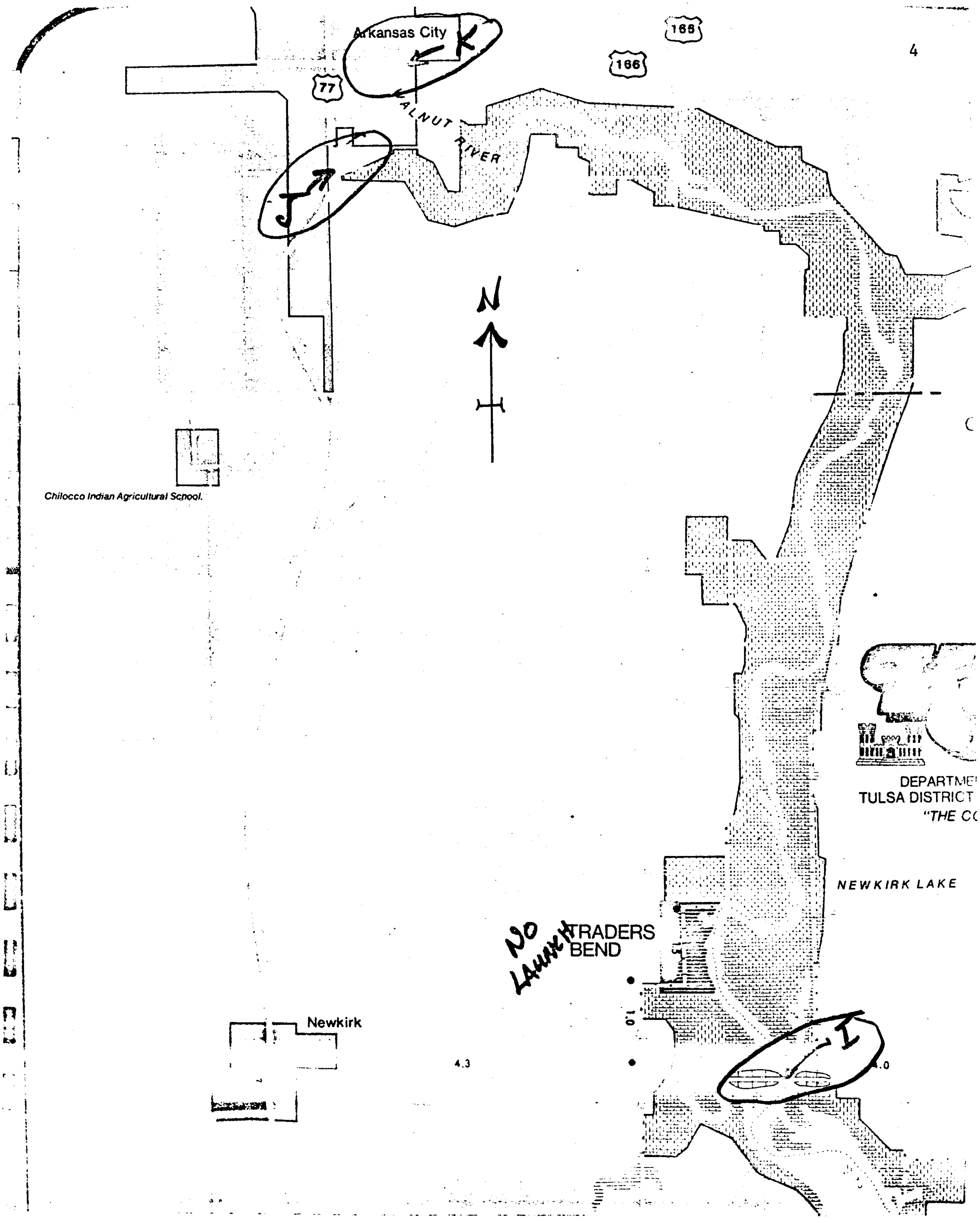

Figure 1b. Location of Sampling Stations.

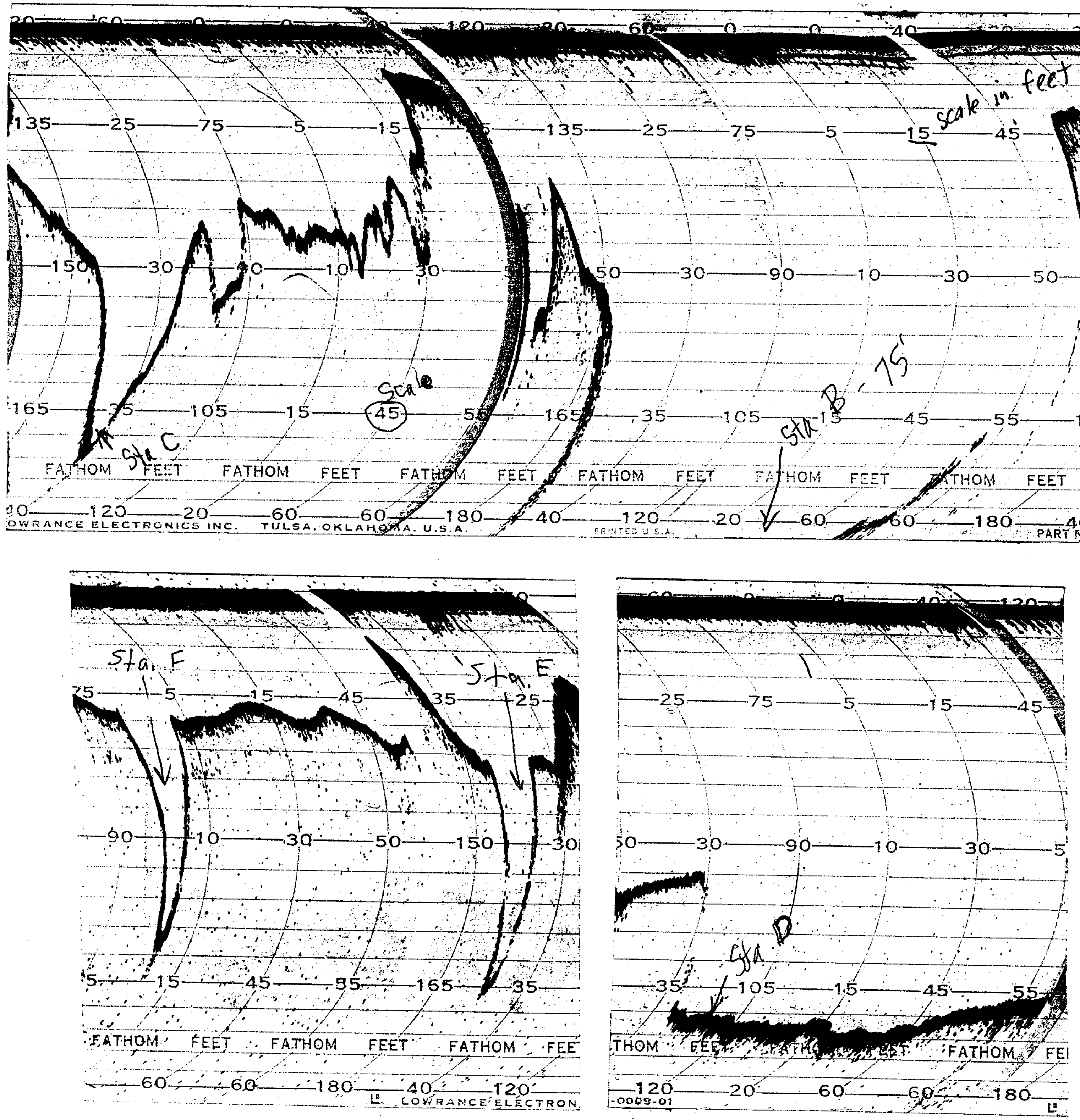

Figure 12. Graph of depth finder readings at each lake station.

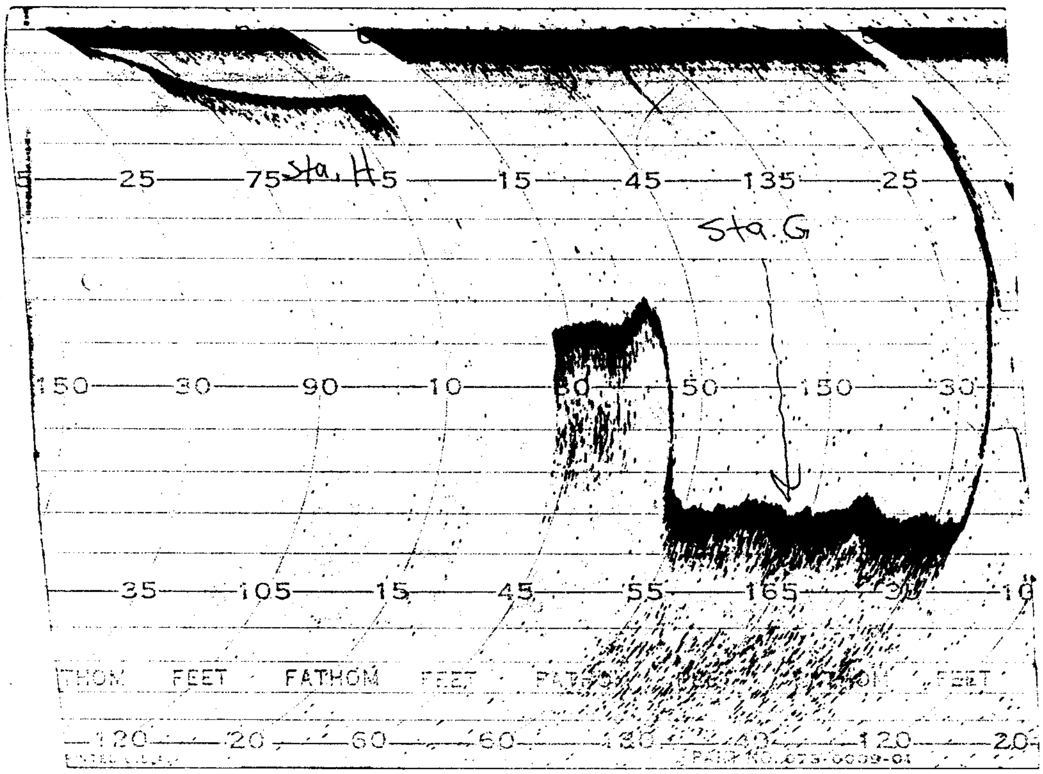

Figure 12 (continued). Graph of depth finder readings at each lake station.

METHODS

Field Collections and Analysis

Water samples for phosphate analyses were collected in acid-washed glass bottles and placed on ice until analyzed in the laboratory. Analyses were performed within 24 hours after collection. Water samples for heavy metals analyses (Fe, Mn and Pb) were collected in polyethylene bottles and acidified with 0.5 ml of concentrated nitric acid in the field. Water samples for mercury analyses were collected in acid-washed glass BOD bottles and acidified with 0.5 ml of concentrated nitric acid. Mercury analyses were performed within 24 hours after collection. Water samples for all other laboratory analyses were collected in polyethylene bottles and placed on ice. Nitrate, nitrite and alkalinities were analyzed within 24 hours after collection.

Field measurements of dissolved oxygen were performed with either a Hydrolab Surveyor or a YSI oxygen probe. Both units were air calibrated and adjusted for atmospheric pressure and ambient air temperature. Conductivity was measured with either a Hydrolab Surveyor or a YSI salinity-conductivity probe. Both units were calibrated against a standard KCl solution according to APHA Standard Methods. Field measurements of pH were performed with either a Hydrolab Surveyor or a portable Orion Specific Ion Meter. Probes were calibrated against standard buffers of 7.00 and 9.16 pH. Depth of water was recorded with a Lowrance recording depth finder. Subsurface water samples were pumped from desired depths with a nylon impeller 12-volt bilge pump through polyethylene hoses. A backup subsurface Van Dorn water sampler was used to supplement the pump system.

Laboratory Analyses

Metals: The cold flameless atomic absorption method was used to analyze samples for concentration of mercury (Hatch and Ott 1968). Total iron and manganese were analyzed by flame atomic absorption. Samples were digested in accordance with EPA procedures (EPA 1974). Total lead in the digested samples was analyzed by heated graphite atomizer accessory for atomic absorption. Organic background was corrected for by subtracting absorbance obtained with a hydrogen lamp from that obtained by normal lead cathode lamp. Matrix interferences were corrected for by methods of standard addition.

All other analyses were performed in accordance with APHA Standard Methods.

RESULTS

Water quality conditions at the uppermost Station I in Kaw Lake were below normal on 17 September 1978. Concentration of dissolved oxygen was only 3.4 mg/1 at 11:00 A.M. (Figures 13,14 & 15). Normally, algal photosynthetic activity during daylight hours would produce enough oxygen for concentrations to be near saturation. Apparently, biodegradable organic substances were present in the incoming river water and were causing an excessive oxygen demand. Probably the concentration of dissolved oxygen was near zero during the night. A few dead shad were observed in the area.

Overall, water quality in the main body of Kaw Lake on 17 September was similar to previous surveys collected in June, July and August (Tables 1 through 4). In general, the total dissolved solids concentration in Kaw Lake was in excess of maximum permissible criteria of 500 mg/1 recommended by USPHS in 1978. The National Academy of Sciences (1972) did not establish limits upon total dissolved solids but upon individual chemicals such as chlorides. The National Academy of Sciences recommended that the maximum permissible concentration of chlorides in drinking water supplies be limited to less than 250 mg/l. The concentration of chlorides in Kaw Lake were generally less than 250 mg/l. However, the chloride concentration in the main body of Kaw Lake ranged from 120 to 280 mg/l. Therefore, Kaw Lake water would meet maximum allowable concentrations of chlorides most of the time.

Iron and manganese were measured asxthe total concentration, i.e. dissolved plus suspended. The NAS (1972) and USPHS (1968) maximum permissible criteria were 0.3 mg/l and 0.05 mg/l for soluble iron and manganese, respectively. The total concentration of iron and manganese both exceeded these levels. However, the soluble concentration possibly was less than the recommended maxima. Similarly, total lead concentration in some Kaw Lake samples exceeded the maximum permissible criteria of 0.05 mg/l.

All other chemical parameters were within acceptable levels as recommended by both NAS (1972) and USPHS (1968).

Primary station codes for EPA's STORET water quality database for sampling locations described in this report are as follows:

Sampling Location	Primary Station Code
A	OKN0131
B	OKN0096
C	OKN0097
D	OKN0098
E	OKN0099
F	OKN0100
G	OKN0101
H	OKN0102
I	OKN0103
J	KSS0012
K	KSS0013

1978

Table 1 Continued. Summary of Field Chemical Analyses of Kaw Lake.

Station	Date	Dissolved Oxygen mg/1	Temp. ^{o}C	pH	Conductance micromhos
A	24 June	8.2	24.8	7.6	800
	15 July	7.7	26.0	7.6	850
	19 Aug	6.9	22.0	7.6	550
	17 Sep	5.2	25.0	8.3	1000
I	24 June	6.7	30.0	7.8	700
	15 July	7.9	30.5	8.4	1200
	19 Aug	3.0	25.0	8.4	2200
	17 Sep	3.4	27.5	8.8	2300
J	24 June	6.8	28.0	8.6	1200
	15 July	11.4	29.0	9.1	2200
	19 Aug	10.6	22.0	9.0	2100
	17 Sep	9.4	27.0	8.9	2700
K	24 June	6.8	27.0	7.4	390
	15 July	9.2	32.0	8.2	1100
	19 Aug	4.6	25.0	7.4	1250
	17 Sep	5.8	28.0	7.8	1380

Table 1. Field Chemical Analyses of Kaw Lake, 24 June 1978.

Station	Depth Feet	Dissolved Oxygen mg/1	Temp. °C	pH	Conductance micromhos
B	1	7.3	24.5	8.03	700
	3	7.25	24.5	8.0	628
	6	7.20	24.5	8.0	620
	9	7.15	24.5	8.0	620
	12	7.15	24.5	8.0	620
	15	7.15	24.5	8.0	620
	18	7.15	24.5	8.0	625
	21	7.15	24.5	8.0	625
	24	7.10	24.5	8.0	625
	27	7.10	24.5	8.0	630
	30	7.10	24.5	8.0	625
	33	7.05	24.5	8.0	630
	36	6.95	24.5	7.95	630
	39	6.90	24.5	7.95	630
	44	6.7	24.2	7.95	625
	66	4.3	23.25	7.6	650
	69	3.4	23.25	7.6	670
	75	2.0	23.0	7.45	655

Table 1. Field Chemical Analyses of Kaw Lake, 24 June 1978.

Station	Depth Feet	Dissolved Oxygen mg/1	Temp. °C	pH	Conductance micromhos
C	1	7.7	25.0	8.0	660
	3	7.7	24.5	8.0	650
	6	7.7	25.0	8.0	650
	9	7.7	25.0	8.0	650
	12	7.7	25.0	8.0	660
	15	7.6	24.0	8.0	660
	18	7.7	25.0	8.0	660
	21	7.6	24.0	8.1	670
	24	7.6	25.0	8.0	660
	27	7.5	25.0	8.0	660
	30	7.5	25.0	8.0	660

Table 1. Field Chemical Analyses of Kaw Lake, 24 June 1978.

Station	Depth Feet	Dissolved Oxygen mg/1	Temp. °C	pH	Conductance micromhos
D	1	9.6	26.0	7.7	715
	3	9.5	26.0	7.7	710
	6	9.5	26.0	7.8	710
	9	9.4	26.0	7.8	710
	12	9.4	26.0	7.9	715
	15	9.3	26.0	8.0	715
	18	9.2	26.0	8.2	715
	21	9.3	26.0	8.2	720
	24	9.2	26.0	8.3	720
	27	9.2	26.0	8.3	720
	30	9.1	26.0	8.3	720
	33	9.3	26.0	8.5	720
	46	7.5	26.0	8.8	720

Table 1. Field Chemical Analyses of Kaw Lake, 24 June 1978.

Station	Depth Feet	Dissolved Oxygen mg/1	Temp. °C	pH	Conductance micromhos
E	1	7.1	25.5	8.0	630
	3	7.0	25.5	7.9	620
	6	6.9	26.0	7.9	620
	9	6.9	25.7	7.9	620
	12	6.9	25.5	7.9	620
	15	6.7	25.2	7.9	610
	18	6.6	25.2	7.9	600
	21	6.3	25.0	7.8	590
	24	6.1	24.5	7.8	580
	27	6.0	25.0	7.8	580
	30	6.0	25.0	7.8	580
	33	6.0	25.0	7.8	580
	45	5.1	24.5	7.8	570

Table 1. Field Chemical Analyses of Kaw Lake, 24 June 1978.

Station	Depth Feet	Dissolved Oxygen mg/1	Temp. °C	pH	Conductance micromhos
F	1	7.8	26.5	8.7	595
	3	7.8	26.5	8.7	595
	6	7.8	26.5	8.7	590
	9	7.8	26.5	8.7	590
	12	7.7	26.5	8.8	595
H	1	9.3	26.0	9.5	750

Table 1. Field Chemical Analyses of Kaw Lake, 24 June 1978.

Station	Depth Feet	Dissolved Oxygen mg/1	Temp. °C	pH	Conductance micromhos
G	1	7.7	26.0	8.8	760
	3	7.5	26.0	8.8	760
	6	7.6	25.5	8.9	760
	9	7.1	25.0	8.9	760
	12	7.3	25.0	9.0	760
	15	7.2	25.0	8.9	760
	18	7.1	25.0	9.0	760
	21	6.8	25.5	9.1	750
	24	6.5	25.0	9.1	730
	27	6.3	24.5	9.2	720
	30	6.4	24.5	9.2	710
	23	6.3	24.5	9.6	680
	40	5.7	24.5	9.5	680

Table 1. Field Chemical Analyses of Kaw Lake, 15 July 1978.

Station	Depth Feet	Dissolved Oxygen mg/l	Temp. °C	pH	Conductance micromhos
B	0	7.7	28.5	8.1	920
	3	7.3	28.0	8.2	920
	6	6.8	28.0	8.3	930
	9	5.9	27.5	8.3	930
	12	5.6	26.5	8.3	930
	15	5.7	26.5	8.3	930
	30	5.2	26.5	8.2	910
	33	5.2	26.5	7.9	910
	45	2.2	25.5	7.9	910
	66	1.5	25.0	7.9	910
	75	1.5	24.5	7.9	780

Table 1. Field Chemical Analyses of Kaw Lake, 15 July 1978.

Station	Depth Feet	Dissolved Oxygen mg/1	Temp. °C	pH	Conductance micromhos
C	0	8.2	29.5	8.4	905
	3	6.4	28.5	8.4	905
	6	6.0	28.5	8.4	905
	9	6.0	28.3	8.4	905
	12	5.9	28.3	8.4	905
	15	5.9	28.5	8.4	905
	18	5.9	28.3	8.4	910
	33	4.1	28.0	8.3	910
	45	3.1	26.5	8.2	895

Table 1. Field Chemical Analyses of Kaw Lake, 15 July 1978.

Station	Depth Feet	Dissolved Oxygen mg/1	Temp. °C	pH	Conductance micromhos
D	0	8.3	29.5	8.3	905
	3	7.7	28.5	8.4	905
	6	6.5	27.5	8.4	905
	9	6.1	28.0	8.4	910
	12	6.0	27.5	8.4	910
	15	5.9	28.0	8.4	910
	18	5.7	27.0	8.4	910
	33	5.4	28.0	8.3	915
	45	3.0	26.5	8.1	895

Table 1. Field Chemical Analyses of Kaw Lake, 15 July 1978.

Station	Depth Feet	Dissolved Oxygen mg/l	Temp. °C	pH	Conductance micromhos
E	0	9.5	31.0	7.8	800
	3	6.4	28.0	7.5	800
	9	5.7	28.0	7.5	800
	12	4.6	28.0	7.5	800
	15	4.1	28.0	7.5	800
	18	3.9	28.0	7.5	800
	39	2.6	27.0	7.5	800

Table 1. Field Chemical Analyses of Kaw Lake, 15 July 1978.

Station	Depth Feet	Dissolved Oxygen mg/1	Temp. °C	pH	Conductance micromhos
F	3	7.5	29.5	7.6	700
	6	7.3	29.5	7.6	750
	9	7.1	29.5	7.5	650
	12	6.9	29.5	7.5	650
	15	6.4	28.0	7.5	750
	18	5.3	28.0	7.5	700
	30	0.6	26.0	7.5	600
H	0	7.5	29.5	8.1	1100
	3	6.9	29.5	8.1	1100
	6	6.7	28.5	8.1	1100
	9	6.6	28.5	8.0	1100
	12	6.6	28.5	8.2	1100
	15	6.5	28.5	8.2	1100

Table 1. Field Chemical Analyses of Kaw Lake, 15 July 1978.

Station	Depth Feet	Dissolved Oxygen mg/1	Temp. °C	pH	Conductance micromhos
G	0	6.7	30.5	8.1	1100
	3	5.4	30.0	7.8	1000
	6	5.2	29.0	7.8	1000
	9	4.8	29.0	7.8	1000
	12	4.2	28.0	7.8	900
	15	3.9	28.0	8.1	900
	18	3.9	27.0	7.8	900
	33	3.5	26.0	8.0	900

Table 1. Field Chemical Analyses of Kaw Lake, 19 Aug 1978.

Station	Depth Feet	Dissolved Oxygen mg/1	Temp. °C	pH	Conductance micromhos
B	1	7.1	25.5	7.7	920
	3	7.2	25.5	7.7	920
	6	7.1	25.5	7.8	920
	9	7.2	26.0	7.8	920
	12	7.3	26.0	7.8	920
	15	7.2	26.0	7.8	920
	18	7.3	26.5	7.8	930
	21	7.3	26.5	7.8	930
	24	7.2	26.0	7.8	920
	27	7.2	26.0	7.8	930
	30	7.2	26.0	7.7	920
	33	7.3	26.0	7.8	920
	45	7.5	26.0	7.8	930
	55	6.8	25.5	7.7	870
	66	6.7	25.5	7.7	920
	75	6.8	25.0	7.6	910

Table 1. Field Chemical Analyses of Kaw Lake, 19 Aug 1978.

Station	Depth Feet	Dissolved Oxygen mg/l	Temp. °C	pH	Conductance micromhos
C	1	8.6	26.5	7.8	990
	3	7.7	26.0	7.8	980
	6	7.8	26.5	7.7	980
	9	7.8	26.5	7.8	970
	12	7.8	26.5	7.8	970
	15	7.8	26.5	7.8	960
	18	7.8	26.5	7.8	960
	21	7.8	26.5	7.7	950
	24	7.9	26.5	7.8	950
	27	7.9	26.5	7.8	950
	30	7.8	26.5	7.8	940
	33	7.8	26.5	7.8	940
	45	7.6	26.5	7.8	870

Table 1. Field Chemical Analyses of Kaw Lake, 19 Aug 1978.

Station	Depth Feet	Dissolved Oxygen mg/l	Temp. °C	pH	Conductance micromhos
D	1	8.4	26.5	7.8	900
	3	8.2	26.5	7.8	900
	6	8.1	26.5	7.7	900
	9	7.9	26.5	7.8	900
	12	7.8	26.5	7.8	900
	15	7.9	26.5	7.8	900
	18	7.8	27.0	7.8	890
	21	7.8	26.5	7.8	900
	24	7.9	26.5	7.8	890
	27	7.9	27.0	7.7	900
	30	7.8	26.5	7.8	900
	33	7.7	27.0	7.8	890
	45	7.7	27.0	7.7	900

Table 1. Field Chemical Analyses of Kaw Lake, 19 Aug 1978.

Station	Depth Feet	Dissolved Oxygen mg/l	Temp. °C	pH	Conductance micromhos
E	1	8.7	27.0	7.8	820
	3	8.2	26.5	7.8	870
	6	7.9	26.5	7.8	870
	9	7.8	26.5	7.8	870
	12	7.6	26.5	7.8	870
	15	7.6	26.0	7.5	870
	18	7.5	26.0	7.6	900
	21	7.5	25.5	7.8	900
	24	7.6	26.5	7.8	900
	27	7.4	26.0	7.8	900
	30	7.5	26.0	7.8	910
	33	7.4	27.0	7.8	910
	45	7.1	26.0	7.8	910

Table 1. Field Chemical Analyses of Kaw Lake, 19 Aug 1978.

Station	Depth Feet	Dissolved Oxygen mg/l	Temp. °C	pH	Conductance micromhos
E	1	9.4	26.5	7.8	780
	3	8.3	26.5	7.8	790
	6	8.2	26.5	7.8	790
	9	8.2	26.5	7.8	800
	12	7.9	26.5	7.8	800
	15	7.9	26.5	7.8	810
	18	7.7	26.0	7.8	810
	21	7.7	26.0	7.8	820
	24	7.8	26.0	7.8	820
	27	7.6	26.0	7.8	820
	30	7.6	26.0	7.8	840
	33	7.6	25.5	7.8	850

Table 1. Field Chemical Analyses of Kaw Lake, 19 Aug 1978.

Station	Depth Feet	Dissolved Oxygen mg/l	Temp. °C	pH	Conductance micromhos
G	1	9.4	27.0	7.8	970
	3	8.7	26.5	7.8	970
	6	8.5	27.0	7.8	970
	9	8.3	27.0	7.8	970
	12	7.5	27.0	7.8	950
	15	6.7	26.5	7.8	950
	18	6.8	26.5	7.8	960
	21	7.0	26.5	7.8	960
	24	7.0	26.5	7.8	960
	27	7.0	26.0	7.8	970
	30	7.0	26.0	7.8	970
	33	6.8	26.0	7.8	980
H	1	11.8	25.0	7.8	770
	3	11.0	25.0	7.8	810
	6	10.2	25.0	7.8	840

Table 1. Field Chemical Analyses of Kaw Lake, 17 Sep 1978.

Station	Depth Meters	Dissolved Oxygen mg/1	Temp. ^oC	pH	Conductance micromhos
B	1	8.1	25.0	7.8	930
	2	7.4	25.0	7.8	930
	3	7.2	25.0	7.8	930
	4	6.8	25.5	7.8	930
	5	7.0	25.0	7.8	930
	8	6.8	25.0	7.8	930
	11	6.8	25.0	7.8	930
	14	5.5	25.5	7.8	930
	17	4.9	25.0	7.8	930
	20	4.9	25.5	7.8	930
	23	4.9	24.5	7.8	930
	24	4.6	24.5	7.8	930

Table 1. Field Chemical Analyses of Kaw Lake, 17 Sep 1978.

Station	Depth Meters	Dissolved Oxygen mg/1	Temp. °C	pH	Conductance micromhos
C	1	8.2	26.0	7.8	940
	2	8.0	26.0	7.8	940
	3	8.0	26.0	7.8	940
	4	8.0	25.5	7.8	940
	5	8.0	25.5	7.8	940
	8	8.0	25.5	7.8	940
	11	8.0	25.5	7.8	940
D	1	9.0	26.5	7.7	1000
	2	8.9	26.5	7.7	1000
	3	8.6	26.5	7.7	1000
	4	8.1	26.0	7.7	1000
	5	8.1	26.0	7.7	1000
	8	8.5	26.0	7.7	1000
	11	8.5	26.0	7.7	1000

Table 1. Field Chemical Analyses of Kaw Lake, 17 Sep 1978.

Station	Depth Meters	Dissolved Oxygen mg/1	Temp. °C	pH	Conductance micromhos
G	1	8.4	27.5	7.6	1000
	2	7.8	26.5	7.6	1000
	3	7.8	27.5	7.6	1000
	4	7.2	26.5	7.6	1000
	5	6.9	27.0	7.6	1000
	8	5.6	25.5	7.6	1000

Table 2. Summary of Laboratory Chemical Analyses of Kaw Lake Water Samples.

