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Quality Assessment of Six Illinois Lakes, 1995

by
Shun Dar Lin and Raman K. Raman
Office of Water Quality Management

Prepared for the
Illinois Environmental Protection Agency

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Illinois State Water Survey
Chemistry Division
Champaign, Illinois

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INTRODUCTION

Illinois Lake Quality Assessment Program

For more than two decades, Federal Clean Lakes Programs (CLPs) have provided guidelines for lake management and watershed protection. The programs have been a resounding success through the cooperative participation of federal and state environmental protection agencies, local organizations, and lake owners.

The state of Illinois has more than 3,000 lakes and reservoirs with surface areas of six acres or more. The origins of these water impoundments vary. Some were formed by glaciers, but most were developed by damming streams. Over 100 of them serve as raw water-supply sources, and a few are used for industrial cooling. They are all invariably used for recreational activities such as fishing, boating, swimming, picnicking, etc.

In Illinois, more than 600 lakes and reservoirs have been evaluated by the Illinois Environmental Protection Agency (Illinois EPA) with funding provided through the Clean Lakes Program under the Federal Clean Water Act. Prior to receiving this grant the Illinois EPA had applied for and received U.S. Environmental Protection Agency (USEPA) Region V Lake Water Quality Assessment (LWQA) grants until 1994. The lakes selected for evaluation were visited once for in-situ monitoring and water and sediment samples collection at the deepest site during summer.

With this project (grant) the scope of the current investigations has changed in that fewer lakes (six instead of approximately 20) are sampled five times during summer instead of once as in the past years.

To fulfill Illinois EPA's goal, the Office of Water Quality Management of the Illinois State Water Survey (ISWS) was contracted to collect data on six selected lakes in the state of Illinois. The ISWS staff visited these lakes and collected water and sediment samples, as well as lake assessment information from various sources.

This report presents all the data obtained for the six lakes assessed in 1995.

Acknowledgments

Partial funding for this survey was provided by the Planning Section of the Illinois EPA's Water Pollution Control Division. Gregg Good, Jeff Mitzelfelt, and Steve Kolsto, Illinois EPA, assisted immeasurably in carrying out this task to its successful completion. Their help is gratefully acknowledged.

Brett Robert, Conservation Agronomist, United States Department of Agriculture - Soil Conservation Service (USDA-SCS), Champaign, Illinois, was instrumental in coordinating and obtaining information pertaining to watershed land-use management practices from several regional offices. The authors immensely appreciate USDA-SCS help.

Special thanks go to the individuals associated with the six lakes surveyed. They were very courteous, provided boats and personnel, shared their information and knowledge about the lakes and their watersheds, which made data collection easier. Without their fullest cooperation, this task could not have been accomplished in a timely and orderly fashion. The authors owe a debt of gratitude to each of them. George Potter and John Carl, private citizens, provided their boats and participated in the field work for Matanzas Lake. Dave Hullinger, ISWS, participated in the field work. Linda Dexter typed the manuscript and the final report, and Eva Kingston edited the manuscript.

SCOPE OF WORK

The ISWS assisted the Illinois EPA in collecting basic lake assessment data, as well as water and sediment samples for 18 sites at six Illinois lakes (three sites for each lake). Figure 1 provides the names and locations of these lakes whose surface areas vary from 50 acres (Long Lake) to 361 acres (Matanzas Lake). Lake types included strip mine, backwater, and dammed stream.

Basic lake assessment data gathered for each lake included: lake location; morphology; hydrology; ownership/access; lake, watershed, and shoreline usages and impairments; water quality problems; source, cause, and magnitude of pollution; lake and watershed management previously undertaken and currently being practiced; and a lake map.

MATERIALS AND METHODS

Lake water and sediment samples were collected at three sites for six Illinois lakes by the ISWS and delivered to Illinois EPA laboratories for analysis. Typically, the deepest location is called station 1. Station 2 is generally designated near the center of the lake; and station 3 is generally located in the upper shallow portion of the lake. Each lake was surveyed five times (April, June, July, August, and October 1995). The physical, chemical, and biological samples were collected. Grab samples were taken at 0.3 meters or m (1 foot) below the surface and 0.6 m (2 feet) above the lake bottom for station 1 if the total depth was greater than 10 feet and only near surface samples for the other two lake sites. Samples were transported in ice and refrigerated until analysis. Sediment samples were taken with an epoxy-coated 15-cm × 15-cm (6-inch × 6-inch) ponar dredge at the deep station only.

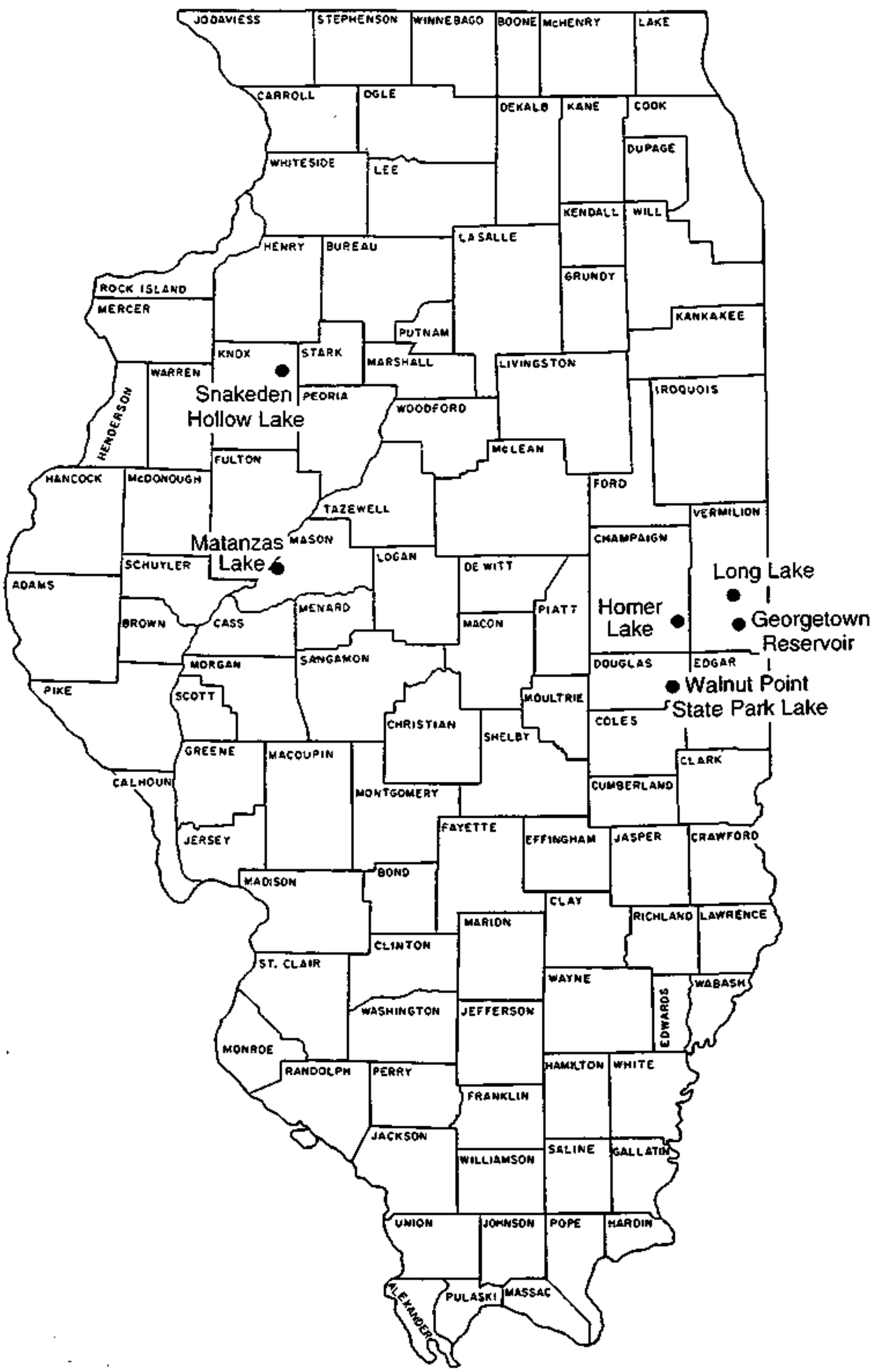

Figure 1. Locations of six lakes monitored

All sampling and sites visits were made from March 23, 1995, through October 3, 1995. Samples were collected according to the Illinois EPA field methods guide quality assurance/quality control procedures (Illinois EPA, 1987).

These samples were delivered to Illinois EPA laboratories for analysis of total suspended solids (TSS); volatile suspended solids (VSS); turbidity; total phosphorus (TP); nitrite/nitrate-nitrogen (NO_2/NO_3-N); ammonia nitrogen (NH_3-N); total kjeldahl nitrogen (TKN); chemical oxygen demand (COD); chlorophyll *a, b, c;* and pheophytine *a*. All analyses were performed using approved methods.

In-situ measurements of water temperature and dissolved oxygen (DO) were made using a 50-foot DO/temperature cable and probe (Yellow Springs Instrument Company model 59), which was calibrated with a saturated water chamber. DO/temperature profiles were measured in the water column at each site at 1- or 2-foot intervals from the surface of the lake.

Lake water transparency was determined with an 8-inch-diameter Secchi disk with black and white quadrant markings attached to a calibrated line. The Secchi disk was lowered until it disappeared from view, and the depth of immersion of the disk was noted. The disk was lowered further, then raised slowly until it reappeared. Again the depth of immersion was recorded. The average of these two measurements was used as the Secchi disk reading. Phenolphthalein alkalinity, total alkalinity, and pH were measured in the field after sample collection.

A weighted bottle sampler and clean half-gallon bottle were used to collect a depth-integrated (surface to twice the Secchi depth) quart sample for chlorophyll at the site. This sample was placed in a foil-wrapped, polyethylene quart bottle for chlorophyll analysis. An adequate volume of the sample was immediately filtered (with a Fisher glass fiber filter G4) with a hand vacuum pump, while in the shade. The algae-laden filter was promptly folded into quadrants, blotted with a paper towel, wrapped in aluminum foil, and placed in a small plastic bag, which was then labeled and stored in a freezer prior to shipment for lab analysis. The volume of filtrate required to saturate each filter with suspended material was recorded to facilitate calculation of chlorophyll concentrations in micrograms per liter (μg/L).

Replicate sediment samples were collected at the deepest station of the lake using a Petite ponar dredge. A portion of each sample was placed in a specially prepared glass bottle for organic analyses and in a plastic bottle for metal and nutrient analyses according to Illinois EPA field methods (Illinois EPA, 1987). All sediment samples were collected on the same dates as the lake water samples and were transported to Illinois EPA laboratories for analysis using approved methods. Sediment samples were analyzed for phosphorus, kjeldahl-nitrogen, total and volatile solids, total organic carbon (TOC), 13 metals, and organic chemicals.

Basic lake assessment information mentioned above was gathered by the ISWS and transferred onto lake assessment forms developed by the Illinois EPA. The completed forms were submitted to the Illinois EPA, and data were incorporated into the Waterbody System and the Comprehensive Lake Data Management System.

RESULTS AND DISCUSSION

Lake and Watershed Information

Lake assessment summaries and watershed information for the six lakes studied are individually shown in illustration A. Two pages of data are presented for each of the six lakes. For each lake, tables indicating the lake's general features, morphology, uses and impairments, water quality problems, causes of quality problems, and lake protection and management are provided. This section describes the information included in each lake summary.

In each summary, general information includes data on the lake's morphology (form), such as surface area, maximum and average depth, lake type, watershed (drainage basin) size, and other features. These features are important in determining how a lake will respond to nutrient or other pollutant loadings. For instance, deep lakes with comparatively small watersheds respond much more slowly to nutrient loadings than do shallow lakes with large watersheds.

Usages and impairments information includes whether public access is available, the annual number of visitors to the lake, types of recreational facilities and usages available and used, and shoreline and watershed land usage. Designated uses and impairments are also described, and warrant further discussion here.

Water quality problems and their causes are presented in each lake summary. The type and extent of problems are noted (e.g., sediment deposition, algal blooms, excessive weeds, etc.), fishing conditions, and major types of fish. The apparent causes and sources of pollution contributing to the problems are identified (e.g., agriculture, construction, nutrients, suspended solids, etc.). These causes and sources of pollution are identified based on knowledge of watershed land uses and activities, discussions with each lake's management personnel, and field observations made during the monitoring visit. By no means are these potential causes and sources meant to be conclusive or quantified; rather, they are meant to bring about an awareness of the particular activities in the lake and its watershed that could impair that lake.

Information concerning lake protection and management is provided for each lake, including the type and extent of best management practice (BMP) implementation in the watershed to protect the lake, and the specific reason for the treatment. Much of this information was gathered from local county Soil and Water Conservation Districts and USDA-SCS personnel.

Shoreline and Lake Area Survey

Shoreline erosion and surrounding lake uses at the six lakes were surveyed. Figures 2-7 show the results of the survey and the sampling stations.

Along both sides of shorelines of Georgetown Reservoir, almost all (98 percent) of the area is wooded. There is one boat ramp next to the water treatment plant near the dam (figure 2).

Homer Lake has nine parking areas around the lake in the Salt Fork River Forest Preserve area. There are also two privies, six trails, four boat ramps, one boat dock, one playground, one shelter house, one observation platform, and a visitor center (figure 3).

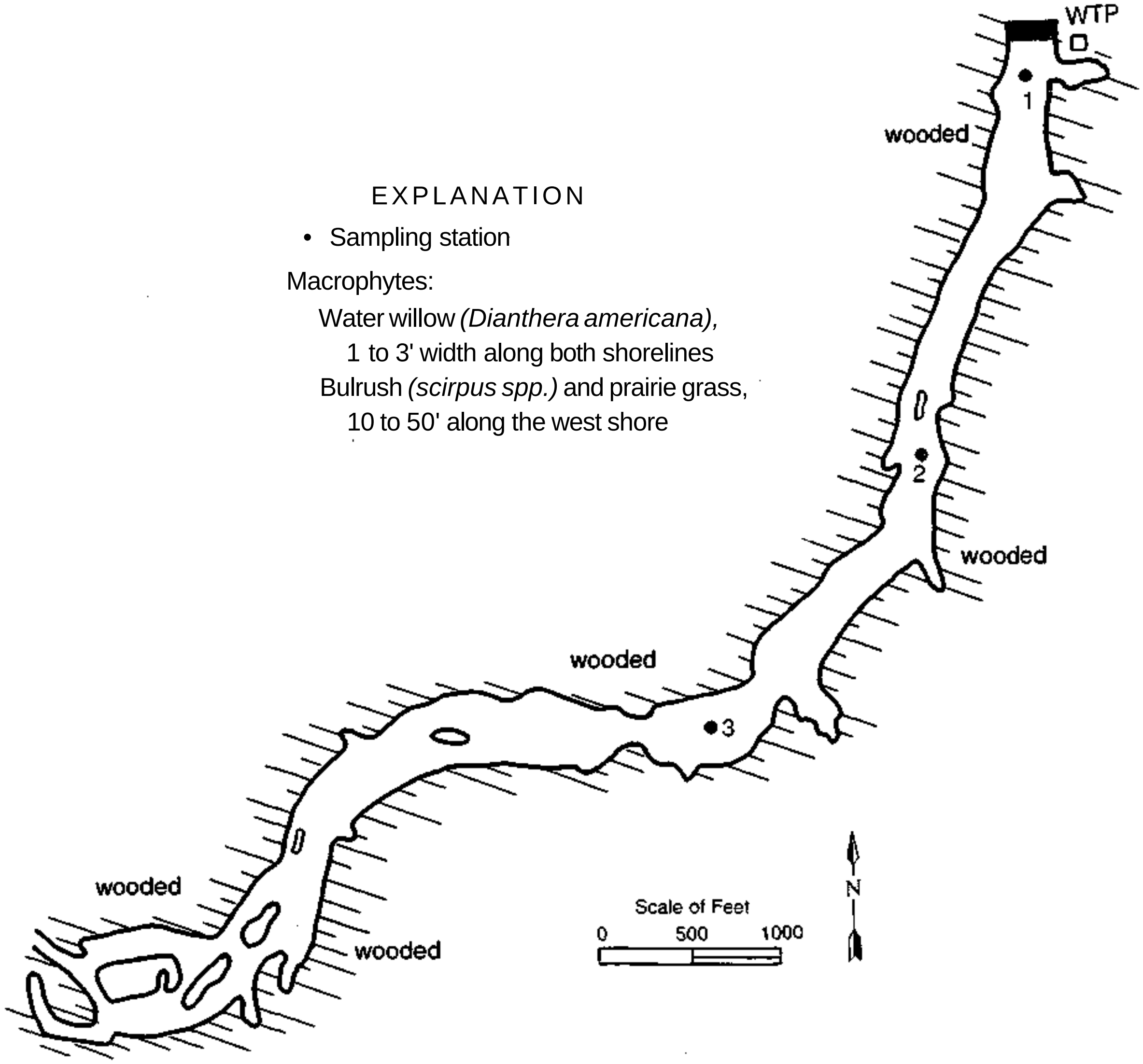

Figure 2. Sampling stations, macrophytes, and shoreline usage of Georgetown Reservoir

