2004 Annual Report
Potters Lake AIS Grant

Submitted to

Wisconsin Department of Natural Resources

July 2005

INTRODUCTION

In 2003, the Potters Lake P & R District (District) received an Aquatic Invasive Species Grant from the Wisconsin Department of Natural Resources (WDNR) to conduct a demonstration whole-lake chemical treatment on Potters Lake. The Grant application included the project plan upon which the WDNR treatment permit was based. That plan, and the subsequent grant, requires extensive monitoring the year prior to treatment, the year of treatment, and three years post treatment. The aquatic plant community and the water quality are to be monitored under the grant. WDNR will monitor the fisheries. US Geological Survey (USGS) collected the water quality samples throughout the summer of 2004.

WHOLE LAKE TREATMENT

The whole lake treatment was conducted on May 5, 2004 with a target fluridone concentration of 6 ppm. At the time of treatment, the lake had approximately 95% plant cover. The dominant species was Eurasian watermilfoil (*Myriophyllum spicatum*). Although the treatment was conducted early in the year, Eurasian watermilfoil was at or near the surface throughout the lake, much before similar conditions were noted on other lakes in the region.

This excessive growth resulted in a high volume of plant material to uptake the fluridone. An EffecTEST™ (SePRO Corp) and FasTEST™ (SePRO Corp) indicated that fluridone levels had dropped below the target concentration of 4 ppm by early June 2004. A re-treatment (commonly referred to as a bump treatment) was conducted on June 11, 2004, applying 2.15 ppb Sonar to bring the fluridone concentrations in the lake back up to the target concentration.

AQUATIC PLANT SURVEY

The week of July 6, 2004, Aron & Associates conducted the year-of-treatment aquatic plant survey on Potters Lake. This survey is part of an ongoing demonstration project to document changes in the aquatic plant community of Potters Lake. This information can be compared with past studies and may be used by future investigators to determine if the aquatic plant population is changing. The impact of various management techniques may be evaluated based on their respective impacts on the aquatic plants. This information should be used to guide future lake management decisions on Potters Lake.

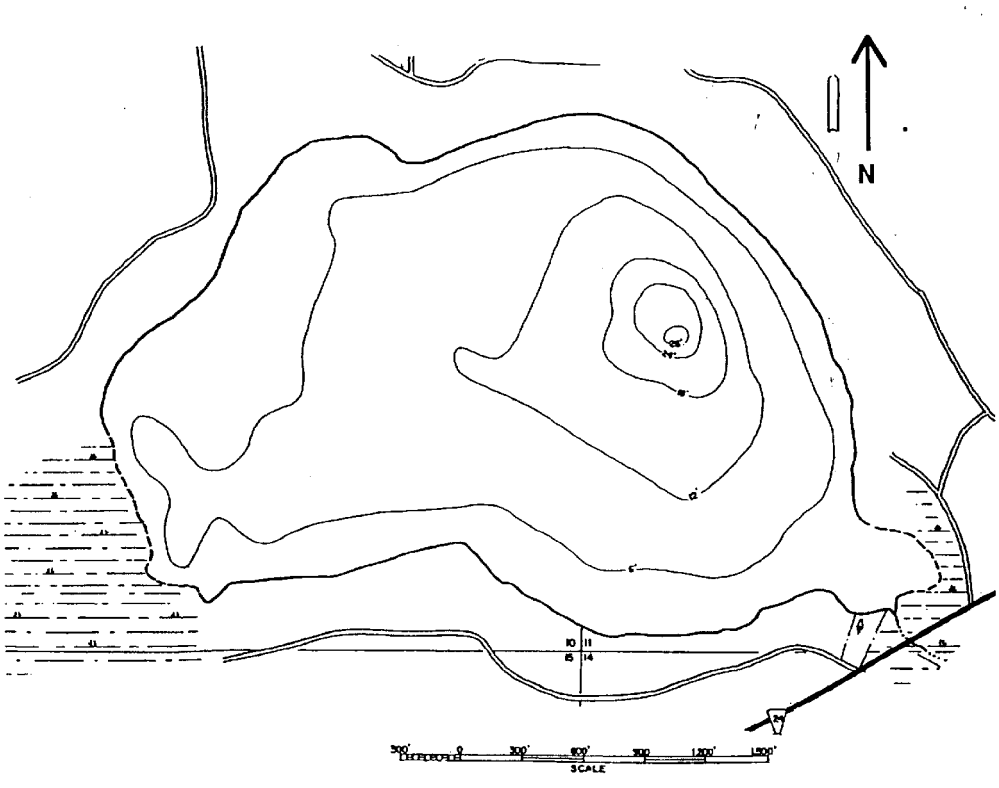
Potters Lake is located in the Town of East Troy, Walworth County, in Southeast Wisconsin. Hydrographic and morphometric data are presented in Table 1. A map of Potters Lake showing depth contours is presented in Map 1.

