2015

Lake Monitoring Report

Random Lake

2015

Lake Monitoring Report

Random Lake

Sydney Rader

Abstract

Random Lake is subject to continual monitoring by a scientific program that includes phosphorus and chlorophyll assays, Secchi depth determinations, temperature and dissolved oxygen profiles. The program is under the auspices of Citizen Lake Monitoring Network. New lake data were recorded in 2015. The data show that water quality in Random Lake is reasonably stable except by invasion of *Eurasian watermilfoil* and *curly leaf pondweed*. Inevitable climate warming will have unknown consequences for Random Lake. Ice-in ice-out dates and weather data are being monitored. A summer blue-green algal bloom was documented. Herbicide treatments were reviewed and a possible reduction of dissolved oxygen in the north basin was noted. The fall turnover was clearly observed at the deephole. Study topics were listed. An annual report was published.

Keywords: limnology, Random Lake

Contents

Introduction

The purpose of this annual report is to publish, for the record, the new data gathered in 2015 about Random Lake. A secondary purpose is provide some context and analysis, drawing from the field of limnology.

Wisconsin DNR has systematized the collection of lake data and maintains a vast database. Access the data here. It is interesting to work with this data, charting and analyzing it. The reader will find examples in this report.

Monitoring of the lake began later in the year than desired because new personnel were not in place until June. Some background: For many years Wayne Stroessner diligently monitored our lake until his retirement in 2013 following the completion of his 2013 report. Fortunately for us he remains a mentor and biologist emeritus, which enabled a successful transition of the responsibilities to Janet Eisenhut who monitored the lake through 2014. Those responsibilities include Secchi depth readings and temperature and dissolved oxygen profiles and preparing lake water samples for total phosphorus and chlorophyll-a assays.

Unfortunately, Janet's time was cut short due to a career move to Madison, Wisconsin and she was relieved by Carol Hertlein Sells' and Sydney Rader's timely appearance. At the June 10th 2015 Random Lake Association meeting Carol and Sydney were interviewed as potential lake monitors. The meeting attendees included: RLA president Joan Knorr, Holli Feutz, Wayne Stroessner, incoming Village president Matthew Brockmeier, outgoing Village president Robert McDermott, Carol Sells, Sydney Rader and others. The follow-up meeting was held on June 14, 2015 and among those present were Janet Eisenhut, Wayne Stroessner, Joan Knorr, Carol Sells, and Sydney Rader. This meeting confirmed Carol and Sydney as official lake monitors and the handoff of supplies and equipment from Janet to Sydney was completed. Included in that equipment was the project's impressive $1K dissolved oxygen meter generously provided by the Random Lake Association!

Wayne Stroessner provided the new monitors important "on the lake" training in certain key lake monitoring procedures, namely, Secchi depth and water sampling for phosphorus and chlorophyll assays. In addition Wayne took Carol Hertlein Sells and Sydney Rader to the location where most of the key observations are made, ensuring consistent and accurate identification of the 22-foot-deep "deephole".

The expertise and continued mentoring by Biologist Emeritus Wayne Stroessner is a gift to Random Lake that deserves to be highlighted. On June 21 he advised:

> *If you want to read about weed treatment results of past years, you can read Pp 35-38 in the 2013 monitoring booklet. There are descriptions of dying time element and general appearance of the treated plants. This might help in knowing what to look for.*
>
> *Just today, with the wind blowing in our direction, our lakefront was loaded with floating plants - mostly Eurasian Water Milfoil, but also some Curly Leaf Pond Weed, Native Milfoil, Sago Pondweed, some Bladderwort and others.*

In July Wayne sounded an alert regarding blue green algae (potentially toxic) that were then blooming:

> *I was able to collect two of those dark ±1” globs of decomposing floating algae - the ones that a rich supply of Planktothrix rubescens was found. The first one was the larger and fell apart as it flowed into the jar. The second one stay together fairly well. I placed them in our freezer but, as you know, glass jars generally break as the water expands. I should have placed them in plastic containers but grabbed the most convenient one because I wanted to pick them up while they were near the pier. You can them up from me anytime.*

This alert set off a flurry of activity that resulted in the microscopic confirmation of *Planktothrix rubescens* in colonies that resembled chunks of soft liver tissue floating in the lake water. We are grateful to Wayne for having the expertise and knowledge of this particular algae and that its blooms recur year after year. Wisconsin DNR experts weighed in on this bloom. (See report section 'Algal Blooms'.)

CITIZEN LAKE MONITORING PROGRAM

The Citizen Lake Monitoring Program began in 1986 under the auspices of the Wisconsin Lakes Partnership. Currently 1100 volunteers gather water quality data on 850 Wisconsin lakes. There are five types of monitoring:

- water clarity
- water chemistry
- ice-on/ice-off
- aquatic invasive species
- native aquatic plants, levels I, II and III

For 2015 information, raw data and questions contact:

Sydney Rader (rader.rl.wi@gmail.com) for water clarity, water chemistry and ice-on/ice-off monitoring.

Carol Hertlein Sells (haertleinsells@gmail.com) for aquatic invasive species and native aquatic plants, levels I, II and III monitoring.

UNDERSTANDING LAKE DATA

This short treatise on limnology is quite good background reading for this report. This, too.

THE PHYSICAL LAKE

Random Lake is a remnant of glacial action some thousands of years ago. Monumental glaciers gouged and scraped the terrain. Much rocky debris was entrained in the ice. When the ice melted, moving water eroded the terrain and copious deposits of rocks were left on the surface. The result was an irregular surface of lakes and hills, littered with glacial till.

As soon a suitable habitat opened up, plants, animals and microbes occupied biological niches in the terrain. Gradually, top soil accumulated, enabling more and more biomass to grow. Before European settlement, Wisconsin was home to natural ecosystems of stupendous beauty. Something has been lost since nature at its richest gave way to human settlement.

Presumably Random Lake was once much deeper. Gradual erosion of the banks and suspended solids carried by incoming stream water put sediments on the lake bottom. Wind blown dust makes a contribution to filling in the lake. Dead and decaying biomass makes a large contribution. A lack of oxygen in the lake bottom means that organic debris does not decompose, it accumulates. Some locals opine that some places in Random Lake have become shallower within their memory.

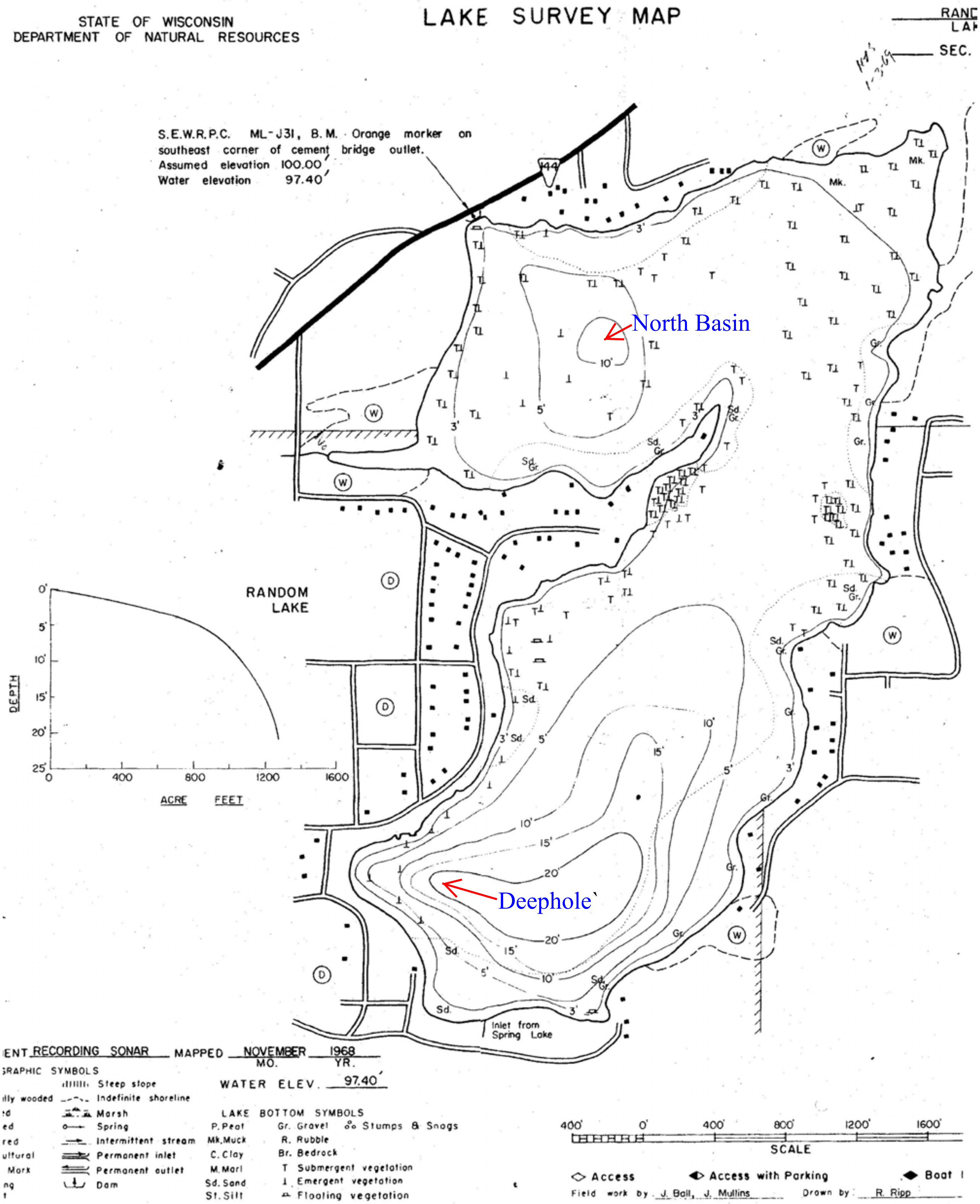
When one probes the lake bottom, it is found to be very soft and deep in most places. I had no trouble driving a pipe 8 feet deep on the eastern shore. How far down is bedrock? No less an authority than Dan Klotz believes the soft sediment is at least 30-40 feet deep. Bedrock has not been found. This is the sediment that has accumulated since the ice age.

Of the present day hydrology of Random Lake, a 'drainage lake,' note that Spring Lake overflows into Random Lake which overflows into Silver Creek which ultimately runs into Lake Michigan at Milwaukee. Add rainfall and snow to this. Subtract evaporation. But much is unknown, such as the movement of groundwater in and out of the lake. If we knew the hydraulic retention time, we could say something about the rate at which undesirable nutrients are cleared. We do know that phosphorus concentration has not clearly trended up or down over the years, meaning that phosphorus is entering the lake about as fast as it is leaving. Phosphorus could enter from Spring Lake water, from local runoff of rainwater, from leachate, from organic matter that falls into the lake, from groundwater, and potentially from leaking sewer pipes. Nitrogen is not being monitored in Random Lake but it is undoubtedly there, an unwanted nutrient that fuels the growth of algae and plants.

Physical profile of Random Lake:

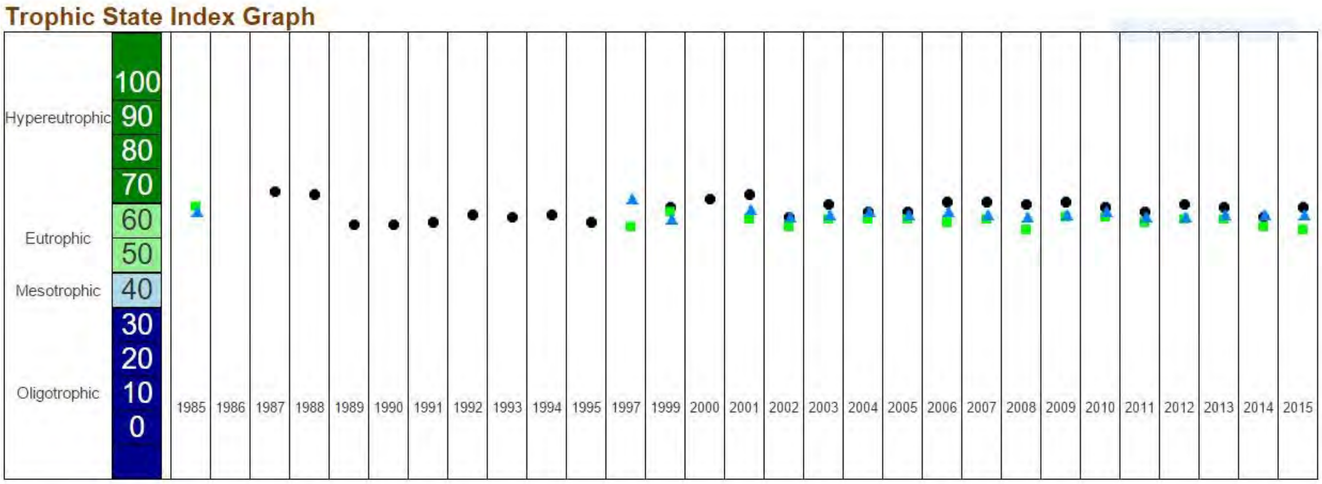
Area:	209-212 acres
Shoreline:	3.6 miles
Volume:	1280 acre feet
Deepest sounding:	23 feet verified by author
Average depth:	6 feet
Under 3 ft depth:	14%
Over 20 ft depth:	4%
3D map of lake bottom:	Bathymetric map
Elevation:	867 feet above sea level
Range of water level:	+ 17.8 inches (2004) - 7.6 inches (2012)
Bottom:	10% sand, 15% gravel, 0% rock, 75% muck
Area of watershed:	?
Alkalinity:	172 ppm
Mean phosphorus:	21.6 µg/L
Stratification dynamic:	dimictic

Bathymetric map November 1968:



TROPHIC STATE OF RANDOM LAKE

Random Lake has been scored as consistently *eutrophic* in recent years–as having waters rich in phosphates, nitrates, and organic nutrients that promote a proliferation of plant life, especially algae.



Monitoring Station: Random Lake - Deep Hole, Sheboygan County
Past Summer (July-August) Trophic State Index (TSI) averages.

[Source]

It is some sort of consolation that Random Lake is, by several measures, stable. It is not getting worse—until invasive species are considered. *Eurasian watermilfoil* and *curly leaf pondweed* have invaded with serious consequences. Further invasions threaten and we need to be vigilant.

IS RANDOM LAKE BECOMING SHALLOWER?

It is normal for lakes to become shallower over a long period of time. Anecdotally some long-time residents have commented that the lake bottom has filled in or become shallower. Unfortunately there is no quantitative evidence to bear on the question, though the question itself is very interesting. At best there could be a study going forward. For starters the [bathymetric map made in November 1968] could be re-done. It is left as an exercise for the reader to design a study of the question.

NOTES

This report was created in LibreOffice 5.0 free office suite and Adobe Acrobat DC.

Interested readers may enter Our Waters, Our Future Writing Contest, deadline February 1, 2016.

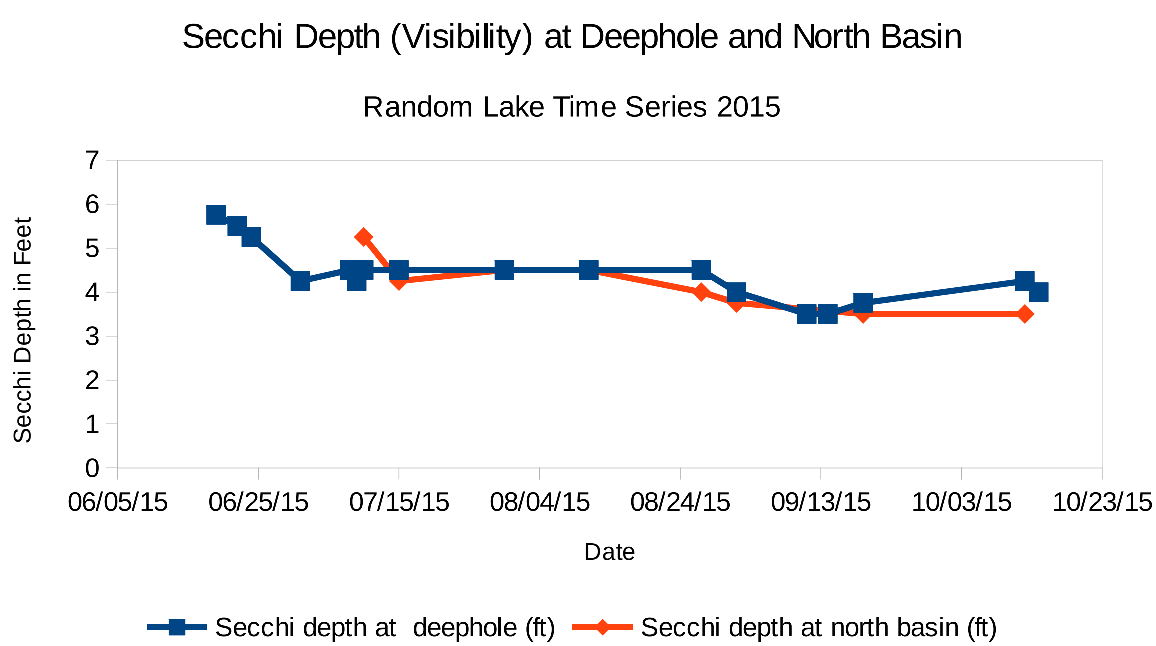
Please report errors and omissions in this report to the author.

Secchi Depth

Secchi depth is a measure of visibility down through a lake water column, as one looks down from the surface. If the water is clear and unturbid, the visibility may extend many feet down, perhaps even to the lake bottom. If the water is turbid, it is because particles of various kinds and sizes are suspended in the water, and these particles act as small obstructions to the passage of light. These small obstructions are cumulative until light no longer reaches below a critical depth. If light doesn't penetrate into deep water, then neither can we see things at that depth. (And neither can plants photosynthesize sugars.) Visibility requires that light be both incident and reflected. For example, to see the bottom of a lake, light must reach the bottom and be reflected back to the observer. Secchi depth and turbidity have a reciprocal relationship: when turbidity is high, Secchi depth is low.

The method for determining Secchi depth relies on a simple apparatus, the Secchi disc (Appendix: Methods and Procedures). The resulting visibility measurement is expressed in feet or meters. The Secchi method is used throughout the world as a quick and easy way of characterizing lake water quality.

Secchi depth has been monitored for many years at Random Lake and new data for 2015 are in:



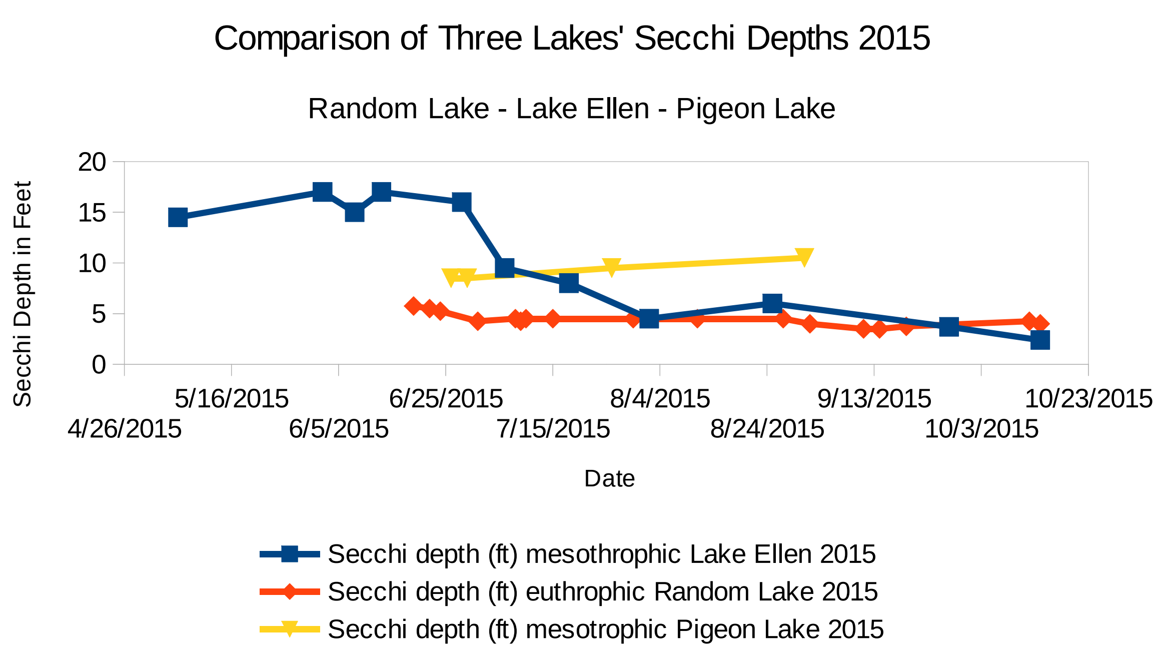
In 2015 monitoring began late. Springtime monitoring was missed. The 2015 Secchi data were uploaded to Wisconsin DNR SWIMS data base as a safe repository where all can access it. Two positions on Random Lake were monitored: the south basin deephole (N 43deg 32.998min W 87deg 57.423min) and the north basin deepest part (N 43deg 33.516min W 87deg 57.277min).

(See map on page 11 for monitoring locations.)

Not surprisingly there is little difference in Secchi depths at two locations on the same lake for a given date.

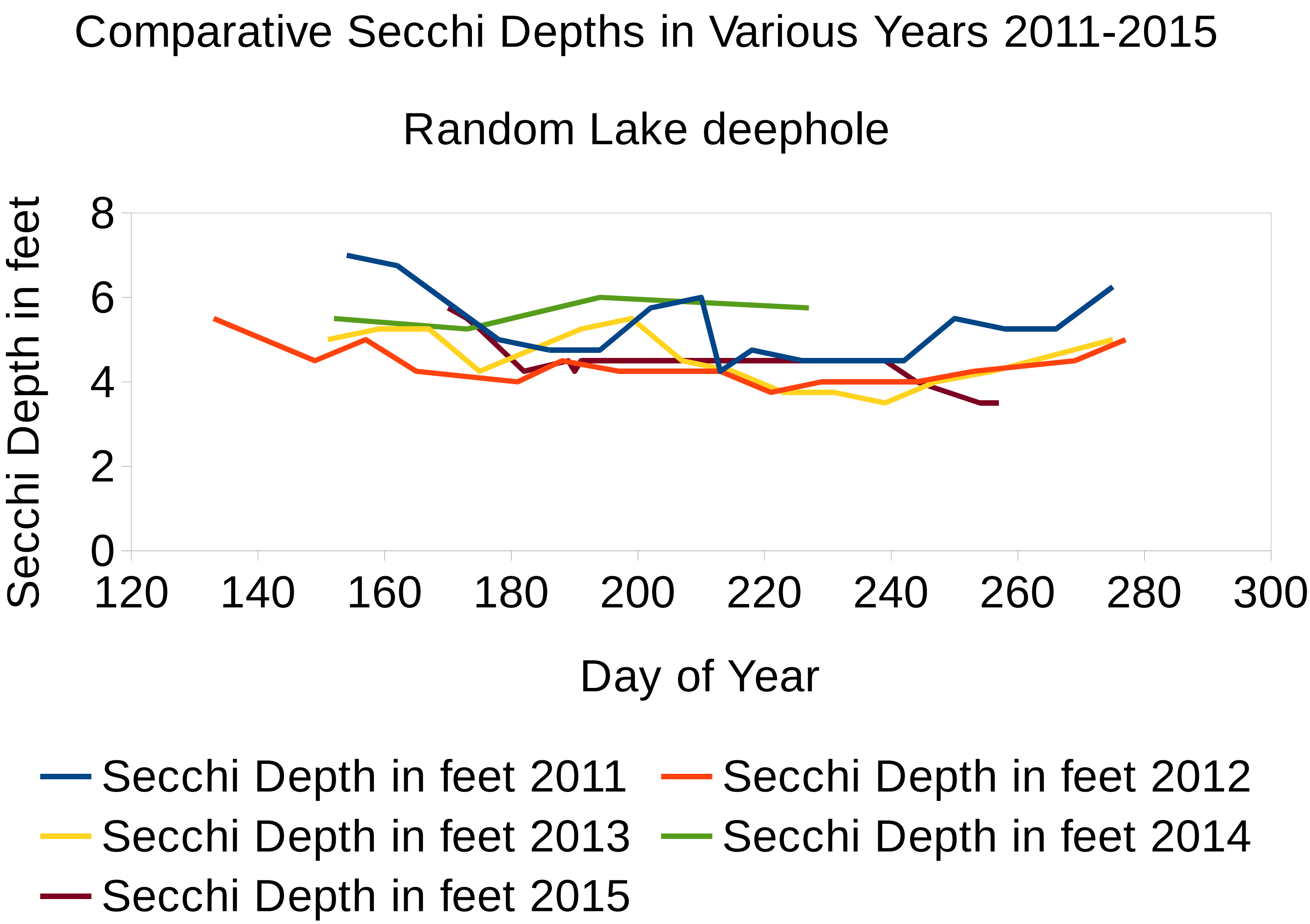
It is believed that in Random Lake the main detriment to water quality and clarity, as reflected in the Secchi measurement, is a suspended microbiome including algae: single-and multi-cellular plants that thrive because of unnaturally high nutrient levels. In other words, greenish algae are the main cause of the observed turbidity and murkiness. Certainly when lake water is filtered through a membrane filter, the greenish algae are retained on the filter. Another plausible cause of turbidity is a temporary stirring up of bottom sediment. At the deephole of Random Lake, the latter effect should be minor.

To put the 2015 Secchi data into perspective, we should compare Random Lake with other nearby lakes, and compare Random Lake 2015 data with previous years' data:

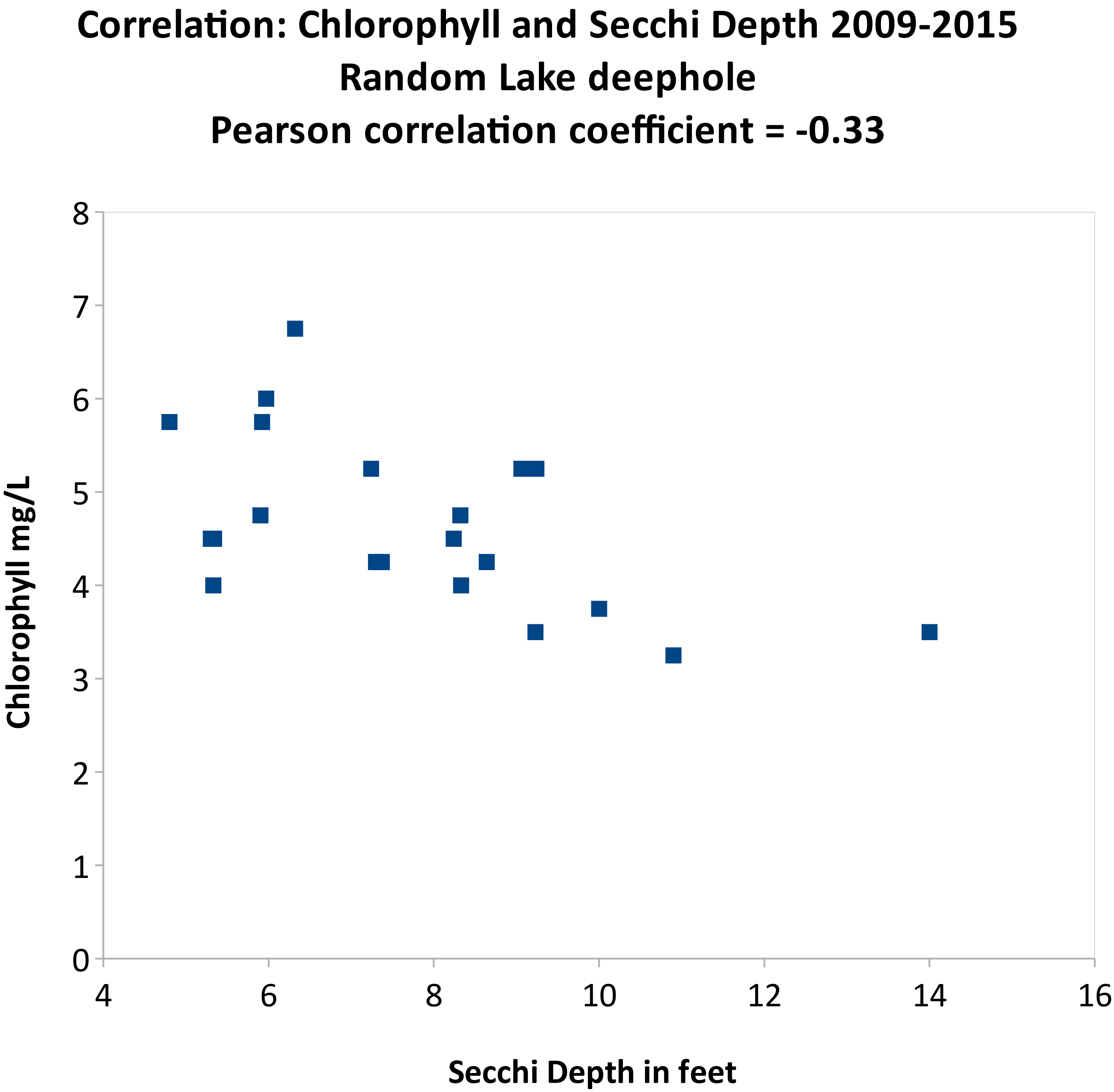


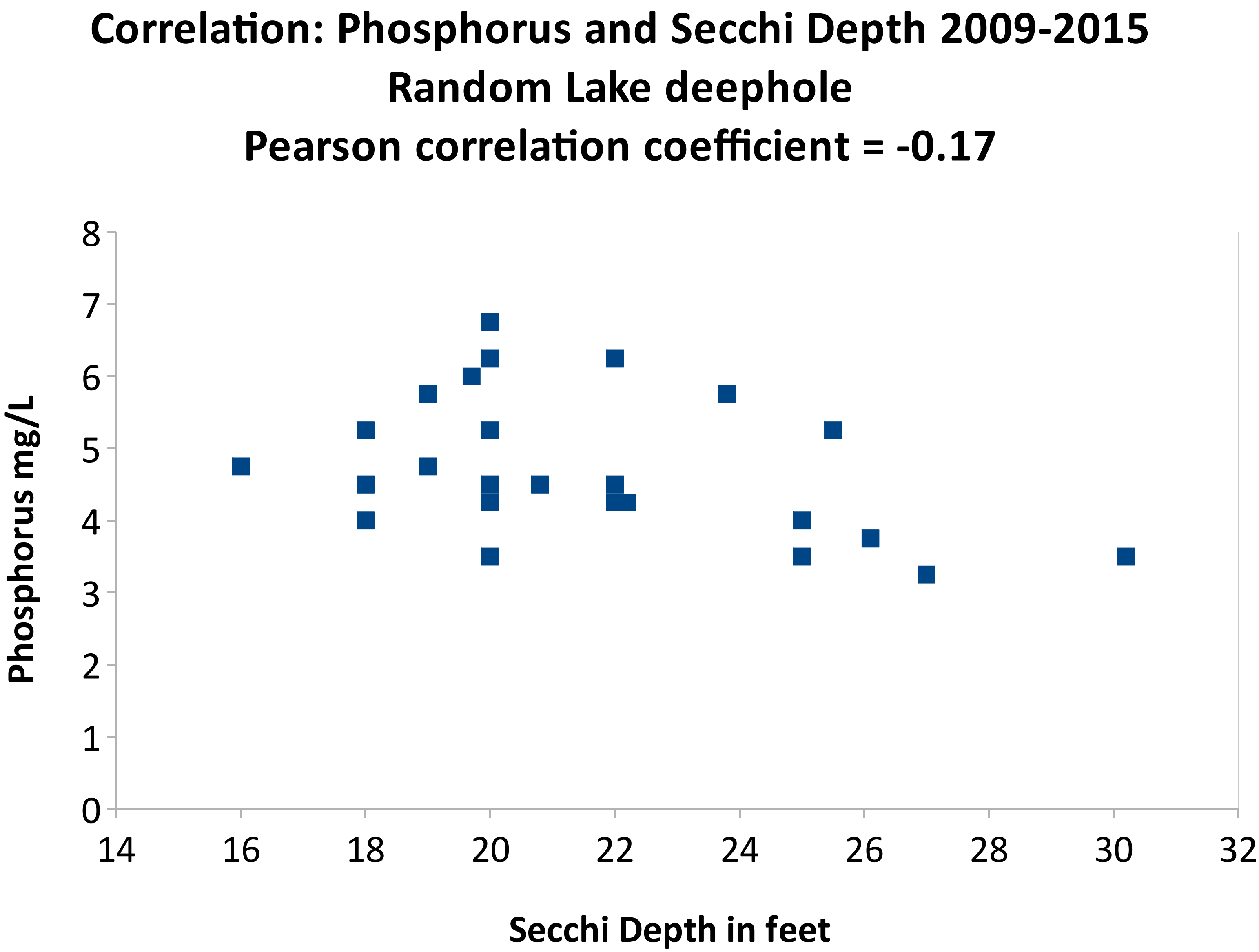
As this graph shows, all lakes are not the same when viewed from the perspective of water clarity. The source of this data is the SWIMS database which holds water quality data on most Wisconsin lakes.

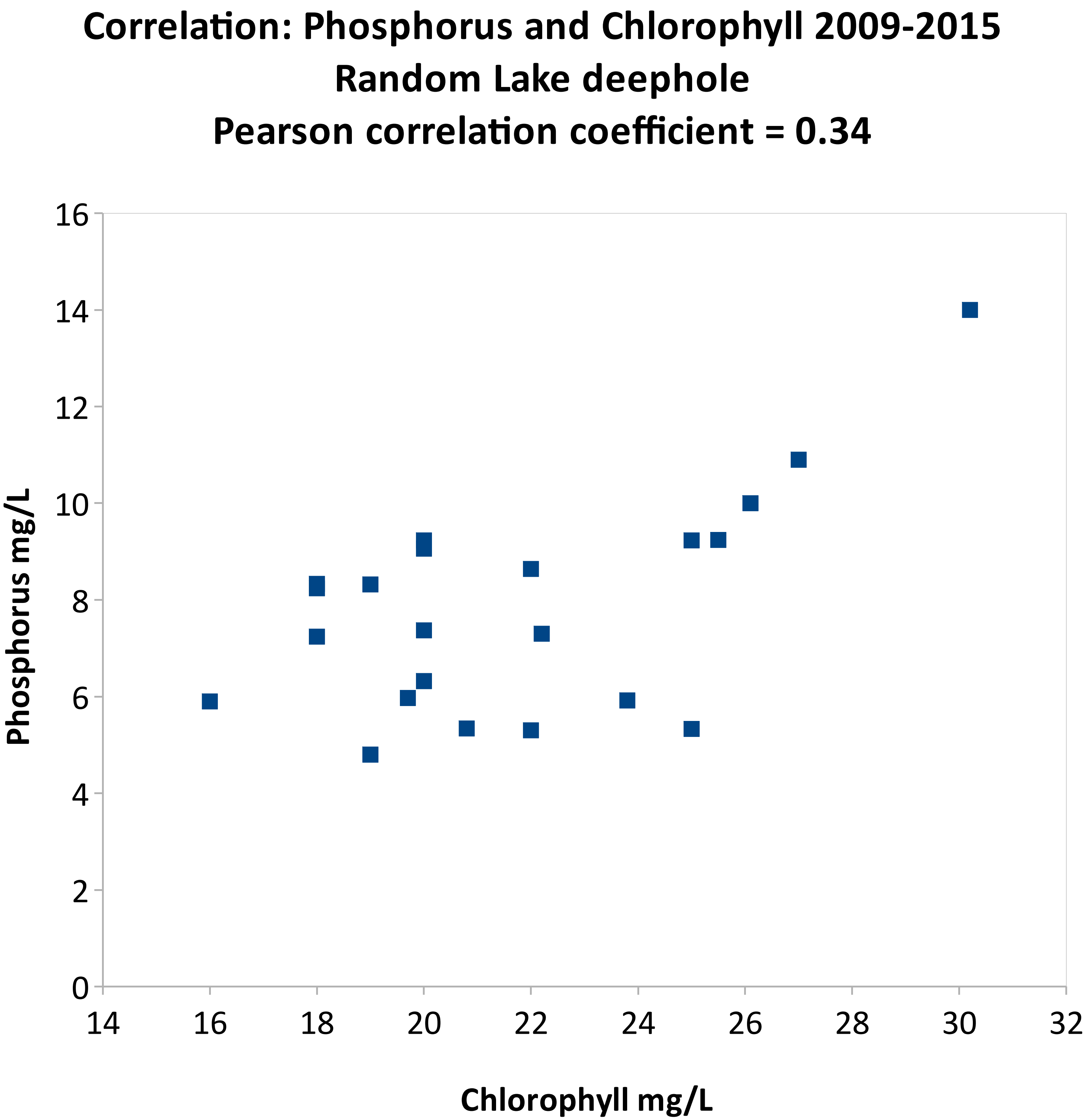
Now we are going to compare water clarity among several recent years. Secchi data from Random Lake deephole were collected for the years 2011-2015. The sampling dates were converted to DAY of YEAR to facilitate inter-year comparisons. From the graph it appears that 2011 and 2014 (blue and green lines) had comparatively clearer lake water. 2012 (red line) was a year of comparatively turbid water. 2013 (yellow line) and 2015 (purple line) had water of intermediate turbidity. However, in late summer of 2015 the lake water was about as turbid as it has ever been in recent years at 3.5 ft Secchi depth. To visualize all of this, see the following graph:


Comparative Secchi Depths in Various Years 2011-2015
Random Lake deephole
Secchi Depth in feet
8
6
4
2
0
120
140
160
180
200
220
240
260
280
300
Day of Year
Secchi Depth in feet 2011
Secchi Depth in feet 2012
Secchi Depth in feet 2013
Secchi Depth in feet 2014
Secchi Depth in feet 2015

We will have more to say about it later, but Secchi depth is weakly correlated with two other measured variables: 1) total phosphorus concentration in lake water, r = -0.17 and 2) chlorophyll-a concentration in lake water, r = -0.33. Phosphorus and chlorophyll are weakly correlated, r = 0.34. Drawing on 2009-2015 data from Random Lake deephole, correlation plots were made. The elongation of the scatter plots is a graphical indication of correlation, be it strong or weak. See the following graphs:


Correlation: Chlorophyll and Secchi Depth 2009-2015
Random Lake deephole
Pearson correlation coefficient = -0.33
Chlorophyll mg/L
Secchi Depth in feet
0
1
2
3
4
5
6
7
8
4
6
8
10
12
14
16


Correlation: Phosphorus and Secchi Depth 2009-2015
Random Lake deephole
Pearson correlation coefficient = -0.17
Phosphorus mg/L
0
1
2
3
4
5
6
7
8
14
16
18
20
22
24
26
28
30
32
Secchi Depth in feet



Correlation: Phosphorus and Chlorophyll 2009-2015
Random Lake deephole
Pearson correlation coefficient = 0.34
Phosphorus mg/L
Chlorophyll mg/L
0
2
4
6
8
10
12
14
16
14
16
18
20
22
24
26
28
30
32

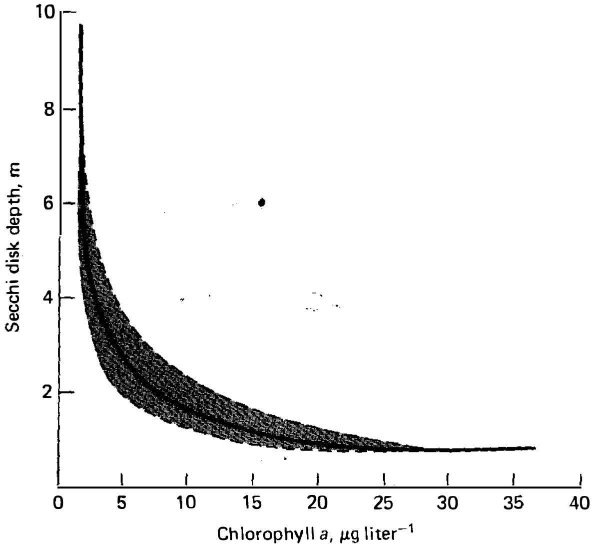


Figure 20-1 Generalized relationship between acetone extracts of chlorophyll a from phytoplankton and Secchi disk depth in lakes. The shaded area shows the variability to be expected with different lakes at different seasons. This relationship will be poor if algae are present in large clumps (Fig. 12-2). Water color or turbidity from suspended sediments may also distort this relationship.

Phosphorus and Chlorophyll

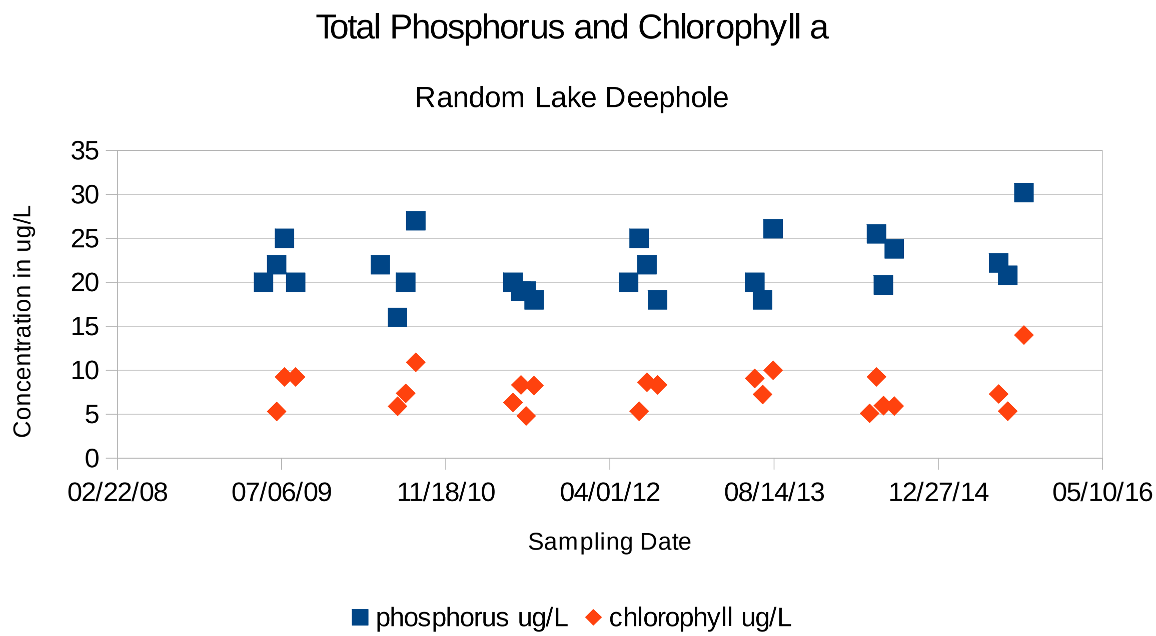
Of all the scientific measurements that could be performed on lake water, phosphorus and chlorophyll assays are the agreed essentials. Wisconsin DNR supports and pays for these tests which are done across most Wisconsin lakes in a routine manner. CLMN personnel collect water samples per schedule and ship them to Wisconsin State Laboratory of Hygiene for analysis.

When it comes to growing algae, phosphorus is usually the essential nutrient that is present in growth limiting quantity. Other growth factors are required, like nitrogen, but they are not usually limiting. Elemental phosphorus is a component atom of phospholipids, nucleotides, nucleic acids, and RNA and DNA macromolecules that are common to algae and all other organisms.

> *Phosphorus is contained in common items like detergents, fertilizer, manure, human waste and decaying plants. These can come from many sources, including runoff from agricultural and urban land, airborne particles, septic systems and industrial discharges, and fertilizer. There are also naturally-occurring sources of phosphorus in lakes, such as decaying organic matter, and eroding rocks and soils. Source*

Green colored Chlorophyll **a** is a specific form of chlorophyll present in algae and other plants and is essential for photosynthesis. Chlorophyll **a** in algae is on the order of 1% by dry weight. The biomass of the algae in the lake water is of the greatest interest, while the chlorophyll assay is merely a convenient indicator of that biomass. Measuring chlorophyll is much easier than counting or weighing algal cells.

Results of several years' monitoring of Random Lake for phosphorus and chlorophyll are presented. Included are the latest results in summer 2015. The general impression is that Random Lake is fairly stable. It would be hard to argue that phosphorus or chlorophyll is trending either up or down. Such stability is a consolation.



The highest phosphorus concentration ever recorded for Random Lake was 44 µg/L back in 1997. The least was 8 µg/L in 2006. These extreme values have the appearance of outliers.

Now a question is posed. Lawn fertilizer is undoubtedly used on lawns in Random Lake watershed. Making reasonable assumptions about its use, calculate the increase in concentration of phosphorus and nitrogen in lake water. This is left as an exercise for the reader. Note: most lawn fertilizer sold locally is phosphorus-free, but garden fertilizer is not.

Imagine if something happened to suddenly increase phosphorus concentration in lake water. This could be a heavy application of agricultural fertilizer in the watershed, followed by a heavy rain. Then we would expect growth of algae and perhaps we would observe an algal bloom. In our measurement of chlorophyll at the deephole, we would find increased chlorophyll concentration. In other words, we might predict a positive correlation between phosphorus and chlorophyll. Indeed, analysis of available data shows such a correlation (see Secchi Depth). And if phosphorus or chlorophyll should increase, Secchi depth is predicted to decrease as lake water becomes more turbid from algae. In other words, we predict that Secchi depth is negatively correlated with phosphorus or chlorophyll.

Too much algae in lake water is not only aesthetically displeasing, it could deplete dissolved oxygen, causing zooplankton and fish to die. This could happen in two ways:
1) At night, algae respire, consuming oxygen
2) Dead algae are decomposed by bacteria, a process requiring oxygen

As far as I know, serious oxygen depletion has not yet happened in Random Lake. (Death of abundant *Eurasian watermilfoil* by herbicide treatment could also deplete oxygen.)

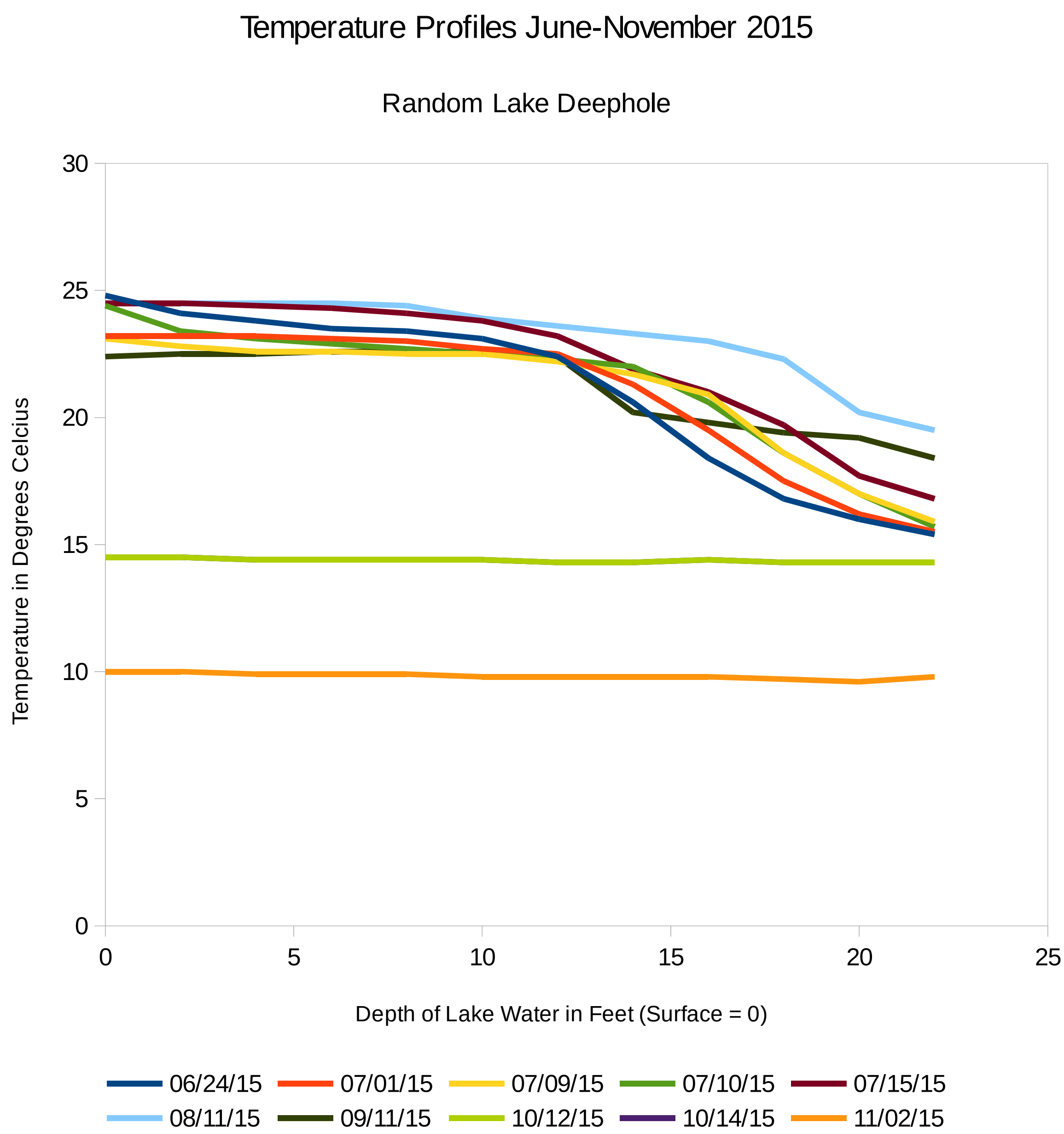
Collection of a water sample from the top six feet of the lake

Dissolved Oxygen and Temperature Profiles

WATER TEMPERATURE PROFILES

In the months June to November, the temperature profile of the lake from 0 to 22 feet deep was periodically measured and recorded. That is, the water temperature was repeatedly measured at various depths below the surface. The lake was temperature-stratified from June until the fall turnover on October 12. After October 12 the lake was isothermal from top to bottom.

