ASSESSMENT OF BIG BOWMAN POND WITH REGARD TO WATER QUALITY, AQUATIC PLANT COMMUNITY, AND WATERSHED ACTIVITIES

A report to the
Big Bowman Pond Association

prepared by

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TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

EXECUTIVE SUMMARY

In accordance with an agreement between Big Bowman Pond Association and Rensselaer Fresh Water Institute, an assessment of the current status of Big Bowman Pond's water quality and aquatic plant community was completed in two scheduled samplings (late summer of 1989 and spring of 1990). Extended sampling and investigation were done as a result of the discovery of changes in both water chemistry and the type of aquatic plants found in the lake. The major change in the aquatic plant community was the appearance (since 1987) and proliferation of the exotic *Nymphoides cordatum* (floating heart) in many of the shallower areas of the lake. An encouraging part of this study was the absence of Eurasian Water-milfoil based on the aquatic plant survey of the entire shoreline.

The change that was chosen as a focus for further investigation was the prominent, elevated levels of chloride in lake water. After analysis of samples obtained in August of 1989, levels of this ion were observed to have steadily increased, at least since the previous FWI assessment study in 1985. Although the levels of chloride were not in the range considered hazardous to human health, it was hoped that if the cause and source of the increased chloride could be found that it would be a key to determining other influences changing the character of Big Bowman Pond. A potential source of elevated chloride levels was identified in the stream entering the southwestern corner of lake. This stream was monitored through the summer of 1990 and erratic levels of dissolved material (including chloride) were observed. Information obtained from the County Highway Department revealed that the culvert channeling this stream under Taborton Road was "packed with salt" over the previous winter in order to keep it open. Chloride levels were also monitored in the lake during this time, and contrary to the previous four-year trend, the concentrations of this ion in lake water steadily decreased over the summer to levels previously reported in 1985.

Other specific "areas of concern" identified as part of this study include: 1) erosion of the steep bank along the east shore where Lawson Road comes very close to the lakes's shoreline, 2) accelerated run-off in clear cut area around new construction on south side of the lake, 3) spring run-off coming down Scott Road and across Lawson Road directly into the lake, 4) activities near the stream coming into the north side of the lake from either a small pond or wetland, and 5) the highly developed southeastern corner of the lake through which two major run-off streams flow during the spring. The Rensselaer County Soil and Water Conservation District should be contacted for suggestion and assistance in controlling nutrient and soil erosion inputs from these and other sources around the lake.

Specific recommendations for further investigation include continued monitoring of chloride levels in the lake; determining the significance of the southwestern inlet on chloride levels in the lake as well as overall lake water chemistry; and determinations of trends in the aquatic plant community by mapping the extent of infestation of *Nymphoides cordatum* from year to year along with more extensive determinations of the entire aquatic plant community every 2-3 years. With the continued possibility of an infestation by Eurasian Watermilfoil, mapping efforts for aquatic plants should include searching for any introductions of this species.

Continued efforts by the Big Bowman Pond Association to protect the lake need to be wide-ranging and include not only items mentioned in this report which should be viewed as examples of the type of conditions requiring attention. Overall vigilance, education, and cooperation between all lake residents will need to be directed towards this effort in order for it to be successful.

INTRODUCTION

In early 1989 the Big Bowman Pond Association contacted the Rensselaer Fresh Water Institute (FWI) to request a follow-up of the water quality assessment done three years earlier (Eichler and Soracco, 1986). By July of that year it was agreed that FWI would sample the lake for water quality in the late summer and again in the spring of the next year. Along with the first water chemistry sampling, a survey of the aquatic vegetation would be done, in particular, to determine if Eurasian Watermilfoil might be present in the lake. The purpose of the second (spring) sampling was to determine the susceptibility of the lake to acid deposition, any effect of which should be most prominent at this time of year.

One of the concerns about the water chemistry of Big Bowman Pond was the level of chloride ion found in its waters, especially in comparison to other water bodies on the Rensselaer Plateau. The possibility of elevated levels of this ion was reported by Armstrong and Soracco (1990). A graph from that report is shown in Figure 1. Also unusually high was Little Bowman Pond which is located across the Taborton Road from Big Bowman Pond. Despite this common feature, the two water bodies are quit different - Little Bowman Pond is a "brown water" pond while Big Bowman has rather clear water. Much of the historical water chemistry data relating to Big Bowman Pond was identified and assembled in a two phase study supported by Rensselaer County and FWI (Armstrong and Soracco, 1989 and 1990). Excerpts from reports of these studies relating to Big Bowman Pond are contained in Appendix N and O. An important source of water chemistry and other data on the lake, identified as part of the County-wide studies, was the work reported by Adirondack Lake Survey Corporation in 1987 (ALSC, 1989). (The portion of this report pertaining to Big Bowman Pond is included in Appendix P.) In fact the data on chloride ion concentrations in Big Bowman Pond contained in this report raised a cause for concern. Not only did the values obtained by the ALSC (an average of 23.04 ppm Cl^-) contribute to elevating the average value determined for Big Bowman

Pond in the Rensselaer County study, but they indicated that the level was rising in comparison to the levels detected by FWI in 1985 (an average of 17.55 ppm Cl^-). Although these levels were not in the range considered hazardous to human health (even if the water was used for drinking), such a perceptible trend in such a short period of time definitely indicated further investigation.

When the morphological characteristics (physical dimensions) given for Big Bowman Pond by several sources are compared there exists slight differences in the values given (e.g., Appendix N compared to Appendix P). An effort was made by Armstrong and Soracco (1989) in their report to represent either the range of values given, or use what was determined by them to be the most accurate value. As an ancillary part of the present investigation, application of a desk-top geographic information system was employed to independently redetermine these characteristics and examine other information about the watershed of Big Bowman Pond - in particular, soil types within the watershed which were only briefly described in earlier reports (Scavia, 1972; Eichler and Soracco, 1986).

The scope of this report and the work done in its preparation are much broader than had been anticipated. It was intended that water chemistries needed to extend and enhance the database for Big Bowman Pond would be obtained and that a good baseline of aquatic plant populations would be established for future reference. Several unexpected results obtained during the course of the study lead to further water chemistry samplings and investigations through the summer of 1990. A satisfactory resolution of the questions raised has not been found as of this writing. Further investigations need to be designed and carried out so that recommendations can be made and appropriate actions taken. However, answers to certain question will only be obtained by continued monitoring and critical analysis of trends as they develop.

The major goals of this present report are to delineate the problems found and to document the work done so far, along with providing the baseline information that was the initial intent of this study. Also background information on the lake or references to appropriate sources have been collected together in this document to provide a basis for the continued development of a comprehensive watershed management plan in which the lake association and residents are presently engaged. An important resource for those engaged in this effort is FWI's Lake Management Manual (Eichler, et al., 1990). This document was prepared to provide a source of general information to accompany FWI's lake assessment reports, and will be used as an integral part of the present report. Therefore, references to Appendix A through M in this report can be found in the lake management manual while Appendix N through S are attached to this report. It has been assumed in the presentation and discussion of data in this report that the reader has a working knowledge of the concepts contained in the lake management manual. When unfamiliar terms or limnological principles are used or referred to in this report, it may be helpful to consult the lake management manual for clarification.

NOTE: All tables and figures have been collected into individual sections at the end of this report. Hopefully this will provide a continuity of text with easy access to supporting material when reading the report. Thereafter, the ability to refer to specific information contained in tables or figures should be made easier by not having to leaf through the whole report.

METHODS

Site Selection for Water Chemistry Sampling

In an attempt to reduce possible confusion and maintain a degree of consistency, a numbering scheme for sites where samples were taken for chemical analysis was patterned after the scheme used in the 1985 FWI study (see Figure 2). The earlier selection was based on locating sites that would be representative of the entire lake. Since this goal was achieved and no substantial difference between the chemistries of the surface sampling sites was found, only certain of these sites (#3 and #6) were used in the current study. A difference in the manner of designating sites between the two studies however does exist, i.e., site #4 was established as the deep midlake site in the 1985 study, but in the current study a designation of site #3 (the same as that used for the near surface sample) with the qualifier of the depth of sample taken has been substituted for the earlier site #4 designation.

New sites were then designated sequentially as they were selected. A brief description of these sites is given in Table 1 and their location is shown in Figure 3. Sites #7 and #8 were established near previous sites #1 and #5 respectively. Both new sites were located in a shallower area of the lake (nearer to the shore) in an attempt to determine if there was a difference in near-shore water as compared to midlake water. Sites #10 through #15 were established in late winter and early spring of 1990 during snow-melt and high run-off conditions where major input to the lake were occurring. Site #9 was established along the outlet stream because the lake surface water were not easily accessible due to ice cover. Once the ice cover had melted, site #16 was established as being representative of surface water. Further into the investigation of elevated chloride ion levels in mid-summer of 1990, site #17 was established at a "small pond"/wetland area in the southwestern portion of the lake's watershed.

Two samples of snow along Taborton Road were also obtained during the winter months. The location chosen for this sampling was about 1/8 mile west of where the road passes between Big and Little Bowman Ponds. One sample was taken on the south side of the road in the accumulations of snow resulting from plowing and the other about 15 feet further south away from the edge of the road in relatively undisturbed snow. In this report these samples are referred to as R1 and R2 respectively.

Water Chemistry Sampling and Analysis

All water samples for chemical analysis were collected in prewashed 500 ml or 1 gal plastic bottles that were rinsed with sample water just prior to sampling. The difference in sample container size depended on whether an analysis for chlorophyll a was desired. Lake surface water samples were obtained in a manner to minimize sampling the surface film and at the maximum possible distance from the sampler's hand and arm. These objectives were accomplished by submersing the open end of the rinsed sampling container (held near the container's bottom or by its handle) into the surface of the water and then tipping the container's opening into the upright position and holding the container submerged until it was filled. Run-off samples were simply allowed to flow into the rinsed container. Deep water samples were obtained by using a Van Dorn sampling bottle. The open Van Dorn bottle was lowered to the depth of the desired sample and then remotely triggered to close, thus collecting a sample of water at the depth it was triggered. Required portion of samples obtained by this method were transferred to one of the two type of plastic bottles after the bottle had been washed with part of the sample. All samples were placed on ice and returned to the laboratory for subsequent processing and analysis. During the summer-1989 and spring-1990 sampling of the lake proper, on-site measurements were taken at the midlake station that included dissolved oxygen (D.O.) and temperature profiles using a YSI Model 54 D.O./Temperature Meter and water transparency by Secchi depth.

Samples returned to the laboratory were divided in several portions to accommodate the needs of the various desired analyses. A measured amount, consisting of about half (2 - 2.5 liters) of the larger (1 gal) samples was drawn, under vacuum, through a glass fiber filter which retained phytoplankton (suspended algae). The filter was then placed in a sheet of absorbent paper, wrapped in aluminum foil, and frozen for subsequent chlorophyll a analysis. The remainder of these larger samples, as well as the smaller samples (500 ml), were divided and processed as follows:

- about 5 ml for pH and conductivity measurements;
- 100 ml for alkalinity determinations;
- about 100 ml which was frozen for subsequent total phosphorous analysis;
- about 200 ml which was filtered (0.4 um Nuclepore filter) and divided into to three portions - about 80 ml was frozen for subsequent total filterable phosphorous analysis, another approximate 80 ml was frozen for subsequent ortho-phosphate analysis, and about 50 ml was refrigerated for subsequent analyses of anions, silica, and ammonium; and
- the remaining volume (about 80 ml) was preserved with nitric acid (0.5% concentration) for subsequent analysis of metal ions.

The methods and equipment used for many of the analyses indicated above are contained in Appendix L of the lake management manual. Additional and/or alternate methods and equipment for some of the analyses performed for this study are as follows:

* Chlorophyll a - Methanol Extraction and Ultra Violet Spectrophotometry (Holm-Hansen and Riemann, 1978; Marker, 1972; and Marker et al., 1980)
* Soluble Silica - Automated Molybdate, Technicon Autoanalyzer II (Standard Method 425E)
* Chloride, Nitrate, and Sulfate - Ion Chromotrography, Dionex QIC Analyzer (EPA Method 300.0)
* Calcium (EPA Method 215.1), Copper (EPA Method 220.1), Iron (EPA Method 236.1), Magnesium (EPA Method 242.1), Potassium (EPA Method 258.1), Sodium (EPA Method 273.1) - Direct Aspiration, Perkin-Elmer Model 403 Atomic Absorption Spectrophotometer

Aquatic Plant Survey

A survey of the entire lake's littoral zone (shallow areas where aquatic plants are located) was conducted to generate a comprehensive macrophyte (aquatic plant) species list. The potential for nuisance growths of plants or the initial establishment of exotic species was also checked.

A quantitative determination of macrophyte abundance in the lake was also done using two diver swim-over transects which are shown in Figure 3. The first transect (A) was located near the outlet and was oriented in east to west direction. Since this was a narrow part of the lake, the transect extended from one shore to the other with the deepest point being 4 meters. The second transect (B) was located in the more residential area in the southeastern corner of the lake. This transect extended from the shore to a depth of 5 meters. Along each transect, the diver (LJT) recorded the abundance of all observed aquatic plant species in each 1 meter depth interval using the following abundance classes:

Class	Code	% Cover Range	Centroid
Abundant	A	Greater than 50% Cover	75%
Common	C	25% to 50% Cover	37.5%
Occasional	O	15% to 25% Cover	20%
Present	P	5% to 15% Cover	10%
Rare	R	Less than 5% Cover	2.5%

This abundance class data was summed for both transects using the centroid of the abundance class. These determination then provided both average depth distributions of plants, and an estimate of the relative abundance of all species in the lake.

Mapping

Using photocopies of appropriate sections of the 7.5 minute U.S. Geological Survey (USGS) map of the Taborton quadrant, a geographically oriented copy of the morphological features of Big Bowman Pond and its watershed were digitized into the "Desk-Top" geographical information system (GIS) MapInfo™. Digitizing of lake bottom depth contours, which are shown in Figure 4, was accomplished by first drawing contours onto a copy of the USGS map using the contours reported by ALSC (1989) as a guide. Soil types found in Big Bowman Pond's watershed were digitized into MapInfo™ from photocopies of maps provided in the Rensselaer County Soil Survey (USDA Soil Conservation Service, 1988).

Using the 4.5 DOS version of MapInfo™, the surface area of the lake and the watershed were determined. The area of the watershed was calculated by subtracting the surface area of the lake from the total area encompassed by the boundary of the watershed. The total volume of water in the lake was determined by first, calculating the volume of water contained between depth contours. These individual calculations were done by determining the area between depth contours using MapInfo™ and then multiplying these values by the average depth between the respective depth contours. These individual volumes were then summed to give the volume of the entire lake.

RESULTS

Lake Morphology and Watershed Analysis

The location, classification, and morphological (physical dimensions) characteristics of Big Bowman Pond are presented in Table 2. Since the measurements and subsequent calculations of several morphometric characteristics were based on data obtained from the boundaries digitized into MapInfo™, these data differ from that previously reported (see Appendix N and P). In general, the values presented in Table 2 are slightly higher than the earlier determinations and represent what appears to be a small (within 10%), but consistent error.

A critical factor affecting the water quality of a lake is the size, characteristics, and activities within the watershed that drains into it. The area encompassed by Big Bowman Pond's watershed is shown in Figure 5 which has the outline drawn on a copy of the USGS topological map. The ratio of the watershed area to lake surface area is about 9.0 (Table 2). This ratio is within the range typical of many lakes. As a comparison the watershed of Little Bowman Pond is shown in Figure 6, and in this case the ratio of watershed area to lake surface area is about 190. Also a number of wetland areas are included within Little Bowman Pond's watershed as compared to Big Bowman Pond's watershed which has very few wetland. These watershed characteristics help to explain the differences in water quality between these two juxtaposed water bodies (i.e., Little Bowman Pond being a very humic, "brown water" pond and Big Bowman Pond having relatively clear water).

Figure 7 shows the soil type found within the Big Bowman Pond watershed. All these soils were "formed in glacial till that was derived mainly from sandstone." Some of the soil types in the southern part of the watershed are poorly drained (Brayton) while most of the rest of the soil are well to moderately drained (Buckland). A full description of these soil types has been reproduced from the Rensselaer County Soil Survey (USDA Soil

Conservation Service, 1988), and is included as Appendix Q. Also in this appendix is a table with information derived for the soil survey document listing potential crop yields and restriction on a variety of potential land uses.

Aquatic Plants

From the survey of the entire shoreline a comprehensive list of aquatic species in Big Bowman Pond was generated. This list with Latin and common names is presented in Table 3. The most common species are listed in order of relative abundance. There were no plants present that are currently on the New York State rare plant list and, most importantly, the exotic Eurasian Watermilfoil was not seen in Big Bowman Pond. Line drawings of common native aquatic plants have been provided in Appendix K some of which were found in Big Bowman Pond. Line drawings from Muenscher (1944) and Odgen et al. (1976) of the other species found in Big Bowman Pond can be found in Appendix R with the exception of the Charophytes, *Nitella* spp. and *Chara* spp. which are macroalga.

During the survey two shallow marshy areas were investigated, one at the lakes northern most point and the other at the outlet. The first site had scattered Water Lily (*Nymphaea odorata*) and a diverse understory population. The outlet site had primarily Water Lily and Cattail (*Typha latifolia*). The embayment south of the outlet was also investigated and the dominant aquatic species were *Sagittaria graminea* and *Utricularia vulgaris*.

The relative abundance of the aquatic vegetation in Big Bowman Pond was determined from data obtained along the transects established at two selected sites (Figure 3). On Transect A (near the outlet) the six species observed are listed in Table 4, the most common being *Najas flexilis* and Charophytes. At the eastern end of this transect the White Water Lily *Nymphaea odorata* and *Potamogeton epihydrus* were prominent. On Transect B (in the southern portion of the lake) the only plant along the shoreline was the exotic

Nymphoides cordatum. This species dominated up to a depth of 1 meter. Between 1 and 4 meters an additional eleven aquatic species were observed (Table 5).

In Table 6, the average relative abundance for each species at each depth interval on both transects are given. As expected the floating leaved species were found in the shallower depths. The submersed species were seen up to a depth of 4 meters, and only Charophytes were seen at depths greater than 5 meters. The average total across all depth intervals indicates the overall estimate of abundance in Big Bowman Pond. The fourteen species able to be ranked are listed in order of abundance in the table.

The species abundance and depth range of these aquatic plants is also depicted in Figure 8 (abbreviations for the species can be found in Tables 3 and 6). This figure graphically shows that the most common species throughout the lake were Charophytes which were abundant up to and including the 5 meter point, where they were the only species seen.

In the shallow depth interval 0-1 meter the only plant present was *Nymphoides cordatum*. This plant may form a canopy such that no other plants can grow due to the lack of sunlight. In the depth interval 1-2 meters the prominent plants were *Eleocharis acicularis*, *Scirpus subterminalis*, *Potamogeton diversifolius*, *Utricularia vulgaris*, *Utricularia intermedia*, *Sagittaria graminea* and *Elodea canadensis*. These species tend to thrive best in shallow water. Also abundant at the 1 meter depth interval were *Najas flexilis* and Charophytes. These species continued to be present throughout the deeper intervals with *Najas flexilis* becoming dominate in the 2-3 meter depth interval. The absence of other species at the 2-3 meter depth interval may be due to the abundance of *Najas* and Charophytes which may out compete other species in this region.

In the 3-4 meter depth interval, *Utricularia purpurea* and *Potamogeton pusillus* were abundant sharing the bottom with *Najas* and Charophytes. The appearance of *Potamogeton epihydrus* and *Nymphaea* growing from depths of 3 and 4 meters, was quite unusual. *P. epihydrus* and *Nymphaea* have floating leaves and therefore tend to be found in shallower water.

Water Chemistry

One of the most instructive measurements of lake water chemistry is the temperature and dissolved oxygen profile obtained at several critical times during the year. In the 1985 study by FWI two of these measurements were made. One of these profiles is reproduced in Figure 9. These data were obtained in mid-summer and showed distinct stratification of the lake and oxygen depletion in the lower waters. The other profile which was included in the earlier report was taken in late fall (November 1, 1985) and showed almost no difference in these two parameter throughout the water column indicating that the lake had "turned over" and had thoroughly mixed by that time of the year. In the current study, we wanted to confirm the earlier summer data or determine if any substantial changes had occurred and also to determine what the lake's profile looked like in the spring of the year. These two profiles are shown in Figures 10 and 11 respectively. The spring profile (Figure 11) shows that the surface waters were beginning to warm and the lake was beginning to stratify. Although the levels of oxygen in the deeper waters was substantial (ca. 10 ppm) the percent saturation in these colder waters (ca. 75%) was beginning to show a depletion in oxygen even this early in the year. The summer profile (Figure 10) obtained during this study was similar to the one from the earlier study (Figure 9). They both show distinct thermal stratification and a distinct depletion of oxygen in the bottom waters (hypolimnion). This hypolimnetic depletion of oxygen is common in temperate lakes and therefore the severity of the depletion and the time it takes to occur needs to be considered. It would appear that Big Bowman Pond is typical or slightly better than similar lakes in the region.

Another similarity to regional lakes noted in the Big Bowman Pond profiles is the elevated level of oxygen at the thermocline (ca. 6 meters) during the summer months (see Figures 9 and 10). This phenomenon has been observed in the profiles obtained from several other small to medium size lakes that we have sampled in Rensselaer County. We have speculated that this is due to algae collecting at this interface between the two bodies of stratified water (epilimnion and hypolimnion).

The results of other chemical analyses of discrete samples taken from the lake and other locations within the watershed of the lake are shown in Table 7. The data are arranged in this table in three sections that reflect lake water chemistry, tributary (run-off) chemistry, and snow along Taborton Road. Table 8 provides further explanation of type and concentration units represented in Table 7. The sampling of the lake in August of 1989 and May of 1990 were what was anticipated to be the focus of this study. These data were generally consistent with those reported in 1985 (Eichler and Soracco, 1986) and 1987 (ALSC, 1989) with the exception of chloride which was accompanied by increased sodium, calcium, and potassium. There appeared to be a trend of increasing chloride levels in the lake which correlated with the above average chloride levels observed in relation to other lakes on the Plateau mention above. Figure 12 shows these data for surface water samples. Analysis of samples taken in August of 1989 served to reinforce this trend and heighten the concern to find a cause. Also not shown on the graph were the data obtained for deeper water in the lake at this time - these values were even higher (i.e., 29.3 and 36.7 ppm chloride - Table 7). It was decided after examination of this summer '89 data that samples of snow along the Taborton Road should be taken. Although levels of chloride in these snow samples were measurable, they were not inordinately high (Table 7).