Table 1. Hydrographic and Morphometric Data Potters Lake

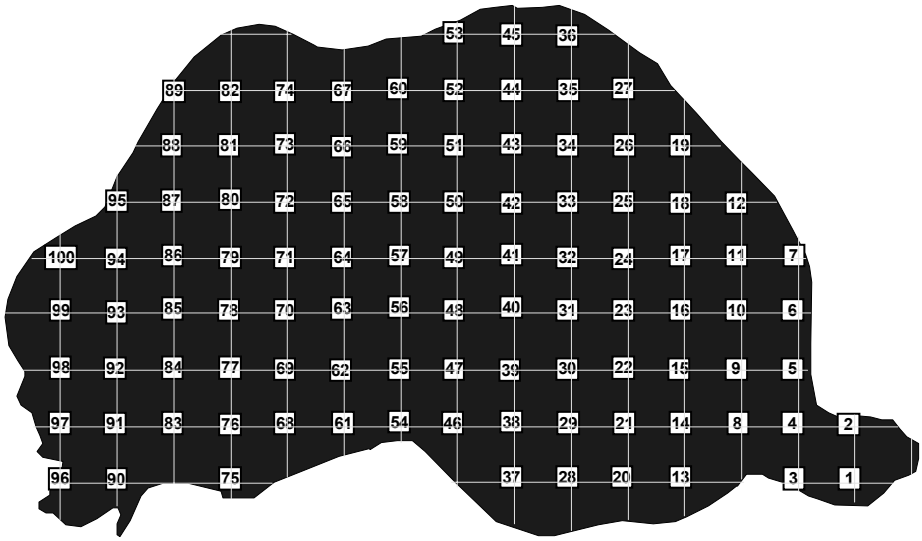
Size of Lake	162 acres
Lake Volume	1304.2 acre feet
Length of Shoreline	2.2 miles
Shore Development Factor*	1.23
Maximum Depth	26 feet
Mean Depth	8 feet
Percent of area less than 3 feet deep	19%
Percent of area greater than 20 feet deep	5.5%
Watershed Area	659.2 acres
Ratio of Watershed Area to Lake Area	4.1 (excluding lake area = 2.31)
Public Frontage, boat launch	100 feet

* Shore Development Factor is defined as the ratio of shoreline to the circumference of a circle with the same area as the lake.

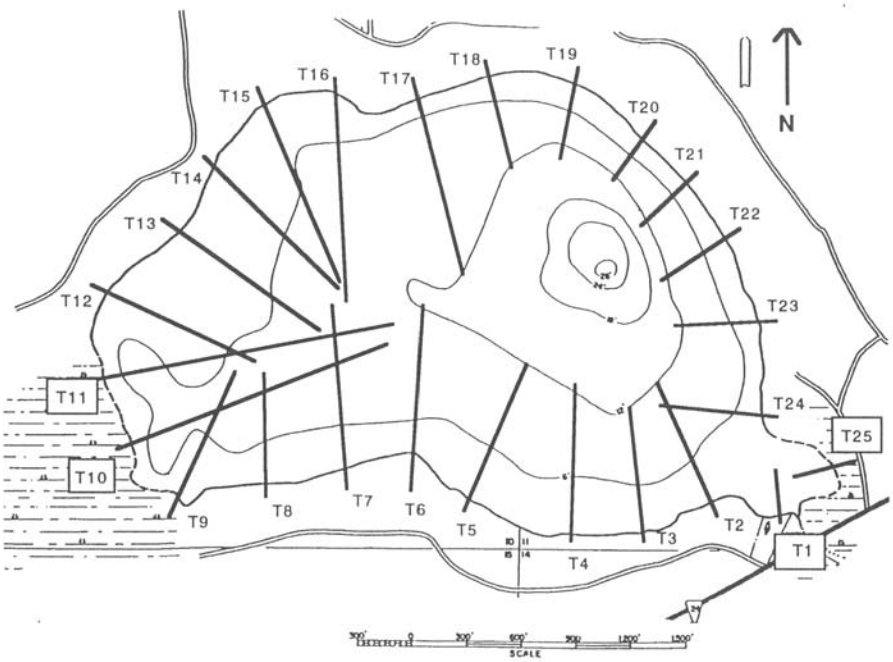
Source: WDNR



Map 1 - Bathymetric Map, Potters Lake, Wisconsin.



Map 2 - Point Intercept Survey Sample Points, Potters Lake, Wisconsin, 2004.



Map 3 -Line Transect Survey Locations on Potters Lake, established in 1992.

Earlier Studies

In October 1997, a whole-lake chemical treatment was conducted on Potters Lake using Sonar™ (SePRO Corporation). Eurasian watermilfoil (*Myriophyllum spicatum*) was the primary target species. The goal of the project was to eliminate Eurasian watermilfoil,

enhancing conditions for native species. A condition of the WDNR permit for the project required that aquatic plants in the lake be monitored. Pre-treatment monitoring has been conducted annually since the 1997 treatment. The monitoring for those years was conducted using the line-transect method.

As Eurasian watermilfoil has re-infested Potters Lake, the District has used harvesting and 2-4,D chemical spot treatments to slow the return of Eurasian watermilfoil.

