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

by

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RENSSELAER COUNTY, NEW YORK

Survey Program Developed and Completed by the

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BACKGROUND

Babcock Lake is located in the northeastern portion of Rensselaer County in the Town of Grafton. The southern two thirds of this lake's watershed is on the Rensselaer Plateau which is hilly, mountainous and heavily forested. The northern third of the watershed is composed of rolling hills with gentle to moderately steep slopes. Elevations within the watershed range from 1324 at the surface of the lake to 1500 feet above sea level.

The lake has a surface area of 51 acres which drains a watershed of 317.6 acres. The lake ultimately drains into the Hudson River via Sunkauissia Creek and the Tomhannock Reservoir. There is a small outlet dam at the southwestern end of the lake which controls the lake level. The lake has a maximum depth of 12 meters (39 ft.) and exhibits thermal and chemical stratification during the summer months. The surficial geology is all till (a sand and gravel soil without exposed bedrock) derived from glacial and alluvial deposits. The soil associations are Worth-Empeyville-Westbury and Troy-Cossayuna-Nassau deposits. These deposits are composed of stones, boulders and outcrops developed on glacial till from shale, slate and sandstone interspersed with gravel and chips of shale and slate. Drainage in these deposits is moderate, and their ability to furnish lime, nitrogen and phosphorus to plants through root uptake is low to medium. Slope and shallowness over bedrock are the main limitations to farm and nonfarm use. These soils are adequate but not well suited for septic system use.

Babcock Lake is primarily a recreational lake with boating, fishing and swimming the primary uses. Powerboats are prohibited and at present there exists no public access. The watershed is densely populated, 332 homes in 1972, with only small areas of undeveloped shoreline. There is no commercial land use on the shore of the lake. Municipal water is supplied to 115 residences (1972) via lake water chlorinated prior to distribution. Sewage treatment is on an individual septic system basis. A partial septic survey conducted by Rensselaer County Health Department found very few catastrophic septic system failures (i.e. surface pooling of sewage). Due to lack of manpower, however, the survey was not completed.

Previous reports state that the lake is not stream fed, however, our staff observed a number of small streams draining into the lake. The portion of the total water flow to the lake that these streams contribute is presently unknown.

Table 1. Physical Features of Babcock Lake.

BABCOCK LAKE - Grafton, Rensselaer County, New York

Maximum Depth	39 feet
Surface Area	51 acres
Watershed Area	317.6 acres
Elevation Above Sea Level	1324 feet
Latitude	42 degrees 48 minutes
Longitude	73 degrees 24 minutes
Annual Precipitation	40-50 inches
Mean Annual Temperature	49° Fahrenheit

SAMPLING LOCATIONS

In order to characterize the chemistry of Babcock 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. In addition, water samples were collected from a stream draining into the lake during our visit in the fall.

Table 2. Chemical Water Quality Sampling Sites.

Site	Name	Location
1	Midlake	The sampling site was located 100 meters west of the Babcock Lake Association Beach in the approximate center of the lake. Maximum water depth at this site was 12 meters.
2	Outlet	The sampling site was located 20 meters northeast of the outlet spillway. Maximum water depth at this site was 3 meters.

3	East Shore	The sampling site was located 10 meters west of the dock at the Corby residence. Maximum water depth at this site was 3 meters.
4	West Shore	The sampling site was located 50 meters east of a white house with a large lawn, flagpole, and screened porch. Maximum water depth at this site was 3 meters.
5	Northeast Bay	The sampling site was located 50 meters from the east and west shores. The location was triangulated between log cabins on the north and west shores and a large white home on the the east. Maximum water depth at this site was 2.5 meters.
6	North Midlake	The sampling site was located 100 meters from the east shore on a line from a green dock on the east shore to the white house described for site 4. Maximum water depth at this site was 8.5 meters.
7	Stream	Water samples from the stream were collected on the Corby property approximately 100 meters upstream from the point where the stream empties into the lake.

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 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.

Coliform bacteria samples 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 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 then 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 maximum depth was greater then 5 meters, deep water point samples were taken using a Van Dorn collection bottle. The Van Dorn bottle is lowered to the depth in the lake where the sample is 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 depth,

2) maximum 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 methods previously described (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. The remainder of each sample was filtered (0.4 um Nuclepore filter) and stored at 4° C until analysed for nitrate, ammonia and chloride concentrations. The analytical methods used for all determinations are listed in Appendix A.