It was then decided that samples of run off into the lake should be taken during the spring thaw. This effort was instructive in many ways. For instance the alkalinity (acid buffering capacity) of the water entering the eastern and southeastern part of the lake was very low, in fact some negative values were obtained both times sites in these areas were sampled (sites 11, 12, and 13 - Table 7). Run off at these site was essentially snow melt which might be expected to have low alkalinity. Overall, there appears to be a slight depression in alkalinity in lake waters in the spring of the year probably resulting from these inputs, but a recovery to previously recorded levels was observed in lake samples taken later during the summer months. These run-off waters as well as those at other sites sampled also contributed substantial amounts of silica, nitrate, and sulfate to the lake.

The initial run off sample that stood out, however, was the one taken at site 14 on March 12. Results of analysis of this sample showed a concentration of chloride of 55 ppm, and for the amount of water that was flowing at the time of that sampling this input to the lake would constitute a significant amount of chloride addition to the lake. After finding two rather high values of chloride at site 14/14A, the next two samples in May had rather moderate concentrations of chloride. (The initial sampling in March was at a point in the overland flow which subsided further into the year and samples were then taken at the outlet of the lower culvert). Continued monitoring of this site along with the newly established site 16 in the lake was then undertaken. In June and July samples taken at this culvert had extremely high levels of chloride (Table 7), however the flow of water had reduces substantially as compared to the that in the spring. These data along with that from lake surface water samples are plotted in Figure 13. At the end of July, an investigation of the source of water to this stream was conducted on the Lebarron farm land with the assistance of DEC personnel and the owner of the property. A small pond, reportedly the "head waters" of this stream, was sampled and the levels of chloride found there were extremely low (site 17 - Table 7) while the sample from the culvert had quite high chloride levels. And then a further sample at site 14A in August showed only moderate levels of chloride.

At similar times of sampling of the run off into the lake, samples of the lake were also taken and analyzed. These proved to only further cloud the understanding of the source of elevated chloride levels in the lake since levels in the lake were dropping (see Figure 14). In fact by August the levels measured in the lake were at or below those reported in 1985.

An often used measure of the overall condition and gross changes in a lake is the transparency of the water. When this measurement, obtained by Secchi depth, reported from several sources was collected together, the graph shown in Figure 15 was obtained. The values obtained in 1972 by RPI students ranged between 3.0 and 4.3 meters during their June through August sampling. During the 1985 FWI study in a comparable time of the year (July), a measurement of 4.5 meters was obtained. The other value reported in the 1985 study was the highest reported for Big Bowman Pond (5.5 meters), but it was taken in November after fall "turn over" and is not included in Figure 15. Then in 1987, the report of the Adirondack Lake Survey Corporation (see Appendix P) contained two values for Secchi depth, one in June and another in July. The value given for the June sample was 9.0 meters, but this seems inordinately high when one considers that the maximum depth of the lake is about 9 meters and three weeks later a value of 3.0 meters was obtained. It is assumed that the June measurement could have possibly been recorded in feet (which would convert to 2.7 meters), and therefore only the later July value is used in Figure 15. The Secchi depth obtained as part of this study in 1989 and 1990 and and by Ms. Karen Cobden (volunteer lay monitor) in 1989 ranged between 3.3 and 4.0 meters. Although there could be many causes for the apparent fluctuation in Secchi depths, the pattern that emerges from this data is striking with regard to recent changes in Big Bowman Pond. Over the period of increasing chloride concentrations, a rise, then a fall, and then return to previous Secchi depths were recorded and just prior to the introduction and expansion of *Nymphoides* is when a reduction in Secchi depth was recorded.

Discussion and implication of these findings have involved many individuals and groups, mainly focusing on road salting practices. A significant occurrence which was determined from the county highway department was that the culvert under the Taborton Road that channels the water leading to sampling site 14/14A was "packed with salt" over the previous winter in order to keep it open. It remains to be determined if the consequences of this action could be the cause of results like those seen in July of the following year.

DISCUSSION AND RECOMMENDATIONS

Much attention during the course of this study was focused on the elevating levels of chloride measured in the lake and their possible source. The reason for pursuing the cause of this trend in the lake's water chemistry was to determine what other influences accompanied the elevated chloride levels, when and if their cause and source could be identified. It has not been proven what the caused of this trend was and what, now seems, to be a reversal of that trend. Monitoring of these levels needs to be continued.

The one distinct trend that was documented was that there has been a dramatic change in the aquatic plant community since the last FWI study of the lake done in 1985 (Eichler and Soracco, 1986) and even since the study conducted by the Adirondack Lake Survey Corporation in 1987 (ALSC, 1989). In the earlier survey conducted by FWI the most abundant submersed species were *Potamogeton robbinsii* and *Potamogeton amplifolius*. In the survey done as part of this study in 1989 these species were not present and seemed to be replaced by *Potamogeton epihydrus* and *Potamogeton pusillus*. The invasion of *Nymphoides cordatum* also appears to be a recent event. This plant was not documented in 1985 or 1987. Whether these rather large changes in the aquatic plant community can be linked directly to changes in lake water chemistry (e.g., elevated chloride levels and thus increased ionic strength) cannot as yet be determined. It is also uncertain if the trends in water chemistry will persist (refer to 1990 lake chloride data). It will be important to determine future trends in both of these aspects of the lake in order to determine what linkage may exist between them and if any course of action is needed.

The exotic "floating heart" *Nymphoides cordatum* maintained a strong and healthy presences in the lake through the summer 1990. Few studies have been done on the nuisance potential of this plant, however as already seen on Big Bowman Pond, it does form large dense floating patches close to the shoreline. These patches make recreational activities such as swimming and boating very difficult. The potential is there for this plant to colonize the entire shoreline of the lake. This plant should be carefully monitored over the next few years, to prepare for the possibility of management. It should be reiterated that no plants listed on the New York State rare plant list were found in Big Bowman Pond which will facilitate the permitting process for any future management projects. The current practice of clearing boating and swimming areas of the plant should be condoned and even encouraged with removal of roots and the disposal of plant material away from lake and shoreline areas.

A project should be initiated to document the extent to which this invasive plant colonized the lake from year-to-year in order to objectively determine what the trend of this infestation is. This documentation can easily be done by lake association members by drawing a map of the beds at the height of the growing season (July-August). Notes should be made of cleared areas for later determination of reinfestation.

The native plant *Potamogeton epihydrus*, although found in several dense patches should not be considered a nuisance plant. The plant was found growing to the surface from depths of 3-4 meters. Other than the Water Lily, this is the only plant that extends through the water column offering a good habitat for various species of fish. As long as this plant does not proliferate to unduly interfere with boating and fishing it should not be viewed with concern. Its presence and extent of coverage could be a good indicator of changes taking place in Big Bowman Pond and should be used as a monitoring tool.

A bright spot in the aquatic plant community picture of Big Bowman Pond is the absence of Eurasian Watermilfoil. However, there exists a real possibility that it could be introduced from other lakes in the county and regulations that can prevent its introduction (e.g., present boating limitations) should be diligently enforced and others put into effect to prevent this from happening (see Appendix C).

It would be advisable to have an aquatic plant survey like that done in 1989 repeated every 2-3 years for comparison purposed especially in light of the rapidity of change in this community over the 4 years between 1985 and 1989.

In general the characteristics of the water chemistry and sediments and thus the plant and animal community which thrive in Big Bowman Pond are controlled by what drains into the lake. Peaks in these additions occur during time of heavy run off. It is neither practical nor desirable to totally divert water flowing into the lake, but it is important to control the composition of these waters as much as possible. The residents around Big Bowman Pond need to be aware of and to control conditions that lead to increasing the nutrient content and other pollutants in water entering the lake. There were several instances noted during this study that could use improvement and there are many more that individual residents could identify. The ones mentioned here should only serve as examples.

Obviously, further investigations need to be done of the situation at the southwest input stream where high chloride levels were measured. As a first step, the impact of road salting practices in this area should be investigated. A primary question to be answered is whether material deposited in the winter could be retained in soils or elsewhere and then be released later in the summer as might be indicated by the results of the July, 1990 sampling of this stream.

Several other areas along the shoreline appear to have a potential for contributing nutrients and sediment to the lake. These areas of concern include: 1) erosion of the steep bank along the east shore where Lawson Road comes very close to the lakes's shoreline, 2) accelerated run-off in clear cut area around new construction on the south side of the lake, 3) spring run-off coming down Scott Road and across Lawson Road directly into the lake, 4) activities near the stream coming into the north side of the lake from either a small pond or wetland, and 5) the highly developed southeastern corner of the lake through which two major run-off streams flow during the spring.

From the perspective of sitting in a boat on the middle of Big Bowman Pond, two prominent, disturbing features are readily obvious. The steep, bare bank in the middle of the eastern shoreline shows signs of erosion, and according to some accounts, material (sand) has been added on several occasions only to later be washed into the lake. This bank should be stabilized either with vegetation or by construction of some type of retaining structure. The Rensselaer Soil Conservation District should be contacted for advice on appropriate measures. The other noticeable area from a mid-lake vantage is along the southern shoreline where a substantial clear cut has been done in conjunction with a new construction. This area should be revegetated with plants that can control run-off into the lake. Again the Rensselaer Soil Conservation District should be contacted for suggestions of the types of plantings that could be done.

Another concern in this area of the lake was raised by Mr. and Mrs. Dan Coiteux in July of 1990. They requested an investigation by regional DEC personnel of their "observance of an orange/rusty colored material along the shoreline." A copy of the report of this investigation is included in Appendix S. Although this observation was attributed to substantial levels of iron in the water, no suggestions of its basic cause or remediation were offered. Further the report includes data on chloride levels within the lake and "a small tributary in the southwest corner of the lake." The levels of chloride differ substantially from those obtained in conjunction with the study presented here. Not withstanding that the DEC representative making this report accompanied one of us (RJS) on the investigation to determine the source of elevated chloride found in the southwest stream documented here, no communication about these series of separate, somewhat conflicting, observation has taken place. Therefore no resolution of differences between this observation (and for that matter where particular sampling sites were located and what methods of sample preparation and analysis were done) has yet occurred as of the writing of the present report - hopefully response to this report by DEC personnel will serve to foster the necessary communication.

Other inputs to the lake that deserve some attention are the stream entering from the north and the spring run-off from Scott Road and along the southeastern area of the lake. Activities in and around the wetland/pond and the stream entering the north part of the lake should be determined for their potential for adding nutrients and other materials to the lake (e.g., during one of the spring 1990 samplings, a hose with a moderate stream of water flowing from an unknown source was located next to this stream). Also during these samplings large volumes of water were entering the lake near Scott road and two culverts under Taborton Road in the southeastern corner of the lake. Results of chemical analysis of samples of these waters (see Table 7) were indicative of snowmelt, but elevated levels of nitrate are of concern as reflected in lake water chemistry which show increased levels in the spring and often measurable levels of nitrate and ammonia throughout the year (see Table 7 and Appendix O). Measures should be taken to minimize the input of nutrients to these waters.

Potential problems in this area relate to development along Scott Road and in the southeastern portion of the lake. Flooding in these areas during this time of year can result in nutrient additions to these waters. These nutrient additions are especially of concern with regard to septic systems. The subject of septic systems was exhaustively covered in the earlier FWI report (Eichler and Soracco, 1986), and this document should be consulted for further actions that could be undertaken.

All these "areas of concern" deserve attention by the Big Bowman Pond Association, and to the extent that the Rensselaer Fresh Water Institute can be of assistance, we would like to continue our involvement with this group.

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Critical review of the data and this manuscript was provided by Mr. Lawrence Eichler, Dr. Robert Lafluer, and Dr. Roger Armstrong. This report is FWI scientific contribution number 572.

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LIST OF TABLES

TABLE 1. Water chemistry sampling sites.

Site Number	Location
RWA1	East Shore opposite Cobdon residence
FWI3	Center of lake at the deepest point
FWI6	Center of the southeastern bay
FWI7	Center of the northern bay across from a windmill structure - further north than site #1 of the 1985 FWI study
FWI8	Center of small western midlake bay further in the bay than site #5 of the 1985 FWI study
FWI9	Outlet stream west of the bridge on the access road
FWIT10	Northern inlet stream north of the culvert under the east/west access road north of the lake
FWIT11	West side of culvert under Lawson Road south of Scott Road
FWIT12	North side of culvert under Taborton Road across from T. Brown's house
FWIT13	North side of culvert under Taborton Road west of site #12
FWIT14	Overland flow past culvert along southwest access road (east of fork in road)
FWIT14A	North side (outlet) of culvert along southwest access road "upstream" of site 14
FWIT15	West side of culvert under Lawson Road at northern end of lake near windmill structure
FWI16	End of dock on south eastern shore across from P.O. Box 120B
FWIT17	Small pond south west of lake on LeBarron farm

TABLE 2. Location, classification, and morphological characteristics of Big Bowman Pond.

PHYSICAL LOCATION AND CLASSIFICATION

Latitude	---	42° 39' 01"
Longitude	---	73° 29' 20"
Elevation above Sea Level	---	1,411 ft (430 m)
Topographical Quadrangle	---	Taborton
Watershed	---	Lower Hudson
DEC Pond Number	---	444
Water Quality Classification	---	B

MORPHOMETRY AND DYNAMICS

Shoreline Length	---	1.22 miles (1.96 km)
Surface Area	---	30.6 acres (12.4 hectares)
Watershed Area	---	275 acres (111 hectares)
Area Ratio: Watershed to Lake	---	9.0
Volume	---	364,680 m^3 (96.4 m-gal)
Maximum Depth	---	33 ft (10 m)
Mean Depth	---	9.66 ft (2.94 m)
Mean Annual Precipitation	---	46 cm
Flushing Rate	---	1.40 times/years

TABLE 3. Aquatic plant species found in Big Bowman Pond on 9 August, 1989.

LATIN NAME	ABR	COMMON NAME
MOST COMMON SPECIES IN ORDER OF RELATIVE ABUNDANCE		
Nymphoides cordatum	NC	Floating Heart
Charophytes (Nitella spp. & Chara spp.)	NS	Macroalga
Najas flexilis	NF	Bushy Pondweed
Utricularia vulgaris	UV	Bladderwort
Utricularia purpurea	UP	Purple-flowered Bladderwort
Nymphaea odorata	NO	White Water Lily
Sparganium fluctuans	SF	Bur-reed
Potamogeton epihydrus	PE	Pondweed
OTHER SPECIES FOUND		
LATIN NAME	ABR	COMMON NAME
Eleocharis acicularis	EA	Spike Rush
Elodea canadensis	EC	Waterweed
Equisetum fluviatile	EF	Marsh Horsetail
Eriocaulon septangulare	ES	Pipewort
Isoetes echinospora var. braunii	IB	Quillwort
Pontederia cordata	PC	Pickerelweed
Potamogeton diversifolius	PD	Spiral Pondweed
Potamogeton pusillus	PP	Pondweed
Sagittaria latifolia	SL	Arrowhead
Sagittaria graminea	SG	Arrowhead
Scirpus subterminalis	SS	Bulrush
Typha latifolia (shoreline)	TL	Broad-leaved Cattail
Utricularia intermedia	UI	Intermediate Bladderwort
Zizania aquatica (shoreline)	ZA	Wild Rice

ABR = Abbreviation

TABLE 4. Vegetation data for Transect A in Big Bowman Pond on 9 August, 1989.

SPECIES	DEPTH INTERVAL (METERS) West Edge 0-1	1-2	2-3	Middle 3-4	East Edge 3-4
Najas flexilis		A	A	O	A
Charophytes		A	A	A	A
Nymphaea odorata					A
Potamogeton diversifolius		P	R		
Potamogeton epihydrus		O	P	O	P
Utricularia intermedia		P	R		

ABUNDANCE CODES:

LETTER	LABEL	PERCENTAGE RANGE
A	ABUNDANT	>50%
C	COMMON	25-50%
P	PRESENT	15-25%
O	OCCASSIONAL	5-15%
R	RARE	<5%

NOTES: This transect went from the east side to the west side of the pond near the outlet. The maximum depth was 4 meters.

TABLE 5. Vegetation data for Transect B in Big Bowman Pond on 9 August, 1989.

SPECIES	DEPTH INTERVAL (METERS) 0-1	1-2	2-3	3-4	4-5
Eleocharis acicularis		O			
Elodea canadensis		A	R	R	
Najas flexilis			A		
Charophytes		A	A	A	A
Nymphoides cordatum	A				
Potamogeton epihydrus		R	C	C	
Potamogeton pusillus				A	
Sagittaria graminea		A			
Scirpus subterminalis		O			
Utricularia intermedia		C			
Utricularia purpurea		R		A	
Utricularia vulgaris		C			

ABUNDANCE CODES:

LETTER	LABEL	PERCENTAGE RANGE
A	ABUNDANT	>50%
C	COMMON	25-50%
P	PRESENT	15-25%
O	OCCASSIONAL	5-15%
R	RARE	<5%

NOTES: This transect went from the south eastern end of the pond toward the center. The maximum depth was 5 meters.

TABLE 6. Aquatic plant species abundance found in Big Bowman Pond on 9 August, 1989.

SPECIES	ABR	DEPTH INTERVAL (METERS) 0-1	1-2	2-3	3-4	4-5	TOTAL
Charophytes	NS	0	75	75	75	75	60
Najas flexilis	NF	0	38	75	28	0	28
Potamogeton epihydrus	PE	0	6	29	28	0	13
Elodea canadensis	EC	0	38	1	1	0	8
Sagittaria graminea	SG	0	38	0	0	0	8
Nymphoides cordatum	NC	38	0	0	0	0	8
Utricularia intermedia	UI	0	29	1	0	0	6
Utricularia purpurea	UP	0	1	0	25	0	5
Potamogeton pusillus	PP	0	0	0	25	0	5
Nymphaea odorata	NO	0	0	0	25	0	5
Utricularia vulgaris	UV	0	19	0	0	0	4
Potamogeton diversifolius	PD	0	10	1	0	0	2
Scirpus subterminalis	SS	0	5	0	0	0	1
Eleocharis acicularis	EA	0	5	0	0	0	1

ABR = Abbreviation

TABLE 7. Results of chemical analyses of samples from Big Bowman Pond, its tributaries, and snow in its watershed.

Site Code	Date	Depth	Smp Type	Alk	Ca	Chla	Cl	Cond	Fe	K	Mg	Na	NH4-N	NO3-N	OP	Direct pH	A-Eq pH	Secc	SiO2-Si	SO4-S	TDP	TP
											IN-LAKE SAMPLES											
RWA1	25-Jul-89	0.0	D	8.8	5.6		24.6	108.5		0.74	0.96	14.3	0.111	-0.002		7.24	7.34		1.02	2.76		
FWI3	09-Aug-89	0.5	D+	9.1	6.0	0.7	25.5	125.2	0.02	0.65	0.80	15.0	0.030	0.010	-0.001	7.28	7.64	4.0	1.00	2.91		0.007
FWI3	09-Aug-89	4.5	D+	7.0	6.0		36.7	135.2	0.02	0.82	0.80	16.0	0.100	0.087	-0.001	6.80	7.54		0.61	3.10		0.009
FWI3	09-Aug-89	8.0	D+	12.1	7.0		29.3	147.9	0.02	0.76	1.12	17.0	0.200	0.452	0.003	6.65	7.82		0.74	2.52		0.013
FWI7	09-Aug-89	0.0	D	8.9	6.0		23.3	122.7	0.15	0.67	1.04	14.0	0.030	-0.002	0.003	7.09	7.63		1.11	2.78		0.013
FWI8	09-Aug-89	0.0	D	7.4	6.0		24.6	123.8	0.06	0.67	1.04	15.0	0.070	0.017	0.001	7.25	7.65		1.01	2.91		0.010
FWI9	12-Mar-90	0.0	D	8.4	5.0		19.6	109.3	0.15	0.60	0.88	12.0	0.030	0.163		6.42	7.31		0.93	2.63		
FWI9	22-Mar-90	0.0	D	7.4	4.8		23.4	122.6		0.66	1.04	14.0	0.020	0.200		6.61	7.18		1.68	2.64	0.005	0.009
FWI16	22-Mar-90	0.0	D	7.8	5.0		24.2	124.1		0.66	1.05	13.9	0.010	0.200		6.46	7.24		1.68	2.63	0.029	0.033
FWI3	01-May-90	0.0	D+	6.5	4.7	1.5	21.8	94.5		1.02	0.98	13.6	0.040	0.164	0.001	6.91	7.16	4.0	1.54	2.99	0.005	0.016
FWI3	01-May-90	8.0	D+	6.6	4.8	1.4	22.3	97.9		0.90	0.91	13.6	0.020	0.186	0.001	6.52	6.81		1.61	2.99	0.004	0.016
FWI6	01-May-90	0.0	D	6.6	4.8	1.6	21.3	95.3		0.60	0.91	12.7	0.010	0.162	0.002	6.86	7.15		1.50	2.99	0.005	0.006
FWI7	01-May-90	0.0	D	7.1	4.5	2.8	19.7	92.2		0.64	0.98	11.7	0.040	0.131	0.005	6.58	6.94		1.39	2.90	0.007	0.009
FWI8	01-May-90	0.0	D	11.3	4.5	1.2	21.2	95.5		0.70	0.91	12.8	0.020	0.156	0.002	6.82	6.96		1.46	2.94	0.005	0.006
FWI16	24-May-90	0.0	D	6.6	4.5		18.3	86.4		0.59	0.88	11.4	-0.010	0.082		6.79	7.02		1.54	2.71	0.003	0.008
FWI16	26-Jun-90	0.0	D	7.9	4.3		18.4	96.1		0.58	0.91	11.6	-0.010	0.015		7.23	6.94		1.02	2.75	0.005	0.011
FWI16	05-Jul-90	0.0	D	8.2	4.9		17.7	93.4		0.67	0.91	11.8	0.014	-0.002		7.33	7.30		0.98	2.65	0.005	0.013
FWI16	27-Jul-90	0.0	D	9.5	5.1		18.2	94.4		0.61	0.95	12.3	0.005	0.007		7.13	7.40		0.98	2.60	0.005	0.009
FWI16	09-Aug-90	0.0	D	9.6	4.9		16.5	89.6		0.60	0.84	12.2	-0.010	0.028		6.96	7.33		0.94	2.45	0.007	0.009
											TRIBUTARY SAMPLES											
FWIT10	12-Mar-90		D	5.0	4.0		11.0	81.5	0.18	0.74	0.80	7.0	0.050	0.434		6.13	7.13		2.30	2.94		
FWIT11	12-Mar-90		D	-1.5	1.5		1.3	41.0	0.10	0.60	0.64	1.5	0.050	0.627		4.69	4.66		1.80	2.53		
FWIT12	12-Mar-90		D	-0.4	1.5		3.9	46.1	0.10	0.42	0.96	3.2	-0.010	0.361		4.78	5.05		0.05	2.57		
FWIT13	12-Mar-90		D	0.8	2.0		9.6	66.0	0.08	0.46	1.12	8.0	-0.010	0.321		5.47	6.04		1.88	2.84		
FWIT14	12-Mar-90		D	9.9	7.0		55.0	249.0	0.14	1.76	1.52	34.0	0.100	0.619		6.66	7.25		1.30	3.59		
FWIT10	22-Mar-90		D	4.2	3.7		9.6	72.1		0.52	0.80	5.1	0.030	0.428		6.07	6.97		2.60	3.08	0.003	0.005
FWIT11	22-Mar-90		D	-1.1	0.8		0.9	34.8		0.48	0.48	1.1	0.040	0.170		4.62	4.71		2.34	2.49	0.022	0.024
FWIT12	22-Mar-90		D	-0.4	0.9		2.0	35.9		0.22	0.48	2.0	-0.010	0.056		4.89	5.08		2.20	2.66	0.004	0.005
FWIT13	22-Mar-90		D	2.9	1.9		14.8	84.1		0.31	0.72	8.4	0.010	0.065		6.00	6.85		2.23	3.17	0.004	0.005
FWIT15	22-Mar-90		D	6.3	2.4		2.1	50.7		0.52	0.80	2.5	0.010	0.364		6.20	7.20		2.60	3.23	0.006	0.008
FWIT14A	22-Mar-90		D	12.2	6.1		38.2	190.9		1.52	1.04	23.6	0.020	0.644		6.83	7.49		2.60	3.71	0.009	0.013
FWIT14A	24-May-90		D	22.8	5.5		15.3	99.3		1.23	0.96	13.4	-0.010	0.247		6.98	7.40		2.65	3.79	0.009	0.012
FWIT14A	30-May-90		D	21.0	5.4		17.3	135.4		1.22	1.04	15.7	-0.010	0.155		7.01	7.54		2.75	3.34	0.009	0.032
FWIT14A	26-Jun-90		D	42.9	13.4		67.4	323.0		2.31	1.80	50.4	0.108	0.205		7.44	7.77		3.38	4.03	0.005	0.015
FWIT14A	05-Jul-90		D	77.0	35.4		190.2	839.0		3.71	3.15	125.8	0.249	0.233		7.74	8.36		3.52	3.29	0.004	0.013
FWIT14A	27-Jul-90		D	60.7	19.2		102.3	446.0		2.61	2.18	79.8	0.107	0.174		7.55	8.23		4.53	4.46	0.010	0.012
FWIT14A	09-Aug-90		D	25.9	7.9		17.5	139.3		1.85	1.24	17.8	0.033	0.217		7.02	7.77		4.22	4.49	0.015	0.018
FWIT17	27-Jul-90		D	10.6	3.7		0.9	34.0		0.71	0.82	1.0	-0.010	0.008		6.48	7.39		0.79	1.49	0.010	0.077
											WATERSHED SNOW SAMPLES											
R1	05-Jan-90		D	54.6	3.0		124.5	519.0	0.05	0.30	0.96	100.0	0.080	0.135		7.42	8.06		0.21	2.24		
R2	05-Jan-90		D	1.1	2.0		59.0	238.0	0.24	0.70	1.84	39.0	0.200	0.628		6.80	6.49		0.05	1.52		

