AN ASSESSMENT OF THE WATER QUALITY OF GLASS LAKE
RENSSELAER COUNTY, NEW YORK

by

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BACKGROUND

Glass Lake is located in the south-central portion of Rensselaer County in the Town of Sand Lake. The lake's watershed is in the hilly area at the foot of the Rensselaer Plateau with a small portion of the eastern part of the watershed on the Plateau. Elevations within the watershed range from 826 feet at the surface of the lake to 1500 feet above sea level.

The lake has a surface area of 111 acres and shares a watershed area of 3276 acres with Crooked Lake. There is a small outlet dam at the northern end of the lake which controls the lake level. The lake ultimately drains into the Hudson River via Wynantskill Creek. The drainage of Glass Lake together with Crooked and Burden Lakes was harnessed in the early 1800's by Henry Burden to provide water power for his rolling mill on the Wynantskill. The outlet dam is still owned by Portec, Inc. The lake has a maximum depth of 20 meters (69 ft.) and exhibits thermal stratification. The surficial geology is all till (a sand and gravel soil without exposed bedrock) derived from glacial and alluvial deposits. The soil associations are Alps-Culvers-Cattaraugus and Worth-Empeyville-Westbury deposits. The former deposits are composed of upland soils derived from red slate and shale. The latter, occurring on the Rensselaer Plateau, consists of stones, boulders and outcrops on glacial till derived from sandstone. Drainage in these deposits is moderate to poor, and their ability to furnish lime, nitrogen and phosphorus to plants via root uptake is low to medium. From soil survey maps published by Rensselaer County Soil Conservation Service, soils on the east side of Glass Lake appear adequate, but soils on the west (unsewered) side of the lake are questionable for septic system use.

Table 1. Physical Features of Glass Lake.

GLASS LAKE - Sand Lake, Rensselaer County, New York

Maximum Depth	69 feet (21 meters)
Surface Area	111 acres (45 hectares)
Watershed Area	1936 acres (783.5 hectares)
Elevation Above Sea Level	826 feet (254 meters)
Latitude	42 degrees 37 minutes
Longitude	73 degrees 32 minutes
Annual Precipitation	35-45 inches (97-125 cm.)
Mean Annual Temperature	47.5° F (8.6° C)

Glass Lake is a recreational lake with boating, fishing and swimming the primary uses. Public access for small boats and swimming is available at Tiffts Beach and it is also possible to launch small boats near the outlet dam where Glass Lake Road meets the lake. The watershed is densely populated, 269 homes in 1972, but some areas of undeveloped shoreline remain on the west side of the lake. The population of the basin by 1972 census was 513. Commercial land use on the shore of the lake is nominal. Sewage treatment is on an individual septic system basis on the west shore of the lake. Most of the east side of the lake is presently or will soon be connected to Sand Lake Sewer District No. 1. A septic survey conducted during the summer of 1970 by Rensselaer County Health Department found that of the 134 occupied structures tested, 22 had septic systems which were overflowing to the surface of the ground.

SAMPLING LOCATIONS

In order to characterize the chemistry of Glass Lake water, six sampling sites were selected (Figure 1 and Table 2). Sites were selected to be representative of the lake as a whole. Selection criteria include: water depth, degree of shoreline development, density of aquatic weed growth, proximity to inlets or outlets, and the presence of public access sites.

Table 2. Chemical Water Quality Sampling Sites.

Site	Name	Location
1	Midlake	The sampling site was located 200 meters

		east of the bay on the west shore in the approximate center of the lake. Maximum water depth at this site was 20 meters.
2	Outlet	The sampling site was located 50 meters south of the outlet dam. Maximum water depth at this site was 3.5 meters.
3	East Shore	The sampling site was located 10 meters from the east shore in front of a large white house with a steep bank. Maximum water depth at this site was 3 meters.
4	West Shore	The sampling site was located 50 meters east of the cove on the west shore. Maximum water depth at this site was 3 meters.
5	Inlet	The sampling site was located 30 meters from the east and west shores of the inlet at the junction of the inlet and Glass Lake. Maximum water depth at this site was 3 meters.
6	North Midlake	The sampling site was located 200 meters west of Tiffts Beach. Maximum water depth at this site was 8.5 meters.

SAMPLING METHODS

At each lake site various types of water samples were collected: a surface grab for coliform bacteria analysis, an integrated sample to a predetermined depth (2, 3, or 5 meters), a deep point sample from near the bottom of the lake in deep waters (i.e. greater than 8 meters), and specimens of aquatic vegetation.

Samples for coliform bacteria analysis were collected by submerging a sterile 500 milliliter bottle below the surface of the water and then inverting it to fill in such a manner that the mouth of the bottle was as far as possible from human skin. Care was taken to avoid collecting portions of the surface film in the sample. All samples for coliform determination were analysed within 6 hours of collection.

Integrated samples, encompassing a portion of the water column, were collected with a polyvinyl chloride hose. The hose was weighted at one end and lowered to the desired depth. The opposite end of the tube was sealed and the entire tube retrieved. The sample was drained into a collection bottle and mixed. Integrated samples were collected at all sites. At sites where the depth was 5 meters or greater, deep water point samples were taken using a Van Dorn collection bottle. The Van Dorn bottle was lowered to the depth in the lake where the sample was to be collected and remotely triggered to shut, thus collecting a sample of water at the depth where it was triggered.

At each site, the following measurements were made if conditions permitted: 1) water transparency by secchi disk, 2) water depth, 3) temperature, and 4) dissolved oxygen (D.O.) using a YSI Model 54 D.O./Temperature Meter. Water samples collected by the two previously described methods (integrator hose and Van Dorn collection bottle) were stored on ice until returned to the laboratory. Immediately upon returning to the laboratory a portion of each sample was analysed for pH, specific conductance and alkalinity. A separate portion to be used for total phosphorus determination was frozen until analysed. A third portion was acidified with nitric acid to a pH of less than two for determination of copper. The remainder of each sample was filtered (0.4 um Nuclepore filter) and stored at 4° C until analysed for nitrate, ammonia, chloride and soluble silica concentrations. The analytical methods used for all determinations are listed in Appendix A.

RESULTS

Samples were collected from Glass Lake on August 11 and 23, and November 20, 1984. The lake was thermally and chemically stratified throughout the summer months and destratified (turned over) by November 20 (Figure 2). Thermal stratification, when used to describe a lake, refers to an increase or decrease in water temperature from the surface to the bottom of the lake. Since most of the heating of the lake occurs at the surface, temperature in the surface waters during the summer months is highest and decreases with depth. There is, however, a zone of rapid temperature change over a small increase in depth (Figure 2). This zone is referred to as the thermocline. This thermocline acts as a barrier, effectively stopping mixing of the waters above it with the waters below it. The part of the lake above the thermocline is referred to as the epilimnion and the portion below the thermocline is known as the hypolimnion. From Figure 2, it is apparent that the thermocline in Glass Lake occurs between 5 and 6 meters (16-20 feet).

Depth profiles of dissolved oxygen and temperature were made on August 11 and 23, and November 20, 1984 (see Figure 2). The lack of oxygen in the hypolimnion (waters deeper than 7 meters) of Glass Lake during the summer controls the type of organisms capable of utilizing this portion of the lake. This lack of oxygen is due to decomposition going on in the deep waters and sediments. Bacterial activity in the sediments of the lake bottom consumes oxygen and once the lake is stratified, the deep waters are effectively cut off from the primary source of oxygen to a lake, the atmosphere. A byproduct of some of the bacteria capable of living in the absence of dissolved oxygen is hydrogen sulfide which gives the water a "rotten egg" odor. Results from samples collected on November 20 (Figure 2) indicated that summer stratification had broken up and temperature and dissolved oxygen levels at all depths in the lake were approximately the same.

The chemical constituents of primary concern for Glass Lake residents would be those which promote the growth of algae and aquatic weeds. These materials, notably phosphorus and nitrogeneous compounds, are fertilizers in that they are present in the shortest supply relative to the amounts needed to sustain algal growth. Addition of one or both of these nutrients generally results in a reduction of water quality since the concentrations of these nutrients control the amount of plants and thus animals capable of growing in the lake. Sources of nitrogen and phosphorus to the lake include: the atmosphere through deposition (rain, snow,etc.), surface runoff of soils, septic system leachate, resuspension from the sediments of the lake, runoff of fertilizers from farm fields or lawns and gardens, and fecal material from domestic animals.