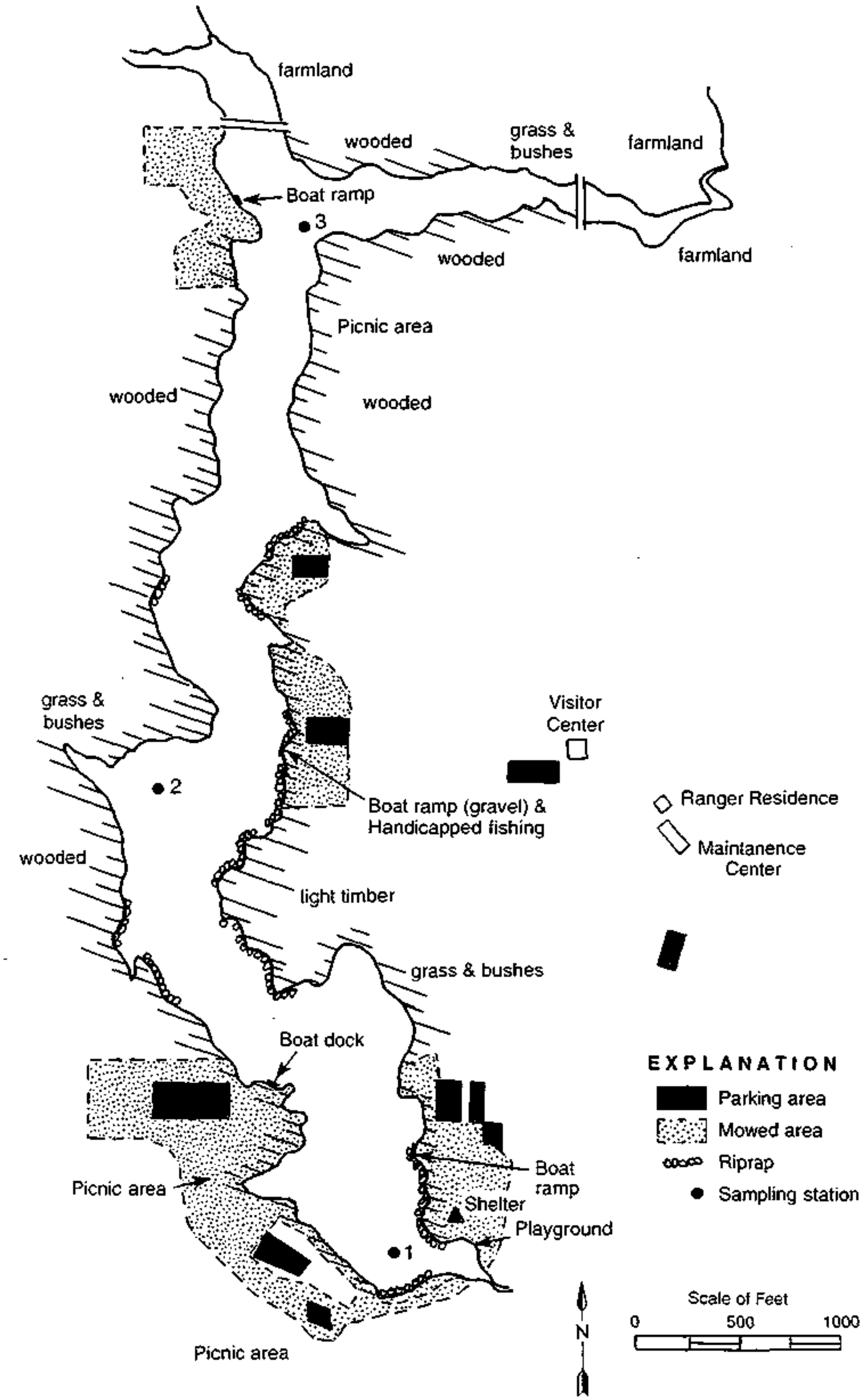

Figure 3. Shoreline and surrounding lake uses of Homer Lake

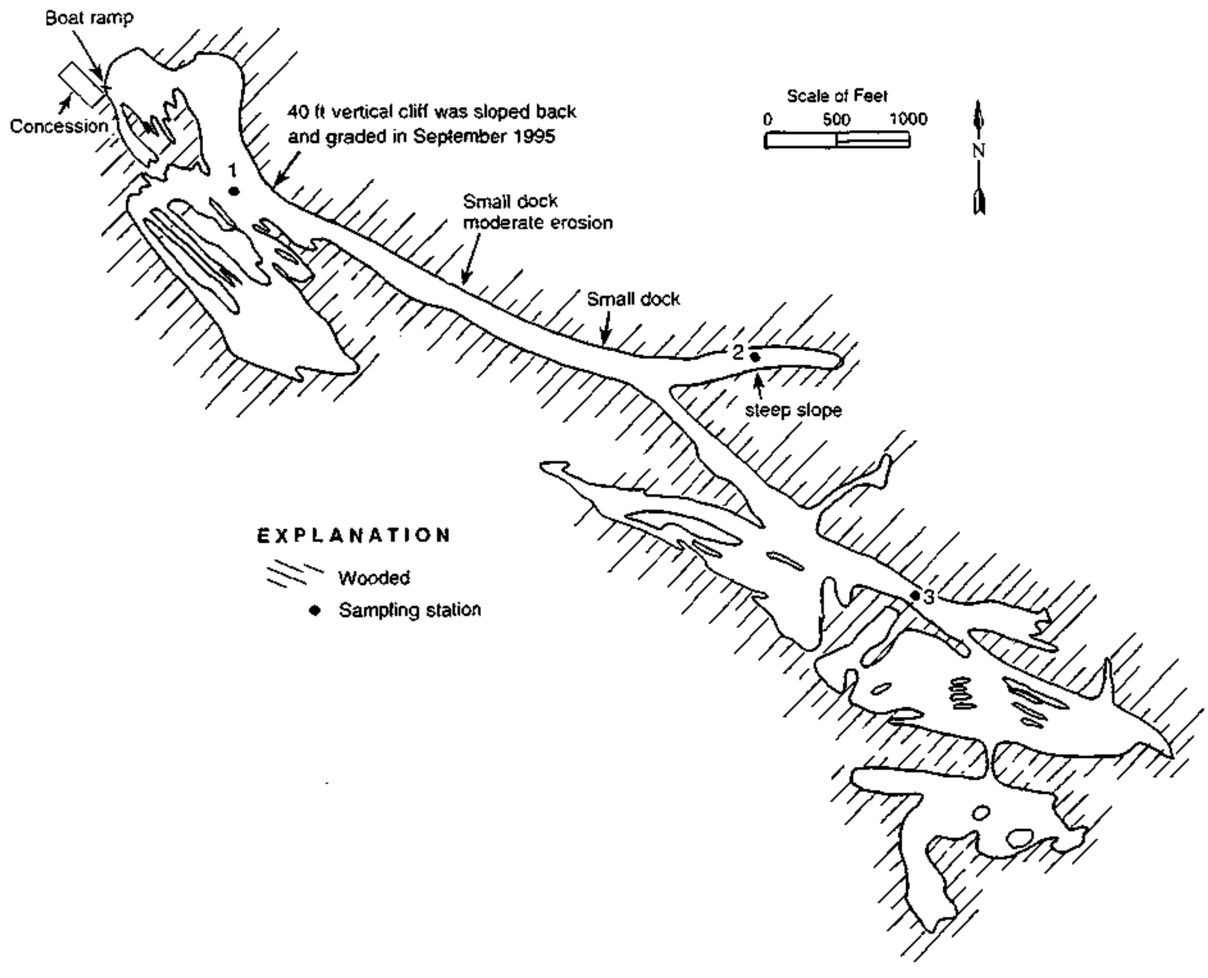

Figure 4. Shoreline erosion and surrounding lake uses of Long Lake

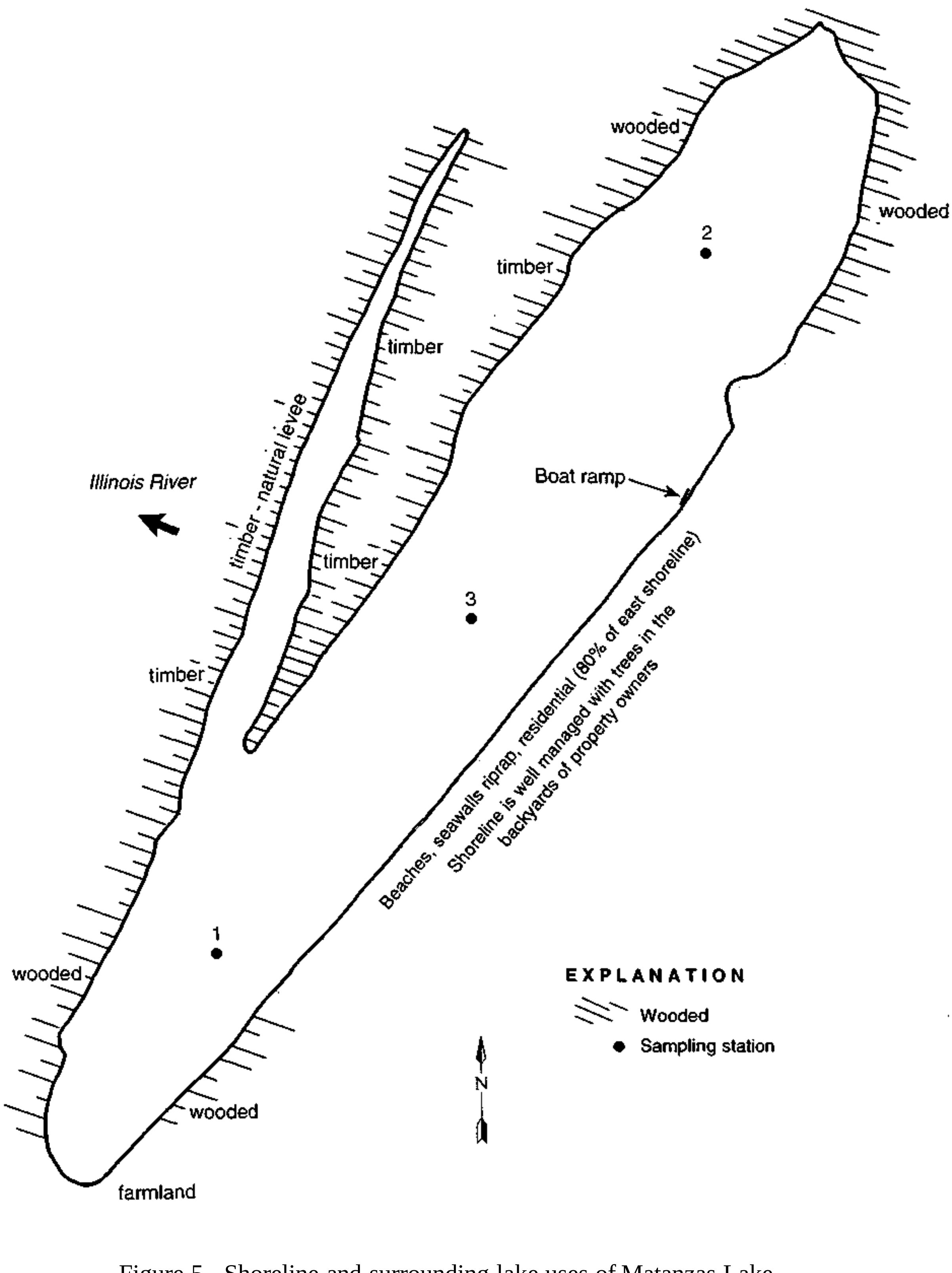

Figure 5. Shoreline and surrounding lake uses of Matanzas Lake

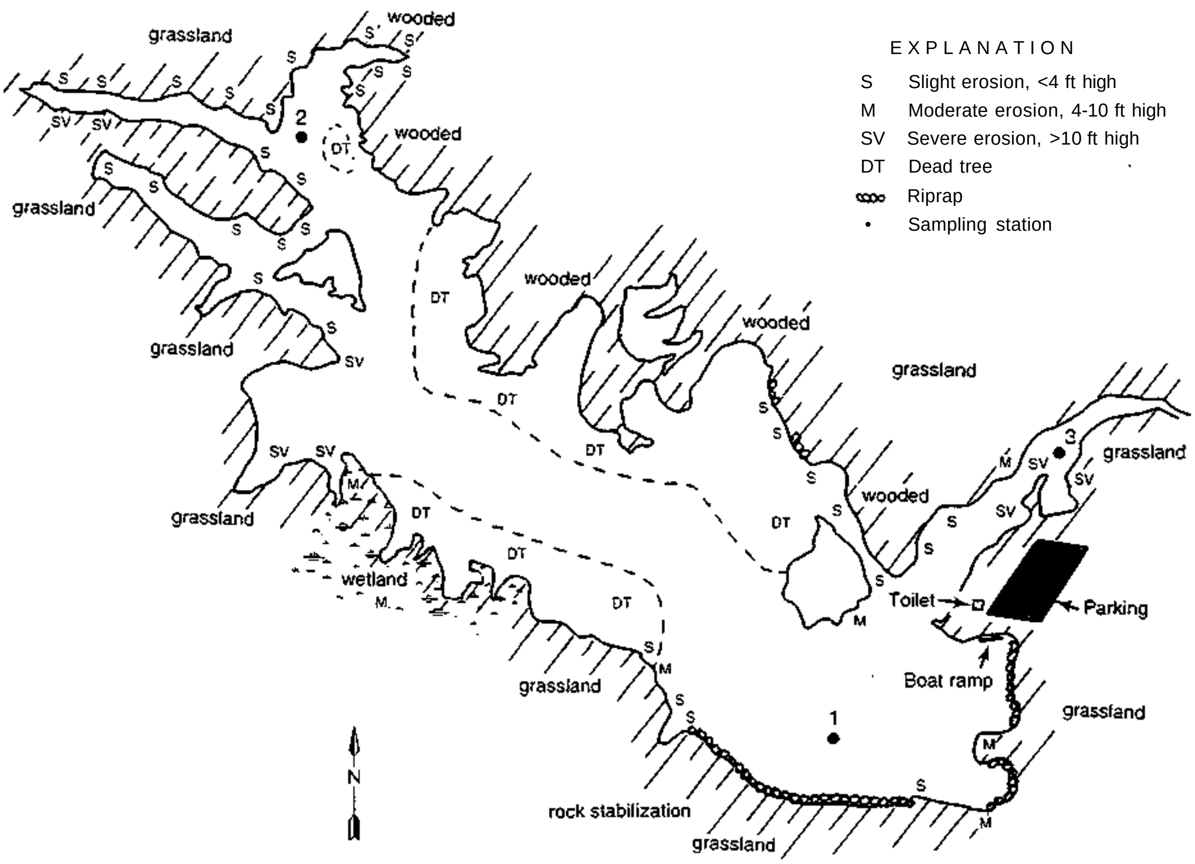

Figure 6. Shoreline erosion and surrounding lake uses of Snakeden Hollow Lake

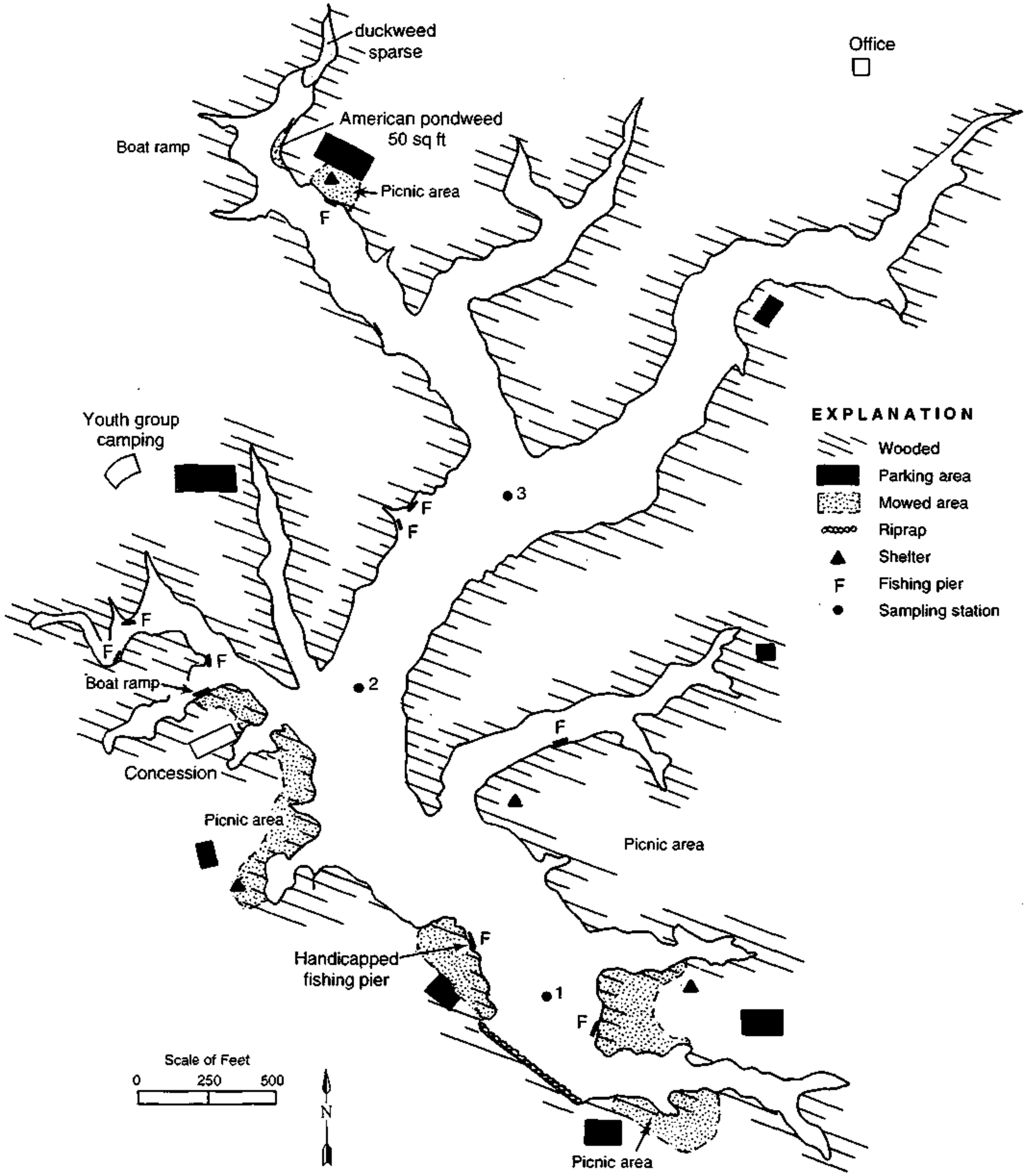

Figure 7. Shoreline and surrounding lake uses of Walnut Point Lake

Long Lake is one of the 22 lakes in Kickapoo State Park. There are two parking lots, one concession store, and one boat ramp at the northwest end of the lake (figure 4). Boat and canoe rental is available. Almost all of the lake shoreline (95 percent) has dense timber growth. The southeast end of the lake is wetland area. In addition, two wetland areas are located on the west side of the center and northwest of the lake. Moderate erosion occurs in some locations along the east bank. A 40-foot cliff near station 1 was sloped back and graded in September 1995 for safety purposes during the study period. The soil was pushed down to the lake during the grading operation .

Matanzas Lake is a backwater lake connected to the Illinois River. Its water level is mainly affected by the Illinois River and not by a small tributary (White Oak Creek). The west and north sides of the lake are wooded. Approximately 60 percent of the east side shoreline is residential with sandy beach. Farming is practiced in the southeast corner of the lake (figure 5).

Snakeden Hollow Lake is a relatively young and deep lake. Grassland and timber wooded areas surround the lake. Many dead tree stumps can be seen in the lake. One boat ramp, a parking lot, and a privy are located at the southeast end of the lake. Erosion problems occur at the west and east sides of the lake shorelines. Riprap had been installed at many locations (figure 6).

As shown in figure 7, Walnut Point Lake, a many-fingered lake, is stream fed and was formed by an earthen dam located on the south side of the lake. Most of the lake shoreline is wooded. Tables and outdoor stoves are in two wooded picnic areas bordering the lake. Firewood is not provided. Eight parking areas are near the picnic areas and boat launches. There are two boat ramps; two trails; two Class B camping areas with tables, stoves, electricity and sanitary dumping station; one Class D walk-in tent camping area; and a youth group camping area. Handicapped fishing piers are available. There is no shoreline erosion problem.

In-Lake Water Quality

The analytical results of water samples collected from the six lakes as well as the mean values are presented in appendices A-F. Water quality data provided include Secchi disk transparency, conductivity, nutrient, suspended solids, alkalinity, pH, COD, turbidity, and chlorophyll parameters. Site depths and sampling dates are also recorded. Table 1 presents the mean concentrations of the water quality parameters for near surface samples of station 1 and the mean of all the three stations of each lake studied.

Statistical analyses were performed with Duncan's multiple range analyses (Federer, 1955) to compare the mean concentrations of each water quality parameter among sampling stations in the lake. There were no differences in mean concentrations for three surface stations for each parameter in Georgetown Reservoir and Matanzas Lake. As shown in table 2, for Homer Lake, the mean pH values at stations 1S (surface) and 2 were significantly greater than at stations 3 and 1B (bottom).

For Long Lake, Snakeden Hollow Lake, and Walnut Point Lake, the mean pH values at stations 1S, 2, and 3 were significantly higher than at station 1B (table 2, note b). There were no statistical differences among these stations otherwise. On the other hand, the mean values for conductivity, total alkalinity, VSS, ammonia-N, TKN, and total and dissolved phosphorus of stations 1S, 2, and 3 were significantly less than that of station 1B for each of these three lakes (table 2, note c). For other parameters measured but not mentioned here, there was no significant difference in mean values of all four stations in

Table 1. Mean Surface Water Quality for Six Lakes Studied

Parameters	*Georgetown* † *1*	*1-3*	*Homer* *1*	*1-3*	*Lone* *1*	*1-3*	*Matanzas* *1*	*1-3*	*Snakeden-Hollow* *1*	*1-3*	*Walnut Point* *1*	*1-3*
Water depth, ft.	7.8	7.4	15.8	10.7	34.8	23.4	9.3	7.5	56.8	30.7	27.5	21.6
Secchi transparency, in.	16.0	16.3	35.4	30.7	113.8	98.8	15.4	14.1	214	149	54.4	49.9
Conductivity, umho/cm	562	567	478	497	1689	1736	479	485	1329	1323	338	347
pH	8.5	8.5	8.6	8.5	8.3	8.3	8.6	8.5	8.4	8.3	9.0	9.0
Alkalinity, mg/L as $CaCO_3$												
Phenolphthalein	5.2	5.6	10.0	5.7	4.2	3.9	5.0	4.9	1.4	1.1	14.2	16.3
Total	225	225	180	187	196	196	161	162	133	119	133	133
Suspended solids, mg/L												
Total	38.4	41.9	8.2	14.5	3.6	4.1	47.8	46.3	2.6	2.7	14.0	16.2
Volatile	8.4	11.5	3.6	4.4	1.2	1.1	11.6	10.9	1.0	1.2	7.6	9.7
Turbidity, NTU	4.5	4.7	4.3	5.2	4.0	3.8	6.0	6.0	3.8	4.2	6.1	6.3
Nitrogen, mg/L												
Ammonia	.092	.063	.050	.077	.078	.047	.040	.043	.092	.057	.076	.083
Nitrite/nitrate	5.21	5.25	3.71	3.72	.01	-	2.54	2.58	0.10	0.09	0.34	0.37
Total kjeldahl	0.90	1.14	0.68	0.73	0.32	0.42	1.14	1.02	0.43	0.38	1.32	1.35
Phosphorus, mg/L												
Total	.0964	.0872	.0376	.0485	.0066	.0081	.2100	.1991	.0048	.0079	.0764	.0796
Dissolved	.0266	.0221	.0076	.0097	.0016	.0020	.0894	.1046	.0016	.0019	.0200	.0235
Pigments, μg/L												
Chlorophyll *a**	35.07	39.82	31.21	29.20	3.45	4.88	72.58	66.65	3.42	6.14	114.85	102.37
Chlorophyll *a***	39.30	45.32	31.99	30.90	3.86	5.49	69.79	68.79	3.74	6.43	107.55	96.98
Chlorophyll *b*	12.07	15.03	5.71	6.34	1.83	2.69	23.44	19.08	1.14	2.20	5.81	5.48
Chlorophyll c	16.18	16.59	8.11	8.81	2.60	2.81	28.26	21.28	1.79	2.36	5.24	5.01
Pheophytin *a*	6.59	8.47	1.97	3.04	0.79	1.18	17.46	10.48	1.33	1.01	0.33	0.62
Sample depth, ft.	2.7	2.8	6.0	5.1	19.0	15.4	2.6	2.4	34.4	21.8	8.5	7.0

Notes:
*Corrected value.
**Uncorrected value.
†For each lake the first list of parameters is for station 1 and the second list is the average for stations 1-3.

Table 2. Results of Statistical Analyses for Mean Values at Four Stations for Four Lakes

Parameters	*Homer Lake*	*Long Lake*	*Snakeden Hollow Lake*	*Walnut Point Lake*
Conductivity			c	
pH	a	**b**	b	b
Total alkalinity		c	c	c
Total suspended solids		c		
Volatile suspended solids			c	
Ammonia-N		c	c	c
Total kjeldahl-N		c		**c**
Total phosphorus		c	c	c
Dissolved phosphorus		c	c	c

Notes: stations 1S, 2 and 3 represent surface waters, and station 1B represents the lake bottom.

Values at stations 1S and 2 are significantly greater than at stations 3 and 1B.

Values at stations 1S, 2, and 3 are significantly greater than at station 1B, and no differences among stations 1, 2, and 3.

Values at stations 1S, 2, and 3 are significantly less than at station 1B, and no differences among stations 1, 2, and 3.

each of these lakes. The average values of water quality characteristics for the three surface stations will be used for discussion later.

Temperature and Dissolved Oxygen

Lakes in the temperate zone generally undergo seasonal variations in temperature throughout the water column. These variations, with their accompanying phenomena, are perhaps the most influential controlling factors within the lakes.

The temperature of a deep lake in the temperate zone is about 4°C during early spring. As air temperatures rise, the upper layers of water warm up and are mixed with the lower layers by wind action. Spring turnover is complete mixing of a lake in the spring when the water temperature is uniform from top to bottom. By late spring, differences in thermal resistance cause the mixing to cease, and the lake approaches the thermal stratification of the summer season. Almost as important as water temperature variations is the physical phenomenon of increasing density with decreasing temperature. These two interrelated forces are capable of creating strata of water of vastly different characteristics within the lake.

During thermal stratification, the upper layer (epilimnion) is isolated from the lower layer of water (hypolimnion) by a temperature gradient (thermocline). Temperatures in the epilimnion and hypolimnion are essentially uniform. The thermocline will typically have a sharp temperature drop per unit depth from the upper to the lower margin. When thermal stratification is established, the lake enters the summer stagnation period, so named because the hypolimnion becomes stagnated.

With cooler air temperatures during the fall season, the temperature of the epilimnion decreases and density of the water increases. This decrease in temperature continues until the epilimnion is the same temperature as the upper margin of the thermocline. Successive cooling through the thermocline to the hypolimnion results in a uniform temperature throughout the water column. The lake then enters the fall circulation period (fall turnover) and is again subjected to a complete mixing by the wind.

Declining air temperatures and the formation of ice cover during the winter produce a slightly inverse thermal stratification. The water column is essentially uniform in temperature at about 3 to 4°C, but slightly colder temperatures of 0 to 2°C prevail just below the ice. With the advent of spring and gradually rising air temperatures, the ice begins to disappear, and the temperature of the surface water rises. The lake again becomes uniform in temperature, and spring circulation occurs (spring turnover).

The most important phase of the thermal regime from the standpoint of eutrophication is the summer stagnation period. The hypolimnion, by virtue of its stagnation, traps sediment materials such as decaying plant and animal matter, thus decreasing the availability of nutrients during the critical growing season. In a eutrophic lake, the hypolimnion becomes anaerobic or devoid of oxygen because of the increased content of highly oxidizable material and because of its isolation from the atmosphere. In the absence of oxygen, the conditions for chemical reduction become favorable, and more nutrients are released from the bottom sediments to the overlying waters.

However, during the fall circulation period, the lake water becomes mixed, and the nutrient-rich hypolimnetic waters are redistributed. The nutrients that remained trapped during the stagnation period become available during the following growing season. Therefore, a continuous supply of plant nutrients from the drainage basin is not mandatory for sustained plant production. After an initial stimulus, the recycling of nutrients within a lake might be sufficient to sustain highly productive conditions for several years.

Impoundment of running water alters its physical, chemical, and biological characteristics. The literature is replete with detailed reports on the effects of impoundments on various water quality parameters. The physical changes in the configuration of the water mass following impoundment reduce reaeration rates to a small fraction of those of free-flowing streams. Where the depth of impoundment is considerable, thermal stratification acts as an effective barrier for the wind-induced mixing of the hypolimnetic zone. Oxygen transfer to the deep waters is essentially confined to the molecular diffusion transport mechanism.

During the period of summer stagnation and increasing water temperatures, the bacterial decomposition of the bottom organic sediments exerts a high rate of oxygen demand on the overlying waters. When this rate of oxygen demand exceeds oxygen replenishment by molecular diffusion, anaerobic conditions begin to prevail in the zones adjacent to the lake bottom. Hypolimnetic zones of man-made impoundments have been found to be anaerobic within a year of their formation.

Tables 3-8 provide the temperature and dissolved oxygen (DO) data collected during this investigation for Georgetown Reservoir, Homer Lake, Long Lake, Matanzas Lake, Snakeden Hollow Lake, and Walnut Point Lake, respectively. Figure 8 is the temperature and DO profiles for the deep stations (station 1) at these lakes.

The surface and near surface values observed in the lakes met the Illinois Pollution Control Board's general use standards with respect to minimum level: not less than 5.0 milligrams per liter (mg/L) at any time. Georgetown Reservoir, an in-channel impoundment and the only water supply reservoir included in this survey, met the criteria at all depths except for one observation very near the mud-water interface on June 16, 1995. Being an in-channel impoundment and shallow, the reservoir remained isothermal throughout. Matanzas Lake, a backwater lake off of the Illinois River had similar characteristics, being shallow and isothermal. However, the lake exhibited greater oxygen depletion during July and August at depths below 4 feet from the surface.

With a maximum depth of 16 feet, Homer Lake is deeper than the aforementioned two lakes and exhibited severe oxygen depletion at depths below 8 feet from the surface during June, July, and August. Generally, there were temperature gradients at depths below 8 feet without the typical hypolimnetic zones. The three deep lakes included in the investigation, Long Lake, Snakeden Hollow Lake, and Walnut Point Lake, typically exhibited the three characteristics of summer stratification. Walnut Point Lake experienced the most severe depletion of DO with practically no oxygen below 5 feet from the surface, and anoxic conditions prevailed in Long Lake at depths below 20 feet and in Snakeden Hollow Lake below 30 feet. The latter two lakes also showed anoxic conditions in the near bottom waters during October lake monitoring.

Percent DO saturation values are determined for the observed DO and temperature and are given in appendix G. Saturation DO values were computed using the formula (Committee on Sanitary Engineering Research, 1960):

$$DO = 14.652 - 0.410022T + 0.0079910T^2 - 0.000077774T^3$$

where

DO = the saturation dissolved oxygen, mg/L

Table 3. Dissolved Oxygen and Temperature Observations in Georgetown Reservoir

Depth, feet	*4/26/95*		*6/16/95*		*7/20/95*		*8/29/95*		*10/5/95*	
	Temp	*DO*	*Temp*	*DO*	*Temp*	*DO*	*Temp*	*DO*	*Temp*	*DO*
Station 1										
0	12.8	7.1	22.3	7.8	24.6	8.7	29.3	14.5	17.4	7.5
1	12.8	7.0	22.2	7.7	24.6	8.7	29.0	13.1	17.4	7.5
2	12.8	7.0	22.1	7.8	27.2	8.5	28.7	11.3	17.4	7.4
3	12.8	6.9	21.9	7.8	27.2	8.4	28.3	10.1	17.4	7.5
4	12.8	6.9	21.7	7.8	27.2	8.3	28.1	9.4	17.4	7.6
5	12.8	6.9	20.7	7.5	27.1	8.3	27.9	8.9	17.4	7.5
6	12.8	6.9	20.1	7.3	27.1	8.1				
7	12.8	6.9	18.7	5.3	27.1	8.0				
8			17.4	4.8						
Station 2										
0	13.0	7.3	21.2	7.8	27.1	8.8	30.7	16.4	18.1	7.5
1	13.0	7.3	21.1	7.8	27.1	8.8	29.4	16.8	18.2	6.9
2	13.0	7.3	20.7	7.8	27.1	8.8	28.7	12.6	18.1	6.6
3	13.0	7.3	20.3	7.7	27.1	8.7	27.9	10.7	18.0	6.9
4	13.0	7.3	19.9	7.7	27.1	8.7	27.7	9.9	17.9	7.1
5	13.0	7.3	19.8	7.6	27.1	8.5	27.6	8.2	17.9	7.2
6	13.0	7.3	19.7	7.5	27.0	7.7	27.5	7.2	17.9	7.3
7	13.0	7.3	17.7	6.3	26.9	7.3	27.4	5.3	17.9	7.2
8	13.0	7.3	17.1	5.6	26.8	6.1	27.2	3.2	17.9	7.0
9	12.9	7.2	16.5	4.4	26.6	5.5			17.9	6.7
Station 3										
0	12.3	7.6	20.5	7.8	26.2	10.1	31.6	17.9	17.8	8.0
1	12.3	7.6	20.5	7.7	26.2	10.3	31.4	19.2	17.9	8.2
2	12.3	7.7	20.3	7.7	26.2	10.4	28.4	11.8	17.8	8.1
3	12.3	7.7	20.2	7.7	26.2	10.4	28.2	10.7	17.7	7.9
4	12.3	7.7	19.8	7.7	26.1	9.8	27.7	8.1	17.6	7.8
5	12.7	7.7	19.7	7.6	26.0	9.3	27.4	6.5	17.6	7.6
6	12.7	7.7	19.1	5.5			27.4	5.4		

Notes:
Temp = temperature in degrees Celsius.
DO = dissolved oxygen in mg/L.