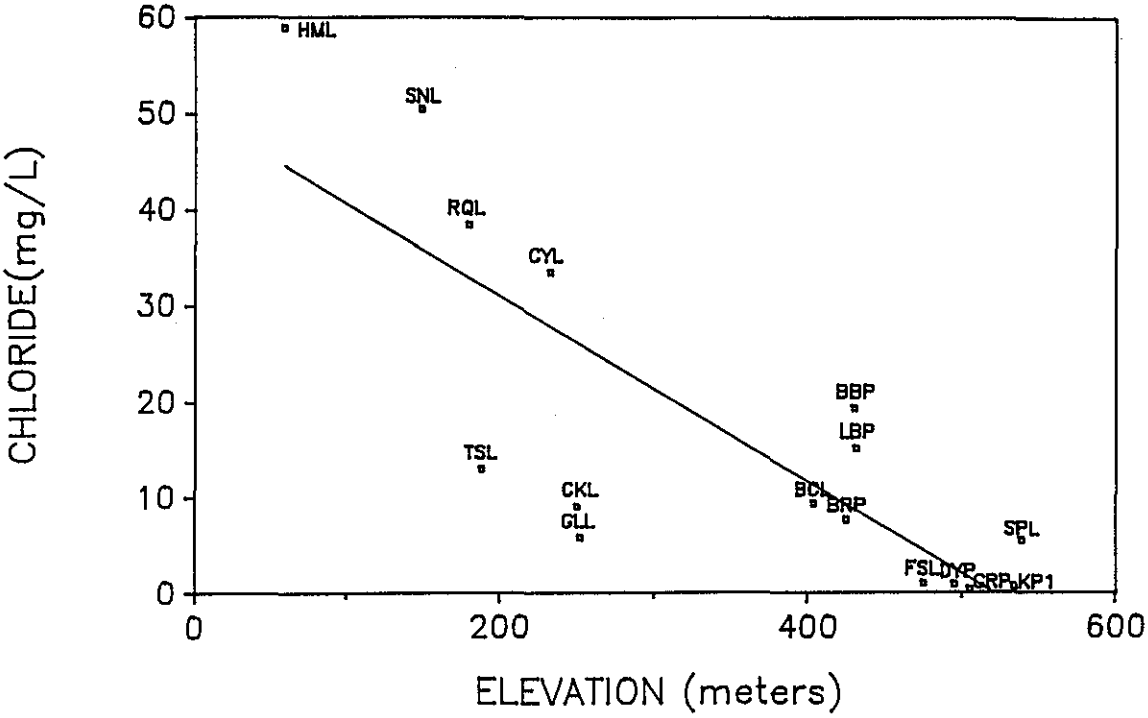
See Table 1 for site locations and Table 8 for description of column headings and units reported.

TABLE 8. Description of abbreviations and units used in chemical analysis table.

Abbreviation	Description	Units
Depth	Depth at which sample was taken	meters
Smp Type	Type of sample taken: D = discrete, at depth indicated; D+ = discrete, but other samples taken at same site at other depths	
Alk	Alkalinity	mg/liter (ppm) as $CaCO_3$
Ca	Calcium	mg/liter (ppm)
Chla	Chlorophyll a	ug/liter (ppb)
Cl	Chloride	mg/liter (ppm)
Cond	Conductivity	micromhos/cm
Fe	Iron	mg/liter (ppm)
K	Potassium	mg/liter (ppm)
Mg	Magnesium	mg/liter (ppm)
Na	Sodium	mg/liter (ppm)
NH4-N	Ammonia as Nitrogen	mg Nitrogen/liter (ppm Nitrogen)
NO3	Nitrate as Nitrogen	mg Nitrogen/liter (ppm Nitrogen)
OP	Ortho Phosphate as Phosphorous "Reactive Phosphate"	mg Phosphorous/liter (ppm Phosphorous)
Direct pH	pH of "unaltered sample"	pH
A-Eq pH	pH obtained after sample has been equilibrated with air	pH
Secc	Secchi Depth	meters
SiO2-Si	Soluble Reactive Silica as Silicon	mg Silicon/liter (ppm Silicon)
SO4-S	Sulfate as Sulfur	mg Sulfur/liter (ppm Sulfur)
TDP	Total Dissolved Phosphorous	mg/liter (ppm)
TP	Total Phosphorous	mg/liter (ppm)

LIST OF FIGURES

RENSSELAER COUNTY WATER BODIES



BCL –	Babcock Lake	KP1 –	Kendall Pond
BBP –	Big Bowman Pond	LEZ –	Lake Elizabeth
BRP –	Black River Pond	LBP –	Little Bowman Pond
BDL –	Burden Lake	RQL –	Reichards Lake
CRP –	Cranberry Pond	ROP –	Round Pond
CKL –	Crooked Lake	SNL –	Snyders Lake
CYL –	Crystal Lake	SPL –	Spring Lake
DYP –	Dyken Pond	TCL –	Taconic Lake
FSL –	Forest Lake	TSL –	Tackawasick Lake
GLL –	Glass Lake	VHR –	Vanderhyden Reservoir
HML –	Hampton Manor Lake		

FIGURE 1

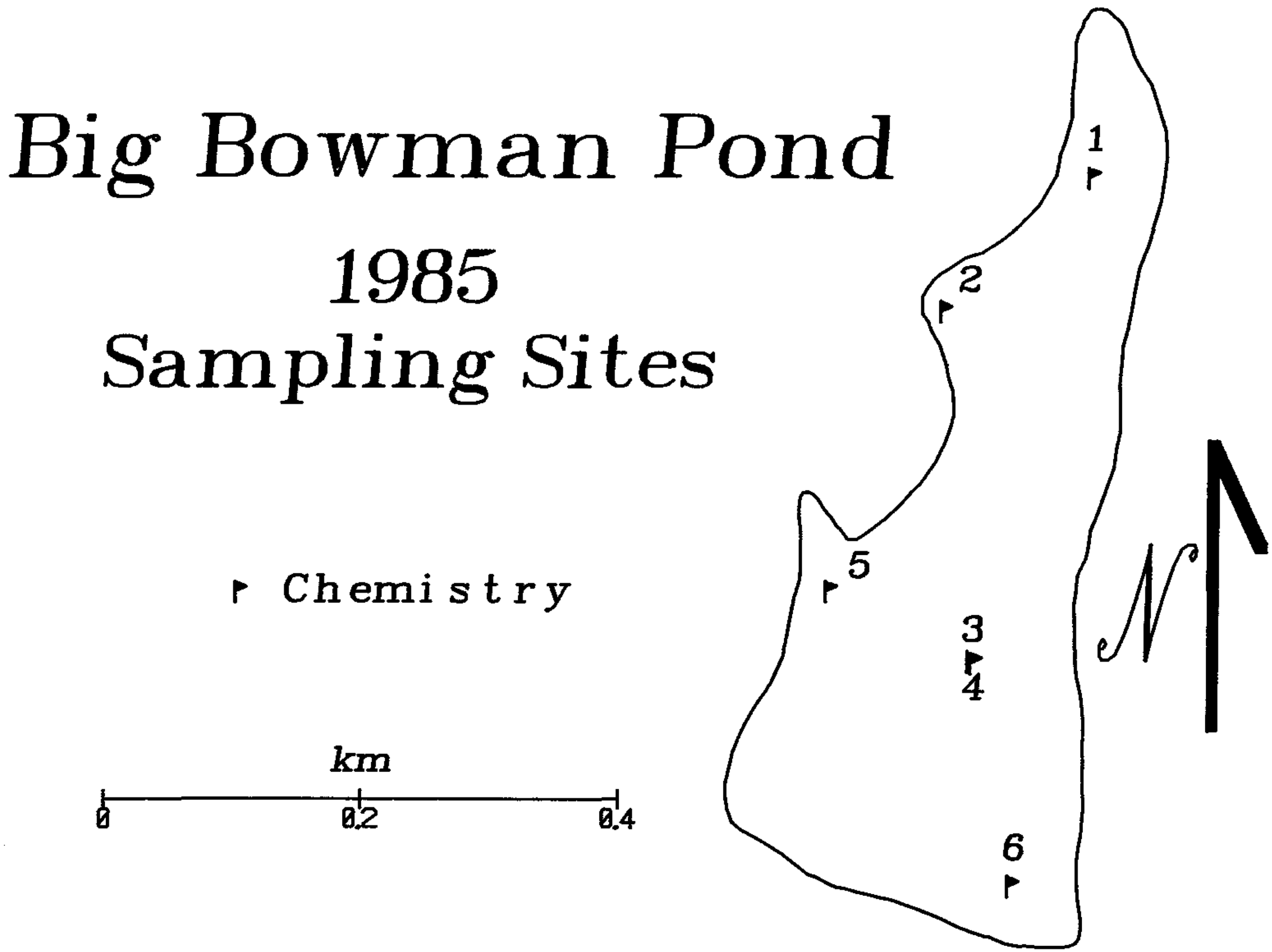

Big Bowman Pond
1985
Sampling Sites
Chemistry
km
0
0.2
0.4
1
2
3
4
5
6
N

FIGURE 2

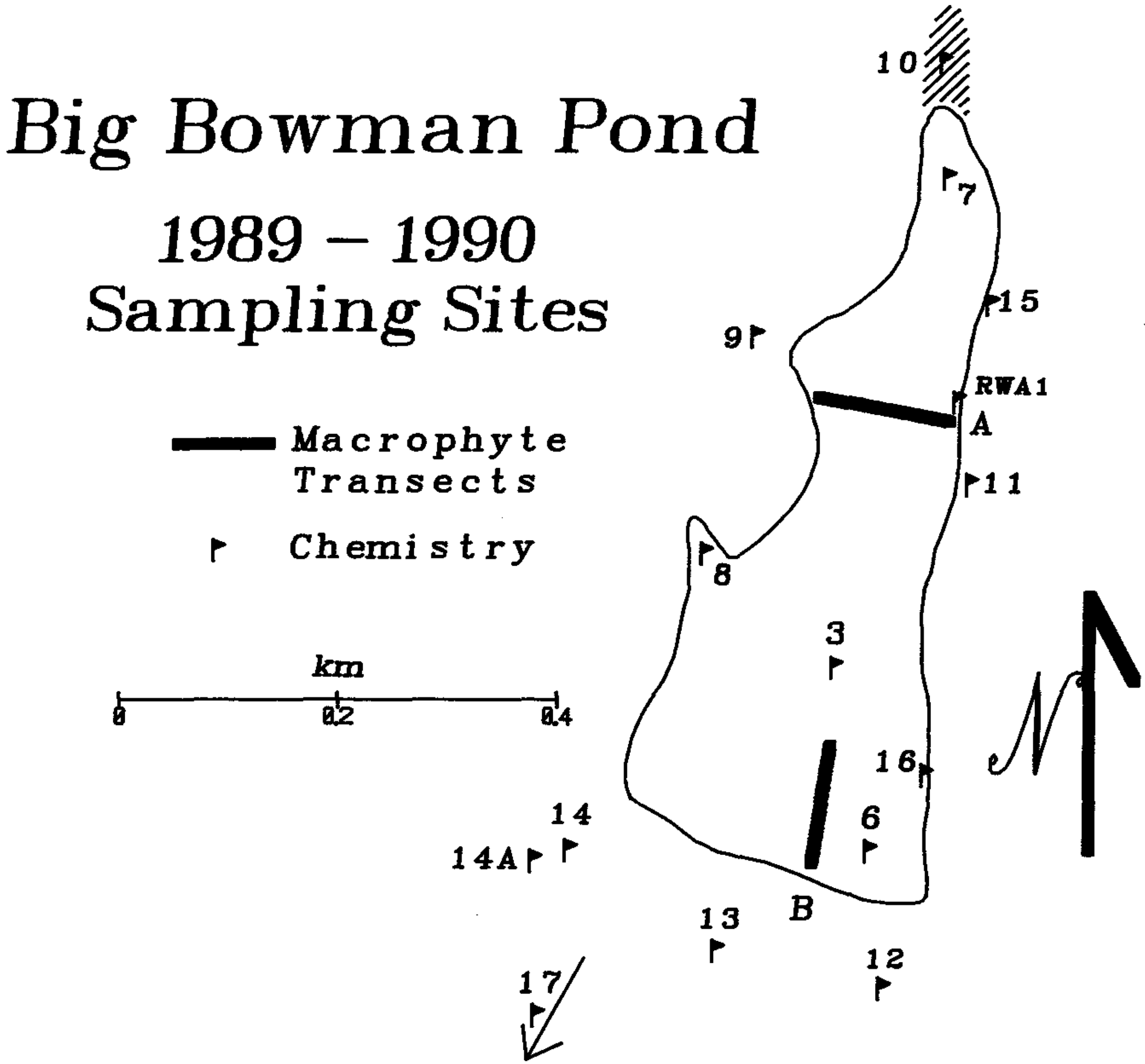

Big Bowman Pond
1989 – 1990
Sampling Sites
Macrophyte Transects
Chemistry
km
0
0.2
0.4
10
7
15
9
RWA1
A
11
8
3
16
14
14A
6
13
B
12
17
N

