Twin Lakes Management Plan

Phase I: Twin Lakes Data Collection (Lake Water Quality, Macrophyte Survey, Precipitation Data, and Lake Level Data)

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Prepared for
Twin Lakes Preservation Association

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with Assistance from:
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Executive Summary

The study described by this report was initiated by the Twin Lakes Preservation Association to investigate the lakes' current condition and provide information for the development of a lake management plan. The study involved collection of data from Twin Lakes, including lake water quality, precipitation, and lake level data during 2002. The U.S. Natural Resources Conservation Service (NCRS) and the Washburn County Land Conservation Department (LCD) were contacted regarding available land use information for the Twin Lakes' watersheds. The lakes' watersheds are natural forestland.

The lake water quality data showed that the lakes exhibited low to moderate productivity and had excellent water quality. Total phosphorus, chlorophyll *a*, and Secchi disc data were within the oligotrophic (low productivity) or mesotrophic (moderate productivity) categories. The lakes observed a stable water quality during the monitoring period. The data indicate the lakes are healthy and have no problems.

Water clarity is correlated with recreational-use of a lake. Secchi disc measurements suggest the lakes' water transparency was suitable for all lake uses and recreational-use impairment did not occur in Twin Lakes.

Temperature data from the lakes indicated North and South Twin lakes were thermally stratified (i.e., temperature layers) during the June through September period. The lakes were completely mixed during the spring and fall. Middle Twin Lake, a shallow lake, was completely mixed during May through October.

The lakes' bottom waters were oxygenated throughout the monitoring period. The oxygenated bottom waters were favorable for the lakes' fishery and prevented recycling of phosphorus from the lakes' sediments.

Specific conductance profiles indicate low concentrations of dissolved solids were observed in the three lakes. The data are consistent with the lakes' chlorophyll and phosphorus data, which are low, and indicate the lakes' water quality is excellent.

Twin Lakes noted a diverse and balanced phytoplankton community. The lakes' phytoplankton community ascertains the lakes' excellent water quality.

Twin Lakes noted a healthy and diverse assemblage of zooplankton. The three major groups of zooplankton were observed in each lake.

The diverse assemblage of macrophyte (aquatic plants) species noted in Twin Lakes is indicative of a stable and healthy macrophyte community. The communities were balanced and the four types of macrophytes were represented in the lakes. Macrophytes were found wherever light penetrated to the lakes' bottom. Maximum depth of macrophyte growth was 9 feet in North Twin Lake and 15 feet in South Twin Lake. Because Middle Twin Lake is shallow, macrophyte growth was observed in the entire water body. Macrophyte density in the lakes was generally light to moderate. A few areas within North and South Twin Lakes observed heavy growth.

Historical Secchi disc data from North and South Twin Lakes were evaluated. The data indicate variation has occurred, but the water quality of each lake has remained stable over time. The measurements have generally been within the mesotrophic (moderately productive) category, with some measurements in the oligotrophic category (low productivity). South Twin Lake observed a measurement in the eutrophic (high productivity) category following the lake's fall mixing event during 2000.

2002 precipitation data indicated 27.3 inches of precipitation occurred at the North Twin Lake gage and 27.5 inches of precipitation occurred at the South Twin Lake gage during the May through October period. 2002 precipitation data from the Middle Twin Lake gage indicated 23.6 inches of precipitation occurred during the May through September period.

The 2002 monitored lake water surface elevations had a range of approximately one half foot during the May through early November period. The lakes' surface elevations were lowest in May or June and highest during August or October.

Analysis of data collected from Twin Lakes in 2002 indicated the lakes are healthy and in good condition. There are no problems evident in the lakes' current water quality.

Completion of additional phases of the Lake Management Plan project for Twin Lakes is recommended to protect the lakes' water quality. Suggested work tasks include preparation of hydrologic and phosphorus budgets for each lake basin and development of a management plan for the lakes' and their watersheds.

Table of Contents

Acknowledgments i

Executive Summary ii

1.0 Introduction 1
1.1 Comprehensive Lake Management Plan 1
1.2 Report Coverage 1

2.0 General Concepts in Lake Water Quality 2
2.1 Eutrophication 2
2.2 Trophic States 2
2.3 Limiting Nutrients 3
2.4 Nutrient Recycling and Internal Loading 4
2.5 Stratification 4
2.6 Watershed 5

3.0 Basin Characteristics 6

4.0 Methods 8
4.1 Lake Water Quality Data Collection 8
4.2 Lake Macrophyte Survey 8
4.3 Evaluation of the Tributary Watershed 12

5.0 Results and Discussion 13
5.1 Compiled Data 13
5.2 Seasonal Patterns in 2002 Water Quality Conditions 13
5.2.1 Phosphorus 13
5.2.2 Chlorophyll *a* 18
5.2.3 Secchi Disc Transparency 19
5.2.4 Temperature, Dissolved Oxygen, and Specific Conductance Profiles 23
5.3 Ecosystem Data 23
5.3.1 Phytoplankton 24
5.2.2 Zooplankton 28
5.2.3 Macrophytes 32
5.4 Evaluation of Historical Secchi Disc Data 36
5.5 Rainfall and Lake Level Data 39

6.0 Conclusions and Recommendations 40
6.1 Conclusions 40
6.2 Recommendations 40

References
Appendices

List of Tables

Table 1 Twin Lakes Morphological Characteristics 6
Table 2 2002 North Twin Lake Water Quality Parameters 9
Table 3 2002 Middle Twin Lake Water Quality Parameters 10
Table 4 2002 South Twin Lake Water Quality Parameters 11
Table 5 2002 Twin Lakes Surface Water May N:P ratios 13
Table 6 2002 Twin Lakes Surface Water Total Phosphorus Data Summary 14
Table 7 2002 Twin Lakes Surface Water Chlorophyll *a* Summary 18

List of Figures

Figure 1 Site Map Twin Lakes 7
Figure 2 North Twin Lake 2002 Total Phosphorus Concentrations 15
Figure 3 Middle Twin Lake 2002 Total Phosphorus Concentrations 16
Figure 4 South Twin Lake 2002 Total Phosphorus Concentrations 17
Figure 5 North Twin Lake 2002 Secchi Disc Transparencies 20
Figure 6 Middle Twin Lake 2002 Secchi Disc Transparencies 21
Figure 7 South Twin Lake 2002 Secchi Disc Transparencies 22
Figure 8 2002 North Twin Lake Phytoplankton Data Summary by Division 25
Figure 9 2002 Middle Twin Lake Phytoplankton Data Summary by Division 26
Figure 10 2002 South Twin Lake Phytoplankton Data Summary by Division 27
Figure 11 2002 North Twin Lake Zooplankton Data Summary 29
Figure 12 2002 Middle Twin Lake Zooplankton Data Summary 30
Figure 13 2002 South Twin Lake Zooplankton Data Summary 31
Figure 14 North Twin Lake June 21, 2002 33
Figure 15 Middle Twin Lake June 21, 2002 34
Figure 16 South Twin Lake June 21, 2002 35
Figure 17 North Twin Lake 1993-2002 Secchi Disc Transparencies 37
Figure 18 South Twin Lake 1994-2002 Secchi Disc Transparencies 38

List of Appendices

Appendix A North Twin Lake Water Quality Data
Appendix B Middle Twin Lake Water Quality Data
Appendix C South Twin Lake Water Quality Data
Appendix D North Twin Lake Level Data
Appendix E Middle Twin Lake Level Data
Appendix F South Twin Lake Level Data

Appendix G North Twin Lake Precipitation Data
Appendix H Middle Twin Lake Precipitation Data
Appendix I South Twin Lake Precipitation Data

1.0 Introduction

Twin Lakes, comprised of North, Middle, and South Twin Lakes, are located in Washburn County, Wisconsin. In recent years, riparian residents of Twin Lakes have been concerned about the lakes' water quality. To ensure that the lakes' water quality is preserved, Twin Lakes Preservation Association initiated the following Twin Lakes Planning Grant Project to investigate the lakes' current condition.

1.1 Comprehensive Lake Management Plan

The ultimate goal of the Twin Lakes Preservation Association is to complete a comprehensive lake management plan. Plan completion involves several steps, including:

- Collection of data (i.e., lake water quality, macrophyte, precipitation, lake level, and watershed land use).
- Preparation of hydrologic and phosphorus budgets for existing watershed land use conditions.
- Preparation of the comprehensive lake management plan.

The project discussed in this report includes the first step to the lake management plan (i.e., collection of data).

1.2 Report Coverage

This report discusses the methodology, results, and conclusions from the data collection project. The report will answer the following two questions that apply to properly managing lakes:

1. What is the water quality of Twin Lakes under existing conditions?
2. Are there problems evident in the water quality?

To answer the first question, this report begins with descriptions of the watershed, the lake, methods of data collection and analysis. The results of water quality monitoring are then summarized in tables, figures, and accompanying descriptions.

To answer the second question, water quality data are analyzed and compared to established water quality standards for lakes.

A background information section is also included in the report. Section 2.0 covers general concepts in lake water quality.

2.0 General Concepts in Lake Water Quality

There are many concepts and terminology that are necessary to describe and evaluate a lake's water quality. This section is a brief discussion of those concepts, divided into the following topics:

- Eutrophication
- Trophic states
- Limiting nutrients
- Nutrient recycling and internal loading
- Stratification
- Watershed

To learn more about these six topics, one can refer to any text on limnology (the science of lakes and streams).

2.1 Eutrophication

Eutrophication, or lake degradation, is the accumulation of sediments and nutrients in lakes. As a lake becomes more fertile, algae and weed growth increases. Eutrophication results from both natural processes and human activities, which accelerate the natural processes. Nutrient and sediment inputs (i.e., loadings) from wastewater treatment plants, septic tanks, and stormwater runoff can far exceed the natural inputs to the lake. The accelerated rate of water quality degradation caused by these pollutants results in unpleasant consequences. These include profuse and unsightly growths of algae (algal blooms) and/or the proliferation of rooted aquatic weeds (macrophytes).

2.2 Trophic States

Lakes differ in water quality because they are at different stages of eutrophication; therefore, criteria have been established to evaluate the nutrient "status" of lakes. Trophic state indices (TSIs) are calculated for lakes on the basis of total phosphorus, chlorophyll *a* concentrations, and Secchi disc transparencies. A TSI value is obtained from any one of these three parameters. TSI values range upward from zero, describing the condition of the lake in terms of its trophic status (i.e., its degree of fertility). Four trophic status designations for lakes are listed below with corresponding TSI value ranges:

1. ***Oligotrophic*** **– [TSI ≤ 37]** Clear, low productivity lakes with total phosphorus concentrations less than or equal to 10 µg/L, chlorophyll *a* concentrations less than or equal to 2 µg/L, and Secchi disc transparencies greater than or equal to 4.6 meters (15 feet).

2. ***Mesotrophic*** – **[38 ≤ TSI ≤ 50]** Intermediate productivity lakes, with 10 to 25 µg/L total phosphorus concentrations, 2 to 8 µg/L chlorophyll *a* concentrations, and Secchi disc measurements of 2 to 4.6 meters (6 to 15 feet).

3. ***Eutrophic*** – **[51 ≤ TSI ≤ 63]** High productivity lakes, with 25 to 57 µg/L total phosphorus concentrations, 8 to 26 µg/L chlorophyll *a* concentrations, and Secchi disc measurements of 0.85 to 2 meters (2.7 to 6 feet).

4. ***Hypereutrophic*** – **[64 ≤ TSI]** Extremely productive lakes, with total phosphorus concentrations greater than 57 µg/L, chlorophyll *a* concentrations greater than 26 µg/L, and Secchi disc measurements less than 0.8 meters (less than 2.7 feet).

Determining the trophic status of a lake is an important step in diagnosing water quality problems. Trophic status indicates the severity of a lake's algal growth problems and the degree of change needed to meet its recreational goals. Additional information, however, is needed to determine the cause of algal growth and a means of reducing it.

2.3 Limiting Nutrients

The quantity or biomass of algae in a lake is usually limited by the water's concentration of an essential element or nutrient—the "limiting nutrient." (For rooted aquatic plants, the nutrients are derived from the sediments.) The limiting nutrient concept is a widely applied principle in ecology and in the study of eutrophication. It is based on the idea that plants require many nutrients to grow, but the nutrient with the lowest availability, relative to the amount needed by the plant, will limit plant growth. It follows then, that identifying the limiting nutrient will point the way to controlling algal growth.

Nitrogen (N) and phosphorus (P) are generally the two growth-limiting nutrients for algae in most natural waters. Analysis of the nutrient content of lake water and algae provides ratios of N:P. By comparing the ratio in water to the ratio in the algae, one can estimate whether a particular nutrient may be limiting. Algal growth is generally phosphorus-limited in waters with N:P ratios greater than 12. Laboratory experiments (bioassays) can demonstrate which nutrient is limiting by growing the algae in lake water with various concentrations of nutrients added. Bioassays, as well as fertilization of in-situ enclosures and whole-lake experiments, have repeatedly demonstrated that phosphorus is usually the nutrient that limits algal growth in fresh waters. Hence, when excessive algal growth causes reduced water transparency, reducing phosphorus in the lake is required to reduce algal abundance and improve water transparency.

2.4 Nutrient Recycling and Internal Loading

Phosphorus enters a lake from either runoff from the watershed or direct atmospheric deposition. It would, therefore, seem reasonable that phosphorus in a lake can decrease by reducing these external loads of phosphorus to the lake. All lakes, however, accumulate phosphorus (and other nutrients) in the sediments from the settling of particles and dead organisms. In some lakes this reservoir of phosphorus can be reintroduced in the lake water and become available again for plant uptake. This resuspension or dissolution of nutrients from the sediments to the lake water is known as "internal loading." The relative amounts of phosphorus coming from internal and external loads vary with each lake. Phosphorus released from internal loading can be estimated from depth profiles (measurements from surface to bottom) of dissolved oxygen and phosphorus concentrations.

2.5 Stratification

The process of internal loading is dependent on the amount of organic material in the sediments and the depth-temperature pattern, or "thermal stratification," of a lake. Thermal stratification profoundly influences a lake's chemistry and biology. When the ice melts and air temperature warms in spring, lakes generally progress from being completely mixed to stratified with only an upper warm well-mixed layer of water (epilimnion), and cold temperatures in a bottom layer (hypolimnion). Because of the density differences between the lighter warm water and the heavier cold water, stratification in a lake can become very resistant to mixing. When this occurs, generally in mid-summer, oxygen from the air cannot reach the bottom lake water and, if the lake sediments have sufficient organic matter, biological activity can deplete the remaining oxygen in the hypolimnion. The epilimnion can remain well-oxygenated, while the water above the sediments in the hypolimnion becomes completely devoid of dissolved oxygen (anoxic). Complete loss of oxygen changes the chemical conditions in the water and allows phosphorus that had remained bound to the sediments to reenter the lake water.

As the summer progresses, phosphorus concentrations in the hypolimnion can continue to rise until oxygen is again introduced (recycled). Dissolved oxygen concentration will increase if the lake sufficiently mixes to disrupt the thermal stratification. Phosphorus in the hypolimnion is generally not available for plant uptake because there is not sufficient light penetration to the hypolimnion to allow for growth of algae. The phosphorus, therefore, remains trapped and unavailable to the plants until the lake is completely mixed. In shallow lakes this can occur throughout the summer, with sufficient wind energy (polymixis). In deeper lakes, however, only extremely high wind energy is sufficient to destratify a lake during the summer and complete mixing only occurs in the spring and fall (dimixis). Cooling air temperature in the fall reduces the epilimnion water temperature, and consequently increases the density of water in the epilimnion. As the epilimnion water density approaches the density of the hypolimnion water, very little energy is needed to cause complete mixing of the lake. When this fall mixing occurs, phosphorus that has built up in the hypolimnion is mixed with the epilimnion water and becomes available for plant growth.

2.6 Watershed

The land area that drains to the lake is called a watershed. The watershed may be small, as is the case of small seepage lakes. Seepage lakes have no stream inlet or outlet and, consequently, their watersheds include the land draining directly to the lake. A lake's watershed may be large, as in drainage lakes. Drainage lakes have both stream inlets and outlets and, consequently, their watersheds include the land draining to the streams in addition to the land draining directly to the lake. Water draining to a lake may carry pollutants that affect the lake's water quality. Consequently, water quality conditions of the lake are a direct result of the land use practices within the entire watershed. Good water quality conditions suggest that proper land uses are occurring in the watershed.

All land use practices within a lake's watershed impact the lake and determine its water quality. Impacts result from the export of sediment and nutrients, primarily phosphorus, to a lake from its watershed. Each land use contributes a different quantity of phosphorus to the lake, thereby, affecting the lake's water quality differently. An understanding of a lake's water quality, therefore, must go beyond an analysis of the lake itself. An understanding of a lake's watershed, phosphorus exported from the watershed, and the relationship between the lake's water quality and its watershed must be understood.

3.0 Basin Characteristics

Twin Lakes, in Washburn County, Wisconsin, covers an area of approximately 258 acres. The three lakes are seepage lakes (Figure 1). Table 1 summarizes the lakes' morphological characteristics.

Table 1 Twin Lakes Morphological Characteristics

Lake	Surface Area (Acres)	Mean Depth (Feet)	Max Depth (Feet)	Estimated Volume (acre-ft.)
North Twin Lake	113	6	20	678
Middle Twin Lake	30	--	7	--
South Twin Lake	115	16	29	1,840

The lakes' fishery is comprised of northern pike, walleye, largemouth bass, and panfish.

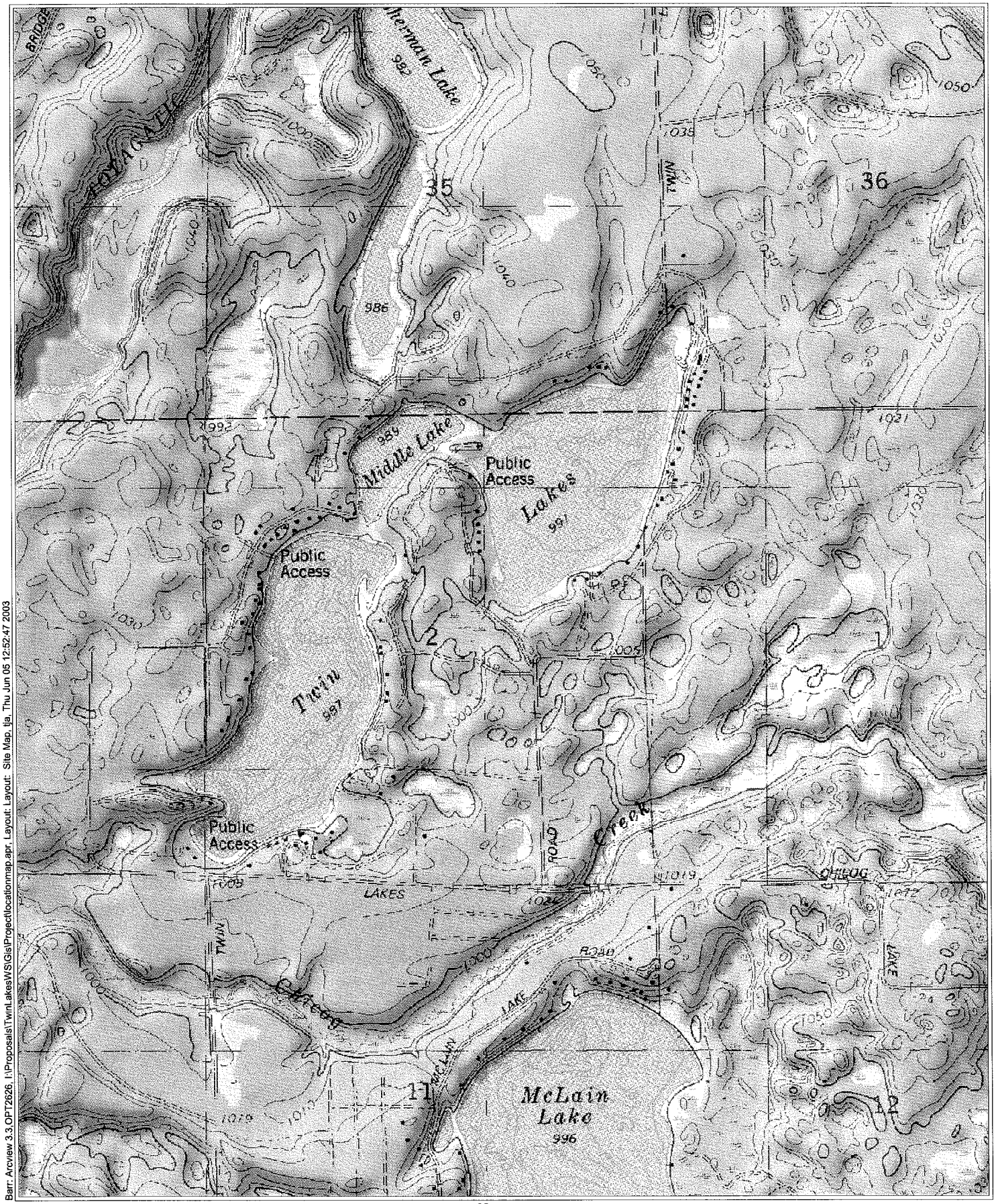

Figure 1
SITE MAP
Twin Lakes

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4.0 Methods

4.1 Lake Water Quality Data Collection

In 2002, a representative lake sampling station was selected for each of the three lakes. Sampling stations were located in the deepest portion of each basin. Water samples were collected once during May and twice per month during June through August. Temperature, dissolved oxygen, specific conductance, and Secchi disc were measured twice per month during May through October and once during February of 2003. A total of seven water quality parameters were measured at the Twin Lakes' sampling stations. Tables 2 through 4 list the water quality parameters, and specify when and at what depths samples or measurements were collected in each basin. Dissolved oxygen, temperature, specific conductance and Secchi disc transparency were measured in the field; whereas, water samples were analyzed in the laboratory for total phosphorus, dissolved ortho phosphorus, dissolved ammonia nitrogen, total Kjeldahl nitrogen, nitrate plus nitrite nitrogen, alkalinity, pH, specific conductance, chlorophyll *a,* phytoplankton, and zooplankton. An evaluation of the project work scope found in the Wisconsin Lake Management Planning Grant applications and data collected during 2002 indicate a few minor discrepancies. The discrepancies resulted from:

- A misunderstanding of work scope by volunteers;
- No analysis of a couple of samples by the laboratory;
- The challenges of coordinating the Wisconsin Lake Management Grant Program and Self Help programs resulted in some differences of sample collection times or depths.