Table 4. Dissolved Oxygen and Temperature Observations in Homer Lake

Depth, feet	*4/24/95*		*6/14/95*		*7/18/95*		*8/30/95*		*10/6/95*	
	Temp	*DO*	*Temp*	*DO*	*Temp*	*DO*	*Temp*	*DO*	*Temp*	*DO*
Station 1										
0	12.7	8.4	23.1	10.7	27.7	9.7	28.4	10.2	18.2	7.7
1	12.7	8.5	23.0	10.9	27.8	10.1	28.4	10.1	18.2	7.7
2	12.7	8.5	22.8	10.9	27.8	10.2	28.4	10.1	18.2	7.7
3	12.7	8.5	22.6	11.1	27.8	10.3	28.4	10.1	18.3	7.7
4	12.6	8.5	22.6	11.1	27.8	10.3	28.3	8.3	18.3	7.7
5	12.6	8.5	22.5	11.2	27.7	9.7	28.1	7.3	18.3	7.7
6	12.6	8.5	22.5	11..2	27.7	10.8	27.7	5.1	18.3	7.9
7	12.6	8.5	22.5	11.1	27.7	9.3	27.6	3.6	18.3	7.6
8	12.6	8.5	19.0	12.3	27.7	9.5	27.2	2.9	18.2	7.4
9	12.6	8.5	16.0	9.1	27.4	7.5	26.3	2.0	18.2	7.1
10	12.2	7.7	14.3	5.8	27.3	3.7	25.5	0.2	18.1	6.8
11	11.5	6.8	13.3	1.9	24.0	2.3	24.2	0.2	18.1	6.5
12	10.9	7.6	13.0	1.0	21.9	1.0	21.8	0.2	18.0	6.2
13	10.8	8.2	12.6	0.8	18.5	0.2	20.5	0.2	17.9	5.0
14	10.7	8.3	12.4	0.5	16.4	0.2	19.2	0.1	17.8	3.9
15	10.7	8.4	12.0	0.4	15.1	0.2	17.7	0.1	17.3	2.3
16	10.6	8.4	11.9	0.4	14.3	0.2	16.7	0.1		
Station 2										
0	13.0	8.8	23.0	10.7	27.8	9.3	28.5	9.2	18.4	6.4
1	12.8	9.1	22.8	10.8	27.8	9.3	28.6	10.2	18.4	6.4
2	12.8	9.0	22.8	10.8	27.8	9.4	28.5	9.0	18.4	6.5
3	12.7	9.1	22.7	10.8	27.8	9.5	28.5	9.8	18.4	6.5
4	12.4	9.1	21.9	10.7	27.7	9.2	28.4	8.8	18.4	6.3
5	12.2	9.1	21.4	10.7	27.6	9.0	28.3	6.8	18.4	6.3
6	12.0	8.9	20.9	10.8	27.6	8.9	28.0	4.7	18.4	6.3
7	11.9	8.3	20.1	10.3	27.6	8.8	27.8	2.4	18.4	6.3
8	11.6	8.3	18.9	9.9	27.6	8.7	27.5	1.9	18.4	6.1
9	11.4	8.3	16.7	6.4	26.8	3.6	26.6	0.8	18.4	4.7
10	11.3	8.3	15.4	3.0	25.5	0.8	25.3	0.8	18.4	4.4
11	10.6	9.4	14.5	0.6	23.1	0.4			18.4	2.6
12	10.2	9.7	14.0	0.6						
Station 3										
0	12.4	10.2	23.2	11.6	27.0	5.2	28.5	3.9	17.4	4.9
1	12.5	10.3	23.0	11.9	26.9	5.2	28.5	4.4	17.5	5.1
2	12.4	10.3	21.5	12.8	26.7	5.3	28.5	4.0	17.5	5.1
3	11.3	9.2	20.8	10.7	26.5	5.3	28.0	2.1	17.5	5.1
4	10.8	8.3	19.9	8.3	26.3	4.7	27.8	0.8	17.4	4.7
5	10.6	7.8	19.4	7.6	25.8	4.8	27.7	0.6	17.3	4.0
6	10.5	7.8								

Notes:
Temp = temperature in degrees Celsius.
DO = dissolved oxygen in mg/L.

Table 5. Dissolved Oxygen and Temperature Observations in Long Lake

Depth,	*4/26/95*		*6/15/95*		*7/18/95*		*8/29/95*		*10/5/95*	
feet	*Temp*	*DO*	*Temp*	*DO*	*Temp*	*DO*	*Temp*	*DO*	*Temp*	*DO*
Station 1										
0	13.4	8.3	23.8	8.2	28.9	7.8	28.8	6.6	19.1	7.9
2	13.4	8.0	23.7	8.7	28.9	7.8	28.8	6.5	19.1	7.9
4	13.3	7.9	23.7	9.1	28.8	7.9	28.8	6.5	19.2	**8.2**
6	13.3	7.5	23.5	9.0	28.9	7.9	28.9	6.5	19.2	8.3
8	13.3	7.5	23.4	9.0	28.5	7.5	28.9	6.4	19.2	8.3
10	13.3	7.4	22.4	9.1	26.9	8.2	28.8	5.5	19.2	8.4
12	13.3	7.4	20.4	9.3	25.1	8.3	28.2	4.5	19.1	8.4
14	13.3	7.3	18.3	9.2	23.5	8.2	27.1	3.4	19.0	7.9
16	11.5	7.3	16.1	8.4	21.4	8.7	25.0	1.9	18.9	7.3
18	10.4	7.2	14.1	6.3	19.2	8.1	22.2	1.0	18.7	5.8
20	8.9	6.0	12.8	5.4	16.8	6.7	19.6	0.5	18.6	4.7
22	8.0	5.7	11.2	4.6	14.4	4.6	16.6	0.2	18.3	3.3
24	7.4	4.8	10.4	3.2	12.1	2.0	14.5	0.2	18.2	2.6
26	7.2	4.3	9.6	2.2	10.4	0.5	12.7	0.2	18.1	2.0
28	6.8	3.3	9.0	1.4	9.7	0.4	11.4	0.2	17.9	1.4
30	6.6	1.7	8.4	0.7	9.0	0.4	10.4	0.2	17.8	0.9
32			7.9	0.4	8.6	0.3	9.6	0.2		
34			7.7	0.3	8.2	0.3	9.3	0.2		
36			7.7	0.3	7.8	0.3	8.7	0.2		
38					7.7	0.3	8.4	0.2		
Station 2										
0	13.7	7.3	23.9	8.0	29.3	7.7	29.1	5.8	18.8	7.4
2	13.7	7.3	23.9	8.0	29.3	7.8	29.1	5.8	18.8	7.7
4	13.7	7.3	23.7	8.0	29.3	7.8	29.1	5.7	18.8	7.7
6	13.4	7.3	23.6	8.0	29.3	7.7	29.0	5.7	18.8	7.8
8	13.1	7.4	23.4	8.1	29.1	7.3	29.0	5.5	18.8	7.8
10	12.9	7.3	22.4	7.9	27.2	7.3	28.8	4.2	18.8	7.9
12	12.7	7.2	20.2	7.0	25.4	7.0	28.1	1.5	18.8	7.9
14	12.4	7.0	18.1	5.0	23.4	6.3	27.3	0.2	18.8	7.9
16	11.5	6.3	16.0	3.0	21.6	4.8	25.3	0.2	18.8	7.8
18	10.0	5.6	14.0	1.6	19.0	0.9	22.6	0.2	18.8	7.8
20	8.9	4.5	13.1	0.3	16.3	0.3	19.3	0.2	18.7	4.9
22	8.1	2.5			14.1	0.3	16.4	0.2	18.3	2.9
24	7.7	0.9					15.0	0.2	17.7	0.9

Table 5. Concluded

Depth, feet	*4/26/95*		*6/15/95*		*7/18/95*		*8/29/95*		*10/5/95*	
	Temp	*DO*	*Temp*	*DO*	*Temp*	*DO*	*Temp*	*DO*	*Temp*	*DO*
Station 3										
0	13.7	7.2	24.2	9.0	29.5	8.0	29.1	6.2	18.7	7.5
2	13.7	7.2	23.1	9.0	29.4	8.1	29.1	6.2	18.7	7.8
4	13.5	7.2	23.6	9.2	29.4	8.2	29.1	6.3	18.7	7.9
6	13.0	7.1	23.5	8.9	29.4	8.3	29.0	6.0	18.7	7.9
8	12.6	6.9	23.3	8.7	29.0	7.7	29.0	5.6	18.7	7.9
10	12.5	6.8	22.1	7.3	27.9	4.4	28.8	2.5	18.7	7.9
12	12.3	6.0	19.8	2.6	26.2	0.2	28.2	0.2	18.7	7.9
14							27.1	0.2	18.7	7.5

Notes:
Temp = temperature in degrees Celsius.
DO = dissolved oxygen in mg/L.

Table 6. Dissolved Oxygen and Temperature Observations in Long Lake

Depth,	*4/26/95*		*6/15/95*		*7/18/95*		*8/29/95*		*10/5/95*	
feet	*Temp*	*DO*	*Temp*	*DO*	*Temp*	*DO*	*Temp*	*DO*	*Temp*	*DO*
Station 1										
0	12.g	10.7	22.1	8.6	29.6	7.1	32.2	12.5	20.6	11.2
1	12.g	10.7	22.0	8.7	29.5	6.g	32.0	12.6	20.6	11.3
2	12.g	10.7	21.9	8.7	29.4	6.4	31.2	11.4	20.6	11.2
3	12.7	10.7	21.7	8.6	29.2	4.9	30.4	9.2	20.6	11.1
4	12.7	10.7	21.5	8.3	28.g	4.2	30.1	6.4	20.6	11.1
5	12.7	10.7	21.5	8.3	2g.6	3.6	29.5	5.0	20.5	10.6
6	12.6	10.7	21.5	8.3	28.3	3.1	29.2	4.g	20.0	8.6
7	12.6	10.5	21.5	8.3			29.2	4.7	19.6	8.1
8	12.6	10.5	21.5	8.2						
9	12.6	10.5	21.4	8.2						
10	12.5	10.4	21.4	8.2						
11	12.0	9.7	21.2	7.6						
12	11.6	9.1	21.1	7.6						
13			21.0	7.5						
14			21.0	7.4						
15			21.0	7.4						
Station 2										
0	12.9	10.7	22.g	9.6	29.6	7.1	32.2	12.5	20.6	11.2
1	12.9	10.7	22.g	9.6	29.5	6.g	32.0	12.6	20.6	11.3
2	12.9	10.7	22.g	9.6	29.4	6.4	31.2	11.4	20.6	11.2
3	12.9	10.7	21.7	8.4	29.2	4.9	30.4	9.2	20.6	11.1
4	12.9	10.7	21.4	8.2	28.8	4.2	30.1	6.4	20.6	11.1
5	12.9	10.7	21.3	8.2	28.6	3.6	29.5	5.0	20.5	10.6
6	12.9	10.6	21.3	8.1	28.3	3.1	29.2	4.g	20.0	8.6
7	12.9	10.6	21.2	8.1			29.2	4.7	19.6	8.1
8	12.9	10.6	21.2	8.1						
9	12.g	10.0	21.2	8.1						
10			21.2	8.1						
11			2.12	8.0						
12			21.1	8.0						

Table 6. Concluded

Depth, feet	*4/26/95*		*6/15/95*		*7/18/95*		*8/29/95*		*10/5/95*	
	Temp	*DO*	*Temp*	*DO*	*Temp*	*DO*	*Temp*	*DO*	*Temp*	*DO*
Station 3										
0	12.7	10.0	22.0	8.1	29.9	6.1	32.0	13.5	21.1	12.0
1	12.7	10.0	22.0	8.0	29.9	6.2	32.0	13.5	21.2	11.9
2	12.7	10.0	21.7	7.8	29.8	5.8	31.8	13.5	20.2	10.8
3	12.7	10.0	21.3	7.4	27.7	3.5	31.6	12.8	19.5	9.6
4	12.7	10.0	21.3	7.5	27.5	3.2	30.8	10.2	19.0	8.1
5	12.6	10.0	21.2	7.4						
6	11.8	9.3	21.2	7.3						
7	11.7	9.3	21.2	7.3						
8	11.8	9.2	21.1	7.2						
9	11.8	9.1	21.1	7.1						
10			21.1	7.1						
11			21.1	7.0						
12			21.0	7.0						

Notes:
Temp = temperature in degrees Celsius.
DO = dissolved oxygen in mg/L.

Table 7. Dissolved Oxygen and Temperature Observations in Snakeden Hollow Lake

Depth,	*4/24/95*		*6/12/95*		*7/12/95*		*8/21/95*		*10/3/95*	
feet	*Temp*	*DO*	*Temp*	*DO*	*Temp*	*DO*	*Temp*	*DO*	*Temp*	*DO*
Station 1										
0	9.7	11.1	20.6	10.0	27.0	8.9	29.0	7.7	18.3	9.2
2	9.7	11.1	20.6	10.0	26.9	9.1	28.9	7.7	18.3	9.5
4	9.7	11.1	20.6	10.0	26.0	9.8	29.0	7.7	18.3	9.7
6	9.6	11.0	20.6	10.1	25.6	9.7	29.0	7.7	18.3	9.7
8	9.5	11.1	20.6	10.1	25.2	9.6	29.0	7.7	18.3	9.7
10	9.4	11.1	20.5	10.1	24.7	9.5	29.0	7.7	18.3	9.7
12	9.4	11.0	20.5	10.1	24.2	9.1	28.9	7.7	18.3	9.6
14	9.4	11.0	20.5	10.1	23.7	8.6	28.9	7.7	18.2	9.6
16	9.4	11.0	17.9	10.5	22.7	7.7	27.4	7.1	18.1	9.5
18	9.3	11.0	17.2	10.4	21.0	6.9	24.6	5.2	18.0	9.5
20	9.2	11.0	16.6	9.2	18.2	5.9	22.1	5.2	18.0	9.2
22	9.2	10.9	15.1	9.2	16.5	6.1	19.8	5.4	17.8	9.3
24	9.1	10.9	14.2	9.2	15.3	6.1	17.7	5.4	17.7	8.6
26	9.1	10.9	13.0	9.7	13.9	6.8	15.8	5.6	17.3	7.8
28	9.1	10.9	12.4	9.8	13.1	7.5	14.7	5.7	16.7	5.9
30	9.0	10.9	11.4	10.0	12.2	7.8	13.6	5.9	16.0	4.3
32	9.0	10.9	11.0	10.0	11.6	8.0	12.7	6.1	14.7	1.7
34	8.9	10.8	10.6	10.1	11.1	7.4	11.9	5.4	13.0	1.1
36	8.8	10.7	10.3	9.9	10.6	7.3	11.1	3.9	12.0	0.9
38	8.8	10.7	10.0	9.5	10.1	7.0	10.4	2.9	11.1	0.9
40	8.6	10.7	9.6	7.8	9.8	6.1	10.0	2.1	10.5	0.9
42	8.4	10.7	9.1	8.1	9.4	5.9	9.2	2.0	9.7	1.0
44	7.8	10.6	8.7	8.2	8.9	5.6	9.0	1.6	9.1	1.0
46	7.8	10.6	8.1	7.6	8.2	5.1	8.4	0.8	8.7	1.0
48	7.1	10.5	7.6	7.3	7.9	4.3	7.9	0.4	8.2	1.0
Station 2										
0	9.4	11.2	20.4	10.7	27.7	9.6	28.6	7.3	18.5	9.2
2	9.4	11.3	20.4	10.7	27.7	9.6	28.7	7.2	18.5	9.4
4	9.4	11.3	20.4	10.7	27.6	9.6	28.7	7.3	18.4	9.5
6	9.4	11.3	20.4	10.7	27.5	9.8	28.7	7.2	18.3	9.7
8	9.3	11.2	20.3	8.8	27.5	9.8	28.6	6.9	18.2	9.7
10	8.9	11.2	19.8	10.2	27.5	6.5	28.5	6.5	18.2	8.4
12			18.3	10.8			28.4	4.3		

Table 7. Concluded

Depth, feet	*4/24/95*		*6/12/95*		*7/12/95*		*8/21/95*		*10/3/95*	
	Temp	*DO*	*Temp*	*DO*	*Temp*	*DO*	*Temp*	*DO*	*Temp*	*DO*
Station 3										
0	9.6	12.1	20.6	11.3	28.4	9.5	28.9	7.4	18.5	9.5
2	9.6	12.2	20.6	11.3	27.1	9.1	28.9	7.4	18.5	9.7
4	9.4	12.2	20.4	11.3	27.1	7.8	28.8	7.4	18.5	10.0
6	9.4	12.0	20.1	10.5	26.0	9.4	28.8	7.3	18.3	9.9
8	9.2	11.8	19.8	9.5	24.5	10.4	28.6	6.9	18.1	10.2
10	9.1	11.8	19.0	9.2	22.7	5.8	28.3	5.3	17.6	11.5
12	8.9	11.7	16.3	10.4	20.3	2.1	26.1	3.9	16.9	9.8
14	8.4	11.3	14.4	10.9	16.7	0.4	22.9	2.4	16.1	7.8
16			12.8	10.2	14.6	0.3	18.9	2.0	16.0	6.1
18			11.8	9.5	13.1	0.3	15.8	0.7	15.5	2.7
20			11.2	8.7	12.1	0.3	13.7	0.3	15.2	1.0
22			10.7	6.4	11.6	0.3	12.3	0.3	14.6	0.7
24			10.5	3.8	10.9	0.3	11.1	0.3	13.4	0.7

Notes:
Temp = temperature in degrees Celsius.
DO = dissolved oxygen in mg/L.

Table 8. Dissolved Oxygen and Temperature Observations in Walnut Point Lake

Depth,	*4/25/95*		*6/15/95*		*7/19/95*		*8/28/95*		*10/4/95*	
feet	*Temp*	*DO*	*Temp*	*DO*	*Temp*	*DO*	*Temp*	*DO*	*Temp*	*DO*
Station 1										
0	14.8	7.9	24.9	8.5	30.4	13.5	29.3	12.3	19.0	14.0
2	14.8	7.9	23.6	8.8	28.5	14.9	27.8	12.3	18.7	14.7
4	14.1	7.7	22.1	5.3	27.7	12.9	26.9	3.5	18.2	13.1
6	13.7	7.6	22.3	2.9	26.8	1.0	25.9	0.4	18.1	11.9
8	13.2	5.8	20.1	1.0	23.9	1.0	23.1	0.3	18.1	11.9
10	12.1	2.7	18.3	0.3	20.7	0.4	20.8	0.3	17.7	0.5
12	11.4	1.2	16.7	0.2	17.7	0.4	18.2	0.3	16.7	0.3
14	10.3	0.9	14.2	0.1	14.6	0.4	14.9	0.3	15.7	0.3
16	8.0	0.6	13.0	0.1	12.9	0.4	13.3	0.3	14.6	0.3
18	7.5	0.6	11.8	0.1	11.6	0.5	12.3	0.3	13.4	0.3
20	7.2	0.5	10.5	0.1	10.6	0.5	11.0	0.3	11.6	0.3
22	6.8	0.3	9.1	0.1	9.7	0.5	10.3	0.3	10.7	0.3
24	6.6	0.2	8.3	0.1	9.0	0.4	9.5	0.3	10.2	0.3
26	6.2	0.1	7.9	0.1	8.3	0.4	8.9	0.3	9.6	0.3
28	6.1	0.1	7.6	0.1	8.0	0.4	8.6	0.3	8.9	0.3
30	6.0	0.1								
32	6.0	0.1								
Station 2										
0	14.6	8.3	24.9	8.4	31.1	13.4	28.5	14.2	18.6	12.6
2	14.4	8.3	24.5	8.5	28.7	15.9	27.7	13.5	18.6	12.9
4	13.5	8.0	22.3	6.4	27.7	13.9	27.0	5.8	18.2	13.0
6	13.4	7.9	21.5	4.8	26.6	1.1	25.6	0.4	18.1	12.0
8	13.2	7.2	20.3	1.4	23.1	0.9	23.4	0.3	17.9	9.3
10	12.6	6.8	18.4	0.5	20.1	0.5	20.1	0.3	17.9	9.3
12	11.6	5.5	16.2	0.2	17.2	0.5	17.7	0.2	17.4	0.5
14	10.4	1.7	14.3	0.2	14.5	0.5	15.6	0.2	15.8	0.4
16	9.3	0.6	12.5	0.1	13.4	0.5	13.7	0.2	14.6	0.4
18	8.2	0.5	10.8	0.1	12.1	0.5	12.1	0.2	13.0	0.4
20	7.6	0.4	9.9	0.1	10.5	0.5	10.8	0.2	11.8	0.4
22	7.1	0.3	9.3	0.1	10.1	0.5	9.9	0.2	10.8	0.4
24	6.8	0.2								

Table 8. Concluded

Depth, feet	*4/25/95*		*6/15/95*		*7/19/95*		*8/28/95*		*10/4/95*	
	Temp	*DO*	*Temp*	*DO*	*Temp*	*DO*	*Temp*	*DO*	*Temp*	*DO*
Station 3										
0	15.5	8.3	25.5	8.5	30.8	14.0	29.1	13.9	18.5	12.2
2	14.7	8.3	25.2	6.5	29.2	16.6	27.5	13.7	18.3	12.2
4	14.1	8.3	23.8	6.5	27.7	14.3	27.1	9.1	18.3	12.2
6	13.7	8.2	21.6	5.1	26.7	3.4	25.9	0.4	18.0	11.6
8	13.1	7.6	20.2	1.7	23.2	0.5	24.0	0.3	18.3	11.3
10	12.8	7.5	18.2	0.3	19.2	0.5	20.2	0.3	17.8	2.9
12	12.1	7.3	16.4	0.2	16.8	0.4	17.6	0.3	16.6	0.4
14	11.4	5.0	14.4	0.2	14.7	0.4	15.3	0.3	15.8	0.4
16	10.0	1.5	12.6	0.1	13.6	0.4	14.4	0.3	14.7	0.4
18			11.9	0.1						

Notes:
Temp = temperature in degrees Celsius.
DO = dissolved oxygen in mg/L.