FIGURE 3

Big Bowman Pond Bathymetry

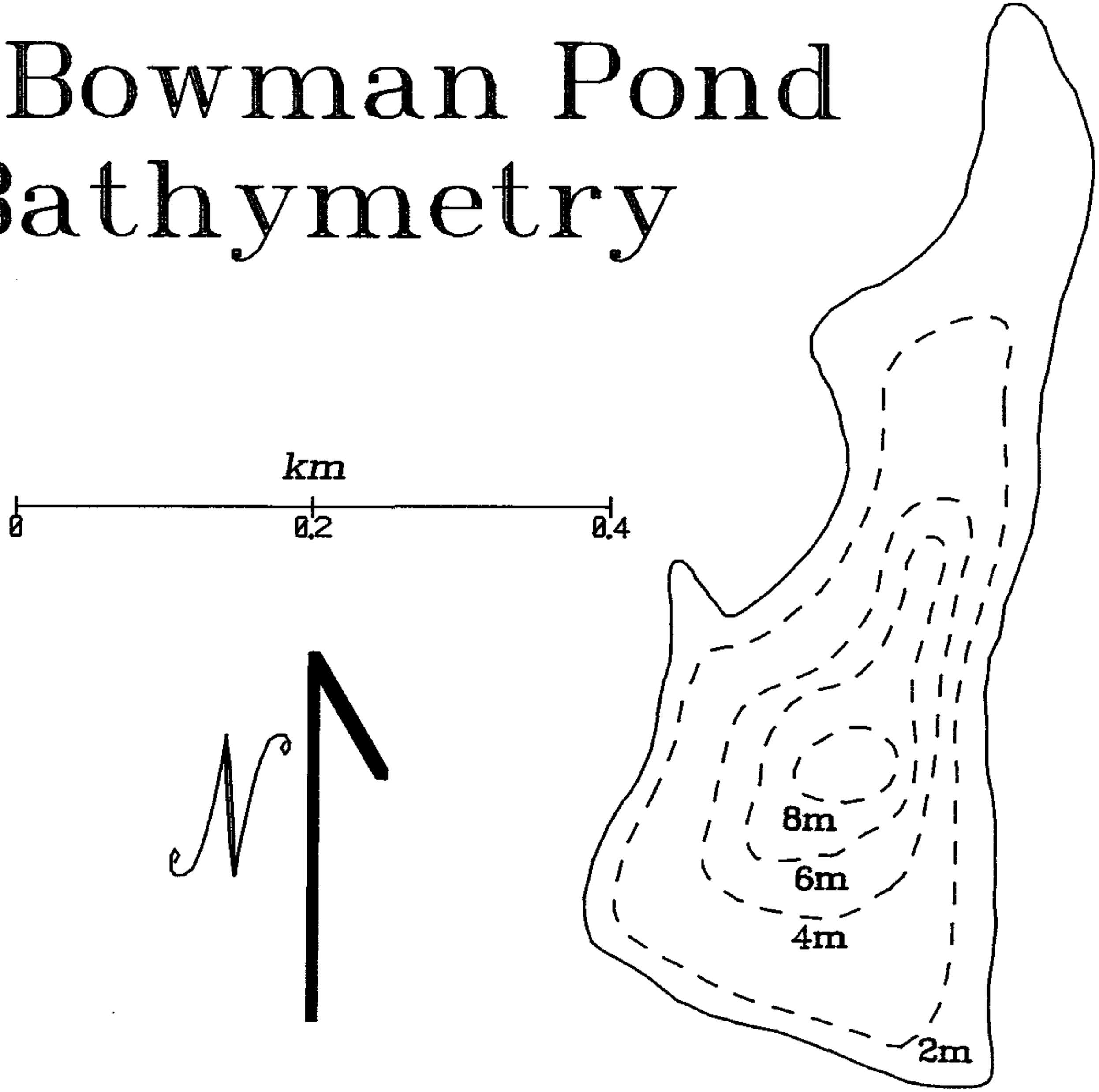


FIGURE 4

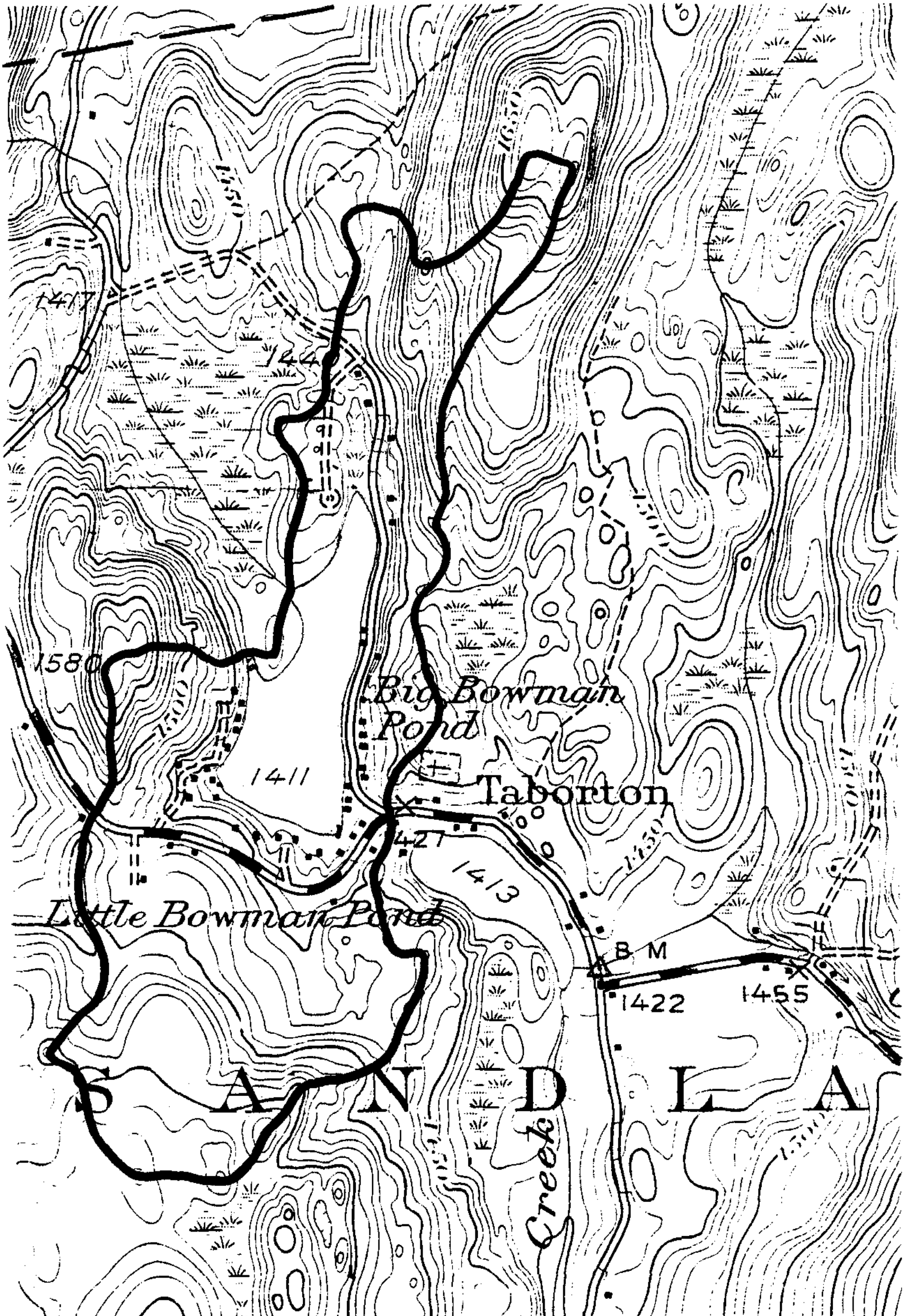
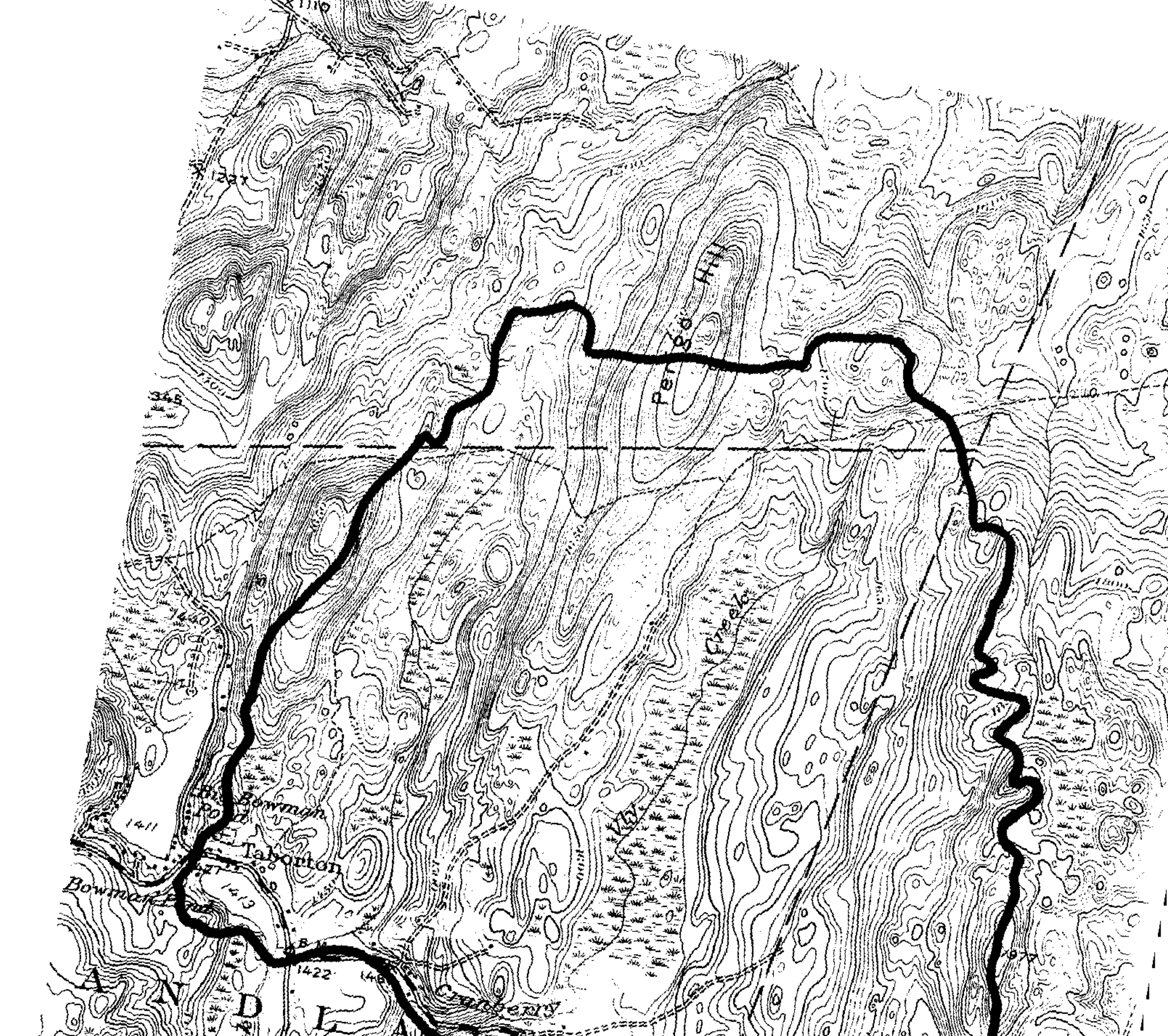

1417
1650
1550
1440
1580
1500
Big Bowman Pond
1411
Taborton
1427
1413
1450
Little Bowman Pond
B M
1422
1455
S A N D L A
Creek

FIGURE 5



Perry Hill
Big Bowman Pond
Taborton
Bowman Pond
Creek
Cranberry
A N D L A K E
Creek
The Glebe

FIGURE 6

Big Bowman Pond

Watershed with Soil Types

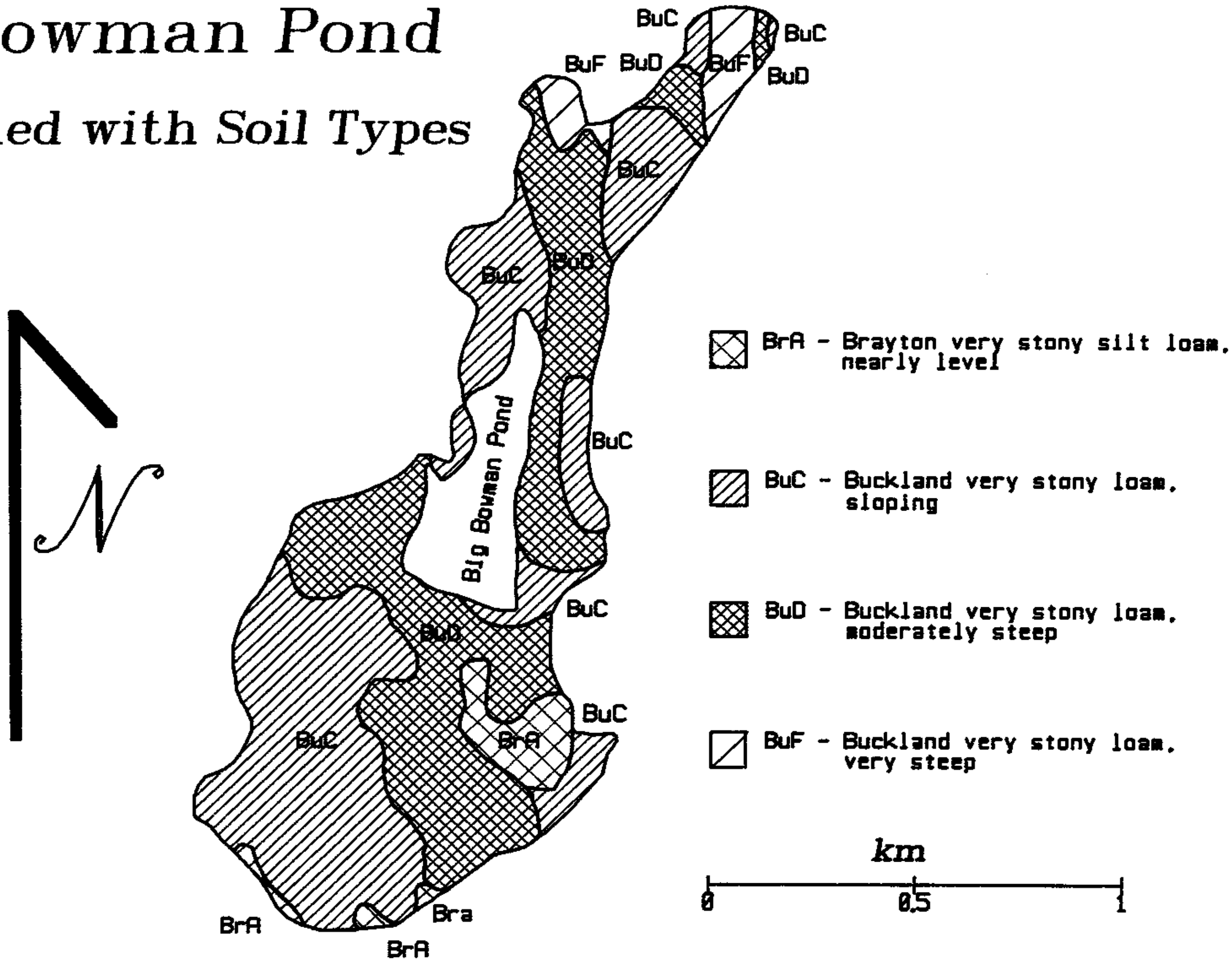
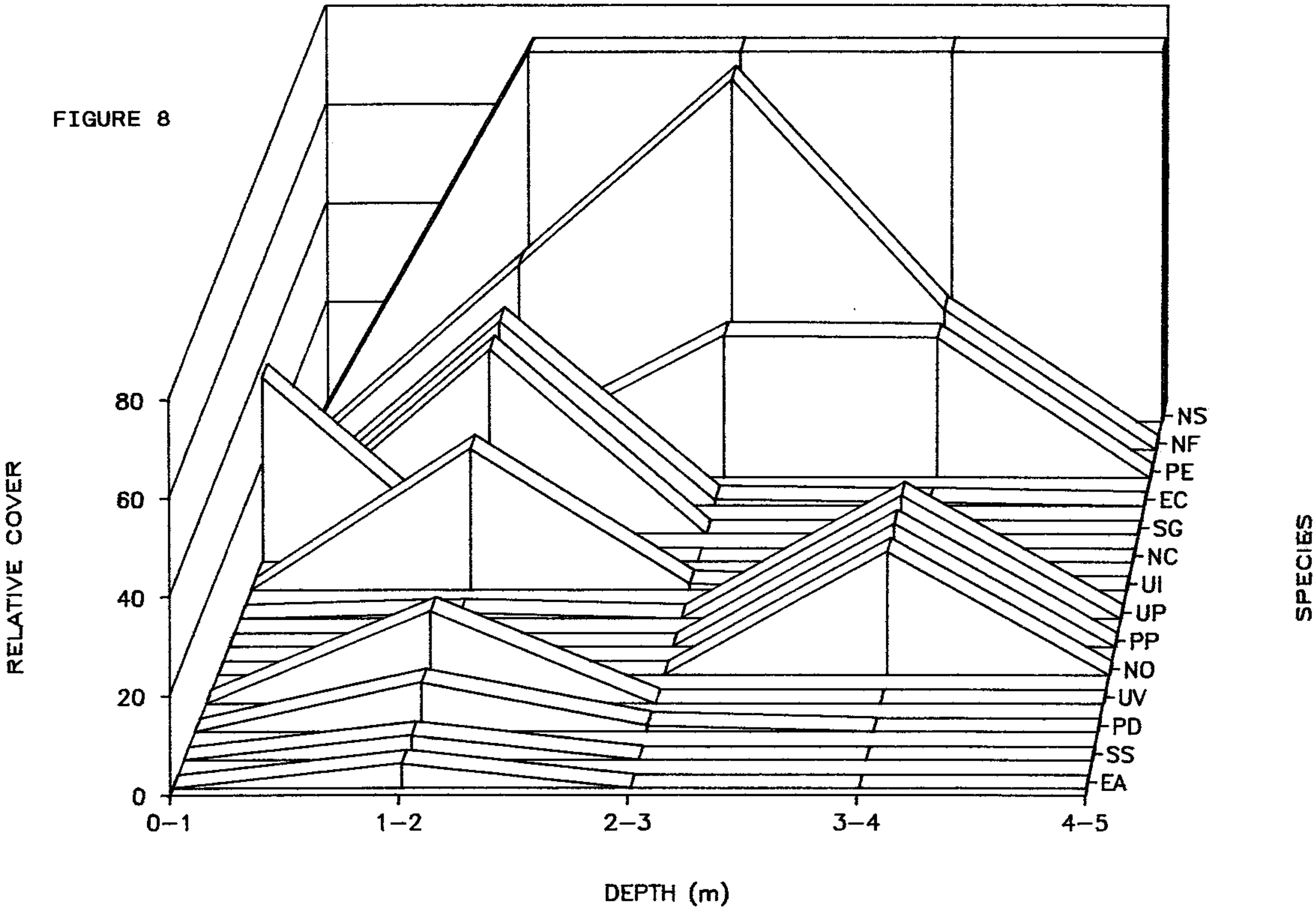


FIGURE 7

FIGURE 8

BIG BOWMAN POND

DEPTH DISTRIBUTION OF AQUATIC PLANTS



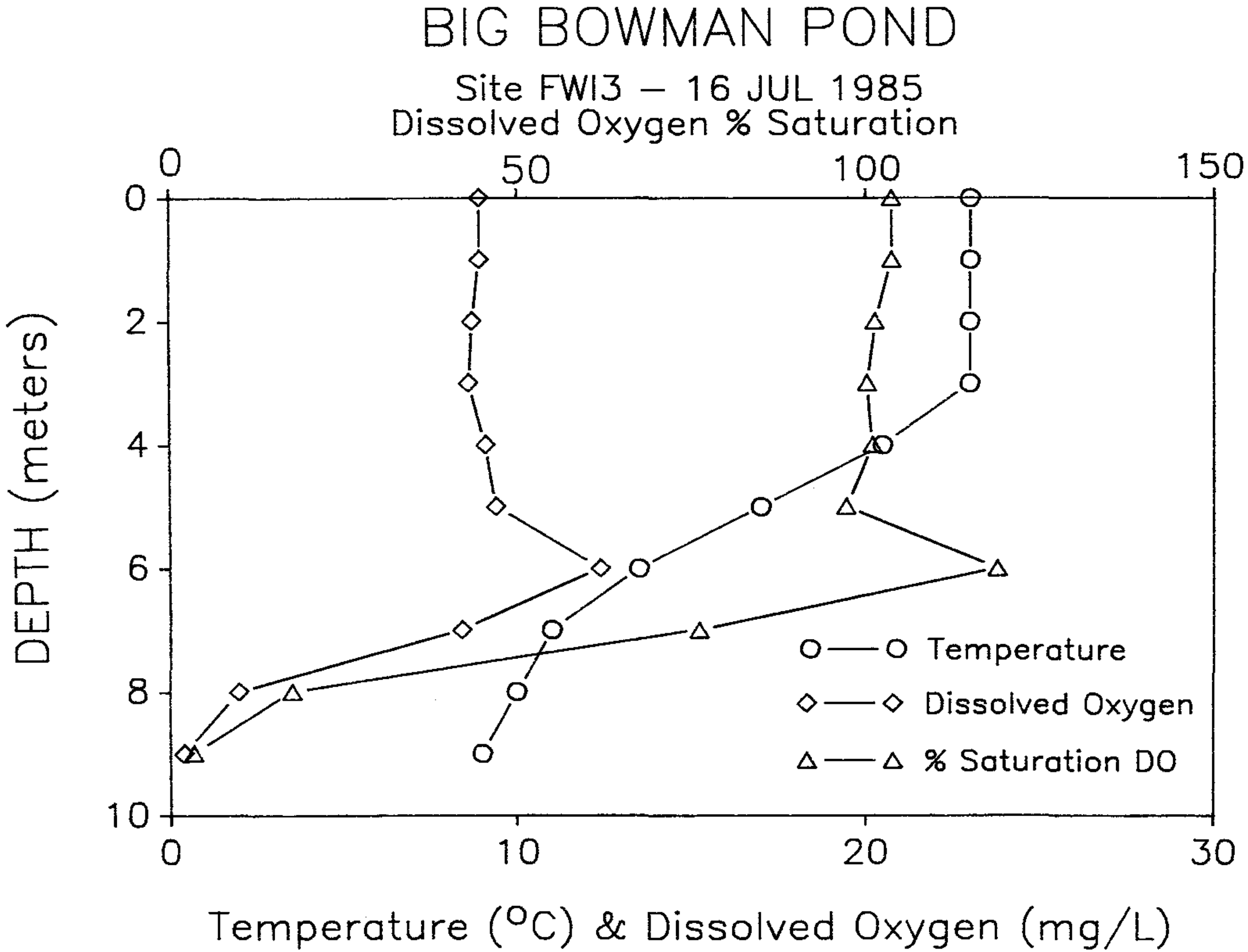

BIG BOWMAN POND
Site FWI3 — 16 JUL 1985
Dissolved Oxygen % Saturation
0
50
100
150
0
2
4
6
8
10
DEPTH (meters)
0
10
20
30
Temperature (°C) & Dissolved Oxygen (mg/L)
Temperature
Dissolved Oxygen
% Saturation DO

FIGURE 9

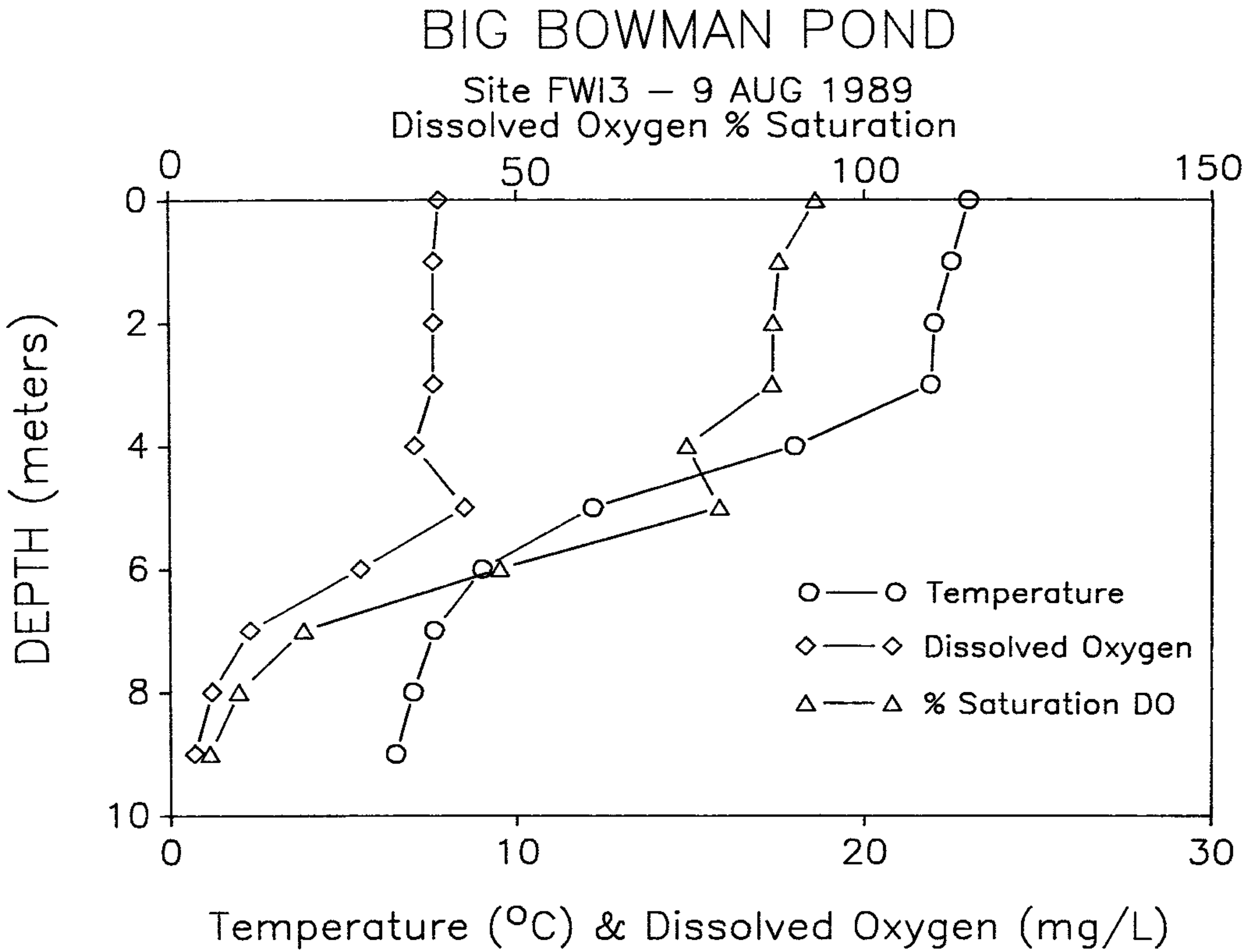

BIG BOWMAN POND
Site FWI3 — 9 AUG 1989
Dissolved Oxygen % Saturation
0
50
100
150
DEPTH (meters)
0
2
4
6
8
10
Temperature
Dissolved Oxygen
% Saturation DO
0
10
20
30
Temperature (°C) & Dissolved Oxygen (mg/L)

