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AN ASSESSMENT OF THE TROPHIC STATUS OF DEER, LOON, AND DIAMOND LAKES

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AN ASSESSMENT OF THE TROPHIC STATUS OF DEER, LOON, AND DIAMOND LAKES

by

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ABSTRACT

The trophie status of Deer, Loon, and Diamond lakes, located north of Spokane, Washington, was evaluated during the 1978 growing season. Sampling occurred bi-weekly from May to November. Historical data were also utilized where possible to determine if water quality had changed in any of the lakes.

The results indicated that all three lakes are mesotrophic, each having nutrient and chlorophyll a concentrations below the levels established for eutrophic waters. All three lakes experienced some degree of hypolimnetic anoxia. Loon Lake experienced the most severe anoxia of the three lakes with the bottom nine meters devoid of oxygen August through October. The mean nutrient concentrations and the extent of hypolimnetic anoxia appeared unchanged from conditions reported in a 1971-1972 DOE study. Loon Lake also had the lowest mean secchi disk depth of the three and was the only lake to have a significant decrease in water clarity from the prior survey.

The 1978 phytoplankton numbers in Loon and Deer lakes experienced significant increases from the 1971-1972 seasons. The species composition appeared to change from domination by the Bacillariophyta to domination by Cyanophyta in both Loon and Diamond lakes. Deer Lake is currently co-dominated by the Chlorophyta and Cyanophyta, a change from the previous co-domination by the Bacillariophyta and Chlorophyta. These phytoplankton changes may only be an artifact due to differing collection techniques used in the previous DOE study.

The water quality of Diamond Lake appears to be spatially affected by sludge beds present from prior log rafting practices. The sludge bed areas were not sampled in this study; however data collected by the EPA indicate they are very productive sites. This problem needs further examination before the trophic state of Diamond Lake can be determined adequately.

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GLOSSARY

(after Dion, 1978)

Acre-foot. The volume of water required to cover 1 acre to a depth of 1 foot, and equal to 43,560 cubic feet, or 325,900 U.S. gallons.

Algae. Small, simple plants, usually aquatic, which contain chlorophyll but lack roots, stems, and leaves.

Algal bloom. A large number of particular algal species. A condition in which the algae cloud the water noticeably.

Anaerobic. Conditions characterized by the absence of oxygen.

Aphotic zone. That part of a water body to which light does not penetrate with sufficient intensity to maintain photosynthesis.

Aquifer. A rock formation that is water bearing.

Bathymetric. Relating to the measurement of water depths, as for a lake.

Benthos community. The organisms living in or on the bottom of an aquatic environment.

Cirque. A deep, steep-walled basin in the side of a mountain, caused by glacial erosion.

Closed lake. A lake, usually in an arid or semi-arid region, that does not have a surface outlet.

Compensation level. The depth at which oxygen production by photosynthesis balances oxygen uptake by respiration.

Consumers. Organisms that are unable to manufacture their food from nonliving matter and that feed upon other organisms.

Coulee. A short gulch or water channel.

Crater lake. A lake that occupies the crater of an inactive volcano.

Cultural eutrophication. The acceleration of the natural aging, or enrichment, process of a lake as a result of man's activities.

Decomposers. Organisms, mostly bacteria or fungi, that break down complex organic material into its inorganic constituents.

Dimictic. A term applied to a lake which undergoes two periods of thermal circulation, or overturn, each year -- in spring and fall.

Drainage basin. The area drained by, or contributing to, a stream, lake, or other water body.

Drift. Any rock material transported and deposited directly or indirectly by a glacier.

Ecosystem. The community of plants and animals interacting together within the physical and chemical environment.

Epilimnion. The upper, relatively warm, circulating zone of water in a thermally stratified lake.

Euphotic zone. That part of a water body where light penetration is sufficient to maintain photosynthesis.

Eutrophic. A term applied to a water body in which organic production is high as a result of a large supply of available nutrients.

Eutrophication The natural process of enrichment and aging of a body of water.

Fall overturn. A natural mixing of thermally stratified waters that commonly occurs during an early autumn. The sequence of events leading to fall overturn includes: (1) cooling of surface water; (2) density change in surface water that produces convection currents form top to bottom; and (3) circulation of the total water volume by wind action. The overturn generally results in a uniformity of the physical and chemical properties of the water.

Fluviatile. Pertaining to a river or stream.

Food chain. The transfer of food energy and materials from plants through other organisms, with repeated eating and being eaten.

Hydrologic cycle. The cycling of water from the earth to the atmosphere in the form of evaporation and transpiration and back to earth in the form of precipitation.

Hypolimnion. The lower, relatively cold, non-circulating water zone in a thermally stratified lake.

Kettle. A basin formed by the melting of a detached mass of glacial ice buried or submerged in glacial drift.

Limnetic zone. The open-water part of a water body above the compensation level.

Limnologist A specialist in the field of limnology

Limnology. The science or study of inland bodies of water, such as lakes.

Littoral zone. The shallow part of a water body where light penetrates to the bottom.

Macrophyte A plant that can be seen with the unaided eye

Mean depth. A morphometric parameter of a lake obtained by dividing the volume by the area.

eromictic. A term applied to a lake in which dissolved substances have increased the density of the bottom water sufficiently to prevent complete vertical mixing.

alimnion. The middle layer of water in a thermally stratified lake, in which temperature decreases rapidly with depth.

ometry. The measurement of the shape characteristics of lakes and lake basins.

ton community. Organisms that are able to navigate at will and consequently are found in virtually all regions of a lake.

euston community. sms that live on or just under the surface film of water

Nutrient. Any chemical element, ion, or compound required by an organism for the continuation of growth, reproduction, and other life processes.

otrophic. Pertaining to waters in which production is low as a consequence of a small supply of available nutrients.

Open lake. A lake, usually in a humid climate, that has a surface outlet.

lake. A crescent-shaped lake formed in the abandoned meander of a river channel.

iphyton community. Organisms that are attached to, or live upon, submerged surfaces.

Phytoplankton plant part of the plankton

lankton (community). Suspended or floading organisms that drift passively with water currents.

Producers. Organisms that can directly utilize dissolved minerals and gases to form organic matter.

ductivity. The total amount of living matter produced in an area per unit time regardless of the fate of the living matter.

ndal zone. The deep part of a water body in which plant growth is limited by the absence of light.

lative depth. A morphometric parameter of a lake defined as the ratio of the maximum depth to the mean lake diameter, in percent.

ablands. Areas where erosion has removed the soil and the underlying rock is exposed or covered largely with its own coarse debris.

chi disk. A disk 20 centimeters in diameter and painted in white and black alternating quadrants, used to measure light transparency in lakes.

Shoreline configuration. A morphometric characteristic of a lake defined as the dimensionless ratio of the shoreline length to the circumference of a circle having the same area as the lake.

Specific conductance. The measure of a water's ability to conduct an electric current, usually expressed as micromhos per centimeter.

Spring overturn. A natural mixing of thermally stratified water that commonly occurs during the early spring. The sequence of events leading to spring overturn includes: (1) melting of ice cover, if present; (2) warming of surface water; (3) temperature change in surface water that produces convection currents from top to bottom; and (4) circulation of the total water volume by wind action. The overturn generally results in a uniformity of the physical and chemical properties of the water.

Succession. The natural evolutionary process in which a lake eventually becomes filled with sediment and reverts back to terrestrial vegetation.

Tarn. A small mountain lake that occupies a basin gouged from rock by a glacier.

Thermal stratification. A temperature distribution characteristic of many lakes in which the water is separated into three horizontal layers; an epilimnion (warm water) at the top, a metalimnion in which the temperature changes rapidly with depth, and a hypolimnion (cold water) at the bottom.

Turbidity. Organic and inorganic materials suspended in water that reduce the penetration of light.

Water-renewal time. The time needed to replace the entire volume of a lake under average conditions of inflow and outflow.

Water-surface zone. That part of the lake at, or imediately below, the surface film of water.

Zooplankton. The animal part of the plankton

INTRODUCTION

Deer, Loon, and Diamond lakes are located north of Spokane, Washington (Figure 1). It is feared that these once oligotrophic lakes are undergoing nutrient enrichment resulting from heavy recreational use and development. Increased domestic usage has the potential for substantially increasing nutrient loading to a system, thereby accelerating eutrophication. The influx of nutrients may originate from several sources; however, the primary source appears to be leachate from septic tank systems used by the residents on the lakes. The responsible and concerned property owners of Deer, Loon, and Diamond lakes proposed sewering projects for their respective lakes hoping to slow or halt cultural eutrophication. In response to these needs, the Eastern Regional Office of the Washington State Department of Ecology (DOE) requested the Water and Wastewater Monitoring Section to conduct a comprehensive study of the three lakes.

The goals of the study were to: (1) determine the current water quality conditions and trophic status of each lake; (2) detect possible changes from conditions reported in a previous DOE study (Bishop, 1973); and (3) make recommendations regarding the sewering priority of each lake.

DESCRIPTION OF THE STUDY AREA

Deer Lake

Deer Lake (Stevens County) is located approximately 32 miles north of Spokane, Washington (Figure 1). Activity on the lake is seasonal (fishing, swimming, boating), with the shoreline densely populated with approximately 500 homes (Bortleson, *et al.*, 1976). About 85 percent are occupied seasonally. The majority of homes utilize on-site wastewater disposal systems (Shoemaker, 1976). Inflow to the lake is from several intermittent streams originating in the surrounding mountainous terrain. The intermittent outflow is controlled by a low weir with flashboards (Bortleson, *et al.*, 1976). No demographic data are available for growth at the lake; however, the annual growth rate for Stevens County between 1970 and 1980 was approximately five percent.

Eighty-three percent of the drainage basin is forested or uncultivated. Agricultural uses and suburban development account for only four percent each, with the lake surface comprising the remaining nine percent (Dion, *et al.*, 1976).

Morphometric data for the lake are listed in Table 1 (Bortleson, *et al.*, 1976).

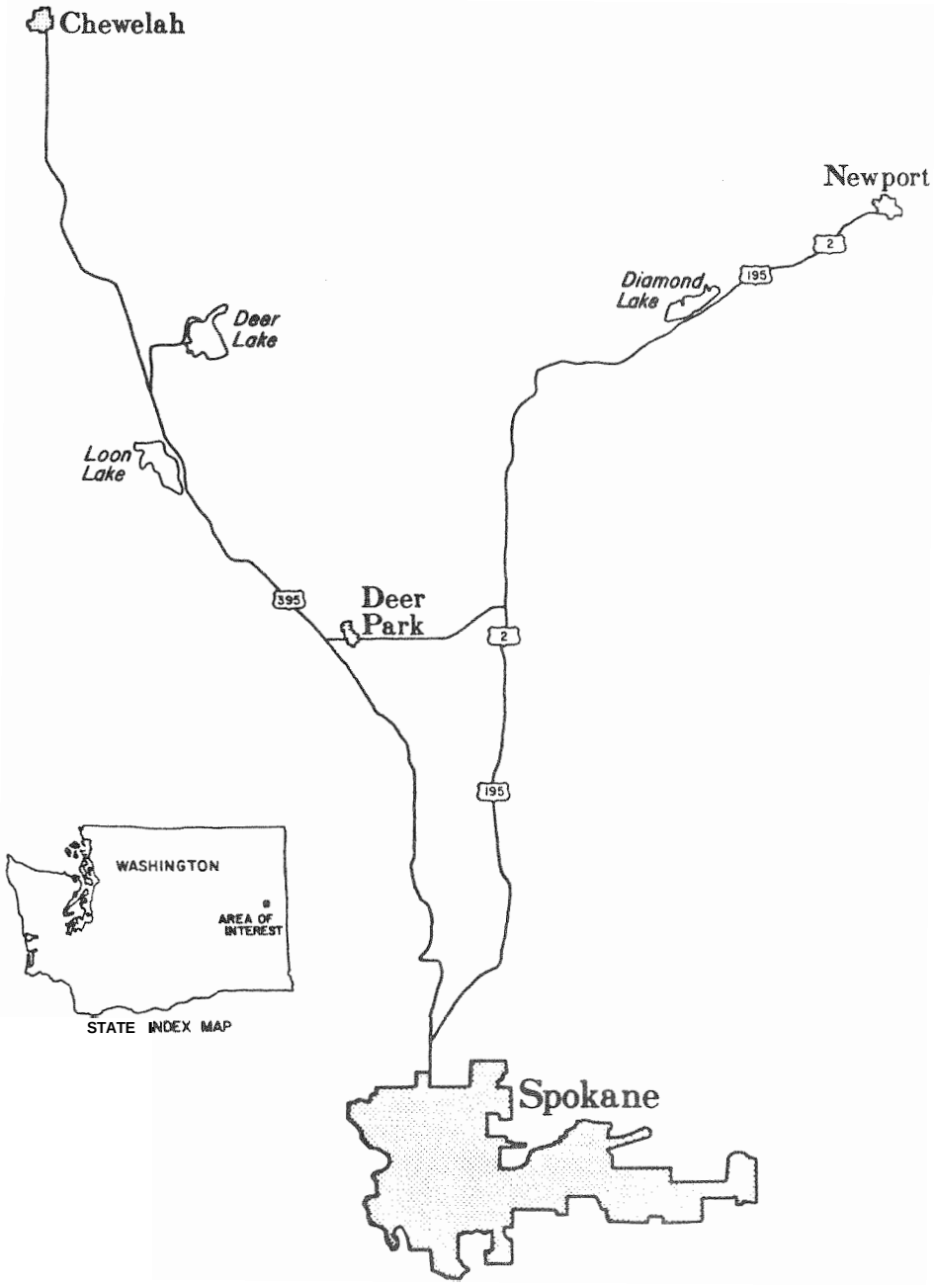

Figure 1. Map showing locations of Loon, Deer, and Diamond Lakes near Spokane, Washington.

Table 1. Morphometric Data for Deer Lake (elevation 2,474 feet)

Drainage Area	18.2 square miles
Surface Area	1,100 acres
Lake Volume	57,000 acre-feet
Mean Depth	52 feet
Maximum Depth	75 feet
Length of Shoreline	45,000 feet

For the study, a single sampling station was located in the deepest part of the lake (Figure 2).

Loon Lake

Loon Lake (Stevens County) is located approximately 28 miles north of Spokane, Washington, near the town of Loon Lake (Figure 1). The predominant recreational activities on the lake occur during the warmer months of the year (May to September) which include fishing, swimming, and boating. There are approximately 600 nearshore homes, two resorts/marinas, and a trailer court located on the lake (Bortleson, *et al.*, 1974), all of which utilize septic systems (Kennedy, 1978).

Several intermittent streams constitute the inflow while outflow is controlled by gages at a weir located on the northeast corner of the lake (Bortleson, et *al.*, 1974). Seventy-one percent of the drainage basin is forested or uncultivated. Agricultural and suburban development account for 13 percent and four percent, respectively, with the lake surface comprising the remaining 12 percent (Dion, et *al.*, 1976). Florphometric data are presented in Table 2 (Bortleson, et *al.*, 1974).

Table 2. Morphometric Data for Loon Lake (elevation 2,381 feet).

Drainage Area	14.1 square miles
Surface Area	7,730 acres
Lake Volume	51,500 acre-feet
Mean Depth	46 feet
Maximum Depth	100 feet
Length of Shoreline	47,800 feet

Figure 3 depicts the location of the two sampling stations on Loon Lake.

Diamond Lake

Diamond Lake (Pend Oreille County) is located near Newport approximately 45 miles north of Spokane, Washington. Recreational periods and activities are similar to the previously mentioned lakes. Approximately 360 homes are located on or near the shore. Only on-site wastewater disposal is available at present (Daly, 1980). Accepted population values

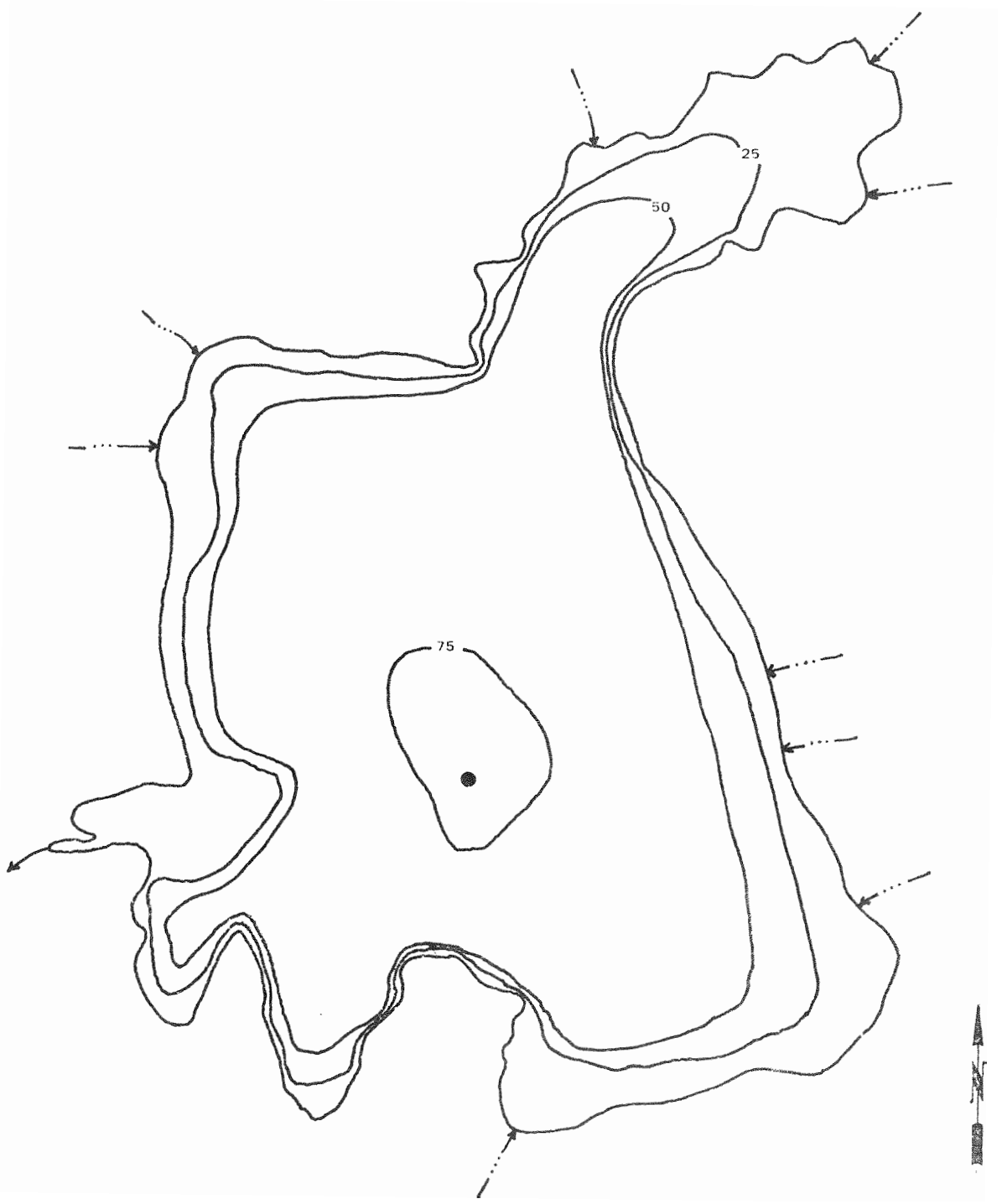

Figure 2. Map showing location of DOE water quality station sampled on Deer Lake during 1978.

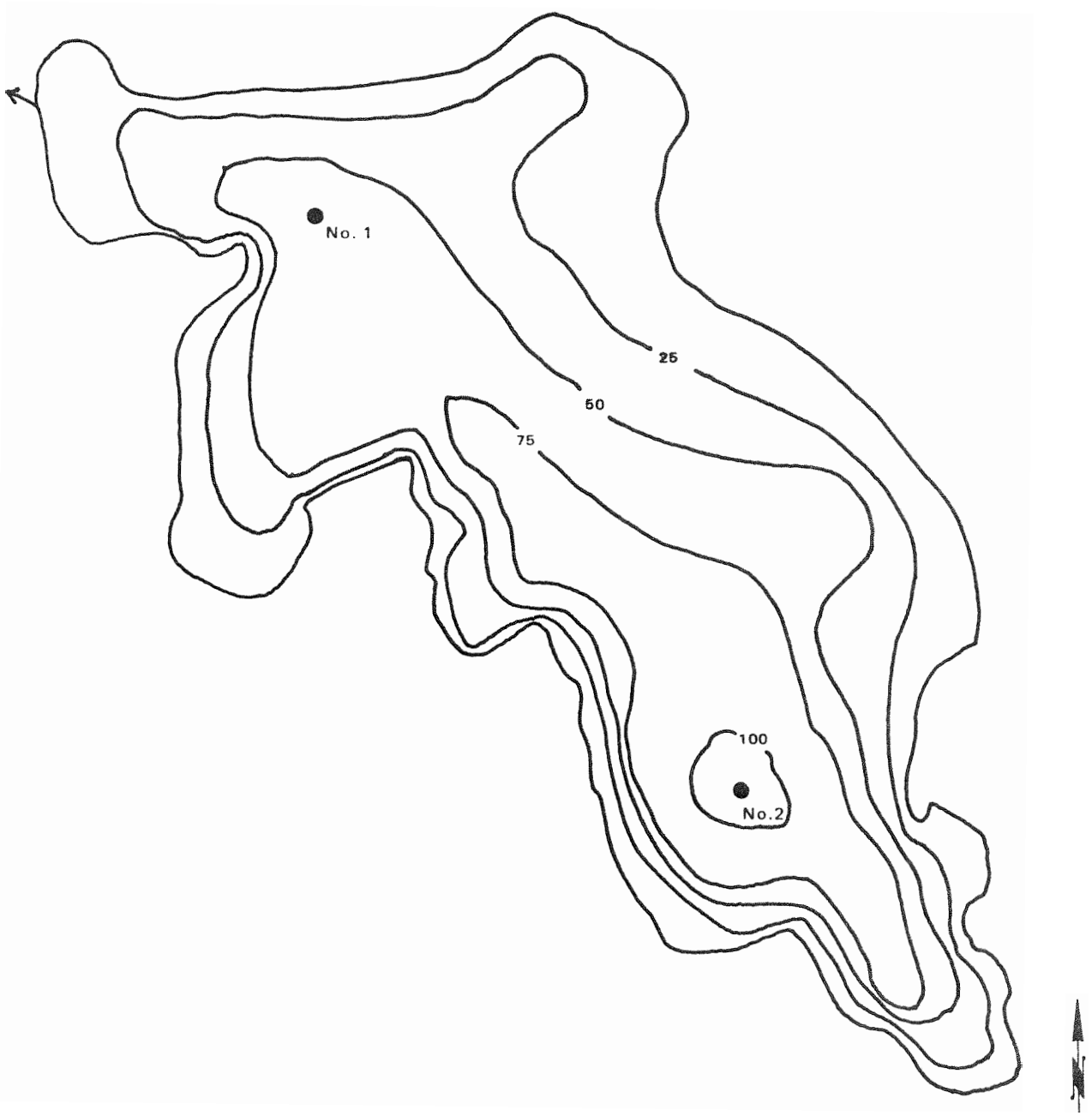

Figure 3. Map showing locations of DOE water quality stations sampled on Loon Lake during 1978.

for Pend Oreille County are not currently available, however the annual growth rate between 1970 and 1980 appears to be between five and six percent.

Inflow is from two unnamed tributaries with one outflow to Moon Creek. Seventy-eight percent of the drainage basin is forested or uncultivated. Agricultural uses and suburban development account for 13 percent and two percent, respectively, with the lake surface comprising the remaining seven percent (Dion, et *al.*, 1976). Data on the lake's morphometry may be found in Table 3 (Bortleson, *el al.*, 1976).

Table 3. Morphometric Data for Diamond Lake (elevation 2,340 feet)

Drainage Area	17.4 square miles
Surface Area	800 acres
Lake Volume	22,000 acre-feet
Mean Depth	27 feet
Maximum Depth	58 feet
Length of Shoreline	37,000 feet

The deepest portion of the lake determined the location of the sampling site (Figure 4).

METHODS AND MATERIALS

A total of 11 sample runs were made during the growing season from May to November, 1978. Although the lakes were studied independently of one another, each was approached utilizing the same investigative format. Unless otherwise stated, all measurements were obtained at three-meter intervals from surface to bottom. All samples were collected, stored, and analyzed as per *Standard Methods for the Examination of Water and Wastewater* (APHA, 1975) and *Methods for Chemical Analysis of Water and Wastes* (U.S. EPA, 1976).

Physical Parameters

Vertical profiles of light attenuation were obtained *in situ* with a Kahlsico submarine photometer (model 268WA310). Light intensities were determined at one-meter intervals to a depth where one percent of the incident surface radiation was observed. This depth determined the lower extent of the euphotic zone (Verduin, 1964). Secchi disk (20 cm) visibility measurements were obtained at each station.

Profile measurements of temperature (°C) and specific conductance (umhos/cm) were determined *in situ* with a Hydrolab® Surveyor (Model 6).