Phosphorus is generally considered to be the primary limiting nutrient to plant growth. Total phosphorus concentrations listed in Tables 3 and 4 indicate that the amount of phosphorus in Glass Lake is moderate and comparable to other Rensselaer County lakes. At any one time, most of the phosphorus is probably tied up in the cellular material of the organisms in the lake. During summer stratification (August 11 and 23 samples), the phosphorus concentrations of the deep waters (midlake, 19 meter site) were much higher than the surface waters. This phenomena is frequently observed in lakes due to the large pool of phosphorus present in the sediments. After the breakup of summer stratification (November 20 samples) phosphorus concentrations throughout the entire lake were similar, indicating that the entire lake had mixed during overturn.

The methods used to determine the amount of nitrogenous compounds in the lake water only measure materials not contained in living tissue or particulate material. From Table 3, it is apparent that there are little or no nitrogenous compounds (ammonia and nitrates) available in the surface waters during the period of summer stratification (August 11 and 23). Most of the the nitrogenous material is probably bound up in living tissue (i.e. algae, plants, fish, etc.). As there was not a discernable algal bloom occurring at the time of sampling, the lack of available ammonia and nitrates indicates that nitrogenous material may be limiting to algal productivity in Glass Lake. The deeper waters of the lake (midlake, 19 meter site) had measurable amounts of ammonia, a byproduct of the decomposition processes going on in the sediments. After fall overturn (November 20 samples), ammonia concentrations throughout the lake were comparable.

Alkalinity and pH records for Glass Lake are listed in Table 3. The pH at all sites was approximately neutral (pH near 7.0). The ability of a lake to neutralize additions of acid via acid rain or surface runoff is measured by alkalinity or the buffering capacity present in the lake water. The alkalinity of Glass Lake ranged from 19.8 to 24.0 mg/L as $CaCO_3$ in the surface waters (epilimnion). The alkalinity recorded in the deeper waters was much higher, 42.0 mg/L, during summer stratification. These alkalinity values are low but as evidenced by the neutral pH of the lake water, it presently has an adequate capacity to buffer any acids coming into the lake. The greatest amount of acid enters the lake during the spring when rapid melting of snow occurs. This is the time when the most acidic (less than 7) pH values are observed in lakes and streams. Since spring water samples were not included in this study, the effects of spring snowmelt on the pH of Glass Lake remains to be determined.

Secchi depth is a simple measure of water transparency. A Secchi disk is lowered into the lake until it is no longer visible from the surface. The depth at which the disk is no longer visible is reported as the secchi depth. Water transparency is controlled by the density of plankton and the amount of fine grained silts and clays present in the water column. Nutrient rich lakes, for example Saratoga Lake listed in Table 4 for comparison, generally have large numbers of plankton in the water which result in low clarity results. Shallow lakes in areas where the soils are mainly fine clays and silts also have generally low secchi transparency readings due to constant resuspension of the fine sediments via wave activity. Water transparency in Glass Lake as measured with a Secchi Disk averaged 3.3 meters (10 feet). This transparency is comparable to reported values for other lakes in Rensselaer County (Table 4).

Specific Conductance is a measure of the total dissolved compounds present in the water. Conductivity values in the surface waters ranged from 62 to 92 umhos. Samples taken from the hypolimnion, waters deeper than seven meters, exhibited higher conductivities than surface water samples with a range of from 77 to 116 umhos. Higher conductivities for the hypolimnion are primarily due to increased concentrations of ammonia and phosphorus.

The chloride concentrations for all samples from Glass Lake ranged from 7.8 to 9.5 milligrams per liter. Concentrations of chloride in this range are average for Rensselaer County (Table 4) and present little or no hazard. Since spring samples were not collected specific statements on input of chlorides to the lake via road salt cannot be made at this time.

Copper concentrations in Glass Lake water were below the analytical limit of detection (10 parts per billion) used by the FWI laboratories. Copper levels were measured due to the use of copper sulfate for algae control in Crooked Lake. It appears that the copper sulfate used in Crooked Lake either remains in Crooked Lake or is removed by the marshy connection between the two lakes before it ever reaches Glass Lake.

The coliform group of bacteria are used as the principal indicator of suitability of water for domestic and recreational use. High densities of coliform bacteria in lake water are indicative of the presence of fecal material from humans or other warm blooded animals. These fecal materials are known to harbor a large variety of disease causing bacteria and viruses. Coliform bacteria are found in the digestive tract of warm blooded animals and excreted with fecal material. Ratios of the different groups of coliform organisms are used to determine whether the sewage source was human or other warm blooded animal, e.g. cattle, poultry, etc. Assays of total and fecal coliform bacteria in Glass Lake were made at various locations to determine potential locations of sewage input and to provide assurance that Glass Lake remains within NYS guidelines for contact recreation (i.e. swimming). Levels of coliform bacteria in the lake (Table 3) are well below the allowable limits set by New York State for contact recreation (Table 5, Class B). The number of fecal coliform bacteria in samples collected during the fall sampling were generally higher than results from the summer samples. Large numbers of non-coliform bacteria in the fall samples made determination of total coliform bacteria levels impossible at this time. Highly turbid conditions (low transparency) were observed for the November 20 sampling which frequently results in elevated levels of bacteria in a lake.

A bathymetric (depth) map of Glass Lake is provided courtesy of the NYSDEC (Figure 3).

Specimens of rooted aquatic plants (macrophytes) were collected at each site. A list of the species collected is included as Table 6. In addition, a map of the weed beds present during the August 23 sampling is included (Figure 4) with a characterization of the different groups of plants found for each bed. Aquatic weeds do not presently appear to be a problem for boating in the lake, but the densities observed in the inlet provide undesirable conditions for swimming or boating. A pamphlet on Mechanical Control of Aquatic Weeds is included for your information. In all likelihood, the weed beds provide habitats for numerous fish and other organisms allowing for a good warm water sports fishery.

Glass Lake supports what is known as a two-story fishery with game fish species which prefer both the warm surface waters and the deep colder waters. The warmwater fishery (bass and panfish) is self supporting. The coldwater fishery (rainbow trout and kokanee salmon) is supported by stocking. The NYS Department of Environmental Conservation annually stocks 1800 rainbow trout (9 inch) and 20,000 fingerling kokanee salmon (1-2 inch). This stocking program has been in effect since 1969 but the reduction or elimination of rainbow trout stocking is anticipated. A list of the fish species reported for Glass Lake (Table 7) is included courtesy of the NYS Department of Environmental Conservation.

The Rensselaer County Department of Health (DOH) has collected samples for water chemistry analysis from Tiffts Beach for many years (Table 8). Results from these water chemistries when compared to results from the present study indicate that the nitrate and chloride concentrations in Glass Lake have remained fairly stable over the last 20 years. Results from studies by Dr. R. Armstrong of Russell Sage and RPI's 1972 study (Table 9), indicated higher levels of nitrate present in Glass Lake than that reported by the DOH (Table 8) or the present study (Table 4). Chloride concentrations reported in this study are somewhat greater than averages from DOH reports. This difference may be due to analytical techniques currently used however, a closer look at the sources of chlorides to the lake is suggested. The primary sources of chloride would include road salt runoff, atmospheric inputs via rain and snow, and inputs from septic systems. The alkalinity of Glass Lake has remained stable since 1972, indicating that acidification of the lake is probably not a problem at the present time.

SUMMARY AND SUGGESTIONS

At present, the water quality of Glass Lake is more than adequate for the primary uses of its' residents, namely swimming, fishing and boating. The chemical and bacteriological results from this study and DOH testing at Tiffts Beach are well within guidelines set by New York State for these uses (Class B, Table 5). Some residences along the shore of the lake however, draw lake water for domestic use. Use of Glass Lake water for drinking or food preparation without prior treatment is not recommended. If residents must use lake water for drinking purposes, chlorination is advisable. In addition, filtration is probably desirable to assure more complete removal of any potentially pathogenic organisms from the water. Intakes for water supplies should be located no deeper than 15 feet to assure well oxygenated water and no shallower than 6 feet to minimize turbidity generated by recreational activities and wave action.

Since the lake is used for contact recreation (swimming) elimination of inputs from septic systems should be of primary concern since they may carry a wide variety of disease causing organisms. Initiation of a new Septic Survey by the Rensselaer County Department of Health (DOH) should be expedited. The survey will determine any severe problems and it then becomes the Department of Health's responsibility to oversee correction of any problems encountered. If the DOH, as a result of a lack of manpower, is unable to complete the survey, the association members may wish to do their own survey. I have included a sample septic survey form for your information (Appendix B). The only shortcoming of doing your own survey is the lack of any legal right to force residents to correct failing systems. DOH may be willing on a case by case basis to help you with this. After completion of the survey, lake residents should still police themselves since systems that were operational during the survey may fail shortly afterward.

As previously discussed, nitrogen and phosphorus compounds entering the lake are likely to cause the greatest problems for recreational users. There are a number of ways that the amount of these nutrients entering the lake can be reduced. Methods for reduction will be discussed in relation to the source of input.