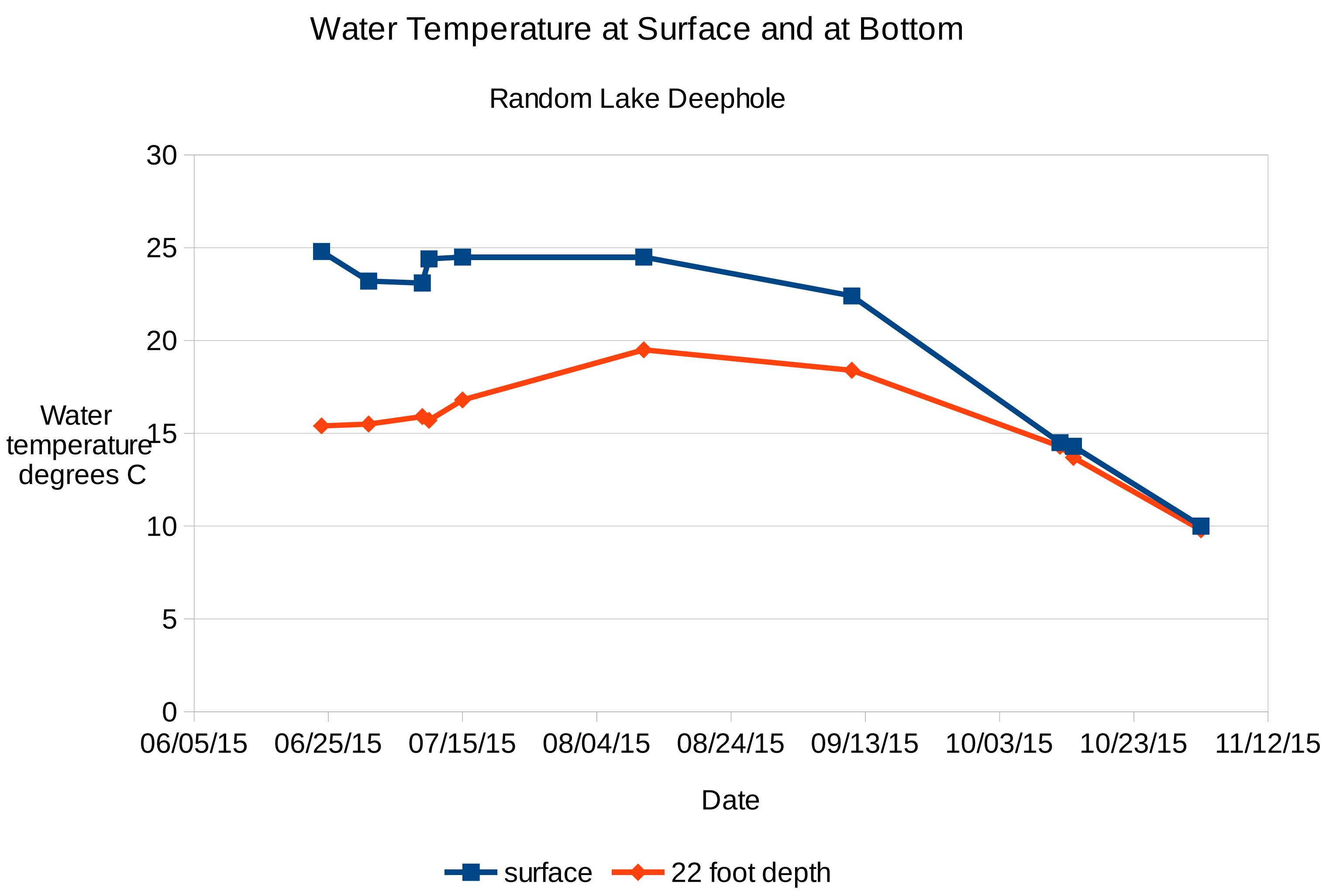
The temperature and DO measurements were taken using a YSI dissolved oxygen meter. The probe that is lowered into the water has both temperature and DO sensors:



These results are neither surprising nor unexpected. With the onset of autumn, cooler air over the lake and reduced sunlight caused the lake water to cool until until mixing occurred on October 12. Then the lake water was isothermal from top to bottom. Whereas, for the warm months, the lake was stratified.

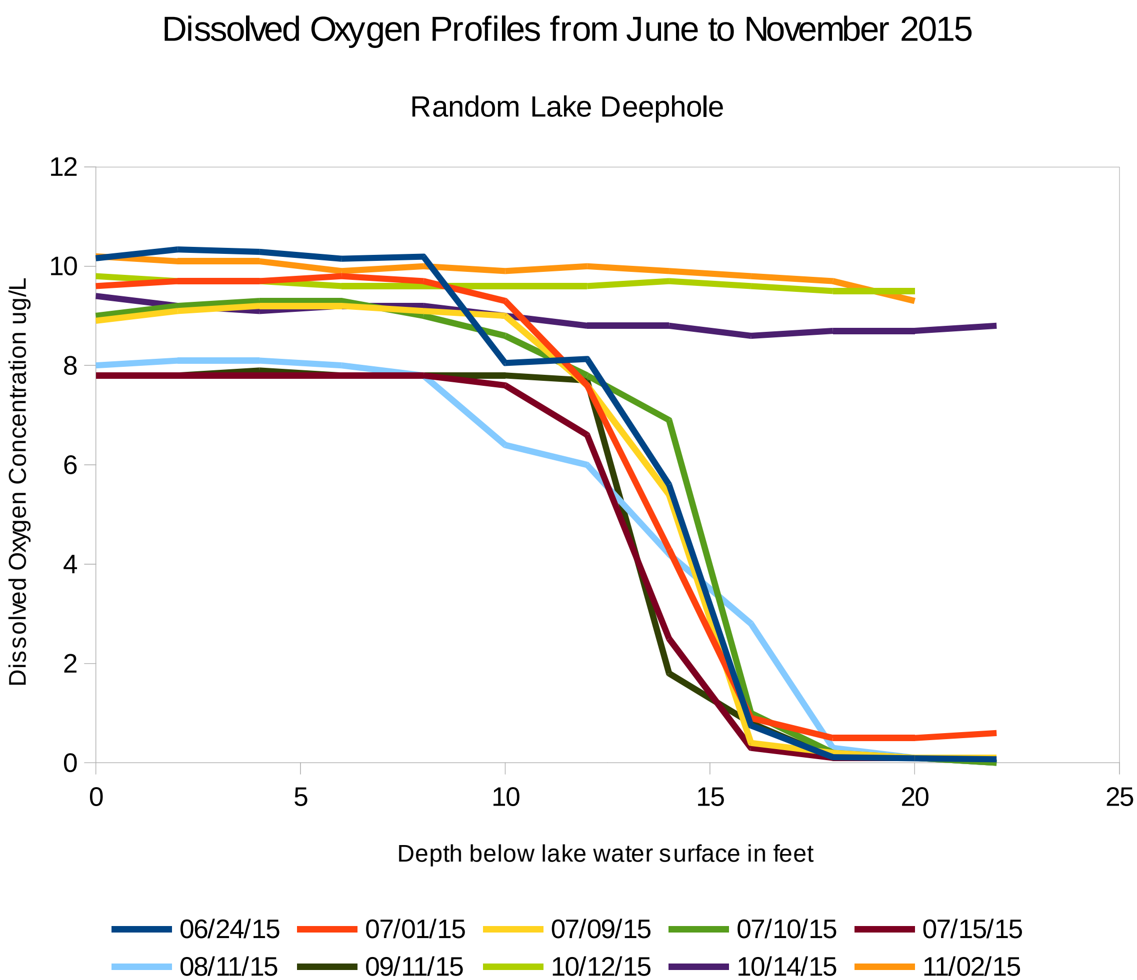
FALL TURNOVER

The fall turnover occurred on about October 12, 2015 on a day when temperature and dissolved oxygen profiles were fortuitously taken. Temperature and oxygen stratification were no longer. Given a thorough mixing of the lake water, the water at all depths was at the same temperature or "isothermal". The mechanics of fall turnover or overturn are explained here and in many other places. Random lake is dimictic, that is, it has both a spring and a fall overturn. The date of spring turnover 2015 is unknown but it would have followed closely on the date of ice-out (March 30, 2015).



DISSOLVED OXYGEN PROFILES JUNE-NOVEMBER 2015

On the same dates as the determination of temperature profiles, dissolved oxygen profiles were measured and recorded. One instrument, the YSI DO meter, was used to measure both temperature and DO simultaneously.



Typically, the top layers of the lake were always oxygenated, while the bottom layer contained little or no oxygen during the warm months. Oxygen was not being replenished to the stagnant bottom layer while bacterial decomposition of organic matter was depleting any available oxygen. Decomposition of organic material at the bottom is limited by scarcely available oxygen, meaning that a lot of organic material remains undecomposed at the bottom. However,

> *Methane from freshwater is often a byproduct of bacterial metabolism, as bacteria break down organic matter under low-oxygen conditions, like in the*

sediment at the bottom of a lake. Source

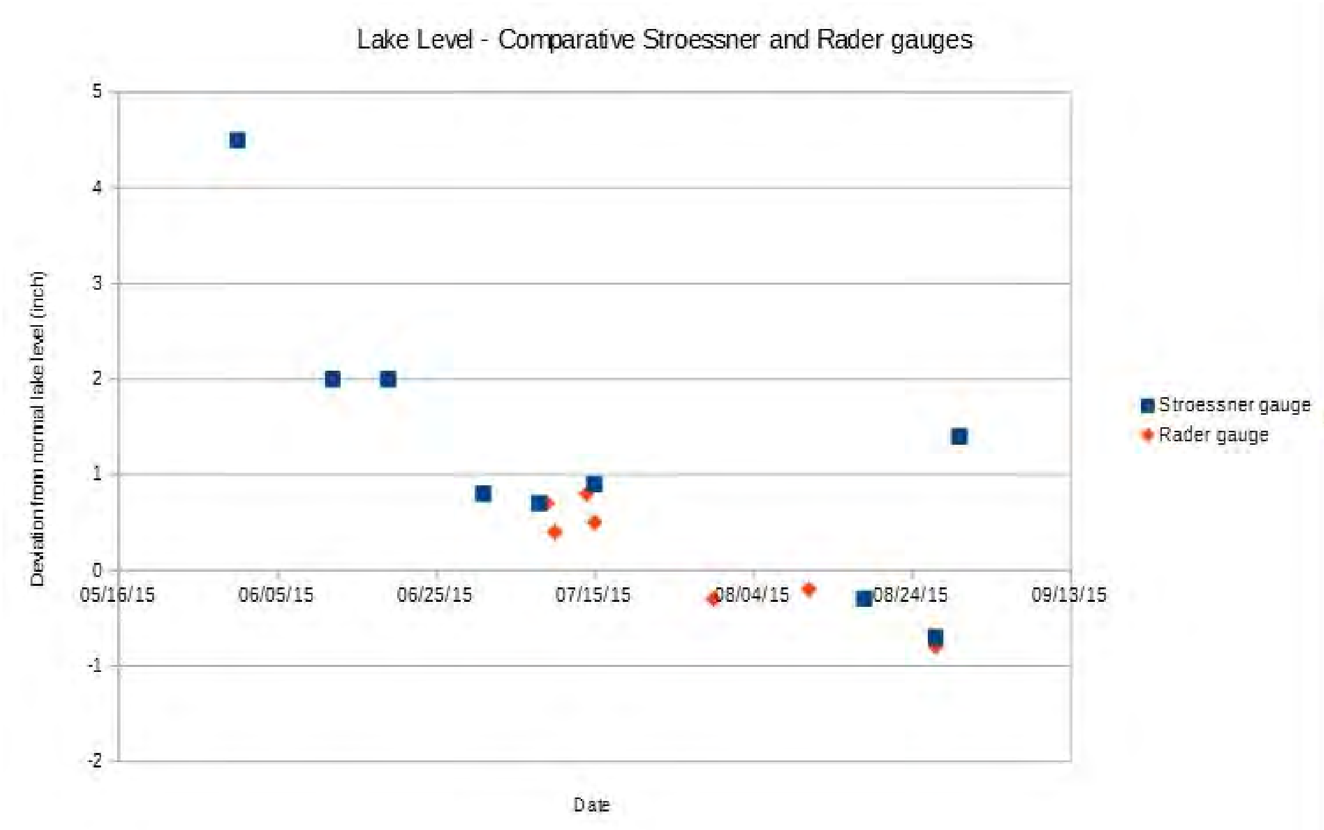
At fall turnover on or about October 12 the lake water strata mixed and oxygen was reintroduced to the depths.

Lake Water Level

Monitoring of lake water level resumed in 2015 using a new gauge. The gauge was installed on the eastern shore at N 43deg 33.278min W 87deg 56.923min, situated among cattails on the author's shallow shoreline. The vertical gauge is a 10-foot long PVC electrical conduit pipe deeply embedded in bottom muck. About 8 feet of the pipe are embedded in muck, and about the top two feet are standing in water and then air. The “normal” mark corresponds with the normal mark on Wayne Stroessner's gauge which has been used for many years to record lake levels.

Unfortunately Random Lake lacks a properly surveyed water elevation gauge that would indicate water level as the number of feet and inches above sea level. It would be a costly undertaking to install a monument in the lake bed and to place a mark of accurately and precisely known elevation. Rachel Sabre of Wisconsin DNR said that their protocol for maintaining official elevation gauges calls for biannual checks by a surveyor. The nominal water elevation of Random Lake is 867 feet. Upstream Spring Lake is nominally 872 ft elevation.

In current practice lake level is reported in inches of water above (+) or below (-) the “normal” level mark, using the *ad hoc* gauge described above. In establishing the new gauge, called “gauge east”, pains were taken to calibrate the new gauge by bringing it into agreement with the old gauge. For the several near-simultaneous readings taken on old and new gauges, good agreement was found. The error or disagreement between Rader's and Stoessner's gauges is no more than about a half inch. Going forward more confidence-building checks can be made as long as Rader and Stroessner collaborate over their respective gauges.



A further defining note on “normal” lake level: the lake level is normal when Random Lake is brim full at the concrete outflow dam on Highway 144 and outflow of water is negligible.

Why measure lake level? For anyone interested in hydrology, lake level has implications for water flow rates in and out of Random Lake which is a drainage lake, water availability, shoreline flooding or dessication, limnology, shoreline infrastructure planning, etc. For a personal and practical reason, I care about lake level because my basement slab is near the water table bordering Random Lake. When lake level is too high my sump pump runs continuously, threatening basement flooding.

Adding to lake water level are precipitation, in-flow from Spring Lake, and perhaps changes in ground water flow. Subtracting from lake water level are evaporation, out-flow into Silver Creek, and perhaps changes in ground water flow. The role of ground water movement, or swells in groundwater waves, is speculative. The hydraulic retention time for Random Lake has not been determined: the time needed for all of the water in the lake to flow into Silver Creek.

Historic water levels on Random Lake for the years 2003-2015 are in the author's database and would be shown succinctly in a graph except that it would take an impractically wide graph. The lake level observations during this time period number over 500 and almost all of them were made by Wayne Stroessner. Exhibit A shows water levels in 2004, including the highest water level ever recorded on Random Lake. Water level on Random Lake can be higher than the dam at Highway 144, provided that water enters the lake much faster than it exits via the bottleneck at the dam. A heavy rain within Random Lake drainage basin, or a series of heavy rains, can certainly raise lake level. Exhibit B shows water levels in 2012, including the lowest water level ever recorded. Lack of rainfall together with evaporation explains why lake level can be lower than normal.

Exhibit A. Historic high water level on Random Lake

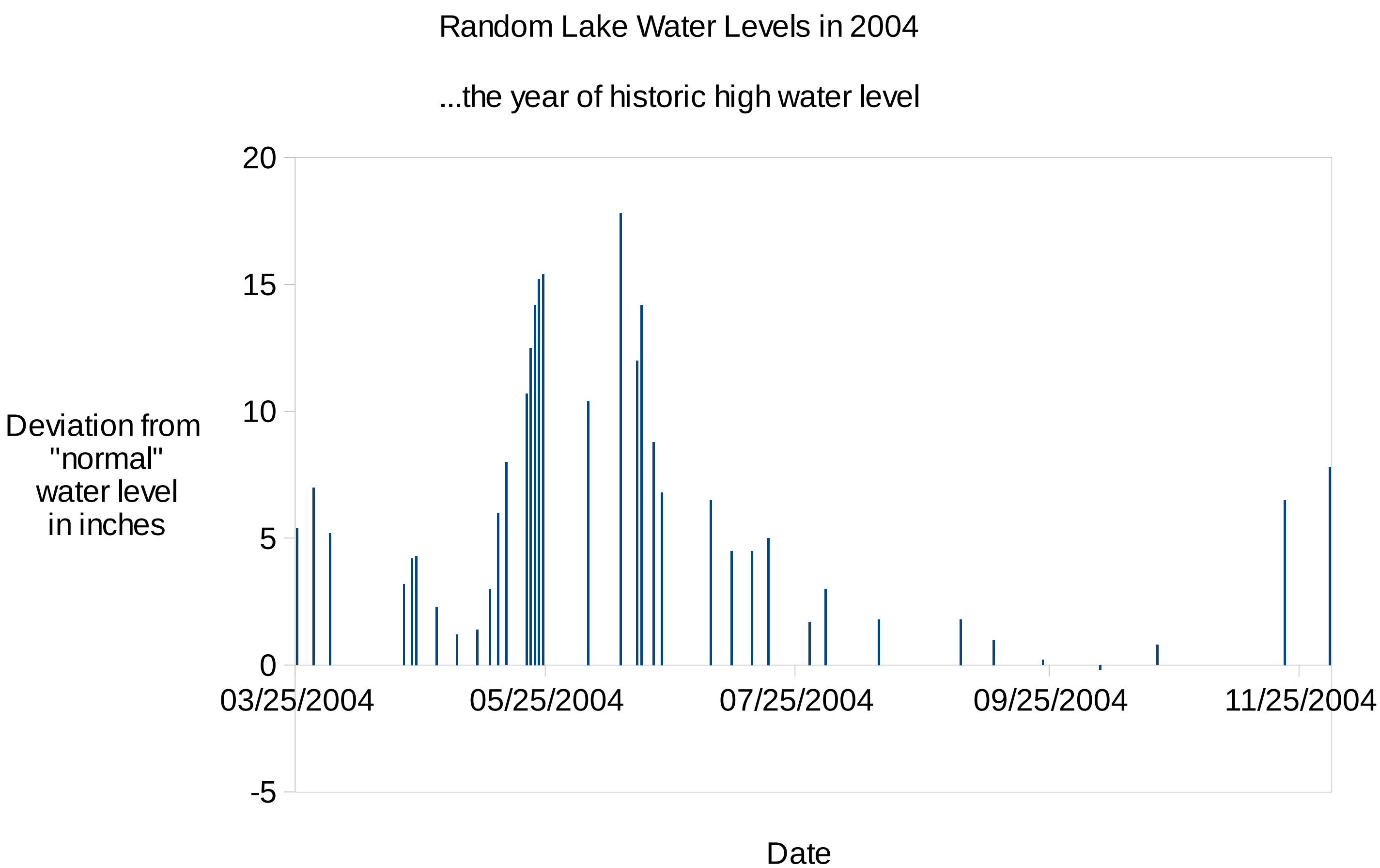
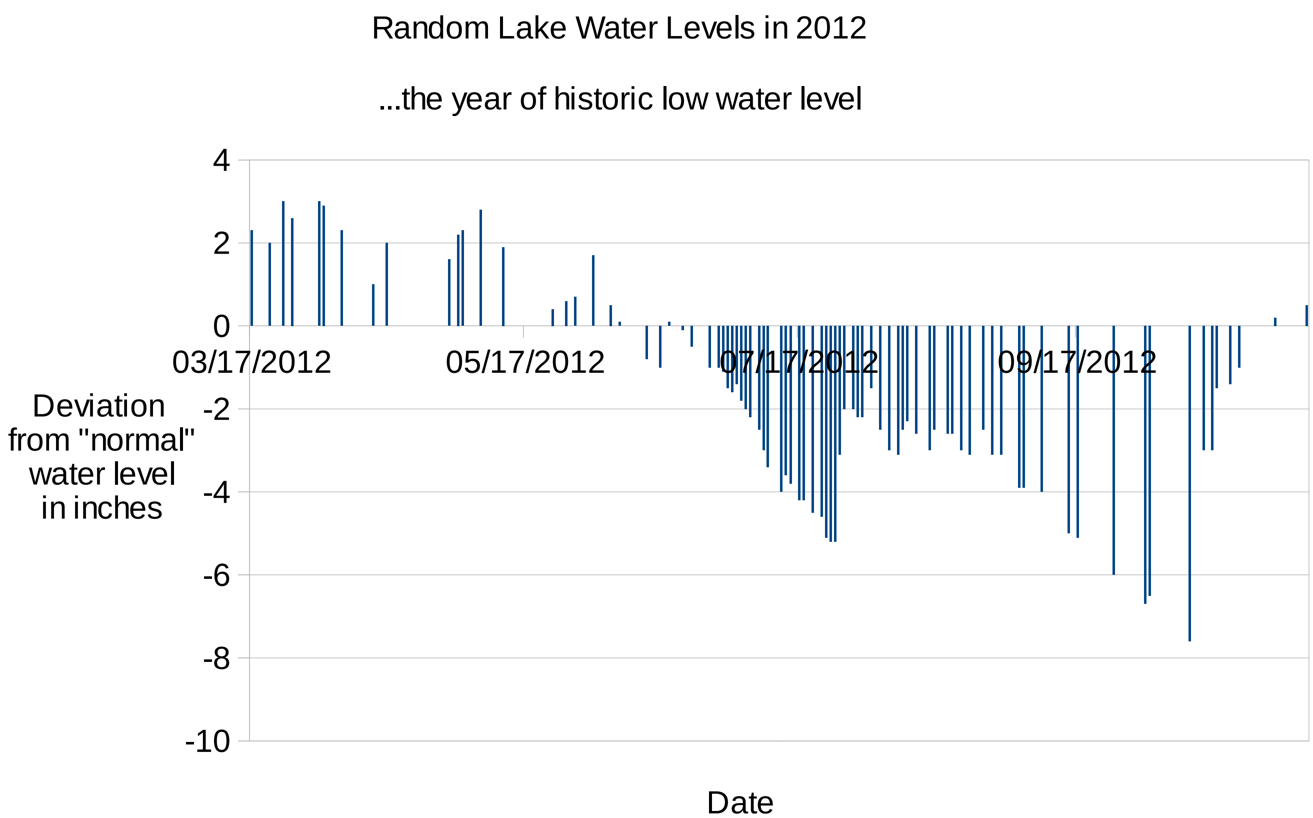
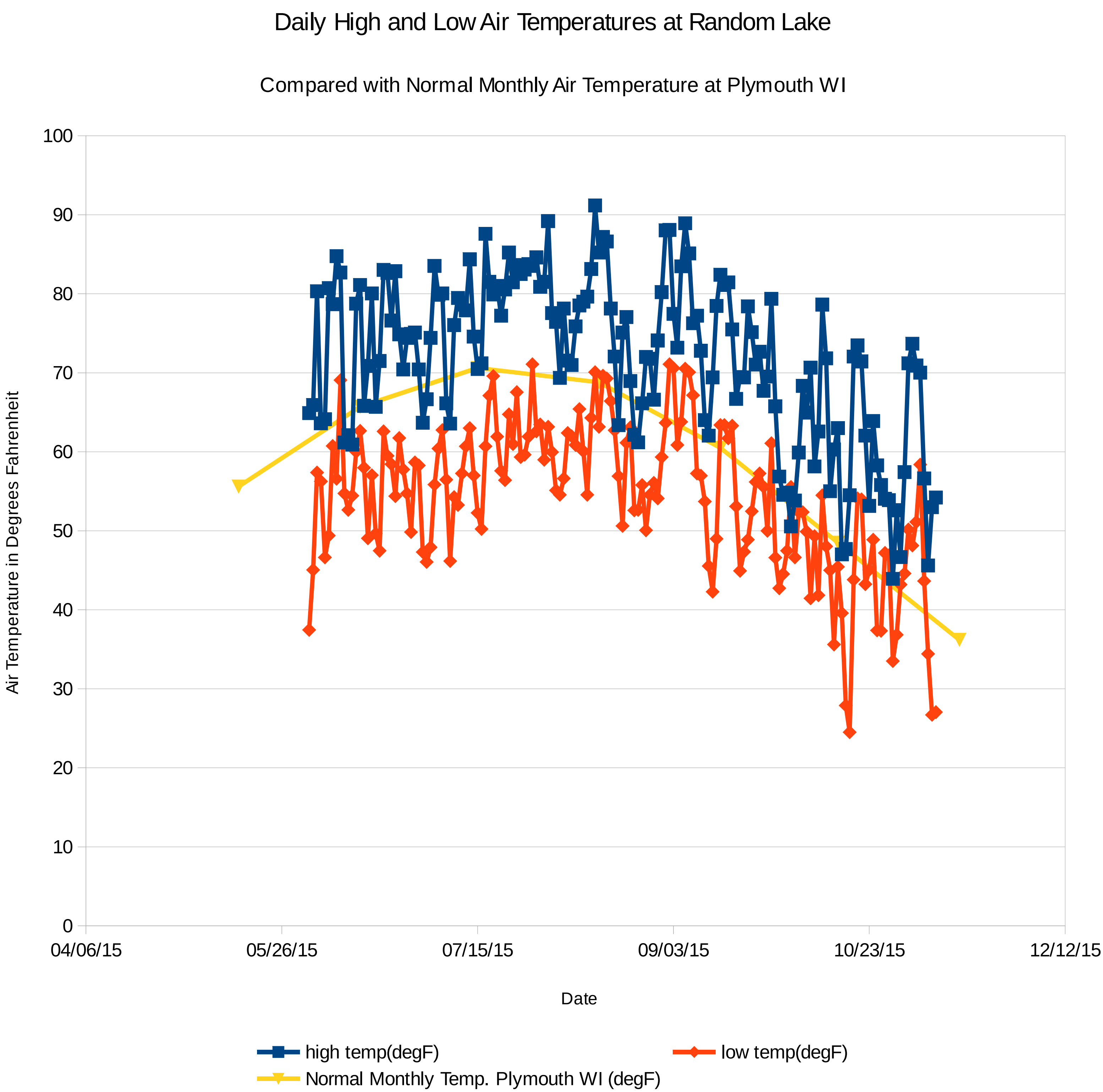


Exhibit B. Historic low water level on Random Lake

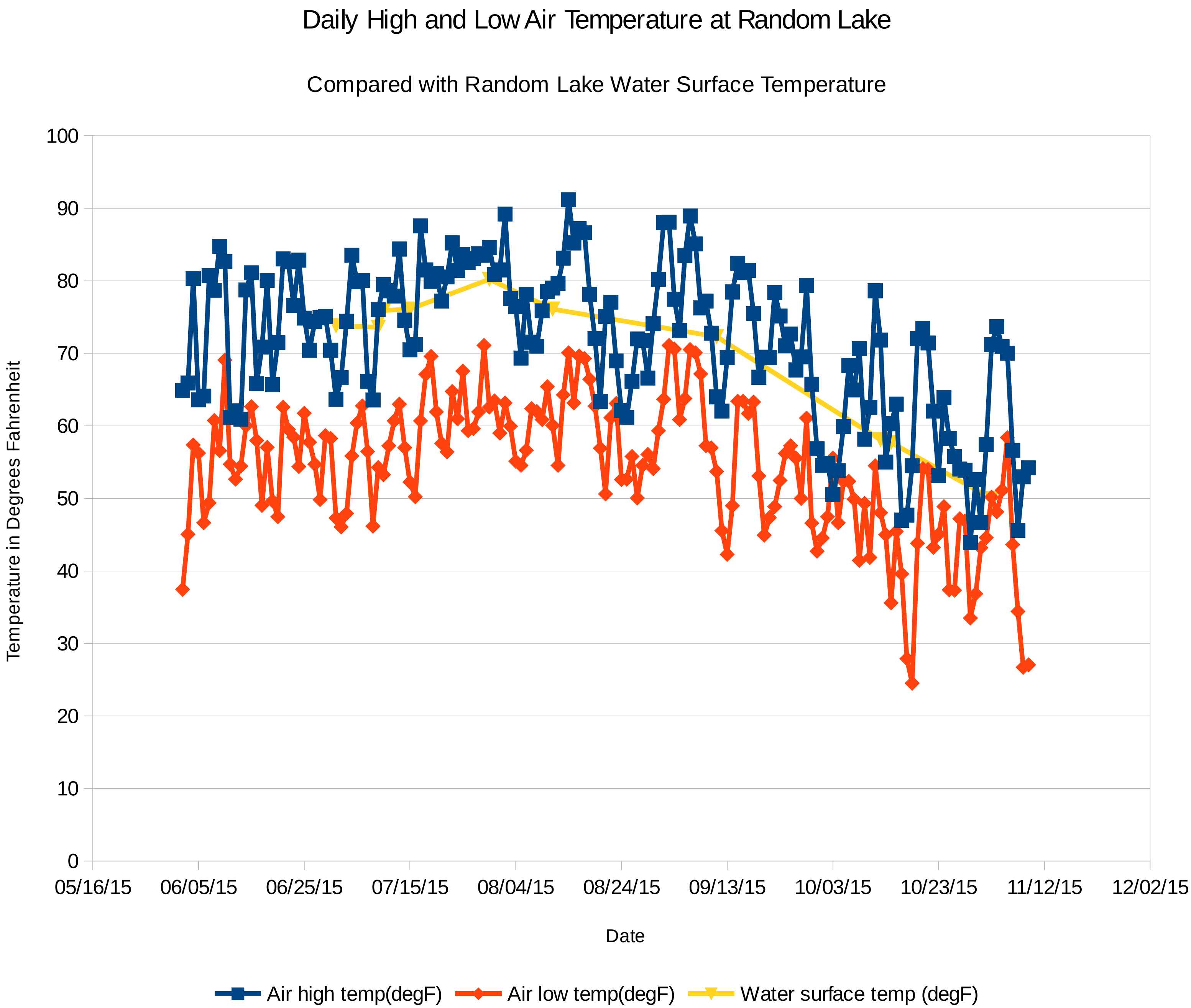


Weather

Air temperature at Random Lake is recorded daily by a weather station at Random Lake School District. The station is a WeatherBug by Earth Networks operated by teacher Michael April. THE SOUNDER newspaper carries a weekly feature *This Week's Weather* on page 6, reporting this same air temperature and rainfall data.

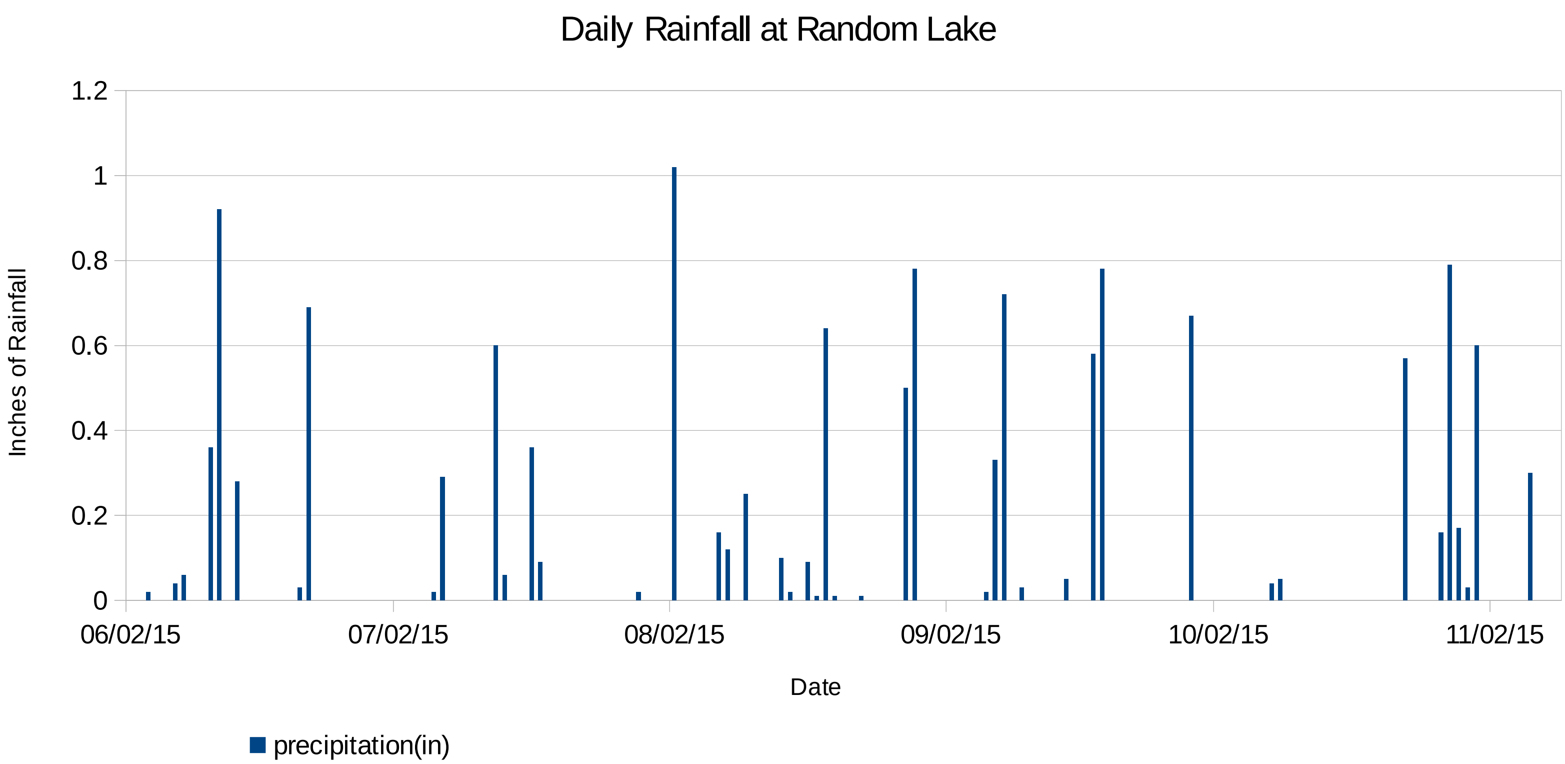

Daily High and Low Air Temperatures at Random Lake
Compared with Normal Monthly Air Temperature at Plymouth WI
Air Temperature in Degrees Fahrenheit
100
90
80
70
60
50
40
30
20
10
0
04/06/15
05/26/15
07/15/15
09/03/15
10/23/15
12/12/15
Date
high temp(degF)
low temp(degF)
Normal Monthly Temp. Plymouth WI (degF)

Air temperature has a large effect on lake water temperature:

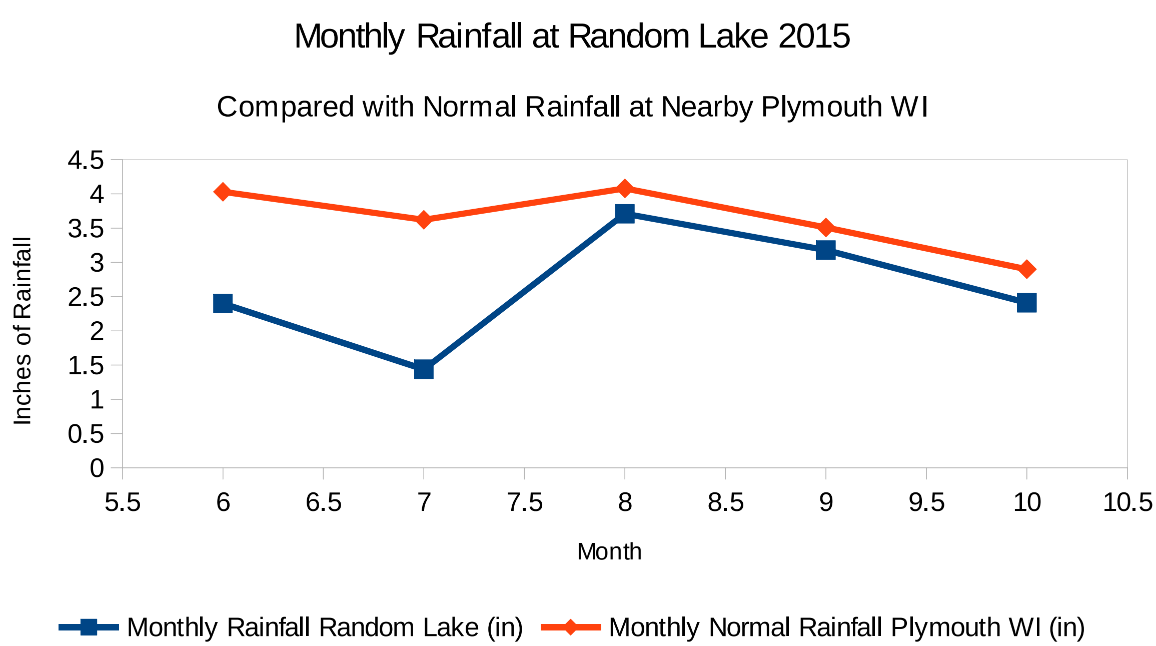


Because lake water is warmed by incident sunlight (as well as by contact with air) during the day, the surface water temperature at midday is more like the daily high air temperature than like the daily low (see foregoing graph).

The Random Lake weather station also records daily rainfall:

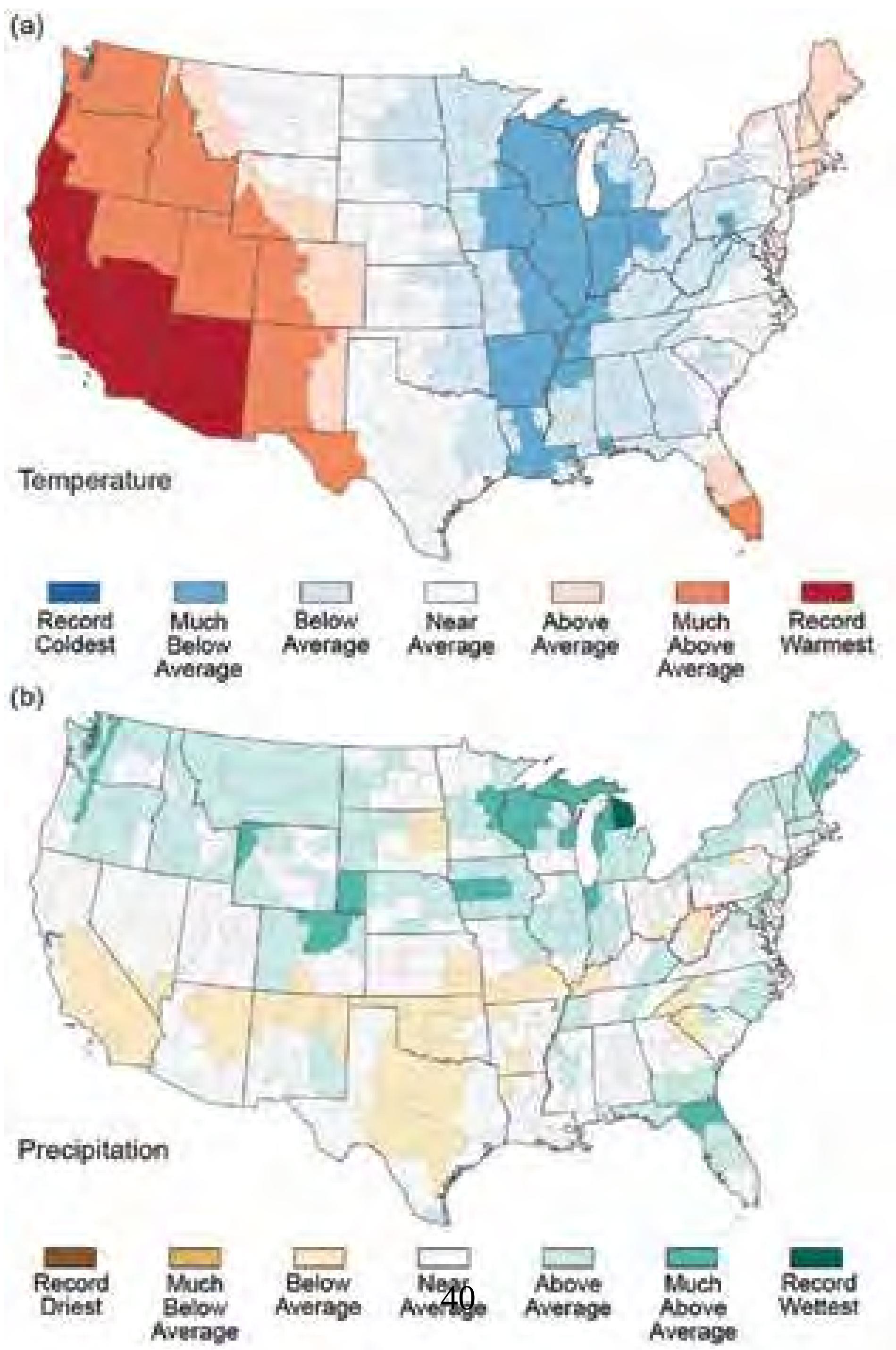


Actual monthly rainfall at Random Lake is compared with climatological average rainfall at Plymouth WI:



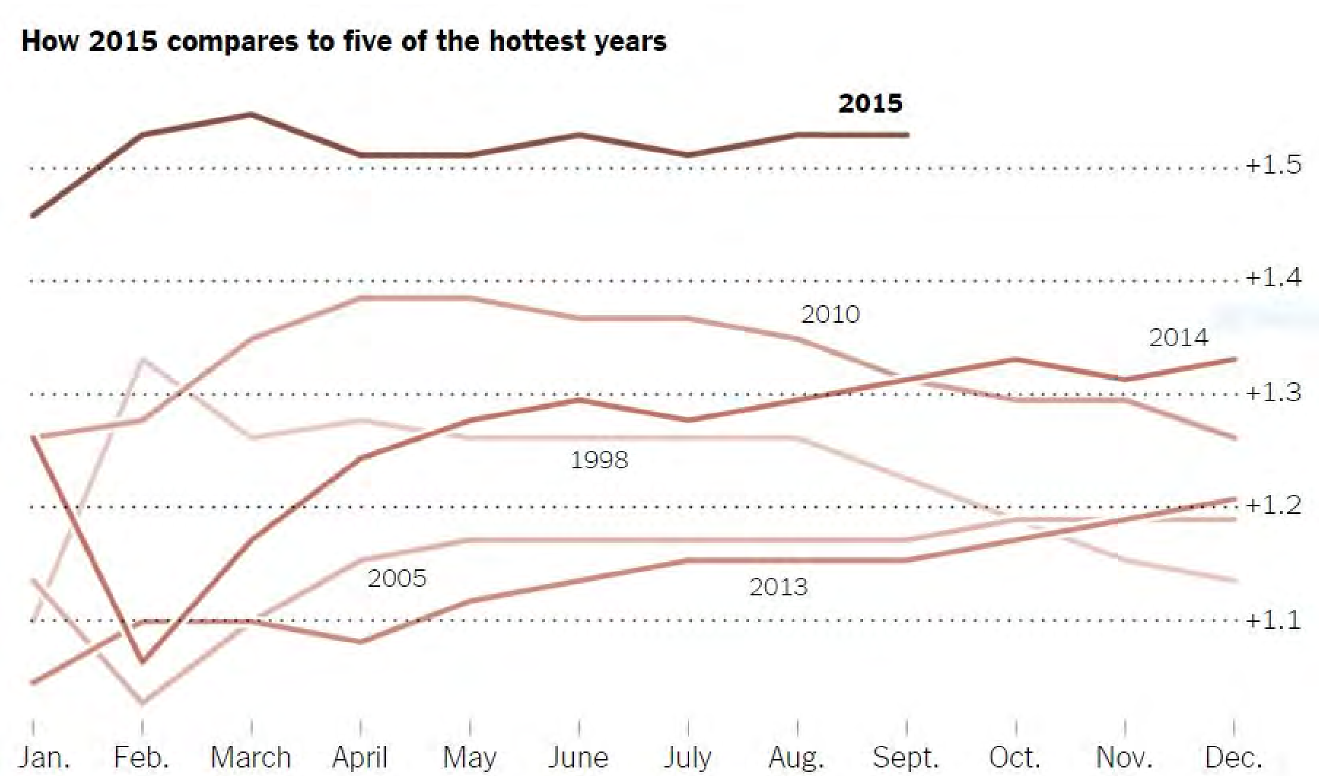
Thus Random Lake received less than average rainfall during the summer and fall months. (If we accept Plymouth WI rainfall norms as a fair substitute for Random Lake norms.)

2014 was the warmest year on record (globally). However, Central and Eastern North America was the only major region to experience a below-average annual temperature in 2014. For instance Plymouth, Wisconsin, where a NOAA weather station is located, reported a 2014 mean surface air temperature of 42.2 deg F which is 3.5 degrees below normal. As shown below the Mississippi valley experienced an unusually cold year, while over coastal regions of the US were warmer than normal.



Mean temperature and precipitation in 2014
Source: *State of the Climate in 2014*

2015 is considered certain to be even warmer than 2014.



Source: New York Times 21 October 2015

The Difference Between Climate and Weather

As background reading see this and this.

Algal Blooms

Wayne Stroessner noted algal blooms in Random Lake in past years. Especially concerning were those blooms involving blue-green algae that potentially contain cyanotoxins. He was first in 2015 to notice a recurrence of a bloom like earlier blooms associated with blue-green algae:

> *I did see four very dark ±1 inch diameter balls of slimy looking algae floating at the surface next to my pier. The last time those appeared, I took samples to John Masterson at the Plymouth DNR office and, with his microscope, we were able to find a rich supply of Planktothrix rubescens - the blue-green cyanobacteria (or algae - in the old book) "...they are known producers of potent hepatotoxins called microcystins." - Wikipedia* [July 10, 2015]

And on a subsequent date:

> *I was able to collect two of those dark ±1" globs of decomposing floating algae - the ones that a rich supply of Planktothrix rubescens was found. The first one was the larger and fell apart as it flowed into the jar. The second one stay together fairly well. I placed them in our freezer...[July 23, 2015]*

On July 18 the author noticed an unusual organic glob of a different kind:

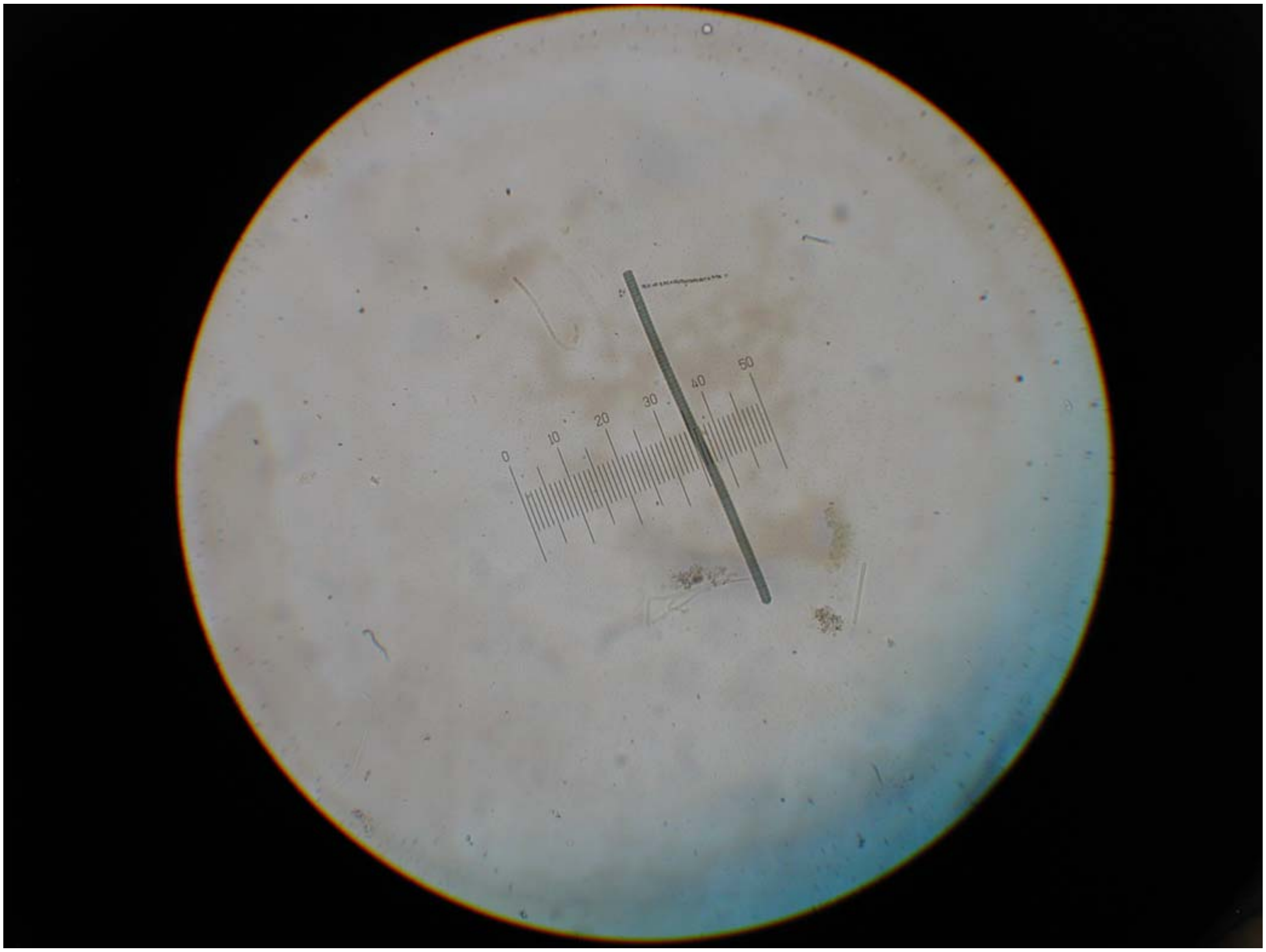
A glob of soft organic matter found in Random Lake near boat launch

Of this green glob Carol Sells observed:

> *I have observed these clumps in the lake for several weeks. They are near our pier as well as along the west and north shores and other piers. I don't recall them from past summers...*[July 22, 2015]

On microscopic examination, the glob was found to contain a variety of unidentified organisms: algae, zooplankton, phytoplankton. We do not know if this green glob evolves into the dark glob (see below) or if it is a different kind of bloom altogether.