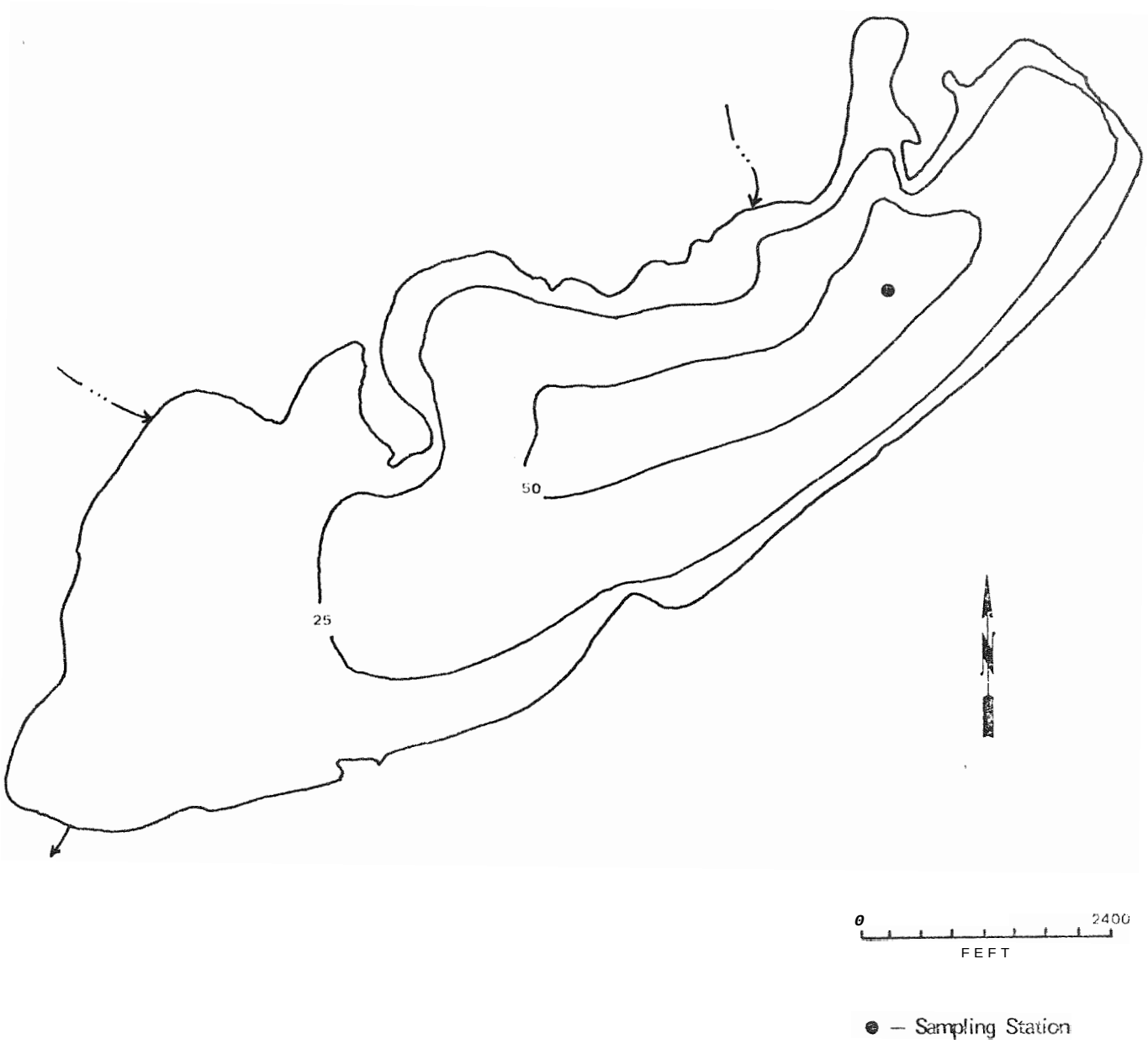

Figure 4. Map showing location of DOE water quality station sampled on Diamond Lake during 1978.

Chemical Parameters

Profile measurements of dissolved oxygen (mg/L) and pH (S.U.) were determined *in situ* with a Hydrolab® Surveyor (Model 6). The dissolved oxygen probe was field calibrated daily utilizing the azide modification of the Winkler method.

Water samples were collected using a one-liter Kemmerer water bottle and analyzed for the following: nitrate-N; nitrite-N; total Kjeldahl-N; ammonia-N; total phosphate-P; orthophosphate-P; calcium hardness; total hardness; total alkalinity; and turbidity. Nutrient samples were preserved in pre-acidified bottles with one ml of 5 N sulfuric acid.

Biological Parameters

The phytoplankton standing crop was evaluated by taking 1,000 ml composite samples from each lake using equal aliquots from the surface, middle, and bottom of the euphotic zone. A 250 ml subsample of the composite was preserved with Lugol's solution for future examination. All phytoplankton samples from Deer, Loon (Station 2), and Diamond lakes were examined by placing a 200 ml subsample of the composite in a phytoplankton settling chamber for 24 hours, allowing it to settle to 25 mls. A one-ml aliquot was placed in a Sedgewick-Rafter counting cell and enumeration was made at 100X employing the strip count technique where all fields in a strip were counted. For samples with low counts, 200 mls were concentrated to 10 ml by a Foerst Continuous Flow Ultracentrifuge at a rate of 500 ml per three minutes. A one-ml aliquot was placed in a Sedgewick-Rafter cell and counted at 200X. The results of the two methods of enumerating were statistically similar. Cell volumes/biovolumes and species identification were made by placing a 0.1-ml aliquot in a Palmer phytoplankton chamber under 400X-to-1000X magnification. The taxonomic keys of Smith (1950), Patrick and Reimer (1966; 1975), and Prescott (1962) were used for phytoplankton identification.

Chlorophyll a samples were analyzed at all stations using a Bausch and Lomb model 100 spectrophotometer. The spectrophotometric determination of pheophytin a was used to calculate chlorophyll a values.

Fecal coliform samples were collected from the surface only, using a 200-ml sterile bottle. The membrane filter method was used to enumerate fecal coliform organisms.

RESULTS AND DISCUSSION

Each lake is unique; however each is also similar to the others in many respects. This similarity, along with the desire for brevity, prompts us to report the results and discussion of each lake collectively by parameter. All parameters are so reported with the exception of the phytoplankton standing crop which is addressed separately by lake.

Physical Parameters

Transparency

The mean secchi disk depths observed at the three lakes, past (Bishop, 1973) and present, are given in Table 4. Means were generated using data obtained from only those months common to both studies. The decline of 1.2 meters in 'oon Lake was the only decrease found to be significant (Student's T test, P = 0.01). This decrease in water clarity may indicate an increase in the algal production.

Table 4. Mean secchi disk depths (m) and number of observations (n) made during 1978 and prior seasons (Bishop, 1973). Values were calculated using all stations from only those months common to both studies.

	Deer		Loon		Diamond	
	(m)	(n)	(m)	(n)	(m)	(n)
1971-1972	7.8	5	6.5	17	6.9	8
1978	7.3	11	5.3	19	6.2	10

Temperature

The three lakes exhibited similar seasonal thermal regimes with the stratification process having already begun by the first sampling in May. A distinct metalimnion was present by early July. The most apparent stratification occurred from mid-July to late August, after which cooling temperatures brought about destratification. Fall turnover was completed by mid-November when homothermic conditions existed throughout the water column of each lake (Figures 5, 6a, 6b, and 7). Temperature profiles present at each sampling may be found for all stations in Appendix B.

The isoline graphs presented in Figures 5 through 10 may pose interpretive problems for those unaccustomed to them. The graphs depict changes in the water column from the surface (0 meters) to the bottom of the lake at one location over time. They also provide an estimate of the concentration at any depth and time as the individual lines delineate zones of equal temperature or oxygen concentration. For example, the temperature profile in Figure 5 shows that the greatest range in temperature was present in early August. The water from the surface to six meters ranges from less than 23 degrees to 21 degrees. At six meters and below, the temperature falls rapidly with increasing depth. The decline slows at 12 meters and the bottom water is seven degrees or less. In November, following fall turnover, the temperature of the entire water column is uniform. These qraphs are intended to supply the reader with a visual means to follow changing conditions over time.

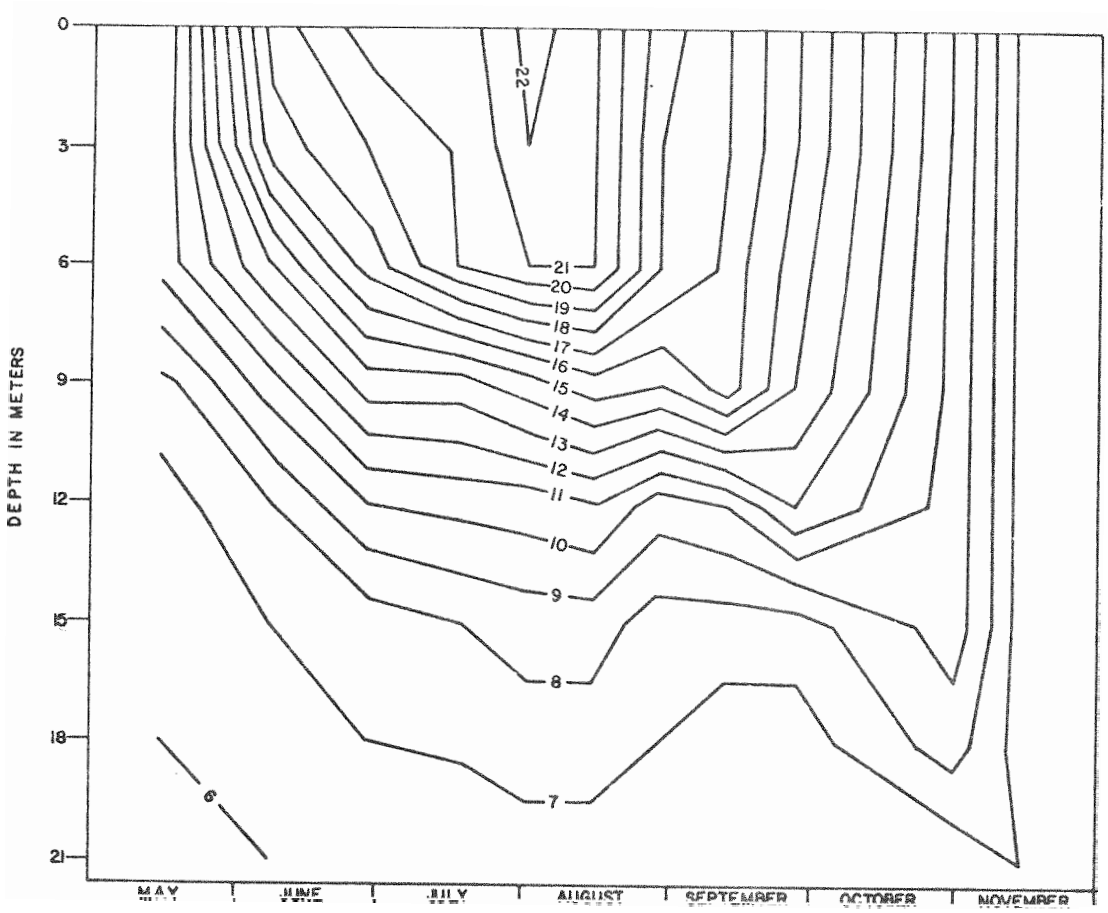

Figure 5. Isolines depicting temperature (°C) conditions at Deer Lake during 1978 DOE water quality study.

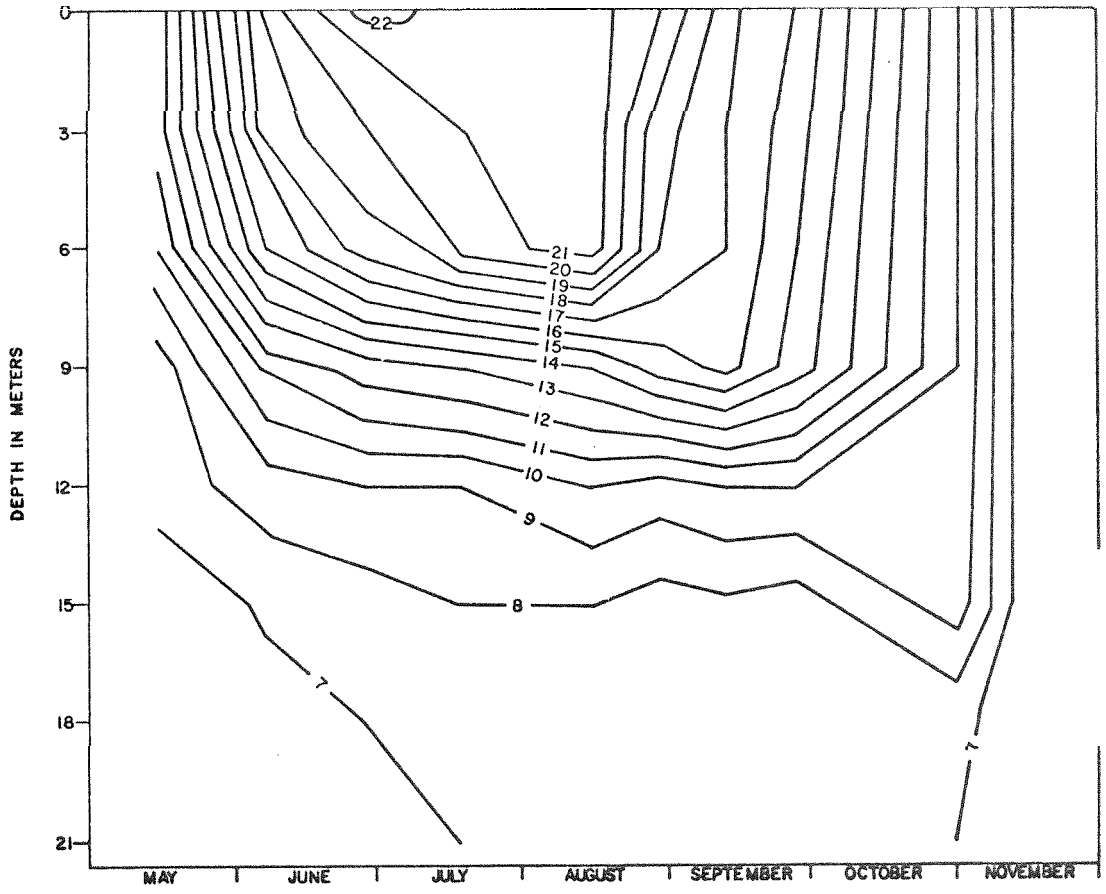

Figure 6a. Isolines depicting temperature (°C) conditions at station 1, Loon Lake, during 1978 DOE water quality study.

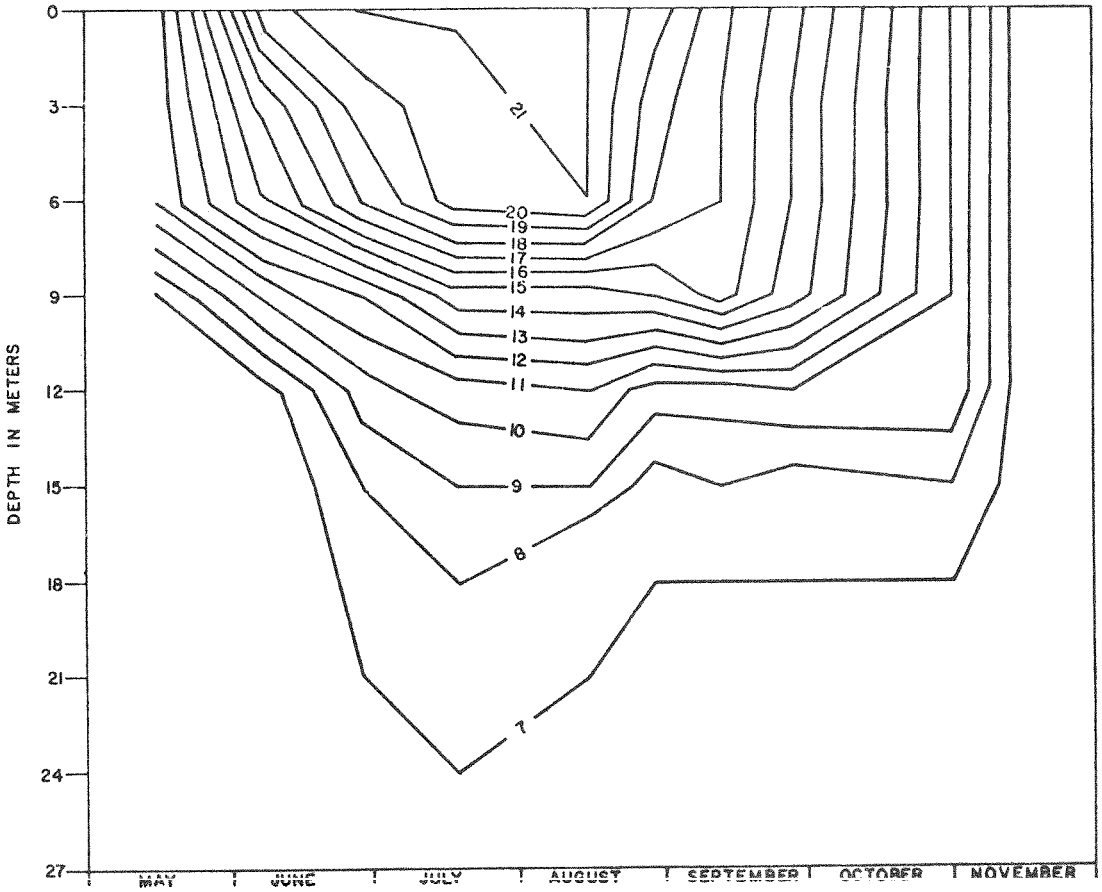

Figure 6b. Isolines depicting temperature (°C) conditions at station 2, Loon Lake, during 1978 DOE water quality study.

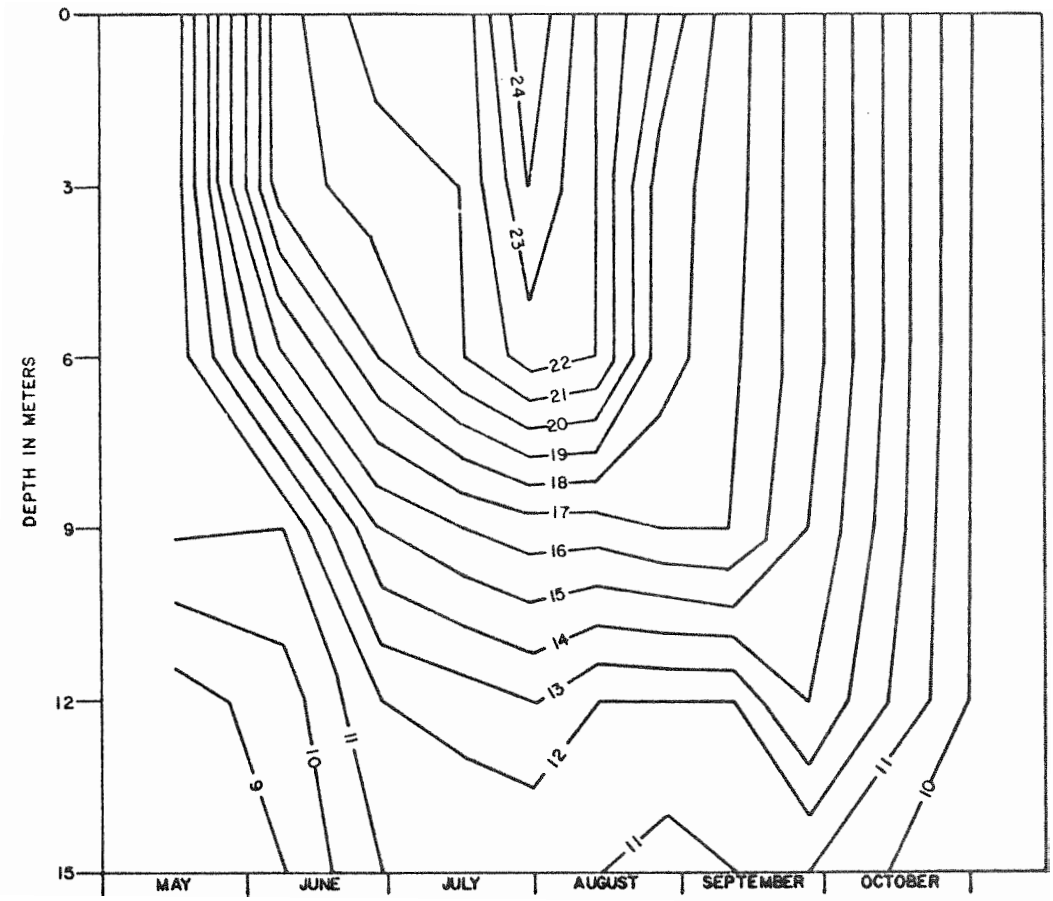

Figure 7. Isolines depicting temperature (°C) conditions at Diamond Lake during 1978 DOE water quality study.

Chemical Parameters

Detailed data for each chemical parameter measured are presented by station in Appendix A. Statistical summaries are also included with the data. It is important to note that values reported as "K" denote the concentration was less than the value given. During averaging, the value was treated as if the inequality was not present. Therefore, the actual mean concentrations of parameters so reported are probably less than indicated.

Dissolved Oxygen

Dissolved oxygen (D.O.) concentrations, for the epilimnion of all three lakes, were at or near complete saturation throughout the study period. The upper portion of the epilimnion was actually found to be super-saturated (greater than 100 percent) for most of the same period. This was probably due to the production of oxygen by the indigenous phytoplankton community.

The D.O. profiles for Deer and Loon lakes (Appendix B) showed D.O. maxima were present in the metalimnion during the majority of the growing season. These positive heterograde curves indicate phytoplankton are concentrated at that point in the water column (Wetzel, 1975). In each case, the D.O. maximum corresponds to the area where the temperature has rapidly declined, therefore creating a density gradient.

Hypolimnetic anoxia was present in each lake during the latter part of the growing season (Figures 8, 9a, 9b, and 10). Dissolved oxygen levels below one mg/L were considered to be anoxic or anaerobic. Hypolimnetic oxygen depletion results from the bacterial and chemical decomposition of the organic materials, phytoplankton and detritus, which drift down from the surface. This problem occurs to varying degrees in mesotrophic and eutrophic lakes and rarely in oligotrophic waters (Hutchinson, 1957). The severity of the problem may be determined by the speed with which anoxia occurs following stratification and the amount of water affected. Anaerobic conditions facilitate nutrient release at the sediment-water interface, often an important factor in a lake's internal nutrient cycle.

Loon Lake exhibited the greatest anoxic conditions in both duration and amount of the water column affected at the deep water station. At its peak, the anoxic water mass in this lake extended from a depth of 18 meters to the bottom at 27 meters. Station 1 showed similar trends from a depth of 15 meters to the bottom. The large anoxic state was also identified in 1971-1972. The lower three meters of Diamond Lake were similarly affected in 1978, as was the lower five meters during the previous study (Bishop, 1973). The difference between years was probably due to seasonal variability. Deer Lake experienced no anoxia in 1971, but during this study the bottom one meter was affected. However, the 1971-1972 sampling stations were located in shallower water; therefore, the slight anoxia observed in 1978 may have been present in 1971 but not detected. Anaerobic conditions in all three lakes had terminated in or by November when fall mixing was complete. Dissolved oxygen profiles for each sampling run are given by station in Appendix B.

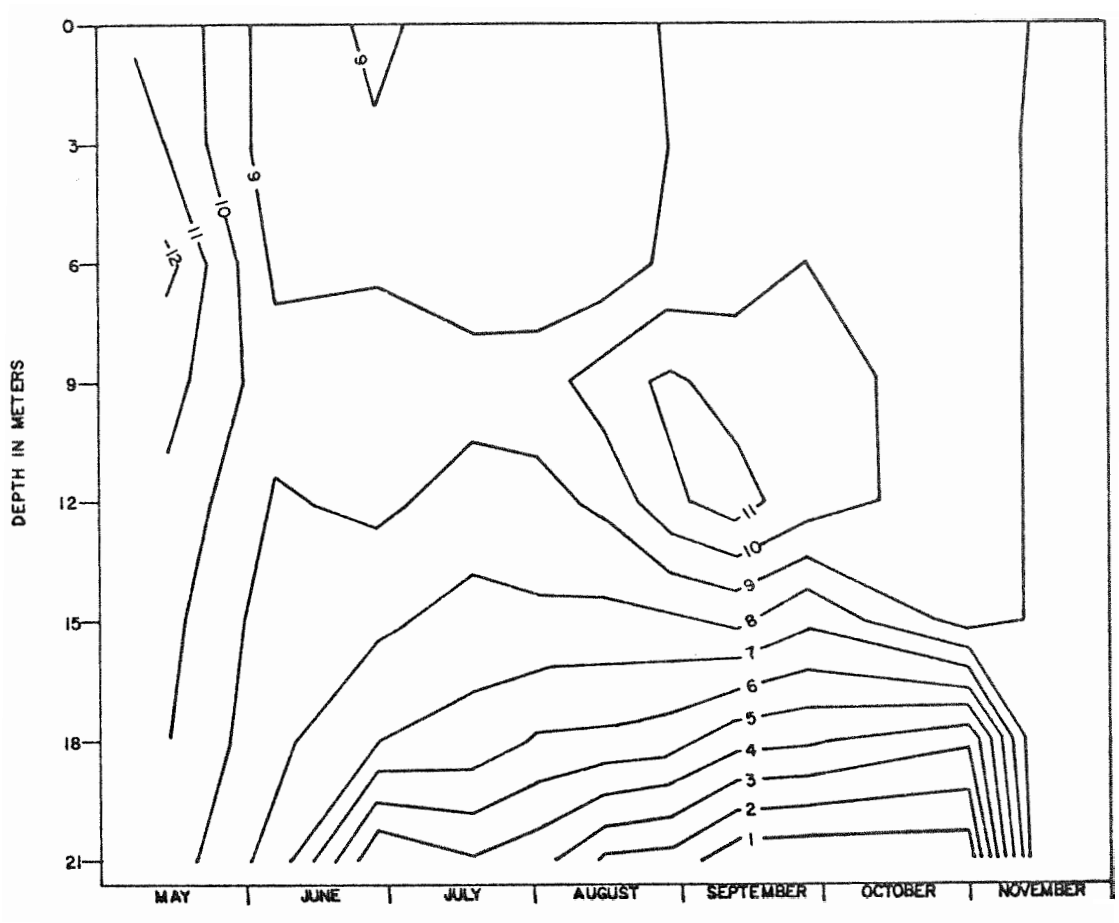

Figure 8. Isolines depicting dissolved oxygen (mg/L) conditions at Deer Lake during 1978 DOE water quality study.