Nutrient additions from the atmosphere through rain, snow, etc. are a large part of the total nutrients added to a lake each year. The ability to reduce inputs from this source is limited. Reduction of the amount of impermeable surfaces adjacent to the lake (paved roads and driveways, sidewalks, etc.) will slow the flow of rainwater to the lake by forcing it to percolate through soils prior to entering the lake. Soils act as a natural filter removing much of the nitrogen and phosphorus compounds before the water reaches the lake. Eliminating stormwater drains emptying directly into the lake is also helpful. The drains may be redirected to small gravelled areas for slow dispersal of the water.

Sewage from failing or improperly located septic systems can be a major source of nutrients to a lake. In a properly maintained and located septic system, solid material is allowed to settle in the septic tank where microorganisms can decompose it into water soluble material. The water soluble components (leachate) are allowed to pass into lateral drainage fields where the liquid slowly percolates into adjacent soils. In the soil, chemical reactions and bacteria remove the nitrogen and phosphorus compounds from the water and convert it to insoluble material, cellular material and gaseous material. Thus, in a properly operating system nitrogen and phosphorus are removed or reduced before the water finally percolates back to the lake. In a system which is not operating properly, insufficient time is available for complete removal of nitrogen and phosphorus compounds before the leachate reaches the lake. Septic system failure is likely to occur when the systems are:

1) built in fill over an old wetland or natural drainage area whose water table is near the surface of the soil.

2) not of sufficient size to handle normal and peak loading rates.

3) located where the depth of soil present over bedrock is less than six feet.

4) located less than 50 feet from the shore of a lake or a stream.

5) located in soils with extremely high permeability or steeply sloping ground resulting in too rapid a movement of liquid through the system.

6) receiving excessive amounts of undigestable or slowly digested materials (i.e. plastics, bone or eggshells) without frequent pumpout.

7) older than 30 years and have never been upgraded.

Extreme septic system failures may be observed as clogged toilets and drains or puddling of water on the surface of the ground near the location of the septic leaching device of the system. Puddling is most likely to occur when the soils are quite wet primarily during the spring of the year and after periods of heavy rain in the summer. Surface pooling of water is also most common at high water usage times of day, generally in the morning. Septic inputs directly into the lake generally result in excessive growth of dense filamentous mats of algae near the point where the sewage enters the lake.

Eroding soils carry considerable amounts of nutrients into the lake. Soils generally contain much greater amounts of nitrogen and phosphorus compounds than lake water. If soils are stabilized by good vegetation cover, only small amounts of nutrients are washed into the lake. If large areas of timber are logged or if roads and developments are improperly designed, large scale erosion of soils frequently results. Soil erosion may be controlled in several ways by: 1) maintaining or planting effective ground cover vegetation (e.g. Crown Vetch) in erosion prone areas, 2) restricting the amount of acreage that may be logged at any one time and the time of year when logging operations occur, 3) providing guidelines on road construction within the basin and methods that contractors use to develop property, and 4) maintainence of a vegetated area along the shoreline. Considerable amounts of soils are deposited in the lake by streams. An example of this process is the delta formed where the stream next to the Glass Lake Inn enters the lake. Some of the soils may be kept out of the lake by minimum adjustments to the stream bed to reduce the water velocity in the stream prior to entry into the lake. Reduced water velocity in the stream will cause the bulk of the suspended soils to be deposited in the low velocity area and with occasional cleanout this area can be maintained fairly easily. Your local Soil Conservation Service representative can provide valuable assistance in determining the extent of erosion problems and suggesting methods for soil conservation.

The runoff of fertilizers applied to lawns and gardens can frequently add nitrogen and phosphorus to a lake. There are a number of "common sense" methods for reducing the inputs from these sources. Don't fertilize early in the spring or at other times when soils are saturated from a recent rainstorm. Try to apply small amounts of fertilizer more frequently (i.e. twice per year add one-half the amount usually applied once per year). Don't locate vegetable gardens or other gardens that you plan to fertilize heavily close to the lake. Don't fertilize immediately before a rainstorm is forecast.

Continued monitoring of Glass Lake water quality by your association is desirable. A chemical assay program as extensive as that presented in this report is not necessary on an annual basis. Lake Association members in conjunction with their water quality committee can make certain measurements that will prove useful in observing any long-term trends in water quality. The Fresh Water Institute currently assists the Lake George Association in operating a Lay Monitoring Program on Lake George. A similar program could be beneficial to Glass Lake. Association members are provided with Secchi disks and thermometers to record the transparency and temperature of the lake once per week during the summer months. At the end of the year, the data is gathered and compared to results from previous years to provide a measure of any significant changes in water clarity. If your association is interested in initiating such a program, an FWI staff member would be glad to meet with you and discuss the training, costs and equipment necessary. On a three of five year basis, more complete chemical assays and observations of the lake may be advisable. These lake observations and chemical assays may be conducted by such groups as Dyken Pond Environmental Management Center, RPI Freshwater Institute, RPI Department of Environmental Engineering, and many others. If the association feels that they want to collect samples and make their own assessments, laboratories such as Bender Labs in Albany, C.T. Male in Latham or the Fresh Water Institute are certainly capable of sample analysis on a per sample fee basis.

The Rensselaer County Department of Health currently monitors the levels of coliform bacteria and selected chemical compounds in the lake adjacent to Tiffts Beach. An annual review of this data would be desirable and is something that can probably be done by members of the association. If professional help is desired, the FWI or some of the state agencies already mentioned can probably be of help.

An informed community is also an important asset. The FWI currently provides a lecture series at our Bolton Landing facility, one evening each week during the summer months, covering environmental and other topics of general interest. Your association could sponsor a similar program at little cost. I have enclosed a list of last summers lecturers to give you an idea of the agencies willing to provide lecturers (Appendix C). In addition, certain universities, state and local agencies offer summer programs and courses for children and adults at nominal costs. I have enclosed the course brochure for summer courses provided by the Fresh Water Institute and I'm sure that the Dyken Pond Environmental Management Center, Five Rivers Environmental Education Center or the Huyck Preserve have similar offerings and may even be willing to conduct one or two day field activities at Glass Lake.

ACKNOWLEDGEMENTS

We would like to thank Dr. Roger Armstrong of the Chemistry Department of Russell Sage College for providing us with his unpublished chemistry data, Doug Carlson of NYSDEC, Region 4 for fisheries data, and Dennis Carroll for providing Rensselaer County Department of Health reports for Glass Lake.

TABLE 3. Results of Water Chemistry from Glass Lake.

Site	Depth (M)	Secchi Depth (Meters)	Alkalinity mg/l as CaCO3	Conductivity (umhos)	TP ppb	Nitrate (ppm)	Chloride (ppm)	Ammonia (ppm)	Copper (ppm)	pH	TC	FC	Soluble Silica (ppm)
08/11/84													
midlake	0-10		20.0	64		0.02	8.3	<0.01	<0.01	6.29	35	30	
stream	surface			44		0.35	2.4	0.05	<0.01	6.50	TNTC	TNTC	
Inn	surface			78		0.55	6.1	0.02	<0.01	7.01	TNTC	TNTC	
08/23/84													
INLET	0-2		20.0	64	11	<0.01	8.4	<0.01	<0.01	6.85	18		
W SHORE	0-3		20.0	64	13	0.02	8.3	<0.01	<0.01	6.75	8	0	
MIDLAKE	0-5	3.8	20.0	63	13	<0.01	8.2	<0.01	<0.01	6.88	5	0	
MIDLAKE	19		42.0	77	74	0.01	8.8	0.2	<0.01	6.87			
OUTLET	0-3	3.6	20.0	62	13	<0.01	8.2	0.01	<0.01	7.23	28		
EAST SHORE	0-3	3.0	20.0	64	14	0.01	9.5	0.04	<0.01	6.81	5	0	
11/20/84													
INLET	0-2		19.8	67	16	<0.01	8.0	<0.01	<0.01	6.85			0.84
W SHORE	0-3		19.8	69	10	0.03	7.9	<0.01	<0.01	6.81	CONF	5	0.74
MIDLAKE	0-5	2.8	19.8	65	13	<0.01	7.8	<0.01	<0.01	6.50	10	7.5	0.87
MIDLAKE	19		19.8	116	9	<0.01	7.9	<0.01	<0.01	6.92			0.87
OUTLET	0-3		19.8	66	10	<0.01	7.8	<0.01	<0.01	6.88	CONF	2	0.91
EAST SHORE	0-3		24.0	69	13	0.01	7.9	0.02	<0.01	6.79	CONF	4	0.79
N MIDLAKE	0-5		19.8	92	13	<0.01	7.9	<0.01	<0.01	6.90	CONF	7.5	0.80
N MIDLAKE	7		31.0	82	9	<0.01	7.9	0.02	0.01	6.94			0.84

TP=Total Phosphorus
TC=Total Coliform Bacteria as Colonies per 100 milliters of sample
FC=Fecal Coliform Bacteria as Colonies per 100 milliters of sample
<=Less Than. This notation is used to indicate concentrations below analytical limit of detection
ppm=Parts per Million
ppb=Parts per Billion
TNTC=Too Numerous to Count
CONF=Confluent or Uncountable Plate

TABLE 4. Surface Water Chemistry for Selected Lakes.