RESULTS

Samples were collected from Babcock Lake on August 13 and 24, October 30 and November 15, 1984. The lake was thermally and chemically stratified throughout the summer months and destratified (turned over) between October 30 and November 15 (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 is highest during the summer months 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 Babcock Lake occurs at about 7 meters (23 feet).

Depth profiles of dissolved oxygen and temperature were done during each sampling of the lake (see Figure 2). The lack of oxygen in the hypolimnion (waters deeper than 7 meters) of Babcock Lake during the summer controls the type of organisms which are active in this portion of the lake. The lack of oxygen is due to decomposition occurring 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 which are active in the absence of dissolved oxygen is hydrogen sulfide which gives the water a "rotten egg" odor. Results from samples collected on November 15 (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 Babcock 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 Babcock 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.

The methods used to determine the amount of nitrogeneous 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 nitrogeneous compounds (ammonia and nitrates) available in the surface waters during the period of summer stratification (August 13, 24 and October 30 samples). Most the nitrogeneous 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 nitrogeneous material may be limiting to algal productivity in Babcock Lake. The deeper waters of the lake (midlake and N. midlake samples) had measurable amounts of ammonia, a byproduct of the decomposition processes occurring in the sediments. When the lake mixed during fall overturn the nitrate and ammonia concentrations of the epilimnion increased (Table 3, November 15 samples). The increase of nitrate and ammonia in the surface waters may spur considerable growth of algae at this time.

Alkalinity and pH records for Babcock 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 Babcock Lake ranged from 15.5 to 16.6 mg/L as $CaCO_3$ in the surface waters (epilimnion). 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 Babcock 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 transparency 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 Babcock Lake as measured with a Secchi Disk averaged 3.7 meters (12 feet). This transparency compares favorably with 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 64 to 75 umhos. Samples taken from the hypolimnion, waters deeper than seven meters, exhibited considerably higher conductivities than other locations with a range of from 110 to 116 umhos during summer stratification. Higher conductivities in the deeper waters are partially due to increased concentrations of ammonia and phosphorus. After fall overturn, the November 15 samples, conductivity values in all parts of the lake were comparable. The sharp reduction in conductivity values in the deeper waters of the lake after fall overturn are a result of the mixing of the entire lake.

The chloride concentrations for all samples from Babcock Lake ranged from 8.8 to 10 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.

The coliform group of bacteria are used as the principal indicator of suitability of water for domestic and recreational use. These 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 Babcock Lake were made at various locations to determine potential locations of sewage input and to provide assurance that Babcock Lake remains within NYS guidelines for drinking water with approved treatment and 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 a potable water supply (Table 5, Class A). The number of coliform bacteria in samples collected during the fall sampling were generally lower than results from the summer samples. Since coliform levels in samples taken during the time of greatest human activity (summer) were higher than samples collected in the fall, minor amounts of sewage may be entering the lake.

Water depth measurements were made at 14 locations to generate a bathymetric map of Babcock Lake (Figure 3). Due to the small number of depth measurements, the map is only of limited value but provides sufficient information for many uses.

Specimens of rooted aquatic plants (macrophytes) present in Babcock Lake were collected at each site. A list of the species found is shown in Table 6. In addition, a map of the weed beds present during the August 24 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 but the densities observed in the northeast bay may provide undesirable conditions for swimming. 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.

A list of the fish species reported for Babcock Lake (Table 7) was obtained courtesy of the NYS Department of Environmental Conservation.

The Rensselaer County Department of Health has collected samples for water chemistry analysis from both the municipal water supply and the association beach for many years (Table 8). Results from these water chemistries indicate that the pH, hardness, and to a lesser extent alkalinity of Babcock Lake have remained fairly stable over the last 43 years. The limited amount of data available for nitrate and ammonia concentrations make generalizations about these nitrogeneous compounds impossible. Chloride concentrations, however, appear to have increased considerably over the same time span. It is possible that the increase in chloride concentration observed is due to improved 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.

SUMMARY AND SUGGESTIONS

At present, the water quality of Babcock Lake is more than adequate for the primary uses of its' residents, namely recreation and potable water after chlorination. The chemical and bacteriological results are well within guidelines set by New York State for these uses (Class A, Table 5). Without active concern, however, the good water quality presently enjoyed by residents is not guaranteed and should not be taken for granted.

Since the lake serves as the source for drinking water, elimination of all inputs from septic systems should be of primary concern. 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. A sample septic survey form has been included 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 scrutinize 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 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. Some of the soils may be removed 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 recent rains. Don't fertilize immediately before a rainstorm is forecast. Try to apply small amounts of fertilizer more frequently (i.e. twice per year using 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.