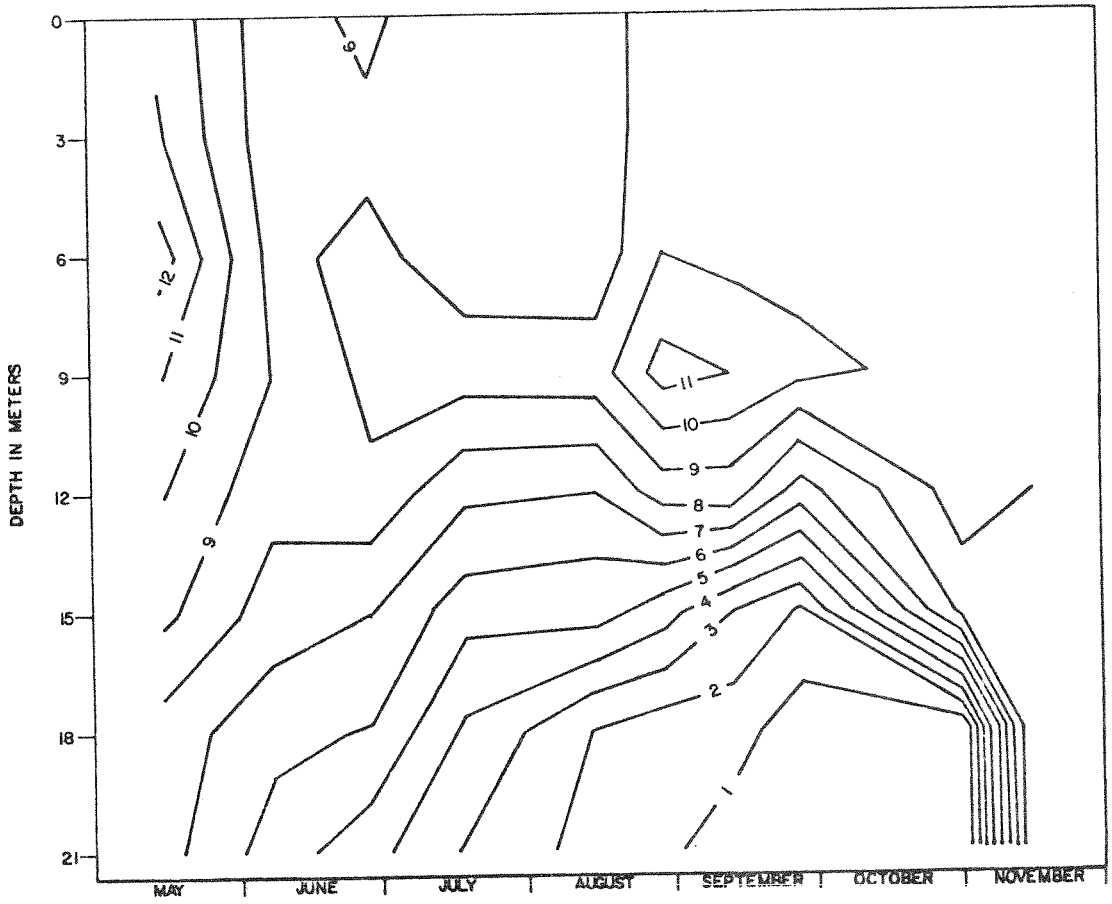

Figure 9a. Isolines depicting dissolved oxygen (mg/L) conditions at station 1, Loon Lake, during 1978 DOE water quality study.

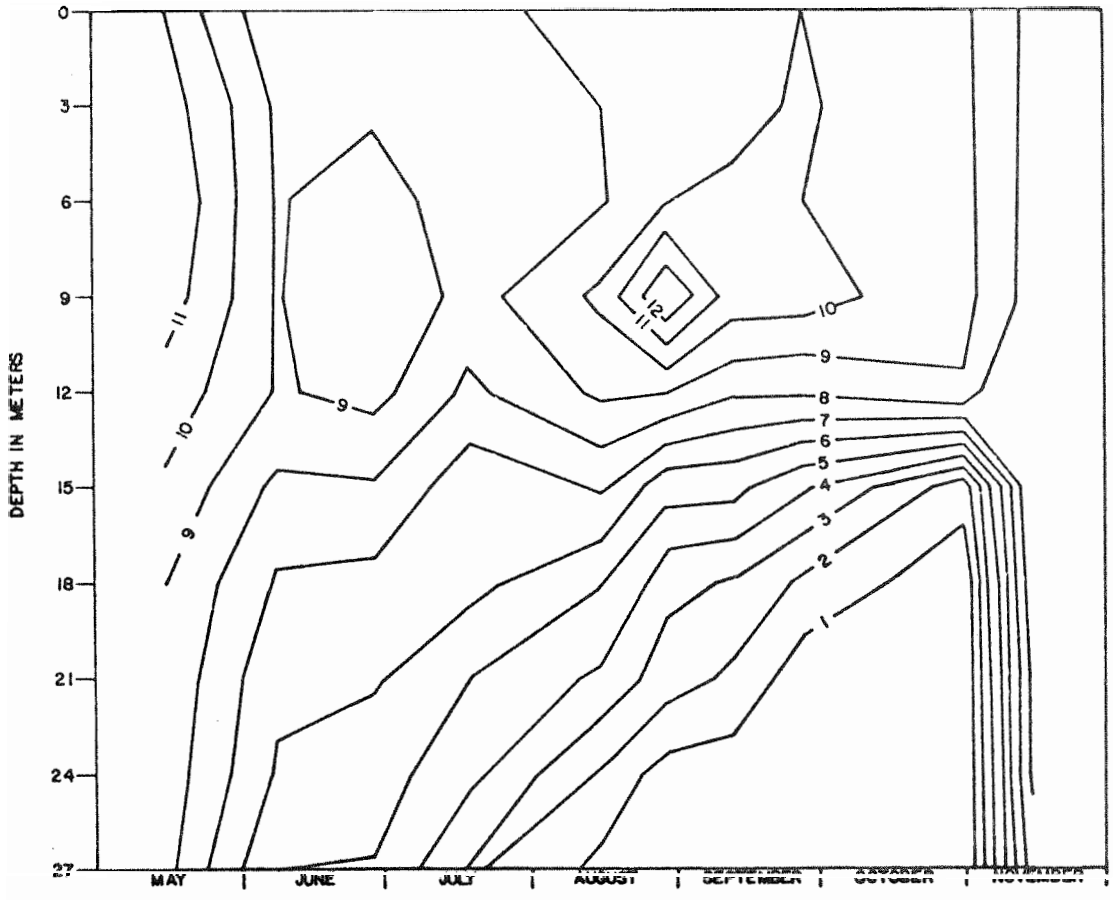

Figure 9b. Isolines depicting dissolved oxygen (mg/L) conditions at station 2, Loon Lake, during 1978 DOE water quality study.

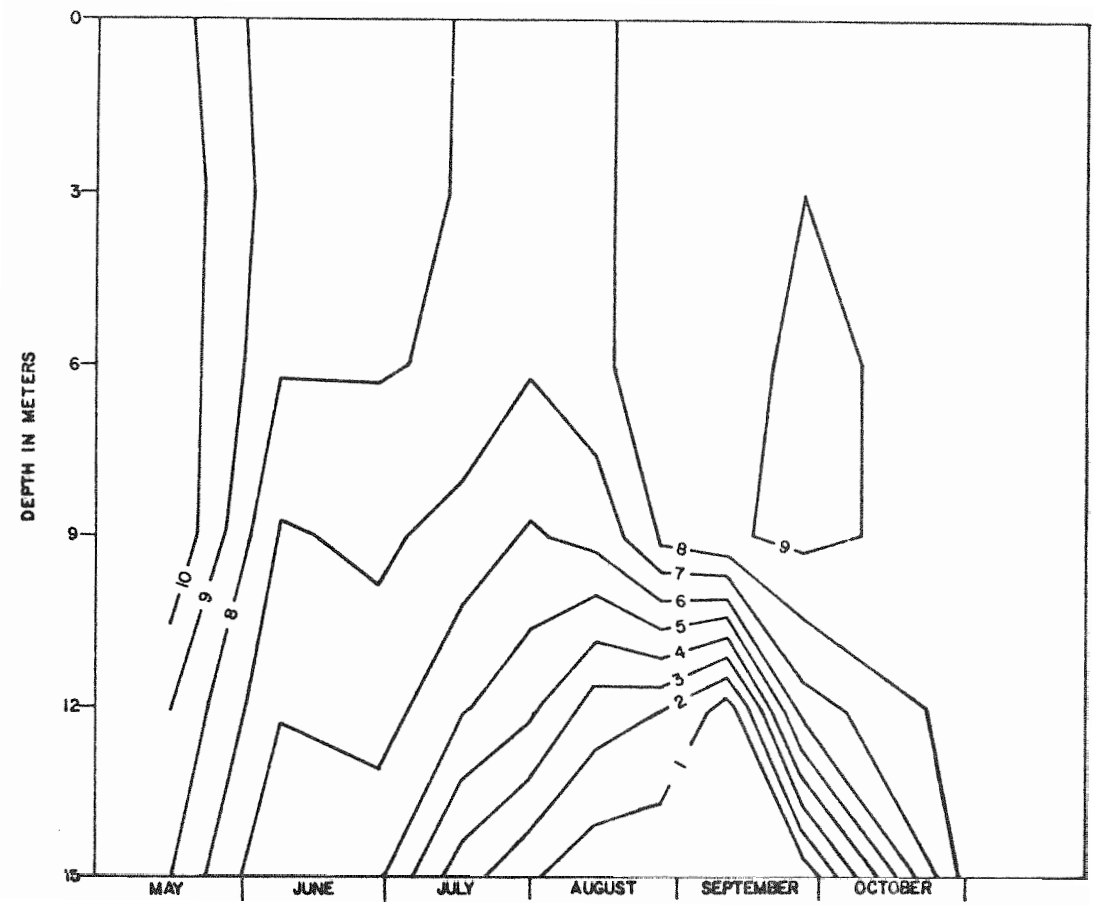

Figure 10. Isolines depicting dissolved oxygen (mg/L) conditions at Diamond Lake during 1978 DOE water quality study.

pH

The pH regimes in Deer, Loon, and Diamond lakes were all similar in 1978, being typical of other thermally stratified lakes. Following stratification, the epilimnion becomes more basic than the hypolimnion, a result of phytoplankton metabolism. The lower pH found in the hypolimnion is a result of decomposition occurring in the lower waters. This condition continues until fall turnover occurs (Wetzel, 1975).

Nutrients

The mean total inorganic nitrogen concentrations, nitrate-N + nitrite-N + ammonia-N, over all depths, and dates were below 0.01 mg/L in all three lakes. The yearly mean dissolved orthophosphate-P concentration in each lake was less than 0.01 mg/L, and the mean total phosphate-P was less than 0.02 mg/L. Inorganic nitrogen, total phosphate-P, and dissolved orthophosphate-P are all necessary phytoplankton nutrients. Sawyer (1947) lists critical levels of each, that if attained, create a high potential for phytoplankton blooms. All lakes in the study area were below the specified critical levels of 0.3 mg/L inorganic nitrogen and 0.05 mg/L total phosphate-P. All lakes were also below the 0.01 mg/L mean dissolved orthophosphate-P concentration. These data indicate Deer, Loon, and Diamond lakes are mesotrophic systems.

The mean concentrations of total and dissolved orthophosphate-P in Deer, Loon, and Diamond lakes during 1971-1972 (Bishop, 1973) and 1978 are presented in Table 5. The amount of phosphate-P appears unchanged from the previous study.

Table 5, Mean concentrations (mg/L) of total phosphate-P and dissolved orthophosphate-P observed previously (Bishop, 1973) and during the 1978 DOE water quality study. Values were calculated from all stations, depths, and dates sampled. K = less than

Lake	Year	$T\text{-}PO_4\text{-}P$ (mg/L)	$O\text{-}PO_4\text{-}P$ (mg/L)
Deer	1971-1972	0.03	0.01
	1978	0.02K	0.01K
Loon	1971-1972	0.02	0.01
	1978	0.02K	0.01K
Diamond	7971-7972	0.02	0.01
	1978	0.02K	0.01K

Our data and the trophic classification of Diamond Lake do not substantiate the findings of the USEPA (1977). In this previous work, the EPA lists Diamond Lake as one of Washington's eutrophic lakes,

The impetus for the disagreement on the trophic state lies entirely in sampling site location. The EPA utilized two stations. The first was very close to our deep water station. Data from this site closely align with the data we collected in 1978 and that collected previously (Bishop, 1973). The second station was located in a littoral area near an old sawmill site. Three sawmills were located on Diamond Lake in the early 1900s. The extensive log rafting which occurred in conjunction with the mills resulted in the formation of large sludge beds (Daly, 1980). Their impact upon the water quality appears to be substantial as this station was nutrient rich and very productive. The EPA averaged the two stations to determine the trophic state of the lake. Our data indicate Diamond Lake is mesotrophic; however, in light of the EPA work, the lake appears to be in a more advanced trophic state than our data indicate.

Biological Parameters

Phytoplankton

The phytoplankton communities of all lakes were evaluated by three methods. The first was an indirect method of measuring phytoplankton standing crop whereby the chlorophyll a content of the water was used as an indicator. The second and third were more direct estimates of standing crop involving actual enumeration and identification of the algae. Phytoplankton quantities were expressed in two ways; numerical densities (cells/ml), and biovolume densities ($\mu m^3/ml \times 10^3$). The numerical densities reflect the number of organisms per unit volume of water. The biovolume densities are dependent upon the size of the organism and thereby reflect the amount of living material present. The detailed results of the phytoplankton identification and enumeration are presented in Appendix C.

Chlorophyll a

The monthly mean chlorophyll a concentration (µg/L) in the euphotic zone was below 1.50 µg/L in all three lakes (Table 6). At no time did any lake have a daily mean euphotic zone concentration greater than 2.80 µg/L. This is well below the criteria of 10 µg/L (Rodhe, 1969) used to classify eutrophic waters.

Phytoplankton Standing Crop

Phytoplankton communities in temperate lakes generally follow similar succession patterns during the growing season. In spring, the algae having rapid growth rates increase quickly, utilizing nutrients recently made available from spring mixing. These organisms also have an advantage at this time as there are very few herbivores present in the water column. Organisms adapted to growth later in the season have the capabilities to survive nutrient-limited conditions and are better suited to withstand pressures exerted by

Table 6. The euphotic zone depths (m) and monthly mean chlorophyll a (µg/L) from Deer, Loon, and Diamond Lakes, DOE water quality study, 1978.

Lake	Date	Euphotic Zone Depth (m)	Chlorophyll a (µg/L)
Deer	5/15	No Data	No Data
	6/07	17	0.60
	6/28	17	1.30
	7/18	18	1.93
	8/01	16	7.61
	8/15	16	1.30
	8/29	16	1.07
	9/12	17	0.83
	9/27	17	0.70
	10/31	17	1.23
	11/14	9	7.67
		Monthly Mean Chlorophyll a	1.31
Loon	5/15	No Data	0.50
	6/07	17	1.15
	6/28	17	0.81
	7/18	17	2.44
	8/15	18	2.04
	8/29	15	1.42
	9/12	15	1.34
	9/27	15	1.07
	10/31	14	1.83
	11/14	13	1.67
		Monthly Mean Chlorophyll a	1.48
Diamond	5/16	No Data	No Data
	6/08	15	1.82
	6/29	14	0.45
	7/17	15	1.13
	7/31	14	1.30
	8/14	14	1.08
	8/28	14	0.83
	9/11	14	1.35
	9/26	14	0.63
	10/31	14	2.68
		Monthly Mean Chlorophyll a	1.40

zooplankton grazing. Grazing has been shown to actually increase the numbers of gelatenous green algae; e.g., *Sphaerocystis Schroeteri*. The many forces controlling phytoplankton succession are very complex with no one chemical, physical, or biological factor singly responsible. The algae present at a given time are best suited to the conditions existing then (Porter, 1977).

Deer Lake

The greatest numerical monthly mean standing crop was observed in August when individual pulses of the green alga *Sphaerocystis Schroeteri* and the blue-green alga *Aphanocapsa delicatissima* occurred at the begining and end of the month, respectively. *A. delicatissima* attained the highest numbers observed in Deer Lake during the study period. A pulse of *Fragilaria crotonensis* on June 7 accounted for the single largest contribution of biovolume by an organism. This was also the highest biovolume observed on an individual date; however, lower volumes later in the month and increases in several phytoplankton divisions in July were sufficient to give that month the highest mean monthly biovolume. Average densities of 457.6 cells/ml and biovolumes of 170.7 $\mu m^3/ml \times 10^3$ were present during any given month in the 1978 growing season (Table 7).

Table 7. Summary of the Deer Lake, Washington, phytoplankton concentrations and divisional dominance (%) observed during the 1978 DOE water quality study. Values were obtained from mean monthly numerical densities (cells/ml) and biovolume concentrations ($\mu m^3/ml \times 10^3$).

Division	Numbers (cells/ml)	Dominance (%)	Biovolume ($\mu m^3/ml \times 10^3$)	Dominance (%)
Bacillariophyta	59.8	13.1	58.5	34.3
Chlorophyta	107.7	23.5	17.3	10.1
Cyanophyta	172.6	37.7	0.1	0.1
Chrysophyta	101.1	22.1	20.2	11.8
Cryptophyta	13.5	3.0	35.0	20.5
Euglenophyta	1.8	0.4	12.8	7.5
Pyrrophyta	1.1	0.2	26.8	15.7
Total	457.6		170.7	

The Cyanophyta, blue-green algae, dominated the phytoplankton community on a numbers basis during 1978; however, due to the

small size of the predominant organisms, comprised only 0.1 percent of the biovolume. The Bacillariophyta, diatoms, were the predominant division comprising 58.5 percent of the observed biovolume. Figure 11 presents population changes the phytoplankton divisions experienced during the 1978 season.

The 1978 phytoplankton community was somewhat different in both composition and numbers from that observed in 1971 and 1972 (Bishop, 1973). An analysis of variance ($P = 0.05$) indicates a significant difference exists between the total cells/ml observed on any sampling in 1971-1972 and those observed in 1978. For comparative purposes, the monthly mean densities for both studies (Table 8) were determined from only those months common to both studies. The predominant phytoplankton division shifted from the Chlorophyta, green algae, in 1971-1972 to the Cyanophyta in 1978. Blue-greens increased from 0.6 percent in 1971-1972 to 27.8 percent during the 1978 season. The "other" category, collectively comprised of the Chrysophyta, golden algae; Cryptophyta, cryptomonads; Euglenophyta, euglenoids; and the Pyrrophyta, red algae, increased similarly in 1978.

Table 8. Summary of the phytoplankton total monthly mean densities (cells/ml) and divisional dominance (%) observed during the 1971-1972 (Bishop, 1973) and 1978 seasons. Values were calculated from only those months common to both studies.

	Numbers (cells/ml)	Divisional Dominance (%)			
		Bacillariophyta	Chlorophyta	Cyanophyta	Others
1971-1972	141.4	45.8	51.9	0.6	1.7
1978	510.5	10.7	29.5	27.8	32.0

Loon Lake

The phytoplankton community was well established in May with pulses of *Dinobryon divergens* and several diatoms. The highest monthly density, 1135 cells/ml, was observed in July when simultaneous pulses of the Bacillariophyta, primarily *F. erotonensis* and *Cyclotella* sp., and the Chlorophyta, predominantly *Gleocystis ampla*, occurred. Similar high densities were observed in August; however, dominance shifted to the Cyanophyta when *Aphanothece nidulans* and *Anabaena circinalis* became prevalent. Maximum cell volumes occurred in July when the aforementioned increases in the diatoms and greens occurred. August's cell volumes were not exceedingly high due to the small size of the blue-greens. The mean monthly numerical density, 466.1 cells/ml, was dominated by the Chlorophyta

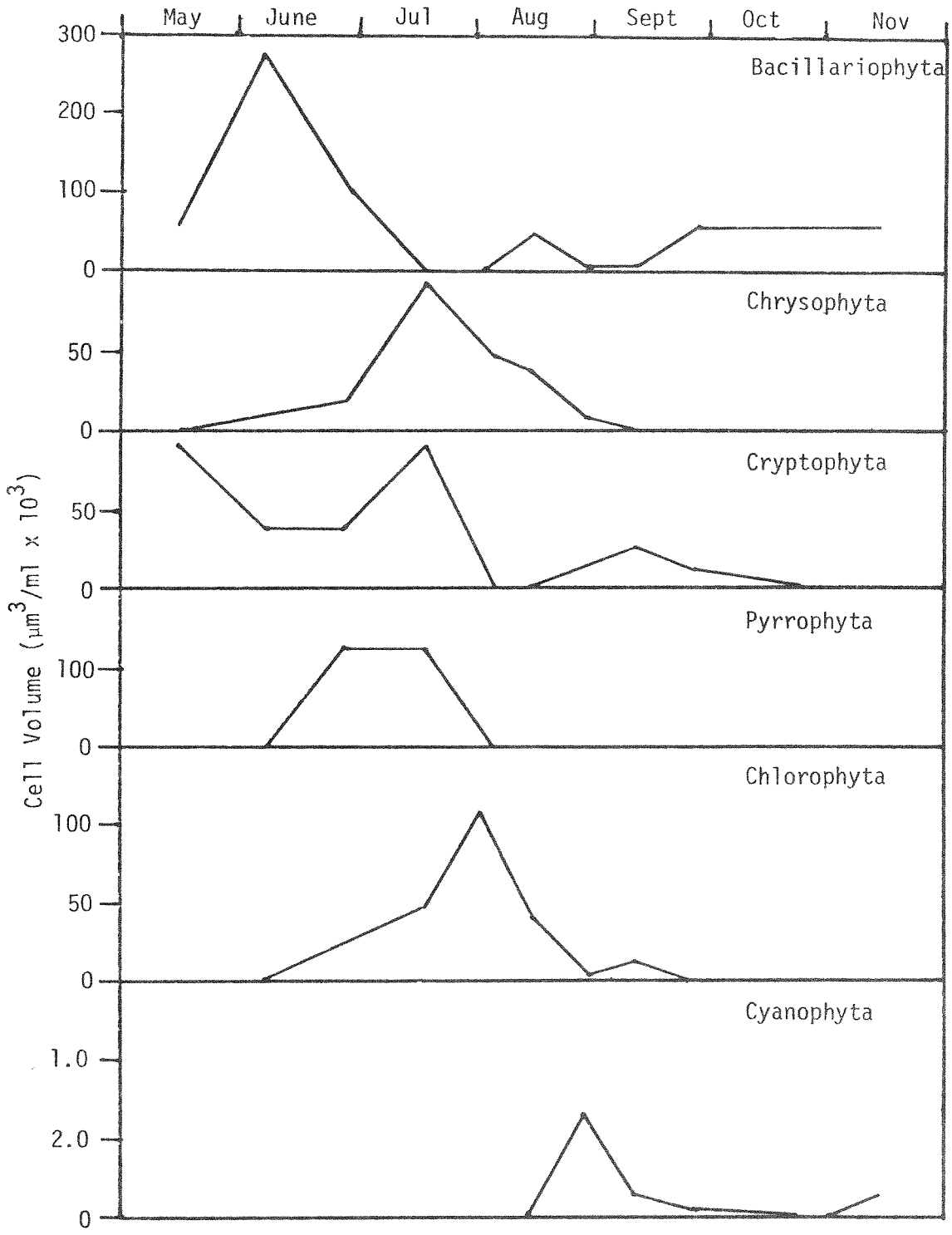

Figure 11. Phytoplankton cell volume ($\mu m^3/ml \times 10^3$) by division, at Deer Lake during the 1978 DOE water quality study.

(Table 9). The Cyanophyta and Bacillariophyta followed at second and third, respectively. The mean monthly cell biovolume of Loon Lake was 315.0 $\mu m^3/ml \times 10^3$. Two divisions were primarily responsible for the total; the Bacillariophyta comprised 42.5 percent and the Chlorophyta, 28.9 percent. The succession regimes of the predominate divisions are represented in Figure 12.

Table 9. Summary of the Loon Lake, Washington, phytoplankton concentrations and divisional dominance (%) observed during the 1978 DOE water quality study. Values were obtained from mean monthly numerical densities (cells/ml) and biovolume concentrations ($\mu m^3/ml \times 10^3$).

Division	Numbers (cells/ml)	Dominance (%)	Biovolume ($\mu m^3/ml \times 10^3$)	Dominance (%)
Bacillariophyta	114.1	24.5	133.8	42.5
Chlorophyta	149.4	32.1	91.0	28.9
Cyanophyta	122.9	26.4	10.6	3.4
Chrysophyta	77.9	16.7	31.0	9.8
Euglenophyta	0.4	0.1	2.3	0.7
Pyrrophyta	1.4	0.3	46.4	14.7
Total	**466.1**		315.0	

The 1978 results indicate a species composition shift has occurred in Loon Lake (Table 10), when compared to what has been reported previously (Bishop, 1973). The Cyanophyta is currently the dominant division with the Bacillariophyta being second. Historically, the Bacillariophyta and the Chlorophyta have maintained the first and second positions. The mean monthly numerical standing crop has also significantly increased (analysis of variance $P = 0.05$) from the 213.3 cells/ml observed previously to 495.8 cells/ml observed in the 1978 growing season.

Table 10. Summary of the phytoplankton total monthly mean densities (cells/ml) and divisional dominance (%) observed during the 1971-1972 (Bishop, 1973) and 1978 seasons. Values were calculated from only those months common to both studies.

	Numbers (cells/ml)	Divisional Dominance (%)			
		Bacillariophyta	Chlorophyta	Cyanophyta	Others
1971-1972	213.3	57.9	36.2	4.4	1.5
1978	495.8	21.7	18.7	38.4	21.3

Diamond Lake

The phytoplankton community of Diamond Lake was well established by the initial sampling in May. Diatoms accounted for the majority of the species observed; however, a small pulse of the large, red alga *Glenodinium Gymnodinium* in May was primarily responsible for the highest mean monthly biovolume, 534.0 $\mu m^3/ml \times 10^3$, observed in the lake. Cell densities were at their greatest when the blue-greens *Anabaena cylindrica* and A. *nidulans* were dominant on July 31 and September 26, respectively. The mean numerical standing crop was at its highest in July when densities reached 467.5 cells/ml. The overall mean monthly numerical standing crop, 255.8 cells/ml, was dominated by the Cyanophyta which contributed 52.5 percent to the total. The Pyrrophyta accounted for only 4.9 percent of the numerical density, but because of their large size, contributed 63.2 percent of the overall mean monthly biovolume (Table 11). Figure 13 depicts the phytoplankton succession during the 1978 season.

Table 11. Summary of the Diamond Lake, Washington, phytoplankton concentrations and divisional dominance (%) observed during the 1978 DOE water quality study. Values were obtained from mean monthly numerical densities (cells/ml) and biovolume concentrations ($\mu m^3/ml \times 10^3$).