Methodology

General Survey

A preliminary survey of the lake was made by boat. An attempt was made to locate all plant communities on the lake by region. Nomenclature follows Crow & Hellquist (2000). No plants samples were collected and preserved since all species found had been collected during previous surveys. The maximum rooting depth on Potters Lake in 2004 was determined to be 16 feet (4.9 m), that is, no plants were found growing in water deeper than 16 feet (4.9 m). Table 2 illustrates the maximum rooting depth for the years that aquatic plant surveys were conducted.

Table 2. Comparison of Maximum Rooting Depths, Potters Lake, 1992 to 2004

Year*	Maximum Rooting Depth, ft (m)
1992	15 (4.9)
1997	14 (4.3)
1998	15 (4.9)
1999	14 (4.3)
2000	14 (4.3)
2001	10 (3.0)
2002	14 (4.3)
2003	12 (3.7)
2004	16 (4.9 m)

*No surveys were conducted in years 1993 through 1996.

Point Intercept Survey

The methodology for the point intercept survey was developed by the WDNR Bureau of Research for the state's Whole Lake Treatment Protocol. A grid and global positioning satellite (GPS) coordinates for sampling, were developed by WDNR and provided to Aron & Associates for use in the Demonstration Whole Lake Treatment Project surveys on Potters Lake.

The initial grid established 100 sample points, Map 4. Samples points were located using a 2004 Garmin GPS LMS330 with an LGC-2000 Receiver. Four rake tows were conducted at each sample point. Each plant species retrieved was recorded and given a density rating in accordance with the WDNR criteria, between 1 and 5. An overall density rating and the dominant species at each sample point was also identified.

The data collected were then used to the mean density and percent of frequency for each species. Lake depth at each sample point was determined by using the Garmin after calibration in the field. That data are provided at the end of this report.

The abundance of each species was determined using four estimates:

1) The frequency is the rating of how often a species occurs in the sample points.

2) The average density rating, or the average density of a species in the sample point where it occurred.

3) The relative density rating, or the average density of a species averaged over all sample points whether or not any species were present.

4) The relative density rating averaged over all sample points in which any species occurred.

Line Transect Survey

A debate has been taking place in Wisconsin over the use of different methodology for the conduct of aquatic plant surveys. Because the line transect method has been used on Potters Lake for the previous 8 surveys, there was a concern that changing methods would prevent quality comparison of the whole-lake treatment results. Therefore, a line transect survey was also conducted on Potters Lake, following the previously established transects, Map 3. The results of that data are provided at the end of this report. Table 4 compares the results of the two methodologies.

2004 Results, Aquatic Plant Survey

At the time of the 2004 survey, Eurasian watermilfoil was still the dominant plant in the lake, however, it was beginning to respond to the fluridone. Some plants had begun to break down, showing no green solid plant material, only mushy remains. Other plants continued to resist the fluridone. Only green, viable plants were counted in the 2004 survey.

A total of thirteen aquatic macrophytes were found during the survey in 2004. Ten species were found during the point-intercept survey. Wetland fringe species are not included in the list of species. Three species, slender naiad (*Najas flexilis*), great bladderwort (*Utricularia vulgaris*), and horned pondweed (*Zanichellia palustris*) were found only during the

general survey. Of those three species, great bladderwort had not been identified as present in Potters Lake during previous surveys.

The plants found in the lake are listed in Table 3. Chara (*Chara* sp.) dominated the shallow water plant community. Eurasian watermilfoil dominated the mid to deep water zones. It was also common in the shallow depths. Sago pondweed (*Stuckenia pectinata*) was found primarily in the 5 to 10 feet (1.5 to 3 m) deep areas. The results of the survey data for the July 2004 survey for all species at each sample depth are included at the end of this report.

The maximum rooting depth in 2004 was 16 feet (4.9 m). Sediments in Potters Lake range from sand and gravel to muck. At 1.5 feet (0.5 m) the substrate is primarily sand and gravel. At 15 feet (4.6 m) the substrate is muck.

Table 3. Potters Lake Aquatic Plant Species - 1997 to 2004

	% Frequency							
Species	**1997**	**1998**	**1999**	**2000**	**2001**	**2002[a]**	**2003**	**2004[b]**
Chara sp.	62	46	68	91	96	88	52	61
Ceratophyllum demersum	38	41	4	4	0	5	8	7
Elodea canadensis	53	0	0	0	0	2	6	4
Lemna minor								1
Myriophyllum spicatum	99	0	0	0	0	66	56	78
Najas flexilis	22	0	0	0	0	0	6	4
Nuphar sp.								X
Nymphaea sp.	X	1	1	2	2	2	1	2
Potamogeton crispus	16	0	8	26	25	16	21	0
P. zosterformis		0						1
Stuckenia pectinata	21	19	21	76	60	55	28	24
Utricularia vulgaris	1							X
Zannichellia palustris	1	0	0	0	0	1	2	X
Zosteralla dubia		9	0		0	5	6	

Notes: [a] Two sampling periods averaged together.
[b] The line transect data are used here to facilitate direct comparisons.
X Found only in the general survey.
Shaded columns indicate whole-lake treatment seasons.

Table 4. Potters Lake Aquatic Plant Species - 2004, Comparison of Results of the Grid Intercept and Line Transect Sampling Techniques.