Microscopic study of a dark globular sample collected by Stroessner on July 23 led to a tentative identification of *Planktothrix rubescens*, a blue-green algae:



Photomicrograph by the author, 400x bright field microscopy. Filament at center resembles reference photos of *Planktothrix rubescens*. Filament diameter 5-10 micrometers.

Here is a reference photo of *Planktothrix rubescens*:

On July 29 Stroessner reported:

> *Today we noticed many of those ±1" diameter dark globs of algae and if the microcystin level is high, we may need an alert the public about the use of the beach and/or lake.*

On July 30 the author replied:

> *In confirmation I've found a massive dark glob near library bay. First step: microscopic examination.*

Further algal specimens were found in library bay on July 31, 2015. A sample is preserved in the freezer. The dark red-brown colonies have about the same density as lake water. The tissue is soft and cohesive yet easily torn. It is not known what precedes and what follows the emergence of this particular stage of the bloom. In general, algal blooms are finely divided or else coalesce as metaphyton. I am aware of no precedent for this particular form of bloom.

Dark globular organic masses in lake water in library bay
(Two dark objects near center of photo)

Dark globular algal bloom (ChapStick for size reference)

Microscopic examination of a dark globular sample by the author again implicated *Planktothrix rubescens*:

Photomicrograph by author, 400x, bright field microscopy. The filaments resemble reference photos of Planktothrix rubescens

To summarize: during the algal bloom of July, dark globs were found scattered all over the lake. This discomfiting event set off a flurry of email traffic among lake monitors, Village officials, and DNR personnel (see Appendix. Algal Bloom July 2015). This way of communicating proved efficient and effective. Wisconsin DNR research scientist, Gina LaLiberte, had the last word on Random Lake's algal bloom of late July:

> *Heidi, John, or Rachel -- please forward to lake association members and homeowners as appropriate. I'm not sure of who everyone is in the email string below.*
>
> *Yes, that micrograph looks like it might be Planktothrix rubescens. If any*

advisories are going to be posted at Random Lake, Sheboygan County Public Health staff need to be involved, as only public health officers have the authority to post health advisories. I would recommend contacting David Roettger, who is the Environmental Health Supervisor. (david.roettger@sheboygancounty.com, 920-459-0325)

This may or may not be a strain of Planktothrix that can produce microcystins. If it is, it is not likely to be producing toxins continuously. If the county or lake association want to pursue toxin testing, they can have that done through the Wisconsin State Laboratory of Hygiene – I can put them in contact with the lab if they are interested. However, please be aware that bloom conditions can change rapidly, and there will be a delay in getting results, so hypothetically a bloom that isn't producing toxins when you collected a sample on Monday might be producing them on Wednesday when you get sampling results back. For that reason, we want people to be cautious about exposure to blue-green algae, and in this sense exposure means ingesting it or inhaling it in water droplets. Some people may also experience skin irritation such as rashes from exposure.

Here are some commons sense recommendations for recreational safety. Although these recommendations were written for planktonic blue-green algae blooms, which are suspended in lake water, they would also apply to the Planktothrix clumps that float on the surface of Random Lake.

Since we cannot determine if a blue-green algal bloom is producing toxins just by looking at it, we want people to be wary of any high concentration of blue-green algae in water. For a good rule of thumb, if you can wade knee-deep into water (without disturbing the sediment) and cannot see your feet because the water is green and opaque, or the water is any other unusual color, you should stay out. Algae cell densities are high enough that if the algae are producing toxins, you could become ill if you swallow water or inhale water droplets. Small children and pets should always be kept away from water in these conditions, since they are more likely to accidentally swallow water. At lower densities, you still want to avoid swallowing water as other pathogens may be present. Since the Planktothrix in Random Lake floats in colonies on the water, it's a little harder to use the knee-deep test to gauge algae levels. Try to avoid swimming in areas with many floating clumps, and avoid swallowing them if they are present in areas where you are swimming. Most people will likely want to keep them out of their *mouth, but dogs might not, so try to keep dogs out of areas with the floating clumps.*

If you use common-sense precautions, you can safely enjoy recreation on Wisconsin's lakes and rivers:

· *Choose locations without noticeably green water for swimming, because wind can concentrate blue-green algal blooms into near-shore areas. Do not swim in water that looks like "pea soup", green or blue paint, or that has a scum layer or puffy blobs floating on the surface.*

· *Do not boat, water ski, etc. over that looks like "pea soup", green or blue paint, or that has a scum layer or puffy blobs floating on the surface (people can be exposed through inhalation).*

· *Do not let children play with scum layers, even from shore.*

· *Always offer fresh, clean water for pets to drink. Do not let pets swim in, or drink, waters experiencing blue-green algae blooms or noticeably green water.*

· *Always take a shower after coming into contact with any surface water (whether or not a blue-green algae bloom appears to be present; surface waters may contain other species of potentially harmful bacteria and viruses).*

· *Pets should be washed off immediately after swimming, before they groom.*

· *Always avoid swallowing untreated surface water – it may contain pathogens other than blue-green algae which could make you ill.*

The Wisconsin Department of Health Services has provided the following guidelines concerning fish consumption:

· *Algal toxins have not shown to accumulate to acutely toxic levels in the fillet.*

· *Clean fish thoroughly and discard the viscera and guts, where toxins may accumulate.*

· *Wash hands after handling fish caught during an algal bloom.*

There are still many unanswered questions about algal toxins in fish. The science is still emerging on chronic effects of consuming many fish meals over time when the fish live in water bodies that repeatedly experience heavy blooms. The DNR *has a website with more information on safe eating guidelines: http://dnr.wi.gov/topic/fishing/consumption/index.html*

There is more information on blue-green algal blooms at the DNR's website: http://dnr.wi.gov/lakes/bluegreenalgae/

and at the Department of Health Services' website: https://www.dhs.wisconsin.gov/water/bg-algae/index.htm

Controlling Invasive Aquatic Plants with Herbicide Treatments

The Village of Random Lake has a program to control aquatic invasive weeds in the lake. The main pests are the abundantly growing Eurasian watermilfoil (exhibit A) and curly leaf pondweed (exhibit B) which interfere with recreational use of the lake. The “crown jewel” of the village needs care and grooming if it is to maintain its character as a recreational lake and home site. The invasive weed program involves the Village Board and the Lakes, Parks and Recreation Committee. Other parties to the program are Wisconsin Department of Natural Resources, Marine Biochemists, Random Lake Association, and the public.

Eurasian water milfoil

curly leaf pondweed

Eurasian water milfoil was discovered in Random Lake in 1993. Curly leaf pondweed was discovered there in 2012. Efforts to control the latter are now being stepped up.

The program to control invasive weeds is of many years' standing and has evolved to the judicious use of herbicides as the first and last choice of treatment (exhibit C). The public is kept informed and invited to participate through public notices (exhibit D). The plants and animals that are native to Random Lake do not really have many influential advocates, let alone legal standing, and are seldom surveyed. Random Lake is not a wildlife preserve. But even if it were a preserve, manager-biologists would see a need to intervene against invasive species.

At the Random Lake Association picnic on June 28, Village president Matthew Brockmeier explained that the June 2015 herbicide treatments should have occurred earlier, not as late as June when the growth of Eurasian watermilfoil was well advanced. The reason that the treatments did not occur in a more timely way in the spring was because of a miscommunication between the Village and Marine Biochemists. Marine Biochemists received the approved herbicide permit from WI DNR approximately a month before notifying the Village.

Brockmeier was interviewed by the author about the weed program. $10K was budgeted in 2015 for weed control; $15708 was actually spent for two rounds of treatments. In 2016 $20K will be provided in order to do more. Brockmeier helped recover documents regarding 2014 herbicide treatments, alleviating a gap in knowledge for a year in which lake monitoring was sporadic. The Village is satisfied with Marine Biochemists' services.

Wisconsin DNR issues permits for management of aquatic plants (Wis. Stats. Chapter NR 107 Aquatic Plant Management). Before performing herbicide treatments, the Village must obtain such a permit (exhibit E).

Marine Biochemists is the firm currently employed by the Village to help obtain the WI DNR permit and accordingly to treat the lake with herbicides. They also survey the lake for invasive weeds and advise the Village. Their employees were on Random Lake on June 11-12 and August 13-14, 2015.

Random Lake Association is comprised mainly of lake shore property owners who take a strong position on the control of aquatic weeds. On occasion RLA has contributed money for control of weedy lake plants, though not in 2015.

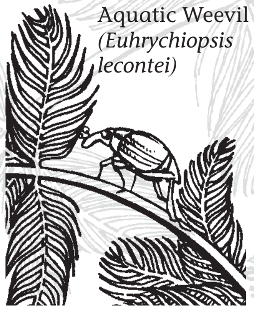
The herbicide treatment dates in 2015 were June 11-12 and August 13-14. Marine Biochemists applied the chemicals according to their detailed plan: Aquathol-K, Cutrine-Plus, DMA4-IVM, and Navigate (exhibits F-I). Good documentation is on record for the treatments (exhibits J-O). Advance legal notices for the June treatments were published in The Sounder and notices mailed to households. On the days of treatment, warning signs were placed on the shoreline of Lakeview Park. Following treatments, the efficacy was not measured and documented in any formal way, although many offending weeds were seen to die. Thus there was no suggestion that the Village did not get its money's worth out of the treatments.

Marine Biochemists on Random Lake

On the future horizon lie other well known and feared aquatic invasive species, namely zebra mussel and starry stonewort. If and when these invaders arrive in Random Lake, new control measures may have to be implemented.

Exhibit A. Eurasian watermilfoil

How Do You Control EWM?



Aquatic Weevil *(Euhrychiopsis lecontei)*

Early detection of EWM growth is critical in stopping the plant from becoming a widespread problem. The best chance to halt these non-native invaders is when they first appear on the scene. EWM often appears near boat landings and at disturbed sites.

New colonies are best removed before they expand. **Hand pulling** and removal from the water is a simple and effective control method for small areas. **Harvesting, raking** or **screening the bottom** also works well. Milfoil can be effectively treated with **selected chemicals** early in the summer before plants flower. A permit is required from the DNR for chemical treatment or bottom screening. **Whole-lake herbicide treatment** is not generally permitted because of the potential to disrupt lake ecosystems by eliminating both invasive and beneficial native plants.

For lakes dominated with beds of milfoil, control efforts must be focused on reducing its spread. **Mechanical harvesting** can open areas for boating and swimming and cut fish cruising lanes. Harvesting encourages growth of native plants while removing milfoil canopies that limit native plant growth.

Biological control of EWM is still uncertain. A small aquatic weevil (*Euhrychiopsis lecontei)* feeds on milfoil and actually prefers EWM. Weevils are found in many Wisconsin lakes. To locate a weevil, look in milfoil stems for signs of damage. There are often small holes or weak spots in the stems that point to weevil damage. These holes allow water to enter the stem, expose the plant to bacterial infection and decrease the plant's buoyancy. The plant will drop lower into the water column and will not canopy out on the surface. Over time, weevils can impact the populations of EWM, but complete eradication is unlikely. Additional research and development is needed before biological control with weevils can be considered an effective management tool.

How Can You Help?

EWM is moved between water bodies by small fragments transported on recreational equipment. Commonly it is transported by boats, trailers, bait buckets, live wells and fishing equipment. To help prevent the spread of EWM and other invasive species, please take the following steps:

- **Inspect and remove** any visible mud, plants, fish or animals before transporting.
- **Drain** water from equipment (boat, motor, trailer, live wells) before transporting.
- **Dispose** of unwanted live bait in the trash.

Wisconsin laws prohibit launching a boat or placing a trailer or boat equipment in navigable waters if it has aquatic plants or zebra mussels attached.

The Clean Boats, Clean Waters Program Builds Awareness About

- Learn to recognize EWM.
- Start a volunteer watercraft inspection program to help educate boaters on how and where EWM and other invasives are most likely to hitch a ride into water bodies.
- Begin monitoring boat landings, marinas and inlets for the first sign of invasion.
- If you suspect a new infestation, report it to your local DNR service center.

Remember, our waterways are the pride of Wisconsin and belong to all of us.

For more information about the "Clean Boats, Clean Waters" program call 715/346-3366.

The Wisconsin Department of Natural Resources provides equal opportunity in its employment, programs, services, and functions under an Affirmative Action Plan. If you have any questions, please write to Equal Opportunity Office, Department of Interior, Washington, D.C. 20240.

This publication is available in alternative format (large print, Braille, audiotape, etc.) upon request. Please call 608/267-7694 for more information.

WISCONSIN DEPT. OF NATURAL RESOURCES

UW Extension

STOP AQUATIC HITCHHIKERS! Prevent the transport of nuisance species. Clean all recreational equipment. www.ProtectYourWaters.net

PRINTED ON RECYCLED PAPER

PUB-WT-781 2004

Designed by L. Pohlod, Blue Sky Illustration & Design, LLC

The Facts . . . On Eurasian Water-Milfoil

What is Eurasian Water-Milfoil (EWM)?

Invasive species disrupt the stability of natural ecosystems and threaten biodiversity. One invasive species of special concern is Eurasian water-milfoil. EWM was introduced into North America and has spread to numerous water bodies across the nation. During the 1960's this aggressive submersed plant found its way into Wisconsin waters. For a current list of EWM-infested water bodies visit www.dnr.wi.gov/org/water/wm/GLWSP/exotics/milfoil.html

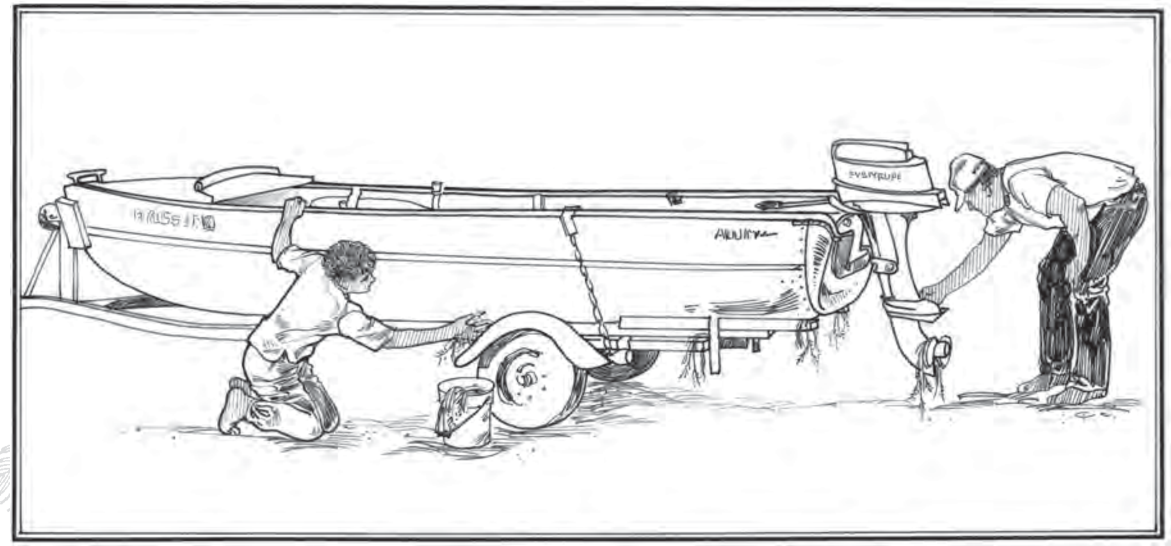
Eurasian water-milfoil threatens native aquatic plant communities and forms thick underwater beds of tangled stems and vast mats of vegetation at the water's surface. These dense beds cause loss of plant diversity, degrade water quality, and may reduce habitat for fish, invertebrates and wildlife. They also hinder boating, swimming and fishing. Many lake organizations and local governments devote much of their management budgets to control this invasive plant. EWM is an affliction that costs citizens of Wisconsin millions of dollars in plant control and lost tourism revenue annually.

How Does It Spread?

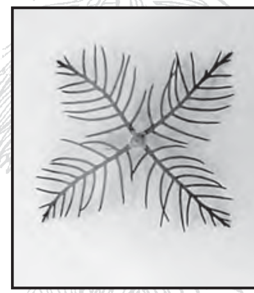
This prolific plant does not spread well by seeds. It spreads by shoots and runners that creep along the beds of lakes and rivers. New plants also grow from small fragments transported from one water body to another. Commonly it's transported by boats and trailers but could also be transported on SCUBA gear, water skis or waterfowl. EWM has become a successful invader primarily by means of its stem fragments. A single fragment can take root and form a new colony.

EWM is most successful in water disturbed by cultural developments such as shoreline construction, watershed runoff, aquatic invasive species control or heavy boat traffic.

EWM also has a competitive advantage in waters that are stressed by pollution. It has difficulty becoming established in waters with healthy populations of native plants. A healthy ecosystem and preservation of native plants is protection against an EWM invasion.



What Does Eurasian Water-Milfoil (*Myriophyllum spicatum*) Look Like?



Northern water-milfoil *(Myriophyllum sibericum)*

Eurasian water-milfoil *(Myriophyllum spicatum)*

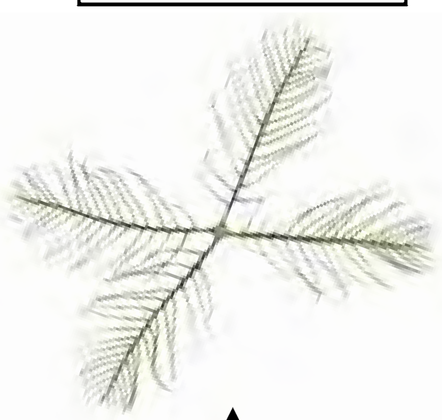
EWM is one of eight water-milfoil species found in Wisconsin and the only one that is not native. The most common native water-milfoil in Wisconsin lakes is northern water-milfoil (*Myriophyllum sibericum*). It bears a strong resemblance to EWM but it is not prone to the rapid growth and canopy formation that make EWM a nuisance.

It is important to be able to distinguish EWM from similar aquatic plants.

- EWM is a submersed aquatic plant with feather-like leaves arranged in whorls (circles) on the stem.
- There are usually 12 to 21 pairs of leaflets per leaf.
- The leaves have a distinct feather-like appearance, with the lower leaflet pairs about half the length of the midrib.
- Stem tips are tassel-like.
- Branching is abundant in water 3 to 10 feet deep.

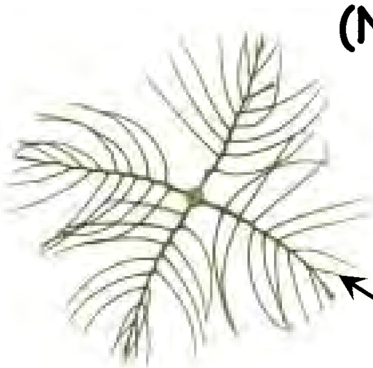
Eurasian water-milfoil
Myriophyllum spicatum
(Non-native)

Leaves in whorls of 3-5 and may be widely spaced along the stem



Note: More than 12 pairs of leaflets

Northern water-milfoil
Myriophyllum sibiricum
(Native)



Note: Usually 12 or fewer pairs of leaflets

EURASIAN WATER-MILFOIL
Myriophyllum spicatum

Eurasian water-milfoil is an exotic species introduced to the United States from its native range in Europe and Asia. The fast growing shoots and extensive canopy formation can obstruct recreation and navigation. The ability to grow in cool water gives it a quick start in the spring. Eurasian water-milfoil often crowds and shades native plants, giving it a competitive advantage.

Description: Eurasian water-milfoil has long, spaghetti like stems, sometimes 6.6 feet (2 m) or more in length, that emerge from roots and rhizomes. Leaves are divided like a feather, with a short stalk and about 12-20 pairs of thread-like leaflets. The leaf divisions are all about the same length and closely spaced, resembling the bones on a fish spine. Leaves are in whorls of 3-5, and can be widely spaced 0.4-1.2 inches (1-3 cm) or more. The flower spike sticks out of the water with whorls of flowers in the axils of short bracts. The 0.08-0.12 inch (2-3 mm) fruit has four parts with a smooth to slightly roughened surface.

Habitat: Eurasian water-milfoil grows submersed in water depths of 3-20 feet (0.9-6 m). The only parts of the plant that may grow out of the water are the flower stalks, which are only a few inches tall. However, the submersed shoots may form a dense canopy right at the water's surface, causing the infamous nuisance problem as well as impacting native plant and animal communities. Rooted in the bottom, the root crowns have many stems growing from them up to the surface. Near the surface, each stem may branch multiple times to form a dense mass.

Similar species: There are seven native species of water-milfoil in this region. Eurasian water-milfoil most closely resembles northern water-milfoil (*Myriophyllum sibiricum).* The most reliable way to distinguish between them is by the number of leaf divisions. Eurasian water-milfoil usually has more than 12 pairs of leaflets, whereas Northern water-milfoil has less than 12 (usually 5-12). The presence or absence of winter buds in late summer is also a helpful characteristic. Northern water-milfoil produces winter buds, but Eurasian water-milfoil does not. Although individual plants of these two species may look similar, their growth form is quite different. Northern water-milfoil doesn't typically form a branched canopy at the water's surface and it grows in a more controlled manner with slower growth and less fragmentation.

Management and Control: Eurasian water-milfoil has been the target of many management strategies ranging from mechanical harvesting to herbicides. There has recently been some evidence that a native weevil (*Euhrychiopsis lecontei*) may provide a biological control. This tiny aquatic weevil has been associated with some natural declines of Eurasian water-milfoil. In some test plots on milfoil infested lakes, the weevil has been shown to reduce milfoil growth and limit canopy formation. The possibility of using a native weevil for biocontrol shows promise (Sheldon and Creed 1995).

Borman, S., Korth, R., Temte, J. Through the Looking Glass – A Field Guide to Aquatic Plants. DNR Publication # FH-207-97.

Madsen, J.D., Welling, C. H. Eurasian Watermilfoil *(Myriophyllum spicatum* L.*)*. Lakeline, Spring 2002. pp 29-30.

Recognizing Eurasian Water-milfoil and Native Look-a-Likes

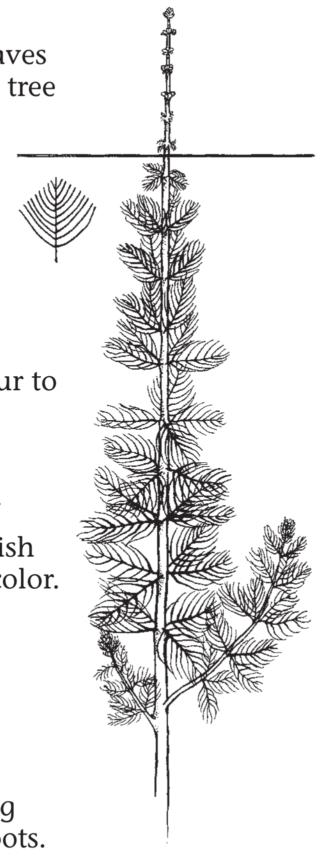
Eurasian water milfoil is one of eight water-milfoil species found in Wisconsin and the only one that is not native. The most common native water-milfoil in Wisconsin lakes is northern water-milfoil. It bears a strong resemblance to Eurasin water-milfoil and identification between the two plants can be difficult. Using this guide helps to distinguish Eurasian water-milfoil from similar native aquatic plants.

Eurasian Water-milfoil
(Myriophyllum spicatum)

- Delicate feather-like leaves. Leaflets are mostly the same length.
- Leaves are usually limp when out of the water.
- Leaves arranged in whorls (circles) of three to five around the stem.
- Usually twelve to twenty-one leaflet pairs per leaf.
- Long spaghetti-like stems.

Northern Water-milfoil
(Myriophyllum sibericum)

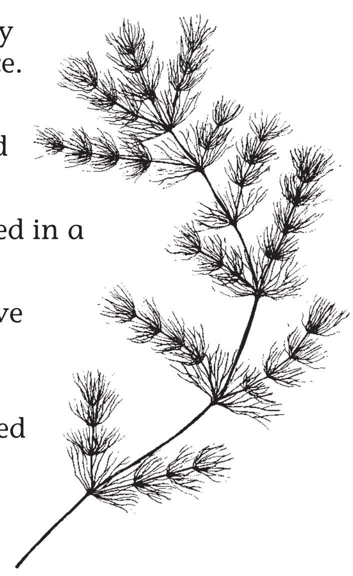
- Rigid feather-like leaves forming a christmas tree shape. The lower leaflets are usually quite long.
- Leaves usually stiff when out of water.
- Leaves arranged in whorls (circles) of four to six around stem.
- Usually seven to ten leaflet pairs per leaf.
- Stem is usually whitish or whitish green in color.



Coontail
(Ceratophyllum demersum)

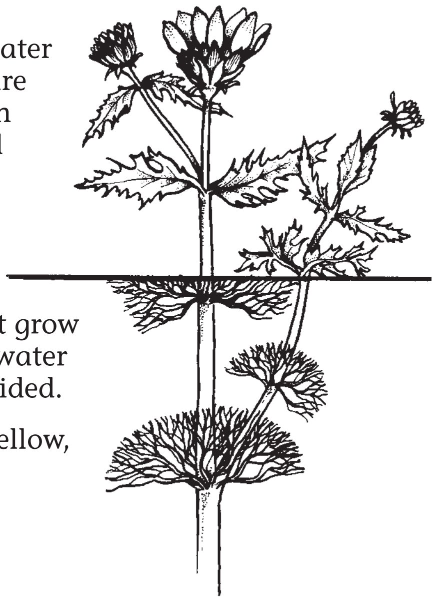
Coontail is a free-floating aquatic plant without roots. It may be completely submersed or partially floating on the surface.

- The leaves are stiff and arranged in whorls.
- Each leaf is divided in a forked pattern.
- Leaf divisions have teeth along one margin.
- Leaves are crowded toward the tip of the stem creating the “coontail” appearance.



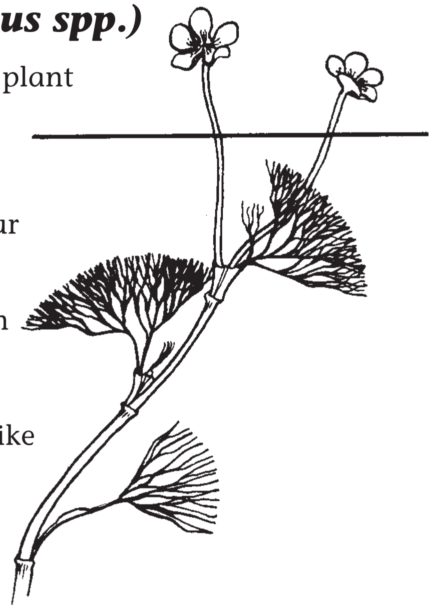
Water Marigold
(Megalodonta beckii)

- Submersed leaves of water marigold are arranged in whorls and cut into many thread-like divisions.
- Leaves that grow above the water are not divided.
- Produces yellow, daisy-like flowers.



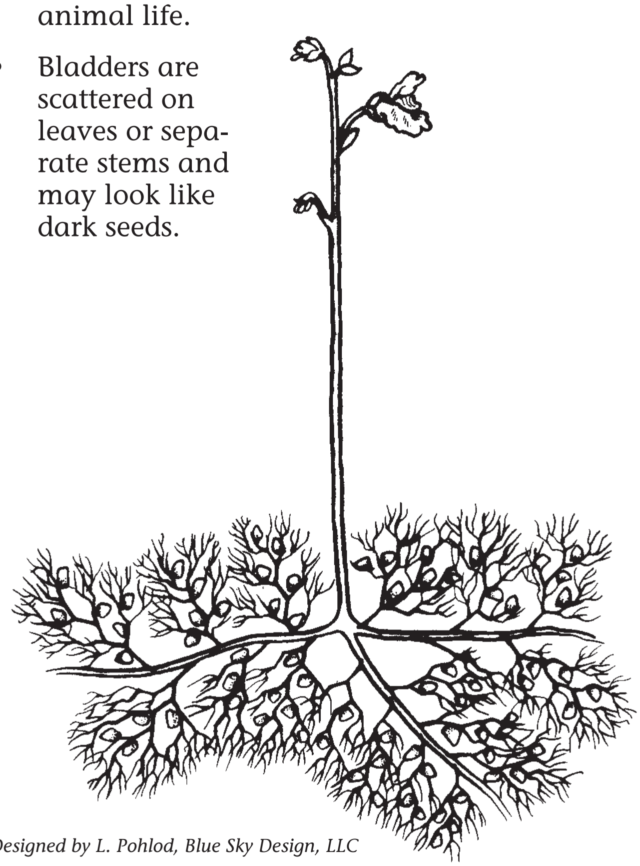
Water Crowfoot
(Ranunculus spp.)

- Submersed plant with finely divided leaves.
- Leaves occur alternately along the stem, not in whorls.
- Small buttercup-like flowers are produced that stick up out of the water.



Common Bladderwort
(Utricularia vulgaris)

- Submersed plant with finely divided leaves.
- Leaves are arranged alternately on the stem.
- Most distinct characteristic is the presence of “bladders” or sacs to capture small animal life.
- Bladders are scattered on leaves or separate stems and may look like dark seeds.



Common Waterweed, Elodea *(Elodea canadensis)*

- Submerged plant with slender stems.
- Small lance-shaped leaves attach directly to the stem.
- Leaves are in whorls of three, or occasionally two near the stem tips.

Designed by L. Pohlod, Blue Sky Design, LLC

PUB-WT-783 2004

Illustrations by Carol Watkins reprinted with permission from “Through the Looking Glass, A Field Guide to Aquatic Plants” by Susan Borman, Robert Korth, and Jo Temke

Several native water-milfoils form winter turions (buds). Turions are overwintering structures that are comprised of densely packed leaves. These turions form on the upper portion of the plant and/or on the plant's side branches during the fall of the year. The turions are often still attached to plants that are found washing up along shorelines in late fall (October-November). These turions break away from the plant and free-float to new areas. In the spring, the turions break dormancy and the small, thick, dark green turion leaves expand and grow. As the plant develops roots and continues to grow, the larger green summer leaves are produced at the tip of the plant. You can sometimes find the turion leaves at the base of the plant even into July. You may also see a "turionic arch" or U-shape at the base of northern water-milfoil throughout the year (early development of the arch is shown in pictures C and D on next page).

Eurasian water-milfoil (EWM) and some native water-milfoils (NWM) do not form winter turions. **If you see turions or the turion leaves, you DO NOT have Eurasian water-milfoil.** If you do not see turions, use other identification features to determine if you have a native water-milfoil or Eurasian water-milfoil. In 2007 some EWM/NWM hybrids were found to have turions. More research is needed in this area.

Whorled Water-milfoil (native)

collected in October

Northern Water-milfoil (native)

Turions (pictures A & B). Turion leaf expansion and growth (picture C), followed by formation of summer leaves (picture D).

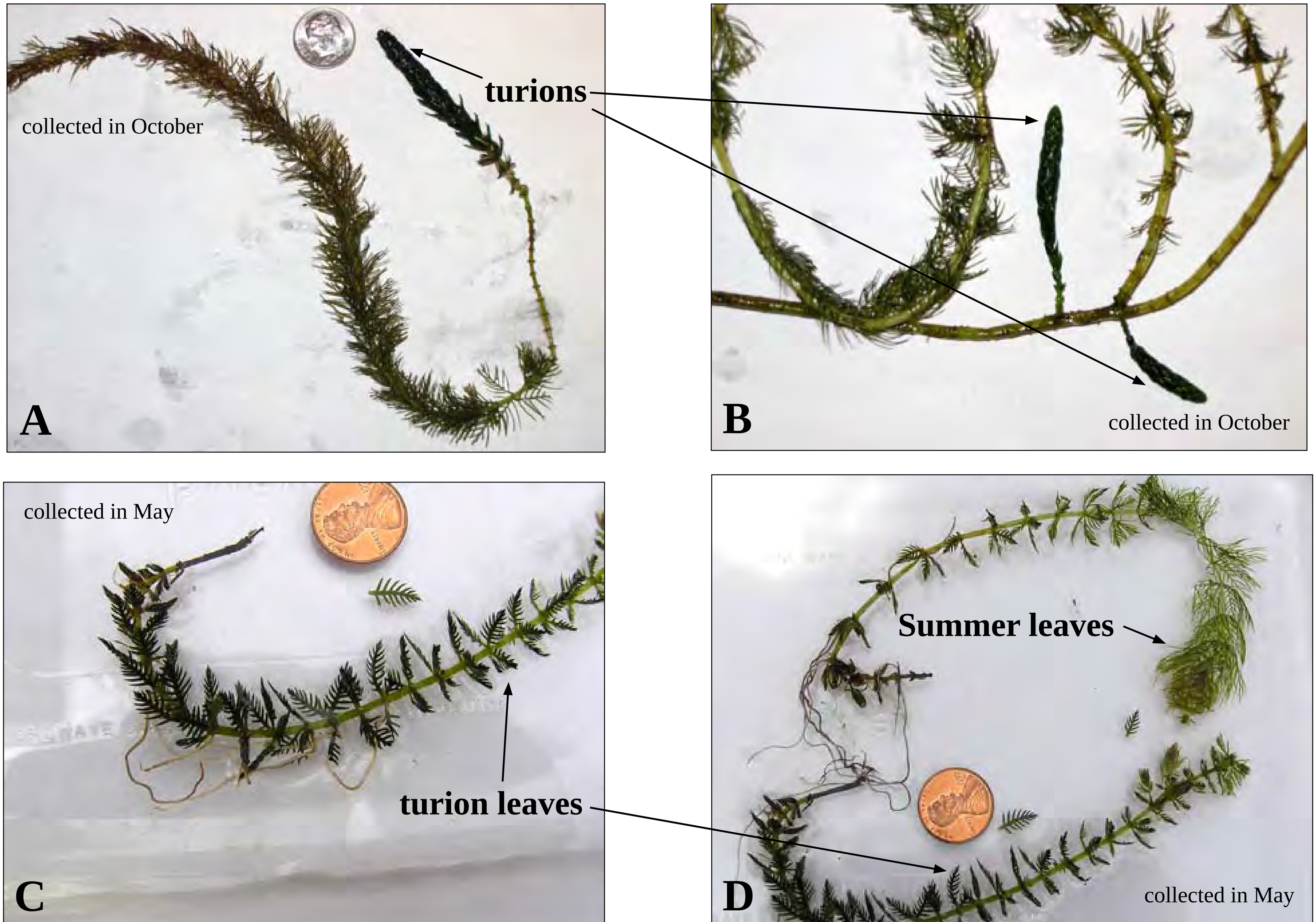


Exhibit B. Curly leaf pondweed

Curly-leaf pondweed

Potamogeton crispus

Description

Curly-leaf Pondweed was likely accidentally introduced to the U.S. along with the common carp in the 1800s, and was established in the Midwest by the 1930s. It is a submersed aquatic plant, though its stems can reach the surface, forming mats. Its leaves are reddish-green, oblong, and about 3 inches long, with distinct wavy edges that are finely toothed. The stem of the plant is flat and reddish-brown. Curly-leaf beds may start in 1-2 feet of water and extend out to 10-12 feet or more.

Curly-leaf pondweed reproduces/spreads through production of burr-like winter buds (turions), which are moved among waterways. These plants can also reproduce by seed, but this plays a relatively small role compared to the vegetative reproduction through turions. New plants form under the ice in winter, making curly-leaf pondweed one of the first nuisance aquatic plants to emerge in the spring. The plants usually drop to the lake bottom by early July.

V. RAMEY, UNIVERSITY OF FLORIDA

Why is curly-leaf a concern?

Curly-leaf pondweed was the most severe nuisance aquatic plant in the Midwest until Eurasian water-milfoil appeared. It forms surface mats that interfere with aquatic recreation. It becomes invasive in some areas because of its tolerance for low light and low water temperatures. These tolerances allow it to get a head start on and outcompete native plants in the spring. In mid-summer, when most aquatic plants are growing, curly-leaf pondweed plants are dying off. Plant die-offs may result in a critical loss of dissolved oxygen. Furthermore, the decaying plants can increase nutrients, which contribute to algal blooms, as well as create unpleasant stinking messes on beaches.

How does curly-leaf spread?

Similar to Eurasian water-milfoil, curly-leaf pondweed can be spread between waterbodies on boats and equipment.

How can you help prevent the spread?

- Inspect and remove aquatic plants, animals, and mud from boat, trailer, and equipment before leaving the water access;
- Drain water from boat, motor, bilge, live wells, and bait containers before leaving the water access;
- Dispose of unwanted bait in the trash;
- Spray/rinse boats and recreational equipment with high pressure and/or hot tap water (> 104° F), especially if moored for more than a day, OR
- Dry boats and equipment thoroughly for at least 5 days.

What are the regulations about curly-leaf pondweed in Wisconsin?

It is unlawful in Wisconsin to:

* Place a boat or trailer with attached aquatic plants or zebra mussels into Wisconsin waters.

Management and control

Once curly-leaf is well established in a lake, it is nearly impossible to eradicate. It does not cause severe problems in every water body, but when it does, several management options may be available. Just as with Eurasian water-milfoil, physical, mechanical, and chemical options are all used to control curly-leaf, depending upon the extent of the infestation and other characteristics of the infested waterbody.

Long-term management requires the reduction or elimination of turions to interrupt the life cycle. To have the maximum benefit, manual/mechanical efforts (such as raking, hand-cutting, or harvesting) as well as chemical control efforts should be undertaken in the spring or early summer, when native plants are still dormant.

Habitat manipulation such as drawdowns and dredging can also be used to manage curly-leaf pondweed. Fall drawdown can kill the plants by exposing them to freezing temperatures and dessication. Dredging can be used as a control by increasing the water depth. In deep water, the plants do not receive enough light to survive. This method can be detrimental to desired plants, as all macrophytes would be prevented from growing for many years. This high level of disturbance may also create favorable conditions for the invasion of other invasive species.

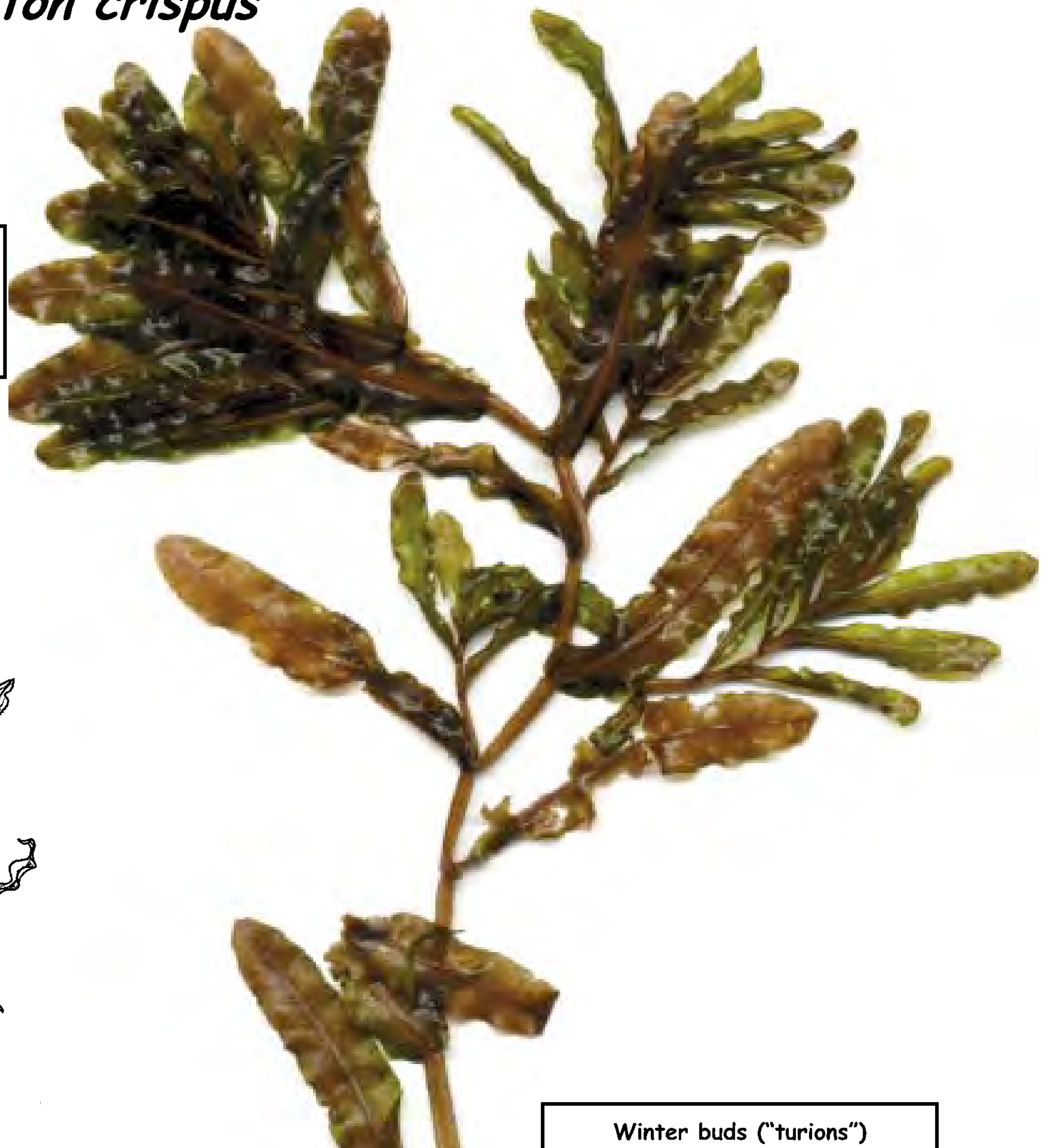
Most management options require a DNR permit. Before engaging in any aquatic plant management or nuisance control activities, contact your local Aquatic Plant Management Coordinator.
Visit www.dnr.wi.gov/org/water/fhp/lakes/aquaplan.htm for more information.

Curly-leaf Pondweed Publication (see Publications section for more information):

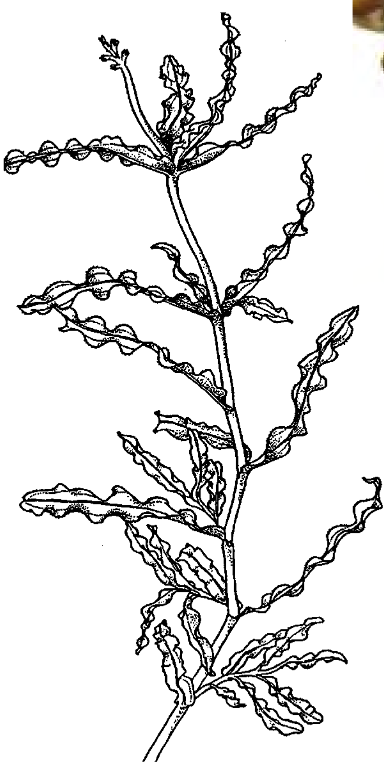
Curly-leaf Wild Card (DNR Publication number WT-759)

*See accompanying CD for curly-leaf pondweed article from Lake Line, a publication of the North American Lake Management Society.

Curly Leaf Pondweed
Potamogeton crispus



Illustrative view of Curly Leaf Pondweed
Note: Wavy leaves resemble lasagna noodles



Curly Leaf Pondweed
Single Leaf

2x

Note: Margins of leaf are serrated (finely-toothed)

Winter buds ("turions") resemble small brown pine cones
Actual size 4-5 cm

CURLY-LEAF PONDWEED
Potamogeton crispus L.

Curly-leaf pondweed is a non-native aquatic plant that can tolerate low temperature waters like those in its native region of northern Europe and Asia. It has proven to be a strong competitor with native species in Wisconsin lakes and streams, particularly in the spring and early summer when it gets a head start on the local competition. The first confirmed specimen of curly-leaf pondweed in the United States was collected in Delaware in the mid-1800's. By the turn of the century, it had spread along the East Coast from Virginia to Canada, and by the 1930's it was established in the Midwest. Currently, curly-leaf pondweed is found throughout the lower 48 states.

Description: This submersed aquatic plant has spaghetti-like stems that often reach the lake surface by mid-June. The oblong leaves attach directly to the stem in an alternate pattern. Leaf margins are wavy (resembling lasagna noodles) and finely toothed creating an overall leaf-texture that is "crispy." In spring, curly-leaf produces flower spikes that stick up above the water surface. The small flowers are arranged in a dense terminal spike on a curved 1-2 inch (25-50 mm) stalk. By June, nutlets (achenes) are mature on the stalks and may drop to the sediment. These seeds play a relatively small role in reproduction compared to their vegetative winter buds, or turions. Turions look like small brown pinecones and are produced in great numbers by mid-summer on shortened branchlets along the stem. Studies of curly-leaf beds in lakes have shown as many as 1600 turions in a one square yard (.8 m) plot. The germination rate for these turions is high, ranging from 60% to 80%.

Habitat: Curly-leaf is considered a deep-water plant. However, in a lake where it is dominant, a bed of curly-leaf may start in 1-2 feet (30-60 cm) of water and extend out to depths of 10-12 feet (3-4 m) or more. This plant has a competitive advantage over many native species because it can tolerate low light conditions, both in the summer during algal blooms and during winter under ice and snow cover. It has been found growing beneath 20 inches (50 cm) of ice and a heavy blanket of snow. The cool water adaptations of curly-leaf set it apart from other Wisconsin aquatic plants. It is actively growing under the ice while most plants are dormant, but dies back in mid-July when other aquatic plants are just reaching their peak growth for the year. In lakes where curly-leaf is dominant, the summer die-off causes increased nutrient levels that can lead to habitat disturbance and degraded water quality (algal blooms).

Management and Control: Curly-leaf pondweed provides food for ducks and valuable winter and spring habitat for fish and invertebrates. These values are overshadowed when curly-leaf dominates a plant population because summer die-off leaves little habitat for the rest of the season and causes increased nutrient levels leading to algal blooms. Selective control of curly-leaf stands and protection or restoration of native species can lead to a balanced plant population. Protecting water quality will also help keep curly-leaf in check because it has a competitive advantage over native plants when water clarity is reduced.

Information adapted from the following source:
Borman, S. Curlyleaf Pondweed. Lake Tides 20(1). pp 5-6.

Exhibit C. History of Herbicide Treatments

1999 Demonstration Sonar Treatment - The October 12, 1999, Sonar treatment was basically an experimental project. Only a few lakes in Wisconsin were used for this testing program. The 10.375 gallons of Sonar (Fluridone) treatment was effective for approximately 2.5 years before the Milfoil became nearly impossible to navigate by swimmers, boats, canoes or other watercraft. Sonar is the trade name for fluridone whose generic name is: 1-methyl-3-phenyl-5-3-(trifluoromethyl)phenyll-41Hl-pyridinone.

The manufacturer of Sonar states that their product provides selective control of aquatic plants...*"Sonar selectively manages problem weeds for a year or longer, with minimal risk to the environment. That makes water usable for recreation, brings the fish population back into balance and restores property values. Water can be enjoyed the way it used to be, because even directly after application, Sonar won't restrict swimming, fishing or drinking. No other aquatic herbicide provides this flexibility."*

Sonar was sprayed into the lake by trained certified applicators who use a GPS (global positioning system) as a navigational guide so that the herbicide is evenly spread throughout the entire lake.

2000 - No treatment was needed. The Sonar applied last year appeared to be very effective.

2001 - Again, no treatment was required, but Eurasian Water Milfoil was becoming more abundant.

In 2002 - Milfoil was once again becoming abundant, so the Village of Random Lake repaired their old weed cutter and harvested some of the weeds so that the lake was again navigable. The Aron Associates report summarized the effectiveness of the 1999 Sonar treatment.

2003 - A permit was applied for use of Fluridone to conduct a whole-lake treatment to reduce the Eurasian watermilfoil population. However, it was determined that treating the entire lake was not necessary, the permit was withdrawn and the DNR returned the $1,270.00 fee. A smaller treatment area of 38 acres was then proposed, the permit was obtained and the treatment of the 38 acres occurred on June 6th using Weedar 64, which is a liquid version of 2,4-D. A $970.00 fee was submitted for this second permit application.

2004 - 2,4-D Treatment - A permit was applied for on June 25th for 44 acres at $25.00/acre to spray the herbicide 2,4-D which was applied on June 30th.

Field data sheets before the spraying showed that the dissolved oxygen curve was the typical S-shaped curve for that time of the year. More sampling was done on July 9th (nine days after spraying); then July 14th and again on July 28th. It was interesting to note that the lower 8 feet of the lake had zero dissolved oxygen levels on July 9th and recovery of oxygen levels took nearly a month. It was also interesting to note that in the "North Basin" dissolved oxygen levels were still normal even though lower levels at the "Deep Hole" were at zero. The 2,4-D treatment kept the lake very usable during the 2004 season, but the Eurasian Water Milfoil plants were reappearing during late summer.

On September 7, 2004, Random Lake signed a "Lake Protection Agreement" with Aron and Associates which covered from May 1, 2004 through December 31, 2008 for a total cost of $98,330.00 - fifty percent would be paid by state aid.

2005 Sonar Treatment - A permit was signed on February 11th for an entire lake treatment. May 5, 2005, was the second time that Random Lake was sprayed with an herbicide called "Sonar" for treatment of Eurasian Water Milfoil by Marine Biochemists of Mequon. 5.2 gallons of Sonar were applied to treat all 209 acres.

The applied concentration of Sonar was 6 ppb (six parts per billion) - a very dilute concentration. Six samples of lake water were taken after the initial application - to determine whether the concentration remained high enough to be effective - on May 9th and 19th: June 6th and 20th; and July 5th and 19th. The water level at the time of application was one inch above the average level. Some of the herbicide may have "flushed" from the lake because it was found that a second 6 ppb application on May 31st was necessary to keep the concentration at an effective level.

Sonar treatments were very expensive, but it provided conditions that made Random Lake usable for multiple purposes. During the entire summer of 2005, the lake was cleared of Eurasian Water Milfoil. Only positive comments could be heard about the condition of the lake this season.