Division	Numbers (cells/ml)	Dominance (%)	Biovolume ($\mu m^3/ml \times 10^3$)	Dominance (%)
Bacillariophyta	51.2	20.0	27.1	14.2
Chlorophyta	20.4	8.0	2.1	1.1
Cyanophyta	134.2	52.5	23.6	12.4
Chrysophyta	34.6	13.5	8.6	4.5
Cryptophyta	2.9	1.1	8.8	4.6
Pyrrophyta	**12.5**	**4.9**	**120.8**	**63.2**
Total	**255.8**		**191.0**	

The lowest phytoplankton concentrations were observed on August 28 and September 11. This is an unusual situation for that time of year and the lake type (Gibbons, 1980). The most probable cause of these low values is one of underestimating the populations due to sampling error. Phytoplankton are not uniformly distributed throughout the euphotic zone. They have migrational patterns and buoyancy differences, both of which tend to concentrate organisms of varying depths (Hutchinson, 1967). The sampling procedure is designed to neither accentuate nor eliminate the effects of phytoplankton concentration. It is, however, possible that overestimation or underestimation could occur if samples were obtained from dense or sparse areas. It appears that the latter occurred, and the

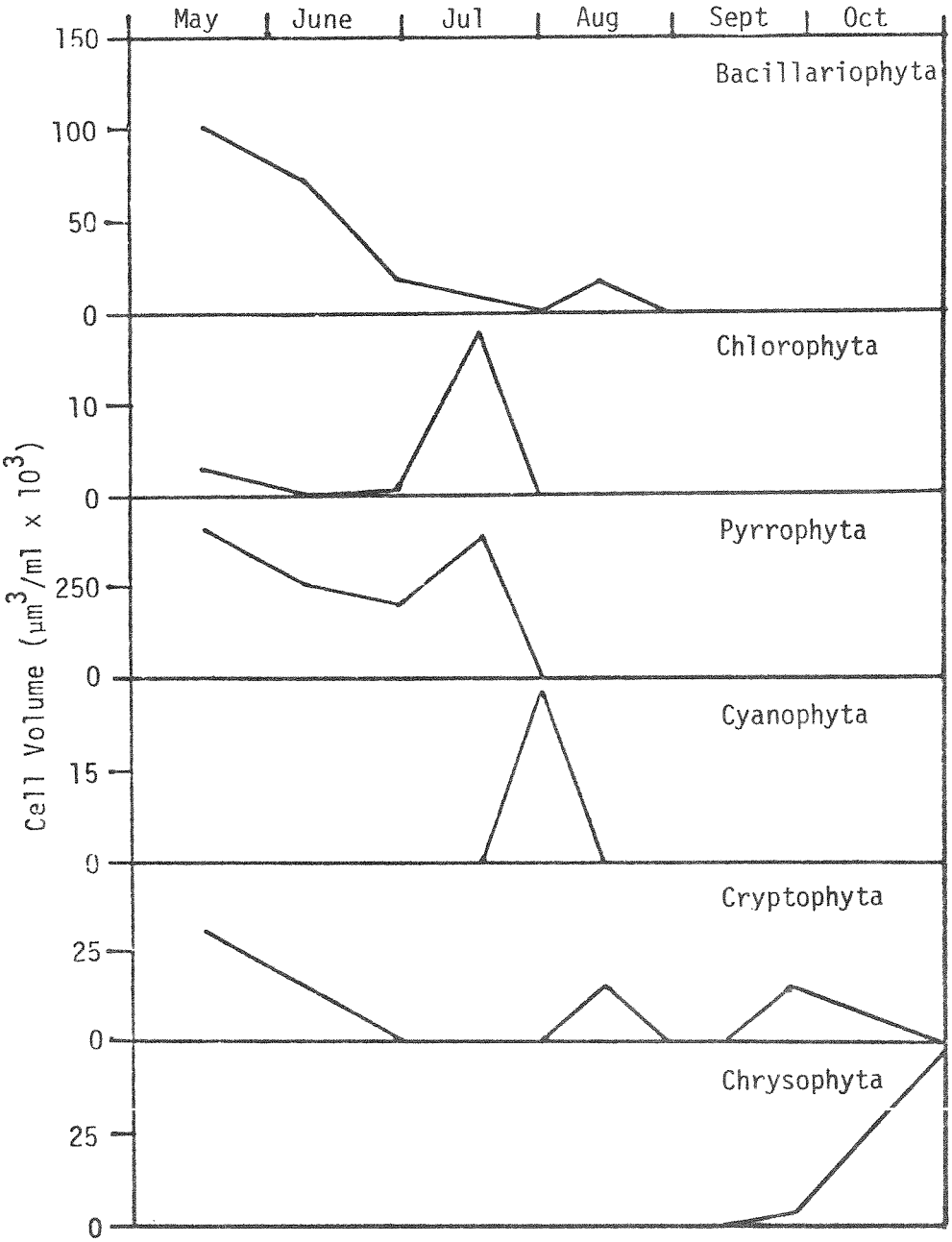

Figure 13. Phytoplankton cell volume ($\mu m^3/ml \times 10^3$) by division, at Diamond Lake during the 1978 DOE water quality study.

low concentrations were not representative of the water column at that time. Previous work (USEPA, 1977) also suggests higher cell densities should have been present in Diamond Lake during the period in question.

As with the other two lakes, the species composition at Diamond Lake has shifted from that observed by Bishop (1973). Table 12 shows the lake to be dominated by the Cyanophyta, a change from the past co-domination by the Bacillariophyta and Chlorophyta. The increase in the monthly mean standing crop was not found to be significant; however, this may have been influenced by the underestimation of the populations in later summer.

Table 12. Summary of the phytoplankton total monthly mean densities (cells/ml) and divisional dominance (%) observed during the 1971-1972 (Bishop, 1973) and 1978 seasons. Values were calculated from only those months common to both studies.

	Numbers (cells/ml)	Divisional Dominance (%)			
		Bacillariophyta	Chlorophyta	Cyanophyta	Others
1971-1972	191.0	49.5	42.1	6.3	2.1
1978	255.6	29.1	12.0	49.9	9.1

Some general trends in the phytoplankton appear to exist in all three lakes of the study. Divisional domination has changed and the mean monthly numerical standing crop has increased from what was observed previously in all lakes (Bishop, 1973). These alterations may indicate changes in the nutrient loading as enrichment will cause species compositional shifts and increases in the phytoplankton standing crop and/or productivity (Schindler and Fee, 1974; Hall, *et al.*, 1970). Caution should be used when making such assumptions about these lakes based upon the phytoplankton data alone. The methodologies used for phytoplankton sample procurement during 1971-1972 (Bishop, 1973) and 1978 are not totally comparable. The earlier samples were obtained from a depth of three meters whereas this study used a composite sample obtained from the surface, middle, and bottom of the euphotic zone. These methodological differences could explain the increased occurrence of the Cyanophyta in the 1978 samples. Some blue-greens are capable of gas vacuole formation which tends to concentrate those organisms at or very near the surface. Phytoplankton also may concentrate at the metalimnion because of the density gradient located at that point. Because neither of these areas were sampled, the phytoplankton may have been underestimated. This might account for the increased mean numerical densities observed in 1978.

Bacteria

All three lakes had very low levels of fecal coliform bacteria during the study period. At no time did bacterial levels exceed two org/100 ml. Washington State's water quality standards state that lake class waters shall not exceed a median value of 50 org/100 ml (DOE, 1977).

CONCLUSIONS AND RECOMMENDATIONS

Deer Lake is mesotrophic and has the least water quality problems of the three lakes. It has the greatest mean depth of the three and the least amount of hypolimnetic oxygen depletion. Deer Lake appears to be able to sustain its present trophic condition longest, and therefore, should probably be the last of the three lakes sewered if present conditions persist. This study indicates Diamond and Loon lakes are also mesotrophic; however, both have some water quality problems which indicate they are not as stable. Loon Lake experienced the greatest degree of hypolimnetic anoxia and also showed a significant decrease in the mean secchi disk depth. The anoxia observed in Diamond Lake was not as severe as the anoxia in Loon Lake; however, it is still noteworthy, as is the probable impact sludge beds have on water quality. The nutrient and phytoplankton discrepancies between the USEPA (1977) work on Diamond Lake and this study indicate that the mesotrophic classification is questionable for the lake as a whole and needs additional work. The sewering of Loon and Diamond lakes needs further evaluation utilizing current demographic and land usage trends present at each lake. Any prioritizing should be related to growth rate, growth potential, and the existing water quality status.

A future water quality study of Deer, Loon, and Diamond lakes should be conducted again in 1983, thereby re-evaluating their status after five years. Future sampling programs should include one or two sites in the littoral areas as well as one deep water station. Diamond Lake should have special attention to determine the extent of the sludge beds and the degree to which they spatially affect water quality. Future investigators may also want to collect the phytoplankton composite samples at equal depths, preferably at two-meter intervals from the surface to the bottom of the euphotic zone. This will increase the number of subsamples and therefore be more representative of the phytoplankton present in the water column.

Conditions appear to have changed little from the previous DOE water quality study of Loon, Deer, and Diamond lakes by Bishop (1973). This indicates no immediate action is required to limit the rate of nutrient loading, as it seems relatively stable. However, this does not preclude the need for resource protection. As urban sprawl and development continues, there will be a need to eliminate on-site sewage disposal and convert to central wastewater treatment facilities. The long-range plans should be considered; however, their implementation is not immediately imperative.

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APPENDIX A

WATER QUALITY DATA

Table A1. DOE water quality monitoring data for Station 1, Deer Lake, Washington.

DEPARTMENT OF ECOLOGY

AGENCY 21540000 RETRIEVAL --- 01 MAY 1980

OFFICE OF WATER PROGRAMS
WATER QUALITY MANAGEMENT DIVISION
WATER & WASTEWATER MONITORING SECTION

DEERO1 DEER LAKE AT MID LAKE

DATES: 78/05/01 TO 78/11/30

STORET MINOR BASIN: UPPER COLUMBIA STORET SUB BASIN: COLVILLE

LATITUDE: 48 0€ 28.0 ELEVATION (FEET): 2482 WATER CLASS: LC
LONGITUDE: 117 35 18.0 COUNTY: STEVENS SEGMENT: 23-59-100

AGENCY: 21540000 STATE: WASHINGTON FTA TYPE: LAKE

TERMINAL STREAM	1ST LEV MILES	2ND LEV MILES	3RD LEV MILES	4TH LEJ MILES	5TH LEV MILES	6TH LEV MILES

DATE FROM TO	TIME	DEPTH METERS	00010 WATER TEMP DEG-C	00035 CONDUCTVY @ 25 C MICROMHOS	00078 TRANSPAR SECCHI METERS	00300 DISSOLVED OXYGEN mg/l	00301 DO PERCENT SATURATN	00400 pH STANDARD UNITS	00070 TURBIDITY TURBMETER NTU	00900 HARDNESS TOT CaCO3 mg/l	00915 CALCIUM DIS-CaCO3 mg/l	00410 ALKALINE T CaCO3 mg/l	
78/05/15	1500	0	10.8	96	7.0	10.8	107.0	7.7	2.0				29
	1500	3	10.6	80		11.0	108.0	7.8	1.0				30
	1500	6	10.4	80		12.2	120.0	7.8	1.0				32
	1500	9	7.8	82		11.4	105.0	7.7	1.0				30
	1500	12	6.5	81		10.7	95.0	7.5	1.0				30
	1500	15	6.3	98		10.3	91.0	7.4	2.0				27
	1500	18	6.0	81		10.0	88.0	7.4	1.0				26
	1500	21	5.3	82		9.5	83.0	7.7	1.0				30
78/06/07	1500	0	18.5	91	6.7	8.5	90.0	7.5	1.0	29	30.0		30
	1500	3	17.5	88		8.4	90.0	7.6	1.0	29	30.0		30
	1500	6	14.C	85		8.8	94.0	7.9	1.0	27	30.0		31
	1500	9	10.5	96		9.4	92.0	7.6	1.0	25	25.0		33
	1500	12	a.0	87		8.9	82.0	7.5	1.0K	31	30.0		31
	1500	15	7.0	88		8.4	76.0	7.3	1.0	29	30.0		33
	1500	18	6.5	88		8.2	73.0	7.2	1.0K	33	30.0		31
	1500	21	6.0	90		7.5	66.0	7.1	6.0	27	25.0		33
78/06/28	1105	0	20.5	105	8.2	9.2	112.0	7.9	1.0	29	30.0		34
	1105	3	19.0	79		8.8	105.0	7.9	1.0	29	25.0		34
	1105	6	17.5	78		8.9	102.0	8.0	1.0	28	25.0		32
	1105	9	13.5	76		9.4	90.0	8.0	4.0	33	25.0		32
	1105	12	10.C	76		9.2	80.0	7.8	2.0	29	30.0		34
	1105	15	7.5	70		8.2	75.0	7.6	1.0	29	25.0		44
	1105	18	7.0	76		7.0	63.0	7.4	1.0	29	25.0		34
	1105	21	6.0	70		3.0	26.0	7.1	1.0	29	25.0		36
78/07/18	1035	0	20.5	88	7.2	8.5	104.0	7.9	1.0	28	18.0		30
	1035	3	20.2	76		8.4	102.0	8.1	5.0	24	16.0		36
	1035	6	20.1	75		8.4	102.0	8.1	3.0		16.0		36
	1035		13.5	77		9.4	93.0	8.2	3.0	26	16.0		34
	1035	12	10.3	75		8.6	84.0	7.9	3.0	24	18.0		32
	1035	15	8.0	76		7.6	70.0	7.6	2.0	26	14.0		34
	1035	18	7.1	77		6.6	60.0	7.5	2.0	26	18.0		32
		21	6.5	79		3.9	35.0	7.2	2.0	24	18.0		34

Table A1. DOE water quality monitoring data for Station 1, Deer Lake, Washington (continued).

78/08/01	1040	0	22.5	73	7.0	8.4	106.0	7.8	3.0	33	30.0	43
	1040	3	22.0	72		8.1	101.0	7.9	2.0	33	35.0	35
	1040	6	21.0	71		8.3	102.0	8.0	2.0	33	35.0	35
	1040	9	14.5	70		9.5	102.0	8.3	2.0	30	30.0	38
	1040	12	10.5	70		8.7	85.0	8.1	2.0	28	30.0	35
	1040	15	8.5	71		7.8	73.0	7.7	5.0	28	30.0	33
	1040	18	7.5	73		5.9	54.0	7.5	2.0	30	30.0	35
	1040	21	6.5	73		3.3	29.0	7.2	4.0	33	25.0	37
78/08/15	1145	0	21.0	94	5.8	8.4	103.0	8.1	1.0	32	24.0	34
	1145	3	21.0	90		8.3	102.0	8.1	1.0	40	24.0	34
	1145	6	21.0	90		8.3	102.0	8.1	1.0	40	20.0	35
	1145	9	15.5	87		10.5	115.0	8.3	1.0	40	24.0	31
	1145	12	11.0	86		9.2	91.0	8.1	1.0	32		31
	1145	15	8.5	88		7.7	72.0	7.8	3.0	36	12.0	32
	1145	18	7.5	87		5.8	53.0	7.5	1.0	36	28.0	31
	1145	21	6.5	88		1.8	16.0	7.3	1.0	36	32.0	30
78/08/29	1035	0	18.5	80	8.4	9.1	106.0	8.0	1.0	40	24.0	34
	1035	3	18.0	77		9.0	104.0	8.0	2.0	44	24.0	32
	1035	6	18.0	75		9.2	106.0	8.0	1.0	40	24.0	34
	1035	9	15.0	73		11.2	121.0	7.8	1.0	44	28.0	34
	1035	12	3.5	72		10.8	103.0	7.5	1.0	44	24.0	31
	1035	15	7.5	73		7.8	71.0	7.3	1.0	36	28.0	32
	1035	18	7.0	73		5.5	48.0	7.2	1.0	44	28.0	33
	1035	21	6.5	77		1.6	14.0	7.2	2.0	36	28.0	37
78/09/12	1130	0	17.0	80	7.6	9.4	107.0	8.0	1.0	40	32.0	36
	1130	3	17.0	78		9.4	107.0	8.1	1.0	48	28.0	43
	1130	6	16.8	76		9.5	107.0	8.1	2.0	40	28.0	35
	1130	9	16.5	77		10.6	119.0	8.0	2.0	44	24.0	33
	1130	12	10.0	77		11.4	111.0	7.6	1.0	40	28.0	33
	1130	15	7.5	77		8.2	75.0	7.3	2.0	48	24.0	38
	1130	18	6.5	78		4.4	39.0	7.1	1.0	44	20.0	41
	1130	21	6.0	81		0.3	3.0	7.1	2.0	40	28.0	43
78/09/27	1205	0	15.0	80	7.3	9.7	105.0	8.1	1.0	48	32.0	36
	1205	3	15.0	78		10.0	108.0	8.1	1.0	40	24.0	34
	1205	6	14.5	80		10.0	108.0	8.1	1.0	40	28.0	34
	1205	9	14.0	80		10.4	111.0	8.0	1.0	36	24.0	34
	1205	12	12.0	79		10.4	106.0	7.5	1.0	48	28.0	32
	1205	15	7.5	78		7.2	60.0	7.2	1.0	36	24.0	32
	1205	18	6.5	77		4.2	37.0	7.1	1.0	44	32.0	34
	1205	21	6.0	78		0.2	2.0	7.1	1.0	40	32.0	36
78/10/31	1100	0	9.8	82	5.5	9.5	92.0	7.7	2.0	44	32.0	32
	1100	3	9.8	78		9.5	92.0	7.7	1.0	44	32.0	32
	1100	6	9.6	80		9.5	91.0	7.7	1.0	36	30.0	32
	1100	9	9.6	80		9.5	91.0	7.7	1.0	40	32.0	33
	1100	12	9.6	78		9.5	91.0	7.7	2.0	40	30.0	33
	1100	15	9.5	80		9.5	91.0	7.6	1.0	36	32.0	33
	1100	18	8.5	81		3.2	30.0	7.1	1.0	40	32.0	33
	1100	21	6.3	83		0.3	3.0	7.1	2.0	40	36.0	35
78/11/14	1030	0	6.6	80	4.3	9.0	80.0	7.5	1.0	36	32.0	34
	1030	3	6.6	79		8.9	80.0	7.5	1.0	40	28.0	34
	1030	6	6.6	80		8.9	80.0	7.5	1.0	40	24.0	36
	1030	9	6.6	78		8.9	80.0	7.5	1.0	36	28.0	36
	1030	12	6.6			8.9	80.0	7.5	1.0	40	24.0	34
	1030	15	6.6			8.9	80.0	7.5	1.0	40	24.0	36
	1030	18	6.6			8.9	80.0	7.6	1.0	40	28.0	36
	1030	21	7.0			8.9	83.0	7.6	2.0	40	32.0	34
NUMBER OF SAMPLES			88	88	11		88	88	88	79	79	86
MAXIMUM VALUE			22.50	105.00	8.40			8.30	6.00	48.00	36.00	54.00
MINIMUM VALUE			5.90	70.00	4.30				1.00	24.00	12.00	27.00

Table A1. DOE water quality monitoring data for Station 1, Deer Lake, Washington (continued).

ARITHMETIC MEAN	11.34	80.11	6.82	8.19	83.15	7.67	1.57	35.70	26.82	33.99
GEOMETRIC MEAN	1.21	1.35	2.22	1.27	1.96	1.15	1.01	1.18	1.25	1.08
MEDIAN	9.60	79.00	7.00	8.90	91.00	7.70	1.00	36.00	28.00	33.00
STANDARD DEVIATION	5.16	6.57	1.21	2.55	28.58	0.34	1.00	6.58	5.20	3.77
VARIANCE	26.66	43.11	1.46	6.53	816.73	0.11	1.01	43.29	27.05	14.24

Table A1. DOE water quality monitoring data for Station 1, Deer Lake, Washington (continued).

DEPARTMENT OF ECOLOGY

AGENCY 21540000 RETRIEVAL --- 01 MAY 1980

OFFICE OF WATER PROGRAMS
WATER QUALITY MANAGEMENT DIVISION
WATER & WASTEWATER MONITORING SECTION

DEER01 DEER LAKE AT MID LAKE

DATES: 78/05/01 TO 78/11/30

STORET MINOR BASIN: UPPER COLUMBIA STORET SUB BASIN: COLVILLE

LATITUDE: 48 06 20.0 ELEVATION (FEET): 2482 WATER CLASS: LC
LONGITUDE: 117 35 18.0 COUNTY: STEVENS SEGMENT: 23-59-100

AGENCY: 21540000 STATE: WASHINGTON STA TYPE: LAKE

TERMINAL STREAM	1ST LEV MILES	2ND LEV MILES	3RD LEV MILES	4TH LEV MILES	5TH LEV MILES	6TH LEV MILES

DATE FROM TO	TIME	DEPTH METERS	00620 NITRATE T NO3-N mg/l	00615 NITRITE T NO2-N mg/l	00610 AMMONIA T NH3-N mg/l	00625 KJELDAHL NITROGEN T mg/l N	00665 TOTAL PHOSPHRUS mg/l P	00671 DIS-ORTHO PHOSPHRUS mg/l P	32211 CHLOROPHL A SPECTRO ug/l	31616 FECAL COLIFORM /100ml MF	
78/05/15	1500	0	0.02K	0.02K	0.04	0.880	0.04	0.05			2K
	1500	3	0.02K	0.02K	0.02K	0.680	0.02	0.02			
	1500	6	0.02K	0.02K	0.02K	0.740	0.02K	0.02K			
	1500	9	0.02K	0.02K	0.02K	0.650	0.02K	0.02K			
	1500	12	0.02K	0.02K	0.02K	0.270	0.02K	0.02K			
	1500	15	0.02K	0.02K	0.03	0.530	0.03	0.02K			
	1500	18	0.02K	0.02K	0.02K	0.450	0.02K	0.02K			
	1500	21	0.02K	0.02K	0.04	0.400	0.05	0.02K			
78/06/07	1500	0	0.01K	0.01K	0.01	0.330	0.04	0.02K	0.00		1K
	1500	3	0.01K	0.01K	0.01K	0.350	0.02	0.02K	0.40		
	1500	6	0.01K	0.01K	0.01K	0.310	0.01	0.02K	0.80		
	1500	9	0.01K	0.01K	0.01K	0.320	0.03	0.02K			
	1500	12	0.01K	0.01K	0.01K	0.360	0.03	0.02K	0.70		
	1500	15	0.01K	0.01K	0.01K	0.250	0.01	0.02K	0.40		
	1500	18	0.01K	0.01K	0.01K	0.310	0.04	0.02K	0.30		
	1500	21	0.01K	0.01K	0.02	0.300	0.03	0.02K			
78/06/28	1105	0	0.01K	0.01K	0.01	0.430	0.03	0.01K	0.30		1K
	1105	3	0.01K	0.01K	0.01	0.210	0.02	0.01K	0.20		
	1105	6	0.01K	0.01K	0.01	0.240	0.02	0.01K	0.30		
	1105	9	0.01K	0.01K	0.01K	0.240	0.03	0.01K	1.40		
	1105	12	0.01K	0.01K	0.01K	0.250	0.02	0.01K	3.10		
	1105	15	0.01K	0.01K	0.02	0.260	0.02	0.01K	2.80		
	1105	18	0.01K	0.01K	0.01	0.310	0.05	0.01K	1.00		
	1105	21	0.01K	0.01K	0.01K	0.180	0.04	0.01K	0.80		
78/07/18	1035	0	0.01K	0.01K	0.01	0.480	0.01K	0.01K	0.00		2
	1035	3	0.01K	0.01K	0.01	0.430	0.01	0.01K	1.20		
	1035	6	0.01K	0.01K	0.01	0.690	0.01	0.01K	0.60		
	1035	9	0.01K	0.01K	0.01	0.490	0.02	0.01K	1.40		
	1035	12	0.01K	0.01K	0.01	0.680	0.02	0.01K	2.60		
	1035	15	0.01K	0.01K	0.02	0.660	0.01	0.01K	4.00		
	1035	18	0.01K	0.01K	0.01	0.540	0.01	0.01K	3.70		

Table A1. DOE water quality monitoring data for Station 1, Deer Lake, Washington (continued).

	1035	21	0.01K	0.01K	0.01	0.740	0.03	0.01K	0.80	
78/08/01	1040	0	0.01K	0.01K	0.01K	0.310	0.01	0.01K	0.80	1K
	1040	3	0.01K	0.01K	0.01K	0.310	0.01	0.01K	0.70	
	1040	6	0.01	0.01K	0.01K	0.300	0.01	0.01K	0.70	
	1040	9	0.01K	0.01K	0.01K	0.280	0.04	0.01K	1.60	
	1040	12	0.01	0.01K	0.01K	0.260	0.02	0.01K	1.70	
	1040	15	0.01K	0.01K	0.01K	0.290	0.04	0.01K	3.00	
	1040	18	0.01	0.01K	0.01	0.320	0.03	0.01K	2.80	
	1040	21	0.01K	0.01K	0.01	0.350	0.03	0.01K	1.50	
78/08/15	1145	0	0.01K	0.01K	0.01	0.400	0.02	0.01K	0.70	1K
	1145	3	0.01K	0.01K	0.01	0.230	0.02	0.01K	0.70	
	1145	6	0.01K	0.01K	0.01K	0.200	0.01	0.01K	0.70	
	1145	9	0.01K	0.01K	0.01	0.290	0.05	0.01K	0.50	
	1145	12	0.01K	0.01K	0.01	0.400		0.01K	1.40	
	1145	15	0.01K	0.01K	0.01K	0.270	0.04	0.01K	2.40	
	1145	18	0.01K	0.01K	0.01K	0.280	0.03	0.01K	2.70	
	1145	21	0.01K	0.01K	0.01K	0.240	0.02	0.01K	1.40	
78/08/20	1035	0	0.01K	0.01K	0.01	0.280	0.03	0.01K	0.60	1K
	1035	3	0.01K	0.01K	0.01	0.290	0.01	0.01K	0.90	
	1035	6	0.01K	0.01K	0.01	0.400	0.02	0.01K	0.80	
	1035	9	0.01K	0.01K	0.01K	0.220	0.01	0.01K	0.70	
	1035	12	0.01K	0.01K	0.01K	0.270	0.01	0.01K	1.20	
	1035	15	0.01K	0.01K	0.02	0.200	0.01	0.01K	1.50	
	1035	18	0.01K	0.01K	0.01	0.280	0.02	0.01K	1.80	
	1035	21	0.01K	0.01K	0.02	0.210	0.02	0.01K	0.90	
78/09/12	1130	0	0.01K	0.01K	0.03	0.210	0.02	0.01K	0.50	1K
	1130	3	0.01K	0.01K	0.01	0.190	0.02	0.01K	0.70	
	1130	6	0.01K	0.01K	0.01	0.140	0.03	0.01K	0.90	
	1130	9	0.01K	0.01K	0.03	0.180	0.08	0.01K	0.80	
	1130	12	0.01K	0.01K	0.02	0.160	0.03	0.01K	1.00	
	1130	15	0.01K	0.01K	0.02	0.100	0.03	0.01K	0.70	
	1130	18	0.01K	0.01K	0.03	0.240	0.02	0.01K	1.20	
	1130	21	0.01K	0.01K	0.01	0.130	0.04	0.01K	1.10	
78/09/27	1205	0	0.01K	0.01K			0.04	0.06	0.70	1K
	1205	3	0.01K	0.01K	0.08	0.380	0.03	0.01K	0.80	
	1205	6	0.01K	0.01K	0.00	0.360	0.02	0.01K	1.00	
	1205	9	0.01K	0.01K	0.04	0.300	0.02	0.01K	0.60	
	1205	12	0.01K	0.01K	0.02	0.310	0.01	0.01K	1.10	
	1205	15	0.01K	0.01K	0.01K	0.290	0.02	0.01K	0.50	
	1205	18	0.01K	0.01K	0.14	0.310	0.02	0.01K	0.20	
	1205	21	0.01K	0.01K	0.03	0.200	0.02	0.01K	0.40	
78/10/31	1100	0	0.01K	0.01K	0.01	0.170	0.02	0.01K	1.30	1K
	1100	3	0.01K	0.01K	0.01	0.170	0.02	0.01K	1.20	
	1100	6	0.01K	0.01K	0.01K	0.230	0.02	0.01K	1.30	
	1100	9	0.01K	0.01K	0.01	0.180	0.02	0.01K	1.20	
	1100	12	0.01K	0.01K	0.01	0.160	0.02	0.01K	1.00	
	1100	15	0.01K	0.01K	0.01	0.190	0.02	0.01K	1.40	
	1100	18	0.01K	0.01K	0.01	0.220	0.03	0.01K	1.20	
	1100	21	0.01K	0.01K	0.01	0.120	0.02	0.01K	1.30	
78/11/14	1030	0	0.01K	0.01K	0.16	0.280	0.01	0.01	1.30	2
	1030	3	0.01K	0.01K	0.01	0.170	0.01	0.01K	2.00	
	1030	6	0.01K	0.01K	0.02	0.250	0.01	0.01K	1.70	
	1030	9	0.01K	0.01K	0.03	0.250	0.01	0.01K	1.60	
	1030	12	0.01K	0.01K	0.01	0.200	0.01K	0.01K	1.60	
	1030	15	0.01K	0.01K	0.02	0.100	0.01K	0.01K	1.70	
	1030	18	0.01K	0.01K	0.02	0.200	0.01K	0.01K	1.80	
	1030	21	0.01K	0.01K	0.14	[illegible]	0.01K	0.01K	1.90	
NUMBER OF SAMPLES			88	88	87		87		78	11
MAXIMUM VALUE			0.02	0.02	0.16		0.08		4.00	2.00

Table A1. DOE water quality monitoring data for Station 1, Deer Lake, Washington (continued).