FIGURE 10

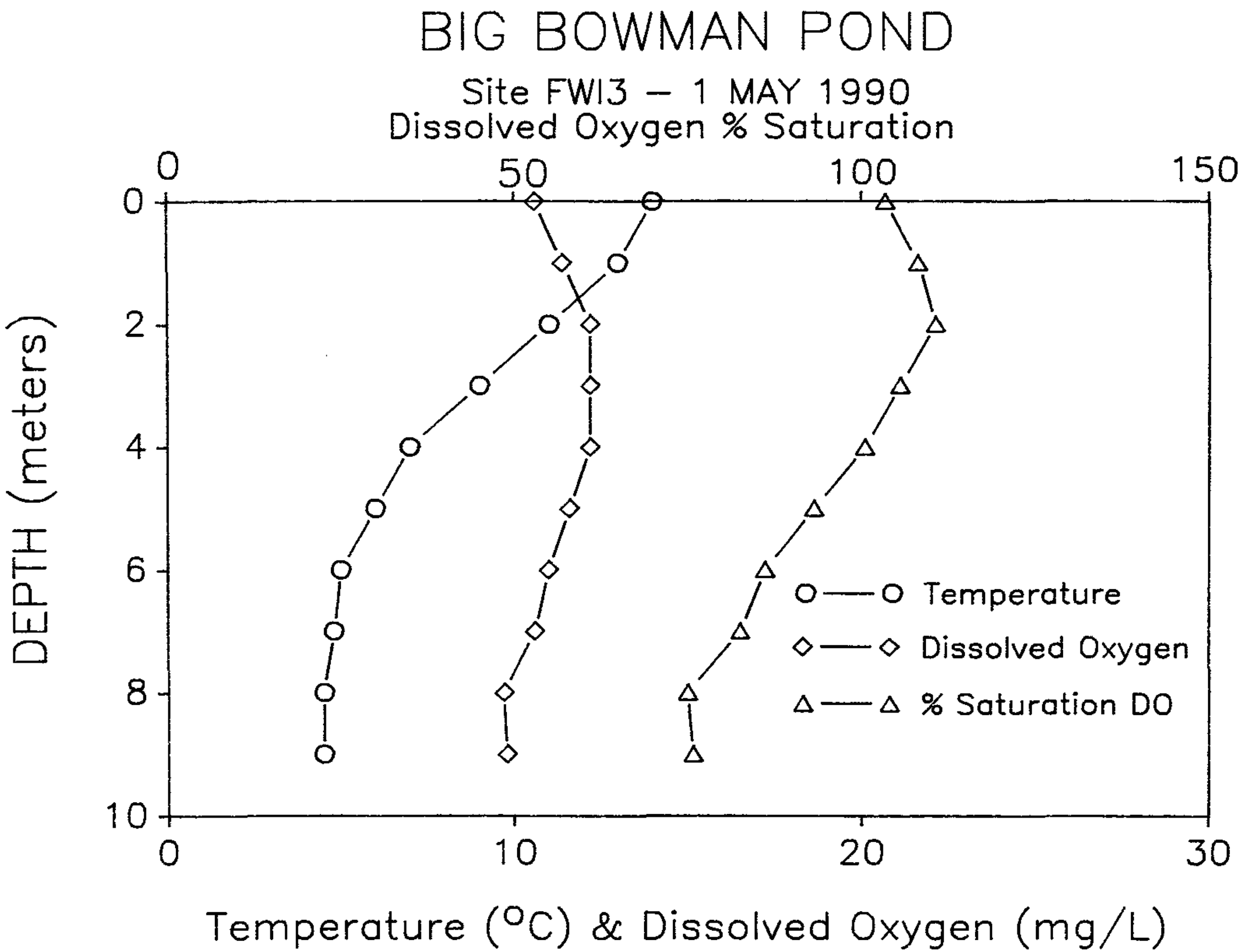

BIG BOWMAN POND
Site FWI3 – 1 MAY 1990
Dissolved Oxygen % Saturation
0
50
100
150
0
2
4
6
8
10
DEPTH (meters)
Temperature
Dissolved Oxygen
% Saturation DO
0
10
20
30
Temperature (°C) & Dissolved Oxygen (mg/L)

FIGURE 11

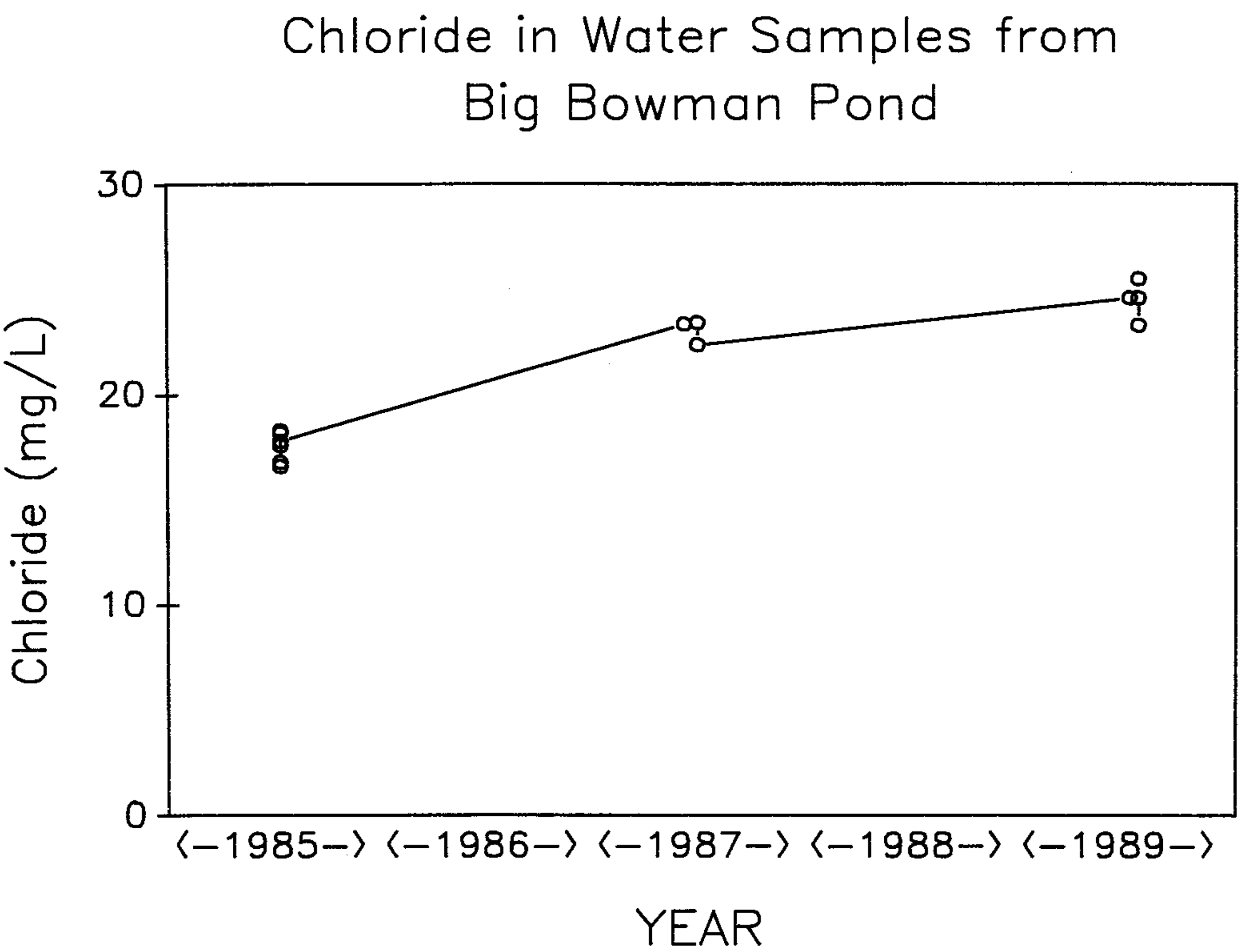

Chloride in Water Samples from
Big Bowman Pond
30
20
10
0
Chloride (mg/L)
(–1985–)
(–1986–)
(–1987–)
(–1988–)
(–1989–)
YEAR

FIGURE 12

Chloride in Water Samples from
Big Bowman Pond and One of Its Inlets

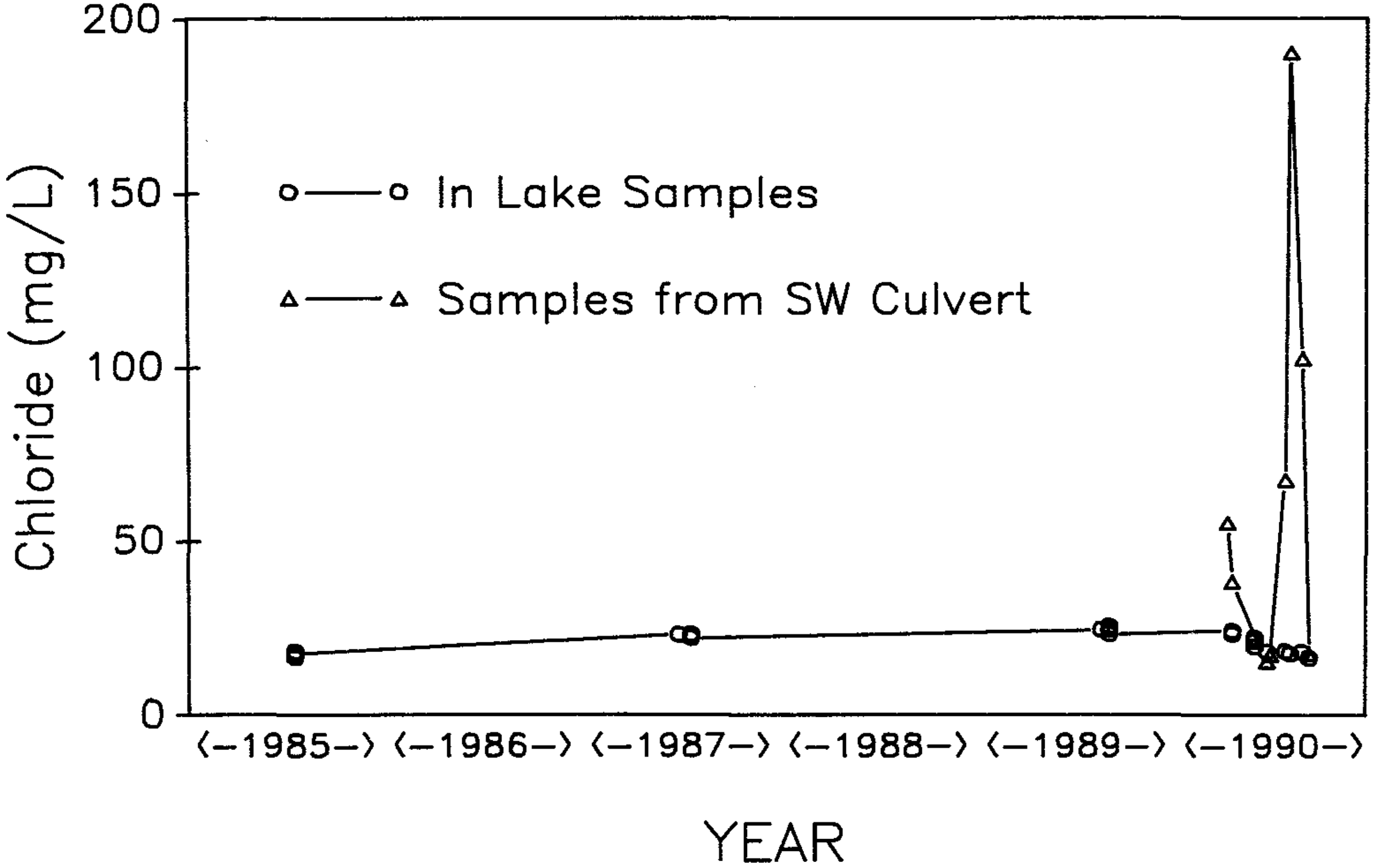


FIGURE 13

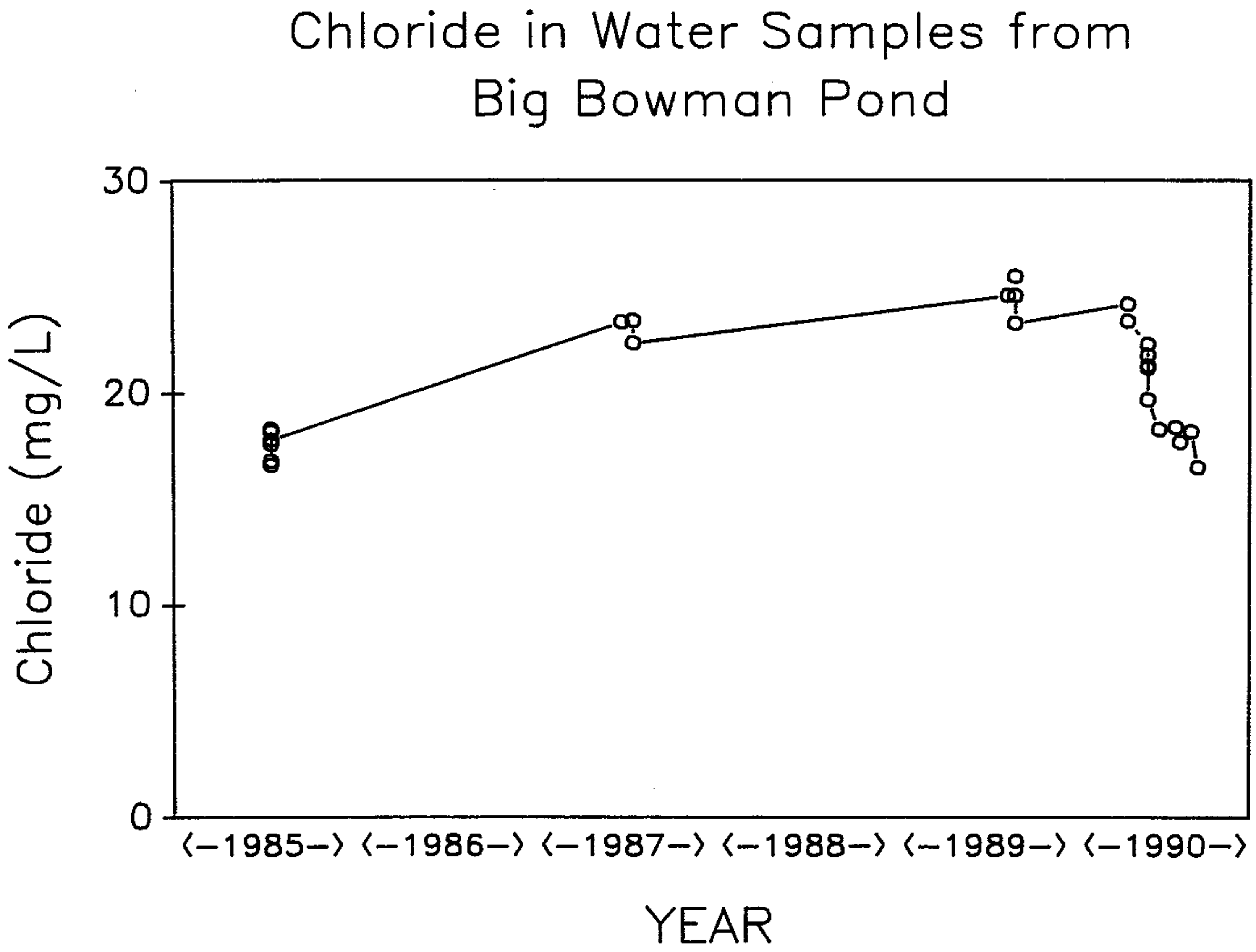
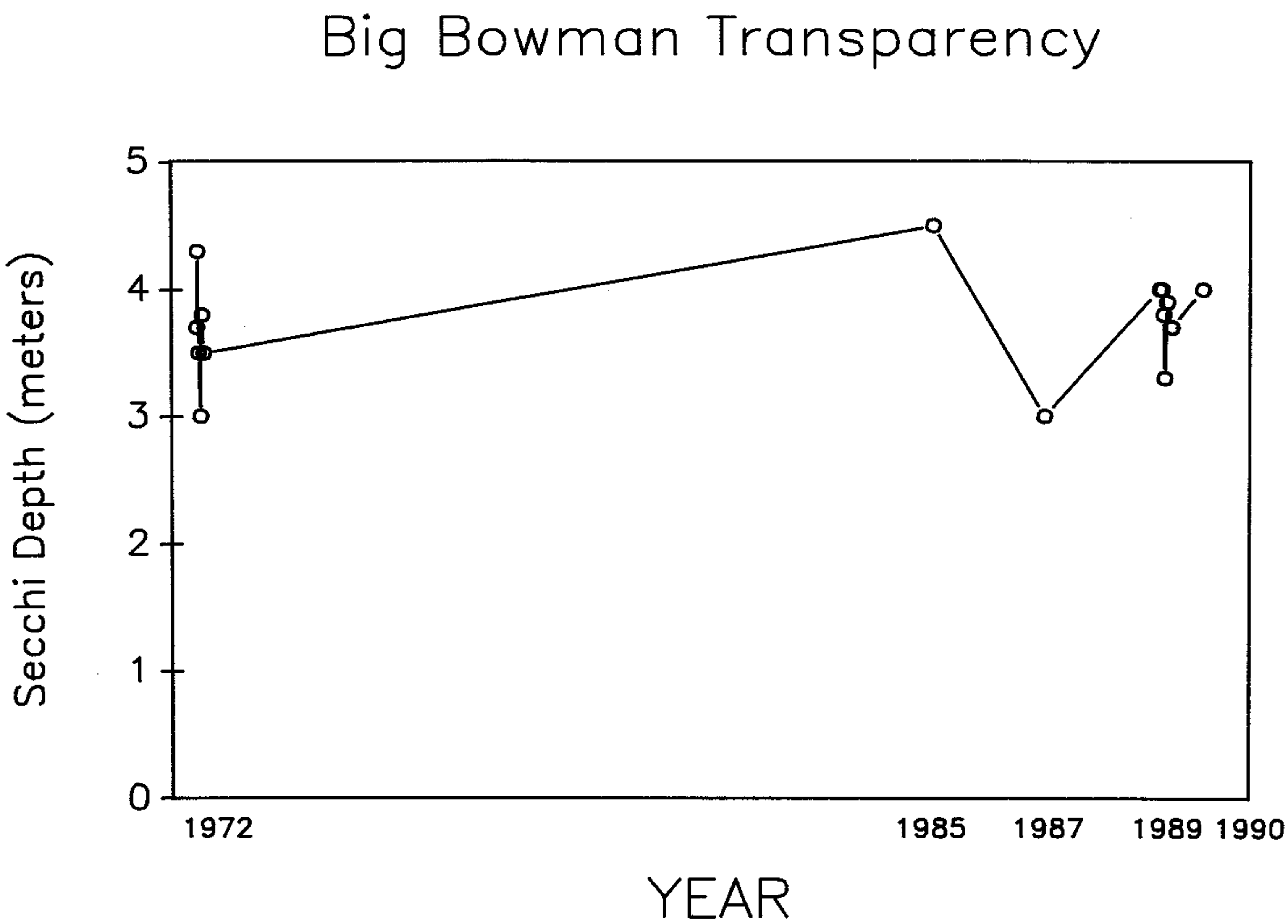

Chloride in Water Samples from
Big Bowman Pond
Chloride (mg/L)
30
20
10
0
<–1985–> <–1986–> <–1987–> <–1988–> <–1989–> <–1990–>
YEAR

FIGURE 14



Big Bowman Transparency
Secchi Depth (meters)
0
1
2
3
4
5
1972
1985
1987
1989
1990
YEAR

FIGURE 15

APPENDIX N

Big Bowman Pond excerpt from Armstrong and Soracco (1989)

BIG BOWMAN POND

LOCATION

Latitude	---	42 degrees 39 minutes 01 seconds
Longitude	---	73 degrees 29 minutes 20 seconds
Topographical Quadrangle	---	Taborton
Watershed	---	Lower Hudson
DEC Pond Number	---	444

MORPHOMETRY

Surface Area	---	29.4-32 acres (12-13 hectares)
Mean Depth	---	13.7 ft (4.2 m)
Maximum Depth	---	29.5 ft (9 m)
Watershed Area	---	251 acres (102 hectares)
Area Ratio: Watershed to Lake	---	8.2
Shoreline Length	---	1.1 m (1.77 km)
Elevation above Sea Level	---	1,411 ft (430 m)
Hydraulic Retention Time	---	1.1 years
Water Quality Classification	---	B

CHRONOLOGY OF DATA COLLECTIONS

DATA		REPORTS and PRESENTATIONS
	1934	
State of New York Conservation Department		
Qualitative Fish Survey		State of New York Conservation Department Report
Water Column Analyses - Alkalinity - pH - Free CO2 - Temperature - Dissolved Oxygen - Transparency		

DATA		REPORTS and PRESENTATIONS
	1972	
Rensselaer Polytechnic Institute Fresh Water Institute Student Survey National Science Foundation Sponsored		
Water Column Analyses - Profiles of: * pH * Temperature * Dissolved Oxygen * Ortho Phosphorus * Total Phosphorus * Nitrate/Nitrite * Hydrogen Sulfide * Total Alkalinity * Phenol Alkalinity * Hardness * Phytoplankton Counts - Zooplankton Counts - Coliform Counts - Secchi Depths		Rensselaer Fresh Water Institute Report #72-33 with Appendices Trophic Status & Comparison to other lakes in the study
Aquatic Plant Species List		
Bathymetric Data		
	1978	
Rensselaer County Comprehensive Sewerage Study		
Trophic Status by Vollenweider model - oligotrophic to mesotrophic		Malcolm Pirnie, Inc. for Rensselaer County & NYS DEC
	1980	
R. Armstrong - Russell Sage		
Water Column Analyses - pH (1 sample) - Alkalinity (1 sample)		
	1983	
R. Armstrong - Russell Sage		
Water Column Analyses - pH (1 sample) - Alkalinity (1 sample) - Total Phosphorus (1 sample) - Calcium (1 sample) - Magnesium (1 sample) - Soluble Silicon (1 sample) - Soluble Aluminum (1 sample)		Presentation at 2nd New York State Symposium on Atmospheric Deposition

DATA	REPORTS and PRESENTATIONS
1985	
FWI/RPI Lake Assessment Big Bowman Pond Assoc. Supported	
Water Column Analyses - Profiles of: * Temp * DO - Secchi Depths - pH - Alkalinity - Conductivity - Total Phosphorus - Nitrate - Chloride - Ammonia - Coliform	Report submitted to Big Bowman Pond Association
Plant Studies - Aquatic plant location with relative abundances	
Previous Data Tabulated - Rensselaer County DOH * Nitrate '41 - '81 * Ammonia '41 - '76 * Chloride '41 - '81 * Alkalinity '41 - '81 * Hardness '41 - '76 * pH '41 - '84 - NYS DEC * Fish Species	

REFERENCE MATERIALS & REPORTS CITED

(see Bibliographic Citation section for full reference and Description of Studies section for further details about a report or study)

CITATIONS: A (1935), C (1972), F (1978), I (1984), M (1985), and O (1987),

APPENDIX O

Big Bowman Pond excerpt from Armstrong and Soracco (1990)

ASSESSMENT OF
BIG BOWMAN POND

Data Set: Appreciable data is available on Big Bowman Pond, but it is limited mainly to observations made in the 1980's. It was included in the 1934 Biological Survey.

