BASELINE WATER QUALITY STUDIES OF SELECTED LAKES AND PONDS IN THE TAUNTON RIVER BASIN 1975, 1979, and 1980

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A NOTE ON LIMNOLOGY AND LAKE RESTORATION PROJECTS

Limnology is the study of inland fresh waters, especially lakes and ponds (lentic water vs. lotic water for streams and rivers). The science encompasses the geological, physical, chemical, and biological events that operate together in a lake basin and are dependent on each other (Hutchinson, 1957). It is the study of both biotic and abiotic features that make up a lake's ecosystem. As pointed out by Dillon (1974) and others before him, in order to understand lake conditions, one must realize that the entire watershed and not just the lake, or the lake and its shoreline, is the basic ecosystem. A very important factor, and one on which the life depends, is the gravitational movement of minerals from the watershed to the lake. Admittedly, the report contained herein concentrates mainly on the lake itself. Yet the foremost problem affecting the lakes and ponds today is accelerated cultural eutrophication, which originates in the watershed and is translated into various non-point sources of pollution. A great deal of lake restoration projects will have to focus on shoreland and lake watershed management.

Hynes (1974) sums up the science well in stating:.."The conclusions...are therefore that any interference with the normal condition of a lake or a stream is almost certain to have some adverse biological effect, even if, from an engineering point of view, the interference results in considerable improvement. At present, it would seem that this is little realized and that often much unnecessary damage is done to river and lake communities simply because of ignorance. It is of course, manifest that sometimes engineering or water supply projects have over-riding importance and even if they have not, the question of balancing one interest against the other must often arise. But, regrettably, even the possibility of biological consequences is often ignored. It cannot be emphasized too strongly that when it is proposed to alter an aquatic environment the project should be considered from the biological as well as the engineering viewpoint. Only then can the full implications of the proposed alteration be assessed properly, and a reasonable decision be taken. Obviously this will vary with the circumstances and the relative importance of the various consequences involved, but, at present, unnecessary and sometimes costly mistakes are often made because the importance of biological study is unknown to many administrators. Often, as for instance in drainage operations, it would be possible to work out compromises which would satisfy both engineering and biological interests."[1]

[1] Hynes, H.B.N., 1974. The Biology of Polluted Waters. University of Toronto Press, Toronto, Ontario, Canada.

EUTROPHICATION

The term "eutrophic" means well-nourished; thus, "eutrophication" refers to natural or artificial addition of nutrients to bodies of water and to the effects of added nutrients (Eutrophication: Causes, Consequences and Correctives, 1969). The process of eutrophication is nothing new or invented by man. It is the process whereby a lake ages and eventually disappears. An undisturbed lake will slowly undergo a natural succession of stages, the end product usually being a bog and, finally, dry land (see Figure A). These stages can be identified by measuring various physical, chemical, and biological aspects of the lake's ecosystem. Man can and often does affect the rate of eutrophication. From a pollutional point of view, these effects are caused by increased population, industrial growth, agricultural practices, watershed development, recreational use of land and waters, and other forms of watershed exploitation.

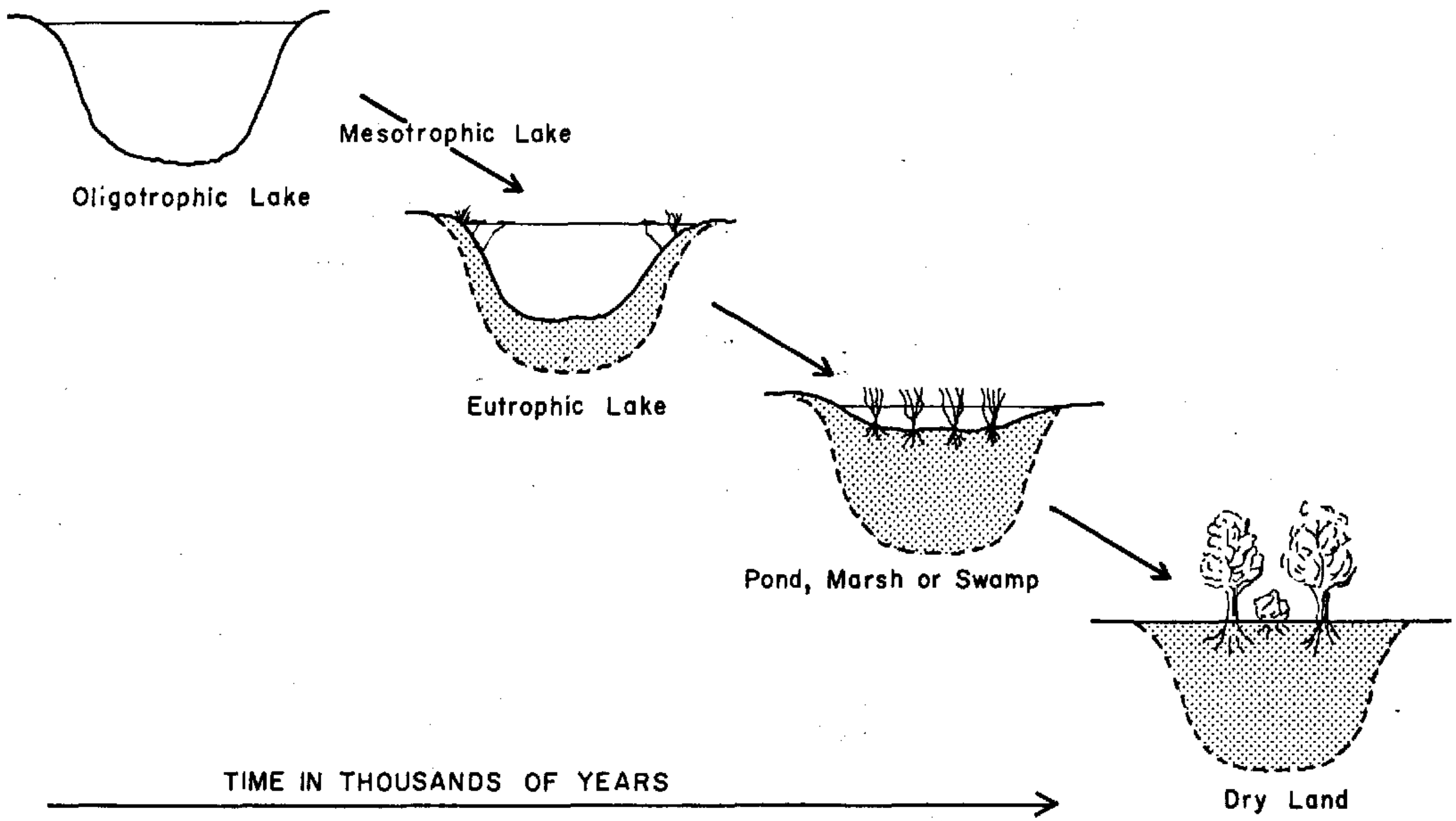
It might also be mentioned that some forms of water pollution are natural. Streams and ponds located in densely wooded regions may experience such heavy leaf fall as to cause asphyxiation of some organisms. Discoloration of many waters in Massachusetts is caused by purely natural processes. As pointed out by Hynes (1974), it is extremely difficult to define just what is meant by "natural waters", which is not necessarily synonomous with "clean waters."

For restorative or preservative purposes of a lake and its watershed, it is important to identify both a lake's problem and the cause of the problem. Problems associated with eutrophication include nuisance algal blooms (especially blue-green algae), excessive aquatic plant growth, low dissolved oxygen content, degradation of sport fisheries, low transparency, mucky bottoms, changes in species type and diversity, and others. The pollutional cause is identified as either point or non-point in origin. A point source of pollution may be an inlet to the lake carrying some waste discharge from upstream. Or it may be an industrial, agricultural, or domestic (e.g., washing machine pipe) waste discharge which can be easily identified, quantified, and evaluated.

Non-point sources of pollution, which are the more common type affecting a lake, are more difficult to identify. They include: agricultural runoff, urban runoff, fertilizers, septic or cesspool leakage, land clearing, and many more. They are often difficult to quantify, and thus evaluate.

An objective of a lake survey is to measure a lake's trophic state; that is, to describe the point at which the lake is in the aging process. The measure most widely used is a lake's productivity. Technically, this involves finding out the amount of carbon fixed per meter per day by the primary producers. Since it is a rather involved procedure to determine the energy

FIGURE A



EUTROPHICATION – the process of aging by ecological succession.

Source: Measures for the Restoration and Enhancement of Quality of Freshwater Lakes. Washington, D.C.: United States Environmental Protection Agency, 1973.

flow through a lake system, the lake survey attempts to indirectly describe the lake's trophic state or level of biological productivity.

During the process of eutrophication, a lake passes through three major broad stages of succession: oligotrophy, mesotrophy, and eutrophy. Each stage has its characteristics (Table A). Data from a lake survey can be analyzed for assessment of the lake's trophic state. Although the level of productivity is not quantified, the physical, chemical, and biological parameters measured go a long way in positioning the lake as to its trophic status. The perimeter survey helps locate and identify sources of pollution. It should be noted, however, that at the present time, there is no single determination that is a universal measure of eutrophication.

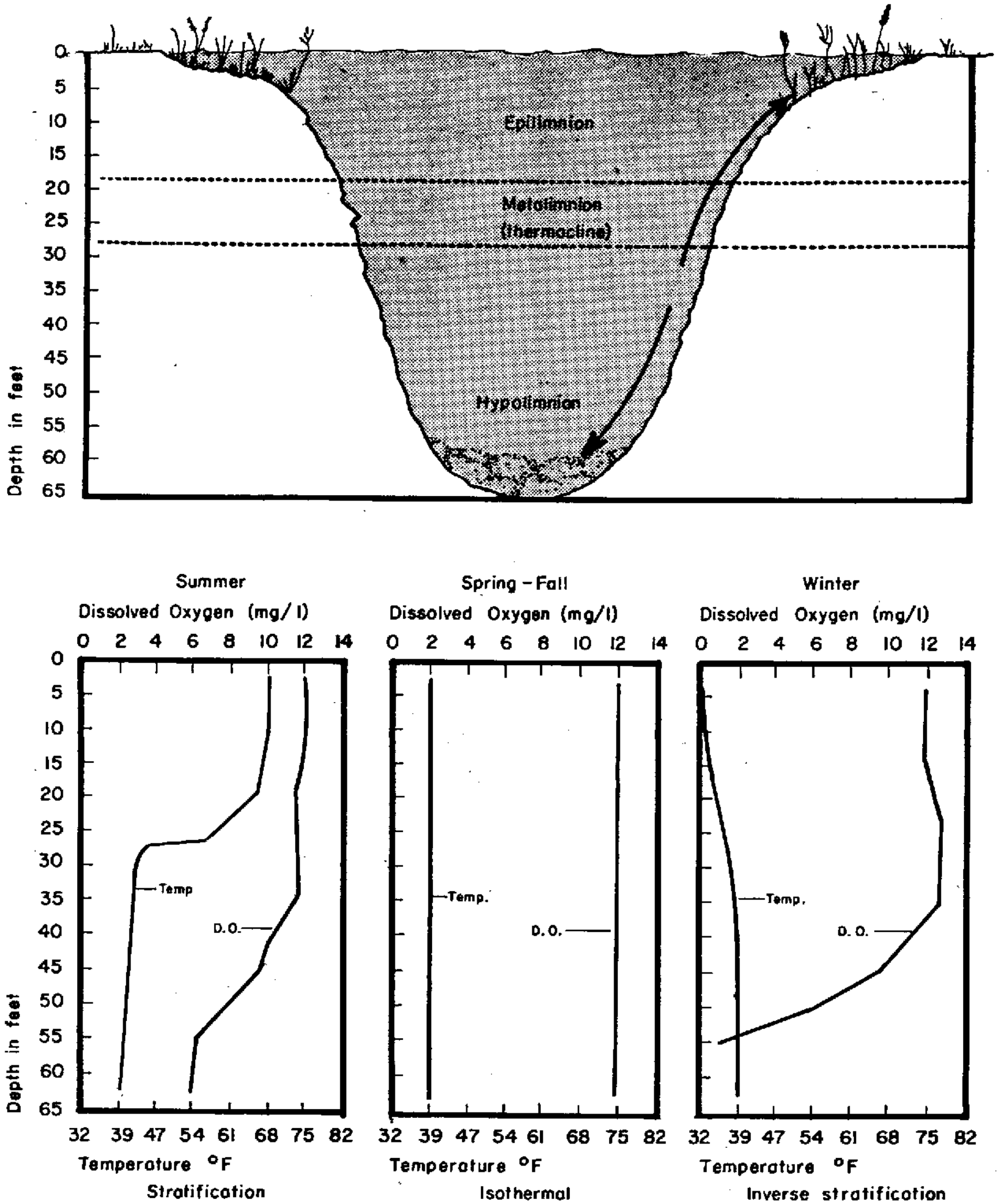
Figure B shows the various zones of a typical stratified lake. In addition to the lake's life history mentioned above, a lake also has characteristic annual cycles. Depending on the season, a lake has a particular temperature and dissolved oxygen profile (Figure B). During the summer season, the epilimnion, or warm surface water, occupies the top zone. Below this is the metalimnion, which is characterized by a thermocline. In a stratified lake, this is the zone of rapid temperature change with depth. The bottom waters, or hypolimnion, contain colder water. The epilimnion is well mixed by wind action, whereas the hypolimnion does not normally circulate. During the spring and fall seasons, these regions break down due to temperature change and the whole lake circulates as one body. In shallow lakes (i.e., 10 to 15 feet maximum depth) affected by wind action, these zones do not exist except for short periods during calm weather.

The summer season (July and August) is the best time to survey a lake in order to measure its trophic status. This is the time when productivity and biomass are at their highest and when their direct or indirect effects can best be measured and observed. The oxygen concentration in the hypolimnion is an important characteristic for a lake. A high level of productivity in the surface waters usually results in low oxygen concentrations in the lake's bottom. Low oxygen in the hypolimnion can adversely affect the life in the lake, especially the cold-water fish which require a certain oxygen concentration. Organic material brought in via an inlet can also cause an oxygen deficit in the hypolimnion. Hutchinson (1957) has amply stressed the importance of dissolved oxygen in a lake.

> "A skilled limnologist can probably learn more about the nature of a lake from a series of oxygen determinations than from any other kind of chemical data. If the oxygen determinations are accompanied by observations on secchi disc transparency, lake color, and some morphometric data, a very great deal is known about the lake."

Nitrogen and phosphorus have assumed prominance in nearly every lake investigation in relating nutrients to productivity (eutrophication). Some investigators (Odum, 1959) use the maximum nitrogen and phosphorus concentrations found during the winter as the basis of nutrient productivity correlation due to the biological minimum caused by environmental conditions. Others use data following the spring overturn as a more reliable basis for nutrient productivity correlation. In any event, considerable caution must be used in transporting nutrient concentration limits found in other lakes to the present situation.

Diagrammatic sketch showing thermal characteristics of temperate lakes



Source: Measures for the Restoration and Enhancement of Quality of Freshwater Lakes. Washington, D.C.: United States Environmental Protection Agency, 1973.

FIGURE B

TABLE A

LAKE TROPHIC CHARACTERISTICS

1. Oligotrophic Lakes

   a. Very deep, thermocline high; volume of hypolimnion large; water of hypolimnion cold.

   b. Organic materials on bottom and in suspension very low.

   c. Electrolytes low or variable; calcium, phosphorus, and nitrogen relatively poor; humic materials very low or absent.

   d. Dissolved oxygen content high at all depths and throughout year.

   e. Larger aquatic plants scarce.

   f. Plankton quantitatively restricted; species many; algal blooms rare; chlorophyceae dominant.

   g. Profundal fauna relatively rich in species and quantity; Tanytarsus type; Corethra usually absent.

   h. Deep-dwelling, cold-water fishes (salmon, cisco, trout) common to abundant.

   i. Succession into eutrophic type.

2. Eutrophic Lakes

   a. Relatively shallow; deep, cold water minimal or absent.

   b. Organic materials on bottom and in suspension abundant.

   c. Electrolytes variable, often high; calcium, phosphorus, and nitrogen abundant; humic materials slight.

   d. Dissolved oxygen in deep stratified lakes of this type minimal or absent in hypolimnion.

   e. Larger aquatic plants abundant.

   f. Plankton quantitatively abundant; quality variable; water blooms common, Myxophyceae and diatoms predominant.

g. Profundal fauna, in deeper stratified lakes of this type; poor in species and quantity in hypolimnion; *Chironomus* type; *Corethra* present.

h. Deep-dwelling, cold-water fishes usually absent; suitable for perch, pike, bass, and other warm-water fishes.

i. Succession into pond, swamp, or marsh.

3. Dystrophic Lakes

   a. Usually shallow; temperature variable; in bog surroundings or in old mountains.

   b. Organic materials in bottom and in suspension abundant.

   c. Electrolytes low; calcium, phosphorus, and nitrogen very scanty; humic materials abundant.

   d. Dissolved oxygen almost or entirely absent in deeper water.

   e. Larger aquatic plants scanty.

   f. Plankton variable; commonly low in species and quantity; Myxophyceae may be very rich quantitavely.

   g. Profundal macrofauna poor to absent; all bottom deposits with very scant fauna; *Chironomus* sometimes present; *Corethra* present.

   h. Deep-dwelling, cold-water fishes always absent in advanced dystrophic lakes; sometimes devoid of fish fauna; when present, fish production usually poor.

   i. Succession into peat bog.

Source: Welch, P.S., *Limnology*, McGraw Hill Book Co., New York, 1952. (Reprinted with permission of the publisher).

Table B depicts concentrations of various substances and other data for two hypothetical lakes, one eutrophic, the other oligotrophic. It is intended as a guide for comparison to the data presented in this report. Each lake, of course, is different from all others. There is no hard and fast rule as to the critical concentrations for each lake. The morphology of a lake (e.g., mean depth) plays an important part in its general well-being. A small, deep lake will react differently to nutrient loading than a large, shallow lake. In the final analysis, each lake is found unique and must be evaluated on an individual basis.

TABLE B

SELECTED DATA FOR TWO HYPOTHETICAL LAKES[1]

CONCENTRATIONS IN mg/l

TROPHIC STATUS[2]	DISSOLVED OXYGEN AT BOTTOM	TRANSPARENCY (SECCHI LEVEL)	NH_3-N	NO_3-N	TOTAL P	PHYTOPLANKTON ASSEMBLAGES	AQUATIC VEGETATION	CHARACTERISTIC FISHERIES
Lake A (Oligotrophic)	High >5.0	High	Low <.03	Low <0.3	Low <0.01	High diversity, low numbers, nearly complete absence of blue-greens.	Sparse	Cold water types
Lake B (Eutrophic)	Low <5.0	Low	High >0.3	High >0.3	High >0.01	Low diversity, high numbers, abundance of blue-greens.	Abundant	Warm-water types

[1]Not established as State standards.

[2]Oligotrophic - nutrient - poor
Eutrophic - high concentrations of nutrients

LAKE METHODOLOGY

Morphometry

Bathymetric maps of the lakes in the Taunton River Basin were prepared either using an original from the Massachusetts Division of Fisheries and Wildlife or constructing one in the field using a fathometer (Raytheon Model DE728A) or a Ray Jefferson Fish Flasher (Model 6006). Morphometric data was determined from these bathymetric maps and from U.S.G.S. topographic maps (7.5 minute series) utilizing a planimeter rotometer, and ruler according to Hutchinson (1957) and Welch (1948).

Sampling Station Location

For each lake surveyed, the following chemical stations were established:

1. Deep hole station(s) on the lake;
2. Inlet stream(s); and
3. Outlet stream.

Occasional special samples were also collected if any waste discharge was suspected or observed.

Data Collection

Physical and Chemical Data

Temperature profiles were made "in situ" with a Thermo Fishometer (Bright Radio Laboratories, Inc., Oceanside, New York) or a tele-thermometer (YSI Model 42SF). Transparency measurements were made with a standard 20 cm Secchi disc. Water samples from the deep hole station(s) were collected with a standard type brass Kemmerer water sampler, while inlet and outlet samples were generally collected below the surface by hand. Chemical samples were collected in thoroughly rinsed glass bottles. Bacteriological samples were taken in sterilized, screw-capped glass bottles. Samples for chemical and bacteriological analyses were transported as soon as possible to the Lawrence Experiment Station of the Department of Environmental Quality Engineering.

Dissolved oxygen samples were collected in the manner prescribed by Welch (1948). The dissolved oxygen concentration was measured by azide modification of the Winkler technique (Standard Methods, APHA, 1971). Titrations were made within several hours after fixing in the field with manganese sulfate and alkali-azide-iodide reagents. The sulfuric acid was added just prior to titrations in the laboratory.

Field pH tests were taken with a Hach Model 17N Wide Range pH kit. Wind, weather, and air temperatures were routinely recorded on each survey, along with any other pertinent observations. The following analyses were performed on samples: pH, total alkalinity, total hardness, ammonia-nitrogen, nitrate-nitrogen, total phosphorus, specific conductance, chloride, sulfate, silica, color, total manganese, total iron, total coliform, fecal coliform, and fecal streptococcus bacteria.

Biological Data

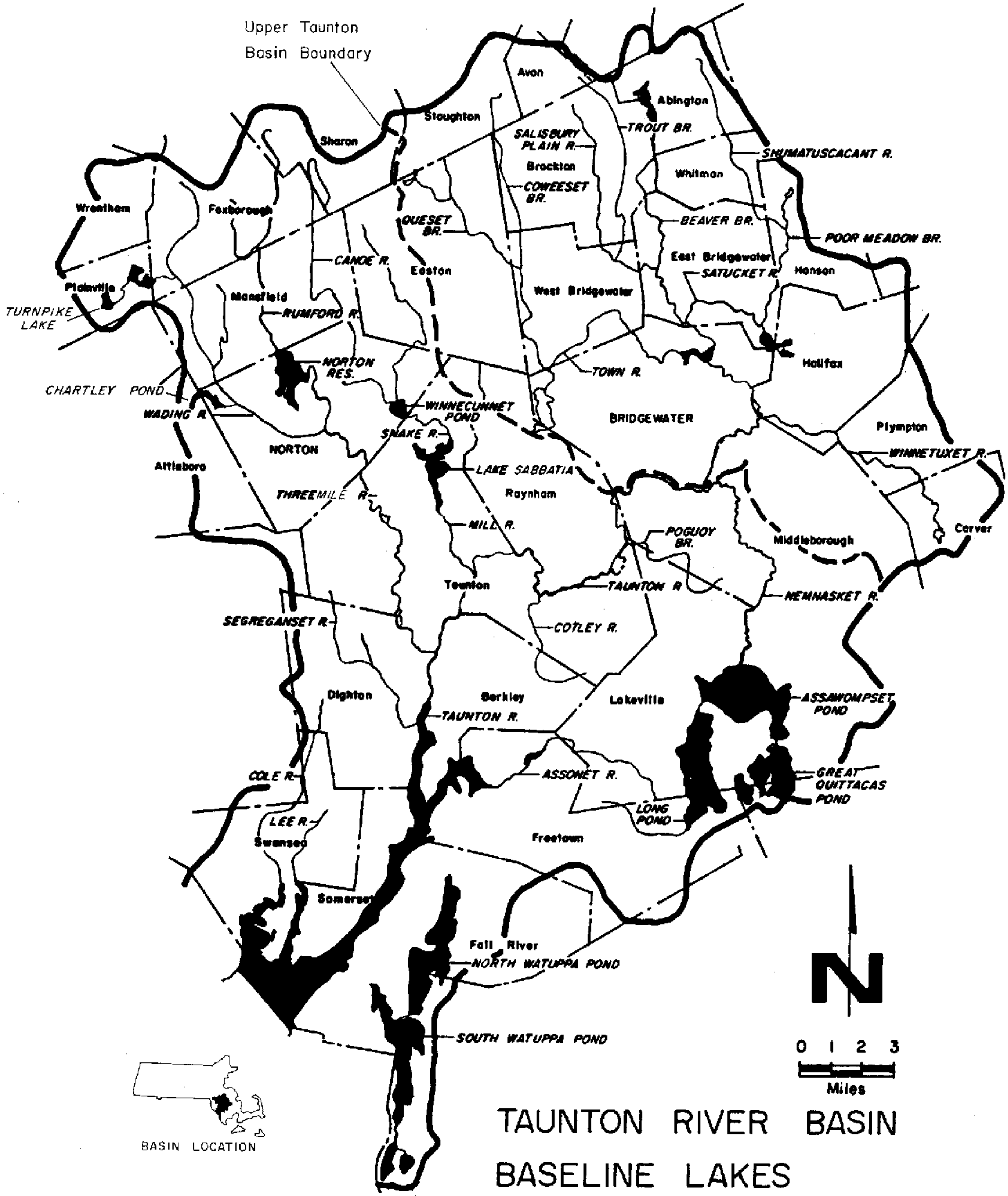
Phytoplankton and Chlorophyll a

During stratification, phytoplankton samples were obtained by a standard procedure described by the Maine Department of Environmental Protection, Division of Lakes and Biological Studies. Each sample consisted of a composite core taken with a one-quarter inch I.D. plastic tube with a weight attached to one end. The tube was lowered at the deep station to the thermocline, pinched below the meniscus, and raised into the boat. The sample was allowed to drain into a clean and rinsed collection bottle. The procedure was repeated until a volume of 500 ml was collected. If unstratified conditions were present then a phytoplankton grab sample was taken instead of a composite sample. The samples were normally analyzed for phytoplankton on the day of collection using a Whipple micrometer and Sedgewick-Rafter cell. The 1975 algal counts were reported as Areal Standard Units per milliliter (Standard Methods, 1971). The 1979 and 1980 counts were reported as cells per milliliter. Smith (1950) and Prescott (1954) were used as sources for identification.

Chlorophyll a analysis (Appendix) was based on methodology from a modified EPA fluorometric procedure developed by the Division of Water Pollution Control at Westborough (Kimball, 1979). Filtered samples were refrigerated for 24 hours after being ground and extracted in 90% acetone. Fluorometer readings were taken at 750 and 630 nannometers before and after treatment with 1N hydrochloric acid (HCl) to correct for pheophytin interference.

Aquatic Vegetation

The aquatic macrophyton community in each lake was located and mapped by slowly examining the entire littoral zone and cove areas by boat. In the very shallow lakes, occasional samples were collected at irregular intervals on imaginary transects run across the open water area of the lake. All habitats were generally sampled and the relative abundance of each plant type noted. Representative macrophytes were collected by hand and, in deeper water, by dragging a simple grappling hook with a weight attached to the shaft. Entire plants were generally collected including flowers and fruits and, if present, the roots, rhizomes or tubers.



TAUNTON RIVER BASIN

BASELINE LAKES

FIGURE C

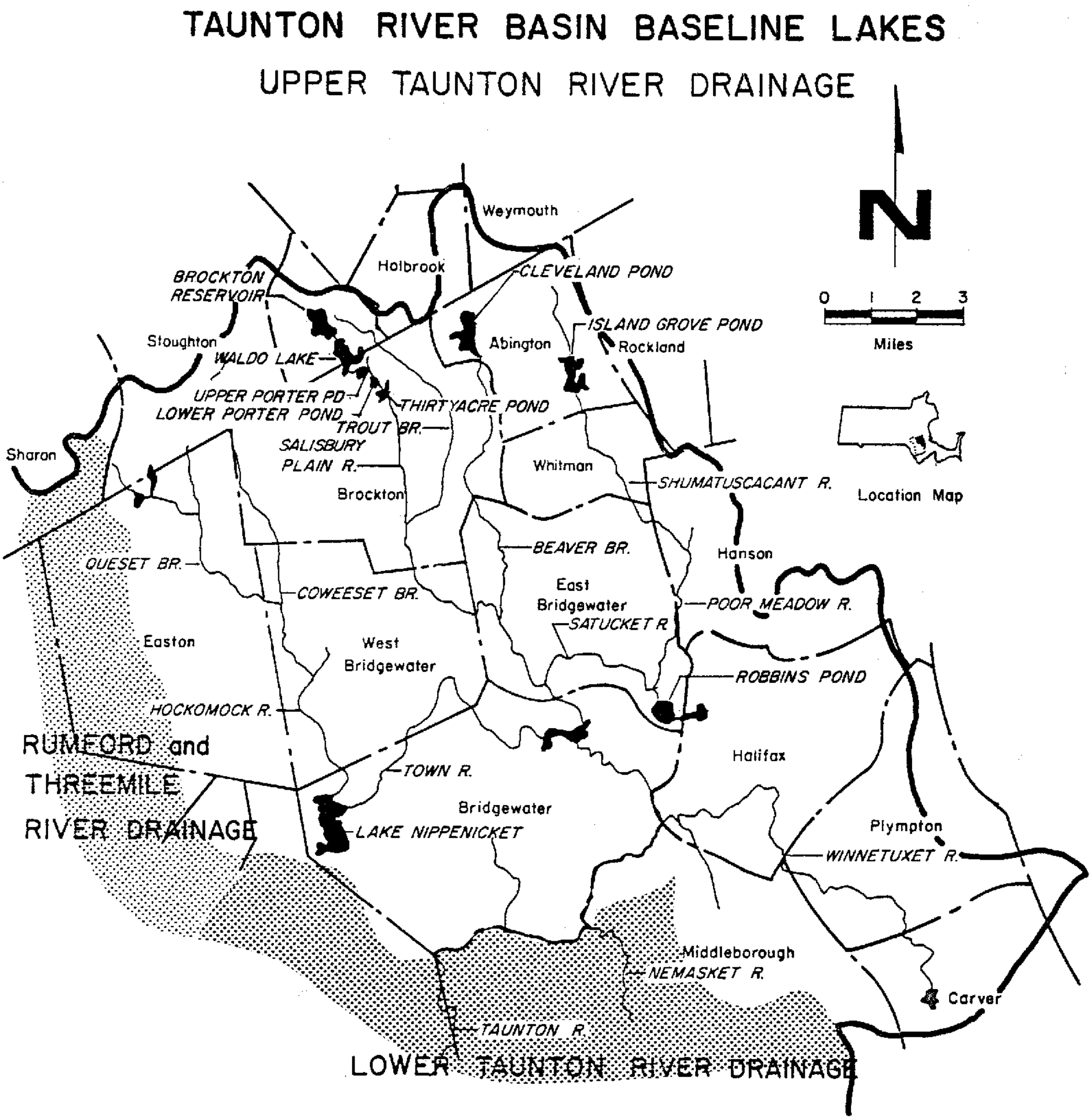


FIGURE C (continued)

Identification of the plant specimens were made using a stereoscopic microscope and various taxonomic keys (Fassett, 1957; Hotchkiss, 1972; and Weldon et al., 1973). Preservation of some representative macrophytes was made by placing them in 5 percent formalin. Some macrophytes could not be keyed to species because the plants were either sterile or in their winter bud stage.