MINIMUM VALUE	0.01	0.01	0.01	0.120	0.01	0.01	0.00	1.00
ARITHMETIC MEAN	0.01	0.01	0.02	0.323	0.02	0.01	1.21	1.27
GEOMETRIC MEAN	0.91	0.91	0.87	0.861	0.87	0.88	0.93	1.07
MEDIAN	0.01	0.01	0.01	0.280	0.02	0.01	1.00	1.00
STANDARD DEVIATION	0.00	0.00	0.03	0.157	0.01	0.01	0.81	0.47
VARIANCE	0.00	0.00	0.00	0.024	0.00	0.00	0.66	0.22

Table A2. DOE water quality monitoring data for Station 1, Loon Lake, Washington.

DEPARTMENT OF ECOLOGY

AGENCY a1540000 RETRIEVAL --- 01 MAY 1980

OFFICE OF WATER PROGRAMS
WATER QUALITY MANAGEMENT DIVISION
WATER & WASTEWATER MONITORING SECTION

LOONO1 LOON LAKE AT NORTHWEST END

DATES: 78/05/01 TO 78/11/30

STORET MINOR BASIN: UPPER COLUMBIA STORET SUB BASIN: COLVILLE

LATITUDE: 48 02 55.0 ELEVATION (FEET): 2381 WATER CLASS: LC
LONGITUDE: 117 37 54.0 COUNTY: STEVENS SEGMENT: 23-59 100

AGENCY: 21540000 STATE: WASHINGTON STA TYPE: LAKE

TERMINAL STREAM | 1ST LEV MILES | 2ND LEV MILES | 3RD LEV MILES | 4TH LEV MILES | 5TH LEV MILES | 6TH LEV MILES

DATE FROM TO	TIME	DEPTH METERS	00010 WATER TEMP DEG-C	00095 CONDUCTVY @ 25 C MICROMHOS	00078 TRANSPAR SECCHI METERS	00300 DISSOLVED OXYGEN mg/l	00301 DO PERCENT SATURATN	00400 pH STANDARD UNITS	00070 TURBIDITY TURBMETER NTU	00900 HARDNESS TOT CaCO3 mg/l	00915 CALCIUM DIS-CaCO3 mg/l	00410 ALKALINE T CaCO3 mg/l	
78/05/15	1300	0	11.5	166	5.5	10.8	108.0	8.3	1.0				66
	1300	3	11.5	154		11.1	111.0	8.4	I. 0				69
	1300	6	10.0	155		12.4	120.0	8.3	1.0				64
	1300	9	7.5	154		11.0	100.0	8.2	2.0				69
	1300	12	7.5	155		10.0	31.0	8.0	1.0				68
	1300	15	6.5	156		9.2	82.0	7.3	1.0				66
	1300	18	6.0	155		7.5	66.0	7.7	1.0				68
	1300	21	6.0	153		7.3	64.0	7.7	1.0				69
78/06/07	1240	0	19.5	182	6.7	8.5	101.0	8.0	1.0	72	62.0		68
	1240	3	18.5	177		8.5	93.0	8.0	1.0	72	64.0		75
	1240	6	10.0	173		8.8	97.0	8.2	1.0	75	64.0		70
	1240	9	11.1	173		9.0	89.0	8.2	1.0	78	62.0		64
	1240	12	5.5	176		E.3	77.0	7.9	1.0		62.0		68
	1240	15	7.2	173		7.5	68.0	7.7	1.0	38	60.0		70
	1240	18	6.5	172		6.3	56.0	7.5	1.0	35	60.0		71
	1240	21	6.5	175		5.5	43.0	7.4	1.0	80	50.0		71
78/06/28	1425	0	22.5	163	6.6	9.2	116.0	8.3	1.0	62	58.G		67
	1425	3	20.0	159		8.8	106.0	8.4	1.0	EL!	58.0		67
	1425	6	18.5	157		3.2	107.0	8.5	2.0	58	54.0		68
	1425	9	12.5	155		9.4	90.0	8.5	2.0	62	56.0		68
	1425	12	4.0	155		137	82.0	8.1	1.0	62	52.0		68
	1425	15	7.5	157		7.0	64.0	7.8	1.0	58	54.0		66
	1425	18	7.0	158		5.9	53.0	7.7	1.0	64	56.0		67
	1425	21	6.5	160		4.3	38.0	7.6	1.0	64	52.0		68
78/07/18	1345	0	21 5	153	6.1	8.3	103.0	8.4	1.0	46	34.0		69
	1345	3	21.0	153		8.2	101.0	8.4	1.0	38	34.0		71
	1345	6	20.5	152		8.6	104.0	8.4	1.0	46	34.0		68
	1345	9	13.0	143		9.4	97.0	8.6	1.0	40	30.0		71
	1345	12	13.0	150		7.2	68.0	8.1	2.0	44	34.0		71
	1345	15	8.0	152		5.3	49.0	7.8	1.0	40	36.0		71
	1345	18	7.0	151		3.8	34.0	7.7	1.0	42	32.0		69
	1345	21	7.0	157		2.9	26.0	7.6	1.0	40	34.0		69

Table A2. DOE water quality monitoring data for Station 1, Loon Lake, Washington (continued).

78/08/15	1350	0	21.5	156	5.6	8.3	103.0	8.6	1.0	80	64.0	69
	1350	3	21.5	153		8.4	104.0	8.7	1.0	76	60.0	71
	1350	6	21.5	148		8.4	104.0	8.7	1.0	76	64.0	71
	1350	9	14.0	148		9.5	101.0	8.6	2.0	68	[illegible]	69
	1350	12	10.0	151		7.0	68.0	8.1	1.0	72	64.0	67
	1350	15	8.0	150		5.2	48.0	7.9	2.0	76	64.0	77
	1350	18	7.0	153		1.9	17.0	7.6	2.0	76	*64.0*	71
	1350	21	7.0	163		1.5	13.0	7.6	2.0	88	*64.0*	74
78/08/29	1300	0	20.0	146	5.3	9.7	117.0	8.3	1.0	80	*60.0*	71
	1300	3	18.5	144		9.6	112.0	8.5	1.0	76	*64.0*	69
	1300	6	18.0	140		10.0	115.0	8.4	1.0	76	60.0	69
	1300	9	15.5	143		11.4	125.0	8.2	1.0	72	56.0	69
	1300	12	9.5	145		8.5	81.0	7.5	1.0	76	28.0	69
	1300	15	7.5	147		4.4	40.0	7.3	1.0	72	16.0	69
	1300	18	7.0	121		1.5	13.0	7.2	1.0	72	24.0	69
	1300	21	7.0	155		1.2	11.0	7.2	1.0	76	*20.0*	69
78/09/12	1330	0	17.4	163	5.0	9.5	108.0	8.5	2.0	80	56.0	75
	1330	3	17.0	160		9.6	109.0	8.7	2.0	76	64.0	77
	1330	6	17.0	160		9.7	110.0	8.7	2.0	80	60.0	81
	1330	9	16.3	160		11.0	123.0	8.6	3.0	72	60.0	81
	1330	12	10.0	168		8.6	83.0	7.8	2.0	76	56.0	79
	1330	15	7.8	167		3.0	28.0	7.5	1.0	80	60.0	90
	1330	18	7.0	165		1.4	13.0	7.5	1.0	72	*56.0*	79
	1330	21	7.0	169		0.5	5.0	7.5	1.0	76	52.0	85
78/09/27	1410	0	16.0	166	4.5	9.9	110.0	8.6	2.0	76	64.0	71
	1410	3	15.5	153		9.8	107.0	8.6	1.0	76	76.0	69
	1410	6	15.0	152		9.6	104.0	8.6	1.0	72	43.0	71
	1410	9	14.5	150		10.3	110.0	7.5	1.0	84	64.0	71
	1410	12	10.0	152		6.6	64.0	7.5	1.0	80	60.0	71
	1410	15	7.5	155		1.9	17.0	7.5	1.0	76	64.0	78
	1410	18	7.0	156		0.4	4.0	7.5	1.0	76	60.0	73
	1410	21	7.0	156		0.7	6.0	7.4	3.0	72	64.0	73
78/10/31	1245	0	10.0	158	5.0	9.8	95.0	8.3	2.0	80	64.0	70
	1245	3	10.0	157		9.5	92.0	8.3	2.0	80	*66.0*	70
	1245	6	10.0	152		9.6	93.0	8.3	1.0	80	64.0	70
	1245	9	10.0	152		9.6	93.0	8.3	1.0	72	72.0	83
	1245	12	9.8	154		9.5	91.0	8.2	1.0	80	64.0	77
	1245	15	9.5	156		8.4	80.0	8.0	2.0	76	*64.0*	74
	1245	18	7.2	159		0.1	1.0	7.4	2.0	80	*60.0*	70
	1245	21	7.0	166		0.1	1.0	7.4	2.0	80	*60.0*	72
78/11/14	1240	0	6.5	171	4.3	9.1	81.0	7.8	1.0	76	60.0	70
	1240	3	6.5	146		9.1	81.0	7.8	1.0	76	68.0	81
	1240	6	6.5	149		9.1	81.0	7.8	1.0	76	64.0	72
	1240	9	6.5	148		9.1	81.0	7.8	1.0	72	60.0	120
	1240	12	6.5	149		9.0	80.0	7.8	1.0	76	64.0	100
	1240	15	6.5	147		9.0	80.0	7.8	1.0	76	64.0	74
	1240	18	6.5	152		8.9	79.0	7.7	1.0	76	60.0	77
NUMBER OF SAMPLES			79	79	10	79	79	79	79	71	71	79
MAXIMUM VALUE			22.50	182.00	6.70	12.40	125.00	8.70	3.00	95.00	76.00	120.00
MINIMUM VALUE			6.00	121.00	4.30	0.10	1.00	7.20	1.00	38.00	16.00	55.00
ARITHMETIC MEAN			11.33	156.53	5.46	7.43	76.00	8.01	1.28	71.41	55.77	72.43
GEOMETRIC MEAN			1.14	1.88	2.21	1.22	2.02	1.26	1.00	1.32	1.60	1.11
MEDIAN			9.50	155.00	5.40	8.60	82.00	8.00	1.00	76.00	60.00	70.00
STANDARD DEVIATION			5.18	9.78	0.82		35.25	0.43	0.50		12.72	7.33
VARIANCE			26.84	95.64	0.66		1242.85	0.18	0.25		161.78	62.51

Table A2. DOE water quality monitoring data for Station 1, Loon Lake, Washington (continued).

DEPARTMENT OF ECOLOGY

AGENCY 21540000 RETRIEVAL --- 01 MAY 1980

OFFICE OF WATER PROGRAMS
WATER QUALITY MANAGEMENT DIVISION
WATER & WASTEWATER MONITORING SECTION

LOONO1 LOON LAKE AT NORTHWEST END

DATES: 78/05/01 TO 78/11/30

STORET MINOR BASIN: UPPER COLUMBIA STORET SUB BASIN: COLVILLE

LATITUDE: 48 02 55.0 ELEVATION (FEET): 2381 WATER CLASS: LC
LONGITUDE: 117 37 54.0 COUNTY: STEVENS SEGMENT: 23-50-100

AGENCY: 21540000 STATE: WASHINGTON STA TYPE: LAKE

TERMINAL STREAM	1ST LEV MILES	2ND LEV MILES	3RD LEV MILES	4TH LEV MILES	5TH LEV MILES	6TH LEV MILES

DATE FROM TO	TIME	DEPTH METERS	00620 NITRATE T NO3-N mg/l	00615 NITRITE T NO2 N mg/l	00610 AMMONIA T NH3-N mg/l	00625 KJELDAHL NITROGEN T mg/l N	00665 TOTAL PHOSPHORUS mg/l P	00671 DIS-ORTHO PHOSPHORUS mg/l P	32211 CHLOROPHL A SPECTRO ug/l	31616 FECAL COLIFORM /100ml MF
78/05/15	1300	0	0.02K	0.02K	0.02K	1.100	0.04	0.02K		2K
	1300	3	0.0214	0.02K	0.02K	0.830	0.02	0.02K		
	1300	6	0.02K	0.02K	0.02K	1.300	0.02K	0.02K		
	1300	9	0.02K	0.02K	0.02K	0.940	0.02K	0.02K		
	1300	12	0.02K	0.02K	0.02K	1.100	0.02	0.02K		
	1300	15	0.02K	0.02K	0.02K	0.800	0.02K	0.02K		
	1300	18	0.02	0.02K	0.02K	0.630	0.02K	0.02K		
	1300	21	0.02	0.02K	0.02K	0.600	0.02	0.02K		
78/06/07	1240	0	0.02K	0.02K	0.01	0.410	0.04	0.02K		1K
	1240	3	0.02K	0.02K	0.01	0.520	0.03	0.02K		
	1240	6	0.02K	0.02K	0.01K	0.420	0.02	0.02K	1.60	
	1240	9	0.02K	0.02K	0.01K	0.490	0.02	0.02K		
	1240	12	0.02K	0.02K	0.01K	0.510	0.02	0.02K	2.30	
	1240	15	0.02K	0.02K	0.01K	0.450	0.02	0.02K	2.10	
	1240	18	0.02K	0.02K	0.01K	0.490	0.02	0.02K	3.80	
	1240	21	0.02K	0.02K	0.02	0.640	0.03	0.02K		
78/06/28	1425	0	0.01K	0.01K	0.01K	0.170	0.01	0.01K	2.00	1K
	1425	3	0.01K	0.01K	0.01K	0.340	0.02	0.01K	1.50	
	1425	6	0.01K	0.01K	0.01K	0.230	0.03	0.01K	0.50	
	1425	9	0.01K	0.01K	0.01K	0.330	0.02	0.01K	1.00	
	1425	12	0.01K	0.01K	0.01K	0.360	0.02	0.01K	1.00	
	1425	15	0.01K	0.01K	0.01K	0.350	0.03	0.01K	2.00	
	1425	18	0.01K	0.01K	0.01K	0.330	0.05	0.03	2.10	
	1425	21	0.01K	0.01K	0.01K	0.330	0.04	0.01K	2.10	
78/07/18	1345	0	0.01K	0.01K	0.01K	0.550	0.01	0.01K	1.30	1K
	1345	3	0.01K	0.01K	0.01K	0.840	0.01	0.01K	1.40	
	1345	6	0.01K	0.01K	0.01K	0.720	0.01	0.01K	1.40	
	1345	9	0.01K	0.01K	0.01K	0.710	0.01	0.01K	3.20	
	1345	12	0.01K	0.01K	0.01K	0.530	0.01	0.01K	3.10	
	1345	15	0.01K	0.01K	0.01K	0.510	0.01	0.01K	2.80	
	1345	18	0.01K	0.01K	0.01K	0.440	0.01	0.01K	1.50	
		21	0.01K	0.01K	0.01K	0.650	0.01	0.01K	1.40	

Table A2. DOE water quality monitoring data for Station 1, Loon Lake, Washington (continued).

78/08/15	1350	0	0.01K	0.01K	0.01K	0.360	0.02	0.01K	1.30	1
	1350	3	0.01K	0.01K	0.01	0.350	0.02	0.01K	1.20	
	1350	6	0.01K	0.01K	0.01K	0.360	0.02	0.01K	1.00	
	1350	9	0.01K	0.01K	0.01	0.310	0.05	0.01K	2.00	
	1350	12	0.01K	0.01K	0.01K	0.330	0.03	0.01K	3.00	
	1350	15	0.01K	0.01K	0.01K	0.300	0.03	0.01K	1.90	
	1350	18	0.01K	0.01K	0.01K	0.200	0.02	0.01K	1.50	
	1350	21	0.01K	0.01K	0.02	0.240	0.05	0.01	1.50	
78/08/29	1300	0	0.01K	0.01K	0.01	0.280	0.02	0.01K	1.10	1K
	1300	3	0.01K	0.01K	0.01	0.290	0.02	0.01K	1.20	
	1300	6	0.01K	0.01K	0.01	0.350	0.02	0.01K	0.90	
	1300	9	0.04	0.01K	0.02	0.360	0.01	0.01K	1.90	
	1300	12	0.04	0.01K	0.01	0.360	0.01	0.01K	2.00	
	1300	15	0.02	0.01K	0.01	0.290	0.02	0.01K	2.50	
	1300	18	0.01K	0.01K	0.01	0.320	0.01	0.01K	2.20	
	1300	21	0.01K	0.01K	0.01	0.270	0.02	0.01K	1.40	
78/09/12	1330	0	0.01K	0.01K	0.02	0.270	0.02	0.01K	0.70	1K
	1330	3	0.01K	0.01K	0.06	0.230	0.02	0.01K	1.10	
	1330	6	0.01K	0.01K	0.04	0.220	0.01	0.01K	1.00	
	1330	9	0.01K	0.01K	0.04	0.270	0.02	0.01K	1.60	
	1330	12	0.01K	0.01K	0.02	0.220	0.02	0.01K	1.50	
	1330	15	0.01K	0.01K	0.03	0.200	0.02	0.01K	2.00	
	1330	18	0.01K	0.01K	0.07	0.180	0.02	0.01K	2.10	
	1330	21	0.01K	0.01K	0.01	0.190	0.03	0.01K	2.40	
78/09/27	1410	0	0.011:	0.01K	0.05	0.400	0.03	0.01	0.70	1K
	1410	3	0.01K	0.01K	0.03	0.870	0.02	0.01K	0.50	
	1410	6	0.01K	0.01K	0.01	0.470	0.02	0.01K	1.00	
	1410	9	0.01K	0.01K	0.01	0.370	0.02	0.01K	1.30	
	1410	12	0.01K	0.01K	0.01	0.100	0.02	0.01K	1.50	
	1410	15	0.01K	0.01K	0.01K	0.320	0.02	0.01K	1.10	
	1410	18	0.01K	0.01K	0.07	0.540	0.03	0.01K	0.70	
	1410	21	0.01K	0.01K	0.02	0.400	0.03	0.01	0.70	
78/10/31	1245	0	0.01K	0.01K	0.06	0.200	0.03	0.01K	1.80	1K
	1245	3	0.01K	0.01K	0.02	0.240	0.02	0.01K	1.70	
	1245	6	0.0: K	0.01K	0.01	0.260	0.03	0.01K	1.90	
	1245	9	0.01K	0.01K	0.01	0.250	0.02	0.01K	2.10	
	1245	12	0.01K	0.01K	0.04	0.480	0.03	0.01K	1.80	
	1245	15	0.01K	0.01K	0.02	0.200	0.03	0.01K	1.70	
	1245	18	0.01K	0.01K	0.01	0.410	0.06	0.01K	1.60	
	1245	21	0.01K	0.01K	0.01	0.210	0.06	0.03	3.80	
78/11/14	1240	0	0.01K	0.01K	0.04	0.200	0.01	0.01K	2.20	1K
	1240	3	0.01K	0.01K	0.04	0.230	0.02	0.01K	2.30	
	1240	6	0.01K	0.01K	0.01	0.250	0.02	0.01K	2.30	
	1240	9	0.01K	0.01K	0.01	0.170	0.01	0.01K	2.40	
	1240	12	0.01K	0.01K	0.01	0.180	0.01	0.01K	2.10	
	1240	15	0.01K	0.01K	0.04	0.210	0.01	0.01K	2.20	
	1240	18	0.01K	0.01K	0.04	0.250	Ow	0.01K	2.40	
NUMBER OF SAMPLES			73	79	79	79	79	79	67	10
MAXIMUM VALUE			0.04	0.02	0.07	1.300	0.06	0.03	3.80	2.00
MINIMUM VALUE			0.01	0.01	0.01	0.100	0.01	0.01	0.50	1.00
ARITHMETIC MEAN			0.01	0.01	0.02	0.418	0.02	0.01	1.74	1.10
GEOMETRIC MEAN			0.90	0.90	0.90	0.924	0.80	0.90	1.00	1.07
MEDIAN			0.01	0.01	0.01	0.350	0.02	0.01	1.70	1.00
STANDARD DEVIATION			0.01	0.00	0.01	0.236	0.01	0.00	0.72	0.32
VARIANCE			0.00		0.00	0.056	0.00		0.51	0.10

Table A3. DOE water quality monitoring data for Station 2, Loon Lake, Washington.

DEPARTMENT OF ECOLOGY

AGENCY 21540000 RETRIEVAL --- 01 MAY 1980

OFFICE OF WATER PROGRAMS
WATER QUALITY MANAGEMENT DIVISION
WATER & WASTEWATER MONITORING SECTION

LOONO2 LOON LAKE S OF GRANITE PT RESORT

DATES: 78/05/01 TO 78/11/30
STORET MINOR BASIN: UPPER COLUMBIA STORET SUB BASIN: COLVILLE

LATITUDE: 48 01 59.0 ELEVATION (FEET): 2301 WATER CLASS: LC
LONGITUDE: 117 36 33.0 COUNTY: STEVENS SEGMENT: 23-59-100

AGENCY: 21540000 STATE: WASHINGTON STA TYPE: LAKE

TERMINAL STREAM	1ST LEV MILES	2ND LEV MILES	3RD LEV MILES	4TH LEV MILES	5TH LEV MILES	6TH LEV MILES

DATE FROM TO	TIME	DEPTH METERS	00010 WATER TEMP DEG-C	00095 CONDUCTVY @ 25 C MICROMHOS	00078 TRANSPAR SECCHI METERS	00300 DISSOLVED OXYGEN mg/l	00301 DO PERCENT SATURATN	00400 pH STANDARD UNITS	00070 TURBIDITY TURBIMETER NTU	00300 HARDNESS TOT CaCO3 mg/l	00915 CALCIUM DIS-CaCO3 mg/l	00410 ALKALINE T CaCO3 mg/l
78/05/15	1200	0	11.4	157	5.5	11.0	110.0	8.3	1.0			63
	1200	3	11.3	155		11.4	114.0	8.3	1.0			69
	1200	6	11.0	159		12.0	119.0	8.3	1.0			69
	1200	9	6.9	159		11.4	102.0	8.2	1.0			64
	1200	12	6.5	155		10.6	94.0	8.0	1.0			68
	1200	15	6.4	153		9.8	87.0	7.9	1.0			68
	1200	18	6.0	155		9.0	79.0	7.8	1.0			71
	1200	21	6.0	155		8.7	76.0	7.7	1.0			68
	1200	24	6.0	157		8.5	75.0	7.7	1.0			64
	1200	27	6.0	157		8.2	72.0	7.6	1.0			68
78/06/07	1100	0	19.5	174	7.0	8.3	90.0	8.1	1.0	85	64.0	66
	1100	3	16.2	176		8.9	93.0	8.0	1.0	75	58.0	70
	1100	6	14.9	181		8.9	90.0	8.0	1.0	65	60.0	70
	1100	9	10.1	179		8.9	86.0	8.0	1.0	68	62.0	70
	1100	12	6.5	175		8.9	79.0	8.0	1.0	78	64.0	66
	1100	15	6.0	174		7.8	68.0	7.7	1.0	72	58.0	70
	1100	18	6.0	176		5.9	62.0	7.6	1.0	68	60.0	66
	1100	21	6.5	174		6.2	55.0	7.6	1.0	70	60.0	68
	1100	24	5.9	175			52.0	7.5	1.0	80	80.0	70
	1100	27	6.0	180		5.0	44.0	7.4	1.0	70	40.0	66
78/06/28	1315	0	21.0	164	6.4	9.0	110.0	8.3	1.0	58	52.0	68
	1315	3	19.5	165		8.8	105.0	8.4	1.0	62	56.0	70
	1315	6	18.0	167		9.5	110.0	8.5	1.0	58	56.0	66
	1315	9	12.0	163		10.0	101.0	8.5	1.0	69	52.0	68
	1315	12	9.5	159		9.3	89.0	8.2	1.0	62	52.0	68
	1315	15	8.0	156		7.9	73.0	7.9	1.0	60	60.0	68
	1315	18	7.0	160		6.7	60.0	7.7	1.0	60	56.0	68
	1315	21	7.0	158		6.1	55.0	7.7	1.0	62	58.0	68
	1315	24	6.5	158		5.5	49.0	7.7	1.0	58	48.0	68
	1315	27	6.3	163		4.9	43.0	7.6	1.0	62	52.0	67
78/07/18	1150	0	21.1	160	5.6	8.5	104.0	8.5	1.0	40	34.0	69
		3	20.6	153		8.3	101.0	8.6	1.0	40		69

Table A3. DOE water quality monitoring data for Station 2, Loon Lake, Washington (continued).