		% Frequency	
Species	**Common Name**	**Grid Intercept Method**	**Line Transect Method**
Chara sp.	Muskgrass, Chara	48	61
Ceratophyllum demersum	Coontail	2	7
Elodea canadensis	Waterweed	2	4
Myriophyllum spicatum	Milfoil	79	78
Lemna minor	Small Duckweed	1	1
Najas flexilis	Slender Naiad	3	4
Nuphar sp.	Yellow Water Lily	X	X
Nymphaea oderata	White Water Lily	2	2
Potamogeton crispus	Curly-leaf Pondweed	0	0
P. zosterformis	Flat-stem Pondweed	1	1
Stuckenia pectinata	Sago Pondweed	12	24
Utricularia vulgaris	Great Bladderwort	X	X
Zannichellia palustris	Horned Pondweed	X	X

X Found only in the general survey.

Summary

The District has conducted significant aquatic plant management activities over the years to keep Potters Lake open to recreational use. Early efforts focused on aquatic plant harvesting, with more recent years using primarily chemical treatment. A demonstration chemical treatment was conducted using Sonar in fall 1997. As Eurasian watermilfoil returned, there were diligent attempts to chemically treat the plant using 2,4-D. However, in 2002, the survey conducted the end of June showed a 50% frequency of Eurasian watermilfoil. A rapid growth of Eurasian watermilfoil occurred immediately after the June survey. An August 2002 survey showed Eurasian watermilfoil had increased to 75% frequency, and 100% frequency by September.

Potters Lake experienced rapid, early growth of Eurasian watermilfoil in 2004. By the May 5th treatment date, Eurasian watermilfoil had reached or was nearly at the surface throughout the lake up to 16 feet (4.9 m). This early growth resulted in the plants' ability to withstand the effects of the fluridone longer than normally expected.

The survey conducted in early July documented the extent of the still-viable Eurasian watermilfoil plants. Late summer 2004 inspections using rake pulls and an underwater video camera showed that much of the Eurasian watermilfoil biomass had died, although small, 6 to 8 inch green Eurasian watermilfoil stems were commonly found with one or

two tiny leaflets on the stems. These stems later in the season were only occasionally found.

The sharp decline in curly-leaf pondweed during the 2004 survey is likely because the plants had already been affected by the whole-lake treatment.

Although highly susceptible to fluridone, both waterweed (*Elodea canadensis*) and slender naiad were present and viable during the 2004 survey.

Early 2005 season lake inspections will attempt to determine if the Eurasian watermilfoil was indeed completely removed from the lake, or whether any viable plant material remains.

FISHERIES

Doug Welch (WDNR Fisheries Biologist) conducted a pre whole-lake treatment fish survey on Potters Lake on May 5, 2004. The entire shoreline was electrofished. His summary is included here:

Largemouth bass were the most abundant gamefish in the sample. The catch rate was 54 per hour. Lengths ranged between 4 and 18.1 inches and the mean length was 14 inches. 37% of the bass in the sample were legal size fish (14 inches or larger). Several year classes were represented. I was impressed with the overall size structure.

Found northern pike were caught and ranged in length between 17.5 and 25.4 inches.

Bluegills were the most abundant panfish in the sample. The catch rate was 132 per hour. Bluegills were between 3.2 and 6.6 inches long. The mean length was 4.5 inches.

Other panfish caught were black crappie, pumpkinseed, yellow perch, black bullhead, and brown bullhead.

21 carp were captured fro a catch rate of 42 per hour. Length range was 13 to 22.8 inches, and the mean length was 18 inches.

Two white suckers and 8 golden shores were also collected.

WATER QUALITY DATA

The USGS conducted water quality monitoring in 2004 water year (October 1, 2003 through October 1, 2004. The results of the monitoring follow this report.

PLANTEST

The PlanTEST by SePRO determines what concentration level of fluridone is needed to achieve control of a plant species. A PlanTEST was conducted in fall 2003. SePRO reported that a level of fluridone of 4 ppb would control Eurasian watermilfoil in Potters Lake.

EFFECTEST

The EffecTEST by SePRO evaluates the reaction of the plants to the fluridone. Plants are collected from four locations around the lake and shipped to the SePRO laboratory. The dosage of treatment, days since treatment, and conditions of the plants are analyzed by lab to see if the plants are reacting properly and whether the current fluridone level is sufficient to control the plants.

Two EffecTESTs were collected in 2004, the first on May 26, 2004, and the second on June 7, 2004. Plants and FasTEST samples were placed in a cooler with ice and shipped by overnight to the lab. According to the lab, the plants were responding to the fluridone exposure, and the fluridone levels were determined to be sufficient to acheive control.

FASTEST

FasTEST by SePRO is an analysis of the fluridone concentration in lake water. The samples are collected, and shipped on ice by overnight to the lab. Six FasTESTs were required as part of the treatment permit on Potters Lake. Ten FasTEST samples were collected and shipped to the lab during 2004. Another 8 FasTEST samples were collected during the EffecTEST sampling. The results of the FasTESTs are provided in Table 5.