STATION A

Date	$CaCO_3$ Hardness mg/l	Turbidity Units JTU	Cl^- mg/l	$SO_4^=$ mg/l	Bicarbonate Alkalinity mg/l
24 June	204	68	150	74	149
15 July	196	61	150	68	136
19 Aug	230	42	230	68	153
17 Sep	226	39	177	41	144
$\bar{x}$	214	52	177	63	146
SD	16	14	38	15	7

Table 2 (continued). STATION A OKNO131

Date	$PO_4^{=}$-P mg/l 660	NO_2^{-}-N mg/l 615	NO_3-N mg/l 620	Total Dissolved Solids mg/l 70304	Suspended Solids mg/l 70299
24 June	.186	.006	.969	556	30
15 July	.180	.006	.813	777	26
19 Aug	.124	.015	.635	626	13
17 Sep	.033	.005	.216	588	15
$\bar{x}$	.131	.008	.658	637	21
SD	.007	.0004	.325	98	8

Table 2. Summary of Laboratory Chemical Analyses of Kaw Lake Water Samples.

STATION B

OKN0096

Date	$CaCO_3$ Hardness mg/l 900	Turbidity Units JTU 70	Cl^- mg/l 940	$SO_4^=$ mg/l 945	Bicarbonate Alkalinity mg/l 410
B1:					
24 June					
15 July	200	50	155	60	138
19 Aug	207	47	195	70	146
17 Sep	210	32	177	42	146
$\bar{x}$	206	43	176	57	143
SD	5	10	20	14	5
B33:					
24 June	204	55	155	76	131
15 July	196	47	150	67	139
19 Aug	211	49	190	68	145
17 Sep	210	41	177	41	140
$\bar{x}$	205	48	168	63	139
SD	7	6	19	15	6
B66:					
24 June	200	85	160	68	137
15 July	196	68	140	65	139
19 Aug	211	59	190	73	144
17 Sep	210	47	187	43	142
$\bar{x}$	204	65	169	62	140
SD	7	16	24	13	3
B75:					
24 June	212	258	162	68	158
15 July	200	61		67	142
19 Aug	214	106	190	70	151
17 Sep	206	68	177	43	144
$\bar{x}$	208	123	176	47	149
SD	6	92	14	30	7

Table 2 (Continued). STATION B OKN0096

Date	$PO_4^{=}$-P mg/1 660	NO_2^{-}-N mg/1 615	NO_3-N mg/1 620	Total Dissolved Solids mg/1 70304	Suspended Solids mg/1 70299
B1:					
24 June					
15 July	.136	.015	.692	490	8
19 Aug	.158	.006	1.043	532	11
17 Sep	.065	.003	.393	575	11
$\bar{x}$	.120	.008	.709	532	10
SD	.049	.006	.325	42	2
B33:					
24 June	.030	.007	.800	477	15
15 July	.140	.015	.706	457	4
19 Aug	.144	.007	.898	516	13
17 Sep	.086	.003	.368	588	10
$\bar{x}$	.100	.008	.693	510	10
SD	.005	.005	.230	58	5
B66:					
24 June	.045	.016	.849	479	22
15 July	.002	.011	.887	493	11
19 Aug	.184	.008	.655	496	52
17 Sep	.055	.003	.466	564	13
$\bar{x}$	.072	.010	.714	508	24
SD	.078	.005	.194	38	19
B75:					
24 June	.088	.032	.814	502	115
15 July	.247	.013	.875	501	12
19 Aug	.173	.008	.657	540	7
17 Sep	.079	.004	.40[illegible]	560	18
$\bar{x}$	.147	.014	.688	526	38
SD	.079	.012	.209	29	52

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Table 2. Summary of Laboratory Chemical Analyses of Kaw Lake Water Samples.

STATION C

OKN0097

Date	$CaCO_3$ Hardness mg/1 900	Turbidity Units JTU 70	Cl^- mg/1 940	$SO_4^=$ mg/1 945	Bicarbonate Alkalinity mg/1 410
C1':					
24 June	208	68	165	74	140
15 July	200	36	148	67	142
19 Aug	207	56	185	70	145
17 Sep	210	32	198	44	142
$\bar{x}$	206	48	174	64	142
SD	4	17	22	13	2
C33':					
24 June	204	47	150	76	135
15 July	200	49	145	68	140
19 Aug	211	54	195	67	148
17 Sep	206	46	198	43	142
$\bar{x}$	205	49	172	64	141
SD	4	4	28	14	5
C45:					
24 June					
15 July	204	96	143	66	142
19 Aug	207	47	190	70	146
17 Sep	214	112	187	43	144
$\bar{x}$	208	85	173	60	144
SD	5	34	26	14	2

Table 2 (Continued). STATION C

OKN0097

Date	$PO_4^{=}$-P mg/1 660	NO_2^{-}-N mg/1 615	NO_3-N mg/1 620	Total Dissolved Solids mg/1 70304	Suspended Solids mg/1 70299
C1':					
24 June	.159	.004	.841	476	12
15 July	.109	.009	.546	484	10
19 Aug	.195	.022	.494	484	25
17 Sep	.033	.004	.357	574	12
$\bar{x}$	.124	.010	.560	504	15
SD	.070	.008	.204	46	7
C33':					
24 June	.146	.004	.264	469	12
15 July	.140	.008	.797	498	19
19 Aug	.173	.016	.513	501	15
17 Sep	.036	.004	.322	556	19
$\bar{x}$	.124	.008	.474	506	16
SD	.060	.006	.240	36	3
C45:					
24 June					
15 July	.089	.013	.801	498	44
19 Aug	.201	.015	.522	504	12
17 Sep	.081	.005	.286	529	59
$\bar{x}$	.124	.011	.536	510	38
SD	.067	.005	.258	16	24

KAW2 (OK)
3567
F=7509

Table 2. Summary of Laboratory Chemical Analyses of Kaw Lake Water Samples.

STATION D

OKN0098

Date	$CaCO_3$ Hardness mg/1 700	Turbidity Units JTU 70	Cl^- mg/1 940	$SO_4^=$ mg/1 745	Bicarbonate Alkalinity mg/1 410
D1:					
24 June	220	101	170	77	141
15 July	200	42	139	64	134
19 Aug	207	71	190	70	143
17 Sep	214	47	208	44	146
$\bar{x}$	210	65	177	64	141
SD	9	27	30	14	5
D33':					
24 June	208	91	170	68	141
15 July	204	47		60	140
19 Aug	207	77	190	68	143
17 Sep	214	61	218	43	146
$\bar{x}$	208	69	193	60	142
SD	4	19	24	12	3
D45':					
24 June	208	102	160	68	148
15 July	188	92	138	67	143
19 Aug	211	75	195	68	145
17 Sep	222	113	218	41	146
$\bar{x}$	207	96	178	61	146
SD	14	16	36	13	2

Table 2 (Continued). STATION D 0KN0098

Date	$PO_4^{=}$-P mg/1 660	NO_2^{-}-N mg/1 615	NO_3-N mg/1 620	Total Dissolved Solids mg/1 70304	Suspended Solids mg/1 70299
D1':					
24 June	.020	.004	.812	502	20
15 July	.150	.006	.574	525	6
19 Aug	.139	.067	.398	501	15
17 Sep	.015	.003	.343	599	15
$\bar{x}$	.081	.020	.532	532	14
SD	.075	.031	.211	46	6
D33':					
24 June	.222	.004	.970	498	18
15 July	.180	.008	.762	490	25
19 Aug	.152	.080	.441	508	14
17 Sep	.048	.004	.343	615	20
$\bar{x}$	.151	.024	.629	528	19
SD	.074	.037	.289	59	5
D45':					
24 June	.252	.006	.824	498	28
15 July	.018	.011	.715	479	24
19 Aug	.165	.079	.448	481	21
17 Sep	.106	.007	.332	632	48
$\bar{x}$	.135	.026	.580	522	30
SD	.098	.036	.228	73	12

Table 2. Summary of Laboratory Chemical Analyses of Kaw Lake Water Samples.

STATION E

OKN0099

Date	$CaCO_3$ Hardness mg/1 900	Turbidity Units JTU 70	Cl^- mg/1 940	$SO_4^=$ mg/1 945	Bicarbonate Alkalinity mg/1 410
E1':					
24 June	204	73	135	74	143
15 July	184	65	126	59	132
19 Aug	211	59	185	63	136
17 Sep					
$\bar{x}$	200	66	149	65	137
SD	14	7	32	8	6
E33':					
24 June	196	109	120	41	150
15 July	200	95	136	59	146
19 Aug	199	56	180	67	135
17 Sep					
$\bar{x}$	198	87	145	56	144
SD	2	27	31	13	8
E45':					
24 June	192	123	115	44	142
15 July					
19 Aug					
17 Sep					
$\bar{x}$					
SD					

KAW3 3727 (OK) 1515

Table 2 (Continued). STATION E OKN0099

Date	$PO_4^{\equiv}$-P mg/1 660	NO_2^--N mg/1 615	NO_3-N mg/1 620	Total Dissolved Solids mg/1 70304	Suspended Solids mg/1 70299
E1':					
24 June	.008	.018	.772	447	17
15 July	.038	.012	.124	441	18
19 Aug	.097	.045	.130	471	17
17 Sep					
$\bar{x}$	.048	.025	.342	453	17
SD	.045	.018	.372	16	0.5
E33':					
24 June	.101	.052	.642	420	36
15 July	.109	.020	.414	406	27
19 Aug	.052	.046	.095	446	16
17 Sep					
$\bar{x}$	.087	.039	.384	424	26
SD	.031	.017	.2755	20	10
E45':					
24 June	.020	.053	.603	412	79
15 July					
19 Aug					
17 Sep					
$\bar{x}$					
SD					

Table 2. Summary of Laboratory Chemical Analyses of Kaw Lake Water Samples.

STATIONS F AND H

Date	$CaCO_3$ Hardness mg/1 900	Turbidity Units JTU 70	Cl^- mg/1 940	$SO_4^=$ mg/1 945	Bicarbonate Alkalinity mg/1 410
F1':					
24 June	196	93	117	37	145
15 July	212	64	120	60	134
19 Aug	211	64	180	73	132
17 Sep					
$\bar{x}$	206	74	139	57	137
SD	9	17	36	18	7
F30':					
24 June	204	99	118	48	144
15 July	188	155	100	18	146
19 Aug	199	65	185	73	134
17 Sep					
$\bar{x}$	197	106	134	46	141
SD	8	45	45	28	6
H1':					
24 June	216	137	175	77	147
15 July	220	115	193	76	154
19 Aug	230	80	280	82	148
17 Sep					
$\bar{x}$	222	111	216	78	150
SD	7	29	56	3	4
H15':					
24 June					
15 July	220	228	185	74	159
19 Aug					
17 Sep					
$\bar{x}$					
SD					

Table 2 (Continued), STATIONS F AND H

Date	$PO_4^{\equiv}$-P mg/1 660	NO_2^--N mg/1 615	NO_3-N mg/1 620	Total Dissolved Solids mg/1 70304	Suspended Solids mg/1 70299
F1':					
24 June	.068	.072	.506	410	40
15 July	.048	.008	.094	447	18
19 Aug	.040	.029	.067	452	20
17 Sep					
$\bar{x}$	.052	.036	.222	436	26
SD	.014	.033	.246	23	12
F30':					
24 June	.048	.069	.559	422	36
15 July	.034	.021	.197	321	38
19 Aug	.095	.029	.076	472	19
17 Sep					
$\bar{x}$	.059	.040	.277	405	31
SD	.032	.026	.251	77	10
H1':					
24 June	.023	.015	.836	521	53
15 July	.259	.058	.576	615	41
19 Aug	.173	.034	.134	631	29
17 Sep					
$\bar{x}$	.152	.036	.517	589	41
SD	.119	.022	.352	59	12
H15':					
24 June					
15 July	.142	.035	.564	661	81
19 Aug					
17 Sep					
$\bar{x}$					
SD					

KAWS 5320 (OK)

F= 7514

Table 2. Summary of Laboratory Chemical Analyses of Kaw Lake Water Samples.

STATION G

OKN0101

Date	$CaCO_3$ Hardness mg/1 900	Turbidity Units JTU 70	Cl^- mg/1 940	$SO_4^=$ mg/1 945	Bicarbonate Alkalinity mg/1 410
G1':					
24 June	212	88	165	74	145
15 July	208	71	170	82	143
19 Aug	211	56	220	73	144
17 Sep	222	51	228	43	146
$\bar{x}$	213	67	196	68	144
SD	6	17	33	17	1.3
G33':					
24 June	208	168	150	76	142
15 July	212	86	152	70	145
19 Aug	211	80	210	73	142
17 Sep	222	75	239	44	146
$\bar{x}$	213	102	188	66	144
SD	6	44	44	15	2
G45':					
24 June	196	193	150	76	137
15 July					
19 Aug					
17 Sep	218	59	228	45	144
$\bar{x}$	207	126	189	61	141
SD	16	95	55	22	5

Table 2 (Continued). STATION G OKN0101

Date	$PO_4^{=}$-P mg/1 660	NO_2^{-}-N mg/1 615	NO_3-N mg/1 620	Total Dissolved Solids mg/1 70304	Suspended Solids mg/1 70299
G1':					
24 June	.156	.005	.950	513	23
15 July	.221	.074	.677	471	11
19 Aug	.141	.100	.213	554	13
17 Sep	.069	.002	.282	620	14
$\bar{x}$	.148	.045	.531	540	15
SD	.062	.049	.346	63	5
G33':					
24 June	.000	.030	.753	492	50
15 July	.164	.048	.600	621	28
19 Aug	.184	.117	.206	526	26
17 Sep	.098	.076	.265	658	26
$\bar{x}$	.112	.068	.456	574	32
SD	.083	.038	.263	78	12
G45':					
24 June	.063	.031	.751	471	56
15 July					
19 Aug					
17 Sep	.002	.004	.384	633	21
$\bar{x}$	.032	.018	.568	552	38
SD	.043	.019	.260	114	25

Table 2. Summary of Laboratory Chemical Analyses of Kaw Lake Water Samples.

STATIONS I, J, K

	Date	$CaCO_3$ Hardness mg/1 700	Turbidity Units JTU 70	Cl^- mg/1 940	$SO_4^=$ mg/1 945	Bicarbonate Alkalinity mg/1 410
I: OKN0103	24 June	169	>395	115	66	140
	15 July	227	217	210	81	152
	19 Aug	329	131	560	102	160
	17 Sep	361	150	586	75	204
	$\bar{x}$	272	223	368	81	164
	SD	89	120	240	15	28
J: KSS0012	24 June	208	>395	260	77	150
	15 July	290	145	450	95	147
	19 Aug	333	99	640	111	139
	17 Sep	373	101	729	78	190
	$\bar{x}$	301	185	520	90	156
	SD	71	142	209	16	23
K: KSS0013	24 June	180	>395	44	<10	149
	15 July	321	68	117	98	150
	19 Aug	303	59	230	108	196
	17 Sep	397	104	239	65	190
	$\bar{x}$	300	156	158	68	171
	SD	90	160	94	49	25

Table 2 (Continued), STATIONS I, J, K

	Date	$PO_4^{=}$-P mg/1 660	NO_2^{-}-N mg/1 615	NO_3-N mg/1 620	Total Dissolved Solids mg/1 70304	Suspended Solids mg/1 70299
I:	24 June	.045	.027	.777	397	332
OKN0103	15 July	.091	.040	.350	1170	108
	19 Aug	.163	.004	.054	1108	82
	17 Sep	.506	.005	.030	1259	92
	$\bar{x}$	.201	.019	.303	984	154
	SD	.209	.018	.348	396	119
J:	24 June	.328	.016	.968	572	345
KSS0012	15 July	.407	.003	.028	593	140
	19 Aug	1.096	.004	.033	1166	83
	17 Sep	1.098	.114	.165	1402	77
	$\bar{x}$	.732	.034	.298	798	161
	SD	.042	.005	.045	607	126
K:	24 June	.033	.025	.938	268	482
KSS0013	15 July	.136	<.001	.028	574	68
	19 Aug	.110	.004	.037	658	41
	17 Sep	.029	.004	.029	810	63
	$\bar{x}$	.077	.008	.258	578	164
	SD	.005	.001	.045	228	213

KAW7 6575 (OK) F=7518

Table 3. Concentration of Heavy Metals in Kaw Lake Water Samples Collected 24 June 1978.

Station	Fe mg/l (1045)	Mn mg/l (1055)	Pb µg/l 1051	Hg µg/l 71900
A-1' OKN0131	1.01	0.10	<5.0	<0.5
B-1'				
B-33' OKN0096	0.45	0.08	<5.0	<0.5
B-66'	1.12	0.19	<5.0	<0.5
B-75'	5.72	0.56	<5.0	<0.5
C-1' OKN0097	0.56	0.06	<5.0	<0.5
C-33'	0.39	0.07	<5.0	<0.5
D-1'	0.56	0.10	<5.0	<0.5
D-33' OKN0098	0.67	0.08	<5.0	<0.5
D-46'	1.46	0.12	<5.0	<0.5
E-1'	0.90	0.08	<5.0	<0.5
E-33' OKN0099	1.68	0.14	<5.0	<0.5
E-45'	1.68	0.17	<5.0	<0.5
F-1' OKN0100	1.07	0.10	<5.0	<0.5
F-12'	1.40	0.12	<5.0	<0.5
G-1'	0.95	0.03	<5.0	<0.5
G-33' OKN0101	2.35	0.08	<5.0	<0.5
G-40'	3.48	0.10	<5.0	<0.5
H-1' OKN0102	2.02	0.19	<5.0	<0.5
I-1' OKN0103	10.88	0.34	<5.0	<0.5
J-1' KSS0012	12.01	0.34	<5.0	<0.5
K-1' KSS0013	23.89	0.43	<5.0	<0.5
EPA Standard	0.42	0.45	298.0	4.5
This Lab.	0.35	0.15	249.0	6.5

KAW8 6659 OK E=7521

Table 4. Concentration of Heavy Metals in Kaw Lake Water Samples Collected 15 July 1978.

Station	Fe mg/1 (1045)	Mn mg/1 (1055)	Pb µg/1 1051	Hg µg/1 71900
A-1' OKN0131	0.50	<0.05	<5.0	<0.5
B-1'	0.05	<0.05	<5.0	<0.5
B-33' OKN0096	0.23	<0.05	<5.0	<0.5
B-66'	0.50	0.19	<5.0	<0.5
B-75'	0.54	0.36	<5.0	<0.5
C-1'	0.14	<0.05	<5.0	<0.5
C-33' OKN0097	0.50	0.07	<5.0	<0.5
C-45'	1.81	0.19	<5.0	<0.5
D-1'	0.23	<0.05	<5.0	<0.5
D-33' OKN0098	0.45	<0.05	<5.0	<0.5
D-45'	6.87	0.36	<5.0	<0.5
E-1' OKN0099	0.45	<0.05	<5.0	<0.5
E-33'	1.27	0.07	<5.0	<0.5
F-1'	0.50	<0.05	<5.0	<0.5
F-30' OKN0100	2.40	0.07	<5.0	<0.5
G-1' OKN0101	0.63	<0.05	<5.0	<0.5
G-33'	0.77	0.19	<5.0	<0.5
H-1' OKN0102	Lost	Lost	<5.0	<0.5
H-15'	6.73	0.36	<5.0	<0.5
I-1' OKN0103	3.74	0.13	<5.0	<0.5
J-1' KSS0012	2.04	0.19	<5.0	<0.5
K-1' KSS0013	0.95	0.25	<5.0	<0.5
EPA Standard	0.42	0.45	298.0	4.5
This Lab.	0.35	0.15	233.0	5.9

Table 5. Concentration of Heavy Metals in Kaw Lake Water Samples Collected 19 August 1978.

Station		Fe mg/l (1045)	Mn mg/l (1055)	Pb µg/l (1051)	Hg µg/l (71900)
A	OKN0131	.54	.09	<5.0	<0.5
B-1'		.62	.11	<5.0	<0.5
B-33'		.54	.11	<5.0	<0.5
B-66'	OKN0096	.46	.06	<5.0	<0.5
B-75'		2.63	.16	<5.0	<0.5
C-1'		.46	.06	<5.0	<0.5
C-33'	OKN0097	.54	.11	<5.0	<0.5
C-45'		1.60	.11	<5.0	<0.5
D-1'		.78	.06	<5.0	<0.5
D-33'	OKN0098	.94	.09	<5.0	<0.5
D-45'		1.02	.06	.38	<0.5
E-1'	OKN0099	.62	<.05	<5.0	<0.5
E-33'		2.55	.11	<5.0	<0.5
F-1'	OKN0100	.62	.09	<5.0	<0.5
F-33'		.62	.06	<5.0	<0.5
G-1'		.62	.09	<5.0	<0.5
G-33'	OKN0101	1.10	.06	<5.0	<0.5
H-1'	OKN0102	.86	<.05	<5.0	<0.5
I	OKN0103	1.74	.26	<5.0	<0.5
J	KSS0012	.54	.21	<5.0	<0.5
K	KSS0013	1.51	.26	<5.0	<0.5
EPA Standard		416 µg/l	45 µg/l	298	4.5
This Lab.		383	61	243	5.9

Table 6. Concentration of Heavy Metals in Kaw Lake Water Samples Collected 17 September 1978.

Station	Fe mg/1 (1045)	Mn mg/1 (1055)	Pb µg/1 1051	Hg µg/1 71900
A-1 OKN0131	2.97	.1	<5.0	<.5
B-1	.22	<.05	<5.0	<.5
B-33 OKN0096	.31	<.05	<5.0	<.5
B-60	.49	<.05	<5.0	<.5
B-75	.80	.14	<5.0	<.5
C-1	.36	<.05	<5.0	<.5
C-33 OKN0097	.67	<.05	<5.0	<.5
C-45	1.20	<.05	<5.0	<.5
D-1	.44	<.05	0.2	<.5
D-33 OKN0098	.75	<.05	<5.0	<.5
D-45	1.64	.06	<5.0	<.5
G-1	.58	<.05	<5.0	<.5
G-33 OKN0101	1.06	.06	<5.0	<.5
G-45	.67	<.05	<5.0	<.5
I-1 OKN0102	2.42	.30	<5.0	<.5
J-1 KSS0012	1.02	.14	<5.0	<.5
K-1 KSS0013	1.95	.26	<5.0	<.5
Epa Standard (µg/1)	417		298	4.5
This Lab. (µg/1)	416		199	6.5

APPENDIX B

WATER QUALITY DATA

KAW LAKE, 1996

Site ID	Date	Time	Depth	Secchi Depth m **00078**	Turbidity NTU **00076**	Total Alkalinity mg/l **00410**	Chloride mg/l **00940**	Total Hardness mg/l **00900**	Sulfate mg/l **00945**	Total Phosphorous mg/l **00665**	Ammonia mg/l **00610**	Nitrite mg/l **00615**
OKN0234	4/30/96	1430	0.5		8.3	144	220	260	24.48	0.0613	0.097	0.03
OKN0234	5/22/96	0000	0.5			172	240	264	28.77	0.0966	0.199	0.055
OKN0234	6/19/96	1531	0.5		13	142	220	232	21	0.1037	0.047	0.05
OKN0234	7/16/96	1415	0			144	210	220	22	0.2179	0.245	0.01
OKN0234	7/31/96	1515	0.5		11.7	140	220	216	48.58	0.1365		
OKN0234	8/13/96	1500	0.5		23.4	122	190	194	30.38	0.1453	0.206	0.04
OKN0234	10/8/96	1430	0.5		43.6	84	120	136	8.38	0.2058	1.01	0.03
OKN0234	11/5/96	1330	0.5		18.4	144	100	210	44.37	0.1875	0.015	0.02
OKN0096	4/30/96	1015	0.5	1.1	6.5	184	220	260	25.2	0.04505	0.208	0.01
OKN0096	5/22/96	1030	0.5	1	9.5	148	240	260	30.58	0.0273	0.214	0.04
OKN0096	6/19/96	1100	0.5	0.8	10.5	130	220	224	21	0.0942	0.064	<.005
OKN0096	6/19/96	1100	21			154	240	252	25	0.0966	0.45	<.005
OKN0096	7/16/96	1000	0.5	0.6	11.2	110	200	188	14	0.072	0.102	0.005
OKN0096	7/16/96	1000	21			140	210	220	21	0.1425	0.207	0.007
OKN0096	7/31/96	1015	0.5	0.93	6.2	120	210	116	44.33	0.069		
OKN0096	7/31/96	1015	22		20.4	180	220	184	44.42	0.5049		
OKN0096	8/13/96	1015	0.5	1.1	5.61	108	210	182	37.05	0.072	0.08	0.02
OKN0096	8/13/96	1015	22		17.72	146	220	218	37.867	0.3652	0.68	0.01
OKN0096	10/8/96	1030	0.5	0.4	*	100	120	144	10.39	0.213	0.167	0.01
OKN0096	10/8/96	1030	23		*	100	130	152	8.74	0.2082	0.186	0.005
OKN0096	11/5/96	1015	0.5	0.35	32	108	120	210	37.42	0.2306	0.095	0.01
OKN0096	11/5/96	1015	22.5		45.6	124	120	190	37.42	0.2306	0.102	0.005
OKN0097	4/30/96	1115	0.5	0.8	9.2	168	220	260	24.02	0.0567	0.14	0.015
OKN0097	5/22/96	1115	0.5	0.7	5.8	164	240	276	28.59	0.1013	0.236	0.06
OKN0097	6/19/96	1139	0.5	0.4	16.9	116	190	188	16	0.1321	0.49	<.005
OKN0097	6/19/96	1139	16			148	220	244	24	0.1628	0.77	0.055
OKN0097	7/16/96	1045	0.5	1.2	6.5	116	210	228	16	0.072	0.071	0.005
OKN0097	7/31/96	1140	0.5	0.96	5.5	120	200	92	42.06	0.0663		
OKN0097	7/31/96	1140	12		31.5	120	200	116	44.33	0.1063		
OKN0097	8/13/96	1100	0.5	0.7	12.1	112	210	196	37.05	0.1125	0.05	0.025
OKN0097	8/13/96	1100	15		49.2	130	210	200	41.66	0.2616	0.382	0.02
OKN0097	10/8/96	1045	0.5	0.3	34.5	100	130	148	9.8	0.2082	0.14	0.015
OKN0097	10/8/96	1045	13		36.1	100	140	156	9.09	0.2009	0.101	0.01
OKN0097	11/5/96	1045	0.5	0.3	32.1	116	130	200	45.99	0.2354	0.104	0.01
OKN0097	11/5/96	1045	16		72	132	140	240	55.84	0.2976	0.162	0.012

Site ID	Date	Time	Depth	Secchi Depth m **00078**	Turbidity NTU **00076**	Total Alkalinity mg/l **00410**	Chloride mg/l **00940**	Total Hardness mg/l **00900**	Sulfate mg/l **00945**	Total Phosphorous mg/l **00665**	Ammonia mg/l **00610**	Nitrite mg/l **00615**
OKN0098	4/30/96	1135	0.5	0.6	16.8	168	250	280	26.83	0.0776	0.244	0.033
OKN0098	5/22/96	1145	0.5	0.6	18	164	250	268	32.49	0.106	0.23	0.08
OKN0098	6/19/96	1212	0.5	0.3	25	112	180	176	14	0.1557	0.44	0.005
OKN0098	6/19/96	1212	6			120	190	192	15	0.1462	0.53	<.005
OKN0098	7/16/96	1115	0.5	0.7	7.5	116	200	192	15	0.089	0.048	0.005
OKN0098	7/31/96	1205	0.5	0.58	13.1	120	200	168	44.99	0.0933		
OKN0098	7/31/96	1205	12		23.1	128	210	140	41.87	0.0825		
OKN0098	8/13/96	1030	0.5	0.4	22.5	114	220	190	37.97	0.1579	0.064	0.03
OKN0098	10/8/96	1145	0.5	0.15	54.7	100	130	148	10.98	0.2302	0.133	0.02
OKN0098	10/8/96	1145	10		62.5	104	150	152	12.52	0.2204	0.114	0.005
OKN0098	11/5/96	1230	0.5	0.3	35.6	128	140	200	56.19	0.2449	0.12	0.025
OKN0098	11/5/96	1230	11		44	136	150	230	60.7	0.2593	0.2	0.005
OKN0099	4/30/96	1200	0.5	0.5	15	164	240	260	28.18	0.0474	0.111	0.015
OKN0099	5/22/96	0000	0.5			160	250	268	31.02	0.1083	0.2	<.005
OKN0099	6/19/96	1238	0.5	0.2	31	110	170	172	14	0.203	0.55	0.005
OKN0099	6/19/96	1238	8			118	180	192	17	0.1533	0.172	<.005
OKN0099	7/16/96	1145	0.5	0.4	19	120	200	180	14	0.1547	0.052	<.005
OKN0099	7/31/96	1245	0.5	0.65	11.1	120	220	104	44.89	0.0555		
OKN0099	7/31/96	1245	11		98.6	132	240	260	36.95	0.3121		
OKN0099	8/13/96	1200	0.5	0.4	22.5	116	210	190	37.76	0.1453	0.035	0.03
OKN0099	10/8/96	1200	0.5	0.15	95.8	96	80	124	9.33	0.1863	0.138	0.01
OKN0099	10/8/96	1200	14		128.3	104	110	156	12.76	0.2499	0.129	<.005
OKN0099	11/5/96	1215	0.5	0.2	63	140	120	200	49.93	0.2569	0.134	0.01
OKN0099	11/5/96	1215	12		51.8	140	120	200	49.93	0.2569	0.138	<.005
OKN0100	4/30/96	1215	0.5	0.5	18.5	160	240	250	26.64	0.0358	0.028	0.01
OKN0100	5/22/96	0000	0.5			172	250	272	32.4	0.113	0.19	<.005
OKN0100	6/19/96	1303	0.5	0.2	34.9	114	200	188	18	0.1581	0.46	<.005
OKN0100	7/16/96	1200	0.5		39.2	122	190	200	14	0.1693	0.086	0.005
OKN0100	7/31/96	1300	0.5		31.8	140	240	120	43.95	0.0744		
OKN0100	7/31/96	1300	6		161.3	128	240	184	40.54	0.1284		
OKN0100	8/13/96	1230	0.5	0.3	29.8	120	210	190	36.64	0.1554	0.075	0.035
OKN0100	10/8/96	1230	0.5	0.1	98.1	96	80	112	8.86	0.1717	0.128	0.04
OKN0100	10/8/96	1230	8		270	100	90	112	3.89	0.1834	0.1	0.02