Clarity: The water clarity is fair to good being reduced by a slight brown water condition.

DO Status: Dissolved oxygen profiles show only minor oxygen depletion in the deepest layers of this pond in the late summer.

Acid Sensitivity: Alkalinity, pH, and dissolved aluminum data collectively suggest that this water body has low sensitivity to impacts from acid precipitation. Big Bowman has relatively high alkalinity for a lake on the Plateau, although there is an indication that this pond's alkalinity has declined somewhat over the past 55 years (see Figure 9).

Trends: With the exception of the possible trend in alkalinity noted above, there is insufficient comparable data over a sufficient time period to determine other trends.

Comments: The levels of dissolved salt - sodium chloride - are somewhat elevated for waters on the Plateau (see Figures 16 and 17), although there are several lakes in the developed lowlands with considerably higher values. Since nearby Little Bowman Pond also has elevated salt levels, it is possible that winter salting of Taborton Road is responsible. Another possible reason is a localized geologic source of sodium chloride (salt) effecting both ponds.

Needs: Big Bowman Pond is under a continuing study by the Fresh Water Institute (RPI). Spring sampling to ascertain the pond's acid sensitivity, at the time of maximum acid stress would be worthwhile. Levels of NaCl should also be determined at this time in the run-off entering the pond. Levels of this material should be determined annually. Geological and hydrological studies could prove to be useful in determining the cause of the elevated salt levels.

Table 5.
BIG BOWMAN POND
Average of Selected Measurements

Measurement	Mean*	No. of Data Points	Source(s)
Aluminum (Al)	0.025	4	D
Alkalinity (Alk)	8.60	11	A, B, D
Calcium (Ca)	5.79	15	A, B, D
Chloride (Cl)	19.38	9	B, D
Conductivity (Cond)	119.7	21	A, B, D
Dissolved Organic Carbon (DOC)	3.7	3	D
Magnesium (Mg)	0.98	4	A(1), D(3)
pH	6.60	50	A, B, C, D
Potassium (K)	0.51	3	D
Secchi (Secc)	3.8	11	B, C, D
Sodium (Na)	13.01	3	D
Sulfate (SO4)	7.00	3	D
Total Nitrogen (TN)			
Total Phosphorus (TP)	0.007	16	A, B, D

*All values are in mg/L (ppm) of the principal element with the following exceptions:

Alk - mg/L of CaCO3
Cond - micro mhos/cm (micro Siemens/cm)
pH - standard pH units
Secc - meters

Sources

A - Roger W. Armstrong
B - Rensselaer Fresh Water Institute
C - Rensselaer Polytechnic Institute
D - Adirondack Lake Survey Corp.

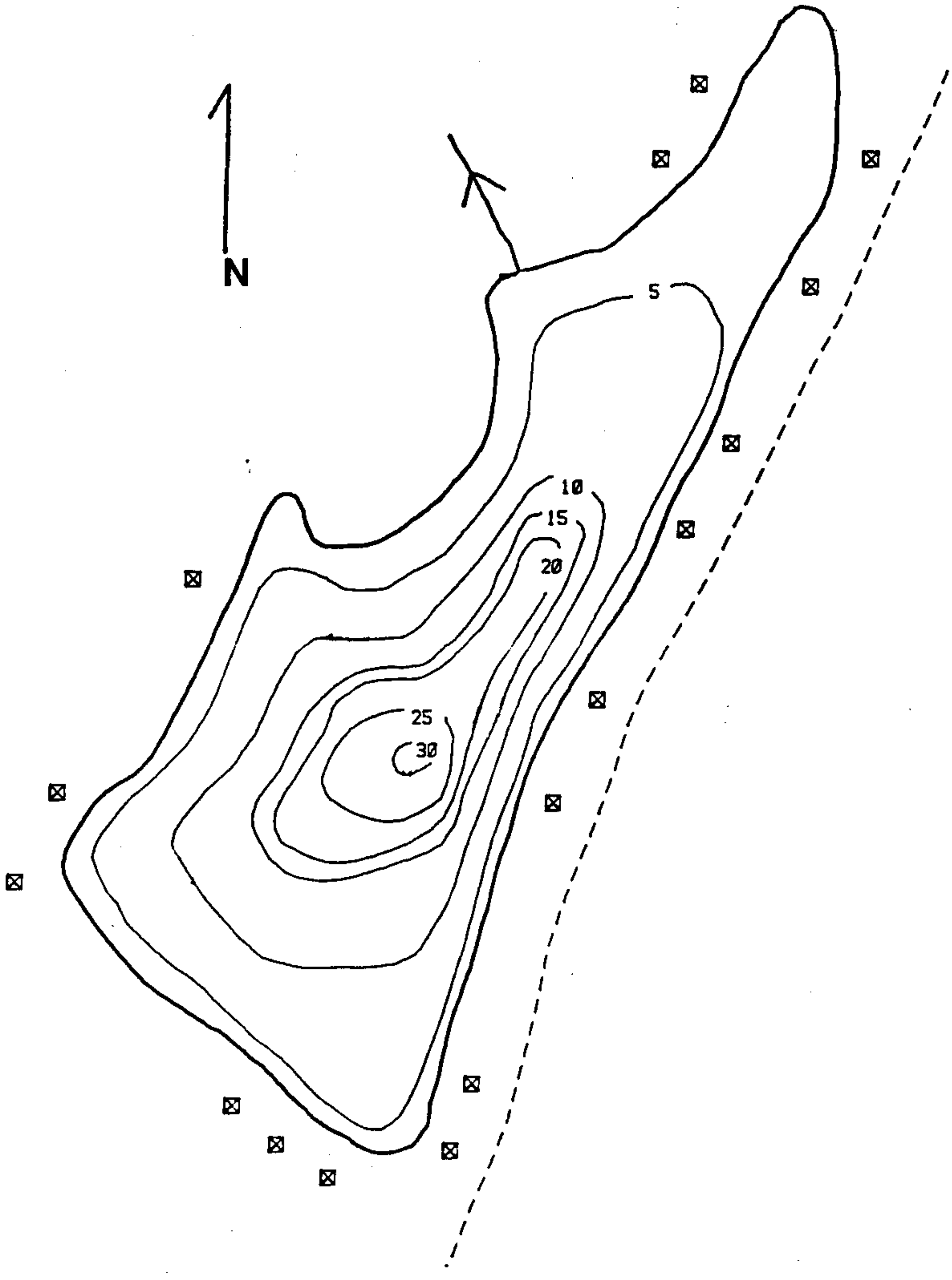


Figure 28.
BIG BOWMAN POND
13-0444
ALSC 6/15/87
CONTOUR INTERVAL: 5 FT
SURFACE AREA: 30 ACRES
MAXIMUM DEPTH: 33 FT
(from ALSC, 1989)

BIG BOWMAN POND

Site Code	Date	Depth	Smp Type	Smp Inst	Smp Vld	Al	Alk	ANC	Ca	Chla	Cl	Cond	Cu	DIC	DOC	Fe	H2S	K	Mg	Mn	Na	NH4	NO3	OP	Direct pH	A-Eq pH	Secc	Si	SO4	TON	TDP	TN	TOC	TP	Zn
NYSBS1	29-Aug-34	6.1	D	NYSBS	1		11.40																		6.70										
NYSBS2	29-Aug-34	0.5	D+	NYSBS	1		11.40																		6.80										
NYSBS2	29-Aug-34	9.2	D+	NYSBS	1		19.00																		6.20										
RPI1	15-Jun-72	0.0	D+	RPI	2		20.80										-0.01						0.100	0.007	5.80		3.7							0.030	
RPI1	15-Jun-72	3.0	D+	RPI	2		27.40										0.02						0.110	0.007	6.00									0.023	
RPI1	15-Jun-72	5.0	D+	RPI	2		27.40										-0.01						0.100	0.003	6.20									0.113	
RPI1	15-Jun-72	8.0	D+	RPI	2		27.40										0.02						0.110	0.003	6.30									0.058	
RPI1	20-Jun-72	0.0	D+	RPI	2		20.80										0.02						0.110	-0.001	6.20		4.3							0.020	
RPI1	20-Jun-72	2.0	D+	RPI	2		20.80										0.03						0.120	0.003	6.10									0.047	
RPI1	20-Jun-72	6.5	D+	RPI	2		20.80										0.03						0.090	0.003	6.00									0.036	
RPI1	20-Jun-72	8.5	D+	RPI	2		20.80										0.02						0.110	0.007	5.90									0.040	
RPI1	28-Jun-72	0.0	D+	RPI	2		13.80										0.03						0.100	0.007	6.30		3.5							0.056	
RPI1	28-Jun-72	3.0	D+	RPI	2		20.80										-0.01						0.110	0.007	6.30									0.063	
RPI1	28-Jun-72	6.5	D+	RPI	2		20.80										0.05						0.170	0.003	6.60									0.087	
RPI1	28-Jun-72	9.0	D+	RPI	2		20.80										0.03						0.110	0.013	6.70									0.056	
RPI1	11-Jul-72	0.0	D+	RPI	2		13.80										0.01						0.100	0.007	6.10		3.0							0.030	
RPI1	11-Jul-72	2.5	D+	RPI	2		13.80										-0.01						0.080	0.007	6.20									0.023	
RPI1	11-Jul-72	5.5	D+	RPI	2		13.80										0.02						0.070	0.013	5.88									0.023	
RPI1	11-Jul-72	8.0	D+	RPI	2		13.80										0.03						0.110	0.003	5.90									0.040	
RPI1	20-Jul-72	0.0	D+	RPI	2		13.80										0.03						0.070	0.013	6.70		3.8							0.036	
RPI1	20-Jul-72	1.5	D+	RPI	2		13.80										0.05						0.070	0.020	6.50									0.038	
RPI1	20-Jul-72	6.0	D+	RPI	2		13.80										0.03						0.140	0.007	6.40									0.047	
RPI1	20-Jul-72	8.0	D+	RPI	2		13.80										0.03						0.100	0.007	6.50									0.013	
RPI1	01-Aug-72	0.0	D+	RPI	2		13.80										0.03						0.060	0.007	6.60		3.5							0.023	
RPI1	01-Aug-72	3.0	D+	RPI	2		13.80										0.02						0.060	-0.001	6.40									0.030	
RPI1	01-Aug-72	5.0	D+	RPI	2		13.80										0.01						0.130	0.003	6.30									0.023	
RPI1	01-Aug-72	8.5	D+	RPI	2		20.80										0.02						0.070	0.007	6.30									0.040	
RWA2S	29-Jul-80	0.5	D	RWA	1		8.30																		7.10										
RWA2S	09-Aug-83	0.5	D	RWA	1	-0.005	7.12		5.00										0.82						6.98	7.30		1.070						0.009	
RWA1	25-Jul-89	0.5	D	RWA	1		6.83					108.5													7.24	7.34									
FWI1	16-Jul-85	0.5	I1	FWI	1		12.00				18.20	120.0										-0.010	-0.010		6.86			0.520						0.007	
FWI2	16-Jul-85	1.0	I2	FWI	1				7.00		17.80	118.0										-0.010	-0.010		7.15			0.520						0.007	
FWI3	16-Jul-85	2.5	I5+	FWI	1		14.00		5.70		18.30	119.0										-0.010	-0.010		7.03		4.5	0.460						0.005	
FWI3	16-Jul-85	9.0	D+	FWI	1				6.10		18.60	130.0										0.180	0.020		6.34			0.590						0.011	
FWI5	16-Jul-85	1.0	I2	FWI	1		12.00		5.60		17.80	118.0										-0.010	-0.010		7.12			0.520						0.008	
FWI6	16-Jul-85	1.0	I2	FWI	1		12.00		5.80		16.80	118.0										-0.010	-0.010		7.17			0.500						0.006	
FWI1	01-Nov-85	0.5	I1	FWI	1		14.00		5.30			112.4										0.020	0.010		7.31			0.600						0.006	
FWI2	01-Nov-85	1.0	I2	FWI	1				6.30			113.7										0.020	-0.010		7.04			0.610						0.004	
FWI3	01-Nov-85	2.5	I5+	FWI	1		16.00		5.60			113.7										0.030	0.010		6.89		5.5	0.620						0.008	
FWI3	01-Nov-85	9.0	D+	FWI	1				5.80			113.7										0.030	-0.010		6.98			0.620						0.005	
FWI5	01-Nov-85	1.0	I2	FWI	1		14.00		5.80			113.7										0.030	-0.010		7.03			0.620						0.007	
FWI6	01-Nov-85	1.0	I2	FWI	1		14.00		5.60			115.0										0.030	0.010		6.97			0.620						0.006	
ALSC6	16-Jun-87	1.5	D	ALSC	1	0.036		170.6	6.07		23.35	117.1	0.002	2.21	3.7	0.048		0.56	1.05	0.096	14.32	-0.001	-0.001		6.92	7.02	3.0	0.560	6.95					0.016	0.002
ALSC1	09-Jul-87	1.5	D+	ALSC	1	0.026		178.7	5.83		23.42	118.3	-0.001	2.50	4.2	0.021		0.50	1.04	0.032	12.60	0.030	-0.001		6.91	7.05	3.0	0.140	6.90					0.008	-0.001
ALSC1	09-Jul-87	7.0	D+	ALSC	1	0.041		167.9	5.82		22.36	112.3	0.007	3.62	3.3	0.012		0.46	1.00	0.012	12.11	-0.001	0.060		6.46	6.89		0.687	7.15					0.005	0.003
FWI3	09-Aug-89	0.5	D+	FWI	1		9.10			0.7		125.2										0.030	0.010	-0.001	7.28	7.64	4.0								
FWI3	09-Aug-89	4.5	D+	FWI	1		7.80					135.2										0.100	0.080	-0.001	6.80	7.54									
FWI3	09-Aug-89	8.0	D+	FWI	1		12.10					147.9										0.200	0.050	0.003	6.85	7.82									
FWI7	09-Aug-89	0.0	D	FWI	1		8.90					122.7										0.030	-0.010	0.003	7.09	7.63									
FWI8	09-Aug-89	0.0	D	FWI	1		7.40					123.8										0.070	0.010	0.001	7.25	7.65									

BIG BOWMAN POND

Site Code	Date	Depth	Smp Type	Smp Inst	Smp Vld	DO	Temp
NYSBS1	29-Aug-34	6.1	G	NYSBS	1	6.8	18.9
NYSBS2	29-Aug-34	0.5	G+	NYSBS	1	7.4	19.5
NYSBS2	29-Aug-34	9.2	G+	NYSBS	1	0.5	12.2
FWI1	16-Jul-85	0.0	P	FWI	1	8.5	25.0
FWI1	16-Jul-85	1.0	P	FWI	1	8.6	24.0
FWI2	16-Jul-85	0.0	P	FWI	1	8.5	24.0
FWI2	16-Jul-85	1.0	P	FWI	1	8.5	23.0
FWI2	16-Jul-85	2.0	P	FWI	1	8.2	23.0
FWI3	16-Jul-85	0.0	P	FWI	1	8.9	23.0
FWI3	16-Jul-85	1.0	P	FWI	1	8.9	23.0
FWI3	16-Jul-85	2.0	P	FWI	1	8.7	23.0
FWI3	16-Jul-85	3.0	P	FWI	1	8.6	23.0
FWI3	16-Jul-85	4.0	P	FWI	1	9.1	20.5
FWI3	16-Jul-85	5.0	P	FWI	1	9.4	17.0
FWI3	16-Jul-85	6.0	P	FWI	1	12.4	13.5
FWI3	16-Jul-85	7.0	P	FWI	1	8.4	11.0
FWI3	16-Jul-85	8.0	P	FWI	1	2.0	10.0
FWI3	16-Jul-85	9.0	P	FWI	1	0.4	9.0
FWI5	16-Jul-85	0.0	P	FWI	1	9.0	24.0
FWI5	16-Jul-85	1.0	P	FWI	1	9.0	23.5
FWI5	16-Jul-85	2.0	P	FWI	1	8.9	23.0
FWI6	16-Jul-85	0.0	P	FWI	1	9.0	24.0
FWI6	16-Jul-85	1.0	P	FWI	1	8.9	23.5
FWI6	16-Jul-85	2.0	P	FWI	1	8.8	23.0
FWI1	01-Nov-85	0.0	P	FWI	1	11.3	7.5
FWI1	01-Nov-85	1.0	P	FWI	1	11.0	7.5
FWI2	01-Nov-85	0.0	P	FWI	1	10.8	8.0
FWI2	01-Nov-85	1.0	P	FWI	1	10.6	8.0
FWI2	01-Nov-85	2.0	P	FWI	1	10.6	8.0
FWI3	01-Nov-85	0.0	P	FWI	1	10.8	9.5
FWI3	01-Nov-85	1.0	P	FWI	1	10.4	9.5
FWI3	01-Nov-85	2.0	P	FWI	1	10.2	9.0
FWI3	01-Nov-85	3.0	P	FWI	1	10.2	9.0
FWI3	01-Nov-85	4.0	P	FWI	1	10.1	9.0
FWI3	01-Nov-85	5.0	P	FWI	1	10.0	9.0
FWI3	01-Nov-85	6.0	P	FWI	1	10.0	9.0
FWI3	01-Nov-85	7.0	P	FWI	1	10.0	9.0
FWI3	01-Nov-85	8.0	P	FWI	1	10.0	9.0
FWI3	01-Nov-85	9.0	P	FWI	1	10.0	9.0
FWI5	01-Nov-85	0.0	P	FWI	1	10.8	9.0
FWI5	01-Nov-85	1.0	P	FWI	1	10.6	9.0
FWI5	01-Nov-85	2.0	P	FWI	1	10.2	9.0
FWI5	01-Nov-85	3.0	P	FWI	1	10.2	8.5
FWI6	01-Nov-85	0.0	P	FWI	1	10.7	9.0
FWI6	01-Nov-85	1.0	P	FWI	1	10.4	9.0
FWI6	01-Nov-85	2.0	P	FWI	1	10.1	8.7
ALSC1	09-Jul-87	0.0	P	ALSC	1		25.6
ALSC1	09-Jul-87	1.5	P	ALSC	1		23.9
ALSC1	09-Jul-87	2.0	P	ALSC	1		23.3
ALSC1	09-Jul-87	4.0	P	ALSC	1		22.2
ALSC1	09-Jul-87	5.0	P	ALSC	1		16.1
ALSC1	09-Jul-87	6.0	P	ALSC	1		11.7
ALSC1	09-Jul-87	7.0	P	ALSC	1		10.0
ALSC1	09-Jul-87	8.0	P	ALSC	1		8.3
ALSC1	09-Jul-87	9.3	P	ALSC	1		7.8
ALSC1	09-Jul-87	1.5	G+	ALSC	1	8.0	

BIG BOWMAN POND

Site Code	Date	Depth	Smp Type	Smp Inst	Smp Vld	DO	Temp
ALSC1	09-Jul-87	7.0	G+	ALSC	1	8.0	
RPI1	15-Jun-72	0.0	P	RPI	3		18.5
RPI1	15-Jun-72	0.0	G+	RPI	2	11.0	18.0
RPI1	15-Jun-72	1.0	P	RPI	3		15.0
RPI1	15-Jun-72	2.0	P	RPI	3		11.0
RPI1	15-Jun-72	3.0	G+	RPI	2	11.0	13.4
RPI1	15-Jun-72	3.5	P	RPI	3		7.0
RPI1	15-Jun-72	5.0	G+	RPI	2	8.0	5.0
RPI1	15-Jun-72	8.0	G+	RPI	2	2.0	3.5
RPI1	15-Jun-72	12.5	P	RPI	3		4.0
RPI1	20-Jun-72	0.0	G+	RPI	2	9.0	19.2
RPI1	20-Jun-72	0.0	P	RPI	3		19.0
RPI1	20-Jun-72	2.0	P	RPI	3		17.0
RPI1	20-Jun-72	2.0	G+	RPI	2	9.0	19.2
RPI1	20-Jun-72	4.0	P	RPI	3		12.0
RPI1	20-Jun-72	6.0	P	RPI	3		6.0
RPI1	20-Jun-72	6.5	G+	RPI	2	10.0	4.4
RPI1	20-Jun-72	8.5	G+	RPI	2	1.4	4.4
RPI1	20-Jun-72	9.0	P	RPI	3		4.0
RPI1	28-Jun-72	0.0	P	RPI	2		19.0
RPI1	28-Jun-72	0.0	G+	RPI	2	8.0	18.2
RPI1	28-Jun-72	1.0	P	RPI	2		18.0
RPI1	28-Jun-72	2.5	P	RPI	2		18.0
RPI1	28-Jun-72	3.0	G+	RPI	2	8.0	17.0
RPI1	28-Jun-72	4.0	P	RPI	2		15.0
RPI1	28-Jun-72	5.0	P	RPI	2		10.0
RPI1	28-Jun-72	5.5	P	RPI	2		8.0
RPI1	28-Jun-72	6.5	G+	RPI	2	6.0	7.4
RPI1	28-Jun-72	7.0	P	RPI	2		5.0
RPI1	28-Jun-72	9.0	G+	RPI	2	1.2	6.0
RPI1	28-Jun-72	10.0	P	RPI	2		5.0
RPI1	11-Jul-72	0.0	G+	RPI	2	10.0	19.4
RPI1	11-Jul-72	1.0	P	RPI	2		19.0
RPI1	11-Jul-72	2.0	P	RPI	2		19.0
RPI1	11-Jul-72	2.5	P	RPI	2		18.5
RPI1	11-Jul-72	2.5	G+	RPI	2	9.0	18.6
RPI1	11-Jul-72	3.0	P	RPI	2		16.5
RPI1	11-Jul-72	4.0	P	RPI	2		14.0
RPI1	11-Jul-72	5.5	G+	RPI	2	8.0	7.8
RPI1	11-Jul-72	5.5	P	RPI	2		9.5
RPI1	11-Jul-72	6.5	P	RPI	2		8.0
RPI1	11-Jul-72	8.0	G+	RPI	2	0.6	5.6
RPI1	11-Jul-72	8.0	P	RPI	2		6.5
RPI1	11-Jul-72	9.0	P	RPI	2		6.5
RPI1	20-Jul-72	0.0	P	RPI	2		25.0
RPI1	20-Jul-72	0.0	G+	RPI	2	7.0	25.5
RPI1	20-Jul-72	1.5	G+	RPI	2	7.0	24.8
RPI1	20-Jul-72	2.0	P	RPI	2		21.5
RPI1	20-Jul-72	3.0	P	RPI	2		16.0
RPI1	20-Jul-72	4.5	P	RPI	2		12.0
RPI1	20-Jul-72	5.0	P	RPI	2		10.0
RPI1	20-Jul-72	6.0	P	RPI	2		9.0
RPI1	20-Jul-72	6.0	G+	RPI	2	5.0	8.0
RPI1	20-Jul-72	7.0	P	RPI	2		9.0
RPI1	20-Jul-72	8.0	G+	RPI	2	0.6	7.0
RPI1	01-Aug-72	0.0	P	RPI	2		18.5