Table 5. Results of FasTEST Monitoring on Potters Lake, 2004.

Potters Lake Sonar Treatment Log
Target Concentration = 6 ppb

Date	Activity	Rate	Amount Applied	Lake Level	Secchi (ft)	FasTEST (ppb)	Site
5/5/2004	Sonar Application	6 ppb	5.25 Gals				
5/5/2004	Plant Sample Collec-DNA						
5/10/2004	FasTEST				12	5.35	Deep Hole
5/19/2004	FasTEST				15.5	5.2	Deep Hole
5/26/2004	EffecTEST/FasTEST					4.1	1
5/26/2004	EffecTEST/FasTEST					4.7	2
5/26/2004	EffecTEST/FasTEST					4.65	3
5/26/2004	EffecTEST/FasTEST					3.8	4
6/2/2004	FasTEST				11	4.2	Deep Hole
6/7/2004	EffecTEST/FasTEST			8.16	15	4.05	1
6/7/2004	EffecTEST/FasTEST					3.7	2
6/7/2004	EffecTEST/FasTEST					4	3
6/7/2004	EffecTEST/FasTEST					3.65	4
6/11/2004	Sonar Application (bump)	2.15 ppb	1.9 Gals	8.18			
6/22/2004	FasTEST					5.25	Deep Hole
7/6/2004	FasTEST			8.06		4.5	Deep Hole
7/20/2004	FasTEST			7.9	6.5		Deep Hole
7/20/2004	FasTEST						4 (West End)
9/7/2004	FasTEST			7.55	3.75	3	Deep Hole
9/7/2004	FasTEST					2.55	4 (West End)
10/6/2004	FasTEST					<1	

LAKE INSPECTIONS

Regular lake inspections were done as part of the sample collection days shown in Table 5. During those, the lake was checked for new growths of milfoil as well as evaluating the decline of the milfoil.

The lake inspections required under the permit and grant will be conducted in 2005.

SPOT TREATMENTS

No spot treatments were conducted in 2004.

WATERCRAFT INSPECTIONS

In 2004, the District was seeking volunteers to conduct the watercraft inspections and set up the program and calendar for the upcoming 3 years. District board worked with the Clean Waters Clean Boats staff to provide training for the volunteers.

No watercraft inspections were conducted in 2004, but will begin in 2005.

424905088204000 POTTER LAKE NEAR MUKWONAGO, WI

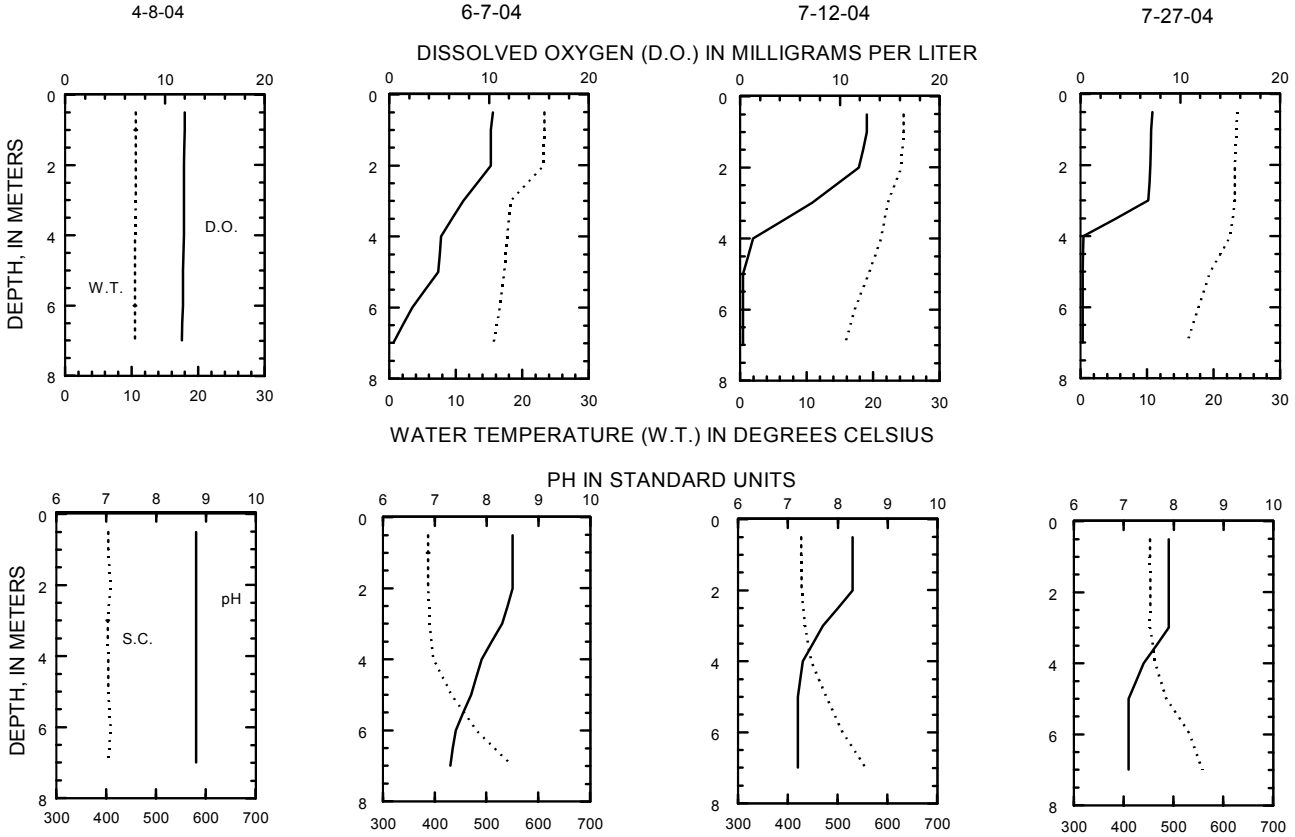
LOCATION.--Lat 42°49'05", long 88°20'40", in NW 1/4 SW 1/4 sec.11, T.4 N., R.18 E., Walworth County, Hydrologic Unit 07120006, 3.3 mi south of Mukwonago.