Continued monitoring of Babcock 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 Babcock 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 are 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 or 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 other chemical compounds in the Babcock Lake municipal water supply. Your water treatment plant operator has access to this information and an annual review of these data would be desirable. Storage of historical data from this source and annual reviews are 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 lectures 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 Babcock Lake.

TABLE 3. Results of Water Chemistry from Babcock Lake

Site	Depth (meters)	Secchi Depth (meters)	Alkalinity mg/l as $CaCO_3$	Conductivity (umhos)	TP (ppb)	Nitrate (ppm)	Chloride (ppm)	Ammonia (ppm)	pH	TC	FC
08/13/84											
midlake	surf.		16.0	64		<0.01	9.5	<0.01	7.27		
N. bay	surf.		16.5	66		<0.01	9.8	0.02	7.28		
outlet	surf.		16.5	66		<0.01	9.6	<0.01	7.48		
8/24/84											
outlet	0-2		16.5	72	13	<0.01	9.9	<0.01	7.00	50	40
W. shore	0-2		15.5	72	14	<0.01	9.7	<0.01	7.15	20	25
N. bay	0-2	3.0	15.5	75	14	<0.01	9.9	<0.01	7.08	40	40
midlake	0-5	3.7	15.5	73	11	<0.01	9.9	<0.01	7.26	10	2
midlake	11		30.0	110	14	<0.01	10.0	0.09	6.56		
E. shore	0-2		15.5	75	10	<0.01	9.9	<0.01	7.20	40	10
10/30/84											
midlake	0-2		16.0	71	3	<0.01	10.0	0.02	6.96	0	0
midlake	8		18.0	74	5	<0.01	10.0	0.05	6.21		
midlake	11		28.0	116	9	0.01	9.9	>1.0	6.36		
stream			11.0	57						TNTC	2
11/15/84											
midlake	0-5		16.5	73	4	0.02	8.8	0.06	6.68	5	0
midlake	11	3.9	16.0	75	5	0.02	9.3	0.07	6.76		
outlet	0-2	4.3	16.6	73	4	0.02	9.6	0.06	6.82	4	0
E. shore	0-2		16.0	73	4	0.02	9.5	0.08	6.81	1	1
W. shore	0-2		16.0	75	6	0.02	9.4	0.06	6.85	2	<1
N. bay	0-2		16.0	74	4	0.02	9.6	0.08	6.83	3	0
N. midlake	0-5		16.0	73	7	0.02	9.5	0.08	6.86	15	<1
N. midlake	8	3.4	16.0	73	6	0.02	9.6	0.08	6.83		
stream			10.4	60		0.02	6.6	<0.01	6.52		

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

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 local 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 Babcock Lake Sampling Sites.

Common Name	Taxonomic Classification	Frequency
Yellow Pond Lily	Nuphar advena	A
White Pond Lily	Nymphaea tuberosa	O
Broad Leafed Pond Weed	Potamegeton amplifolius	A
Waterweed	Elodea	A
Broad Leaved Cattail	Typha latifolia	C

A= Abundant
C= Common
O= Occasional

Table 7. Fish Indigenous to Babcock Lake.

Common Name	Taxonomic 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
Yellow Perch	Perca flavescens