The minor discrepancies, however, did not adversely impact the monitoring program.

4.2 Lake Macrophyte Survey

Aquatic macrophytes (plants) were mapped on June 21. The qualitative survey determined macrophyte coverage, species, and density (low, moderate, or abundant density).

Table 2 2002 North Twin Lake Water Quality Parameters

Parameters	Depth (meters)	5/13	6/1	6/17	7/2	7/16	7/31	8/7	8/19	9/2	9/18	9/29	10/17	2/15/03
Dissolved Oxygen	Surface to bottom profile	X	X	X	X	X	X	X	X	X	X	X	X	X
Temperature	Surface to bottom profile	X	X	X	X	X	X	X	X	X	X	X	X	X
Specific Conductance	Surface to bottom profile	X	X	X	X	X	X	X	X	X	X	X	X	X
Chlorophyll a	0-2	X			X	X	X	X	X	X				
Secchi Disc	—	X	X	X	X	X	X	X	X	X	X	X	X	
Total Phosphorus	Surface, middle,and near- bottom	X		X	X	X		X	X					
Dissolved Ortho Phosphorus	0-2	X		X	X	X	X	X	X	X				
Total Kjeldahl Nitrogen	0-2	X												
Dissolved Ammonia Nitrogen	0-2	X												
Nitrate + Nitrite Nitrogen	0-2	X												
Lab Specific Conductance	0-2	X												
Alkalinity	0-2	X												
pH	0-2	X												
Phytoplankton	0-2					X			X					
Zooplankton	0-2					X			X					

Table 3 2002 Middle Twin Lake Water Quality Parameters

Parameters	Depth (meters)	5/13	6/1	6/17	7/2	7/16	7/31	8/7	8/19	9/2	9/17	9/29	10/17	2/15/03
Dissolved Oxygen	Surface to bottom profile	X	X	X	X	X	X	X	X	X	X	X	X	X
Temperature	Surface to bottom profile	X	X	X	X	X	X	X	X	X	X	X	X	X
Specific Conductance	Surface to bottom profile	X	X	X	X	X	X	X	X	X	X	X	X	X
Chlorophyll a	0-2	X												
Secchi Disc	—	X		X	X	X		X	X	X	X	X	X	
Total Phosphorus	Surface and near-bottom	X		X	X	X		X	X					
Dissolved Ortho Phosphorus	0-2	X		X	X	X		X	X					
Total Kjeldahl Nitrogen	0-2	X												
Dissolved Ammonia Nitrogen	0-2	X												
Nitrate + Nitrite Nitrogen	0-2	X												
Lab Specific Conductance	0-2	X												
Alkalinity	0-2	X												
pH	0-2	X												
Phytoplankton	0-2					X			X					
Zooplankton	0-2					X			X					

Table 4 2002 South Twin Lake Water Quality Parameters

Parameters	Depth (meters)	5/13	6/1	6/17	7/2	7/16	7/31	8/7	8/19	9/2	9/17	9/29	10/17	2/15/03
Dissolved Oxygen	Surface to bottom profile	X	X	X	X	X	X	X	X	X	X	X	X	X
Temperature	Surface to bottom profile	X	X	X	X	X	X	X	X	X	X	X	X	X
Specific Conductance	Surface to bottom profile	X	X	X	X	X	X	X	X	X	X	X	X	X
Chlorophyll a	0-2	X		X	X	X	X	X	X	X				
Secchi Disc	—	X	X	X	X	X	X	X	X	X	X	X	X	
Total Phosphorus	Surface, middle,and near- bottom	X		X	X	X		X	X					
Dissolved Ortho Phosphorus	0-2	X		X		X	X	X	X					
Total Kjeldahl Nitrogen	0-2	X												
Dissolved Ammonia Nitrogen	0-2	X												
Nitrate + Nitrite Nitrogen	0-2	X												
Lab Specific Conductance	0-2	X												
Alkalinity	0-2	X												
pH	0-2	X												
Phytoplankton	0-2					X			X					
Zooplankton	0-2					X			X					

4.3 Evaluation of the Tributary Watershed

The U.S. Natural Resources Conservation Service (NRCS) and the Washburn County Land Conservation Department (LCD) were contacted regarding available land use information for the Twin Lakes' watersheds. They indicated the lakes' watersheds are natural forestland. No additional information is currently available.

5.0 Results and Discussion

5.1 Compiled Data

Water quality data acquired by the 2002 monitoring program are compiled in Appendices A through I. Appendices A through C present the tabulated in-lake water quality data for the three lakes. Selected water quality parameters from Appendices A through C are analyzed and summarized in the discussion below. Lake level data for the three lakes are shown in Appendices D through F. Appendices G through I contain precipitation data for the three lakes.

5.2 Seasonal Patterns in 2002 Water Quality Conditions

An evaluation of 2002 Twin Lakes water quality data was completed to evaluate the lakes' current water quality conditions. The evaluation was based upon a standardized lake rating system. The rating system uses the lakes' total phosphorus, chlorophyll *a*, and Secchi disc transparency measurements to assign each lake to a water quality category that best describes its water quality. Water quality categories include oligotrophic (i.e., excellent water quality), mesotrophic (i.e., good water quality), eutrophic (i.e., poor water quality), and hypereutrophic (i.e., very poor water quality). Temperature, dissolved oxygen, and specific conductance profiles were evaluated to determine the lakes' mixing patterns, oxygen content, and dissolved solids content.

5.2.1 Phosphorus

> *Phosphorus is the plant nutrient that most often limits the growth of algae. Phosphorus-rich lake water indicates a lake has the potential for abundant algal growth, which can lead to lower water transparency and a decline in hypolimnetic oxygen levels in a lake.*

Algal growth is generally phosphorus-limited in waters with nitrogen (N) to phosphorus (P) ratios greater than 12. To determine which nutrient limited algal growth in Twin Lakes, the May N:P ratios for the three lakes were evaluated. Based on the data presented in Table 5, algal growth in the three lakes is phosphorus limited. This means that the lakes had excess nitrogen relative to their phosphorus content. The quantity of algae in the lakes was determined by the lakes' phosphorus content.

Table 5 2002 Twin Lakes Surface Water May N:P Ratios

Lake	May N:P Ratios
North Twin	42
Middle Twin	46
South Twin	60

Total phosphorus data collected from North and Middle Twin Lakes during 2002 were within the mesotrophic category , indicating intermediate productivity (Figures 2 and 3). Total phosphorus data collected from South Twin Lake during 2002 was within the oligotrophic category, indicating low productivity (Figure 4). The following phosphorus ranges and summer averages were observed in the three lakes:

Table 6 2002 Twin Lakes Surface Water Total Phosphorus Data Summary

Lake	Minimum [TP] (mg/L)	Maximum [TP] mg/L	Avg. Summer [TP] mg/L
North Twin	0.012	0.017	0.014
Middle Twin	0.011	0.016	0.013
South Twin	0.009	0.011	0.010

The lakes observed stable water quality throughout the monitoring period. The data indicate the lakes' current phosphorus levels are sufficient for a healthy lake ecosystem, but too low to allow algae to grow to problematic proportions. Hence, the data indicate the lakes do not currently experience water quality problems.

North Twin Lake 2002
Total Phosphorus Concentrations

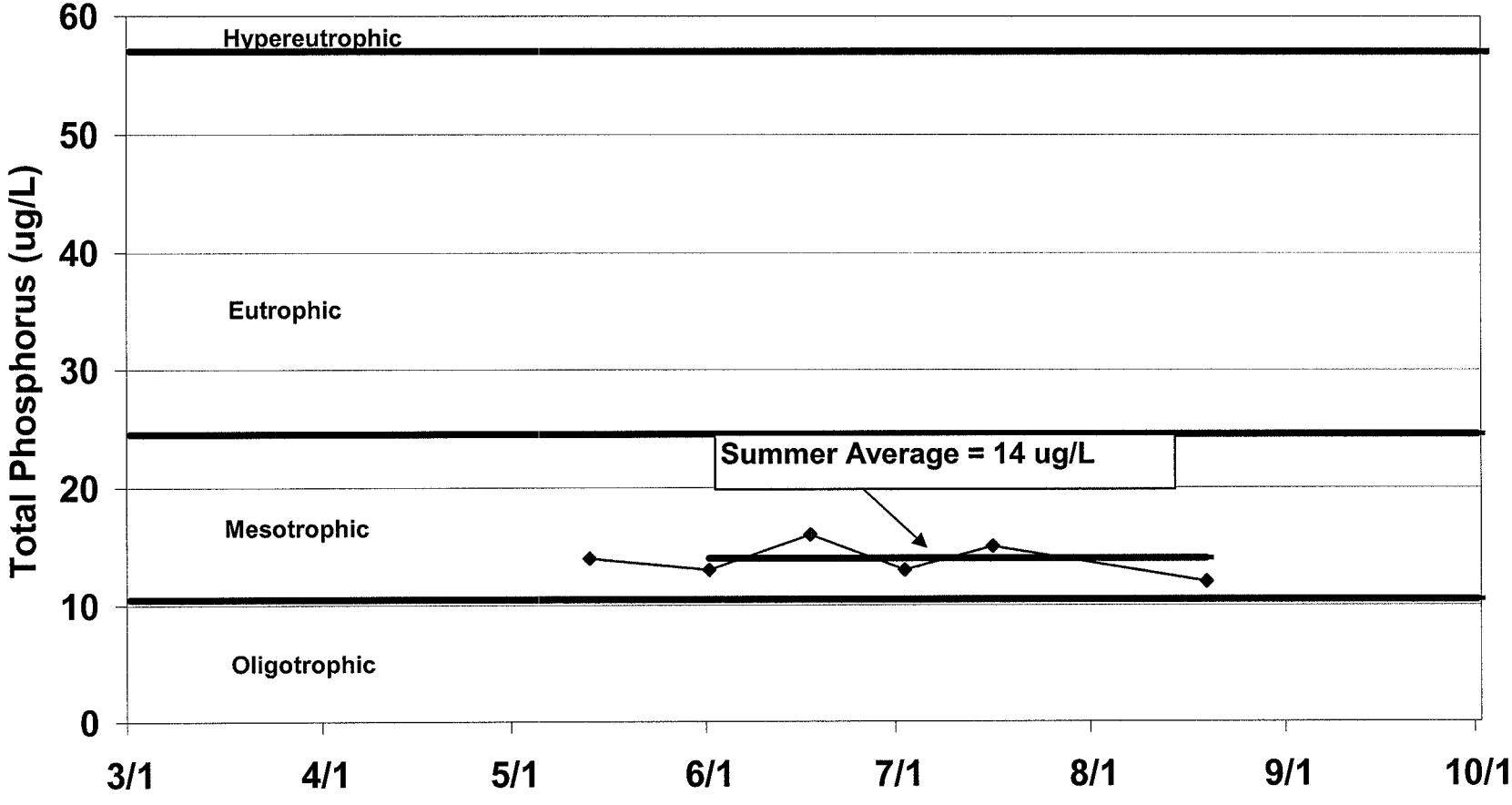


Figure 2

Middle Twin Lake 2002
Total Phosphorus Concentrations

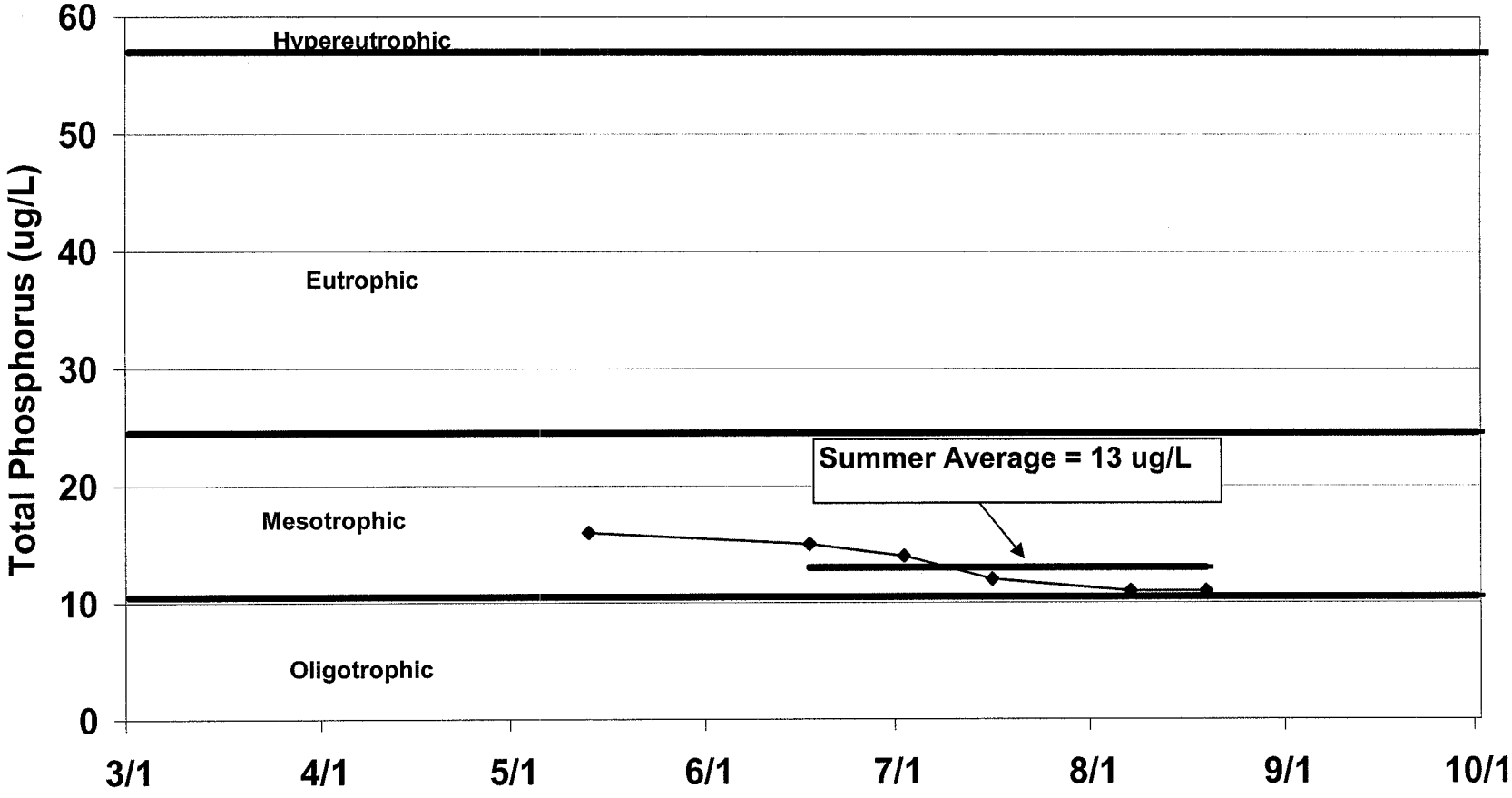


Figure 3

South Twin Lake 2002
Total Phosphorus Concentrations

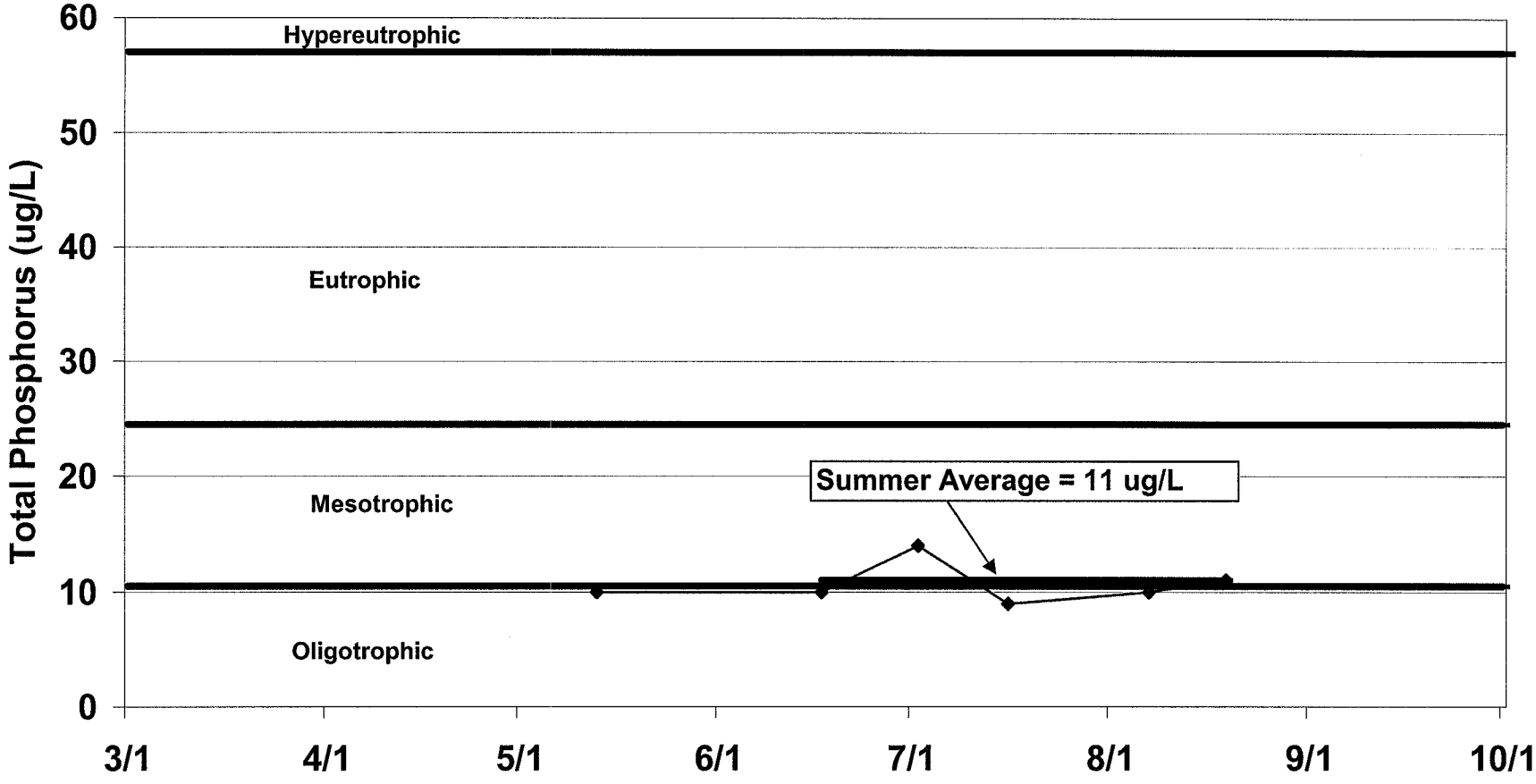


Figure 4

5.2.2 Chlorophyll *a*

Chlorophyll a is a measure of algal abundance within a lake. High chlorophyll a concentrations indicate excessive algal abundance (i.e., algal blooms), which can lead to recreational-use impairment.