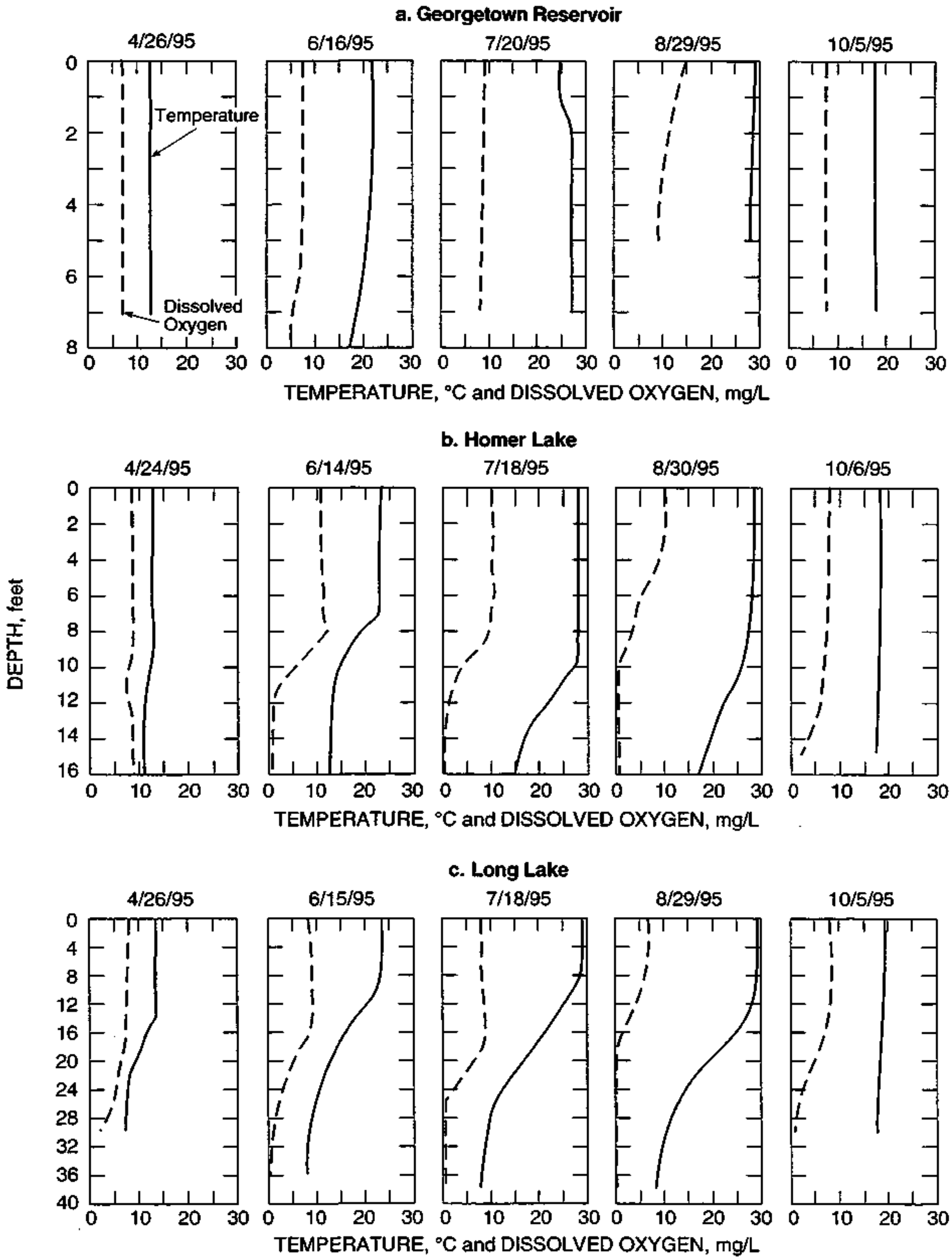

Figure 8. Dissolved oxygen and temperature profiles at station 1 of each lake

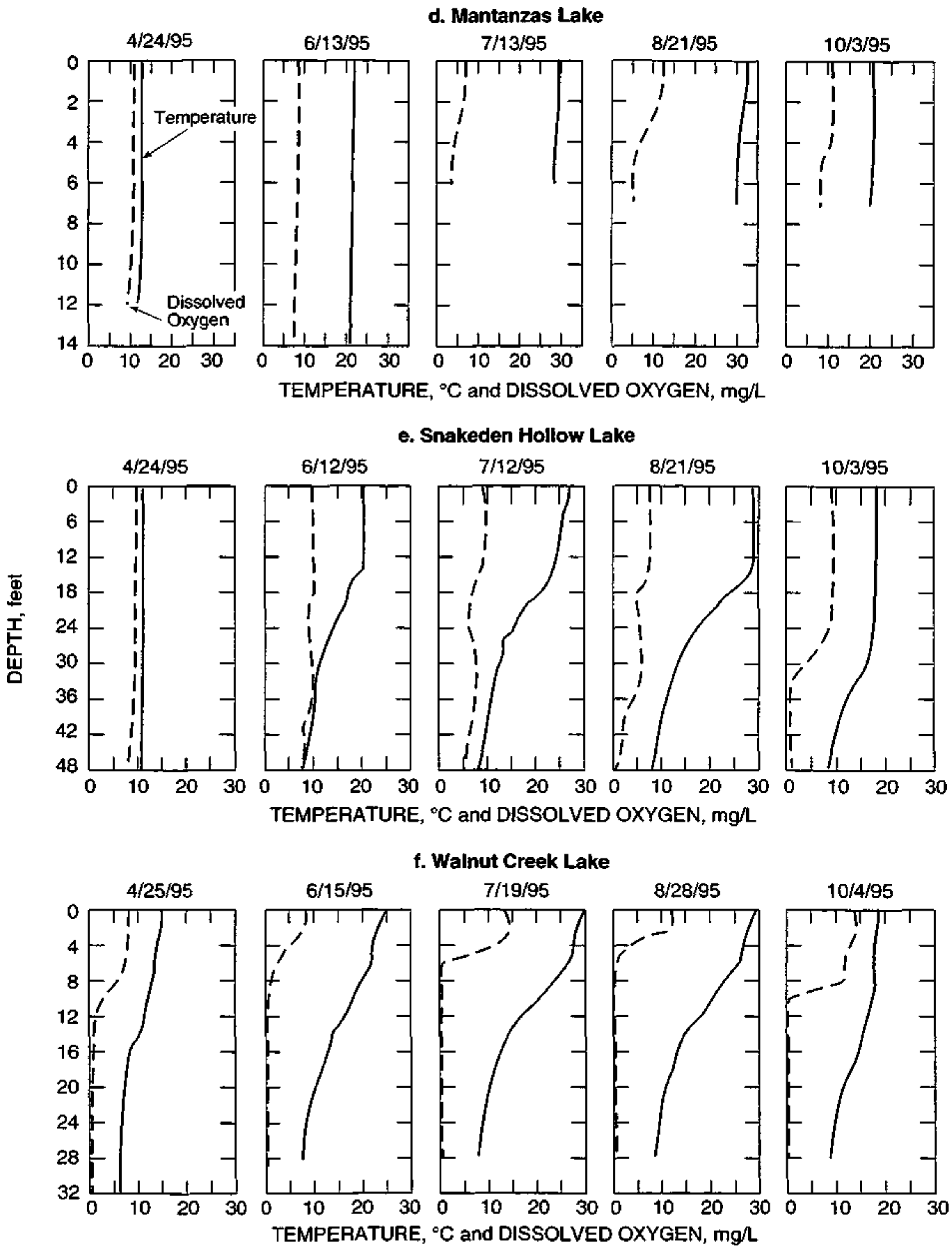

Figure 8. Concluded

T = water temperature, °C

Tables 9-14 provide the computed percent DO saturation values for Georgetown Reservoir, Homer Lake, Long Lake, Matanzas Lake, Snakeden Hollow Lake, and Walnut Point Lake, respectively. Georgetown Reservoir exhibited supersaturated conditions during August observations. Homer Lake exhibited 33 percent supersaturation from June - August. Long Lake had a very minor degree of supersaturation in June and July and none in August. Matanzas Lake showed a very high degree of supersaturation in August and a moderate degree of supersaturation in October. Snakeden Hollow Lake experienced a low degree of supersaturation during June to August and marginal supersaturation during October. Walnut Point Lake exhibited a high degree of supersaturation in the top 4-6 feet of the epilimnetic zone demarcated sharply by nearly anoxic waters below this zone during the summer months. The extremes of oxygen conditions were most pronounced in this lake among all the lakes monitored in this study.

Secchi Disk Transparency

Water transparency is measured with a Secchi disk on a calibrated rope, which suggests the depth of light penetration into a body of water. From the water surface to approximately two to three times the Secchi disk depth is the region of a lake where enough sunlight penetrates to allow photosynthetic production of oxygen by algae and other aquatic plants.

Secchi disk transparency for the six lakes studied ranged from 7 inches at station 2 in Matanzas Lake on October 3, 1995 (appendix D) to 285 inches at station 1S (surface) in Snakeden Hollow Lake on the same date (appendix E). In a previous survey of 25 Illinois lakes, Lin and Raman (1993) found the highest Secchi disk transparency as 186 inches in Strode Lake in Fulton County. For a survey of southern Illinois lakes, Burns (1991) reported the highest Secchi disk transparency (240 inches) in Crystal Lake in Perry County.

Since Georgetown Reservoir is a small in-channel dammed impoundment; as expected, it has generally low Secchi transparency. The two shallow lakes studied, namely, Matanzas Lake and Georgetown Reservoir, had low Secchi disk readings < 24 inches (table 1), which indicates the level generally associated with lake impairment (Illinois EPA, 1978). Homer Lake has a mean Secchi transparency of 31 inches. Three lakes (Long, Snakeden Hollow, and Walnut Point) had Secchi transparency > 48 inches (table 1). The minimum recommended Secchi transparency set by the Illinois Department of Public Health for bathing beaches is 48 inches. Nevertheless, a lake that does not meet the transparency criteria does not necessarily constitute a public health hazard.

Total and Volatile Suspended Solids

Total suspended solids (TSS) represent material residue left on a filter < 2.0 micrometers (μm) nominal pore size, i.e., the amount of all inorganic and organic materials suspended in the water column. Typical inorganic components originate from the weathering and erosion of rocks and soils in a lake's watershed and resuspension of lake sediments. Organic components are derived from a variety of biological origins, but in a lacustrine environment they are mainly composed of algae and resuspended plant and animal material from the lake bottom. Volatile suspended solids (VSS) indicate the fraction of the total suspended solids that is organic in nature, the portion of TSS lost to ignition at 500 ± 50°C.

The amount of suspended solids found in impounded waters is small compared to the amount found in streams, because solids tend to settle to the bottom in lakes.

Table 9. Percent Saturation of Dissolved Oxygen in Georgetown Reservoir, 1995

Depth, feet	*4/26*	*6/16*	*7/20*	*8/29*	*10/5*
Station 1					
0	67	91	106	192	79
1	66	89	106	173	79
2	66	90	108	148	78
3	65	90	107	132	79
4	65	89	106	122	80
5	65	84	106	103	79
6	65	81	103		
7	65	57	102		
8		50			
Station 2					
0	70	89	112	223	80
1	70	88	112	223	74
2	70	88	112	165	70
3	70	86	111	138	70
4	70	85	111	127	75
5	70	84	108	105	76
6	70	83	98	92	77
7	70	67	93	68	76
8	70	58	77	41	74
9	68	45	69		74
Station 3					
0	71	87	126	248	85
1	71	86	129	265	87
2	72	86	130	153	86
3	72	86	130	139	83
4	72	85	122	104	82
5	73	84	116	83	80
6	73	60		69	

Table 10. Percent Saturation of Dissolved Oxygen in Homer Lake, 1995

Depth, feet	*4/24*	*6/14*	*7/18*	*8/30*	*10/6*
Station 1					
0	79	126	125	133	82
1	80	128	130	132	82
2	80	128	132	132	82
3	80	130	133	132	82
4	80	130	133	108	82
5	80	131	125	95	82
6	80	131	139	65	85
7	80	129	120	46	81
8	80	134	122	36	79
9	80	93	96	25	76
10	72	57	47	2	72
11	63	18	28	2	69
12	69	10	12	2	66
13	74	8	2	2	53
14	75	5	2	1	41
15	76	4	2	1	24
Station 2					
0	84	126	120	120	69
1	86	127	120	134	69
2	85	127	121	118	70
3	86	126	123	128	68
4	85	123	118	115	68
5	85	122	116	89	68
6	83	122	114	61	68
7	77	114	113	31	68
8	77	107	112	24	65
9	76	66	46	10	50
10	76	30	10	10	47
11	85	6	5		28
12	86	6	6		
Station 3					
0	96	137	66	51	51
1	97	140	66	58	54
2	97	146	67	52	54
3	84	121	67	27	54
4	75	92	59	10	49
5	70	83	60	8	42
6	70				

Table 11. Percent Saturation of Dissolved Oxygen in Long Lake, 1995

Depth, feet	*4/26*	*6/15*	*7/18*	*8/29*	*10/5*
Station 1					
0	80	98	103	87	86
2	77	104	103	85	86
4	76	109	104	85	89
6	72	107	104	86	91
8	72	107	98	84	91
10	71	106	104	72	92
12	71	104	102	58	91
14	70	98	97	43	86
16	67	86	99	23	79
18	65	62	88	12	63
20	52	51	69	5	51
22	48	42	45	2	35
24	40	29	19	2	28
26	36	19	4	2	21
28	27	12	4	2	15
30	14	6	3	2	10
32		3	3	2	
34		3	3	2	
36		3	3	2	
38			3	2	
Station 2					
0	133	96	102	77	80
2	133	96	103	77	83
4	133	95	103	75	83
6	129	95	102	75	84
8	125	96	96	73	89
10	123	92	93	55	85
12	120	78	86	19	85
14	116	53	75	3	85
16	106	31	10	2	84
18	89	16	3	2	84
20	77	3	3	2	52
22	69			2	31
24	65			2	10
Station 3					
0	70	108	107	82	81
2	70	106	108	82	84
4	69	110	109	83	85
6	67	106	110	79	85
8	65	103	102	74	85
10	64	84	57	33	85
12	56	29	3	3	85
14				3	81

Table 12. Percent Saturation of Dissolved Oxygen in Matanzas Lake, 1995

Depth, feet	*4/24*	*6/13*	*7/13*	*8/21*	*10/3*
Station 1					
0	101	99	95	175	126
1	101	100	91	176	127
2	101	100	85	157	126
3	101	99	65	125	125
4	101	95	55	86	125
5	101	95	47	67	119
6	101	95	40	64	95
7	99	95		62	89
8	99	94			
9	99	93			
10	98	93			
11	90	86			
12	84	86			
13		85			
14		84			
15		84			
Station 2					
0	102	113	95	175	126
1	102	113	91	176	127
2	102	113	85	157	126
3	102	96	65	125	125
4	102	93	55	86	125
5	102	93	47	67	119
6	101	92	40	64	95
7	101	92		62	89
8	101	92			
9	95	92			
10		92			
11		91			
12		91			
Station 3					
0	95	93	82	189	136
1	95	92	83	189	135
2	95	89	78	188	120
3	95	84	45	177	105
4	95	85	41	139	88
5	94	84			
6	86	83			
7	86	83			
8	85	82			
9	84	80			
10		80			
11		79			
12		79			

Table 13. Percent Saturation of Dissolved Oxygen in Snakeden Hollow Lake, 1995

Depth, feet	*4/24*	*6/12*	*7/12*	*8/21*	*10/3*
Station 1					
0	98	112	113	117	98
2	98	112	115	120	102
4	98	112	122	130	104
6	97	113	120	128	104
8	97	113	118	127	104
10	97	113	116	125	104
12	96	113	110	120	103
14	96	113	103	113	103
16	96	111	90	99	101
18	96	109	78	84	101
20	96	95	63	68	98
22	95	92	63	67	98
24	95	90	61	64	91
26	95	92	66	69	82
28	95	92	72	74	61
30	94	92	73	75	44
32	94	91	74	76	17
34	93	91	67	69	10
36	92	88	66	67	8
38	92	84	62	63	8
40	92	69	54	54	8
42	91	70	52	51	9
44	89	70	48	48	9
46	89	64	43	43	9
48	87	61	36	36	8

Depth, ***feet***	*4/24*	*6/12*	*7/12*	*8/21*	*10/3*
Station 2					
0	98	118	124	96	99
2	99	120	124	94	101
4	99	120	123	96	102
6	99	120	126	94	104
8	98	98	126	90	104
10	97	113	83	85	90
12		116			

Depth, feet	*4/24*	*6/12*	*7/12*	*8/21*	*10/3*
Station 3					
0	106	127	124	97	102
2	107	127	116	97	104
4	107	126	99	97	107
6	105	117	117	96	106
8	103	105	125	90	109
10	102	100	68	69	121
12	101	107	23	49	102
14	96	107	4	28	80
16		97	3	22	62
18		88	3	7	27
20		79	3	3	10
22		58	3	3	7
24		34	3	3	7

Table 14. Percent Saturation of Dissolved Oxygen in Walnut Point Lake, 1995

Depth, feet	*4/25*	*6/15*	*7/19*	*8/28*	*10/4*
Station 1					
0	78	104	183	163	152
2	78	105	195	159	159
4	75	61	166	44	140
6	74	34	13	5	127
8	55	11	12	4	127
10	25	3	4	3	5
12	11	2	4	3	3
14	8	1	4	3	3
16	5	1	4	3	3
18	5	1	5	3	3
20	4	1	5	3	3
22	2	1	4	3	3
24	2	1	3	3	3
26	1	1	3	3	3
28	1	1	3	3	3
30	1				
32	1				
Station 2					
0	82	103	184	186	136
2	82	104	209	174	139
4	77	74	179	74	139
6	76	55	14	5	128
8	69	16	11	4	139
10	64	5	6	3	99
12	51	2	5	2	5
14	15	2	5	2	4
16	5	1	5	2	4
18	4	1	5	2	4
20	3	1	4	2	4
22	2	1	4	2	4
24	1				
Station 3					
0	84	105	191	184	131
2	82	80	220	176	131
4	81	78	184	116	129
6	79	58	43	5	123
8	73	19	6	4	121
10	71	3	5	3	31
12	68	2	4	3	4
14	46	2	1	3	4
16	13	1	4	3	4
18		1			

However, in shallow lakes this aspect is greatly modified by wind and wave actions and by the type and intensity of use to which these lakes are subjected.

Generally, the higher the TSS concentration, the lower the Secchi disk reading. A high TSS concentration results in decreased water transparency, which can reduce photosynthetic activities, and subsequently decrease the amount of oxygen produced by algae, possibly creating anoxic conditions. Anaerobic water may limit fish habitats and potentially cause taste and odor problems by releasing noxious substances such as hydrogen sulfide, ammonia, iron, and manganese from lake bottom sediments.

During this study, TSS in the surface water samples of the lakes studied ranged from 1 mg/L at station 2 in Walnut Point Lake on April 25, 1995 (appendix F) to 96 mg/L at station 2 in Georgetown Reservoir on October 5, 1995 (appendix A). Very low TSS concentration (2 mg/L) was also observed at all three surface stations in Snakeden Hollow Lake on many sampling dates (appendix E) and at stations 2 and 3 in Long Lake (appendix C). The mean surface water TSS concentrations were between 2.6 mg/L for Snakeden Hollow Lake and 46.3 mg/L for Matanzas Lake (table 1).

TSS concentrations in the near-bottom waters ranged from 3 mg/L at station 1B in Walnut Point Lake on April 25, 1995 (appendix F) to 244 mg/L at station 1B in Long Lake on October 5, 1995 (appendix C).

VSS concentrations in surface waters for the six lakes studied ranged from ≤ 1 mg/L (Homer, Long, Snakeden Hollow, and Walnut Point Lakes) to 36 mg/L at station 2 in Georgetown Reservoir on October 5, 1996 (appendices A, B, E, F). VSS levels for near-bottom samples were between 2 mg/L in Long Lake on June 15, 1995 and in Walnut Point Lake on April 25, 1996, and 66 mg/L also in Long Lake on October 5, 1995 (appendices C, F). These high TSS and VSS concentrations could be the result of the sloughing off of the unstable high bank into the lake near the sampling station.

Turbidity

Turbidity is an expression of the property of water that causes light to be scattered and absorbed by a turbidimeter, and is reported as nephelometric turbidity units (NTU). Turbidity in water is caused by dissolved substances and suspended matter, such as clay, silt, finely divided inorganic and organic matter, soluble colored organic compounds, and plankton and other microorganisms. Generally, turbidity in lakes is influenced by sediment runoff carried into a lake from its watershed, algae in the water column, or resuspension of lake bottom sediments.

Turbidity of 18 site samples from the six lakes assessed ranged from 1.2 NTU for surface water (at station 3 in Snakeden Hollow Lake on October 3, 1995, see appendix E) and 2.2 NTU for bottom water (at station 1B in Walnut Point Lake on June 15, 1995, see appendix F) to 19 NTU for surface water (at station 2 in Walnut Point Lake on August 28, 1995, see appendix F) and 15 NTU for bottom water (at station 1B in Walnut Point Lake on August 28, 1995, see appendix F). Illinois Lake Assessment Criteria (Illinois EPA, 1978) for a moderate amount of sediment set a turbidity value between 7 and 14 NTU. Turbidity > 15 NTU is indicative of substantial suspended sediment. On the basis of mean surface turbidity levels listed in table 1, all six lakes are considered to have minimal amounts of suspended sediments.

Conductivity

Specific conductance provides a measure of a water's capacity to convey electric current and is used as an estimate of the dissolved mineral quality of water. This property is related to the total concentration of ionized substances in water and the temperature at which the measurement is made. Specific conductance is affected by factors such as the nature of dissolved substances, the relative concentrations, and the ionic strength of the water sample. The geochemistry of the drainage basin is the major factor determining the chemical constituents in the waters. Practical applications of conductivity measurements include determination of the purity of distilled or deionized water, quick determination of the variations in dissolved mineral concentrations in water samples, and estimation of dissolved ionic matter in water samples.

The mean conductivity values of surface water samples were between 347 umho/cm (Walnut Point Lake) and 1736 umho/cm (Long Lake) at 25°C. Very high conductivity values of 1888 umho/cm (at station 3 on April 26, 1995) and 1991 umho/cm (at station 1B on August 29, 1995), respectively were observed for the surface and bottom waters in Long Lake (appendix C). High conductivities (1251-1512 umho/cm) were also found in Snakeden Hollow Lake (appendix G). Long Lake is a final-cut impoundment, and Snakeden Hollow Lake is in the heavily mined area. Conductivity levels in the other four lakes were lower in the range of approximately 300-700 umho/cm (appendices A, B, D, and E).

pH

The pH value is a measure of the acidity of water: values < 7.0 indicate acidic water, and values > 7.0 indicate basic (or alkaline) water. A pH of 7.0 is exactly "neutral". Although rainwater in Illinois is acidic (pH about 4.4), most of the lakes can offset this acidic input by an abundance of natural buffering compounds in the lake water and the watershed. One species of carbonate, carbonic acid, usually controls pH to the greatest extent and is consumed by algae and other plants for growth. A rise in pH can occur due to photosynthetic uptake of carbonic acid and cause water to become more basic. Values > 8.0 in Illinois lakes are usually indicative of photosynthetic demand of carbon dioxide. Most Illinois lakes have a pH between 6.5 and 9.0. The IPCB (1990) standard of pH for general-use water quality is also in a range between 6.5 and 9.0, except for natural causes.

The pH levels at the six lake surface waters ranged from 8.0 to 9.7 (appendices A-F). In fact, all lakes with the exception of Walnut Point Lake had pH < 9.0. In Walnut Point Lake, eight of 15 surface water samples had pH > 9.0 (appendix F). Photosynthetic activities occurred in all six lakes.

The pH values for lake bottom waters were found to be lower than those for lake surface waters. They were between 6.9 and 8.1 (appendices A-F) and met the Illinois EPA's general-use pH standards. Only one sample collected from station 1B in Walnut Point Lake on October 4, 1995 had pH < 7.0 (appendix F).

Alkalinity

Alkalinity is a measure of water's acid-neutralizing capacity. It is expressed in terms of an equivalent amount of calcium carbonate ($CaCO_3$). Alkalinity is mainly the result of carbonates, bicarbonates, and hydroxide ions in water. Total alkalinity is the sum of acid required to bring water to a pH of 4.5. Phenolphthalein alkalinity is the amount of acid needed to bring the water to a pH of 8.3.

Lakes with low alkalinity are to have the potential to be susceptible to acid rain damage. However, Illinois lakes usually have high alkalinity and thus are well buffered from the impacts of acid rain.

Phenolphthalein Alkalinity. Surface waters at 18 sites had phenolphthalein alkalinity of 0-29 mg/L as $CaCO_3$. The highest value occurred in August in Walnut Point Lake (appendix G). Approximately 40 percent of surface waters had no phenolphthalein alkalinity. Bottom water samples did not have phenolphthalein alkalinity.

Total Alkalinity. Total alkalinity as $CaCO_3$ of 18 sites surface waters were between 96 mg/L (station 3 in Snakeden Hollow Lake on October 3, 1995) and 258 mg/L (station 3 in Homer Lake on April 25, 1995). These values are typical of Illinois lakes. With a few exceptions, lake bottom waters generally have higher total alkalinity than the lake surface waters. Of the four sites sampled, total alkalinity as $CaCO_3$ for bottom waters ranged from 145 mg/L in Snakeden Hollow Lake on June 12, 1995 (appendix E) to 307 mg/L in Walnut Point Lake on October 4, 1995 (appendix G). The greatest difference between bottom and surface total alkalinity occurred in Walnut Point Lake.

Nitrogen

Nitrogen is generally found in surface waters in the form of ammonia (NH_3), nitrite (NO_2), nitrate (NO_3), and organic nitrogen. Organic nitrogen is determined by subtracting NH_3 nitrogen from the total kjeldahl nitrogen (TKN) measurements. Organic nitrogen content can indicate the relative abundance of organic matter (algae and other vegetative matter) in water, but has not been shown to be directly used as a growth nutrient by planktonic algae. Nitrogen is an essential nutrient for plant and animal growth, but it can cause algal blooms in surface waters and create public health problems at high concentrations. The Illinois Pollution Control Board (1990) has set standards for nitrate not to exceed 10 mg/L nitrate nitrogen or 1 mg/L nitrite nitrogen for public water-supply and food processing waters.

Nitrate is readily used by algae as a nutrient at approximately the same extent as ammonia. If the sum of NO_2 and NO_3 nitrogen concentrations exceeds 0.30 mg/L, it may stimulate algal growth. NH_3 is a natural end product of decomposed organic material. It can exist in water in two forms as ionized (NH_4^+; ammonium) and un-ionized (NH_3 ammonia). High levels of ammonia can be toxic to aquatic organisms, but the level of toxicity depends on water temperature and pH. The IPCB (1990) stipulates an ammonia nitrogen limitation of 15 mg/L.

Ammonia Nitrogen. Inspection of appendices indicates that the surface water ammonia nitrogen levels ranged from concentrations that were less than detectable (0.01 mg/L) for at least one sample, at 17 sites except for station 3 in Homer Lake to 0.34 mg/L at station 1S in Long Lake on October 5, 1995. NH_3 concentrations for all surface waters increased during October 1995 at all 18 sites.

Ammonia concentrations in the bottom waters can be more important in that the NH_3 will rapidly be oxidized to nitrite/nitrate after lake turnover occurs. The observed bottom water NH_3 levels were higher and ranged from 0.05 mg/L at station 1B in Homer Lake on April 25, 1995 to 17.0 mg/L in Walnut Point Lake on July 19 and October 4, 1995. These two near bottom water samples exceeded the IPCB's ammonia nitrogen limitation (15 m/L).

Nitrite/Nitrate Nitrogen. The sum of nitrite and nitrate (NO_2 + NO_3) nitrogen for five lakes (except for Georgetown Reservoir) was under the detection limit (0.01 mg/L) for both surface and bottom water samples (not all stations). The high concentration of 11.2 mg/L was found in Georgetown Reservoir on June 16, 1995. For Georgetown Reservoir, samples collected in April and June 1995, the NO_2/NO_3 levels exceeded IPCB standards of 10 mg/L (appendix A).