2006 - During each day of lake monitoring (usually every eighth day) the entire lake was searched for EWM and none was found during the entire season even into late fall. However, on August 25, 2006, one milfoil plant was found in the southeast part of the lake. Luckily, it was a Whorled Water Milfoil (*Myriophyllum verticillatum*) plant, a native milfoil species considered as a beneficial plant.

As a result of the Sonar treatment in 2005 to eliminate the EWM, other native species became more abundant. There were numerous varieties of pondweed (*Potamogeton*) especially Sago Pondweed (*Potamogeton pectinatus*), Curly-leaf Pondweed (*Potamogeton crispus*), Large-leaf Pondweed (*Potamogeton amplifolius*) and several other species. In the shallower waters at the bottom of the lake there appeared to be more Chara (also called Muskgrass or Stonewort), a plant that often is encrusted by calcium carbonate, giving the plant a harsh, crusty feel.

Aron & Associates compiled another Aquatic Plant Survey booklet which was a followup study of the Sonar chemical treatment.

2007 - 1.6 acres of lake were treated with 2,4-D to touch up some spots at the northeast end of the lake near the fish refuge area. Otherwise the milfoil population was under control from the 2005 "Sonar" herbicide treatment.

2008 - Only small areas were treated with 2,4-D on July 1st. Otherwise the milfoil population was "under control" from the 2005 "Sonar" herbicide treatment with more sprigs of milfoil spreading into new areas this year. Most Eurasian Water Milfoil (EWM) plants were dying but new, fresh plants were reappearing northwest and due east of the swimming beach, north of the public pier, at Conger's property and at the northwest end of the north basin on July 21st.

2009 - Native milfoil (Wisconsin has seven native species) was floating on the surface on May 12th, but dormant EWM could be seen below the surface. On May 29th EWM was healthy and increasing in abundance. On June 13th the Village President Bob McDermott, the weed applicator, and I surveyed the lake for EWM. On the July 7th regular survey, the EWM appeared to be more abundant than the past two years. Marine Biochemists from Mequon got a permit to treat twenty (20) acres at $25.00/acre (A permit was signed on June 24, 2009) . On July 14th the 2,4-D spray treatment occurred. A short time later, most EWM turned tan in color as well as some pond weeds.

2010 - It was difficult to find Eurasian Water Milfoil for most of the summer except for a couple of sprigs of native milfoil found floating at the surface on July 26th. On August 4th cyanobacteria (*Planktothrix rubescens*), commonly referred to as "blue-green algae" were discovered and identified especially along the southeastern part of the "Deep Hole." This is the first time that these organisms were ever noticed or identified in this lake. (See "THE NOTORIOUS BLUE-GREENS" in this report.) While monitoring the lake on August 27th two new sites were discovered containing EWM - near the Harden and the Taylor residences. A permit for spraying less than 50 acres at $20.00/acre for a total of $1,250.00 was signed on April 30, 2010.

2011 - On August 18th Navigate was used to treat ten (10) acres The permit was signed on July 20th. Navigate is an aquatic granular formulation of 2,4-D or 2,4-Dichlorophenoxyacetic acid. Eight days later, the Eurasian Water Milfoil had turned to a light tan color with very little green. Many milfoil leaflets were floating near the surface. Only a few plants were missed by the spray application - located about six lots east of the swimming beach. A second episode of *Planktothrix rubescens* appeared on July 25th.

2012 - A permit was applied for on June 24 for treatment of 50 acres at $25.00/acre for $1,240.00 total. On June 14, 2012, the lake was treated with Navigate to control Eurasian Water Milfoil. By June 29th, EWM plants were no longer green. However, most native (Northern) milfoil appeared to be healthy. The water surface temperature was very warm around the time of the Navigate treatment. On July 6th the water surface temperature reached 92ºF (the highest ever recorded since our Lake Monitoring Program began). One wonders which had the greatest effect on destroying the EWM...the extreme temperature or the Navigate spray, or both? While monitoring on July 15th it was noted that EWM was a tan/ brown color, indicating its destruction. During the month of August the native (Northern) milfoil increased rapidly, there appeared to be more than ever seen in any other year.

2013 - On June 25 the lake was treated with Navigate to control Eurasian Water Milfoil. See Warning - Pesticide Treatment Area poster. Monitoring comments about EWM as written in field notes on:

July 2: "EWM sprayed 1 week ago - much gray to brown EWM, but some had more green than expected."

July 10: "EWM still abundant east of Bear's property; most other EWM is greatly reduced."

July 18: "EWM not found from beach to Bear's property, but much dying EWM along Taylor's & Mayer's property."

July 26: "EWM no longer at Taylor's or Mayer's property - either the recent spray job killed them or the high temperature put them into dormancy."

August 3: "much dead EWM floating; only one live EWM plant at Mayer's."

August 11: "no visible live EWM anywhere."

August 19: "some fresh Northern Milfoil and Common Bladderwort; EWM mostly dormant at fishery otherwise there was none."

August 27: "EWM very sparse."

September 4: "EWM reappearing at public pier, Taylor's & Mayer's; 3 entire milfoil plants were floating in a cluster at site #1 (Deep Hole) - 2 were Northern Milfoil 1 was green EWM"

September 13: "EWM is re-establishing at public pier, DeLuca's, Mayer's, Taylor's, swimming area, at end of "point" and along fish reserve."

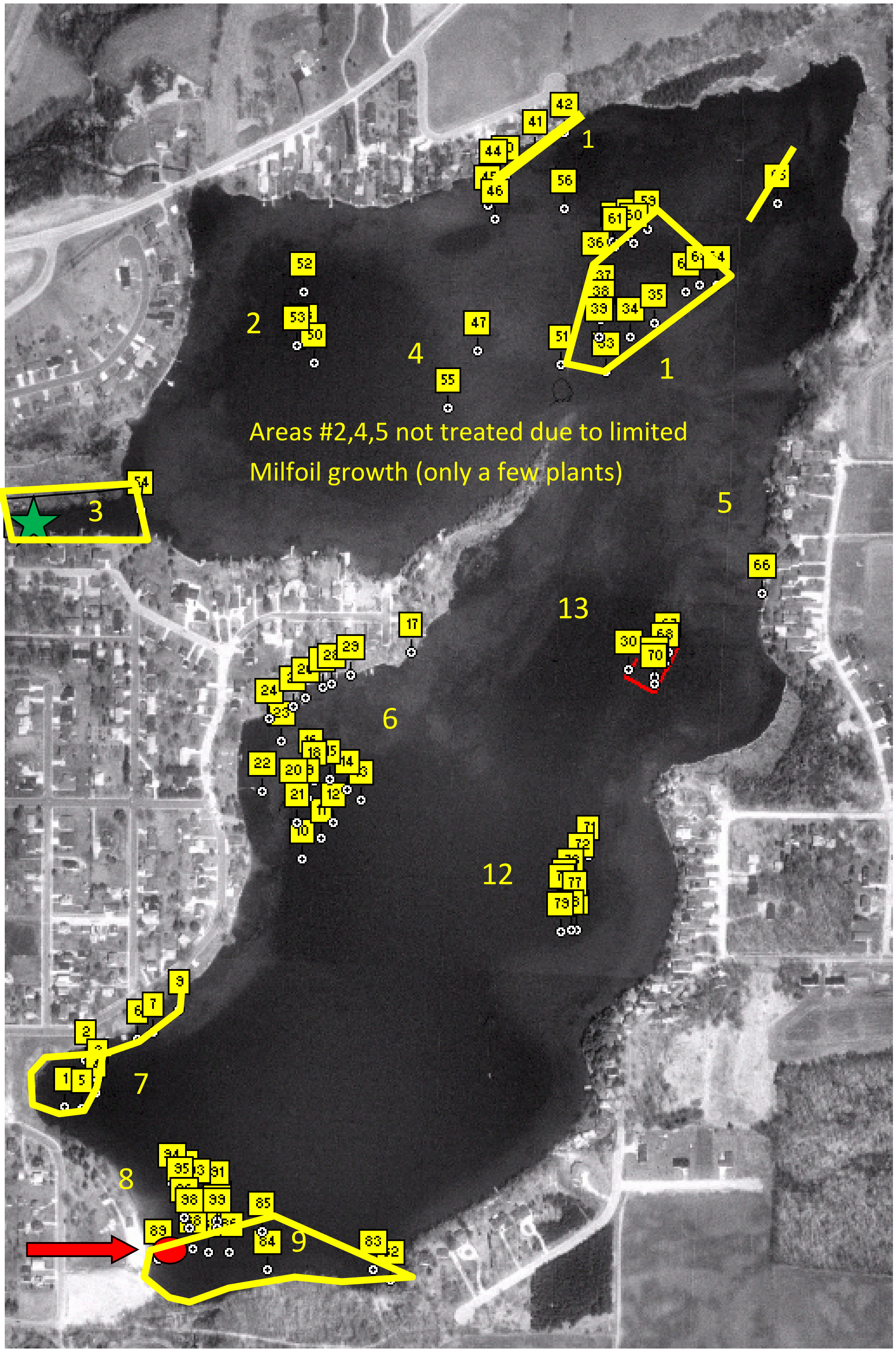
October 2: "EWM abundant at Mayer's. Taylor's and empty lot - otherwise mostly scattered."

Random Lake—Sheboygan County, WI

July 9, 2014 Treatment Map

★ Algae Treated with-Cutrine-Plus for Filamentous Algae.

Location	Acres
1	4.2
2	0
3	1.25
4	0
5	0
6	3.8
7	3.5
8	0.75
9	4.00
10	0.00
11	0.00
12	0.70
13	1.7
	19.9



Treated with Harvester and Aquathol-K for all species adjacent to Beach (0.4 acre)

Note: No Curlyleaf Pondweed Present (dies back by 4th of July)

Marine Biochemists
6302 W. Eastwood Ct.
Mequon, WI 53092
www.marinebiochemists.com
(888) 558-5106

Aquatic Plant Management Herbicide Treatment Record

Notice: Completion of this form is a condition of WI DNR permits and provides records required by WDNR (NR107, WPDES 5.1) and DATCP (ATCP 29.21 & 29.22). The Department may not issue you future permits unless you complete and submit this form. Personally identifiable information required on this form is not likely to be used for purposes other than that for which it is originally collected. It may also be made available to requesters under Wisconsin Open Records law (ss. 19.31—19.39 Wis. Stats.).

Submit This Form: 1) Immediately if any unusual circumstances occurred during the treatment, 2) As soon as possible, no later than 30 days after treatment, 3) By October 1 if no treatment occurred

Completion of this form along with the Permit satisfies the requirements of WDNR **WDNR (NR107, WPDES 5.1) and DATCP (ATCP 29.21 &**

General Permit Information **Waterbody name (including ponds, eg., Smith Pond and Address)** **Treatment Information**

Permit Number	Waterbody	Treatment Date	Start Time	End Time
SE 2014 60 903	Random Lake (Village of)	7/9/14	0830	1530
County: Sheboygan		Water Temp (F): 76	Air Temp (F): 71 82	Wind Speed & Direction: 5 NW
Treatment Area Size (Acres): 19.9 acres total	Avg. Depth (Ft.): 4-5'	Dissolved Oxygen (ppm):	On Site DNR Supervision Present? ☐ Yes ☒ No If yes, Supervisor Name:	

Visual Observations/Notes: Treated portions of/all of the following Permit Areas: 1,3,6,7,9 (liquid 2,4-D), 8,12,13 (granular 2,4-D). Also treated area #3 for algae and Native Species in Beach Area (0.4 acre) No Adverse Conditions Noted

Water Use Restriction Signs Posted in Accordance with NR107? ☒ Yes ☐ No 1 day swimming, 21 days irrigation

Note: Applicator Shall Provide Customer free copy of pesticide label used upon request

Name of Applicator(s)		Certification #	License #
Paul Hinterberg	☐	89833	440931
Jim Kannenberg	☐	28668	224269
Tom Lloyd	☐	53869	146250
Marc Schmitz	☐	77687	280174
Brian Suffern	☒	1517	142402
	☐		

Application Business Information
Marine Biochemists
6302 W. Eastwood Ct.
Mequon, WI 53092
(888) 558-5106

Name of Person Completing Form Brian J Suffern

Date 7/9/14

Pond	Product Used	E.P.A. Registration No.	Quantity Applied	Concentration (ppm) Or Rate (gal./acre) Applied
A. ☐ B. ☐ C. ☐ D. ☐	Aquathol-K	70506-176	1.25 gal	1.5 ppm to .4A/3'
A. ☐ B. ☐ C. ☐ D. ☐	Clearigate	8959-51		
A. ☐ B. ☐ C. ☐ D. ☐	Cutrine-Plus	8959-10	3.0 gal	0.2 ppm to 1.25A/4' (Algae)
A. ☐ B. ☐ C. ☐ D. ☐	DMA4-IVM	62719-3	90.5 gal	2 ppm to ~16.8A/4' Milfoil
A. ☐ B. ☐ C. ☐ D. ☐	Harpoon	8959-54		
A. ☐ B. ☐ C. ☐ D. ☐	Harvester	100-1091-8959	0.5 gal	1 gal/acre
A. ☐ B. ☐ C. ☐ D. ☐	Hydrothol 191	70506-175		
A. ☐ B. ☐ C. ☐ D. ☐	Navigate	228378959	450#	150#/acre to 3.1 acres (Milfoil)

Contract Type: Per Treatment ☐ **Seasonal** ☐

FOR OFFICE USE ONLY

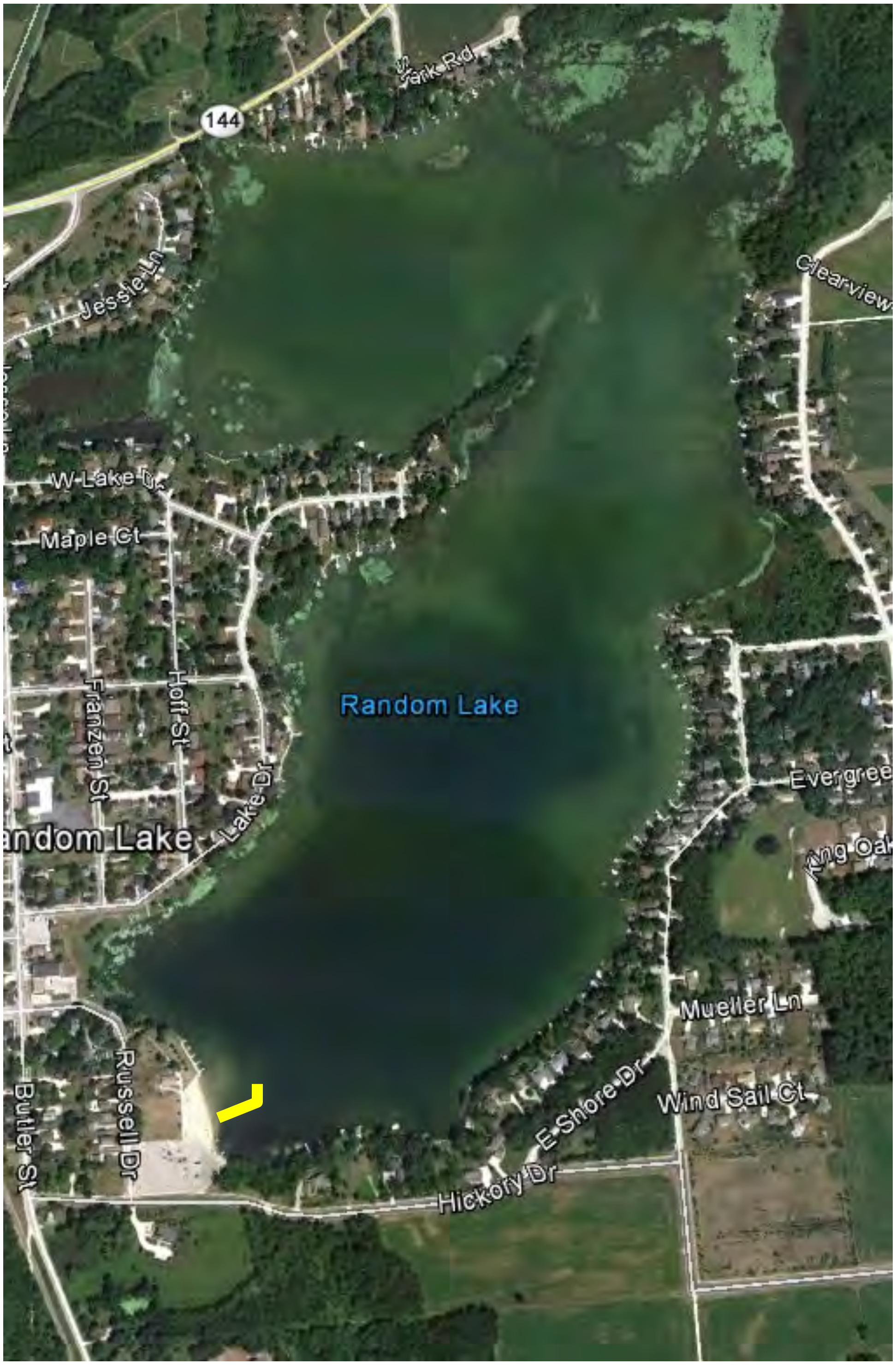
Product/Item Code **Amount** **Customer #**

Additional Instructions For Invoicing:

MB 5/14

Random Lake-Sheboygan County

August 5, 2014 Treatment Areas



Treatment Area (shown in Yellow): 0.34 Acres/3 ft.   Aquathol-K: 2 gal. (3 ppm)
Cutrine-Plus: 0.75 gal. (0.25 ppm) Harvester: 0.5 gal (1.5 gal/acre)

Marine Biochemists
6302 W. Eastwood Ct.
Mequon, WI 53092
(888) 558-5106
www.marinebiochemists.com

Aquatic Plant Management Herbicide Treatment Record

Notice: Completion of this form is a condition of WI DNR permits and provides records required by WDNR (NR107, WPDES 5.1) and DATCP (ATCP 29.21 & 29.22). The Department may not issue you future permits unless you complete and submit this form. Personally identifiable information required on this form is not likely to be used for purposes other than that for which it is originally collected. It may also be made available to requesters under Wisconsin Open Records law (ss. 19.31—19.39 Wis. Stats.).

Submit This Form: 1) Immediately if any unusual circumstances occurred during the treatment, 2) As soon as possible, no later than 30 days after treatment, 3) By October 1 if no treatment occurred

Completion of this form along with the Permit satisfies the requirements of WDNR **WDNR (NR107, WPDES 5.1) and DATCP (ATCP 29.21 &**

Treatment 9 AM
Lake Survey 11 AM

General Permit Information **Waterbody name (including ponds, eg., Smith Pond and Address)** **Treatment Information**

Permit Number: SE 2014-60-903	Random Lake	Treatment Date: 8/5/14	Start Time: 0815	End Time: 0900
County: Sheboygan	Village of Random Lake	Water Temp (F): 78	Air Temp (F): 72	Wind Speed & Direction: <5 NE
Treatment Area Size (Acres): 0.34 A	Avg. Depth (Ft.): 3'	Dissolved Oxygen (ppm):	On Site DNR Supervision Present? ☐ Yes ☒ No If yes, Supervisor Name:	

Visual Observations/Notes: Conducted treatment for control of native plant species adjacent to swim area. While area immediately south of beach had improved somewhat, I decided to re-treat it as well as an area running parallel to Beach just outside of swim area markers for dense growth of Variable leaf Pondweed, Sago Pondweed, etc. No Adverse Conditions Noted

Water Use Restriction Signs Posted in Accordance with NR107? ☒ Yes ☐ No

Note: Applicator Shall Provide Customer free copy of pesticide label used upon request

Name of Applicator(s)		Certification #	License #
Paul Hinterberg	☐	89833	440931
Jim Kannenberg	☐	28668	224269
Tom Lloyd	☐	53869	146250
Marc Schmitz	☐	77687	280174
Brian Suffern	☒	1517	142402
Travis Lanser	☐		

Application Business Information
Marine Biochemists
6302 W. Eastwood Ct.
Mequon, WI 53092
(888) 558-5106

Name of Person Completing Form Brian J Suffern

Date 8/5/14

Pond	Product Used	E.P.A. Registration No.	Quantity Applied	Concentration (ppm) Or Rate (gal./acre) Applied
A. ☐ B. ☐ C. ☐ D. ☐	Aquathol-K	70506-176	2 gal	3 ppm
A. ☐ B. ☐ C. ☐ D. ☐	Clearigate	8959-51		
A. ☐ B. ☐ C. ☐ D. ☐	Cutrine-Plus	8959-10	0.75 gal	~0.25 ppm
A. ☐ B. ☐ C. ☐ D. ☐	DMA4-IVM	62719-3		
A. ☐ B. ☐ C. ☐ D. ☐	Harpoon	8959-54		
A. ☐ B. ☐ C. ☐ D. ☐	Harvester	100-1091-8959	0.5 gal	~1.5 gal/acre
A. ☐ B. ☐ C. ☐ D. ☐	Hydrothol 191	70506-175		
A. ☐ B. ☐ C. ☐ D. ☐				

Contract Type: Per Treatment ☐ **Seasonal** ☐

FOR OFFICE USE ONLY

Product/Item Code ____________ **Amount** ____________ **Customer #** ____________

Additional Instructions For Invoicing: ____________

MB 5/14

Random Lake-Sheboygan County

August 18, 2014 Treatment Areas

Areas 5,7,9 treated w/ DMA4-IVM (liquid) at concentration of 2 ppm.   Total 4.1 A/4.5' , 25.5 gal.
Areas 1-4 treated with Navigate Herbicide (granular) at 100#/acre. Total 1.5 acres. 150# Product.

Marine Biochemists
6302 W. Eastwood Ct.
Mequon, WI 53092
(888) 558-5106

Aquatic Plant Management Herbicide Treatment Record

Notice: Completion of this form is a condition of WI DNR permits and provides records required by WDNR (NR107, WPDES 5.1) and DATCP (ATCP 29.21 & 29.22). The Department may not issue you future permits unless you complete and submit this form. Personally identifiable information required on this form is not likely to be used for purposes other than that for which it is originally collected. It may also be made available to requesters under Wisconsin Open Records law (ss. 19.31—19.39 Wis. Stats.).

Submit This Form: 1) Immediately if any unusual circumstances occurred during the treatment, 2) As soon as possible, no later than 30 days after treatment, 3) By October 1 if no treatment occurred

Completion of this form along with the Permit satisfies the requirements of WDNR **WDNR (NR107, WPDES 5.1) and DATCP (ATCP 29.21 &**

General Permit Information **Waterbody name (including ponds, eg., Smith Pond and Address)** **Treatment Information**

Permit Number	Waterbody	Treatment Date	Start Time	End Time
SE 2014 60 903	Random Lake	8/18/14	8:45	1130
County: Sheboygan	c/o Village of Random Lake	Water Temp (F): 74°F	Air Temp (F): 75°F	Wind Speed & Direction: 5 SE

Treatment Area Size (Acres)	Avg. Depth (Ft.)	Dissolved Oxygen (ppm)	On Site DNR Supervision Present?
5.6 acres	4.5'		☐ Yes ☒ No If yes, Supervisor Name:

Visual Observations/Notes: Target Species: Eurasian Watermilfoil
Treated all/or portions of Pre-Treatment Map Areas 1 thru 5, 7 and 9. Areas 5, 7, 9 (total of 4.1 acres) were treated with DMA4 (liquid). Areas 1-4 (1.5 acres total) treated with Navigate (granular)

Water Use Restriction Signs Posted in Accordance with NR107? ☒ Yes ☐ No 1 day swimming 21 days irrigation

Note: Applicator Shall Provide Customer free copy of pesticide label used upon request

Name of Applicator(s)		Certification #	License #
Paul Hinterberg	☐	89833	440931
Jim Kannenberg	☐	28668	224269
Tom Lloyd	☐	53869	146250
Marc Schmitz	☐	77687	280174
Brian Suffern	☒	1517	142402
Travis Linsen	☒	95401 ~~[illegible]~~ 4	299674

Application Business Information
Marine Biochemists
6302 W. Eastwood Ct.
Mequon, WI 53092
(888) 558-5106

No Adverse Conditions observed

Name of Person Completing Form Brian Suffern

Date 8/18/14

Pond	Product Used	E.P.A. Registration No.	Quantity Applied	Concentration (ppm) Or Rate (gal./acre) Applied
A. ☐ B. ☐ C. ☐ D. ☐	Aquathol-K	70506-176		
A. ☐ B. ☐ C. ☐ D. ☐	Clearigate	8959-51		
A. ☐ B. ☐ C. ☐ D. ☐	Cutrine-Plus	8959-10		
A. ☐ B. ☐ C. ☐ D. ☐	DMA4-IVM	62719-3	25.5 gal	2 ppm to 4.1 acres/4.5' avg
A. ☐ B. ☐ C. ☐ D. ☐	Harpoon	8959-54		
A. ☐ B. ☐ C. ☐ D. ☐	Harvester	100-1091-8959		
A. ☐ B. ☐ C. ☐ D. ☐	Hydrothol 191	70506-175		
A. ☐ B. ☐ C. ☐ D. ☐	Navigate	228318 8959	150#	100#/acre to 1.5 acres

Contract Type: Per Treatment ☐ **Seasonal** ☐

FOR OFFICE USE ONLY

Product/Item Code ____________ **Amount** ____________ **Customer #** ____________

Additional Instructions For Invoicing: ____

MB 5/14

Exhibit D. Legal Notice

Lake Weed Spray
Thursday, June 11, 2015

NOTICE OF APPLICATION FOR
AQUATIC PLANT MANAGEMENT PERMIT

The Village of Random Lake intends to apply for a permit from the Wisconsin Department of Natural Resources to treat up to approximately 67 acres of water in Random Lake with aquatic pesticides to control algae and/or aquatic plants. The proposed treatment would occur between May 18 and September 30, 2015.

The Village of Random Lake will conduct a public informational meeting on the proposed treatment if five or more individuals, organizations, special units of government, or local units of government request one. The meeting would give interested parties a chance to learn more about the proposed treatment from the permit applicant. The Village of Random Lake is not required to, but may, change the proposed treatment based on information provided by citizens attending the meeting.

Any request for a public meeting on this proposed treatment must be made within five (5) days after this notice is published. The request must specify the topics to be discussed at the meeting, including the problems and alternatives, and must be sent in writing to The Village of Random Lake, PO Box 344, Random Lake, WI 53075 and to the Wisconsin Department of Natural Resources, 9531 Rayne Rd., Sturtevant, WI 53177.

This Public Notice is required by Chapter NR107, Wisconsin Administrative Code.

The Village of Random Lake

Approved Permit

Exhibit E. approved permit

State of Wisconsin DNR
DNR Department of Natural Resources
Water Permit Central Intake – attn. APM
PO Box 7185
Madison, WI 53707-7185

Chemical Aquatic Plant Control Application and Permit
Wisconsin Pollutant Discharge Elimination System (WPDES)
Pesticide Pollutant Permit Application
Form 3200-004 (R 03/13)

DNR Use Only	
ID Number: SE-2015-60-793	Permit Expiration Date: 10/1/2015
Waterbody #: 30300	Fee Received: 1270.00

Notice: Use of this form is required by the Department for any application filed pursuant to s. 281.17(2), Wis. Stats., and Chapters NR 107, 200 and 205, Wis. Adm. Code. This permit application is required to request coverage for pollutant discharge into waters of the state. Personally identifiable information on this form may be provided to requesters to the extent required by Wisconsin's Open Records Law [ss. 19.31-19.39, Wis. Stats.].

Section I – Applicant Information – Name of Permit Applicant. Also indicate names and addresses of all individuals, associations, communities or town sanitary districts sponsoring treatment. Attach additional sheets if necessary.

	Home Address	Lake Address
Name	Village of Random Lake	Village of Random Lake
Street Address	PO Box 344	PO Box 344
City	Random Lake	Random Lake
State	WI	WI
ZIP Code	53075	53075

APR 30 2015

Phone Number (include area code) Primary: (920) 994-4852 Secondary:
Email Address: rschmid@randomlake.org

Section II – Aquatic Plant Control Location

Waterbody to be Treated (waterbody where treatment area is located): Random Lake
Lake Surface Area: 209 acres
Estimated Surface Area that is 10 Feet or Less in Depth: 160 acres

County: Sheyboygan | Section: 26 | Township: 13 N | Range: 21 | ☒ E ☐ W
Latitude: | Longitude:

Is the waterbody a private pond? ☐ Yes ☒ No
Does the waterbody have public access? ☒ Yes ☐ No

Adjacent Riparian Property Owner Names (attach sheets if necessary)
1. See attached list
2.
3.
4.
5.
6.
7.

Name of Lake Property Owners' Association Representative or Lake District Representative (if none, please indicate): Rita Schmid, Clerk/Treasurer

Name of Applicator or Firm: Marine Biochemists
Street or Route: 6302 W Eastwood Ct
City: Mequon | State: WI | ZIP Code: 53092
County: Ozaukee | Phone Number (include area code): (262) 238-0406
Email Address: brian.suffern@lonza.com
Applicator Certification Number for Category 5 Aquatic Pesticide Application: 1517
Business Location License Number (if applicable): 93-010049-005505
Restricted Use Pesticide License Number (if applicable):

Area(s) Proposed for Control: (Note details in permit cover letter for final permitted sizes of treatment areas.)

	Treatment Length		Treatment Width		Estimated Acreage	Average Depth
A.	ft. X		ft. ÷ 43,560 ft^2 =			ft.
B.	ft. X		ft. ÷ 43,560 ft^2 =			ft.
C.	ft. X		ft. ÷ 43,560 ft^2 =			ft.
D.	ft. X		ft. ÷ 43,560 ft^2 =			ft.
E.	ft. X		ft. ÷ 43,560 ft^2 =			ft.

Total Estimated Acres
Total from lines A - E:
Total from Attached Sheets:
Grand Total: 66.4

If the estimated acreage is greater than 10 acres, or is greater than 10 percent of the estimated area 10 feet or less in depth in Section II, complete and attach Form 3200-004A, Large-Scale Treatment Worksheet. Private pond treatments are exempted from this requirement.

Is this area within or adjacent to a sensitive area designated by the Department of Natural Resources? ☐ Yes ☒ No

DNR Use: NHI Review? ☒ Yes ☐ No Describe: Conducted 5-5-15

Section III – Fees

1. s. NR 107.11(1), Wis. Adm. Code, lists the conditions under which the permit fee is limited to the $20 minimum charge.
2. s. NR 107.11(4), Wis. Adm. Code, lists the uses that are exempt from permit requirements.
3. s. NR 107.04(2), Wis. Adm. Code, provides for a refund of acreage fees if the permit is denied or if no treatment occurs.
4. Fee calculations: Basic Permit Fee (non-refundable) .... $ 20.00

   If proposed treatment is over 0.25 acre, calculate acreage fee:
   (round up to nearest whole acre, to maximum of 50 acres.)

   >50 acres X $25 per acre = $ 1250.00

   If proposed treatment is ≤ 0.25 acre, acreage fee is $0.

   Enter Acreage Fee (from above)........................ 1250.00

   Total Fee Enclosed .... $ 1,750.00

☐ **Site Map:** Attach a sketch or a printed map of lake indicating area and dimensions of each individual area where plant control is desired and flow of surface water outside treatment area. Also show location of property owners riparian to and adjacent to the treatment area. Attach a separate list of owners and corresponding treatment dimensions coded to the lake map, if necessary.

Section IV – Reasons for Aquatic Plant Control

Is this permit being requested in accordance with an approved Aquatic Plant Management Plan? ☒ Yes ☐ No

Treatment Type: ☒ Lake ☐ Pond ☐ Wetland ☐ Marina ☐ Other

Goal of Aquatic Plant Control:

- ☒ Reduce nuisance algae accumulation
- ☒ Maintain navigational channel for common use
- ☒ Maintain private access for boating
- ☒ Maintain private access for fishing
- ☒ Improve swimming
- ☐ Control of purple loosestrife
- ☒ Control of invasive exotics
- ☐ Other: ____________

Nuisance Caused By:

- ☒ Algae
- ☐ Emergent water plants (majority of leaves and stems growing above water surface, e.g. cattails, bulrushes)
- ☐ Floating water plants (majority of leaves floating on water surface, e.g., waterlilies, duckweed)
- ☒ Submerged water plants (leaves and stems below water surface, flowering parts may be exposed, e.g., milfoil, coontail)
- ☐ Other: ____________

List Target Plants

Note: Different plants require different chemicals for effective treatment. Do not purchase chemical before identifying plants.

Eurasian Watermilfoil, Curlyleaf Pondweed (lake-wide)
Native plant species in immediate swim/launch area only

Section V – Chemical Control

Alternatives to Chemical Control:	Feasible?	If No, Why Not?
1. Mechanical harvesting	☐ Yes ☒ No	May exacerbate problem by spreading weeds
2. Hand pulling	☐ Yes ☒ No	Too labor intensive for large and/or deep areas
3. Hand raking	☐ Yes ☒ No	Too labor intensive for large and/or deep areas
4. Hand cutting	☐ Yes ☒ No	Too labor intensive for large and/or deep areas
5. Sediment screens/covers	☐ Yes ☒ No	Cost-prohibitive for large areas
6. Dredging	☐ Yes ☒ No	Cost-prohibitive, with impact on non-target species
7. Lake drawdown	☐ Yes ☒ No	May not have desired results; limited possible drawdown
8. Nutrient controls in watershed	☐ Yes ☐ No	
9. Other:	☐ Yes ☐ No	

Note: If proposed treatment involves multiple properties, consider feasibility of EACH alternative for EACH property owner.

If you checked yes to any of the alternatives listed above, please explain your decision to use chemical controls:

Cost and effectiveness

Section V – Chemical Control (continued)

Trade Name of Proposed Chemical(s)
DMA4-IVM, Navigate, Aquathol-K, Aquathol Super K, Cutrine-Plus, Tribune (or Reward, Harvester)

Method of Application: Gasoline powered spray pump (liquids) Granular spreaders or blower (granular)

Will surface water outflow and/or overflow be controlled to prevent chemical loss? ☐ Yes ☒ No

Have the proposed chemicals been permitted in a prior year on the proposed site? ☒ All ☐ Some ☐ None

What were the results of the treatment?
Positive results for several years

Note: Chemical fact sheets for aquatic pesticides used in Wisconsin are available from the Department of Natural Resources upon request.

Section VI – Applicant Responsibilities and Certification

1. The applicant has prepared a detailed map which shows the length, width and average depth of each area proposed for the control of rooted vegetation and the surface area in acres or square feet for each proposed algae treatment.
2. The applicant understands that the Department of Natural Resources may require supervision of any aquatic plant management project involving chemicals. Under s. NR 107.07, Wis. Adm. Code, supervision may include inspection of the proposed treatment area, chemicals and application equipment before, during or after treatment. The applicant is required to notify the regional office 4 working days in advance of each anticipated treatment with the date, time, location and size of treatment unless the Department waives this requirement. Do you request the Department to waive the advance notification requirement? ☐ Yes ☒ No
3. The applicant agrees to comply with all terms or conditions of this permit, if issued, as well as all provisions of Chapter NR 107, Wis. Adm. Code. The required application fee is attached.
4. The applicant has provided a copy of the current application to any affected property owners' association, inland lake district and, in the case of chemical applications for rooted aquatic plants, to all owners of property riparian or adjacent to the treatment area. The applicant has also provided a copy of the current chemical fact sheet for the chemicals proposed for use to any affected property owner's association or inland lake district.

☒ Check if you are signing as Agent for Applicant. Note: Applicator Responsible for WPDES

I hereby certify that the above information is true and correct and that copies of this application have been provided to the appropriate parties named in Section II and that the conditions of the permit and pesticide use will be adhered to.

Signature of Applicant

4/27/2015
Date Signed

All portions of this permit, map and accompanying cover letter must be in possession of the chemical applicator at time of treatment. During treatment all provisions of Chapter NR 107, specifically ss. NR 107.07 and NR 107.08, Wis. Adm. Code, must be complied with, as well as the specific conditions contained in the permit cover letter.

Section VII – WPDES Permit Request

Is WPDES coverage being requested? Refer to http://dnr.wi.gov/topic/wastewater/aquaticpesticides.html for more information.

☐ No: ☐ Already have WPDES coverage until Sept. 2016 ☐ Yes – complete section VII with signature
☐ WPDES coverage not needed

Select which permit you are requesting: ☐ WI-0064556-1 Aquatic Plants, Algae & Bacteria
☐ WI-0064564-1 Aquatic Animals
☐ WI-0064581-1 Mosquitoes & other Flying Insects

Indicate WPDES permitee responsible for the pollutant discharge: ☐ Applicator ☐ Sponsor

Do you expect the pest control activity will result in a detectable pollutant discharge to waters of the state beyond the treatment area boundary or a pollutant residual in waters of the state after the treatment project is completed? ☐ Yes ☐ No

If yes, identify the pollutant(s): ____________________

Are you planning to incorporate integrated pest management principles, as specified in the WPDES permit, into your pest control activity to minimize any pollutant residual or pollutant discharge beyond the treatment area? ☐ Yes ☐ No

Type of WPDES coverage being requested: ☐ One Treatment Site ☐ Statewide Coverage

For informational purposes, select areas of WI for most of your aquatic treatments: ☐ NW ☐ NE ☐ SW ☐ SE

Is WPDES coverage being requested for more than 1 year?
☐ Yes ☐ No If yes, the permittee will remain in "active" WPDES status until a Notice of Termination is submitted.

I hereby certify that I am the authorized representative (as specified in Ch. NR 205.07(1)(g), Wis. Adm. Code) of the pest treatment activity which is the subject of this permit application. I certify that the information contained in this form and attachments is, to the best of my knowledge, true, accurate and complete.

Signature of Authorized Representative	Printed Name	Date Signed

Section VIII – Permit to Carry Out Chemical Treatment (Leave Blank – DNR Use Only)

The foregoing application is approved. Permission is hereby granted to the applicant to chemically treat the waters described in the application during the season of 20 15.

Application fee received? ☒ Yes ☐ No	State of Wisconsin Department of Natural Resources For the Secretary By ____________________ Regional Director or Designee
Advance notification of treatment required? ☒ Yes ☐ No	5-5-15 Date Signed 5-5-15 Date Mailed

Please Note:

If you believe that you have a right to challenge this decision, you should know that Wisconsin statutes and administrative rules establish time periods within which requests to review Department decisions must be filed.

For judicial review of a decision pursuant to ss. 227.52 and 227.53, Wis. Stats., you have 30 days after the decision is mailed or otherwise served by the Department, to file your petition with the appropriate circuit court and serve the petition on the Department. Such a petition for judicial review shall name the Department of Natural Resources as the respondent.

This notice is provided pursuant to s. 227.48(2), Wis. Stats.

To request a contested case hearing pursuant to s. 227.42, Wis. Stats., you have 30 days after the decision is mailed, or otherwise served by the Department, to serve a petition for hearing on the Secretary of the Department of Natural Resources. The filing of a request for a contested case hearing is not a prerequisite for judicial review and does not extend the 30-day period for filing a petition for judicial review.

Exhibit F

AQUATHOL® K

AQUATIC HERBICIDE

For aquatic plant control in quiescent, slow moving, and flowing water aquatic sites.

ACTIVE INGREDIENT:	
Dipotassium salt of endothall*	40.3%
OTHER INGREDIENTS:	59.7%
TOTAL	100.0%

Contains 4.23 lbs. dipotassium endothall* per gallon
*7-oxabicyclo [2.2.1]heptane-2,3-dicarboxylic acid equivalent 28.6%

KEEP OUT OF REACH OF CHILDREN

DANGER PELIGRO

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle. (If you do not understand the label, find someone to explain it to you in detail.)

FIRST AID

IF IN EYES:
- Hold eye open and rinse slowly and gently with water for 15-20 minutes.
- Remove contact lenses, if present, after the first 5 minutes, then continue rinsing.
- Call a poison control center or doctor for treatment advice.

IF SWALLOWED:
- Call a poison control center or doctor immediately for treatment advice.
- Have person sip a glass of water if able to swallow.
- Do not induce vomiting unless told by a poison control center or doctor.
- Do not give anything by mouth to an unconscious person.

IF ON SKIN OR CLOTHING:
- Take off contaminated clothing.
- Rinse skin immediately with plenty of water for 15-20 minutes.
- Call a poison control center or doctor for treatment advice.

IF INHALED:
- Move person to fresh air.
- If person is not breathing, call 911 or ambulance, then give artificial respiration, preferably mouth-to-mouth if possible.
- Call a poison control center or doctor for treatment advice.

HOT LINE NUMBER: Have the product container or label with you when calling a poison control center or doctor, or going for treatment. You may also contact 866-673-6671 (Rocky Mountain Poison Control Center) for emergency medical treatment information.

See inside for additional precautionary statements.

NOTE TO PHYSICIAN: Measures against circulatory shock, respiratory depression, and convulsion may be needed.

EPA Registration No. 70506-176

Batch/Lot No.: ________________

Net Contents: ________________

UPI

United Phosphorus, Inc.
630 Freedom Business Center, Suite 402
King of Prussia, PA 19406
1-800-438-6071

PRODUCT INFORMATION

Aquathol K is a liquid concentrate soluble in water which is effective against a broad range of aquatic plants. Dosage rates indicated for the application of Aquathol K are measured in parts per million (ppm) of dipotassium endothall.

PRECAUTIONARY STATEMENTS
HAZARDS TO HUMANS AND DOMESTIC ANIMALS
DANGER

CORROSIVE. CAUSES IRREVERSIBLE EYE DAMAGE. MAY BE FATAL IF SWALLOWED. HARMFUL IF INHALED OR ABSORBED THROUGH SKIN. DO NOT GET IN EYES, ON SKIN, OR ON CLOTHING. AVOID BREATHING VAPORS OR SPRAY MIST. PROLONGED OR FREQUENTLY REPEATED SKIN CONTACT MAY CAUSE ALLERGIC REACTIONS IN SOME INDIVIDUALS.

Personal Protective Equipment (PPE)

Mixers, Loaders, Applicators and other handlers must wear:

- Long-sleeved shirt and long pants,
- Shoes and socks,
- Chemical-resistant gloves made of any waterproof material,
- Protective eyewear,
- NIOSH-approved respirator with a dust/mist filter with MSHA/NIOSH approval number prefix TC-21C or any N, R, P, or HE filter.

  Exception: During application, the respirator need not be worn, provided that the pesticide is applied in a manner (such as direct metering or subsurface application from the rear of a vessel that is moving into the wind) such that the applicator will have no contact with the pesticide.

See Engineering Controls for additional requirements.

User Safety Requirements:

Follow the manufacturers' instructions for cleaning/maintaining PPE. If no such instructions for washables exist, use detergent and hot water. Keep and wash PPE separately from other laundry.

Discard clothing or other absorbent materials that have been drenched or heavily contaminated with this product's concentrate. Do not reuse them.

Engineering Controls:

When mixers and loaders use a closed system designed by the manufacturer to enclose the pesticide to prevent it from contacting handlers or other people AND the system is functioning properly and is used and maintained in accordance with the manufacturers written operating instructions, the handlers need not wear a respirator, provided the required respirator is immediately available for use in an emergency such as a spill or equipment breakdown.

When handlers use closed systems, enclosed cabs, or aircraft in a manner that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides [40 CFR 170.240(d)(4-6)], the handler PPE requirements may be reduced or modified as specified in the WPS.

User Safety Recommendations

User should:

- Wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet.
- Remove clothing/PPE immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.
- Remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

ENVIRONMENTAL HAZARDS

Do not contaminate water by cleaning of equipment or disposal of equipment washwaters.

This pesticide is toxic to mammals.

Treatment of aquatic plants can result in oxygen loss from decomposition of dead plants. This loss can cause fish suffocation. Water bodies containing very high plant density should be treated in sections to prevent suffocation of fish.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

Do not apply this product in a way that will contact workers or other persons, either directly or through drift.

- For quiescent or slow moving water treatments: Waters treated with Aquathol K may be used for swimming, fishing, and irrigating turf, ornamental plants and crops immediately after treatment with the following exceptions: Do not use the Aquathol K treated water to irrigate the following for 7 days after the treatment: annual nursery or greenhouse crops including hydroponics and newly seeded or transplanted annual crops, newly seeded or transplanted ornamentals, and newly sodded or seeded turf. Do not use treated water for animal consumption within the following periods:

  0.5 ppm dipotassium salt – 7 days after application

  4.25 ppm dipotassium salt – 14 days after application

  5.0 ppm dipotassium salt – 25 days after application
- For flowing water treatments: Waters treated with Aquathol K may be used for swimming, fishing, livestock watering, and irrigating turf, ornamental plants and crops immediately after treatment with the following exceptions: Do not use the Aquathol K treated water to irrigate the following: annual nursery or greenhouse crops including hydroponics and newly seeded or transplanted annual crops, newly seeded or transplanted ornamentals, and newly sodded or seeded turf.
- Phytotoxicity is not expected on plants or crops irrigated with Aquathol K treated water, however, all species and cultivars (varieties) have not been tested.
- Undiluted Aquathol K may be injurious to crops, grass, ornamentals, and other foliage.
- Do not use Aquathol K treated water for chemigation as interactions between Aquathol K and other pesticides and fertilizers are not known.
- Do not use Aquathol K in brackish or saltwater.
- Wash out spray equipment with water after each operation.
- Avoid contact of spray concentrate (product) directly or by drift with non-target plants or crops as injury may result.

HOW TO APPLY:

Aquathol K is a contact herbicide; consequently, apply when target plants are present.

Aquathol K should be sprayed on the water or injected below the water surface. It may be applied as a concentrate or diluted with water depending on the equipment.

In instances where the plant(s) to be controlled is an exposed surface problem (i.e., some of the broad-leaved pond weeds) coverage is important. For best results, apply the concentrate with the least amount of water compatible with the application equipment.

Drinking Water (Potable Water)

Consult with appropriate state or local water authorities before applying this product to public waters. State or local agencies may require permits.

The drinking water (potable water) restrictions on this label are to ensure that consumption of water by the public is allowed only when the concentration of endothall acid in the water is less than the MCL (Maximum Contamination Level) of 0.1 ppm. Applicators should consider the unique characteristics of the treated waters to assure that endothall acid concentrations in potable drinking water do not exceed 0.1 ppm at the time of consumption.

For Lakes, Ponds, and other Quiescent Water Bodies:

- For Aquathol K applications, the drinking water setback distance from functioning potable water intakes in the treated water body must be greater than or equal to 600 feet.
- Note: Existing potable water intakes that are no longer in use, such as those replaced by a connection to a municipal water system or a potable water well, are not considered to be functioning potable water intakes.

For Irrigation Canals and other Flowing Water Bodies:

- Applicator is responsible to assure that treated water does not enter potable water intakes. For Aquathol K applications, potable water intakes must be closed when treated water is present at the intake. In the event the water intake cannot be closed, treatments must only be made downstream from the intake in order to assure Aquathol K treated water does not enter the potable water system.

QUIESCENT OR SLOW MOVING WATER TREATMENTS: SURFACE OR INJECTED APPLICATIONS

For aquatic plant control in quiescent or slow moving water, Aquathol K recommended use rates can be found in the following chart. Since the active ingredient is water soluble and tends to diffuse from the treated area, select the dosage rate applicable to the area to be treated. Marginal treatments of large bodies of water require higher rates as indicated.

Use higher labeled rates of Aquathol K when making treatments to small areas with an increased potential for rapid dilution or when treating narrow areas such as boat lanes or shoreline treatments where dilution may reduce the exposure of plants to Aquathol K.

Use lower labeled rates of Aquathol K for large contiguous treatment blocks or in protected areas such as coves where reduced water movement will not result in rapid dilution of Aquathol K from the target treatment area or when treating entire lakes or ponds.

PLANTS CONTROLLED AND AQUATHOL K DOSAGE RATE CHART

	APPLICATION RATE			
	Entire Pond/Lake or Large Area Treatment		Spot or Lake Margin Treatment	
Aquatic Plant	**ppm Dipotassium Endothall**	**gallons Aquathol K per Acre Ft.**	**ppm Dipotassium Endothall**	**gallons Aquathol K per Acre Ft.**
Bur Reed, Sparganium spp.	3.0-4.0	1.9-2.6	4.0-5.0	2.6-3.2
Coontail, Ceratophyllum spp.	2.0-3.0	1.3-1.9	3.0-5.0	1.9-3.2
Horned Pondweed, Zannichellia palustris	2.0-3.0	1.3-1.9	3.0-5.0	1.9-3.2
Sago Pondweed, Stuckenia pectinata	1.0-2.0	0.6-1.3	2.0-5.0	1.3-3.2
Hydrilla, Hydrilla verticillata	1.0-4.0	0.6-2.6	2.0-5.0	1.3-3.2
Hygrophila*, Hygrophila polysperma	4.0-5.0	2.6-3.2	5.0	3.2
Milfoil, Myriophyllum spp.	2.0-3.0	1.3-1.9	3.0-5.0	1.9-3.2
Naiad, Najas spp.	2.0-4.0	1.3-2.6	3.0-5.0	1.9-3.2
Pondweed, Potamogeton spp.	0.75-3.0	0.45-1.9	1.5-5.0	1.0-3.2
Including:				
American, P. nodosus	2.0-3.0	1.3-1.9	3.0-5.0	1.9-3.2
Largeleaf (Bass Weed), P. amplifolius	2.0-3.0	1.3-1.9	3.0-5.0	1.9-3.2
Curlyleaf, P. crispus	0.75-1.5	0.45-1.0	1.5-5.0	1.0-3.2
Flatstem, P. zosteriformis	2.0-3.0	1.3-1.9	3.0-5.0	1.9-3.2
Floating-leaf, P. natans	1.0-2.0	0.6-1.3	2.0-5.0	1.3-3.2
Illinois, P. Illinoensis	1.5-2.5	1.0-1.6	2.5-5.0	1.6-3.2
Narrowleaf, P. pusillus	1.0-2.0	0.6-1.3	2.0-5.0	1.3-3.2
Threadleaf, P. filiformis	2.0-3.0	1.3-1.9	3.0-5.0	1.9-3.2
Variable Leaf, P. diversifolius	1.0-2.0	0.6-1.3	2.0-5.0	1.3-3.2
Parrotfeather, Myriophyllum aquaticum	2.0-3.0	1.3-1.9	3.0-5.0	1.9-3.2
Water Stargrass, Heteranthera spp.	2.0-3.0	1.3-1.9	3.0-5.0	1.9-3.2

* Suppression only

The following charts indicate the quantity of Aquathol K to be applied.