PERIOD OF RECORD.--February 1993 to current year.

REMARKS.--Lake sampled at the deep hole. Lake ice-covered during February sampling. Water-quality analyses done by Wisconsin State Laboratory of Hygiene.

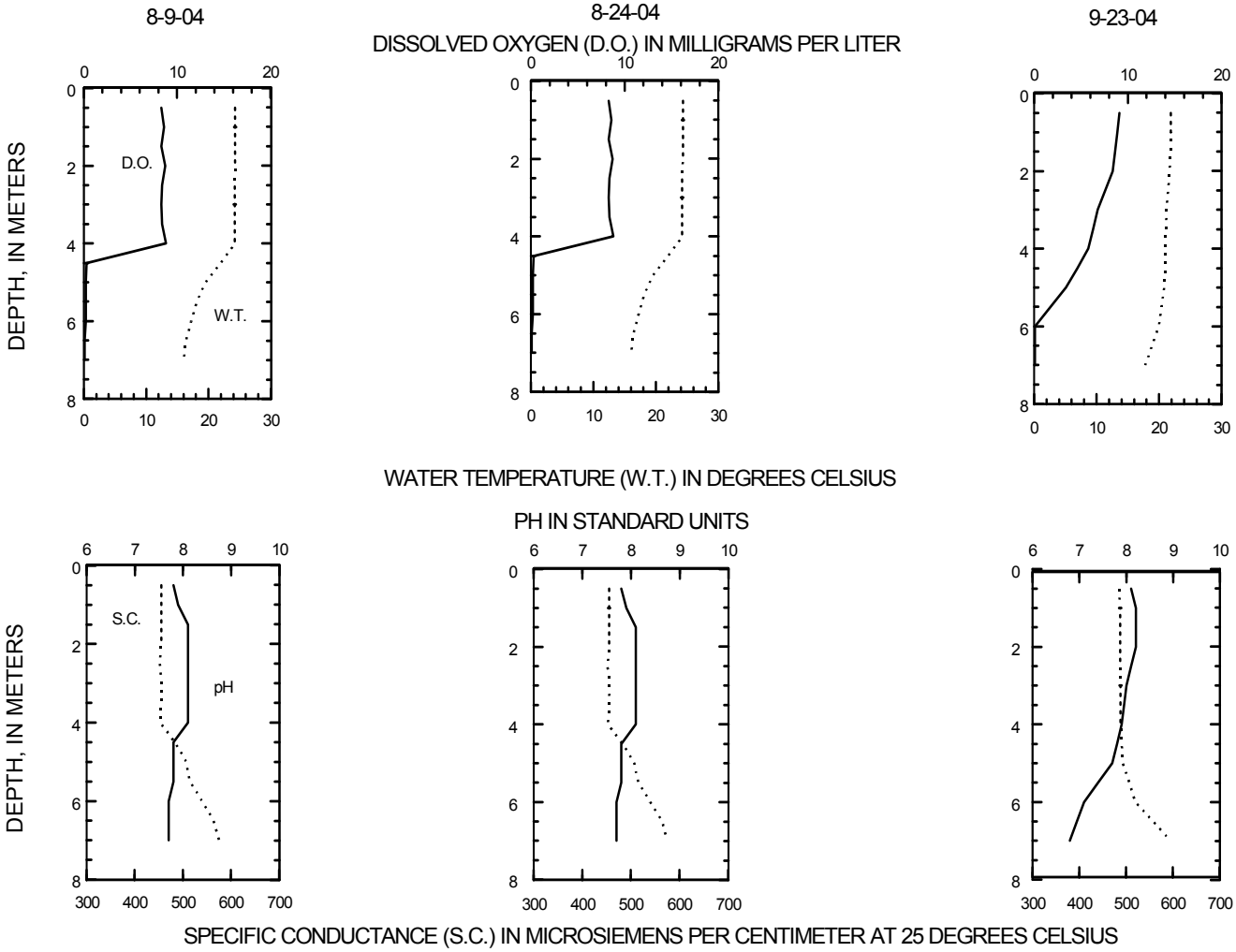
WATER-QUALITY DATA, APRIL 8 TO JULY 27, 2004
(Milligrams per liter unless otherwise indicated)