Total Kjeldahl Nitrogen. Total kjeldahl nitrogen represents the sum of ammonia-nitrogen and organic nitrogen present in a water. For the lake surface waters, TKN ranged from 0.1 kmg/L (at station 3 in Georgetown Reservoir on July 20, 1995 and at station 3 in Snakeden Hollow Lake on October 3, 1995) to 5.6 mg/L at station 2 in Georgetown Reservoir on October 5, 1995. The surface TKN levels in Long Lake and Snakeden Hollow Lake were generally lower (appendices B and E) while TKN for bottom waters ranged from 0.46 mg/L in Snakeden Hollow Lake on June 12, 1995 to 13.8 mg/L in Walnut Point Lake on October 4,1995.

Phosphorus

Total Phosphorus. Total phosphorus (TP) represents all forms of phosphorus in water. Dissolved phosphorus is the soluble portion of TP. Phosphorus, an essential plant nutrient, occurs in natural water and wastewaters almost solely as phosphates. In relatively uncontaminated lakes, the TP of lake surface waters is generally in the range of 0.01 and 0.03 mg/L (Hutchinson, 1967; APHA, AWWA, and WEF, 1992). Phosphorus is frequently the limiting nutrient in a lake ecosystem. Excessive concentrations of TP, like nitrate, can cause noxious growths of algae and other aquatic plants, and TP levels of 0.03 mg/L have been shown to create nuisance algae/plant growth. The IPCB (1990) stipulates that "Phosphorus as P shall not exceed 0.05 mg/L in any reservoir or lake, or in any system at the point where it enters any reservoir or lake."

Total phosphorus values of the 18 sites collected from six lakes' surface waters ranged from under the detection limit of 0.001 mg/L (station 1 in Snakeden Hollow Lake on April 24, 1995 and station 1 in Long Lake on June 15, 1995) to 0.278 mg/L (stations 2 and 3 in Matanzas Lake on August 21, 1995). Lakes influenced by rivers, such as Matanzas Lake and Georgetown Reservoir have shown high TP levels (mean TP of 0.199 and 0.087 mg/L, respectively). Table 1 also indicates that impoundments in mined areas, Long and Snakeden Hollow Lakes, had lower TP values (both 0.008 mg/L).

Lake bottom waters had higher TP levels. They ranged from 0.014 mg/L in Long Lake on June 15, 1995 to 2.88 mg/L in Walnut Point Lake on July 19, 1995. The mean TP concentrations at station 1B in Homer, Long, Snakeden Hollow, and Walnut Point Lakes were 0.129, 0.039, 0.171, and 1.592 mg/L, respectively.

Dissolved Phosphorus. Dissolved phosphorus (DP) values of the 90 surface water samples (18 locations) taken from six lakes studied ranged from under the detection limit of 0.001 mg/L on June 15 and July 18, 1995 in Long Lake (appendix C) and June 12, July 12, and August 21, 1995 in Snakeden Hollow Lake (appendix E) to 0.211 mg/L (station 2 in Matanzas Lake on October 3, 1995). Matanzas Lake had the highest DP levels. The mean DP in surface waters for Georgetown, Homer, Long, Matanzas, Snakeden Hollow, and Walnut Point Lakes (table 1) were 0.022, 0.010, 0.002, 0.105, 0.002, and 0.024 mg/L, respectively.

Examination of data in the appendices indicates that the DP concentrations for the bottom waters were between 0.002 mg/L (Homer Lake on April 25, 1995 and Long Lake on June 15, 1995) to 2.45 mg/L (Walnut Point Lake on July 19, 1995). The mean DP levels of bottom waters for Homer, Long, Snakeden Hollow, and Walnut Point Lakes were 0.071, 0.004, 0.129, and 1.414 mg/L, respectively.

Chlorophyll

Chlorophyll α is a primary photosynthetic pigment in all oxygen evolving photosynthetic organisms. Extraction and quantification of chlorophyll *a* can be used to estimate biomass or standing crop of planktonic algae present in a body of water. Other algae pigments, particularly chlorophyll *b* and c can give information on the type of algae present. Blue-green algae (Cyanophyta) contain only chlorophyll *a,* while both the green algae (Chlorophyta) and the euglenoids (Euglenophyta) contain chlorophyll *a* and *c.* Chlorophyll *a* and *c* are also present in the diatoms, yellow-green, and yellow-brown (Chrysophyta), as well as dinoflagellates (Pyrrhophyta). These accessory pigments can be used to identify the types of algae present in a lake. Pheophytin *a* results from the breakdown of chlorophyll *a.* A large amount of pheophytin *a* indicates a stressed algal population or a recent algal die-off. As direct microscopic examination of water samples was used to identify and enumerate the type and concentrations of algae present in the water samples, the indirect method of making such assessments was not employed in this investigation.

The appendices A-F also present observed concentrations of chlorophyll *a* and other pigments. The corrected chlorophyll *a* levels were between 1.59 µg/L at station 2 in Snakeden Hollow Lake on April 24, 1995 and 301.92 µg/L at station 1 in Walnut Point Lake on June 15, 1995. As shown in table 1, the mean chlorophyll *a* concentrations for Georgetown, Homer, Long, Matanzas, Snakeden Hollow, and Walnut Point Lakes were 39.82, 29.20, 4.88, 66.65, 6.14, and 102.37 µg/L, respectively. The mean chlorophyll *b* levels were 15.03, 6.34, 2.69, 19.08, 2.20, and 5.48 µg/L, respectively. The mean chlorophyll *c* concentrations were 16.59, 8.81, 2.81, 21.28, 2.36, and 5.01 µg/L, respectively. Pheophytin *a* in the six lakes were 8.47, 3.04, 1.18, 10.48, 1.01, and 0.62 ug/L, respectively.

Macrophytes

Macrophytes are commonly called aquatic vegetation (or weeds). The macrophyton consists principally of aquatic vascular flowering plants, but it also includes the aquatic mosses, liverworts, ferns, and larger macroalgae (APHA *et al.,* 1992). Macrophytes may include submerged, emerged, and floating plants, and filamentous algae. In most lakes and ponds aquatic vegetation is found that may beneficially and/or adversely impact the natural ecosystem. Reasonable amounts of aquatic vegetation improve water clarity by preventing shoreline erosion, stabilizing sediment, storing nutrients, and providing habitat and hiding places for many small fish (young of the year, bluegill, sunfish, etc.). They also provide food, shade, and oxygen for aquatic organisms; block water movement (wind wave); and utilize nutrients in the water, reducing the excessive growth of phytoplankton.

However, excessive growth of aquatic vegetation generally interferes with recreational activities (fishing, boating, swimming, etc.); adversely affects aquatic life (overpopulation of small fish, benthic invertebrates); causes fish kill; emits taste and odor in water due to decomposition of dense weed beds; blocks water movement and retards heat transfer, creating vertical temperature gradients; and destroys aesthetic value to the extent of decreasing the economic values of properties surrounding a lake. Under these circumstances, aquatic plants are often referred to as weeds.

The macrophyte survey was conducted in June 1995 for all the lakes. A survey of the macrophyte beds was carried out using a boat and a lake map. The macrophyte beds were probed thoroughly with a garden rake to determine the presence/absence of aquatic vegetation. This survey enabled the delineation of areal extent of macrophytes in the lake only. The quantitative assessment of macrophytes in the lakes was not made. However, the relative densities (dense, sparse, etc.) were noted.

Figures 2 and 9-12 plot the areal extent of macrophyte beds as determined during the survey and/or laboratory identifications of dominant species observed. No macrophyte was found in Matanzas Lake. In Georgetown Reservoir, water willow (*Dianthera americand)* grew along both sides of shorelines within 1-3 feet from the bank. Bulrush (*Scirpus* spp.) and prairie grass were observed along the west shore 10-50 feet from the bank (figure 2) in Georgetown Reservoir.

There were seven species of macrophytes found in Homer Lake. Curlyleaf pondweed (*Potamogeton crispus),* coontail (*Ceratophyllum demersum),* duckweed (*Lemna* spp.), Eurasian water milfoil (*Myriophyllum spicatum*), horned pondweed (*Zannechellia palustris),* bulrush, and cattail (*Typha* spp.) covered a 10-50 foot width of the littoral zone almost all around the lake (figure 9). In addition, there is a dense growth of curlyleaf pondweed and coontail in the northeast arm of the lake.

Figure 10 shows the six macrophyte species observed in Long Lake: water willow, coontail, Eurasian water milfoil, broadleaf water milfoil *{Myriophyllum heterophyllum*), horned pondweed, and curlyleaf pondweed.

As shown in figure 11, eight macrophyte species, i.e. curlyleaf pondweed, coontail, chara, American pondweed (*Potamogeton nodosus),* sago pondweed *{Potamogeton pectinatus),* bulrush, American elodea *{Elodea canadensis),* and a filamentous algae were observed in Snakeden Hollow Lake. Approximately 80 percent of the shorelines were covered by macrophytes. In contrast, only a very small portion (less than 1 percent) of shoreline in the northwest part of Walnut Point Lake was covered by aquatic vegetation (figure 12). American pondweed was the dominant vegetation. Duckweed was also in the northwestern tip of the lake.

Trophic State

Eutrophication is a normal process that affects every body of water from its time of formation. As a lake ages, the degree of enrichment from nutrient materials increases. In general, the lake traps a portion of the nutrients originating in the surrounding drainage basin. In addition, precipitation, dry fallout, and ground-water inflow are the other contributing sources.

A wide variety of indices of lake trophic conditions have been proposed in the literature. Indices have been based on Secchi disk transparency; nutrient concentrations; hypolimnetic oxygen depletion; and biological parameters, including chlorophyll *a,* species abundance, and diversity. The USEPA suggests in its *Clean Lake Program Guidance Manual* (1980) the use of four parameters as trophic indicators: Secchi disk transparency, concentrations of chlorophyll a, phosphorus, and carbon in water.

In addition, the lake trophic state index (TSI) developed by Carlson (1977) on the basis of Secchi disk transparency (SD), chlorophyll *a* (CHL), and surface water total phosphorus (TP) can be used to calculate a lake's trophic state. The TSI number can be calculated from SD in meters (m), CHL in micrograms per liter (µg/L), and TP in ug/L as follows:

on the basis of SD, $TSI = 60 - 14.4 \ln (SD)$ (1)
on the basis of CHL, $TSI = 9.81 \ln (CHL) + 30.6$ (2)
on the basis of TP, $TSI = 14.42 \ln (TP) + 4.15$ (3)

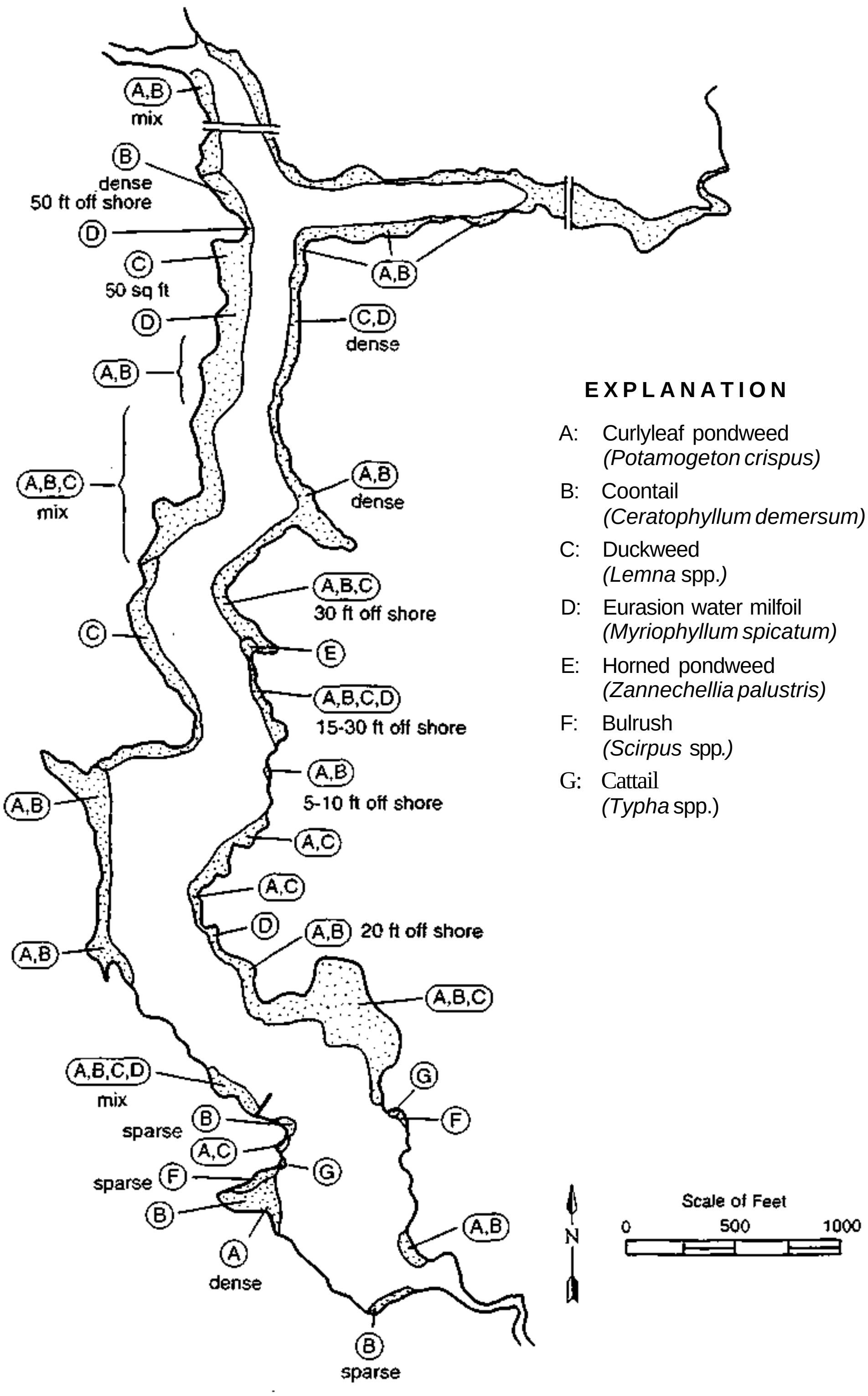

Figure 9. Macrophytes in Homer Lake, June 14, 1995

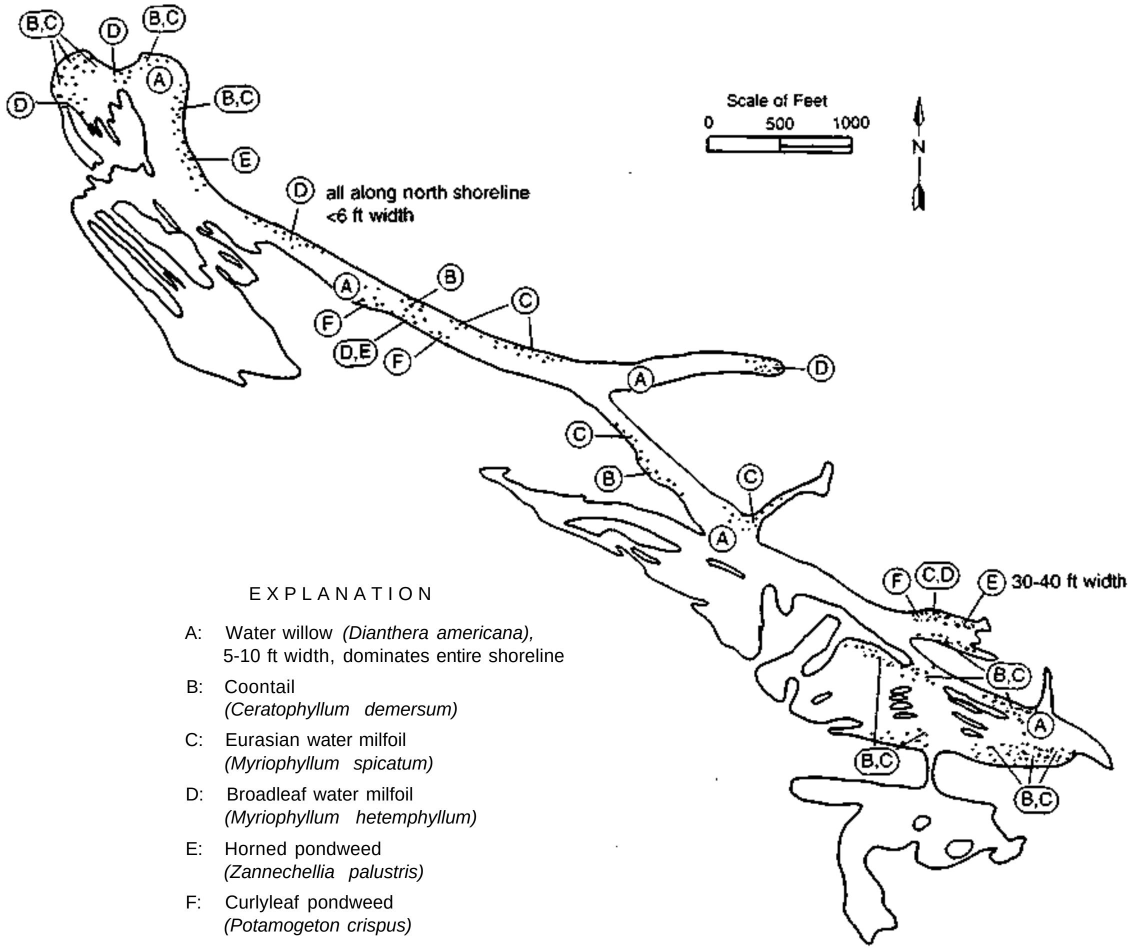

Figure 10. Macrophytes in Long Lake, June 15, 1995

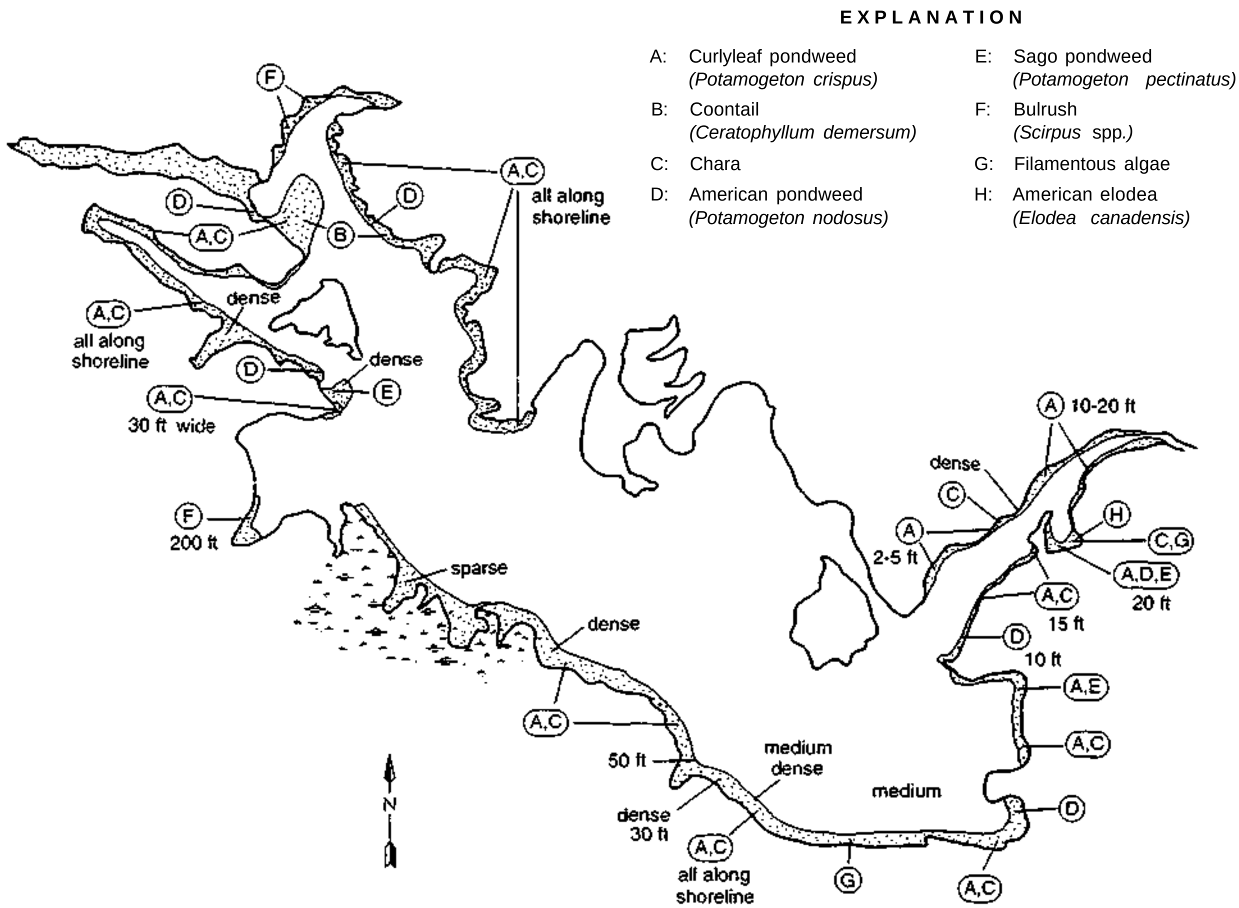

Figure 11. Macrophytes in Snakeden Hollow Lake, June 12,1995

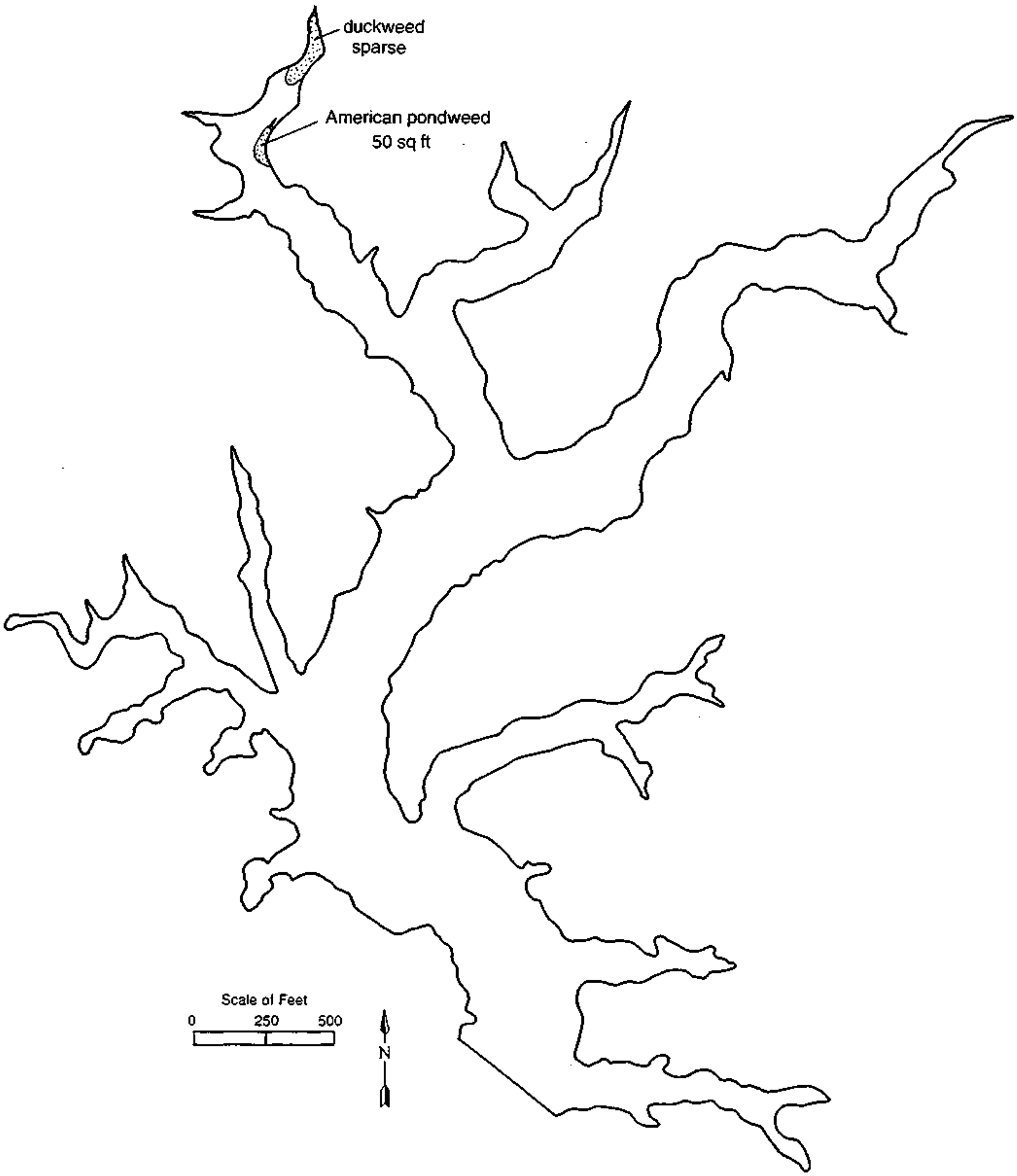

Figure 12. Macrophytes in Walnut Point Lake, June 15,1995

The index is based on the amount of algal biomass in surface water, using a scale of zero to 100. Each increment often in the TSI represents a theoretical doubling of biomass in the lake. The advantages and disadvantages of the use of TSI were discussed by Hudson *et al.* (1990). The accuracy of Carlson's index is often diminished by water coloration or suspended solids other than algae. Applying TSI classification to lakes dominated by rooted aquatic plants may indicate less eutrophication than what actually exists.