TAUNTON RIVER BASIN LAKE SURVEYS

Introduction

The Taunton River Basin is located in southeastern Massachusetts and flows into Mount Hope Bay. During the summer of 1975, nine lakes in that basin were sampled by the Water Quality and Research Section of the Division of Water Pollution Control for baseline water quality data. These lake surveys were conducted concurrently with the 1975 water quality survey of the Taunton River Basin which was published in December, 1975 (see: The Taunton River Basin Water Quality Survey Data, DWPC, 1975).

During the summers of 1979 and 1980 five lakes in the Taunton River Basin were surveyed. Two of these surveys (Chartley Pond and Winnecunnet Pond) were re-surveys.

A baseline lake survey is generally completed in one day. The survey consists of bathymetric mapping of the lake; chemical and biological sampling of the open water areas, tributary streams, and outlet; and a qualitative mapping of the aquatic macrophyton community in the lake. The primary purpose of this type of survey is to identify any point (and sometimes non-point) sources of water pollution and to classify the lake as to its trophic level. Included at the end of this report is the current trophic status listing of the nine lakes surveyed.

The locations of the lakes sampled are shown in Figure C. Following is a short description of each lake and its location. The general terrain of the Taunton River Basin can be described as flat with substantial areas of wetlands.

Lake Descriptions

Island Grove Pond

Date of Sampling: 9 June 1975

This small (33 acres) and shallow(7 feet maximum depth) impoundment is located on the Shumatuscacant River in the Town of Abington about midway between the town centers of Brockton and Rockland. The area surrounding Island Grove Pond is heavily developed and a recreational park (Island Grove Park) is located on the eastern shore. A town sanitary landfill, reportedly closed at present, is located upstream of the impoundment. The Shumatuscacant River begins about 2 miles north in a swampy region which divides the Taunton Basin from the Weymouth River Basin. It then flows through the center of Abington before reaching Island Grove Pond. Some years ago the town drained the pond, stripped the bottom and spread sand over it. The entire pond therefore has about a 7 foot depth. During the survey the inlet water quality appeared degraded and the entire lake was highly colord. The aquatic vegetation consisted mainly of Elodea sp. around the perimeter with the open area of the impoundment generally free of any growth. There was a low phytoplankton population during the survey dominated by flagellates. The low transparency reading (4.5 feet) was due to the high color content of the water rather than algae or suspended solids.

Thirtyacre Pond

Date of Sampling: 11 June 1975

Thirtyacre Pond is a small (24 acres), shallow (7 feet maximum depth) impoundment located in the City of Brockton and forms part of the D.W. Field recreational park system. This park system consists of five (formerly six) ponds on Salisbury Brook immediately northwest of the heart of Brockton. There was once an ice house located on the pond but only the foundation blocks remain underwater. Since the pond is part of the D.W. Field Park there are no dwellings located around it. During the survey aquatic vegetation was confined mostly to the cove areas and the phytoplankton count was very low. The low transparency (4.5 feet) was caused by a very high color content.

Brockton Reservoir

Date of Sampling: 21 July 1975

This artificial pond is the first pond in the D.W. Field Park system located northwest of Brockton City. It is 83 acres in size and has a maximum depth of 20 feet at its southern end. It once served as a water supply for the City of Brockton. The pond sits at the head of the Salisbury River and is fed by a small tributary called Beaver Brook. There are some four small islands in the pond and dense aquatic vegetation rings the perimeter. During the survey the water appeared fairly clear with only moderate to low color and a 7.5 foot transparency. The phytoplankton count was very low. The pond was stratified and showed low dissolved oxygen in the hypolimnion.

Waldo Lake

Date of Sampling: 22 July 1975

This 70 acre pond is the second in a line of five in the D.W. Field Park system. A land filled causeway divides the pond, both halves having a maximum depth of about 9 feet. It is an irregularly shaped body of water with several peninsulas and islands located in it. The pond was plagued by dense aquatic vegetation growth but showed a very low phytoplankton count during the survey. The southern half of the pond measured a 4.0 foot transparency and the northern half showed 6.0 feet. Waldo Lake also appeared more colored than Brockton Reservoir just north of it. Similar to the other ponds in the park system, this one sits on the Salisbury River and has no dwellings around it. Two other ponds in the park, Upper and Lower Porter Ponds, were not sampled during the survey.

Lake Nippenicket

Date of Sampling: 23 July 1975

This large (354 acres) but shallow (6 feet maximum depth) lake is located in the western corner of Bridgewater about 4 miles northeast from the City of Taunton. The lake literally sits in the Hockomock Swamp with the Dead and Titicut Swamps located immediately to the south. Black Brook flows from the northwest through the Hockomock Swamp and more or less into Lake Nippenicket. The lake forms the headwaters of the Town River which flows out the northeast corner of the lake. Part of the Titicut Swamp drains into the lake at the southern end. In consequence of all this wetland drainage, Lake Nippenicket has extremely high color and often an odor reminiscent of Actinomyces, a musty, earthy odor. The transparency in the lake during the survey was only 2.5 feet. Despite a predominantly sandy substrate, the lake had fairly dense aquatic vegetative growth, particularly in the northern section which was completely choked with water milfoil and fanwort. Development around the lake is minimal and mostly located at the southern end. A public beach is located in the southeast corner and was quite crowded during the survey. Phytoplankton growth in the lake was extremely scant.

Robbins Pond

Date of Sampling: 24 July 1975

This 124 acre, very shallow (five feet depth) pond is located in the southeast corner of East Bridgewater. The pond surficially resembles Lake Nippenicket with very high color, sandy substrate, and dense aquatic vegetative growth. The Satucket River flows out from the north of the pond while the southern end receives swamp drainage. Also similar to Lake Nippenicket was scant phytoplankton growth and very low transparency (3.5 feet). It might also be mentioned that both ponds contained a high iron content. There is moderate development around the lake which includes a trailer camp on the southern shore. The high color and presence of aquatic plants did not seem to defer people from swimming or enjoying the lake.

Cleveland Pond

Date of Sampling: 4 August 1975

This small (88 acres), very shallow (6 feet maximum depth) pond is located on the western edge of Abington and just northeast of the City of Brockton. Several small brooks draining swamplands converge and flow into the north end of the pond while Beaver Brook flows out of the southern end. Cleveland Pond is situated in the Ames Nowell State Park and thus has no development around it. It is a highly irregularly shaped pond with very dense aquatic vegetative growth (mostly water milfoil, pickerelweed, and fanwort) across nearly the entire pond. Although the algal population was low, a very high color content caused a low transparency of only 2.5 feet. A dam located at the southern end is controlled by State Park personnel. The maximum depth of six feet is near this dam and the remainder of the pond is a scant two feet. The pond was not stratified at the time of the survey but the dissolved oxygen on the bottom was only 1.1 mg/l under calm weather conditions.

Winnecunnet Pond

Dates of Sampling: 5 August 1975 and 5 June 1980

This 148 acre, shallow (11 feet maximum depth) pond is located in the eastern corner of Norton alongside the Taunton City boundary. The Canoe River and Mulberry Meadow Brook (which drains through several cranberry bogs) enter on the northwest side while the Snake River drains out of the southwest corner of the pond. Fairly dense housing surrounds the pond's perimeter. The littoral zone experiences dense aquatic plant growth, particularly water milfoil and waterweed. Again, the algal population was low during the survey but very high water color caused a low transparency of five feet. Also similar to several other lakes and ponds in the Taunton Basin Winnecunnet Pond was found to have a high iron concentration.

Chartley Pond

Dates of Sampling: 6 August 1975 and 5 June 1980

Chartley Pond is a small (59 acres), narrow, and shallow (7 feet maximum depth) impoundment located on Chartley Brook at the Norton-Attleboro town line about three miles southwest of Norton Reservoir. Chartley Brook, which drains extensive wetlands, flows in from the south and the pond's outlet flows almost directly into the Wading River at the Village of Chartley. The pond is mostly bordered by wetland and is nearly free of development. There was dense aquatic plant growth around the pond during the survey with duckweed and water milfoil especially dense. The south-western half of the pond was four feet or less in depth, providing favorable conditions for vegetative growth. It might be noted that duckweed is normally confined to sluggish river or stream-type environments. Due to the surrounding wetlands the water was extremely colored, with a transparency of 1.5 feet. The iron concentrations were high as with many of the other ponds in the basin. Station 1 at the eastern end of the impoundment showed only 3.0 mg/l oxygen at the surface and 0.2 mg/l on the bottom. Algal growth was low with flagellates dominating the sample.

Turnpike Lake

Date of Sampling: 27 June 1979

Turnpike Lake, a shallow (4 feet maximum depth) lake of 115 acres, is located in the eastern half of Plainville just northwest of the community of Wilkens Four Corners. The lake is unevenly trisected by Shepard Street and Route 1 to form a large southern basin (about 98 acres), a small middle basin (4.5 acres), and a slightly larger northern basin (about 12 acres). The area around the pond is mainly undeveloped. Much of the land to the north (drained to the lake by Hawthorne Brook) and west (drained to the lake by Old Mill Brook) is marsh land. The lake drains into an unnamed brook which then flows into Lake Mirimichi to the northeast. The entire lake was choked with aquatic plants, particularly milfoil and fanwort. Algal populations were fairly low.

Lake Sabbatia

Date of Sampling: 25 August 1980

This is a fairly large lake (251 acres) with a moderate depth (30 feet maximum) in its main basin. The north and south basins, however, are shallow (less than 5 feet and 10 feet, respectively). The lake is located in the north central part of Taunton. Two major inlets feed Lake Sabbatia from the north. They are the Snake River, which drains a large swamp (Hockomock Swamp) to the northeast, and an unnamed connection from Watson Pond to the northwest. The Mill River is the outlet of the lake to the south. The southern and eastern shores of the lake are developed for residential use. Dever State School is located along the western shore. The northern shore is relatively undeveloped. The north and south basins and shallow portions of the main basin were very densely populated by aquatic plants, particularly pondweeds, wild celery, and fanwort. Algal populations were also high with bluegreen algae dominating.

South Watuppa Pond

Date of Sampling: 30 June 1980

South Watuppa Pond is a large (1,446 acres), but shallow (22 feet maximum depth) pond located on the border between Fall River and Westport near the Rhode Island-Massachusetts border. The area around this pond is highly developed for both industrial and residential use. Four named brooks, one unnamed brook, and a culvert connecting to North Watuppa Pond represent the surface inlets to the pond. Sucker Brook drains Stafford Pond (to the southwest of South Watuppa Pond) and enters at the northwest part of the pond. The short unnamed brook enters on the western shoreline. Stony Brook and Briggs Road Brook enter the pond on its southern end and drain Sawdy Pond and Devol Pond, respectively. Borden Brook enters a bay on the northeastern side of the pond to drain a marshy area upstream. The connection between North and South Watuppa Ponds runs under Route 195 at the northern end of South Watuppa Pond. Outlet waters form the Quequechan River.

The survey reported herein represents a follow-up survey to an intensive study which was carried out from April 1974-April 1975 (Chesebrough et al. 1977). Aquatic plant populations were not abundant in South Watuppa Pond. Algal populations, however, were quite high with blue-green algae dominating.

CONCLUSIONS

Some general conclusions can be stated regarding the water quality of the nine lakes surveyed in the Taunton River Basin. Although some of these points may be applied to other, similar waterbodies in the area, caution is advised in doing so. The following conclusions are based only on the water quality data collected from the nine lakes surveyed by the Massachusetts Division of Water Pollution Control during 1975.

1. The lakes and ponds are shallow (less than 10 foot average depth) with very few thermally stratifying during the summer season.

2. The water is highly colored, due to extensive wetlands in most of the watersheds.

3. Most of the lakes have high total iron concentrations, again related to wetland drainage.

4. Relatively low pH and low total alkalinity (less than 25 mg/1) characterize the waterbodies; thus they are weakly buffered.

5. The waterbodies had very low nitrate-nitrogen concentrations.

6. The waterbodies had very low phytoplankton populations with a near absence of blue-green algal types.

7. There was extensive aquatic vegetation in most of the lakes and ponds surveyed.

8. The waterbodies had very low transparencies, due mostly to the high color content of the waters.

TAUNTON RIVER BASIN

BASELINE LAKE STUDIES

WATER QUALITY

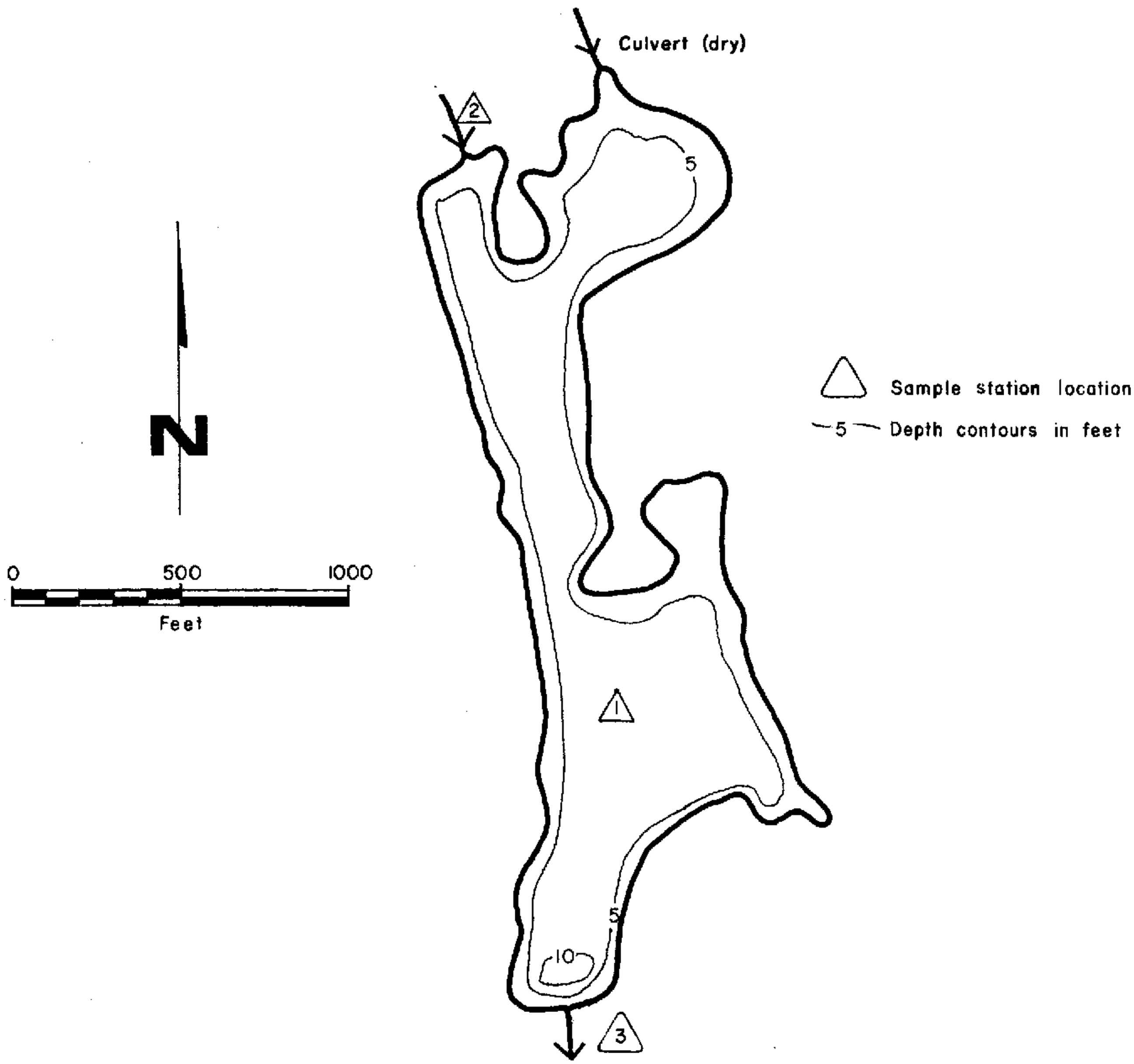
AND

BIOLOGICAL DATA

ISLAND GROVE POND

ABINGTON

33 ACRES



BATHYMETRIC MAP AND LOCATION OF SAMPLING STATIONS

FIGURE I

TABLE 1

ISLAND GROVE POND

MORPHOMETRIC DATA

Maximum Legnth	2,200 feet	670 meters
Maximum Effective Length	2,200 feet	670 meters
Maximum Width	1,000 feet	305 meters
Maximum Effective Width	1,000 feet	305 meters
Maximum Depth	10 feet	3.0 meters
Mean Depth	4.5 feet	1.4 meters
Mean Width	653 feet	200 meters
Area	33 acres	13 hectares
Volume	154 acre-feet	190,000 cubic meters
Shoreline	9,200 feet	2,810 meters
Development of Shoreline	2.2	
Development of Volume	1.9	
Mean to Maximum Depth Ratio	0.64	
Drainage Area	1,943 acres	787 hectares

ISLAND GROVE POND - ABINGTON
TEMPERATURE and DISSOLVED OXYGEN PROFILE
JUNE 9, 1975

FIGURE 2

STATION 1

Depth (feet)	Temp. °F	D.O. (mg/l)
Surface	67.0	9.1
1	67.0	-
2	67.0	-
3	66.0	-
4	65.5	-
5	65.5	-
6	64.5	-
7	64.5	9.3

Secchi Disc Transparency
4.5 feet @ 1150 hours

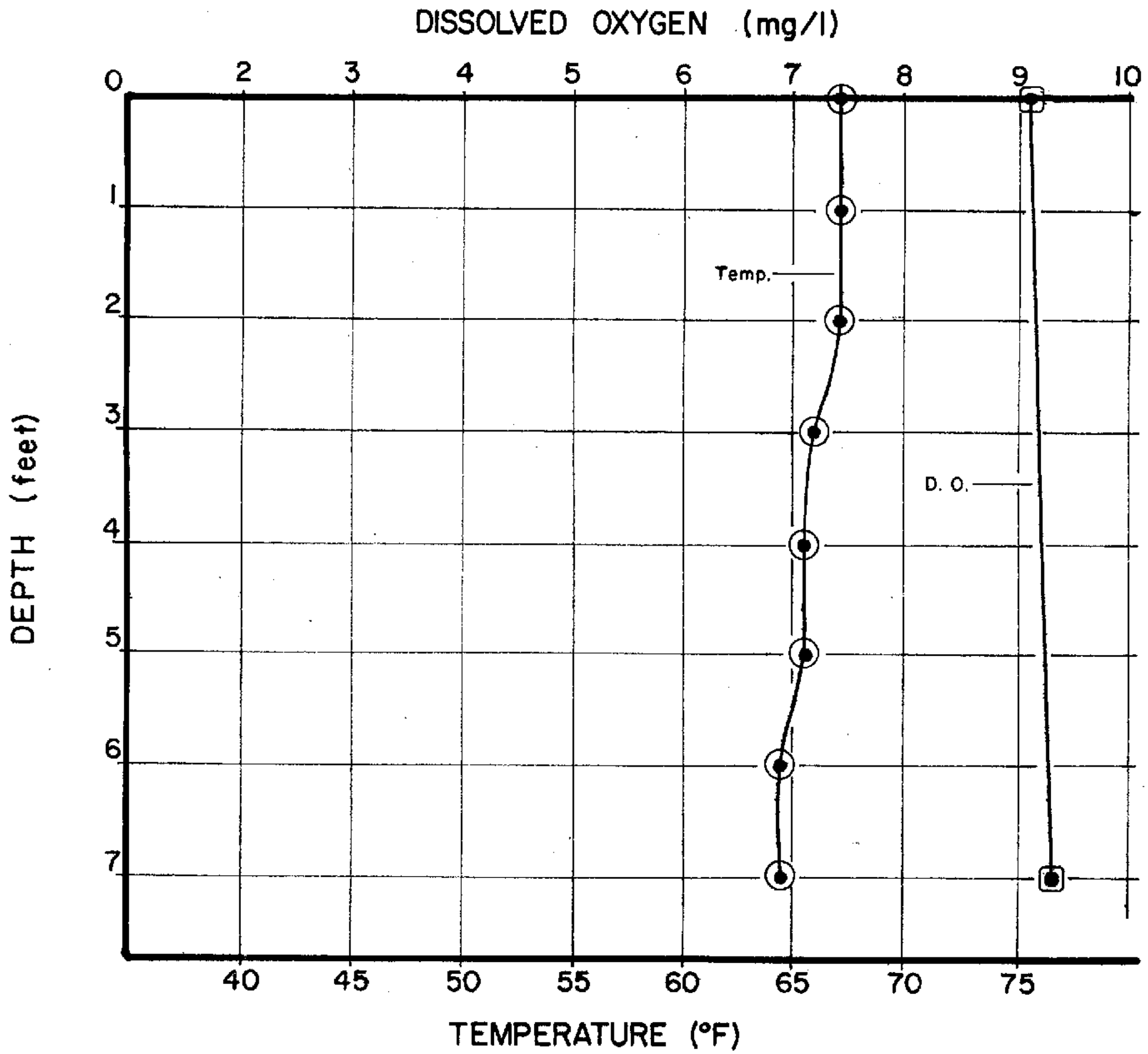


TABLE 2

ISLAND GROVE POND

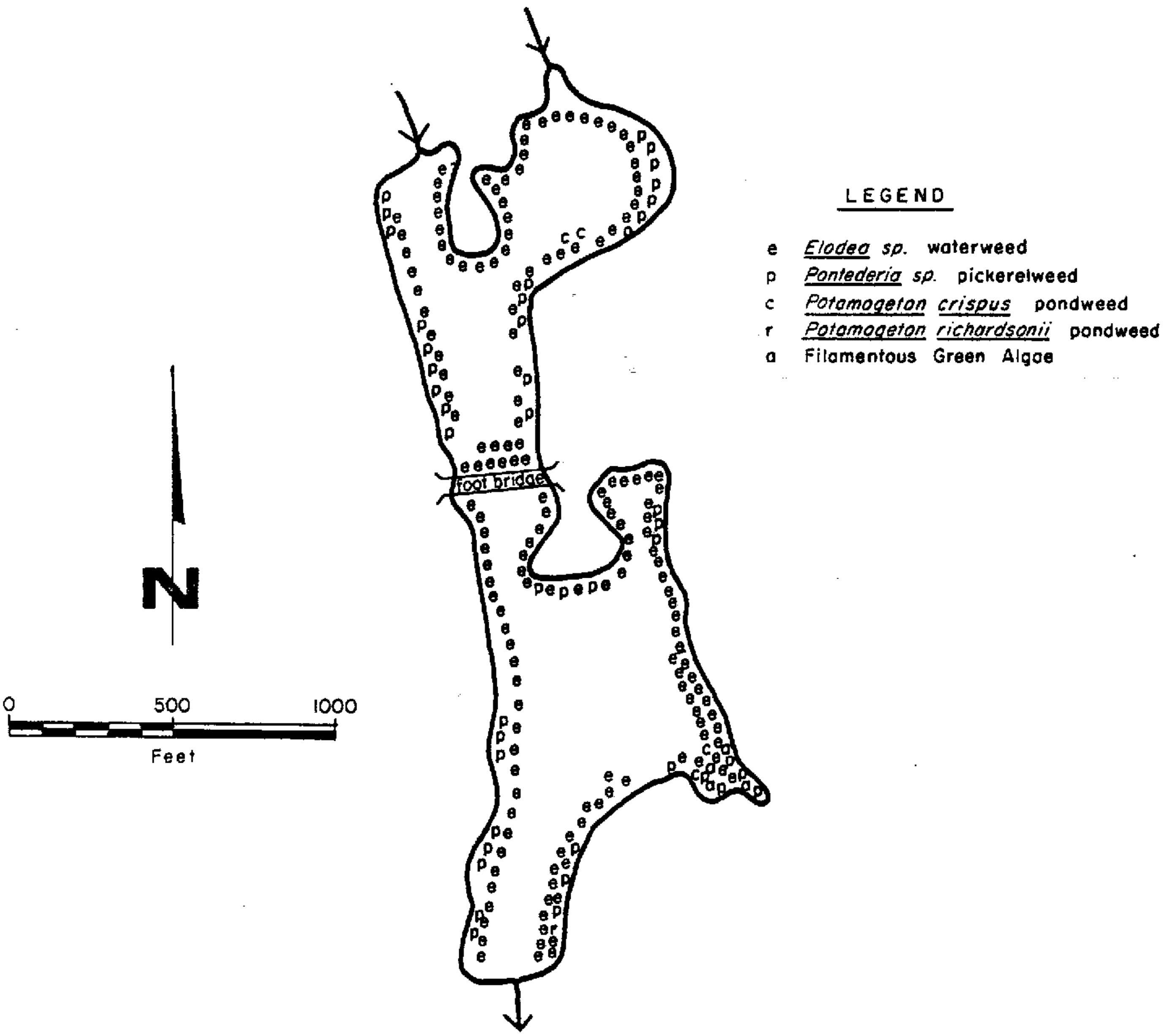
WATER QUALITY DATA (mg/l)

June 9, 1975

PARAMETER	STA. 1 @ 4 FT.	STA. 2	STA. 3
pH (Standard Units)	7.4	6.6	7.3
Total Alkalinity	22	17	20
Total Hardness	35	35	35
Ammonia-N	0.08	0.11	0.05
Nitrate-N	0.5	0.9	0.5
Total P	0.04	0.04	0.04
Silica	3.3	3.9	1.4
Chlorides	48	42	59
Conductivity (micromhos/cm)	200	185	200
Sulfate	17	15	18
Color (color units)	60	70	50

ISLAND GROVE POND

ABINGTON



DISTRIBUTION OF AQUATIC VEGETATION

FIGURE 3

TABLE 3

ISLAND GROVE POND

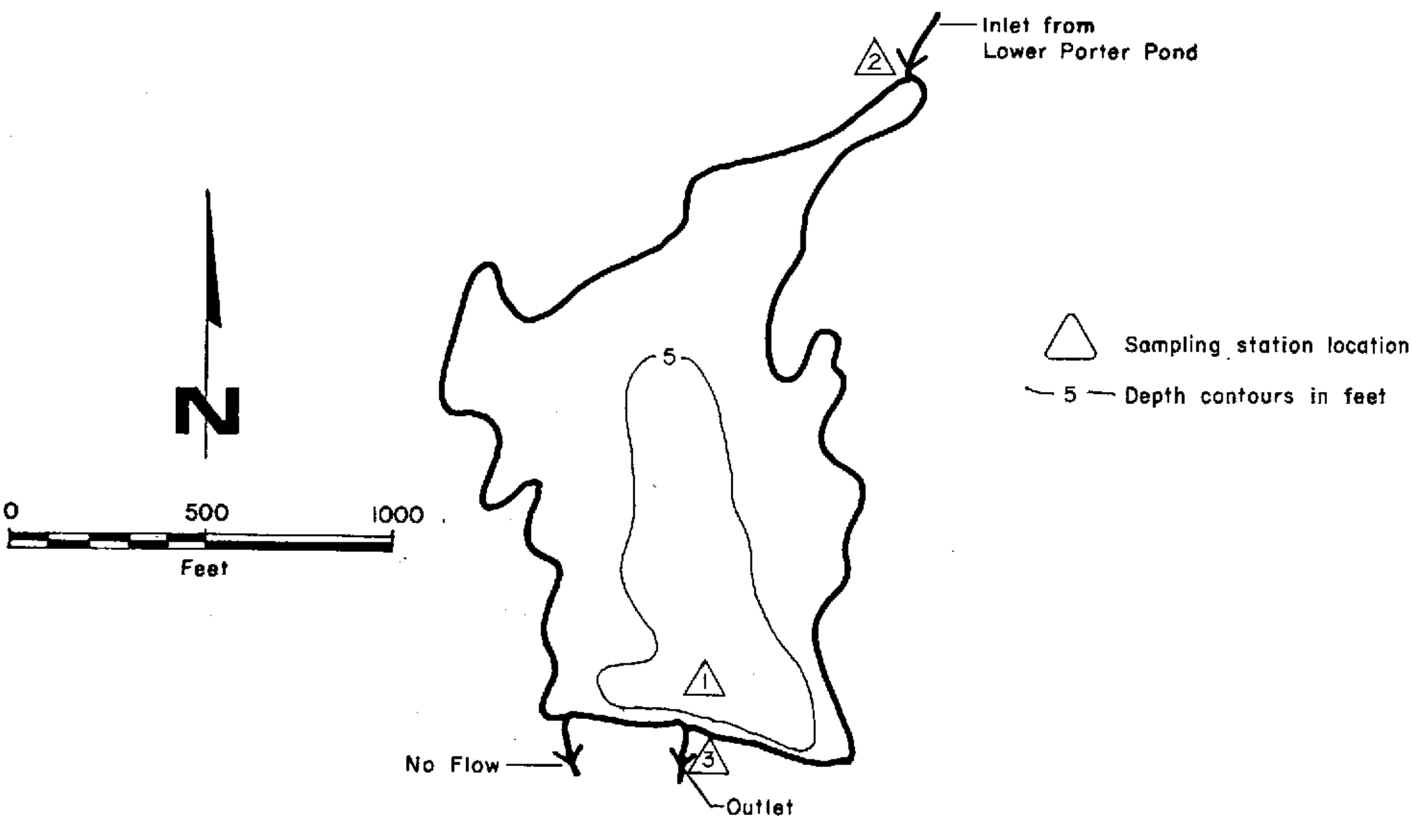
MICROSCOPIC EXAMINATION IN AREAL STANDARD UNITS/ml