The 2002 Twin Lakes chlorophyll *a* data indicate that low to moderate algal growth occurred in the lakes. North Twin Lake chlorophyll *a* data were in the oligotrophic category during May through early August. Data were in the mesotrophic category during mid-August through September. Middle Twin Lake chlorophyll *a* data were in the oligotrophic category during May. No other chlorophyll data were collected from Middle Twin Lake. South Twin Lake chlorophyll *a* data were in the oligotrophic category during May through July. Data were in the mesotrophic category during August. The following chlorophyll *a* ranges and summer averages were observed in the three lakes:

Table 7 2002 Twin Lakes Surface Water Chlorophyll *a* Summary

Lake	Minimum [Chl *a*] (μg/L)	Maximum [Chl *a*] (μg/L)	Average Summer [Chl *a*] (μg/L)
North Twin	0.09	3.7	1.1
Middle Twin	<1	<1	--
South Twin	0.5	4.3	2.1

The data indicate the lakes' current chlorophyll *a* levels are sufficient for a healthy lake ecosystem and indicate the lakes have excellent water quality.

5.2.3 Secchi Disc Transparency

Secchi disc transparency is a measure of water clarity. Perceptions and expectations of people using a lake are generally correlated with water clarity. Results of a survey completed by the Metropolitan Council (Osgood, 1989) revealed the following relationship between a lake's recreational use impairment and Secchi disc transparencies:

- *Moderate to severe use-impairment occurs at Secchi disc transparencies less than 1 meter (3.3 feet).*
- *Moderate impairment occurs at Secchi disc transparencies of 1 to 2 meters.*
- *Minimal impairment occurs at Secchi disc transparencies of 2 to 4 meters.*
- *No impairment occurs at Secchi disc transparencies greater than 4 meters*

North Twin Lake Secchi disc measurements were generally in the mesotrophic category (See Figure 5). Improved water transparency during the late summer period, however, resulted in measurements in the oligotrophic category during late August and late September. Middle Twin Lake, a shallow lake, was clear to the bottom on all sample dates (See Figure 6). South Twin Lake generally noted measurements in the oligotrophic category (See Figure 7).

Water clarity is correlated with recreational-use of a lake. Secchi disc measurements suggest the lakes' water transparency was suitable for all lake uses and recreational use impairment did not occur in Twin Lakes.

North Twin Lake 2002
Secchi Disc Transparencies

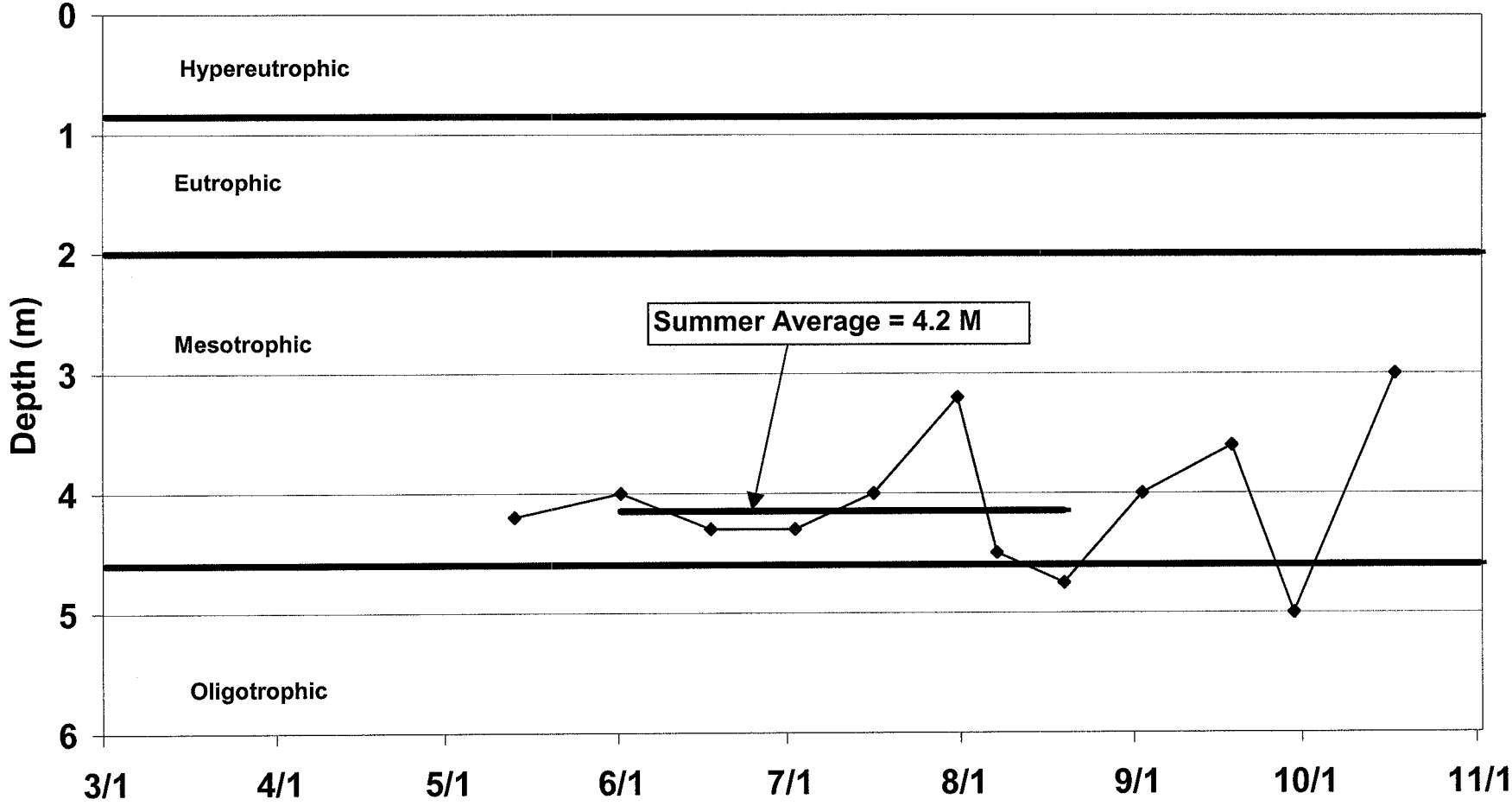


Figure 5

Middle Twin Lake 2002
Secchi Disc Transparencies

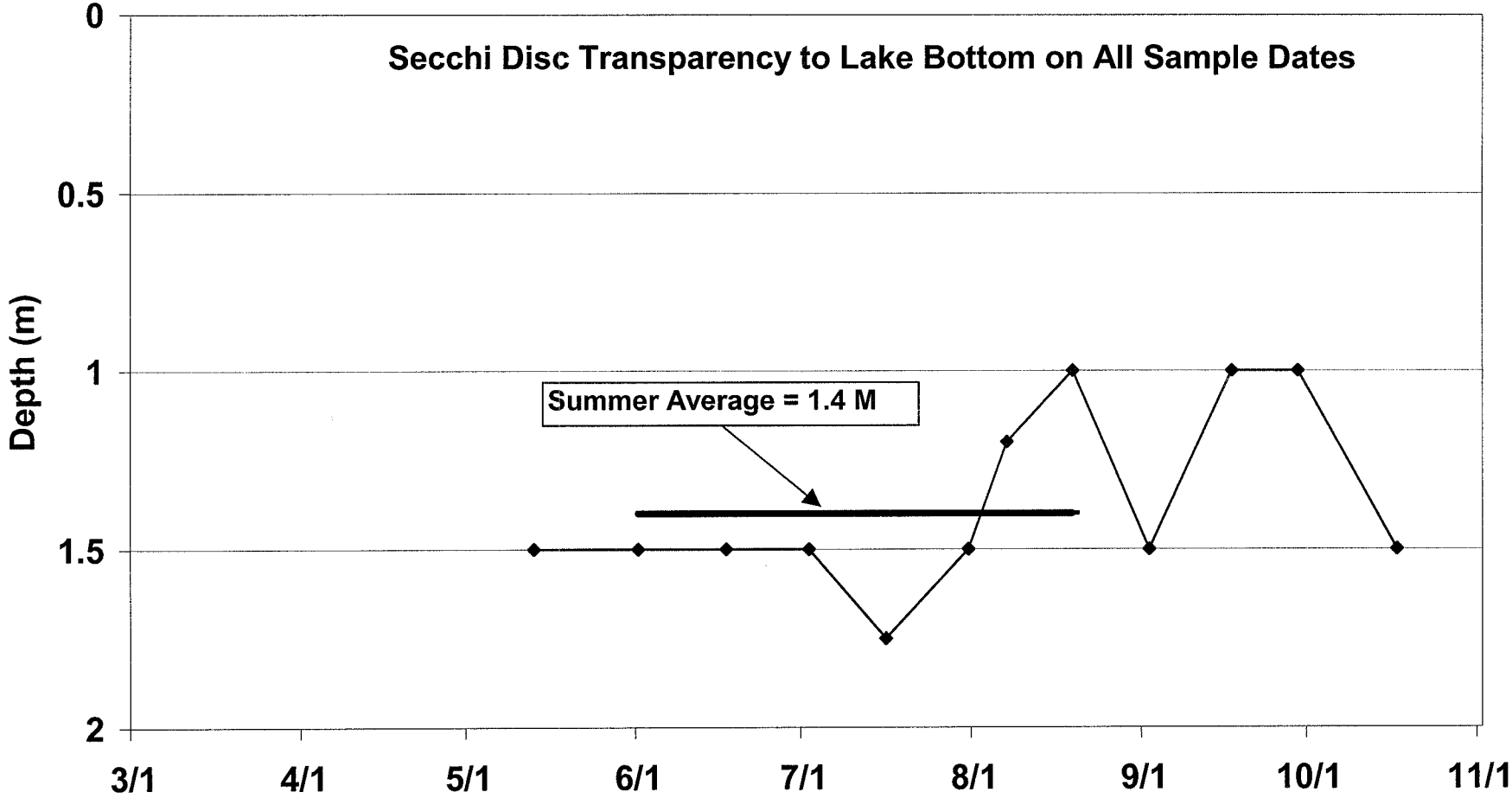


Figure 6

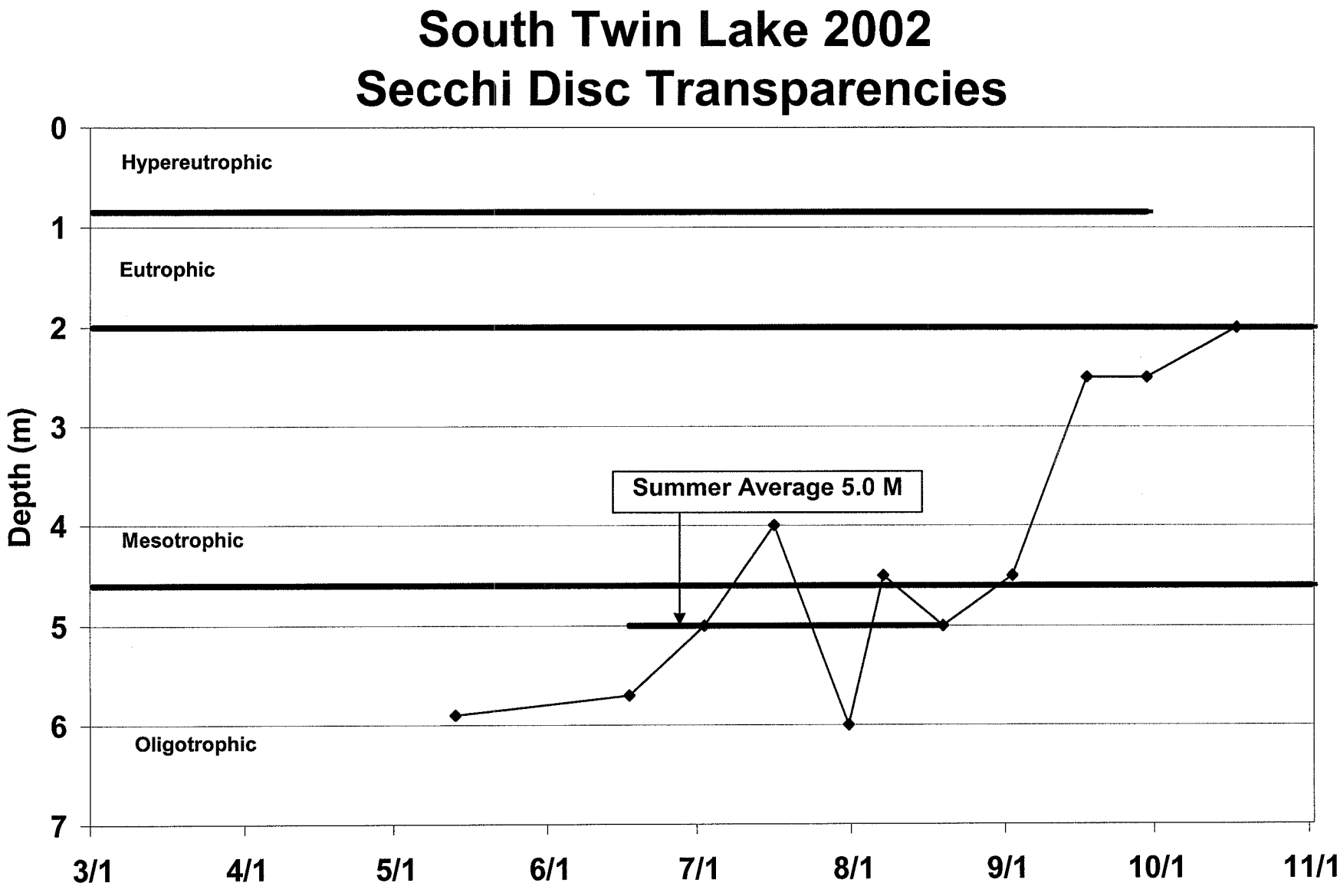

South Twin Lake 2002
Secchi Disc Transparencies
Depth (m)
0
1
2
3
4
5
6
7
Hypereutrophic
Eutrophic
Mesotrophic
Oligotrophic
Summer Average 5.0 M
3/1
4/1
5/1
6/1
7/1
8/1
9/1
10/1
11/1

Figure 7

5.2.4 Temperature, Dissolved Oxygen, and Specific Conductance Profiles

Temperature, dissolved oxygen, and specific conductance profiles were used to determine the stratification (mixing) pattern in each lake.

Temperatuer, dissolved oxygen, and specific conductance data are found in Appendix A. Temperature profiles indicate Middle Twin Lake was completely mixed during May through October. Such mixing is typical for shallow lakes, such as Middle Twin Lake (maximum depth of 7 feet). North Twin Lake (maximum depth of 20 feet was completely mixed during May, was weakly stratified during June through September, and was completely mixed during October. South Twin Lake (maximum depth of 29 feet) was completely mixed during May, was completely stratified during June through July, was weakly stratified during August through September, and was completely mixed during October. In winter, the lakes' bottom waters were slightly warmer than their surface (i.e., below ice) waters.

Anoxic (i.e., <1 mg/L dissolved oxygen) conditions were not observed in the lakes during the monitoring period. Hence, the lakes' oxygenated bottom waters likely minimized the recycling of phosphorus from the lakes' sediments.

Specific conductance profiles indicate low concentrations of dissolved solids were observed in the three lakes. The data are consistent with the lakes' phosphorus and chlorophyll data, which are low and indicate the lakes' water quality is excellent. Specific conductance measurements in the near-bottom waters of North Twin Lake were slightly higher than surface water measurements during July. Specific conductance values in the near-bottom waters of South Twin Lake were slightly higher than surface water measurements during mid-June through August. Recycling of phosphorus from the lake's sediments is the likely cause of the higher specific conductance measurements in the lakes' near bottom waters. Total phosphorus concentrations in the near-bottom waters were higher than surface water concentrations on sample dates during the period when bottom waters observed higher specific conductance values than the lakes' surface waters.

5.3 Ecosystem Data

Ecosystem describes the community of living things within Twin Lakes and their interaction with the environment in which they live. The interdependency of the ecosystem is best illustrated by the food web. The food web begins with the primary producers, which are green plants, such as phytoplankton (algae) and macrophytes (aquatic weeds). They take in carbon dioxide and water and use the sun's energy to produce their own food. Next in the chain are the primary consumers or herbivores, which eat plants. The most populous of these consumers is the zooplankton, which prey upon algae (phytoplankton). Succeeding the primary consumers are the secondary consumers or

planktivores, which include sunfish and crappies. The diet of these fish includes zooplankton and other primary consumers. Tertiary consumers or predator fish occupy the next level of the food chain. This group includes bass and northern pike, which consume crappies and bluegill sunfish. At the top of the food chain are omnivores, such as humans, which eat bass and northern pike. A less visible component of the food chain, the decomposers, include bacteria living at the lake bottom, which break down dead and decaying organisms into nutrients and other essential elements. All life in a food chain is interdependent. If any one group becomes unbalanced, all life in the food chain is adversely impacted. An aquatic ecosystem is managed to maintain balance between the phytoplankton, zooplankton, small fish (crappies and bluegill sunfish), and large fish (northern pike and bass).

5.3.1 Phytoplankton

The phytoplankton species in Twin Lakes form the base of the lakes' food web. Phytoplankton, also called algae, are small aquatic plants naturally present in all lakes. They derive energy from sunlight (through photosynthesis) and from dissolved-nutrients found in lake water. They provide food for several types of animals, including zooplankton, which are in turn eaten by fish. A phytoplankon population in balance with the lakes' zooplankton population is ideal for fish production.

During 2002, Twin Lakes noted a diverse phytoplankton community (Figures 8 through 10). A mixture of algal groups were observed in the lakes, including green, yellow-brown, blue-green, diatoms, cryptomonads, and dinoflagellates. A relatively small number of blue-green algae were found in each lake. Numbers of blue-green algae increase with increases in lake phosphorus concentrations. Hence, low numbers of blue-green algae are associated with low nutrient lakes and high numbers of blue-green algae are associated with high nutrient lakes. High numbers of blue-green algae are very unfavorable for lakes for the following reasons:

- Blue-green algae are inedible to fish, waterfowl, and most zooplankters and, hence, not subject to biological control;
- Blue-green algae float at the lake surface in expansive algal blooms;
- Blue-green algae may be toxic to animals when occurring in large blooms;
- Blue-green algae disrupt lake recreation during the summer period.

The Twin Lakes phytoplankton community ascertains the lakes' excellent water quality and excellent food source for the lakes' herbivore communities.