BIG BOWMAN POND

Site Code	Date	Depth	Smp Type	Smp Inst	Smp Vld	DO	Temp
RPI1	01-Aug-72	0.0	G+	RPI	2	8.0	20.8
RPI1	01-Aug-72	3.0	P	RPI	2		18.5
RPI1	01-Aug-72	3.0	G+	RPI	2	8.0	20.8
RPI1	01-Aug-72	4.0	P	RPI	2		14.2
RPI1	01-Aug-72	4.5	P	RPI	2		10.0
RPI1	01-Aug-72	5.0	G+	RPI	2	8.0	10.3
RPI1	01-Aug-72	5.5	P	RPI	2		8.3
RPI1	01-Aug-72	8.5	G+	RPI	2	0.2	6.0
RPI1	01-Aug-72	8.5	P	RPI	2		6.0
FWI3	09-Aug-89	0.0	P	FWI	1	7.8	23.0
FWI3	09-Aug-89	1.0	P	FWI	1	7.6	22.5
FWI3	09-Aug-89	2.0	P	FWI	1	7.6	22.0
FWI3	09-Aug-89	3.0	P	FWI	1	7.6	21.9
FWI3	09-Aug-89	4.0	P	FWI	1	7.1	18.0
FWI3	09-Aug-89	5.0	P	FWI	1	8.5	12.2
FWI3	09-Aug-89	6.0	P	FWI	1	5.5	9.0
FWI3	09-Aug-89	7.0	P	FWI	1	2.3	7.6
FWI3	09-Aug-89	8.0	P	FWI	1	1.2	7.0
FWI3	09-Aug-89	9.0	P	FWI	1	0.7	6.5

APPENDIX P

Big Bowman Pond excerpt from Adirondack Lake Survey Corp. (1989)

BIG BOWMAN POND
130444 (LH)

****
* LOCATION and STATUS *
****

Latitude:	423903
Longitude:	732920
Elevation:	430 m
Quadrangle:	K271 TABORTON
County:	RENSSELAER
Ownership:	PRIVATE
Posting:	POSTED

Access

Type	Owner-ship	Posted Status	Distance To Road	Road Class
ROAD	PRIVATE	POSTED	0.0 km	2 WHEEL DR

Boat Access

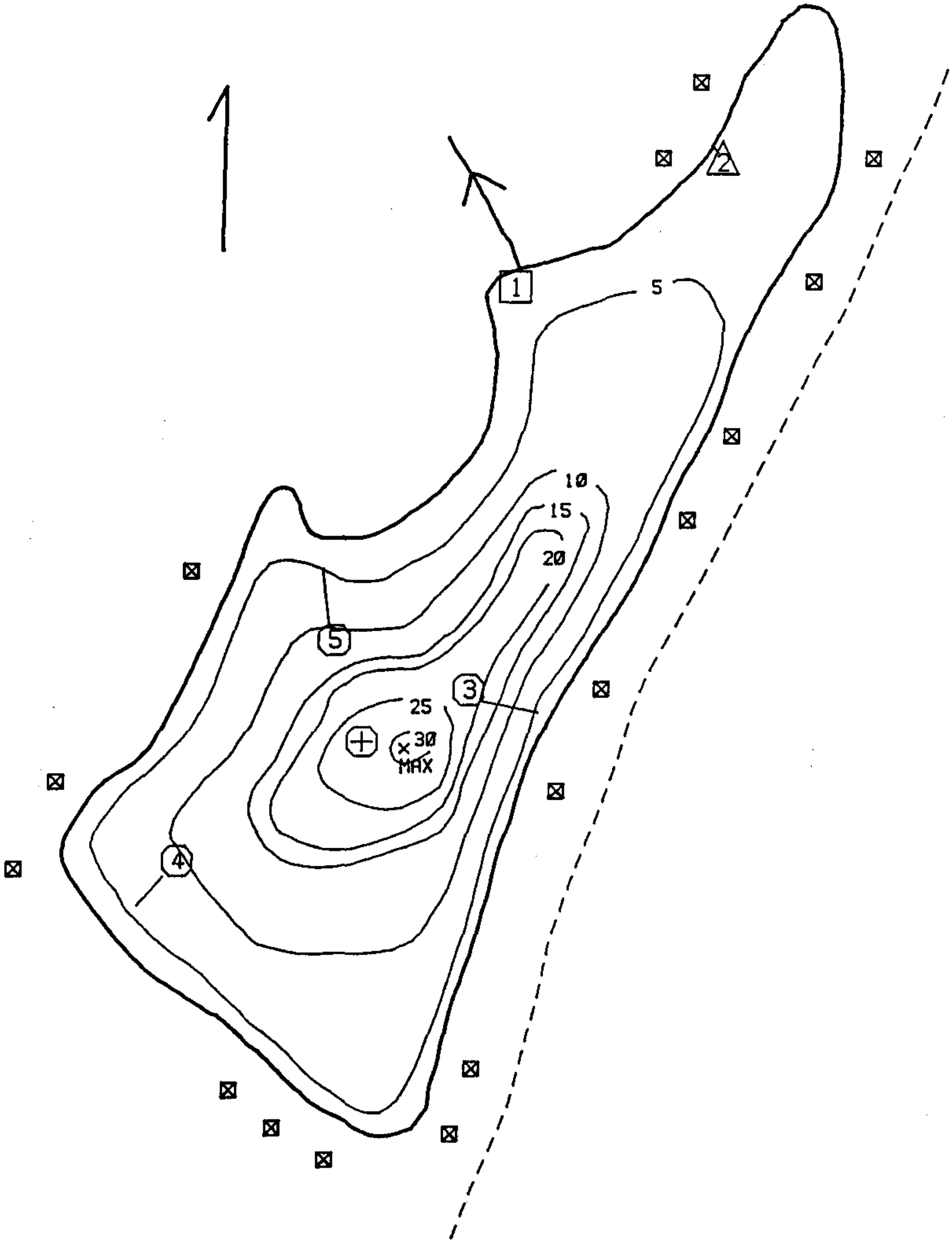
Type:	HAND LAUNCH
Ownership:	PRIVATE

General Watershed Characteristics(%)

Deciduous Forest:	50
Coniferous Forest:	
Decid-Conif Mix:	15
Shrub-Sapling Area:	5
Wetland:	
Open Grass:	
Agricultural:	
Developed:	30

Immediate Shoreline Characteristics(%)

Deciduous Forest:	15
Coniferous Forest:	
Decid-Conif Mix:	15
Shrub-Sapling Area:	10
Wetland:	
Open Grass:	
Agricultural:	
Developed:	60
Sand-Gravel Beach:	
Boulder Rock Ledge:	



BIG BOWMAN POND
13-0444
ALSC 6/15/87
CONTOUR INTERVAL: 5 FT
SURFACE AREA: 30 ACRES
MAXIMUM DEPTH: 33 FT

325'
DWELLING
ROAD/TRAIL

6/15/87
WATER CHEMISTRY
150 FT GILL NET
30 FT MINNOW NET
MINNOW TRAP

BIG BOWMAN POND
130444 (LH)

****
* MORPHOMETRICS *
****

Area:	Surface(SA):	12.0 ha
====	Watershed(WA):	101.9 ha
	Littoral Zone:	8.1 ha
	SA/WA Ratio:	.12
Depth:	Mean:	2.8 m
=====	Max:	10.1 m
	Volume:	330213 m3
	Shoreline Length:	1.9 km
	Mean Annual Runoff:	46 cm
	Flushing Rate:	1.4 times/year
	Shoreline Slope <5 deg.:	10 %

Shoalwater Substrate(%)
=======================

Boulder:	35
Rubble:	15
Gravel:	10
Sand:	10
Muck/Silt:	15
Organic:	15

Date: 06/15/1987

Inlet:
=====

NO INLET PRESENT

Outlet:
======

1 Estimated Flow: 2538.70 liters/minute
Outlet Dam: NO

Remarks:
06/15 POND IS SURROUNDED BY TOO MANY HOUSES TO PUT ON THE MAP.

BIG BOWMAN POND
130444 (LH)

****
* INVERTEBRATES *
* MACROPHYTES *
****

Macroinvertebrates
==================

Date: 06/15/1987

Method: D-FRAME DIP NET

Phylum	Class	Order	Family
ARTHROPODA	CRUSTACEA	CLADOCERA	UNSPECIFIED
		AMPHIPODA	UNSPECIFIED
		DECAPODA	ASTACIDAE
	INSECTA	EPHEMEROPTERA	CAENIDAE
		EPHEMEROPTERA	EPHEMERELLIDAE
		ODONATA	LIBELLULIDAE
		ODONATA	LESTIDAE
		ODONATA	COENAGRIIDAE
		ODONATA	GOMPHIDAE
		ODONATA	AESHNIDAE
		HEMIPTERA	GERRIDAE
		HEMIPTERA	MESOVELIIDAE
		COLEOPTERA	HALIPLIDAE
		COLEOPTERA	DYTISCIDAE
		COLEOPTERA	GYRINIDAE
		DIPTERA	CHIRONOMIDAE
MOLLUSCA	GASTROPOD	MESOGASTROPODA	VIVIPARIDAE
	PELECYPOD	UNIONOIDA	UNSPECIFIED
		VENEROIDA	SPHAERIIDAE

Aquatic Macrophytes
===================

Date: 06/15/1987

	Type(%)
Emergent vegetation:	2
Submergent vegetation:	5
Floating vegetation:	3
Open water:	95

BIG BOWMAN POND
130444 (LH)

****
* INVERTEBRATES *
* MACROPHYTES *
****

Aquatic Macrophytes

Species

FONTINALIS spp.
EQUISETUM spp.
TYPHA spp.
SPARGANIUM spp.
POTAMOGETON spp.
DULICHIUM spp.
SCIRPUS spp.
ERIOCAULON spp.
IRIS spp.
NUPHAR spp.
NYMPHAEA spp.
UTRICULARIA spp.
ALGAE-NUMEROUS TAXA

Date: 07/09/1987

Type(%)	
Emergent vegetation:	0
Submergent vegetation:	10
Floating vegetation:	5
Open water:	95

Species

TYPHA spp.
SPARGANIUM spp.
POTAMOGETON spp.
PONTEDERIA spp.
IRIS spp.
NUPHAR spp.
NYMPHAEA spp.
UTRICULARIA spp.

BIG BOWMAN POND
130444 (LH)

****
* FISHERIES SUMMARY *
****

Date: 06/15/1987

Station: 1 M-TRAP .25" METAL 17.9 hrs
=========== DEPTH SET: .3 m

Species	#	Total Wt (g)	Length Range (mm)
NO FISH CAPTURED			

Station: 2 MONO G-NET 30' 19.6 hrs
=========== MIN DEPTH: .5 m MAX DEPTH: 1.0 m

Species	#	Total Wt (g)	Length Range (mm)
GOLDEN SHINER	2	18	104 - 104

Station: 3 E-S GILL NET 150' 18.8 hrs
=========== MIN DEPTH: 1.5 m MAX DEPTH: 7.3 m

Species	#	Total Wt (g)	Length Range (mm)
CHAIN PICKEREL	3	520	100 - 331
GOLDEN SHINER	1	40	151 - 151
BROWN BULLHEAD	1	400	306 - 306
ROCK BASS	3	480	181 - 225
LARGEMOUTH BASS	1	2100	513 - 513
YELLOW PERCH	26	1820	146 - 231

Station: 4 E-S GILL NET 150' 18.8 hrs
=========== MIN DEPTH: 2.1 m MAX DEPTH: 2.7 m

Species	#	Total Wt (g)	Length Range (mm)
CHAIN PICKEREL	1	580	441 - 441
GOLDEN SHINER	3	210	181 - 205
BROWN BULLHEAD	3	802	57 - 300
ROCK BASS	7	1480	185 - 251
LARGEMOUTH BASS	1	940	406 - 406
YELLOW PERCH	24	2100	*

BIG BOWMAN POND
130444 (LH)

****
* FISHERIES SUMMARY *
****

Date: 06/15/1987

Station: 5 E-S GILL NET 150' 18.8 hrs
=========== MIN DEPTH: 3.0 m MAX DEPTH: 4.6 m

Species	#	Total Wt (g)	Length Range (mm)
GOLDEN SHINER	2	90	157 - 176
BROWN BULLHEAD	3	940	257 - 310
ROCK BASS	9	1590	161 - 240
PUMPKINSEED	2	210	155 - 196
YELLOW PERCH	10	600	*

CATCH PER UNIT EFFORT (#/Hour) BY SPECIES AND GEAR TYPE

Species	150 Ft Gill Net	30 Ft Minnow Net	Minnow Trap
CHAIN PICKEREL	.07	0.00	0.00
GOLDEN SHINER	.11	.10	0.00
BROWN BULLHEAD	.12	0.00	0.00
ROCK BASS	.34	0.00	0.00
PUMPKINSEED	.04	0.00	0.00
LARGEMOUTH BASS	.04	0.00	0.00
YELLOW PERCH	1.06	0.00	0.00
Hours Set	56.4	19.6	17.9

Remarks:
06/15 NO SUITABLE SEINING SITES FOUND.

BIG BOWMAN POND
130444 (LH)

* CHEM/PHYS PARAMETERS *

DATE(1987)	06/16	07/09	07/09
STATION	6	1	1
DEPTH(m)	1.5	1.5	7.0
PHYS/CHEM DATA			
FIELD pH	6.37	5.86	5.75
LAB pH	6.92	6.91	6.46
AIR EQ pH	7.02	7.05	6.89
ANC (ueq/l)	170.6	178.7	167.9
DIC (mg/l-C)	2.21	2.50	3.62
DOC (mg/l-C)	3.7	4.2	3.3
LAB (Pt-Co)	10	10	20
FIELD (Pt-Co)	15	35	30
VISUAL COLOR	OTHER	OTHER	
SECCHI DEPTH(m)	9.0	3.0	
SP. COND (25 C) (umhos/cm)	117.1	116.3	112.3
ANIONS (mg/l)			
SIO2	1.2	.3	1.9
SO4	6.95	6.90	7.15
NO3-N	LTD	LTD	.06
CL	23.35	23.42	22.36
F	.099	.108	.091
TOTAL P1	.012	.007	.004
TOTAL P2	.019	.009	.006
CATIONS (mg/l)			
NH4-N	LTD	.03	LTD
CA	6.07	5.63	5.82
MG	1.05	1.04	1.00
NA	14.32	12.60	12.11
K	.56	.50	.46
TRACE METALS (mg/l)			
AL	.036	.026	.041
FE	.048	.021	.012
MN	.096	.032	.012
PB	LTD	LTD	LTD
ZN	.002	LTD	.003
CU	.002	LTD	.007

BIG BOWMAN POND
130444 (LH)

****
* CHEM/PHYS PARAMETERS *
****

==

MIDSUMMER TEMPERATURE PROFILE

DATE: 07/09/87

Station	Depth(m)	Temp (C)	D.O.(ppm)	LAB pH
1	0.0	25.6		
1	1.5	23.9	8.0	6.91
1	2.0	23.3		
1	4.0	22.2		
1	5.0	16.1		
1	6.0	11.7		
1	7.0	10.0	8.0	6.46
1	8.0	8.3		
1	9.3	7.8		

==

Remarks:
06/15 PREVIOUS 48 HOURS WEATHER WARM WITH RAIN. WATER COLOR YELLOW-GREEN.
07/09 PREVIOUS 48 HOUR WEATHER; HOT & HUMID WITH SOME SHOWERS. WATER COLOR LIGHT-GREEN.

APPENDIX Q

Big Bowman Pond excerpt from Soil Survey of Rensselaer County, U. S. Dept. of Agriculture, Soil Conservation Service (1988)

Brayton Series

The Brayton series consists of deep, somewhat poorly drained or poorly drained soils on till plains of the grit plateau. These soils formed in glacial till that was derived mainly from sandstone. These soils have a dense fragipan in the subsoil. Slope ranges from 0 to 3 percent.

Typical pedon of Brayton gravelly silt loam in an area of Brayton very stony silt loam, nearly level; in a wooded area, 100 feet east of Long Pond Road, 3/4 mile northeast of the outlet of Second Pond; town of Grafton:

O2—1 inch to 0; decomposed leaf litter.

Ap1—0 to 7 inches; very dark grayish brown (10YR 3/2) gravelly silt loam; weak medium granular structure; friable; many roots; 15 percent coarse fragments; very strongly acid; clear smooth boundary.

Ap2—7 to 11 inches; dark brown (10YR 3/3) gravelly silt loam; moderate medium granular structure; friable; common roots; 15 percent coarse fragments; strongly acid; clear smooth boundary.

B21—11 to 16 inches; grayish brown (2.5Y 5/2) gravelly loam; common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; common roots; 25 percent coarse fragments; strongly acid; clear wavy boundary.

B22—16 to 19 inches; light olive brown (2.5Y 5/4) loam; many medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few roots; 20 percent coarse fragments; strongly acid; clear wavy boundary.

Bx1—19 to 30 inches; olive brown (2.5Y 4/4) gravelly loam; strong thick platy structure within coarse and very coarse prisms; very firm; few roots on prism faces; light brownish gray (2.5Y 6/2) coats on prisms having streaks outlined by reddish brown (5YR 4/4) borders; manganese stains; 20 percent coarse fragments; medium acid; clear wavy boundary.

Bx2—30 to 60 inches; yellowish brown (10YR 5/4) gravelly loam; strong thick platy structure within coarse and very coarse prisms; very firm; streaks of light olive gray (5Y 6/2) with brown to dark brown (7.5YR 4/4) borders on prisms; 25 percent coarse fragments; slightly acid.

The solum is 40 inches or more thick. Depth to bedrock is more than 5 feet. Depth to the fragipan ranges from 13 to 24 inches. Coarse fragments, mainly sandstone, make up 10 to 35 percent of the volume of the soil above the fragipan and 10 to 45 percent of the fragipan. Reaction above the fragipan is very strongly acid to slightly acid, and in the fragipan it is medium acid to neutral.

The Ap horizon has hue of 10YR or 2.5Y, value of 3 to 4, and chroma of 2 or 3. Texture is loam, silt loam, or sandy loam and is gravelly in places.

The B2 horizon has hue of 10YR or 2.5Y, value of 3 to 6, and chroma of 2 to 4. Texture is loam or sandy loam and is gravelly in places.

The Bx horizon has hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 2 to 4. Texture is loam or sandy loam and is gravelly or very gravelly in places.

Buckland Series

The Buckland series consists of deep, well drained or moderately well drained soils on the grit plateau. These soils formed in glacial till that was derived mainly from sandstone. These soils have a very firm fragipan in the lower part of the subsoil. Slope ranges from 3 to 50 percent.

Typical pedon of Buckland loam in an area of Buckland very stony loam, sloping; in a wooded area, 75 feet east of Woods Road, 50 feet north of access road to Davitt Pond, 1/4 mile west of parking lot; town of Poestenskill:

O1—2 inches to 0; dark reddish brown (5YR 2/2) partially decomposed leaf mat.

A1—0 to 2 inches; very dark grayish brown (10YR 3/2) loam; weak fine granular structure; very friable; many fine and medium roots; 10 percent coarse fragments; very strongly acid; abrupt wavy boundary.

B2—2 to 18 inches; dark yellowish brown (10YR 4/4) gravelly loam; weak medium subangular blocky structure parting to weak fine granular; very friable; many fine and medium roots; 25 percent coarse fragments; very strongly acid; clear wavy boundary.

A'2—18 to 22 inches; brown (10YR 5/3) gravelly loam; few fine faint light brownish gray (10YR 6/2) and few fine distinct brown (7.5YR 4/4) mottles; weak medium platy structure; firm; common fine and medium roots; common fine pores; 20 percent coarse fragments; very strongly acid; abrupt wavy boundary.

B'x—22 to 60 inches; brown (10YR 4/3) gravelly loam; few fine yellowish brown (10YR 5/4) mottles; moderate very coarse prismatic structure parting to weak medium subangular blocky; very firm, brittle; grayish brown (10YR 5/2) ped faces; 3/8 to 1/2 inch streaks between prisms, streak are light gray (10YR 7/1) with strong brown (7.5YR 5/6) borders; prisms range from 6 inches to 20 inches in width; discontinuous clay films in pores; 20 percent coarse fragments; black manganese stains; medium acid.

The solum is 40 inches or more thick. Depth to bedrock is more than 60 inches. Depth to the top of the fragipan ranges from 18 to 36 inches. Texture throughout is silt loam, loam, or sandy loam and is gravelly in places. Coarse fragments, mainly of sandstone, make up 5 to 25 percent of the volume of the soil above the fragipan and 10 to 35 percent of the fragipan. Reaction is strongly acid to very strongly acid above the pan and strongly acid to medium acid in the fragipan.

The Ap or A1 horizon has hue of 10YR, value of 2 to 4, and chroma of 2.

The B2 horizon has hue of 5YR to 10YR, value of 4 or 5, and chroma of 4 to 6.