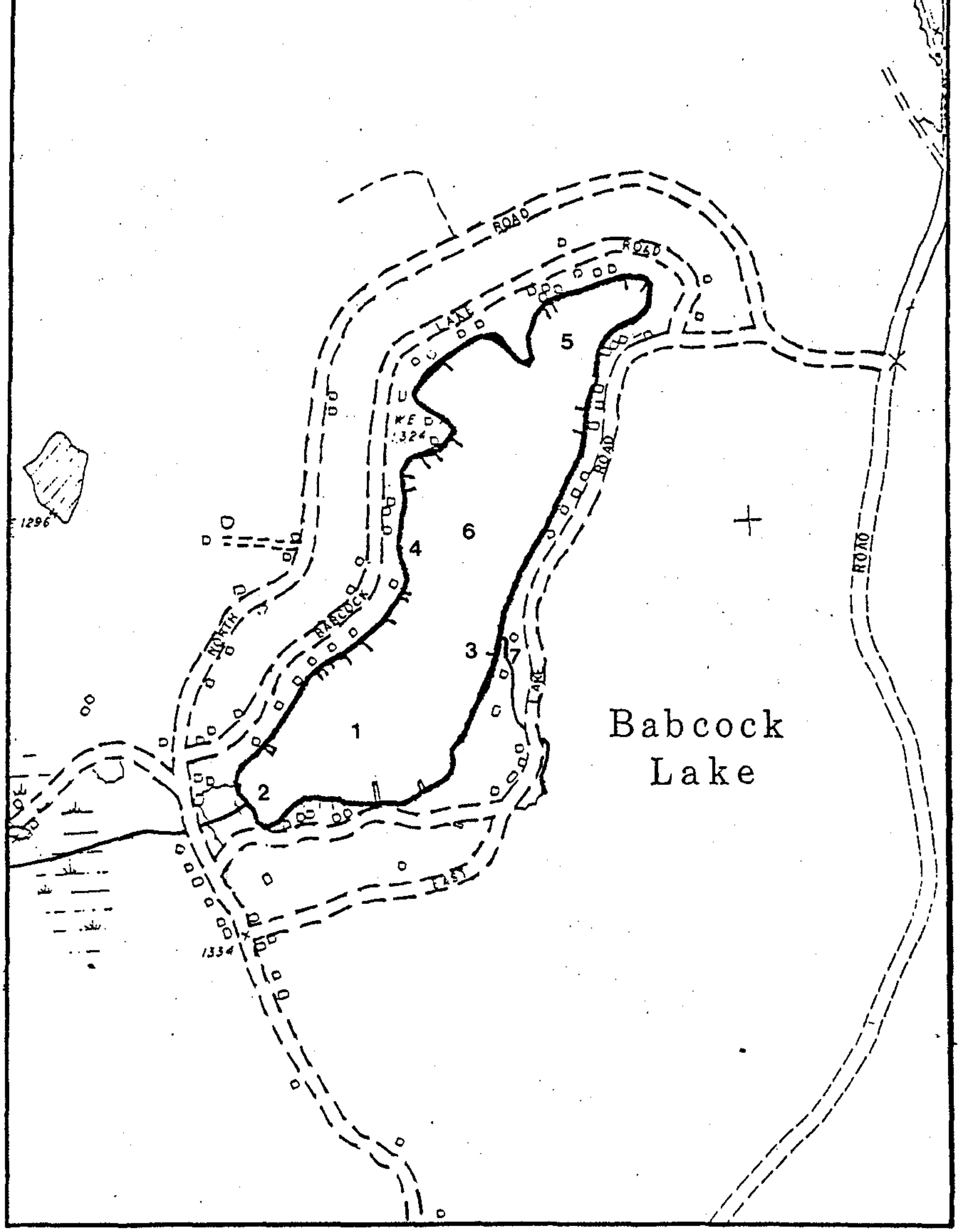
Table 8. DOH Records for Chlorinated Public Water Supply Serving 115 Camps on Babcock Lake.

Date	Nitrate (ppm)	Ammonia (ppm)	Chloride (ppm)	Alkalinity (ppm)	Hardness	pH
08/07/41	0.02	0.09	2.4	8.0	22.0	7.0
08/06/44	0.02	0.09	1.8	6.0	22.0	7.1
09/07/55	0.06	0.16	2.0	13.0	24.0	6.1
06/19/73	<0.10	0.03	7.0	1.9	23.0	6.8
05/23/74	<0.10	<0.02	5.0	15.0	25.0	7.1
08/21/75	<0.20	<0.05	7.0	22.0	23.0	7.3
06/22/76	<0.09	0.03	7.8	17.0	22.0	7.4
06/24/76	0.09	0.03	5.6		23.0	
07/29/78	<0.50		<5.0			
09/18/80	<0.50		9.5			
08/06/81	<0.20		8.5	17.0		
09/09/82						7.6
10/11/82						7.6
06/02/83						7.6
06/29/83						7.6
07/21/83						7.5
05/07/84						7.8
05/21/84						7.6
06/25/85						7.5
07/03/84						7.6
07/30/84						8.0
08/22/84						7.2

RESULTS FROM SAMPLES OF SURFACE WATER AT PUBLIC BEACH

Date	Nitrate (ppm)	Chloride (ppm)	pH
07/20/76	<0.5	<5.0	
08/04/77	<0.5	<5.0	
08/15/77	<0.5	<5.0	
08/29/77	<0.5	5.0	
08/21/78	<0.5	7.0	
07/07/81			7.2
07/13/82			7.4
07/11/83			7.4
06/20/84			6.8

Figure 1. Sampling Site Locations.