2002 North Twin Lake Phytoplankton Data
Summary by Division

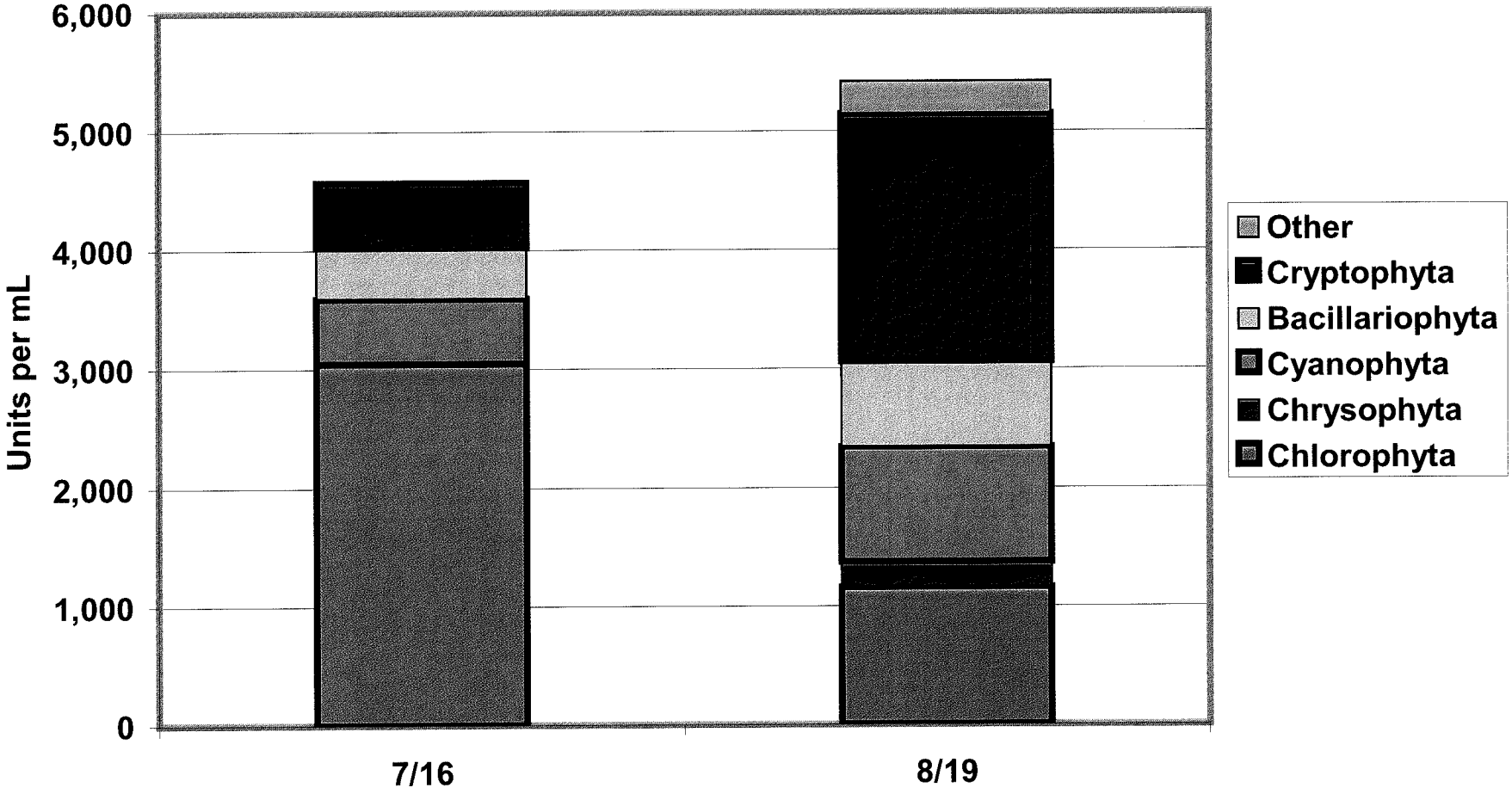


Figure 8

2002 Middle Twin Lake Phytoplankton Data Summary by Division

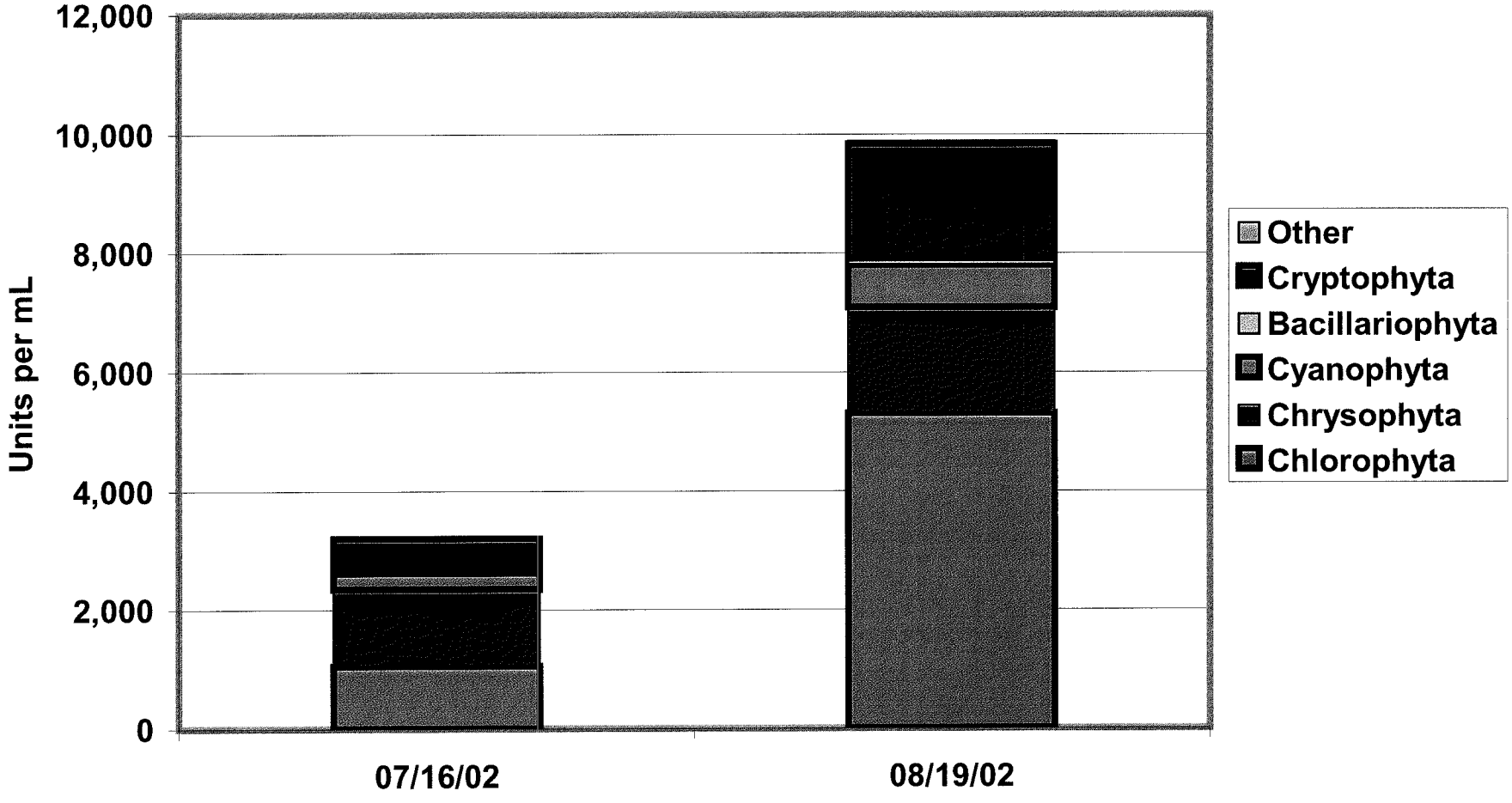


Figure 9

2002 South Twin Lake Phytoplankton Data Summary by Division

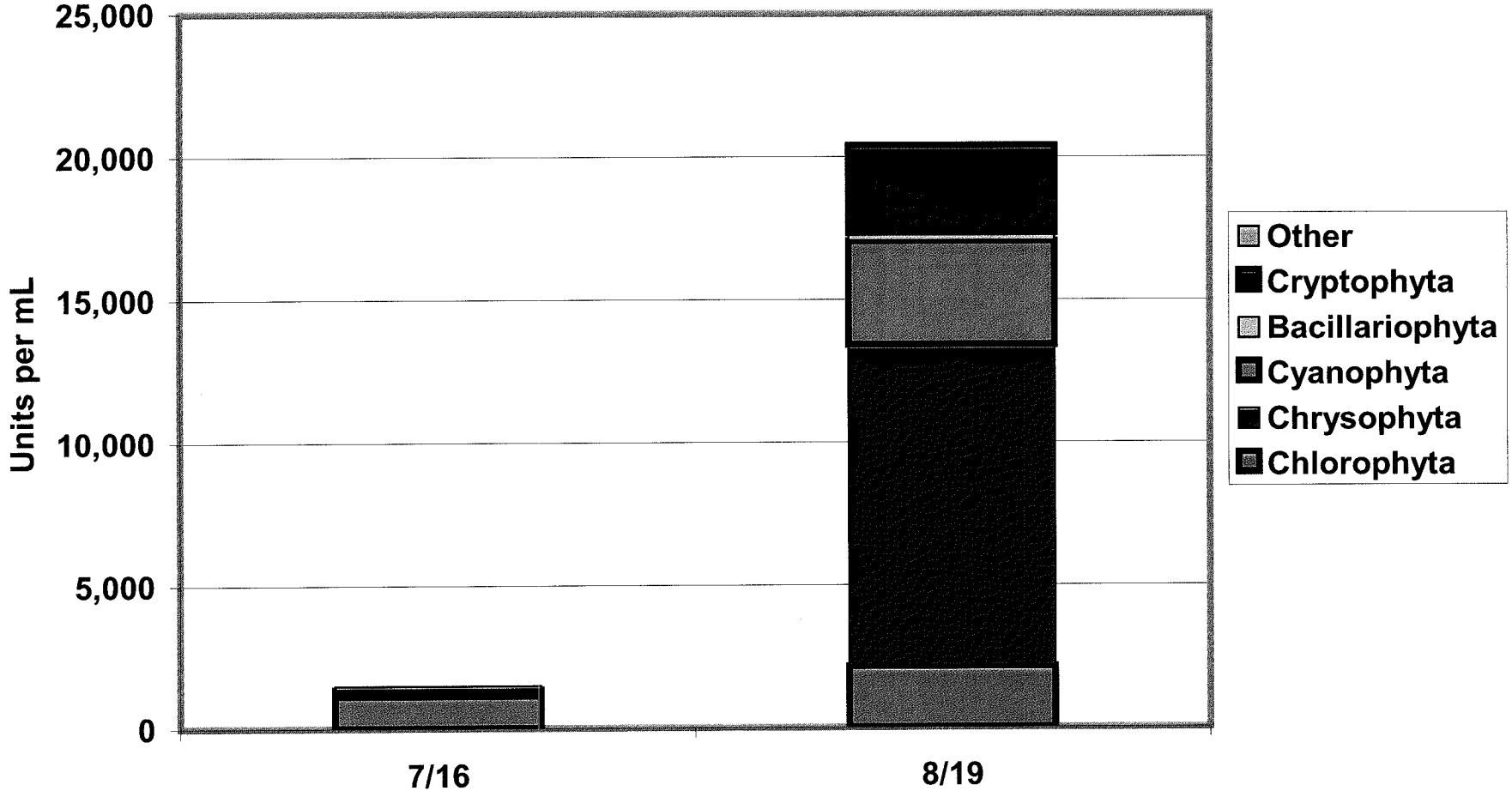


Figure 10

5.3.2 Zooplankton

Zooplankton are the second step in the Twin Lakes' food web. They are microscopic animals that feed on particulate matter, including algae, and are, in turn, eaten by fish.

Healthy zooplankton communities are characterized by balanced densities (number per meter squared) of the three major groups of zooplankton: cladocera, copepods, and rotifers. Fish predation, however, may alter community structure and reduce the numbers of larger-bodied zooplankters (i.e., larger bodied cladocera).

Twin Lakes noted a healthy and diverse assemblage of zooplankton. The three major groups of zooplankton were observed in each lake (Figures 11 through 13). Smaller bodied zooplankters predominated the lakes' communities during the July and August sample periods. Typically, fish predation of the larger-bodied zooplankters reduces their numbers during the early summer. Hence, dominance by smaller bodied zooplankters during July and August is considered typical.

2002 North Twin Lake
Zooplankton Data Summary

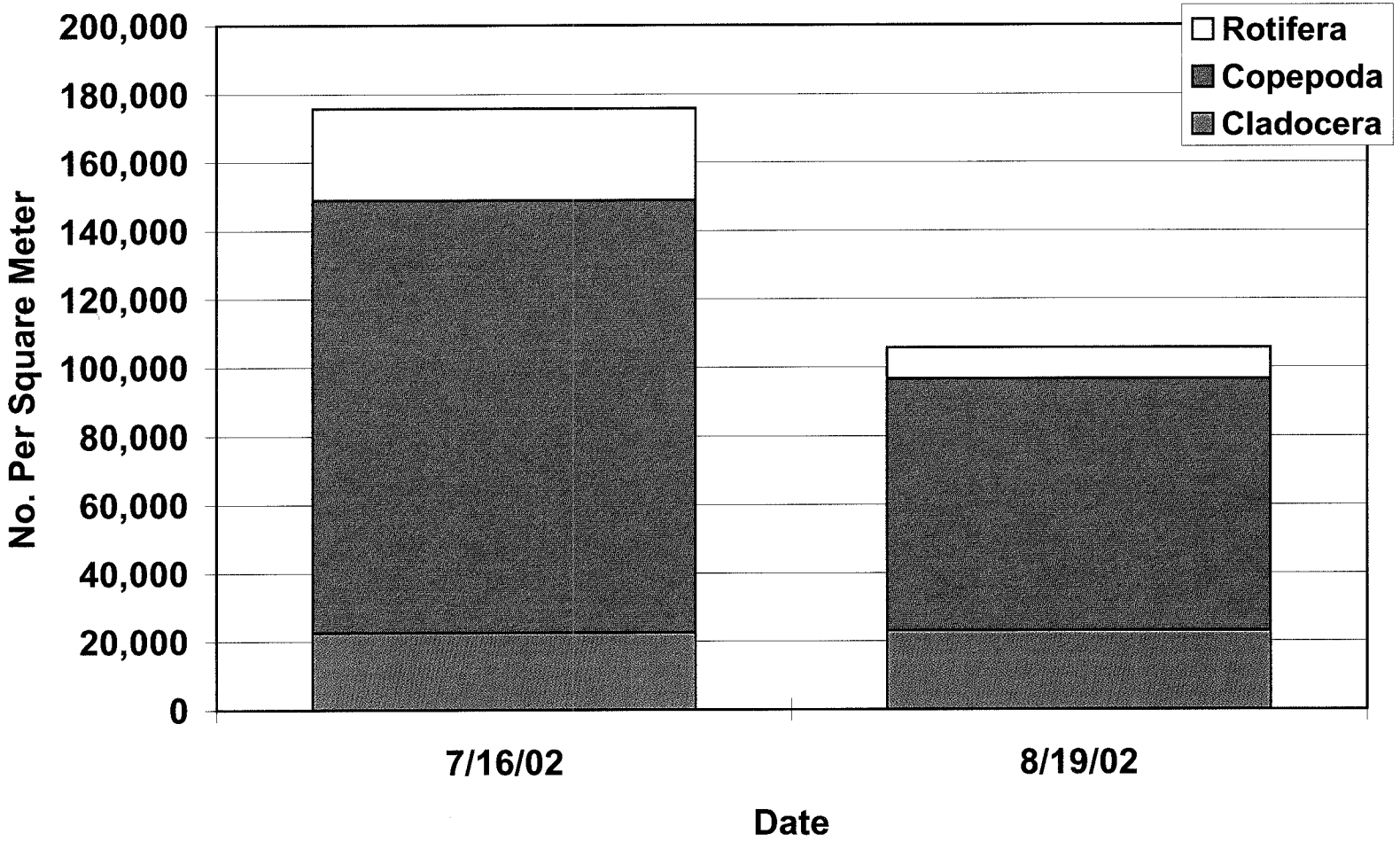
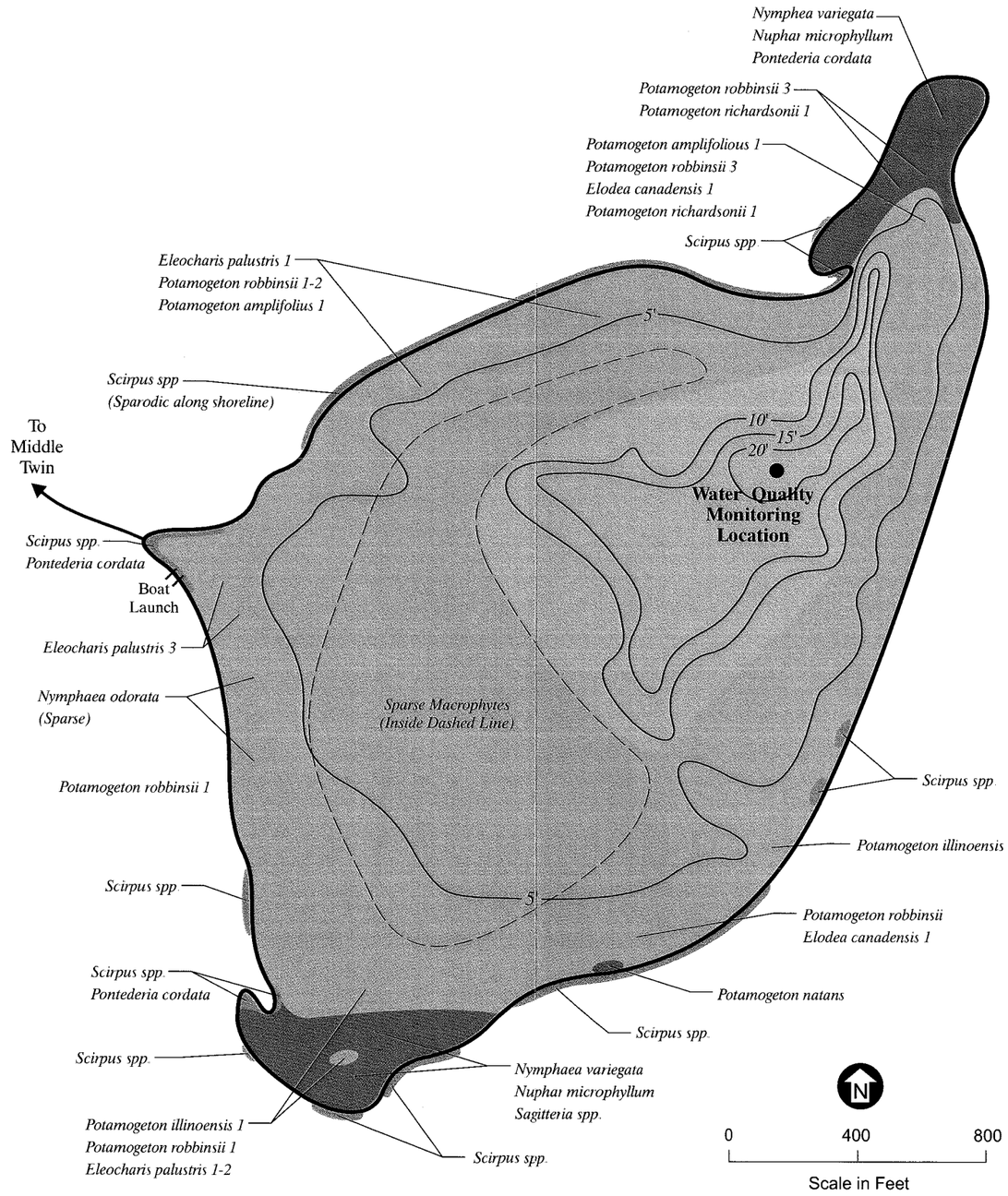


Figure 11

NORTH TWIN LAKE MACROPHYTE SURVEY
June 21, 2002

- No Macrophytes Found in Water > 9 Feet.
- Macrophyte Densities Estimated as Follows: 1=Light; 2=Moderate; 3= Heavy.
- Eleocharis palustrus (Creeping Spikerush) is Dense on South Side of Lake, Mats Break Loose and Float on Surface of Lake.

Submerged Aquatic Plants:	Illinois pondweed	*Potamogeton illinoensis*
	Robbin's pondweed	*Potamogeton robbinsii*
	Large leaf pondweed	*Potamogeton amplifolius*
	Richardson's pondweed	*Potamogeton richardsonii*
	Elodea	*Elodea canadensis*
	Floating leaf pondweed	*Potamogeton natans*
Floating Leaf:	White water lily	*Nymphaea odorata*
	Yellow water lily	*Nuphar variegata*
	Floating leaf pondweed	*Potamogeton natans*
	Little yellow water lily	*Nuphar microphyllum*
Emergent:	Bulrush	*Scirpus spp.*
	Pickeral weed	*Pontederia cordata*
	Sagittaria spp.	*Arrowhead*
	Creeping spikerush	*Eleocharis palustris*
No Aquatic Vegetation Found:		



NOTE: Floating mats of Eleocharis palustris, mainly near boat launch and south/southeast side of lake.