June 9, 1975

ORGANISM	STATION 1
ALGAE	
Bacillariophyceae	
Asterionella sp.	30
Chlorophyceae	
Scenedesmus sp.	5
Staurastrum sp.	100
Chlorella sp.	5
Oocystis sp.	5
Sphaerocystis sp.	5
PROTOZOA	
Sarcodina (Amoeboid)	80
Mastigophora	
Ceratium sp.	100
Dinobryon sp.	465
Mallomonas sp.	55
Synura sp.	40
Unidentified pigmented	125
Rotifera[1]	
Unidentified	1
Amorphous Matter	5,625

[1]Number of organisms

BATHYMETRIC MAP
AND
LOCATION OF SAMPLING STATIONS



THIRTYACRE POND

BROCKTON

24 ACRES

FIGURE 4

TABLE 4

THIRTYACRE POND

MORPHOMETRIC DATA

Maximum Length	1,340 feet	410 meters
Maximum Effective Length	1,350 feet	410 meters
Maximum Width	1,000 feet	305 meters
Maximum Effective Width	1,000 feet	305 meters
Maximum Depth	7 feet	2.1 meters
Mean Depth	3 feet	0.9 meters
Mean Width	774 feet	235 meters
Area	24 acres	9.7 hectares
Volume	74 acre-feet	91,300 cubic meters
Shoreline	6,000 feet	1,830 meters
Development of Shoreline	1.7	
Development of Volume	1.3	
Mean to Maximum Depth Ratio	0.43	
Drainage Area	213 acres	86 hectares

FIGURE 5

STATION I

Depth (feet)	Temp. °F	D.O. (mg/l)
Surface	71.5	7.8
1	71.5	-
2	70.5	-
3	70.0	-
4	68.0	7.4
5	67.0	-
6	66.0	-
7	66.0	7.3

Secchi Disc Transparency
4.5 feet @ 1150 hours

THIRTYACRE POND - BROCKTON
TEMPERATURE and DISSOLVED OXYGEN PROFILE
JUNE 11, 1975

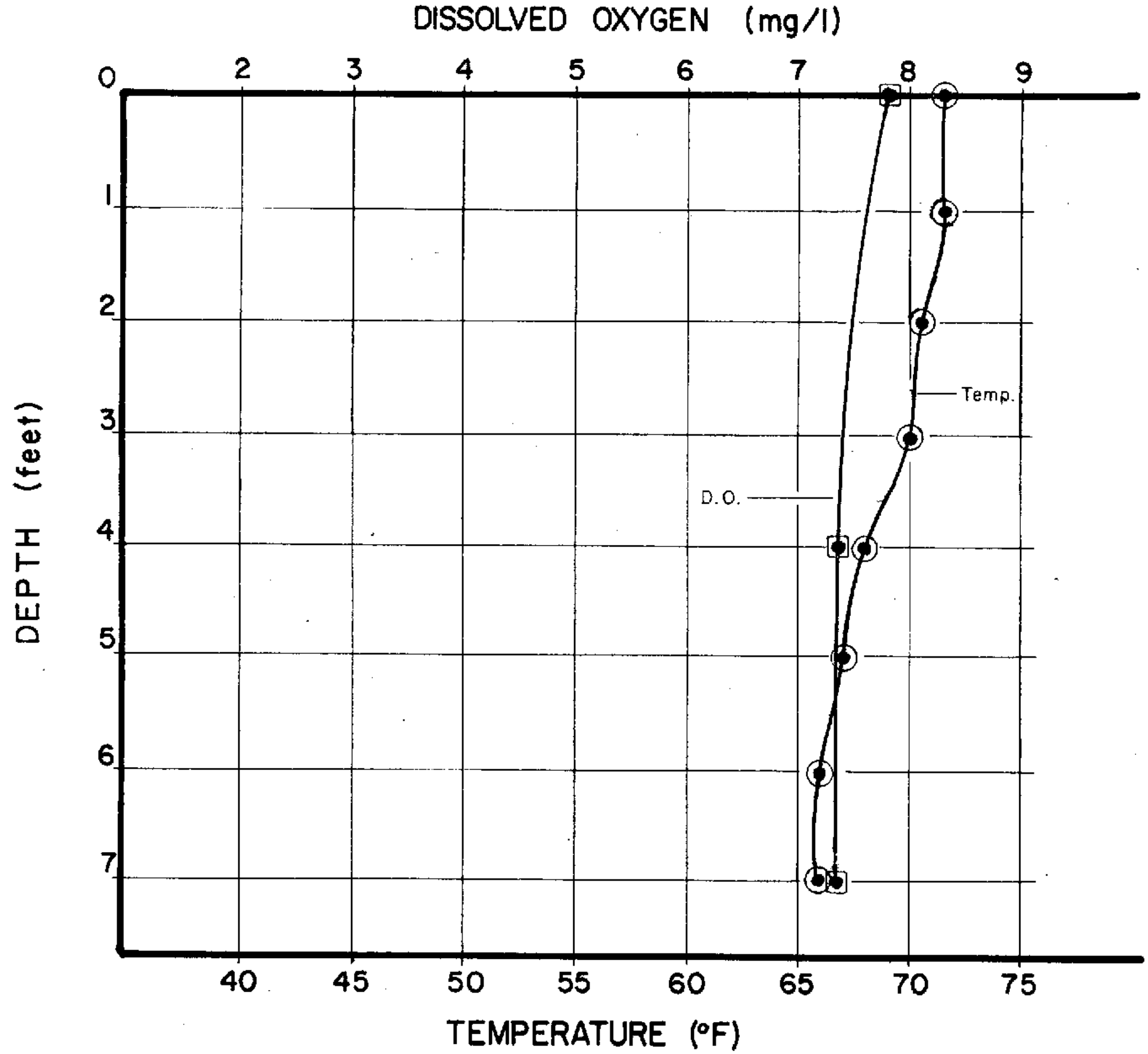


TABLE 5

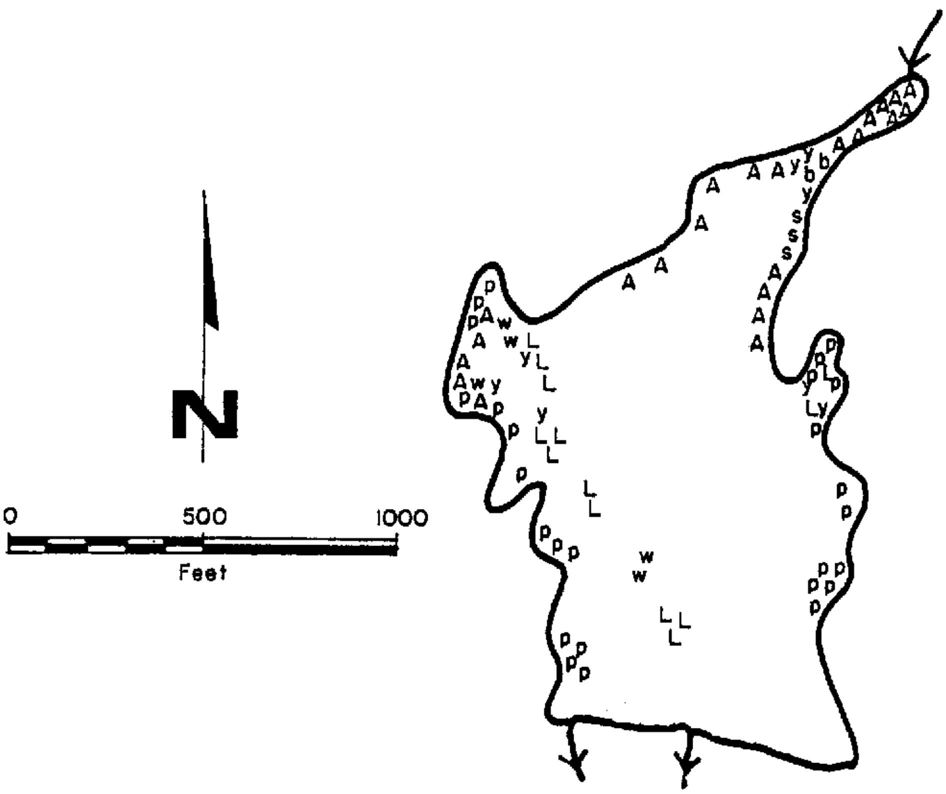
THIRTYACRE POND

WATER QUALITY DATA (mg/l)

June 11, 1975

PARAMETER	STA. 1 @ 4 FT.	STA. 2	STA. 3
pH (Standard Units)	7.0	7.1	7.0
Total Alkalinity	17	14	17
Total Hardness	35	35	35
Ammonia-N	0.12	0.10	0.12
Nitrate-N	0.0	0.0	0.0
Total P	0.05	0.06	0.05
Silica	1.7	1.4	1.7
Chlorides	61	62	58
Conductivity (micromhos/cm)	225	220	225
Sulfate	13	13	12
Color (color units)	90	60	80

DISTRIBUTION OF AQUATIC VEGETATION



LEGEND

- p *Pontederia* sp. pickerelweed
- L *Nymphaea* sp. white water lily
- y *Nuphar* sp. yellow water lily
- A *Sagittaria* sp. arrowhead
- w *Brasenia* sp. water shield
- s *Carex* sp. sedge
- b *Utricularia* sp. bladderwort

THIRTYACRE POND

BROCKTON

FIGURE 6

TABLE 6

THIRTYACRE POND

MICROSCOPIC EXAMINATION IN AREAL STANDARD UNITS/ml

June 11, 1975

ORGANISM	STATION 1
ALGAE	
Bacillariophyceae	
Synedra sp.	15
Chlorophyceae	
Unidentified Coccoid	35
Amorphous Matter	4,250

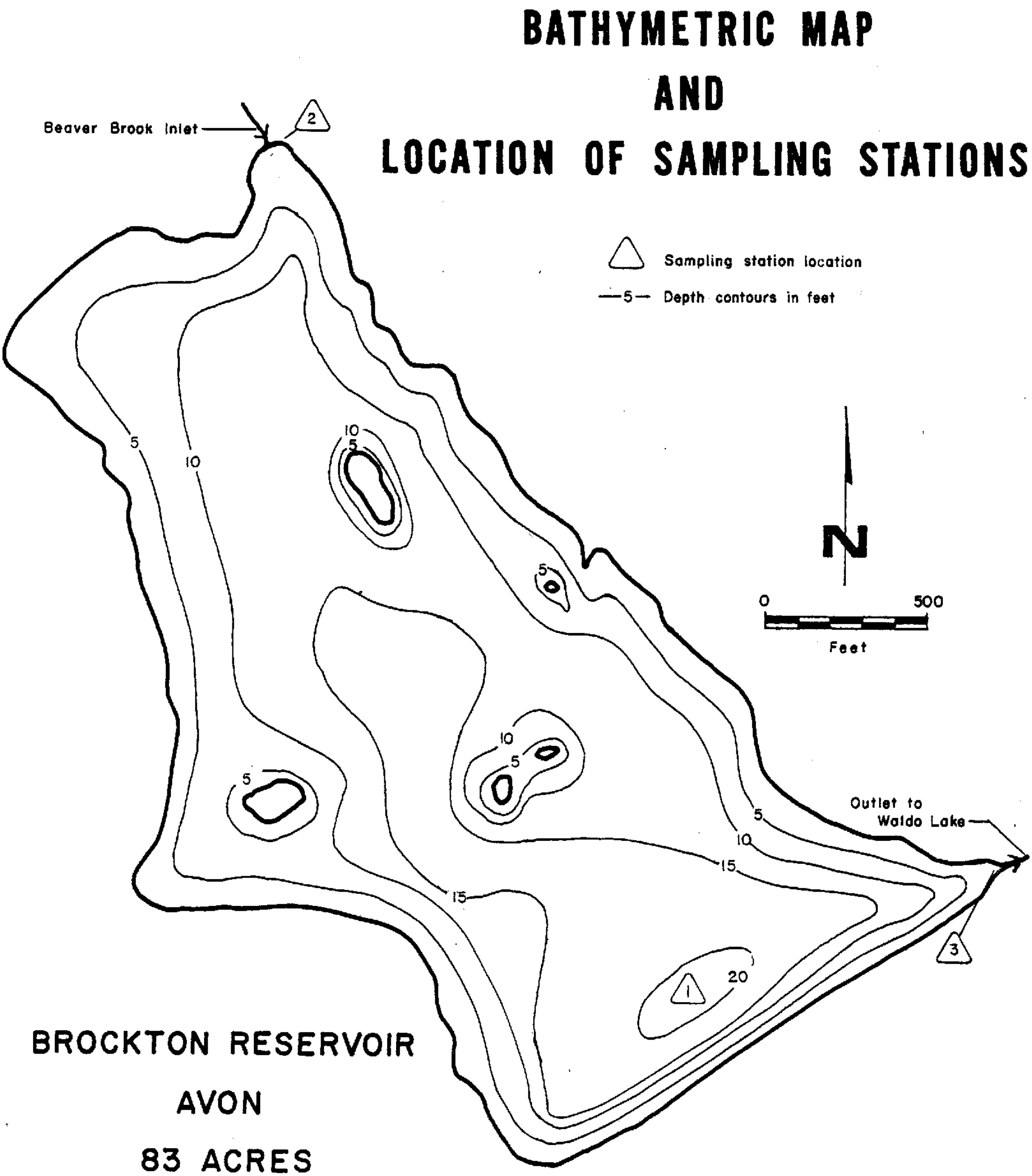

BATHYMETRIC MAP
AND
LOCATION OF SAMPLING STATIONS
Beaver Brook Inlet
2
Sampling station location
—5— Depth contours in feet
N
0
500
Feet
5
10
15
20
1
3
Outlet to
Waldo Lake
BROCKTON RESERVOIR
AVON
83 ACRES

FIGURE 7

TABLE 7

BROCKTON RESERVOIR

MORPHOMETRIC DATA

Maximum Length	3,500 feet	1,070 meters
Maximum Effective Length	3,500 feet	1,070 meters
Maximum Width	1,600 feet	490 meters
Maximum Effective Width	1,600 feet	490 meters
Maximum Depth	20 feet	6.1 meters
Mean Depth	11.5 feet	3.5 meters
Mean Width	1,033 feet	315 meters
Area	83 acres	34 hectares
Volume	964 acres	1,189,100 cubic meters
Shoreline	9,000 feet	2,750 meters
Development of Shoreline	1.3	
Development of Volume	1.7	
Mean to Maximum Depth Ratio	0.58	
Drainage Area	1,811 acres	733 hectares

FIGURE 8

STATION I

Depth (feet)	Temp. °F	D.O. (mg/l)
Surface	77.0	7.3
2	77.0	-
4	77.0	-
5	77.0	7.3
6	77.0	-
8	76.0	-
10	72.5	6.3
12	66.0	5.6
14	62.5	-
15	61.0	1.5
16	59.0	-
18	55.5	-
20	54.5	1.5

Secchi Disc Transparency
7.5 feet @ 1320 hours

BROCKTON RESERVOIR - AVON
TEMPERATURE and DISSOLVED OXYGEN PROFILE
JULY 21, 1975

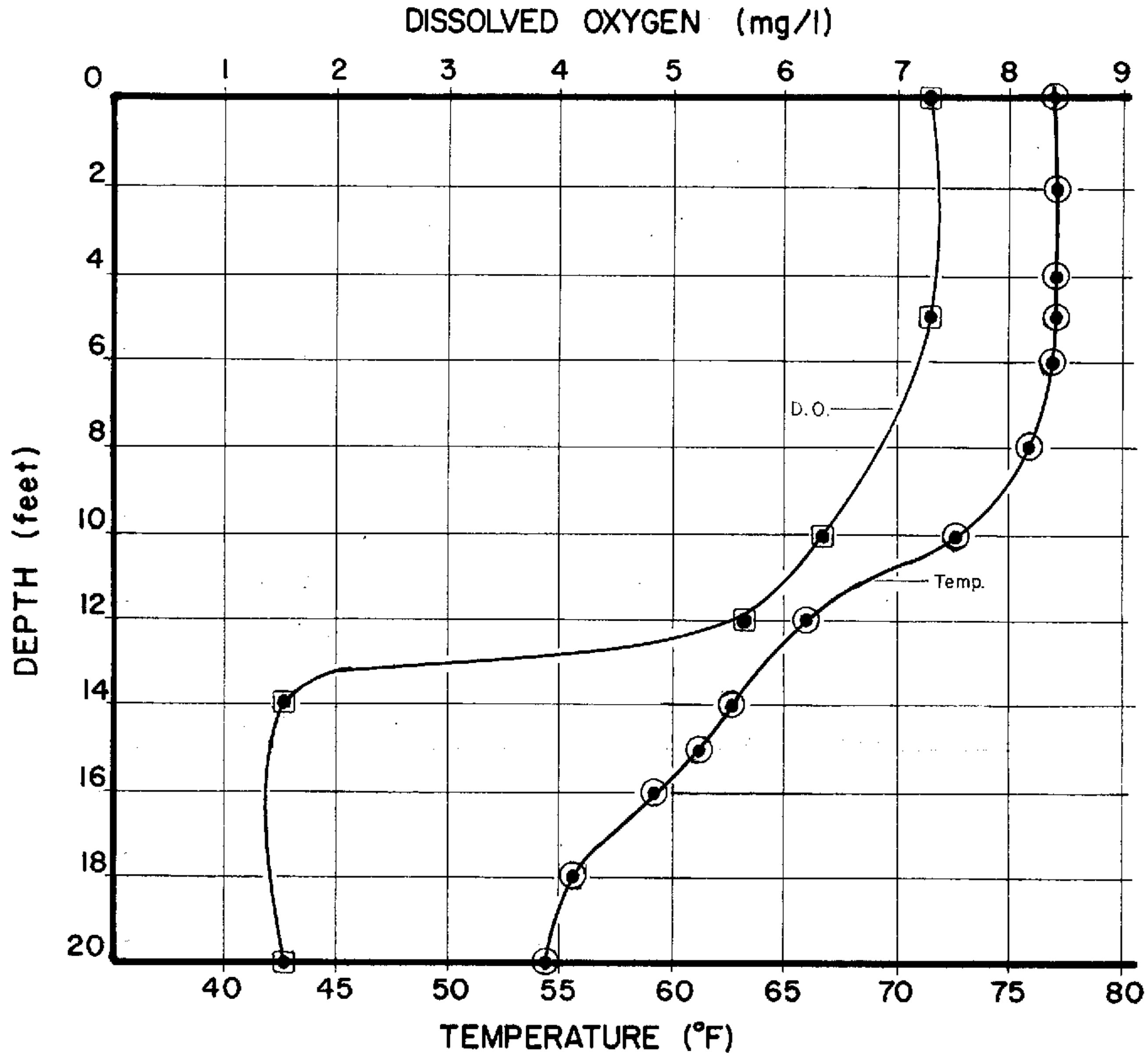


TABLE 8

BROCKTON RESERVOIR

WATER QUALITY DATA (mg/l)

July 21, 1975

PARAMETER	STA. 1 @ 0.0 FT.	STA. 1 @ 20 FT.	STA. 2	STA. 3
pH (Standard Units)	7.1	6.5	7.1	7.1
Total Alkalinity	15	18	14	14
Total Hardness	35	37	36	35
Ammonia-N	0.00	0.23	0.00	0.00
Nitrate-N	0.0	0.0	0.0	0.0
Total P	0.01	0.01	0.01	0.01
Silica	0.7	0.6	0.8	0.6
Chlorides	67	65	68	66
Conductivity (micromhos/cm)	270	290	290	290
Sulfate	12	13	12	11
Iron	0.18	0.08	0.20	0.13
Manganese	0.03	1.2	0.02	0.01

DISTRIBUTION OF AQUATIC VEGETATION

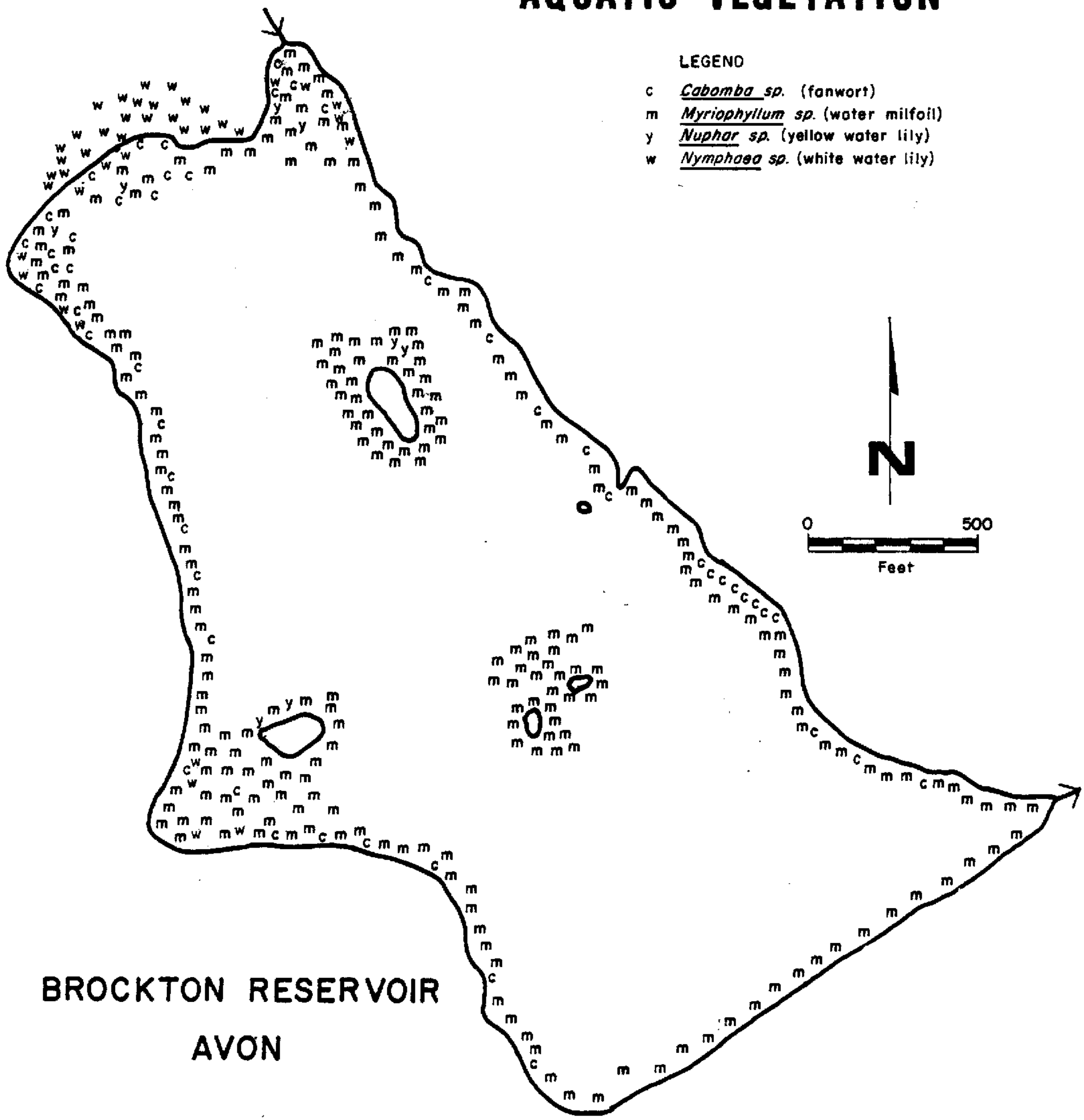


FIGURE 9

TABLE 9

BROCKTON RESERVOIR

MICROSCOPIC EXAMINATION IN AREAL STANDARD UNITS/ml

July 21, 1975

ORGANISM	STATION 1
ALGAE	
Chlorophyceae	
Pediastrum sp.	37
Unidentified Coccoid	66
PROTOZOA	
Mastigophora	
Eudorina sp.	44
Amorphous Matter	1,962

BATHYMETRIC MAP AND LOCATION OF SAMPLING STATIONS

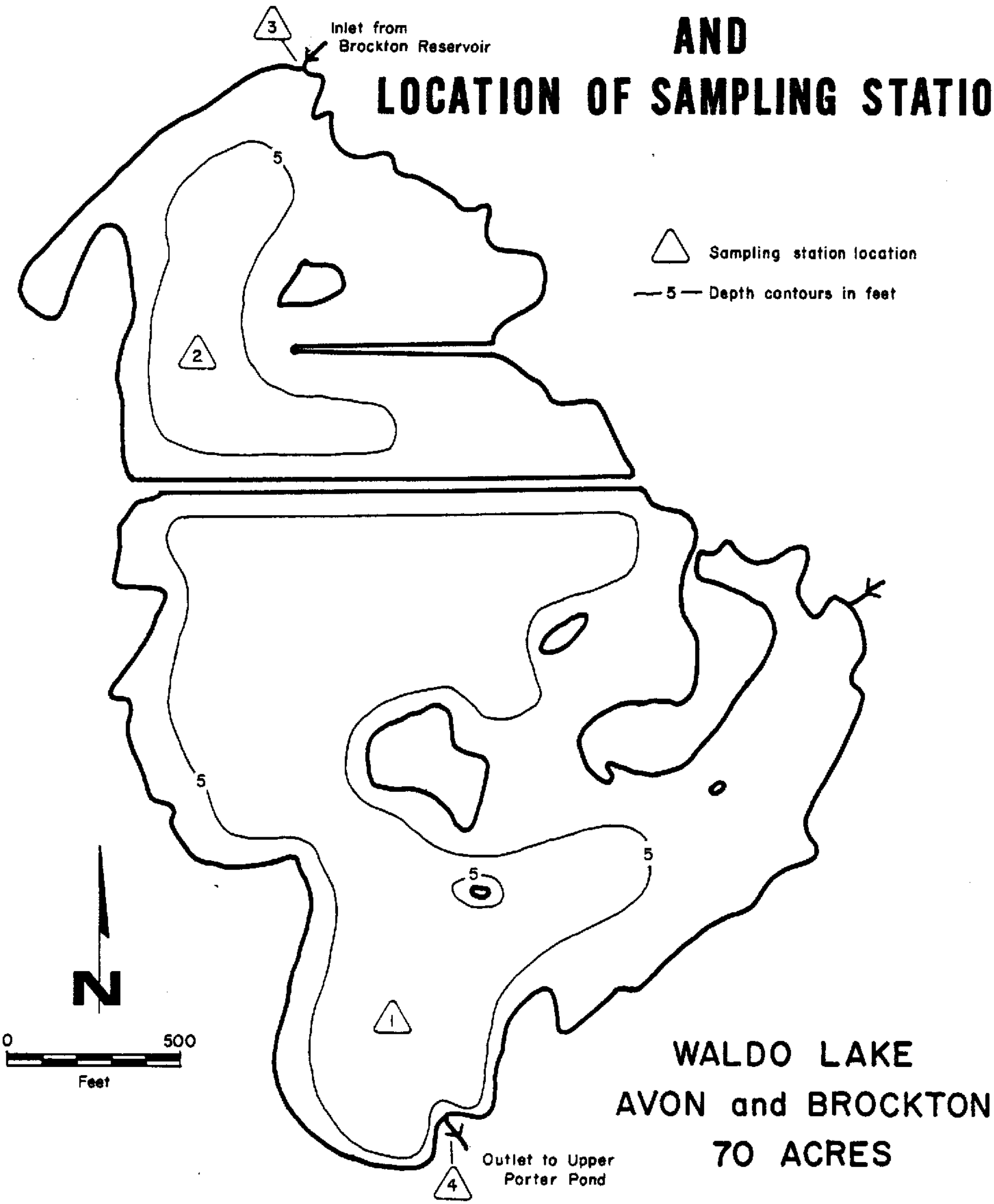


FIGURE 10

TABLE 10

WALDO LAKE

MORPHOMETRIC DATA

Maximum Length	1,400 feet	430 meters
Maximum Effective Length	1,400 feet	430 meters
Maximum Width	1,300 feet	400 meters
Maximum Effective Width	1,300 feet	400 meters
Maximum Depth	9 feet	2.7 meters
Mean Depth	4.5 feet	1.4 meters
Mean Width	2,178 feet	665 meters
Area	70 acres	28 hectares
Volume	300 acre-feet	370,050 cubic meters
Shoreline	11,100 feet	3,385 meters
Development of Shoreline	1.8	
Development of Volume	1.5	
Mean to Maximum Depth Ratio	0.5	
Drainage Area	231 acres	94 hectares