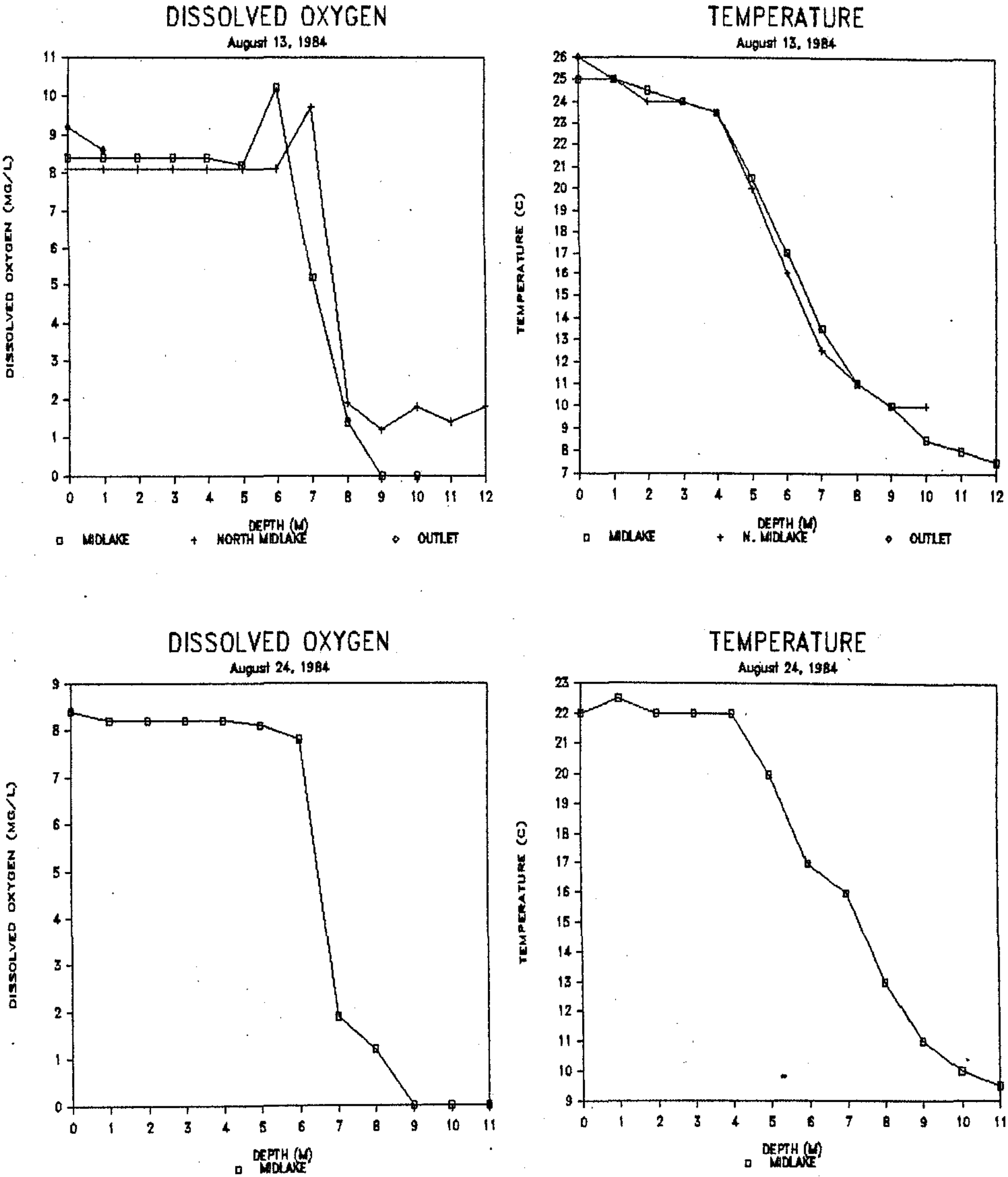


Figure 2. Dissolved Oxygen and Temperature Profiles for Babcock Lake.