Site ID	Date	Time	Depth	Secchi Depth m **00078**	Turbidity NTU **00076**	Total Alkalinity mg/l **00410**	Chloride mg/l **00940**	Total Hardness mg/l **00900**	Sulfate mg/l **00945**	Total Phosphorous mg/l **00665**	Ammonia mg/l **00610**	Nitrite mg/l **00615**
OKN0101	4/30/96	1240	0.5	0.6	13.5	168	270	280	25.65	0.0845	0.275	0.033
OKN0101	5/22/96	0000	0.5			152	230	256	28.51	0.1667	0.48	0.2
OKN0101	6/19/96	1320	0.5	0.05	75	116	140	164	12	0.2504	0.046	0.01
OKN0101	6/19/96	1320	10			110	130	160	13	0.2456	0.045	0.01
OKN0101	7/16/96	1215	0.5	0.6	20.6	116	200	200	23	0.1693	0.059	<.005
OKN0101	7/16/96	1215	10			118	190	196	16	0.2763	0.073	0.008
OKN0101	7/31/96	1315	0.5	0.38	20.1	120	230	184	43.57	0.1149		
OKN0101	7/31/96	1315	10		62.1	124	240	148	47.26	0.123		
OKN0101	8/13/96	1300	0.5	0.15	42.4	110	210	182	37.25	0.216	0.104	0.05
OKN0101	10/8/96	1250	0.5	0.15	73.6	100	130	152	12.05	0.2375	0.098	0.04
OKN0101	10/8/96	1250	11		80.1	108	130	164	13.58	0.2229	0.114	0.01
OKN0101	11/5/96	1200	0.5	0.25	38.3	136	150	230	65.22	0.2473	0.14	0.05
OKN0101	11/5/96	1200	11		52	172	180	290	89.89	0.312	0.148	0.005
OKN0102	4/30/96	1300	0.5	0.2	58.8	136	250	250	29.63	0.1658	0.118	0.08
OKN0102	5/22/96	0000	0.5			156	230	240	28.16	0.2204	0.424	0.115
OKN0102	6/19/96	1352	0.5	0.04	145.2	126	210	184	18	0.3758	0.046	0.02
OKN0102	7/16/96	1245	0.5	0.1	102.4	120	210	196	28	0.4831	0.266	0.07
OKN0102	7/31/96	1400	0.5	0.18	67.9	120	240	144	46.03	0.0825		
OKN0102	8/13/96	1315	0.5	0.05	257	110	110	170	45.66	0.2615	0.609	0.035
OKN0102	10/8/96	1315	0.5	0.1	110.7	112	120	188	17.84	0.2833	0.113	0.03
OKN0102	11/5/96	1145	0.5	0.14	60.7	204	170	300	88.62	0.3263	0.154	0.035
OKN0103	4/30/96	0000	0.5	0.1	77.8	132	190	240	30.63	0.1658	0.163	0.1
OKN0103	5/22/96	1402	0.5	0.04	152	156	230	260	34.04	0.2578	0.621	0.125
OKN0103	6/19/96	0000	0.5			108	260	168	17	0.4255	0.042	0.02
OKN0103	7/16/96	1300	0.5	0.045	278	84	240	82	29	0.9137		
OKN0103	7/31/96	1600	0.5		102.1	88	310	84	54.45	0.0717		
OKN0103	8/13/96	1330	0.5	0.1	765	92	60	168	119.22	0.537	0.298	0.06
OKN0103	10/8/96	1345	0.5	0.1	99.3	164	200	312	56.95	0.4033	0.12	0.04
OKN0103	11/5/96	1130	0.5	0.2	55.1	216	230	310	101.94	0.3239	0.047	0.03

Site ID	Date	Time	Depth	Nitrate mg/l **00620**	Total Organic Nitrogen mg/l **00605**	Total Organic Carbon mg/l **00680**	TSS mg/l **00530**	TDS mg/l **70300**	Total Arsenic mg/l **01002**	Total Cadmium mg/l **01027**	Total Chromium mg/l **01034**
OKN0234	4/30/96	1430	0.5	0.46	0.18	5.7	7		< 0.01	< 0.01	< 0.01
OKN0234	5/22/96	0000	0.5	0.52	0.42	3.8	8	810	< 0.01	< 0.01	< 0.01
OKN0234	6/19/96	1531	0.5	1	0.628	4	13	5430	< 0.01	< 0.01	< 0.01
OKN0234	7/16/96	1415	0	0.05	0.415	3.6	18	1320	< 0.01	< 0.01	< 0.01
OKN0234	7/31/96	1515	0.5								
OKN0234	8/13/96	1500	0.5	0.78	0.6	4.2	11	640	< 0.01	< 0.01	< 0.01
OKN0234	10/8/96	1430	0.5	0.69	1.58	3	26	450	< 0.01	< 0.01	< 0.01
OKN0234	11/5/96	1330	0.5	0.58	0.41	2.7	22	560	< 0.01	< 0.01	< 0.02
OKN0096	4/30/96	1015	0.5	0.046	0.247	4.9	5		< 0.01	< 0.01	< 0.01
OKN0096	5/22/96	1030	0.5	0.6	0.63	4	10	780	< 0.01	< 0.01	< 0.01
OKN0096	6/19/96	1100	0.5	0.82	0.529	4.3	1	660	< 0.01	< 0.01	< 0.01
OKN0096	6/19/96	1100	21	2.2	0.485	3.8	8	730	< 0.01	< 0.01	< 0.01
OKN0096	7/16/96	1000	0.5	1.1	0.699	4.8	7	550	< 0.01	< 0.01	< 0.01
OKN0096	7/16/96	1000	21	1.2	0.445	4.1	9	690	< 0.01	< 0.01	< 0.01
OKN0096	7/31/96	1015	0.5								
OKN0096	7/31/96	1015	22								
OKN0096	8/13/96	1015	0.5	0.85	0.9	4.1	1	590	< 0.01	< 0.01	< 0.01
OKN0096	8/13/96	1015	22	0.37	0.5	3.8	20	630	< 0.01	< 0.01	< 0.01
OKN0096	10/8/96	1030	0.5	0.93	0.407	3	28	450	< 0.01	< 0.01	< 0.01
OKN0096	10/8/96	1030	23	0.42	0.714	4	21	450	< 0.01	< 0.01	< 0.01
OKN0096	11/5/96	1015	0.5	0.96	0.427	3.8	11	520	< 0.01	< 0.01	< 0.02
OKN0096	11/5/96	1015	22.5	0.05	0.428	4	71	550	< 0.01	< 0.01	< 0.02
OKN0097	4/30/96	1115	0.5	0.52	0.124	6	3		< 0.01	< 0.01	< 0.01
OKN0097	5/22/96	1115	0.5	0.78	0.58	3.9	15	720	< 0.01	< 0.01	< 0.01
OKN0097	6/19/96	1139	0.5	0.95	0.282	5.5	10	540	< 0.01	< 0.01	< 0.01
OKN0097	6/19/96	1139	16	2	0.505	3.9	11	670	< 0.01	< 0.01	< 0.01
OKN0097	7/16/96	1045	0.5	<.005	0.459	4.8	5	550	< 0.01	< 0.01	< 0.01
OKN0097	7/31/96	1140	0.5								
OKN0097	7/31/96	1140	12								
OKN0097	8/13/96	1100	0.5	0.87	0.83	4.3	4	600	< 0.01	< 0.01	< 0.01
OKN0097	8/13/96	1100	15	0.85	0.59	4.1	21	580	< 0.01	< 0.01	< 0.01
OKN0097	10/8/96	1045	0.5	0.9	1.5	4	16	460	< 0.01	< 0.01	< 0.01
OKN0097	10/8/96	1045	13	0.76	0.79	4	17	480	< 0.01	< 0.01	< 0.01
OKN0097	11/5/96	1045	0.5	0.82	0.35	3.9	25	560	< 0.01	< 0.01	< 0.02
OKN0097	11/5/96	1045	16	0.85	0.72	4.1	54	640	< 0.01	< 0.01	< 0.02

Site ID	Date	Time	Depth	Nitrate mg/l **00620**	Total Organic Nitrogen mg/l **00605**	Total Organic Carbon mg/l **00680**	TSS mg/l **00530**	TDS mg/l **70300**	Total Arsenic mg/l **01002**	Total Cadmium mg/l **01027**	Total Chromium mg/l **01034**
OKN0098	4/30/96	1135	0.5	0.62	0.088	6.3	9		< 0.01	< 0.01	< 0.01
OKN0098	5/22/96	1145	0.5	0.56	0.59	3.9	14	760	< 0.01	< 0.01	< 0.01
OKN0098	6/19/96	1212	0.5	1	1.03	4.8	15	490	< 0.01	< 0.01	< 0.01
OKN0098	6/19/96	1212	6	1.1	0.494	4.7	20	550	< 0.01	< 0.01	< 0.01
OKN0098	7/16/96	1115	0.5	0.01	0.8	4.6	4	580	< 0.01	< 0.01	< 0.01
OKN0098	7/31/96	1205	0.5								
OKN0098	7/31/96	1205	12								
OKN0098	8/13/96	1030	0.5	1	0.85	4.9	9	610	< 0.01	< 0.01	< 0.01
OKN0098	10/8/96	1145	0.5	1.05	0.71	4	32	430	< 0.01	< 0.01	< 0.01
OKN0098	10/8/96	1145	10	0.95	0.61	4	65	440	< 0.01	< 0.01	< 0.01
OKN0098	11/5/96	1230	0.5	0.96	0.37	3.9	26	620	< 0.01	< 0.01	< 0.02
OKN0098	11/5/96	1230	11	0.82	0.46	4.5	33	630	< 0.01	< 0.01	< 0.02
OKN0099	4/30/96	1200	0.5	0.35	0.176	7.9	14		< 0.01	< 0.01	< 0.01
OKN0099	5/22/96	0000	0.5	5	0.02	4.2	33	1310	< 0.01	< 0.01	< 0.01
OKN0099	6/19/96	1238	0.5	1.8	0.856	5	27	490	< 0.01	< 0.01	< 0.01
OKN0099	6/19/96	1238	8	0.96	0.535	4.6	25	530	< 0.01	< 0.01	< 0.01
OKN0099	7/16/96	1145	0.5	0.06	0.672	4.7	17	590	< 0.01	< 0.01	< 0.01
OKN0099	7/31/96	1245	0.5								
OKN0099	7/31/96	1245	11								
OKN0099	8/13/96	1200	0.5	0.88	0.51	4.5	14	590	< 0.01	< 0.01	< 0.01
OKN0099	10/8/96	1200	0.5	0.95	0.75	4	62	310	< 0.01	< 0.01	< 0.01
OKN0099	10/8/96	1200	14	0.89	0.84	4	99	430	< 0.01	< 0.01	< 0.01
OKN0099	11/5/96	1215	0.5	0.98	0.93	4.6	31	430	< 0.01	< 0.01	< 0.02
OKN0099	11/5/96	1215	12	0.78	1.62	4.2	32	560	< 0.01	< 0.01	< 0.02
OKN0100	4/30/96	1215	0.5	0.05	0.361	10.3	16		< 0.01	< 0.01	< 0.01
OKN0100	5/22/96	0000	0.5	6	0.02	4	54	1390	< 0.01	< 0.01	< 0.01
OKN0100	6/19/96	1303	0.5	0.64	0.984	5.1	25	600	< 0.01	< 0.01	< 0.01
OKN0100	7/16/96	1200	0.5	0.08	0.537	4.7	32	590	< 0.01	< 0.01	< 0.01
OKN0100	7/31/96	1300	0.5								
OKN0100	7/31/96	1300	6								
OKN0100	8/13/96	1230	0.5	0.75	0.72	4.7	18	590	< 0.01	< 0.01	< 0.01
OKN0100	10/8/96	1230	0.5	0.8	0.71	3	45	400	< 0.01	< 0.01	< 0.01
OKN0100	10/8/96	1230	8	0.76	0.85	4	141	290	< 0.01	< 0.01	< 0.01

Site ID	Date	Time	Depth	Nitrate mg/l **00620**	Total Organic Nitrogen mg/l **00605**	Total Organic Carbon mg/l **00680**	TSS mg/l **00530**	TDS mg/l **70300**	Total Arsenic mg/l **01002**	Total Cadmium mg/l **01027**	Total Chromium mg/l **01034**
OKN0101	4/30/96	1240	0.5	0.26	0.265	9.3	5		< 0.01	< 0.01	< 0.01
OKN0101	5/22/96	0000	0.5	0.62	1.18	4.4	18	780	< 0.01	< 0.01	< 0.01
OKN0101	6/19/96	1320	0.5	0.098	0.81	5.9	56	480	< 0.01	< 0.01	< 0.01
OKN0101	6/19/96	1320	10	1.1	0.788	5.5	53	590	< 0.01	< 0.01	< 0.01
OKN0101	7/16/96	1215	0.5	0.28	0.665	4.2	19	580	< 0.01	< 0.01	< 0.01
OKN0101	7/16/96	1215	10	0.04	0.577	4.8	53	540	< 0.01	< 0.01	< 0.01
OKN0101	7/31/96	1315	0.5								
OKN0101	7/31/96	1315	10								
OKN0101	8/13/96	1300	0.5	1	1	4.8	32	590	< 0.01	< 0.01	< 0.01
OKN0101	10/8/96	1250	0.5	0.93	0.65	*	22	410	< 0.01	< 0.01	< 0.01
OKN0101	10/8/96	1250	11	0.13	0.9	4	65	460	< 0.01	< 0.01	< 0.01
OKN0101	11/5/96	1200	0.5	1.02	0.42	4	32	590	< 0.01	< 0.01	< 0.02
OKN0101	11/5/96	1200	11	0.29	0.68	4.6	54	1260	< 0.01	< 0.01	< 0.02
OKN0102	4/30/96	1300	0.5	0.48	0.686	17.3	66		< 0.01	< 0.01	< 0.01
OKN0102	5/22/96	0000	0.5	0.62	1.24	5	91	690	< 0.01	< 0.01	< 0.01
OKN0102	6/19/96	1352	0.5	0.54	1.494	6.1	43	630	< 0.01	< 0.01	< 0.01
OKN0102	7/16/96	1245	0.5	<.005	0.754	5.7	99	560	< 0.01	< 0.01	< 0.01
OKN0102	7/31/96	1400	0.5								
OKN0102	8/13/96	1315	0.5	0.88	1.44	6.4	211	390	< 0.01	< 0.01	< 0.01
OKN0102	10/8/96	1315	0.5	0.98	0.76	4	86	460	< 0.01	< 0.01	< 0.01
OKN0102	11/5/96	1145	0.5	0.96	0.38	4.4	67	650	< 0.01	< 0.01	< 0.02
OKN0103	4/30/96	0000	0.5	0.62	0.297	15.3	58		< 0.01	< 0.01	< 0.01
OKN0103	5/22/96	1402	0.5	0.58	1.24	5.2	598	690	< 0.01	< 0.01	< 0.01
OKN0103	6/19/96	0000	0.5	0.6	1.268	6.7	56	690	< 0.01	< 0.01	< 0.01
OKN0103	7/16/96	1300	0.5					630	< 0.01	< 0.01	< 0.01
OKN0103	7/31/96	1600	0.5								
OKN0103	8/13/96	1330	0.5	1.8	4.6	5.6	1346	150	< 0.01	< 0.01	< 0.01
OKN0103	10/8/96	1345	0.5	1.6	1.47	4	161	840	< 0.01	< 0.01	< 0.01
OKN0103	11/5/96	1130	0.5	1.42	0.73	4.4	57	960	< 0.01	< 0.01	< 0.02

Site ID	Date	Time	Depth	Total Copper mg/l **01042**	Total Iron mg/l **01045**	Total Mercury mg/l **71900**	Total Manganese mg/l **01055**	Total Nickel mg/l **01067**	Total Lead mg/l **01051**	Total Selenium mg/l **01147**	Total Zinc mg/l **01092**
OKN0234	4/30/96	1430	0.5	< 0.01	0.19	< .02	0.04	< 0.01	< 0.01	< 0.01	< 0.01
OKN0234	5/22/96	0000	0.5	< 0.01	< .01	< .02	0.05	< 0.01	< 0.01	< 0.01	0.05
OKN0234	6/19/96	1531	0.5	< 0.01	< .02	< .02	0.14	< 0.01	< 0.01	< 0.01	< 0.01
OKN0234	7/16/96	1415	0	< 0.01	0.19	< .02	0.46	< 0.01	< 0.01	< 0.01	< 0.01
OKN0234	7/31/96	1515	0.5								
OKN0234	8/13/96	1500	0.5	< 0.01	1.06	< .02	0.28	< 0.01	< 0.01	< 0.01	< 0.01
OKN0234	10/8/96	1430	0.5	< 0.01	0.13	< .02	< .01	< .05	< .05	< 0.01	< .02
OKN0234	11/5/96	1330	0.5	< 0.02	0.35	< .02	< .01	< .05	< .05	< 0.01	< .02
OKN0096	4/30/96	1015	0.5	< 0.01	< 0.01	< .02	0.03	< 0.01	< 0.01	< 0.01	< 0.01
OKN0096	5/22/96	1030	0.5	< 0.01	< .01	< .02	0.07	< 0.01	< 0.01	< 0.01	< 0.01
OKN0096	6/19/96	1100	0.5	< 0.01	0.07	< .02	0.02	< 0.01	< 0.01	< 0.01	< 0.01
OKN0096	6/19/96	1100	21	< 0.01	0.06	< .02	0.08	< 0.01	< 0.01	< 0.01	< 0.01
OKN0096	7/16/96	1000	0.5	< 0.01	< .01	< .02	0.03	< 0.01	< 0.01	< 0.01	< 0.01
OKN0096	7/16/96	1000	21	< 0.01	0.1	< .02	0.08	< 0.01	< 0.01	< 0.01	< 0.01
OKN0096	7/31/96	1015	0.5								
OKN0096	7/31/96	1015	22								
OKN0096	8/13/96	1015	0.5	< 0.01	0.12	< .02	0.08	< 0.01	< 0.01	< 0.01	< 0.01
OKN0096	8/13/96	1015	22	< 0.01	0.47	< .02	1.49	< 0.01	< 0.01	< 0.01	< 0.01
OKN0096	10/8/96	1030	0.5	< 0.01	< .02	< .02	< .01	< .05	< .05	< .05	< .02
OKN0096	10/8/96	1030	23	< 0.01	0.04	< .02	< .01	< .05	< .05	< 0.01	< .02
OKN0096	11/5/96	1015	0.5	< 0.02	0.41	< .02	< .01	< .05	< .05	< 0.01	< .02
OKN0096	11/5/96	1015	22.5	< 0.02	0.08	< .02	< .01	< .05	< .05	< 0.01	< .02
OKN0097	4/30/96	1115	0.5	< 0.01	0.25	< .02	< .01	< 0.01	< 0.01	< 0.01	0.02
OKN0097	5/22/96	1115	0.5	< 0.01	0.35	< .02	0.06	< 0.01	< 0.01	< 0.01	0.04
OKN0097	6/19/96	1139	0.5	< 0.01	0.25	< .02	< .01	< 0.01	< 0.01	< 0.01	< 0.01
OKN0097	6/19/96	1139	16	< 0.01	0.08	< .02	0.02	< 0.01	< 0.01	< 0.01	< 0.01
OKN0097	7/16/96	1045	0.5	< 0.01	< 0.01	< .02	0.05	< 0.01	< 0.01	< 0.01	< 0.01
OKN0097	7/31/96	1140	0.5								
OKN0097	7/31/96	1140	12								
OKN0097	8/13/96	1100	0.5	< 0.01	0.58	< .02	0.07	< 0.01	< 0.01	< 0.01	< 0.01
OKN0097	8/13/96	1100	15	< 0.01	0.73	< .02	0.39	< 0.01	< 0.01	< 0.01	< 0.01
OKN0097	10/8/96	1045	0.5	< 0.01	0.07	< .02	< .01	< .05	< .05	< 0.01	< .02
OKN0097	10/8/96	1045	13	< 0.01	0.63	< .02	0.03	< .05	< .05	< 0.01	< .02
OKN0097	11/5/96	1045	0.5	< 0.02	0.3	< .02	< .01	< .05	< .05	< 0.01	< .02
OKN0097	11/5/96	1045	16	< 0.02	0.54	< .02	< .01	< .05	< .05	< 0.01	< .02

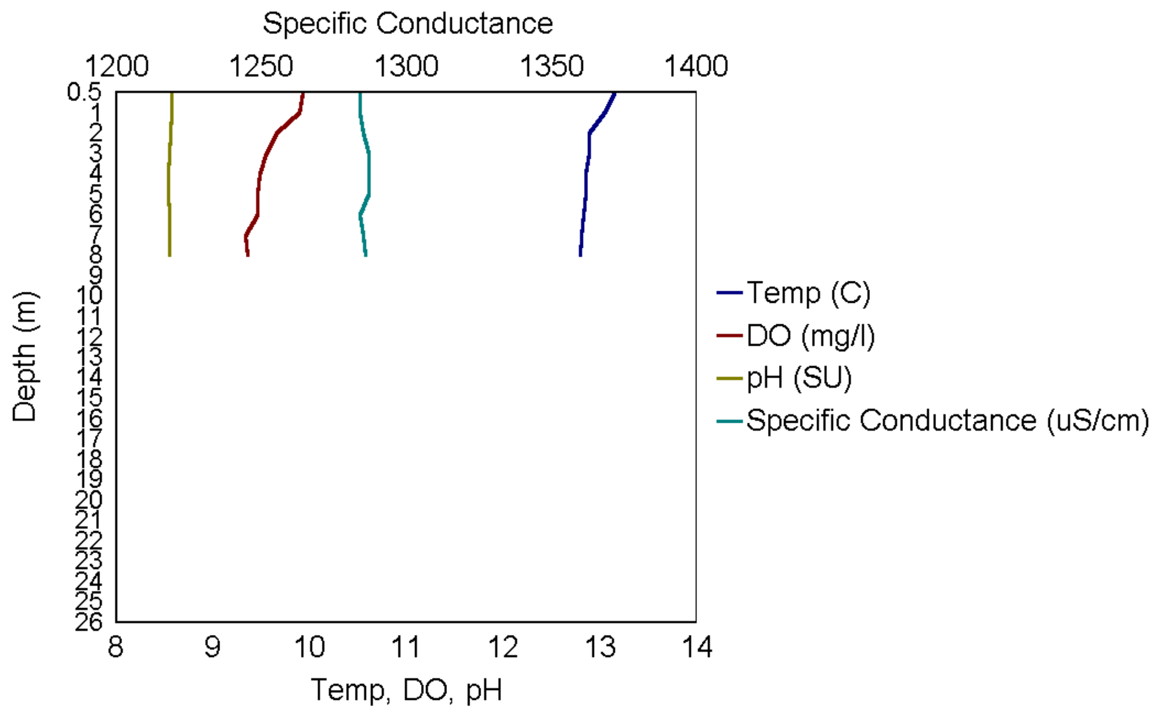
Site ID	Date	Time	Depth	Total Copper mg/l **01042**	Total Iron mg/l **01045**	Total Mercury mg/l **71900**	Total Manganese mg/l **01055**	Total Nickel mg/l **01067**	Total Lead mg/l **01051**	Total Selenium mg/l **01147**	Total Zinc mg/l **01092**
OKN0098	4/30/96	1135	0.5	< 0.01	0.25	< .02	0.03	< .05	< 0.01	< 0.01	0.02
OKN0098	5/22/96	1145	0.5	0.01	0.21	< .02	0.05	< 0.01	< 0.01	< 0.01	< 0.01
OKN0098	6/19/96	1212	0.5	< 0.01	0.3	< .02	0.03	< 0.01	< 0.01	< 0.01	< 0.01
OKN0098	6/19/96	1212	6	< 0.01	0.32	< .02	0.02	< 0.01	< 0.01	< 0.01	< 0.01
OKN0098	7/16/96	1115	0.5	< 0.01	< 0.01	< .02	0.09	< 0.01	< 0.01	< 0.01	< 0.01
OKN0098	7/31/96	1205	0.5								
OKN0098	7/31/96	1205	12								
OKN0098	8/13/96	1030	0.5	< 0.01	0.68	< .02	0.07	< 0.01	< 0.01	< 0.01	< 0.01
OKN0098	10/8/96	1145	0.5	< 0.01	0.1	< .02	< .01	< .05	< .05	< 0.01	< .02
OKN0098	10/8/96	1145	10	< 0.01	0.06	< .02	< .01	< .05	< .05	< 0.01	< .02
OKN0098	11/5/96	1230	0.5	< 0.02	0.5	< .02	< .01	< .05	< .05	< 0.01	< .02
OKN0098	11/5/96	1230	11	< 0.02	0.48	< .02	< .01	< .05	< .05	< 0.01	< .02
OKN0099	4/30/96	1200	0.5	< 0.01	0.28	< .02	0.03	< 0.00	< 0.01	< 0.01	< 0.01
OKN0099	5/22/96	0000	0.5	< 0.01	0.22	< .02	0.05	< 0.01	< 0.01	< 0.01	< 0.01
OKN0099	6/19/96	1238	0.5	< 0.01	0.95	< .02	0.04	< 0.01	< 0.01	< 0.01	0.09
OKN0099	6/19/96	1238	8	< 0.01	0.77	< .02	0.05	< 0.01	< 0.01	< 0.01	0.02
OKN0099	7/16/96	1145	0.5	< 0.01	0.25	< .02	0.15	< 0.01	< 0.01	< 0.01	< 0.01
OKN0099	7/31/96	1245	0.5								
OKN0099	7/31/96	1245	11								
OKN0099	8/13/96	1200	0.5	< 0.01	0.59	< .02	0.04	< 0.01	< 0.01	< 0.01	< 0.01
OKN0099	10/8/96	1200	0.5	< 0.01	0.83	< .02	0.05	< .05	< .05	< 0.01	< .02
OKN0099	10/8/96	1200	14	< 0.01	0.78	< .02	0.09	< .05	< .05	< 0.01	< .02
OKN0099	11/5/96	1215	0.5	< 0.02	0.85	< .02	< .01	< .05	< .05	< 0.01	< .02
OKN0099	11/5/96	1215	12	< 0.02	0.64	< .02	< .01	< .05	< .05	< 0.01	< .02
OKN0100	4/30/96	1215	0.5	< 0.01	0.2	< .02	0.06	< .05	< 0.01	< 0.01	< 0.01
OKN0100	5/22/96	0000	0.5	< 0.01	0.28	< .02	0.1	< 0.01	< 0.01	< 0.01	< 0.01
OKN0100	6/19/96	1303	0.5	< 0.01	0.29	< .02	0.08	< 0.01	< 0.01	< 0.01	< 0.01
OKN0100	7/16/96	1200	0.5	< 0.01	0.3	< .02	0.19	< 0.01	< 0.01	< 0.01	< 0.01
OKN0100	7/31/96	1300	0.5								
OKN0100	7/31/96	1300	6								
OKN0100	8/13/96	1230	0.5	< 0.01	0.27	< .02	<10	< 0.01	< 0.01	< 0.01	< 0.01
OKN0100	10/8/96	1230	0.5	< 0.01	0.81	< .02	0.05	< .05	< .05	< 0.01	< .02
OKN0100	10/8/96	1230	8	< 0.01	4.26	< .02	0.29	< .05	< .05	< 0.01	< .02

Site ID	Date	Time	Depth	Total Copper mg/l **01042**	Total Iron mg/l **01045**	Total Mercury mg/l **71900**	Total Manganese mg/l **01055**	Total Nickel mg/l **01067**	Total Lead mg/l **01051**	Total Selenium mg/l **01147**	Total Zinc mg/l **01092**
OKN0101	4/30/96	1240	0.5	< 0.01	0.22	< .02	0.03	< 0.01	< 0.01	< 0.01	0.05
OKN0101	5/22/96	0000	0.5	< 0.01	0.15	< .02	0.08	< 0.01	< 0.01	< 0.01	0.05
OKN0101	6/19/96	1320	0.5	< 0.01	2.51	< .02	0.05	0.01	< 0.01	< 0.01	< 0.01
OKN0101	6/19/96	1320	10	< 0.01	2.5	< .02	0.3	< 0.01	< 0.01	< 0.01	< 0.01
OKN0101	7/16/96	1215	0.5	< 0.01	0.17	< .02	0.06	< 0.01	< 0.01	< 0.01	< 0.01
OKN0101	7/16/96	1215	10	< 0.01	0.41	< .02	0.16	< 0.01	< 0.01	< 0.01	< 0.01
OKN0101	7/31/96	1315	0.5								
OKN0101	7/31/96	1315	10								
OKN0101	8/13/96	1300	0.5	< 0.01	0.44	< .02	0.06	< 0.01	< 0.01	< 0.01	< 0.01
OKN0101	10/8/96	1250	0.5	< 0.01	0.12	< .02	< .01	< .05	< .05	< 0.01	< .02
OKN0101	10/8/96	1250	11	< 0.01	0.13	< .02	< .01	< .05	< .05	< 0.01	< .02
OKN0101	11/5/96	1200	0.5	< 0.02	0.28	< .02	< .01	< .05	< .05	< 0.01	< .02
OKN0101	11/5/96	1200	11	< 0.02	0.77	< .02	< .01	< .05	< .05	< 0.01	< .02
OKN0102	4/30/96	1300	0.5	< 0.01	1.06	< .02	0.08	< 0.01	< 0.01	< 0.01	< 0.01
OKN0102	5/22/96	0000	0.5	< 0.01	1	< .02	0.16	< 0.01	< 0.01	< 0.01	< 0.01
OKN0102	6/19/96	1352	0.5	< 0.01	5.17	< .02	0.12	< 0.01	< 0.01	< 0.01	< 0.01
OKN0102	7/16/96	1245	0.5	< 0.01	0.52	< .02	0.17	< 0.01	< 0.01	< 0.01	< 0.01
OKN0102	7/31/96	1400	0.5								
OKN0102	8/13/96	1315	0.5	< 0.01	5.82	< .02	0.38	< 0.01	< 0.01	< 0.01	< 0.01
OKN0102	10/8/96	1315	0.5	< 0.01	0.21	< .02	0.03	< .05	< .05	< 0.01	< .02
OKN0102	11/5/96	1145	0.5	< 0.02	0.78	< .02	< .01	< .05	< .05	< 0.01	< .02
OKN0103	4/30/96	0000	0.5	< 0.01	1.53	< .02	0.1	< 0.01	< 0.01	< 0.01	< 0.01
OKN0103	5/22/96	1402	0.5	< 0.01	6.01	< .02	0.44	< 0.01	< 0.01	< 0.01	0.03
OKN0103	6/19/96	0000	0.5	< 0.01	5.52	< .02	0.26	< 0.01	< 0.01	< 0.01	< 0.01
OKN0103	7/16/96	1300	0.5	< 0.01	1.74	< .02	0.38	< 0.01	< 0.01	< 0.01	< 0.01
OKN0103	7/31/96	1600	0.5								
OKN0103	8/13/96	1330	0.5	< 0.01	10.57	< .02	1.09	< 0.01	< 0.01	< 0.01	< 0.01
OKN0103	10/8/96	1345	0.5	< 0.01	0.1	< .02	0.05	< .05	< .05	< 0.01	< .02
OKN0103	11/5/96	1130	0.5	< 0.02	0.72	< .02	< .01	< .05	< .05	< 0.01	< .02