A TSI is derived from the average of three calculated results using formulas (l)-(3) for every monitored lake at each site. It is used to define the trophic state of a lake as indicated in table 15, which is modified from Carlson (1977). Table 16 lists the values of TSI and trophic state for six lakes (18 sites). The TSI for three stations in each lake are generally similar, as can be seen in table 16, based on either CHL or TP. In Long Lake and Snakeden Hollow Lake, the TP-TSI was generally lower than SD- and CHL-TSI. Average of SD-, TP-, and CHL-TSI for each station of a lake are again similar. The overall average TSI for each lake is also presented in Table 16 in bold. Using this overall TSI average, trophic condition of a lake was determined on the basis of criteria listed in table 15. Trophic conditions for the six lakes studied encompassed all four categories. Snakeden Hollow is classified as oligotrophic. Long Lake is in mesotrophic condition. Three lakes (Georgetown Reservoir, Homer Lake, and Walnut Point Lake) can be considered eutrophic. Matanzas Lake is hypereutrophic.

Lake Use Support

Definition

The degree of use support identified for each designated use indicates the ability of the lake: 1) to support a variety of high-quality recreational activities, such as boating, sport fishing, swimming, and aesthetic enjoyment; 2) to support healthy aquatic life and sport fish populations; and 3) to provide adequate, long-term quality and quantity of water for public or industrial water supply (if applicable). Determination of a lake's use support is based upon the state's water quality standards as described in Subtitle C of Title 35 of the State of Illinois Administrative Code. Each of four established use designation categories (including General Use, Public and Food Processing Water Supply, Lake Michigan, and Secondary Contact and Indigenous Aquatic Life) has a specific set of water quality standards.

The lake uses assessed in this report fall under General Use standards, primarily the 0.05 mg/L TP standard. The TP standard has been established for the protection of aquatic life, primary-contact (e.g., swimming) and secondary-contact (e.g., boating) recreation, agriculture, and industrial uses. In addition, lake-use support is based in part on the amount of sediment, macrophytes, and algae in the lake and how these might impair designated lake uses. The following is a summary of the various classifications of use impairment:

Full = full support of designated uses, with minimal impairment

Full/threatened = full support of designated uses, indications of declining water quality or evidence of existing use impairment problems

Partial/minor = partial support of designated uses, with slight impairment

Partial/moderate = partial support of designated uses, with moderate impairment

Table 15. Quantitative Definitions of Lake Trophic States

Trophic state	*Secchi disc transparency (inches)*	*(meter)*	*Chlorophyll a (µg/L)*	*Total phosphorus, lake surface (µg/L)*	*TSI*
Oligotrophy	>157	>4.0	<2.6	<12	<40
Mesotrophic	79-157	2.0-4.0	2.6-7.2	12-24	40-50
Eutrophic	20-79	0.5-2.0	7.2-55.5	24-96	50-70
Hypereutrophic	<20	<0.5	>55.5	>96	>70

Table 16. Mean Trophic State Index Values

	Georgetown Reservoir			*Homer Lake*		
	Station 1	*Station 2*	*Station 3*	*Station 1*	*Station 2*	*Station 3*
Secchi transparency	73.3	73.4	72.9	62.7	63.0	68.6
Total phosphorus	67.3	65.1	65.5	55.6	57.0	61.3
Chlorophyll	60.5	62.2	64.1	62.8	62.5	69.1
Station average	67.1	66.9	67.5	60.4	60.8	61.1
Lake average		67.1			**60.8**	
Trophic condition		Eutrophic			Eutrophic	

	Long Lake			*Matanzas Lake*		
	Station 1	*Station 2*	*Station 3*	*Station 1*	*Station 2*	*Station 3*
Secchi transparency	45.1	46.1	50.4	75.0	76.6	77.0
Total phosphorus	27.7	31.9	36.9	81.1	74.4	80.8
Chlorophyll	42.7	45.6	47.0	71.9	70.3	70.1
Station average	38.5	41.2	44.8	76.0	74.4	76.0
Lake average		41.5			75.5	
Trophic condition		Mesotrophic			Hypereutrophic	

	Snakeden Hollow Lake			*Walnut Point Lake*		
	Station 1	*Station 2*	*Station 3*	*Station 1*	*Station 2*	*Station 3*
Secchi transparency	36.1	45.0	45.4	64.3	64.4	64.1
Total phosphorus	23.5	29.1	35.7	66.5	67.0	67.3
Chlorophyll	40.5	41.5	49.8	71.4	70.2	68.7
Station average	33.5	38.5	43.7	67.4	67.2	66.7
Lake average		38.6			67.1	
Trophic condition		Oligotrophic			Eutrophic	

Nonsupport = no support of designated uses, with severe impairment

Full-use supporting lakes may still exhibit some impairment, or have slight to moderate amounts of sediment, macrophytes, or algae in a portion of the lake (e.g., headwaters or shoreline); however, most of the lake acreage shows minimal impairment of the aquatic community and uses. *It is important to emphasize that if a lake is rated as not fully supporting designated uses, it does not necessarily mean that the lake cannot be used for those purposes or that a health hazard exists.* Rather, it indicates impairment in the ability of significant portions of the lake waters to support either a variety of quality recreational experiences or a balanced sport fishery. Since most lakes are multiple-use water bodies, a lake can fully support one designated use (e.g., aquatic life) but exhibit impairment of another (e.g., swimming).

Partial-use supporting lakes have a designated use that is slightly to moderately impaired in a portion of the lake (e.g., swimming impaired by excessive aquatic macrophytes or algae, or boating impaired by sediment accumulation). So-called nonsupport lakes have a designated use that is severely impaired in a substantial portion of the lake (e.g., a large portion of the lake has so much sediment that boat ramps are virtually inaccessible, boating is nearly impossible, and fisheries are degraded). However, in other parts of the same nonsupport lake (e.g., near a dam), the identical use may be supported. *Again, nonsupport does not necessarily mean that a lake cannot support any uses, that it is a public health hazard, or that its use is prohibited.*

Lake-use support and level of attainment were determined for aquatic life, recreation, swimming, and overall lake use, using methodologies described in the Illinois EPA's *Illinois Water Quality Report 1992-1993* (Illinois EPA, 1994).

The primary criterion in the aquatic life use assessment is an Aquatic Life Use Impairment Index (ALI); while in the recreation use assessment the primary criterion is a Recreation Use Impairment Index (RUI). While both indices combine ratings for TSI (Carlson, 1977) and degree of use impairment from sediment and aquatic macrophytes, each index is specifically designed for the assessed use. ALI and RUI relate directly to the TP standard of 0.05 mg/L. If a lake water sample is found to have a TP concentration at or below the standard, the lake is given a "full support" designation. The aquatic life use rating reflects the degree of attainment of the "fishable goal" of the Clean Water Act; whereas the recreation use rating reflects the degree to which pleasure boating, canoeing, and aesthetic enjoyment may be obtained at an individual lake.

The assessment of swimming use for primary-contact recreation was based on available data using two criteria: 1) Secchi disk transparency depth data and 2) Carlson's TSI. The swimming use rating reflects the degree of attainment of the "swimmable goal" of the Clean Water Act. If a lake is rated "nonsupport" for swimming, it does not mean that the lake cannot be used or that health hazards exist. It indicates that swimming may be less desirable than at those lakes assessed as fully or partially supporting swimming.

Finally, in addition to assessing individual aquatic life, recreation, and swimming uses, the overall use support of the lake was assessed. The overall use support methodology aggregates the use support attained for each of the individual lake uses assessed. Values assigned to each use-support attainment category are summed and averaged, and then used to assign an overall lake-use attainment value for the lake.

Lake Use Support Analysis

An analysis of lake use support for the six lakes studied was carried out employing the methodology developed by the Illinois EPA (1994). The analysis was performed on the basis of aquatic life use, recreation use, swimming use, and overall use. Table 17 presents the basic information along with assessed lake-use support information. The use-support analysis results for both Long Lake and Snakeden Hollow Lake are the same: full support for aquatic life, recreation, swimming, and overall uses. On the other hand, Matanzas Lake is nonsupport on the basis of all four uses.

For aquatic life use, Homer Lake is also classified as full support; while Georgetown Reservoir and Walnut Point Lake are partial/moderate and partial/minor support, respectively. For recreation use, Georgetown Reservoir and Homer Lake are determined to be partial-use support with moderate impairment; Walnut Point Lake is partial-use support with minor impairment. For swimming use, Georgetown Reservoir and Walnut Point Lake are considered as partial-use support with moderate impairment; Homer Lake is partial/minor support. Unfortunately, Matanzas Lake is designated for swimming with a nice beach, but the quality of water is not desirable for swimming on the basis of 1995 data. For overall use, Georgetown Reservoir is partial/moderate support; while Homer and Walnut Point Lakes are partial/minor support. The results of analyses suggest that the water quality of final cut lakes is very good and that of river impoundments is relatively poor.

Lake Sediment Characteristics

Lake sediment can act both as sinks and as potential pollutant sources (for pollutants such as phosphorus and metals) affecting water quality. Its metal and/or organic chemical toxicities can directly affect the presence of aquatic animals and plants on the lake bottom. Lake sediments, if and when dredged, should be carefully managed to prevent surface water and ground-water contamination. Sediment monitoring is becoming increasingly important as a tool for detecting pollution loading in lakes and streams.

Metals and Inorganics

While there are no regulatory agencies that promulgate lake sediment quality standards, sediment quality in Illinois has been generally assessed using the Classification of Illinois Lake Sediments report developed by Kelly and Hite (1981). Recently, Mitzelfelt of Illinois EPA (1995) developed the Lake Sediment Classification shown in table 18 based on 1987-1994 Illinois data. His percentiles correspond to the approximate equivalents of one and two standard deviations from the mean for a normal distribution population.

Table 19 presents metal and inorganic concentrations of surficial sediments collected from six lakes studied. Comparison of tables 18 and 19 reveals that phosphorus levels in lake sediments can be considered as normal. Total kjeldahl nitrogen in Georgetown Reservoir is in the low (below normal) category; while that in the other five lakes is in the normal ranges. For metals in sediments, such as arsenic, barium, chromium, copper, lead, manganese, nickel, and zinc are either below or in normal concentrations for this investigation. Cadmium, mercury, and silver were below detectable levels for most sediments. Potassium was not detected in Georgetown Reservoir and station 1 of Long Lake. Potassium levels in other lakes are generally in the normal range; while that at station 3 of Long Lake is at an elevated level. Iron concentrations at station 3 of Long Lake and at station 1 of Snakeden Hollow Lake were considered as elevated. This is most likely due to natural causes. The iron levels at all the sites in the other four lakes are in normal or low ranges (less than normal).

Table 17. Assessment of Use Support for Six Lakes

	Georgetown Reservoir		*Homer Lake*	
I. Aquatic life use	*Value*	*ALI points*	*Value*	*ALI points*
1. Mean trophic state index	67.1	60	60.8	60
2. Macrophyte impairment	7%	10	23%	0
3. Mean nonvolatile suspended solids	304. mg/L	15	3.0 mg/L	0
Total points:		85		60
Criteria points:		=85		<75
Use **Support:**		**Partial/Moderate**		**Full**
II. Recreation use	*Value*	*RUI points*	*Value*	*RUI points*
1. Mean trophic state index	67.1	67	60.8	61
2. Macrophyte impairment	7%	5	23%	10
3. Mean nonvolatile suspended solids	30.4 mg/L	15	10.1 mg/L	10
Total points:		87		81
Criteria points:		75<RUI<90		75<RUI<90
Use Support:		**Partial/Moderate**		**Partial/Moderate**
III. Swimming use	*Value*	*Degree of use support*	*Value*	*Degree of use support*
1. Secchi depth < 24 inches	93%	Partial/Moderate	27%	Partial/Minor
2. Fecal coliform > 200/100 mL	(not determined)	-		-
3. Mean trophic state index	67.1	Partial/Moderate	60.8	Partial/Minor
Use **Support:**		**Partial/Moderate**		**Partial/Minor**
IV. Overall use	2.0		3.3	
Use Support:		**Partial/Moderate**		**Partial Minor**

Notes:
ALI = aquatic life use impairment index.
RUI = recreation use impairment index.

Table 17. Continued

	Long Lake		*Matanzas Lake*	
I. Aquatic life use	*Value*	*ALIpoints*	*Value*	*ALIpoints*
1. Mean trophic state index	41.7	**50**	75.5	70
2. Macrophyte impairment	20%	**0**	0%	15
3. Mean nonvolatile suspended solids	3.0 mg/L	**0**	35.4 mg/L	15
Total points:		**50**		100
Criteria points:		**<75**		=95
Use Support:		**Full**		**Nonsupport**
II. Recreation use	*Value*	*RUIpoints*	*Value*	*RUIpoints*
1. Mean trophic state index	41.7	42	75.5	76
2. Macrophyte impairment	20%	10	0%	0
3. Mean nonvolatile suspended solids	3.0 mg/L	5	35.4 mg/L	15
Total points:		49		72
Criteria points:		RUI<60		90<RUI
Use **Support:**		**Full**		**Nonsupport**
III. Swimming use	*Value*	*Degree of use support*	*Value*	*Degree of use support*
1. Secchi depth < 24 inches	0%	Full	60%	Partial/Moderate
2. Fecal coliform > 200/100 mL		-		-
3. Mean trophic state index	41.7	Full	75.5	Nonsupport
Use **Support:**		**Full**		**Nonsupport**
IV. Overall use	5.0		1.0	
Use Support:		**Full**		**Nonsupport**

Notes:
ALI = aquatic life use impairment index.
RUI = recreation use impairment index.

Table 17. Concluded

	Snakeden Hollow Lake		*Walnut Point Lake*	
I. Aquatic life use	*Value*	*ALI points*	*Value*	*ALI points*
1. Mean trophic state index	38.6	40	67.1	60
2. Macrophyte impairment	16%	10	1%	15
3. Mean nonvolatile suspended solids	1.5 mg/L	0	6.5 mg/L	0
Total points:		50		75
Criteria points:		<75		=75
Use **Support:**		**Full**		**Partial/Minor**
II. Recreation use	*Value*	*RUI points*	*Value*	*RUIpoints*
1. Mean trophic state index	38.6	39	67.1	67
2. Macrophyte impairment	16%	10	1%	0
3. Mean nonvolatile suspended solids	1.5 mg/L	0	6.5 mg/L	5
Total points:		49		72
Criteria points:		RUI<60		60<RUI<75
Use Support:		**Full**		**Partial/Minor**
III. Swimming use	*Value*	*Degree of use support*	*Value*	*Degree of use support*
1. Secchi depth < 24 inches	0%	Full	60%	Partial/Moderate
2. Fecal conform > 200/100 mL				-
3. Mean trophic state index	38.6	Full	67.1	Partial/Moderate
Use **Support:**		**Full**		**Partial/Moderate**
IV. Overall use	5.0		2.7	
Use Support:		**Full**		**Partial/Minor**

Notes:
ALI = aquatic life use impairment index.
RUI = recreation use impairment index.

Table 18. Classification of Lake Sediments (revised 1996)

	*Detection Limit**	*Low*	*Normal*	*Elevated*	*Highly Elevated*
Phosphorus	0.1	<394	394-<1115	1115-<2179	≥ 2179
kjeldahl-N	1.0	<1300	1300-<5357	5357-<11700	≥ 11700
Cadmium	0.1	n/a**	<5	5-<14	≥ 14
Copper	1.0	<16.7	16.7-<100	100-<590	≥ 590
Lead	0.1	<14	14-<59	59-<339	≥ 339
Mercury	0.1	n/a	<0.15	0.15-<0.701	≥ 0.701
Arsenic	0.5	<4.1	4.1-<14	14-<95.5	≥ 95.5
Chromium	10	<13	13-<27	27-<49	≥ 49
Iron	10	<16000	16000-<37000	37000-<56000	≥ 56000
Manganese	10	<500	500-<1700	1700-<5500	≥ 5500
Zinc	10	<59	59-<145	145-<1100	≥ 1100
Nickel	1.0	<14.3	14.3-<31	31-43	≥ 43
Silver	0.1	n/a	<0.1	0.1-<1	≥ 1
Potassium	1.0	<410	410-<2100	2100-<2797	≥ 2797
Barium	1.0	<94	94-<271	271-<397	≥ 397
PCBs	10	n/a	<10	10-<89	≥ 89
Aldrin	1	n/a	<1	1-<1.2	≥ 12
Dieldrin	1	n/a	<3.4	3.4-<15	≥ 15
DDT	10	n/a	<10	10-180	≥ 180
Chlordane	5	n/a	<5	5-12	≥ 12
Endrin	1	n/a	<1	n/a	≥ 1
Methoxychlor	5	n/a	<5	n/a	≥ 5
alph-BHC	1	n/a	<1	n/a	≥ 1
gamma-BHC	1	n/a	<1	n/a	≥ 1
HCB	1	n/a	<1	n/a	≥ 1
Heptachlor	1	n/a	<1	n/a	≥ 1
Heptachlor epoxide	1	n/a	<1	1-<1.6	≥ 1.6

Notes:
* Amounts of metals and inorganics expressed as mg/kg, organics as µg/kg.
** Data not available.
Source: Jeff Mitzelfelt, IEPA, 1995.

Table 19. Characteristics of Sediments in Six Illinois Lakes, 1995

	Georgetown Reservoir (Julv 20)		*Homer Lake (July 19)*		*Long Lake (Julv 18)*		*Matanzas Lake (Julv 13)*		*Snakeden Hollow Lake (Julv 12)*		*Walnut Point Lake (Julv 19)*	
*Parameters **	*Station I*	*Station 3*	*1*	*3*	*1*	*3*	*1*	*3*	*1*	*2*	*1*	*3*
Phosphorus	495	488	640	669	464	492	1032	918	747	420	917	726
kjeldahl nitrogen	70	420	1544	1812	1905	3664	3117	7803	1864	1784	2365	1489
Solids, % wet	53.8	51.5	31.1	34.6	43.0	39.2	32.2	45.5	33.4	31.8	26.5	38.2
Volatile solids, %	5.5	6.0	11.1	8.2	6.4	9.1	9.7	7.2	10.3	7.9	12.2	8.6
TOC, %	4.52	4.22	9.93	4.43	10.19	12.06	5.9	6.09	6.55	7.84	12.04	4.91
Arsenic	4.3	4.0	5.6	4.0	3.0	7.8	8.4	6.7	5.9	4.7	9.2	8.6
Barium	74	72	174	128	31	101	145	102	108	101	266	211
Cadmium	1K**	1K	1K	1K	1K	1K	2	1K	1K	1K	1K	1K
Chromium	9	10	17	14	8	26	26	19	19	15	20	18
Copper	13	12	24	20	8	23	28	20	24	15	25	22
Iron	12000	12000	19000	16000	11000	**38000**	31000	19000	**38000**	17000	**38000**	30000
Lead	13	12	16	14	10K	19	23	20	27	27	21	16
Manganese	493	437	655	479	268	467	1000	661	819	776	1000	595
Mercury	0.1K	0.1K	0.1K	0.1K	0.1K	0.1K	0.1K	0.1K	0.1K	0.1K	0.1K	0.1K
Nickel	12	12	20	17	12	27	28	20	**39**	29	22	18
Potassium	1000K	1000K	1700	1300	1000K	2800	1900	1400	2000	1700	2000	1800
Silver	1K	1K	1K	1K	1K	1K	1K	1K	1K	4	1K	1K
Zinc	55	52	79	65	33	99	133	93	71	30	84	70
Water depth, ft	7	5	16	5	38	12	6	4	55	10	27	16

Notes:
Values in bold exceed the normal limit.
*Units measured in mg/kg, unless specified.
**K indicates that values were below the detection level.

Organic Compounds

Chlorinated hydrocarbon compounds consist of a group of pesticides that are no longer in use but persist in the environment. These compounds, such as polychlorinated biphenyls (PCBs), chlordane, dieldrin, and DDT, present a somewhat unique problem in aquatic systems due to their potential for bioaccumulation in fish in the food web. Organochlorine compounds are relatively insoluble in water but highly soluble in lipids where they are retained and accumulated. Minute and often undetectable concentrations of these compounds in water and sediment may ultimately pose a threat to aquatic life and then possibly to human health.

Table 20 presents the observed concentrations of tested organochlorine compounds. An examination of table 20 indicates that with a few exceptions, most parameters assessed were below detectable levels. A comparison of tables 19 and 20 reveals that the total PCB concentrations in Matanzas Lake may be considered as elevated. Dieldrin was detected in four lakes (Georgetown, Homer, Matanzas, and Walnut Point), however, the concentrations are in the normal ranges. At station 1 of both Matanzas and Walnut Point Lakes, P,P'-DDE was detected. Alpha-BHC was found at the deepest station (station 1) of Snakeden Hollow Lake and Walnut Point Lake at highly elevated concentrations (>1.0 μg/kg) at station 1 of Matanzas Lake. This organic is not listed in the classification table.

SUMMARY

This report includes all data collected in 1995 for 18 sites in six Illinois lakes. The data are presented in the form of individual listings of lake assessment information for each lake (Illustration A). Each lake summary includes morphological data, watershed information, lake usages and impairments, water quality problems and causes, fish information, and lake protection management.

The report discusses results of physical and chemical assessment of in-situ observations, water samples, and sediment quality. Two lakes (Snakeden Hollow and Long Lakes) have superior water quality. Eventhough Matanzas Lake has poor water and sediment quality, it is currently being used for swimming. Any significant differences among the three sampling stations for each lake were analyzed. For each lake, the facilities in lake park area and shoreline conditions as well as macrophytes growth were surveyed and presented.

Trophic condition and lake use support were also assessed for each lake. On the basis of trophic index, the six lakes are classified as noted herein: Snakeden Hollow Lake as oligotrophic; Long Lake as mesotrophic; three lakes (Georgetown, Homer, and Walnut Point Lakes) as eutrophic; and Matanzas Lake as hypereutrophic. Lake use support for Georgetown, Homer, Long, Matanzas, Snakeden Hollow, and Walnut Point Lakes are partial/moderate, partial/minor, full, partial/minor, full, and nonsupport, respectively.

Table 20. Organic Characteristics of Sediments in Six Illinois Lakes, 1995

Organic compounds, mg/L	*Georgetown Reservoir (July 20)*		*Homer Lake (Julv 19)*		*Long Lake (Julv 18)*		*Matanzas Lake (Julv 13)*		*Snakeden Hollow Lake (Julv 12)*		*Walnut Point Lake (Julv 19)*	
	Station 1	*Station 3*	*1*	*3*	*1*	*3*	*1*	*3*	*1*	*2*	*1*	*3*
Total PCBs	10K	10K	10K	10K	10K	10K	20	9.9	10K	10K	10K	10K
Aldrin	1k	1k	1k	1k	1k	1k	1k	1k	1k	1k	1k	1k
Dieldrin	2.2	1.3	3.4	1k	1k	1k	2.0	1k	1k	1k	3.0	1.1
Total DDT	10K	10K	10K	10K	10K	10K	10K	10K	10K	10K	10K	10K
P,P'-DDE	1k	1k	1k	1k	1k	1k	1.5	1k	1k	1k	1.1	1k
P,P'-DDD	1k	1k	1k	1.1	1k	1k	1k	2K	1k	1k	1k	1k
P,P'-DDT	1k	1k	1k	1k	1k	1k	1k	1k	1k	1k	1k	1k
Chlordane												
Total	5K	5K	5K	5K	5K	5K	5K	5K	5K	5K	5K	5K
CIS isomer	2K	2K	2K	2K	2K	2K	2K	2K	2K	2K	2K	2K
Trans isomer	2K	2K	2K	2K	2K	2K	2K	2K	2K	2K	2K	2K
Endrin	1k	1k	1k	1k	1k	1k	1k	1k	1k	1k	1k	1k
Methyoxychlor	5K	5K	5K	5K	5K	5K	5K	5K	5K	5K	5K	5K
Alpha-BHC	1k	1k	1k	1k	1k	1k	1k	1k	1.2	1k	1.3	1k
Gamma-BHC (Lindane)	1k	1k	1k	1k	1k	1k	1k	1k	1k	1k	1k	1k
Hexachlorobenzene	1k	1k	1k	1k	1k	1k	2.1	1k	1k	1k	1k	1k
Heptachlor	1k	1k	1k	1k	1k	1k	1k	1k	1k	1k	1k	1k
Heptachlor epoxide	1k	1k	1k	1k	1k	1k	1k	1k	1k	1k	1k	1k
Water depth, ft	7	5	16	5	38	12	6	4	55	10	27	16

Note: A K indicates values below the detection level.

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Illustration A. Lake Assessment Information for Six Illinois Lakes

Abbreviations

Under *Usages and Impairments:*

Full: full support
F/Th: full/threatened
P/Mi: partial/minor
P/Mo: partial/moderate

(1), (2), (3), (4): from low to high level of use
P: potential for increased use
I: increasing trend of use
D: decreasing trend of use

Under *Water Quality and Problems,* and *Causes of Water Quality Problems:*

M/N: minimal/none
S: slight
M: moderate
H: high or substantial

Georgetown Reservoir

(Little Vermilion River Reservoir)

I. General Information

County	Vermilion
Map Code	**RBS**
Lake Location	South of Georgetown
Deepest Point Latitude	39°57'30"
Longitude	87°38'42"
Lake Surface Area, acres	55.1
Length of Shoreline, miles	5.6
Maximum Depth, feet	10
Average Depth, feet	**3**
Lake Storage Capacity, acre-feet	171
Watershed Drainage Area, acres	17,280
Hydraulic Retention Time, years	0.1
Lake Type	Dammed Stream
Year Constructed	1936

Ownership Municipal

Owner/Manager: City of Georgetown
Address: 208 S. Walnut, Georgetown, IL 61846
Telephone: 217/662-2626

Inflowing Streams Little Vermilion River

Outflowing Streams Little Vermilion River

Other publicly owned lakes in the county

Clear, Long, Vermilion, Mingo, and many strip-mined lakes.