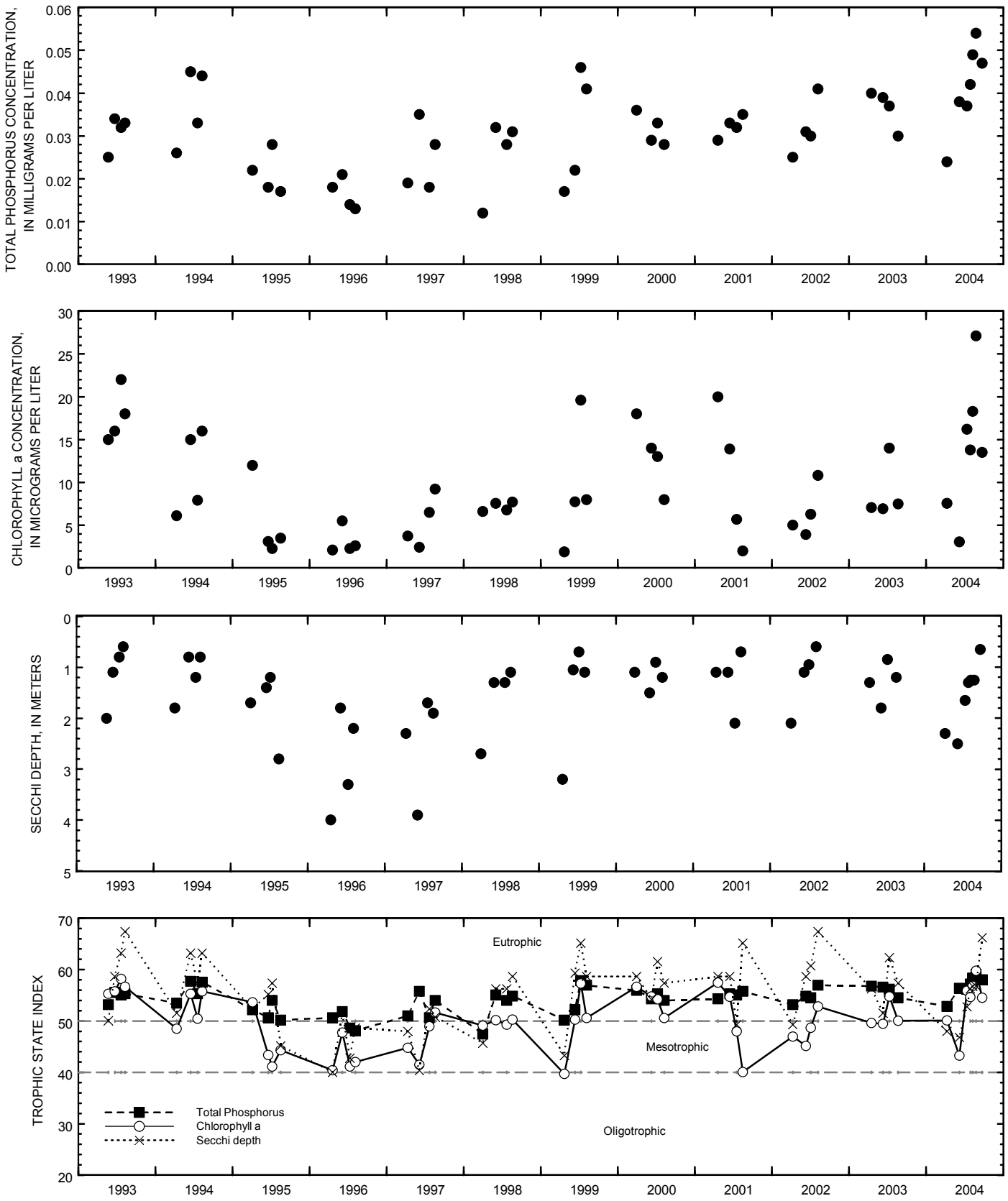
Date	Apr-8		Jun-7		Jul-12		Jul-27	
Lake stage (ft)	6.74		8.44		8.36		8.08	
Secchi depth (m)	2.3		2.5		1.7		1.3	
Depth of sample (m)	0.5	7	0.5	7	0.5	7	0.5	7
Chlorophyll a, phytoplankton (µg/L)	7.6	--	3.1	--	16.2	--	13.8	--
Water temperature (°C)	10.6	10.5	23.3	15.7	24.6	15.7	23.6	16.0
Specific conductance (µS/cm)	404	404	387	550	427	555	453	558
pH	8.8	8.8	8.5	7.3	8.3	7.2	7.9	7.1
Dissolved oxygen (mg/L)	12.0	11.7	10.4	0.4	12.7	0.3	7.2	0.2
Phosphorus, total (as P)	0.024	0.020	0.038	0.134	0.037	0.369	0.042	0.263
Phosphorus, ortho, dissolved (as P)	0.005	--	--	--	0.018	--	--	--
Nitrogen, NO_2 + NO_3, diss. (as N)	0.019	--	--	--	<0.019	--	--	--
Nitrogen, ammonia, dissolved (as N)	0.026	--	--	--	0.024	--	--	--
Nitrogen, amm. + diss., total (as N)	--	--	--	--	0.89	--	--	--
Nitrogen, amm. + org., total (as N)	1.2	--	--	--	--	--	--	--
Color (Pt-Co. scale)	10	--	--	--	--	--	--	--
Turbidity (NTU)	1.9	--	--	--	--	--	--	--
Hardness, as $CaCO_3$	150	--	--	--	--	--	--	--
Calcium, dissolved (Ca)	25.5	--	--	--	--	--	--	--
Magnesium, dissolved (Mg)	20.4	--	--	--	--	--	--	--
Sodium, dissolved (Na)	23.1	--	--	--	--	--	--	--
Potassium, dissolved (K)	2	--	--	--	--	--	--	--
Alkalinity, as $CaCO_3$	121	--	--	--	--	--	--	--
Sulfate, dissolved (SO_4)	7	--	--	--	--	--	--	--
Chloride, dissolved (Cl)	49.8	--	--	--	--	--	--	--
Silica, dissolved (SiO_2)	0.066	--	--	--	--	--	--	--
Solids, dissolved, at 180°C	234	--	--	--	--	--	--	--
Iron, dissolved (Fe) (µg/L)	<100	--	--	--	--	--	--	--
Manganese, dissolved, (Mn) (µg/L)	<1	--	--	--	--	--	--	--