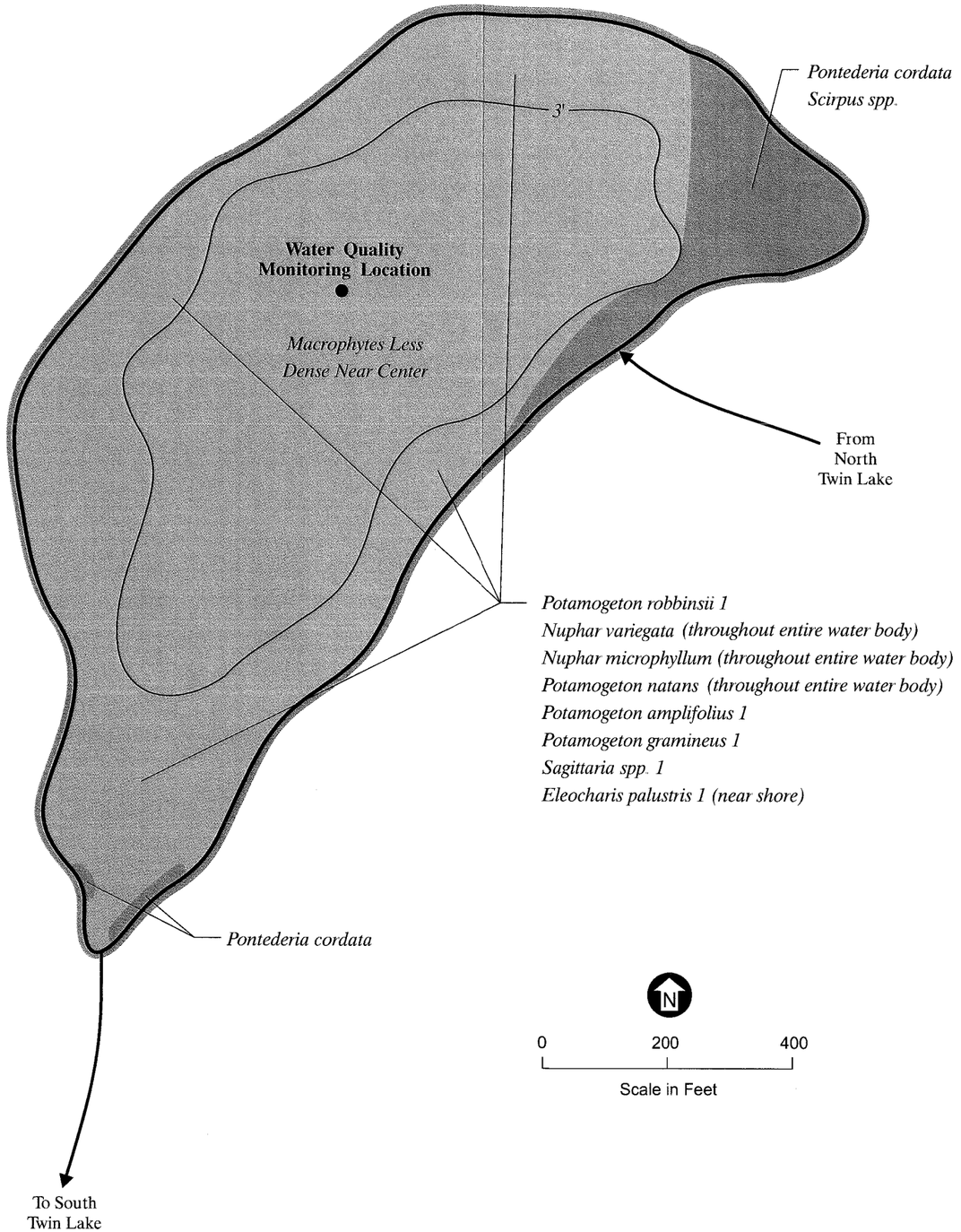
NORTH TWIN LAKE
June 21, 2002

P:\4966\012\LAKEMAPS\NORTHTWIN\2002combined.CDR RLG 06-06-03

MIDDLE TWIN LAKE MACROPHYTE SURVEY
June 21, 2002

- Macrophytes Found in Entire Water Body, Less Dense Near the Center
- Macrophyte Densities Estimated as Follows: 1=Light; 2=Moderate; 3= Heavy
- Entire Shoreline has Sporadic Areas *Scirpus spp., Pontederia cordata*

Submerged Aquatic Plants:	Grassy pondweed	*Potamogeton gramineus*
	Robbin's pondweed	*Potamogeton robbinsii*
	Large leaf pondweed	*Potamogeton amplifolius*
	Floating leaf pondweed	*Potamogeton natans*
Floating Leaf:	Yellow water lily	*Nuphar variegata*
	Little yellow water lily	*Nuphar microphyllum*
Emergent:	Bulrush	*Scirpus spp.*
	Pickerelweed	*Pontederia cordata*
	Arrowhead	*Sagittaria spp.*
	Creeping spikebush	*Eleocharis palustris*
No Aquatic Vegetation Found:		



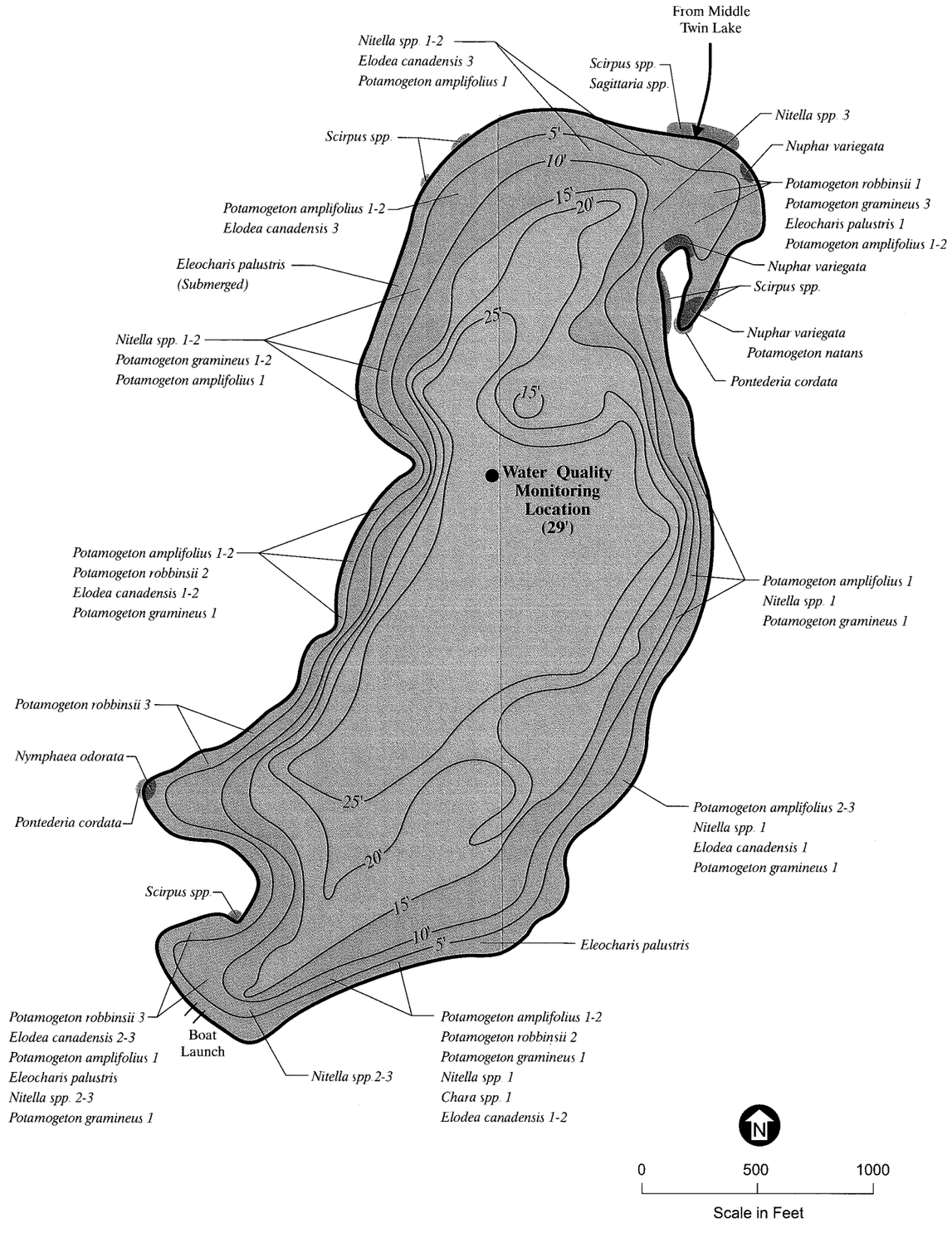
MIDDLE TWIN LAKE
June 21, 2002

P:\49660\12\LAKEMAPS\NORTHTWIN\2002combined.CDR RLG 06-06-03

SOUTH TWIN LAKE MACROPHYTE SURVEY
June 21, 2002

- No Macrophytes Found in Water > 10-15 Feet
- Macrophyte Densities Estimated as Follows: 1=Light; 2=Moderate; 3= Heavy
- 10-15 Foot Depths Contained Mainly *Nitella spp.* Near the Bottom
- Macrophyte Density is Greater in the 0-10 Foot Depth Ranges

Submerged Aquatic Plants:	Grassy pondweed	*Potamogeton gramineus*
	Robbin's pondweed	*Potamogeton robbinsii*
	Large leaf pondweed	*Potamogeton amplifolius*
	Elodea	*Elodea canadensis*
	Muskgrass	*Chara spp.*
	Stonewort	*Nitella spp.*
	Floating leaf pondweed	*Potamogeton natans*
Floating Leaf:	White water lily	*Nymphaea odorata*
	Yellow water lily	*Nuphar variegata*
Emergent:	Pickerelweed	*Pontederia cordata*
	Bulrush	*Scirpus spp.*
	Sagittaria	*Arrowhead*
	Creeping spikebush	*Eleocharis palustris*
No Aquatic Vegetation Found:		



SOUTH TWIN LAKE
June 21, 2002

P:\4966\012\LAKEMAPS\SOUTHTWIN2002combined.CDR RLG 06-06-03

2002 Middle Twin Lake
Zooplankton Data Summary

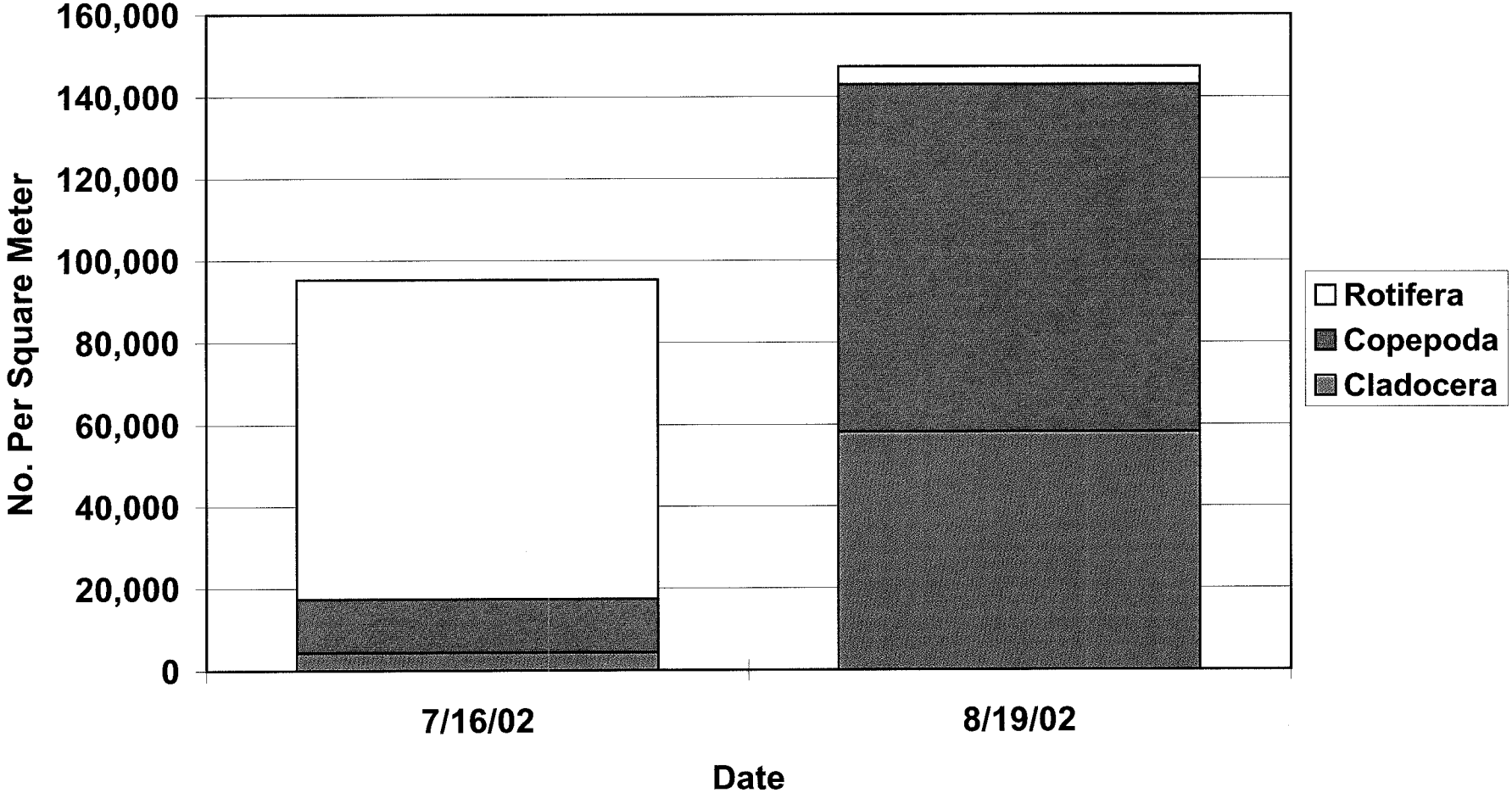


Figure 12

2002 South Twin Lake
Zooplankton Data Summary

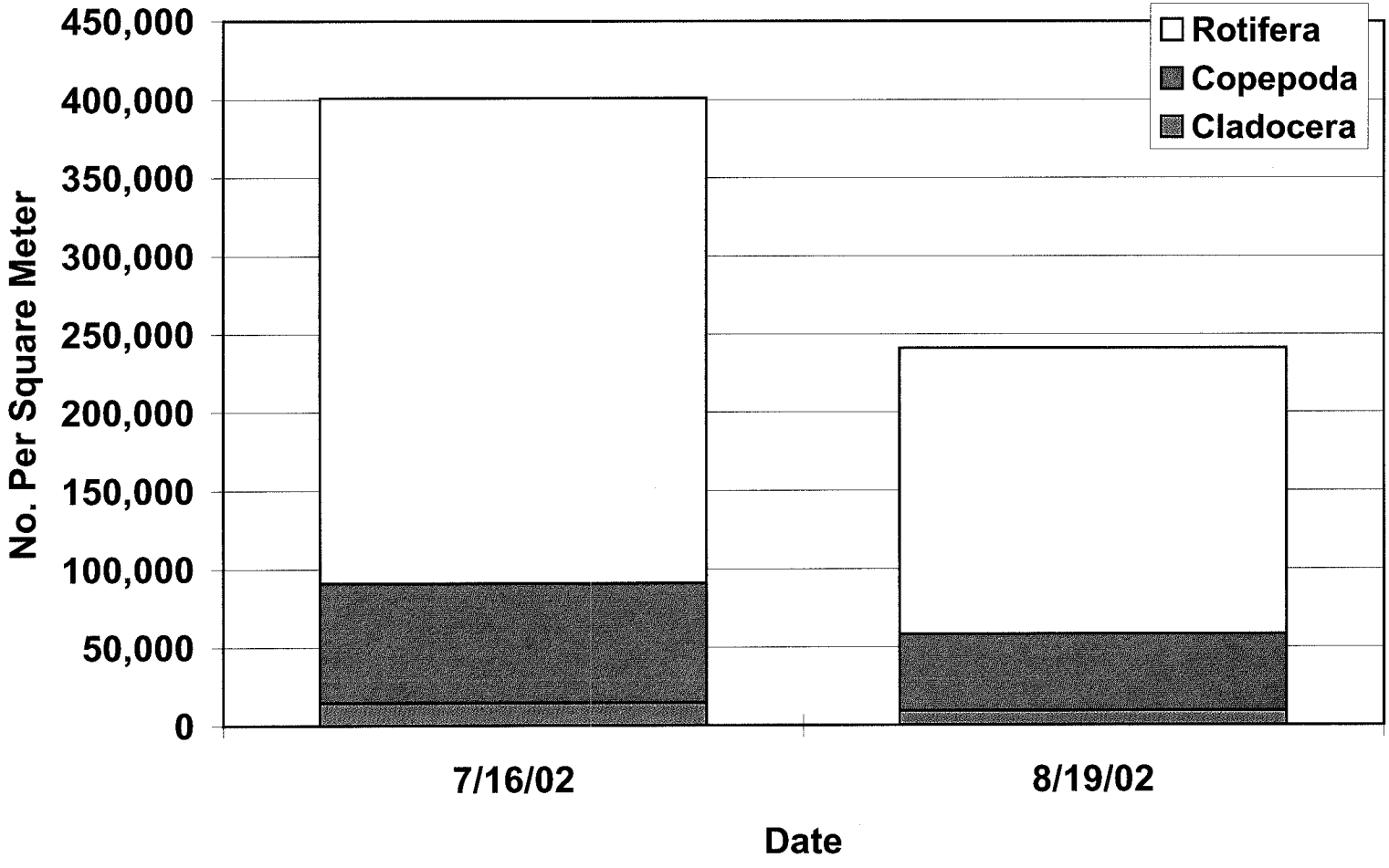


Figure 13

5.3.3 Macrophytes

Aquatic plants (i.e., macrophytes and phytoplankton) are a natural part of most lake communities and provide many benefits to fish, wildlife, and people. They are the primary producers in the aquatic food chain, providing food for other aquatic life. Macrophytes describe the aquatic plants growing in the shallow (littoral) area of the lake.

The Twin Lakes' macrophyte communities were surveyed on June 21, 2002 to determine locations of macrophyte growth and to determine relative abundance and frequency of occurrence of species. Survey results are presented in Figures 14 through 16.

The diverse assemblage of macrophyte (aquatic plants) species noted in North, Middle, and South Twin Lakes is indicative of a stable and healthy macrophyte community. A total of 13 species were observed in North Twin Lake and South Twin Lake. Ten species were observed in Middle Twin Lake. All species observed in the lakes are native species commonly found in Wisconsin lakes. The diverse macrophyte community found in each lake provides excellent habitat for fish and invertebrates (i.e., food for fish).

The four types of macrophytes–submersed plants, floating-leaf plants, emergent plants, and the alga *Chara*–were represented in the Twin Lakes macrophyte communities. Hence, the communities were balanced.

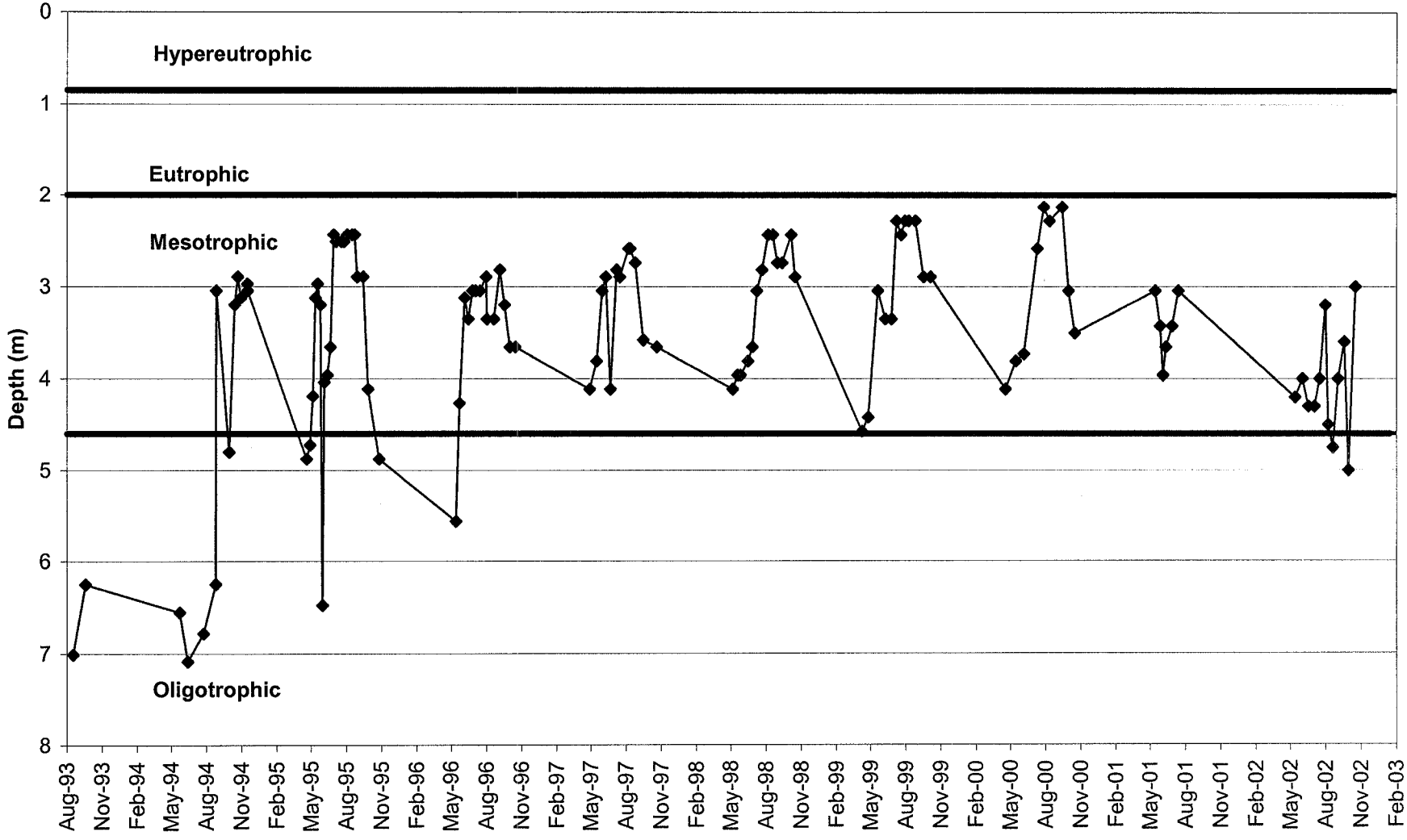
Macrophyte growth in the lakes was apparently light limited. Hence, macrophytes were found wherever light penetrated to the lakes' bottom. Macrophyte growth in North Twin Lake occurred in depths up to 9 feet. Because of its shallow depth, macrophytes in Middle Twin Lake were found in the entire water body. Middle Twin Lake macrophyte growth was less dense near the lake's center than in near-shore areas. Macrophyte growth in South Twin Lake occurred in depths less than 15 feet. Macrophyte growth was more dense in depths less than 10 feet than in depths from 10 to 15 feet.