Gallons of Aquathol K to Treat One Acre-Foot of Water

	Rate (ppm)						
	0.75	**1.0**	**1.5**	**2.0**	**3.0**	**4.0**	**5.0**
	gallons/A-ft.						
1 acre ft.	0.45	0.6	1.0	1.3	1.9	2.6	3.2

Fluid Ounces of Aquathol K to Treat 1,000 Square-Feet per Foot of Depth

	Rate (ppm)						
	0.75	**1.0**	**1.5**	**2.0**	**3.0**	**4.0**	**5.0**
	fl. oz./1,000 ft.^{2}						
1,000 ft.^{2}	1.4	1.9	2.8	3.8	5.7	7.6	9.4

FLOWING WATER TREATMENTS (WITH THE EXCEPTION OF IRRIGATION CANALS): DRIP OR METERING SYSTEM APPLICATIONS

For aquatic plant control in flowing water, Aquathol K recommended use rates can be found in the following chart. Apply Aquathol K in a manner to achieve the desired rate and adequate mixing so product is distributed throughout the entire water column. Adequate concentration (rate) and exposure time (length of treatment) will impact Aquathol K efficacy on the target plant species. Although Aquathol K is a contact herbicide adequate exposure time is critical. The rates and the length of treatment are guidelines to control the target species. The following rate chart has been developed based on Concentration Exposure Time (CET) data for Aquathol K. The CET concept allows rates and the length of exposure to be adjusted for different treatment scenarios.

AQUATHOL K APPLICATION RATES FOR FLOWING WATER TREATMENTS

	Length of Treatment (hours)							
	6	**8**	**12**	**18**	**24**	**36**	**48**	**72**
Plant Species	Rate (ppm)							
Pondweeds (Potamogeton spp.) Sago Pondweed (Stuckenia pectinata)	4.0-5.0	3.0-4.0	2.0-3.0	1.5-2.5	1.0-2.0	0.75-1.5	0.5-1.0	0.5
Milfoil (Myriophyllum spp.) Parrotfeather (Myriophyllum aquaticum) Coontail (Ceratophyllum spp.) Horned pondweed (Zannichellia spp.) Hydrilla (Hydrilla verticillata) Naiad (Najas spp.) Water Stargrass (Heteranthera spp.)	5.0	4.0-5.0	3.0-4.0	2.0-3.0	1.5-2.5	1.0-2.0	0.75-1.5	0.5-1.0

NOTE: Hygrophila (Hygrophila polysperma) may be suppressed at the higher application rates listed in this table.

Restrictions: Do not apply more than 30 ppm per growing season, not to exceed 5 ppm per application. Do not apply more than a total of 5 ppm within a 7-day interval.

Note: There is no Pre-harvest Interval (PHI) for crops irrigated with treated water.

To calculate the amount of Aquathol K required for a particular treatment use the following formula:

[Cubic Feet per Second (CFS) X Length of Treatment (hrs.) X Rate (ppm)] x 0.052947 = Gallons of Aquathol K Needed for Treatment

To calculate the amount of Aquathol K to be applied per hour use the following formula:

Gallons of Aquathol K per Hour = Total Gallons of Aquathol K / Length of Treatment (hrs.)

STORAGE AND DISPOSAL

Do not contaminate water, food, or feed by storage and disposal.

Pesticide Storage: Store in the original container. Do not store in a manner where cross-contamination with other pesticides, fertilizers, food or feed could occur. Storage at temperatures below 32°F may result in the product freezing or crystallizing. Should this occur the product must be warmed to 50°F or higher and thoroughly agitated. In the event of a spill during handling or storage, absorb with sand or other inert material and dispose of absorbent in accordance with the Pesticide Disposal instructions listed below.

Pesticide Disposal: Pesticide wastes are acutely hazardous. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

Container Handling:

(for Nonrefillable containers)

Nonrefillable container. Do not reuse or refill this container. Triple rinse or pressure rinse container (or equivalent) promptly after emptying.

For containers 5 gallons or less:

Triple rinse as follows: Empty the remaining contents into application equipment or a mix tank and drain for 10 seconds after the flow begins to drip. Fill the container 1/4 full with water and recap. Shake for 10 seconds. Pour rinsate into application equipment or a mix tank or store rinsate for later use or disposal. Drain for 10 seconds after the flow begins to drip. Repeat this procedure two more times.

Or

Pressure rinse as follows: Empty the remaining contents into application equipment or a mix tank and continue to drain for 10 seconds after the flow begins to drip. Hold container upside down over application equipment or mix tank or collect rinsate for later use or disposal. Insert pressure rinsing nozzle in the side of the container, and rinse at about 40 PSI for at least 30 seconds. Drain for 10 seconds after the flow begins to drip.

For containers more than 5 gallons:

Triple rinse as follows: Empty the remaining contents into application equipment or a mix tank. Fill the container 1/4 full with water. Replace and tighten closures. Tip container on its side and roll it back and forth, ensuring at least one complete revolution, for 30 seconds. Stand container on its end and tip it back and forth several times. Turn the container over onto its other end and tip it back and forth several times. Empty the rinsate into application equipment or a mix tank or store rinsate for later use or disposal. Repeat this procedure two more times.

Or

Pressure rinse as follows: Empty the remaining contents into application equipment or a mix tank. Insert pressure rinsing nozzle in the side of the container, and rinse at about 40 PSI for at least 30 seconds. Pour or pump rinsate into application equipment or rinsate collection system. Drain for 10 seconds after the flow begins to drip.

Then offer for recycling if available or puncture and dispose of in a sanitary landfill, or by incineration, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.

(for Refillable containers)

Refillable container. Refill this container with pesticide only. Do not use this container for any other purpose. Cleaning the container before final disposal is the responsibility of the person disposing of the container. Cleaning before refilling is the responsibility of the refiller. To clean the container before final disposal empty the remaining contents from this container into application equipment or mix tank. Fill the container about 10 percent full with water. Agitate vigorously or recirculate water with the pump for 2 minutes. Pour or pump rinsate into application equipment or rinsate collection system. Repeat this rinsing procedure two more times. Then offer for recycling if available or reconditioning if appropriate or puncture and dispose of in a sanitary landfill, or by other procedures approved by state and local authorities.

EMERGENCY TELEPHONE NUMBERS

CHEMTREC: (800) 424-9300

MEDICAL: (866) 673-6671 Rocky Mountain Poison Control Center

IMPORTANT INFORMATION
READ BEFORE USING PRODUCT

CONDITIONS OF SALE AND LIMITATION OF WARRANTY AND LIABILITY

NOTICE: Read the entire Directions for Use and Conditions of Sale and Limitation of Warranty and Liability before buying or using this product. If the terms are not acceptable, return the product at once, unopened, and the purchase price will be refunded.

The Directions for Use of this product reflect the opinion of experts based on field use and tests, and must be followed carefully. It is impossible to eliminate all risks associated with the use of this product. Crop injury, ineffectiveness or other unintended consequences may result because of such factors as manner of use or application, weather or crop conditions, presence of other materials or other influencing factors in the use of the product, which are beyond the control of United Phosphorus, Inc. or Seller. Handling, storage, and use of the product by Buyer or User are beyond the control of United Phosphorus, Inc. and Seller. All such risks shall be assumed by Buyer and User, and Buyer and User agree to hold United Phosphorus, Inc. and Seller harmless for any claims relating to such factors.

TO THE EXTENT CONSISTENT WITH APPLICABLE LAW, UNITED PHOSPHORUS, INC. AND SELLER MAKE NO WARRANTIES OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE NOR ANY OTHER EXPRESS OR IMPLIED WARRANTY EXCEPT AS STATED ON THIS LABEL.

To the extent consistent with applicable law, United Phosphorus, Inc. or Seller shall not be liable for any incidental, consequential or special damages resulting from the use or handling of this product and **THE EXCLUSIVE REMEDY OF THE USER OR BUYER, AND THE EXCLUSIVE LIABILITY OF UNITED PHOSPHORUS, INC. AND SELLER FOR ANY AND ALL CLAIMS, LOSSES, INJURIES OR DAMAGES (INCLUDING CLAIMS BASED ON BREACH OF WARRANTY, CONTRACT, NEGLIGENCE, TORT, STRICT LIABILITY OR OTHERWISE) RESULTING FROM THE USE OR HANDLING OF THIS PRODUCT, SHALL BE THE RETURN OF THE PURCHASE PRICE OF THE PRODUCT OR, AT THE ELECTION OF UNITED PHOSPHORUS, INC. OR SELLER, THE REPLACEMENT OF THE PRODUCT.**

United Phosphorus, Inc. and Seller offer this product, and Buyer and User accept it, subject to the foregoing conditions of sale and limitations of warranty and of liability, which may not be modified except by written agreement signed by the duly authorized representative of United Phosphorus, Inc.

Aquathol is a registered trademark of United Phosphorus, Inc.

Rev. 9/15/11

70506-176(092211-4047)

Made in U.S.A.

Exhibit G

SPECIMEN LABEL

CUTRINE-PLUS®

ALGAECIDE and HERBICIDE

GENERAL INFORMATION

This product is a liquid copper-based formulation containing ethanolamine chelating agents to prevent the precipitation of copper with carbonates and bicarbonates in the water. This product effectively controls a broad range of algae including: **Planktonic** (suspended) forms such as the Cyanobacteria (Microcystis, Anabaena & Aphanizomenon), Green algae (Raphidocelis & Cosmarium) Golden algae (Prymnesium parvum) and diatoms (Navicula & Fragilaria); **Filamentous** (mat-forming) forms such as the Green Algae (Spirogyra, Cladophora, Ulothrix & Rhizoclonium) and **Benthic** (bottom-growing) forms such as Chara and Nitella. This product has also been proven effective in controlling the rooted aquatic plant, ***Hydrilla verticillata***. Waters treated with this product may be used for swimming, fishing, further potable water treatment, livestock watering or irrigating turf, ornamental plants or crops after treatment.

DIRECTIONS FOR USE

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling. For applications in waters destined for use as drinking water, those waters must receive additional and separate potable water treatment. Do not apply more than 1.0 ppm as metallic copper in these waters. Read entire label and use strictly in accordance with precautionary statements and directions.

GENERAL APPLICATION RESTRICTIONS:

(For end-use products in containers ≥ 5 gallons or ≥ 50 pounds.)

Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application. For any requirements specific to your State or Tribe, consult the State or Tribe agency responsible for pesticide regulation.

(For end-use consumer products in containers less than 5 gallons or less than 50 pounds)

Do not apply this product in a way that will contact adults, children, or pets, either directly or through drift. Some states may require permits for the application of this product to public waters. Check with your local authorities.

(For all sizes) Do not enter or allow others to enter until application of product has been completed.

PRE-TREATMENT CONSIDERATIONS:

(For end-use products in containers ≥ 5 gallons or ≥ 50 pounds.)

In **Potable Water Reservoirs**, **Lakes**, **Industrial Ponds & Wastewater** or other monitored water systems, initial treatment with this product must be considered at the onset of nuisance bloom conditions as evidenced by initial taste and odor complaints; high cell counts or chlorophyll *a* concentrations; high MIB or geosmin concentrations; visible surface scum formations; low Secchi disk readings; significant daily fluctuations in dissolved oxygen; and/or sudden increases in pH. Monitoring of several of these parameters on a regular basis will assist in optimizing the timing of treatments and reducing the amounts of this product needed for seasonal control. Identification of primary nuisance species or genera may also be helpful in determining and refining dosage rates.

(For end-use consumer products in containers less than 5 gallons or less than 50 pounds)

In Ponds (Farm, Fire, Fish, Golf Course, Irrigation, Ornamental, Storm water Retention, Swimming), Small Lakes, Fish Hatcheries, Aquaculture Facilities, treatment with this product should be started when visible, actively growing algae and susceptible plants appear in spring, preferably before significant surface accumulations occur. Aeration and/or fountain system, where available, should be in operation at the time of treatment.

Spray Drift Management

A variety of factors including weather conditions (e.g., wind direction, wind speed, temperature, relative humidity) and the method of application (e.g., ground, aerial, airblast, chemigation) can influence pesticide drift. The applicator must evaluate all factors and make appropriate adjustments when applying this product.

Droplet Size

Apply only as a medium or coarser spray (ASAE standard 572) or a volume mean diameter of 300 microns or greater for spinning atomizer nozzles.

Wind Speed

Do not apply at wind speeds greater than 15 mph. Only apply this product if the wind direction favors on-target deposition (approximately 3 to 10 mph), and there are no sensitive areas within 250 feet down wind.

Temperature Inversions

If applying at wind speeds less than 3 mph, the applicator must determine if a) conditions of temperature inversion exist, or b) stable atmospheric conditions exist at or below nozzle height. Do not make applications into areas of temperature inversions or stable atmospheric conditions.

Other State and Local Requirements

Applicators must follow all state and local pesticide drift requirements regarding application of copper compounds. Where states have more stringent regulations, they must be observed.

Equipment

All ground application equipment must be properly maintained and calibrated using appropriate carriers or surrogates.

FOR USE IN: LAKES; POTABLE WATER RESERVOIRS; PONDS; FISH HATCHERIES AND RACEWAYS; CROP AND NON-CROP IRRIGATION CONVEYANCE SYSTEMS (DITCHES, CANALS AND LATERALS)

ACTIVE INGREDIENTS:
Copper Ethanolamine Complex, Mixed (Mono CAS# 14215-52-2 and Tri CAS# 82027-59-6)*..........27.9%
OTHER INGREDIENTS.......................................72.1%
TOTAL...100.0%

*Metallic copper equivalent, 9%.
Contains 0.909 lbs. of elemental copper per gallon.

KEEP OUT OF REACH OF CHILDREN

CAUTION

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle. (If you do not understand the label, find someone to explain it to you in detail.)

See Additional Precautions on Back Panel

SCAN TO VIEW ON YOUR MOBILE PHONE

Manufactured for:
Applied Biochemists
W175 N11163 Stonewood Drive
Suite 234
Germantown, Wisconsin 53022
1-800-558-5106
www.appliedbiochemists.com
Pat. No. 3,930,834
EPA Reg. No. 8959-10
EPA Est. No. 42291-GA-1

This specimen label is intended as informational purposes only and not for use as container labeling.

SURFACE SPRAY / INJECTION
SLOW-FLOWING OR QUIESCENT WATER BODIES
ALGAECIDE APPLICATION

For effective control, proper chemical concentration must be maintained for a minimum of three hours contact time. The application rates in the chart are based on static or minimal flow situations. Where significant dilution or loss of water from unregulated inflows or outflows occur (raceways) within a three hour period, chemical may have to be metered in.

1. Identify the form of algae growth present as one of the following types: Planktonic (suspended), Filamentous (mat forming), or Benthic (Chara/Nitella) and estimate the density of growth (Low, Medium, High). Use **Table 1 - Copper Concentration** to select the desired PPM (Parts per Million) **Copper** needed, based upon the algal form and density.

Table 1 - Copper Concentration

Form of Algal Growth	Density of Growth		
	Low	Medium	High
Planktonic	0.2	0.4	0.6
Filamentous	0.2	0.6	0.8
Benthic	0.4	0.7	1.0

2. Refer to the **Table 2 – Product Application Rate** and determine gallons of product needed per Acre-foot corresponding to the desired PPM concentration determined in Step #1.

Table 2 - Product Application Rate (Gallons)

PPM Copper	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
Gallon per Acre-ft	0.6	0.9	1.2	1.5	1.8	2.1	2.4	2.7	3.0

3. Determine acre-feet within the intended treatment area (area of infestation) by measuring length, width plus averaging several depth readings within the treatment area. Use the formula:

$$\frac{\text{Length (ft.) x Width (ft.) X Avg. Depth (ft.)}}{43{,}560} = \text{Acre-Feet}$$

4. Multiply Acre-Feet calculated in Step #3 times the gallons of this product determined in Step #2 to determine number of gallons of this product required for the intended treatment area.
5. Before applying, dilute the required amount of this product with enough water to ensure even distribution with the type of equipment being used. Typical dilution range is 9:1 when using backpack-type sprayer or up to 50:1 when using water pump equipment or large tank sprayers.
6. Break up floating algae mats manually before spraying or with force of power sprayer if one is used. Use hand or power sprayer adjusted to rain-sized droplets to cover area evenly taking water depth into consideration. If using underwater injection systems such as drop hoses or booms with weighted drop hoses, ensure boat pattern is uniform throughout treatment area. Spray shoreline areas first to avoid trapping fish.
7. Clean spray equipment by flushing with clean water after treatment and follow **STORAGE AND DISPOSAL** instructions on the label for empty or remaining partial containers.
8. Under conditions of heavy infestation, treat only ⅓ to ½ of the water body at a time to avoid fish suffocation caused by oxygen depletion from decaying algae. (see additional Environmental Hazards).

OTHER TREATMENT FACTORS AND CONSIDERATIONS

- Calm and sunny conditions when water temperature is at least 60ºF will usually expedite control results.
- Effective control of algae requires direct contact with all cells throughout the water column, since these plants do not have vascular systems to transport copper from cell to cell.
- Visible reduction in algae growth should be observed in 24 to 48 hours following application with full infestation and water temperatures.
- Re-treat areas if re-growth or new growth begins to appear and seasonal control is desired. Identify new growth to re-check required copper concentration that may be needed for control. Apply treatment along the shore and proceed outwards in bands to allow fish to move into untreated areas.
- No more than ½ of the water body may be treated at one time. (refer to Environmental Hazards for additional guidance)
- The minimum retreatment interval between consecutive treatments is 14 days.

CUTRINE-PLUS® Granular Algaecide may be used as an alternative in low volume flow situations, spot treatments or treatment of bottom-growing algae in deep water.

Permits: Some states may require permits for the application of this product to public waters. Check with your local authorities.

HERBICIDE APPLICATION (For Hydrilla Control)

CUTRINE-PLUS®: Control of *Hydrilla verticillata* can be obtained from copper concentrations of 0.4 to 1.0 ppm resulting from product treatment. Choose the application rate based upon stage and density of Hydrilla growth and respective water depth from the chart below.

CUTRINE-PLUS® : HARVESTER® TANK MIX

On waters where enforcement of use restrictions for recreational, domestic and irrigation uses are acceptable, the following mixture can be used as an alternative Hydrilla control method.

Tank mix 3 gallons of CUTRINE-PLUS® with 2 gallons of HARVESTER®. Apply mixture at the rate of 5 gallons per surface acre. Dilute with at least 9 parts water and apply as a surface spray or underwater injection.

Application Rates
Gallons/Surface Acre*

Growth/Stage Relative Density	PPM copper	Depth (in feet)*					
		1	2	3	4	5	6
Early Season Low Density	0.4	1.2	2.4	3.6	4.8	6.0	7.2
	0.5	1.5	3.0	4.5	6.0	7.5	9.0
	0.6	1.8	3.6	5.4	7.2	9.0	10.8
Mid-Season Moderate Density	0.7	2.1	4.2	6.3	8.4	10.5	12.6
Late Season High Density	0.8	2.4	4.8	7.3	9.6	12.0	14.4
	0.9	2.7	5.4	8.1	10.8	13.5	16.2
	1.0	3.0	6.0	9.0	12.0	15.0	18.0

*Application rates for depths greater than six feet may be obtained by adding the rates given for the appropriate combination of depths. Application rates should not result in excess of 1.0 ppm copper concentration within treated water.

Observe all cautions and restrictions on the labels of both products used in this mixture.

FLOWING WATER
DRIP SYSTEM APPLICATION -
FOR USE IN POTABLE WATER AND IRRIGATION CONVEYANCE SYSTEMS

PRE-TREATMENT CONSIDERATIONS

In **Crop and Non-Crop Irrigation Conveyance Systems:** Ditches Canals & Laterals, product treatments must be applied as soon as algae or aquatic vascular plants begin to interfere noticeably with normal delivery of water (clogging of lateral headgates, suction screens, weed screens and siphon tubes). Delaying treatment could perpetuate the problem causing massing and compacting of plants. Heavy infestations and low flow conditions may require increasing water flow rate during application.

Accurately determine water flow rates. In the absence of weirs, orifices, or similar devices which give accurate water flow measurements, volume of flow may be estimated by the following formula:

Average Width (feet) x Average Depth (feet) x Velocity* (feet/second) x 0.9
= Cubic Feet per Second (C.F.S.)

*Velocity is the time it takes a floating object to travel a given distance. Dividing the distance traveled (feet) by the time (seconds) will yield velocity (feet/second). Repeat this measurement at least three times at the intended application site then averaged.

- After accurately determining the water flow rate in C.F.S. or gallons/minute, find the corresponding product drip rate on the chart below.
- Calculate the amount of this product needed to maintain the drip rate for a period of 3 hours by multiplying Qts./Hr. x 3; ml/Min. x 180; or Fl. Oz./Min. x 180. Dosage will maintain 1.0 ppm Copper concentration in the treated water for the 3 hour period. Introduction of the chemical should be made in the channel at weirs or other turbulence-creating structures to promote the dispersion of chemical.

WATER FLOW RATE		PRODUCT DRIP RATE*		
C.F.S.	Gal./Min.	Qts./Hr.	Ml/Min.	Fl.Oz./Min.
1	450	1	16	0.5
2	900	2	32	1.1
3	1350	3	47	1.6
4	1800	4	63	2.1
5	2250	5	79	2.7

- Pour the required amount of this product into a drum or tank equipped with a brass needle valve and constructed to maintain a constant drip rate. Use a stop watch and appropriate measuring container to set the desired drip rate. Readjust accordingly if flow rate changes during the 3 hour treatment period.
- Distance of control obtained down the waterway will vary depending upon density of vegetation growth. Treatment period may have to be extended up to 6 hours in areas where control may be difficult due to high flows or significant growth. Periodic maintenance treatments may be required to maintain seasonal control.

Chemigation System Application

This product may be applied for the maintenance of chemigation systems. To control algae in chemigation systems this product should be applied continuously during water application. For continuous addition application apply 0.60 – 3.0 gallons of this product per 1,000,000 (one million) gallons of water (1.80 - 9.0 gallons of this product per acre-foot of water). The copper concentration range is 0.20 to 1.0 ppm. Do not exceed 1.0 ppm of copper or 2.75 gallons of this product per 100,000 gallons of water. For additional guidance regarding specific calibrations or application techniques contact application equipment manufacturer, supplier, or pest control advisor. It is not necessary to agitate or dilute this product in the supply tank before application to chemigation systems.

Application Rates for Chemigation Systems

Copper Concentration (ppm)	Amount of This Product Per Acre-Foot
	Gallons
0.2	0.60
0.3	0.90
0.4	1.20
0.5	1.50
0.6	1.80
0.7	2.10
0.8	2.40
0.9	2.70
1.0	3.00

CHEMIGATION SYSTEM APPLICATION

- Apply product only through sprinkler and drip irrigation systems including: center pivot, lateral move, end tow, side (wheel) roll, traveler, big gun, solid set, or hand move; flood (basin), furrow, border or drip systems.
- Crop injury, lack of effectiveness, or illegal pesticide residues in the crop can result from non-uniform distribution of treated water.
- If you have questions about calibration, contact Applied Biochemists, State Extension Service, equipment manufacturer, or other experts.
- Do not connect an irrigation system (including greenhouse systems) used for pesticide application to a public water system unless the pesticide label-prescribed safety devices for public water systems are in place (refer to the Chemigation Systems Connected to a Public Water Supply section of this label).
- Trained personnel, knowledgeable of the Chemigation system and responsible for its operation or under the supervision of the responsible person, shall shut the system down and make necessary adjustments should the need arise. The system should be inspected, calibrated, and maintained before product application begins.

Chemigation Systems Connected to a Public Water Supply

- Public water system is a system for the provision to the public of piped water for human consumption if such system has at least 15 service connections or regularly serves an average of at least 25 individuals daily at least 60 days out of the year.
- Chemigation systems connected to public water systems must contain a functional, reduced-pressure zone, back flow preventer (RPZ) or the functional equivalent in the water supply line upstream from the point of pesticide introduction. There shall be a complete physical break (air gap) between the flow outlet end of the fill pipe and the top or overflow rim of the reservoir tank of at least twice the inside diameter of the fill pipe.
- The pesticide injection pipeline must contain a functional, automatic, quick-closing check valve to prevent the backflow of solution toward the injection.
- The pesticide injection pipeline must contain a functional, normally closed, solenoid operated valve located on the intake side of the injection pump and connected to the system interlock to prevent fluid from being withdrawn from the supply tank when the irrigation system is either automatically or manually shut down.
- The system must contain functional interlocking controls to automatically shut off the pesticide injection pump when the water pump motor stops or in cases where there is no water pump, when the water pressure decreases to the point where pesticide distribution is adversely affected.
- Systems must use a metering pump, such as a positive displacement injection pump (e.g.,diaphragm pump) effectively designed and constructed of materials that are compatible with pesticides in use and capable of being fitted with a system interlock.
- Inspect, calibrate and maintain the system before product application.

Sprinkler Chemigation Requirements

- The system must contain a functional check valve, vacuum relief valve, and low pressure drain appropriately located on the irrigation pipeline to prevent water source contamination from back flow.
- The pesticide injection pipeline must contain a functional, automatic, quick-closing check valve to prevent the backflow of solution toward the injection pump.
- The pesticide injection pipeline must also contain a functional, normally closed, solenoid operated valve located on the intake side of the injection pump and connected to the system interlock to prevent fluid from being withdrawn from the supply tank when the irrigation system is either automatically or manually shut down.
- The system must contain functional interlocking controls to automatically shut off the pesticide injection pump when the water pump motor stops.
- The irrigation line or water pump must include a functional pressure switch which will stop the water pump motor when the water pressure decreases to the point where pesticide distribution is adversely affected.
- Systems must use a metering pump, such as a positive displacement injection pump (e.g. diaphragm pump) effectively designed and constructed of materials that are compatible with pesticides and capable of being fitted with a system interlock.
- Do not apply when drift would extend beyond the area intended for treatment.

Floor (Basin). Furrow and Border Chemigation Requirements

- Gravity Flow Systems pesticide dispensing system must meter the pesticide into the water at the head of the field and downstream of a hydraulic discontinuity such as a drop structure or weir box to decrease potential for water source contamination from back flow if water flow stops.
- Pressurized water systems with a pesticide injection system must meet the following requirements:
  - The system must contain a functional check valve, vacuum relief valve, and low pressure drain appropriately located on the irrigation pipeline to prevent water source contamination from back flow.
  - The pesticide injection pipeline must contain a functional, automatic, quick-closing check valve to prevent the backflow of solution toward the injection pump.
  - The pesticide injection pipeline must also contain a functional, normally closed,solenoid-operated valve located on the intake side of the injection pump and connected to the system interlock to prevent fluid from being withdrawn from the supply tank when the irrigation system is either automatically or manually shut down.
  - The system must contain functional interlocking controls to automatically shut off the pesticide injection pump when the water pump motor stops.
  - The irrigation line or water pump must include a functional pressure switch which will stop the water pump motor when the water pressure decreases to the point where pesticide distribution is adversely affected.
  - Systems must use a metering pump, such as a positive displacement injection pump (e.g., diaphragm pump) effectively designed and constructed of materials that are compatible with pesticides and capable of being fitted with a system interlock.

Drip Chemigation Requirements

- The system must contain a functional check valve, vacuum relief valve, and low pressure drain appropriately located on the irrigation pipeline to prevent water source contamination from back flow.
- The pesticide injection pipeline must contain a functional, automatic, quick-closing check valve to prevent the backflow of solution toward the injection pump.
- The pesticide injection pipeline must also contain a functional, normally closed, solenoid operated valve located on the intake side of the injection pump and connected to the system interlock to prevent fluid from being withdrawn from the supply tank when the irrigation system is either automatically or manually shut down.
- The system must contain functional interlocking controls to automatically shut off the pesticide injection pump when the water pump motor stops.
- The irrigation line or water pump must include a functional pressure switch which will stop the water pump motor when the water pressure decreases to the point where pesticide distribution is adversely affected.
- Systems must use a metering pump, such as a positive displacement injection pump (e.g.. diaphragm pump) effectively designed and constructed of materials that are compatible with pesticides and capable of being fitted with a system interlock.

Submersed Plant Control Applications

This product can be applied to control hydrilla (*Hydrilla verticillata*), egeria (*Egeria densa*), and other aquatic weeds susceptible to copper treatment. Apply at a rate to achieve 0.70 to 1.0 ppm copper (3.72 to 5.32 Gallons/Acre foot). In heavily infested areas, a second application after the 14 day retreatment interval may be necessary.

Tank Mix Applications

This product can be tank mixed with other herbicides to improve efficacy; and to control algae in areas where heavy algae growth may cover target submersed plant species and interfere with herbicide exposure. Do not mix concentrates in tank without first adding water. To ensure compatibility, conduct a jar test before application. This product must not be mixed with any product containing a label prohibition against such mixing and must be used in accordance with the most restrictive label limitations and precautions. Label dosage rates must not be exceeded.

FIRST AID

If on skin or clothing:
- Take off contaminated clothing.
- Rinse skin immediately with plenty of water for 15-20 minutes.
- Call a Poison Control Center or doctor for treatment advice .

If swallowed:
- Call a Poison Control Center or doctor immediately for treatment advice.
- Have person sip a glass of water if able to swallow.
- Do not induce vomiting unless told to do so by a Poison Control Center or doctor.
- Do not give anything by mouth to an unconscious person.

If in eyes:
- Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye.
- Call a Poison Control Center or doctor for treatment advice.

If inhaled:
- Move person to fresh air.
- If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth if possible.
- Call a Poison Control Center or doctor for further treatment advice.

Have the product container or label with you when calling a Poison Control Center or doctor, or going for treatment.

In case of emergency call 1-800-654-6911

PRECAUTIONARY STATEMENTS

HAZARDS TO HUMANS AND DOMESTIC ANIMALS

CAUTION. Harmful if swallowed or absorbed through skin. Causes moderate eye irritation. Avoid contact with skin, eyes or clothing.

Personal Protective Equipment (PPE)

Mixers, loaders, applicators, and other handlers must wear the following:
- Long-sleeved shirt and long pants,
- Shoes and socks.

USER SAFETY REQUIREMENTS

Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables exist, use detergent and hot water. Keep and wash PPE separately from other laundry. Discard clothing and other absorbent material that have been drenched or heavily contaminated with the product's concentrate. Do not reuse them. Users must wash hands before eating, drinking, chewing gum, using tobacco or using the toilet. Remove clothing/PPE immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing. Remove PPE immediately after handling this product. As soon as possible, wash thoroughly and change into clean clothing. Wash outside of gloves before removing.

Potable water sources treated with this copper product may be used as drinking water only after proper additional potable water treatments.

ENVIRONMENTAL HAZARDS:

Do not use in waters containing Koi and hybrid goldfish. Not intended for use in small volume, garden pond systems.

FISH AND AQUATIC ORGANISMS:

Waters treated with this product may be hazardous to aquatic organisms. Treatment of aquatic weeds and algae can result in oxygen loss from decomposition of dead algae and weeds. This oxygen loss can cause fish and invertebrate suffocation. To minimize hazard, do not treat more than ½ of the water body to avoid depletion of oxygen due to decaying vegetation. Wait at least 10 to 14 days between treatments. Begin treatment along the shore and proceed outwards in bands to allow fish to move into untreated areas. In regions where ponds freeze in winter, treatment should be done 6 to 8 weeks before expected freeze time to prevent masses of decaying algae under an ice cover. Consult with the State or local agency with primary responsibility for regulating pesticides before applying to public waters, to determine if a permit is required. This pesticide is toxic to some fish and aquatic invertebrates and may contaminate water through runoff. This product has a potential for runoff for several months or more after application. Poorly draining soils and soils with shallow water tables are more prone to produce runoff that contains this product. Do not contaminate water when disposing of equipment wash-waters or rinsate.

Certain water conditions including low pH (≤6.5) low dissolved organic carbon (DOC) levels (3.0 mg/L or lower), and "soft" waters (i.e., alkalinity less than 50 mg/L), increases the potential acute toxicity to non-target aquatic organism. Potable water sources treated with copper products may be used as drinking water only after proper additional potable water treatments. Trout and other species of fish may be killed at application rates recommended on the label, especially in soft or acidic waters as described above. Do not contaminate water when disposing of equipment washwaters or rinsate.

To protect listed species in California, contact your County Agricultural Commissioner or refer to the Department of Pesticide Regulation's PRESCRIBE Internet Database: http://www.cdpr.ca.gov/docs/endspec/prescint

STORAGE & DISPOSAL:

Do not contaminate water, food or feed by storage or disposal. Open dumping is prohibited.

PESTICIDE STORAGE:

Keep container closed when not in use. Keep pesticide in original container. Do not put concentrate or dilute into food or drink containers. Do not reuse or refill container. Do not contaminate feed, feedstuffs, or drinking water. Do not store or transport near feed or food.

PESTICIDE DISPOSAL:

Wastes resulting from the use of this product must be disposed of on site or at an approved waste disposal facility.

CONTAINER DISPOSAL:

(For ≤5 gallon non-refillable containers only):

Nonrefillable container. Do not reuse container. Triple rinse as follows: Empty the remaining contents into application equipment or a mix tank. Fill the container ¼ full with water and recap. Shake for 10 seconds. Pour rinsate into application equipment or a mix tank or store rinsate for later use or disposal. Drain for 10 seconds after the flow begins to drip. Repeat this procedure two more times. Then offer for recycling or reconditioning if available or puncture and dispose of in approved landfill, or incineration, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke. Consult Federal, State or local authorities for approved alternative procedures.

(For >5 gallon non-refillable containers only):

Nonrefillable container. Do not reuse container. Triple rinse as follows: Empty the remaining contents into application equipment or a mix tank. Fill the container ¼ with water and recap. Replace and tighten closures. Tip container on its side and roll it back and forth, ensuring at least one complete revolution, for 30 seconds. Stand container on its end and tip it back and forth several times. Empty the rinsate into application equipment or a mix tank or store rinsate for later use or disposal. Repeat this procedure two more times. Then offer for recycling or reconditioning if available or puncture and dispose of in approved landfill, or incineration, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke. Consult Federal, State or local authorities for approved alternative procedures.

(For 275 Gallon refillable container only): Refillable container. Cleaning the container before final disposal is the responsibility of the person disposing of the container. Cleaning before refilling is the responsibility of the refiller. To clean the container before final disposal, empty the remaining contents from this container into application equipment or mix tank. Fill container about 10 percent full with water. Agitate vigorously or recirculate water with pump for 2 minutes. Pour or pump rinsate into application equipment or rinsate collection system. Repeat rinsing procedure two more times. Then offer for recycling or reconditioning if available or puncture and dispose of in approved landfill, or incineration, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke. Consult Federal, State or local authorities for approved alternative procedures.

WARRANTY

To the extent consistent with applicable law neither the manufacturer nor the seller makes any warranty, expressed or implied concerning the use of this product other than indicated on the label. To the extent consistent with applicable law buyer assumes risk of use of this material when such use is contrary to label instructions. Read and follow the label directions.

Cutrine-Plus® and Harvester® are registered trademarks of Arch Chemicals, Inc.

051815/ESL020515

Exhibit H

Specimen Label

Dow AgroSciences

DMA® 4 IVM

Herbicide

For selective control of many broadleaf weeds in forests, ornamental turfgrass, non-cropland and aquatic areas. Also for control of trees by injection.

Active Ingredient:
2,4-Dichlorophenoxyacetic acid,
dimethylamine salt 46.3%
Other Ingredients..53.7%
Total..100.0%

2,4-dichlorophenoxyacetic acid - 38.4% - 3.8 lb/gal

EPA Reg. No. 62719-3

Keep Out of Reach of Children

DANGER PELIGRO

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle. (If you do not understand the label, find someone to explain it to you in detail.)

Agricultural Use Requirements

Use this product only in accordance with its labeling and with the Worker Protection Standard, 40 CFR Part 170. Refer to the label booklet under "Agricultural Use Requirements" in the Directions for Use section for information about this standard.

Refer to **inside of label booklet for Directions for Use.**

Notice: Read the entire label. Use only according to label directions. **Before using this product, read Warranty Disclaimer, Inherent Risks of Use, and Limitation of Remedies at end of label booklet. If terms are unacceptable, return at once unopened.**

In case of emergency endangering health or the environment involving this product, call 1-800-992-5994.

Agricultural Chemical: Do not ship or store with food, feeds, drugs or clothing.

Precautionary Statements

Hazards to Humans and Domestic Animals

DANGER

Corrosive • Causes Irreversible Eye Damage • Harmful If Swallowed, Inhaled Or Absorbed Through The Skin

Do not get in eyes, on skin, or on clothing. Avoid breathing vapor or spray mist. Wash thoroughly with soap and water after handling.

Personal Protective Equipment (PPE)

Some materials that are chemical-resistant to this product are made of any waterproof material. If you want more options, follow the instructions for category A on an EPA chemical resistance category selections chart.

All pilots must wear:
- Long-sleeved shirt and long pants
- Shoes plus socks

All mixers, loaders, flaggers, other applicators and handlers must wear:
- Long-sleeved shirt and long pants
- Shoes plus socks
- Chemical-resistant gloves
- Protective eyewear
- Chemical resistant apron when mixing or loading, cleaning up spills or equipment, or otherwise exposed to the concentrate

See engineering controls for additional requirements.

Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables exist, use detergent and hot water. Keep and wash PPE separately from other laundry.

Engineering Controls

When handlers use closed systems or enclosed cabs in a manner that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides [40 CFR 170.240 (d)(4-6)], the handler PPE requirements may be reduced or modified as specified in the WPS.

Pilots must use an enclosed cockpit that meets the requirements listed in the Worker Protections Standard (WPS) for agricultural pesticides [40 CFR 170.240 (d)(4-6)].

User Safety Recommendations

Users should:
- Wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet.
- Remove clothing/PPE immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.
- Remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

First Aid

If in eyes: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a poison control center or doctor for treatment advice.
If on skin or clothing: Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. Call a poison control center or doctor for treatment advice.
If swallowed: Call a poison control center or doctor immediately for treatment advice. Have person sip a glass of water if able to swallow. Do not induce vomiting unless told to do so by the poison control center or doctor. Do not give anything by mouth to an unconscious person.
If inhaled: Move person to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably by mouth-to-mouth, if possible. Call a poison control center or doctor for further treatment advice.

Have the product container or label with you when calling a poison control center or doctor, or going for treatment.

Note to Physician: Probable mucosal damage may contraindicate the use of gastric lavage.

Environmental Hazards

This product is toxic to fish and aquatic invertebrates. For terrestrial uses: Do not apply directly to water, to areas where surface water is present, or to intertidal areas below the mean high water mark. Drift or runoff may adversely affect aquatic invertebrates and non-target plants. Drift and runoff may be hazardous to aquatic organisms in water adjacent to treated areas. Do not contaminate water when disposing of equipment washwaters or rinsate.

This chemical has properties and characteristics associated with chemicals detected in groundwater. The use of this chemical in areas where soils are permeable, particularly where the water table is shallow, may result in groundwater contamination. Application around a cistern or well may result in contamination of drinking water or groundwater.

Aquatic Weed Control: Fish breathe dissolved oxygen in the water and decaying weeds also use oxygen. When treating continuous, dense weed masses, it may be appropriate to treat only part of the infestation at a time. For example, apply the product in lanes separated by untreated strips that can be treated after vegetation in treated lanes has disintegrated. During the growing season, weeds decompose in a 2 to 3 week period following treatment. Begin treatment along the shore and proceed outwards in bands to allow fish to move into untreated areas. Waters having limited and less dense weed infestations may not require partial treatments.

Directions for Use

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.
Read all Directions for Use carefully before applying.

Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application. For any requirements specific to your state or tribe, consult the agency responsible for pesticide regulation.

Agricultural Use Requirements

Use this product only in accordance with its labeling and with the Worker Protection Standard, 40 CFR Part 170. This Standard contains requirements for the protection of agricultural workers on farms, forests, nurseries, and greenhouses, and handlers of agricultural pesticides. It contains requirements for training, decontamination, notification, and emergency assistance. It also contains specific instructions and exceptions pertaining to the statements on this label about personal protective equipment (PPE), and restricted-entry interval. The requirements in this box only apply to uses of this product that are covered by the Worker Protection Standard.

Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 48 hours.

PPE required for early entry to treated areas that is permitted under the Worker Protection Standard and that involves contact with anything that has been treated, such as plants, soil, or water, is:

- Coveralls
- Chemical-resistant gloves made of any waterproof material
- Shoes plus socks
- Protective eyewear

Non-Agricultural Use Requirements

The requirements in this box apply to uses of this product that are NOT within the scope of the Worker Protection Standard for Agricultural Pesticides (40 CFR Part 170). The WPS applies when this product is used to produce agricultural plants on farms, forests, nurseries, or greenhouses.

Entry Restrictions for Non-WPS Uses: Do not enter or allow people (or pets) to enter the treated area until sprays have dried.

Storage and Disposal

Do not contaminate water, food, or feed by storage or disposal.

Pesticide Storage: Keep container tightly closed when not in use. If exposed to subfreezing temperatures, the product should be warmed to at least 40°F and mixed thoroughly before using.

Pesticide Disposal: Pesticide wastes are toxic. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal law and may contaminate groundwater. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste Representative at the nearest EPA Regional Office for guidance.

Nonrefillable containers 5 gallons or less:

Container Handling: Nonrefillable container. Do not reuse or refill this container.

Triple rinse or pressure rinse container (or equivalent) promptly after emptying. **Triple rinse** as follows: Empty the remaining contents into application equipment or a mix tank and drain for 10 seconds after the flow begins to drip. Fill the container 1/4 full with water and recap. Shake for 10 seconds. Pour rinsate into application equipment or a mix tank or store rinsate for later use or disposal. Drain for 10 seconds after the flow begins to drip. Repeat this procedure two more times. **Pressure rinse** as follows: Empty the remaining contents into application equipment or a mix tank and continue to drain for 10 seconds after the flow begins to drip. Hold container upside down over application equipment or mix tank or collect rinsate for later use or disposal. Insert pressure rinsing nozzle in the side of the container, and rinse at about 40 psi for at least 30 seconds. Drain for 10 seconds after the flow begins to drip. Then offer for recycling if available or puncture and dispose of in a sanitary landfill, or by incineration, or by other procedures allowed by state and local authorities.

Refillable containers larger than 5 gallons:

Container Handling: Refillable container. Refill this container with pesticide only. Do not reuse this container for any other purpose. Cleaning the container before final disposal is the responsibility of the person disposing of the container. Cleaning before refilling is the responsibility of the refiller. To clean the container before final disposal, empty the remaining contents from this container into application equipment or a mix tank. Fill the container about 10% full with water and, if possible, spray all sides while adding water. If practical, agitate vigorously or recirculate water with the pump for two minutes. Pour or pump rinsate into application equipment or rinsate collection system. Repeat this rinsing procedure two more times. Then offer for recycling if available, or puncture and dispose of in a sanitary landfill, or by incineration, or by other procedures allowed by state and local authorities.

Nonrefillable containers 5 gallons or larger:

Container Handling: Nonrefillable container. Do not reuse or refill this container.

Triple rinse or pressure rinse container (or equivalent) promptly after emptying. **Triple rinse** as follows: Empty the remaining contents into

Storage and Disposal (Cont.)

application equipment or a mix tank. Fill the container 1/4 full with water. Replace and tighten closures. Tip container on its side and roll it back and forth, ensuring at least one complete revolution, for 30 seconds. Stand the container on its end and tip it back and forth several times. Turn the container over onto its other end and tip it back and forth several times. Empty the rinsate into application equipment or a mix tank or store rinsate for later use or disposal. Repeat this procedure two more times. **Pressure rinse** as follows: Empty the remaining contents into application equipment or a mix tank and continue to drain for 10 seconds after the flow begins to drip. Hold container upside down over application equipment or mix tank or collect rinsate for later use or disposal. Insert pressure rinsing nozzle in the side of the container, and rinse at about 40 psi for at least 30 seconds. Drain for 10 seconds after the flow begins to drip. Then offer for recycling if available, or puncture and dispose of in a sanitary landfill, or by incineration, or by other procedures allowed by state and local authorities.

Product Information

DMA® 4 IVM herbicide is intended for selective control of many broadleaf weeds in forests, ornamental turfgrass, non-cropland and aquatic areas. Also for control of trees by injection.

Apply DMA 4 IVM as a water or oil-water spray during warm weather when target weeds or woody plants are actively growing. Application under drought conditions will often give poor results. Use low spray pressure to minimize drift. Generally, the lower dosages specified on this label will be satisfactory for young, succulent growth of susceptible weed species. For less susceptible species and under conditions where control is more difficult, use higher specified rates. Deep-rooted perennial weeds such as Canada thistle and field bindweed and many woody plants usually require repeated applications for satisfactory control. Consult your State Agricultural Experiment stations or Extension Service Weed Specialists for recommendations from this label that best fit local conditions.

Use Precautions and Restrictions

Be sure that use of DMA 4 IVM conforms to all application regulations.

Chemigation: Do not apply this product through any type of irrigation system.

Excessive amounts of 2,4-D in the soil may temporarily inhibit seed germination and plant growth.

Use of this product in certain portions of California, Oregon, and Washington is subject to the January 22, 2004 Order for injunctive relief in Washington Toxics Coalition et al. v. EPA, C01-0132C, (W.D. W.A.). For further information, please refer to EPA website: http://www.epa.gov/espp/litstatus/wtc/index.htm.

Spray Drift Management

A variety of factors including weather conditions (e.g., wind direction, wind speed, temperature, relative humidity) and method of application (e.g., ground, aerial, airblast) can influence pesticide drift. The applicator must evaluate all factors and make appropriate adjustments when applying this product.

Droplet Size

When applying sprays that contain 2,4-D as the sole active ingredient, or when applying sprays that contain 2,4-D mixed with active ingredients that require a coarse or coarser spray, apply only as a coarse or coarser spray (ASABE Standard 572) or a volume mean diameter of 385 microns or greater for spinning atomizer nozzles.

When applying sprays that contain 2,4-D mixed with other active ingredients that require a medium or more fine spray, apply only as a medium or coarser spray (ASABE Standard 572) or a volume mean diameter of 300 microns or greater for spinning atomizer nozzles.

Wind Speed

Do not apply at wind speeds greater than 15 mph. Only apply this product if the wind direction favors on-target deposition and there are not sensitive areas (including residential areas, bodies of water, known habitat for nontarget species, nontarget crops) within 250 feet downwind. If applying a medium spray, leave one swath unsprayed at the downwind edge of the treated field.

Temperature Inversions

If applying at wind speeds less than 3 mph, the applicator must determine if: a) conditions of temperature inversion exist, or b) stable atmospheric conditions exist at or below nozzle height. Do not make applications into areas of temperature inversions or stable atmospheric conditions.

Susceptible Plants

Do not apply under circumstances where spray drift may occur to food, forage, or other plantings that might be damaged or crops thereof rendered unfit for sale, use or consumption. Susceptible crops include cotton, okra, flowers, fruit trees, grapes (in growing stage), fruit trees (foliage), soybeans (vegetative stage), ornamentals, sunflowers, tomatoes, beans, and other vegetables, or tobacco. Small amounts of spray drift that may not be visible may injure susceptible broadleaf plants.

Other State and Local Requirements
Applicators must follow all state and local pesticide drift requirements regarding application of 2,4-D herbicides. Where states have more stringent regulations, they must be observed.

Equipment
All aerial and ground application equipment must be properly maintained and calibrated using appropriate carriers or surrogates.

Aerial Application
The boom length must not exceed 75% of the wingspan or 90% of the rotor blade diameter.

Release spray at the lowest height consistent with efficacy and flight safety. Do not release spray at a height greater than 10 feet above the crop canopy unless a greater height is required for aircraft safety. This requirement does not apply to forestry or rights-of-way applications.

When applications are made with a crosswind, the swath will be displaced downwind. The applicator must compensate for this by adjusting the path of the aircraft upwind.

Groundboom Application
Do not apply with a nozzle height greater than 4 feet above the crop canopy.

Mixing

Mix DMA 4 IVM only with water unless otherwise directed on this label. Add about half of the water to the mixing tank, then add the DMA 4 IVM with agitation, and finally the rest of the water with continuing agitation.

Note: Adding oil, wetting agent, or other surfactant to the spray mixture may increase effectiveness on weeds, but also may reduce selectivity to crops resulting in crop damage.

Tank Mixing: When tank mixing, read and follow the label of each tank mix product used for precautionary statements, directions for use, weeds controlled, and geographic and other restrictions. Use in accordance with the most restrictive of label limitations and precautions. Do not exceed any active ingredient's maximum use rates when tank mixing. Do not tank mix this product with any product containing a label prohibition against tank mixing with 2,4-D.

Tank Mix Compatibility Testing: A jar test is recommended prior to tank mixing to ensure compatibility of this product and other pesticides. Use a clear glass quart jar with lid and mix the tank mix ingredients in their relative proportions. Invert the jar containing the mixture several times and observe the mixture for approximately 1/2 hour. If the mixture balls-up, forms flakes, sludges, jels, oily films or layers, or other precipitates, it is not compatible and the tank mix combination should not be used.

Mixing with Liquid Nitrogen Fertilizer
This product may be combined with liquid nitrogen fertilizer suitable for foliar application to accomplish broadleaf weed control and fertilization of corn, small grains or pastures in a single operation. Use DMA 4 IVM in accordance with directions for these crops provided in this label.
Use liquid fertilizer at rates recommended by the supplier or Extension Service Specialist. Test for mixing compatibility as describe above before mixing in spray tank. A compatibility aid such as Unite or Compex may be needed in some situations. Compatibility is best with liquid fertilizer solutions containing only nitrogen. Mixing with N-P-K solutions may not be satisfactory, even with the addition of a compatibility aid. Pre-mixing 1 part DMA 4 IVM with up to 4 parts water may help in situations when mixing difficulty occurs.