Lake	Secchi Depth (meters)	Alkalinity (mg/l as CaCO3)	Specific Conductance (umhos)	Total Phosphorus (ppb)	Nitrate (ppm)	Ammonia (ppm)	Chloride (ppm)
Lake George New York	8.0	26.0	95.0	5.0	<0.01	<0.01	6.5
Babcock Lake Rensselaer Co., NY	3.7	16.0	72.0	13.0	0.01	0.03	9.6
Glass Lake Rensselaer Co., NY	3.3	24.0	67.0	13.0	0.01	<0.01	8.2
Crooked Lake Rensselaer Co., NY	3.5	15.0	71.0	15.0	0.01	0.03	10.0
Saratoga Lake Saratoga Co., NY	2.2	77.0		100.0	0.30	0.30	

TABLE 5. Classifications and Standards for Fresh Surface Waters.

Class	Best Usage	Limits	Dissolved Oxygen Standards: Trout Waters Minimum Daily Average	Trout Waters Minimum	Non Trout Waters Minimum Daily Average	Non Trout Waters Minimum	Coliform Standards*: Monthly Median Value	20% of Sample	Monthly Geometric Mean	pH	Total Dissolved solids	Phenolic Compounds
AA	Water Supply for Drinking or Food Processing	Waters will meet Health Department Standards	6 mg/l	5 mg/l	5 mg/l	4 mg/l	Less than 50/100 ml coliforms	Less than 240/100 m coliforms	---	6.5-8.5	As low as practicable, less than 500mg/l	Less than 0.001mg/l (phenol)
A	Water Supply for Drinking or Food Processing	Waters will meet Health Department Standards for Drinking Water with Approved Treatment	6 mg/l	5 mg/l	5 mg/l	4 mg/l	Less than 5000/100 ml coliforms	Less than 20,000/ 100 ml coliforms	Less than 200/100 ml fecal coliforms	6.5-8.5	As low as practicable, less than 500mg/l	Less than 0.005mg/l (phenol)
B	Contact recreation and other uses except water supply and food processing	------	6 mg/l	5 mg/l	5 mg/l	4 mg/l	** Less than 2,400/100 ml coliforms	** Less than 5,000/ 100 ml coliforms	** Less than 200/100ml focal coliforms	6.5-8.5	None detrimental to aquatic life. Waters currently less than 500mg/l shall remain below this limit.	------
C	Fishing and other uses except water supply, food processing and contact recreation	------	6 mg/l	5 mg/l	5 mg/l	4 mg/l	------	------	** Less than 10,000/100ml coliforms and 2,000/100ml fecal coliforms	6.5-8.5	None detrimental to aquatic life. Waters currently less than 500mg/l shall remain below this limit.	------

D	Secondary contact recreation. Waters are not suitable for propagation of fish	Waters must be suitable for fish survival	------	------	-----	3 mg/l	------	------	------	6.0-9.5	------	------
N	Employment of water in its natural condition for whatever compatible purposes	No waste discharges without approved filtration through 200' of unconsolidated earth	Natural	Natural	Natural	Natural	Natural	Natural	Natural	Natural	Natural	------

Notes: Additional Standards applicable to the above classifications: Turbidity - no increase that will cause a substantial visible contrast to natural conditions; Color - None from man-made sources that will be detrimental to the specified best usage of waters; Suspended, colloidal or other solids - None from any waste discharge which will cause deposition to the best usage of water; Oil and floating substances - No residue attributable to a waste discharge nor visible oil films nor globules of grease; Taste and Odor producing substances, toxic wastes and deleterious substances - None that will be injurious to fish life or to make the waters unsafe or unsuitable for any classified use.

With reference to certain toxic substances affecting fish life, the establishment of any single numerical standard for waters of New York State would be too restrictive. There are many waters, which because of poor buffering capacity and composition will require special study to determine safe concentrations of toxic substances. However, most of the non-trout waters near industrial areas in this state will have an alkalinity of 80 mg/l or above. Without considering increased or decreased toxicity from possible combinations, the following may be considered as safe stream concentrations for certain substances to comply with the above standard for this type of water. Water of lower alkalinity must be considered since the toxic effect of most pollutants will be greatly increased. Ammonia or Ammonium Compounds - Not greater than 2.0 mg/l expressed as NH_3 at pH 8 or above: Cyanide - Not greater than 0.1 mg/l expressed as CN: Ferro or Ferricyanide - Not greater than 0.4 mg/l expressed as $Fe(CN)_6$: Copper - Not greater than 0.2 mg/l expressed as Cu: Zinc - Not greater than 0.3 mg/l expressed as Zn: Cadmuim - Not greater than 0.3 mg/l expressed as Cd.

Table 6. Rooted Aquatic Plants Found at Glass Lake Sampling Sites.

Common Name	Classification	Frequency
Yellow Pond Lily	Nuphar advena	A
White Pond Lily	Nymphaea tuberosa	O
Broad Leafed Pond Weed	Potamegeton amplifolius	A
Fern Pondweed	Potamegeton robbinsii	A
Waterweed	Elodea	A
Broad Leaved Cattail	Typha latifolia	C
Pickerelweed	Pontederia cordata	C
Coontail	Ceratophyllum demersum	A

A= Abundant
C= Common
O= Occasional

Table 7. Fish Species Present in Glass Lake.

Common Name	Classification
Largemouth Bass	Micropterus salmoides
Smallmouth Bass	Micropterus dolomieui
Chain Pickerel	Esox niger
Brown Bullhead	Ictalurus nebulosus
Pumpkinseed Sunfish	Lepomis gibbosus
Redbreast Sunfish	Lepomis auritus
Rock Bass	Ambloplites rupestris
Black Crappie	Pomoxis nigromaculatus
White Perch	Morone americana
Yellow Perch	Perca flavescens
Rainbow Trout	Salmo gairdneri
Kokanee Salmon	Oncorhynchus nerka

Table 8. DOH Records for Glass Lake Water Sampled at Tiffts Beach.

Date	Nitrate (ppm)	Chloride (ppm)
06/09/64	0.04	5.0
07/20/64	0.04	4.0
08/18/64	0.04	4.0
07/07/65	0.12	4.0
07/21/65	0.04	4.0
08/04/65	0.12	6.0
08/18/65	0.12	4.0
09/02/65	0.04	4.0
07/06/66	0.12	7.0
07/13/66	0.12	6.0
07/20/66	0.04	5.0
08/02/66	0.04	4.0
06/21/67	0.08	5.0
07/13/67	0.12	5.0
08/03/67	0.08	5.0
06/18/68	0.04	3.0
07/16/68	0.04	5.0
08/19/68	0.04	6.0
06/03/69	0.04	6.0
06/30/69	0.04	4.0
07/14/69	0.08	4.0
07/28/69	0.04	3.0
08/11/69	0.08	3.0
05/18/70	0.12	6.0
07/06/70	0.08	5.0
07/27/70	0.04	5.0
08/25/70	0.16	6.0
06/03/71	0.04	5.0
06/15/71	0.04	5.0
06/28/71	0.04	5.0
07/13/71	0.04	5.0
07/27/71	0.04	5.0
08/10/71	0.04	5.0
08/24/71	0.04	5.0
06/20/72	0.04	5.0
07/12/72	0.04	7.0
08/08/72	0.04	5.0
06/06/73	0.04	4.0
07/02/73	0.08	4.0
07/18/73	0.04	3.0
06/11/74	0.04	4.0
07/02/74	0.04	5.0
07/22/74	0.04	4.0
08/06/74	0.04	5.0
05/22/75	<0.20	7.0

Table 8 (cont.). DOH Records for Glass Lake Water Sampled at Tiffts Beach.

Date	Nitrate (ppm)	Chloride (ppm)
06/20/75	<0.20	5.0
06/26/75	<0.20	15.0
07/28/77	<0.50	5.0
06/21/79	<0.50	6.0
11/20/80	<0.50	9.5

Table 9. Surveys of Glass Lake Water Chemistry.