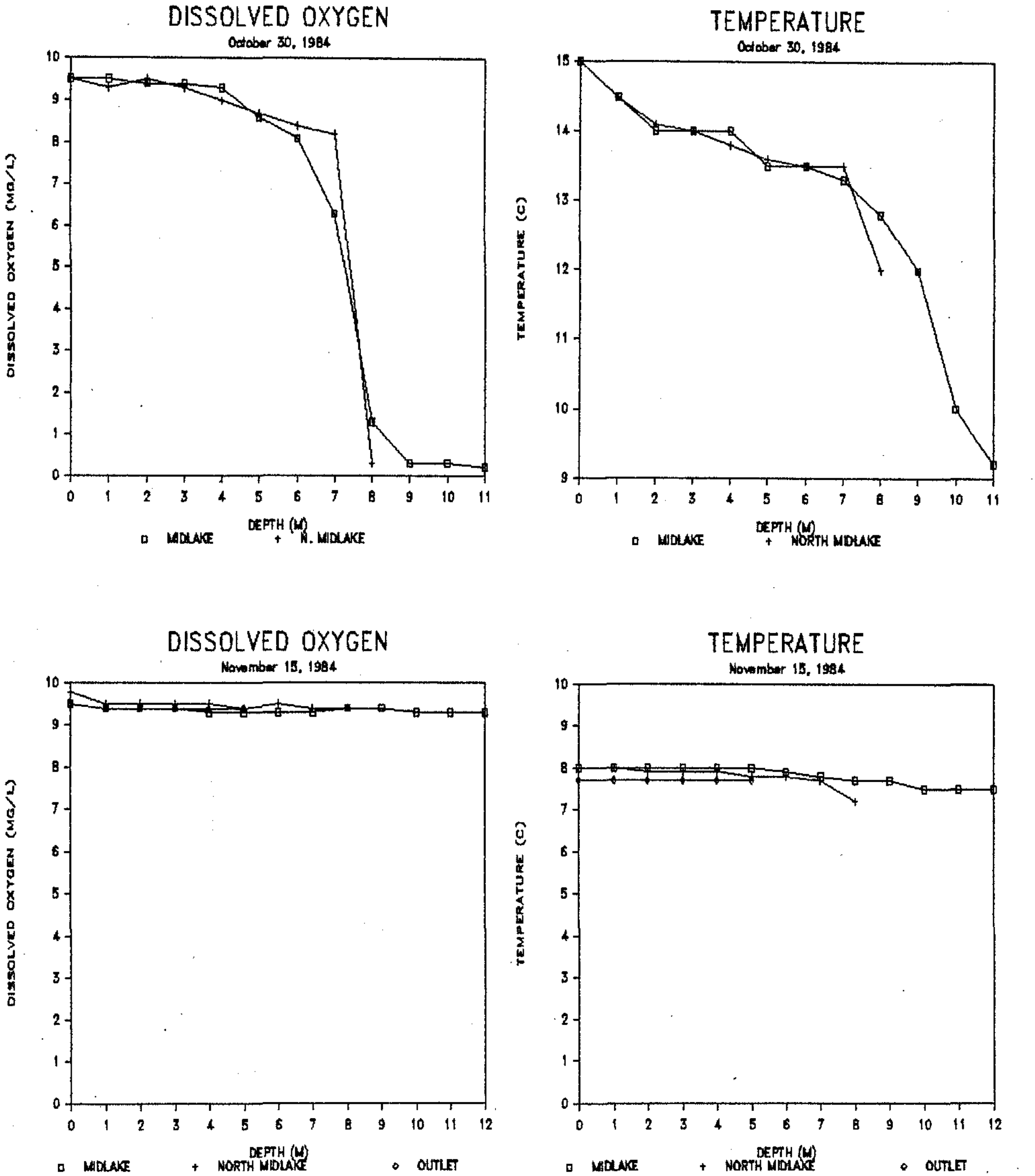


Figure 2 (cont.). Dissolved Oxygen and Temperature Profiles of Babcock Lake.

Figure 3. Bathymetric (Depth) Map of Babcock Lake.