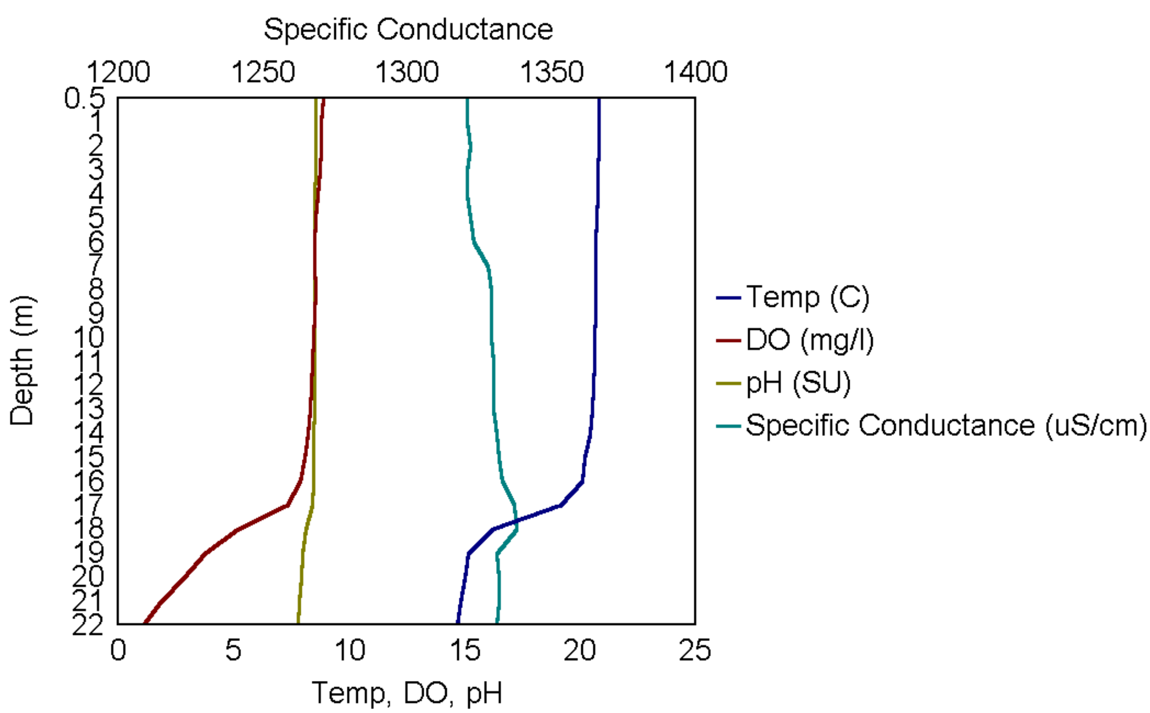
APPENDIX C

VERTICAL PROFILES

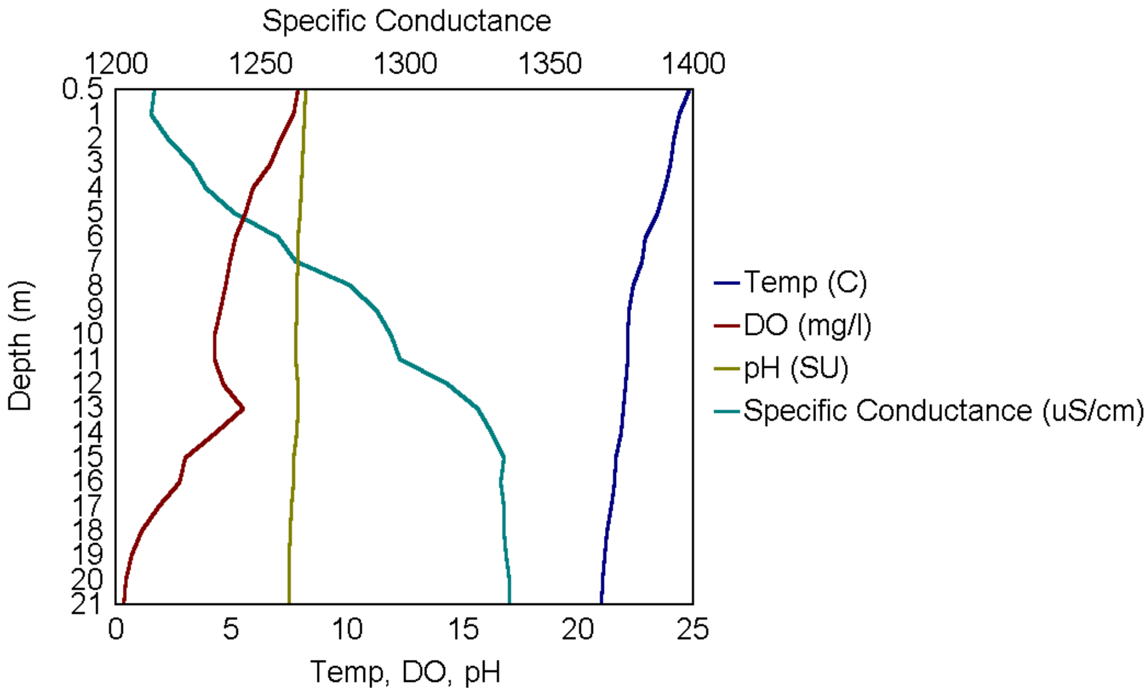
KAW LAKE, 1996



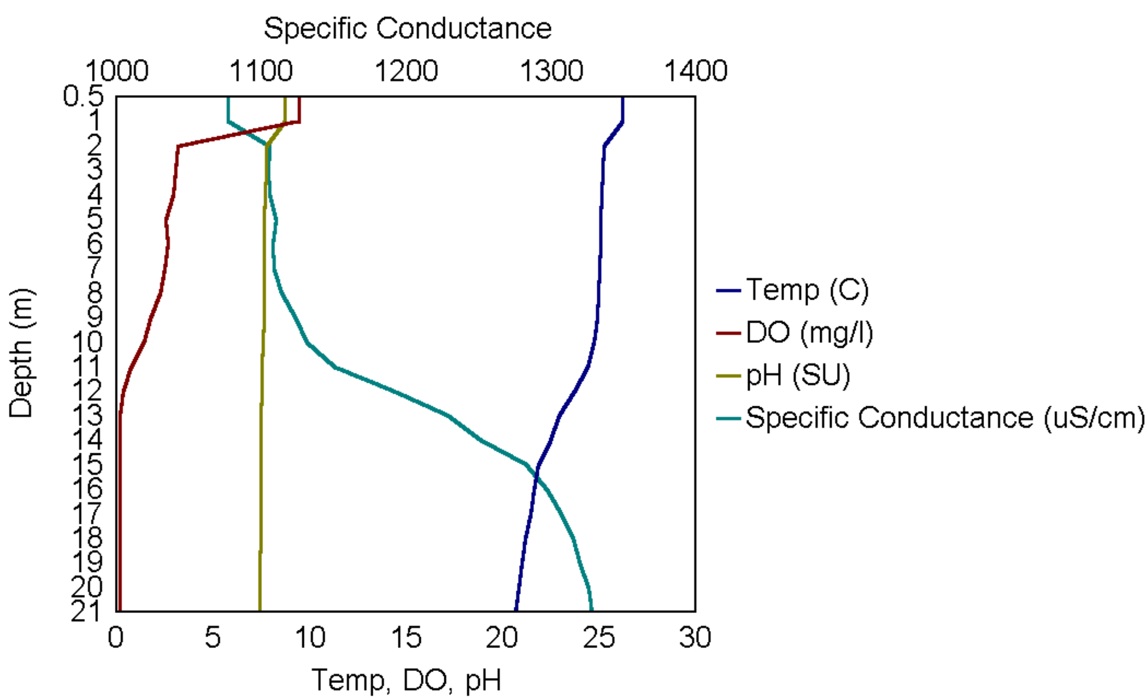
Vertical profile of water temperature (°C), dissolved oxygen (mg/l), pH (standard units), and specific conductance, Kaw Lake, Oklahoma, station OKN0096, 30 April 1996.



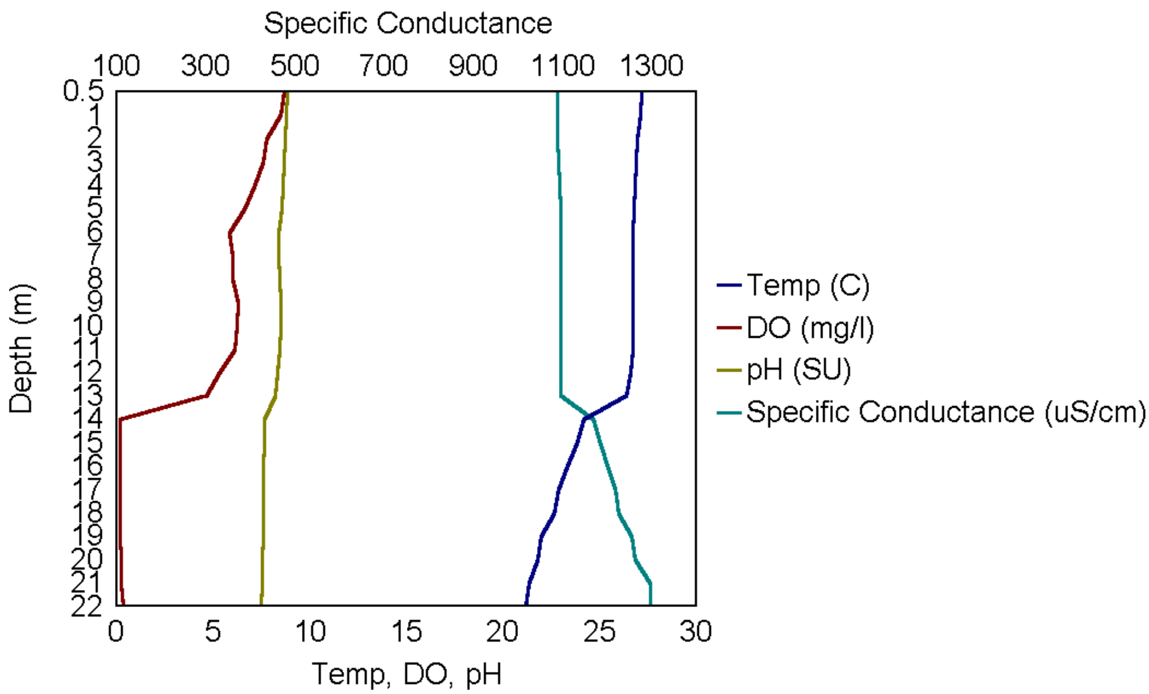
Vertical profile of water temperature (°C), dissolved oxygen (mg/l), pH (standard units), and specific conductance, Kaw Lake, Oklahoma, station OKN0096, 22 May 1996.



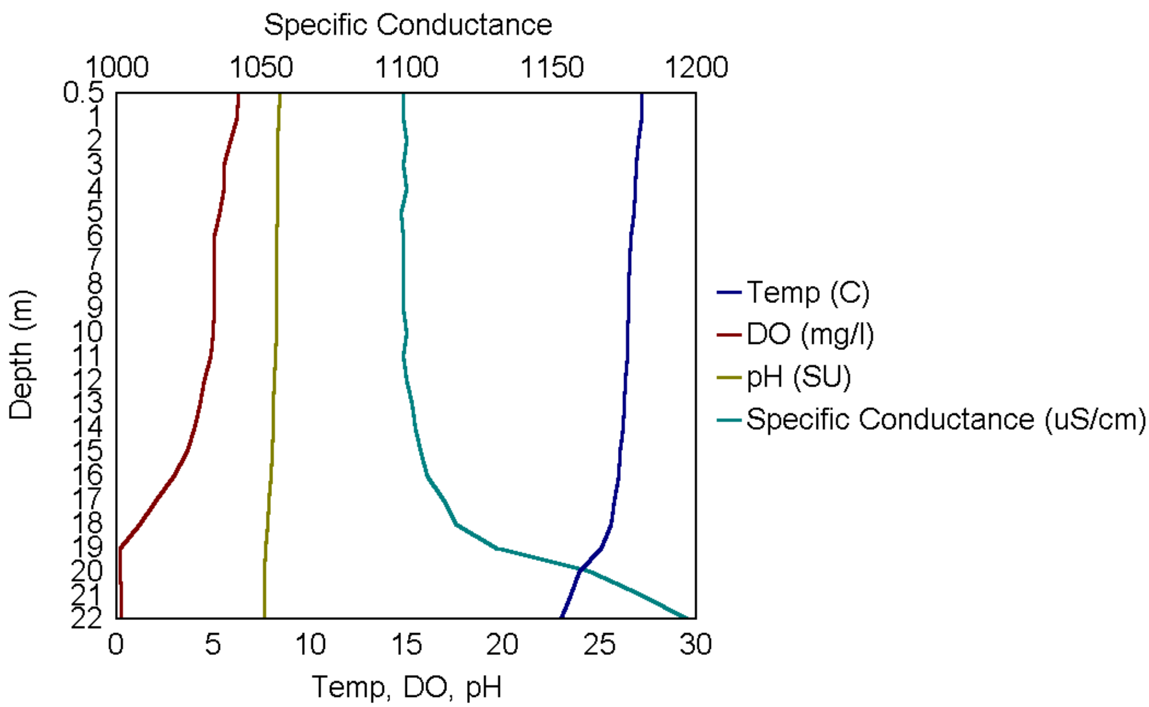
Vertical profile of water temperature (^{o}C), dissolved oxygen (mg/l), pH (standard units), and specific conductance, Kaw Lake, Oklahoma, station OKN0096, 19 June 1996.



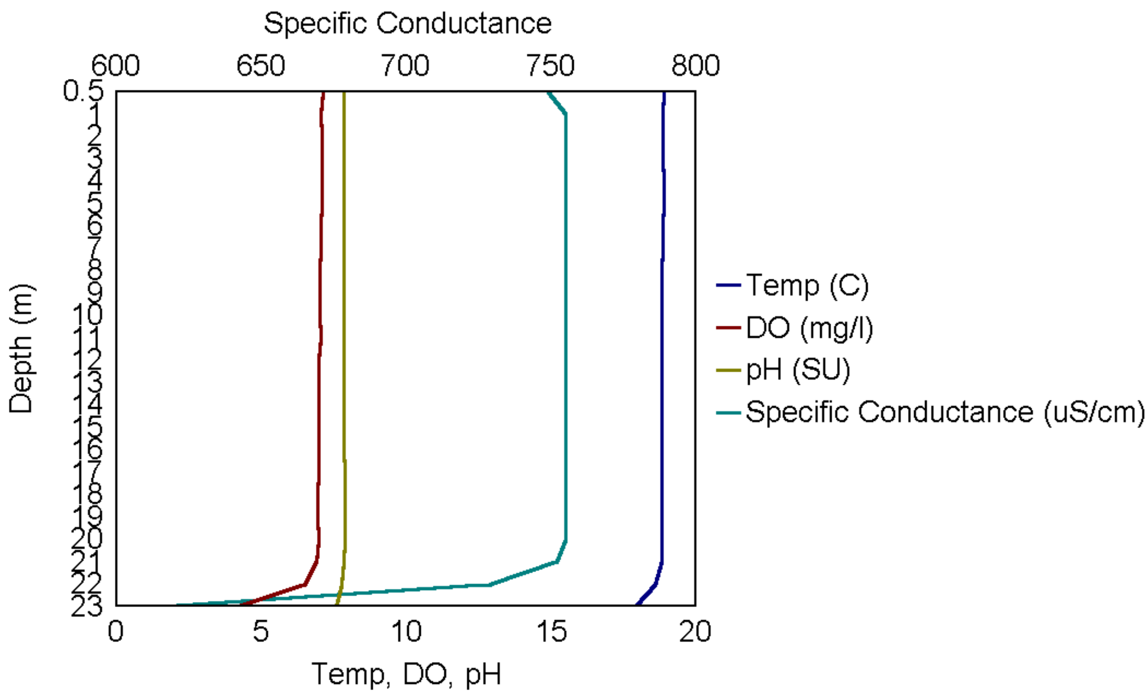
Vertical profile of water temperature (^{o}C), dissolved oxygen (mg/l), pH (standard units), and specific conductance, Kaw Lake, Oklahoma, station OKN0096, 16 July 1996.



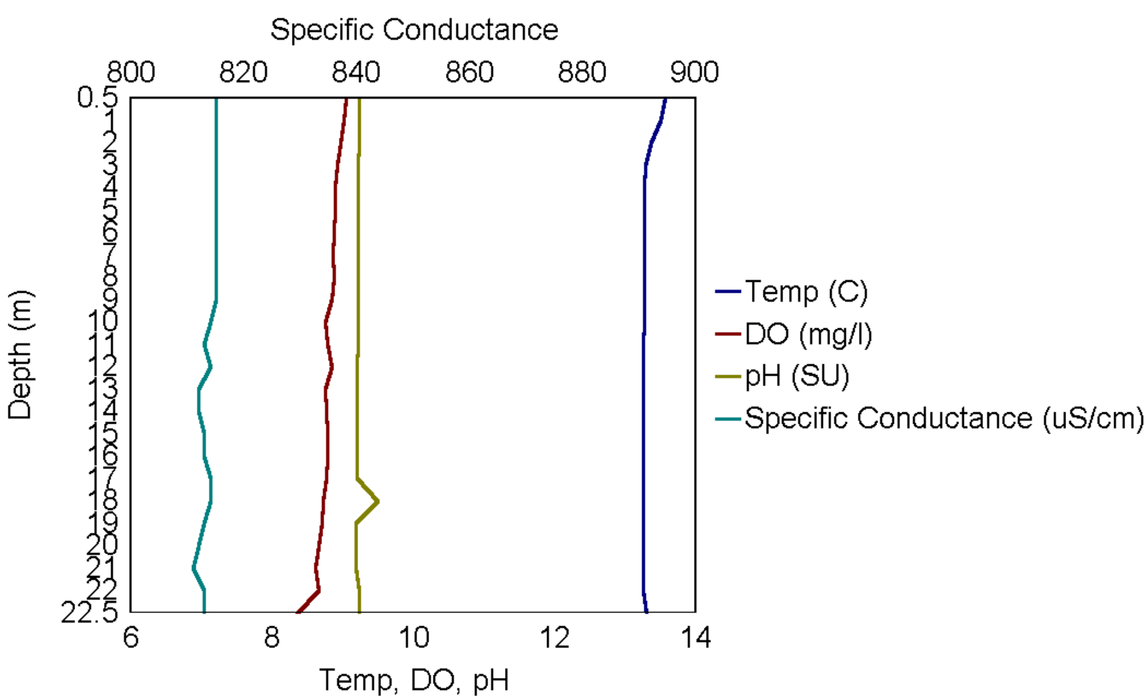
Vertical profile of water temperature (°C), dissolved oxygen (mg/l), pH (standard units), and specific conductance, Kaw Lake, Oklahoma, station OKN0096, 31 July 1996.



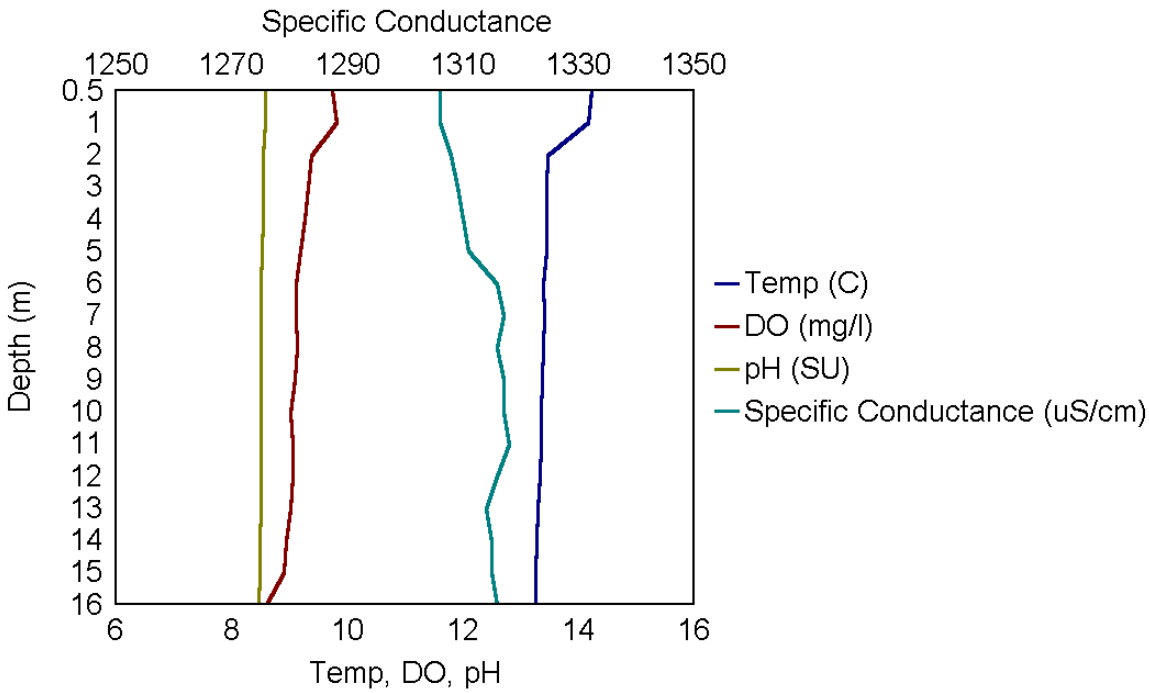
Vertical profile of water temperature (°C), dissolved oxygen (mg/l), pH (standard units), and specific conductance, Kaw Lake, Oklahoma, station OKN0096, 13 August 1996.



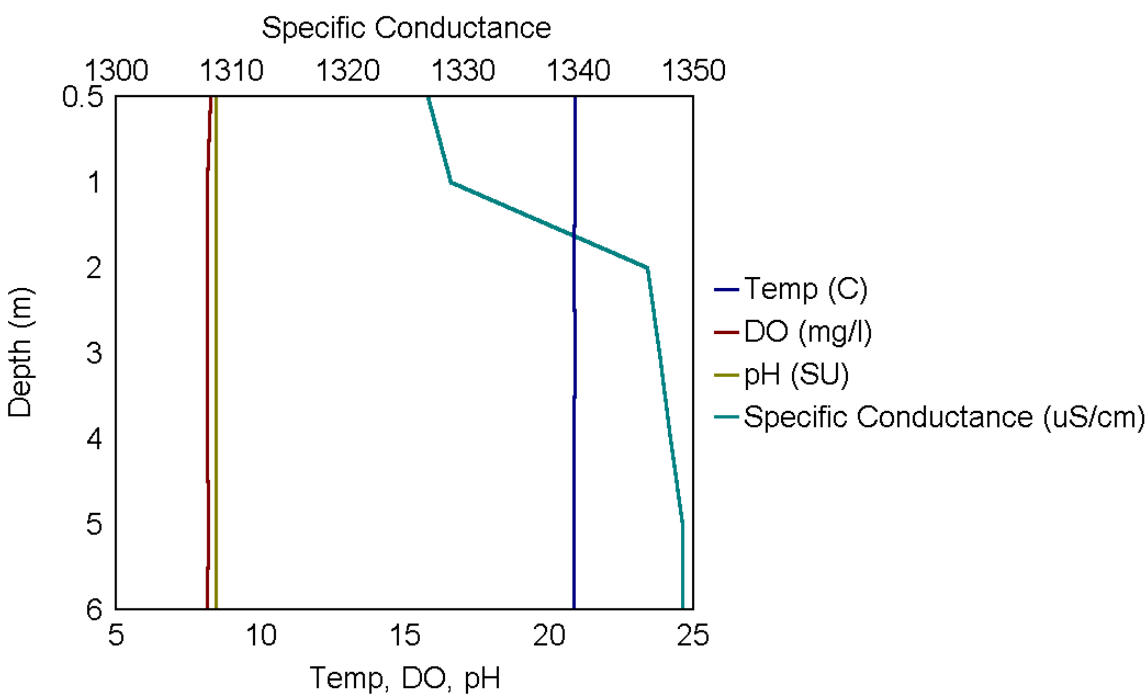
Vertical profile of water temperature (°C), dissolved oxygen (mg/l), pH (standard units), and specific conductance, Kaw Lake, Oklahoma, station OKN0096, 8 October 1996.



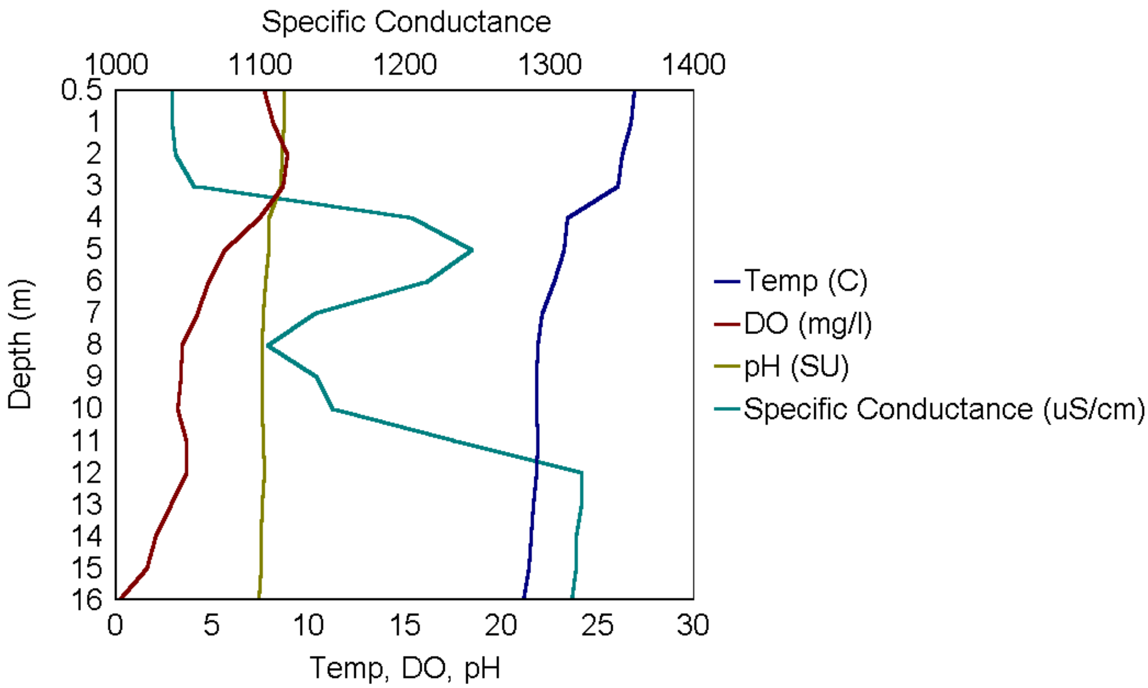
Vertical profile of water temperature (°C), dissolved oxygen (mg/l), pH (standard units), and specific conductance, Kaw Lake, Oklahoma, station OKN0096, 5 November 1996.