Date	Nitrate (ppm)	pH	Total Phosphorus (ppb)	Secchi Depth (meters)	Alkalinity (ppm)	Ammonia (ppm)
1972[1]	0.09	5.6-7.0	40	3.6	23.2	
1976[2]	0.75	6.0-6.9	31	4.4	20.6	0.06
1977[2]				5.9		
1978[2]		7.0-7.5	7	5.5		
1984[3]	0.01	6.3-7.2	13	3.3	24.0	<0.01

1 - Results from A Survey of Rensselaer County Lakes, Rensselaer Polytechnic Institute, Troy, NY.

2 - Results obtained from Dr. R. Armstrong, Dept. of Chemistry, Russell Sage College, Troy, NY. Nitrate data is from a single sample analysed in a student lab.

3 - Results of Present Survey.

Figure 1. Glass Lake Sampling Site Locations.

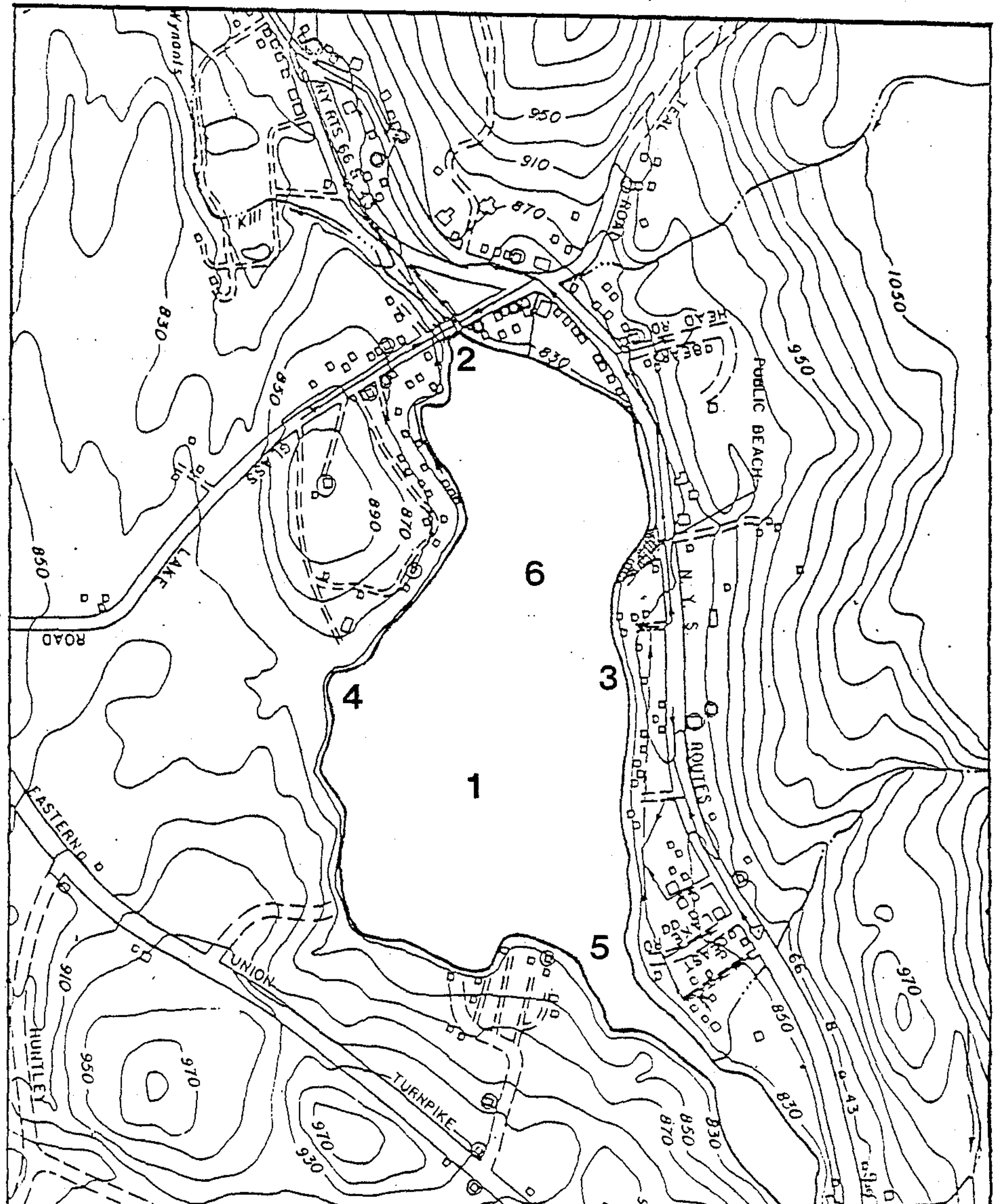


Figure 2. Dissolved Oxygen and Temperature Profiles of Glass Lake.

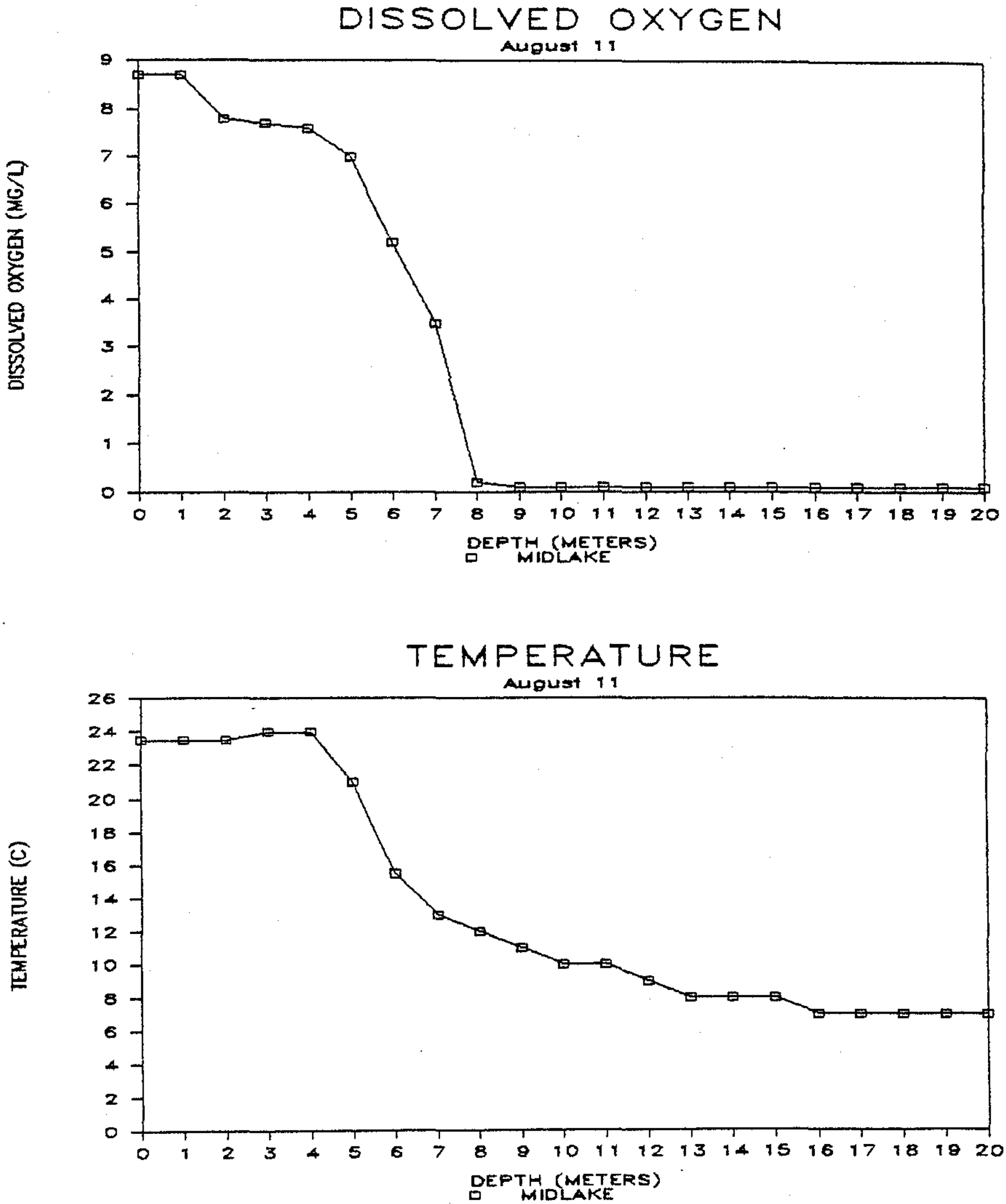
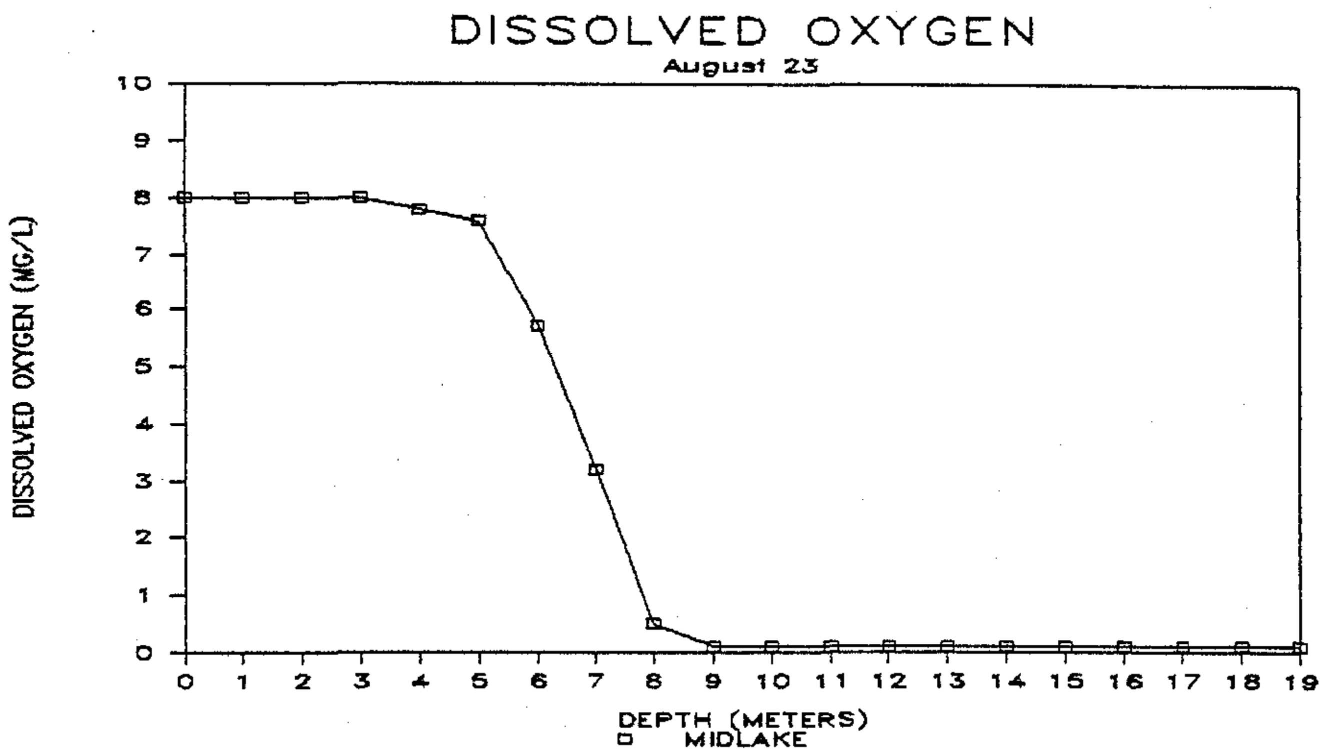