FIGURE II

Depth (feet)	Station 1 Temp. °F	Station 1 D.O. (mg/l)	Station 2 Temp. °F	Station 2 D.O. (mg/l)
Surface	73.5	7.9	77.0	6.9
1	73.5	-	77.0	-
2	73.5	-	77.0	-
3	73.5	-	76.0	-
4	73.5	-	76.0	-
5	73.5	7.5	74.5	6.5
6	71.5	-	73.5	-
7	70.5	-	73.5	6.0
8	70.5	-	-	-
9	68.0	7.2	-	-

Secchi Disc Transparency

Station 1: 6.0 feet @ 1300 hours

Station 2: 4.0 feet @ 1130 hours

WALDO LAKE - AVON-BROCKTON
TEMPERATURE and DISSOLVED OXYGEN PROFILE
JULY 22, 1975

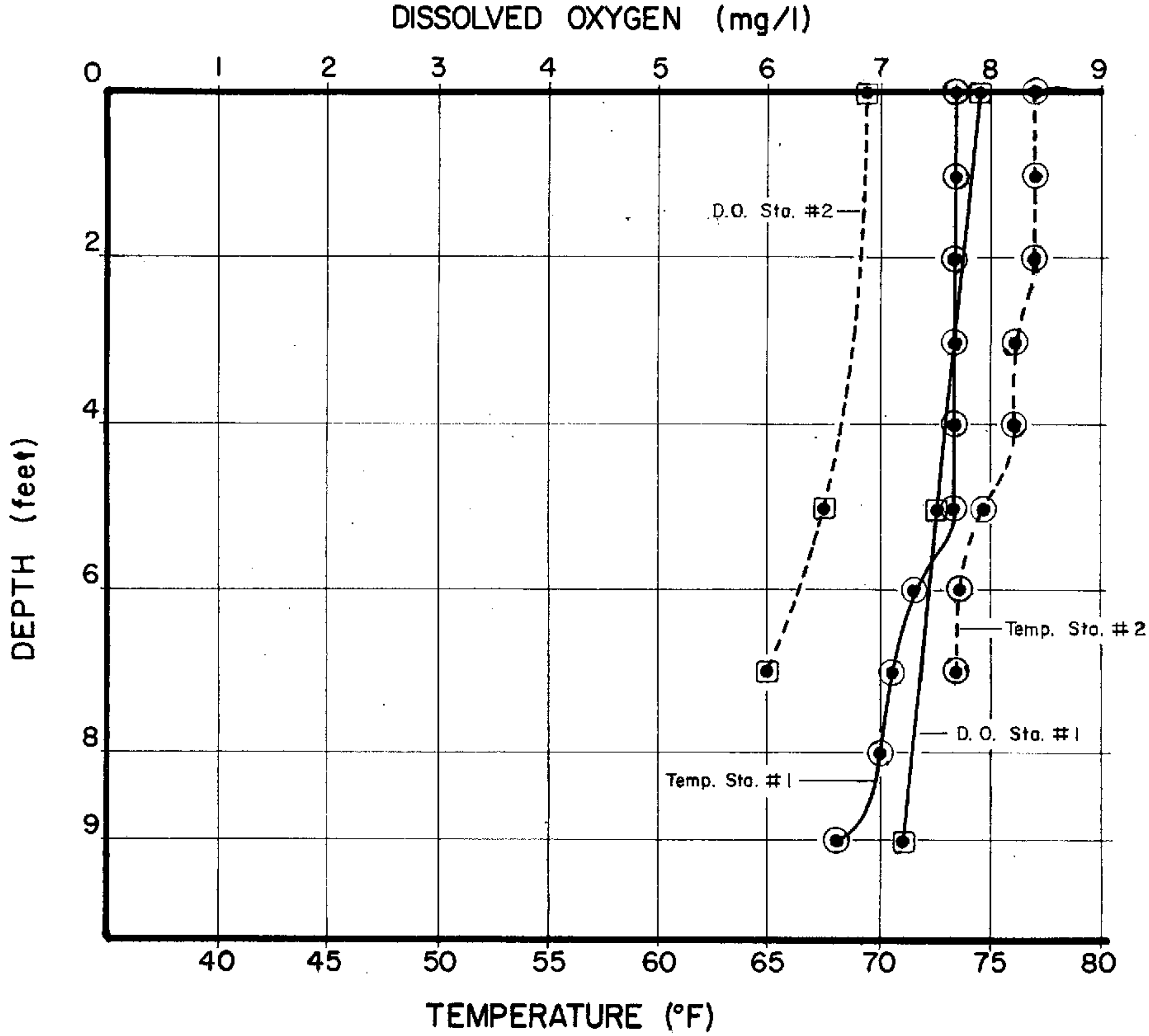


TABLE 11

WALDO LAKE

WATER QUALITY DATA (mg/1)

July 22, 1975

PARAMETER	STA. 1 @ 5 FT.	STA. 2 @ 5 FT.	STA. 3	STA. 4
pH (Standard Units)	7.4	7.0	7.0	7.3
Total Alkalinity	14	14	15	13
Total Hardness	32	35	37	31
Ammonia-N	0.00	0.08	0.00	0.00
Nitrate-N	0.0	0.0	0.1	0.0
Total P	0.02	0.02	0.06	0.09
Silica	2.0	1.4	1.1	1.4
Chlorides	63	65	67	62
Conductivity (micromhos/cm)	270	280	260	260
Sulfate	11	12	12	11
Iron	0.11	0.33	0.16	0.10
Manganese	0.03	0.04	0.03	0.03

DISTRIBUTION OF AQUATIC VEGETATION

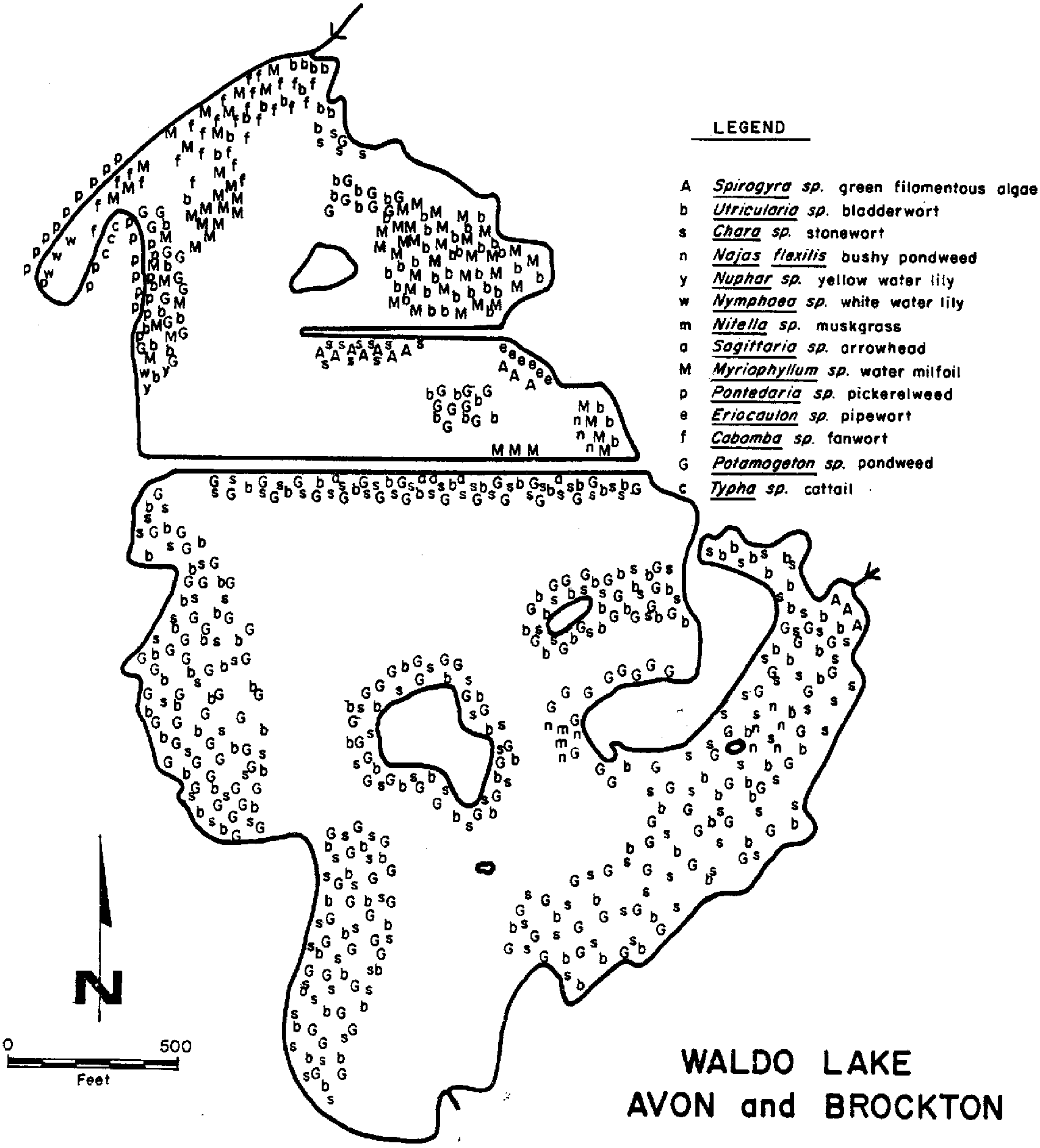


FIGURE 12

TABLE 12

WALDO LAKE

MICROSCOPIC EXAMINATION IN AREAL STANDARD UNITS/ml

July 22, 1975

ORGANISM	STATION 1	STATION 2
ALGAE		
Chlorophyceae		
Unidentified Coccoid	7	-
PROTOZOA		
Unidentified Flagellates	29	-
Mastigophora		
Eudorina sp.	29	110
Amorphous Matter	3,969	1,374

BATHYMETRIC MAP
AND
LOCATION OF SAMPLING STATIONS

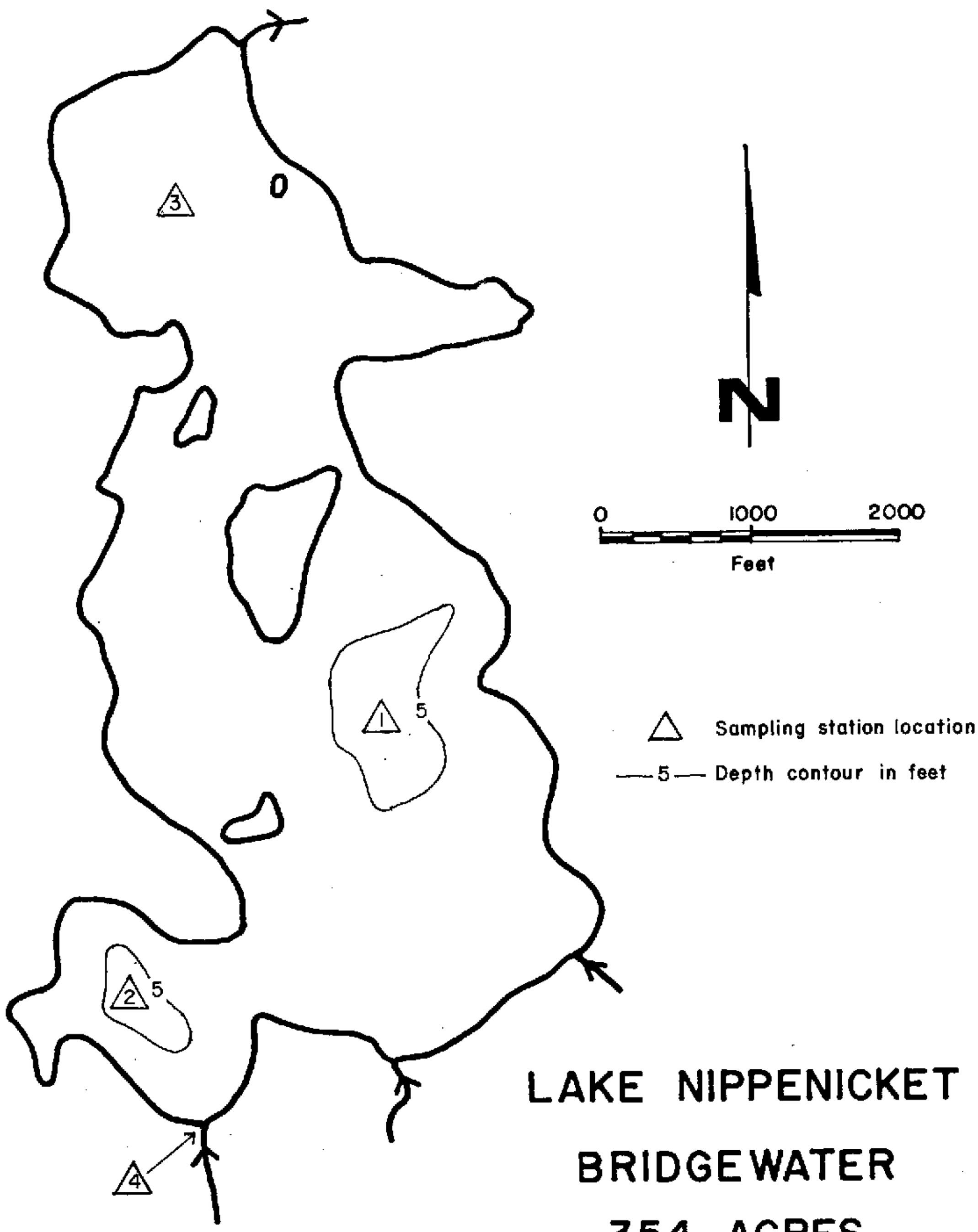


FIGURE 13

TABLE 13

LAKE NIPPENICKET

MORPHOMETRIC DATA

Maximum Length	7,400 feet	2,260 meters
Maximum Effective Length	4,400 feet	1,340 meters
Maximum Width	4,000	1,220 meters
Maximum Effective Width	4,000 feet	1,220 meters
Maximum Depth	6 feet	1.8 meters
Mean Depth	2 feet	0.6 meters
Mean Width	2,084 feet	635 meters
Area	354 acres	143 hectares
Volume	751 acre-feet	926,400 cubic meters
Shoreline	26,000 feet	7,930 meters
Development of Shoreline	1.9	
Development of Volume	1.0	
Mean to Maximum Depth Ratio	0.33	
Drainage Area	1,538 acres	623 hectares

FIGURE 14

Depth (feet)	Station 1 Temp. °F	Station 1 D.O. (mg/l)	Station 2 Temp. °F	Station 2 D.O. (mg/l)
Surface	79.5	6.9	81.5	6.9
1	79.5	-	81.5	-
2	79.5	-	80.5	-
3	79.5	6.6	80.5	6.9
4	79.5	-	79.5	-
5	79.0	6.6	78.0	5.9
6	79.0	-	77.0	-

Secchi Disc Transparency

Station: 2.5 feet @ 1000 hours

Station: 2.5 feet @ 1300 hours

LAKE NIPPENICKET - BRIDGEWATER
TEMPERATURE and DISSOLVED OXYGEN PROFILE
JULY 23, 1975

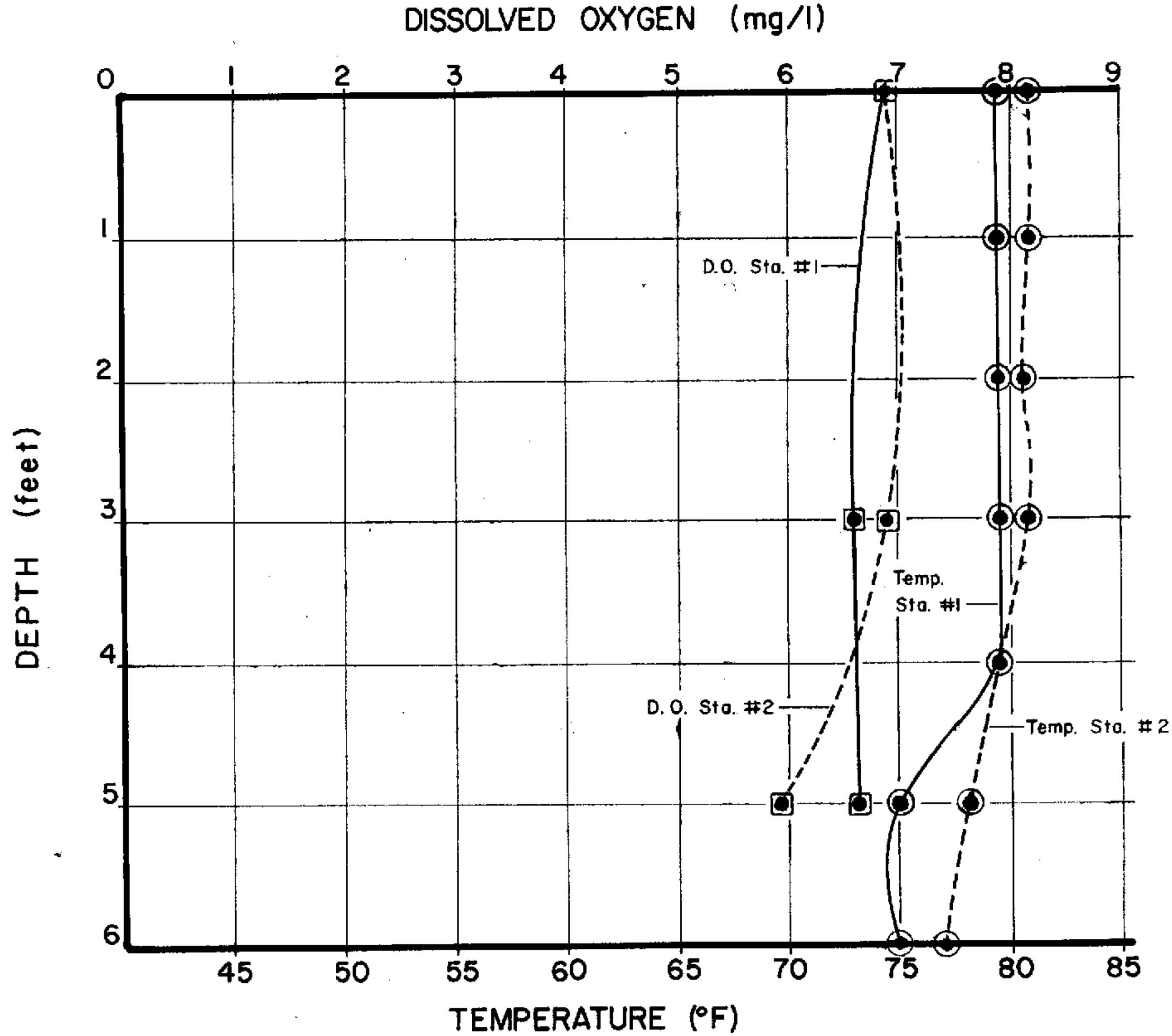


TABLE 14

LAKE NIPPENICKET

WATER QUALITY DATA (mg/1)

July 23, 1975

PARAMETER	STA. 1 @ 3 FT.	STA. 2 @ 3 FT.	STA. 3	STA. 4
pH (Standard Units)	5.8	5.8	6.3	5.1
Total Alkalinity	2.0	2.0	3.0	3.0
Total Hardness	15	15	15	18
Ammonia-N	0.05	0.06	0.01	0.89
Nitrate-N	0.0	0.0	0.0	0.0
Total P	0.05	0.04	0.01	0.36
Silica	1.8	1.8	1.2	4.9
Chlorides	22	21	22	37
Conductivity (micromhos/cm)	114	110	110	175
Sulfate	10	10	11	10
Color (color units)	125	125	125	400
Iron	1.9	1.9	1.5	4.8
Manganese	0.09	0.08	0.03	0.11

DISTRIBUTION OF AQUATIC VEGETATION

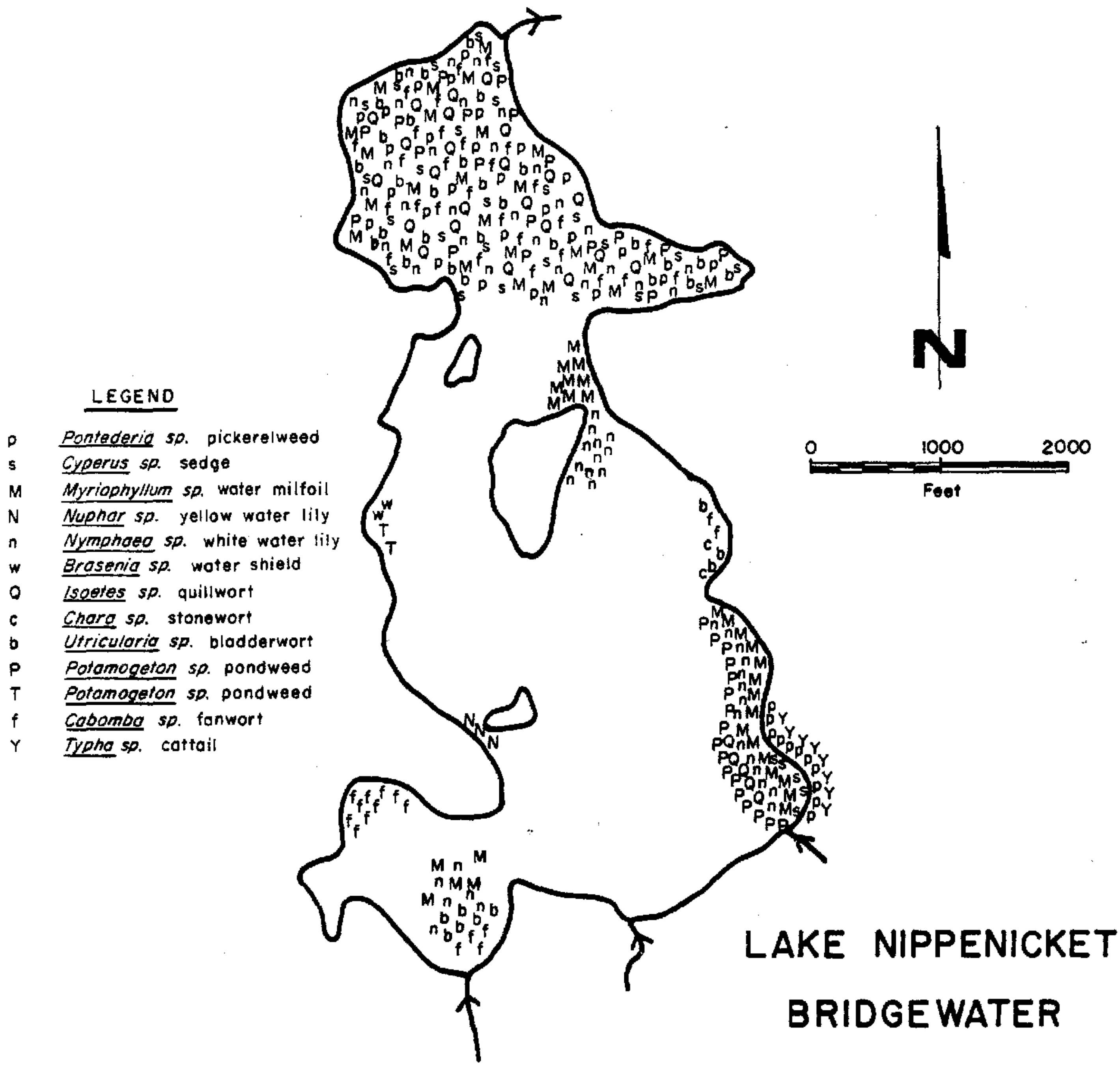


FIGURE 15

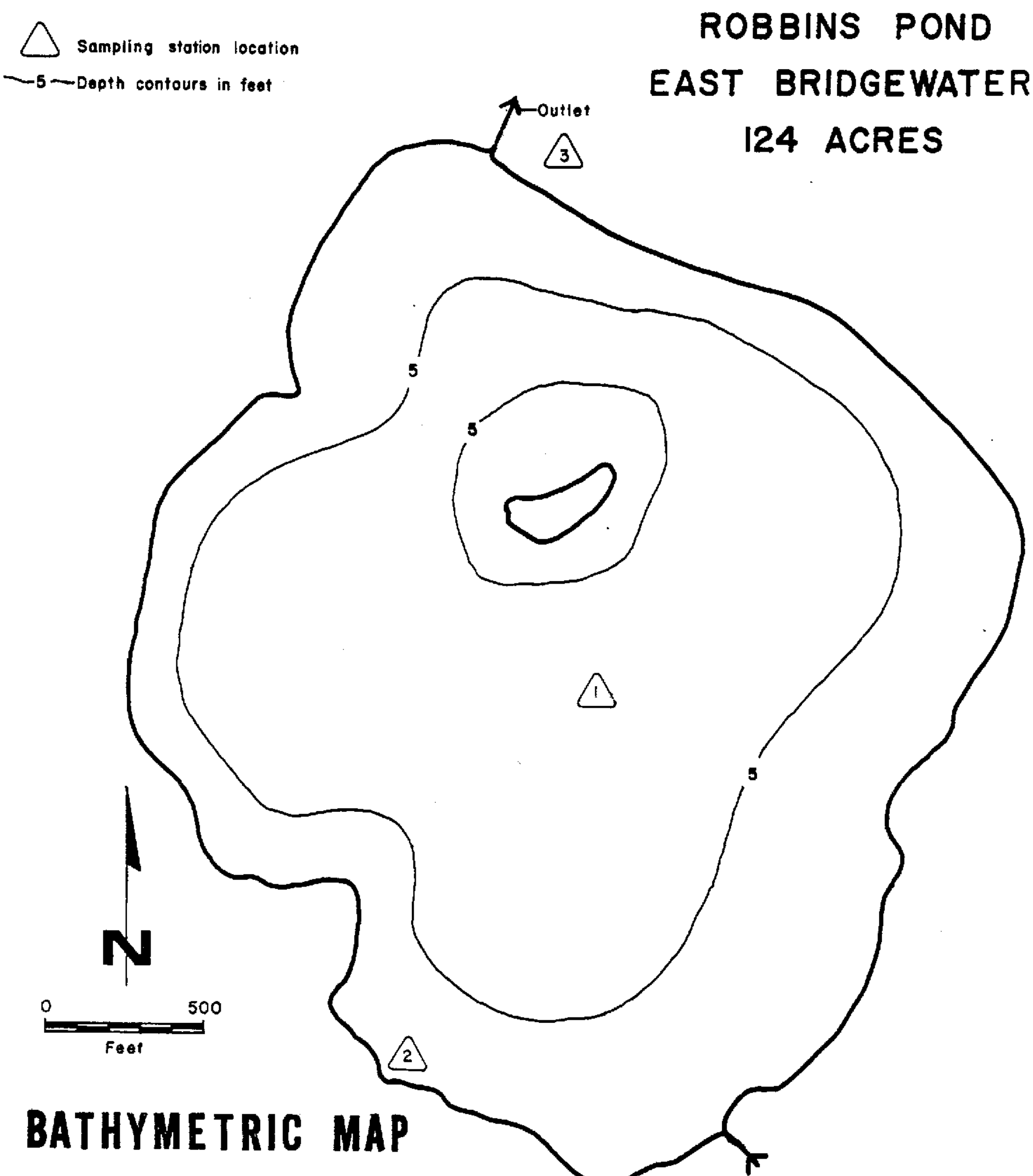
TABLE 15

LAKE NIPPENICKET

MICROSCOPIC EXAMINATION IN AREAL STANDARD UNITS/ml

July 23, 1975

ORGANISM	STATION 1	STATION 2	STATION 3
ALGAE			
Chlorophyceae			
Closterium sp.	-	-	-
Unidentified Coccoid	4	-	-
PROTOZOA			
Sarcodina (Amoeboid)			
Actinosphaerium sp.	-	-	37
Amorphous Matter	2,000	1,175	1,668



BATHYMETRIC MAP AND LOCATION OF SAMPLING STATIONS

FIGURE 16

TABLE 16

ROBBINS POND

MORPHOMETRIC DATA

Maximum Length	3,150 feet	960 meters
Maximum Effective Length	3,150 feet	960 meters
Maximum Width	2,700 feet	825 meters
Maximum Effective Width	2,700 feet	825 meters
Maximum Depth	5 feet	1.5 meters
Mean Depth	4 feet	1.2 meters
Mean Width	1,715 feet	520 meters
Area	124 acres	50 hectares
Volume	495 acre-feet	610,600 cubic meters
Shoreline	9,000 feet	2,750 meters
Development of Shoreline	1.1	
Development of Volume	2.4	
Mean to Maximum Depth Ratio	0.8	
Drainage Area	171 acres	69 hectares

FIGURE 17

STATION I

Depth (feet)	Temp. °F	D.O. (mg/l)
Surface	81.5	6.9
1	81.5	-
2	81.5	-
3	80.5	-
4	79.0	-
5	79.0	6.4