Unique Features

A bubbled air facility is installed near the lake and the dam.

II. Usages and Impairments

Public Access Yes

Entire lake bottom publicly owned but entire shoreline is not accessible, unlimited free access.

Visitors per Year 100,000 - 250,000

Designated Uses and Impairments

Fish and aquatic wildlife	M
Domestic water supply	H

Nonrecreational Lake Usage

Potable water supply - 4, **P, I**

Recreational Lake Usage

Fishing - (3)
Camping - (1)
Picnicing - (1)

Recreational Facilities

Boat ramp - 1
Parks- 1

Shoreline Usage, %

Residential	1
Cropland	70
Woodland	29

Watershed Drainage **Area Usage,** %

Cropland	60
Pasture or grassland	30
Woodland	10

ILL Water Quality and Problems

Problems

Algal blooms	S
Water level fluctuation	S

Differences in Turbidity and Water Quality*

In different portions of lake? No

At different times of the year? Yes

Fishing Good

Major Types of Fish

Bluegill, brown bullhead, carp, green sunfish, largemouth bass, warmouth, white crappie, spotted and white sucker

* Turbidity will change rapidly along with pH and alkalinity during heavy rain.

Georgetown Reservoir

IV. Causes of Water Quality Problems

Potential Pollution Sources

Sewage treatment plant effluent, runoff (feedlot, cropland, pasture/grassland), septic tanks, sediment in lake

Causes of Impairment	
Priority organics	S
Siltation	M
Sources of Impairment	
Point sources	H
Storm sewers	H
Feedlots	M

V. Lake Protection Management

Treatment Date	*Type* ***and Extent of Treatment***		***Reason for Treatment***
	Grassed waterway	55 acres	Erosion control
	Grade stabilization structure	11	Erosion control
5/1991	Field border strip	2,000 ft	Erosion control
5/1991	Permanent vegetative cover	225 acres	Erosion control
4/1991	Tree planting	100 acres	Erosion control
	Conservation cropping system	28,000 acres	
7/1992	Other (well testing)	30	Nitrate, pesticides

Cropland Tillage	***%***
No-till	10
Mulch till with 30% residue or more	17
Mulch till with <30% residue	10
Moldboard plow	7
Chisel or disc till >30% residue	15
Chisel or disc till <30% residue	31
Crop rotation	10

Homer Lake

I. General Information

County	Champaign
Map code	RBO
Lake Location	2 miles NW of Homer
Deepest Point Latitude	40°03'45"
Longitude	87°59'07"
Lake Surface Area, acres	80.8
Length of Shoreline, miles	5.3
Maximum Depth, feet	24
Average Depth, feet	8.1
Lake Storage Capacity, acre-feet	679
Watershed Drainage Area, acres	9280
Hydraulic Retention Time, years	**0.1**
Lake Type	Dammed stream
Year Constructed	1969

Ownership Champaign County

Owner/Manager: Cham. Co. Forest Pres. Dist.
Address: 2573 South Homer Lake Road
Homer, IL 61840
Telephone: 217/896-2733

Inflowing Streams Conkey Branch
Outflowing Streams Salt Fork River

Unique Features
None

II. Usages and Impairments

Public Access Yes

Entire lake bottom publicly owned and entire shoreline public access; boating fee $13.50/yr for county residents, $21.00/yr for non-residents. Electric motors only

Visitors per Year <25,000

Designated Uses and Impairments

Fish and aquatic wildlife S

Nonrecreational Lake Usage
None

Recreational Lake Usage

Fishing (4) Low power boating (4)
Sailboating (2) Waterfowl observation (3)
Picnicking (4)
Environmental education activities (schools, YMCA, Boy & Girl Scouts) (2)

Recreational Facilities
4 boat ramps, park, picnic areas, boat rental, pavilion (25'x35'), indoor toilet, hiking, camping, hunting, winter sports, concession, handicapped access

Shoreline Usage, %

Residential	10
Recreation development	25
Pasture and grassland	40
Woodland	25

Watershed Drainage Area Usage, %

Cropland	90
Pasture and grassland	2
Woodland	2
Residential (2%) & recreation development	4
Wetland (1%) & wildlife (1%)	2

III. Water Quality and Problems

Problems

Suspended sediment	**M**
Sediment deposition	**M**
Algal blooms	**M**
Aquatic macrophytes	**H**
Taste/odor	M
Water level fluctuation	S
Fish kills	M/N

Differences in Turbidity and Water Quality

In different portions of lake? Yes
At different times of the year? Yes

Fishing Good

Major Types of Fish
Brown bullhead, black crappie, bluegill, large-mouth bass, channel catfish, redear sunfish, northern pike, carp
The lake has not been treated with $CuSO_4$ the last five years.

Homer Lake

IV. Causes of Water Quality Problems

Potential Pollution Sources

Runoffs (construction site, feedlot, cropland, pasture/grassland, woodland), septic tanks, livestock operations, erosion (streambank and shoreline), sediment in lake, rough fish

Causes **of Impairment**	
Nutrients	M
Siltation	H
Organic enrichment/DO depletion	M
Taste and odor	S
Sources of **Impairment**	
Agriculture	H
Pasture land	S
Nature	S

V. Lake Protection Management

Treatment Date	*Type and Extent of Treatment*		*Reason for Treatment*
	Grassed waterway	5 acres	
	Pond	2	
	Field border strip	4,000 ft	
	Conservation cropping system	7,000 acres	

Cropland Tillage	*%*
No-till	18
Mulch till with 30% residue or more	5
Mulch till with <30% residue	72
Moldboard plow	5

Long Lake

I. General Information

County Vermilion
Map code **RBM**
Lake Location 4 miles **W** of Danville
Deepest Point Latitude 40°07'52"
Longitude 87°44'30"
Lake Surface Area, acres 49.7
Length of Shoreline, miles **3.4**
Maximum Depth, feet (cliff backfill, 38') 36
Average Depth, feet **8.8**
Lake Storage Capacity, acre-feet 448
Watershed Drainage Area, acres **99**
Hydraulic Retention Time, years **9.1**
Lake Type Coal strip-mine
Year Constructed 1927

Ownership
Owner/Manager: State of Illinois
Address: 10906 Kickapoo Park Road
Oakland, IL 61858
Telephone: 217/442-4915
Inflowing Streams None
Outflowing Streams Middle Fork River

Unique Features
The largest of 22 water ponds in the 2842 acre state park

II. Usages and Impairments

Public Access Yes
Entire lake bottom publicly owned and entire shoreline public access, unlimited free access, electric motors only
Visitors per Year >200,000
Designated Uses and Impairments

Fish and aquatic wildlife	M
Cold water fishery	S
General recreation	H

Nonrecreational Lake Usage
None

Recreational **Lake** Usage
Fishing (3), I Low power boating (3)
Camping (3), I Waterfowl observation (3), I
Picnicking (3)

Recreational Facilities
Boat ramps - 2 picnic areas - 2
Boat rental -1 concession stand - 1
Camping areas - 2 hunting, hiking, & running
canoeing scuba diving, winter sports

Shoreline Usage, %

Woodland	80
Wetland	18
Recreation development	2

Watershed Drainage Area Usage, %

Residential	20
Cropland	20
Pasture or grassland	12
Woodland	28
Wetland and wildlife	20

III. Water Quality and Problems

Problems

Algal blooms	S
Aquatic macrophytes	S

Differences in Turbidity and Water Quality
In different portions of lake? **No**
At different times of the year? Yes
Fishing Fair
Major Types of Fish
Largemouth bass, channel catfish, bluegill, redear sunfish, green sunfish, black crappie, carp, grass pike, northern pike, black bullhead, warmouth

Long Lake

IV. Causes of Water Quality Problems

Potential Pollution Sources

Woodland runoff, mining spoil piles, septic tanks, erosion (streambank and shoreline), waterfowl, roughfish, boating activity

Causes of Impairment

Siltation	M

Sources of Impairment

Nonirrigated crop production	S
Lake shoreline and stream bank erosion	S
Highway maintenance and runoff	S
Natural	S
Recreation activities	S
Waterfowl	S

Note: At high Middle Fork River levels, the river overflows into the lake. It can raise the lake level up to 5 feet and increase turbidity.

V. Lake Protection Management

Treatment Date	*Type and Extent of Treatment*	*Reason for Treatment*
None		

Matanzas Lake

I. General Information

County Mason
Map code RDZV
Lake Location 2 miles S of Havana
Deepest Point Latitude 40°14'38"
Longitude 90°05'55"
Lake Surface Area, acres 36.1
Length of Shoreline, miles 7.0
Maximum Depth, feet 8
Average Depth, feet 5
Lake Storage Capacity, acre-feet 1805
Watershed Drainage Area, acres (backwater)
Hydraulic Retention Time, years -
Lake Type Dammed Stream (side channel)
Year Constructed 1940s

Ownership Public
Owner/Manager: Lake Association
Address: 12928 SR 78 Havana
Telephone: 309/543-0752
Inflowing Streams Ill. R., White Oak Creek
Outflowing Streams None **(Ill.** R.)
Other publicly owned lakes in the county:
Chautauqua, Clear, Crane, Liverpool, Otter, Quiver, Sangamon, and Stewart

Unique Features
The lake is connected to Illinois River which influences the water level of the lake. Residences are all along the east shore.

II. Usages and Impairments

Public Access Yes
Entire lake bottom publicly owned and entire shoreline public access (controlled), $30 annual fee, unlimited access
Visitors per Year >200,000
Designated Uses and Impairments
General recreation M

Nonrecreational Lake Usage
None

Recreational Lake Usage

Fishing (3)	High power boating (3)
Swimming (2)	Waterfowl hunting (2)
Water skiing (3)	Waterfowl observation (4)

Recreational Facilities
Swimming beach - 1, boat ramp - 1

Shoreline Usage, %

Residential	40
Cropland	5
Pasture or grassland	5
Woodland	50

Watershed Drainage Area Usage, %

Residential urban	0.5
Cropland	95
Pasture/grassland	2
Woodland	2
Wetland & wildlife	0.5

HI. Water Quality and Problems

Problems

Suspended sediment	H
Sediment deposition	H
Algal blooms	M/S
Water level fluctuation	H
Fish kills	M/S

Differences in Turbidity and Water Quality
In different portions of lake? **No**
At different times of the year? Yes
Fishing Good
Major Types **of Fish**
Channel catfish, buffalo, crappie, smallmouth bass, sauger, freshwater drum, redear sunfish, dog fish, garr

Matanzas Lake

IV. Causes of Water Quality Problems

Potential Pollution Sources

Runoff (cropland, woodland, lawn), septic tanks

The lake is connected to the Illinois River during high water.

Causes of Impairment	
Unknown toxicity	S
Pesticides	S

Sources of Impairment	
Agriculture	S

V. Lake Protection Management

Treatment Date	*Type and Extent of Treatment*		*Reason for Treatment*
	Field border strip	1,000 ft	
	Permanent vegetative cover	100 acres	
	Tree planting		
	Diversion		
	Conservation cropping system	10,000	
	Livestock exclusion	100	

Cropland Tillage	*%*
No-till	11
Mulch till with 30% residue or more	63
Mulch till with <30% residue	26

Snakeden Hollow Lake

I. General Information

County	Knox
Map code	UDU
Lake Location	1 mile SE of Victoria
Deepest Point Latitude	41°00'23"
Longitude	90°04'16"
Lake Surface Area, acres	176
Length of Shoreline, miles	6.66
Maximum Depth, feet	55
Average Depth, feet	28
Lake Storage Capacity, acre-feet	4,948
Watershed Drainage Area, acres	2,120
Hydraulic Retention Time, years	-
Lake Type	Dammed stream
Year Constructed	1978

Ownership State

Owner/Manager: Department of Nat. Resources
Address: 1936 IL Hwy 167, Victoria, IL 61485
Telephone: 309/879-2607

Inflowing Streams -

Outflowing Streams into other lake

Unique Features

The lake is the deepest man-made lake in Illinois. Ninety percent of the watershed is owned by DNR and land use is managed - conservation Canada geese.

II. Usages and Impairments

Public Access Yes

Entire lake bottom publicly owned and entire shoreline public access unlimited free access; restricted during October to January 16 when the area is for a waterfowl refuge

Visitors per Year 25,000-100,000

Designated Uses and Impairments

Fish and aquatic wildlife	S
General recreation	S

Nonrecreational Lake Usage

None

Recreational Lake Usage

Fishing (4) Low power boating (4)
Picnicking (2) Waterfowl hunting (3)
Waterfowl observation (3), I

Recreational Facilities

One boat ramp; park (this is a low recreational development site - primarily for fishing and hunting)

Shoreline Usage, %

Cropland	5
Pasture or grassland	70
Woodland	20
Wetland	5

Watershed Drainage Area Usage, %

Cropland	30
Pasture and woodland	2
Recreation development and other	3
Wetland	5
Wildlife	60

III. Water Quality and Problems

Problems

Suspended sediment	M/N
Sediment deposition	M/N
Aquatic macrophytes	S
Taste/Odor	S
Water level fluctuation	M/N
Fish kills	M/N

Differences in Turbidity and Water Quality

In different portions of lake? Yes

At different times of the year? Yes

Fishing Excellent

Major Types of Fish

Largemouth bass, smallmouth bass, bluegill, black crappie, bullhead, channel catfish, muskie, redear sunfish, green sunfish, brown trout, rainbow trout, and walleye

Snakeden Hollow Lake

IV. Causes of Water Quality Problems

Potential Pollution Sources

Sewage treatment plant effluent, runoff (cropland, pasture/grassland, woodland), mining, shoreline erosion, waterfowl

Causes of Impairment

Unknown toxicity	S
Suspended solids	S
Noxious aquatic plants	S
Organic enrichment/DO depletion	S

Sources of Impairment

Municipal	S	Nonpoint sources	S
Agriculture	S	Pasture land	S
Waterfowl	S	Erosion	S

V. Lake Protection Management

Treatment Date	*Type and Extent of Treatment*		*Reason for Treatmnt*
7/19/95	Grassed waterway	4 acres	
	Grade stabilization structure	8	
	Pond	1	Wildlife habitat
	Field border strip	30,000 ft	
	Permanent vegetation cover	2,320 acres	
	Tree planting	2 acres	
	Diversion	6,000 ft	Strip mine high walls
	Conservation cropping system	800 acres	
	Livestock exclusion	10,400 ft	

Cropland Tillage	*%*
No-till	20
Mulch till with 30% residue or more	30
Mulch till with <30% residue	30
Chisel or disc till ≥ 30% residue	10
Chisel or disc till <30% residue	10

Walnut Point Lake

I. General Information

County	Douglas
Map code	RBK
Lake Location	3 miles N of Oakland
Deepest Point Latitude	39°40'21"
Longitude	88°02'05"
Lake Surface Area, acres	58.7
Length of Shoreline, miles	6.3
Maximum Depth, feet	3.1
Average Depth, feet	11.5
Lake Storage Capacity, acre-feet	673
Watershed Drainage Area, acres	2560
Hydraulic Retention Time, years	0.315
Lake Type	Dammed stream
Year Constructed	1968

Ownership State

Owner/Manager: IL Dept. of Nat. Resources
Address: R.R#2, Box 250, Oakland, IL 61943
Telephone: 217/346-3336

Inflowing Streams Unnamed

Outflowing Streams Embarras River

Unique Features

Narrow litoral zone

II. Usages and Impairments

Public Access Yes

Entire lake bottom publicly owned and entire shoreline public access. State registered boat with electric motor only

Visitors per Year >200,000

Designated Uses and Impairments

Fish and aquatic wildlife	S
General recreation	S

Nonrecreational **Lake** Usage

None

Recreational Lake Usage

Fishing (4), I	Low power boating (4)
Sailboating (1)	Picnicking (4)
Camping (4)	Water observation (3)
Ice fishing	Ice skating

Recreational Facilities

Boat ramps - 2	picnic areas - 8
hiking trails - 2	concession stand
camping areas - 2	handicapped access
park (hunting)	

Shoreline Usage, %

Woodland	95
Recreation development	5

Watershed Drainage Area Usage, %

Cropland	71
Pasture or grassland	6
Woodland	16
Residential	4.5
Recreation development	1.5
Wildlife	1

III. Water Quality and Problems

Problems

Suspended sediment	M
Sediment deposition	M
Algal blooms	M
Aquatic macrophytes	S
Taste/odor	S
Water level fluctuation	M/N
Fish kills	M/N

Differences in Turbidity and Water Quality

In different portions of lake?	No
At different times of the year?	No

Fishing Good

Major Types of Fish

Largemouth bass, bluegill, redear, sunfish, black crappie, channel catfish, brown bullhead

Walnut Point Lake

IV. Causes of Water Quality Problems

Potential Pollution Sources

Runoff (cropland, pasture/grassland, woodland), livestock operations, shoreline erosion, sediment in lake, geese

Causes of Impairment	
Pesticides	S
Siltation	S
Sources of Impairment	
Agriculture	S
Nonpoint sources	S

V. Lake Protection Management

Treatment Date	*Type and Extent of Treatment*		*Reason for Treatment*
	Terrace	10,800 linear ft	
	Grassed waterway	8 acres	
	Grade stabilization structure	3	
	Field border strip	1,500 ft	
	Permanent vegetative cover	10 acres	
	Diversion	2,000 ft	
	Conservation cropping system	920 acres	

Cropland Tillage	*%*
No-till	45
Mulch till with 30% residue or more	21
Mulch till with <30% residue	3
Moldboard plow	28
Chisel or disc till >30% residue	3

Appendix A. Water Quality Characteristics of Georgetown Reservoir, 1995

	Station 1						Station 2					
Parameters	*4/26*	*6/16*	*7/20*	*8/29*	*10/5*	*Mean*	*4/26*	*6/16*	*7/20*	*8/29*	*10/5*	*Mean*
Total depth of site, ft	7	8	7	8	9	7.8	9	9	9	8	9	8.8
Secchi transparency, inches	20	16	17	17	10	16	20	17	18	15	10	16
Conductivity, µmho/cm	645	633	578	457	499	562	640	630	584	473	500	565
pH	8.4	8.4	8.3	9.0	8.3	8.5	8.4	8.4	8.3	8.9	8.4	8.5
Alkalinity, mg/L as $CaCO_3$												
Phenolphthalein	4	2	0	20	0	5.2	4	2	0	20	2	5.6
Total	249	245	237	188	208	225	245	241	233	196	213	225
Suspended solids, mg/L												
Total	19	28	- 21	40	84	38.4	20	18	57	38	96	45.8
Volatile	3	5	6	18	10	8.4	3	3	12	14	36	13.6
Turbidity, NTU	7.9	2.9	5.2	3.9	2.5	4.8	8.2	2.7	5.6	2.9	2.7	4.4
Nitrogen, mg/L												
Ammonia	0.12	0.06	0.06	.01K	0.21	0.092	0.07	0.07	0.04	.01K	0.11	0.06
Nitrite/nitrate	10.4	11.1	4.2	0.33	0.06	5.21	10.4	11.2	4.0	0.90	0.04	5.31
Total kjeldahl	0.11	0.88	0.60	1.5	1.4	0.90	0.32	0.71	0.42	1.3	5.6	1.67
Phosphorus, mg/L												
Total	.031	.060	.070	.184	.137	.096	.028	.047	.077	.106	.138	.079
Dissolved	.020	.037	.017	.022	.037	.027	.014	.023	.016	.012	.031	.019
Pigments, µg/L												
Chlorophyll *a**	8.90	6.28	30.66	10.68	22.70	35.07	7.16	11.78	32.04	79.51	44.73	35.04
Chlorophyll *a***	11.41	9.82	32.84	111.22	31.20	39.30	12.21	11.23	36.48	95.34	55.33	42.12
Chlorophyll *b*	13.65	13.25	6.19	12.68	14.58	12.07	15.01	16.08	5.30	16.92	19.59	14.58
Chlorophyll *c*	18.52	19.40	5.46	16.18	16.18	15.15	22.41	24.08	7.05	17.50	17.17	17.64
Pheophytin *a*	5.64	7.46	2.57	2.54	14.69	4.13	10.16	0.86	6.09	23.50	14.02	3.99
Sample depth, ft	3.4	2.7	3	2.8	1.7	2.7	3.4	2.9	3	3.2	1.7	2.8

Notes:
A K indicates less than detection value.
*corrected value.
**uncorrected value.

Appendix A. Concluded

Parameters	*Station 3*					
	4/26	*6/16*	*7/20*	*8/29*	*10/5*	*Mean*
Total depth of site, ft	6.3	6	5	6	5	5.7
Secchi transparency, inches	26	17	16	15	10	17
Conductivity, µmho/cm	646	646	587	480	500	572
pH	8.4	8.4	8.5	8.9	8.4	8.5
Alkalinity, mg/L as $CaCO_3$						
Phenolphthalein	4	2	4	18	2	6.0
Total	245	241	241	192	208	225
Suspended solids, mg/L						
Total	27	20	26	48	86	41.4
Volatile	2	3	9	14	34	12.4
Turbidity, NTU	11	2.8	5.7	3.0	2.9	5.1
Nitrogen, mg/L						
Ammonia	0.05	0.04	.01K	.01K	0.08	0.038
Nitrite/nitrate	10.4	11.2	3.5	0.95	0.04	5.22
Total kjeldahl	0.16	0.96	0.1K	1.1	1.9	0.84
Phosphorus, mg/L						
Total	.023	.045	.122	.090	.150	.086
Dissolved	.012	.020	.015	.012	.043	.020
Pigments, ug/L						
Chlorophyll *a**	6.20	11.55	63.89	114.81	50.36	49.36
Chlorophyll *a***	7.66	13.78	66.84	122.73	61.75	54.55
Chlorophyll *b*	7.41	20.67	9.07	33.63	20.38	18.43
Chlorophyll, *c*	10.23	30.19	8.84	15.03	20.64	16.99
Pheophytin *a*	3.15	6.13	2.19	10.41	17.67	3.56
Sample depth, ft	4.4	2.9	2.6	2.5	1.7	2.8

Notes:
A K indicates less than detection value.
*corrected value.
**uncorrected value.

Appendix B. Water Quality Characteristics of Homer Lake, 1995

	Station 1. surface						*Station 1. bottom*					
Parameters	*4/25*	*6/14*	*7/19*	*8/30*	*10/6*	*Mean*	*4/25*	*6/14*	*7/19*	*8/30*	*10/6*	*Mean*
Total depth of site, ft	16	16	16	16	15	15.8	16	16	16	16	15	15.8
Secchi transparency, inches	27	67	34	25	24	35						
Conductivity, µmho/cm	617	547	449	369	406	477	673	470	486	525	407	512
pH	8.5	8.4	8.7	9.0	8.4	8.6	8.2	8.0	7.6	7.8	8.1	8.0
Alkalinity, mg/L as $CaCO_3$												
Phenolphthalein	16	2	12	16	4	10	-	-	-	-	-	
Total	241	196	158	139	170	181	274	184	213	254	166	218
Suspended solids, mg/L												
Total	11	5	7	10	8	8.2	13	-	36	31	14	23.5
Volatile	5	2	1	6	4	3.6	4	-	24	8	5	10.3
Turbidity, NTU	6.9	1.9	4.5	5.1	3.0	4.3	7.2	-	5.3	7.8	2.7	5.8
Nitrogen, mg/L												
Ammonia	0.03	.01K	01K	0.06	0.14	.05	0.05	0.52	0.84	3.5	0.30	1.04
Nitrite/nitrate	6.2	8.8	3.5	0.01	0.05	3.71	7.9	5.6	1.07	.01K	0.04	2.92
Total kjeldahl	0.57	0.67	0.29	1.1	0.76	0.68	0.72	1.2	1.1	2.8	0.86	1.34
Phosphorus												
Total	.026	.026	.029	.047	.060	.038	.024	.150	.083	.314	.073	.129
Dissolved	.004	.009	.008	.006	.011	.008	.002	.083	.011	.248	.011	.071
Pigments, µg/L												
Chlorophyll *a**	22.10	12.59	19.83	64.08	37.47	31.99						
Chlorophyll *a***	25.24	14.86	20.20	61.11	38.52	38.52						
Chlorophyll *b*	11.16	8.26	4.18	1.41	3.54	5.71						
Chlorophyll *c*	21.70	12.56	1.37	1.20	3.72	8.11						
Pheophytin *a*	5.62	4.23	0	0	0	3.27						
Sample depth, ft	4.5	11.3	5.7	4.4	4	6.0						

Notes:
A K indicates less than detection value.
*corrected value.
""""uncorrected value.