	1150	6	20.5	152		8.4	102.0	8.6	1.0	40	36.0	68
	1150	9	14.5	151		8.6	92.0	8.7	1.0	40	34.0	68
	1150	12	10.5	151		7.8	70.0	8.2	1.0	44	34.0	71
	1150	15	9.0	152		6.4	60.0	7.9	1.0	40	34.0	69
	1150	18	8.0	152		6.3	58.0	7.8	2.0	40	30.0	71
	1150	21	7.5	156		5.0	46.0	7.7	3.0	40	32.0	69
	1150	24	7.0	157		4.2	38.0	7.6	2.0	42	36.0	68
	1150	27	6.5	162		2.9	26.0	7.5	2.0	40	32.0	66
78/08/15	1300	0	21.0	162	5.6	9.6	118.0	8.6	1.0	72	60.0	68
	1300	3	21.0	170		9.0	110.0	8.6	1.0	76	64.0	71
	1300	6	21.0	170		8.9	109.0	8.6	1.0	76	64.0	69
	1300	9	14.5	160		10.2	109.0	8.8	1.0	76	64.0	76
	1300	12	11.0	158		9.2	91.0	8.4	1.0	76	40.0	71
	1300	15	9.0	169		7.1	67.0	8.0	1.0	72		69
	1300	18	7.5	167		5.1	46.0	7.8	1.0	76	60.0	67
	1300	21	7.0	172		3.8	34.0	7.7	1.0	72	64.0	67
	1300	24	6.5	174		1.9	17.0	7.6	1.0	76	64.0	69
	1300	27	6.7	180		0.6	5.0	7.6	1.0	72	64.0	71
78/08/29	1210	0	19.5	172	6.1	9.3	111.0	8.5	2.0	72	68.0	66
	1210	3	18.5	202		9.2	107.0	8.5	1.0	72	64.0	67
	1210	6	18.0	167		10.0	115.0	8.5	1.0	76	60.0	66
	1210	9	15.0	153		13.0	141.0	8.3	1.0	76	64.0	68
	1210	12	9.5	152		9.0	86.0	7.6	1.0	76	60.0	69
	1210	15	7.5	155		5.4	49.0	7.4	1.0	72	60.0	71
	1210	18	7.0	155		3.3	30.0	7.3	1.0	76	64.0	67
	1210	21	6.5	153		2.5	22.0	7.4	2.0	80	60.0	67
	1210	24	6.0	156		0.4	4.0	7.4	1.0	72	60.0	67
	1210	27	6.0	161		0.1	1.0	7.4	1.0	76	60.0	71
78/09/12	1245	0	17.3	164	5.2	9.6	103.0	8.6	1.0	72	52.0	81
	1245	3	17.0	152		9.7	110.0	8.6	1.0	72	56.0	73
	1245	6	17.0	153		10.2	115.0	8.7	1.0	80	56.0	73
	1245	9	16.5	149		10.6	119.0	8.7	1.0	72	60.0	79
	1245	12	9.5	148		8.1	77.0	7.8	1.0	76	60.0	83
	1245	15	8.0	147		5.3	49.0	7.6	1.0	72	52.0	77
	1245	18	7.0	154		2.9	26.0	7.5	1.0	76	60.0	83
	1245	21	6.8	153		1.8	16.0	7.5	1.0	80	64.0	79
	1245	24	6.5	155		0.4	4.0	7.5	1.0	80	56.0	75
	1245	27	6.0	155		0.2	2.0	7.5	1.0	80	56.0	81
78/09/27	1320	0	15.5	155	4.9	10.0	110.0	8.7	1.0	76	64.0	73
	1320	3	15.0	153		10.1	109.0	8.6	2.0	76	64.0	71
	1320	6	15.0	158		10.0	108.0	8.6	1.0	80	60.0	71
	1320	9	14.5	159		10.4	111.0	8.5	1.0	76	64.0	73
	1320	12	10.0	154		8.1	78.0	7.6	1.0	80	60.0	69
	1320	15	7.5	156		4.1	37.0	7.4	1.0	76	64.0	
	1320	18	7.0	156		1.8	16.0	7.4	1.0	76	64.0	
	1320	21	6.5	156		0.3	3.0	7.4	1.0	80	64.0	
	1320	24	6.5	159		0.2	2.0	7.4	1.0	80	68.0	73
	1320	27	6.5	162		0.4	4.0	7.5	1.0	80	68.0	73
78/10/31	1200	0	10.0	168	5.0	9.2	89.0	8.2	2.0	76	64.0	72
	1200	3	10.0	162		9.2	89.0	8.2	2.0	80	64.0	67
	1200	6	10.0	159		9.2	89.0	8.2	2.0	76	68.0	70
	1200	9	10.0	159		9.3	90.0	8.2	1.0	72	64.0	70
	1200	12	9.8	161		8.9	86.0	8.1	2.0	76	64.0	70
	1200	15	8.0	157		1.5	14.0	7.3	2.0	80	56.0	85
	1200	18	7.0	161		0.2	2.0	7.4	1.0	80	64.0	76
	1200	21	6.7	167		0.2	2.0	7.4	2.0	84	60.0	76
	1200	24	[illegible]	170		0.2	[illegible]	7.4	2.0	80	56.0	72
	1200	27		176		0.2		7.4	3.0	80	60.0	74
78/11/14	1140	0			3.7	7.8		7.7	1.0	[illegible]	[illegible]	72
	1140					7.8		7.6	1.0			83

Table A3. **DOE** water quality monitoring data for Station 2, Loon Lake, Washington (continued).

1140	6	6.7	148		7.8	70.0	7.6	1.0	76	60.0	83
1140	9	6.7	147		7.7	69.0	7.7	1.0	72	52.0	110
1140	12	6.6	149		7.7	69.0	7.8	1.0	76	60.0	95
1140	15	6.6	150		7.8	69.0	7.8	1.0	76	56.0	74
1140	18	6.6	147		7.8	69.0	7.8	1.0	76	64.0	74
1140	21	6.6	150		7.3	65.0	7.8	1.0	76	60.0	70
1140	24	6.6	153		7.1	63.0	7.8	1.0	76	60.0	86
1140	27	6.6	160		6.6	59.0	7.8	1.0	80	64.0	72
NUMBER OF SAMPLES		100	100	10	99	100	100	100	90	89	100
MAXIMUM VALUE		21.10	202.00	7.00	13.00	141.00	8.80	3.00	85.00	80.00	110.00
MINIMUM VALUE		5.90	147.00	3.70	0.10	1.00	7.30	1.00	40.00	30.00	64.00
ARITHMETIC MEAN		10.20	160.37	5.50	6.86	68.81	7.94	1.17	70.22	57.03	71.37
GEOMETRIC MEAN		1.18	1.49	1.87	1.25	2.06	1.23	1.00	1.26	1.24	1.09
MEDIAN		7.50	158.00	5.55	7.90	72.50	7.80	1.00	76.00	60.00	70.00
STANDARD DEVIATION		4.89	9.59	0.91	3.40	37.05	0.44	0.43	12.02	10.01	6.86
VARIANCE		23.87	92.05	[illegible]	[illegible]	1372.42	[illegible]	0.18	144.49	[illegible]	47.04

Table A3. DOE water quality monitoring data for Station 2, Loon Lake, Washington (continued).

DEPARTMENT OF ECOLOGY

AGENCY 21540000 RETRIEVAL --- 01 MAY 1980

OFFICE OF WATER PROGRAMS
WATER QUALITY MANAGEMENT DIVISION
WATER & WASTEWATER MONITORING SECTION

LOON02 LOON LAKE S OF GRANITE PT RESORT

DATES: 78/05/01 TO 78/11/30

STORET MINOR BASIN: UPPER COLUMBIA STORET SUB BASIN: COLVILLE

LATITUDE: 4301 53.0 ELEVATION (FEET): 2381 WATER CLASS: LC
LONGITUDE: 117 36 73.0 COUNTY: STEVENS SEGMENT: 23-53 100

AGENCY: 21540000 STATE: WASHINGTON STA TYPE: LAKE

TERMINAL STREAM | 1ST LEV MILES | 2ND LEV MILES | 3RD LEV MILES | 4RD LEV MILES | 5TH LEV MILES | 6TH LEV MILES

DATE FROM TO	TIME	DEPTH METERS	00620 NITRATE T NO3-N mg/l	00615 NITRITE T NO2-N mg/l	00610 AMMONIA T NH3-N mg/l	00625 KJELDAHL NITROGEN T mg/l N	00665 TOTAL PHOSPHORUS mg/l P	00671 DIS-ORTHO PHOSPHRUS mg/l P	32211 CHLOROPHL A SPECTRO ug/l	31616 FECAL COLIFORM /100ml MF
78/05/15	1200	0	0.02K	0.02K	0.02K	0.470	0.02K	0.02K	0.50	2K
	1200	3	0.02K	0.02K	0.02K	0.690	0.03	0.02K		
	1200	6	0.02K	0.02K	0.02K	0.760	0.02K	0.02K		
	1200	9	0.02K	0.02K	0.02K	0.800	0.02K	0.02K		
	1200	12	0.02K	0.02K	0.02K	0.740	0.02K	0.02K		
	1200	15	0.02K	0.02K	0.02K	0.980	0.02K	0.02K		
	1200	18	0.02K	0.02K	0.02K	1.100	0.02K	0.02K		
	1200	21	0.02K	0.02K	0.02K	1.400	0.02K	0.02K		
	1200	24	0.02K	0.02K	0.02K	1.000	0.02K	0.02K		
	1200	27	0.02	0.02K	0.02K	0.900	0.02K	0.02K		
78/06/07	1100	0	0.02K	0.02K	0.01	0.490	0.02	0.02K	0.50	1K
	1100	3	0.02K	0.02K	0.01	0.450	0.02	0.02K	0.40	
	1100	6	0.02K	0.02K	0.01K	0.460	0.02	0.02K		
	1100	9	0.02K	0.02K	0.01K	0.520	0.02	0.02K		
	1100	12	0.02K	0.02K	0.01K	0.430	0.02	0.02K	1.70	
	1100	15	0.02K	0.02K	0.01K	0.470	0.02	0.02K	2.00	
	1100	18	0.02K	0.02K	0.01K	0.450	0.02	0.02K		
	1100	21	0.02K	0.02K	0.01K	0.450	0.02	0.02K		
	1100	24	0.02K	0.02K	0.01K	0.330	0.03	0.02K		
	1100	27	0.04	0.02K	0.01	0.390	0.02	0.02K		
78/06/28	1315	0	0.01K	0.01K	0.01K	0.270	0.02	0.01K	0.00	1K
	1315	3	0.01K	0.01K	0.01K	0.320	0.02	0.01K	0.50	
	1315	6	0.01K	0.01K	0.01K	0.350	0.03	0.01K	1.10	
	1315	9	0.01K	0.01K	0.01K	0.300	0.02	0.01K	0.60	
	1315	12	0.01K	0.01K	0.01K	0.300	0.03	0.01K	1.00	
	1315	15	0.01K	0.01K	0.01K	0.330	0.03	0.01K	0.50	
	1315	18	0.01K	0.01K	0.01K	0.300	0.03	0.01K	2.00	
	1315	21	0.01K	0.01K	0.01K	0.450	0.06	0.01K	1.40	
	1315	24	0.01K	0.011'	0.01K	0.300	0.04	0.01K	1.00	
	1315	27	0.01K	0.01K	0.01	0.300	0.04	0.01K	1.00	
78/07/18	1150	0	0.01K	0.01K	0.01K	0.540	0.01	0.01K	1.30	1K
	1150	3	0.01K	0.01K	0.01K	0.630	0.01	0.01K	1.30	

Table A3. DOE water quality monitoring data for Station 2, Loon Lake, Washington (continued).

	1150	6	0.01K	0.01K	0.01K	0.500	0.01	0.01K	1.70	
	1150	9	0.01K	0.01K	0.01K	0.540	0.01	0.01K	3.00	
	1150	12	0.01K	0.01K	0.01K	0.420	0.01	0.01K	3.20	
	1150	15	0.01K	0.01K	0.01K	0.600	0.01	0.01K	3.40	
	1150	18	0.01K	0.01K	0.01K	0.430	0.01	0.01K	3.20	
	1150	21	0.01K	0.01K	0.01K	0.380	0.01	0.01K	2.10	
	1150	24	0.02	0.01K	0.02	0.600	0.01	0.01K	1.60	
	1150	27	0.01K	0.01K	0.01	0.470	0.02	0.01K	0.90	
78/08/15	1300	0	0.01K	0.01K	0.01K	0.340	0.02	0.01K	1.30	1K
	1300	3	0.01K	0.01K	0.01K	0.410	0.02	0.01K	1.60	
	1300	6	0.01K	0.01K	0.01K	0.430	0.02	0.01K	1.20	
	1300	9	0.01K	0.01K	0.01	0.360	0.02	0.01K	2.60	
	1300	12	0.01K	0.01K	0.01	0.410	0.0s	0.01K	2.60	
	1300	15	0.01K	0.01K	0.01K	0.510	0.03	0.01K	2.60	
	1300	18	0.01K	0.01K	0.01K	0.360	0.04	0.01K	2.40	
	1300	21	0.01K	0.01K	0.01K	0.270	0.03	0.01K	1.50	
	1300	24	0.01K	0.01K	0.01K	0.240	0.02	0.01K	1.20	
	1300	27	0.01K	0.01K	0.01	0.310	0.02	0.01K	0.50	
78/08/29	1210	0	0.01K	0.01K	0.02	0.470	0.03	0.01K	0.70	1K
	1210	3	0.01K	0.01K	0.01	0.470	0.03	0.01K	0.70	
	1210	6	0.01K	0.011;	0.01	0.400	0.03	0.01K	1.40	
	1210	9	0.01K	0.01K	0.06	0.470	0.02	0.01K	1.50	
	1210	12	0.01K	0.01K	0.04	0.240	0.02	0.01K	2.00	
	1210	15	0.01K	0.01K	0.06	0.300	0.02	0.01K	2.20	
	1210	18	0.01K	0.01K	0.02	0.320	0.02	0.01K	1.80	
	1210	21	0.01K	0.01K	0.01	0.430	0.03	0.01K	1.50	
	1210	24	0.01K	0.01K	0.02	0.330	0.03	0.01K	1.10	
	1210	27	0.01	0.011:	0.03	0.420	0.02	0.01K	1.00	
78/09/12	1245	0	0.01K	0.01K	0.04	0.310	0.04	0.02	1.20	1K
	1245	3	0.01K	0.01K	0.03	0.210	0.03	0.01	0.70	
	1245	6	0.01K	0.01K	0.03	0.250	0.02	0.01K	1.40	
	1245	9	0.01K	0.01K	0.04	0.250	0.02	0.01K	1.70	
	1245	12	0.01K	0.01K	0.40	0.280	0.04	0.01K	1.80	
	1245	15	0.01K	0.01K	0.04	0.190	0.03	0.01K	1.10	
	1245	18	0.01K	0.01K	0.03	0.190	0.03	0.01K	2.20	
	1245	21	0.01K	0.01K	0.05	0.360	0.03	0.01K	1.30	
	1245	24	0.01	0.01K	0.09	0.230	0.03	0.01K	0.60	
	1245	27	0.03	0.01K	0.11	0.330	0.on	0.01K	0.40	
78/09/27	1320	0	0.01K	0.01K	0.02	0.580	0.02	0.01K	1.20	1K
	1320	3	0.01K	0.01K	0.06	0.500	0.04	0.01K	0.70	
	1320	6	0.01K	0.01K	0.01	0.610	0.02	0.01K	0.40	
	1320	9	0.01K	0.01	0.43	0.480	0.02	0.01K	0.90	
	1320	12	0.01K	0.01K	0.03	0.400	0.03	0.01K	1.50	
	1320	15	0.01K	0.01K	0.04	0.430	0.02	0.01K	1.70	
	1320	18	0.01K	0.01K	0.09	0.340	0.02	0.01K	0.70	
	1320	21	0.01K	0.01K	0.02	0.420	0.02	0.01K	0.70	
	1320	24	0.01K	0.01K	0.84	0.400	0.03	0.01K	0.60	
	1320	27	0.01K	0.0111	0.10	0.350	0.04	0.01	0.20	
78/10/31	1200	0	0.01K	0.01K	0.01	0.210	0.02	0.01K	1.70	1K
	1200	3	0.01K	0.01K	0.01	0.210	0.03	0.01K	2.00	
	1200	6	0.01K	0.01K	0.01	0.240	0.03	0.01K	1.90	
	1200	9	0.01K	0.01K	0.01	0.230	0.03	0.01K	1.70	
	1200	12	0.01K	0.01K	0.01	0.250	0.02	0.01K	1.90	
	1200	15	0.01K	0.01K	0.12	0.310	0.03	0.01	1.80	
	1200	18	0.01K	0.011:	0.01	0.100	0.09	0.01	0.90	
	1200	21	0.01K	0.01K	0.01	0.100	0.05	0.01	1.60	
	1200	24	0.01K	0.01K	0.05	0.220	0.06	0.04	0.20	
	1200	27	0.01K	0.01K	0.15	0.330	0.da	0.07	0.40	
78/11/14	1140	0	0.01K	0.01K	0.02	0.250	0.02	0.01K		1K
	1140	3	0.01K	0.01K	0.11	0.080	0.02	0.01K		

Table A3. DOE water quality monitoring data for Station 2, Loon Lake, Washington (continued).

1140	6	0.01K	0.01K	0.02	0.160	0.02	0.01K	1.80	
1140	9	0.01K	0.01K	0.04	0.200	0.02	0.01K	1.80	
1140	12	0.01K	0.01K	0.03	0.130	0.02	0.01K	1.50	
1140	15	0.01K	0.01K	0.02	0.240	0.03	0.01K	1.80	
1140	18	**0.01K**	0.01K	0.01	0.260	0.02	0.01K	1.60	
1140	21	0.01K	0.01K	0.03	0.220	0.03	0.01K	1.40	
1140	24	0.01K	0.01K	0.02	0.240	0.03	0.01K	1.70	
1140	27	0.01K	0.01K	0.03	0.220	0.03	0.01	1.60	
NUMBER OF SAMPLES		100	100	100	100	100	100	85	10
MAXIMUM VALUE		**0.04**	0.02	0.84	1.400	0.03	0.07	3.40	2.00
MINIMUM VALUE		**0.01**	0.01	0.01	0.080	0.01	0.01	0.00	1.00
ARITHMETIC MEAN		**0.01**	0.01	0.04	0.415	0.03	0.01	1.40	1.10
GEOMETRIC MEAN		0.92	0.92	0.92	0.872	0.92	0.92	0.92	1.07
MEDIAN		**0.01**	0.01	0.01	0.385	0.02	0.01	1.40	1.00
STANDARD DEVIATION		**0.01**	0.00	0.10	0.220	0.01	0.01	0.72	0.32
VARIANCE		0.00	0.00	0.01	0.048	0.00	0.00	0.52	0.10

Table A4. DOE water quality monitoring data for Station 1, Diamond Lake, Washington.

DEPARTMENT OF ECOLOGY

AGENCY 21540000 RETRIEVAL --- 01 MAY 1980

OFFICE OF WATER PROGRAMS
WATER QUALITY MANAGEMENT DIVISION
WATER & WASTEWATER MONITORING SECTION

DIAM-31 DIAMOND LAKE MID LAKE OFF PUB AC

DATES: 78/05/01 TO 78/11/30

STORET MINOR BASIN: SPOKANE STORET SUB BASIN: LITTLE SPOKANE

LATITUDE: 48 07 57.0 ELEVATION (FEET): 2360 WATER CLASS: LC
LONGITUDE: 117 11 12.0 COUNTY: PEND OREILLE SEGMENT: 24-55-100

AGENCY: 21540000 STATE: WASHINGTON STA TYPE: LAKE

TERMINAL STREAM	1ST LEV MILES	2ND LEV MILES	3RD LEV MILES	4TH LEV MILES	5TH LEV MILES	6TH LEV MILES

DATE FROM TO	TIME	DEPTH METERS	00010 WATER TEMP DEG-C	00095 CONDUCTVY @ 25 C MICROMHOS	00078 TRANSPAR SECCHI METERS	00300 DISSOLVED OXYGEN mg/l	00301 DO PERCENT SATURATN	00400 pH STANDARD UNITS	00070 TURBIDITY TURBIMETER NTU	00900 HARDNESS TOT CaCO3 mg/l	00915 CALCIUM DIS-CaCO3 mg/l	00410 ALKALINE T CaCO3 mg/l	
78/05/16	1035	0	11.4	69	3.7	10.4	104.0	7.7	1.0				27
	1035	3	11.4	69		10.7	107.0	7.7	5.0	1035	6	11.2	
72						10.7	106.0	7.7	5.0				27
	1035	9	11.1	71		11.0	10'3.0	7.7	1.M				17
	1035	12	8.5	67		9.0	84.0	7.1	1.0K				29
	1035	15	8.0	74		8.0	74.0	7.0	1.0K				31
78/06/08	1210	0	19.5	80		8.2	97.0	8.0	1.0	25	25.0		32
	1210	3	19.5	75		8.4	100.0	7.8	1.0	25	25.0		30
	1210	6	15.3	72		8.1	89.0	7.8	1.0	27	30.0		30
	1210	9	11.0	64		6.9	68.0	7.4	1.0	27	20.0		12
10		12	9.5	67		6.1	58.0	7.1	1.0	27	25.0		51
	1210	15	9.0	65		5.0	47.0	6.9	1.0	25	25.0		30
78/06/29	1105	0	21.5	72	9.4	8.9	110.0	8.2	1.0	25	25.0		28
	1105	3	20.5	69		8.4	102.0	8.2	1.0	29	25.0		28
	1105	6	19.0	70		8.1	95.0	8.3	1.0	25	20.0		28
	1105	9	15.0	69		7.2	78.0	8.2	1.0	29	25.0		28
	1105	12	12.0	85		6.5	66.0	8.1	1.0	29	23.0		28
	1105	15	11.0	70		5.1	50.0	7.6	2.0	25	23.0		22
73/07/17	1330	0	21.1	68	6.1	7.8	96.0	7.7	2.0	26	10.0		33
	1330	3	21.1	66		7.9	97.0	8.1	2.0	22	14.0		27
	1330	6	21.0	66		7.8	96.0	8.1	9.0	26	14.0		29
	1330	9	16.0	66		6.6	73.0	7.5	2.0	22	14.0		31
	1330	12	12.5	64		5.1	52.0	7.3	1.0	22	8.0		29
	1330	15	11.0	68		2.4	24.0	7.1	3.0	22	14.0		31
78/07/31	1420	0	25.0	69	6.2	7.4	98.0	7.5	1.0	33	25.0		28
	1420	3	24.0	68		7.1	93.0	7.5	1.0	22	25.0		30
	1420	6	22.5	69		7.1	89.0	7.7	1.0	28	25.0		28
	1420	9	16.5	65		5.9	66.0	7.4	2.0	23	20.0		26
	1420	12	13.0	67		4.3	45.0	7.1	2.0	27	25.0		28
	1420	15	11.0	70		1.1	11.0	7.0	2.0	27	20.0		28
78/08/14	1415	0	22.0	70	6.9	7.8	98.0	7.6	1.0	36	20.0		28
	1415	3	22.0	70		7.8	98.0	7.9	1.0	40	20.0		31

Table A4. DOE water quality monitoring data for Station 1, Diamond Lake, Washington (continued),

	1415	6	22.0	68		7.8	98.0	7.7	1.0	32	24.0	29
	1415	9	16.5	68		6.3	71.0	7.5	2.0	32	24.0	28
	1415	12	12.0	68		2.5	25.0	7.1	2.0	[illegible]	20.0	29
	1415	15	11.0	70		0.3	3.0	6.9	3.0	36	20.0	31
78/08/22	1410	0	20.0	71	6.9	8.7	105.0	7.5	1.0	40	28.0	29
	1410	3	18.5	67		8.6	101.0	7.6	1.0	36	28.0	31
	1410	6	18.5	66		8.6	101.0	7.5	1.0			29
	1410	9	17.0	66		8.1	92.0	7.2	1.0			29
	1410	12	12.0	66		2.0	20.0	6.8	1.0			29
	1410	15	10.5	71		0.2	2.0	6.9	2.0			31
78/09/11	1430	0	17.6	75	6.6	8.6	98.0	7.4	2.0	40	20.0	30
	1430	3	17.5	70		8.5	97.0	7.5	2.0	32	24.0	30
	1430	6	17.3	69		8.7	98.0	7.4	2.0	32	24.0	30
	1430	9	17.0	68		8.9	101.0	7.3	2.0	32	24.0	30
	1430	12	12.0	69		0.4	4.0	6.8	1.0	36	20.0	30
	1430	15	11.0	44		0.1	1.0	6.8	3.0	44	20.0	42
78/09/27	1030	0	15.5	80	5.2	9.1	100.0	7.7	1.0	36	24.0	32
	1030	3	15.5	73		9.0	98.0	7.7	1.0	36	28.0	32
	1030	6	15.5	70		9.2	101.0	7.7	1.0	36	20.0	32
	1030	9	15.0	70		9.2	100.0	7.6	1.0	40	24.0	30
	1030	12	14.0	70		6.5	60.0	7.1	1.0	32	20.0	28
	1030	15	11.0	74		0.1	1.0	7.0	2.0	32	20.0	32
78/10/31	0930	0	10.0	71	5.2	8.7	84.0	7.7	1.0	40	24.0	28
	0930	3	10.0	69		8.6	83.0	7.4	1.0	44	24.0	40
	0930	6	10.0	70		8.6	83.0	7.4	2.0	44	28.0	30
	0930	9	10.0	70		8.6	83.0	7.4	2.0	40	24.0	30
	0930	12	10.0	70		8.5	82.0	7.4	1.0	40	24.0	28
	0930	15	9.0	72		8.5	80.0	7.4	1.0	36	28.0	32
NUMBER OF SAMPLES			60	60	9	60	60	60	60	50	50	58
MAXIMUM VALUE			25.00	85.00	9.40	11.00	110.00	8.30	9.00	44.00	30.00	51.00
MINIMUM VALUE			8.00	44.00	3.70	0.10	1.00	6.80	1.00	22.00	8.00	20.00
ARITHMETIC MEAN			14.93	69.35	6.24	6.93	76.03	7.49	1.65	31.48	22.30	29.38
GEOMETRIC MEAN			1.21	1.31	1.16	1.14	1.73	1.18	1.00	1.13	1.32	1.12
MEDIAN			15.00		6.20	7.95	89.00	7.50	1.00	32.00	24.00	29.50
STANDARD DEVIATION			4.62		1.57	2.96	32.26	0.39	1.30	6.56	4.35	5.35
[illegible]			21.36		2.45		1040.68	0.15	[illegible]	43.07	18.95	11.21

Table A4. DOE water quality monitoring data for Station 1, Diamond Lake, Washington (continued).