Macrophyte density in the lakes was generally light to moderate, reflecting the low to moderate nutrient status of the lakes. A few areas within North and South Twin lakes noted heavy macrophyte growth. A dense growth of *Eleocharis palustrus* (creeping spikerush) was observed on the south side of North Twin Lake. Mats broke loose and were observed floating on the lake's surface, particularly near the boat launch.

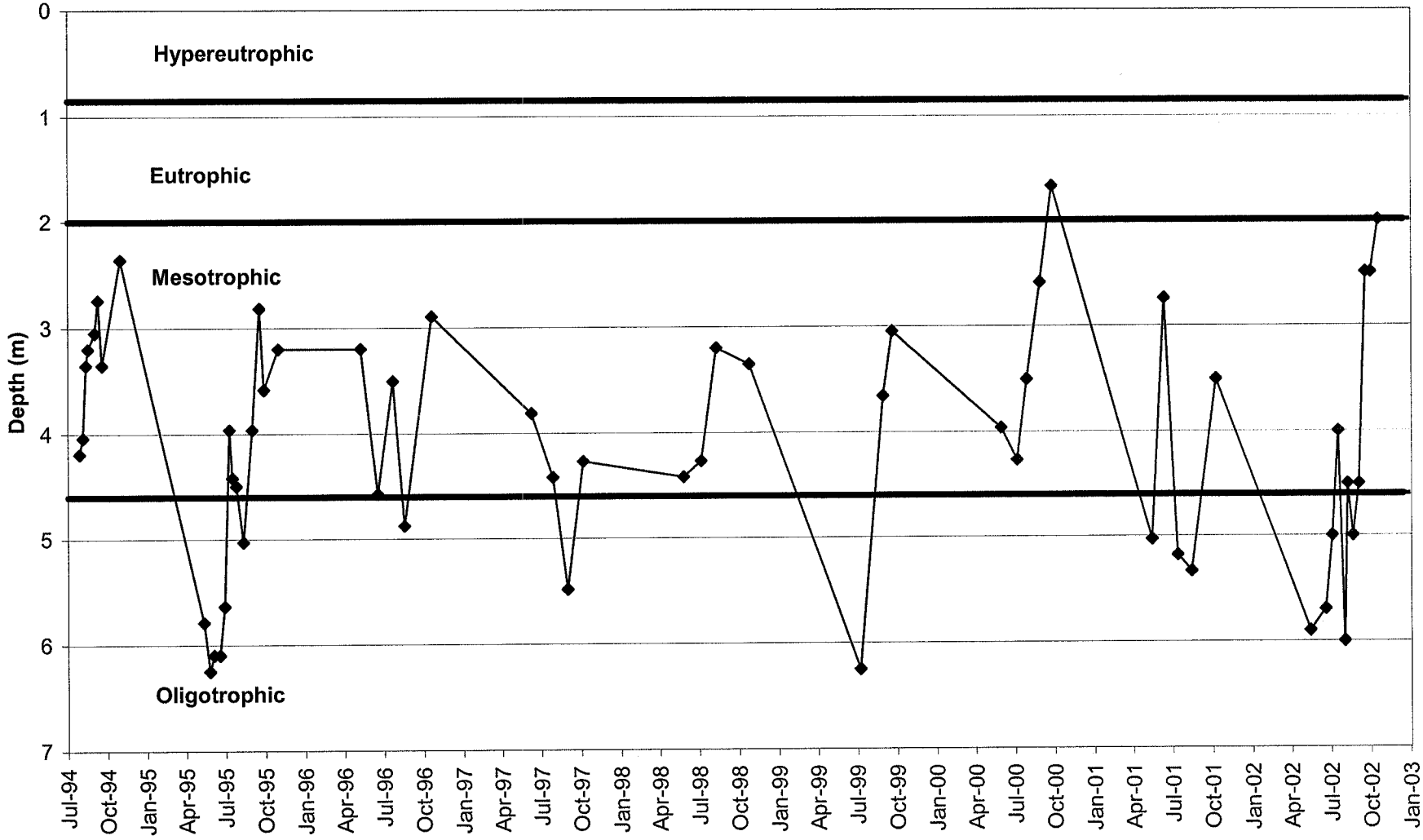
5.4 Evaluation of Historical Secchi Disc Data

Summer Secchi disc data were collected from North Twin Lake during the 1993 through 2002 period and from South Twin Lake during the 1994 through 2002 period. The data indicate variation has occurred, but the water quality of each lake has remained stable over time. The lakes' water transparency has generally been within the mesotrophic category, with some measurements in the oligotrophic category. South Twin Lake observed a measurement in the eutrophic category following the lake's fall mixing event during 2000.

North Twin Lake 1993-2002
Secchi Disc Transparencies



South Twin Lake 1994-2002
Secchi Disc Transparencies



5.5 Rainfall and Lake Level Data

As previously mentioned, precipitation was measured in 2002 at three rain gages within the Twin Lakes' watershed and read daily by volunteers to determine daily precipitation amounts. One gage was located adjacent to North Twin Lake, one gage was located adjacent to Middle Twin Lake, and one gage was located adjacent to South Twin Lake.. Precipitation was measured during the May through October period at North and South Twin gages. A total of 27.3 inches of precipitation was measured at the North Twin gage and a total of 27.5 inches of precipitation was measured at the South Twin gage. Precipitation was measured during the May through September period at the Middle Twin gage. A total of 23.6 inches of precipitation was measured.

Two staff gages in each of the three lakes were read daily in to determine the change in storage within the lake. The gages were read on a daily basis during the period mid May through early November, 2002. The monitored lake water surface elevations had a range of approximately one half foot. The low lake surface elevation occurred in May or June , 2002 and the high lake surface elevation occurred during August or October, 2002.

The staff gage readings will be used to determine daily lake volume changes in a subsequent Phase of the Lake Management Plan project.

6.0 Conclusions and Recommendations

6.1 Conclusions

An analysis of data collected from Twin Lakes during 2002 was completed and two questions were answered:

1. What is the water quality of Twin Lakes under existing conditions?

Twin Lakes are healthy and in good condition. The average summer phosphorus concentrations from the lakes' epilimnion (i.e., surface waters) ranged from 10 to 14 µg/L. The lakes' average summer chlorophyll *a* concentrations ranged from 1.1 to 2.1 µg/L. North and South Twin Lakes observed average summer Secchi disc transparency measurements of 4.1 and 4.3 meters, respectively. Middle Twin Lake observed Secchi disc transparency measurements to its bottom on all sample occasions. These values indicate the lakes are in the oligotrophic (excellent water quality) or mesotrophic (good water quality) categories. 2002 Twin Lakes' phytoplankton, zooplankton and macrophyte (aquatic plant) communities were diverse, healthy, and indicative of excellent water quality.

2. Are there problems evident in the water quality?

No, there are no problems evident in the Twin Lakes' current water quality.

6.2 Recommendations

Completion of additional phases of the Lake Management Plan project for Twin Lakes is recommended to protect the lakes' water quality. Details of the recommended work tasks follow.

Development of a management plan for Twin Lakes and the lakes' watersheds affords the opportunity to evaluate the water quality impacts of different watershed and lake management scenarios. The following work tasks of the lake management plan project are recommended:

- Prepare hydrologic and phosphorus budgets for each lake basin.
- Establish a long-term water quality goal for each lake basin.
- Determine potential development and watershed management practices in the lakes' watersheds.
- Model the estimated water quality degradation from watershed development and the estimated benefits from implementation of watershed management practices to mitigate development impacts.
- Determine development scenarios and watershed management practices that result in goal achievement.
- Develop a management plan for Twin Lakes and their watersheds

References

Carlson, R.E., 1977. *A Trophic State Index for Lakes*. Limnology and Oceanography, 22:2.

Engel, S. 1985. *Aquatic Community Interactions of Submerged Macrophytes: Phytoplankton, Zooplankton, Macrophytes, Fishes, Benthos*. Technical Bulletin No. 156, Department of Natural Resources, Madison, Wisconsin.

Osgood, R.A., 1989. *Assessment of Lake Use-Impairment in the Twin Cities Metropolitan Area*. Prepared for the Minnesota Pollution Control Agency. Metropolitan Council Publication 590-89-130. 12 pp.

Appendices

Appendix A
North Twin Lake Water Quality Data

Water Quality Data Summary
North Twin Lake

Location	Date	Max. Depth (M)	Secchi Disc (M)	Sample Depth (M)	D.O. (mg/L)	Temp. (°C)	Specific Cond. (umhos/cm @ 25 C)	pH (Std. Units)	Chl a (ug/L)	Alkalinity (mg/L)	Dissolved Ammonia Nitrogen (mg/L)	Nitrate + Nitrite Nitrogen (mgL)	Total Kjeldahl Nitrogen (mgL)	Total P (mg/L)	Dissolved Ortho. P (mg/L)
North Twin Lake Deep Hole															
	5/13/02	6.1	4.2	Surface		9.4	40	7.73	<1	26	0.077	0.025	0.56	0.014	0.007
				1	11.4	9.2	40								
				2	11.6	9.0	39								
				3	11.8	8.8	40								
				4	11.8	8.6	40							0.014	
				5	11.9	8.5	40								
				5.5	11.9	8.3	40							0.013	
	6/1/02		4	Surface	9.0	3.9	39								
				1	9.0	4.0	40								
				2	8.5	3.9	39								
				3	8.5	3.9	39								
				4	9.4	3.7	37								
				5	9.5	3.6	30								
				5.5		3.6	30								
	6/17/02	6.1	4.3	Surface	8.1	22	63							0.016	<0.002
				1	8.3	20.9	63								
				2	8.5	20.9	62								
				3	8.2	20.5	62		1					0.016	
				4	7.5	20.1	65							0.014	
				5	6.1	19.1	65								
				5.5	4.8	19.0	60								
				6.1										0.012	
	7/2/02	5.5	4.3	Surface	10.6	29.2	65		1.34					0.013	Not Analyzed
				1	10.4	29.2	65								
				2	10.2	29.0	65								
				3	9.6	28.8	68								
				4	10.8	26.0	61							0.017	
				5	8.8	24.0	65								
				5.5	5.2	23.5	75							0.019	
	7/16/02	5.5	4.0	Surface	11.2	28	60		0.090					0.015	<0.002
				1	11.0	28	62		0.84						
				2	10.8	28	62								
				3	10.5	28	62								
				4	9.7	26	58							0.015	
				5	7.8	25.5	62								
				5.5	4.9	24.8	68							0.023	

Water Quality Data Summary
North Twin Lake

Location	Date	Max. Depth (M)	Secchi Disc (M)	Sample Depth (M)	D.O. (mg/L)	Temp. (°C)	Specific Cond. (umhos/cm @ 25 C)	pH (Std. Units)	Chl a (ug/L)	Alkalinity (mg/L)	Dissolved Ammonia Nitrogen (mg/L)	Nitrate + Nitrite Nitrogen (mgL)	Total Kjeldahl Nitrogen (mgL)	Total P (mg/L)	Dissolved Ortho. P (mg/L)
North Twin Lake Deep Hole															
	7/31/02	6.5	3.2	Surface	11.1	28	60.1								
				1	11.1	28	60.1								
				2	11.0	28	60.1								
				3	9.5	28	60.1								
				4	9.5	26	60.1								
				5	7.0	25	60.1								
				5.5		25	70								
				6.5	5.2	24									
	8/7/02		4.5	Surface	12.4	24.5	59		1.11					Not Collected	0.010
				1	11.5	24.0	59								
				2	11.4	24.0	60								
				3	11.4	23.8	61								
				4	11.7	23.8	60							0.013	
				5	11.6	23.2	60								
				6	10.6	22.8	55							0.013	
	8/19/02	7	4.75	Surface	11.2	21	58		2.68					0.012	<0.002
				1	11.0	21	58		2.77					0.019	
				2	10.9	21	58								
				3	10.3	20.5	58								
				4	9.8	20.5	58							0.014	
				5	9.9	20.5	60								
				5.5	9.0	20.5	60								
				7										0.013	
	9/2/02		4.0	Surface	11.2	22.8	60								
				1	11.1	22.8	61								
				2	11.2	22.5	62								
				3	11.2	22.6	62								
				4	11.1	22.5	64								
				5	11.0	22.5	64								
				5.5		22.2	62								
	9/18/02		3.6	Surface	12.3	21.5	56								
				1	12.3	21.5	56		3.72						
				2	12.3	21.5	58								
				3	12.3	21.2	58								
				4	12.3	21.2	58								
				5	11.5	20.5	58								
				5.5	10.8	20.5	58								

Water Quality Data Summary
North Twin Lake

Location	Date	Max. Depth (M)	Secchi Disc (M)	Sample Depth (M)	D.O. (mg/L)	Temp. (°C)	Specific Cond. (umhos/cm @ 25 C)	pH (Std. Units)	Chl a (ug/L)	Alkalinity (mg/L)	Dissolved Ammonia Nitrogen (mg/L)	Nitrate + Nitrite Nitrogen (mgL)	Total Kjeldahl Nitrogen (mgL)	Total P (mg/L)	Dissolved Ortho. P (mg/L)
North Twin Lake Deep Hole															
	9/29/02		5	Surface	12.2	14	41								
				1	12.3	14	41								
				2	12.2	13.8	41								
				3	11.9	13.8	42								
				4	11.9	13.6	45								
				5	11.9	13.8	45								
				5.5	11.7	13.5	42								
	10/17/02		3	Surface	15	7.5	30								
				1	15	7.9	30								
				2	15	7.8	30								
				3	15	7.8	30								
				4	14.9	7.5	30								
				5	14.9	7.5	32								
				6	14.9	7.5	35								
				6.5	14.5	8	40								
				7	Mud										
	2/15/03	7		Surface		0	10								
				1	12.4	2.5	50								
				2	12.5	3.5	60								
				3	11.8	3.9	60								
				4	11.5	4	60								
				5	11.4	4.5	60								
				6	8.2	4.9	80								
				7		5	80								

NORTH TWIN LAKE

SAMPLE: 0-2 METERS

STANDARD INVERTED MICROSCOPE ANALYSIS METHOD

DIVISION	TAXON	7/16/2002 units/mL	8/19/2002 units/mL
CHLOROPHYTA (GREEN ALGAE)	*Ankistrodesmus Brauni*	117	0
	Chlamydomonas globosa	2,342	1,053
	Coelastrum microporum	39	0
	Elakotothrix sp.	78	42
	Selenastrum minutum	390	21
	Sphaerocystis Schroeteri (Colony)	78	21
	Staurastrum sp.	0	21
	CHLOROPHYTA TOTAL	**3,045**	**1,159**
CHRYSOPHYTA (YELLOW-BROWN ALGAE)	*Dinobryon sociale*	0	211
	CHRYSOPHYTA TOTAL	**0**	**211**
CYANOPHYTA (BLUE-GREEN ALGAE)	*Anabaena flos-aquae*	0	126
	Aphanocapsa delicatissima	39	0
	Merismopedia sp.	0	42
	Microcystis aeruginosa	390	653
	Microcystis incerta	39	147
	Oscillatoria limnetica	78	0
	CYANOPHYTA TOTAL	**547**	**969**
BACILLARIOPHYTA (DIATOMS)	*Amphora ovalis*	0	21
	Cocconeis placentula	0	21
	Cymbella sp.	0	63
	Fragilaria crotonensis	312	337
	Navicula sp.	0	211
	Stephanodiscus sp.	78	63
	Synedra acus	0	0
	Synedra ulna	39	0
	BACILLARIOPHYTA TOTAL	**429**	**716**
CRYPTOPHYTA (CRYPTOMONADS)	*Cryptomonas erosa*	547	2,086
	CRYPTOPHYTA TOTAL	**547**	**2,086**
EUGLENOPHYTA (EUGLENOIDS)	**EUGLENOPHYTA TOTAL**	**0**	**0**
PYRRHOPHYTA (DINOFLAGELLATES)	*Ceratium hirundinella*	0	274
	PYRRHOPHYTA TOTAL	**0**	**274**
	TOTALS	**4,568**	**5,415**

NORTH TWIN LAKE

ZOOPLANKTON ANALYSIS

DIVISION	TAXON	7/16/2002 Vertical Tow (m) #/m2	8/19/2002 #/m2
CLADOCERA	*Bosmina longirostris*	0	0
	Ceriodaphnia sp.	0	0
	Chydorus sphaericus	0	0
	Daphnia ambigua	0	0
	Daphnia galeata mendotae	0	0
	Daphnia pulex	0	0
	Daphnia retrocurva	0	4,598
	Diaphanosoma leuchtenbergianum	22,547	18,391
	Immature Cladocera	0	4,598
	CLADOCERA TOTAL	**22,547**	**22,989**
COPEPODA	*Cyclops sp.*	36,075	18,391
	Diaptomus sp.	9,019	9,196
	Nauplii	81,169	45,978
	Copepodid	0	0
	COPEPODA TOTAL	**126,263**	**73,565**
ROTIFERA	*Asplanchna priodonta*	4,509	0
	Filinia longiseta	4,509	4,598
	Lecane sp.	18,038	18,391
	Keratella cochlearis	257,035	137,934
	Kellicottia sp.	9,019	9,196
	Polyarthra vulgaris	49,603	82,761
	Trichocerca cylindrica	27,056	9,196
	Trichocerca multicrinis	0	4,598
	ROTIFERA TOTAL	**27,056**	**9,196**
	TOTALS	**175,866**	**105,750**

Appendix B
Middle Twin Lake Water Quality Data

Water Quality Data Summary
Middle Twin Lake

Location	Date	Max. Depth (M)	Secchi Disc (M)	Sample Depth (M)	D.O. (mg/L)	Temp. (°C)	Specific Cond. (umhos/cm @ 25 C)	pH (Std. Units)	Chl a (ug/L)	Alkalinity (mg/L)	Dissolved Ammonia Nitrogen (mg/L)	Nitrate + Nitrite Nitrogen (mgL)	Total Kjeldahl Nitrogen (mgL)	Total P (mg/L)	Dissolved Ortho. P (mg/L)
Middle Twin Lake Deep Hole															
	5/13/02	1.5	1.5	Surface	10.6	8.8	30	7.49	<1	22	0.096	0.023	0.71	0.016	0.008
				1	10.5	8.5	30								
				1.5	10.8	8.5	30							0.018	
	6/1/02	1.5	1.5	Surface	8.8	24.5	40								
			"clear to bottom"	1	8.7	24.5	40								
				1.5	8.35	23	45								
	6/17/02	1.5	1.5	Surface	7.0	22	55		Not Collected					0.015	<0.002
			"clear to bottom"	1	6.9	21.5	56								
				1.5	6.8	21	58							0.016	
	7/2/02	1.5	1.5	Surface	9.5	28.5	60		Not Collected					0.014	<0.002
			"clear to bottom"	1	8.8	28.5	60								
				1.5	8.4	28.5	60							0.015	

Water Quality Data Summary
Middle Twin Lake

Location	Date	Max. Depth (M)	Secchi Disc (M)	Sample Depth (M)	D.O. (mg/L)	Temp. (°C)	Specific Cond. (umhos/cm @ 25 C)	pH (Std. Units)	Chl a (ug/L)	Alkalinity (mg/L)	Dissolved Ammonia Nitrogen (mg/L)	Nitrate + Nitrite Nitrogen (mgL)	Total Kjeldahl Nitrogen (mgL)	Total P (mg/L)	Dissolved Ortho. P (mg/L)
Middle Twin Lake Deep Hole															
	7/16/02	1.75	1.75	Surface	10.6	26	51		Not Collected					0.012	<0.002
			"clear to bottom"	1	9.6	26	52								
				1.5	9.4	26	58							0.015	
	7/31/02	1.5	1.5	Surface	9.4	28.5	55								
			"clear to bottom"	1	9.0	28.5	55								
				1.5	7.2	27	55								
	8/7/02	1.2	1.2	Surface	11.1	24	51		Not Collected					0.011	<0.002
			"clear to bottom"	1	10.6	23.2	52							0.011	
	8/19/02	1.5	1.0	Surface	10.3	20.5	50		Not Collected					0.011	<0.002
			"clear to bottom"	1	10.2	20.5	50							0.014	
	9/2/02	1.5	1.5	Surface	10.3	23	51								
			"clear to bottom"	1	9.9	22.8	52								
				1.5		22.8	55								
	9/17/02	1.0	1.0	Surface	12.2	22.2	50								
			"clear to bottom"	1	12.4	21.8	51								
	9/29/02	1.0	1.0	Surface	13	13.3	36								
			"clear to bottom"	1	13.2	13.1	36								
	10/17/02	1.5	1.5	Surface	16	7	22								
			"clear to bottom"	1	15.2	7	28								
				1.5	15.2	7	20								
	2/15/03			Surface	16.4	0	10								
				1	16	1.5	8								
				2		3	Mud								