Secchi Disc Transparency
3.5 feet @ 1200 hours

ROBBINS POND - EAST BRIDGEWATER
TEMPERATURE and DISSOLVED OXYGEN PROFILE
JULY 24, 1975

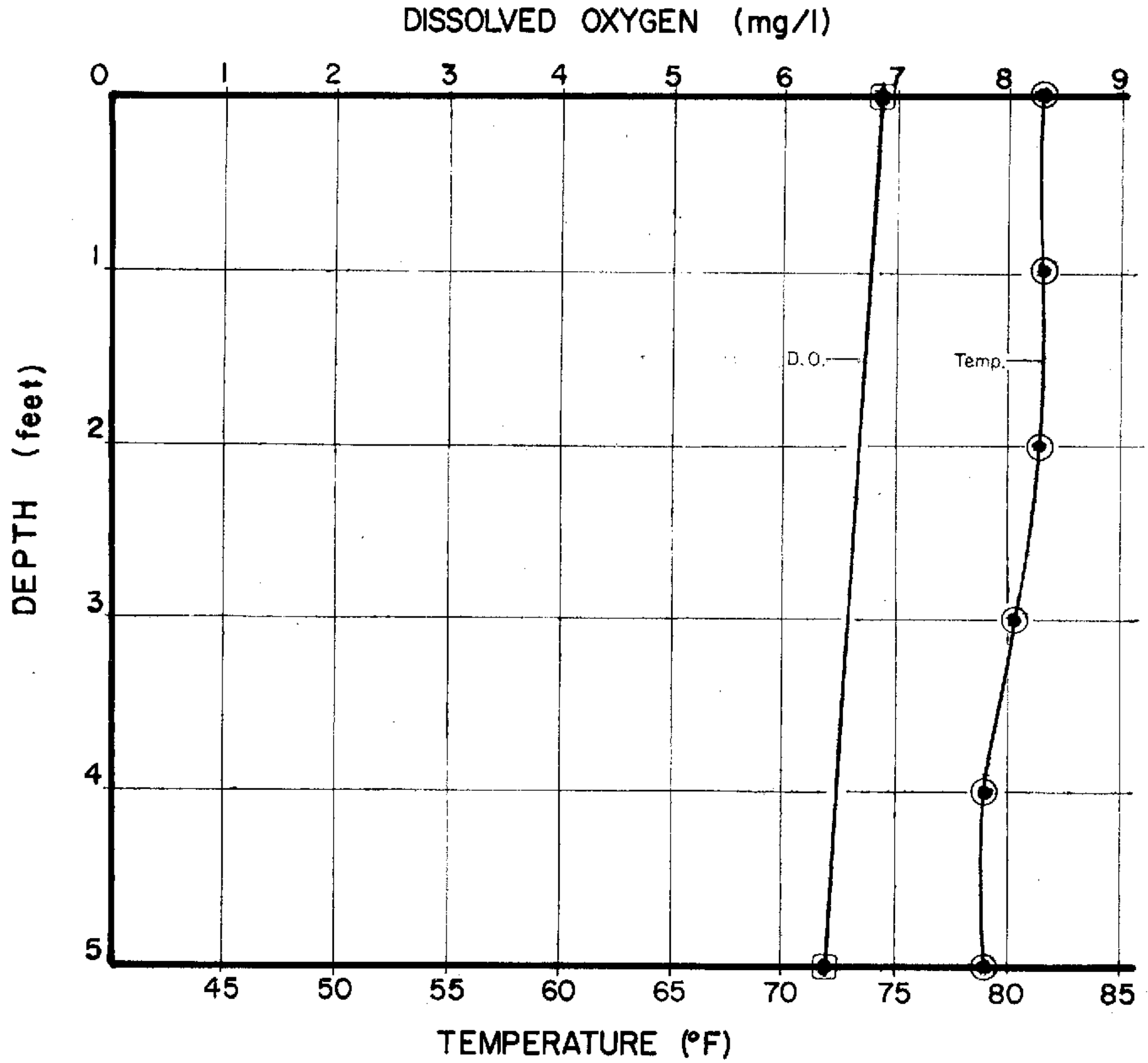


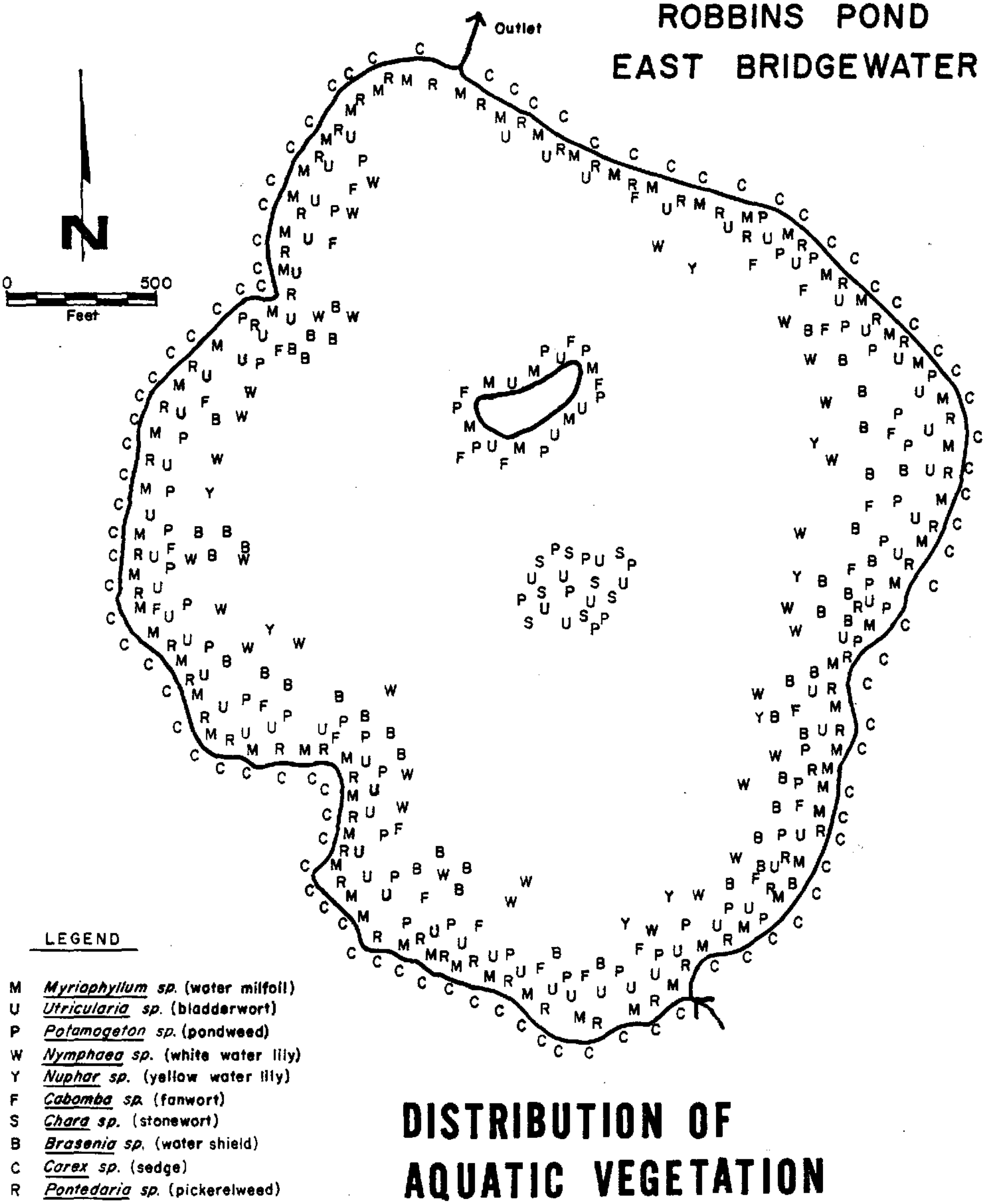
TABLE 17

ROBBINS POND

WATER QUALITY DATA (mg/l)

July 24, 1975

PARAMETER	STA. 1 @ 3 FT.	STA. 2 @ TRAILER CAMP	STA. 3
pH (Standard Units)	6.0	6.1	6.1
Total Alkalinity	3.0	3.0	5.0
Total Hardness	12	13	13
Ammonia-N	0.06	0.01	0.07
Nitrate-N	0.0	0.0	0.0
Total P	0.04	0.29	0.05
Silica	1.4	0.6	1.2
Chlorides	19	21	14
Conductivity (micromhos/cm)	80	82	82
Sulfate	8.0	8.0	8.0
Color (color units)	125	100	125
Iron	1.9	1.5	1.7
Manganese	0.08	0.03	0.07



DISTRIBUTION OF AQUATIC VEGETATION

FIGURE 18

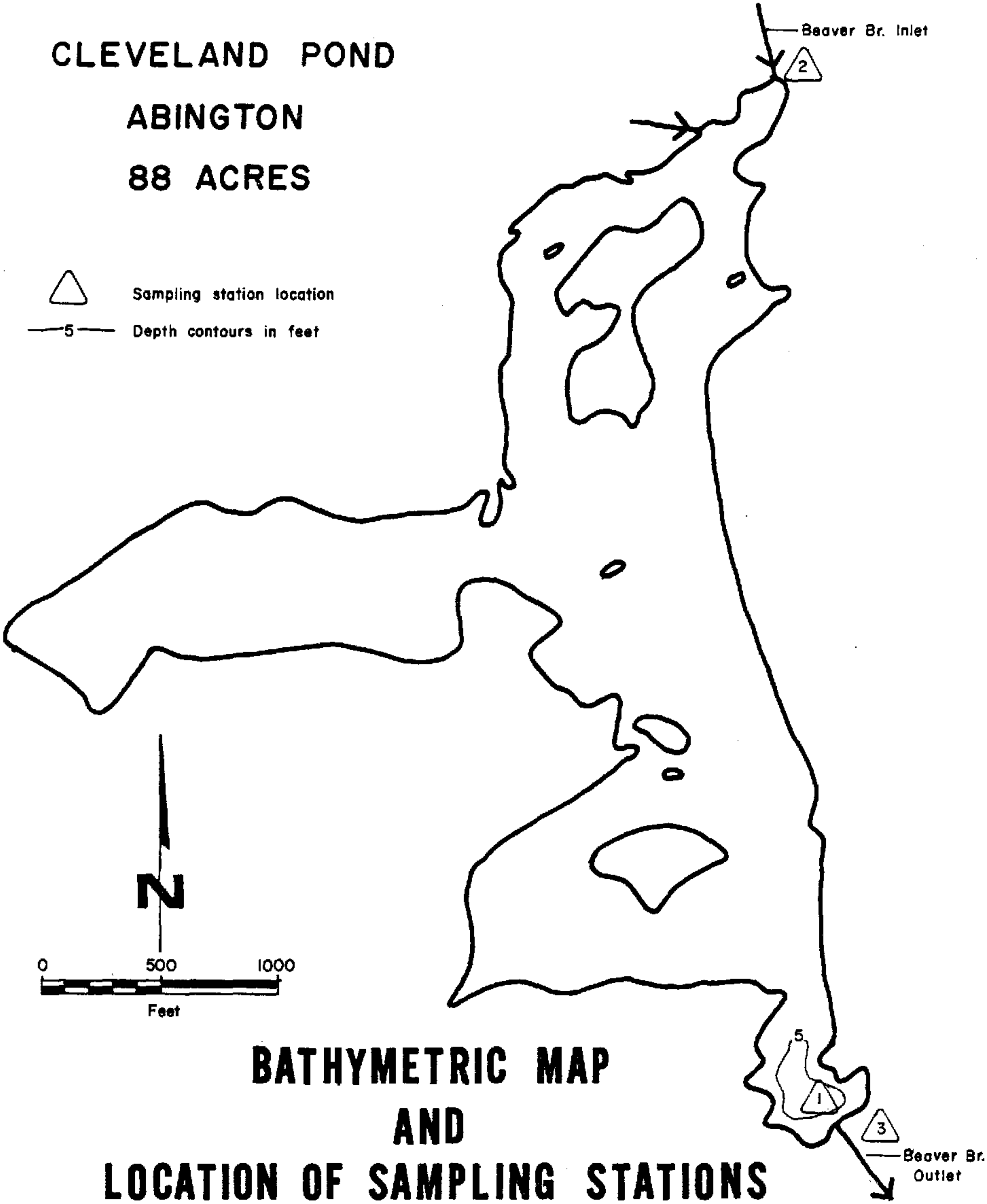
TABLE 18

ROBBINS POND

MICROSCOPIC EXAMINATION IN AREAL STANDARD UNITS/ml

July 24, 1975

ORGANISM	STATION 1
ALGAE	
Bacillariophyceae	
Unidentified	22
Chlorophyceae	
Tetraedron sp.	22
Chlorella sp.	29
Unidentified Coccoid	22
PROTOZOA	
Sarcodina (Amoeboid)	15
Amorphous Matter	6,115



BATHYMETRIC MAP
AND
LOCATION OF SAMPLING STATIONS

FIGURE 19

TABLE 19

CLEVELAND POND

MORPHOMETRIC DATA

Maximum Length	3,000 feet	915 meters
Maximum Effective Length	3,000 feet	915 meters
Maximum Width	3,000 feet	915 meters
Maximum Effective Width	3,000 feet	915 meters
Maximum Depth	6 feet	1.8 meters
Mean Depth	2 feet	0.6 meters
Mean Width	1,278 feet	390 meters
Area	88 acres	36 hectares
Volume	176 acre-feet	217,100 cubic meters
Shoreline	17,000 feet	5,190 meters
Development of Shoreline	2.4	
Development of Volume	1.0	
Mean to Maximum Depth Ratio	0.33	
Drainage Area	1,816 acres	735 hectares

CLEVELAND POND - ABINGTON
TEMPERATURE and DISSOLVED OXYGEN PROFILE
AUGUST 4, 1975

FIGURE 20

STATION 1

Depth (feet)	Temp. °F	D.O. (mg/l)
Surface	80.0	7.9
1	79.0	-
2	78.0	-
3	78.0	5.8
4	77.0	-
5	75.0	1.1
6	75.0	-

Secchi Disc Transparency
2.5 feet @ 1100 hours

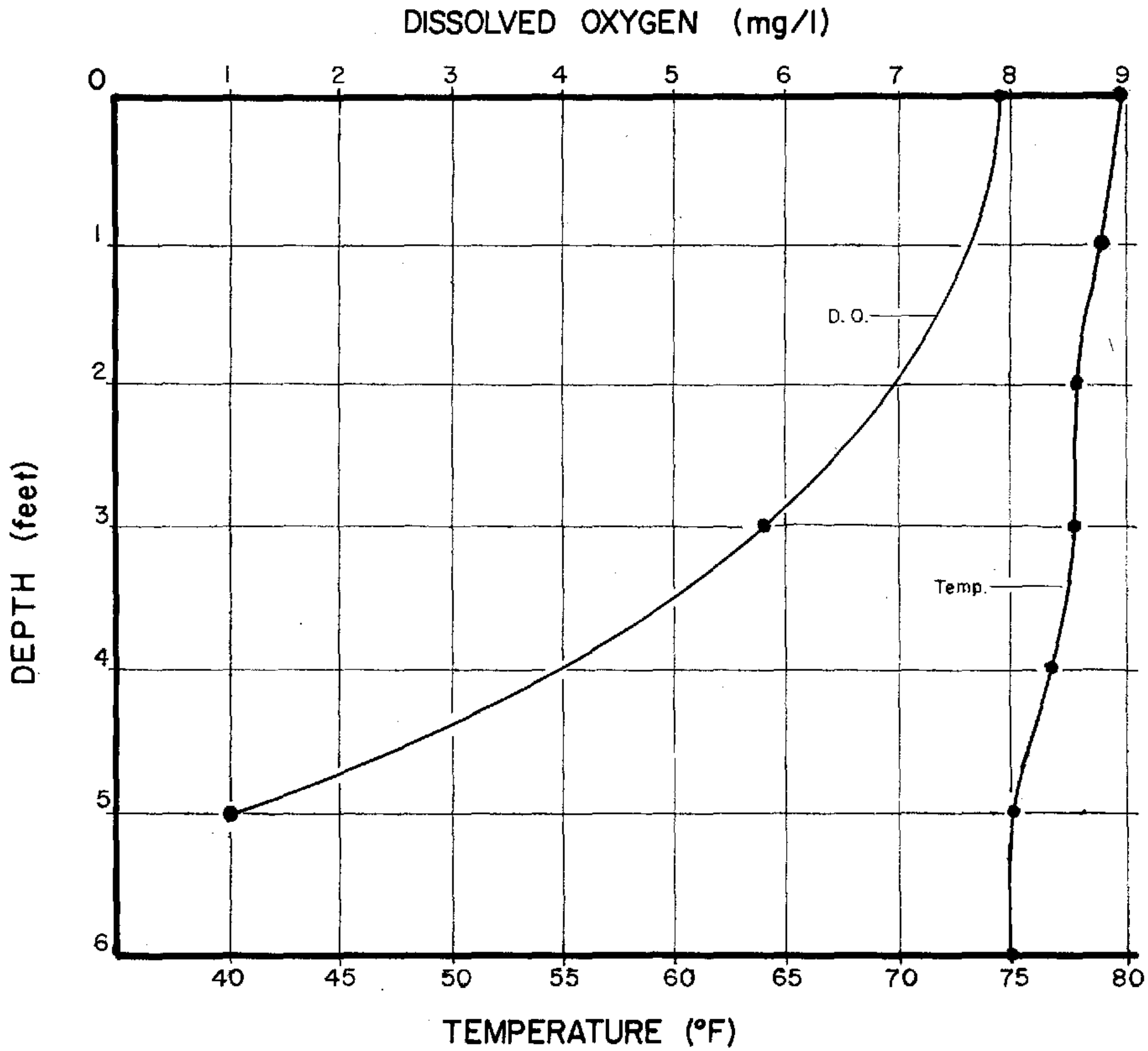


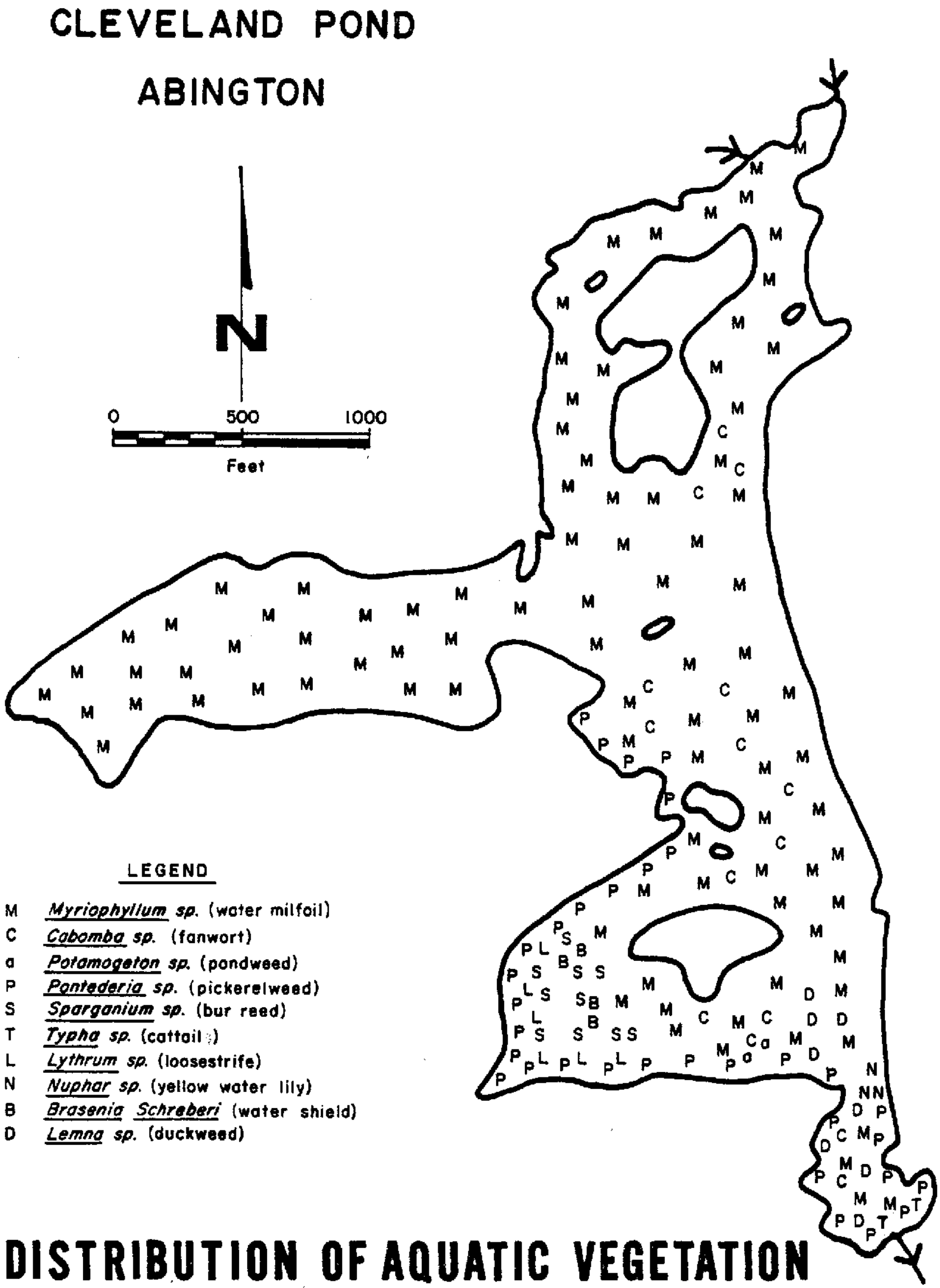
TABLE 20

CLEVELAND POND

WATER QUALITY DATA (mg/l)

August 4, 1975

PARAMETER	STA. 1 @ 0.0 FT.	STA. 1 @ 5 FT.	STA. 2	STA. 3
pH (Standard Units)	6.7	6.6	6.7	6.5
Total Alkalinity	19	20	27	18
Total Hardness	20	21	33	21
Ammonia-N	0.03	0.12	0.39	0.09
Nitrate-N	0.0	0.0	0.2	0.0
Total P	0.09	0.11	0.55	0.12
Silica	1.0	1.0	9.2	1.0
Chlorides	22	21	37	22
Conductivity (micromhos/cm)	114	114	180	114
Sulfate	4.0	4.0	7.0	5.0
Color (color units)	130	140	300	180
Iron	1.7	2.0	3.3	1.8
Manganese	0.28	0.47	0.40	0.17
Suspended Solids	8.0	6.0	10	7.5
Total Solids	124	124	200	118



DISTRIBUTION OF AQUATIC VEGETATION

FIGURE 21

TABLE 21

CLEVELAND POND

MICROSCOPIC EXAMINATION IN AREAL STANDARD UNITS/ml

August 4, 1975

ORGANISM	STATION 1
ALGAE	
Chlorophyceae	
Closterium sp.	116
Protococcus sp.	182
Staurastrum sp.	7
Unidentified Coccoid	36
PROTOZOA	
Mastigophora	
Eudorina sp.	181
Unidentified nonpigmented	109
Unidentified pigmented	7
Crustacea[1]	1
Amorphous Matter	2,514

[1]Number of organisms

WINNECUNNET POND
NORTON
BATHYMETRIC MAP &
SAMPLING STATIONS

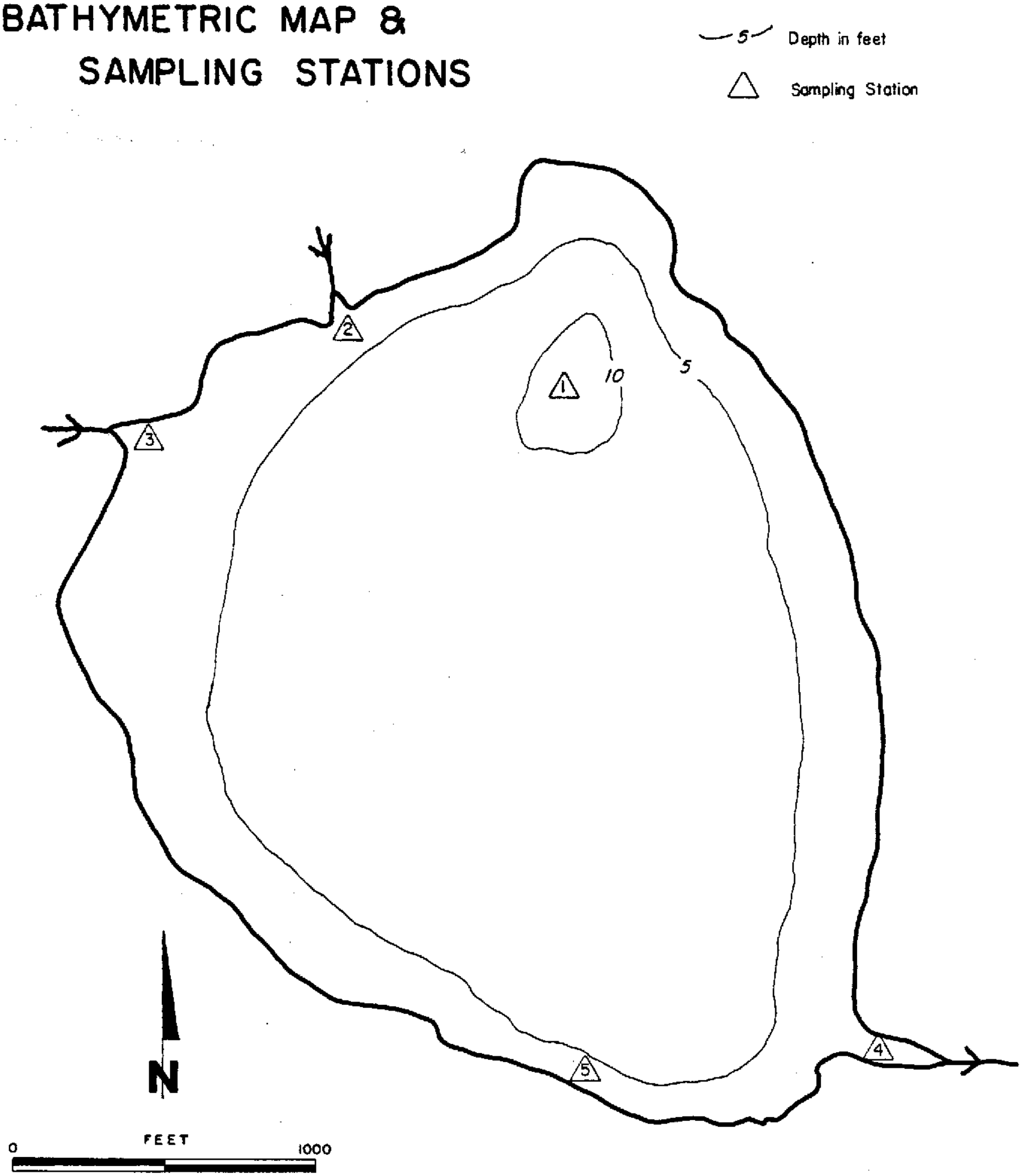


FIGURE 22

TABLE 22

WINNECUNNET POND

MORPHOMETRIC DATA

Maximum Length	3,400 feet	1,040 meters
Maximum Effective Length	3,400 feet	1,040 meters
Maximum Width	2,700 feet	825 meters
Maximum Effective Width	2,700 feet	825 meters
Maximum Depth	11 feet	3.4 meters
Mean Depth	5 feet	1.5 meters
Mean Width	1,896 feet	580 meters
Area	148 acres	60 hectares
Volume	740 acre-feet	912,800 cubic meters
Shoreline	10,000 feet	3,050 meters
Development of Shoreline	1.1	
Development of Volume	1.4	
Mean to Maximum Depth Ratio	0.45	
Drainage Area	20,000 acres	8,100 hectares
Canoe River Drainage Area	11,948 acres	4,840 hectares
Mulberry Brook Drainage Area	7,481 acres	3,030 hectares

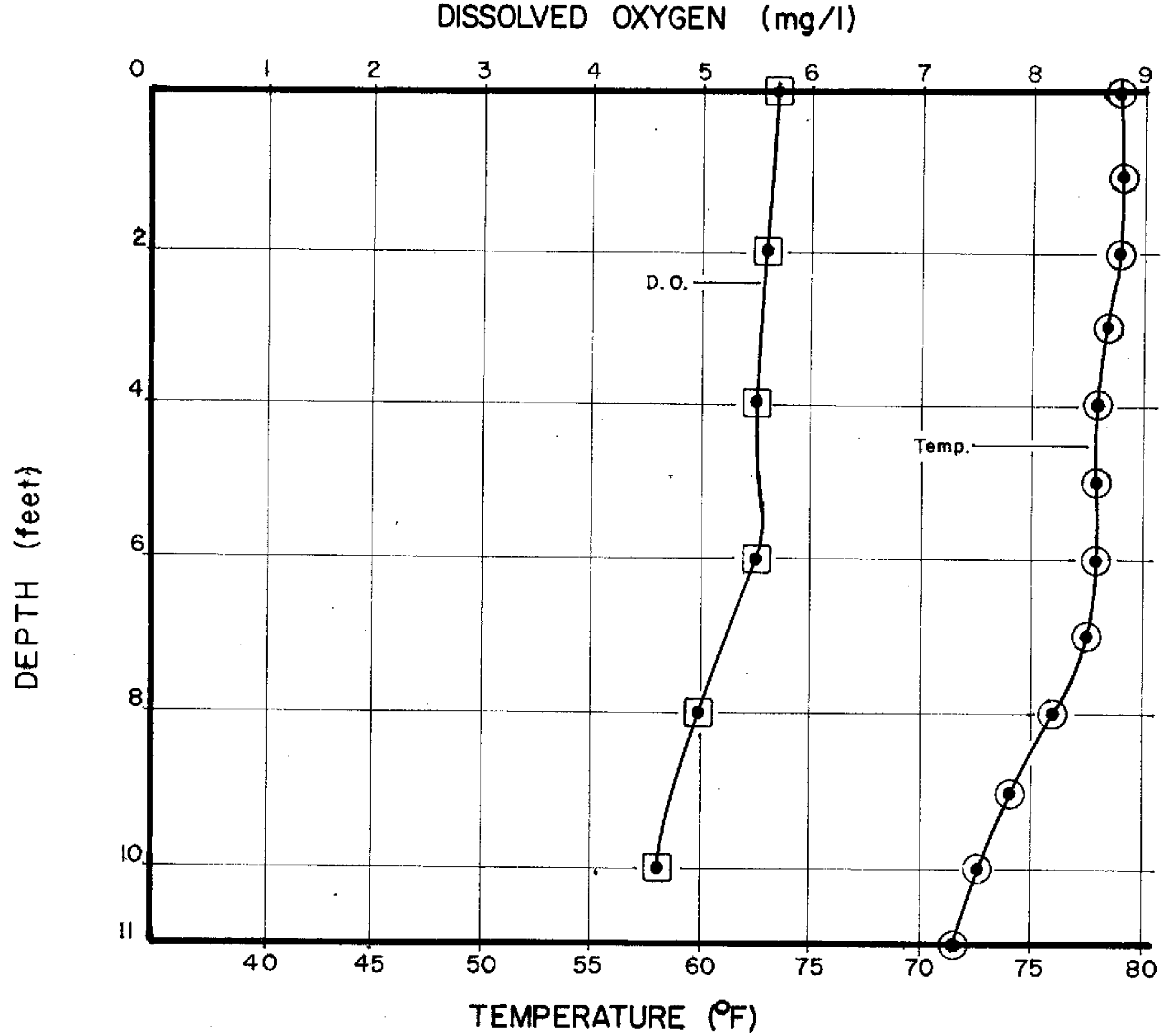
FIGURE 23

STATION 1

Depth (feet)	Temp. °F	D.O. (mg/l)
Surface	79.0	5.7
1	79.0	-
2	79.0	5.6
3	78.5	-
4	78.0	5.5
5	78.0	-
6	78.0	5.5
7	77.5	-
8	76.0	5.0
9	74.0	-
10	72.5	4.6
11	71.5	-