DEPARTMENT OF ECOLOGY

AGENCY 21540000 RETRIEVAL -- 01 MAY 1980

OFFICE OF WATER PROGRAMS
WATER QUALITY MANAGEMENT DIVISION
WATER & WASTEWATER MONITORING SECTION

DIAM01 DIAMOND LAKE MID LAKE OFF PUB AC

DATES: 78/05/01 TO 78/11/30
STORET MINOR BASIN: SPOKANE STORET SUB BASIN: LITTLE SPOKANE

LATITUDE: 48 07 57.0 ELEVATION (FEET): 2300 WATER CLASS: LC
LONGITUDE: 117 11 12.0 COUNTY: PEND OREILLE SEGMENT: 24-55-100

AGENCY: 21540000 STATE: WASHINGTON STA TYPE: LAKE

TERMINAL STREAM	1ST LEV MILES	2ND LEV MILES	3RD LEV MILES	4TH LEV MILES	5TH LEV MILES	6TH LEV MILES

DATE FROM TO	TIME	DEPTH METERS	00620 NITRATE T NO3-N mg/l	00615 NITRITE T NO2-N mg/l	00610 AMMONIA T NH3-N mg/l	00625 KJELDAHL NITROGEN T mg/l N	00665 TOTAL PHOSPHORUS mg/l P	00671 DIS-ORTHO PHOSPHORUS mg/l P	32211 CHLOROPHL A SPECTRO ug/l	31616 FECAL COLIFORM /100ml MF	
78/05/16	1035	0	0.0K	0.02K	0.02K	0.420	0.02K	0.02K			1K
	1035	3	0.02K	0.02K	0.02K	0.540	0.04	0.02K			
	1035	6	0.02K	0.02K	0.02K	0.530	0.02K	0.02K			
	1035	9	0.02K	0.02K	0.02K	0.670	0.02K	0.02K			
	1035	12	0.02K	0.02K	0.02K	0.450	0.02K	0.02K			
	1035	15	0.02K	0.02K	0.03	0.320	0.03	0.02K			
78/06/08	1210	0	0.01K	0.01K	0.01	0.450	0.01	0.02K	1.80		1K
	1210	3	0.01K	0.01K	0.01K	0.430	0.01	0.02K	0.50		
	1210	6	0.01K	0.01K	0.01	0.430	0.01	0.02K	0.30		
	1210	9	0.01K	0.01K	0.01K	0.470	0.01	0.02K	1.20		
	1210	12	0.01K	0.01K	0.01K	0.420	0.02	0.02K	3.10		
	1210	15	0.01	0.01K	0.05	0.500	0.02	0.02K	3.40		
78/06/20	1105	0	0.01K	0.01K	0.01K	0.410	0.03	0.01K	0.30		
	1105	3	0.01K	0.01K	0.01K	0.320	0.02	0.01K	0.30		
	1105	6	0.01K	0.01K	0.01	0.350	0.02	0.01K	0.50		
	1105	9	0.01K	0.01K	0.01	0.400	0.02	0.01K	0.50		
	1105	12	0.01K	0.01K	0.03	0.330	0.02	0.01K	0.30		
	1105	15	0.01K	0.01K	0.04	0.400	0.02	0.01K	0.80		
78/07/17	1330	0	0.01K	0.01K	0.01	0.640	0.01	0.01K	0.80		2
	1330	3	0.01K	0.01K	0.01	0.560	0.01	0.01K	1.10		
	1330	6	0.01K	0.01K	0.01	0.600	0.01	0.01K	1.10		
	1330	9	0.01K	0.01K	0.01	0.700	0.01	0.01K	1.70		
	1330	12	0.01K	0.01K	0.03	0.660	0.02	0.01K	1.30		
	1330	15	0.01K	0.01K	0.20	0.930	0.01	0.01K	0.80		
78/07/31	1420	0	0.01K	0.01K	0.05	0.630	0.05	0.01K	1.20		1K
	1420	3	0.01	0.01K	0.02	0.650	0.02	0.01K	0.70		
	1420	6	0.01K	0.01K	0.01	0.430	0.02	0.01K	0.60		
	1420	9	0.01K	0.01K	0.01K	0.380	0.02	0.01K	1.40		
	1420	12	0.01K	0.01K	0.01	0.540	0.03	0.01K	2.50		
	1420	15	0.01K	0.01K	0.12	0.530	0.03	0.01K	1.40		
78/08/14	1415	0	0.01K	0.01K	0.01	0.750	0.04	0.01K	0.90		1

Table A4 DOE water quality monitoring data for Station 1, Diamond Lake, Washington (continued).

	1415	3	0.01K	0.01K	0.01	0.510	0.02	0.01K	0.90	
	1415	6	0.01K	0.01K	0.01K	0.430	0.02	0.01K	1.20	
	1415	9	0.01K	0.01K	0.01	0.390	0.01	0.01K	0.70	
	1415	12	0.01K	0.01K	0.03	0.470	0.02	0.01K	1.50	
	1415	15	0.01K	0.01K	0.14	0.820	0.03	0.01K	1.30	
78/08/22	1410	0	0.01K	0.01K	0.03	0.500	0.02	0.01K	0.70	
	1410	3	0.01K	0.01K	0.03	0.410	0.01	0.01K	0.50	
	1410	6	0.01K	0.01K	0.01	0.390	0.01	0.01K	0.90	
	1410	9	0.01K	0.01K	0.02	0.400	0.01	0.01K	0.50	
	1410	12	0.01K	0.01K	0.03	0.150	0.02	0.01K	0.60	
	1410	15	0.01K	0.01K	0.11	0.700	0.01	0.01K	1.80	
78/09/11	1430	0	0.01K	0.01K	0.05	0.350	0.02	0.01K	0.70	1K
	1430	3	0.01K	0.01K	0.06	0.360	0.02	0.01K	0.80	
	1430	6	0.01K	0.01K	0.42	0.420	0.02	0.01K	0.80	
	1430	9	0.01K	0.01K	0.13	0.280	0.02	0.01K	0.70	
	1430	12	0.01K	0.01K	0.06	0.290	0.03	0.01K	3.00	
	1430	15	0.01K	0.01K	0.29	0.520	0.03	0.01K	2.10	
78/09/27	1030	0	0.01K	0.01K	0.03	0.380	0.02	0.01K	0.70	1K
	1030	3	0.01K	0.01K	0.01	0.390	0.03	0.01K	0.70	
	1030	6	0.01K	0.01K	0.01	0.430	0.02	0.01K	0.50	
	1030	9	0.01K	0.01K	0.02	0.450	0.02	0.01K	1.10	
	1030	12	0.01K	0.01K	0.06	0.440	0.02	0.01K	0.40	
	1030	15	0.01K	0.01K	0.12	0.750	0.02	0.01K	0.40	
78/10/31	0930	0	0.01K	0.01K	0.08	0.300	0.03	0.01K	2.00	1
	0930	3	0.01K	0.01K	0.06	0.330	0.02	0.01K	3.40	
	0930	6	0.01K	0.01K	0.06	0.370	0.02	0.01K	2.30	
	0930	9	0.01K	0.01K	0.06	0.340	0.02	0.01K	2.60	
	0930	12	0.01K	0.01K	0.06	0.350	0.02	0.01K	2.30	
	0930	15	0.01K	0.01K	0.07	0.380	0.02	0.01K	3.50	
NUMBER OF SAMPLES			60	60	60	60	60	60	54	8
MAXIMUM VALUE			0.02	0.02	0.42	0.930	0.05	0.02	3.50	2.00
MINIMUM VALUE			0.01	0.01	0.01	0.150	0.01	0.01	0.30	1.00
ARITHMETIC MEAN			0.01	0.01	0.05	0.477	0.02	0.01	1.25	1.13
GEOMETRIC MEAN			0.87	0.87	0.87	0.937	0.87	0.87	0.98	1.00
MEDIAN			0.01	0.01	0.03	0.430	0.02	[illegible]	0.90	1.00
STANDARD DEVIATION			0.00	0.00	0.07	0.153	0.01		0.88	0.35
VARIANCE			0.00	0.00	0.00		0.00		0.77	0.13

APPENDIX B

Dissolved Oxygen and Temperature Profiles

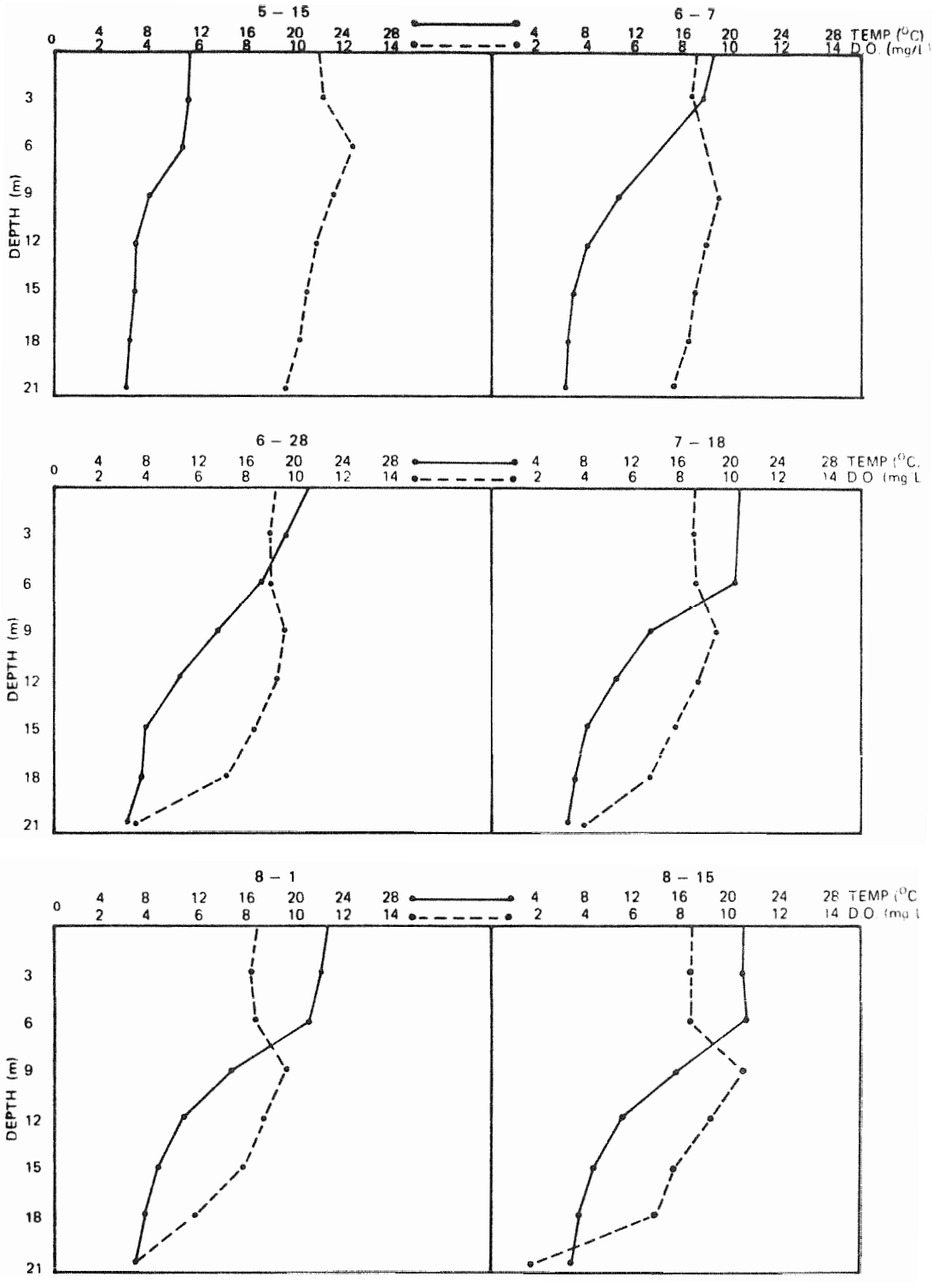

Figure B 1. Deer Lake temperature (°C) and dissolved oxygen (mg/L) profiles observed during 1978 **DOE** water quality study.

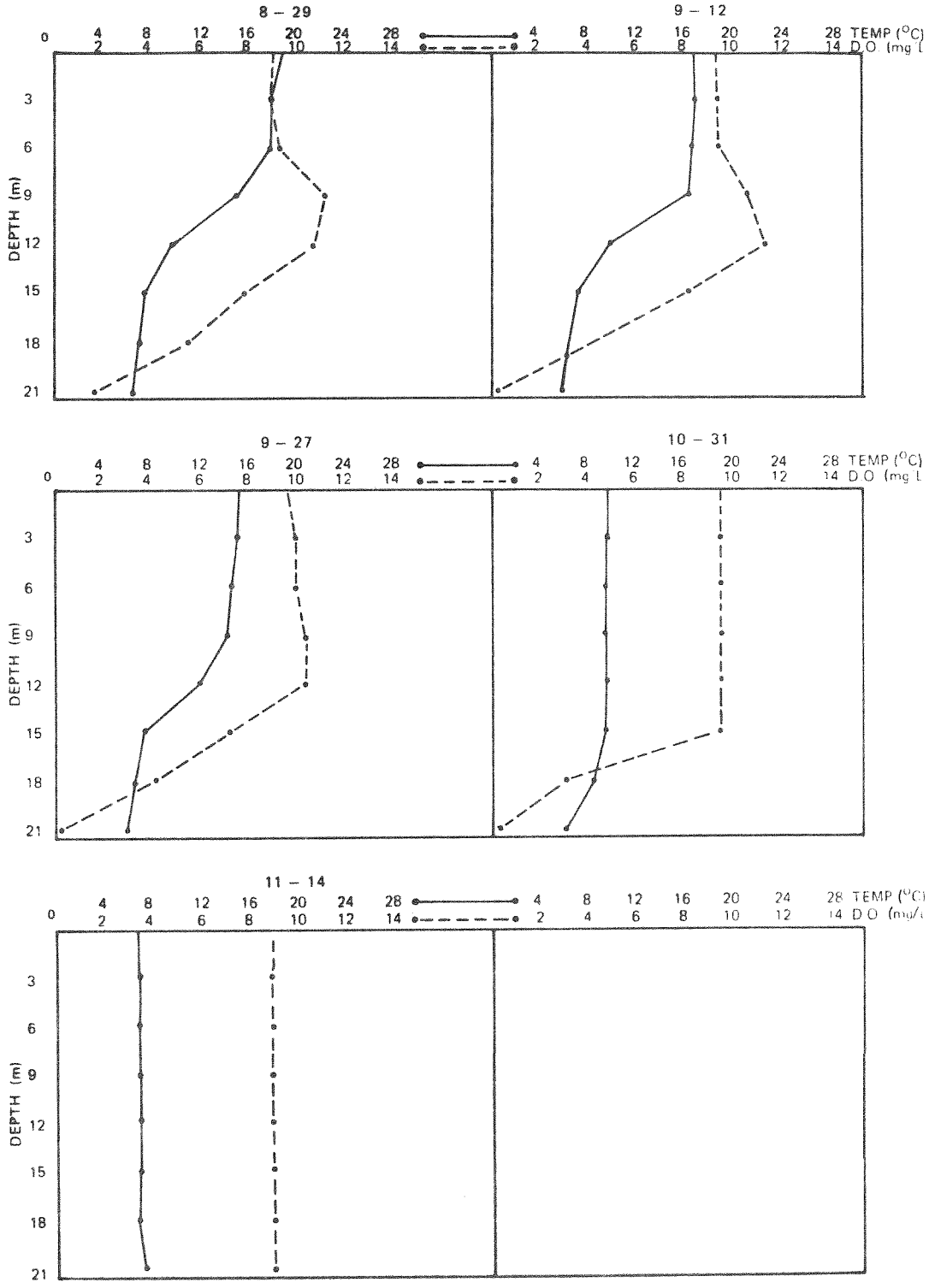

Figure B 1. Deer Lake temperature (°C) and dissolved oxygen (mg/L) profiles observed during 1978 DOE water quality study (continued).

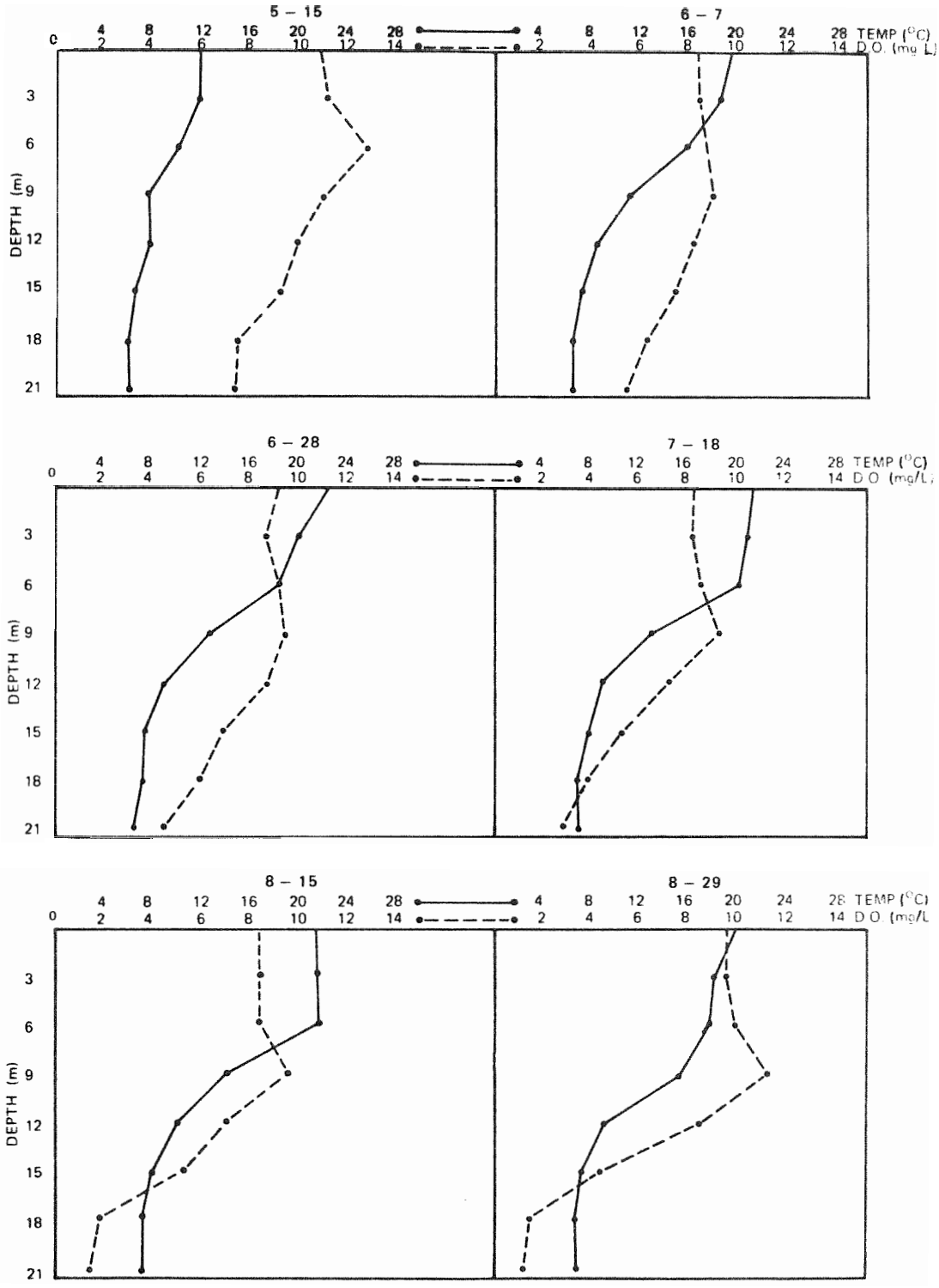

Figure B 2. Loon Lake temperature (°C) and dissolved oxygen (mg/L) profiles observed at station 1 during 1978 DOE water quality study.

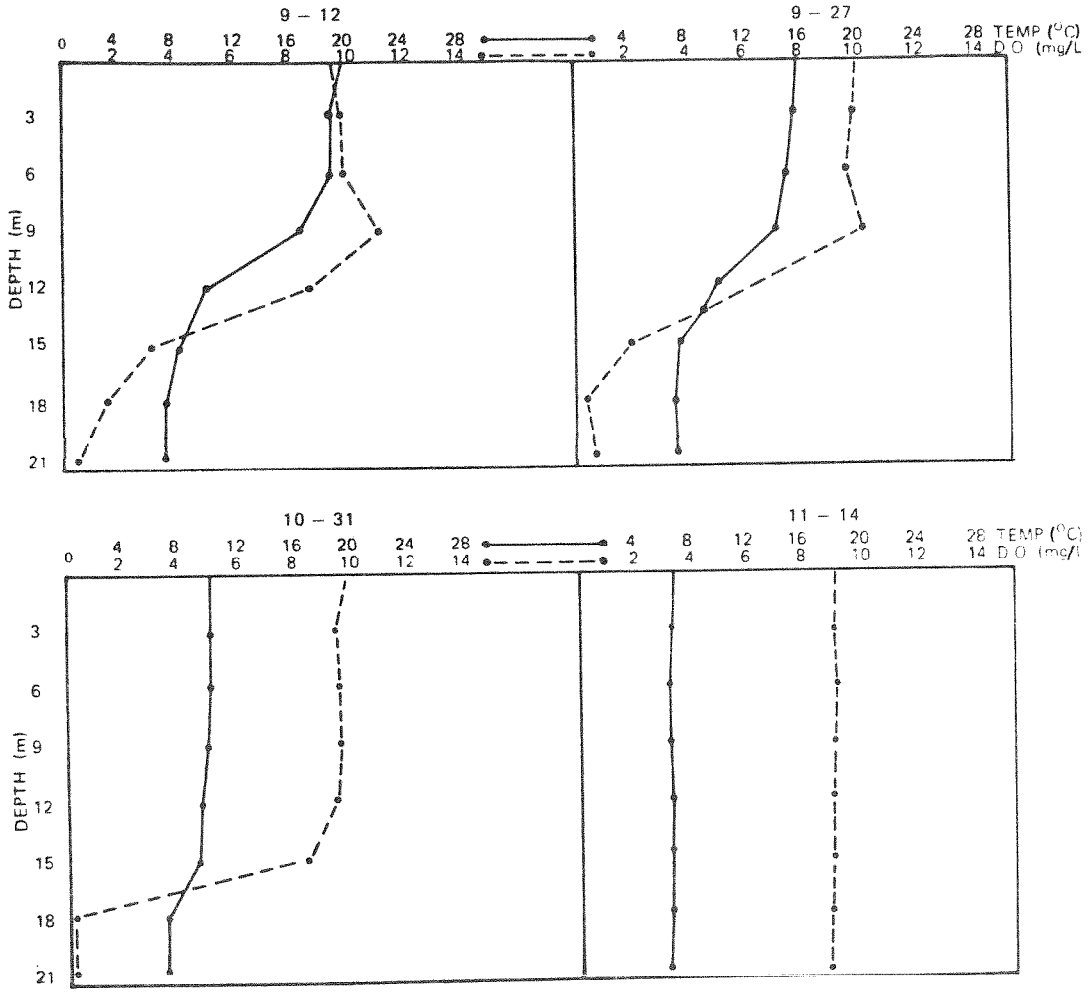

Figure B 2. Loon Lake temperature (°C) and dissolved oxygen (mg/L) profiles observed at station 1 during 1978 DOE water quality study (continued).

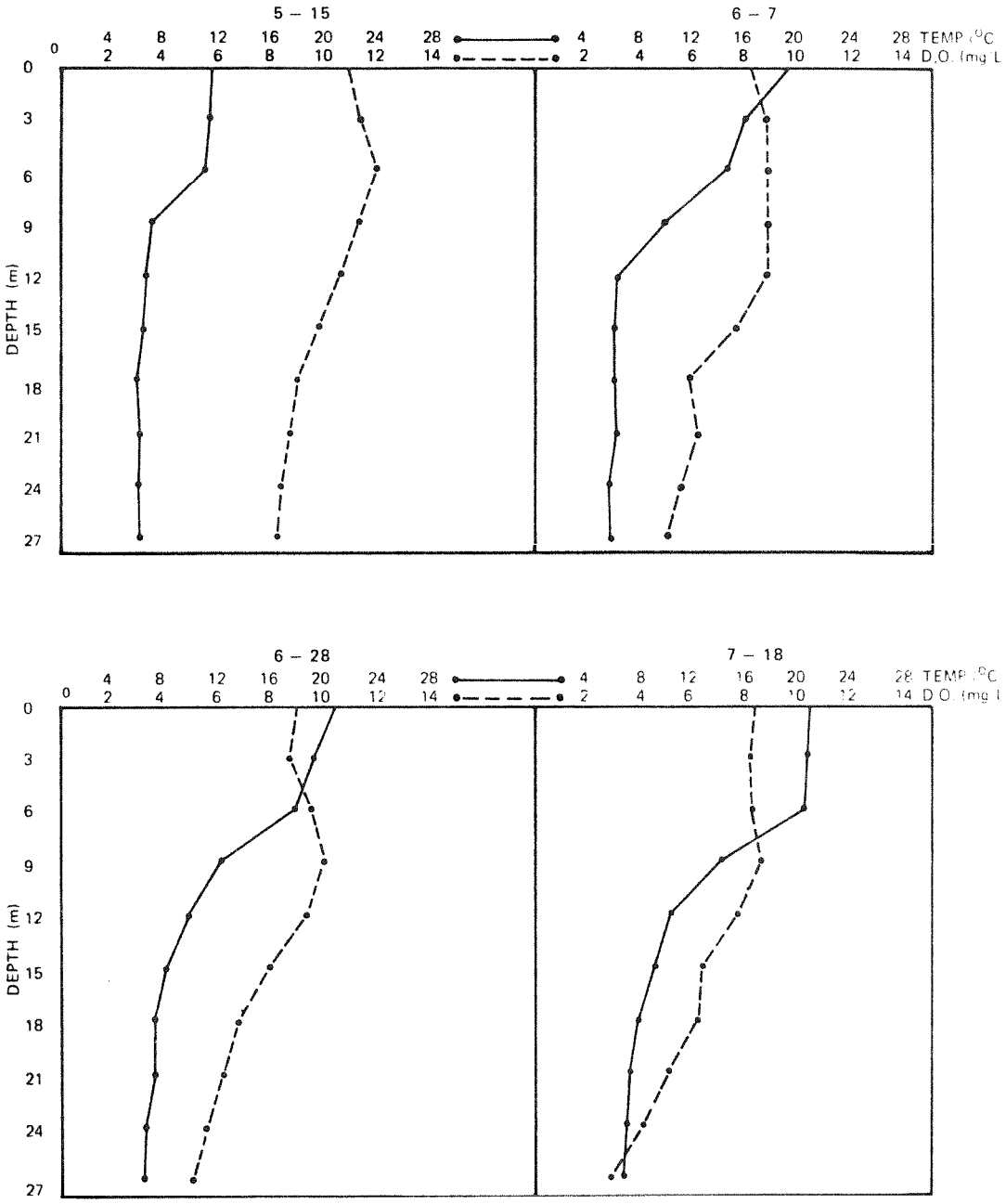

Figure B 3. Loon Lake temperature (°C) and dissolved oxygen (mg/L) profiles observed at station 2 during 1978 WE water quality study.