Figure 2 (cont.). Dissolved Oxygen and Temperature Profiles of Glass Lake.



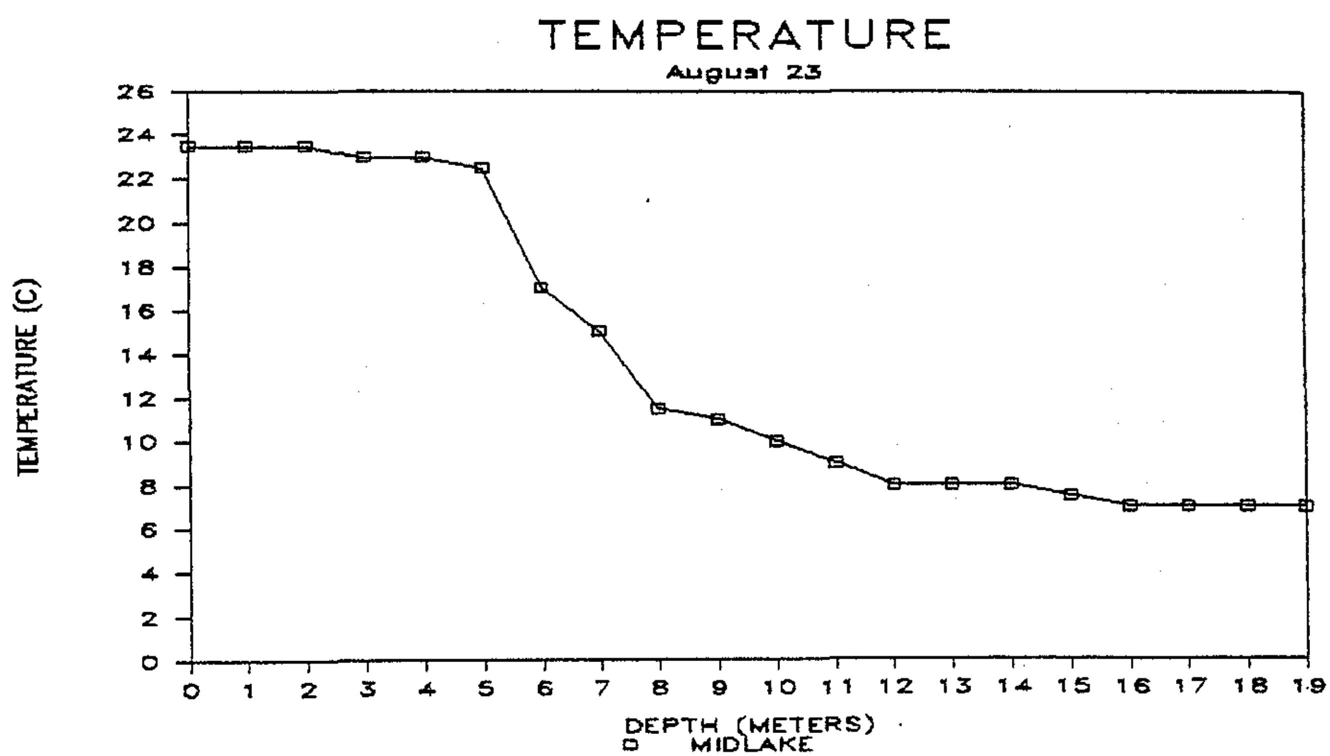
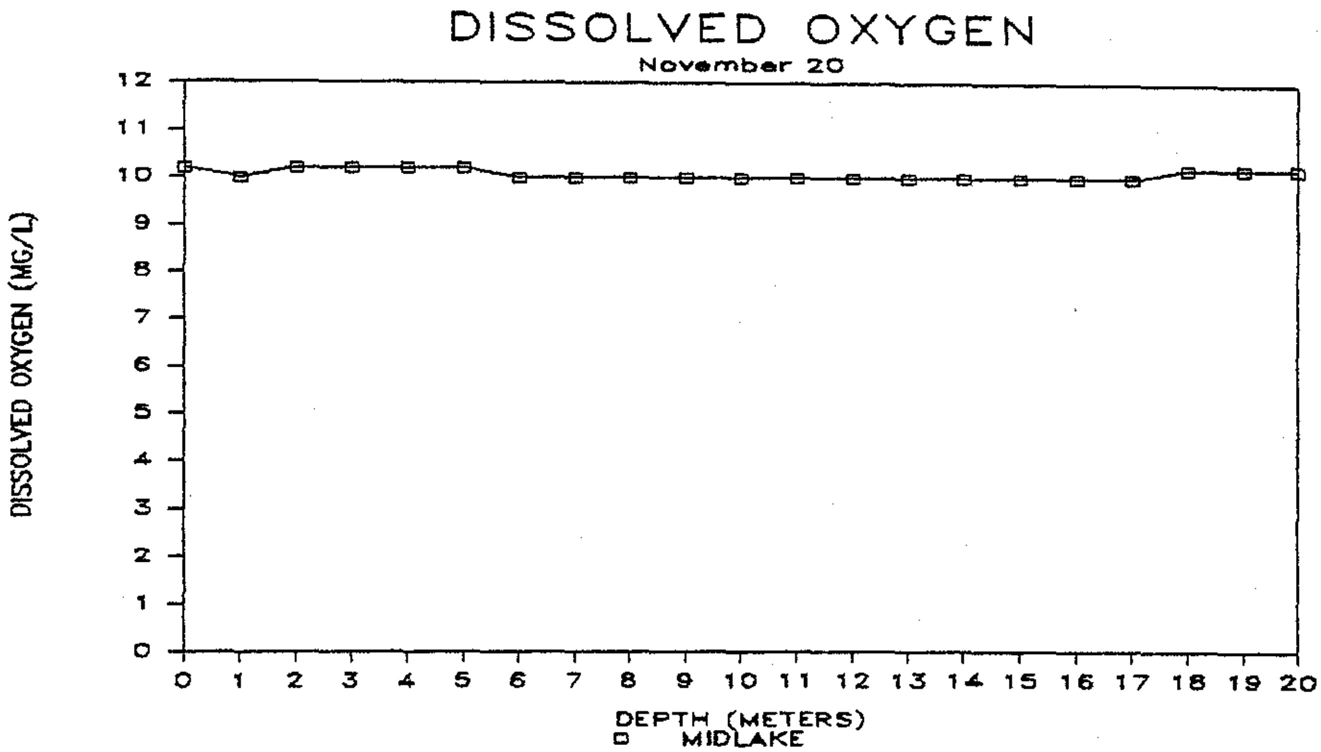


Figure 2 (cont.). Dissolved Oxygen and Temperature Profiles of Glass Lake.