Appendix B. Concluded

Parameters	*Station 2. surface* 4/25	6/14	7/19	8/30	10/6	Mean	*Station 3* 4/25	6/14	7/19	8/30	10/6	Mean	*Station 2 bottom* 4/25	*Tributary East* 4/25	*Tributary West* 4/25
Total depth of site, ft	12	12	11	11	11	11.2	6	5	5	5	5	5.2	12	1	1
Secchi transparency, inches	29	67	32	26	21	35	24	21	22	18	24	22	-	-	24
Conductivity, µmho/cm	627	556	465	380	406	486	694	647	470	403	414	526	679	710	725
pH	8.5	8.3	8.9	9.0	8.3	8.6	8.3	8.2	8.1	8.3	8.0	8.2	8.2	8.5	8.3
Alkalinity, mg/L as $CaCO_3$															
Phenolphthalein	12	0	8	16	0	7.2	-	-	-	0	-		-	12	0
Total	241	200	158	143	166	182	258	245	174	147	168	198	262	282	258
Suspended solids, mg/L															
Total	11	3	8	6	16	8.8	16	-	20	24	46	26.5	10	3	4
Volatile	6	1	3	4	7	4.2	3	-	7	7	5	5.5	3	1	1
Turbidity, NTU	7.1	1.7	5.1	8.1	2.7	4.9	6.9	-	4.9	11	2.5	6.3	7.0	6.6	6.8
Nitrogen, mg/L															
Ammonia	0.01	0.06	.01K	0.06	0.16	0.06	0.08	0.09	0.05	0.09	0.29	0.12	0.04	0.05	0.02
Nitrite/nitrate	6.4	8.8	3.1	.01K	0.05	3.67	8.5	9.5	0.77	0.02	0.06	3.77	7.9	9.7	8.9
Total kjeldahl	0.50	0.77	0.4	1.4	0.90	0.79	0.56	0.69	0.46	1.2	0.79	0.74	0.34	0.19	0.10
Phosphorus															
Total	.023	.025	.035	.061	.075	.044	.019	.035	.068	.128	.071	.064	.017	.008	.011
Dissolved	.005	.003	.002	.026	.014	.010	.004	.002	.121	.012	.019	.012	.001K	.002	.003
Pigments, µg/L															
Chlorophyll *a**	24.48	7.71	28.48	62.87	34.12	33.05	5.34	18.69	14.83	64.32	21.11	27.66			
Chlorophyll *a***	27.61	10.00	29.48	60.89	37.26	37.26	6.52	20.78	14.72	71.72	24.57	24.57			
Chlorophyll *b*	14.08	6.89	1.99	2.18	4.88	6.00	6.86	12.44	2.80	10.21	4.25	7.31			
Chlorophyll *c*	25.93	10.35	2.40	3.32	6.52	9.70	10.72	18.55	1.55	8.53	3.67	8.60			
Pheophytin *a*	5.90	4.33	0.18	0	3.88	3.36	2.67	4.21	0	9.59	4.97	3.40			
Sample depth, ft.	4.9	10	5.3	4.6	3.5	5.7	4	3.5	3.7	3	4	3.6			

Notes:
A K indicates less than detection value.
*corrected value.
**uncorrected value.

Appendix C. Water Quality Characteristics of Long Lake, 1995

Parameters	*Station 1, surface*						*Station 1. bottom*					
	4/26	*6/15*	*7/18*	*8/29*	*10/5*	*Mean*	*4/26*	*6/15*	*7/18*	*8/29*	*10/5*	*Mean*
Total depth of site, ft.	30	36	38	38	32	34.8	30	36	38	38	32	34.8
Secchi transparency, inches	82	162	108	102	114	114	-	-	-	-	-	
Conductivity, µmho/cm	1827	1595	1630	1674	1722	1690	1966	1945	1962	1991	1755	1924
pH	8.5	8.3	8.3	8.3	8.0	8.3	8.1	7.7	7.7	7.8	7.7	7.8
Alkalinity, mg/L as $CaCO_3$												
Phenolphthalein	16	0	0	0	5	4.2	-	-	-	-	-	-
Total	229	192	184	180	196	196	241	237	282	294	225	256
Suspended solids, mg/L												
Total	4	4	3	3	4	3.6	36	8	22	26	244	67
Volatile	1	1	1	1	2	1.2	6	2	4	8	66	17.2
Turbidity, NTU	7.2	3.1	5.0	3.2	1.6	4.0	10	3.7	3.7	7.9	5.5	6.2
Nitrogen, mg/L												
Ammonia	0.02	0.01K	.01K	.01K	0.34	0.078	1.9	0.37	1.4	1.0	0.07	0.95
Nitrite/nitrate	0.01K	0.01	.01K	.01K	.01K	-	0.05	0.08	.01K	.01K	.01K	-
Total kjeldahl	0.14	0.28	0.44	0.44	0.32	0.324	0.96	0.63	1.9	1.5	1.3	1.258
Phosphorus, mg/L												
Total	.009	.001	.005	.011	.007	.0066	.023	.014	.047	.033	.077	.0388
Dissolved	.001	.001K	.001	.002	.003	.0016	.004	.002	.004	.006	.004	.0040
Pigments, µg/L												
Chlorophyll *a**	3.47	3.63	4.11	2.82	3.20	3.45						
Chlorophyll *a***	3.86	4.87	4.06	3.01	3.48	3.86						
Chlorophyll *b*	2.66	4.43	0.62	0.55	0.91	1.83						
Chlorophyll *c*	3.38	6.70	1.36	0.74	0.80	2.60						
Pheophytin *a*	0.83	2.50	0	0.22	0.38	0.79						
Sample depth, ft.	14	27	18	17	19	19						

Notes:
A **K** indicates less than detection value.
*corrected value.
***uncorrected value.

Appendix C. Concluded

Parameters	*Station 2* 4/26	*Station 2* 6/15	*Station 2* 7/18	*Station 2* 8/29	*Station 2* 10/5	*Station 2* Mean	*Station 3* 4/26	*Station 3* 6/15	*Station 3* 7/18	*Station 3* 8/29	*Station 3* 10/5	*Station 3* Mean	*Sta. 2 bottom 4/26*	*Sta. 3 bottom 4/26*
Total depth of site, ft	24	20	22	23	24	22.6	12	12	12	14	14	12.8	24	12
Secchi tranparency, inches	82	134	108	96	105	105	60	98	89	72	70	78	-	-
Conductivity, µmho/cm	1873	1506	1640	1701	1733	1707	1888	1590	1630	1717	1731	1711	1884	1814
pH	8.5	8.3	8.3	8.3	8.1	8.3	8.5	8.3	8.3	8.3	8.2	8.3	8.1	8.3
Alkalinity, mg/L as $CaCO_3$														
Phenolphthalein	16	0	0	0	0	3.2	16	0	0	0	5	4.2	-	-
Total	241	196	184	180	200	200	233	192	184	172	188	194	233	229
Suspended solids, mg/L														
Total	4	2	8	3	4	4.2	7	4	4	2	5	4.4	6	10
Volatile	1	1k	1	1	1	1	1	1	1	1	2	1.2	2	1
Turbidity, NTU	6.7	2.9	3.2	3.7	1.9	3.7	7.2	2.8	3.0	3.8	2.3	3.8	6.9	6.8
Nitrogen, mg/L														
Ammonia	0.04	0.01K	.01K	.01K	0.07	0.028	0.07	0.02	.01K	.01K	0.07	0.036	0.18	0.04
Nitrite/nitrate	0.01K	0.01	.01K	.01K	0.02	-	.01K	.01K	.01K	.01K	0.02	-	0.06	0.01
Total kjeldahl	0.23	0.23	0.52	0.83	0.83	0.528	0.20	0.25	0.52	0.44	0.68	0.418	0.31	0.26
Phosphorus, mg/L														
Total	.011	.005	.003	.009	.010	.0076	.014	.005	.010	.010	.012	.0102	.014	.022
Dissolved	.002	.001K	.001K	.001	.003	.0016	.004	.001K	.001K	.003	.005	.0028	.003	.005
Pigments, µg/L														
Chlorophyll *a**	3.74	3.56	6.90	4.81	4.63	4.73	3.47	16.02	4.27	5.07	3.56	6.48		
Chlorophyll *a***	3.57	4.25	6.87	5.68	4.88	5.05	3.74	20.83	4.50	4.70	4.00	7.55		
Chlorophyll *b*	0.94	3.29	0.63	6.50	1.51	2.57	1.59	12.12	0.74	2.63	1.18	3.65		
Chlorophyll *c*	0.85	4.90	1.49	0	1.78	1.80	1.25	16.90	0.40	0.08	1.56	4.04		
Pheophytin *a*	0.00	1.42	0	1.92	0.36	0.74	0.45	8.74	0.21	0	0.68	2.02		
Sample depth, ft	14	18	18	16	17	16.6	10	8.3	10	12	12	10.5		

Notes:
A **K** indicates less than detection value.
*corrected value.
**uncorrected value.

Appendix D. Water Quality Characteristics of Matanzas Lake, 1995

	Station 1. surface						Station 2					
Parameters	*4/24*	*6/13*	*7/13*	*8/21*	*10/3*	*Mean*	*4/24*	*6/13*	*7/13*	*8/21*	*10/3*	*Mean*
Total depth of site, ft	12	15	6	6.7	6.8	9.3	9.8	12	4	4	4	6.8
Secchi tranparency, inches	30	13	14	12	8	15	30	12	10	12	7	14
Conductivity, µmho/cm	593	601	423	397	380	479	585	598	415	412	405	483
pH	8.4	8.2	8.7	8.8	8.7	8.6	8.3	8.2	8.7	8.7	8.8	8.5
Alkalinity, mg/L as $CaCO_3$												
Phenolphthalein	2	0	4	10	9	5.0	0	0	4	7	12	4.6
Total	161	189	139	163	154	161	168	187	131	162	159	161
Suspended solids, mg/L												
Total	12	94	27	30	76	47.8	5	48	54	32	84	44.6
Volatile	4	14	12	10	18	11.6	4	10	13	10	12	9.8
Turbidity, NTU	5.9	2.5	5.3	6.9	9.2	6.0	6.4	2.6	5.3	7.2	10	6.3
Nitrogen, mg/L												
Ammonia	0.06	0.04	0.01K	0.01	0.08	0.04	0.05	0.03	0.01K	.01K	0.07	0.034
Nitrite/nitrate	6.2	6.4	0.04	.01K	0.04	2.54	6.2	6.4	0.01K	0.05	.01K	2.54
Total kjeldahl	0.74	0.80	2.20	1.2	0.74	1.14	0.67	0.94	1.8	1.2	0.82	1.09
Phosphorus, mg/L												
Total	.173	.192	.235	.267	.183	.210	.164	.201	.226	.278	.037	.181
Dissolved	.121	.118	.040	.135	.034	.089	.118	.118	.050	.145	.211	.128
Pigments, µg/L												
Chlorophyll *a**	34.86	49.45	89.00	93.07	96.53	72.58	27.56	50.20	71.20	62.82	98.26	62.01
Chlorophyll *a***	39.16	52.27	133.22	92.61	95.61	69.87	29.35	52.78	82.56	78.64	96.72	68.01
Chlorophyll *b*	19.19	32.65	39.62	15.35	10.41	23.44	13.49	30.92	13.22	14.04	10.45	16.42
Chlorophyll *c*	20.63	48.23	54.00	7.64	10.81	28.26	13.52	43.66	7.85	12.46	12.25	17.95
Pheophytin *a*	7.71	6.63	72.98	0	0	17.46	3.19	5.87	16.02	24.03	0	9.82
Sample depth, ft	5	2.2	2.3	2	1.5	2.6	5	2	1.7	2	1.3	2.4

Notes:
A K indicates less than detection value.
*corrected value.
**uncorrected value.

Appendix D. Concluded

	Station 3						*Station l, bottom*		*Tributary*
Parameters	*4/24*	*6/13*	*7/13*	*8/21*	*10/3*	*Mean*	*4/24*	*6/13*	*4/24*
Total depth of site, ft	8.9	12	4	4	3.8	6.5	12	15	1
Secchi tranparency, inches	21	13	10	12	8	13	-	-	-
Conductivity, µmho/cm	619	597	440	407	406	494	592	595	414
pH	8.2	8.1	8.3	8.9	8.8	8.5	8.3	8.0	8.2
Alkalinity, mg/L as $CaCO_3$									
Phenolphthalein	-	-	0	17	9	5.2	-	-	-
Total	173	185	135	160	158	162	164	186	163
Suspended solids, mg/L									
Total	18	52	47	33	82	46.4	13	44	38
Volatile	4	14	9	14	16	11.4	2	6	5
Turbidity, NTU	6.4	2.0	5.3	8.0	7.6	5.9	6.1	2.7	6.7
Nitrogen, mg/L									
Ammonia	0.08	0.08	0.05	.01K	0.06	0.056	0.06	0.06	0.05
Nitrite/nitrate	6.8	6.4	0.14	.01K	0.05	2.68	6.2	6.2	0.70
Total kjeldahl	0.77	1.1	0.30	1.2	0.78	0.83	0.81	0.84	0.10
Phosphorus, mg/L									
Total	.182	.203	.171	.278	.197	.206	.169	.236	.055
Dissolved	.130	.108	.040	.163	.039	.096	.118	.115	.023
Pigments, µg/L									
Chlorophyll *a**	47.84	24.48	46.73	130.69	77.13	65.37			
Chlorophyll *a***	46.06	28.24	55.21	134.40	78.49	68.48			
Chlorophyll *b*	26.46	16.44	10.29	23.45	10.23	17.37			
Chlorophyll *c*	32.91	23.84	7.87	8.88	14.64	17.63			
Pheophytin *a*	0.00	7.19	12.46	1.12	0	4.15			
Sample depth, ft	3.5	2.2	1.7	2	1.3	2.1			

Notes:
A K indicates less than detection value.
*corrected value.
**uncorrected value.

Appendix E. Water Quality Characteristics of Snakeden Hollow Lake, 1995

	Station 1. surface						Station 1. bottom					
Parameters	*4/24*	*6/12*	*7/12*	*8/21*	*10/3*	*Mean*	*4/24*	*6/12*	*7/12*	*8/21*	*10/3*	*Mean*
Total depth of site, ft	58	58	58	58	53	56.8	58	58	58	58	53	56.8
Secchi tranparency, inches	270	160	146	210	285	214	-	-	-	-	-	
Conductivity, µµmho/cm	1387	1322	1301	1305	1330	1329	1512	1476	1482	1498	1473	1488
pH	8.2	8.4	8.5	8.4	8.5	8.4	7.6	7.6	8.0	7.8	7.9	7.8
Alkalinity, mg/L as $CaCO_3$												
Phenolphthalein	0	1	2	1	3	1.4	-	-	-	-	-	
Total	131	119	108	101	107	133	155	145	192	186	178	171
Suspended solids, mg/L												
Total	2	2	4	3	2	2.6	142	21	45	31	19	51.6
Volatile	1k	1	1	1	1k	1	12	4	5	4	5	6
Turbidity, NTU	6.6	2.3	5.5	3.3	1.4	3.8	6.5	4.1	5.7	7.1	7.7	6.2
Nitrogen, mg/L												
Ammonia	0.10	0.03	.01K	.01K	0.31	0.092	0.37	0.18	1.10	0.97	0.86	0.696
Nitrite/nitrate	0.16	0.27	.07	.01K	.01K	.104	0.34	0.33	0.04	0.04	01K	.152
Total kjeldahl	0.27	0.44	0.65	0.66	0.14	.43	0.50	0.46	3.60	1.3	0.84	1.34
Phosphorus, mg/L												
Total	.001	.009	.003	.005	.006	.0048	.099	.016	.380	.268	.093	.1712
Dissolved	.001	.002	.001K	.001	.003	.0016	.028	.010	.322	.227	.058	.1290
Pigments, µg/L												
Chlorophyll *a**	1.69	2.29	1.96	2.99	8.19	3.24						
Chlorophyll *a***	2.18	2.71	2.05	3.42	8.34	3.74						
Chlorophyll *b*	1.79	2.37	0.04	0.49	0.99	1.14						
Chlorophyll *c*	2.33	3.43	0.27	0.60	2.30	1.79						
Pheophytin *a*	0.97	0.92	0.04	0.60	0	1.33						
Sample depth, ft	45	27	28	35	37	34.4						

Notes:
A K indicates less than detection value.
*corrected value.
**uncorrected value.

Appendix E. Concluded

Parameters	Station 2 4/24	Station 2 6/12	Station 2 7/12	Station 2 8/21	Station 2 10/3	Station 2 Mean	Station 3. surface 4/24	Station 3. surface 6/12	Station 3. surface 7/12	Station 3. surface 8/21	Station 3. surface 10/3	Station 3. surface Mean	Station 3 bottom 4/24
Total depth of site, ft	10	10	10	13	11	11	25	24	24.5	24.6	24	24.3	25
Secchi tranparency, inches	114	87	99	147	120	113	198	94	51	117	133	119	-
Conductivity, µmho/cm	1416	1329	1303	1311	1367	1345	1397	1251	1251	1275	1307	1296	1414
pH	8.1	8.4	8.31	8.33	8.4	8.3	8.2	8.3	8.4	8.2	8.5	8.3	7.8
Alkalinity, mg/L as $CaCO_3$													
Phenolphthalein	0	1	3	1	1	1.2	0	0	1	-	2	0.6	-
Total	133	121	105	104	108	114	130	123	109	97	96	111	139
Suspended solids, mg/L						"							
Total	2	3	2	2	2	2.2	2	5	4	4	2	3.4	2
Volatile	1k	1	1	1	1	1	1	3	2	1	1k	1.6	1
Turbidity, NTU	6.5	2.6	7.0	5.9	1.3	4.7	6.1	2.2	5.2	6.6	1.2	4.3	5.5
Nitrogen, mg/L													
Ammonia	0.06	.01K	.01K	.01K	0.12	0.042	0.07	.01K	01K	.01K	0.09	0.038	0.35
Nitrite/nitrate	0.17	0.30	0.05	.01K	.01K	.108	0.11	0.12	.01K	0.01	.01K	.052	0.08
Total kjeldahl	0.17	0.29	0.58	0.56	0.20	0.36	0.22	0.41	0.63	0.49	.01K	0.35	0.41
Phosphorus, mg/L													
Total	.002	.010	.009	.004	.008	.0066	.005	.016	.013	.006	.009	.0098	.016
Dissolved	.001	.001K	.003	.002	.007	.0028	.001K	.001K	.001K	.001K	.003	.0014	.004
Pigments, µg/L													
Chlorophyll *a**	1.59	2.94	3.20	4.52	3.74	3.20	2.85	4.01	6.94	39.46	5.72	11.80	
Chlorophyll *a***	1.86	4.17	3.23	4.85	4.23	3.67	3.36	4.95	6.88	37.63	6.55	11.87	
Chlorophyll *b*	1.27	4.12	0.46	0.75	1.05	1.53	2.38	4.30	0.86	9.79	2.58	3.95	
Chlorophyll *c*	1.40	6.48	0.84	0.88	1.70	2.26	2.87	6.87	1.48	2.56	1.46	3.05	
Pheophytin *a*	0.53	2.48	0	0.37	0.75	0.83	1.01	1.98	0	0	1.35	0.87	
Sample depth, ft	8	8	16.5	24.5	9	13.2	2.3	16	8.5	19.5	22	17.8	

Notes:
A K indicates less than detection value.
*corrected value.
**uncorrected value.

Appendix F. Water Quality Characteristics of Walnut Point Lake, 1995

	Station 1, surface						*Station 1. bottom*					
Parameters	*4/25*	*6/15*	*7/19*	*8/28*	*10/4*	*Mean*	*4/25*	*6/15*	*7/19*	*8/28*	*10/4*	*Mean*
Total depth of site, ft	32	28	27	27	28	27.5	32	28	27	27	28	27.5
Secchi tranparency, inches	198	13	18	19	24	54.4	-	-	-		-	
Conductivity, µmho/cm	381	353	318	301	336	338	440	484	663	531	631	552
pH	8.4	8.4	9.4	9.6	9.0	9.0	7.6	7.5	7.1	7.3	6.9	7.3
Alkalinity, mg/L as $CaCO_3$												
Phenolphthalein	8	2	20	25	16	14.2	-	-	-	-	-	
Total	151	135	119	115	147	133	200	225	306	266	307	261
Suspended solids, mg/L												
Total	2	28	15	10	15	14.0	3	32	80	20	20	31.0
Volatile	1k	18	2	6	11	7.6	2	18	24	8	15	13.4
Turbidity, NTU	5.1	2.1	4.3	12	6.9	6.1	4.8	2.2	4.1	15	11	7.4
Nitrogen, mg/L												
Ammonia	0.27	0.02	.01K	.01K	0.07	0.076	1.9	4.4	17	9.1	17.0	9.88
Nitrite/nitrate	0.77	0.90	.01K	.01K	.01K	0.340	0.01K	0.01K	0.01	0.02	.01K	0.012
Total kjeldahl	0.71	2.3	0.82	1.8	0.98	1.32	2.1	6.2	11.4	1.6	13.8	7.02
Phosphorus, mg/L												
Total	.060	.084	.061	.088	.089	.076	.262	.958	2.88	1.48	2.38	1.592
Dissolved	.041	.010	.009	.011	.029	.020	.214	.845	2.45	1.44	2.12	1.414
Pigments, µg/L												
Chlorophyll *a**	5.34	301.92	68.89	88.11	110.01	114.85						
Chlorophyll *a***	5.85	260.74	68.91	88.47	113.79	107.55						
Chlorophyll *b*	3.37	10.59	1.25	6.59	7.24	5.81						
Chlorophyll *c*	4.36	0	2.88	1.48	17.46	5.24						
Pheophytin *a*	1.02	0	0	0	0.64	0.33						
Sample depth, ft	30	2.2	3	3.2	4	8.5						

Notes:
A K indicates less than detection value.
*corrected value.
**uncorrected value.

Appendix F. Continued

Parameters	Station 2, surface						Station 3, surface					
	4/25	*6/15*	*7/19*	*8/28*	*10/4*	*Mean*	*4/25*	*6/15*	*7/19*	*8/28*	*10/4*	*Mean*
Total depth of site, ft	24	21	21	22	22	21.5	16	17	16	15	15	15.8
Secchi tranparency, inches	162	14	19	18	27	48	156	16	19	17	28	47
Conductivity, µmho/cm	385	390	332	307	360	355	396	355	334	302	358	349
pH	8.4	9.3	9.7	9.7	8.9	9.2	7.6	9.3	9.4	9.7	8.9	9.0
Alkalinity, mg/L as $CaCO_3$												
Phenolphthalein	4	20	20	29	16	17.8	-	20	20	29	16	17.0
Total	147	131	119	115	144	131	176	131	119	115	144	137
Suspended solids, mg/L												
Total	1	34	11	40	13	19.8	1	18	9	34	12	14.8
Volatile	1k	12	6	26	10	11.0	1	16	6	20	9	10.4
Turbidity, NTU	4.9	3.0	3.8	19	4.7	7.1	5.1	2.9	3.8	13	4.6	5.9
Nitrogen, mg/L												
Ammonia	0.28	0.06	.01K	0.03	0.09	0.094	0.28	0.03	.01K	.01K	0.07	0.080
Nitrite/nitrate	0.87	0.92	.01K	.01K	.01K	0.364	1.09	0.93	.01K	.01K	.01K	0.410
Total kjeldahl	0.59	3.0	0.78	1.9	1.1	1.47	0.65	2.7	0.78	0.98	1.2	1.26
Phosphorus, mg/L												
Total	.060	.070	.069	.096	.104	.080	.062	.067	.064	.104	.116	.083
Dissolved	.046	.019	.016	.017	.026	.025	.046	.021	.021	.015	.025	.026
Pigments, µg/L												
Chlorophyll *a**	4.01	187.97	66.75	107.69	105.28	94.34	1.60	193.31	69.95	109.30	115.46	97.92
Chlorophyll *a***	4.27	170.40	63.04	103.92	112.18	90.76	2.16	171.35	67.25	107.23	115.11	92.62
Chlorophyll *b*	3.08	9.32	1.75	8.18	6.19	5.70	2.43	8.78	0.63	5.63	7.10	4.91
Chlorophyll *c*	4.97	2.46	2.80	3.01	11.67	4.98	4.01	3.30	1.90	1.23	13.62	4.81
Pheophytin *a*	0.67	0.00	0	0	5.80	1.29	1.20	0	0	0	0	0.24
Sample depth, ft	22	2.3	3.2	3	4.5	7.0	14	2.7	3.2	2.8	4.7	5.5

Notes:
A **K** indicates less than detection value.
*corrected value.
**uncorrected value.

Appendix F. Concluded

Parameters	*Station 2, bottom 4/25*	*Station 3, bottom 4/25*	*Tributary east 4/25*	*Tributary west 4/25*
Total depth of site, ft	24	16	1.5	1
Secchi tranparency, inches	-	-	-	
Conductivity, µmho/cm	438	446	609	601
PH	7.7	8.0	7.8	8.1
Alkalinity, mg/L as $CaCO_3$				
Phenolphthalein	-	-	-	-
Total	205	188	225	249
Suspended solids, mg/L				
Total	8	11	4	2
Volatile	5	7	1	1k
Turbidity, NTU	5.0	5.3	9.1	6.6
Nitrogen, mg/L				
Ammonia	1.7	0.72	0.03	0.09
Nitrite/nitrate	0.01	1.94	8.0	5.2
Total kjeldahl	1.8	0.90	0.1K	0.21
Phosphorus, mg/L				
Total	.291	.160	.016	.028
Dissolved	.250	.113	.014	.017
Pigments, µg/L				
Chlorophyll *a**				
Chlorophyll *a***				
Chlorophyll *b*				
Chlorophyll *c*				
Pheophytin *a*				
Sample depth, ft				

Notes:
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*corrected value.
**uncorrected value.

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