Secchi Disc Transparency
5.0 feet @ 1130 hours

WINNECUNNET POND - NORTON
TEMPERATURE and DISSOLVED OXYGEN PROFILE
AUGUST 5, 1975



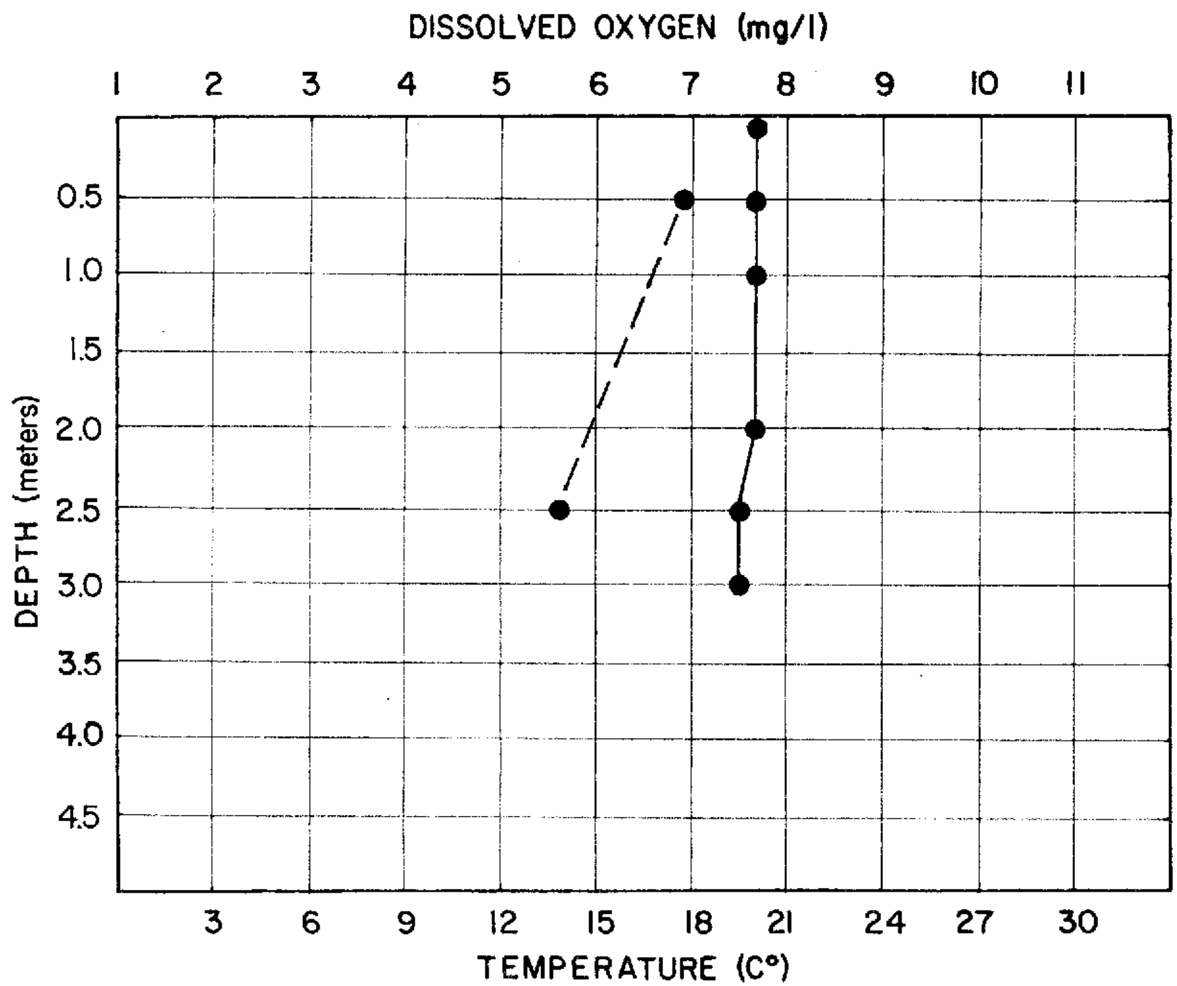
DISSOLVED OXYGEN & TEMPERATURE PROFILE — 5 JUNE 1980

WINNECUNNET POND — NORTON

FIGURE 24

STATION I

Temp. C°	D.O. mg/l	Depth meters
20.0	-	0.0
20.0	6.9	0.5
20.0	-	1.0
20.0	-	2.0
19.5	5.7	2.5
19.5	-	3.0



——— Temperature

— — — Dissolved Oxygen

TABLE 23

WINNECUNNET POND

WATER QUALITY DATA (mg/1)

August 5, 1975

PARAMETER	STA. 1 @ 0.0 FT.	STA. 1 @ 10 FT.	STA. 2	STA. 3	STA. 4
pH (Standard Units)	6.8	6.8	6.5	6.4	6.7
Total Alkalinity	12	11	16	12	11
Total Hardness	21	16	22	18	20
Ammonia-N	0.04	0.05	0.04	0.29	0.35
Nitrate-N	0.0	0.0	0.3	0.4	0.3
Total P	0.06	0.04	0.02	0.02	0.01
Silica	0.9	1.3	5.1	1.8	1.2
Chlorides	10	10	15	8.0	10
Conductivity (micromhos/cm)	86	74	102	72	86
Sulfate	11	9.0	9.0	9.0	9.0
Color (color units)	100	110	80	50	110
Iron	1.7	1.7	0.80	0.80	1.7
Manganese	0.04	0.04	0.18	0.07	0.04
Suspended Solids	3.5	2.5	2.5	2.5	2.5
Total Solids	76	74	114	66	78

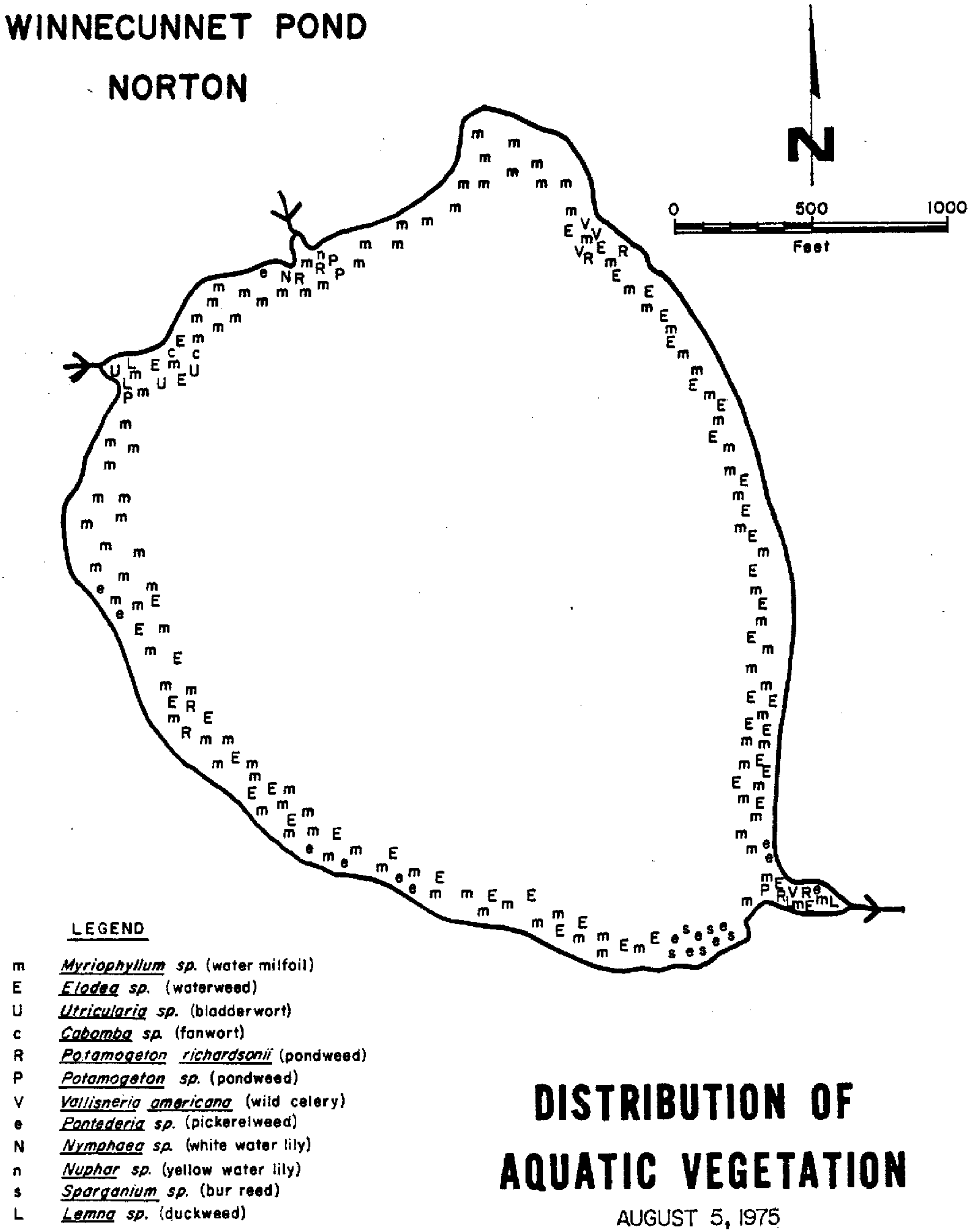
TABLE 24

WINNECUNNET POND

WATER QUALITY DATA (mg/l)

June 5, 1980

PARAMETER	STA. 1 @ 1.5 FT.	STA. 1 @ 8.2 FT.	STA. 2	STA. 3	STA. 4	STA. 5
Temperature (^{o}F)	20.0	19.5	17.0	17.0	20.0	15.0
Dissolved Oxygen	6.9	5.7	6.8	7.8	8.9	--
Secchi Disc (feet)	5.2	--	--	--	--	--
pH (Standard Units)	7.2	7.1	7.1	7.1	7.0	6.9
Total Alkalinity	15	13	14	15	11	9
Total Hardness	17	16	16	16	16	39
Chlorides	7	7	6	8	7	9
Conductivity (micromhos/cm)	70	70	68	82	74	86
Total Kjeldahl-N	0.58	0.57	0.56	0.72	0.70	0.79
Ammonia-N	0.17	0.18	0.07	0.16	0.08	0.14
Nitrate-N	0.1	0.1	0.2	0.2	0.1	0.1
Total Phosphorus	0.08	0.04	0.03	0.08	0.06	0.14
Suspended Solids	5.5	0.5	0.5	2.0	0.0	42
Total Solids	54	56	44	64	44	64
Iron	1.1	0.75	0.45	0.93	0.60	1.5
Manganese	0.24	0.12	0.06	0.12	0.06	0.08
Total Coliform (#/100 ml)	20	--	1200	100	186	600
Fecal Coliform (#/100 ml)	<5	--	60	20	20	320
Chlorophyll _a_ (mg/m^3)	0.68					



WINNECUNNET POND
NORTON
N
0 500 1000
Feet
LEGEND
m *Myriophyllum* sp. (water milfoil)
E *Elodea* sp. (waterweed)
U *Utricularia* sp. (bladderwort)
c *Cabomba* sp. (fanwort)
R *Potamogeton richardsonii* (pondweed)
P *Potamogeton* sp. (pondweed)
V *Vallisneria americana* (wild celery)
e *Pontederia* sp. (pickerelweed)
N *Nymphaea* sp. (white water lily)
n *Nuphar* sp. (yellow water lily)
s *Sparganium* sp. (bur reed)
L *Lemna* sp. (duckweed)
DISTRIBUTION OF
AQUATIC VEGETATION
AUGUST 5, 1975

FIGURE 25

WINNECUNNET POND
NORTON
AQUATIC VEGETATION MAP
5 JUNE 1980

- △ Macroscopic algae (mats, clumps, etc.)
- U *Utricularia* sp. (Bladderwort)
- Q_2 *Polygonum* sp. (Smartweed)
- N_1 *Nymphaea* sp. (Water Lily)
- N_5 *Nuphar* sp. (Yellow Water Lily)
- S *Sparganium* sp. (Bur Reed)
- P *Potamogeton* sp. (Pondweed)
- P_2 *P. crispus*
- P_3 *P. Richardsonii*
- P_4 *P. Robbinsii*
- P_5 *P. epihydrus*
- P_8 *P. natans*
- a_1 *Peltandra virginica* (Arrow Arum)
- B *Scirpus* sp. (Bulrush)
- B_2 *S. cyperinus*
- l_1 *Decodon verticillatus* (Swamp Loosestrife)
- e_1 *Eriocaulon* sp. (Pipewort)
- h_3 *Myriophyllum* sp. (Water Milfoil)
- T *Typha latifolia* (Common Cattail)
- C_1 *Chara* (Stonewort, Muskgrass)
- C_2 *Nitella* (Stonewort)

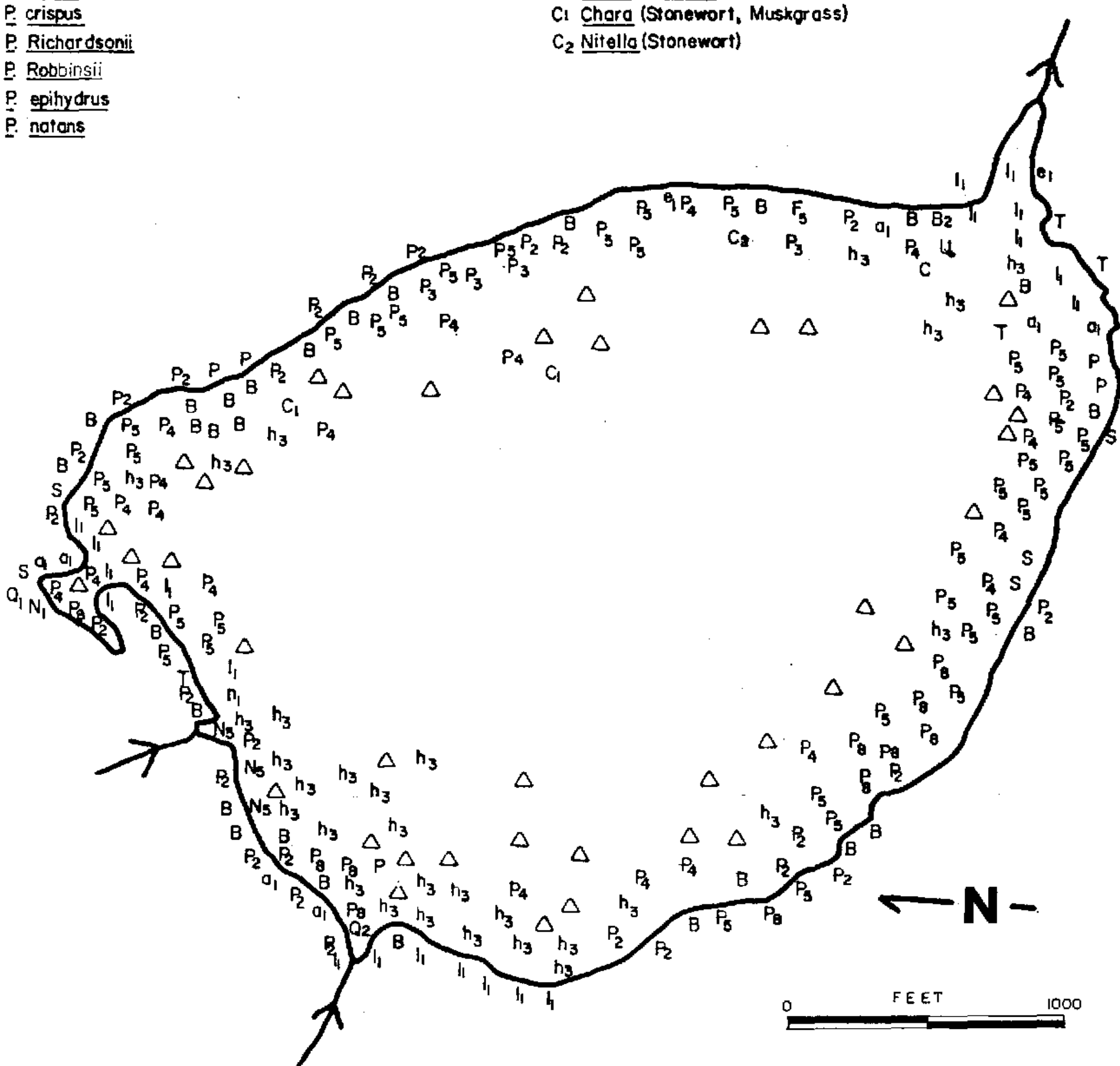


FIGURE 26

TABLE 25

WINNECUNNET POND

MICROSCOPIC EXAMINATION IN AREAL STANDARD UNITS/ml

August 5, 1975

ORGANISM	STATION 1
ALGAE	
Chlorophyceae	
Protococcus sp.	72
Unidentified Coccoid	7
PROTOZOA	
Mastigophora	
Glenodinium sp.	15
Amorphous Matter	2,501

NOTE: Winnecunnet Pond was chemically treated sometime prior to survey

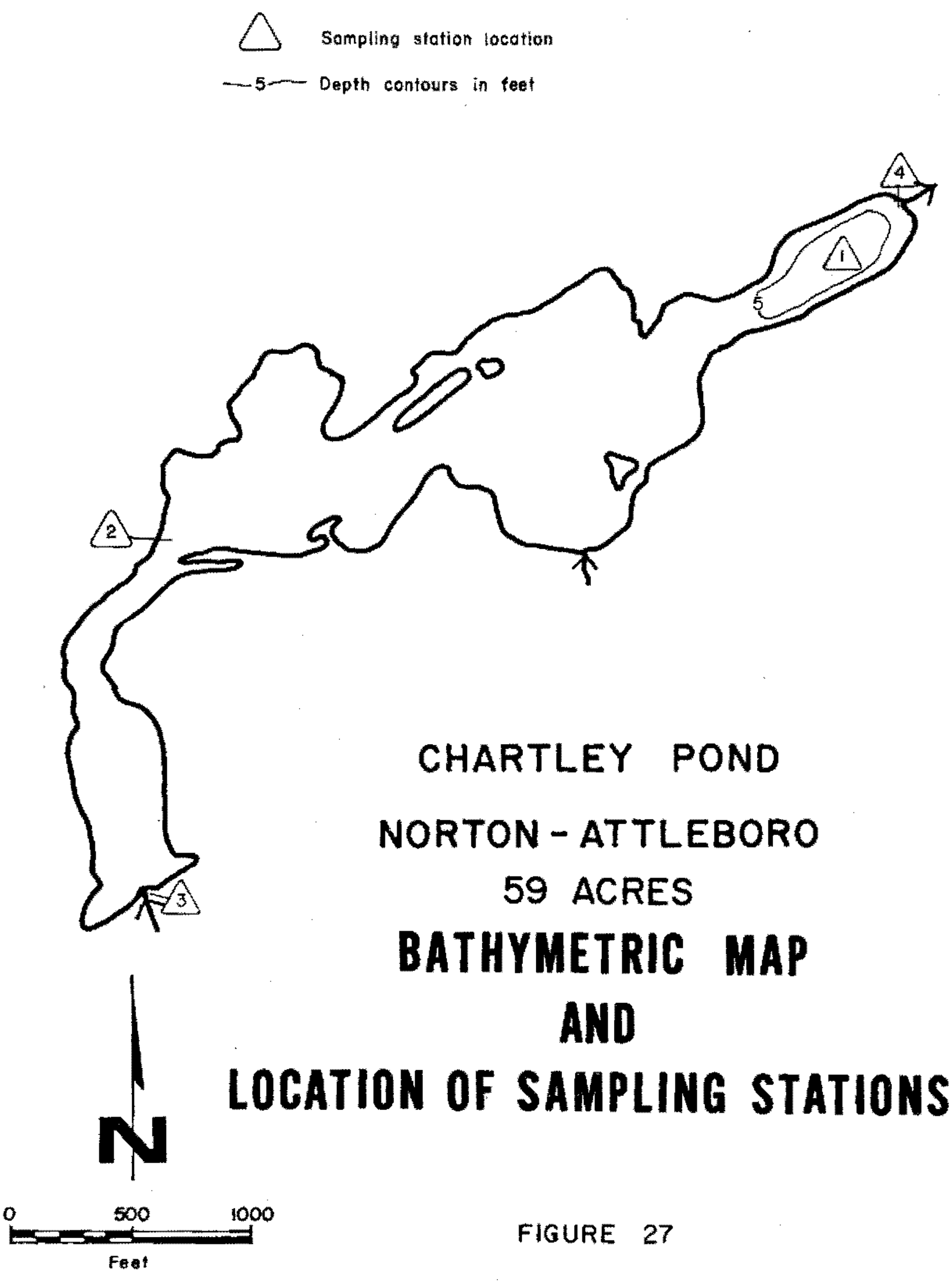
TABLE 26

WINNECUNNET POND

MICROSCOPIC EXAMINATION (cells/ml)

June 5, 1980

ORGANISM	STATION 1
Chrysophyta (Golden brown algae)	
Bacillariophyceae (Diatoms)	
Navicula sp.	14
Flagellates	
Chroomonas sp.	14
TOTAL	28



CHARTLEY POND

NORTON - ATTLEBORO

59 ACRES

BATHYMETRIC MAP

AND

LOCATION OF SAMPLING STATIONS

FIGURE 27

TABLE 27

CHARTLEY POND

MORPHOMETRIC DATA

Maximum Length	3,650 feet	1,110 meters
Maximum Effective Length	3,650 feet	1,110 meters
Maximum Width	1,300 feet	400 meters
Maximum Effective Width	1,300 feet	400 meters
Maximum Depth	7 feet	2.1 meters
Mean Depth	2 feet	0.6 meters
Mean Width	704 feet	215 meters
Area	59 acres	24 hectares
Volume	113 acre-feet	139,400 cubic meters
Shoreline	14,000 feet	4,270 meters
Development of Shoreline	2.5	
Development of Volume	0.9	
Mean to Maximum Depth Ratio	0.29	
Drainage Area	2,460 acres	995 hectares

FIGURE 28

STATION I

Depth feet	Temp. °F	D.O. mg/l
Surface	76.0	3.0
1	76.0	-
2	75.5	0.6
3	73.0	-
4	73.0	0.6
5	72.0	-
6	69.0	-
7	66.5	0.2

Secchi Disc Transparency
1.5 feet @ 1135 hours

CHARTLEY POND - NORTON-ATTLEBORO
TEMPERATURE and DISSOLVED OXYGEN PROFILE
AUGUST 6, 1975

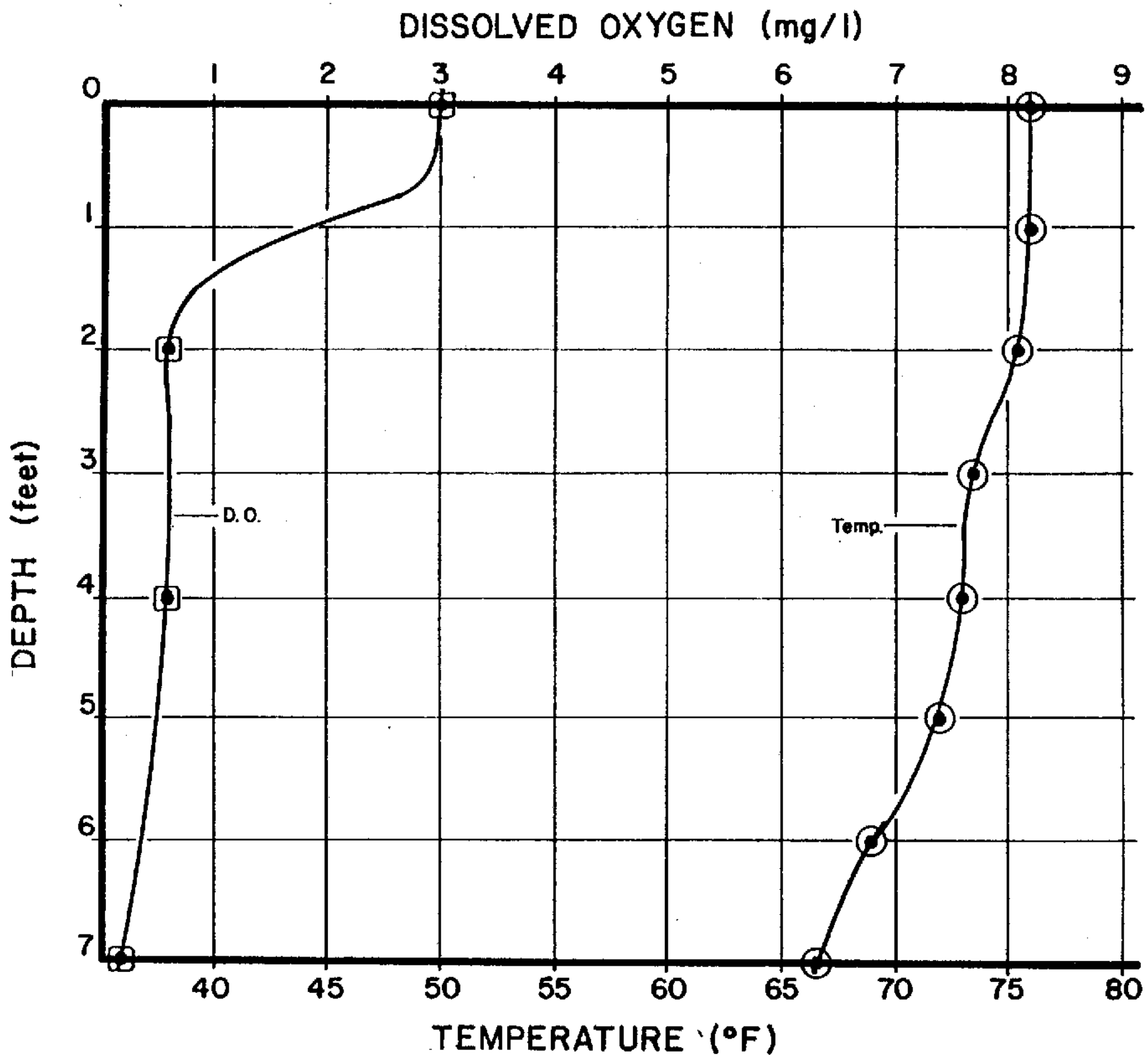


TABLE 28

CHARTLEY POND

WATER QUALITY DATA (mg/l)

August 6, 1975

PARAMETER	STA. 1 @ 0.0 FT.	STA. 1 @ 7 FT.	STA. 2	STA. 3	STA. 4
pH (Standard Units)	6.5	6.4	6.1	5.9	6.6
Total Alkalinity	20	21	20	16	20
Total Hardness	23	23	24	25	23
Ammonia-N	0.06	0.08	0.04	0.10	0.45
Nitrate-N	0.0	0.0	0.0	0.0	0.0
Total P	0.21	0.25	0.28	0.09	0.17
Silica	1.4	7.9	1.3	1.6	12
Chlorides	17	16	18	14	15
Conductivity (micromhos/cm)	110	110	116	110	110
Sulfate	4.0	4.0	4.0	3.0	4.0
Color (color units)	350	300	350	500	450
Iron	2.5	2.6	2.5	3.3	2.2
Manganese	0.17	0.21	0.30	0.12	0.16
Suspended Solids	2.0	4.5	8.0	11	1.0
Total Solids	132	136	138	182	126