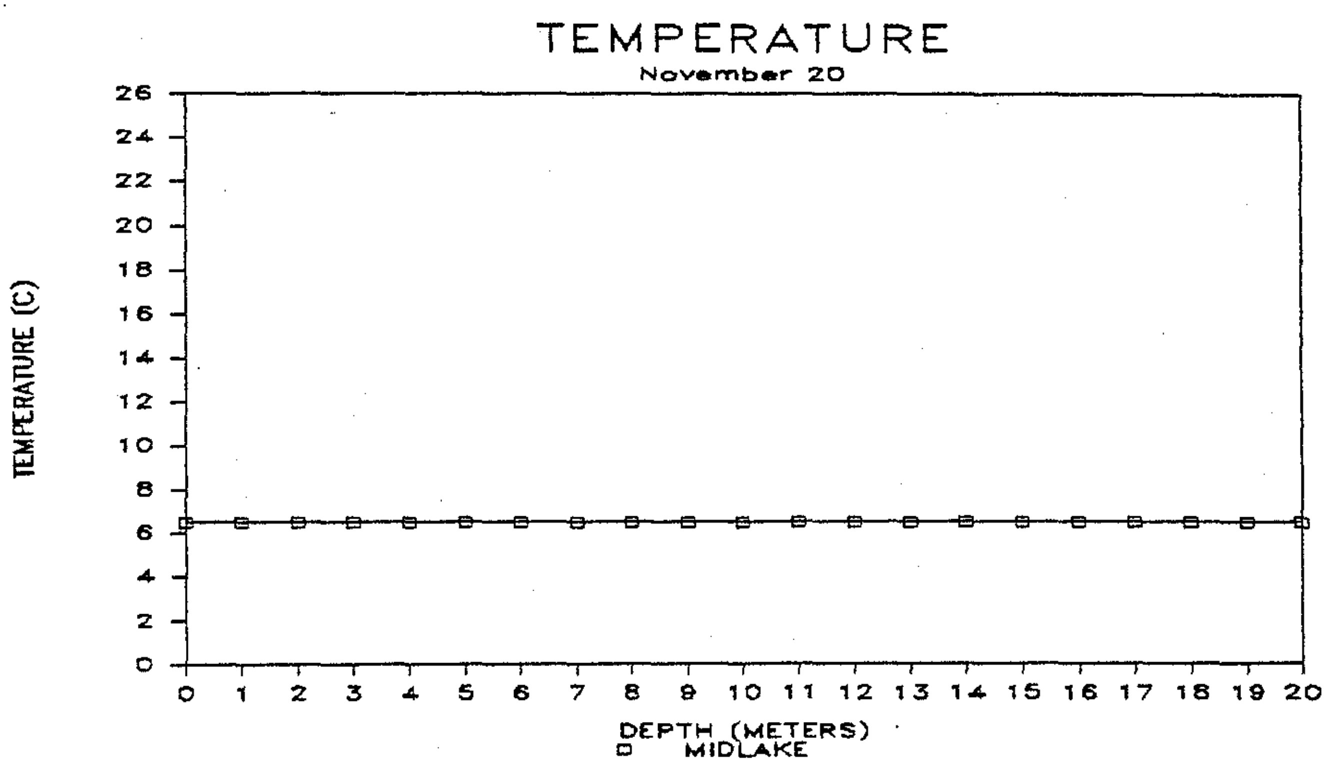


Figure 3. Bathymetric (Depth) Map of Glass Lake. All depths are reported in feet.

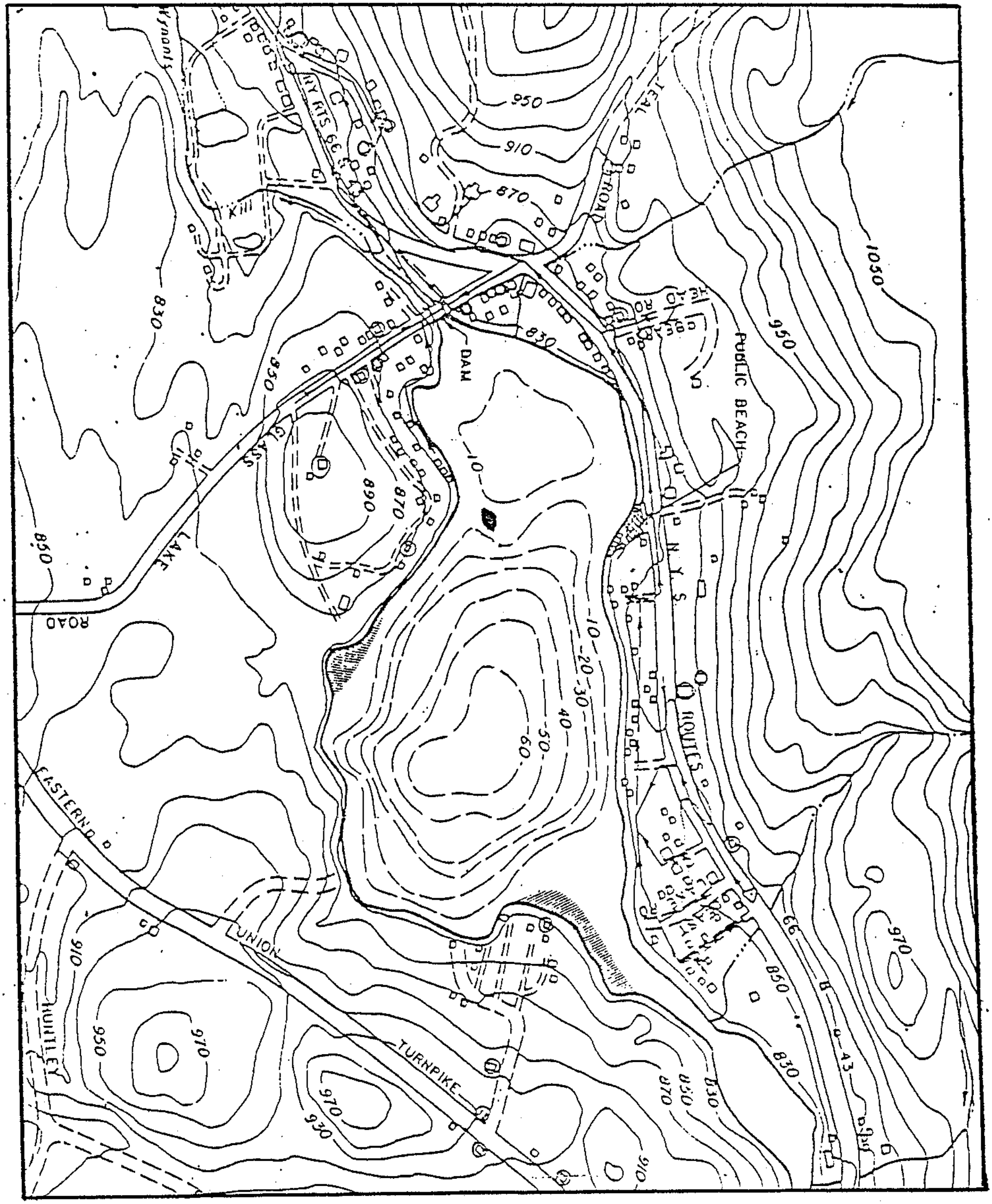
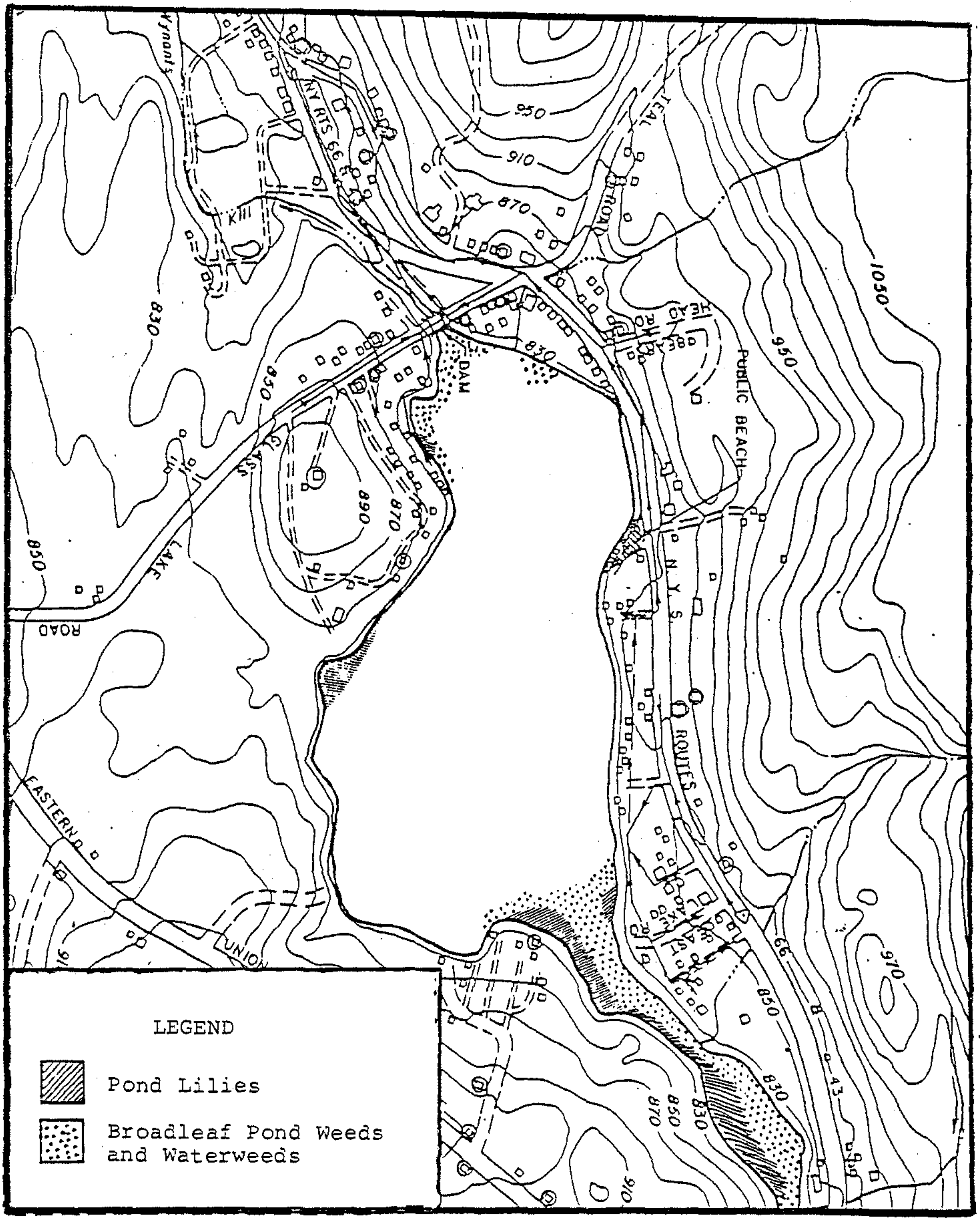