MIDDLE TWIN LAKE

SAMPLE: 0-2 METERS

STANDARD INVERTED MICROSCOPE ANALYSIS METHOD

DIVISION	TAXON	7/16/2002 units/mL	8/19/2002 units/mL
CHLOROPHYTA (GREEN ALGAE)	*Ankistrodesmus falcatus*	0	21
	Chlamydomonas globosa	742	4,994
	Cosmarium sp.	0	21
	Elakotothrix gelatinosa	39	0
	Lagerheimia sp.	39	0
	Oocystis parva	0	105
	Quadrigula sp.	0	42
	Scenedesmus sp.	39	42
	Selenastrum sp.	78	21
	Staurastrum sp.	0	63
	Tetraedron minimum	117	0
	CHLOROPHYTA TOTAL	**1,054**	**5,310**
CHRYSOPHYTA (YELLOW-BROWN ALGAE)	*Chrysophaerella longispina*	0	464
	Dinobryon sociale	1,288	1,306
	CHRYSOPHYTA TOTAL	**1,288**	**1,770**
CYANOPHYTA (BLUE-GREEN ALGAE)	*Anabaena affinis*	0	211
	Anabaena flos-aquae	0	190
	Coelosphaerium Naegelianum	39	21
	Microcystis aeruginosa	234	232
	Oscillatoria limnetica	0	63
	CYANOPHYTA TOTAL	**273**	**716**
BACILLARIOPHYTA (DIATOMS)	*Cymbella sp.*	0	21
	Melosira granulata	0	42
	Navicula sp.	39	21
	Stephanodiscus sp.	0	21
	BACILLARIOPHYTA TOTAL	**39**	**105**
CRYPTOPHYTA (CRYPTOMONADS)	*Cryptomonas erosa*	547	1,938
	CRYPTOPHYTA TOTAL	**547**	**1,938**
EUGLENOPHYTA (EUGLENOIDS)	**EUGLENOPHYTA TOTAL**	**0**	**0**
PYRRHOPHYTA (DINOFLAGELLATES)	*Ceratium hirundinella*	0	42
	PYRRHOPHYTA TOTAL	**0**	**42**
	TOTALS	**3,201**	**9,882**

MIDDLE TWIN LAKE

ZOOPLANKTON ANALYSIS

DIVISION	TAXON	7/16/2002 Vertical Tow (m) #/m2	8/19/2002 #/m2
CLADOCERA	*Bosmina longirostris*	0	44,652
	Ceriodaphnia sp.	4,333	8,930
	Chydorus sphaericus	0	0
	Daphnia ambigua	0	0
	Daphnia galeata mendotae	0	0
	Daphnia pulex	0	0
	Daphnia retrocurva	0	0
	Diaphanosoma leuchtenbergianum	0	4,465
	Immature Cladocera	0	0
	CLADOCERA TOTAL	**4,333**	**58,047**
COPEPODA	*Cyclops sp.*	0	22,326
	Diaptomus sp.	0	0
	Nauplii	12,998	62,513
	Copepodid	0	0
	COPEPODA TOTAL	**12,998**	**84,838**
ROTIFERA	*Asplanchna priodonta*	38,993	49,117
	Filinia longiseta	8,665	0
	Lecane sp.	0	0
	Keratella cochlearis	142,974	102,699
	Keratella quadrata	4,333	4,465
	Kellicottia sp.	4,333	0
	Polyarthra vulgaris	38,993	62,513
	Polyarthra eurypta	0	13,396
	Trichocerca cylindrica	77,986	4,465
	Trichocerca multicrinis	0	0
	ROTIFERA TOTAL	**77,986**	**4,465**
	TOTALS	**95,316**	**147,351**

Appendix C
South Twin Lake Water Quality Data

Water Quality Data Summary
South Twin Lake

Location	Date	Max. Depth (M)	Secchi Disc (M)	Sample Depth (M)	D.O. (mg/L)	Temp. (°C)	Specific Cond. (umhos/cm @ 25 C)	pH (Std. Units)	Chl a (ug/L)	Alkalinity (mg/L)	Dissolved Ammonia Nitrogen (mg/L)	Nitrate + Nitrite Nitrogen (mgL)	Total Kjeldahl Nitrogen (mgL)	Total P (mg/L)	Dissolved Ortho. P (mg/L)
South Twin Lake Deep Hole															
	5/13/02	8.0	5.9	Surface	10.5	8.5	30	7.41	<1	18	0.029	0.051	0.55	0.010	0.003
				1	10.7	8.3	30								
				2	10.9	8.1	30								
				3	11.0	8.1	30								
				4	10.9	8.0	30							0.036	
				5	11.0	8.0	30								
				6	10.9	8.0	30							0.016	
				7	10.9	8.0	32								
				7.5	10.4	8.0	35								
				8										0.017	

Water Quality Data Summary
South Twin Lake

Location	Date	Max. Depth (M)	Secchi Disc (M)	Sample Depth (M)	D.O. (mg/L)	Temp. (°C)	Specific Cond. (umhos/cm @ 25 C)	pH (Std. Units)	Chl a (ug/L)	Alkalinity (mg/L)	Dissolved Ammonia Nitrogen (mg/L)	Nitrate + Nitrite Nitrogen (mgL)	Total Kjeldahl Nitrogen (mgL)	Total P (mg/L)	Dissolved Ortho. P (mg/L)
South Twin Lake Deep Hole															
	6/1/02			Surface	8.5	20.25	40								
				1	9.5	20.0	40								
				2	9.5	19.75	40								
				3	10.2	19.5	40								
				4	10.7	15.0	35								
				5	10.8	14.5	35								
				6	10.9	14.0	35								
				7	10.3	13.5	35								
				7.5	9.1	13.5	35								
	6/17/02	7.5	5.7	Surface	7.5	20.0	45		1					0.010	<0.002
				1	7.5	20.0	45								
				2	7.8	19.75	48								
				3	7.8	19.5	50								
				4	7.7	19.0	49							0.014	
				5	7.4	17.8	50								
				6	7.0	15.9	45							0.023	
				7	3.6	14.9	49								
				7.5	2.4	14.5	50							0.041	
	7/2/02	7.5	5.0	Surface	9.5	27.5	48		2.00						
				1	9.4	27.5	45								
				2	9.4	27.1	45							0.014	
				3	9.4	27.1	48								
				4	11.8	24.0	42							0.013	
				5	12.2	21.5	42								
				6	12.5	18.0	42								
				7	11.8	16.1	45								
				7.5	11.2	15.1	60.2							0.028	
	7/16/02	8	4	Surface	10.8	27	43		0.47					0.009	<0.002
				1	10.6	27	43								
				2	10.5	27	43								
				3	10.5	27	43								
				4	10.9	26.1	43							0.010	
				5	11.1	24	41								
				6	12.1	20.2	41							0.017	
				7	7.1	17.2	49								
				7.5	1.8	17.2	52								
				8										0.035	

Water Quality Data Summary
South Twin Lake

Location	Date	Max. Depth (M)	Secchi Disc (M)	Sample Depth (M)	D.O. (mg/L)	Temp. (°C)	Specific Cond. (umhos/cm @ 25 C)	pH (Std. Units)	Chl a (ug/L)	Alkalinity (mg/L)	Dissolved Ammonia Nitrogen (mg/L)	Nitrate + Nitrite Nitrogen (mgL)	Total Kjeldahl Nitrogen (mgL)	Total P (mg/L)	Dissolved Ortho. P (mg/L)
South Twin Lake Deep Hole															
	7/31/02	7.5	6	Surface	10.3	27.5	42								
				1	10.3	27.5	42								
				2	10.5	27.1	45								
				3	10.4	27	45								
				4	10.4	26.2	45								
				5	10.2	25.2	45								
				6	9.9	23	45								
				7	9.2	19	50								
				7.5		18.2	65								
	8/7/02	8	4.5	Surface	10.2	24.6	45		2.58					Collected	<0.002
				1	10.1	24.5	48								
				2	10.2	24.2	46								
				3	10.2	24.2	48								
				4	10.2	24.0	48							0.010	
				5	10.1	24.0	48								
				6	9.5	24.0	48							0.011	
				7	4.7	19.5	56								
				7.5	7.5	18.5	55								
				8		17.5	70							0.026	
	8/19/02	7.5	5.0	Surface	10.5	21.8	45								
				1	10.3	22.0	45		4.27					0.011	<0.002
				2	10.2	22.0	45								
				3	10.2	22.2	47								
				4	10.1	22.2	47							0.013	
				5	10.0	22.2	47								
				6	9.6	22.0	49							0.013	
				7	8.4	21.2	51								
				7.5	4.0	20.5	57							0.019	
	9/2/02		4.5	Surface	11.4	23.0	45								
				1	11.5	23.0	48								
				2	11.4	23.0	48								
				3	11.2	23.0	48								
				4	11.2	22.8	49								
				5	11.2	22.8	50								
				6	10.5	22.5	50								
				7	7.2	21.1	53								
				7.5	2.6	21.0	55								

Water Quality Data Summary
South Twin Lake

Location	Date	Max. Depth (M)	Secchi Disc (M)	Sample Depth (M)	D.O. (mg/L)	Temp. (°C)	Specific Cond. (umhos/cm @ 25 C)	pH (Std. Units)	Chl a (ug/L)	Alkalinity (mg/L)	Dissolved Ammonia Nitrogen (mg/L)	Nitrate + Nitrite Nitrogen (mgL)	Total Kjeldahl Nitrogen (mgL)	Total P (mg/L)	Dissolved Ortho. P (mg/L)
South Twin Lake Deep Hole															
	9/17/02		2.5	Surface	12.2	22.0	42								
				1	12.2	22.0	42								
				2	12.2	22.0	45								
				3	12.2	21.5	47								
				4	12.2	21.5	47								
				5	12.0	21.5	48								
				6	11.8	21.3	48								
				7	11.7	21.3	48								
				7.5	11.5	21.3	48								
				8	Mud	21.0	Mud								
	9/29/02		2.5	Surface	12.0	16.8	30								
				1	11.9	16.8	31								
				2	11.9	16.8	31								
				3	11.7	16.8	32								
				4	11.6	16.5	32								
				5	11.5	16.5	32								
				6	11.4	16.5	32								
				7	11.5	16.5	33								
				7.5	11.4	16.5	35								
	10/17/02		2	Surface	13.5	10.0	20								
				1	13.4	10.2	22								
				2	13.4	10.2	22								
				3	13.2	10.2	25								
				4	13.1	10.2	24								
				5	13.0	10.2	25								
				6	13.0	10.2	22								
				7	13.0	10.2	28								
				7.5	12.9	10.0	25								
	2/15/03	8		Surface	15.2	1.0	30								
				1	14.1	4.0	30								
				2	13.0	4.0	29								
				3	12.5	4.0	29								
				4	12.4	4.5	29								
				5	12.3	4.5	29								
				6	12.3	4.5	29								
				7	12.7	4.5	30								
				8		5.0	31								

SOUTH TWIN LAKE

SAMPLE: 0-2 METERS

STANDARD INVERTED MICROSCOPE ANALYSIS METHOD

DIVISION	TAXON	7/16/2002 units/mL	8/19/2002 units/mL
CHLOROPHYTA (GREEN ALGAE)	*Chlamydomonas globosa*	1,132	1,857
	Cosmarium sp.	0	121
	Staurastrum curvatum	0	40
	Staurastrum limeticum var. cornutum	0	81
	Staurastrum paradoxum	0	40
	CHLOROPHYTA TOTAL	**1,132**	**2,140**
CHRYSOPHYTA (YELLOW-BROWN ALGAE)	*Chrysophaerella longispina*	0	10,860
	Dinobryon sociale	0	404
	CHRYSOPHYTA TOTAL	**0**	**11,263**
CYANOPHYTA (BLUE-GREEN ALGAE)	*Anabaena affinis*	0	484
	Anabaena flos-aquae	0	2,463
	Aphanizomenon flos-aquae	0	81
	Coelosphaerium Naegelianum	0	161
	Microcystis aeruginosa	117	444
	CYANOPHYTA TOTAL	**117**	**3,633**
BACILLARIOPHYTA (DIATOMS)	*Amphora ovalis*	0	40
	Fragilaria crotonensis	0	121
	Melosira granulata	0	40
	Navicula sp.	0	81
	BACILLARIOPHYTA TOTAL	**0**	**283**
CRYPTOPHYTA (CRYPTOMONADS)	*Cryptomonas erosa*	117	3,068
	CRYPTOPHYTA TOTAL	**117**	**3,068**
EUGLENOPHYTA (EUGLENOIDS)	**EUGLENOPHYTA TOTAL**	**0**	**0**
PYRRHOPHYTA (DINOFLAGELLATES)	*Ceratium hirundinella*	39	0
	Peridinium cinctum	78	0
	PYRRHOPHYTA TOTAL	**117**	**0**
	TOTALS	**1,484**	**20,387**

SOUTH TWIN LAKE

ZOOPLANKTON ANALYSIS

DIVISION	TAXON	7/16/02 Vertical Tow (m) #/m2	8/19/02 #/m2
CLADOCERA	*Bosmina longirostris*	9,549	0
	Ceriodaphnia sp.	0	0
	Chydorus sphaericus	0	0
	Daphnia ambigua	0	0
	Daphnia galeata mendotae	4,775	4,465
	Daphnia pulex	0	0
	Daphnia retrocurva	0	0
	Diaphanosoma leuchtenbergianum	0	4,465
	Immature Cladocera	0	0
	CLADOCERA TOTAL	**14,324**	**8,930**
COPEPODA	*Cyclops sp.*	0	8,930
	Diaptomus sp.	19,099	4,465
	Nauplii	57,296	35,721
	Copepodid	0	0
	COPEPODA TOTAL	**76,394**	**49,117**
ROTIFERA	*Asplanchna priodonta*	0	4,465
	Filinia longiseta	0	0
	Lecane sp.	52,521	4,465
	Keratella cochlearis	143,239	120,560
	Kellicottia sp.	19,099	4,465
	Polyarthra vulgaris	76,394	49,117
	Trichocerca cylindrica	14,324	0
	Trichocerca multicrinis	4,775	0
	ROTIFERA TOTAL	**310,352**	**183,072**
	TOTALS	**401,070**	**241,120**

Appendix D
North Twin Lake Level Data

2002 LAKE LEVEL READINGS
NORTH TWIN LAKE WISCONSIN LAKE MANAGEMENT PROJECT

GAGE # 1 (left)

*** Moved measurement Sticks**

MONTH: May	
Day	Lake Level (Ft.)
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	1.35
21	1.31
22	1.32
23	1.33
24	1.30
25	1.30
26	1.29
27	1.29
28	1.27
29	1.27
30	1.27
31	1.25

MONTH: June	
Day	Lake Level (Ft.)
1	1.25
2	1.23
3	1.23
4	1.23
5	1.21
6	1.78*
7	1.78
8	1.84
9	1.84
10	1.83
11	1.85
12	1.82
13	1.88
14	1.88
15	1.86
16	1.84
17	1.84
18	1.82
19	1.82
20	
21	1.89
22	1.92
23	1.94
24	1.98
25	1.97
26	1.97
27	1.95
28	1.94
29	1.93
30	1.92

MONTH: July	
Day	Lake Level (Ft.)
1	1.90
2	1.88
3	1.86
4	1.85
5	1.83
6	1.82
7	
8	2.15
9	2.11
10	2.17
11	2.16
12	2.14
13	2.14
14	2.12
15	2.10
16	2.09
17	2.07
18	2.07
19	2.05
20	
21	2.05
22	2.04
23	2.05
24	2.05
25	2.06
26	2.02
27	2.06
28	2.08
29	2.08
30	2.06
31	2.08

2002 LAKE LEVEL READINGS
NORTH TWIN LAKE WISCONSIN LAKE MANAGEMENT PROJECT

GAGE # 1 (left)

MONTH: August	
Day	Lake Level (Ft.)
1	2.06
2	2.03
3	
4	2.10
5	2.08
6	2.06
7	2.04
8	2.02
9	2.01
10	
11	2.00
12	2.02
13	2.00
14	1.90
15	2.02
16	2.02
17	
18	2.11
19	2.10
20	2.08
21	2.17
22	2.16
23	2.15
24	2.14
25	2.14
26	2.13
27	2.12
28	2.11
29	2.10
30	2.09
31	2.08

MONTH: September	
Day	Lake Level (Ft.)
1	3.46
2	3.54
3	3.52
4	3.51
5	3.51
6	3.55
7	3.54
8	3.53
9	3.52
10	3.54
11	3.52
12	3.51
13	3.50
14	3.49
15	3.48
16	3.47
17	3.46
18	3.44
19	3.48
20	3.47
21	3.46
22	3.43
23	3.44
24	3.42
25	3.47
26	3.47
27	3.46
28	3.45
29	3.44
30	3.46

MONTH: October	
Day	Lake Level (Ft.)
1	3.45
2	3.44
3	3.43
4	3.64
5	3.64
6	3.68
7	3.68
8	3.68
9	3.67
10	3.67
11	3.68
12	3.69
13	3.68
14	3.67
15	3.65
16	3.65
17	3.65
18	3.65
19	3.64
20	
21	
22	
23	
24	
25	3.65
26	
27	
28	
29	
30	
31	

2002 LAKE LEVEL READINGS
NORTH TWIN LAKE WISCONSIN LAKE MANAGEMENT PROJECT

GAGE # 1 (left)

MONTH: November	
Day	Lake Level (Ft.)
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	

2002 LAKE LEVEL READINGS
NORTH TWIN LAKE WISCONSIN LAKE MANAGEMENT PROJECT

GAGE # 2 (right)

*** Moved measurement Sticks**

MONTH: May	
Day	Lake Level (Ft.)
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	1.15
21	1.14
22	1.14
23	1.14
24	1.14
25	1.10
26	1.00
27	1.00
28	1.09
29	1.09
30	1.09
31	1.07

MONTH: June	
Day	Lake Level (Ft.)
1	1.05
2	1.03
3	1.04
4	1.04
5	1.02
6	3.16*
7	3.16
8	3.22
9	3.22
10	3.20
11	3.22
12	3.20
13	3.26
14	3.25
15	3.23
16	3.22
17	3.21
18	3.20
19	3.20
20	
21	3.26
22	3.28
23	3.30
24	3.35
25	3.34
26	3.34
27	3.32
28	3.31
29	3.30
30	3.29

MONTH: July	
Day	Lake Level (Ft.)
1	3.28
2	3.26
3	3.24
4	3.23
5	3.21
6	3.20
7	
8	3.53
9	3.49
10	3.55
11	3.54
12	3.52
13	3.52
14	3.50
15	3.49
16	3.46
17	3.45
18	3.44
19	3.42
20	
21	3.42
22	3.41
23	3.39
24	3.39
25	3.40
26	3.38
27	3.44
28	3.45
29	3.46
30	3.43
31	3.45

2002 LAKE LEVEL READINGS
NORTH TWIN LAKE WISCONSIN LAKE MANAGEMENT PROJECT

GAGE # 2 (right)

MONTH: August	
Day	Lake Level (Ft.)
1	3.43
2	3.41
3	
4	3.48
5	3.46
6	3.44
7	3.42
8	3.40
9	3.39
10	
11	3.38
12	3.40
13	3.39
14	3.37
15	4.00
16	4.00
17	3.75
18	3.49
19	3.48
20	3.46
21	3.55
22	3.54
23	3.53
24	3.52
25	3.52
26	3.51
27	3.50
28	3.49
29	3.48
30	3.47
31	3.46

MONTH: September	
Day	Lake Level (Ft.)
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	

MONTH: October	
Day	Lake Level (Ft.)
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	
31	

2002 LAKE LEVEL READINGS
NORTH TWIN LAKE WISCONSIN LAKE MANAGEMENT PROJECT

GAGE # 2 (right)

MONTH: November	
Day	Lake Level (Ft.)
1	
2	3.60
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	

Appendix E
Middle Twin Lake Level Data

2002 LAKE LEVEL READINGS
MIDDLE TWIN LAKE WISCONSIN LAKE MANAGEMENT PROJECT

GAGE # 1 (left)

MONTH: May	
Day	Lake Level (Ft.)
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	1.30
15	1.30
16	1.30
17	1.30
18	1.28
19	1.26
20	1.26
21	1.24
22	1.24
23	1.22
24	1.22
25	1.20
26	1.20
27	1.20
28	1.20
29	1.18
30	1.16
31	

MONTH: June	
Day	Lake Level (Ft.)
1	1.12
2	1.12
3	1.12
4	1.12
5	1.10
6	1.10
7	1.10
8	1.15
9	1.16
10	1.16
11	1.16
12	1.16
13	1.16
14	1.24
15	1.24
16	1.22
17	1.22
18	1.20
19	1.18
20	1.24
21	1.32
22	1.32
23	1.34
24	1.34
25	1.34
26	1.30
27	1.28
28	1.24
29	1.24
30	1.22