TABLE 29

CHARTLEY POND

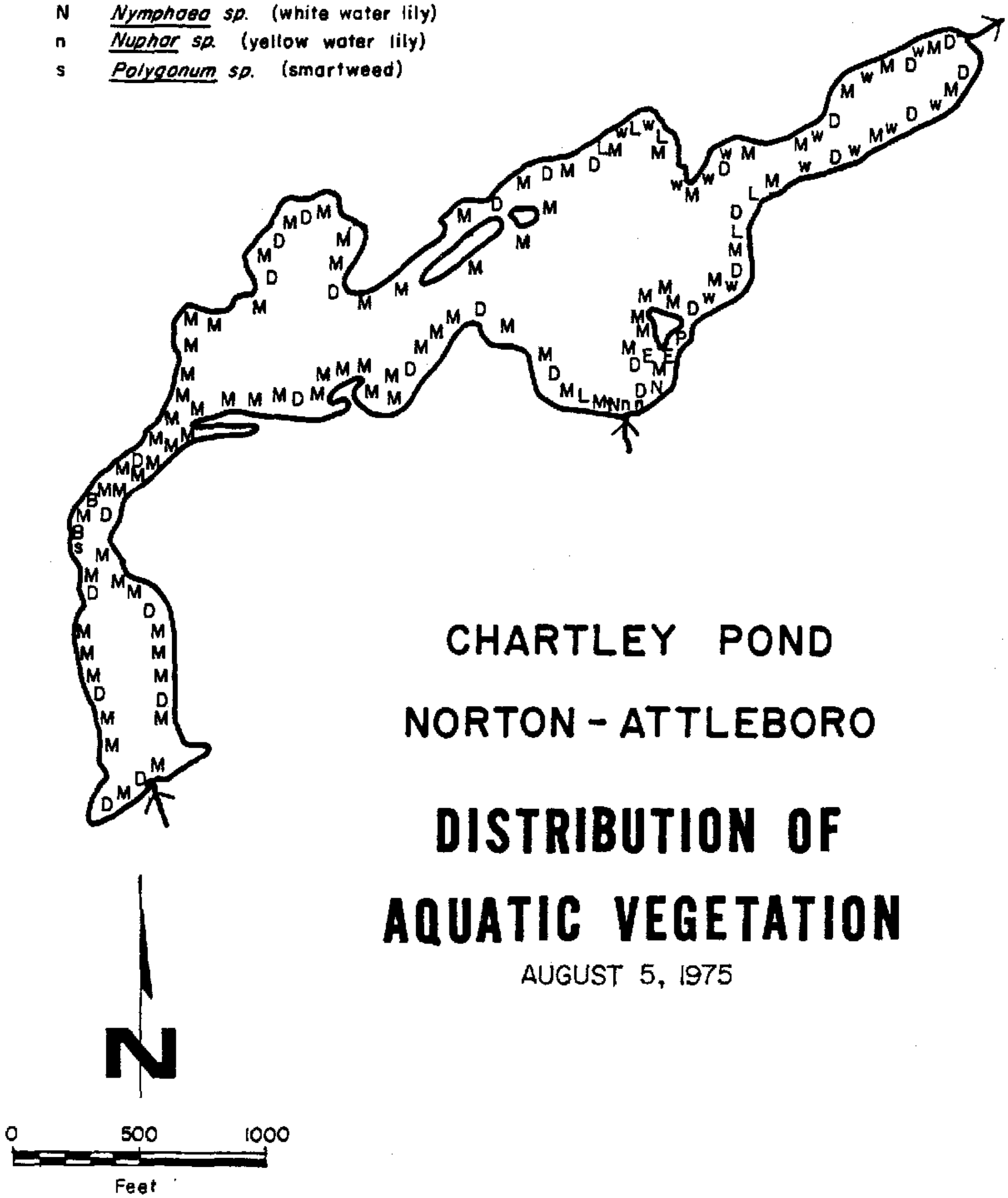
WATER QUALITY DATA (mg/l)

June 5, 1980

PARAMETER	STA. 1 @ 0 FT.	STA. 1 @ 7 FT.	STA. 2	STA. 3
Temperature (^{o}F)	68.0	67.1	64.4	68.0
Dissolved Oxygen	2.5	--	1.3	1.8
Secchi Disc (Feet)	1.3	--	--	--
pH (Standard Units)	7.1	7.0	7.3	7.1
Total Alkalinity	25	29	26	21
Total Hardness	50	45	39	18
Chlorides	20	20	20	20
Conducticity (micromhos/cm)	170	180	180	180
Total Kjeldahl-N	1.2	1.4	1.2	0.2
Ammonia-N	0.48	0.51	0.46	0.41
Nitrate-N	0.1	0.2	0.0	0.0
Total Phosphorus	0.50	0.55	0.53	0.54
Suspended Solids	2.0	4.0	2.0	3.0
Total Solids	126	128	134	134
Iron	1.9	1.9	0.80	1.8
Manganese	0.21	0.23	0.24	0.25
Total Coliform (#/100 ml)	40	--	240	20
Fecal Coliform (#/100 ml)	10	--	30	<5
Chlorophyll _a_ (mg/m^3)	3.32			

LEGEND

- M *Myriophyllum sp.* (water milfoil)
- D *Lemna sp.* (duckweed)
- B *Utricularia sp.* (bladderwort)
- L *Lythrum sp.* (loosestrife)
- P *Potamogeton sp* (pondweed)
- E *Elodea sp.* (waterweed)
- w *Pontederia sp.* (pickerelweed)
- N *Nymphaea sp.* (white water lily)
- n *Nuphar sp.* (yellow water lily)
- s *Polygonum sp.* (smartweed)



CHARTLEY POND

NORTON - ATTLEBORO

DISTRIBUTION OF AQUATIC VEGETATION

AUGUST 5, 1975

FIGURE 29

CHARTLEY POND
NORTON / ATTLEBORO
AQUATIC VEGETATION MAP
5 JUNE 1980

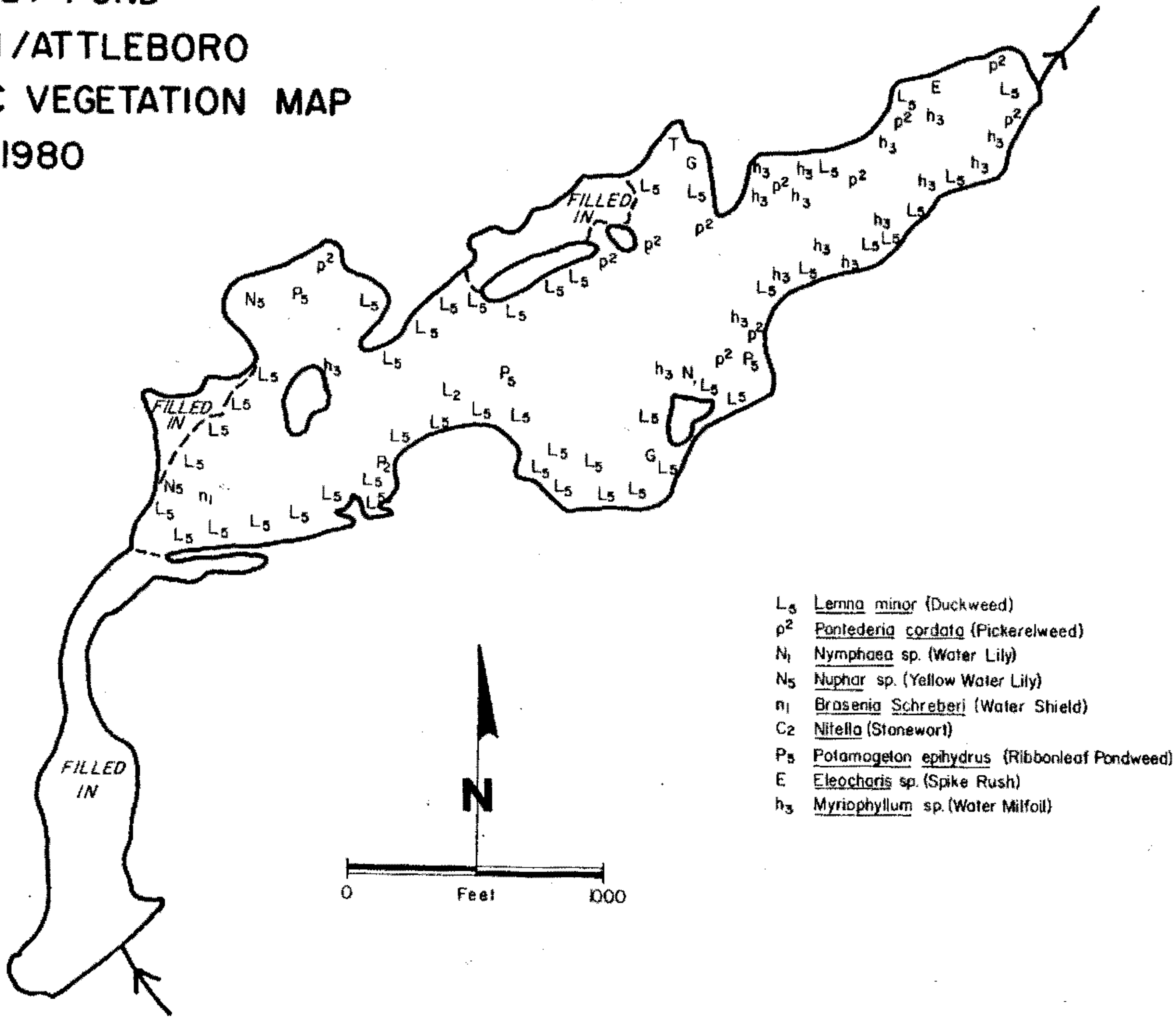


FIGURE 30

TABLE 30

CHARTLEY POND

MICROSCOPIC EXAMINATION IN AREAL STANDARD UNITS/ml

August 6, 1975

ORGANISM	STATION 1
ALGAE	
Bacillariophyceae	
Melosira sp.	72
PROTOZOA	
Mastigophora	
Mallomonas sp.	239
Eudorina sp.	254
Phacus sp.	29
Pandorina sp.	87
Pleodorina sp.	22
Crustacea[1]	3
Amorphous Matter	4,749

[1]Number of organisms

TABLE 31

CHARTLEY POND

MICROSCOPIC EXAMINATION (Cells/ml)

June 5, 1980

ORGANISM	STATION 1
Chlorophyta (Green algae)	
Oocystis sp.	28
Chrysophyta (Golden brown algae)	
Chrysophyceae	
Cryptochrysis sp.	56
Bacillariophyceae (Diatoms)	
Melosira sp.	140
Navicula sp.	28
TOTAL	252

TURNPIKE LAKE
PLAINVILLE
SAMPLING STATION MAP
27 JUNE 1979

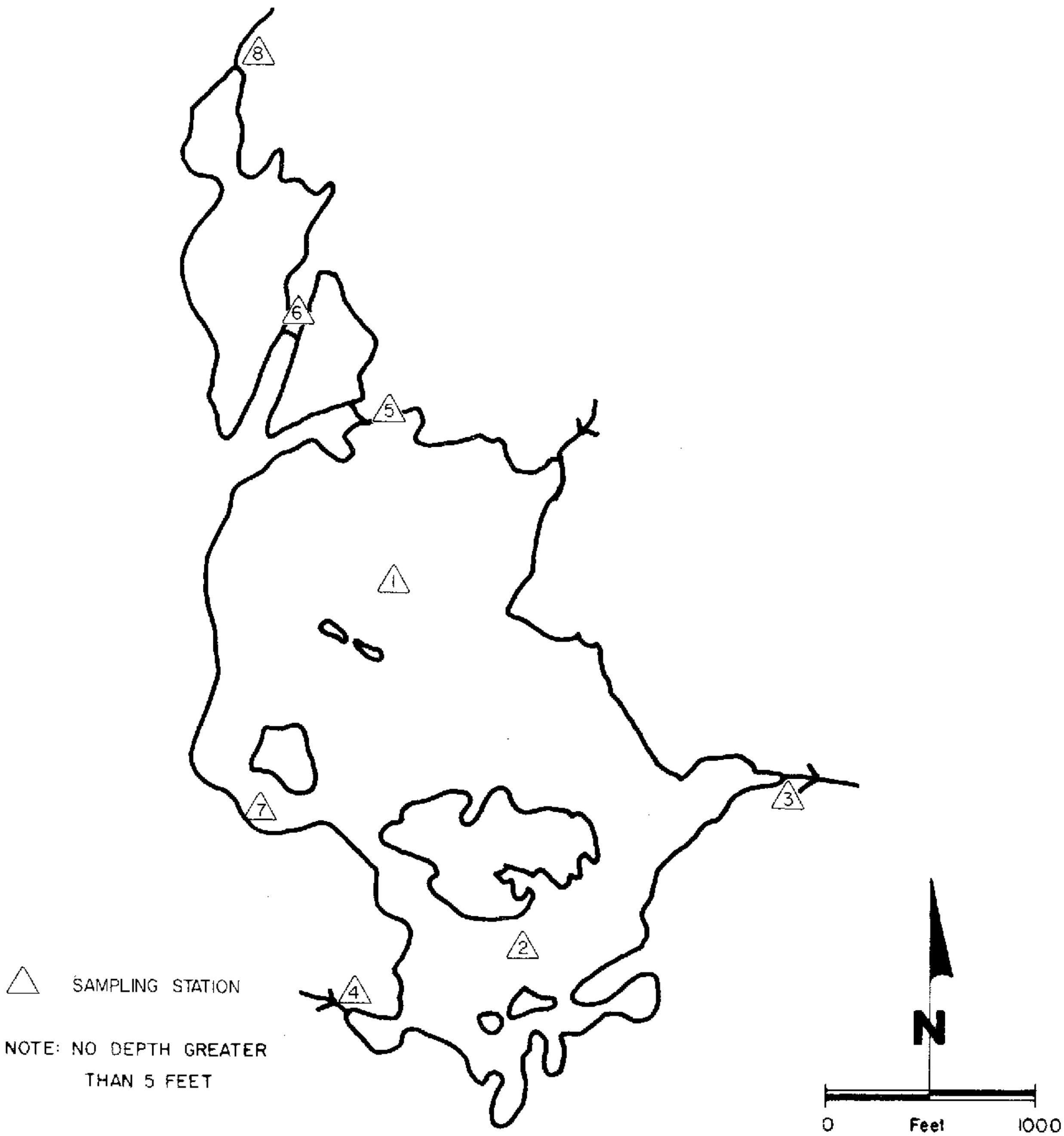


FIGURE 31

TABLE 32

TURNPIKE LAKE

MORPHOMETRIC DATA

Maximum Length	3,400 feet	1,040 meters
Maximum Effective Length	2,850 feet	870 meters
Maximum Width	2,150 feet	655 meters
Maximum Effective Width	2,100 feet	640 meters
Maximum Depth	4 feet	1.2 meters
Mean Depth	1.5 feet	0.4 meters**
Mean Width	1,470 feet	450 meters*
Area	115 acres	47 hectares*
Volume	170 acre-feet	203,900 cubic meters**
Shoreline	19,800 feet	6,000 meters*
Development of Shoreline	2.5	
Development of Volume	1.1	
Mean to Maximum Depth Ratio	0.38	

*All three basin
**Assuming 4 feet maximum depth in all three basins

TABLE 33

TURNPIKE LAKE

WATER QUALITY DATA (mg/l)

June 27, 1979

PARAMETER	STA. 1 @ 0 FT.	STA.2	STA. 3	STA. 4	STA. 5	STA. 6	STA. 7	STA. 8
Temperature (^{o}F)	72.0	75.0	70.0	69.5	69.0	72.0	69.0	62.0
Dissolved Oxygen	8.2	7.8	--	8.0	7.1	8.3	8.5	6.0
Secchi Disc (feet)	4+	--	--	--	--	--	--	--
Color (Platinum Units)	50	45	40	70	50	40	50	25
pH (Standard Units)	7.4	7.0	7.0	6.5	7.0	7.2	6.6	6.8
Total Alkalinity	15	12	12	10	20	21	9	20
Total Hardness	21	20	20	18	32	32	18	36
Chlorides	23	24	23	34	30	28	14	29
Conductivity (micromhos/cm)	133	124	120	168	165	162	96	166
Total Kjeldahl-N	0.69	0.58	0.52	0.74	0.53	0.39	0.24	0.23
Ammonia-N	0.01	0.02	0.01	0.03	0.01	0.01	0.01	0.04
Nitrate-N	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.8
Total Phosphorus	0.01	0.12	0.10	0.10	0.10	0.09	0.11	0.09
Suspended Solids	1.5	1.0	2.0	3.5	3.0	3.0	5.5	3.5
Total Solids	20	20	22	48	50	56	12	62
Iron	0.65	0.60	0.40	2.4	0.75	0.25	0.30	0.14
Manganese	0.01	0.00	0.00	0.13	0.00	0.00	0.03	0.01
Silica	2.1	0.1	3.0	2.2	0.1	1.1	4.5	10
Total Coliform (#/100 ml)	10	10	500	90	50	30	120	130
Fecal Coliform (#/100 ml)	<5	5	150	15	5	<5	5	50
Chlorophyll a (mg/m^3)	0.95							

TURNPIKE LAKE
PLAINVILLE
AQUATIC VEGETATION MAP
27 JUNE 1979

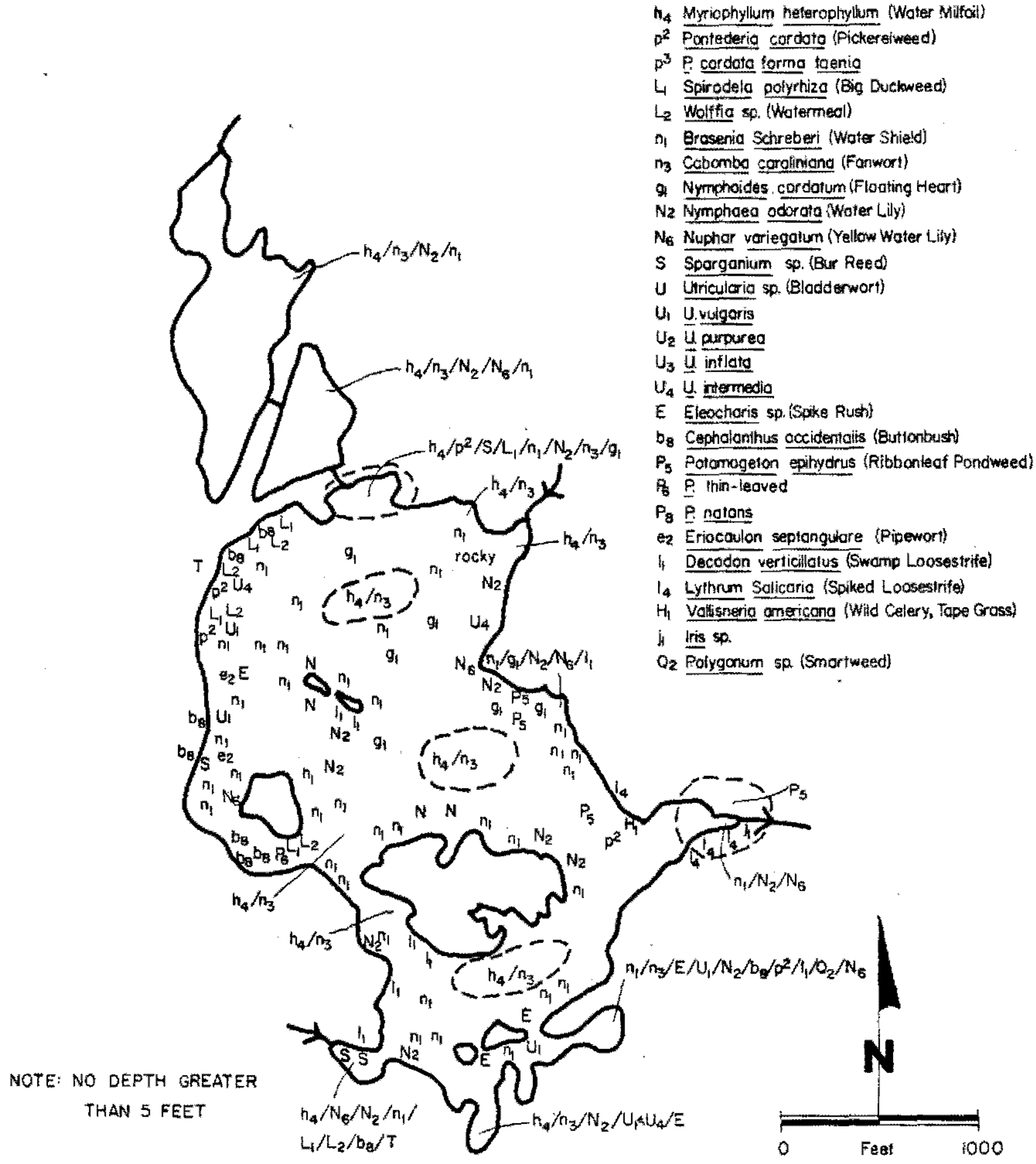


FIGURE 32

TABLE 34

TURNPIKE LAKE

MICROSCOPIC EXAMINATION (cells/ml)

June 27, 1981

ORGANISM	STATION 1
Cyanophyta (Blue-green algae)	
Unidentified coccoid form	172
Chlorophyta (Green algae)	
Haematococcus sp.	29
Closterium sp.	29
Chrysophyta (Golden brown algae)	
Chrysophyceae	
Dinobryon sp.	57
Mallomonas sp.	57
Euglenophyta	
Euglena sp.	29
Pyrrophyta (Dinoflagellates)	
Glenodinium sp.	57
Other flagellates	
Chroomonas sp.	29
Unidentified (2 types)	57
TOTAL	516

LAKE SABBATIA
TAUNTON
BATHYMETRIC MAP &
SAMPLING STATIONS
25 AUGUST 1980

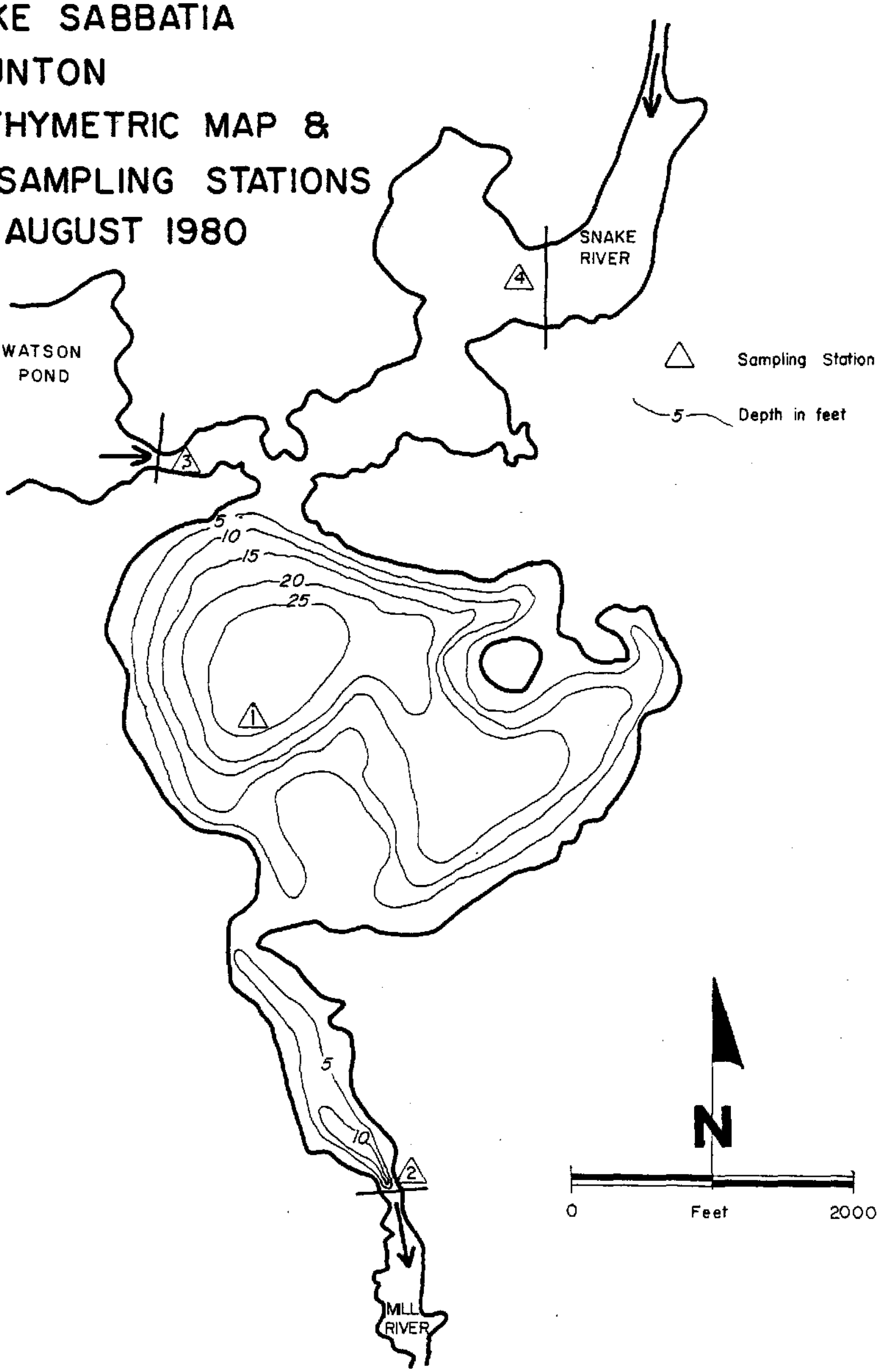


FIGURE 33

TABLE 35

LAKE SABBATIA

MORPHOMETRIC DATA

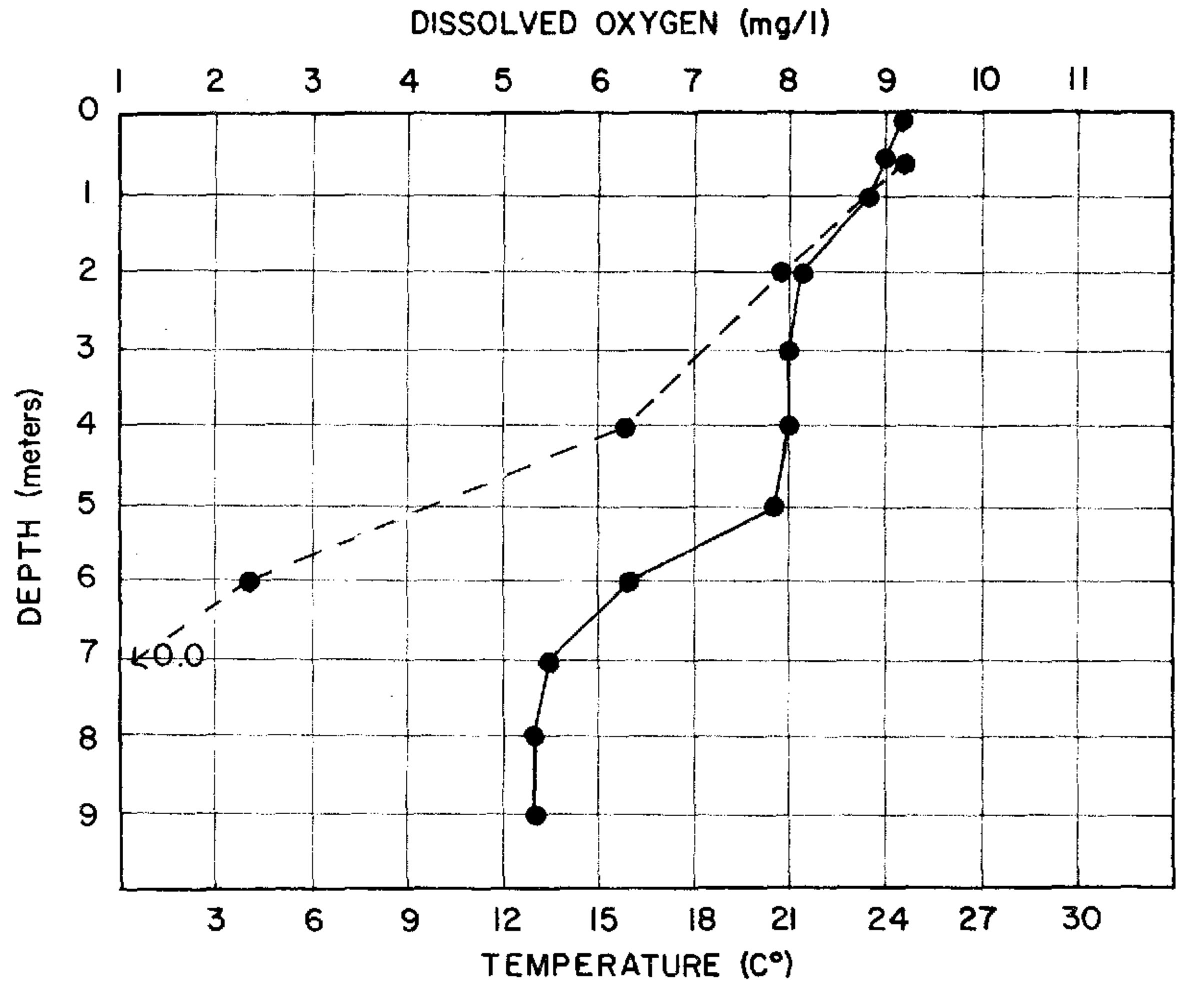
Maximum Length	3,980 feet	1,215 meters
Maximum Effective Length	3,980 feet	1,215 meters
Maximum Width	3,280 feet	1,000 meters
Maximum Effective Width	3,280 feet	1,000 meters
Maximum Depth	30 feet	9.2 meters
Mean Depth	7.5 feet	2.3 meters
Mean Width	2,750 feet	840 meters
Area	251 acres	102 hectares
Volume	1,890 acre-feet	2,305,500 cubic meters
Shoreline	27,840 feet	8,490 meters
Development of Shoreline	2.4	
Development of Volume	0.75	
Mean to Maximum Depth Ratio	0.25	