Fill the tank about half full with the liquid fertilizer, then add the required amount of DMA 4 IVM with agitation.. Maintain agitation and continue filling the tank with liquid fertilizer. Apply immediately and continue agitation in spray tank during application. **Do not store the spray mixture.** Application during very cold weather (near freezing) is not advisable.

Sprayer Clean-Out
To avoid injury to desirable plants, equipment used to apply this product should be thoroughly cleaned before re-use or applying other chemicals.

1. Rinse and flush application equipment thoroughly after use at least three times with water. Dispose of all rinse water by application to treatment area or apply to non-cropland area away from water supplies.
2. During the second rinse, add 1 quart of household ammonia for every 25 gallons of water. Circulate the solution through the entire system so that all internal surfaces are contacted (15 to 20 min). Let the solution stand for several hours, preferably overnight.
3. Flush the solution out of the spray tank through the boom.
4. Rinse the system twice with clean water, recirculating and draining each time.
5. Remove nozzles and screens and clean separately.
6. If equipment is to be used to apply another pesticide or agricultural chemical to a 2,4-D susceptible crop, additional steps may be required to remove all traces of 2,4-D, including cleaning of disassembled parts and replacement of hoses or other fittings that may contain absorbed 2,4-D.

Application

Apply with calibrated air or ground equipment using sufficient spray volume to provide adequate coverage of target weeds or as otherwise directed in specific use directions. For broadcast application, use a spray volume of 3 gallons or more per acre by air and 10 gallons or more per acre for ground equipment. Where states have regulations which specify minimum spray volumes, they should be observed. In general, spray volume should be increased as crop canopy, height and weed density increase in order to obtain adequate spray coverage. **Do not apply less than 3 gallons total spray volume per acre.**

Rate Ranges and Application Timing
The lower dosages given will be satisfactory for young, succulent growth of sensitive weed species. For less sensitive species and under conditions where control is more difficult, the higher dosages will be needed. Apply DMA 4 IVM during warm weather when weeds are young and actively growing.

Spot Treatments
To prevent misapplication, spot treatments should be applied with a calibrated boom or with hand sprayers using a fixed spray volume per 1000 sq ft as indicated below.

Hand-Held Sprayers: Hand-held sprayers may be used for spot applications of DMA 4 IVM. Care should be taken to apply the spray uniformly and at a rate equivalent to a broadcast application. Application rates in the table are based upon the application rate for an area of 1000 sq ft. Mix the amount of DMA 4 IVM (fl oz or ml) corresponding to the desired broadcast rate in 1 to 3 gallons of spray. To calculate the amount of DMA 4 IVM required for larger areas, multiply the table value (fl oz or ml) by the thousands of sq ft to be treated. An area of 1000 sq ft is approximately 10.5 X 10.5 yards (strides) in size.

Rate Conversion Table for Spot Treatment:

Label Broadcast Rate (pint/acre)							
1/2	2/3	3/4	1	2	3	4	8
Equivalent Amount of DMA 4 IVM per 1000 sq ft							
1/5 fl oz[1] (5.5 ml)	1/4 fl oz (7.3 ml)	1/3 fl oz (8.3 ml)	3/8 fl oz (11 ml)	3/4 fl oz (22 ml)	1 fl oz (33 ml)	1 1/2 fl oz (44 ml)	3 fl oz (88 ml)

[1]Conversion factors: 1 fl oz = 29.6 (30) ml

Band Application: DMA 4 IVM may be applied as a band treatment. Use the formulas below to determine the appropriate rate and volume per treated acre.

$$\frac{\text{Band width in inches}}{\text{Row width in inches}} \times \text{Broadcast rate per acre} = \text{Band rate per treated acre}$$

$$\frac{\text{Band width in inches}}{\text{Row width in inches}} \times \text{Broadcast volume per acre} \quad \text{Band volume per treated acre}$$

Weeds Controlled

Annual or Biennial Weeds

beggarticks[1]
bittercress, smallflowered
bitterweed
broomweed, common[1]
burdock, common
buttercup, smallflowered[1]
carpetweed
cinquefoil, common
cinquefoil, rough
cocklebur, common
coffeeweed
copperleaf, Virginia
croton, Texas
croton, woolly
flixweed
galinsoga
geranium, Carolina
hemp, wild
horseweed (marestail)
jewelweed
jimsonweed
knotweed[1]
kochia
lambsquarters, common
lettuce, prickly[1]
lettuce, wild
lupines
mallow, little[1]
mallow, Venice[1]
marshelder
morningglory, annual
morningglory, ivy
morningglory, woolly
mousetail
mustards (except blue mustard)
parsnip, wild
pennycress, field
pepperweed[1]
pigweeds (*Amaranthus* spp.)[1]
poorjoe
primrose, common
purslane, common
pusley, Florida
radish, wild
ragweed, common
ragweed, giant
rape, wild
rocket, yellow
salsify, common[1]
salsify, western[1]
shepherdspurse
sicklepod
smartweed (annual species)[1]
sneezeweed, bitter
sowthistle, annual
sowthistle, spiny
spanishneedles
sunflower
sweetclover
tansymustard
thistle, bull
thistle, musk[1]
thistle, Russian (tumbleweed)[1]
velvetleaf
vetches

Perennial Weeds

alfalfa[1]
artichoke, Jerusalem[1]
aster, many-flower[1]
Austrian fieldcress[1]
bindweed (hedge, field and European)[1]
blue lettuce
blueweed, Texas
broomweed
bullnettle[1]
carrot, wild[1]
catnip
chicory
clover, red[1]
coffeeweed
cress, hoary[1]
dandelion[1]
docks[1]
dogbanes[1]
eveningprimrose, cutleaf
garlic, wild[1]
goldenrod
hawkweed, orange[1]
healal
ironweed, western
ivy, ground[1]
Jerusalem artichoke
loco, bigbend
nettles (including stinging)[1]
onion, wild[1]
pennywort
plantains
ragwort, tansy[1]
sowthistle, perennial
thistle, Canada[1]
vervains[1]
waterplantain
wormwood

[1]These weeds are only partially controlled and may required repeat applications and/or use of higher specified rates of this product even under ideal conditions of application.

Specific Use Directions

Forestry and Non-Cropland Areas

Agricultural Use Requirements for Forest Use (Except Tree Injection Use): For use in forests, follow PPE and re-entry instructions in the Agricultural Use Requirements section under the Directions for Use heading of this label.

Agricultural Use Requirements for Forest (Tree Injection Only) and Non-Cropland Areas: When this product is applied to non-cropland areas, and when applied by tree injection in forest sites, follow re-entry requirements given in the Non-Agricultural Use Requirements section under the Directions for Use heading of this label.

Forestry Uses
Forest site preparation, forest roadsides, brush control, established conifer release (including Christmas trees and reforestation areas)

Treatment Site/ Method of Application	DMA 4 IVM	Specific Use Directions
annual weeds biennial and perennial broadleaf weeds and susceptible woody plants	2 - 4 pt/acre 4 - 8 pt/acre	Apply when weeds are small and growing actively before the bud stage. Apply when biennial and perennial species are in the seedling to rosette stage and before flower stalks appear. For difficult to control perennial broadleaf weeds and woody species, use up to 1 gallon of DMA 4 IVM and 1 to 4 quarts of Garlon® 3A herbicide per acre. For conifer release, make application in early spring before budbreak of conifers when weeds are small and actively growing.
spot treatment to control broadleaf weeds	1.28 fl oz/gal of spray solution (see instructions for Spot Treatment)	**Note:** To control broadleaf weeds in small areas with a hand sprayer, use an application rate equivalent to the specified broadcast rate and spray to thoroughly wet all foliage. Mix 1.28 fl oz per gallon of spray solution and apply through pump up sprayer or backpack sprayer. Addition of a non ionic surfactant is recommended to improve coverage. See rate conversion table and instructions for Spot Treatment and use of hand-held sprayers under Application.
conifer release: species such as white pine, ponderosa pine, jack pine, red pine, black spruce, white spruce, red spruce, and balsam fir	1 1/2 - 3 qt/acre	To control competing hardwood species such as alder, aspen, birch, hazel, and willow, apply from mid to late summer when growth of conifer trees has hardened off and woody plants are still actively growing. Apply with ground or air equipment, using sufficient spray volume to ensure complete coverage. Because this treatment may cause occasional conifer injury, do not apply if such injury cannot be tolerated.
directed spray: Conifer plantations including pine	4 qt/100 gal	Apply when brush or weeds are actively growing by directing the spray so as to avoid contact with conifer foliage and injurious amounts of spray. Apply in oil, oil-water, or water carrier in a spray volume of 10 to 100 gallons per acre.
basal spray (may also be used in rangeland, pastures, and noncropland)	8 qt/100 gal or	Thoroughly wet the base and root collar of all stems until the spray begins to accumulate around the root collar at the ground line. Wetting stems with the mixture may also aid in control.
surface of cut stumps (may also be used in rangeland, pastures, and noncropland)	2.5 fl oz/gal of water	Apply as soon as possible after cutting trees. Thoroughly soak the entire stump with the 2,4-D mixture including cut surface, bark and exposed roots.
frill and girdle (may also be used in rangeland, pastures, and noncropland)		Cut frills (overlapping V-shaped notches cut downward through the bark in a continuous ring around the base of the tree) using an axe or other suitable tool. Treat freshly cut frills with as much of the 2,4-D mixture as they will hold.

Forestry Uses

Forest site preparation, forest roadsides, brush control, established conifer release (including Christmas trees and reforestation areas) (Cont.)

Treatment Site/ Method of Application	DMA 4 IVM	Specific Use Directions
tree injection application (may also be used in rangeland, pastures, and noncropland)	(1 - 2 ml per injection site)	To control unwanted hardwood trees such as elm, hickory, oak, and sweetgum in forests and other non-crop areas, apply by injecting at a rate of 1 ml of undiluted DMA 4 IVM per inch of trunk diameter at breast height (DBH) as measured approximately 4 1/2 ft above the ground. However, injection should occur as close to the root collar as possible and the injection bit must penetrate the inner bark. Applications may be made throughout the year, but for best results apply between May 15 and October 15. Maples should not be treated during the spring sap flow. For hard to control species such as ash, maple, and dogwood use 2 ml of undiluted DMA 4 IVM per injection site or double the number of 1 ml injections. **Note: No Worker Protection Standard worker entry restrictions or worker notification requirements apply when this product is directly injected into agricultural plants.**

Precautions and Restrictions:
- Do not allow sprays to contact conifer shoot growth (current year's new growth) or injury may occur.
- Do not apply to nursery seed beds.
- For conifer release, do not use on plantations where pine or larch are among the desired species.
- For broadcast applications, do not apply more than 8.42 pints of DMA 4 IVM (4 lb of acid equivalent) per acre per 12-month period.
- Limited to 1 broadcast application per year
- For basal spray, cut surface stumps, and frill applications, do not apply more than 16.84 pints of DMA 4 IVM (8 lb of acid equivalent) per 100 gallons of spray solution.

Non-Cropland Areas

Such as fencerows, hedgerows, roadsides, drainage ditches, rights-of way, utility power lines, railroads, airports, and other non-crop areas

Treatment Site/ Method of Application	DMA 4 IVM (pint/acre)	Specific Use Directions
annual broadleaf weeds biennial and perennial broadleaf weeds susceptible woody plants on rights-of-way	2 - 4 4 4 - 8	Apply when annual weeds are small and growing actively before the bud stage. Biennial and perennial weeds should be rosette to bud stage, but not flowering at the time of application. For difficult to control perennial broadleaf weeds and woody species, tank mix up to 1 gallon of DMA 4 IVM plus 1 to 4 quarts of Garlon 3A per acre. **For ground application:** (High volume) apply a total of 100 to 400 gallons per acre; (low volume) apply a total of 10 to 100 gallons per acre. **For helicopter:** Apply a total of 5 to 30 gallons per acre spray volume.
spot treatment to control broadleaf weeds	1.28 fl oz/gal of spray solution (see instructions for Spot Treatment)	**Note:** To control broadleaf weeds in small areas with a hand sprayer, use an application rate equivalent to the broadcast rate specified for this treatment site and spray to thoroughly wet all foliage. Mix 1.28 fl oz per gallon of spray solution and apply through pump up sprayer or backpack sprayer. Addition of a non ionic surfactant is recommended to improve coverage. See rate conversion table and instructions for Spot Treatment and use of hand-held sprayers under Application.
tree injection application		See instructions for tree injection application in Forestry Uses section.
southern wild rose broadcast application spot treatment	 up to 4 1.28 fl oz/gal of spray solution	Broadcast: Apply in a spray volume of 5 gallons or more per acre by aircraft or 10 gallons or more per acre by ground equipment. Apply when foliage is well developed. Thorough coverage is required. Mix 1.28 fl oz per gallon of spray solution and apply through pump up sprayer or backpack sprayer. Addition of a non ionic surfactant is recommended to improve coverage. Two or more treatments may be required.

Precautions and Restrictions:
- Do not apply to newly seeded areas until grass is well established.
- Bentgrass, St. Augustine, clover, legumes and dichondra may be severely injured or killed by this treatment.
- **Annual and perennial weeds:** Do not apply more than 4.21 pints of DMA 4 IVM (2 lb of acid equivalent) per acre per application. Do not make more than two applications per season. Do not reapply to a treated area within 30 days of a previous application.
- **Woody plants:** Do not apply more than 8.42 pints of DMA 4 IVM (4 lb of acid equivalent) per acre per use season. Do not make more than one application per season.
- Applications to non-cropland areas are not applicable to treatment of commercial timber or other plants being grown for sale or other commercial uses, or for commercial seed production, or for research purposes.

Turfgrass Uses

Ornamental Turfgrass (Excluding Grasses Grown for Seed or Sod Farms)
(Includes cemeteries and parks, airfields, roadsides, vacant lots, drainage ditch banks)

Use Requirements for Ornamental Turfgrass Areas: When this product is applied to ornamental turfgrass areas, follow PPE and reentry instructions in the Non-Agricultural Use Requirements section of this label.

Treatment Site/ Application Timing	DMA 4 IVM (pint/acre)	Specific Use Directions
ornamental turfgrass (postemergence)		Apply when weeds are small and actively growing. For best results, apply when soil moisture is adequate for active weed growth.
seedling grass (five-leaf stage or later)	3/4 - 1	Deep-rooted perennial weeds such as bindweed and Canada thistle may require repeat applications.
well-established grasses	2 - 3	Do not apply to newly seeded grasses until well established (five-leaf stage or later) and then use a maximum of 1 pint per acre. Cool season grasses are tolerant of higher rates.
biennial and perennial broadleaf weeds	3	

Precautions and Restrictions:

- Do not use on creeping grasses such as bent except as a spot treatment.
- Do not use on injury-sensitive southern grasses such as St. Augustinegrass.
- Do not use on dichondra or other herbaceous ground covers. Legumes may be damaged or killed.
- Do not reapply within 21 days of a previous application.
- **Reseeding:** Delay reseeding at least 30 days following application. Preferably, with spring application, reseed in the fall and with fall application, reseed in the spring.
- Do not apply more than 2 broadcast applications per year per treatment site (does not include spot treatments).
- Do not apply more than 6.32 pints per acre of DMA 4 IVM (3 lb of acid equivalent) per year.

Aquatic Uses

Use Requirements for Aquatic Areas: When this product is applied to aquatic areas, follow PPE and re-entry instructions in the Non-Agricultural Use Requirements section of this label.

Control of Weeds and Brush on Banks of Irrigation Canals and Ditches

Target Plants	DMA 4 IVM (pint/acre)	Specific Use Directions
annual weeds	2 to 4	Apply using low pressure spray (10 to 40 psi) in a spray volume of 20 to 100 gallons per acre using power operated spray equipment. Apply when wind speed is low, 5 mph or less. Apply working upstream to avoid accidental concentration of spray into water. Cross-stream spraying to opposite banks is not permitted and avoid boom spraying over water surface. When spraying shoreline weeds, allow no more than a 2-foot overspray onto water surface with an average of less than 1 foot of overspray to prevent significant water contamination. Apply when weeds are small and growing actively before the bud stage. Apply when biennial and perennial species are in the seedling to rosette stage and before flower stalks appear. For hard to control weeds, a repeat application after 30 days at the same rate may be needed. For woody species and patches of perennial weeds, mix 1 gallon of DMA 4 IVM per 64 to 150 gallons of total spray. Wet foliage by applying about 3 to 4 gallons of spray per 1000 sq ft (10.5 X 10.5 steps).
biennial and perennial broadleaf weeds and susceptible wood plants	4	

Restrictions and Limitations:

- Do not apply more than 2 treatments per season or reapply within 30 days.
- Use 2 gallons or more of spray solution per acre.
- Do not apply more than 4.21 pints (2 lb of acid equivalent) per acre per application or more than 8.42 pints (4 lb of acid equivalent) per acre per use season.

Do not use on small canals with a flow rate less than 10 cubic feet per second (CFS) where water will be used for drinking purposes. CFS may be estimated by using the formula below. The aproximate velocity needed for the calculation can be detemrined by observing the length of time that it takes a floating object to travel a defined distance. Divide the distance (ft) by the time (sec) to estimate velocity (ft per sec). Repeat 3 times and use the average to calculate CFS.

Average Width (ft) x Average Depth (ft) x Average Velocity (ft per sec) = CFS

For ditchbank weeds: Do not spray cross-stream to opposite bank. Do not allow boom spray to be directed onto water.

For shoreline weeds: Boom spraying onto water surface must be held to a minimum and allow no more than a 2-foot overspray onto water with an average of less than 1 foot overspray to prevent introduction of greater than negligible amounts of chemical into the water.

Aquatic Weed Control in Ponds, Lakes, Reservoirs, Marshes, Bayous, Drainage Ditches, Canals, Rivers and Streams That are Quiescent or Slow Moving, Including Programs of the Tennessee Valley Authority

Notice to Applicators: Before application, coordination and approval of local and state authorities may be required, either by letter or agreement or issuance of special permits for aquatic applications.

Emergent and Floating Aquatic Weeds: Including Water hyacinth (*Eichornia crassipe*)

Application Rate: 2 to 4 quarts per acre.

Specific Use Directions

Application Timing: Spray weed mass only. Apply when water hyacinth plants are actively growing. Repeat application as necessary to kill regrowth and plants missed in previous operation. Use the 4 quart per acre rate when plants are mature or when weed mass is dense.

Surface Application: Use power operated sprayers with boom or spray gun mounted on boat, tractor or truck. Thorough wetting of foliage is essential for maximum control. Use 100 to 400 gallons of spray mixture per acre. Special precautions such as use of low pressure, large nozzles and spray thickening agents should be taken to avoid spray drift to susceptible crops. Follow label directions for use of any drift control agent.

Aerial Application: Use drift control spray equipment or thickening agent mixed in the spray mixture. Apply 1 gallon of DMA 4 IVM per acre using standard boom systems using a minimum spray volume of 5 gallons per acre. For Microfoil drift control spray systems, apply DMA 4 IVM in a total spray volume of 12 to 15 gallons per acre.

Restrictions and Limitations for Surface Applications to Emergent Aquatic Weeds

- Do not exceed 8.42 pints per acre (4 lb of acid equivalent) per surface acre per
- Spot treatments are permitted.
- Limited to two applications per season.
- Minimum of 21 days between applications.

Fish breathe dissolved oxygen in the water and decaying weeds also use oxygen. When treating continuous, dense weed masses, it may be appropriate to treat only part of the infestation at a time. For example, apply the product in lanes separated by untreated strips that can be treated after vegetation in treated lanes has disintegrated. During the growing season, weeds decompose in a 2 to 3 week period following treatment. Waters having limited and less dense weed infestations may not require partial treatments. Other local factors such as water exchange and sediment load can also influence the dissolved oxygen level. Coordination and approval of local and state authorities may be required, either by letter of agreement or issuance of special permits for aquatic applications.

Water Use:

1. **Water for irrigation or sprays:**
   A. If treated water is intended to be used only for crops or non-crop areas that are labeled for direct treatment with 2,4-D such as pastures, turfgrass or cereal grains, the treated water may be used to irrigate and/or mix sprays for these sites at anytime after the 2,4-D aquatic application.
   B. Due to potential phytotoxicity considerations, the following restrictions are applicable: If treated water is intended to be used to irrigate or mix sprays for plants grown in commercial nurseries and greenhouses; and other plants or crops that are not labeled for direct treatment with 2,4-D, the water must not be used unless one of the following restrictions has been observed:
      i. A setback distance from functional water intake(s) of ≥600 ft. was used for the application, or,
      ii. A waiting period of 7 days from the time of application has elapsed, or,
      iii. An approved assay indicates that the 2,4-D concentration is 100 ppb (0.1 ppm) or less at the water intake. Wait at least 3 days after application before initial sampling at water intake.
2. **Drinking water (potable water):**
   A. Consult with appropriate state or local water authorities before applying this product to public waters. State or local agencies may require permits. The potable water use restrictions on this label are to ensure that consumption of water by the public is allowed only when the concentration of 2,4-D in the water is less than the MCL (Maximum Contaminant Level) of 70 ppb. Applicators should consider the unique characteristics of the treated waters to assure that 2,4-D concentrations in potable water do not exceed 70 ppb at the time of consumption.
   B. For floating and emergent weed applications, the drinking water setback distance from functioning potable water intakes is ≥600 ft.
   C. If no setback distance of ≥600 ft. is used for the application, applicators or the authorizing organization must provide a drinking water notification prior to a 2,4-D application to the party responsible for a public water supply or to individual private water users. Notification to the party responsible for a public water supply or to individual private water users must be done in a manner to assure that the party is aware of a water use restrictions when this product is applied to potable water.

   The following is an example of an example of notification via posting, but other methods of notification which convey the above restrictions may be used and may be required in some cases under state or local law or as a condition of a permit.

   Example:
   Posting notification should be located every 250 feet including the shoreline of the treated area and up to 250 feet of shoreline past the application site to include immediate public access points. Posting must include the day and time of application. Posting may be removed if analysis of a sample collected at the intake 3 days or more following application shows that the concentration in the water is less than 70 ppb (100 ppb for irrigation or sprays), or after 7 days following application, whichever occurs first.

   Text of notification: Wait 7 days before diverting functioning surface water intakes from the treated aquatic site to use as drinking water, irrigation, or sprays, unless water at functioning drinking water intakes is tested at least 3 days after application and is demonstrated by assay to contain not more than 70 ppb 2,4-D (100 ppb for irrigation or sprays).
   Application Date: ______ Time: _____ .
   D. Following each application of this product, treated water must not be used for drinking water unless one of th following restrictions has been observed:
      i. A setback distance from functional water intake(s) of ≥600 ft. was used for the application, or,
      ii. A waiting period of at least 7 days from the time of application has elapsed, or,
      iii. An approved assay indicates that the 2,4-D concentration is 70 ppb (0.07 ppm) or less at the water intake. Sampling for drinking water analysis should occur no sooner than 3 days after 2,4-D application. Analysis of samples must be completed by a laboratory that is certified under the Safe Drinking Water Act to perform drinking water analysis using a currently approved version of analytical Method Number 515, 555, other methods for 2,4-D as may be listed in Title 40 CFR Part 141.24, or Method Number 4015 (immunoassay of 2,4-D) from U.S. EPA Test Methods for Evaluating Solid Waste SW-846.
   E. Note: Existing potable water intakes that are no longer in use, such as those replaced by a connection to a municipal water system or a potable water well, are not considered to be functioning potable water intakes.
   F. Drinking water setback distances do not apply to terrestrial applications of 2,4-D adjacent to water bodies with potable water intakes.

Submerged Aquatic Weeds: Including Eurasian Water Milfoil (*Myriophyllum spicatum*)

Treatment Site	Maximum Application Rate[1]	Specific Use Directions
aquatic weed control in ponds, lakes, reservoirs, marshes, bayous, drainage ditches, canals, rivers and streams that are quiescent or slow moving, including programs of the Tennessee Valley Authority	2.84 gallons (10.8 lb of acid equivalent) per acre foot	**Application Timing:** For best results, apply in spring or early summer when aquatic weeds appear. Check for weed growth in areas heavily infested the previous year. A second application may be needed when weeds show signs of recovery, but no later than mid-August in most areas. **Subsurface Application:** Apply DMA 4 IVM undiluted directly to the water through a boat mounted distribution system. Shoreline areas should be treated by subsurface injection application by boat to avoid aerial drift. **Surface Application:** Use power operated boat mounted boom sprayer. If rate is less than 5 gallons per acre, dilute to a minimum spray volume of 5 gallons per surface acre. **Aerial Application:** Use drift control spray equipment or thickening agents mixed with sprays to reduce drift. Apply through standard boom systems in a minimum spray volume of 5 gallons per surface acre. For Microfoil drift control spray systems, apply DMA 4 IVM in a total spray volume of 12 to 15 gallons per acre. Apply to attain a concentration of 2 to 4 ppm (see table below).

[1]DMA 4 IVM contains 3.8 lb of acid equivalent per gallon of product.

Table 1: Amount to Apply for a Target Subsurface Concentration

Surface Area	Average Depth (ft)	For typical conditions – 2 ppm (2,4-D a.e./acre)	For typical conditions – 2 ppm (DMA 4 IVM gal/acre)	For difficult conditions – 4 ppm* (2,4-D a.e./acre)	For difficult conditions – 4 ppm* (DMA 4 IVM gal/acre)
1 acre	1	5.4	1.42	10.8	2.84
	2	10.8	2.84	21.6	5.68
	3	16.2	4.26	32.4	8.53
	4	21.6	5.68	43.2	11.37
	5	27.0	7.10	54.0	14.21

*Examples include spot treatments of pioneer colonies of eurasian water milfoil and certain difficult to control aquatic species.

Restrictions and Limitations for Aquatic Sites With Submersed Weeds
Do not exceed 10.8 lb acid equivalent per acre foot.

Fish breathe oxygen in the water and a water-oxygen ratio must be maintained. Decaying weeds use up oxygen, but during the period when applications should be made, the weed mass is fairly sparse and the weed decomposition rate is slow enough that the water-oxygen ratio is not disturbed by treating the entire area at one time. If treatments must be applied later in the season when the weed mass is dense and repeat treatments are needed, apply product in lanes, leaving buffer strips which can then be treated when vegetation in treated lanes has disintegrated. During the growing season, weeds decompose in a 2- to 3-week period following treatment.

Do not apply within 21 days of previous application. Limited to 2 applications per season.

When treating moving bodies of water, applications must be made while traveling upstream to prevent concentration of 2,4-D downstream from the application.

Coordination and approval of local and state authorities may be required, either by letter of agreement or issuance of special permits for such use.

Water Use:

1. Water for irrigation or sprays:

A. If treated water is intended to be used only for crops or non-crop areas that are labeled for direct treatment with 2,4-D such as pastures, turfgrass or cereal grains, the treated water may be used to irrigate and/or mix sprays for these sites at anytime after the 2,4-D aquatic application.

B. Due to potential phytotoxicity and/or residue considerations, the following restrictions are applicable:

If treated water is intended to be used to irrigate or mix sprays for unlabeled crops, non-crop areas or other plants not labeled for direct treatment with 2,4-D, the water must not be used unless one of the following restrictions has been observed:

i) A setback distance described in the Drinking Water Setback Table was used for the application, or,

ii) A waiting period of 21 days from the time of application has elapsed, or,

iii) An approved assay indicates that the 2,4-D concentration is 100 ppb (0.1 ppm) or less at the water intake. See Table 3 for the waiting period after application but before taking the initial sampling at water intake.

2. Drinking water (potable water):

A. Consult with appropriate state or local water authorities before applying this product to public waters. State or local agencies may require permits. The potable water use restrictions on this label are to ensure that consumption of water by the public is allowed only when the concentration of 2,4-D in the water is less than the MCL (Maximum Contaminant Level) of 70 ppb. Applicators should consider the unique characteristics of the treated waters to assure that 2,4-D concentrations in potable water do not exceed 70 ppb at the time of consumption.

B. For submersed weed applications, the drinking water setback distances from functioning potable water intakes are provided in Table 2 Drinking Water Setback Distance (below).

C. If no setback distance from the Drinking Water Setback Table (Table 2) is to be used for the application, applicators or the authorizing organization must provide a drinking water notification and an advisory to shut off all potable water intakes prior to a 2,4-D application. Notification to the party responsible for a public water supply or to individual private water users must be done in a manner to assure that the party is aware of the water use restrictions when this product is applied to potable water.

The following is an example of an example of notification via posting, but other methods of notification which convey the above restrictions may be used and may be required in some cases under state or local law or as a condition of a permit.

Example:
Posting notification should be located every 250 feet including the shoreline of the treated area and up to 250 feet of shoreline past the application site to include immediate public access points. Posting should include the day and time of application. Posting may be removed if analysis of a sample collected at the intake no sooner than stated in Table 3 (below) shows that the concentration in the water is less than 70 ppb (100 ppb for irrigation or sprays), or after 21 days following application, whichever occurs first.

Text of notification: Wait 21 days before diverting functioning surface water intakes from the treated aquatic site to use as drinking water, irrigation, or sprays, unless water at functioning drinking water intakes is tested no sooner than (insert days from Table 3) and is demonstrated by assay to contain not more than 70 ppb 2,4-D (100 ppb for irrigation or sprays).
Application Date: _____ Time: _____ .

D. Following each application of this product, treated water must not be used for drinking water unless one of the following restrictions has been observed:

i) A setback distance described in the Drinking Water Setback Distance Table was used for the application, or,

ii) A waiting period of at least 21 days from the time of application has elapsed, or,

iii) An approved assay indicates that the 2,4-D concentration is 70 ppb (0.07 ppm) or less at the water intake. Sampling for drinking water analysis should occur no sooner than stated in Table 3. Analysis of samples must be completed by a laboratory that is certified under The Safe Drinking Water Act to perform drinking water analysis using a currently approved version of analytical Method Number 515, 555, other methods for 2,4-D as may be listed in Title 40 CFR, Part 141.24, or Method Number 4015 (immunoassay of 2,4-D) from U.S. EPA Test Methods for Evaluating Solid Waste SW-846.

E. Note: Existing potable water intakes that are no longer in use, such as those replaced by a connection to a municipal water system or a potable water well, are not considered to be functioning potable water intakes.

F. Drinking water setback distances do not apply to terrestrial applications of 2,4-D adjacent to water bodies with potable water intakes.

Table 2: Drinking Water Setback Distance for Submersed Weed Applications

Application Rate and Minimum Setback Distance (feet) From Functioning Potable Water Intake			
1 ppm*	2 ppm*	3 ppm*	4 ppm*
600	1200	1800	2400

*ppm acid equivalent target water concentration

Table 3: Sampling for Drinking Water Analysis After 2,4-D Application for Submersed Weed Applications

Minimum Days After Application Before Initial Water Sampling at the Functioning Potable Water Intake			
1 ppm*	2 ppm*	3 ppm*	4 ppm*
5	10	10	14

*ppm acid equivalent target water concentration

Terms and Conditions of Use

If terms of the following Warranty Disclaimer, Inherent Risks of Use and Limitation of Remedies are not acceptable, return unopened package at once to the seller for a full refund of purchase price paid. To the extent permitted by law, otherwise, use by the buyer or any other user constitutes acceptance of the terms under Warranty Disclaimer, Inherent Risks of Use and Limitation of Remedies.

Warranty Disclaimer

Dow AgroSciences warrants that this product conforms to the chemical description on the label and is reasonably fit for the purposes stated on the label when used in strict accordance with the directions, subject to the inherent risks set forth below. TO THE EXTENT PERMITTED BY LAW, Dow AgroSciences MAKES NO OTHER EXPRESS OR IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR ANY OTHER EXPRESS OR IMPLIED WARRANTY.

Inherent Risks of Use

It is impossible to eliminate all risks associated with use of this product. Crop injury, lack of performance, or other unintended consequences may result because of such factors as use of the product contrary to label instructions (including conditions noted on the label, such as unfavorable temperatures, soil conditions, etc.), abnormal conditions (such as excessive rainfall, drought, tornadoes, hurricanes), presence of other materials, the manner of application, or other factors, all of which are beyond the control of Dow AgroSciences or the seller. To the extent permitted by law, all such risks shall be assumed by buyer.

Limitation of Remedies

To the extent permitted by law, the exclusive remedy for losses or damages resulting from this product (including claims based on contract, negligence, strict liability, or other legal theories), shall be limited to, at Dow AgroSciences' election, one of the following:

1. Refund of purchase price paid by buyer or user for product bought, or
2. Replacement of amount of product used.

To the extent permitted by law, Dow AgroSciences shall not be liable for losses or damages resulting from handling or use of this product unless Dow AgroSciences is promptly notified of such loss or damage in writing. To the extent permitted by law, in no case shall Dow AgroSciences be liable for consequential or incidental damages or losses.

The terms of the Warranty Disclaimer, Inherent Risks of Use and Limitation of Remedies cannot be varied by any written or verbal statements or agreements. No employee or sales agent of Dow AgroSciences or the seller is authorized to vary or exceed the terms of the Warranty Disclaimer or Limitation of Remedies in any manner.

Produced for
Dow AgroSciences LLC
9330 Zionsville Road
Indianapolis, IN 46268

Label Code: D02-141-004
Replaces Label: D02-141-003
LOES Number: 010-00108

EPA accepted 06/14/10

Revisions:

1. Goggles or faceshield changed to protective eyewear.

SPECIMEN LABEL

Exhibit I

Navigate®

A SELECTIVE HERBICIDE
FOR CONTROLLING CERTAIN
UNWANTED AQUATIC PLANTS

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

READ ENTIRE LABEL BEFORE USING THIS PRODUCT. USE STRICTLY IN ACCORDANCE WITH LABEL PRECAUTIONARY STATEMENTS AND DIRECTIONS.

GENERAL PRECAUTIONS AND RESTRICTIONS

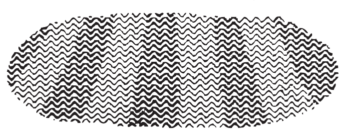
Do not apply this product in a way that will contact workers or other persons, either directly or through drift.
Only protected handlers may be in the area during application.
Do not enter or allow others to enter the treated area until dusts have settled.
Do not use in or near a greenhouse.

OXYGEN RATIO

Fish breathe oxygen in the water and a water/oxygen ratio must be maintained. Decaying weeds use up oxygen, but during the period when this product should be used, the weed mass is fairly sparse and the weed decomposition rate is slow enough so that the water/oxygen ratio is not disturbed by treating the entire area at one time.

If treatments must be applied later in the season when the weed mass is dense and repeat treatments are needed, spread granules in lanes, leaving buffer strips which can then be treated when vegetation in treated lanes has disintegrated. During the growing season, weeds decompose in a 2 to 3 week period following treatment.

Buffer lanes should be 50 to 100 feet wide. Treated lanes should be as wide as the buffer strips. (See illustration to the right.)



WATER pH

Best results are generally obtained if the water to be treated has a pH less than 8. A pH of 8 or higher may reduce weed control. If regrowth occurs within a period of 6 to 8 weeks, a second application may be needed.

PERMIT TO USE CHEMICALS IN WATER

In many states, permits are required to control weeds by chemical means in public water. If permits are required, they may be obtained from the Chief, Fish Division, State Department of Conservation or the State Department of Public Health.

GENERAL INFORMATION

This product is formulated on special heat treated attaclay granules that resist rapid decomposition in water, sink quickly to lake or pond bottoms and release the weed killing chemical into the critical root zone area.

This product is designed to selectively control the weeds listed on the label. While certain other weed may be suppressed, control may be incomplete. Reduced control may occur in lakes where water replacement comes from bottom springs.

WHEN TO APPLY

For best results, spread this product in the spring and early summer, during the time weeds start to grow. If desired, this timing can be checked by sampling the lake bottom in areas heavily infested with weeds the year before.

If treatments are delayed until weeds form a dense mat or reach the surface, two treatments may be necessary. Make the second treatment when weeds show signs of recovery. Treatments made after September may be less effective depending upon water temperature and weed growth. Occasionally, a second application will be necessary if heavy regrowth occurs or weeds reinfest from untreated areas.

EPA REG. NO. 228-378-8959
EPA EST. NO. 42291-GA-1

ACTIVE INGREDIENT:
Butoxyethyl Ester of 2,4-Dichlorophenoxyacetic Acid*..27.6%
OTHER INGREDIENTS:..........................72.4%
TOTAL:...100.0%

*Isomer specific by AOAC Method, Equivalent to 2,4-Dichlorophenoxyacetic Acid........................19%

KEEP OUT OF REACH OF CHILDREN

CAUTION

See Inside For Additional Precautionary Statements

Manufactured for:
applied biochemists
W175N11163 Stonewood Dr. Ste. 234,
Germantown, WI 53022 • 1-800-558-5106
www.appliedbiochemists.com

HOW TO APPLY

FOR LARGE AREAS: Use a fertilizer spreader or mechanical seeder such as the Gerber or Gandy or other equipment capable of uniformly applying this product. Before spreading any chemical, calibrate your method of application to be sure of spreading the proper amount. When using boats and power equipment, you must determine the proper combination of (1) boat speed, (2) rate of delivery from the spreader, and (3) width of swath covered by the granules.

FOR SMALL AREAS (Around Docks or Isolated Patches of Weeds): Use a portable spreader such as the Cyclone seeder or other equipment capable of uniformly applying this product. Estimate or measure out the area you want to treat. Weigh out the amount of material needed and spread this uniformly over the area. More uniform coverage is obtained by dividing the required amount in two and covering the area twice, applying the second half at right angles to the first.

Use the following formula to calibrate your spreader's delivery in pounds of this product per minute.

$$\frac{\text{Miles per hour x spreader width x pounds per acre}}{495}$$

Example: To apply 100 pounds of this product per acre using a spreader that covers a 20 foot swath from a boat traveling at 4 miles per hour, set the spreader to deliver 16 pounds of this product per minute.

$$\frac{\text{4 mph x 20 feet x 100 lbs./A}}{495}$$

AMOUNTS TO USE

Rates of application vary with resistance of weed species to the chemical, density of weed mass at time of treatment, stage of growth, water depth, and rate of water flow through the treated area. Use the higher rate for dense weeds, when water is more than 8 feet deep and where there is a large volume turnover.

SUSCEPTIBLE WEEDS

Water Milfoil (*Myriophylum* spp.)
Water stargrass (*Heteranthera dubia*)

SLIGHTLY TO MODERATELY RESISTANT WEEDS

Bladderwort (*Utricularia* spp.)
White water lily (*Nymphaea* spp.)
Yellow water lily or spatterdock* (*Nuphar* spp.)
Water shield (*Brasenia* spp.)
Water chestnut (*Trapa natans*)
Coontail* (*Ceratophyllum demersum*)
*Repeat treatments may be needed.

AQUATIC USE PRECAUTIONS AND RESTRICTIONS

FLOATING AND EMERGENT WEEDS

Maximum of 4.0 lbs 2,4-D ae or 21 lbs of this product per surface acre per application. Limited to 2 applications per season. Minimum of 21 days between applications. Spot treatments are permitted.

Apply to emergent aquatic weeds in ponds, lakes, reservoirs, marshes, bayous, drainage ditches, non-irrigation canals, rivers, and streams that are quiescent or slow moving.

Coordination and approval of local and state authorities may be required, either by letter of agreement or issuance of special permits for aquatic applications.

<u>Water Use for Floating and Emergent Weeds</u>

1. Water for irrigation or sprays:

A. If treated water is intended to be used only for crops or non-crop areas that are labeled for direct treatment with 2,4-D such as pastures, turf, or cereal grains, the treated water may be used to irrigate and/or mix sprays for these sites at anytime after the 2,4-D aquatic application.

B. Due to potential phytotoxicity considerations, the following restrictions are applicable:
If treated water is intended to be used to irrigate or mix sprays for plants grown in commercial nurseries and greenhouses; and other plants or crops that are not labeled for direct treatment with 2,4-D, the water must not be used unless one of the following restrictions has been observed:
i. A setback distance from functional water intake(s) of greater than or equal to 600 feet was used for the application, or,
ii. A waiting period of 7 days from the time of application has elapsed, or,
iii. An approved assay indicates that the 2,4-D concentration is 100 ppb (0.1 ppm) or less at the water intake. Wait at least 3 days after application before initial sampling at water intake.

2. Drinking water (potable water):

A. Consult with appropriate state or local water authorities before applying this product to public waters. State or local agencies may require permits. The potable water use restrictions on this label are to ensure that consumption of water by the public is allowed only when the concentration of 2,4-D in the water is less than the MCL (Maximum Contaminant Level) of 70 ppb. Applicators should consider the unique characteristics of the treated waters to assure that 2,4-D concentrations in potable water do not exceed 70 ppb at the time of consumption.

B. For floating and emergent weed applications, the drinking water setback distance from functioning potable water intakes is greater than or equal to 600 feet.

C. If no setback distance of greater than or equal to 600 feet is used for application, applicators or the authorizing organization must provide a drinking water notification prior to a 2,4-D application to the party responsible for public water supply or to individual private water users. Notification to the party responsible for a public water supply or to individual private water users must be done in a manner to assure that the party is aware of the water use restrictions when this product is applied to potable water.
The following is an example of a notification via posting, but other methods of notification which convey the above restrictions may be used and may be required in some cases under state or local law or as a condition of a permit.
Example: Posting notification should be located every 250 feet including the shoreline of the treated area and up to 250 feet of shoreline past the application site to include immediate public access points. Posting must include the day and time of application. Posting may be removed if analysis of a sample collected at the intake 3 or more days following application shows that the concentration in the water is less than 70 ppb (100 ppb for irrigation or sprays), or after 7 days following application, whichever occurs first.
Text of notification: Wait 7 days before diverting functioning surface water intakes from the treated aquatic site to use as drinking water, irrigation, or sprays, unless water at functioning drinking water intakes is tested at least 3 days after application and is demonstrated by assay to contain not more than 70 ppb 2,4-D (100 ppb for irrigation or sprays). Application Date:_____ Time:______

D. Following each application of this product, treated water must not be used for drinking water unless one of the following restrictions has been observed:
i. A setback distance from functional water intake(s) of greater than or equal to 600 feet was used for the application, or,
ii. A waiting period of at least 7 days from the time of application has elapsed, or,
iii. An approved assay indicates that the 2,4-D concentration is 70 ppb (0.07 ppm) or less at the water intake. Sampling for drinking water analysis should occur no sooner than 3 days after 2,4-D application. Analysis of samples must be completed by a laboratory that is certified under the Safe Drinking Water Act to perform drinking water analysis using a currently approved version of analytical Method Number 515, 555, other methods for 2,4-D as may be listed in Title 40 CFR, Part 141.24, or Method Number 4015 (immunoassay of 2,4-D) from U.S. EPA Test Methods for Evaluating Solid Waste SW-846.

E. Note: Existing potable water intakes that are no longer in use, such as those replaced by a connection to a municipal water system or a potable water well, are not considered to be functioning potable water intakes.

F. Drinking water setback distances do not apply to terrestrial applications of 2,4-D adjacent to water bodies with potable water intakes.

3. Swimming:

A. Do not swim in treated water for a minimum of 24 hours after application.

B. Users must provide notification prior to performing a 2,4-D BEE application. Notification to the party responsible for the public swimming area or to individual private users must be done in a manner to assure that the party is aware of the water use swimming restrictions when this product is applied to water. The following is an example of a notification via posting, but other methods of notification which convey the above restrictions may be used and may be required in some cases under state or local law or as a condition of a permit.
Example: Posting notification should be located every 250 feet including the shoreline of the treated area and up to 250 feet of shoreline past the application site to include immediate public access points.
Text of notification: Do not swim in treated water for a minimum of 24 hours after application. Application Date: ______ Time: _____

4. Except as stated above, there are no restrictions on using water from treated areas for swimming, fishing, watering livestock or domestic purposes.

SUBMERSED WEEDS

Maximum of 10.8 lbs 2,4-D ae or 56.8 lbs of this product per acre-foot per application.

Limited to 2 applications per season.

Apply to aquatic weeds in ponds, lakes, reservoirs, marshes, bayous, drainage ditches, non-irrigation canals, rivers, and streams that are quiescent or slow moving. Do not apply within 21 days of previous application.

When treating moving bodies of water, applications must be made while traveling upstream to prevent concentration of 2,4-D downstream from the application.

Coordination and approval of local and state authorities may be required, either by letter of agreement or issuance of special permits for such use.

Table 1. Amount of 2,4-D to Apply for a Target Subsurface Concentration

Surface Area	Average Depth	For typical conditions 2 ppm 2,4-D ae/acre-foot	For difficult conditions* 4 ppm 2,4-D ae/acre-foot
1 Acre	1 Foot	5.4 pounds (28.4 lbs of this product)	10.8 pounds (56.8 lbs of this product)
	2 Feet	10.8 pounds (56.8 lbs of this product)	21.6 pounds (110.8 lbs of this product)
	3 Feet	16.2 pounds (85.2 lbs of this product)	32.4 pounds (170.5 lbs of this product)
	4 Feet	21.6 pounds (110.8 lbs of this product)	43.2 pounds (227.3 lbs of this product)
	5 Feet	27.0 pounds (142.1 lbs of this product)	54.0 pounds (284.2 lbs of this product)

*Examples include spot treatment of pioneer colonies of Eurasian Water Milfoil and certain difficult to control aquatic species.

Note: The same "Water for Irrigation or Spray" restrictions for Floating and Emergent Weeds apply to Submersed Weeds.

Water Use for Submersed Weeds

1. Water for irrigation or sprays:

A. If treated water is intended to be used only for crops or non-crop areas that are labeled for direct treatment with 2,4-D such as pastures, turf, or cereal grains, the treated water may be used to irrigate and/or mix sprays for these sites at anytime after the 2,4-D aquatic application.

B. Due to potential phytotoxicity considerations, the following restrictions are applicable:
If treated water is intended to be used to irrigate or mix sprays for unlabeled crops, non-crop areas or other plants not labeled for direct treatment with 2,4-D, the water must not be used unless one of the following restrictions has been observed:
i. A setback distance described in the Drinking Water Setback Table was used for the application, or,
ii. A waiting period of 21 days from the time of application has elapsed, or,
iii. An approved assay indicates that the 2,4-D concentration is 100 ppb (0.1 ppm) or less at the water intake. See Table 3 for the waiting period after application but before taking the initial sampling at water intake.

2. Drinking water (potable water):

A. Consult with appropriate state or local water authorities before applying this product to public waters. State or local agencies may require permits. The potable water use restrictions on this label are to ensure that consumption of water by the public is allowed only when the concentration of 2,4-D in the water is less than the MCL (Maximum Contaminant Level) of 70 ppb. Applicators should consider the unique characteristics of the treated waters to assure that 2,4-D concentrations in potable water do not exceed 70 ppb at the time of consumption.

B. For submersed weed applications, the drinking water setback distances from functioning potable water intakes are provided in Table 2. Drinking Water Setback Distance (on next page).

C. If no setback distance from the Drinking Water Setback Table (Table 2) is to be used for the application, applicators or the authorizing organization must provide a drinking water notification and an advisory to shut off all potable water intakes prior to a 2,4-D application. Notification to the party responsible for a public water supply or to individual private water users must be done in a manner to assure that the party is aware of the water use restrictions when this product is applied to potable water.
The following is an example of a notification via posting, but other methods of notification which convey the above restrictions may be used and may be required in some cases under state or local law or as a condition of a permit.
Example: Posting notification should be located every 250 feet including the shoreline of the treated area and up to 250 feet of shoreline past the application site to include immediate public access points. Posting should include the day and time of application. Posting may be removed if analysis of a sample collected at the intake no sooner than stated in Table 3 (below) shows that the concentration in the water is less than 70 ppb (100 ppb for irrigation or sprays), or after 21 days following application, whichever occurs first.
Text of notification: Wait 21 days before diverting functioning surface water intakes from the treated aquatic site to use as drinking water, irrigation, or sprays, unless water at functioning drinking water intakes is tested no sooner than (insert days from Table 3) and is demonstrated by assay to contain not more than 70 ppb 2,4-D (100 ppb for irrigation or sprays).
Application Date: ______ Time: _____

D. Following each application of this product, treated water must not be used for drinking water unless one of the following restrictions has been observed:
i. A setback distance described in the Drinking Water Setback Distance Table was used for the application, or,
ii. A waiting period of at least 21 days from the time of application has elapsed, or,
iii. An approved assay indicates that the 2,4-D concentration is 70 ppb (0.07 ppm) or less at the water intake. Sampling for drinking water analysis should occur no sooner than stated in Table 3. Analysis of samples must be completed by a laboratory that is certified under the Safe Drinking Water Act to perform drinking water analysis using a currently approved version of analytical Method Number 515, 555, other methods for 2,4-D as may be listed in Title 40 CFR, Part 141.24, or Method Number 4015 (immunoassay of 2,4-D) from U.S. EPA Test Methods for Evaluating Solid Waste SW-846.

E. Note: Existing potable water intakes that are no longer in use, such as those replaced by a connection to a municipal water system or a potable water well, are not considered to be functioning potable water intakes.

F. Drinking water setback distances do not apply to terrestrial applications of 2,4-D adjacent to water bodies with potable water intakes.

Table 2. Drinking Water Setback Distance for Submersed Weed Applications

Application Rate and Minimum Setback Distance (feet) From Functioning Potable Water Intake			
1 ppm*	2 ppm*	3 ppm*	4 ppm*
600	1200	1800	2400

*ppm acid equivalent target water concentration

Table 3. Sampling for Drinking Water Analysis After 2,4-D Application for Submersed Weed Applications

Minimum Days After Application Before Initial Water Sampling at the Functioning Potable Water Intake			
1 ppm*	2 ppm*	3 ppm*	4 ppm*
5	10	10	14

*ppm acid equivalent target water concentration

3. Swimming:

A. Do not swim in treated water for a minimum of 24 hours after application.

B. Users must provide the following notification prior to performing a 2,4-D BEE application. Notification to the party responsible for the public swimming area or to individual private users must be done in a manner to assure that the party is aware of the water use swimming restrictions when this product is applied to water.
The following is an example of a notification via posting, but other methods of notification which convey the above restrictions may be used and may be required in some cases under state or local law or as a condition of a permit.
Example: Posting notification should be located every 250 feet including the shoreline of the treated area and up to 250 feet of shoreline past the application site to include immediate public access points.
Text of notification: Do not swim in treated water for a minimum of 24 hours after application. Application Date: ______ Time: _____

4. **Except as stated above, there are no restrictions on using water from treated areas for swimming, fishing, watering livestock or domestic purposes.**

Use of this product in certain portions of California, Oregon, and Washington is subject to the January 22, 2004 Order for injunctive relief in Washington Toxics Coalition, et al. v. EPA, C01-0132C, (W.D. WA).