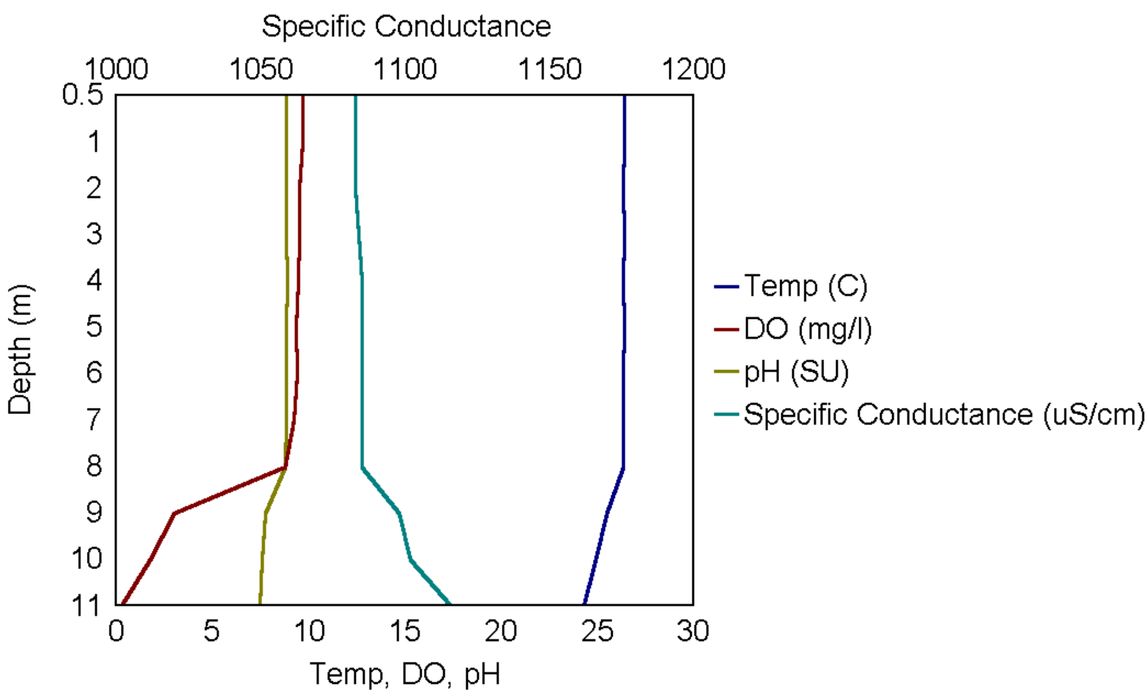
Vertical profile of water temperature (°C), dissolved oxygen (mg/l), pH (standard units), and specific conductance, Kaw Lake, Oklahoma, station OKN0097, 30 April 1996.



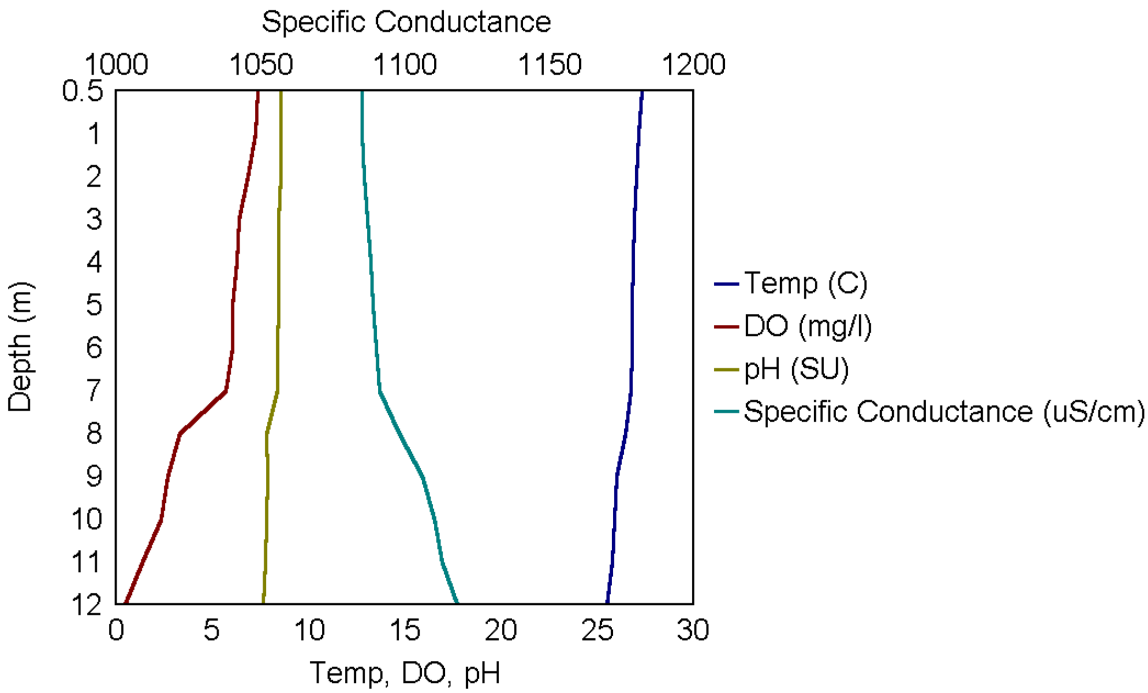
Vertical profile of water temperature (°C), dissolved oxygen (mg/l), pH (standard units), and specific conductance, Kaw Lake, Oklahoma, station OKN0097, 22 May 1996.



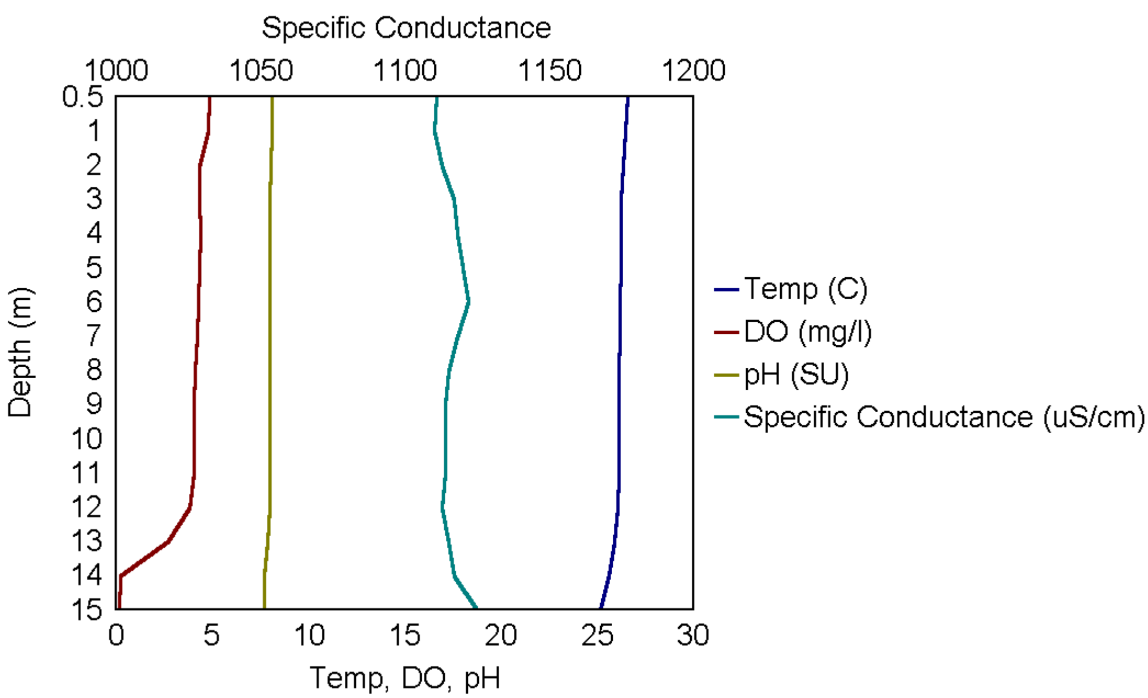
Vertical profile of water temperature (^{o}C), dissolved oxygen (mg/l), pH (standard units), and specific conductance, Kaw Lake, Oklahoma, station OKN0097, 19 June 1996.



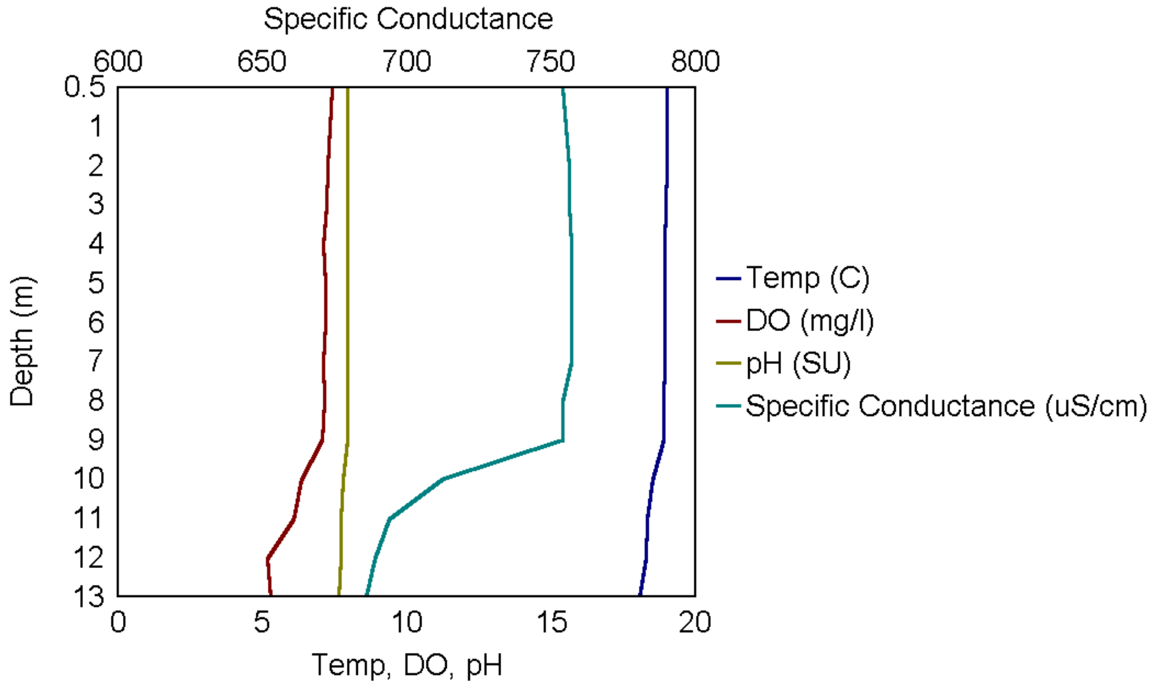
Vertical profile of water temperature (^{o}C), dissolved oxygen (mg/l), pH (standard units), and specific conductance, Kaw Lake, Oklahoma, station OKN0097, 16 July 1996.



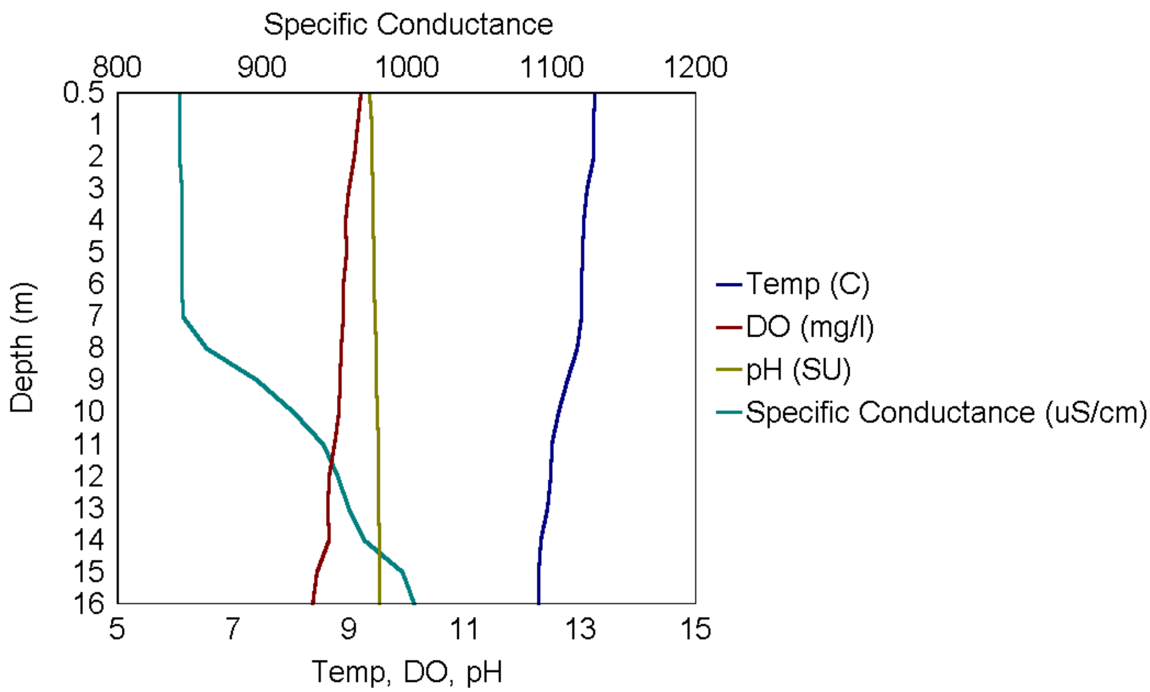
Vertical profile of water temperature (^{o}C), dissolved oxygen (mg/l), pH (standard units), and specific conductance, Kaw Lake, Oklahoma, station OKN0097, 31 July 1996.



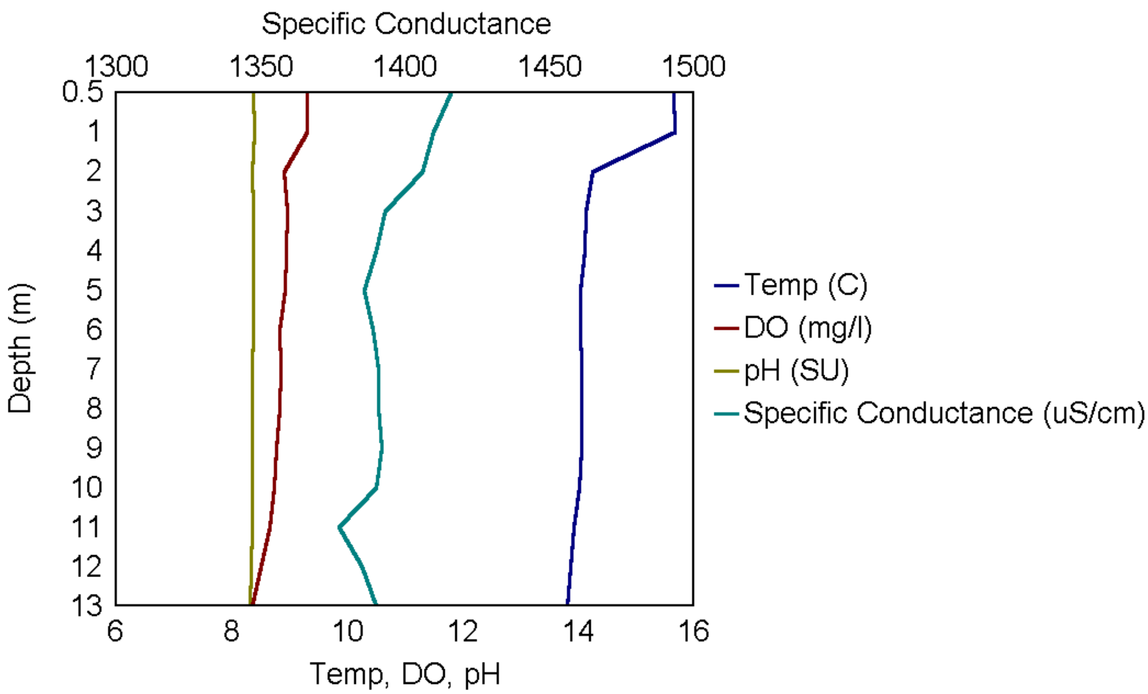
Vertical profile of water temperature (^{o}C), dissolved oxygen (mg/l), pH (standard units), and specific conductance, Kaw Lake, Oklahoma, station OKN0097, 13 August 1996.



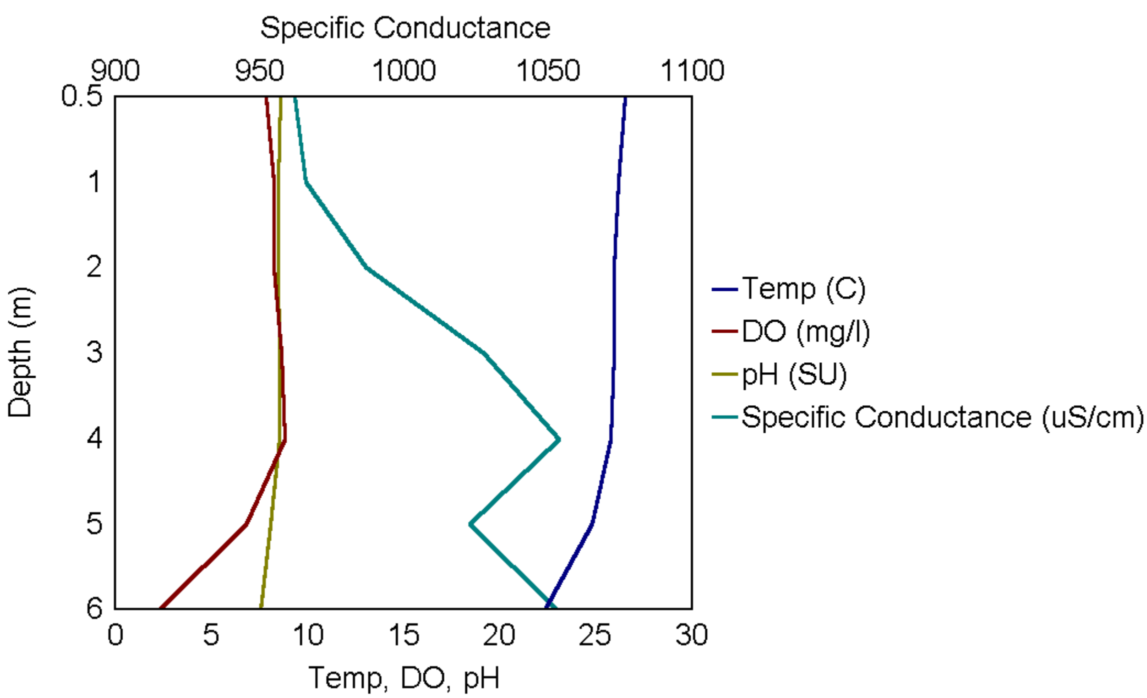
Vertical profile of water temperature (^oC), dissolved oxygen (mg/l), pH (standard units), and specific conductance, Kaw Lake, Oklahoma, station OKN0097, 8 October 1996.



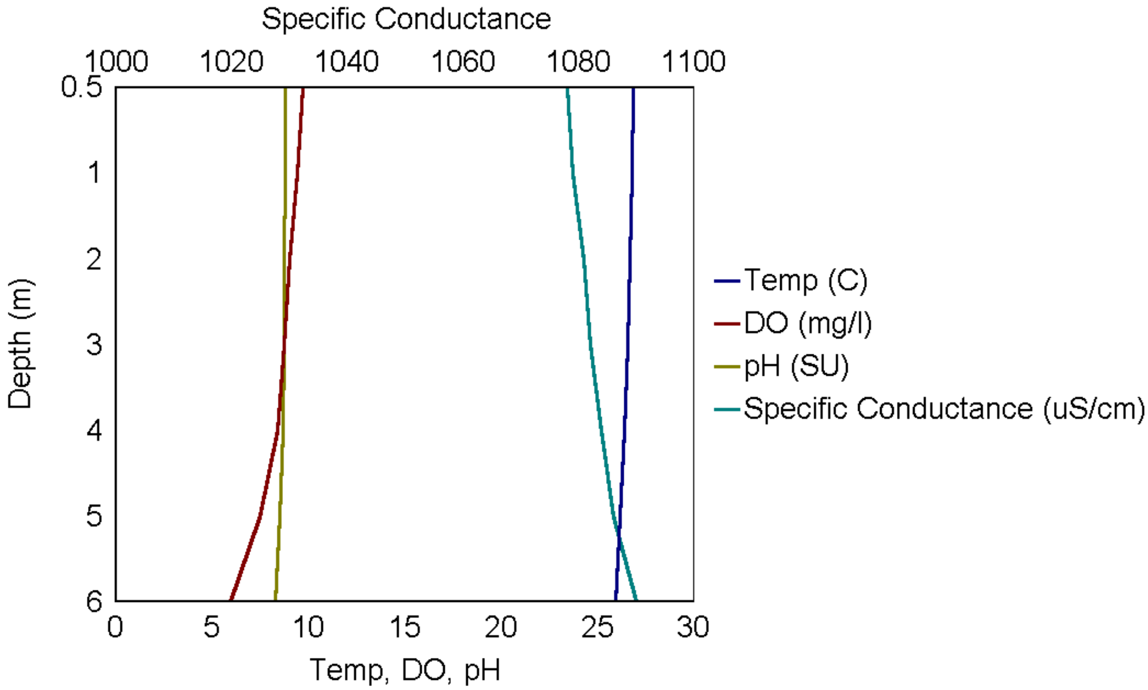
Vertical profile of water temperature (^oC), dissolved oxygen (mg/l), pH (standard units), and specific conductance, Kaw Lake, Oklahoma, station OKN0097, 5 November 1996.



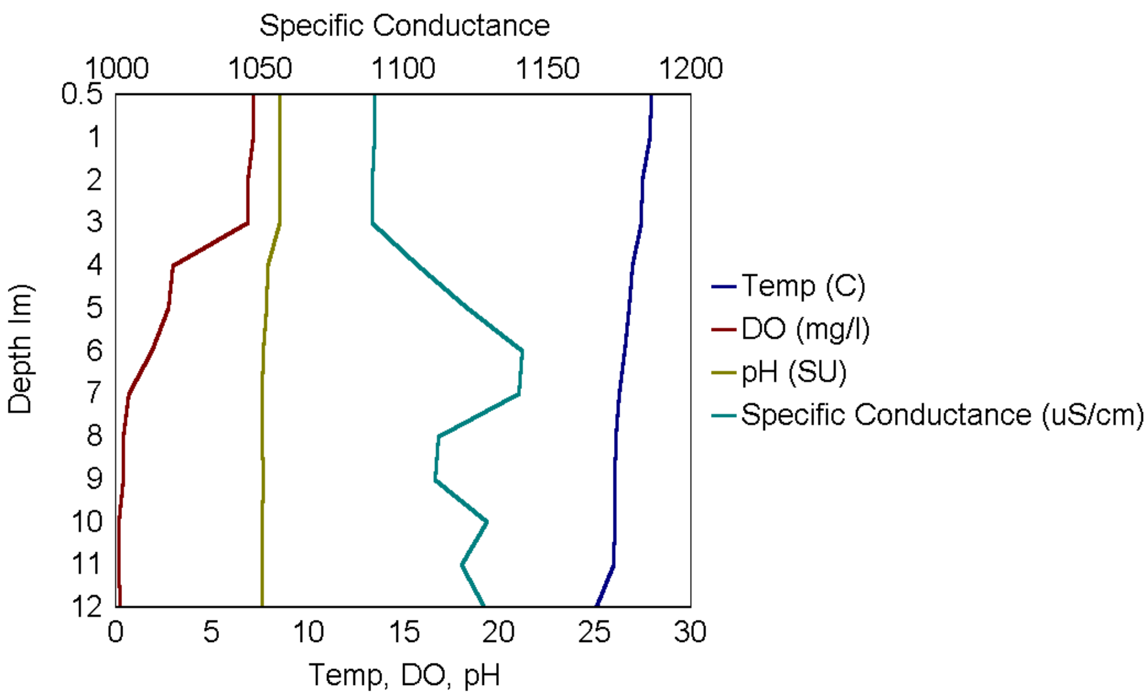
Vertical profile of water temperature (°C), dissolved oxygen (mg/l), pH (standard units), and specific conductance, Kaw Lake, Oklahoma, station OKN0098, 30 April 1996.



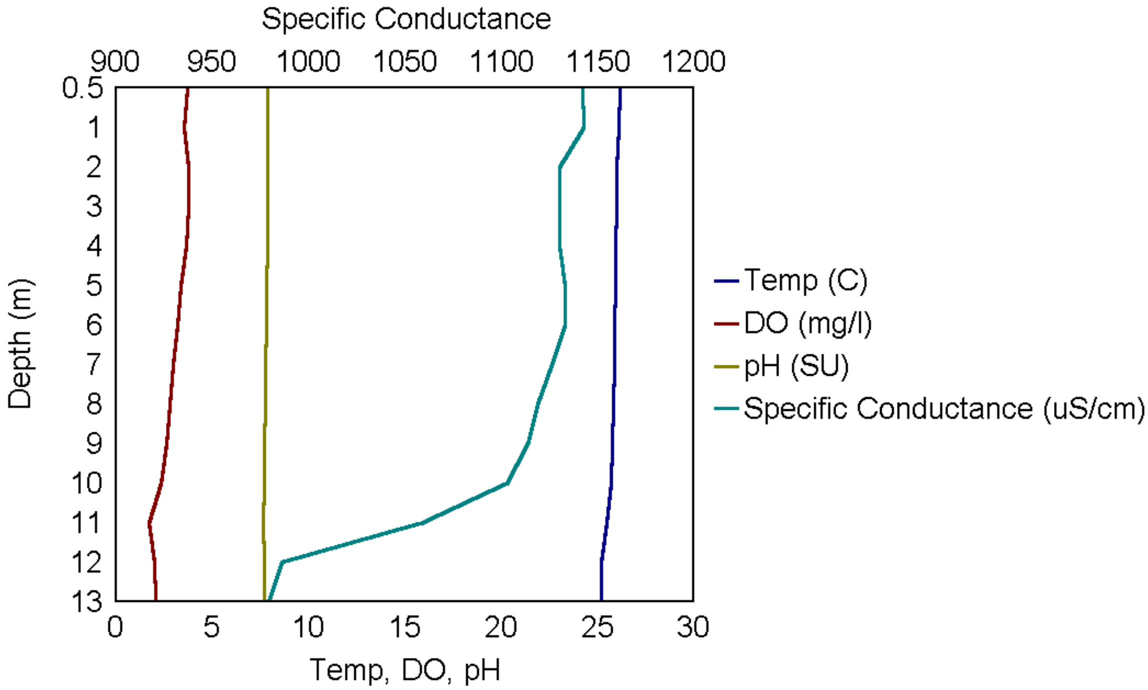
Vertical profile of water temperature (°C), dissolved oxygen (mg/l), pH (standard units), and specific conductance, Kaw Lake, Oklahoma, station OKN0098, 19 June 1996.



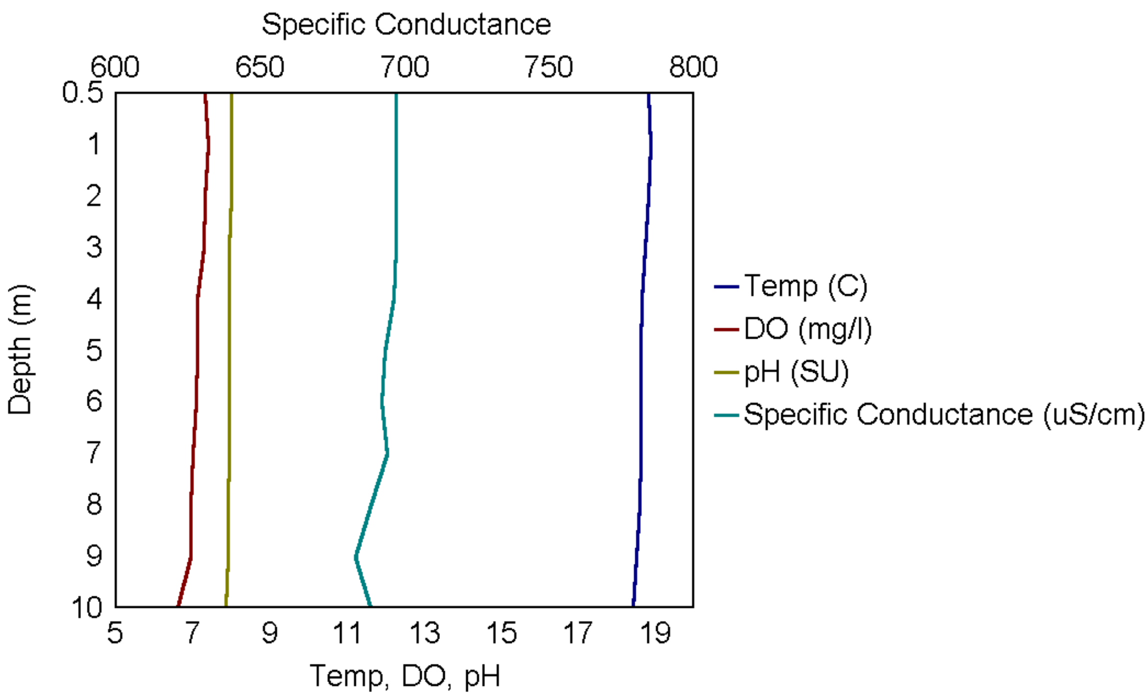
Vertical profile of water temperature (°C), dissolved oxygen (mg/l), pH (standard units), and specific conductance, Kaw Lake, Oklahoma, station OKN0098, 16 July 1996.



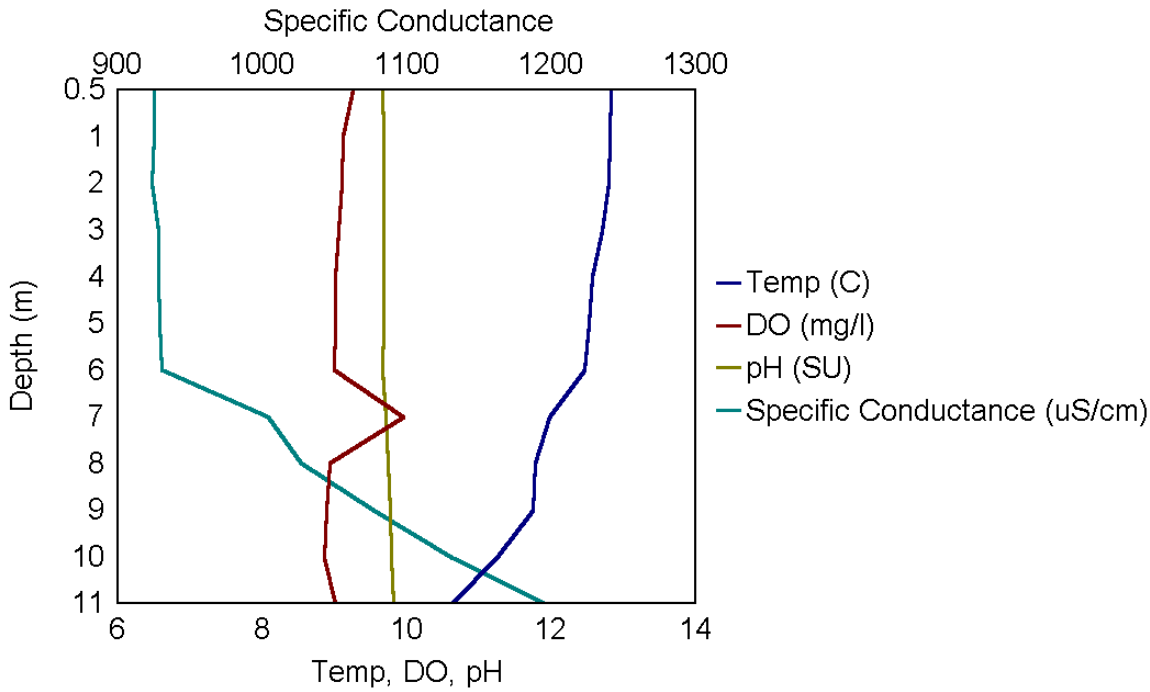
Vertical profile of water temperature (°C), dissolved oxygen (mg/l), pH (standard units), and specific conductance, Kaw Lake, Oklahoma, station OKN0098, 31 July 1996.