DISSOLVED OXYGEN & TEMPERATURE PROFILE — 25 AUGUST 1980

LAKE SABBATIA — TAUNTON

STATION 1

Temp. C°	D.O. mg/l	Depth meters
24.5	-	0
24.0	9.1	0.5
23.5		1.0
21.5	7.9	2.0
21.0	-	3.0
21.0	6.2	4.0
20.5	-	5.0
16.0	2.3	6.0
13.5	-	7.0
13.0	0.0	8.0
13.0	-	9.0



——— Temperature

— — — Dissolved Oxygen

FIGURE 34

TABLE 36

LAKE SABBATIA

WATER QUALITY DATA (mg/l)

August 25, 1980

PARAMETER	STA. 1 @ 1.5 ft.	STA. 1 @ 13 ft.	STA. 1 @ 26.2 ft.	STA. 2	STA. 3	STA. 4
Temperature (^oC)	24.0	21.0	13.0	26.1	26.1	24.4
Dissolved Oxygen	9.1	6.2	0.0	9.5	4.7	8.6
Secch Disc (Feet)	3.3	--	--	--	--	--
pH (Standard Units)	6.6	6.4	6.2	6.7	6.3	6.5
Total Alkalinity	8	5	11	9	13	11
Total Hardness	15	16	17	17	21	20
Chlorides	8	8	5	7	9	8
Conductivity (micromhos/cm)	68	68	68	82	82	102
Total Kjeldahl-N	1.6	0.73	1.7	0.93	1.7	0.63
Ammonia-N	0.02	0.09	0.63	0.01	0.33	0.03
Nitrate-N	0.0	0.0	0.0	0.0	0.0	0.1
Total Phosphorus	0.08	0.03	0.35	0.05	0.08	0.05
Suspended Solids	4.5	2.0	6.0	8.0	7.0	2.5
Total Solids	42	50	80	52	70	58
Iron	0.75	0.75	11	0.75	0.51	0.58
Manganese	0.07	0.08	0.90	0.03	0.15	0.10
Total Coliform (#/100 ml)	20	--	--	500	<10	340
Fecal Coliform (#/100 ml)	<5	--	--	20	<5	30
Fecal Streptocci (#/100 ml)	<5	--	--	<5	<5	<5
Chlorophyll *a* (mg/m^3)	4.57			1.62		

AQUATIC VEGETATION MAP
LAKE SABBATIA
TAUNTON
25 AUGUST 1980

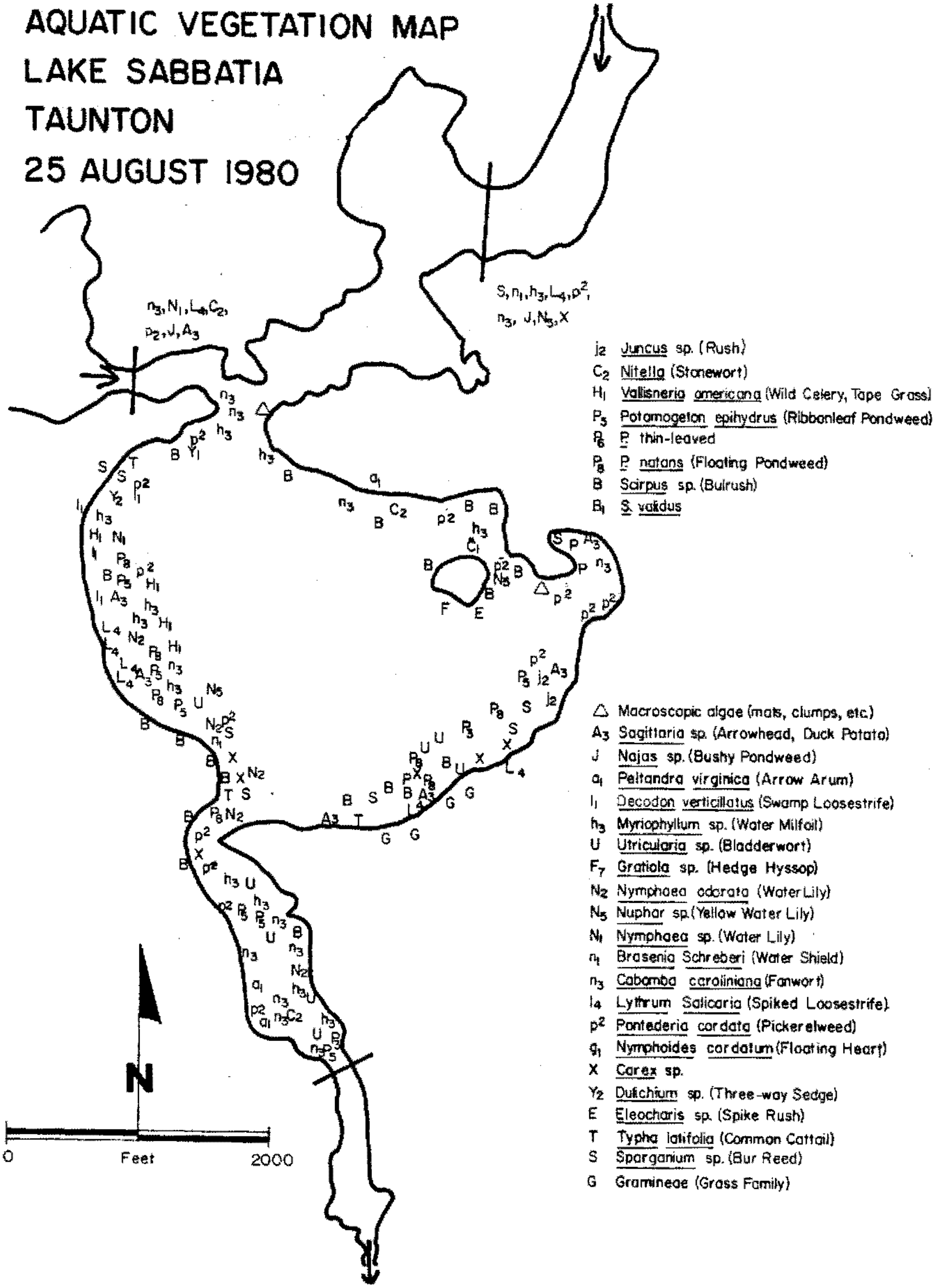


FIGURE 35

TABLE 37

LAKE SABBATIA

MICROSCOPIC EXAMINATION

August 25, 1980

ORGANISM	STATION 1	STATION 2
Cyanophyta (Bluegreen algae)		
Anabaena sp.	---	731
Coelosphaerium sp.	---	197
Microcystis sp.	---	28
Chlorophyta (Green algae)		
Coelastrum sp.	---	84
Cosmarium sp.	---	28
Elakatothrix sp.	28	---
Gleocystis sp.	56	--
Golenkinia sp.	--	28
Oocystis sp.	84	450
Sphaerocystis sp.	112	112
Staurastrum sp.	56	28
Flagellates		
Chroomonas sp.	28	--
Cryptomonas sp.	28	--
TOTAL	392	1,686

SOUTH WATUPPA POND
FALL RIVER - WESTPORT
BATHYMETRIC & SAMPLING STATION MAP
30 JUNE 1980

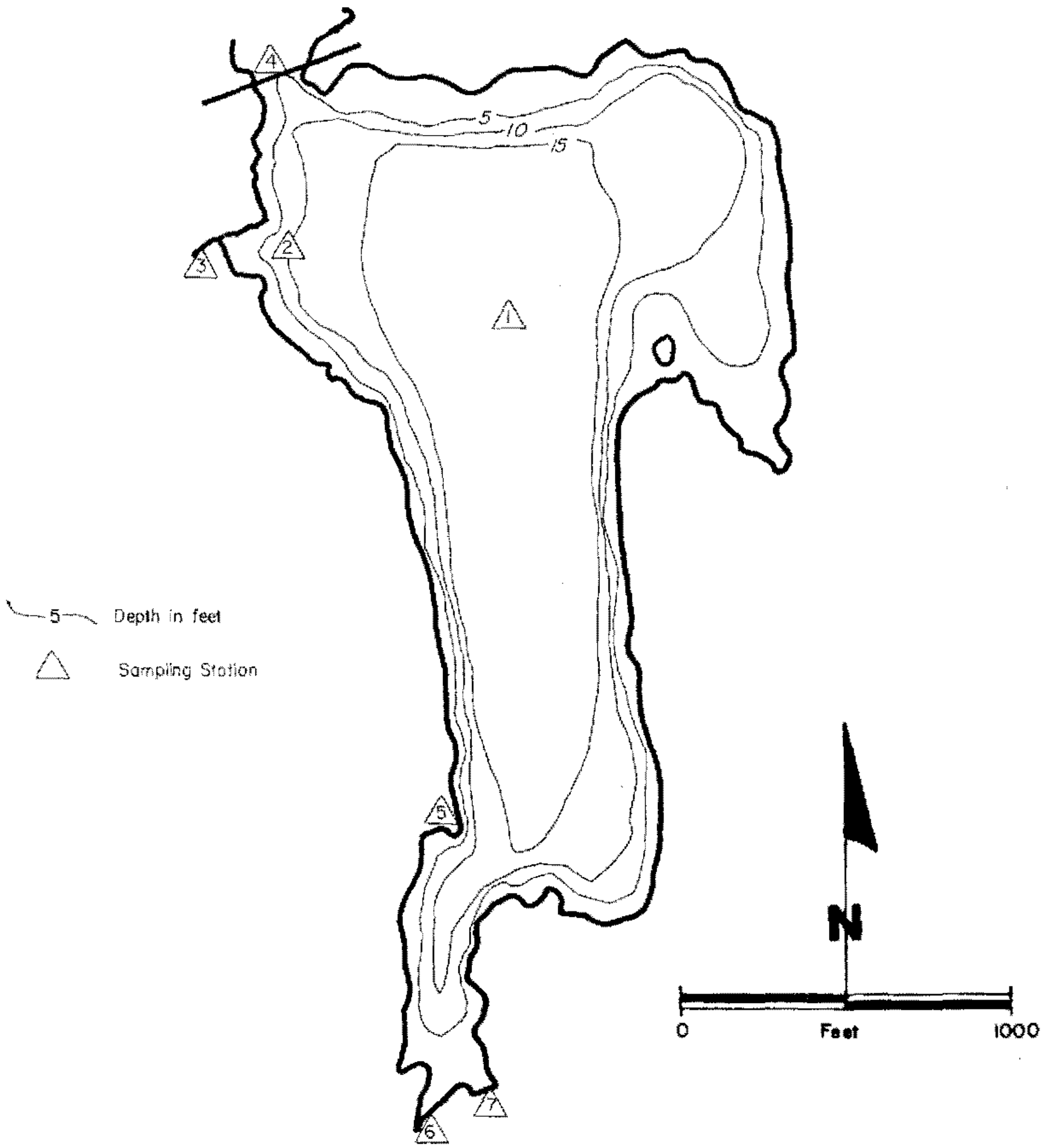


FIGURE 36

TABLE 38

SOUTH WATUPPA POND

MORPHOMETRIC DATA

Maximum Length	3.18 miles	5.12 kilometers
Maximum Effective Length	3.18 miles	5.12 kilometers
Maximum Width	1.59 miles	2.56 kilometers
Maximum Effective Width	1.59 miles	2.56 kilometers
Maximum Depth	22 feet	6.7 meters
Mean Depth	15 feet	4.6 meters
Mean Width	0.71 miles	1.14 kilometers
Area	1,446 acres	586 hectares
Volume	22,246 acre-feet	27,440,400 cubic meters
Shoreline	55,000 feet	16,790 meters
Development of Shoreline	1.8	
Development of Volume	2.1	
Mean Depth to Maximum Depth Ratio	0.68	
Drainage Area	9,449 acres	3,825 hectares

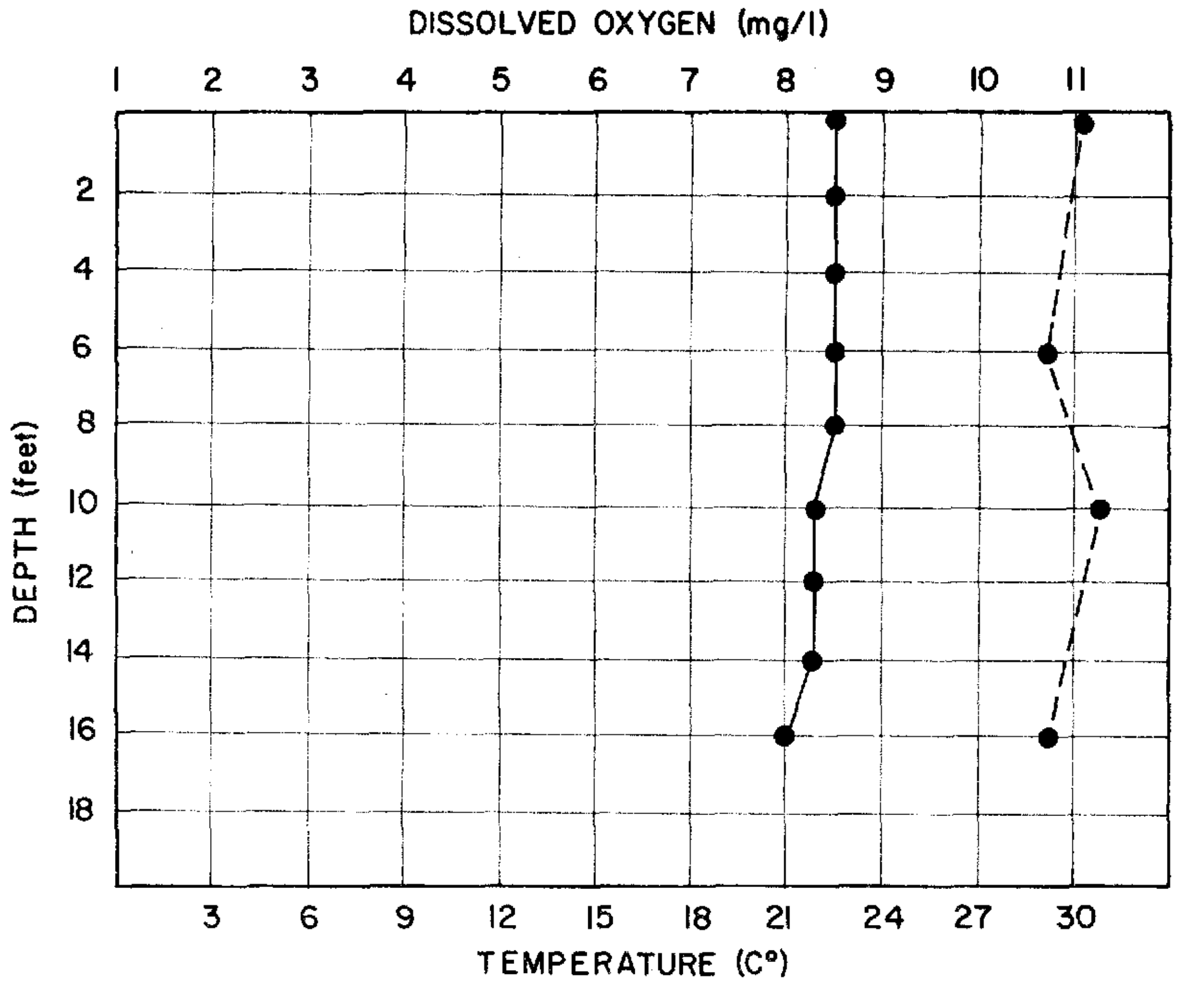
FIGURE 37

DISSOLVED OXYGEN & TEMPERATURE PROFILE — 30 JUNE 1980

SOUTH WATUPPA POND — FALL RIVER / WESTPORT

STATION I

Temp. C°	D.O. mg/l	Depth feet
22.5	11.1	0
22.5	-	2
22.5	-	4
22.5	10.7	6
22.5	-	8
22.0	11.2	10
22.0	-	12
22.0	-	14
21.0	10.7	16



——— Temperature

— — — Dissolved Oxygen

TABLE 39

SOUTH WATUPPA POND

WATER QUALITY DATA (mg/l)

June 30, 1980

PARAMETER	STA. 1 @ 0 Ft.	STA. 1 @ 15 FT.	STA. 2	STA. 3	STA. 4	STA. 5	STA. 6	STA. 7
Tempeature (^{o}C)	22.5	21.5	21.5	20.0	22.0	22.0	22.0	21.5
Dissolved Oxygen	11.1	10.7	10.3	11.0	10.4	10.5	9.8	9.5
Secchi Disc (Feet)	3.5	--	--	--	--	--	--	--
pH (Standard Units)	7.1	6.9	7.3	7.2	7.2	7.3	7.2	7.4
Total Alkalinity	12	12	10	27	14	10	11	10
Total Hardness	26	26	26	46	26	24	26	26
Chlorides	21	21	22	29	23	23	22	22
Conductivity (micromhos/cm)	138	139	142	200	144	142	137	141
Total Kjeldahl-N	0.76	0.65	0.95	0.74	0.81	0.62	0.53	0.55
Ammonia-N	0.00	0.01	0.01	0.28	0.01	0.04	0.06	0.00
Nitrate-N	0.0	0.0	0.0	1.0	0.1	0.0	0.0	0.1
Total Phosphorus	0.07	0.05	0.01	0.02	0.04	0.02	0.02	0.02
Suspended Solids	6	8	7	4	5	5	6	5
Total Solids	108	88	88	138	134	92	106	98
Iron	0.08	0.08	0.08	1.0	0.10	0.08	0.15	0.14
Manganese	0.17	0.18	0.17	0.21	0.16	0.17	0.31	0.30
Total Coliform (#/100 ml)	5	--	5	9,000	60	20	40	80
Fecal Coliform (#/100 ml)	<5	--	<5	2,200	<10	<10	10	10
Chlorophyll *a* (mg/m^3)	20.30							

SOUTH WATUPPA POND
FALL RIVER - WESTPORT
AQUATIC VEGETATION MAP
30 JUNE 1980

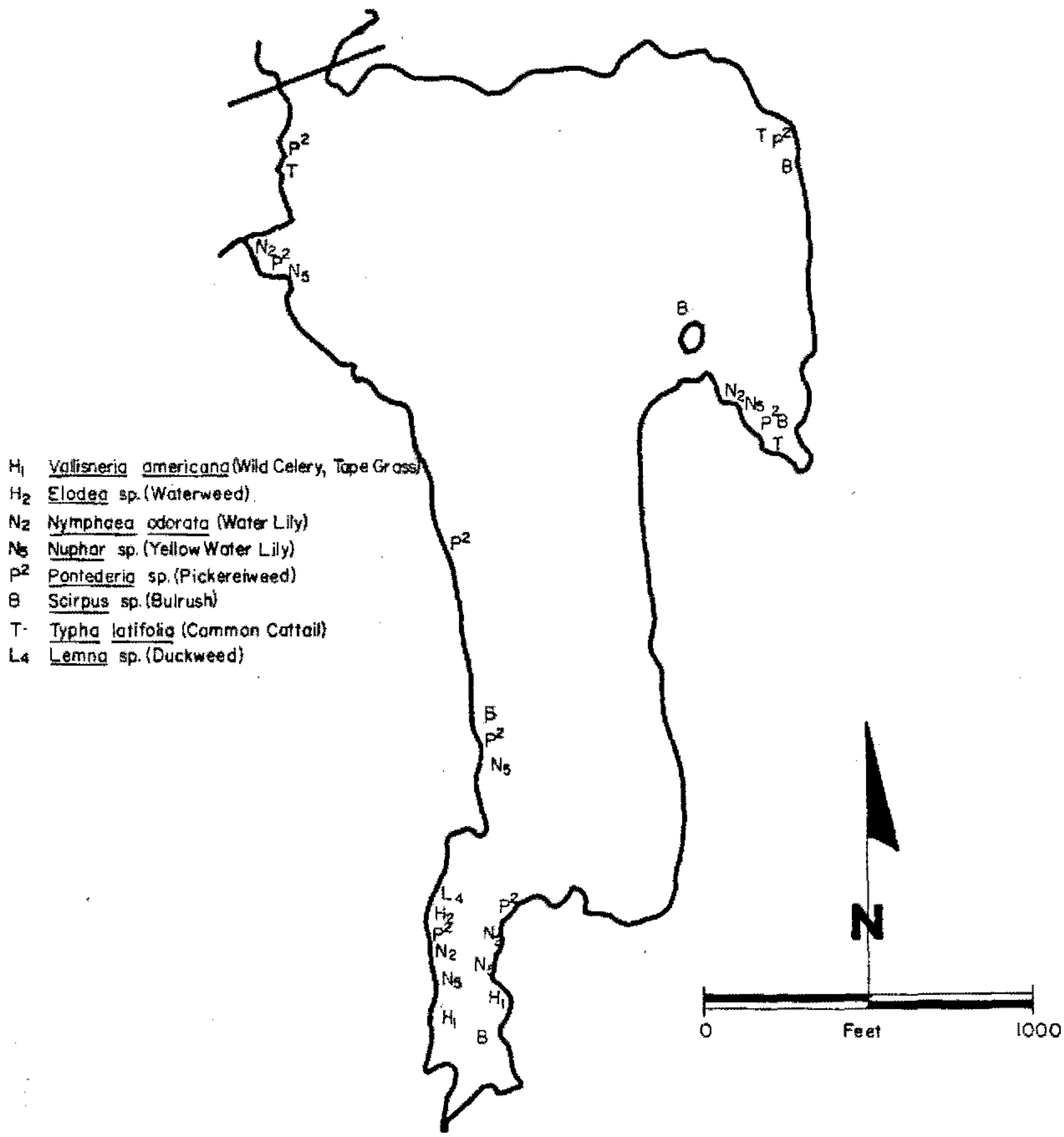


FIGURE 38

TABLE 40

SOUTH WATUPPA POND

MICROSCOPIC EXAMINATION (Cells/ml)

June 30, 1980

ORGANISM	STATION 1
Cyanophyta (Blue-green algae)	
Chroococcus sp.	534
Coelosphaerium sp.	309
Microcystis sp.	506
Chlorophyta (Green algae)	
Coelastrum sp.	84
Gleocystis sp.	28
Oocystis sp.	28
Sphaerocystis sp.	112
Staurastrum sp.	590
Chrysophyta (Golden brown algae)	
Bacillariophyceae (Diatoms)	28
Pyrrophyta (Dinoflagellates)	
Ceratium sp.	56
TOTAL	2,275

TABLE 41

TAUNTON RIVER BASIN

LAKE PRIORITY LISTING AND TROPHIC STATUS[1]

NAME	LOCATION	CLASS	TROPHIC STATUS
Chartley Pond	Norton/Attleboro	Unstratified	Eutrophic
Cleveland Pond	Abington	Unstratified	Eutrophic/ Mesotrophic
Lake Sabbatia	Taunton	Stratified	Mesotrophic
Island Grove Pond	Abington	Unstratified	Mesotrophic
South Watuppa Pond	Fall River/Westport	Unstratified	Mesotrophic
Brockton Reservoir	Avon	Stratified	Mesotrophic
Nippenicket Lane	Bridgewater	Unstratified	Mesotrophic
Winnecunnet Pond	Norton	Unstratified	Mesotrophic
Waldo Lake	Brockton/Avon	Unstratified	Mesotrophic
Turnpike Lake	Plainville	Unstratified	Mesotrophic
Robbins Pond	Bridgewater	Unstratified	Oligotrophic
Thirtyacre Pond	Brockton	Unstratified	Oligotrophic

[1] SOURCE: Commonwealth of Massachusetts, Division of Water Pollution Control. Massachusetts Lake Classification Program, Westborough, 1981.

DESCRIPTION OF TERMS

MAXIMUM LENGTH: Length of line connecting two most remote extremities of lake. Represents true open-water length; does not cross any land other than islands.

MAXIMUM EFFECTIVE LENGTH: Length of straight line connecting most remote extremities of lake along which wind and wave action occur without any kind of land interruption. Often identical with maximum length.

MAXIMUM WIDTH: Length of straight line connecting most remote transverse extremities over water at right angles to maximum length axis.

MAXIMUM EFFECTIVE WIDTH: Similar to maximum effective length only at right angles to it.

MAXIMUM DEPTH: Maximum depth known for lake.

MEAN DEPTH: Volume of lake divided by its surface area.

MEAN WIDTH: Area of lake divided by maximum length.

AREA: Refers to surface area of lake exclusive of islands. Determined by planimetry from outline of map.

VOLUME: Determined by computing the volume of each horizontal stratum as limited by the several submerged contours on the bathymetric (hydrographic) map and taking the sum of the volumes of all such strata.

SHORELINE: Length of lake's perimeter, measured from map with rotometer (map measurer).

DEVELOPMENT OF SHORELINE: Degree of regularity or irregularity of shoreline expressed as index figure. It is the ratio of the length of the shoreline to the length of the circumference of a circle of an area equal to that of the lake. It cannot be less than unity. The quantity can be regarded as a measure of the potential effect of littoral processes on the lake.

DEVELOPMENT OF VOLUME: Defined as the ratio of the volume of the lake to that of a cone of basal area equal to the lake's area and height equal to the maximum depth.

MEAN DEPTH - MAXIMUM DEPTH RATIO: Mean depth divided by maximum depth. It serves as an index figure which indicates in general the character of the approach of basin shape to conical forms.

LENTIC: Relating to still or calm water, as lakes or ponds.

LOTIC: Relating to moving water, as rivers or streams.

EPILIMNION: The circulating, superficial layer of a lake or pond lying above the metalimnion which does not exhibit thermal stratification.

METALIMNION: The layer of water in a lake between the epilimnion and hypolimnion in which the temperature exhibits the greatest difference in a vertical direction.

HYPOLIMNION: The deep layer of a lake lying below the metalimnion and removed from surface influences (i.e., not circulating).

THERMOCLINE: Coincident with metalimnion; relates to lake zone with greatest temperature change in a vertical direction.

CLINOGRADE: A stratification curve of temperature or of a chemical substance in a lake that exhibits a uniform slope from the surface into deep water.

ORTHOGRADE: A stratification curve for temperature or a chemical substance in a lake which has a straight uniform course.

HETEROGRADE: A stratification curve for temperature or a chemical substance in a lake that exhibits a non-uniform slope from top to bottom. It can be positive (metalimnetic maximum) or negative (metalimnetic minimum).

CULTURAL EUTROPHICATION: Enrichment or rapid increase in productivity of a body of water caused by man. It is an accelerated process as opposed to natural, slow aging of a body of water. Visual effects include nuisance algal blooms, low transparency, extensive aquatic plant growth, loss of cold water fisheries due to oxygen depletion, and others. It is caused by the rapid increase in nutrient additions to the lake.

AQUATIC PLANTS: An aquatic can be defined as a vascular plant that germinates and grows with at least its base in the water and is large enough to be seen with the naked eye. The following three broad categories are recognized:

1. EMERGENT: Those plants rooted at the bottom and projecting out of the water for part of their length.
   Examples: Arrowhead (*Sagittaria* sp.)
   Pickerelweed (*Pontederia* sp.)

2. FLOATING: Those which wholly or in part float on the surface of the water and usually do not project above it.
   Examples: Water shield (*Brasenia* sp.)
   Yellow water lily (*Nuphar* sp.)

3. SUBMERGED: Those which are continuously submerged (except sometimes for floating or emergent inflorescences).
   Examples: Bladderwort (*Utricularia* sp.)
   Pondweed (*Potamogeton* sp.)

SESTON: All the particulate matter suspended in the water.

DIMICTIC LAKE: One with spring and fall turnovers (temperate lakes).

SILICA: This substance (SiO_2) is necessary for diatom growth. The concentration of silica is often closely linked with the diatom populations growth. The limiting concentration is usually considered to be 0.5 mg/1.

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APPENDIX

CHLOROPHYLL a PROCEDURES

I. Reagents and Apparatus

A. Fluorometer

1. "Blue lamp" Turner No. 110-853
2. Excitation Filter: Corning CS-5-60, #5543, 2 in^2, 4.9 mm polished
3. Emission Filter: Corning CS-2-64, #2408, 2 in^2, 3.0 mm polished
4. R-136 photo multiplier tube

B. Tissue grinder and tube

C. Vacuum flask and pump

D. Millipore filter holder

E. Glass fiber filters: Reeve Angel, grade 924AH, 2.1 cm.

F. Centrifuge (Fisher Scientific Safety Centrifuge)

G. 15 ml graduated conical end centrifuge tubes with rubber stoppers

H. 90% acetone

I. 1 N HCL (11.1 dilution of distilled water to conc. HCl)

J. Saturated magnesium carbonate solution in distilled H_2O

II. Procedure

A. Filter 50 ml (or less if necessary) of sample through glass fiber filter under vacuum

B. Push the filter to the bottom of tissue grinding tube

C. Add about 3 ml of 90% acetone and 0.2 ml of the $MgCO_3$ solution

D. Grind contents for 3 minutes

E. The contents of the grinding tube are carefully washed into a 15 ml graduated centrifuge tube

F. Q.S. to 10 ml with 90% acetone

G. Tubes are then centrifuged for 20 minutes and the supernatent decanted immediately into stoppered test tubes.

Procedure (continued)

H. Test tubes are wrapped with aluminum foil and stored in the refrigerator for 24 hours.

I. The tubes are allowed to come to room temperature, the temperature recorded, the samples poured into cuvettes, and then the samples are read on the fluorometer. (The fluorometer must be warmed up for at least 1/2 hr. before taking a reading).

J. 0.2 ml of 1 N HCl solution is added to the sample in the cuvette, the cuvette stoppered and inverted and righted 4 times to mix thoroughly, and the sample is read again.

K. Both values are recorded, along with the window orifice size and whether the high sensitivity or the regular door was used.