Figure 4. Map of Rooted Aquatic Plant Beds in Glass Lake.



APPENDICES

Appendix A. Analytical Methods and Equipment.

Analysis	Method	Instrument
pH	Expanded Scale pH/millivolt meter	Orion, Model 811
Alkalinity	Gran Plot Titration	Orion, Model 811
Specific Conductance	Wheatstone Bridge type meter	YSI, Model 31
Chloride	Automated Ferricyanide (EPA Method, 325.2)	Technicon Autoanalyzer II
Nitrate	Automated Cadmium Reduction (EPA Method, 353.2)	Technicon Autoanalyzer II
Ammonia	Automated Phenate (EPA Method, 350.1)	Technicon Autoanalyzer II
Soluble Silica	Automated Molybdate (Standard Methods, 425E)	Technicon Autoanalyser II
Total Phosphorus	Single Reagent Ascorbic Acid (EPA Method, 365.2)	Bausch and Lomb Spec 710
Copper	Flame Atomic Absorption (EPA Method, 220.1)	Perkin-Elmer Model 403
Total Coliform	Membrane Filtration (Standard Methods, 909A)	
Fecal Coliform	Membrane Filtration (Standard Methods, 909C)	

EPA Methods = USEPA, 1979, Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, Cincinnati, OH.

Standard Methods = APHA-AWWA-WPCF, 1980, Standard Methods for the Examination of Water and Wastewater, 15th ed. American Public Health Association, Washington, D.C. 1134 pp.

APPENDIX B.

FORM NO.__________

SANITARY SURVEY

1. SITE_DESCRIPTION

A. NAME OF OCCUPANT____

B. MAILING ADDRESS____
Street Address, Box Number

____
City, Town, Zip Code

____
Telephone

C. NAME OF OWNER____

D. PROPERTY LOCATION____

E. TAX MAP NUMBER____

2. TYPE_OF_BUILDING

A. PRIVATE RESIDENCE
B. APARTMENT BUILDING
C. HOTEL OR MOTEL — NUMBER OF UNITS____________
D. RESTAURANT
E. OTHER — DESCRIPTION_______________

____

F. YEAR BUILDING CONSTRUCTED________________________________

G. LENGTH OF OCCUPANCY:
SEASONAL — FROM________TO_______
YEAR ROUND
VACANT

H. AVERAGE NUMBER OF OCCUPANTS OR PATRONS_________
I. COLOR AND CONSTRUCTION TYPE______________________________
____

J. APPROXIMATE SIZE (FT^2) OF LAWN AND GARDEN_______________

K. USE LAWN OR GARDEN FERTILIZER

YES_____ ANNUAL AMT (IF KNOWN)_____LBS.

3. WATER_SUPPLY

A. TYPE PUBLIC MAINS
PRIVATE WELL APPROXIMATE DEPTH (FEET)_____

B. CHLORINATED YES
NO

C. WATER USAGE

SHOWERS	______
BATH TUBS	______
DISHWASHERS	______
GARBAGE DISPOSAL	______
SINKS	______
TOILETS	______
WASHING MACHINE	______

4. WASTEWATER_DISPOSAL_FACILITIES

A. TYPE OF SYSTEM

CESSPOOL__ SEPTIC TANK-SEEPAGE PIT__
SEPTIC TANK-TILE FIELD__ HOLDING TANK__
OTHER DESCRIPTION________________________________
____

B. TANK CONSTRUCTION

SIZE (gallons)______________________
AGE (years) ______________________
TYPE OF CONSTRUCTION:
CONCRETE___
METAL___
OTHER___ DESCRIPTION________________________
____

HOW MANY YEARS SINCE PUMPED?__________________

APPROXIMATE DISTANCE FROM LAKE (feet)__________

C. TILE FIELD

APPROXIMATE LENGTH (feet)____________
AGE (years)
APPROXIMATE DISTANCE FROM LAKE (feet)_______________

D. SEEPAGE PITS

NUMBER OF PITS________ AGE(years)__________
SIZE________ APPROXIMATE DISTANCE FROM LAKE
(feet)__________

E. SKETCH OF BUILDING AND SYSTEM

5. PROBLEMS

A. WHAT PROBLEMS HAS YOUR SYSTEM CAUSED?

ODORS____
SLOW DRAINING OF PLUMBING____
SURFACING OF SEWAGE________
BACKUP OF SEWAGE INTO HOUSE____
NONE _____
OTHER___ DESCRIPTION__________________________________
____

B. HOW OFTEN DO PROBLEMS OCCUR?___________________________
____

C. IF YOU LIVE ALONG THE LAKESHORE, DO YOU NOTICE ANY OF THE FOLLOWING, ADJACENT TO YOUR PROPERTY?

ALGAE OR SCUM ON ROCKS ________
AQUATIC VEGETATION ("WEEDS") ________

6. OTHER INFORMATION

A. WHAT TYPE OF SOIL DO YOU HAVE:

SANDY LOAM SILTY LOAM
CLAY DON'T KNOW

B. SOIL COLOR

BLACK-DARK BROWN
LIGHT BROWN
GRAY
REDDISH-BROWN

C. HOW WELL DRAINED IS YOUR SOIL?

WELL DRAINED_________
DRAINS SLOWLY________
DON'T KNOW___________

D. ARE THERE ROCK OUTCROPS ON YOUR PROPERTY?

YES _____
NO _____

E. WOULD YOU BE WILLING TO ALLOW AN ONSITE TEST OF YOUR WASTEWATER DISPOSAL SYSTEM: YES____ NO____

7. <u>SIGNATURE OF PERSON (S) WHO FILLED OUT FORM</u>

_____________________________________ DATE_____________

8. <u>COMMENTS OR REMARKS</u>

____

____

____

____

____