Vertical profile of water temperature (°C), dissolved oxygen (mg/l), pH (standard units), and specific conductance, Kaw Lake, Oklahoma, station OKN0098, 13 August 1996.



Vertical profile of water temperature (°C), dissolved oxygen (mg/l), pH (standard units), and specific conductance, Kaw Lake, Oklahoma, station OKN0098, 8 October 1996.



Vertical profile of water temperature (°C), dissolved oxygen (mg/l), pH (standard units), and specific conductance, Kaw Lake, Oklahoma, station OKN0098, 5 November 1996.

APPENDIX E

MONTHLY RESERVOIR DATA

KAW LAKE, 1996

Table D-1. Hydrolab data for Kaw Lake Station OKN0234

Site ID	Date	Depth m	Water Temperature C 00010	Dissolve Oxygen mg/l 00299	pH SU 00400	Specific Conductance uS/cm 00094
OKN0234	4/30/96	0.5	13.36	9.85	8.56	1262
OKN0234	5/22/96					
OKN0234	6/19/96	0.5	22.98	4.94	7.82	1264
OKN0234	7/16/96	0.5	23.28	7.26	7.91	1225
OKN0234	7/31/96	0.5	24.62	7.81	8.18	1177
OKN0234	8/13/96	0.5	25.93	5.99	8.14	1101
OKN0234	10/8/96	0.5	19.2	7.11	8.09	744
OKN0254	11/5/96	0.5	16.09	8.43	9.18	862
		Mean	20.78	7.34		1091
		Min	13.36	4.94	7.82	744
		Max	25.93	9.85	9.18	1264

Table D-2. Hydrolab data for Kaw Lake Station OKN0096

Site ID	Date	Depth m	Water Temperature C 00010	Dissolve Oxygen mg/l 00299	pH SU 00400	Specific Conductance uS/cm 00094
OKN0096	4/30/96	0.5	13.15	9.93	8.57	1284
OKN0096	4/30/96	1	13.05	9.9	8.57	1284
OKN0096	4/30/96	2	12.89	9.65	8.56	1285
OKN0096	4/30/96	3	12.89	9.55	8.55	1287
OKN0096	4/30/96	4	12.86	9.48	8.54	1287
OKN0096	4/30/96	5	12.86	9.46	8.54	1287
OKN0096	4/30/96	6	12.83	9.46	8.55	1284
OKN0096	4/30/96	7	12.81	9.34	8.55	1285
OKN0096	4/30/96	8	12.8	9.36	8.55	1286
OKN0096	5/22/96	0.5	20.79	8.89	8.53	1321
OKN0096	5/22/96	1	20.79	8.81	8.54	1321
OKN0096	5/22/96	2	20.79	8.77	8.54	1322
OKN0096	5/22/96	3	20.77	8.75	8.53	1321
OKN0096	5/22/96	4	20.76	8.64	8.52	1321
OKN0096	5/22/96	5	20.69	8.56	8.51	1322
OKN0096	5/22/96	6	20.67	8.51	8.5	1323
OKN0096	5/22/96	7	20.66	8.52	8.5	1328
OKN0096	5/22/96	8	20.67	8.54	8.5	1329
OKN0096	5/22/96	9	20.65	8.52	8.5	1329
OKN0096	5/22/96	10	20.62	8.45	8.5	1329
OKN0096	5/22/96	11	20.6	8.42	8.5	1330
OKN0096	5/22/96	12	20.57	8.37	8.49	1330
OKN0096	5/22/96	13	20.51	8.32	8.49	1330
OKN0096	5/22/96	14	20.41	8.2	8.47	1331
OKN0096	5/22/96	15	20.2	8.07	8.46	1332
OKN0096	5/22/96	16	20.1	7.9	8.44	1333
OKN0096	5/22/96	17	19.15	7.3	8.39	1337
OKN0096	5/22/96	18	16.18	5.2	8.12	1338
OKN0096	5/22/96	19	15.17	3.75	8	1331
OKN0096	5/22/96	20	14.99	2.83	7.93	1332
OKN0096	5/22/96	21	14.82	1.85	7.85	1332
OKN0096	5/22/96	22	14.67	1.1	7.8	1331
OKN0096	6/19/96	0.5	24.8	7.84	8.21	1213
OKN0096	6/19/96	1	24.36	7.68	8.16	1212
OKN0096	6/19/96	2	24.13	7.1	8.1	1218
OKN0096	6/19/96	3	24	6.68	8.07	1226
OKN0096	6/19/96	4	23.73	5.89	8.01	1231
OKN0096	6/19/96	5	23.39	5.6	7.95	1241
OKN0096	6/19/96	6	22.88	5.14	7.87	1256
OKN0096	6/19/96	7	22.73	4.9	7.84	1262
OKN0096	6/19/96	8	22.39	4.74	7.83	1281
OKN0096	6/19/96	9	22.18	4.48	7.8	1290
OKN0096	6/19/96	10	22.11	4.27	7.78	1295
OKN0096	6/19/96	11	22.11	4.27	7.78	1298
OKN0096	6/19/96	12	22.05	4.65	7.84	1315
OKN0096	6/19/96	13	21.95	5.47	7.85	1325
OKN0096	6/19/96	14	21.85	4.32	7.81	1330

Site ID	Date	Depth m	Water Temperature C 00010	Dissolve Oxygen mg/l 00299	pH SU 00400	Specific Conductance uS/cm 00094
OKN0096	6/19/96	15	21.62	2.96	7.68	1334
OKN0096	6/19/96	16	21.56	2.75	7.65	1333
OKN0096	6/19/96	17	21.4	1.82	7.58	1334
OKN0096	6/19/96	18	21.25	1.08	7.51	1334
OKN0096	6/19/96	19	21.14	0.65	7.48	1335
OKN0096	6/19/96	20	21.03	0.39	7.47	1336
OKN0096	6/19/96	21	21	0.34	7.46	1336
OKN0096	7/16/96	0.5	26.17	9.45	8.7	1077
OKN0096	7/16/96	1	26.17	9.44	8.71	1077
OKN0096	7/16/96	2	25.26	3.18	7.76	1106
OKN0096	7/16/96	3	25.19	3.08	7.74	1105
OKN0096	7/16/96	4	25.15	2.94	7.71	1106
OKN0096	7/16/96	5	25.08	2.55	7.67	1110
OKN0096	7/16/96	6	25.04	2.65	7.67	1108
OKN0096	7/16/96	7	25.01	2.52	7.66	1109
OKN0096	7/16/96	8	24.97	2.3	7.64	1114
OKN0096	7/16/96	9	24.9	1.74	7.63	1124
OKN0096	7/16/96	10	24.75	1.44	7.59	1131
OKN0096	7/16/96	11	24.38	0.74	7.55	1151
OKN0096	7/16/96	12	23.73	0.33	7.52	1192
OKN0096	7/16/96	13	22.89	0.18	7.5	1229
OKN0096	7/16/96	14	22.47	0.17	7.49	1252
OKN0096	7/16/96	15	21.86	0.17	7.48	1283
OKN0096	7/16/96	16	21.59	0.17	7.47	1297
OKN0096	7/16/96	17	21.42	0.17	7.47	1307
OKN0096	7/16/96	18	21.16	0.18	7.45	1315
OKN0096	7/16/96	19	21	0.18	7.44	1320
OKN0096	7/16/96	20	20.81	0.18	7.42	1326
OKN0096	7/16/96	21	20.65	0.19	7.4	1328
OKN0096	7/31/96	0.5	27.16	8.65	8.81	1087
OKN0096	7/31/96	1	27.09	8.49	8.8	1087
OKN0096	7/31/96	2	26.91	7.74	8.7	1089
OKN0096	7/31/96	3	26.85	7.57	8.66	1091
OKN0096	7/31/96	4	26.81	7.16	8.61	1094
OKN0096	7/31/96	5	26.74	6.62	8.53	1095
OKN0096	7/31/96	6	26.72	5.86	8.4	1095
OKN0096	7/31/96	7	26.72	6.01	8.41	1096
OKN0096	7/31/96	8	26.71	6.03	8.42	1095
OKN0096	7/31/96	9	26.7	6.29	8.47	1095
OKN0096	7/31/96	10	26.7	6.24	8.48	1095
OKN0096	7/31/96	11	26.68	6.11	8.43	1095
OKN0096	7/31/96	12	26.62	5.31	8.32	1096
OKN0096	7/31/96	13	26.38	4.66	8.22	1096
OKN0096	7/31/96	14	24.18	0.17	7.65	1169
OKN0096	7/31/96	15	23.8	0.17	7.63	1183
OKN0096	7/31/96	16	23.32	0.19	7.61	1202
OKN0096	7/31/96	17	22.84	0.18	7.6	1219
OKN0096	7/31/96	18	22.62	0.19	7.59	1226
OKN0096	7/31/96	19	21.97	0.2	7.57	1255

Site ID	Date	Depth m	Water Temperature C 00010	Dissolve Oxygen mg/l 00299	pH SU 00400	Specific Conductance uS/cm 00094
OKN0096	7/31/96	20	21.79	0.21	7.56	1261
OKN0096	7/31/96	21	21.33	0.23	7.51	1297
OKN0096	7/31/96	22	21.19	0.33	7.5	1297
OKN0096	8/13/96	0.5	27.18	6.29	8.41	1099
OKN0096	8/13/96	1	27.16	6.22	8.4	1099
OKN0096	8/13/96	2	26.97	5.92	8.35	1100
OKN0096	8/13/96	3	26.87	5.55	8.32	1099
OKN0096	8/13/96	4	26.83	5.53	8.32	1100
OKN0096	8/13/96	5	26.78	5.32	8.31	1098
OKN0096	8/13/96	6	26.58	5.06	8.26	1099
OKN0096	8/13/96	7	26.53	5.06	8.26	1099
OKN0096	8/13/96	8	26.48	5.02	8.25	1099
OKN0096	8/13/96	9	26.48	5.02	8.25	1099
OKN0096	8/13/96	10	26.45	4.97	8.25	1100
OKN0096	8/13/96	11	26.42	4.9	8.23	1099
OKN0096	8/13/96	12	26.31	4.56	8.18	1100
OKN0096	8/13/96	13	26.26	4.28	8.12	1102
OKN0096	8/13/96	14	26.21	4.02	8.1	1103
OKN0096	8/13/96	15	26.01	3.63	8.06	1105
OKN0096	8/13/96	16	25.96	2.95	7.97	1107
OKN0096	8/13/96	17	25.76	2.05	7.85	1113
OKN0096	8/13/96	18	25.56	1.22	7.8	1117
OKN0096	8/13/96	19	25.08	0.19	7.71	1131
OKN0096	8/13/96	20	23.94	0.2	7.66	1163
OKN0096	8/13/96	21	23.5	0.22	7.65	1181
OKN0096	8/13/96	22	23	0.25	7.62	1197
OKN0096	10/8/96	0.5	18.88	7.12	7.86	749
OKN0096	10/8/96	1	18.86	7.06	7.86	755
OKN0096	10/8/96	2	18.86	7.11	7.85	755
OKN0096	10/8/96	3	18.86	7.08	7.86	755
OKN0096	10/8/96	4	18.88	7.08	7.86	755
OKN0096	10/8/96	5	18.88	7.08	7.86	755
OKN0096	10/8/96	6	18.86	7.05	7.85	755
OKN0096	10/8/96	7	18.86	7.06	7.85	755
OKN0096	10/8/96	8	18.84	7.03	7.85	755
OKN0096	10/8/96	9	18.84	7.03	7.85	755
OKN0096	10/8/96	10	18.83	7.01	7.85	755
OKN0096	10/8/96	11	18.83	7.05	7.85	755
OKN0096	10/8/96	12	18.83	7	7.85	755
OKN0096	10/8/96	13	18.83	6.97	7.85	755
OKN0096	10/8/96	14	18.83	6.97	7.85	755
OKN0096	10/8/96	15	18.83	7	7.85	755
OKN0096	10/8/96	16	18.84	6.99	7.85	755
OKN0096	10/8/96	17	18.84	6.99	7.87	755
OKN0096	10/8/96	18	18.84	6.93	7.87	755
OKN0096	10/8/96	19	18.84	6.93	7.87	755
OKN0096	10/8/96	20	18.84	7	7.87	755
OKN0096	10/8/96	21	18.81	6.9	7.85	752
OKN0096	10/8/96	22	18.6	6.51	7.79	729

Site ID	Date	Depth m	Water Temperature C 00010	Dissolve Oxygen mg/l 00299	pH SU 00400	Specific Conductance uS/cm 00094
OKN0096	10/8/96	23	17.93	4.22	7.58	618
OKN0096	11/5/96	0.5	13.57	9.04	9.24	815
OKN0096	11/5/96	1	13.51	9.01	9.24	815
OKN0096	11/5/96	2	13.37	8.97	9.23	815
OKN0096	11/5/96	3	13.29	8.92	9.22	815
OKN0096	11/5/96	4	13.27	8.89	9.21	815
OKN0096	11/5/96	5	13.27	8.89	9.21	815
OKN0096	11/5/96	6	13.27	8.88	9.21	815
OKN0096	11/5/96	7	13.27	8.86	9.21	815
OKN0096	11/5/96	8	13.27	8.87	9.21	815
OKN0096	11/5/96	9	13.27	8.84	9.21	815
OKN0096	11/5/96	10	13.27	8.76	9.21	814
OKN0096	11/5/96	11	13.26	8.79	9.21	813
OKN0096	11/5/96	12	13.26	8.85	9.2	814
OKN0096	11/5/96	13	13.26	8.76	9.2	812
OKN0096	11/5/96	14	13.26	8.77	9.2	812
OKN0096	11/5/96	15	13.26	8.78	9.2	813
OKN0096	11/5/96	16	13.26	8.78	9.2	813
OKN0096	11/5/96	17	13.26	8.77	9.2	814
OKN0096	11/5/96	18	13.26	8.72	9.5	814
OKN0096	11/5/96	19	13.26	8.7	9.19	813
OKN0096	11/5/96	20	13.26	8.66	9.18	812
OKN0096	11/5/96	21	13.26	8.62	9.18	811
OKN0096	11/5/96	22	13.26	8.66	9.23	813
OKN0096	11/5/96	22.5	13.3	8.35	9.24	813
		Mean	20.71	5.58		1095
		Min	12.8	0.17	7.4	618
		Max	27.18	9.93	9.5	1338

Table D-3. Hydrolab data for Kaw Lake Station OKN0097

Site ID	Date	Depth m	Water Temperature C 00010	Dissolve Oxygen mg/l 00299	pH SU 00400	Specific Conductance uS/cm 00094
OKN0097	4/30/96	2	13.46	9.38	8.55	1308
OKN0097	4/30/96	3	13.44	9.32	8.54	1309
OKN0097	4/30/96	4	13.45	9.27	8.54	1310
OKN0097	4/30/96	5	13.44	9.19	8.53	1311
OKN0097	4/30/96	6	13.4	9.11	8.51	1316
OKN0097	4/30/96	7	13.41	9.12	8.51	1317
OKN0097	4/30/96	8	13.39	9.13	8.51	1316
OKN0097	4/30/96	9	13.38	9.09	8.5	1317
OKN0097	4/30/96	10	13.36	9.03	8.5	1317
OKN0097	4/30/96	11	13.35	9.06	8.5	1318
OKN0097	4/30/96	12	13.33	9.06	8.5	1316
OKN0097	4/30/96	13	13.29	9.03	8.5	1314
OKN0097	4/30/96	14	13.27	8.95	8.49	1315
OKN0097	4/30/96	15	13.26	8.91	8.49	1315
OKN0097	4/30/96	16	13.25	8.6	8.47	1316
OKN0097	5/22/96	0.5	20.88	8.27	8.45	1327
OKN0097	5/22/96	1	20.89	8.15	8.45	1329
OKN0097	5/22/96	2	20.86	8.14	8.46	1346
OKN0097	5/22/96	3	20.87	8.14	8.46	1347
OKN0097	5/22/96	4	20.86	8.16	8.46	1348
OKN0097	5/22/96	5	20.84	8.18	8.46	1349
OKN0097	5/22/96	6	20.86	8.17	8.46	1349
OKN0097	6/19/96	0.5	26.91	7.72	8.76	1039
OKN0097	6/19/96	1	26.7	8.18	8.74	1039
OKN0097	6/19/96	2	26.29	8.88	8.62	1041
OKN0097	6/19/96	3	26.04	8.67	8.59	1054
OKN0097	6/19/96	4	23.42	7.45	7.96	1205
OKN0097	6/19/96	5	23.23	5.67	7.93	1246
OKN0097	6/19/96	6	22.72	4.82	7.78	1215
OKN0097	6/19/96	7	22.09	4.23	7.64	1138
OKN0097	6/19/96	8	21.88	3.41	7.57	1105
OKN0097	6/19/96	9	21.81	3.36	7.57	1139
OKN0097	6/19/96	10	21.81	3.22	7.59	1150
OKN0097	6/19/96	11	21.88	3.69	7.66	1234
OKN0097	6/19/96	12	21.8	3.68	7.7	1322
OKN0097	6/19/96	13	21.65	2.86	7.62	1322
OKN0097	6/19/96	14	21.53	2.08	7.55	1318
OKN0097	6/19/96	15	21.44	1.59	7.51	1318
OKN0097	6/19/96	16	21.15	0.22	7.43	1315
OKN0097	7/16/96	0.5	26.38	9.71	8.85	1083
OKN0097	7/16/96	1	26.38	9.66	8.85	1083
OKN0097	7/16/96	2	26.34	9.5	8.85	1083
OKN0097	7/16/96	3	26.37	9.51	8.85	1084
OKN0097	7/16/96	4	26.34	9.43	8.86	1085
OKN0097	7/16/96	5	26.36	9.36	8.84	1085
OKN0097	7/16/96	6	26.34	9.4	8.85	1085
OKN0097	7/16/96	7	26.34	9.23	8.82	1085

Site ID	Date	Depth m	Water Temperature C 00010	Dissolve Oxygen mg/l 00299	pH SU 00400	Specific Conductance uS/cm 00094
OKN0097	7/16/96	8	26.3	8.76	8.79	1085
OKN0097	7/16/96	9	25.46	3.02	7.74	1098
OKN0097	7/16/96	10	24.88	1.75	7.6	1102
OKN0097	7/16/96	11	24.28	0.27	7.47	1116
OKN0097	7/31/96	0.5	27.31	7.36	8.57	1085
OKN0097	7/31/96	1	27.13	7.22	8.57	1085
OKN0097	7/31/96	2	27.04	6.84	8.54	1086
OKN0097	7/31/96	3	26.92	6.36	8.46	1087
OKN0097	7/31/96	4	26.85	6.24	8.43	1088
OKN0097	7/31/96	5	26.79	6.04	8.41	1089
OKN0097	7/31/96	6	26.77	6.03	8.39	1090
OKN0097	7/31/96	7	26.74	5.7	8.35	1091
OKN0097	7/31/96	8	26.42	3.3	7.79	1098
OKN0097	7/31/96	9	26.01	2.69	7.87	1106
OKN0097	7/31/96	10	25.89	2.32	7.83	1110
OKN0097	7/31/96	11	25.75	1.37	7.73	1113
OKN0097	7/31/96	12	25.48	0.48	7.66	1118
OKN0097	8/13/96	0.5	26.53	4.84	8.08	1111
OKN0097	8/13/96	1	26.46	4.79	8.07	1110
OKN0097	8/13/96	2	26.31	4.32	8.02	1113
OKN0097	8/13/96	3	26.23	4.34	8	1117
OKN0097	8/13/96	4	26.21	4.39	8	1118
OKN0097	8/13/96	5	26.21	4.31	8	1120
OKN0097	8/13/96	6	26.18	4.27	7.99	1122
OKN0097	8/13/96	7	26.14	4.22	7.98	1118
OKN0097	8/13/96	8	26.12	4.12	7.98	1115
OKN0097	8/13/96	9	26.1	4.07	7.97	1114
OKN0097	8/13/96	10	26.1	4.07	7.97	1114
OKN0097	8/13/96	11	26.08	4.03	7.97	1114
OKN0097	8/13/96	12	26.02	3.83	7.95	1113
OKN0097	8/13/96	13	25.9	2.68	7.84	1115
OKN0097	8/13/96	14	25.6	0.2	7.7	1117
OKN0097	8/13/96	15	25.12	0.19	7.67	1125
OKN0097	10/8/96	0.5	19.01	7.39	7.94	754
OKN0097	10/8/96	1	19	7.34	7.94	755
OKN0097	10/8/96	2	18.98	7.25	7.93	756
OKN0097	10/8/96	3	18.96	7.21	7.94	756
OKN0097	10/8/96	4	18.93	7.12	7.93	757
OKN0097	10/8/96	5	18.93	7.17	7.93	757
OKN0097	10/8/96	6	18.92	7.19	7.93	757
OKN0097	10/8/96	7	18.91	7.11	7.93	757
OKN0097	10/8/96	8	18.9	7.15	7.93	754
OKN0097	10/8/96	9	18.88	7.05	7.93	754
OKN0097	10/8/96	10	18.52	6.33	7.79	712
OKN0097	10/8/96	11	18.32	6.06	7.73	694
OKN0097	10/8/96	12	18.26	5.16	7.71	689
OKN0097	10/8/96	13	18.03	5.28	7.65	686
OKN0097	11/5/96	0.5	13.24	9.21	9.36	843
OKN0097	11/5/96	1	13.23	9.14	9.39	843

Site ID	Date	Depth m	Water Temperature C 00010	Dissolve Oxygen mg/l 00299	pH SU 00400	Specific Conductance uS/cm 00094
OKN0097	11/5/96	2	13.22	9.08	9.4	843
OKN0097	11/5/96	3	13.11	9	9.41	844
OKN0097	11/5/96	4	13.06	8.94	9.41	844
OKN0097	11/5/96	5	13.03	8.96	9.42	844
OKN0097	11/5/96	6	13.01	8.9	9.43	844
OKN0097	11/5/96	7	13.02	8.9	9.44	845
OKN0097	11/5/96	8	12.94	8.86	9.46	862
OKN0097	11/5/96	9	12.76	8.84	9.47	897
OKN0097	11/5/96	10	12.62	8.82	9.49	922
OKN0097	11/5/96	11	12.51	8.74	9.5	942
OKN0097	11/5/96	12	12.48	8.65	9.51	952
OKN0097	11/5/96	13	12.42	8.64	9.51	960
OKN0097	11/5/96	14	12.32	8.66	9.53	970
OKN0097	11/5/96	15	12.28	8.45	9.53	997
OKN0097	11/5/96	16	12.28	8.37	9.52	1005
		Mean	20.66	6.56		1082
		Min	12.28	0.19	7.43	686
		Max	27.31	9.71	9.53	1349

Table D-4. Hydrolab data for Kaw Lake Station OKN0098

Site ID	Date	Depth m	Water Temperature C 00010	Dissolve Oxygen mg/l 00299	pH SU 00400	Specific Conductance uS/cm 00094
OKN0098	4/30/96	0.5	15.65	9.3	8.37	1416
OKN0098	4/30/96	1	15.67	9.31	8.39	1410
OKN0098	4/30/96	2	14.24	8.91	8.35	1406
OKN0098	4/30/96	3	14.14	8.97	8.37	1393
OKN0098	4/30/96	4	14.11	8.94	8.37	1390
OKN0098	4/30/96	5	14.04	8.93	8.38	1386
OKN0098	4/30/96	6	14.04	8.84	8.37	1389
OKN0098	4/30/96	7	14.05	8.85	8.36	1391
OKN0098	4/30/96	8	14.05	8.84	8.36	1391
OKN0098	4/30/96	9	14.05	8.78	8.35	1392
OKN0098	4/30/96	10	14.02	8.74	8.35	1390
OKN0098	4/30/96	11	13.93	8.67	8.36	1377
OKN0098	4/30/96	12	13.86	8.5	8.33	1385
OKN0098	4/30/96	13	13.81	8.35	8.31	1390
OKN0098	5/22/96	0.5				
OKN0098	6/19/96	0.5	26.53	7.82	8.55	962
OKN0098	6/19/96	1	26.18	8.24	8.49	966
OKN0098	6/19/96	2	25.93	8.24	8.45	987
OKN0098	6/19/96	3	25.93	8.63	8.5	1028
OKN0098	6/19/96	4	25.8	8.82	8.51	1054
OKN0098	6/19/96	5	24.8	6.8	8.07	1023
OKN0098	6/19/96	6	22.36	2.28	7.55	1053
OKN0098	7/16/96	0.5	26.83	9.7	8.79	1078
OKN0098	7/16/96	1	26.77	9.43	8.78	1079
OKN0098	7/16/96	2	26.66	9.01	8.73	1081
OKN0098	7/16/96	3	26.53	8.76	8.71	1082
OKN0098	7/16/96	4	26.4	8.41	8.66	1084
OKN0098	7/16/96	5	26.14	7.47	8.53	1086
OKN0098	7/16/96	6	25.9	5.97	8.25	1090
OKN0098	7/31/96	0.5	27.9	7.14	8.53	1090
OKN0098	7/31/96	1	27.83	7.14	8.54	1090
OKN0098	7/31/96	2	27.42	6.84	8.53	1089
OKN0098	7/31/96	3	27.36	6.85	8.54	1089
OKN0098	7/31/96	4	26.9	2.95	7.92	1105
OKN0098	7/31/96	5	26.76	2.75	7.84	1122
OKN0098	7/31/96	6	26.52	1.84	7.68	1141
OKN0098	7/31/96	7	26.23	0.66	7.62	1140
OKN0098	7/31/96	8	226.08	0.39	7.64	1112
OKN0098	7/31/96	9	26.02	0.4	7.66	1111
OKN0098	7/31/96	10	26.02	0.16	7.61	1129
OKN0098	7/31/96	11	25.95	0.16	7.63	1120
OKN0098	7/31/96	12	25.02	0.18	7.59	1128
OKN0098	8/13/96	0.5	26.15	3.69	7.85	1142
OKN0098	8/13/96	1	26.1	3.55	7.84	1143
OKN0098	8/13/96	2	25.99	3.76	7.89	1130
OKN0098	8/13/96	3	25.98	3.75	7.89	1130
OKN0098	8/13/96	4	25.95	3.67	7.87	1130

Site ID	Date	Depth m	Water Temperature C 00010	Dissolve Oxygen mg/l 00299	pH SU 00400	Specific Conductance uS/cm 00094
OKN0098	8/13/96	5	25.91	3.34	7.81	1133
OKN0098	8/13/96	6	25.89	3.21	7.79	1133
OKN0098	8/13/96	7	25.85	2.97	7.76	1126
OKN0098	8/13/96	8	25.8	2.79	7.73	1119
OKN0098	8/13/96	9	25.78	2.6	7.71	1114
OKN0098	8/13/96	10	25.73	2.33	7.69	1103
OKN0098	8/13/96	11	25.47	1.74	7.65	1059
OKN0098	8/13/96	12	25.22	2	7.67	986
OKN0098	8/13/96	13	25.18	2.04	7.67	979
OKN0098	10/8/96	0.5	18.81	7.3	7.98	697
OKN0098	10/8/96	1	18.87	7.39	7.98	697
OKN0098	10/8/96	2	18.81	7.32	7.98	697
OKN0098	10/8/96	3	18.73	7.28	7.95	697
OKN0098	10/8/96	4	18.66	7.12	7.95	696
OKN0098	10/8/96	5	18.62	7.11	7.94	693
OKN0098	10/8/96	6	18.61	7.09	7.93	692
OKN0098	10/8/96	7	18.61	7.01	7.93	694
OKN0098	10/8/96	8	18.58	6.93	7.92	688
OKN0098	10/8/96	9	18.51	6.93	7.9	683
OKN0098	10/8/96	10	18.43	6.61	7.86	688
OKN0098	11/5/96	0.5	12.83	9.26	9.67	925
OKN0098	11/5/96	1	12.82	9.12	9.69	925
OKN0098	11/5/96	2	12.8	9.11	9.68	924
OKN0098	11/5/96	3	12.7	9.06	9.69	928
OKN0098	11/5/96	4	12.57	9.02	9.69	928
OKN0098	11/5/96	5	12.53	9.01	9.69	929
OKN0098	11/5/96	6	12.46	9	9.67	931
OKN0098	11/5/96	7	11.97	9.96	9.71	1004
OKN0098	11/5/96	8	11.78	8.94	9.75	1027
OKN0098	11/5/96	9	11.75	8.89	9.77	1077
OKN0098	11/5/96	10	11.25	8.86	9.79	1131
OKN0098	11/5/96	11	10.62	9.01	9.82	1196
		Mean	23.34	6.41		1072
		Min	10.62	0.16	7.55	683
		Max	226.08	9.96	9.82	1416