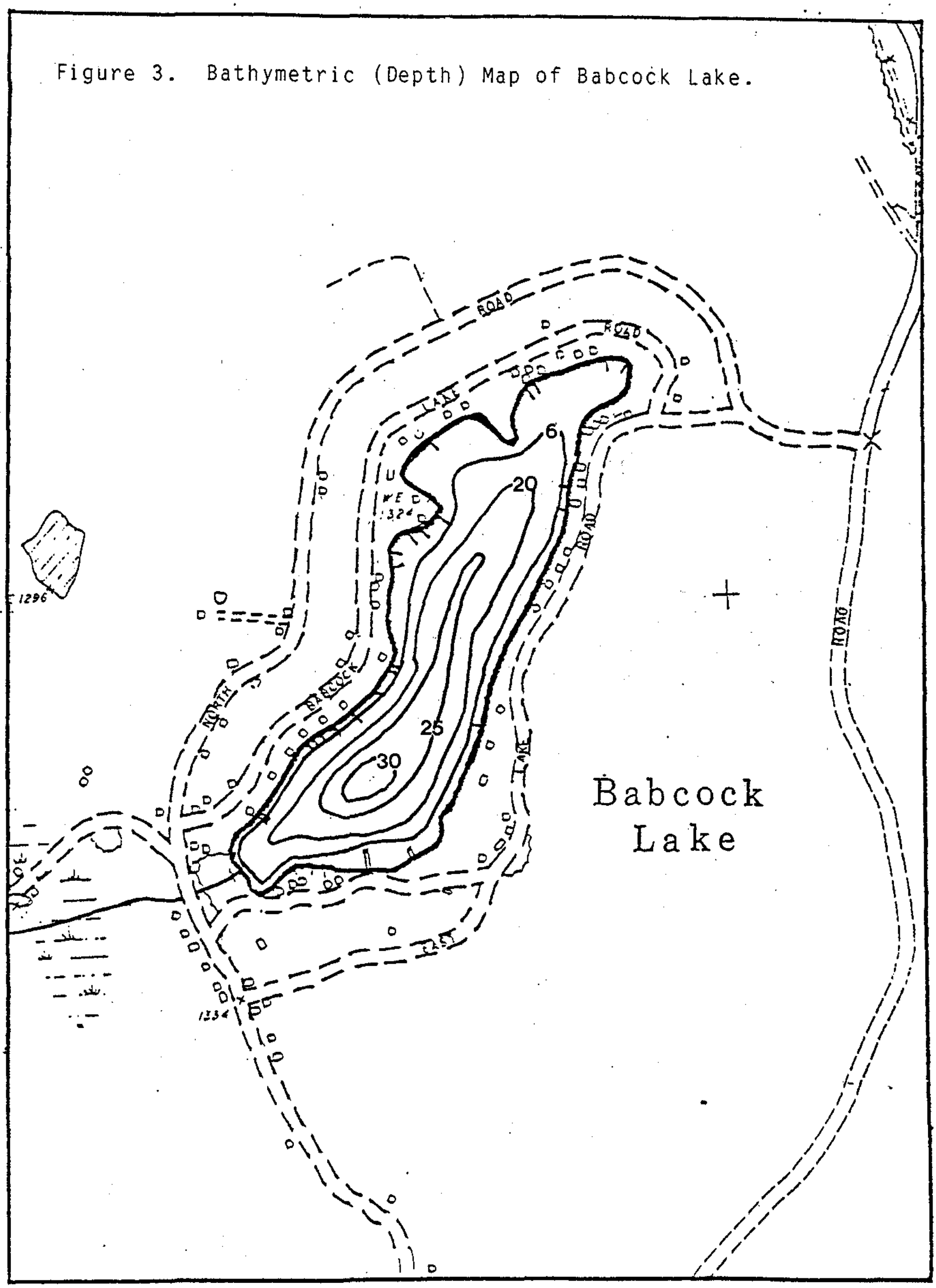
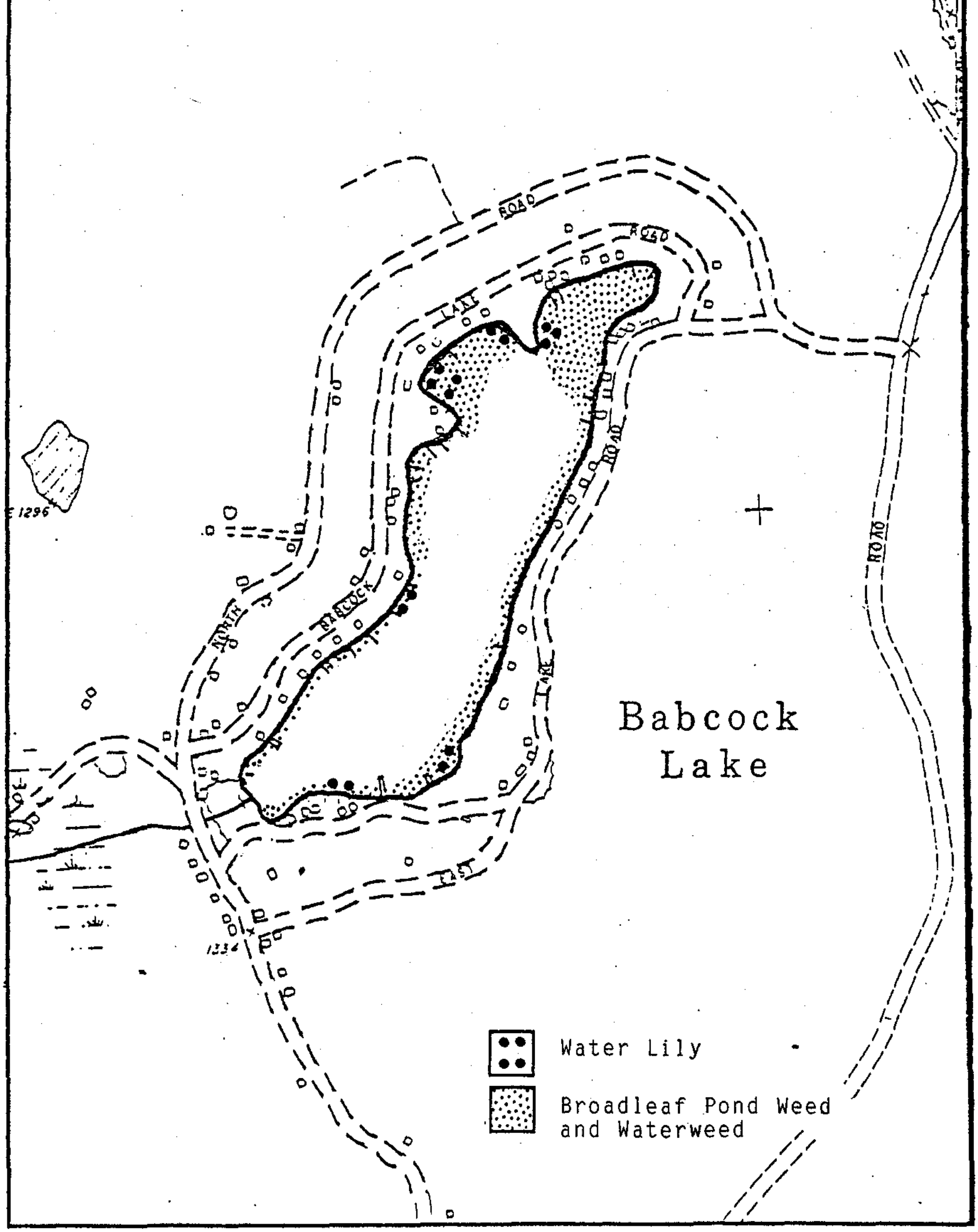