WATER-QUALITY DATA, AUGUST 9 TO SEPTEMBER 23, 2004
(Milligrams per liter unless otherwise indicated)

Date	Aug-9			Aug-24		Sep-23	
Lake stage (ft)	8.06			7.89		7.62	
Secchi depth (m)	1.3			1.3		0.7	
Depth of sample (m)	0.5	5	7	0.5	7	0.5	7
Chlorophyll a, phytoplankton (µg/L)	18.3	--	--	27.1	--	13.5	--
Water temperature (°C)	24.3	19.5	16.0	22.4	17.7	21.9	17.8
Specific conductance (µS/cm)	455	507	575	471	543	485	595
pH	7.8	7.8	7.7	8.0	6.8	8.1	6.8
Dissolved oxygen (mg/L)	8.3	0.2	0.1	9.3	0.1	9.1	0.1
Phosphorus, total (as P)	0.049	0.064	0.162	0.054	0.124	0.047	0.154





Surface total phosphorus, chlorophyll a concentrations, Secchi depths, and TSI data for Potter Lake, near Mukwonago, Wisconsin.

REFERENCES

Borman, S, B. Korth, and J. Tempte, 1997. Through the Looking Glass. Wisconsin Department of Natural Resources, 248 pp.

Crows, G. and C. Hellquist, 2000. Aquatic and Wetland Plants, Vols 1 and 2. University of Wisconsin Press.

Engel, S., 1989. Lake Use Planning in Local Efforts to Manage Lakes, Wisconsin Department of Natural Resources, 5 pp.

Fassett, N.C., 1957. A Manual of Aquatic Plants. University of Wisconsin Press, Madison, 405pp.

Fassett, N.C., 1969. A Manual of Aquatic Plants. University of Wisconsin Press, Madison, 405pp.

Gleason, H.A., 1952. The New Britton and Brown Illustrated Flora of the Northeastern United States and Adjacent Canada. Hafner Press, 483 pp.

Hauxwell, J, P. Garrison and K. Wagner, 2004. Guidelines for Whole-Lake Fluridone Re-Treated Research Lakes in Wisconsin - Potter and Random Lakes. WDNR.

Hoyer, M.V. and D. E. Canfield Jr., eds. 1997. Aquatic Plant Management in Lakes and Reservoirs. Prepared by the North American Lake Management Society and the Aquatic Plant Management Society for the US Environmental Protection Agency. 103 pp.

Nichols, S.A. and J. G. Vennie, 1991. Attributes of Wisconsin Lake Plants. University of Wisconsin-Extension Geological and Natural History Survey, 19 pp.

Nichols, S. A. and Byron M. Shaw, 1986. Ecological Life Histories of the Three Aquatic Nuisance Plants, Myriophyllum spicatum, Potamogeton crispus, and Elodea canadensis. Hydrobiologia 131, 3-21.

Province of British Colombia, Informational Bulletin, A summary of Biological Research on Eurasian Water Milfoil in British Colombia. vol. XI, 18 pp.

SePRO. Sonar Guide To Aquatic Habitat Management. SePRO Corporation, 23 pp.

Smith, C.S. and J. W. Barko, 1990, Ecology of Eurasian Watermilfoil. Journal of Aquatic Plant Management. 28:55-64

Wagner, Kenneth, 1990, Assessing Impacts of Motorized Watercraft on Lakes: Issues and Perceptions. North American Lake Management Society, 17pp.

Wisconsin Department of Natural Resources, 1985. Aquatic Community Interactions of Submerged Macrophytes. Technical Bulletin No. 156, Wisconsin Department of Natural Resources, 79 pp.