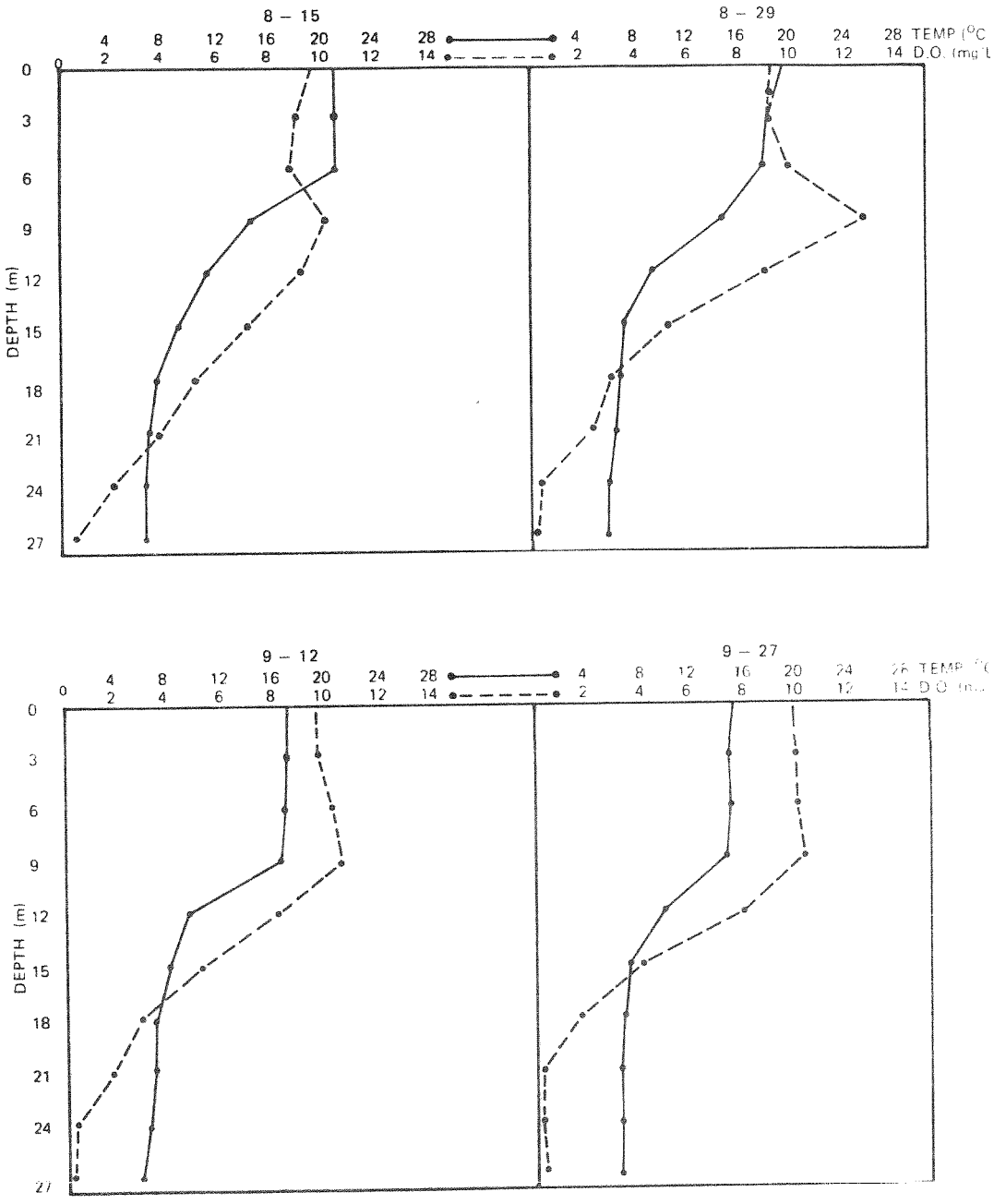

Figure B 3. Loon Lake temperature (°C) and dissolved oxygen (mg/L) profiles observed at station 2 during 1978 DOE water quality study (continued).

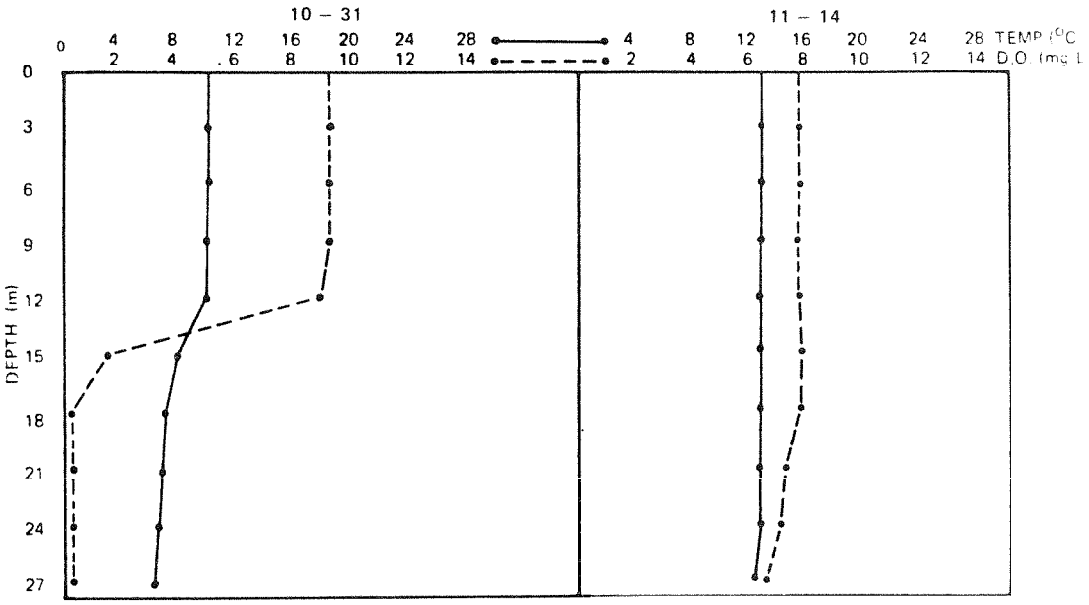

Figure B 3. Loon Lake temperature (°C) and dissolved oxygen (mg/L) profiles observed at station 2 during 1978 DOE water quality study (continued).

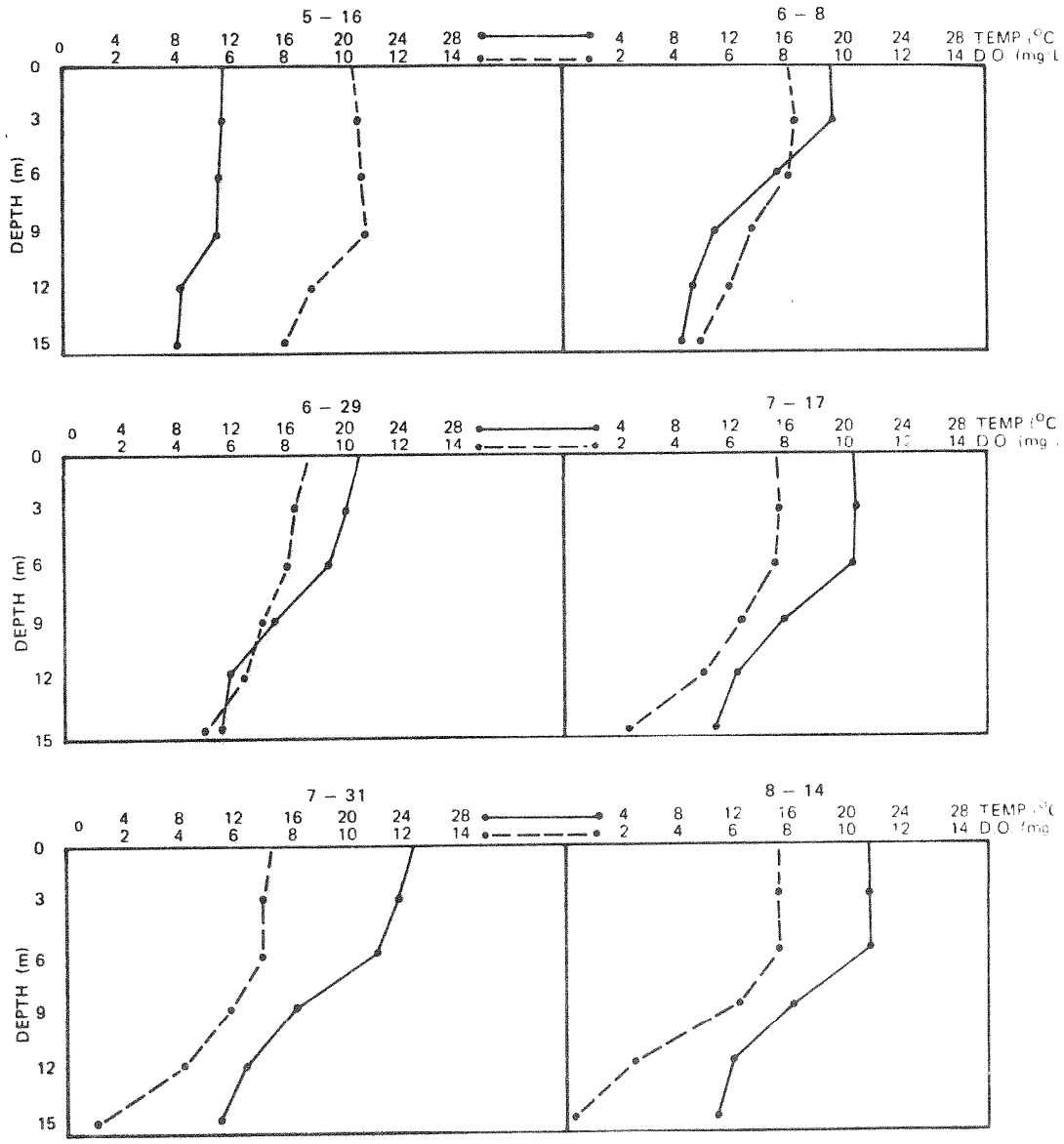

Figure B 4. Diamond Lake temperature (°C) and dissolved oxygen (mg/L) profiles observed during 1978 DOE water quality study.

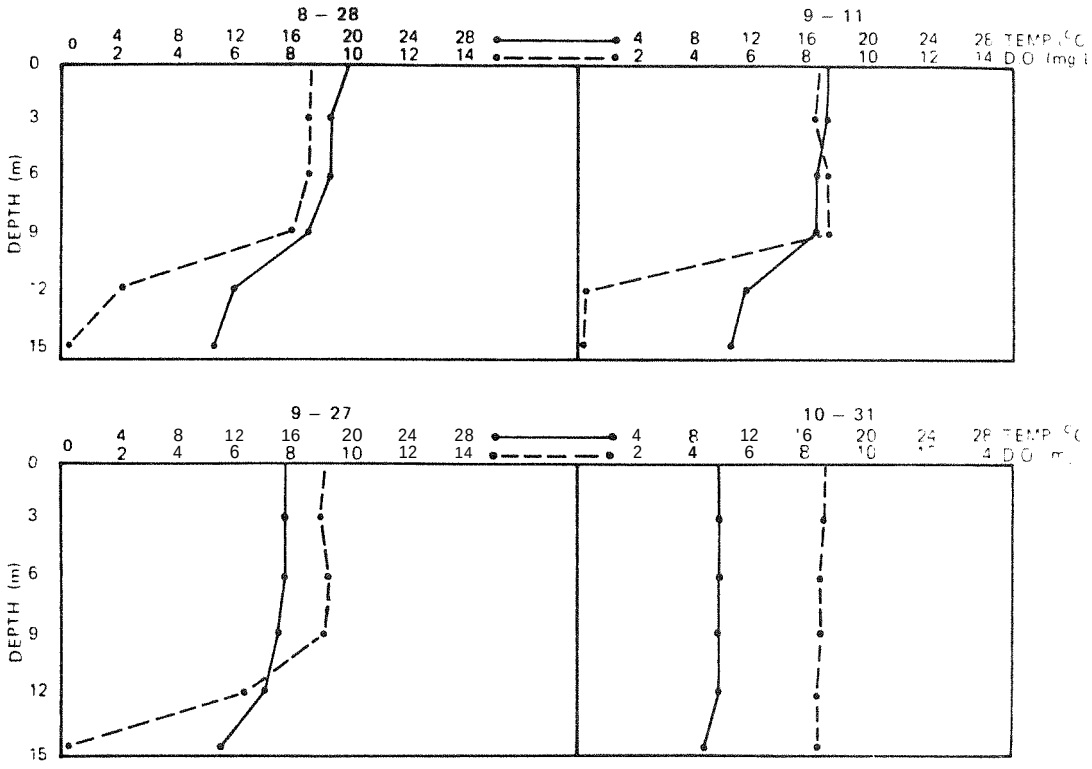

Figure B 4. Diamond Lake temperature (°C) and dissolved oxygen (mg/L) profiles observed during 1978 DOE water quality study (continued).

APPENDIX C

Phytoplankton Data

Table C1. Phytoplankton numbers (cells/ml) and biovolume (μm^3/ml x 10^3) observed from Deer Lake, WA during DOE water quality study, 1978.

Species	May 15		June 7		June 28		July 18		August 1		August 15	
	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume
Bacillariophyta												
Asterionella formosa											40.0	32.0
Cyclotella meneghiniana			5.0	1.3	15.0	3.9	10.0	2.6	10.0	2.6	15.0	3.9
Diatoma sp.												
Fragilaria crotonensis	50.0	57.0	230.0	263.0	60.0	69.0						
Stephanodiscus sp.					5.0	2.7					20.0	10.6
Tabellaria fenestrata			5.0	12.0	10.0	25.0						
Division Totals	50.0	57.0	240.0	276.3	90.0	100.6	10.0	2.6	10.0	2.6	75.0	46.5
Chlorophyta												
Ankistrodesmus fractus	10.0	0.9	5.0	0.4								
Cosmarium sp.					5.0	10.0						
Desmidium sp.							30.0	21.0				
Nano-plankton	15.0	0.8			10.0	0.5						
Sphaerocystis Schroeteri					120.0	16.0	200.0	27.0	800.0	108.0	320.0	43.0
Division Totals	25.0	1.7	5.0	0.4	135.0	26.5	230.0	48.0	800.0	108.0	320.0	43.0
Chrysophyta												
Dinobryon divergens	5.0	1.0	55.0	11.0	100.0	20.0	465.0	93.0	235.0	47.0	190.0	38.0
Division Totals	5.0	1.0	55.0	11.0	100.0	20.0	465.0	93.0	235.0	47.0	190.0	38.0
Cryptophyta												
Cryptomonas erosa	35.0	91.0	15.0	39.0	15.0	39.0	35.0	91.0				
Division Totals	35.0	91.0	15.0	39.0	15.0	39.0	35.0	91.0	0.0	0.0	0.0	0.0
Cyanophyta												
Aphanocapsa delicatissima												
Aphanothece nidulans												
Gloeocapsa punctata												
Division Totals	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Euglenophyta												
Phacus sp.			10.0	71.0	5.0	36.0	5.0	36.0				
Division Totals	0.0	0.0	10.0	71.0	6.0	36.0	5.0	36.0	0.0	0.0	0.0	0.0
Pyrrophyta												
Ceratium hirundinella					5.0	125.0	5.0	125.0				
Division Totals	0.0	0.0	0.0	0.0	5.0	125.0	5.0	125.0	0.0	0.0	0.0	0.0
OVERALL TOTALS	115.0	150.7	325.0	397.7	350.0	347.1	750.0	395.6	1145.0	157.6	585.0	127.5

Table C1. Phytoplankton numbers (cells/ml) and biovolume (μm^3/ml x 10^3) observed from Deer Lake, WA during DOE water quality study, 1978 - Continued.

Species	August 29 Number	August 29 Volume	September 12 Number	September 12 Volume	September 27 Number	September 27 Volume	October 31 Number	October 31 Volume	November 14 Number	November 14 Volume
Bacillariophyta										
Asterionella formosa							70.0	56.0	60.0	48.0
Cyclotella meneghiniana					10.0	50.0				
Diatoma sp.										
Fragilaria crotonensis	15.0	8.0	15.0	8.0	5.0	2.7	5.0	2.7	10.0	5.3
Stephanodiscus sp.										
Tabellaria fenestrata										
Division Totals	15.0	8.0	15.0	8.0	15.0	52.7	75.0	58.7	70.0	53.3
Chlorophyta										
Ankistrodesmus fractus										
Cosmarium sp.										
Desmidium sp.										
Nano-plankton					5.0	0.3				
Sphaerocystis Schroeteri	40.0	5.4	80.0	11.0						
Division Totals	40.0	5.4	80.0	11.0	5.0	0.3	0.0	0.0	0.0	0.0
Chrysophyta										
Dinobryon divergens	40.0	8.0							5.0	1.0
Division Totals	40.0	8.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	1.0
Cryptophyta										
Cryptomonas erosa	5.0	13.0	10.0	26.0	5.0	13.0				
Division Totals	5.0	13.0	10.0	26.0	5.0	13.0	0.0	0.0	0.0	0.0
Cyanophyta										
Aphanocapsa delicatissima	1000.0	0.2								
Aphanothece nidulans			500.0	0.3	250.0	0.1			500.0	0.3
Gloeocapsa punctata	40.0	1.1								
Division Totals	1040.0	1.3	500.0	0.3	250.0	0.1	0.0	0.0	500.0	0.3
Euglenophyta										
Phacus sp.										
Division Totals	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pyrrophyta										
Ceratium hirundinella										
Division Totals	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OVERALL TOTALS	1140.0	35.7	605.0	45.3	275.0	66.1	75.0	58.7	575.0	54.6

Table C2. Phytoplankton numbers (cells/ml) and biovolume (μm^3/ml x 10^3) observed from Loon Lake, WA during DOE water quality study, 1978.

Species	May 15		June 7		June 28		July 18		August 15	
	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume
Bacillariophyta										
Amphora sp.	5.0	64.0								
Asterionella formosa	30.0	13.0	80.0	34.0	20.0	8.5	15.0	6.4	20.0	8.5
Cyclotella sp.	10.0	10.0	15.0	15.0	40.0	40.0	150.0	150.0	125.0	125.0
Fragilaria crotonensis	15.0	17.0			125.0	138.0	150.0	165.0	110.0	121.0
Navicula sp.	5.0	28.0					10.0	56.0		
Synedra sp.	20.0	11.0	15.0	8.0					5.0	2.7
Synedra ulna	10.0	28.0	5.0	14.0	5.0	14.0			5.0	14.0
Tabellaria fenestrata	10.0	27.0								
Division Totals	105.0	198.0	115.0	71.0	190.0	200.5	325.0	377.4	265.0	271.2
Chlorophyta										
Cosmarium bioculatum	5.0	8.9	5.0	8.9			5.0	8.9	5.0	8.9
Elakatothrix gelatinosa							10.0	5.5		
Gloeocystis ampla							660.0	492.0		
Nano-plankton					5.0	0.3				
Sphaerocystis Schroeteri									240.0	31.0
Division Totals	5.0	8.9	5.0	8.9	5.0	0.3	675.0	506.4	245.0	39.9
Chrysophyta										
Dinobryon divergens	310.0	123.0	115.0	46.0	80.0	32.0	135.0	54.0		
Division Totals	310.0	123.0	115.0	46.0	80.0	32.0	135.0	54.0	0.0	0.0
Cyanophyta										
Anabaena circinalis					30.0	7.7				
Aphanothece nidulans									375.0	0.2
Gloeocapsa punctata									20.0	0.6
Division Totals	0.0	0.0	0.0	0.0	30.0	7.7	0.0	0.0	395.0	0.8
Euglenophyta										
Phacus sp.										
Division Totals	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pyrrophyta										
Ceratium hirundinella										
Glenodinium Gymnodinium	5.0	75.0								
Division Totals	5.0	75.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OVERALL TOTALS	425.0	404.9	235.0	125.9	305.0	240.5	1135.0	937.8	905.0	311.9

Table C2. Phytoplankton numbers (cells/ml) and biovolume (μm^3/ml x 10^3) observed from Loon Lake, WA during DOE water quality study, 1978 - Continued.

Species	August 29 Number	August 29 Volume	September 12 Number	September 12 Volume	September 27 Number	September 27 Volume	October 31 Number	October 31 Volume	November 14 Number	November 14 Volume
Bacillariophyta										
Amphora sp.										
Asterionella formosa										
Cyclotella sp.	20.0	20.0	20.0	20.0	15.0	15.0	5.0	5.0	15.0	15.0
Fragilaria crotonensis			25.0	28.0					25.0	28.0
Navicula sp.										
Synedra sp.										
Synedra ulna										
Tabellaria fenestrata										
Division Totals	20.0	20.0	45.0	48.0	15.0	15.0	5.0	5.0	40.0	43.0
Chlorophyta										
Cosmarium bioculatum					5.0	8.9				
Elakatothrix gelatinosa	20.0	11.0	50.0	28.0						
Gloeocystis ampla	160.0	119.0								
:Jane-plankton	40.0	2.0								
Sphaerocystis Schroeteri	120.0	15.0			80.0	10.0				
Division Totals	340.0	147.0	50.0	28.0	85.0	18.9	0.0	0.0	0.0	0.0
Chrysophyta										
Dinobryon divergens			5.0	2.0						
Division Totals	0.0	0.0	5.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0
Cyanophyta										
Anabaena circinalis	250.0	64.0	245.0	63.0						
Aphanothece nidulans	350.0	0.2								
Gloeocapsa punctata			30.0	0.8	220.0	6.2	100.0	2.8		
Division Totals	600.0	64.2	275.0	63.8	220.0	6.2	100.0	2.8	0.0	0.0
Euglenophyta										
Phacus sp.	5.0	32.0								
Division Totals	5.0	32.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pyrropnyti!										
Ceratium hirundinella					10.0	500.0				
Glenodinium Gymnodinium										
Division Totals	0.0	0.0	0.0	0.0	10.0	500.0	0.0	0.0	0.0	0.0
OVERALL TOTALS	965.0	263.2	375.0	141.8	330.0	540.1	105.0	7.8	40.0	43.0

Table C3. Phytoplankton numbers (cells/ml) and biovolume ($\mu m^3/ml \times 10^3$) observed from Diamond Lake, WA during DOE water quality study, 1978.

Species	May 16 Number	May 16 Volume	June 8 Number	June 8 Volume	June 29 Number	June 29 Volume	July 17 Number	July 17 Volume	July 31 Number	July 31 Volume
Bacillariophyta										
Asterionella formosa	70.0	56.0	70.0	56.0	5.0	4.0				
Cyclotella meneghiniana	150.0	45.0	5.0	2.0			30.0	9.0	5.0	2.0
Melosira granulata										
Synedra ulna			5.0	14.0						
Tabellaria fenestrata					5.0	13.0				
Division Totals	220.0	101.1	80.0	72.0	10.0	17.0	30.0	9.0	5.0	2.0
Chlorophyta										
Nano-plankton	55.0	3.0			15.0	0.8				
Sphaerocystis Schroeteri							120.0	18.0		
Division Totals	55.0	3.0	0.0	0.0	15.0	0.8	120.0	18.0	0.0	0.0
Chrysophyta										
Dinobryon divergens									5.0	0.1
Division Totals	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	0.1
Cryptophyta										
Cryptomonas ovata	10.0	30.0	5.0	15.0						
Division Totals	10.0	30.0	5.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0
Cyanophyta										
Anabaena cylindrica									500.0	29.0
Aphanothece nidulans							250.0	0.1		
Chroococcus prescottii			20.0	1.0						
Gloeocapsa punctata										
Division Totals	0.0	0.0	20.0	1.0	0.0	0.0	250.0	0.1	500.0	29.0
Pyrrophyta										
Ceratium hirundinella							5.0	250.0		
Glenodinium Gymnodinium	40.0	400.0	25.0	250.0	20.0	200.0	20.0	200.0		
Division Totals	40.0	400.0	25.0	250.0	20.0	200.0	25.0	450.0	0.0	0.0
OVERALL TOTALS	325.0	534.0	130.0	388.0	45.0	217.8	425.0	477.1	510.0	31.1

Table C3. Phytoplankton numbers (cells/ml) and biovolume (μm^3/ml x 10^3) observed from Diamond Lake, WA during DOE water quality study, 1978 - Continued.

Species	August 14 Number	August 14 Volume	August 28 Number	August 28 Volume	September 11 Number	September 11 Volume	September 26 Number	September 26 Volume	October 31 Number	October 31 Volume
Bacillariophyta										
Asterionella formosa										
Cyclotella meneghiniana			5.0	1.5					10.0	3.0
Melosira granulata	25.0	16.0								
Synedra ulna										
Tabellaria fenestrata										
Division Totals	25.0	16.0	5.0	1.5	0.0	0.0	0.0	0.0	10.0	3.0
Chlorophyta										
Nano-plankton										
Sphaerocystis Schroeteri										
Division Totals	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chrysophyta										
Dinobryon divergens							20.0	5.0	195.0	49.0
Division Totals	0.0	0.0	0.0	0.0	0.0	0.0	20.0	5.0	195.0	49.0
Cryptophyta										
Cryptomonas ovata	5.0	15.0					5.0	15.0		
Division Totals	5.0	15.0	0.0	0.0	0.0	0.0	5.0	15.0	0.0	0.0
Cyanophyta										
Anabaena cylindrica										
Aphanothece nidulans	250.0	0.1					500.0	0.3		
Chroococcus prescottii					20.0	1.0				
Gloeocapsa punctata					20.0	0.6	10.0	0.3	20.0	0.6
Division Totals	250.0	0.1	0.0	0.0	40.0	1.6	510.0	0.6	20.0	0.6
Pyrrophyta										
Ceratium hirundinella										
Glenodinium Gymnodinium										
Division Totals	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OVERALL TOTALS			5.0	1.5		1.6	535.0	20.6	225.0	52.6