For further information, please refer to http://www.epa.gov/espp/litstatus/wtc/index.htm.

PRECAUTIONARY STATEMENTS

HAZARDS TO HUMANS AND DOMESTIC ANIMALS

CAUTION Causes moderate eye irritation. Avoid contact with eyes or clothing.

PERSONAL PROTECTIVE EQUIPMENT (PPE):

All loaders, applicators, and other handlers must wear:

- long-sleeved shirt and long pants,
- shoes plus socks

Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables exist, use detergent and hot water. Keep and wash PPE separately from other laundry.

USER SAFETY RECOMMENDATIONS

Users Should:

- Wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet.
- Remove clothing/PPE immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing. If pesticide gets on skin, wash immediately with soap and water.
- Remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

FIRST AID

IF IN EYES

- Hold eye open and rinse slowly and gently with water for 15 to 20 minutes.
- Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye.
- Call a poison control center or doctor for treatment advice.

IF SWALLOWED

- Call a poison control center or doctor immediately for treatment advice.
- Have person sip a glass of water if able to swallow.
- Do not induce vomiting unless told to do so by a poison control center or doctor.
- Do not give anything by mouth to an unconscious person.

IF ON SKIN OR CLOTHING

- Take off contaminated clothing.
- Rinse skin immediately with plenty of water for 15 to 20 minutes.
- Call a poison control center or doctor for treatment advice.

IF INHALED

- Move person to fresh air.
- If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth if possible.
- Call a poison control center or doctor for further treatment advice.

HOT LINE NUMBER

Have the product container or label with you when calling a poison control center or doctor, or going for treatment.

IN CASE OF EMERGENCY CALL: 1-800-654-6911

ENVIRONMENTAL HAZARDS

Fish breathe dissolved oxygen in the water and decaying weeds also use oxygen. When treating continuous, dense weed masses, it may be appropriate to treat only part of the infestation at a time. For example, apply the product in lanes separated by untreated strips that can be treated after vegetation in treated lanes has disintegrated. During the growing season, weeds decompose in a 2 to 3 week period following treatment. Begin treatment along the shore and proceed outwards in bands to allow fish to move into untreated areas. Waters having limited and less dense weed infestations may not require partial treatments.

For Chemical Spill, Leak, Fire, or Exposure, Call CHEMTREC (800) 424-9300

For Medical Emergencies Only, call (800)-654-6911

STORAGE AND DISPOSAL

Do not contaminate water, food or feed by storage or disposal.

PESTICIDE STORAGE: Always use original container to store pesticides in a secured warehouse or storage building. Do not store near seeds, fertilizers, insecticides or fungicides. Do not stack more than two pallets high. It is recommended that a SARA Title III emergency response plan be created for storage facilities. Do not transport in the passenger compartment of any vehicle.

PESTICIDE DISPOSAL: Pesticide wastes are toxic. If container is damaged or if pesticide has leaked, clean up all spilled material. Improper disposal of excess pesticide, spray mixtures or rinsate is a violation of Federal law and may contaminate groundwater. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

CONTAINER DISPOSAL: Nonrefillable container. Do not reuse or refill this container. Completely empty container into application equipment, then offer for recycling if available, or dispose of empty container in a sanitary landfill or by incineration or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.

WARRANTY DISCLAIMER

The directions for use of this product must be followed carefully. TO THE EXTENT CONSISTENT WITH APPLICABLE LAW, (1) THE GOODS DELIVERED TO YOU ARE FURNISHED "AS IS" BY MANUFACTURER OR SELLER AND (2) MANUFACTURER AND SELLER MAKE NO WARRANTIES, GUARANTEES, OR REPRESENTATIONS OF ANY KIND TO BUYER OR USER, EITHER EXPRESS OR IMPLIED, OR BY USAGE OF TRADE, STATUTORY OR OTHERWISE, WITH REGARD TO THE PRODUCT SOLD, INCLUDING, BUT NOT LIMITED TO MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, USE, OR ELIGIBILITY OF THE PRODUCT FOR ANY PARTICULAR TRADE USAGE. UNINTENDED CONSEQUENCES, INCLUDING BUT NOT LIMITED TO INEFFECTIVENESS, MAY RESULT BECAUSE OF SUCH FACTORS AS THE PRESENCE OR ABSENCE OF OTHER MATERIALS USED IN COMBINATION WITH THE GOODS, OR THE MANNER OF USE OR APPLICATION, INCLUDING WEATHER, ALL OF WHICH ARE BEYOND THE CONTROL OF MANUFACTURER OR SELLER AND ASSUMED BY BUYER OR USER. THIS WRITING CONTAINS ALL OF THE REPRESENTATIONS AND AGREEMENTS BETWEEN BUYER, MANUFACTURER AND SELLER, AND NO PERSON OR AGENT OF MANUFACTURER OR SELLER HAS ANY AUTHORITY TO MAKE ANY REPRESENTATION OR WARRANTY OR AGREEMENT RELATING IN ANY WAY TO THESE GOODS.

LIMITATION OF LIABILITY

TO THE EXTENT CONSISTENT WITH APPLICABLE LAW, IN NO EVENT SHALL MANUFACTURER OR SELLER BE LIABLE FOR SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, OR FOR DAMAGES IN THEIR NATURE OF PENALTIES RELATING TO THE GOODS SOLD, INCLUDING USE, APPLICATION, HANDLING, AND DISPOSAL MANUFACTURER OR SELLER SHALL NOT BE LIABLE TO BUYER OR USER BY WAY OF INDEMNIFICATION TO BUYER OR TO CUSTOMERS OF BUYER, IF ANY, OR FOR ANY DAMAGES OR SUMS OF MONEY, CLAIMS OR DEMANDS WHATSOEVER, RESULTING FROM OR BY REASON OF, OR RISING OUT OF THE MISUSE, OR FAILURE TO FOLLOW LABEL WARNINGS OR INSTRUCTIONS FOR USE, OF THE GOODS SOLD BY MANUFACTURER OR SELLER TO BUYER. ALL SUCH RISKS SHALL BE ASSUMED BY THE BUYER, USER, OR ITS CUSTOMERS. BUYER'S OR USER'S EXCLUSIVE REMEDY, AND MANUFACTURER'S OR SELLER'S TOTAL LIABILITY SHALL BE FOR DAMAGES NOT EXCEEDING THE COST OF THE PRODUCT.

If you do not agree with or do not accept any of directions for use, the warranty disclaimers, or limitations on liability, do not use the product, and return it unopened to the Seller, and the purchase price will be refunded.

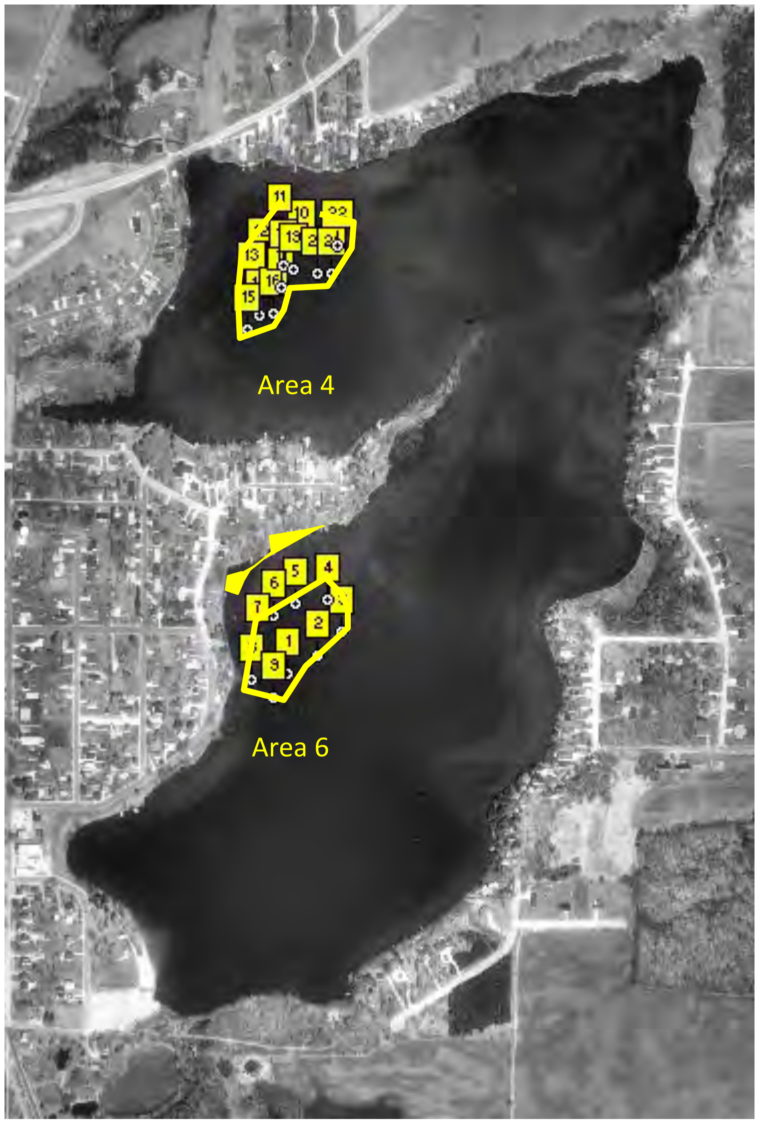
110111

Exhibit J

Random Lake—Sheboygan County

June 11,2015 Treatment Areas*

* Balance of Treatment Postponed by Weather



Area	Acres	Depth	DMA4-IVM	Aquathol-K
6	3	6	25.25	
4a	4	4	22.5	
4b	0.5	2	1.5	0.6
	7.5		49.25	0.6

Treatment Concentrations

DMA4-IVM: 2.0 ppm

Aquathol-K: 1.0 ppm

Marine Biochemists
6302 W. Eastwood Ct.
Mequon, WI 53092
(888) 558-5106
www.marinebiochemists.com

Exhibit K

Aquatic Plant Management Herbicide Treatment Record

Notice: Completion of this form is a condition of WI DNR permits and provides records required by WDNR (NR107, WPDES 5.1) and DATCP (ATCP 29.21 & 29.22). The Department may not issue you future permits unless you complete and submit this form. Personally identifiable information required on this form is not likely to be used for purposes other than that for which it is originally collected. It may also be made available to requesters under Wisconsin Open Records law (ss. 19.31—19.39 Wis. Stats.).

Submit This Form: 1) Immediately if any unusual circumstances occurred during the treatment, 2) As soon as possible, no later than 30 days after treatment, 3) By October 1 if no treatment occurred

Completion of this form along with the Permit satisfies the requirements of WDNR **WDNR (NR107, WPDES 5.1) and DATCP (ATCP 29.21 &**

General Permit Information **Waterbody name (including ponds, eg., Smith Pond and Address)** **Treatment Information**

Permit Number	Waterbody	Treatment Date	Start Time	End Time
SE2015607B	Random Lake	6/11/15	0915	1:00 PM
County		**Water Temp (F)**	**Air Temp (F)**	**Wind Speed & Direction**
Sheboygan	Village of Random Lake	75	62°F	Calm

Treatment Area Size (Acres)	Average Depth (Ft.)	Water Volume (Acre-Ft.)	Est. Water Volume (Acre-Ft)	On Site DNR Supervision Present?
7.5	~~8~~ 4.7ft			☐ Yes ☒ No If yes, Supervisor Name:

Visual Observations/Notes

Only were able to complete treatment of (2) larger areas before rains arrived at ~11:30 a.m. Posted Water Use Restrictions along all treatment shorelines. No Adverse Conditions Noted

Water Use Restriction Signs Posted in Accordance with NR107? ☒ Yes ☐ No 1 day swimming, 21 days irrigation

Note: Applicator Shall Provide Customer free copy of pesticide label used upon request

Name of Applicator(s)		Certification #	License #
Paul Hinterberg	☐	89833	440931
Jim Kannenberg	☐	28668	224269
Tom Lloyd	☐	53869	146250
Marc Schmitz	☐	77687	280174
Brian Suffern	☒	1517	142402
	☐		

Application Business Information
Marine Biochemists
6302 W. Eastwood Ct.
Mequon, WI 53092
(888) 558-5106

Name of Person Completing Form Brian J. Suffern

Date 6/11/15

Pond	Product Used	E.P.A. Registration No.	Quantity Applied	Concentration (ppm) Or Rate (gal./acre) Applied
A. ☐ B. ☐ C. ☐ D. ☐	Aquathol-K	70506-176	0.6 gal	1 ppm to 0.5A/2'
A. ☐ B. ☐ C. ☐ D. ☐	Clearigate	8959-51		
A. ☐ B. ☐ C. ☐ D. ☐	Cutrine-Plus	8959-10		
A. ☐ B. ☐ C. ☐ D. ☐	DMA4-IVM	62719-3	49.25 gal	2 ppm to 7.5A/4.7' avg
A. ☐ B. ☐ C. ☐ D. ☐	Harpoon	8959-54		
A. ☐ B. ☐ C. ☐ D. ☐	Harvester	100-1091-8959		
A. ☐ B. ☐ C. ☐ D. ☐	Hydrothol 191	70506-175		
A. ☐ B. ☐ C. ☐ D. ☐				

Contract Type: **Per Treatment** ☐ **Seasonal** ☐

FOR OFFICE USE ONLY

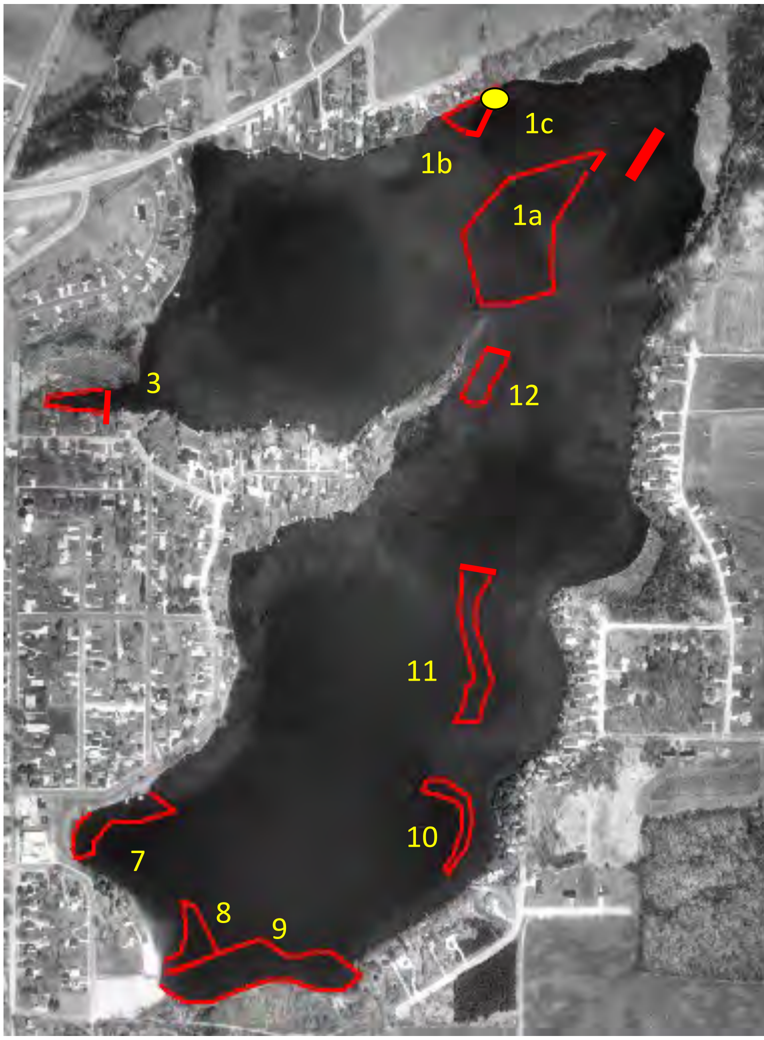
Product/Item Code ____________ **Amount** ____________ **Customer #** ____________

Additional Instructions For Invoicing: ____________________

Exhibit L

Random Lake -Sheboygan County, WI

June 12, 2015 Treatment Areas



Area	Acres	DMA4	Aquathol-K	Navigate	Cutrine-Plus
1a	7.6	41.5			
1b	0.5				0.6
1c	0.2	0.5	0.25		
3	0.5	2.25	1		
7	1.4	6.5	2		
8	0.7			70	
9	3.4	19	3		
10	1.3			130	
11	1	5.5			
12	1.1	4.75			
	17.7	80	6.25	200	

June 11/12, 2015 Totals by Product Type

DMA4-IVM @ 2 ppm: 22.7 acres, 129.25 gal (Eurasian Watermilfoil)

Aquathol-K @ 1ppm: 4.1 acres, 6.85 gal (Curlyleaf Pondweed)

Navigate (2,4-D Granular) @ 100#/acre: 2.0 acres, 200# (Eurasian Watermilfoil

Cutrine-Plus @ 0.2 ppm: 0.5 acres, 0.6 gal (filamentous algae)

Marine Biochemists
6302 W. Eastwood Ct.
Mequon, WI 53092
(888) 558-5106
www.marinebiochemists.com

Exhibit M

Aquatic Plant Management Herbicide Treatment Record

Notice: Completion of this form is a condition of WI DNR permits and provides records required by WDNR (NR107, WPDES 5.1) and DATCP (ATCP 29.21 & 29.22). The Department may not issue you future permits unless you complete and submit this form. Personally identifiable information required on this form is not likely to be used for purposes other than that for which it is originally collected. It may also be made available to requesters under Wisconsin Open Records law (ss. 19.31—19.39 Wis. Stats.).

Submit This Form: 1) Immediately if any unusual circumstances occurred during the treatment, 2) As soon as possible, no later than 30 days after treatment, 3) By October 1 if no treatment occurred

Completion of this form along with the Permit satisfies the requirements of WDNR **WDNR (NR107, WPDES 5.1) and DATCP (ATCP 29.21 &**

General Permit Information | Waterbody name (including ponds, eg., Smith Pond and Address) | Treatment Information

Permit Number: SE2015 60793	Random Lake		Treatment Date: 6/12/15	Start Time: 1230	End Time: 1900
County: Sheboygan	Village of Random Lake		Water Temp (F): 73	Air Temp (F): 62	Wind Speed & Direction: 10 NE
Treatment Area Size (Acres): ~18 acres	Avg. Depth (Ft.)	Dissolved Oxygen (ppm)	On Site DNR Supervision Present? ☐ Yes ☒ No If yes, Supervisor Name:		

Visual Observations/Notes: Completed Balance of Treatment, See map for details

June 11/12 Totals

I Eurasian Watermilfoil
a) DMA4-IVM: 22.7 acres / 129.25 gal total
b) Navigate: 2.0 acres / 200 # total

II Curlyleaf Pondweed / Beach
4.1 acres / Aquathol K 6.85 gal

III Algae 0.5A/2 0.6 gal Cutrine

Water Use Restriction Signs Posted in Accordance with NR107? ☒ Yes ☐ No   1 day swimming 21 days irrigation

Note: Applicator Shall Provide Customer free copy of pesticide label used upon request

Name of Applicator(s)		Certification #	License #
Paul Hinterberg	☐	89833	440931
Jim Kannenberg	☐	28668	224269
Tom Lloyd	☐	53869	146250
Marc Schmitz	☐	77687	280174
Brian Suffern	☒	1517	142402
	☐		

Application Business Information
Marine Biochemists
6302 W. Eastwood Ct.
Mequon, WI 53092
(888) 558-5106

No Adverse Conditions Noted

Name of Person Completing Form: Brian J Suffern

Date: 6/12/15

Pond	Product Used	E.P.A. Registration No.	Quantity Applied	Concentration (ppm) Or Rate (gal./acre) Applied
A. ☐ B. ☐ C. ☐ D. ☐	Aquathol-K	70506-176	6.25 gal	1 ppm to 3.6A/3'
A. ☐ B. ☐ C. ☐ D. ☐	Clearigate	8959-51		
A. ☐ B. ☐ C. ☐ D. ☐	Cutrine-Plus	8959-10	0.6 gal	0.2 ppm to 0.5A/2'
A. ☐ B. ☐ C. ☐ D. ☐	DMA4-IVM	62719-3	80 gal	2 ppm to 15.2A/3.75' avg
A. ☐ B. ☐ C. ☐ D. ☐	Harpoon	8959-51		
A. ☐ B. ☐ C. ☐ D. ☐	Harvester	100-1091-8959		
A. ☐ B. ☐ C. ☐ D. ☐	Hydrothol 191	70506-175		
A. ☐ B. ☐ C. ☐ D. ☐	Navigate	2283788959	200 #	100 #/acre to 2 acres

Contract Type: Per Treatment ☐ Seasonal ☐

FOR OFFICE USE ONLY

Product/Item Code | Amount | Customer #

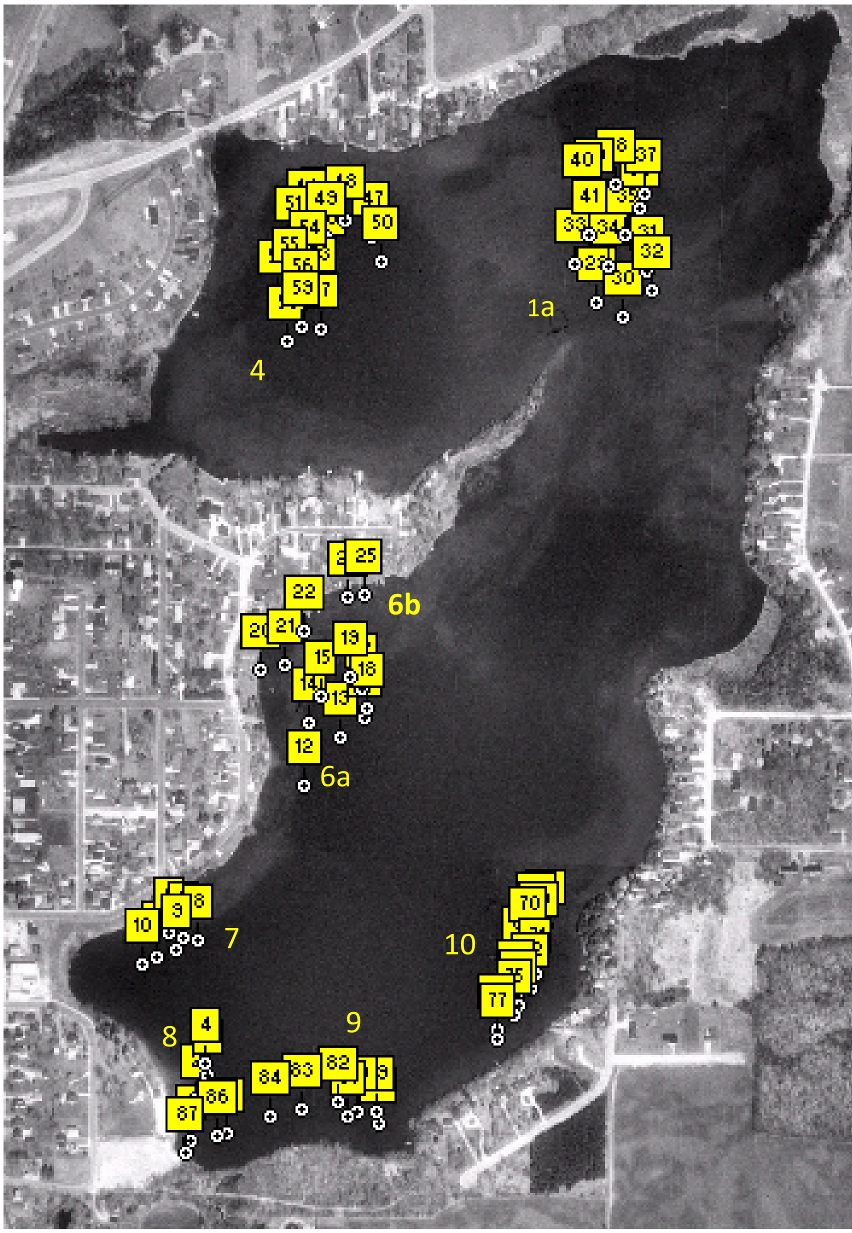
Additional Instructions For Invoicing:

MB 5/14

Exhibit N

Random Lake—Sheboygan County

August 13/14, 2015 Eurasian Watermilfoil Treatment



Area	Acres
1a	2.8
4	1.7
6a	1.5
6b	1.0
7	0.5
8	0.5
9	2.8
10	0.6
	11.4

Non-Highlighted Areas treated on 8-13-15.
Highlighted Areas Postponed until 8-14-15 due to wind/wave action within these areas.

Two Day Treatment Total: 11.4 acres
DMA4-IVM Herbicide Applied at 2 ppm concentration. Total Quantity Used 69.75 gallons.

Marine Biochemists
6302 W. Eastwood Ct.
Mequon, WI 53092
(888) 558-5106
www.marinebiochemists.com

Exhibit O

Aquatic Plant Management Herbicide Treatment Record

Notice: Completion of this form is a condition of WI DNR permits and provides records required by WDNR (NR107, WPDES 5.1) and DATCP (ATCP 29.21 & 29.22). The Department may not issue you future permits unless you complete and submit this form. Personally identifiable information required on this form is not likely to be used for purposes other than that for which it is originally collected. It may also be made available to requesters under Wisconsin Open Records law (ss. 19.31—19.39 Wis. Stats.).

Submit This Form: 1) Immediately if any unusual circumstances occurred during the treatment, 2) As soon as possible, no later than 30 days after treatment, 3) By October 1 if no treatment occurred

Completion of this form along with the Permit satisfies the requirements of WDNR **WDNR (NR107, WPDES 5.1) and DATCP (ATCP 29.21 &**

General Permit Information **Waterbody name (including ponds, eg., Smith Pond and Address)** **Treatment Information**

Permit Number: SE 2015-60-793	Random Lake	Treatment Date: 8/13/15	Start Time: 0930	End Time: 13:15
County: Sheboygan	Village of Random Lake	Water Temp (F): 78	Air Temp (F): 82	Wind Speed & Direction: SW 5-10 start, 10-15 finish

Treatment Area Size (Acres)	Average Depth (Ft.)	Water Volume (Acre-Ft.)	Est. Water Volume (Acre-Ft)	On Site DNR Supervision Present?
8.0 Acres	4.5-4.75'			☐ Yes ☒ No If yes, Supervisor Name:

Visual Observations/Notes: Treated areas 4, 6a, 6b, and 7-9 on our "Pre Treatment Survey Map". Areas 1 & 10 could not be treated due to winds/wave action in late morning/early afternoon (SW 10-15). To be completed tomorrow. Winds were <10 mph before noon.

Water Use Restriction Signs Posted in Accordance with NR107? ☒ Yes ☐ No 1 day swimming, 21 days irrigation

Note: Applicator Shall Provide Customer free copy of pesticide label used upon request

Name of Applicator(s)		Certification #	License #
Paul Hinterberg	☐	89833	440931
Jim Kannenberg	☐	28668	224269
Tom Lloyd	☐	53869	146250
Marc Schmitz	☐	77687	280174
Brian Suffern	☒	1517	142402
	☐		

Application Business Information
Marine Biochemists
6302 W. Eastwood Ct.
Mequon, WI 53092
(888) 558-5106

Name of Person Completing Form Brian J Suffern

Date 8/13/15

Pond	Product Used	E.P.A. Registration No.	Quantity Applied	Concentration (ppm) Or Rate (gal./acre) Applied
A. ☐ B. ☐ C. ☐ D. ☐	Aquathol-K	70506-176		
A. ☐ B. ☐ C. ☐ D. ☐	Clearigate	8959-51		
A. ☐ B. ☐ C. ☐ D. ☐	Cutrine-Plus	8959-10		
A. ☐ B. ☐ C. ☐ D. ☐	DMA4-IVM	62719-3	52.25	2 ppm to 8 acres/4.5'-4.75'
A. ☐ B. ☐ C. ☐ D. ☐	Harpoon	8959-54		
A. ☐ B. ☐ C. ☐ D. ☐	Harvester	100-1091-8959		
A. ☐ B. ☐ C. ☐ D. ☐	Hydrothol 191	70506-175		
A. ☐ B. ☐ C. ☐ D. ☐				

Contract Type: Per Treatment ☐ **Seasonal** ☐

FOR OFFICE USE ONLY

Product/Item Code ______________ **Amount** ______________ **Customer #** ______________

Additional Instructions For Invoicing: ______________________________

____

Aquatic Plant Management Herbicide Treatment Record

Notice: Completion of this form is a condition of WI DNR permits and provides records required by WDNR (NR107, WPDES 5.1) and DATCP (ATCP 29.21 & 29.22). The Department may not issue you future permits unless you complete and submit this form. Personally identifiable information required on this form is not likely to be used for purposes other than that for which it is originally collected. It may also be made available to requesters under Wisconsin Open Records law (ss. 19.31—19.39 Wis. Stats.).

Submit This Form: 1) Immediately if any unusual circumstances occurred during the treatment, 2) As soon as possible, no later than 30 days after treatment, 3) By October 1 if no treatment occurred

Completion of this form along with the Permit satisfies the requirements of WDNR **WDNR (NR107, WPDES 5.1) and DATCP (ATCP 29.21 &**

General Permit Information **Waterbody name (including ponds, eg., Smith Pond and Address)** **Treatment Information**

Permit Number	Waterbody	Treatment Date	Start Time	End Time
SE 2015-60-793	Random Lake	8/14/15	0945	12:45
County		**Water Temp (F)**	**Air Temp (F)**	**Wind Speed & Direction**
Sheboygan	Village of Random Lake	80	85	W 5-10

Treatment Area Size (Acres)	Average Depth (Ft.)	Water Volume (Acre-Ft.)	Est. Water Volume (Acre-Ft)	On Site DNR Supervision Present?
3.4	3-4			☐ Yes ☒ No If yes, Supervisor Name:

Visual Observations/Notes Completed balance of treatment that was Postponed due to wind/wave action. Applied material via subsurface injection

No Adverse Conditions noted

Water Use Restriction Signs Posted in Accordance with NR107? ☒ Yes ☐ No 1 day swimming

Note: Applicator Shall Provide Customer free copy of pesticide label used upon request

Name of Applicator(s)		Certification #	License #
Paul Hinterberg	☐	89833	440931
Jim Kannenberg	☐	28668	224269
Tom Lloyd	☐	53869	146250
Marc Schmitz	☐	77687	280174
Brian Suffern	☒	1517	142402
	☐		

Application Business Information
Marine Biochemists
6302 W. Eastwood Ct.
Mequon, WI 53092
(888) 558-5106

Name of Person Completing Form Brian Suffern

Date 8/14/15

Pond	Product Used	E.P.A. Registration No.	Quantity Applied	Concentration (ppm) Or Rate (gal./acre) Applied
A. ☐ B. ☐ C. ☐ D. ☐	Aquathol-K	70506-176		
A. ☐ B. ☐ C. ☐ D. ☐	Clearigate	8959-51		
A. ☐ B. ☐ C. ☐ D. ☐	Cutrine-Plus	8959-10		
A. ☐ B. ☐ C. ☐ D. ☐	DMA4-IVM	62719-3	17.5	2 ppm to 3.4 acres / 3.75 avg
A. ☐ B. ☐ C. ☐ D. ☐	Harpoon	8959-54		
A. ☐ B. ☐ C. ☐ D. ☐	Harvester	100-1091-8959		
A. ☐ B. ☐ C. ☐ D. ☐	Hydrothol 191	70506-175		
A. ☐ B. ☐ C. ☐ D. ☐				

Contract Type: Per Treatment ☐ **Seasonal** ☐ **FOR OFFICE USE ONLY**

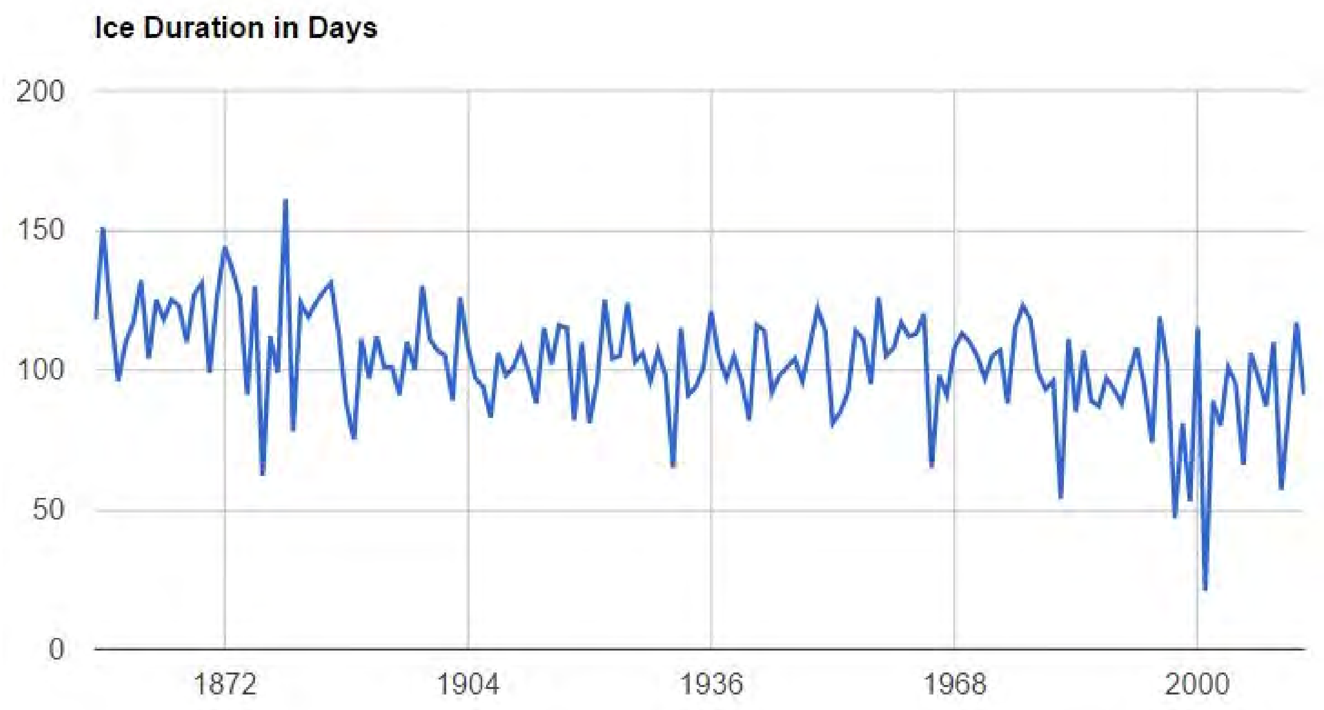
Product/Item Code ______ **Amount** ______ **Customer #** ______

Additional Instructions For Invoicing: ______

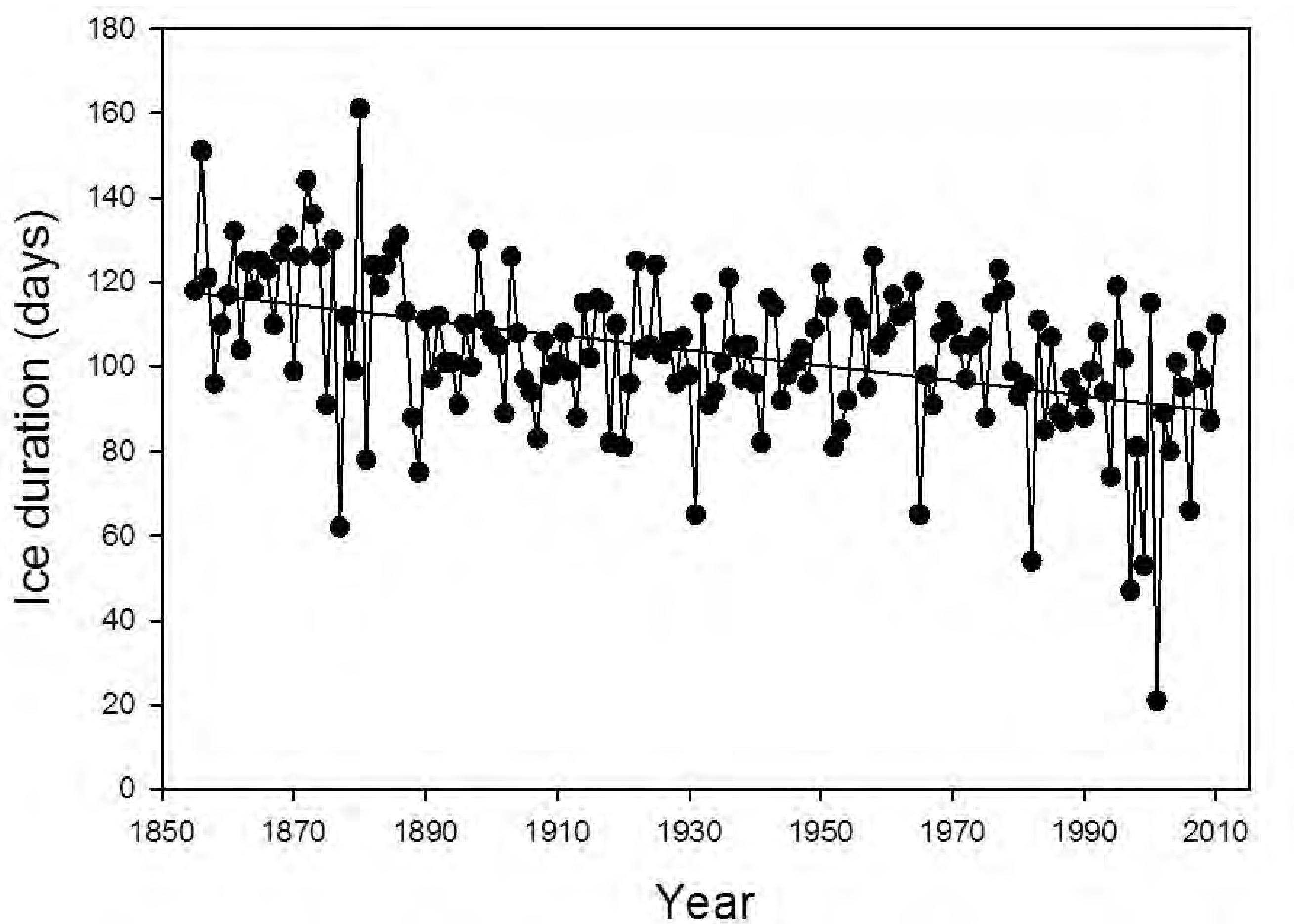
Ice-In Ice-Out

The annual “ice-in” or freeze date is defined as the first date on which the water body is observed to be completely covered by ice. The annual “ice-off,” “ice-out,” thaw, or breakup date is defined as the date of the last breakup observed before the summer open water phase. Ice duration is the number of days from ice-in to ice-out.

In the case of Lake Mendota, the most studied lake in the world, a 160-year long trend in ice duration is clear. The number of days of ice duration each year was plotted against calendar year:

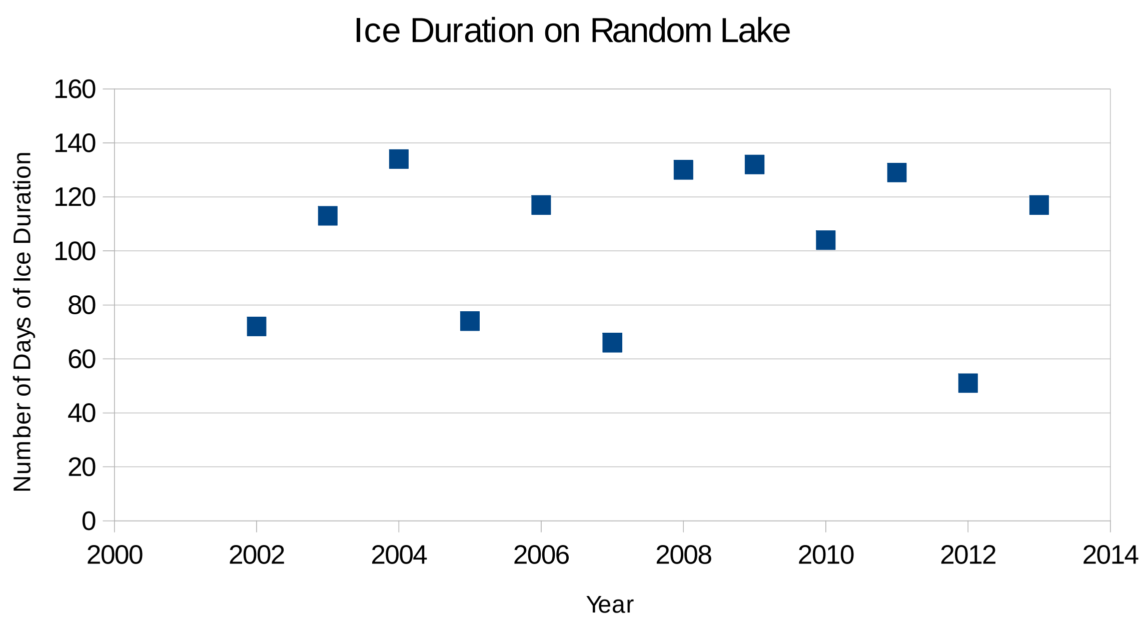


Here is the famous data set again with the trend line drawn:



The trend is hypothetically explained by climate change in Madison, Wisconsin from 1850 to now. It is left as an exercise for the reader to gather weather data from Madison, Wisconsin and to relate that data to ice duration.

The ice duration data for Random Lake only goes back to 2002. A plot of the data does not clearly show a trend because, if there were a trend, it is obscured by a high noise level or random variation in year-to-year ice duration. At any rate, here are the results:



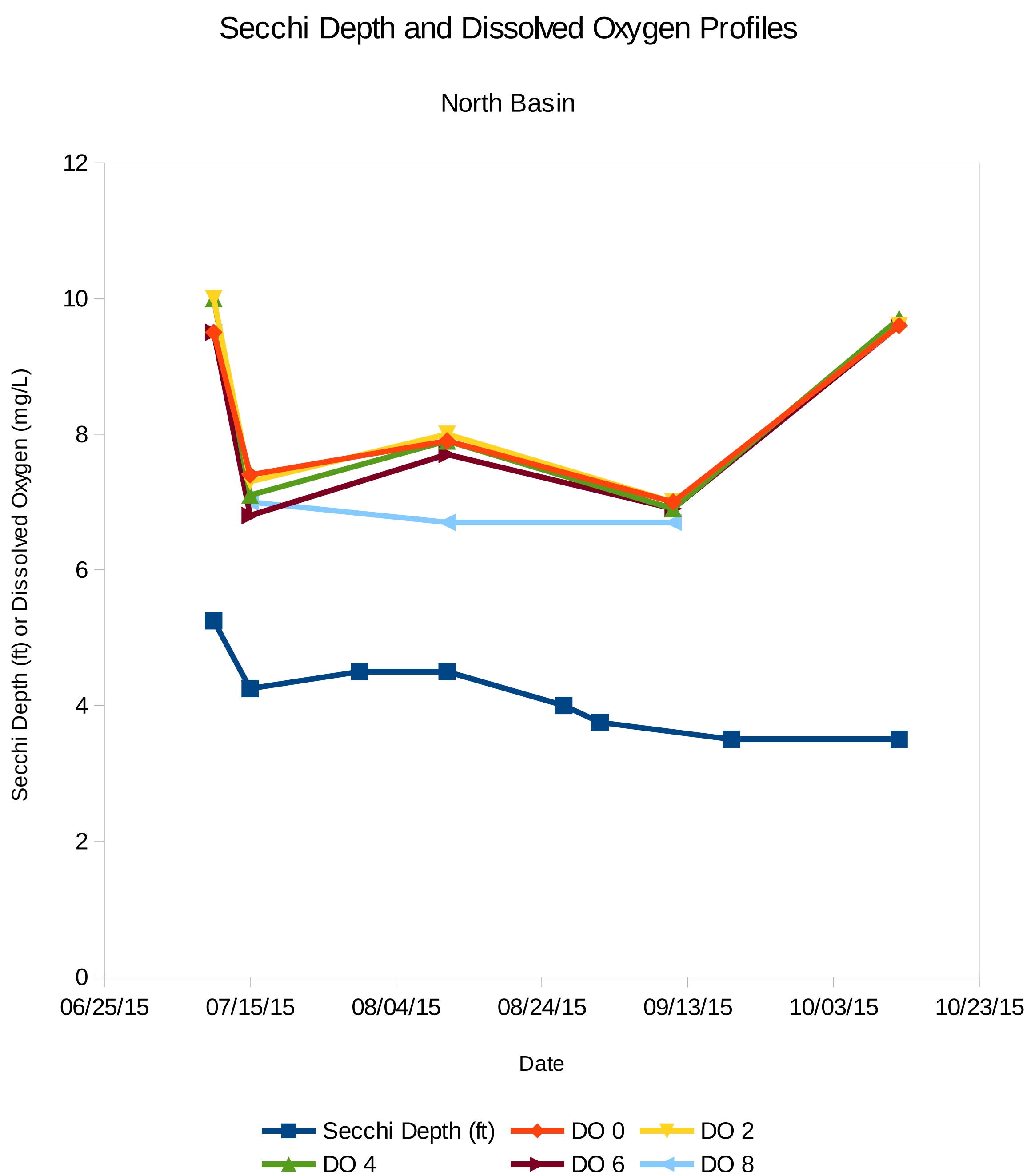
A trend could be formally drawn but we would not have much statistical confidence in it. If we continue to collect ice duration data for Random Lake for many years to come, we will later be in a position to spot a trend. It is a good bet that Wisconsin will continue its gradual warming trend as green house gases increase their concentration in the atmosphere. Experts project that Wisconsin's mean annual temperature will increase by several degrees by the year 2050! Note: ice duration data for 2014 was not collected and data for 2015 is not in yet.

North Basin Monitoring

The North Basin of Random Lake is enveloped by Lake Drive, West Lake Drive, Jessie Lane, Highway 144, and Stark Road shorelines. A deep if not the deepest point is located at N 43deg 33.516min W 87deg 57.277min with a 10+ ft sounding. However, the area that is >10-ft deep is small such that a boat positioned over that point is likely to drift on slack anchor lines and get soundings of <10 ft. Thus, in practice, temperature and DO profiles may only go down to 8 feet deep before hitting bottom. It is fair to say that the North Basin has a *Eurasian watermilfoil* problem as the invader is abundant everywhere.

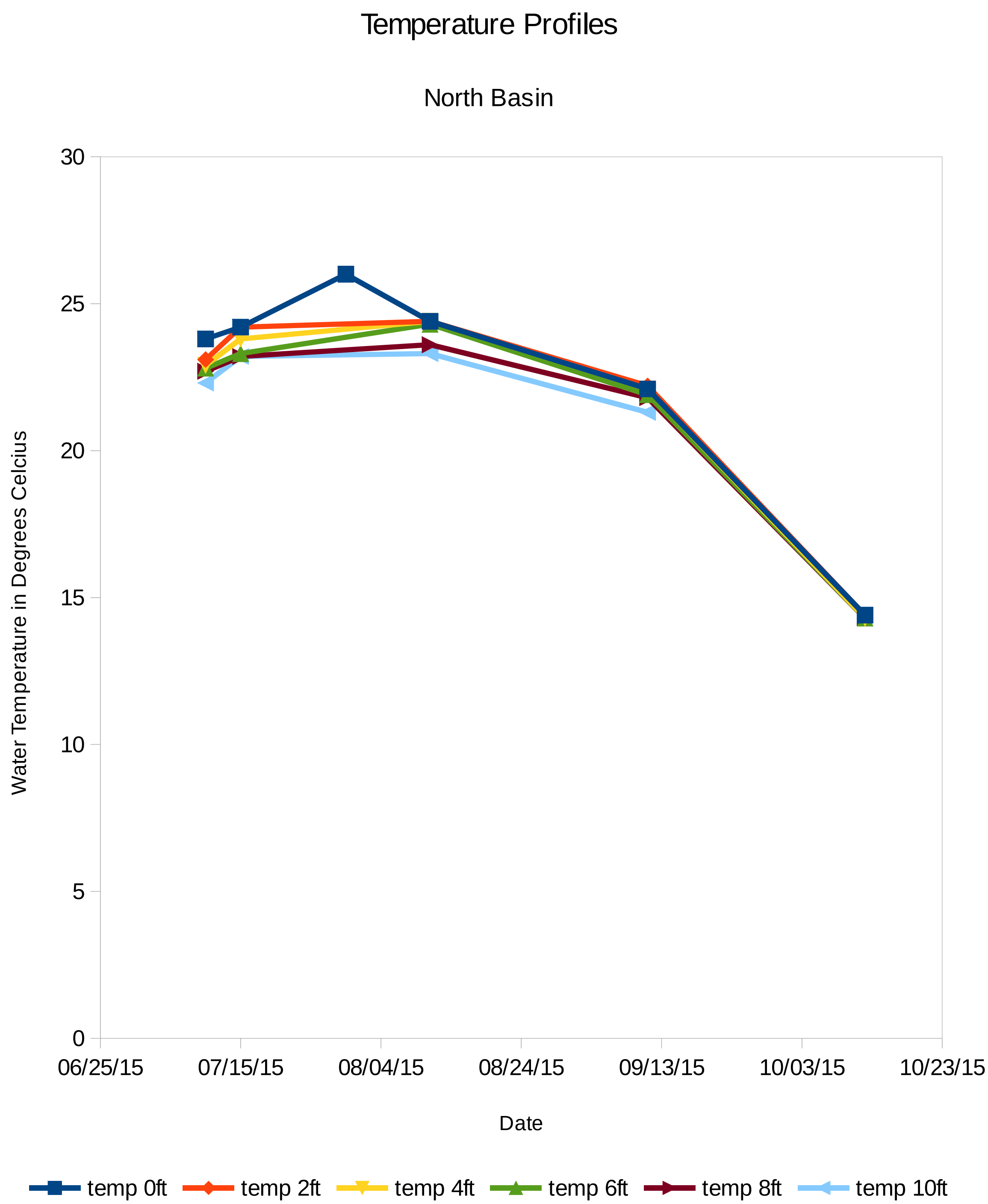
Wayne Stroessner last monitored the North Basin in 2004 and then stopped as WDNR did not support phosphorus and chlorophyll assays for a second sampling point on Random Lake. A summary 2004 report is archived here. Wayne found a location that was >= 12-ft deep. Next year I need to find this deepest location.