Table D-5. Hydrolab data for Kaw Lake Station OKN0099

Site ID	Date	Depth m	Water Temperature C 00010	Dissolve Oxygen mg/l 00299	pH SU 00400	Specific Conductance uS/cm 00094
OKN0099	4/30/96	0.5	15.47	9.43	8.48	1365
OKN0099	4/30/96	1	14.8	8.78	8.34	1399
OKN0099	4/30/96	2	14.54	8.56	8.29	1410
OKN0099	4/30/96	3	14.52	8.46	8.28	1411
OKN0099	4/30/96	4	14.51	8.52	8.28	1412
OKN0099	4/30/96	5	14.52	8.49	8.28	1413
OKN0099	4/30/96	6	14.43	8.6	8.31	1395
OKN0099	4/30/96	7	14.28	8.89	8.34	1374
OKN0099	5/22/96	0.5				
OKN0099	6/19/96	0.5	29	7.18	8.49	936
OKN0099	6/19/96	1	28.84	7.24	8.49	938
OKN0099	6/19/96	2	27.05	6.39	8.24	992
OKN0099	6/19/96	3	26.83	5.85	8.11	1013
OKN0099	6/19/96	4	26.41	4.92	7.88	1063
OKN0099	6/19/96	5	25.74	3.13	7.72	1088
OKN0099	6/19/96	6	24.79	1.96	7.58	1133
OKN0099	6/19/96	7	23.77	0.98	7.48	1213
OKN0099	6/19/96	8	22.9	0.41	7.3	1260
OKN0099	7/16/96	0.5	26.81	7.09	8.2	1079
OKN0099	7/16/96	1	26.8	6.83	8.2	1080
OKN0099	7/16/96	2	26.78	6.77	8.2	1081
OKN0099	7/16/96	3	26.74	6.73	8.2	1083
OKN0099	7/16/96	4	26.73	6.7	8.19	1083
OKN0099	7/16/96	5	26.72	6.7	8.19	1084
OKN0099	7/16/96	6	26.58	6.44	8.15	1084
OKN0099	7/31/96	0.5	28.61	8.47	8.75	1094
OKN0099	7/31/96	1	28.54	8.19	8.73	1093
OKN0099	7/31/96	2	27.84	6.73	8.54	1101
OKN0099	7/31/96	3	27.44	6.1	8.39	1101
OKN0099	7/31/96	4	27.45	6.02	8.39	1101
OKN0099	7/31/96	5	27.22	5.29	8.3	1102
OKN0099	7/31/96	6	27.14	5.17	8.26	1101
OKN0099	7/31/96	7	26.3	1.6	7.75	1104
OKN0099	7/31/96	8	25.82	0.36	7.65	1110
OKN0099	7/31/96	9	25.69	0.16	7.64	1111
OKN0099	7/31/96	10	25.56	0.15	7.64	1113
OKN0099	7/31/96	11	25.56	0.18	7.64	1114
OKN0099	8/13/96	0.5	27.25	6.62	8.37	1110
OKN0099	8/13/96	1	26.88	6.23	8.34	1109
OKN0099	8/13/96	2	26.33	5.15	8.14	1116
OKN0099	8/13/96	3	25.84	4.02	7.94	1127
OKN0099	8/13/96	4	25.6	4.36	8.04	1092
OKN0099	8/13/96	5	25.5	4.61	8.06	1088
OKN0099	8/13/96	6	25.29	4.86	8.1	1075
OKN0099	8/13/96	7	253.1	4.34	8.04	1052
OKN0099	8/13/96	8	24.87	4.27	8.03	1041
OKN0099	8/13/96	9	24.81	4.2	8.02	1037

Site ID	Date	Depth m	Water Temperature C 00010	Dissolve Oxygen mg/l 00299	pH SU 00400	Specific Conductance uS/cm 00094
OKN0099	8/13/96	10	24.77	4.08	8.01	1027
OKN0099	8/13/96	11	24.53	3.82	8	989
OKN0099	8/13/96	12	23.39	1.93	7.96	607
OKN0099	8/13/96	13	22.98	1.36	7.9	600
OKN0099	10/8/96	0.5	18.42	7.02	7.88	504
OKN0099	10/8/96	1	18.41	6.94	7.87	507
OKN0099	10/8/96	2	18.35	6.82	7.87	512
OKN0099	10/8/96	3	18.3	6.62	7.84	532
OKN0099	10/8/96	4	18.06	6.21	7.8	584
OKN0099	10/8/96	5	17.96	6.17	7.8	586
OKN0099	10/8/96	6	17.96	5.92	7.78	595
OKN0099	10/8/96	7	18.05	5.7	7.76	630
OKN0099	10/8/96	8	18.08	5.64	7.76	657
OKN0099	10/8/96	9	18.08	5.61	7.76	658
OKN0099	10/8/96	10	18.08	5.56	7.76	685
OKN0099	10/8/96	11	18.08	5.48	7.75	674
OKN0099	10/8/96	12	18.05	5.35	7.75	675
OKN0099	10/8/96	13	18.01	5.13	7.73	672
OKN0099	10/8/96	14	17.98	4.6	7.7	669
OKN0099	11/5/96	0.5	10.86	9.63	9.55	556
OKN0099	11/5/96	1	10.85	9.52	9.53	556
OKN0099	11/5/96	2	10.78	9.49	9.52	556
OKN0099	11/5/96	3	10.68	9.46	9.52	563
OKN0099	11/5/96	4	10.62	9.27	9.51	567
OKN0099	11/5/96	5	10.68	9.11	9.53	586
OKN0099	11/5/96	6	10.92	9.21	9.54	677
OKN0099	11/5/96	7	11.32	9.16	9.67	744
OKN0099	11/5/96	8	11.59	9.12	9.64	847
OKN0099	11/5/96	9	11.68	9.12	9.66	876
OKN0099	11/5/96	10	11.73	9.04	9.68	895
OKN0099	11/5/96	11	11.75	9.06	9.7	898
OKN0099	11/5/96	12	11.74	9.12	9.7	897
		Mean	23.86	6.06	8.3001	950
		Min	10.62	0.15	7.3	504
		Max	253.1	9.63	9.7	1413

Table D-6. Hydrolab data for Kaw Lake Station OKN0100

Site ID	Date	Depth m	Water Temperature C 00010	Dissolve Oxygen mg/l 00299	pH SU 00400	Specific Conductance uS/cm 00094
OKN0100	4/30/96	0.5	15.7	10.65	8.67	1337
OKN0100	4/30/96	1	14.75	9.98	8.57	1338
OKN0100	4/30/96	2	14.47	9.74	8.51	1343
OKN0100	5/22/96	0.5				
OKN0100	6/19/96	0.5	29.43	8.93	8.77	1113
OKN0100	6/19/96	1	28.85	7.87	8.64	1117
OKN0100	6/19/96	2	27.67	6.41	8.37	1121
OKN0100	6/19/96	3	27.19	5.71	8.29	1123
OKN0100	7/16/96	0.5	26.65	7.18	8.3	1076
OKN0100	7/16/96	1	26.62	6.97	8.3	1076
OKN0100	7/16/96	2	26.56	6.95	8.3	1078
OKN0100	7/16/96	3	26.23	6.78	8.27	1079
OKN0100	7/16/96	4	26.08	6.31	8.22	1079
OKN0100	7/16/96	5	25.55	4.32	7.94	1084
OKN0100	7/31/96	0.5	28.16	6.34	8.36	1095
OKN0100	7/31/96	1	27.88	6.04	8.34	1096
OKN0100	7/31/96	2	27.4	5.57	8.27	1099
OKN0100	7/31/96	3	27.01	5.33	8.19	1100
OKN0100	7/31/96	4	26.87	4.25	8.07	1101
OKN0100	7/31/96	5	26.59	1.52	7.8	1106
OKN0100	7/31/96	6	26.44	0.55	7.73	1112
OKN0100	8/13/96	0.5	26.54	6.89	8.43	1070
OKN0100	8/13/96	1	26.06	6.29	8.39	1058
OKN0100	8/13/96	2	24.78	2.57	8.19	1028
OKN0100	8/13/96	3	24.35	4.88	8.08	992
OKN0100	8/13/96	4	23.95	4.06	7.97	878
OKN0100	8/13/96	5	23.74	3.61	7.92	815
OKN0100	8/13/96	6	23.51	2.93	7.86	756
OKN0100	10/8/96	0.5	18.53	6.67	7.87	482
OKN0100	10/8/96	1	18.42	6.6	7.86	482
OKN0100	10/8/96	2	18.28	6.47	7.86	481
OKN0100	10/8/96	3	18.17	6.4	7.84	474
OKN0100	10/8/96	4	18.18	6.39	7.84	474
OKN0100	10/8/96	5	18.15	6.3	7.83	473
OKN0100	10/8/96	6	18.13	6.18	7.82	473
OKN0100	10/8/96	7	17.93	5.36	7.77	465
OKN0100	10/8/96	8	17.9	3.55	7.65	465
		Mean	23.41	5.90		932
		Min	14.47	0.55	7.65	465
		Max	29.43	10.65	8.77	1343

Table D-7. Hydrolab data for Kaw Lake Station OKN0101

Site ID	Date	Depth m	Water Temperature C 00010	Dissolve Oxygen mg/l 00299	pH SU 00400	Specific Conductance uS/cm 00094
OKN0101	4/30/96	0.5	16.78	8.92	8.32	1470
OKN0101	4/30/96	1	15.76	8.95	8.33	1470
OKN0101	4/30/96	2	14.37	8.37	8.25	1490
OKN0101	4/30/96	3	14.34	8.36	8.25	1490
OKN0101	4/30/96	4	14.32	8.3	8.24	1590
OKN0101	4/30/96	5	14.36	8.33	8.24	1520
OKN0101	4/30/96	6	14.36	8.32	8.25	1520
OKN0101	4/30/96	7	14.34	8.25	8.26	1530
OKN0101	4/30/96	8	14.32	8.16	8.25	1530
OKN0101	4/30/96	9	14.21	7.79	8.23	1500
OKN0101	4/30/96	10	14.12	7.55	8.25	1500
OKN0101	5/22/96	0.5				
OKN0101	6/19/96	0.5	26.73	6.82	7.89	863
OKN0101	6/19/96	1	26.57	6.9	7.99	882
OKN0101	6/19/96	2	26.48	6.62	8	889
OKN0101	6/19/96	3	26	6.23	7.8	851
OKN0101	6/19/96	4	25.8	4.55	7.73	845
OKN0101	6/19/96	5	24.9	2.63	7.57	804
OKN0101	6/19/96	6	22.23	0.5	7.29	678
OKN0101	6/19/96	7	21.63	0.25	7.25	759
OKN0101	6/19/96	8	21.4	0.23	7.25	905
OKN0101	6/19/96	9	21.4	0.22	7.25	922
OKN0101	6/19/96	10	21.33	0.2	7.27	985
OKN0101	7/16/96	0.5	26.41	6.05	7.98	1090
OKN0101	7/16/96	1	25.79	4.99	7.86	1092
OKN0101	7/16/96	2	25.63	4.73	7.82	1092
OKN0101	7/16/96	3	25.61	4.6	7.83	1093
OKN0101	7/16/96	4	25.41	4.2	7.75	1090
OKN0101	7/16/96	5	25.37	3.6	7.71	1088
OKN0101	7/16/96	6	25.24	3.25	7.65	1081
OKN0101	7/16/96	7	25.13	1.88	7.56	1069
OKN0101	7/16/96	8	24.97	0.98	7.44	1055
OKN0101	7/16/96	9	24.97	0.23	7.38	1025
OKN0101	7/16/96	10	23.9	0.17	7.33	997
OKN0101	7/31/96	0.5	27.88	6.22	8.3	1117
OKN0101	7/31/96	1	27.84	6.02	8.29	1115
OKN0101	7/31/96	2	27.54	5.68	8.26	1109
OKN0101	7/31/96	3	27.31	5.26	8.21	1108
OKN0101	7/31/96	4	27.21	4.6	8.04	1122
OKN0101	7/31/96	5	27.12	4.45	7.99	1132
OKN0101	7/31/96	6	27.08	4.56	7.99	1132
OKN0101	7/31/96	7	26.96	3.45	7.83	1150
OKN0101	7/31/96	8	26.85	1.97	7.68	1162
OKN0101	7/31/96	9	26.31	0.18	7.53	1179
OKN0101	7/31/96	10	26.25	0.2	7.5	1181
OKN0101	8/13/96	0.5	26.3	4.7	7.95	1093
OKN0101	8/13/96	1	26.13	4.17	7.86	1113

Site ID	Date	Depth m	Water Temperature C 00010	Dissolve Oxygen mg/l 00299	pH SU 00400	Specific Conductance uS/cm 00094
OKN0101	8/13/96	2	25.84	3.95	7.84	1087
OKN0101	8/13/96	3	25.73	4.03	7.84	1067
OKN0101	8/13/96	4	25.67	4.06	7.84	1056
OKN0101	8/13/96	5	25.31	3.93	7.83	936
OKN0101	8/13/96	6	24.7	3.07	7.75	807
OKN0101	8/13/96	7	24.15	2.75	7.73	683
OKN0101	8/13/96	8	24.09	2.78	7.73	672
OKN0101	8/13/96	9	23.79	2.91	7.74	607
OKN0101	8/13/96	10	23.62	2.44	7.74	550
OKN0101	10/8/96	0.5	18.95	7.44	8.06	667
OKN0101	10/8/96	1	19	7.43	8.06	669
OKN0101	10/8/96	2	18.78	7.32	8.06	668
OKN0101	10/8/96	3	18.68	7.45	8.05	668
OKN0101	10/8/96	4	18.66	7.41	8.05	669
OKN0101	10/8/96	5	18.64	7.35	8.05	669
OKN0101	10/8/96	6	18.62	7.28	8.05	671
OKN0101	10/8/96	7	18.62	7.28	8.05	679
OKN0101	10/8/96	8	18.61	7.31	8.04	680
OKN0101	10/8/96	9	18.59	7.14	8.02	685
OKN0101	10/8/96	10	18	5.23	7.84	829
OKN0101	10/8/96	11	17.85	4.74	7.79	862
OKN0101	11/5/96	0.5	12.23	9.21	9.61	1002
OKN0101	11/5/96	1	12.26	9.25	9.61	1002
OKN0101	11/5/96	2	11.88	9.08	9.62	1026
OKN0101	11/5/96	3	10.98	9.37	9.67	1128
OKN0101	11/5/96	4	10.48	9.49	9.7	1199
OKN0101	11/5/96	5	10.35	9.63	9.69	1203
OKN0101	11/5/96	6	10	9.75	9.74	1220
OKN0101	11/5/96	7	9.91	9.89	9.75	1225
OKN0101	11/5/96	8	9.9	9.89	9.75	1226
OKN0101	11/5/96	9	9.9	9.9	9.95	1227
OKN0101	11/5/96	10	9.92	9.85	9.76	1226
OKN0101	11/5/96	11	9.93	9.73	9.74	1227
		Mean	20.62	5.58		1041
		Min	9.9	0.17	7.25	550
		Max	27.9	9.9	9.95	1590

Table D-8. Hydrolab data for Kaw Lake Station OKN0102

Site ID	Date	Depth m	Water Temperature C 00010	Dissolve Oxygen mg/l 00299	pH SU 00400	Specific Conductance uS/cm 00094
OKN0102	4/30/96	0.5	16.7	10.8	8.48	1330
OKN0102	4/30/96	1	14.35	8.65	8.05	1379
OKN0102	5/22/96	0.5				
OKN0102	6/19/96	0.5	29.03	6.69	8.49	1192
OKN0102	6/19/96	1	27.48	5.78	8.37	1306
OKN0102	7/16/96	0.5	27.05	6.51	8.38	1131
OKN0102	7/16/96	1	25.48	4.46	8.15	1157
OKN0102	7/31/96	0.5	28.62	5.69	8.08	1170
OKN0102	7/31/96	1	28.05	5.01	7.98	1184
OKN0102	8/13/96	0.5	25.69	3.7	7.81	636
OKN0102	8/13/96	1	24.14	2.17	7.7	652
OKN0102	10/8/96	0.5	19.2	7.23	8.08	691
OKN0102	10/8/96	1	18.88	6.9	8.04	701
OKN0102	10/8/96	2	18.48	6.34	8.03	693
OKN0102	11/5/96	0.5	10.05	10.07	9.71	1340
OKN0102	11/5/96	1	9.74	9.97	9.72	1323
		Mean	21.5	6.66		1059
		Min	9.74	2.17	7.7	636
		Max	29.03	10.8	9.72	1379

Table D-9. Hydrolab data for Kaw Lake Station OKN0103

Site ID	Date	Depth m	Water Temperature C 00010	Dissolve Oxygen mg/l 00299	pH SU 00400	Specific Conductance uS/cm 00094
OKN0103	4/30/96	0.5	16.6	8.85	8.15	1075
OKN0103	5/22/96	0.5	30.2	7.04	8.72	1311
OKN0103	6/19/96					
OKN0103	7/16/96	0.5	28.44	7.03	8.11	1158
OKN0103	7/31/96	0.5	30.2	7.83	9.25	1365
OKN0103	8/13/96	0.5	24.8	5.58	7.92	433
OKN0103	10/8/96	0.5	18.33	8.4	8.52	1350
OKN0103	11/5/96	0.5	11.11	12.21	9.89	1503
		Mean	22.8	8.13		1171
		Min	11.1	5.58	7.92	433
		Max	30.2	12.21	9.89	1503

APPENDIX E

MONTHLY RESERVOIR DATA

KAW LAKE, 1996

KAW LAKE
MONTHLY LAKE REPORT
JAN 96

DAY	POOL ELEVATIONS FT-NGVD 0800	POOL ELEVATIONS FT-NGVD 2400	STORAGE 2400HR AC-FT	RELEASES DSF POWER	RELEASES DSF TOTAL	EVAP INCHES 8A TO 8A	INFLOW ADJ DSF	RAINFALL INCHES 7A TO 7A DAM	RAINFALL INCHES 7A TO 7A BSN
PRIOR MONTH		1010.18	409612						
1	1010.21	1010.16	409271	612	612	0.050	800	0.00	0.00
2	1010.33	1010.24	410637	0	511	0.050	800	0.00	0.00
3	1010.21	1010.18	409612	0	804	0.050	800	0.00	0.01
4	1010.12	1010.25	410808	0	804	0.050	800	0.00	0.00
5	1010.32	1010.30	411661	0	805	0.050	800	0.00	0.01
6	1010.40	1010.23	410466	0	805	0.050	800	0.00	0.00
7	1010.09	1010.25	410808	0	805	0.050	800	0.00	0.00
8	1010.29	1010.13	408759	0	804	0.050	700	0.00	0.00
9	1010.08	1010.10	408247	0	804	0.050	700	0.00	0.01
10	1010.06	1010.12	408588	0	2357	0.050	700	0.00	0.00
11	1009.87	1009.61	400066	0	2253	0.050	700	0.00	0.00
12	1009.61	1009.67	401062	0	289	0.050	700	0.00	0.00
13	1009.59	1009.86	404216	0	290	0.050	700	0.00	0.00
14	1009.79	1009.93	405378	0	290	0.050	700	0.00	0.00
15	1009.79	1009.98	406208	0	290	0.050	700	0.00	0.00
16	1010.06	1010.08	407906	0	290	0.050	700	0.00	0.00
17	1010.24	1010.12	408588	0	290	0.050	700	0.00	0.00
18	1010.12	1009.71	401726	0	290	0.050	700	0.00	0.03
19	1009.61	1010.00	406540	0	173	0.050	700	0.00	0.00
20	1010.05	1010.09	408077	0	113	0.050	700	0.00	0.00
21	1009.94	1010.40	413368	0	113	0.100	700	0.00	0.00
22	1010.38	1010.17	409442	109	109	0.100	700	0.00	0.00
23	1009.98	1009.75	402390	4098	4098	0.050	600	0.00	0.00
24	1009.47	1009.43	397078	4111	4111	0.050	600	0.00	0.00
25	1009.40	1009.32	395252	2323	2323	0.050	600	0.00	0.00
26	1009.15	1008.74	385733	2308	2308	0.050	600	0.00	0.00
27	1008.65	1008.78	386381	2313	2313	0.050	600	0.00	0.00
28	1008.78	1008.74	385733	2358	2358	0.050	600	0.00	0.00
29	1008.45	1008.33	379100	3528	3528	0.050	600	0.00	0.00
30	1008.15	1007.80	370622	3544	3544	0.050	600	0.00	0.00
31	1007.71	1007.45	365131	2758	2758	0.050	600	0.00	0.00
TOTAL				28062	41243	1.650	21500	0.00	0.06
AVERAGE	1009.67			905	1330		694	NORMAL=	0.81

MAXIMUM 1010.54 415757 DATE=21 TOP CONSERVATION POOL 1010.00
MINIMUM 1007.45 365131 DATE=31 TOP FLOOD POOL 1044.50

INFLOW VOLUME= 42645 AC-FT

TURBINES DOWN FOR ABOUT 3 WKS STARTING 3 JAN FOR REPAIR.
SEASONAL DRAWDOWN STOPPED AT 410P,11JAN AND POSTPONED UNTIL 23 JAN
SO THAT RELEASES CAN BE USED FOR HYDROPOWER.
SEASONAL POOL DRAWDOWN STARTED 4:45PM ON 22 JAN.
EVAPORATION ESTIMATED FOR THE MONTH.

REPORT IS SUBJECT TO CHANGE AND/OR REVISION

KAW LAKE
MONTHLY LAKE REPORT
FEB 96

DAY	POOL ELEVATIONS FT-NGVD 0800	2400	STORAGE 2400HR AC-FT	RELEASES DSF POWER	TOTAL	EVAP INCHES 8A TO 8A	INFLOW ADJ DSF	RAINFALL INCHES 7A TO 7A DAM	BSN
PRIOR MONTH		1007.45	365131						
1	1007.44	1007.44	364974	412	412	0.050	600	0.15	0.00
2	1007.29	1007.37	363875	411	411	0.050	600	0.10	0.00
3	1007.41	1007.49	365758	218	218	0.050	700	0.00	0.00
4	1007.53	1007.61	367641	223	223	0.050	700	0.00	0.00
5	1007.65	1007.65	368269	410	410	0.050	700	0.00	0.00
6	1007.65	1007.74	369680	438	438	0.050	700	0.00	0.00
7	1007.76	1007.62	367798	1610	1610	0.050	700	0.00	0.00
8	1007.62	1007.53	366386	1463	1463	0.050	800	0.00	0.00
9	1007.56	1007.55	366699	835	835	0.050	1000	0.00	0.00
10	1007.60	1007.61	367641	821	821	0.050	1000	0.00	0.00
11	1007.62	1007.60	367484	810	810	0.050	1000	0.00	0.00
12	1007.62	1007.56	366856	1103	1103	0.050	1000	0.00	0.00
13	1007.57	1007.52	366229	1413	1413	0.050	1000	0.00	0.00
14	1007.51	1007.41	364502	1622	1622	0.050	1000	0.00	0.00
15	1007.43	1007.41	364502	1150	1150	0.050	1000	0.00	0.00
16	1007.34	1007.31	362934	705	705	0.050	800	0.00	0.00
17	1007.34	1007.36	363718	703	703	0.100	800	0.00	0.00
18	1007.37	1007.41	364502	406	406	0.100	800	0.00	0.00
19	1007.42	1007.42	364660	632	632	0.100	800	0.00	0.00
20	1007.44	1007.45	365131	608	608	0.100	800	0.00	0.00
21	1007.49	1007.48	365601	590	590	0.100	800	0.00	0.00
22	1007.47	1007.46	365288	640	640	0.100	800	0.00	0.00
23	1007.49	1007.45	365131	1562	1562	0.100	1500	0.00	0.01
24	1007.48	1007.42	364660	1930	1930	0.100	1700	0.00	0.00
25	1007.48	1007.43	364817	2082	2082	0.100	2200	0.00	0.00
26	1007.42	1007.43	364817	1707	1707	0.100	1700	0.00	0.00
27	1007.45	1007.47	365444	815	815	0.100	1200	0.00	0.10
28	1007.48	1007.46	365288	731	731	0.100	800	0.00	0.00
29	1007.52	1007.49	365758	656	656	0.100	800	0.00	0.00
TOTAL				26706	26706	2.100	28000	0.25	0.11
AVERAGE	1007.49			921	921		966	NORMAL=	0.99

MAXIMUM 1007.76 369995 DATE= 7 TOP CONSERVATION POOL 1010.00
MINIMUM 1007.29 362620 DATE= 2 TOP FLOOD POOL 1044.50

INFLOW VOLUME= 55537 AC-FT

POOL GAGE REPAIRED ON 6 FEB AT 11AM.
EVAPORATION ESTIMATED FOR THE MONTH.

REPORT IS SUBJECT TO CHANGE AND/OR REVISION

KAW LAKE
MONTHLY LAKE REPORT
MAR 96

DAY	POOL ELEVATIONS FT-NGVD 0800	2400	STORAGE 2400HR AC-FT	RELEASES DSF POWER	TOTAL	EVAP INCHES 8A TO 8A	INFLOW ADJ DSF	RAINFALL INCHES 7A TO 7A DAM	BSN
PRIOR MONTH		1007.49	365758						
1	1007.51	1007.50	365915	674	674	0.100	800	0.00	0.00
2	1007.56	1007.52	366229	640	640	0.100	800	0.00	0.00
3	1007.57	1007.54	366542	640	640	0.100	800	0.00	0.00
4	1007.53	1007.50	365915	771	771	0.100	800	0.00	0.00
5	1007.49	1007.57	367013	733	733	0.100	800	0.00	0.00
6	1007.65	1007.48	365601	733	733	0.100	600	0.00	0.00
7	1007.56	1007.47	365444	953	953	0.100	600	0.00	0.00
8	1007.47	1007.38	364032	701	701	0.100	600	0.00	0.00
9	1007.38	1007.37	363875	635	635	0.100	600	0.00	0.00
10	1007.39	1007.35	363561	655	655	0.100	600	0.00	0.00
11	1007.36	1007.34	363405	677	677	0.100	600	0.00	0.00
12	1007.35	1007.41	364502	420	420	0.260	600	0.00	0.00
13	1007.40	1007.42	364660	464	464	0.230	600	0.00	0.00
14	1007.46	1007.57	367013	464	464	0.200	1700	0.00	0.00
15	1007.57	1007.62	367798	118	118	0.070	1000	0.74	0.61
16	1007.64	1007.74	369680	118	118	0.170	800	0.00	0.00
17	1007.76	1007.86	371563	88	88	0.170	1100	0.00	0.02
18	1007.90	1007.94	372819	90	90	0.160	800	0.30	0.12
19	1007.94	1008.01	373922	138	138	0.210	800	0.00	0.01
20	1008.03	1008.05	374569	121	121	0.140	800	0.00	0.00
21	1008.08	1008.16	376348	92	92	0.140	800	0.00	0.00
22	1008.18	1008.22	377319	122	122	0.100	800	0.00	0.00
23	1008.21	1008.31	378776	88	88	0.200	800	0.00	0.00
24	1008.28	1008.50	381850	122	122	0.180	800	0.16	0.00
25	1008.48	1008.45	381041	127	127	0.150	800	0.00	0.19
26	1008.45	1008.50	381850	119	119	0.150	800	0.00	0.00
27	1008.59	1008.58	383145	183	183	0.120	800	0.04	0.00
28	1008.60	1008.64	384115	121	121	0.190	800	0.20	0.03
29	1008.66	1008.72	385409	115	115	0.080	800	0.00	0.02
30	1008.75	1008.88	387998	133	133	0.090	800	0.00	0.03
31	1008.88	1008.88	387998	123	123	0.100	800	0.22	0.35
TOTAL				11178	11178	4.210	24600	1.66	1.38
AVERAGE	1007.92			361	361		794	NORMAL=	1.97

MAXIMUM 1008.88 387998 DATE=31 TOP CONSERVATION POOL 1010.00
MINIMUM 1007.30 362777 DATE=11 TOP FLOOD POOL 1044.50

INFLOW VOLUME= 48793 AC-FT

EVAPORATION ESTIMATED FOR THE MONTH.

REPORT IS SUBJECT TO CHANGE AND/OR REVISION

KAW LAKE
MONTHLY LAKE REPORT
APR 96

DAY	POOL ELEVATIONS FT-NGVD 0800	2400	STORAGE 2400HR AC-FT	RELEASES DSF POWER	TOTAL	EVAP INCHES 8A TO 8A	INFLOW ADJ DSF	RAINFALL INCHES 7A TO 7A DAM	BSN
PRIOR MONTH		1008.88	387998						
1	1008.89	1008.96	389293	119	119	0.170	800	0.00	0.00
2	1008.91	1009.01	390106	153	153	0.270	800	0.00	0.00
3	1008.97	1009.10	391600	125	125	0.520	800	0.00	0.00
4	1009.17	1009.15	392430	121	121	0.260	800	0.00	0.00
5	1009.18	1009.18	392928	118	118	0.200	800	0.00	0.00
6	1009.21	1009.26	394256	118	118	0.160	800	0.00	0.00
7	1009.29	1009.39	396414	120	120	0.160	800	0.00	0.00
8	1009.39	1009.44	397244	122	122	0.170	800	0.00	0.00
9	1009.48	1009.53	398739	116	116	0.150	800	0.00	0.00
10	1009.56	1009.57	399402	431	431	0.240	800	0.00	0.00
11	1009.62	1009.56	399236	410	410	0.290	800	0.00	0.00
12	1009.70	1009.68	401228	292	292	0.550	800	0.00	0.08
13	1009.70	1009.67	401062	565	565	0.150	800	0.00	0.00
14	1009.68	1009.69	401394	516	516	0.200	800	0.00	0.03
15	1009.67	1009.66	400896	500	500	0.200	800	0.00	0.01
16	1009.66	1009.64	400564	577	577	0.240	800	0.00	0.00
17	1009.64	1009.62	400232	435	435	0.500	800	0.00	0.00
18	1009.67	1009.72	401892	161	161	0.440	800	0.00	0.00
19	1009.72	1009.83	403718	249	249	0.480	800	0.00	0.00
20	1009.73	1009.78	402889	90	90	0.350	800	0.00	0.00
21	1009.79	1009.85	404050	159	159	0.350	800	0.00	0.00
22	1010.02	1009.88	404548	774	774	0.250	1000	1.51	0.07
23	1009.88	1009.84	403884	569	569	0.160	600	0.00	0.00
24	1009.86	1009.85	404050	122	122	0.280	600	0.00	0.00
25	1010.03	1009.92	405212	120	120	0.510	600	0.00	0.00
26	1009.96	1009.96	405876	173	173	0.400	600	0.00	0.00
27	1009.99	1009.98	406208	185	185	0.220	600	0.00	0.00
28	1010.03	1010.12	408588	153	153	0.220	1500	0.00	1.25
29	1010.21	1010.17	409442	975	975	0.450	1500	0.18	0.07
30	1010.24	1010.16	409271	2610	2610	0.170	1400	0.00	0.03
TOTAL				11178	11178	8.710	25200	1.69	1.54
AVERAGE	1009.64			373	373		840	NORMAL=	2.72

MAXIMUM	1010.24	410637	DATE=30	TOP CONSERVATION POOL	1010.00
MINIMUM	1008.87	387837	DATE= 2	TOP FLOOD POOL	1044.50

INFLOW VOLUME= 49983 AC-FT

POWER RELEASES WERE INCREASED TO GET BOAT IN STILLING BASIN FOR SLUICE GATE INSPECTION ON 24 APR 96.