The A'2 horizon has hue of 10YR, value of 5 or 6, and chroma of 1 to 3.

The B'x horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 or 3.

Buckland soils in this county are taxadjuncts to the Buckland series because they lack a spodic horizon; are very strongly acid above the fragipan and strongly acid in the pan; have hue of 5YR and chroma of 6 in the B2 horizon and hue of 10YR in the B'x horizon; and have very coarse prismatic structure in the B'x horizon. These differences, however, do not greatly affect the use or management of these soils.

SOIL TYPE
AND RESTRICTIONS

	Brayton very stony silt loam, nearly level	Buckland very stony loam, sloping	Buckland very stony loam, moderately steep
Characteristic	BrA	BuC	BuD
Yield per Acre of Crops and Pasture	Not suited for most crops, Pasture - 1.5 animal units (e.g., cow) per acre	Not suited for most crops, Pasture - 2.5 animal units per acre	Not suited for most crops, Pasture - 2.0 animal units per acre
Woodland Management			
Erosion Hazard	Slight	Slight	Slight
Equipment Limitation	Sever	Slight	Moderate
Seedling Mortality	Sever	Slight	Slight
Windthrow Hazard	Sever	Slight	Slight
Potential Productivity (examples)	Northern Red Oak 43 cu ft/ acre Sugar Maple 38 cu ft/ acre Eastern White Pine 119 cu ft/ acre	Sugar Maple 36 cu ft/ acre Eastern White Pine 129 cu ft/ acre	Sugar Maple 36 cu ft/ acre Eastern White Pine 129 cu ft/ acre
Recreational Development			
Camp Areas	Sever: wetness percs slowly.	Moderate: slope, large stones, wetness.	Sever: slope.
Picnic Areas	Sever: wetness percs slowly.	Moderate: slope, large stones, wetness.	Sever: slope.
Playgrounds	Sever: large stones, wetness.	Sever: slope, large stones.	Sever: slope, large stones.
Paths and Trails	Sever: wetness.	Moderate: wetness.	Sever: slope.

Characteristic	SOIL TYPE AND RESTRICTIONS BrA	BuC	BuD
Building Site Development			
Shallow Excavations	Sever: wetness.	Sever: wetness.	Sever: slope, wetness.
Dwellings Without Basements	Sever: wetness.	Moderate: wetness.	Sever: slope.
Dwellings With Basements	Sever: wetness.	Sever: wetness.	Sever: slope, wetness.
Small Commercial Buildings	Sever: wetness.	Sever: slope.	Sever: slope.
Local Roads and Streets	Sever: wetness, frost action.	Moderate: frost action, wetness.	Sever: slope.
Lawns and Landscaping	Sever: wetness.	Moderate: slope, large stones.	Sever: slope.
Sanitary Facilities			
Septic Tank Absorption Fields	Sever: wetness percs slowly.	Sever: percs slowly, wetness.	Sever: slope, percs slowly, wetness.
Sewage Lagoon Areas	Slight ------	Sever: slope.	Sever: slope.
Trench Sanitary Landfill	Sever: wetness.	Sever: wetness.	Sever: slope, wetness.
Area Sanitary Landfill	Sever: seepage wetness.	Moderate: wetness.	Sever: slope.
Daily Cover for Landfill	Poor: small stones, wetness.	Fair: slope, small stones, wetness.	Poor: slope.

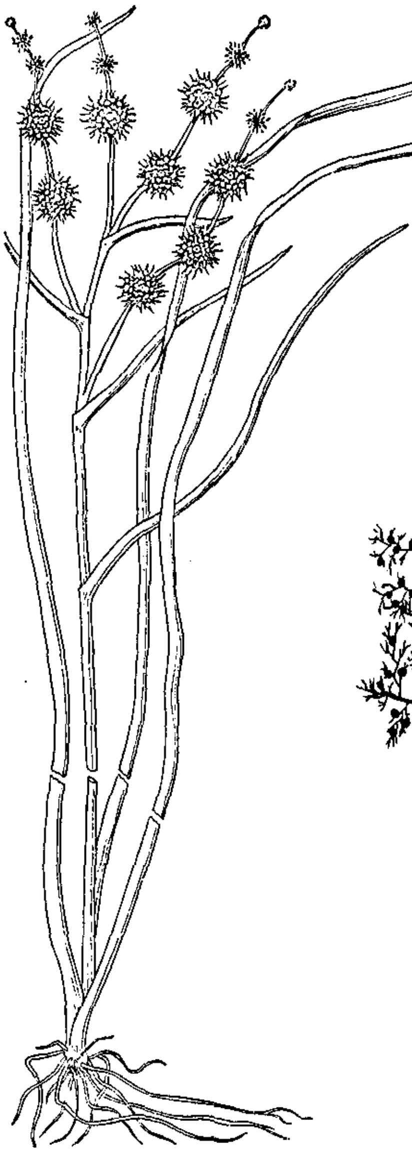
Page 2 of 3

Characteristic	SOIL TYPE AND RESTRICTIONS BrA	BuC	BuD
Construction Material			
Roadfill	Poor: wetness.	Fair: wetness.	Poor: slope.
Sand	Improbable: excess fines.	Improbable: excess fines.	Improbable: excess fines.
Gravel	Improbable: excess fines.	Improbable: excess fines.	Improbable: excess fines.
Topsoil	Poor: area reclaim, large stones, wetness.	Poor: large stones.	Poor: slope, large stones.
Water Management			
Drainage	Percs slowly, frost action.	Slope -----	Slope -----
Terraces and Diversions	Large stones, wetness.	Slope, rooting depth, large stones, wetness.	Slope, rooting depth, large stones, wetness.
Grassed Waterways	Large stones, wetness.	Slope, large stones, rooting depth, wetness.	Slope, large stones, rooting depth, wetness.

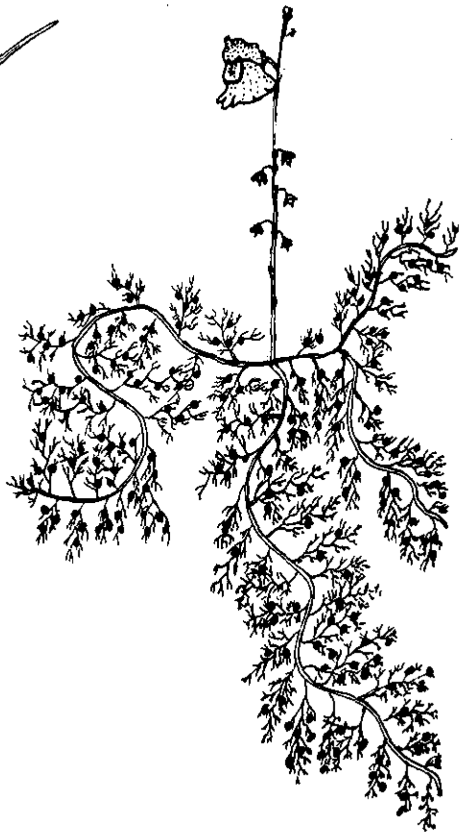
Page 3 of 3

APPENDIX R

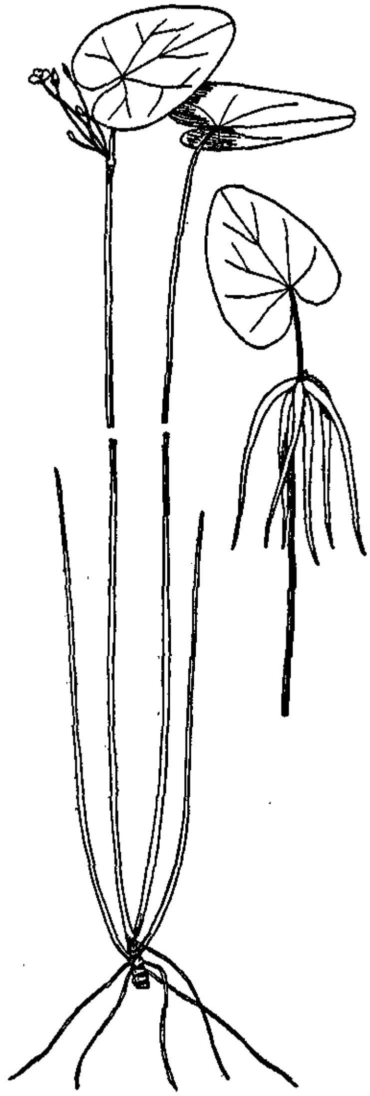
Line drawing of some of the aquatic plants found in Big Bowman Pond from Muenscher (1944) and Odgen et al. (1976)



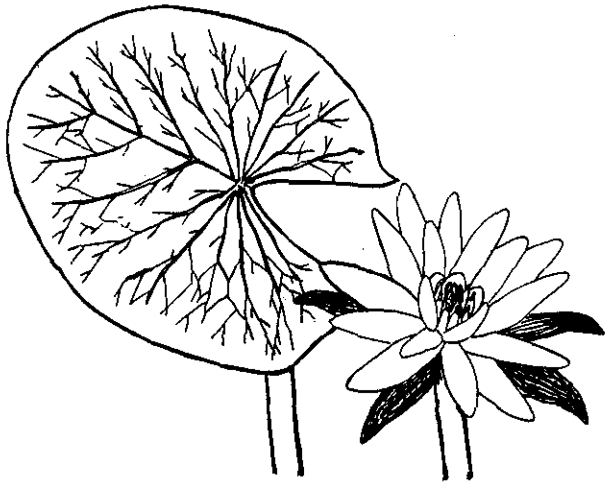
Sparganium fluctuans
Bur-reed



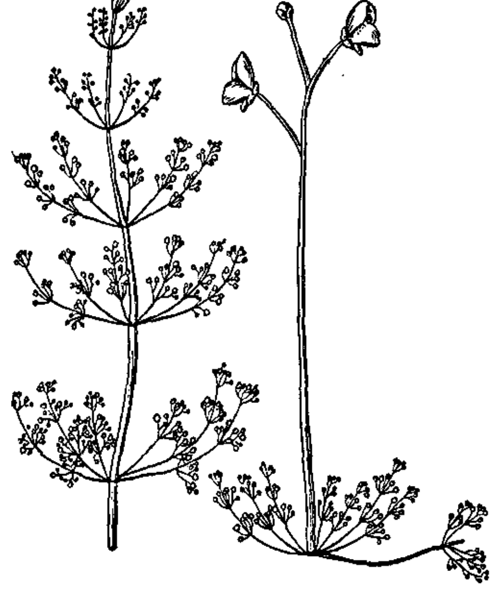
Utricularia vulgaris
Bladderwort



Nymphoides cordatum
Floating Heart

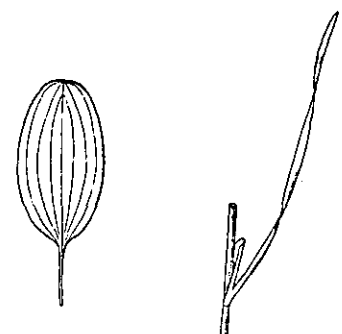


Nymphaea odorata
White Water Lily



Utricularia purpurea
Purple-flowered Bladderwort

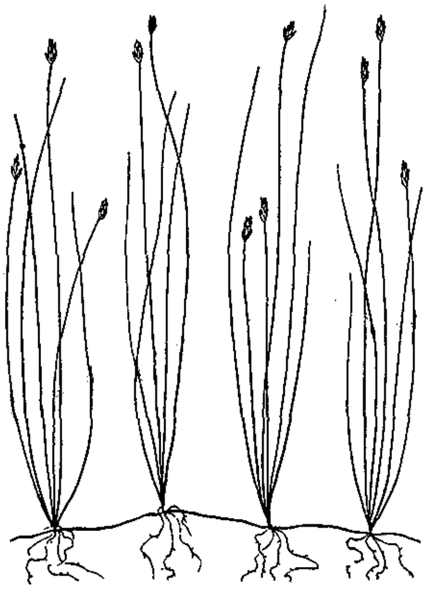
Potamogeton epihydrus
Pondweed



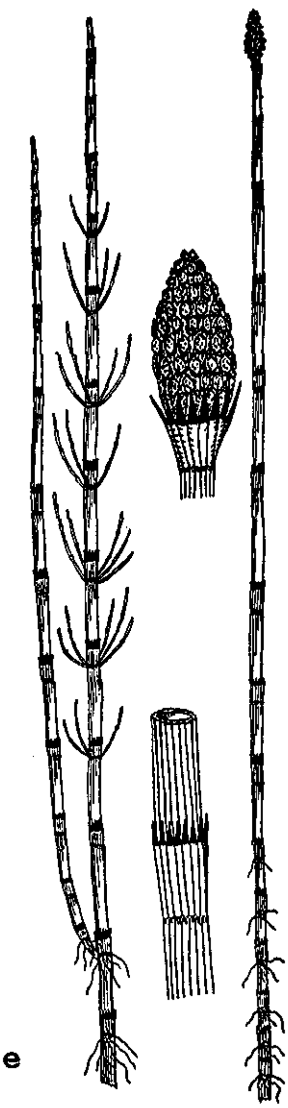
A B

Potamogeton diversifolius
Pondweed

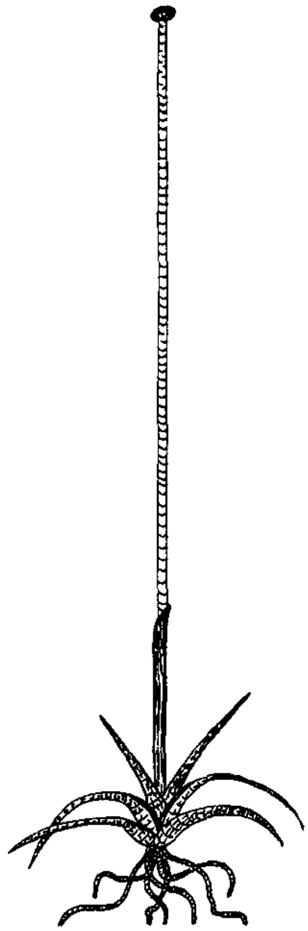
A. Floating leaf
B. Submersed leaf with stipule



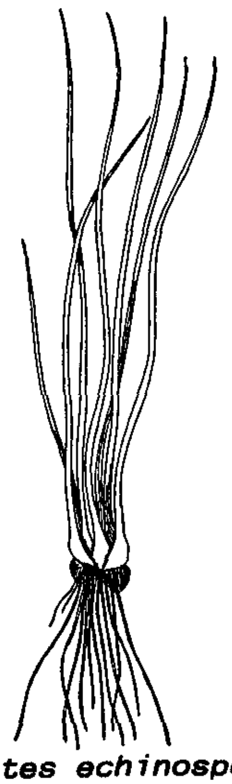
Eleocharis acicularis
Spike Rush



Equisetum fluviatile
Marsh Horsetail

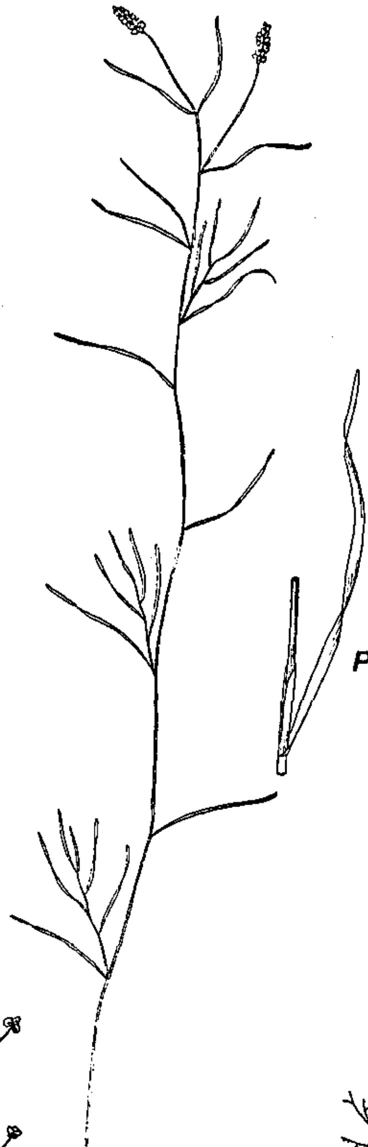


Eriocaulon septangulare
Pipewort

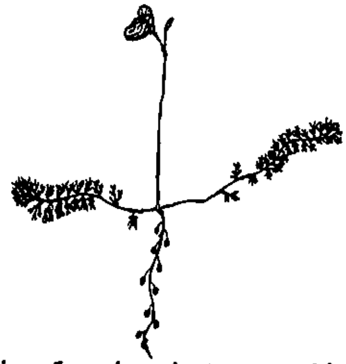


Isoetes echinospora
var. braunii
Quillwort

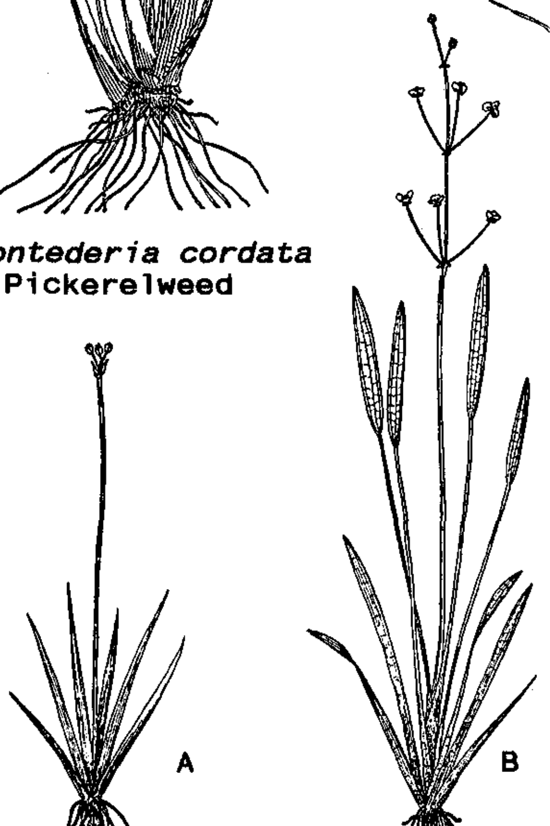
Pontederia cordata
Pickerelweed



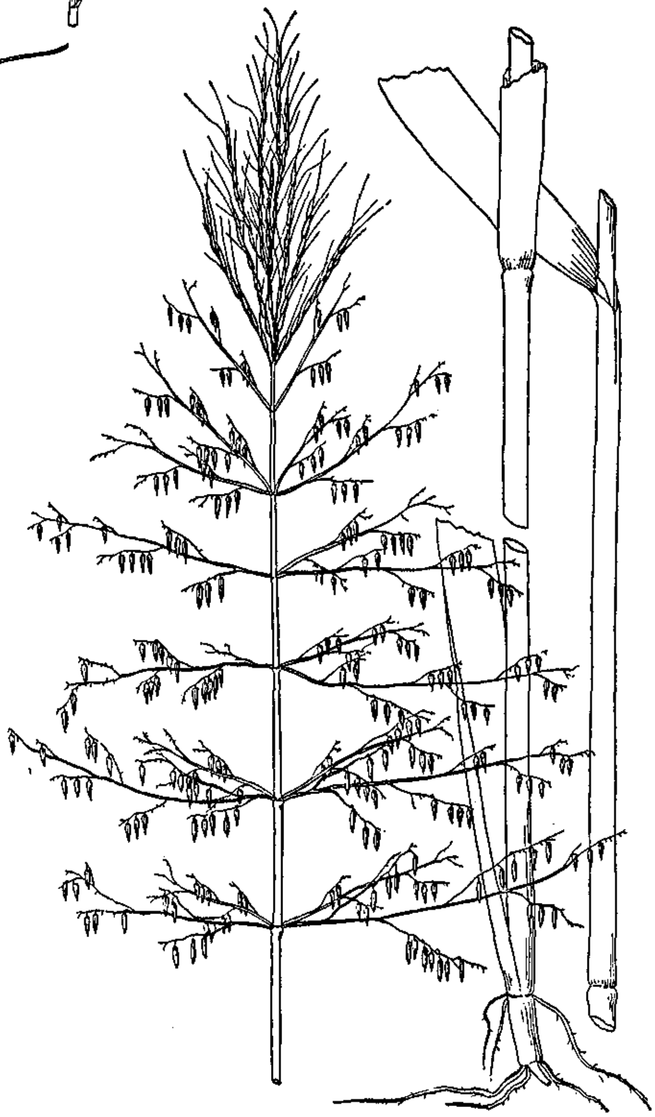
Potamogeton pusillus
Pondweed



Utricularia intermedia
Intermediate Bladderwort



Sagittaria graminea
Arrowhead
A. From deep water - short rosette of leaves
B. From shallow water - two kinds of leaves



Zizania aquatica
Wild Rice

APPENDIX S

Letter from NYS DEC Region IV to Mr & Mrs. Coiteux
regarding samples taken July 12, 1990

New York State Department of Environmental Conservation
2176 Guilderland Avenue, Schenectady, New York 12306
(518) 382-0680

Thomas C. Jorling
Commissioner

July 23, 1990

Mr. & Mrs. Dan Coiteux
135A Taborton Road
Sand Lake, NY 12153

Re: Big Bowman Pond
Town of Sand Lake
Rensselaer County

Dear Mr. & Mrs. Coiteux:

On July 12, 1990, representatives of this office visited Big Bowman Pond in response to your inquiries concerning the observance of a orange/rusty colored material along the shoreline. Based upon our observations, the material appears to be iron bacteria, which is commonly found in water containing iron. A sample of the lake water was also taken and analyzed and found to contain 3.5 mg/l of iron, thus confirming the presence of iron. The water quality standard for iron in a Class B pond is 0.3 mg/l.

Samples were also taken of the lake water and a small tributary in the southwest corner of the lake for the purposes of analyzing for chloride. Within the lake, 2.6 mg/l of chloride were found. Within the tributary 4.5 mg/l of chloride were detected. The water quality standard for chloride in a Class A water is 250 mg/l. Big Bowman Pond is classified as a Class B water, so the standard is not applicable. If the pond and tributary were Class A drinking waters, however, the measured levels would fall much below the standard. I have enclosed a copy of our Water Quality Regulations for your information.

Should you have any questions on this, please contact me.

Sincerely,

Andrea J. Dzierwa

Andrea J. Dzierwa, P.E.
Senior Sanitary Engineer
Region IV

AJD/ml-15AD13