MONTH: July	
Day	Lake Level (Ft.)
1	1.22
2	1.22
3	1.22
4	1.18
5	1.14
6	1.12
7	1.16
8	1.50
9	1.48
10	1.52
11	1.52
12	1.52
13	1.50
14	1.48
15	1.46
16	1.46
17	1.44
18	1.42
19	1.40
20	1.40
21	1.42
22	1.38
23	1.34
24	1.34
25	1.34
26	1.32
27	1.44
28	1.44
29	1.42
30	1.42
31	1.44

2002 LAKE LEVEL READINGS
MIDDLE TWIN LAKE WISCONSIN LAKE MANAGEMENT PROJECT

GAGE # 1 (left)

MONTH: August	
Day	Lake Level (Ft.)
1	1.42
2	1.38
3	1.44
4	1.42
5	1.40
6	1.40
7	1.40
8	1.38
9	1.38
10	1.34
11	1.36
12	1.36
13	1.34
14	1.34
15	1.34
16	1.50
17	1.48
18	1.44
19	1.44
20	1.42
21	1.52
22	1.52
23	1.54
24	1.54
25	1.52
26	1.50
27	1.46
28	1.45
29	1.45
30	1.45
31	1.42

MONTH: September	
Day	Lake Level (Ft.)
1	1.52
2	1.50
3	1.46
4	1.45
5	1.45
6	1.52
7	1.52
8	1.52
9	1.50
10	1.50
11	1.50
12	1.48
13	1.46
14	1.46
15	1.46
16	1.45
17	1.45
18	1.45
19	1.45
20	1.45
21	1.45
22	1.43
23	1.42
24	1.40
25	1.40
26	1.40
27	1.43
28	1.42
29	1.42
30	

MONTH: October	
Day	Lake Level (Ft.)
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	
31	

2002 LAKE LEVEL READINGS
MIDDLE TWIN LAKE WISCONSIN LAKE MANAGEMENT PROJECT

GAGE # 1 (left)

MONTH: November	
Day	Lake Level (Ft.)
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	

2002 LAKE LEVEL READINGS
MIDDLE TWIN LAKE WISCONSIN LAKE MANAGEMENT PROJECT

GAGE # 2 (right)

MONTH: May	
Day	Lake Level (Ft.)
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	1.30
15	1.30
16	1.30
17	1.30
18	1.28
19	1.26
20	1.26
21	1.24
22	1.24
23	1.22
24	1.22
25	1.20
26	1.20
27	1.20
28	1.18
29	1.18
30	1.16
31	

MONTH: June	
Day	Lake Level (Ft.)
1	1.12
2	1.12
3	1.12
4	1.12
5	1.10
6	1.10
7	1.10
8	1.15
9	1.16
10	1.16
11	1.16
12	1.16
13	1.16
14	1.24
15	1.24
16	1.22
17	1.22
18	1.20
19	1.18
20	1.24
21	1.32
22	1.32
23	1.34
24	1.34
25	1.34
26	1.30
27	1.28
28	1.24
29	1.24
30	1.22

MONTH: July	
Day	Lake Level (Ft.)
1	1.22
2	1.22
3	1.22
4	1.18
5	1.14
6	1.12
7	1.16
8	1.50
9	1.48
10	1.52
11	1.52
12	1.52
13	1.50
14	1.48
15	1.46
16	1.46
17	1.44
18	1.42
19	1.40
20	1.40
21	1.42
22	1.38
23	1.34
24	1.34
25	1.34
26	1.32
27	1.44
28	1.44
29	1.42
30	1.42
31	1.44

2002 LAKE LEVEL READINGS
MIDDLE TWIN LAKE WISCONSIN LAKE MANAGEMENT PROJECT

GAGE # 2 (right)

MONTH: August	
Day	Lake Level (Ft.)
1	1.42
2	1.38
3	1.44
4	1.42
5	1.40
6	1.40
7	1.40
8	1.38
9	1.38
10	1.34
11	1.36
12	1.36
13	1.34
14	1.34
15	1.34
16	1.50
17	1.48
18	1.44
19	1.44
20	1.42
21	1.52
22	1.52
23	1.54
24	1.54
25	1.52
26	1.50
27	1.46
28	1.45
29	1.45
30	1.45
31	1.42

MONTH: September	
Day	Lake Level (Ft.)
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	

MONTH: October	
Day	Lake Level (Ft.)
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	
31	

2002 LAKE LEVEL READINGS
MIDDLE TWIN LAKE WISCONSIN LAKE MANAGEMENT PROJECT

GAGE # 2 (right)

MONTH: November	
Day	Lake Level (Ft.)
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	

Appendix F
South Twin Lake Level Data

2002 LAKE LEVEL READINGS
SOUTH TWIN LAKE WISCONSIN LAKE MANAGEMENT PROJECT

GAGE # 1 (left)

MONTH: May	
Day	Lake Level (Ft.)
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	1.33
14	1.35
15	1.36
16	1.36
17	1.35
18	1.35
19	1.34
20	1.32
21	1.27
22	1.25
23	1.24
24	1.22
25	1.21
26	1.21
27	1.21
28	1.21
29	1.20
30	1.20
31	1.20

MONTH: June	
Day	Lake Level (Ft.)
1	1.20
2	1.20
3	1.21
4	1.22
5	1.23
6	1.23
7	1.22
8	1.25
9	1.26
10	1.26
11	1.30
12	1.25
13	1.20
14	1.25
15	1.30
16	1.25
17	1.20
18	1.16
19	1.20
20	1.20
21	1.22
22	1.28
23	1.28
24	1.26
25	1.24
26	1.23
27	1.22
28	1.21
29	1.21
30	1.20

MONTH: July	
Day	Lake Level (Ft.)
1	1.20
2	1.20
3	1.18
4	1.23
5	1.23
6	1.22
7	1.20
8	1.18
9	1.50
10	1.48
11	1.45
12	1.44
13	1.51
14	1.50
15	1.48
16	1.47
17	1.45
18	1.42
19	1.39
20	1.37
21	1.40
22	1.38
23	1.37
24	1.36
25	1.36
26	1.37
27	1.37
28	1.45
29	1.44
30	1.42
31	1.45

2002 LAKE LEVEL READINGS
SOUTH TWIN LAKE WISCONSIN LAKE MANAGEMENT PROJECT

GAGE # 1 (left)

MONTH: August	
Day	Lake Level (Ft.)
1	1.43
2	1.43
3	1.40
4	1.44
5	1.45
6	1.44
7	1.43
8	1.42
9	1.40
10	1.39
11	1.41
12	1.43
13	1.43
14	1.42
15	1.44
16	1.44
17	1.50
18	1.50
19	1.49
20	1.48
21	1.54
22	1.55
23	1.55
24	1.54
25	1.52
26	1.50
27	1.49
28	1.48
29	1.50
30	1.49
31	1.48

MONTH: September	
Day	Lake Level (Ft.)
1	1.48
2	1.55
3	1.54
4	1.52
5	1.51
6	1.54
7	1.52
8	1.51
9	1.50
10	1.55
11	1.55
12	1.55
13	1.52
14	1.50
15	1.48
16	1.47
17	1.45
18	1.43
19	1.44
20	1.44
21	1.47
22	1.46
23	1.45
24	1.43
25	1.42
26	1.46
27	1.45
28	1.45
29	1.44
30	1.46

MONTH: October	
Day	Lake Level (Ft.)
1	1.45
2	1.44
3	1.44
4	1.57
5	1.57
6	1.60
7	1.59
8	1.59
9	1.58
10	1.58
11	1.58
12	1.66
13	1.66
14	1.66
15	1.65
16	1.65
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	
31	

2002 LAKE LEVEL READINGS
SOUTH TWIN LAKE WISCONSIN LAKE MANAGEMENT PROJECT

GAGE # 1 (left)

MONTH: November	
Day	Lake Level (Ft.)
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	

2002 LAKE LEVEL READINGS
SOUTH TWIN LAKE WISCONSIN LAKE MANAGEMENT PROJECT

GAGE # 2 (right)

MONTH: May	
Day	Lake Level (Ft.)
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	1.35
14	1.36
15	1.37
16	1.37
17	1.36
18	1.36
19	1.35
20	1.33
21	1.28
22	1.26
23	1.25
24	1.23
25	1.22
26	1.22
27	1.22
28	1.22
29	1.22
30	1.21
31	1.21

MONTH: June	
Day	Lake Level (Ft.)
1	1.21
2	1.21
3	1.22
4	1.23
5	1.24
6	1.24
7	1.23
8	1.26
9	1.27
10	1.27
11	1.31
12	1.28
13	1.25
14	1.26
15	1.25
16	1.30
17	1.21
18	1.18
19	1.21
20	1.21
21	1.23
22	1.29
23	1.29
24	1.27
25	1.24
26	1.23
27	1.23
28	1.22
29	1.22
30	1.21

MONTH: July	
Day	Lake Level (Ft.)
1	1.21
2	1.20
3	1.19
4	1.24
5	1.24
6	1.23
7	1.21
8	1.20
9	1.51
10	1.49
11	1.47
12	1.46
13	1.52
14	1.49
15	1.47
16	1.45
17	1.47
18	1.45
19	1.40
20	1.39
21	1.42
22	1.41
23	1.40
24	1.38
25	1.37
26	1.38
27	1.38
28	1.46
29	1.45
30	1.43
31	1.46

2002 LAKE LEVEL READINGS
SOUTH TWIN LAKE WISCONSIN LAKE MANAGEMENT PROJECT

GAGE # 2 (right)

MONTH: August	
Day	Lake Level (Ft.)
1	1.44
2	1.42
3	1.41
4	1.45
5	1.45
6	1.44
7	1.44
8	1.43
9	1.41
10	1.40
11	1.42
12	1.44
13	1.44
14	1.43
15	1.43
16	1.45
17	1.52
18	1.52
19	1.50
20	1.49
21	1.55
22	1.56
23	1.56
24	1.55
25	1.53
26	1.52
27	1.50
28	1.51
29	1.49
30	1.48
31	1.49

MONTH: September	
Day	Lake Level (Ft.)
1	1.48
2	1.56
3	1.55
4	1.54
5	1.56
6	1.55
7	1.53
8	1.52
9	1.51
10	1.56
11	1.56
12	1.55
13	1.52
14	1.51
15	1.49
16	1.48
17	1.47
18	1.46
19	1.45
20	1.45
21	1.48
22	1.47
23	1.46
24	1.44
25	1.43
26	1.47
27	1.46
28	1.46
29	1.45
30	1.47

MONTH: October	
Day	Lake Level (Ft.)
1	1.46
2	1.46
3	1.45
4	1.58
5	1.58
6	1.61
7	1.60
8	1.60
9	1.59
10	1.59
11	1.59
12	1.67
13	1.67
14	1.67
15	1.66
16	1.66
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	
31	

2002 LAKE LEVEL READINGS
SOUTH TWIN LAKE WISCONSIN LAKE MANAGEMENT PROJECT

GAGE # 2 (right)

MONTH: November	
Day	Lake Level (Ft.)
1	1.47
2	1.46
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
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23	
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25	
26	
27	
28	
29	
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Appendix G
North Twin Lake Precipitation Data

2002 PRECIPITATION DATA--
TWIN LAKES WISCONSIN LAKE MANAGEMENT PROJECT
North Twin Lake

MONTH: May	
Day	**Precipitation (Inches)**
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	Trace
26	0.10
27	
28	
29	
30	
31	

2002 PRECIPITATION DATA--
TWIN LAKES WISCONSIN LAKE MANAGEMENT PROJECT
North Twin Lake

MONTH: June	
Day	**Precipitation (Inches)**
1	
2	
3	0.25
4	0.10
5	
6	
7	
8	0.75
9	
10	
11	0.20
12	
13	
14	0.975
15	
16	0.10
17	
18	
19	0.40
20	
21	0.75
22	
23	0.50
24	0.50
25	Trace
26	0.10
27	
28	
29	
30	

2002 PRECIPITATION DATA--
TWIN LAKES WISCONSIN LAKE MANAGEMENT PROJECT
North Twin Lake

MONTH: July	
Day	**Precipitation (Inches)**
1	
2	
3	
4	
5	0.30
6	
7	1.2
8	2.8
9	
10	0.90
11	
12	
13	
14	
15	
16	
17	
18	0.30
19	
20	
21	0.15
22	0.40
23	
24	
25	0.30
26	0.10
27	0.80
28	0.10
29	0.40
30	
31	

2002 PRECIPITATION DATA--
TWIN LAKES WISCONSIN LAKE MANAGEMENT PROJECT
North Twin Lake

MONTH: August	
Day	**Precipitation (Inches)**
1	
2	
3	
4	2.2
5	
6	
7	
8	
9	
10	
11	0.30
12	0.40
13	
14	
15	0.40
16	0.40
17	1.6
18	
19	
20	
21	1.2
22	
23	
24	
25	
26	
27	
28	
29	0.05
30	
31	

2002 PRECIPITATION DATA--
TWIN LAKES WISCONSIN LAKE MANAGEMENT PROJECT
North Twin Lake

MONTH: September	
Day	**Precipitation (Inches)**
1	0.20
2	1.2
3	
4	
5	0.20
6	0.70
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	0.60
20	
21	
22	
23	0.40
24	
25	0.70
26	0.20
27	
28	
29	
30	

2002 PRECIPITATION DATA--
TWIN LAKES WISCONSIN LAKE MANAGEMENT PROJECT
North Twin Lake

MONTH: October	
Day	**Precipitation (Inches)**
1	
2	
3	
4	2.4
5	
6	0.90
7	
8	
9	
10	
11	
12	0.50
13	
14	
15	
16	
17	
18	
19	0.20
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	
31	

Appendix H
Middle Twin Lake Precipitation Data

2002 PRECIPITATION DATA--
TWIN LAKES WISCONSIN LAKE MANAGEMENT PROJECT
North Twin Lake

MONTH: November	
Day	**Precipitation (Inches)**
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	

2002 PRECIPITATION DATA--
TWIN LAKES WISCONSIN LAKE MANAGEMENT PROJECT
Middle Twin Lake

MONTH: May	
Day	**Precipitation (Inches)**
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	0.10
14	0.10
15	0.00
16	0.00
17	0.00
18	0.00
19	0.00
20	0.00
21	0.00
22	0.00
23	0.00
24	Trace
25	Trace
26	Trace
27	Trace
28	0.00
29	0.00
30	0.00
31	

2002 PRECIPITATION DATA--
TWIN LAKES WISCONSIN LAKE MANAGEMENT PROJECT
Middle Twin Lake

MONTH: June	
Day	Precipitation (Inches)
1	0.00
2	0.20
3	Trace
4	0.15
5	Trace
6	0.00
7	0.80
8	0.00
9	0.00
10	0.20
11	0.00
12	Trace
13	1.0
14	0.00
15	0.00
16	0.00
17	0.00
18	0.00
19	0.50
20	0.10
21	0.70
22	0.60
23	0.60
24	Trace
25	0.00
26	0.00
27	0.00
28	0.00
29	0.00
30	0.00

2002 PRECIPITATION DATA--
TWIN LAKES WISCONSIN LAKE MANAGEMENT PROJECT
Middle Twin Lake

MONTH: July	
Day	**Precipitation (Inches)**
1	0.00
2	0.00
3	Trace
4	0.00
5	0.02
6	0.00
7	2.40
8	3.35
9	0.00
10	1.00
11	0.00
12	0.00
13	0.00
14	0.00
15	0.00
16	0.00
17	0.00
18	0.15
19	0.00
20	0.00
21	0.00
22	0.20
23	0.00
24	0.00
25	0.20
26	0.00
27	1.10
28	0.40
29	Trace
30	0.00
31	0.50

2002 PRECIPITATION DATA--
TWIN LAKES WISCONSIN LAKE MANAGEMENT PROJECT
Middle Twin Lake

MONTH: August	
Day	**Precipitation (Inches)**
1	Trace
2	0.00
3	0.90
4	0.00
5	0.00
6	0.00
7	0.00
8	0.00
9	0.00
10	Trace
11	0.65
12	Trace
13	0.00
14	0.00
15	1.00
16	1.9
17	0.00
18	0.00
19	0.00
20	0.65
21	0.00
22	0.00
23	0.00
24	0.00
25	0.00
26	0.00
27	0.00
28	0.00
29	Trace
30	0.00
31	0.00

2002 PRECIPITATION DATA--
TWIN LAKES WISCONSIN LAKE MANAGEMENT PROJECT
Middle Twin Lake

MONTH: September	
Day	**Precipitation (Inches)**
1	1.4
2	0.00
3	0.00
4	0.15
5	0.35
6	0.00
7	0.00
8	0.00
9	0.50
10	0.00
11	0.00
12	0.00
13	0.00
14	0.00
15	0.00
16	0.00
17	0.00
18	0.00
19	0.00
20	0.40
21	0.00
22	0.00
23	Trace
24	0.40
25	0.00
26	0.90
27	Trace
28	Trace
29	
30	

2002 PRECIPITATION DATA--
TWIN LAKES WISCONSIN LAKE MANAGEMENT PROJECT
Middle Twin Lake

MONTH: October	
Day	**Precipitation (Inches)**
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	
31	

2002 PRECIPITATION DATA--
TWIN LAKES WISCONSIN LAKE MANAGEMENT PROJECT
Middle Twin Lake

MONTH: November	
Day	**Precipitation (Inches)**
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	

Appendix I
South Twin Lake Precipitation Data

2002 PRECIPITATION DATA--
TWIN LAKES WISCONSIN LAKE MANAGEMENT PROJECT
South Twin Lake

MONTH: May	
Day	**Precipitation (Inches)**
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	0.60
14	Trace
15	0.20
16	0.00
17	0.00
18	0.00
19	0.00
20	0.00
21	0.00
22	0.00
23	0.00
24	0.00
25	0.00
26	0.00
27	0.00
28	0.00
29	0.00
30	0.00
31	0.00

2002 PRECIPITATION DATA--
TWIN LAKES WISCONSIN LAKE MANAGEMENT PROJECT
South Twin Lake

MONTH: June	
Day	**Precipitation (Inches)**
1	0.00
2	0.00
3	0.10
4	0.30
5	0.00
6	0.00
7	0.80
8	0.00
9	0.00
10	0.80
11	0.00
12	0.00
13	1.1
14	0.00
15	0.00
16	0.00
17	0.00
18	0.70
19	0.00
20	0.00
21	1.0
22	0.00
23	0.00
24	0.00
25	0.00
26	0.00
27	0.00
28	0.00
29	0.00
30	0.00

2002 PRECIPITATION DATA--
TWIN LAKES WISCONSIN LAKE MANAGEMENT PROJECT
South Twin Lake

MONTH: July	
Day	**Precipitation (Inches)**
1	0.00
2	0.00
3	0.50
4	0.00
5	0.00
6	1.1
7	0.00
8	3.0
9	0.00
10	0.00
11	0.00
12	1.1
13	0.00
14	0.00
15	0.00
16	0.00
17	0.00
18	0.00
19	0.00
20	0.40
21	0.10
22	0.00
23	0.00
24	0.00
25	0.30
26	0.00
27	0.90
28	0.40
29	0.00
30	0.00
31	0.30

2002 PRECIPITATION DATA--
TWIN LAKES WISCONSIN LAKE MANAGEMENT PROJECT
South Twin Lake

MONTH: August	
Day	**Precipitation (Inches)**
1	0.00
2	0.00
3	0.80
4	0.30
5	0.00
6	0.00
7	0.00
8	0.00
9	0.00
10	0.00
11	0.30
12	0.40
13	0.00
14	0.00
15	0.70
16	0.00
17	1.3
18	0.00
19	0.00
20	0.00
21	1.4
22	0.00
23	0.00
24	0.00
25	0.00
26	0.00
27	0.00
28	0.00
29	0.20
30	0.00
31	0.00

2002 PRECIPITATION DATA--
TWIN LAKES WISCONSIN LAKE MANAGEMENT PROJECT
South Twin Lake

MONTH: September	
Day	**Precipitation (Inches)**
1	1.3
2	
3	
4	
5	0.70
6	
7	
8	
9	
10	1.1
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	0.50
21	
22	
23	0.20
24	
25	0.80
26	0.10
27	
28	
29	
30	0.20

2002 PRECIPITATION DATA--
TWIN LAKES WISCONSIN LAKE MANAGEMENT PROJECT
South Twin Lake

MONTH: October	
Day	**Precipitation (Inches)**
1	
2	
3	
4	2.5
5	
6	0.50
7	
8	
9	
10	0.50
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	
31	

2002 PRECIPITATION DATA--
TWIN LAKES WISCONSIN LAKE MANAGEMENT PROJECT
South Twin Lake

MONTH: November	
Day	**Precipitation (Inches)**
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	