KAW LAKE
MONTHLY LAKE REPORT
MAY 96

DAY	POOL ELEVATIONS FT-NGVD 0800	2400	STORAGE 2400HR AC-FT	RELEASES DSF POWER	TOTAL	EVAP INCHES 8A TO 8A	INFLOW ADJ DSF	RAINFALL INCHES 7A TO 7A DAM	BSN
PRIOR MONTH		1010.16	409271						
1	1010.11	1010.02	406882	2017	2017	0.330	1200	0.00	0.00
2	1010.05	1010.08	407906	831	831	0.280	1200	0.00	0.00
3	1010.11	1010.12	408588	829	829	0.260	1200	0.00	0.00
4	1010.17	1010.17	409442	609	609	0.180	1100	0.00	0.03
5	1010.17	1010.20	409954	609	609	0.190	1000	0.00	0.17
6	1010.24	1010.08	407906	1579	1579	0.240	800	0.14	0.06
7	1010.08	1009.99	406374	1481	1481	0.270	800	0.00	0.17
8	1009.97	1009.89	404714	1496	1496	0.130	800	0.00	0.38
9	1009.92	1009.83	403718	1544	1544	0.280	1200	0.00	0.11
10	1010.01	1010.02	406882	2039	2039	0.280	3600	0.51	0.50
11	1010.07	1010.06	407564	2067	2067	0.070	2600	0.00	0.13
12	1010.13	1010.13	408759	2057	2057	0.080	2500	0.00	0.00
13	1010.19	1010.06	407564	2438	2438	0.080	1900	0.00	0.04
14	1010.07	1010.41	413538	2137	2137	0.040	1900	0.00	0.96
15	1010.46	1010.32	412003	2501	2501	0.140	1900	0.00	0.01
16	1010.33	1010.16	409271	2487	2487	0.300	1400	0.00	0.01
17	1010.19	1010.01	406711	2468	2468	0.380	1400	0.00	0.00
18	1010.07	1009.92	405212	1557	1557	0.480	1400	0.00	0.01
19	1010.01	1009.91	405046	1566	1566	0.440	1200	0.00	0.00
20	1009.92	1009.97	406042	827	827	0.410	1200	0.00	0.00
21	1009.98	1009.94	405544	923	923	0.340	1000	0.00	0.00
22	1009.97	1009.89	404714	932	932	0.340	1000	0.00	0.00
23	1009.96	1009.91	405046	802	802	0.230	1000	0.00	0.00
24	1009.93	1009.93	405378	590	590	0.440	1000	0.00	0.00
25	1009.95	1009.97	406042	461	461	0.330	1000	0.02	0.26
26	1009.98	1010.06	407564	453	453	0.320	1300	0.00	0.56
27	1010.03	1010.09	408077	454	454	0.120	1000	0.24	0.23
28	1010.10	1010.14	408930	1033	1033	0.400	1000	0.00	0.00
29	1010.16	1009.89	404714	2895	2895	0.180	1000	0.00	0.00
30	1009.89	1009.65	400730	3680	3680	0.380	2000	0.00	0.00
31	1009.74	1009.60	399900	2766	2766	0.150	2600	0.11	0.01
TOTAL				48128	48128	8.090	44200	1.02	3.64
AVERAGE	1010.01			1553	1553		1426	NORMAL=	4.26

MAXIMUM 1010.46 414393 DATE=15 TOP CONSERVATION POOL 1010.00
MINIMUM 1009.60 399900 DATE=31 TOP FLOOD POOL 1044.50

INFLOW VOLUME= 87669 AC-FT

POOL GAGE RESET. B.M. USED TO SET PREVIOUS POOL GAGE WAS 0.36FT. LOW.

REPORT IS SUBJECT TO CHANGE AND/OR REVISION

KAW LAKE
MONTHLY LAKE REPORT
JUN 96

DAY	POOL ELEVATIONS FT-NGVD 0800	2400	STORAGE 2400HR AC-FT	RELEASES DSF POWER	TOTAL	EVAP INCHES 8A TO 8A	INFLOW ADJ DSF	RAINFALL INCHES 7A TO 7A DAM	BSN
PRIOR MONTH		1009.60	399900						
1	1009.96	1010.02	406882	2130	2130	0.490	5800	1.89	1.10
2	1010.16	1010.40	413368	2198	2198	0.220	5500	0.00	0.00
3	1010.57	1010.61	416952	3686	3686	0.240	5500	0.00	0.00
4	1010.60	1010.54	415757	5014	5014	0.290	5500	0.00	0.38
5	1010.53	1010.36	412685	5311	5311	0.170	6000	0.00	0.23
6	1010.65	1010.71	418660	7195	7195	0.360	7500	0.32	0.04
7	1010.74	1010.85	421049	7066	7066	0.170	8400	0.48	0.52
8	1010.91	1010.96	422928	5392	5392	0.280	6500	0.00	0.05
9	1010.96	1010.86	421220	5463	5463	0.250	4700	0.00	0.00
10	1010.80	1010.61	416952	5452	5452	0.250	3400	0.00	0.79
11	1010.53	1010.29	411490	5464	5464	0.300	2600	0.00	0.00
12	1010.26	1010.06	407564	2518	3059	0.310	2100	0.00	0.01
13	1010.13	1010.08	407906	1936	2006	0.200	1900	0.00	0.00
14	1010.14	1010.09	408077	1582	1582	0.300	1800	0.00	0.01
15	1010.13	1010.19	409783	846	846	0.250	1800	0.00	0.03
16	1010.21	1010.24	410637	1202	1202	0.230	1800	0.15	0.09
17	1010.31	1010.21	410125	1936	1936	0.250	1800	0.90	0.04
18	1010.25	1010.09	408077	1503	1503	0.290	1200	0.00	0.01
19	1010.17	1010.10	408247	1690	1690	0.380	1200	0.00	0.18
20	1010.14	1010.01	406711	1889	1889	0.300	1200	0.00	0.00
21	1010.02	1009.85	404050	1487	1487	0.350	1200	0.00	0.00
22	1010.02	1009.99	406374	560	560	0.350	1000	0.00	0.01
23	1010.01	1010.01	406711	553	553	0.360	1000	0.00	0.00
24	1010.05	1010.06	407564	855	855	0.380	1200	0.00	0.74
25	1010.06	1010.11	408417	1014	1014	0.200	1550	0.00	0.01
26	1010.15	1010.12	408588	800	800	0.250	1400	0.00	0.04
27	1010.12	1010.15	409101	1065	1065	0.270	1200	0.00	0.00
28	1010.15	1010.15	409101	876	876	0.170	1050	0.00	0.03
29	1010.18	1010.14	408930	735	735	0.350	1050	0.00	0.00
30	1010.19	1010.15	409101	737	737	0.390	850	0.00	0.03
TOTAL				78155	78766	8.600	87700	3.74	4.34
AVERAGE	1010.27			2605	2626		2923	NORMAL=	4.35

MAXIMUM	1010.99	423439	DATE= 8	TOP CONSERVATION POOL	1010.00
MINIMUM	1009.60	399900	DATE= 1	TOP FLOOD POOL	1044.50

INFLOW VOLUME= 173950 AC-FT

REPORT IS SUBJECT TO CHANGE AND/OR REVISION

KAW LAKE
MONTHLY LAKE REPORT
JUL 96

DAY	POOL ELEVATIONS FT-NGVD 0800	POOL ELEVATIONS FT-NGVD 2400	STORAGE 2400HR AC-FT	RELEASES DSF POWER	RELEASES DSF TOTAL	EVAP INCHES 8A TO 8A	INFLOW ADJ DSF	RAINFALL INCHES 7A TO 7A DAM	RAINFALL INCHES 7A TO 7A BSN
PRIOR MONTH		1010.15	409101						
1	1010.20	1010.14	408930	40	40	0.470	100	0.00	0.34
2	1010.17	1010.16	409271	1000	1000	0.330	1400	0.00	0.01
3	1010.20	1010.12	408588	1205	1205	0.430	1100	0.00	0.00
4	1010.19	1010.08	407906	968	1039	0.460	900	0.00	0.00
5	1010.09	1010.03	407053	1093	1289	0.360	1000	0.00	0.01
6	1010.06	1010.02	406882	553	772	0.360	900	0.00	0.00
7	1010.10	1009.99	406374	1054	1054	0.490	1000	0.00	0.01
8	1010.09	1010.01	406711	898	898	0.450	1300	0.18	1.13
9	1010.02	1010.15	409101	957	1027	0.390	2300	0.42	0.30
10	1010.23	1010.18	409612	2454	2957	0.090	3300	0.27	0.24
11	1010.22	1010.08	407906	2336	3149	0.150	2300	0.35	0.04
12	1010.12	1009.88	404548	2400	2400	0.160	800	0.00	0.01
13	1009.90	1009.90	404880	750	750	0.150	1200	0.00	0.00
14	1009.97	1009.98	406208	800	800	0.340	1800	1.25	0.53
15	1010.00	1010.00	406540	500	550	0.330	1600	0.00	0.00
16	1010.05	1010.13	408759	380	380	0.320	1400	0.00	0.00
17	1010.16	1010.11	408417	797	1234	0.400	1300	0.00	0.01
18	1010.16	1010.12	408588	629	951	0.420	1200	0.00	0.19
19	1010.14	1010.10	408247	742	1046	0.450	1100	0.00	0.01
20	1010.08	1010.03	407053	778	1187	0.430	1000	0.00	0.03
21	1010.08	1009.95	405710	843	1253	0.470	800	0.00	0.01
22	1009.91	1009.99	406374	1003	1044	0.470	700	0.05	0.29
23	1009.97	1009.87	404382	912	930	0.390	600	0.24	0.13
24	1009.93	1009.88	404548	827	850	0.350	600	0.25	0.02
25	1009.88	1009.78	402889	924	1076	0.200	600	0.00	0.09
26	1009.77	1009.49	398074	2715	2996	0.360	600	0.03	0.42
27	1009.46	1009.12	391932	2980	3316	0.080	500	0.10	0.44
28	1009.08	1008.70	385086	2903	4071	0.190	500	0.00	0.00
29	1008.62	1008.21	377158	3017	4467	0.530	500	0.00	0.04
30	1008.27	1008.27	378129	305	375	0.140	950	0.17	0.13
31	1008.32	1008.31	378776	449	490	0.210	950	0.00	0.00
TOTAL				37212	44596	10.370	34300	3.31	4.43
AVERAGE	1009.77			1200	1439		1106	NORMAL=	3.30

MAXIMUM	1010.24	410637	DATE=10	TOP CONSERVATION POOL	1010.00
MINIMUM	1008.21	377158	DATE=29	TOP FLOOD POOL	1044.50

INFLOW VOLUME= 68033 AC-FT

REPORT IS SUBJECT TO CHANGE AND/OR REVISION

KAW LAKE
MONTHLY LAKE REPORT
AUG 96

DAY	POOL ELEVATIONS FT-NGVD 0800	POOL ELEVATIONS FT-NGVD 2400	STORAGE 2400HR AC-FT	RELEASES DSF POWER	RELEASES DSF TOTAL	EVAP INCHES 8A TO 8A	INFLOW ADJ DSF	RAINFALL INCHES 7A TO 7A DAM	RAINFALL INCHES 7A TO 7A BSN
PRIOR MONTH		1008.31	378776						
1	1008.33	1008.34	379262	494	494	0.330	800	0.00	0.04
2	1008.35	1008.34	379262	430	500	0.170	550	0.00	0.06
3	1008.40	1008.30	378614	419	565	0.310	550	0.00	0.02
4	1008.36	1008.26	377967	418	529	0.360	550	0.00	0.00
5	1008.29	1008.29	378452	340	433	0.470	700	0.00	0.02
6	1008.31	1008.29	378452	388	570	0.220	700	0.11	0.17
7	1008.32	1008.43	380717	378	456	0.450	1800	0.00	0.02
8	1008.40	1008.41	380393	1458	1458	0.470	1400	0.94	0.32
9	1008.38	1008.20	376996	2250	2250	0.220	700	0.00	0.05
10	1008.24	1008.31	378776	2005	2525	0.280	3450	0.14	0.44
11	1008.49	1008.73	385571	2150	2515	0.060	5500	0.86	1.39
12	1008.96	1008.70	385086	3426	5547	0.140	5700	0.00	0.03
13	1008.48	1008.62	383792	4076	6095	0.260	5500	0.00	0.00
14	1008.77	1008.55	382659	3586	5130	0.230	4800	0.00	0.00
15	1008.67	1008.41	380393	3385	4882	0.260	4000	0.00	0.02
16	1008.50	1008.34	379262	2222	3177	0.240	2800	0.00	0.01
17	1008.51	1008.60	383468	1128	1579	0.320	3725	0.89	0.39
18	1008.66	1008.71	385248	706	1010	0.080	2050	0.21	0.02
19	1008.77	1008.64	384115	1821	2692	0.290	2260	0.00	0.00
20	1008.70	1008.38	379908	3030	3796	0.300	1805	0.00	1.28
21	1008.24	1008.15	376187	4635	5722	0.270	3940	0.00	0.17
22	1008.23	1008.42	380555	3726	5007	0.200	7350	0.00	0.01
23	1008.47	1008.40	380232	4620	5743	0.260	5705	0.00	0.30
24	1008.44	1008.21	377158	4910	5816	0.300	4350	0.00	0.28
25	1008.36	1008.33	379100	4602	5927	0.180	6985	0.00	0.02
26	1008.39	1008.39	380070	4760	5483	0.170	6010	0.31	0.19
27	1008.44	1008.21	377158	4358	6018	0.080	5600	0.40	0.16
28	1008.11	1008.21	377158	4490	5333	0.130	4430	0.00	0.00
29	1008.29	1008.31	378776	2973	2973	0.180	3895	0.00	0.00
30	1008.41	1008.39	380070	1792	2470	0.220	3210	0.16	0.01
31	1008.51	1008.44	380879	1481	2218	0.190	2645	0.36	0.04
TOTAL				76457	98913	7.640	103460	4.38	5.46
AVERAGE	1008.40			2466	3191		3337	NORMAL=	3.17

MAXIMUM 1009.01 390106 DATE=12 TOP CONSERVATION POOL 1010.00
MINIMUM 1008.10 375378 DATE=28 TOP FLOOD POOL 1044.50

INFLOW VOLUME= 205210 AC-FT

REPORT IS SUBJECT TO CHANGE AND/OR REVISION

KAW LAKE
MONTHLY LAKE REPORT
SEP 96

DAY	POOL ELEVATIONS FT-NGVD 0800	2400	STORAGE 2400HR AC-FT	RELEASES DSF POWER	TOTAL	EVAP INCHES 8A TO 8A	INFLOW ADJ DSF	RAINFALL INCHES 7A TO 7A DAM	BSN
PRIOR MONTH		1008.44	380879						
1	1008.57	1008.54	382497	926	1612	0.040	2525	0.03	0.07
2	1008.66	1008.62	383792	736	1597	0.210	2370	0.00	0.00
3	1008.68	1008.49	381688	2273	3536	0.250	2540	0.00	0.04
4	1008.56	1008.36	379585	2074	3004	0.140	2040	0.00	0.00
5	1008.42	1008.35	379423	1386	1636	0.200	1650	0.00	0.00
6	1008.40	1008.34	379262	1283	1477	0.190	1525	0.00	0.00
7	1008.40	1008.34	379262	1092	1430	0.260	1500	0.00	0.01
8	1008.40	1008.34	379262	937	1219	0.150	1270	0.04	0.02
9	1008.38	1008.33	379100	990	1247	0.100	1300	0.00	0.00
10	1008.38	1008.31	378776	970	1201	0.250	1300	0.00	0.00
11	1008.35	1008.37	379747	774	774	0.270	1250	0.00	0.00
12	1008.45	1008.38	379908	1193	1198	0.270	1425	0.00	0.03
13	1008.42	1008.37	379747	1162	1298	0.350	1340	0.00	0.00
14	1008.43	1008.37	379747	1230	1266	0.260	1320	0.00	0.02
15	1008.52	1008.73	385571	990	990	0.120	3930	0.80	0.31
16	1008.77	1008.53	382336	2838	2838	0.000	1250	1.88	1.06
17	1008.57	1008.50	381850	2381	2381	0.090	2170	0.00	0.01
18	1008.63	1008.50	381850	1830	1830	0.070	1885	0.14	0.23
19	1008.55	1008.60	383468	1538	1538	0.120	2450	0.78	1.29
20	1008.73	1008.84	387352	2971	2994	0.200	4950	0.00	0.10
21	1009.06	1009.80	403220	4145	4145	0.000	12280	0.00	0.03
22	1010.19	1010.49	414904	4125	4125	0.270	10140	0.00	0.00
23	1010.62	1009.76	402556	4238	12598	0.250	6505	0.00	0.00
24	1008.96	1008.56	382821	5446	11904	0.260	2020	0.57	0.08
25	1008.52	1009.12	391932	4049	4049	0.140	8640	0.00	0.00
26	1010.75	1011.71	436227	4325	4793	0.000	27150	2.95	0.82
27	1011.91	1012.28	446552	0	4443	0.050	9650	0.11	0.19
28	1012.49	1012.83	456710	2078	2078	0.000	7315	0.00	0.00
29	1013.07	1013.24	464407	1979	1979	0.210	5945	0.00	0.00
30	1013.36	1013.24	464407	4076	4076	0.160	4195	0.00	0.00
TOTAL				64035	89256	4.880	133830	7.30	4.31
AVERAGE	1009.34			2135	2975		4461	NORMAL=	3.42

MAXIMUM 1013.36 466686 DATE=30 TOP CONSERVATION POOL 1010.00
MINIMUM 1008.31 378776 DATE=10 TOP FLOOD POOL 1044.50

INFLOW VOLUME= 265448 AC-FT

REPORT IS SUBJECT TO CHANGE AND/OR REVISION

KAW LAKE
MONTHLY LAKE REPORT
OCT 96

DAY	POOL ELEVATIONS FT-NGVD 0800	2400	STORAGE 2400HR AC-FT	RELEASES DSF POWER	TOTAL	EVAP INCHES 8A TO 8A	INFLOW ADJ DSF	RAINFALL INCHES 7A TO 7A DAM	BSN
PRIOR MONTH		1013.24	464407						
1	1013.29	1013.15	462699	4212	4212	0.210	3465	0.00	0.00
2	1013.18	1013.02	460230	4179	4179	0.210	3010	0.00	0.00
3	1013.07	1012.83	456710	4186	4186	0.140	2475	0.00	0.00
4	1012.84	1012.62	452831	4200	4200	0.110	2245	0.00	0.98
5	1012.69	1012.47	450060	3225	3225	0.000	1980	0.00	0.00
6	1012.55	1012.38	448399	3070	3070	0.280	2295	0.00	0.00
7	1012.40	1012.20	445074	3954	3954	0.120	2345	0.00	0.07
8	1012.09	1011.85	438714	5443	5443	0.120	2310	0.72	0.32
9	1011.76	1011.50	432495	5410	5410	0.140	2400	0.00	0.00
10	1011.39	1011.06	424676	5443	5443	0.240	1600	0.00	0.00
11	1010.91	1010.60	416782	5328	5328	0.190	1350	0.00	0.00
12	1010.53	1010.24	410637	5022	5022	0.000	1925	0.00	0.00
13	1010.15	1009.88	404548	4974	4974	0.000	1900	0.00	0.00
14	1009.92	1009.71	401726	3270	3270	0.000	2250	0.00	0.00
15	1009.79	1009.70	401560	2309	2309	0.810	2320	0.00	0.00
16	1009.68	1009.54	398904	2752	2752	0.180	1530	0.00	0.00
17	1009.64	1009.47	397742	2544	2544	0.240	2070	0.00	0.00
18	1009.52	1009.34	395584	2655	2655	0.240	1565	0.00	0.01
19	1009.39	1009.23	393758	2195	2195	0.000	1400	0.00	0.03
20	1009.35	1009.24	393924	2207	2207	0.260	2395	0.00	0.00
21	1009.40	1009.28	394589	2039	2039	0.210	2460	0.00	0.02
22	1009.35	1009.22	393592	1535	1535	0.180	1080	0.72	0.41
23	1009.30	1009.34	395584	487	487	0.100	1550	0.16	0.10
24	1009.40	1009.38	396248	1032	1032	0.120	1470	0.00	0.00
25	1009.39	1009.45	397410	509	509	0.210	1100	0.00	0.00
26	1009.53	1009.61	400066	509	509	0.000	2100	0.00	0.04
27	1009.97	1010.27	411149	515	515	0.530	6100	1.73	0.50
28	1010.34	1010.21	410125	2878	2878	0.090	2400	0.06	0.01
29	1010.08	1009.98	406208	5025	5025	0.170	3300	0.27	0.36
30	1010.06	1009.83	403718	3576	3576	0.300	2400	0.00	0.00
31	1009.91	1009.92	405212	1441	1441	0.150	2200	0.00	0.00
TOTAL				96124	96124	5.550	68990	3.66	2.85
AVERAGE	1010.53			3101	3101		2225	NORMAL=	2.35

MAXIMUM	1013.29	465357	DATE= 1	TOP CONSERVATION POOL	1010.00
MINIMUM	1009.19	393094	DATE=22	TOP FLOOD POOL	1044.50

INFLOW VOLUME= 136840 AC-FT

REPORT IS SUBJECT TO CHANGE AND/OR REVISION

KAW LAKE
MONTHLY LAKE REPORT
NOV 96

DAY	POOL ELEVATIONS FT-NGVD 0800	2400	STORAGE 2400HR AC-FT	RELEASES DSF POWER	TOTAL	EVAP INCHES 8A TO 8A	INFLOW ADJ DSF	RAINFALL INCHES 7A TO 7A DAM	BSN
PRIOR MONTH		1009.92	405212						
1	1009.89	1009.85	404050	1920	1920	0.090	1300	0.00	0.00
2	1009.95	1009.81	403386	2117	2117	0.000	1900	0.00	0.00
3	1009.91	1009.77	402722	1740	1740	0.170	1500	0.00	0.00
4	1009.84	1009.92	405212	940	940	0.140	1500	0.30	0.17
5	1009.95	1009.96	405876	987	987	0.060	1500	0.00	0.09
6	1010.05	1010.07	407735	1542	1542	0.120	1600	0.00	0.00
7	1010.09	1010.09	408077	948	948	0.130	1600	0.00	0.00
8	1010.14	1009.99	406374	2080	2080	0.150	1500	0.00	0.00
9	1010.03	1009.93	405378	2070	2070	0.000	2000	0.00	0.00
10	1009.99	1009.86	404216	1906	1906	0.270	1500	0.00	0.00
11	1009.92	1009.84	403884	1526	1526	0.000	1200	0.00	0.00
12	1009.88	1009.75	402390	1723	1723	0.230	1300	0.00	0.00
13	1009.80	1009.83	403718	940	940	0.010	1300	0.00	0.00
14	1009.87	1009.79	403054	976	976	0.000	1200	0.05	0.01
15	1009.83	1009.84	403884	1008	1008	0.020	1450	0.00	0.01
16	1009.84	1011.47	431961	716	716	0.050	14950	0.00	0.45
17	1012.33	1014.58	490139	796	796	0.050	30150	3.65	2.00
18	1015.77	1017.61	551344	3423	6080	0.050	37000	0.00	0.03
19	1018.43	1019.10	582830	5500	14109	0.050	30000	0.00	0.00
20	1019.14	1018.90	578550	5500	15254	0.050	13150	0.00	0.00
21	1018.74	1018.48	569640	5400	12352	0.050	7900	0.00	0.00
22	1018.39	1018.33	566460	5485	9285	0.050	7700	0.00	0.00
23	1018.37	1018.56	571338	5641	8001	0.000	10450	0.00	0.00
24	1018.64	1018.57	571550	5658	8018	0.000	8100	0.03	0.00
25	1018.56	1018.35	566883	5606	8813	0.000	6450	0.00	0.00
26	1018.18	1017.84	556131	5508	10008	0.000	4550	0.00	0.00
27	1017.64	1017.23	543436	5469	9969	0.000	3600	0.00	0.00
28	1017.03	1016.58	530091	5653	10153	0.000	3450	0.00	0.02
29	1016.44	1016.15	521328	5625	9952	0.000	5550	0.83	0.31
30	1016.08	1015.85	515277	5623	7616	0.050	4600	0.12	0.12
TOTAL				94026	153546	1.790	209950	4.98	3.21
AVERAGE	1013.53			3134	5118		6998	NORMAL=	1.61

MAXIMUM	1019.14	583694	DATE=20	TOP CONSERVATION POOL	1010.00
MINIMUM	1009.75	402390	DATE=12	TOP FLOOD POOL	1044.50

INFLOW VOLUME= 416430 AC-FT

REPORT IS SUBJECT TO CHANGE AND/OR REVISION

KAW LAKE
MONTHLY LAKE REPORT
DEC 96

DAY	POOL ELEVATIONS FT-NGVD 0800	POOL ELEVATIONS FT-NGVD 2400	STORAGE 2400HR AC-FT	RELEASES DSF POWER	RELEASES DSF TOTAL	EVAP INCHES 8A TO 8A	INFLOW ADJ DSF	RAINFALL INCHES 7A TO 7A DAM	RAINFALL INCHES 7A TO 7A BSN
PRIOR MONTH		1015.85	515277						
1	1015.71	1015.47	507696	5607	7580	0.050	4400	0.00	0.03
2	1015.31	1015.08	499916	5468	8273	0.050	3800	0.00	0.12
3	1014.98	1014.65	491502	5473	7873	0.050	3600	0.00	0.02
4	1014.52	1014.31	484879	5393	7793	0.000	4400	0.00	0.00
5	1014.18	1013.94	477701	5384	7784	0.000	4200	0.00	0.00
6	1013.79	1013.71	473333	5381	6306	0.000	4100	0.00	0.00
7	1013.80	1013.76	474283	4007	4007	0.000	4500	0.00	0.00
8	1013.85	1013.78	474663	4075	4075	0.000	4300	0.00	0.00
9	1013.82	1013.71	473333	4264	4264	0.000	3600	0.00	0.00
10	1013.73	1013.62	471624	4487	4487	0.000	3600	0.00	0.00
11	1013.65	1013.53	469915	4515	4515	0.000	3650	0.00	0.00
12	1013.53	1013.38	467066	4459	4459	0.000	3000	0.00	0.00
13	1013.41	1013.23	464217	4505	4505	0.000	3050	0.00	0.00
14	1013.24	1013.24	464407	4470	4470	0.000	4600	0.00	0.00
15	1013.10	1012.85	457079	4515	4515	0.000	3000	0.00	0.00
16	1012.86	1012.86	457264	4586	4586	0.000	2500	0.00	0.00
17	1012.73	1012.58	452093	4543	4543	0.050	1950	0.00	0.00
18	1012.50	1012.26	446182	4310	4310	0.000	1300	0.00	0.00
19	1012.23	1011.91	439780	4499	4499	0.000	1300	0.00	0.00
20	1011.86	1011.51	432673	4870	4870	0.000	1300	0.00	0.00
21	1011.48	1011.19	426986	4883	4883	0.000	2000	0.00	0.00
22	1011.16	1010.93	422415	4870	4870	0.000	2600	0.00	0.00
23	1010.91	1010.70	418489	4955	4955	0.000	3000	0.00	0.00
24	1010.62	1010.50	415075	3155	3155	0.050	1400	0.00	0.00
25	1010.44	1010.36	412685	3095	3095	0.000	1900	0.00	0.00
26	1010.44	1010.33	412173	1856	1856	0.000	1600	0.00	0.00
27	1010.38	1010.29	411490	2039	2039	0.000	1700	0.00	0.00
28	1010.36	1010.33	412173	1890	1890	0.050	2300	0.00	0.00
29	1010.43	1010.37	412856	1797	1797	0.050	2300	0.00	0.00
30	1010.47	1010.28	411320	3098	3098	0.050	2200	0.00	0.01
31	1010.36	1010.15	409101	3151	3151	0.050	2000	0.00	0.00
TOTAL				129600	142503	0.450	89150	0.00	0.18
AVERAGE	1012.41			4181	4597		2876	NORMAL=	1.07

MAXIMUM	1015.85	515277	DATE= 1	TOP CONSERVATION POOL	1010.00
MINIMUM	1010.15	409101	DATE=31	TOP FLOOD POOL	1044.50

INFLOW VOLUME= 176826 AC-FT

REPORT IS SUBJECT TO CHANGE AND/OR REVISION