Figure 4. Map of Aquatic Weed Beds in Babcock Lake. Completed August 24, 1984.



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
Total Phosphorus	Single Reagent Ascorbic Acid (EPA Method 365.2)	Bausch and Lomb Spec 710
Copper	Direct Aspiration (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. SIGNATURE OF PERSON (S) WHO FILLED OUT FORM

____ DATE______________

8. COMMENTS OR REMARKS

____

____

____

____

____

Appendix C.

Fresh Water Institute

Summer Lecture Series

concerning Lake George & the Adirondacks

Rensselaer's Fresh Water Institute, newly relocated on route 9N in Bolton Landing, is pleased to host a weekly series of presentations to the general public by distinguished professional specialists.

Monday June 28	Rare and Endangered Plants of New York *Richard S. Mitchell*, New York State Biological Survey, Albany
Wednesday July 7	Furbearers and Furbearer Research in the Adirondacks *Mark Brown*, Dept of Environmental Conservation, Warrensburg
Wednesday July 14	History of Warren County Courthouse *Donald Fangboner*, Lake George Historical Society, Lake George Village
Monday July 19	The Timber Rattlesnake: Natural History of a Threatened Species *William Brown*, Skidmore College, Saratoga Springs
Monday July 26	The Geology of the Adirondack Mountains: Their Birth, Death and Resurrection *Yngvar Isachsen*, New York State Geological Survey, Albany
Monday August 2	Natural History of Adirondack Game Fish *Carl George*, Union College, Schenectady
Monday August 9	Multiple Use Management of Woodlands *Richard Nason*, Finch Pruyn, Glens Falls
Monday August 16	Prehistoric Archeology in New York *Philip Lord*, New York State Archeological Survey, Albany
Monday August 23	C.H. Peck—The Man Who Named Mushrooms *John Haines*, New York State Biological Survey, Albany
Monday August 30	The New York State Forest Preserve *Gary A. Randorf*, The Adirondack Council, Elizabethtown

Program begins at 7:30 PM. Tours of the new FWI site will be given at 7:00 PM preceding each program.

Funding for this series has been provided by generous gifts from the UPS Foundation, The Knapp Fund and Mrs. Edmund Froelich.