Monitored in 2015 were Secchi depth and temperature and DO profiles:



This is speculative, but the herbicide treatments in the North Basin in mid-June, aimed at killing *Eurasian water milfoil*, may have led to the slight decline of dissolved oxygen observed in mid summer to levels of 7-8 mg/L DO. The dead and decaying plant tissue consumes DO under aerobic bacterial action. In worst case situations, rotting organic material can completely deplete a waterbody of dissolved oxygen and then fish die. To my knowledge this has not happened on Random Lake.

We do not see much temperature stratification in the shallow North Basin:



Not shown here, but we do not see any noteworthy temperature difference between the surface water of North Basin vs. surface water of the deephole of the south basin, given the same date and virtually the same sampling time for both locations.

Study Topics

Ambitious students might wish to research a topic:

- rate of sedimentation in lake bed
- measurement of flow rate of water in and out of lake
- determination of hydraulic retention time
- investigation of ground water flow
- automated monitoring of lake water level
- improvements to static lake level gauge
- mapping of Random Lake watershed
- investigation of food web
- determination of nitrogen and other analytes in lake water
- implementation of chlorophyll assay at home
- microscopy of zooplankton, phytoplankton, bacteria
- plant survey
- analysis of lake bottom sediments
- involvement of students in lake monitoring
- implementation of defenses against invasive species
- effects of climate change on Random Lake
- children's book on a theme of lake monitoring
- calculation of phosphorus and nitrogen pollution from lawn and garden fertilizers
- microbiological safety of swimming beach

Bibliography

Applied Biochemists. *How to Identify and Control Water Weeds and Algae: an International Guide to Water Management* 5th ed. Ed. James C. Schmidt et al. Germantown, Wisconsin: Applied Biochemists, 1998. Web.

Betz, Carolyn Rumery, et al. *Wisconsin Citizen Lake Monitoring Training Manual (Chemistry Procedures)* 3rd ed. Madison, Wisconsin: Bureau of Science Services, Wisconsin Department of Natural Resources, 2009. Web.

Betz, Carolyn Rumery, et al. *Wisconsin Citizen Lake Monitoring Training Manual (Secchi Disk Procedures)* 3rd ed. Madison, Wisconsin: Bureau of Science Services, Wisconsin Department of Natural Resources, 2009. Web.

Blunden, J. and D. S. Arndt, Eds., 2015: State of the Climate in 2014. *Bull. Amer. Meteor. Soc.*, **96** (7), S1–S267.

Bras, Rafael L. *Hydrology: An Introduction to Hydrologic Science*. Reading, Massachusetts: Addison-Wesley Publishing Company, 1990. Print.

Brock, Thomas. *A Eutrophic Lake: Lake Mendota, Wisconsin*. New York: Springer-Verlag, 1985. Print.

Bronmark, Christer and Lars-Anders Hansson. *The Biology of Lakes and Ponds*. 2nd ed. New York: Oxford University Press Inc., 2005. Print.

Goldman, Charles R. and Alexander J. Horne. *Limnology*. New York: McGraw-Hill Book Company, 1983. Print.

Groves, Tony, et al. *Mapping and Understanding your Lake's Watershed,* Web.

Miller Michael A., et al. *Field Guide to Wisconsin Streams*. Madison, Wisconsin: The University of Wisconsin Press, 2014. Print.

Shaw, Byron, et al. *Understanding Lake Data*. Madison, Wisconsin: Board of Regents of the University of Wisconsin System, Cooperative Extension Publishing Operations, 2004. Web.

Stroessner, Wayne. *Random Lake Monitoring Program*. Serial six volumes 2003-2013.

Self published. Print. Lakeview Community Library, Random Lake, Wisconsin.

Wisconsin's Changing Climate: Impacts and Adaptation. 2011. Wisconsin Initiative on Climate Change Impacts. Nelson Institute for Environmental Studies, University of Wisconsin-Madison and the Wisconsin Department of Natural Resources, Madison, Wisconsin. Web.

Appendix: Monitoring Methods and Procedures

Data Handling

When out on the lake making observations and measurements, I enter the data on paper forms. On returning to the home office, I enter that data into spreadsheets (LibreOffice) and upload data to SWIMS (Surface Water Integrated Monitoring System). Paper records are then discarded. The spreadsheet files on the home office computer are periodically backed up on a USB thumbdrive. Anyone can request a copy of these spreadsheets. --Sydney Rader

How Do You Prepare to Sample?

The Day You Sample

On the day you plan to sample, complete the top portion of your field data sheet by filling in the Waterbody # (or WBIC), Station # (or Storet #), and Volunteer IDs (or names). If you do not know what these numbers are contact your CLMN regional coordinator. Before you launch your boat, make sure you have an anchor, sufficient gas, and personal flotation devices in your boat.

Before using your dissolved oxygen meter, be sure to read the owner's manual. In order to get accurate data from your meter, you must learn how to calibrate your meter and use your meter properly. Please keep a Calibration Log (see Appendix 7) to ensure good data.

If you use a YSI hand-held dissolved oxygen meter, please refer to the document "Helpful Tips When Calibrating YSI Hand-held Dissolved Oxygen Meter (Appendix 7) or refer to your manufacturer's instructions for calibration and use.

Sampling Overview

Dissolved Oxygen Meter

The CLMN allows volunteers to use their own dissolved oxygen meter to take your readings. If you choose to collect your dissolved oxygen data using this method, it is important to remember that some meters *must* be calibrated every time they are used. A calibration log and tips for using a meter is included in Appendix 7. The calibration log will keep you in tune with the performance of you meter, which ultimately will help you collect quality data. Please follow all instructions for care and maintenance found in the operation manual for your particular model as maintenance of the meter is imperative to get good data. If you choose this method you must inform your CLMN coordinator so they can flag the database with this information. At this time, the CLMN does not provide dissolved oxygen meters for volunteer use.

ON LAKE PROCEDURES

Dissolved Oxygen Monitoring

Dissolved Oxygen Meter

STEP 1. Your regional coordinator will assign 5 to 10 depths to sample for dissolved oxygen. Your meter will also record temperature. You will collect dissolved oxygen and temperature data at the same depths.

STEP 2. Follow manufacturer's instruction for calibration and use.

STEP 3. Lower the probe to the assigned depth. Record temperature and dissolved oxygen reading from the meter onto your data sheet.

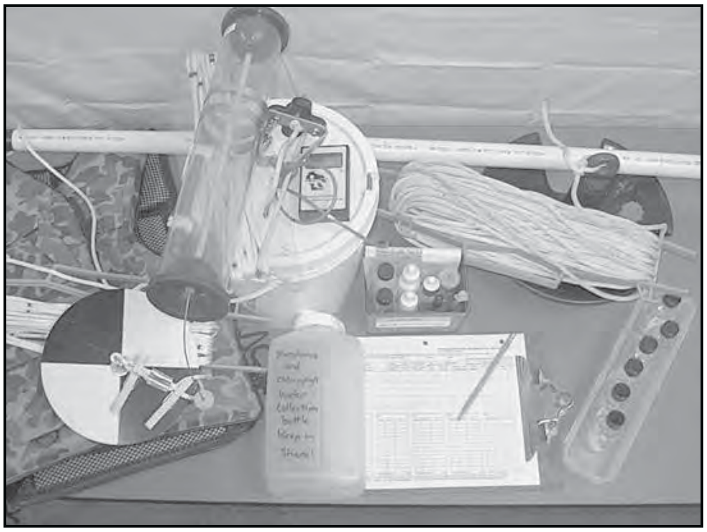
NOTE: Dissolved oxygen should be collected in the "mg/L" mode only. Some meters are calibrated in percent saturation, so be sure to use the mg/L mode while gathering data.

Record the type of meter you are using under "observations" on your data sheet.

6. DISSOLVED OXYGEN MONITORING:

Using the Titration Method

Before you start sampling, be sure to read the following pages to familiarize yourself with the equipment and the procedures that you will be using. *All of the procedures that you will follow in sampling your lake are done for specific reasons. It is very important that you follow the sampling procedures exactly as they are laid out in the following pages to ensure good, consistent, high quality data. The following pages will provide you with sufficient background on the design of the equipment and proper procedures to use.*



DNR PHOTO

Please remember to keep all sampling equipment and chemicals out of the reach of children. Many of the chemicals you will be using are hazardous (see Appendix 1). After sampling, it is very important to rinse and thoroughly air dry all of the equipment that you used. As always keep paperwork and envelopes separate from equipment.

What Equipment Will You Need?

At your training session, your CLMN regional coordinator will outline and provide all of the equipment that you will need to successfully monitor your lake.

- ☑ Manual
- ☑ Lake map with sampling sites marked
- ☑ Life jackets (you provide)
- ☑ Anchor and rope (you provide)
- ☑ Field data sheets
- ☑ Pencil and waterproof pen
- ☑ Van Dorn sampling bottle
- ☑ Safety gloves
- ☑ Safety goggles
- ☑ Chemicals and equipment in the LaMotte® titration kit (**note:** all chemicals should be replaced every year): manganous sulfate, alkaline potassium iodide azide, sulfuric acid, sodium thiosulfate, starch indicator solution, syringe, 25-ml graduated cylinder, eye dropper, dissolved oxygen sample bottles (labeled with appropriate depths) and rack, glass vial with plastic lid.

ESS INO METHOD 151.1
Chlorophyll *a*, Fluorescence
(EPA 445.0, rev. 1.2, Sept. 1997 and Welschmeyer, 1994)

1. Scope and Application

1.1. Chlorophyll *a*, a characteristic algal pigment, constitutes approximately 1 to 2% (dry weight) of planktonic algal biomass. This feature makes chlorophyll *a* a convenient indicator of algal biomass.

1.2. This method is applicable to the analysis of chlorophyll *a* in surface waters.

1.3. The Limit of Detection was determined according to ESS INO QA 116. The detection limit is dependent on sample volume filtered and fluorescence intensity. The detection limit for the instrument is 4 µg/L in the extract, which is always 13 mL. Based on a filtered volume of 200 mL, the sample limit of detection (LOD) is 0.26 µg/L, ((4 µg/L x 0.013L)/0.2 L) and the limit of quantification (LOQ) is 0.87 µg/L. Applicable concentration range for samples is dependent on volume filtered. The instrument is calibrated to approximately 800 µg/L.

2. Summary of Method

2.1. Algal cells are concentrated by filtering a known volume of water through a membrane filter (47 mm, 5.0 µm poresize). The pigments are extracted from the concentrated algal sample in a solution of aqueous 90% acetone aided by bath type sonication. The chlorophyll *a* concentration is determined by fluorescence. The excitation wavelength is 436 ηm with a slit width of 5.0 ηm. The fluorescence is measured at a wavelength of 680 ηm and a slit width of 3.0 ηm. The fluorescence spectrophotometer is calibrated with pure chlorophyll *a* standards of a known concentration. The resulting calibration curve is used to determine the chlorophyll *a* concentration in the sample extracts. The concentration of the chlorophyll *a* in the natural water sample is reported in µg/L

2.2. This method deviates from EPA 445.0 in the following ways:

2.2.1. Millipore type SM, 47 mm 5.0 µm membrane filters are used instead of the glass fiber filters recommended in the method to provide continuity with Wisconsin's historical chlorophyll data (WIDNR long-term trend monitoring data).

2.2.2. A Branson Ultrasonic Cleaner (Bath type sonication) is used to aid in extracting the chlorophyll from the algal cells instead of a tissue grinder. Bath type sonication is more efficient and is comparable to tissue grinding under most circumstances (see ref. 15.3, 15.4, and 15.5).

2.2.3 The instrument is calibrated every day of analysis. The instrument software uses linear regression rather than response factors for calibration.

2.2.4 A quality control sample (QCS) is run every day of analysis prior to sample analysis.

2.2.5 All sample results are determined "uncorrected", with no acidification for pheophytin correction according to Welschmeyer (15.1) and EPA 445.0, rev 1.2, 1997) (15.2). Because the fluorescence spectrometer used for this test is a higher resolution instrument, pheophytin correction is unnecessary (see reference 15.15).

2.2.6 Thirteen (13) mL of 90% acetone is used for extraction.

3. Safety and Waste Management

3.1 General safety practices for all laboratory operations are outlined in the Chemical Hygiene Plan and General Laboratory Safety Plan for the Agriculture Drive Facility, and the University of Wisconsin Laboratory Safety Guide (see ref. 15.6- 15.7).

3.2 All laboratory wastes, excess reagents and samples must be disposed of in a manner that is consistent with applicable rules and regulations.

4. Sample Preservation and Preparation

4.1 Samples for chlorophyll *a* analysis filtered in the field must be folded and put into a 15 mL polypropylene centrifuge tube, labeled with the sample volume filtered, wrapped in foil, and promptly shipped to the lab on ice.

4.2 Samples for chlorophyll *a* analysis to be filtered in the lab must be collected in a plastic quart bottle and be packed with ice in a dark cooler at the time of collection. These samples must be kept in the dark before filtering and filtering must occur within 48 hours of receipt. For these samples, filter no more than 200 mL of sample through a 47 mm, 5 µm pore size membrane filter and applying vacuum. Vacuum should not exceed 6 inches of mercury (20kPa). Less volume should be filtered if the chlorophyll concentration is expected to be high or filtering takes longer than 10 minutes. The filtration process must be performed in subdued light. For detailed filtering instructions please see appendix 2 at the end of this SOP. Refer to ESS INO GENOP 151 (15.19) to process these samples through HORIZON.

4.2.1 Fold the filter into quarters, insert into a graduated 15 mL polypropylene conical centrifuge tube with a screw cap, and store in a dark freezer. Be sure to record the appropriate information, including volume filtered, on the lab filtered chlorophyll log sheet.

4.3 Store field filtered samples in freezer upon arrival at the lab. Insert filters into graduated 15 mL polypropylene conical centrifuge tubes with screw caps when necessary.

4.4 Thirteen mL of 90% aqueous acetone solution is added to all samples prior to sonification.

4.5 Samples may be held at -20˚C for up to 3½ weeks after filtering. Although there is no mandated holding time for chlorophyll, the laboratory strives to complete analyses with the recommended 3½ week holding time.

4.6 Periphyton samples collected on filters will be handled in exactly the same manner as field filtered chlorophylls with any deviations mentioned in ESS INO GENOP 151 (15.19).

4.7 Periphyton samples collected on glass slides will be prepared according to Appendix 4 and processed through HORIZON according to ESS INO GENOP 151 (15.19).

5. Interferences and Comments

5.1. Any substance that fluoresces at 680 ηm may interfere in the accurate measurement of chlorophyll *a*. Using the narrow slit width (3.0 ηm) eliminates most common interferences.

5.2. Handle samples in subdued light to prevent photochemical breakdown of the chlorophyll.

5.3. Handle filters with forceps to prevent breakdown of chlorophyll from hand contact.

5.4. Protect the acetone extract from more than momentary exposure to light.

6. Reagents and Standards

6.1 Aqueous acetone solution (90%): Mix 90 parts reagent grade acetone with 10 parts reagent water. This solution has an expiration date of one year from date prepared. Record appropriate information in logbook #14 (under the 90% Acetone tab). The reagent code will also be written on the bench records, the bottle itself, and the repipettor. This logbook is located by the BOD computer in room 119.

6.2 Reagent water, ASTM Type I: Prepare by passing R.O. water through a U.S. Filter Pure-Plus Water System.

6.3. Chlorophyll *a* Standard stock: Obtained from Sigma Chemical (St. Louis, MO.) in dry form and diluted with aqueous 90% acetone (6.1). Sigma #C-6144, (chlorophyll *a* from *Anacystis nidulans* algae) 1 mg size.

6.3.1. In subdued light, quantitatively transfer the entire contents of the vial to a 100 mL volumetric flask using 90% acetone to rinse all material from the vial. Dilute to the mark with additional 90% acetone and mix thoroughly. The nominal concentration is about 10 mg/L. The actual chlorophyll *a* concentration is determined by averaging four replicate readings using the spectrophotometric method (uncorrected) described in ESS INO IOP 151.1 (see appendix 1). All pertinent information, including the stock standard code, manufacturer, lot#, date received, concentration, date prepared, analyst's initials and expiration date must be recorded in the standards logbook #13, located in the Wet Chemistry area. The stock standard must be stored in a light tight box in the -20ºC freezer, located in the alcove in room 119. The expiration date is one year from the date prepared.

6.3.2. Working standards: Prepare the following working standards immediately after confirming the stock standard concentration as in 6.3.1. All standards are diluted to volume with aqueous 90% acetone (6.1). Please note that the below working standards are nominal concentrations. The exact concentration will vary from lot to lot. All concentrations for the working standards need to be determined by averaging three replicate readings using the spectrophotometric method (uncorrected) described in ESS INO IOP 151.1 (see appendix 1). All pertinent information (as in 6.3.1) must be recorded in the standards logbook #ESS475, located in the Wet Chemistry area, room 119. Transfer working standards to screw capped amber bottles and label. The working standards must be stored in a light tight box in the -20ºC freezer, located in the alcove in room 119. The expiration date is six months from the date prepared.

Volume of stock (6.3.1) standard (mL)	Diluted to volume (mL)	Nominal concentration mg/L
0.30*	250	0.012
2.5	500	0.050†
5	500	0.100†
10	500	0.200†
25	500	0.500†
20	250	0.800

*Use an electronic, variable volume Rainin pipette to prepare this standard. Class A volumetric pipettes may used for the rest.

† These standards are rotated as the IPC

6.4. Quality control sample (QCS): Prepare from a different Sigma lot than the stock standard. Sigma catalog # C5753 (chlorophyll *a* from spinach)

6.4.1. Prepare a 10 mg/L (nominal concentration) stock QCS and determine actual concentration as in 6.3.1 (average of four replicate readings). Transfer to a screw capped amber bottle, and label. All pertinent information must be recorded in the standards logbook #13, located in the Wet Chemistry area, room 119. The stock QCS must be stored in a light tight box in the -20ºC freezer, located in the alcove in room 119. The expiration date should be one year from the date prepared.

6.4.2. Prepare a 100 µg/L (nominal concentration) QCS (to be used with every analytical run) and determine actual concentration as in 6.3.2 (average of three replicate readings). Transfer to a screw capped amber bottle, and label. All pertinent information must be recorded in the standards logbook #ESS475, located in the Wet Chemistry area. The QCS must be stored in a light tight box in the -20ºC freezer, located in the alcove in room 119. The expiration date is six months from the date prepared.

7. Apparatus

7.1 Standard laboratory glassware including membrane filtration apparatus.

7.2 Millipore Type SM, 47 mm, 5.0 µm pore size membrane filters.

7.3 Calibrated 15 mL polypropylene centrifuge tubes with screw caps.

7.4 Vacuum source with an adjustable vacuum gauge.

7.5 Light-tight box capable of holding a 40-tube test tube rack.

7.6 Branson Model 5210 MT Ultrasonic Cleaner for cell disruption.

7.7 International Equipment Company Model K centrifuge, capable of attaining 500XG.

7.8 Perkin-Elmer fluorescence spectrometer, model LS – 55.

7.9 Re-pipet dispenser, 25 mL capacity.

7.10 Rainin variable volume electronic pipettes, Eppendorf mechanical air displacement pipettes and standard class A volumetric pipettes.

8. Quality Control

8.1 Please refer to the Environmental Health Division Quality Assurance Manual (15.10) for general information on quality control procedures. Important specifics include:

8.1.1 Accuracy and precision calculations.

8.1.2 Corrective action procedures (including documentation requirements) for instrument problems or analytical problems.

8.2 A Laboratory Reagent Blank (LRB) will be analyzed with every analytical run. This is made by taking a membrane filter (7.2), placing it in a 15mL polypropylene centrifuge tube (7.3), adding 13mL of 90% acetone (6.1), and carrying it through the entire preparation procedure. This will be analyzed at the beginning of the analytical run, and after every 20 samples and must be within ±0.26 µg/L, the LOD based on filtered volume of 200mL. If the LRB fails it should be re-analyzed. If it still fails the analyst should evaluate if recalibration would improve the blank reading. If recalibration is done the samples back to the last good LRB and IPC must be re-analyzed. If recalibration does not cause the blank to be acceptable, the 20 samples associated with that LRB must be qualified with a comment stating that the LRB exceeded acceptable limits.

8.3 A working QCS (see section 6.4.2) is run at the beginning of every analytical run. The observed concentration of the QCS must be within ± 10% of the true value (6.4.2) before proceeding with analysis. Re-prepare the QCS if prep error is suspected and reanalyze. If QCS still fails, re-calibrate and try again. If subsequent attempts fail and samples cannot be stored, proceed with the analyses and qualify all results.

8.4 The Limit of Detection (LOD, the concentration at which the result is definitely distinguishable from a blank) must be verified annually, or after any significant work is done on the instrument. For more information on LOD protocol, see ESS INO QA 116 (15.13).

8.5 At least 10% of lab filtered chlorophyll samples are analyzed in duplicate. The difference between the duplicate measurements must be within control limits before sample results are considered acceptable. Samples that fail to meet QC limits will be qualified. Since the majority of samples are field filtered and planktonic material tends to be heterogenous in nature, little corrective action can be taken to improve precision. Visual examination of the extract, documentation and notification of data users through qualifiers is about all that can be done. Consequently, entire batches of data are not qualified based on duplicate QC failures.

8.5.1 The QC limits for duplicate analyses can be found in HORIZON or the duplicate must be within ± the LOD of the original result.

8.6 Field duplicate analyses are only analyzed when our clients provide us with duplicate filters. Therefore, separate QC limits have not been developed for these tests.

8.7 A 90% acetone blank (Calibration Blank—CB) is run at the beginning of each analytical run, every ten samples, and at the end of each analytical run. The blank must be < 0.26 µg/L based on a 200 mL volume (sample LOD). If the initial blank exceeds the LOD, the intercept from the calibration is examined to determine whether there was a problem at calibration, the initial blank is contaminated or if the fluorescence cell is dirty. If the intercept is high or the cell dirty, it is cleaned and the instrument re-calibrated. The initial blank and QCS must be acceptable before proceeding with analysis.

8.8 An Instrument Performance Check (IPC) (see section 6.3.1) is run every 10 samples. The IPC must be within ± 10% of the true value. If it deviates from this acceptable limit, the analyst will attempt to determine whether the cell has become dirty, the instrument has drifted, or the IPC is contaminated. If the problem can be identified, it is corrected, the instrument re-calibrated and all samples back to the last valid IPC will be reanalyzed.

8.9 Dilutions are typically made by adding 1mL of sample to 4mL of 90% acetone solution using mechanical air displacement pipettes (7.10). Dilute high samples, add the sample numbers to analytical run list, change the dilution factor to reflect the 5x dilution, and analyze along with an IPC and CB every ten samples and at end of the run of diluted samples. Dilution concentrations should be within 90%-110% of the original concentration. If dilutions do not agree with the initial concentration, another different dilution should be performed to verify. If two serial dilutions do not agree (90%-110%), the sample result must be qualified.

8.10 An initial demonstration of capability (DOC) and annual continued proficiency checks will be performed according to reference 15.12.

8.11 Record date, analyst, intensities of top standard and QCS, standards and QCS codes, HORIZON batch number, and any applicable comments in instrument logbook # 89.

9. Method Calibration

9.1 The calibration curve is constructed using a blank and six (6) standards of increasing concentration of chlorophyll *a* from approximately the limit of quantification (LOQ = 12 µg/L) up to approximately 800 µg/L (see section 6.3.2). These concentrations are for chlorophyll *a* in the acetone solution extract.

9.2 The working calibration standards (6.3.2) are set out on the counter and allowed to warm to room temperature in the dark and used to calibrate the instrument each analysis day. The stock working calibration standards are discarded after six (6) months.

9.3 The sample chlorophyll concentrations are calculated directly within the instrument software using a linear regression. The standards are entered in the instrument sequence in mg/L (ppm) even though the samples are reported out in µg/L (ppb) chlorophyll *a*. This is done due to limitations of the software correction factor field. Please refer to software printout in Figure 1 for further explanation. Since all standards and samples must have the same concentration units in the software, the reporting units for the samples must be changed manually after every analytical run. This is done by making a single line through the (ppm) above the sample results, and initial and date the correction.

9.4 The calibration curve must have a correlation coefficient r ≥0.999. The curve is printed out for visual verification. If unable to achieve the ≥0.999 r coefficient, visually check for standards that are obviously bad, re-make standards as needed, and recalibrate. **DO NOT** proceed with the analysis until the problem is resolved.

10. Procedure

10.1 Refer to ESS INO GENOP 151 (15.19) to determine procedures necessary to process samples through HORIZON.

10.2 All tubes must be unwrapped, or unpackaged as necessary, being sure to place the barcode label (with the lab slip number) on the tube. Place any filters received in foil, or in a miscellaneous container, in a graduated 15 mL polypropylene conical centrifuge (7.3) tube with screw cap and be sure to transfer barcode label to tube. All tubes are placed in racks of 36 (due to max sample places in centrifuge), in the order of the worklist (field filtered first, then lab filtered).

10.3 Add 13 mL of aqueous 90% acetone (section 6.1), using a repipette dispenser, to each sample tube. Shake vigorously for 20 seconds to break up filter. Place tubes in the light-tight box when not being processed.

10.4 Suspend rack with tubes in the ultrasonic bath with water one inch from the top. Cover (to exclude light) and sonicate for 25 minutes. Shake tubes vigorously for 20 seconds and return the rack to the light-tight box.

10.5 Place the light-tight box in the < 4°C cold room and allow the extract to steep overnight.

10.6 Shake sample tubes vigorously after steeping overnight. Clarify the extract by centrifuging the tubes for 30 minutes at approximately 500XG (setting of 30-35 on International Equipment Company Model K centrifuge).

10.7 Put the pump tubing on the LS-55 fluorescence spectrometer (7.8) into the pump roller and adjust tension to obtain smooth flow. Rinse the fluorescence cell with 90% acetone.

10.8 Open FLWinlab software and select "chlorophyll.mth" under the applications listed.

10.9 Under the "Setup parameters" tab change the destination filename to: U<fiscal yr. Date>.rpt

10.10 Under the "References" tab change standard concentrations to 3 decimal places. The software automatically changes concentrations to 2 decimal places when closed.

10.11 Under "Samples" tab, enter QCS, IPC, (both corr. fact. = 1000), CB (corr.fact. = 65), the sample lab numbers and correction factors ((13/vol filtered) x 1000). Sample numbers may be entered using the barcode scanner attached to the instrument and the lab worklist which has all the barcodes printed out (and the volumes to calculate the correction factors).

10.12 Place aspiration tubing in blank 90% acetone and click on "Measure background" button, (value should be near 0.000). Calibrate the instrument by running a blank and subsequent standards in increasing concentration order (linear, with calculated intercept). The correlation coefficient (corr) must be ≥ 0.999 before samples can be analyzed.

10.13 After calibration, evaluate and verify the calibration process (QCS, IPC, and CB.) before beginning analysis of samples. Analyze the IPC and CB every ten samples and at the end of the run, and a LRB at the beginning and after every 20 samples. Take the appropriate corrective action described in the Quality Control Section (8) if any IPC, CB or LRB exceeds limits.

10.13.1 Record the fluorescence intensity of the QCS and the top calibration standard in the instrument logbook #89 along with the standard and QCS codes and HORIZON batch number.

10.14 Remove one tube at a time from the light-tight box and using the sipper system, aspirate sample into the instrument. The intensity will be measured and the concentration will be automatically calculated. Both values are recorded in the .rpt data file. Return the sample to the light tight box in case reanalysis is required. At end of run click on "Save Results" button.

10.15 If the fluorescence intensity of a sample is greater than the top standard intensity, return the sample tube to the light-tight box so it can be diluted and re-analyzed at the end of the analytical run by making a new "Samples" list, with a correction factor that reflects the proper dilution.

10.16 When all samples have been analyzed, print the calibration and sample files using the printer icon. Data are saved on the network in G:/Flwinlab/Data/filename.rpt.

10.17 Transfer the data according to ESS INO GENOP 151 (ref. 15.19).

11. Calculations.

11.1 The sample intensities are converted to concentration by the software based on a linear regression calibration curve. A correction factor is applied to convert the concentration from the regression to the sample concentration in µg/L.

11.2 The general equation for determining the chlorophyll is as follows:

11.2.1 mg/L from regression*13 mL (extract volume)*1/mL sample filtered * 1000 µg/mg = chlorophyll a in µg/L.

11.3 The correction factor is used to convert the concentration of chlorophyll *a* in the extract to the concentration of chlorophyll *a* in the sample based on the extract volume and the volume of sample filtered. This process is accomplished using a correction factor.

11.3.1 The Perkin-Elmer instrument software has a limit of 2 decimal places. Consequently, we cannot calibrate in units of µg/L because the correction factor (see 11.2.1) has too few decimal places and it would be have to be rounded. For example, if calibrating in µg/L, the correction factor would be 0.065. However, the software would round that factor to 0.06, which would bias test results. To get around this problem, we calibrate in mg/L and add a multiplication factor so we can report in units of µg/L. Details of the correction factor follow.

11.3.2 Correction Factor = (13 mL of sample in extract / mL of sample filtered)*1000. For most samples, the factor is: (13mL / 200 mL)*1000=65.

11.3.3 For dilutions (section 8.9) the correction factor needs to reflect the dilution (multiplied by 5 for a fivefold dilution). For example, a sample diluted 1 to 5 that has 13 mL of extract and 200 mL of sample filtered would need a correction factor of 325 (65*5=325). This ensures that the result is properly calculated by the software. For the correct way to enter dilutions into the software see ESS INO GENOP 151 (15.19).

11.4 Duplicates and spikes are calculated as shown in the EHD QA manual (15.10).

12. Data Management

12.1 QC data will be evaluated in the HORIZON operating system.

12.2 The entire analytical run is passed on to another chemist for QC audit. An analytical run will include: cover sheet with queue, batch number, and HBN, a batch worklist for each of the prep batches and any and all analytical batches, and all raw data.

12.3 Once the QC audit has been completed the entire run is stapled together and filed with the other chlorophyll runs.

13. Definitions

13.1 Definitions of terms in this SOP may be found in section 3.0 of Method 445.0 (see ref. 15.2).

13.2 General definitions of other terms that may be used in this method are found in the EHD Quality Assurance Manual (see ref. 15.10).

14. Method Performance

14.1 Where applicable, the laboratory's initial accuracy and precision data (LOD's and DOC's) were generated in compliance with the reference method and the Inorganic Chemistry Department's standard operating procedures: ESS INO QA 115 (see ref. 15.12), and ESS INO QA 116 (see ref. 15.13). Data generated within the last two years will be kept on file within the Inorganic Chemistry Department. Data older than two years may be archived in the basement.

15. References

15.1 Welschmeyer, 1994 Fluorometric analysis of chlorophyll *a* in the presence chlorophyll b and pheopigments. Lmnol. Oceanogr. 39(8), pp. 1985-1992, (1994)

15.2 Environmental Protection Agency (EPA) Method 445.0 rev 1.2 (September, 1997).

15.3 Garrison, P., Comparison of Grinding samples vs. Sonicating, Memorandum, (1990).

15.4 Bowman, G. and Easterday, P. Proposed improvements in chlorophyll testing at the State Laboratory of Hygiene, Memorandum, (1995).

15.5 Nelson, D.H. Improved Chlorophyll Extraction Method, Science, 132, p. 351, (1960).

15.6 AG DR SAFETY GENOP 102, Chemical Hygiene Plan and General Laboratory Safety Plan, Wisconsin State Laboratory of Hygiene.

15.7 University of Wisconsin—Madison, Chemical & Radiation Protection Office, Safety Department (262-8769), "Laboratory Safety Guide," 2004, http://www.fpm.wisc.edu/safety.

15.8 Axler, R.P, and C.J.Owen. Measuring Chlorophyll and Pheaophytin: Whom Should you Believe? Lake and Reserv. Manage. 8(2): pp. 143-151. (1994).

15.9 2009 TNI Standard, Volume 1: Management and Technical Requirements for Laboratories Performing Environmental Analysis, The NELAC Institute, 2009.

15.10 Quality Assurance Manual, Environmental Health Division, Wisconsin State Laboratory of Hygiene.

15.11 ESS INO METHOD 150.1, "Chlorophyll, Spectrophotometric, Trichromatic and Monochromatic Methods." Archived.

15.12 ESS INO QA 115, "Initial DOC and Annual Continued Proficiency Check Procedures."

15.13 ESS INO QA 116, "LOD Procedures."

15.14 ESS INO QA 114, "LIMS Quality Assurance Worksheet Procedures."

15.15 Kennedy-Parker, D., G. Krinke, G. Bowman, P. Rasmussen, and R. Arneson, "Maintaining Continuity in Chlorophyll Trend Data While Improving the Analytical Method," poster presentation, Wisconsin State Laboratory of Hygiene, and Wisconsin Department of Natural Resources, Feb., 2003.

15.16 LS 55 Luminescence spectrometer User's Guide, PerkinElmer Ltd., part # 09934436, release A, Aug. 2000.

15.17 FL WinLab Software User's Guide, PerkinElmer Ltd., part # 09934434, release A, Aug. 2000.

15.18 Fl WinLab Software disk, V4.00.02, L225-8001 Issue B, June 2001.

15.19 ESS INO GENOP 151, "Chlorophyll HORIZON Procedure."

Version Tracking

Version Date	Ver #	Revised by	Changes Made
July, 2011	4.0	D. Kennedy-Parker	Some formatting changes, updated section 6 to reflect new standards prep, using 1mg stock instead of 5mg stock for Sigma. Removed confusing language about minimum volume in section 1. Added corrective language about the LRB to section 8.3. Removed LDR definition since it is not acceptable for this method.
Jan. 2012	5.0	S. Hill/B. Clary	Added outside document references to section 15. Added appendix 3, sample volume correction factor table. Added section 8.4, LOD information.
March 2014	6.0	B. Clary	Updated sections 8.5.1, 10, and 12 and also Appendix 2 for HORIZON. Added to sample handling, section 4. Added appendix 4 for periphytons. Corrected some procedural issues. Added reference to HORIZON GENOP 151 (15.19). Corrected logbook references in Appendix 1 and section 6. Updated figure 1 to reflect actual run.

Appendix 1
ESS INO IOP 151.1
Determination of Chlorophyll *a* Standards and Quality Control Sample Concentrations

The actual concentration of the stocks, standards, and the 2nd source quality control sample (QCS) used to calibrate and verify the Perkin-Elmer LS-55 fluorescence spectrometer, must be determined by spectrophotometric means, prior to analysis of samples for chlorophyll *a*. The following process must be used for those determinations.

1. Prepare the standards and QCS as in ESS INO METHOD 151.1 section 6.3 and section 6.4.

2. Turn on the Beckman DU-650 spectrophotometer and click on the VIS lamp to ON. Allow the instrument to warm up for one hour. The instrument will go through an automatic system check which includes wavelength calibration check, stray light and lamp intensity verification. DO NOT proceed if any error messages are displayed during the start-up sequence. Call for Beckman service if start-up problems cannot be corrected by the analyst. Install the cell holder in place on beam track. Use the 1mm cell holder for stock solutions, and the 5mm cell holder for working standards and QCS.

3. Select **fixed wavelength, Method, A:\ Unchloro, Exit**. The method and wavelengths are now programmed. The analysis should be performed in dim light.

4. Fill the 5mm cell with 90% acetone and click on **Blank** at the bottom of the screen. This will zero the instrument on all wavelengths. Click on number **1** type in “CB” using keyboard, or screen keys, and right click on mouse to read. The intensities should be near zero.

5. Empty cell and fill with appropriate solution, select next number, type in nominal concentration and right click to read. Empty cell and repeat for each replicate. Do four replicates for stock solutions, and three replicates for working solutions.

6. End with a blank (CB) and print results.

7. Enter values into R:\Ehd\ESS(4900)\ESS Inorg(4910)\General Chemistry\Chlorophyll\unchlor.xls. This will calculate the actual chlorophyll *a* concentrations. Calculate average of replicates and record in logbook #ESS475, located in the General Chemistry area. Label amber solution bottles with reagent code, preparation date, analyst, and expiration date. Stock standards expire in one year, and working solutions expire in six months. Store all in chlorophyll freezer at -20ºC.

Appendix 2

Filtering Samples for Chlorophyll *a* Analysis

1. Refer to ESS INO GENOP 151 (15.19) to determine the procedures necessary to process these samples through HORIZON.
2. Adjust vacuum gauge to approximately -6 inches Hg. Nearly all the way out. Make this adjustment with your finger completely covering the end of the vacuum jet.
3. Connect filtering flask to vacuum jet.
4. Insert bottom half of filtering funnel into flask.
5. Place 5.0 µm filter on fritted portion of filtering funnel.
6. Clamp upper portion of filtering funnel over filter.
7. Rinse entire apparatus with reagent water.
8. Shake sample container well and pour into graduated cylinder (max. volume 200 mL).
9. Immediately pour graduated cylinder contents into filtering funnel. Rinse the graduated cylinder into the filtering funnel with reagent water.
10. As liquid level reaches filter, rinse the sides of the filtering funnel and close the vacuum jet.
11. Remove filter and place into 15 mL capped tube. Put lab number on tube and record the sample volume filtered on the batch worklist.
12. Place in light tight box, until all filtering is complete, then transfer to light tight box in -20º C freezer.
13. Rinse all parts of filtering apparatus with reagent water and re-assemble with new filter.
14. When all samples are filtered, rinse apparatus, disassemble and store below counter.

Appendix 3

Chlorophyll a Sample Volume Correction Factor for PE LS-55

VOLUME	C.F.x1000
10	1300.00
25	520.00
30	433.33
50	260.00
60	216.67
100	130.00
150	86.67
200	65.00
250	52.00
300	43.33
350	37.14
400	32.50
450	28.89
500	26.00
550	23.64
600	21.67
650	20.00

VOLUME	C.F.x1000
700	18.57
750	17.33
800	16.25
850	15.29
900	14.44
950	13.68
1000	13.00
1050	12.38
1100	11.82
1150	11.30
1200	10.83
1250	10.40
1300	10.00
1350	9.63
1400	9.29
1450	8.97
1500	8.67

Appendix 4
Procedure for Periphyton Samples Collected on Glass Slides

1. Periphyton samples will arrive on a number of glass slides. For the procedure for processing these through HORIZON see ESS INO GENOP 151 (15.19). All samples will be held in the freezer in the solids room in room 119 until preparation day. Make sure to follow proper safety procedures; wear gloves for this operation.
2. Label a 15mL centrifuge tube (7.3) for each periphyton sample and place all tubes in a green rack.
3. Rinse the plastic funnel into the waste bucket with the squeeze bottle of 90% Acetone (6.1). Place the funnel into the centrifuge tube.
4. Remove the first glass slide from the sample. Use a razorblade to scrape each side of the slide into the funnel. Rinse the razorblade into the funnel with the squeeze bottle. Make sure to use the squeeze bottle sparingly as the total volume in the tube will be 13mL.
5. After scraping both sides of the slide and rinsing the razorblade, rinse both sides of the slide with the acetone solution.
6. Repeat steps 4 and 5 for each slide in the sample. Make sure to record the number of slides in order to correctly compute the periphyton concentration and adjust the LODs in HORIZON according to ESS INO GENOP 151 (15.19).
7. After completing the process for each slide in the sample rinse the funnel with the acetone solution into the tube to make sure all the material makes it into the tube. Dilute the tube up to the 13mL mark with the acetone solution.
8. If over-dilution has occurred make a note of this and adjust the LOD in HORIZON accordingly.
9. Take these samples through the remaining preparation process as normal from this point.
10. Analyze the samples as any other chlorophyll samples with a correction factor of 1.
11. Hand-calculate the periphyton result per area using the following equation:

$$(\text{Chlorophyll a result in } \mu g/L*V)/(S*0.0038m^2) = \text{Periphyton concentration in } \mu g/m^2$$

Where V is the volume of extract in L (usually 0.013L) and S is the number of slides. This is the value that will be entered into HORIZON according to ESS INO GENOP 151 (15.19).

Figure 1

```
Quantitation results file:C:\FLWINLAB\DATA\UY1108.rpt
Generated on :11-08-2013, at time:11:40:44
************************************************************
Measurement conditions
Method:                 C:\FLWINLAB\METHODS\Chorophyll.mth
Analyst:                BAC*1022
Comments:               ESS INO METHOD 151.1 rev.5 January, 2012
(EPA 445.0 rev.1.2 and Welschmeyer,1994)
Chlorophyll 0.0- approx. 550ppb
EM slit 3 nm EX slit 5 nm
Std conc. entered as mg/L
Sample results for Chlorophyll a reported as ug/L

------------------------------------------------------------
Ex. wavelength (nm):    436
Em. wavelength (nm):    680
Ex. slit (nm):          2.5
Em. slit (nm):          3.0
Integration time (s):   1.00
Em. filter:             open

Sipper parameters:
Pump time(s):   10.0
Delay time(s):  0.0
Purge time(s):  0.0
Purge direction backwards
************************************************************
Reference sample results
------------------------------------------------------------
Std#    Conc*Fact        Intens.         BG     Factor
           (ppb)
------------------------------------------------------------
Cal BLK    0.000         0.000          0.000          1.00
Std 0.0089        0.009           0.625          0.000          1.00  1
Std 0.0429        0.043           4.065          0.000          1.00  1 Standards are entered as mg/L in second column
Std 0.0915        0.091           9.409          0.000          1.00  1
Std 0.1840        0.184          18.478          0.000          1.00  1
Std 0.4637        0.464          47.589          0.000          1.00  1
Std 0.7386        0.739          75.166          0.000          1.00  1 Any sample that has intensity >top std is diluted
------------------------------------------------------------
Fit equation:
Y = 102.139 x + -0.134                                          Regression equation used for calculations
Correlation     1.0000                                          Correlation Coefficient (r)
************************************************************
Unknown sample results
------------------------------------------------------------
Std#            Conc*Fact  Intens.      BG       Factor       Info    Conc*fact column converts sample concentration to ug/L
                (ppb)                                                 using ((13mL extraction vol/vol filtered in mL)*1000)
------------------------------------------------------------
16206            200.994   20.395      0.000    1000.00               HORIZON number for QCS, factor of 1000. Generally first.
IPC 42.9ppb       43.610    4.320      0.000    1000.00               Factor of 1000 for all IPCs
CB <0.26ppb        0.085    0.000      0.000      65.00               Factor of 65 for all CBs
16207              0.085    0.000      0.000      65.00               HORIZON number for first LRB, factor of 65
103994001          2.335   18.212      0.000      13.00
104456001          3.499    5.364      0.000      65.00               65 represents 200mL filtered, basis for LOD.
104456002          7.456   11.582      0.000      65.00
104456003          8.098   12.591      0.000      65.00
104456004          5.662    8.762      0.000      65.00       X5      Info column contains dilution
104458001          2.368    3.586      0.000      65.00
104458002         11.374   17.738      0.000      65.00
104458003         20.094   31.440      0.000      65.00
104458004          4.121    6.341      0.000      65.00
104458005          7.183   11.153      0.000      65.00
IPC 91.5ppb       88.500    8.905      0.000    1000.00
CB <0.26ppb        0.085    0.000      0.000      65.00
```

Written by: __ Brian Clary _________ Date: ___3/27/14______

Title: __ Senior Chemist _____________

Unit: ___EHD Metals__________________

Reviewed by: _ D. Kennedy-Parker _______ Date: ____3/27/14________

Title: __ Chemist Supervisor _____________

Unit: ___EHD Metals ____________

Approved by: _ Kevin Kaufman ________ Date: __3/27/2014____

Title: __ Advanced Chemist

Unit: ___EHD Metals_______

Certification Statements received from:
D. Kennedy-Parker
Kevin Kaufman
Brian Clary

Wisconsin State Laboratory of Hygiene
Environmental Health Division
Inorganic Chemistry Dept.

ESS INO METHOD 310.2

Phosphorus, Total, Persulfate Digestion (EPA/600/R-93/100, Method 365.1)

1. Scope and Application

1.1. This method is applicable to the determination of total phosphorus in drinking, ground and surface waters and domestic and industrial wastes in the range of 0.005 to 1.0 mg P/L.

1.2. The method limit of detection (LOD) = 0.005 mg/L

1.3. The method limit of quantification (LOQ) = 0.016 mg/L

2. Summary of Method

2.1. Samples are digested in an autoclave for 30 minutes at 121°C and 15-20 psi with ammonium persulfate and sulfuric acid to convert all phosphorus to orthophosphate. The orthophosphate ion $(PO_4)^{3-}$ reacts with ammonium molybdate and antimony potassium tartrate, under acidic, conditions to form a complex. This complex is reduced with ascorbic acid to form a blue complex which absorbs light at 880 nm. The absorbance is proportional to the concentration of the orthophosphate in the sample.

2.2. The determinative steps in this method are identical to EPA method 365.1 (15.1). However, because the EPA method is written specifically for air-segmented continuous flow technology that is no longer available, the specific “plumbing” scheme (pump tubes and reagent proportions, etc.) used are adapted to match the Lachat flow injection instrumentation. The specific flow scheme used in this SOP is from Lachat method 10-115-01-1-F (15.2).

3. Safety, Waste Management, & Pollution Prevention

3.1. General safety practices for all laboratory operations are outlined in the Chemical Hygiene Plan for the Agriculture Drive Facility (15.3).

3.2. All laboratory wastes, excess reagents and samples must be disposed of in a manner that is consistent with applicable rules and regulations.

3.3. Waste disposal guidelines are described in the University of Wisconsin Laboratory Safety Guide (15.4).

4. Sample Handling and Preservation

4.1. Samples are collected in a State Lab of Hygiene (SLH) 250 mL plastic bottle. Bottle quality is verified following the procedure outlined in reference (15.11).

4.2. Samples are preserved in the field by the addition of 1 mL of 25% H_2SO_4 per 250 mL sample to a pH of less than 2. They are cooled to 4°C until analysis is performed.

4.3. Maximum holding time (after sample acidification) is 28 days from date of collection.

5. Interferences

5.1. Concentrations of ferric iron $(Fe)^{3-}$ greater than 50 mg/L will cause a negative error due to precipitation of, and subsequent loss, of orthophosphate. Samples high in iron can be pretreated with sodium bisulfite to eliminate this interference. Treatment with bisulfite will also remove the interference due to arsenates.

5.2. Silica forms a pale blue complex which also absorbs at 880 nm. This interference is generally insignificant as a silicate concentration of approximately 30 mg SiO_2/L would be required to produce a 0.005 mg/L positive error in orthophosphate.

5.3. A list of interferences is documented in Method 365.1, section 4 of EPA Methods for Chemical Analysis of Water and Wastes (1993) (15.1).

6. Reagents and Standards

6.1. Reagent water (ASTM Type I water): All reagents and standards must be made with ASTM Type I water (U.S. Filter Corp., Lowell, MA).

6.2. Stock acid solution, 5.6M Sulfuric Acid (H_2SO_4): Dilute 310 mL of concentrated H_2SO_4 to 1 L with ASTM Type I water (Caution: solution will get hot). Store in a glass container. Holding time = 6 months.

6.3. Working digestion acid solution: Dissolve 12.8 g ammonium persulfate ($(NH_4)_2S_2O_8$) and 32 mL of 5.6M H_2SO_4 (6.2) in a 100 mL volumetric flask. Dilute to mark with ASTM Type I water. Prepare daily.

6.4. Stock Ammonium Molybdate Solution: In a 1 L volumetric flask dissolve 40.0 g ammonium molybdate tetrahydrate [$(NH_4)_6Mo_7O_{24} \cdot 4H_20$] in approximately 800 mL of ASTM Type I water. Dilute to the mark and invert to mix. Store in plastic and refrigerate at 4°C. Holding time = 6 months.

6.5. Stock Antimony Potassium Tartrate Solution: In a 1 L volumetric flask dissolve 3.0 g antimony potassium tartrate (potassium antimonyl tartrate hemihydrate $K(SbO)C_4H_4O_6 \cdot 3 \cdot H_2O$) in approximately 800 mL of ASTM Type I water. Dilute to the mark and invert to mix. Store in a dark bottle and refrigerate at 4°C. Holding time = 6 months.

6.6. Molybdate Color Reagent: (Rinse down sides of flask and mix between each reagent). To a 1 L volumetric flask add approximately 500 mL ASTM Type I water and then add 21.0 mL concentrated H_2SO_4 (Caution: solution will get hot). When the flask can be comfortably handled, add 72.0 mL Stock Antimony Potassium Tartrate Solution (6.5) and 213 mL Ammonium Molybdate Solution (6.4). Dilute to mark. Store in glass jar and refrigerate at 4°C. To prevent bubble formation, degas with helium at 140 kPa (20 lb/in^2) through a helium degassing tube for one minute prior to use. Holding time = 7 days.

6.7. Ascorbic Acid Reducing Solution (0.33M): In a 1 L volumetric flask dissolve 60.0 g ascorbic acid in about 700 mL of ASTM Type I water. Add 1.0 g dodecyl sulfate ($CH_3(CH_2)_{11}OSO_3Na$) (wetting reagent). Dilute to the mark and invert to mix. Filter through a 0.45 um filter and refrigerate at 4°C. Degas with helium prior to use. Discard if the solution becomes yellow. Holding time = 7 days.

6.8. Carrier: Sulfuric Acid 0.16M. In a 1 L volumetric flask add 500 mL ASTM Type I water and 9.0 mL concentrated H_2SO_4. Dilute to the mark and invert to mix. Use this reagent to perform any dilutions at the instrument. Degas with helium prior to use. Holding time = 7 days.

6.9. NaOH-EDTA Cleaning Solution: In a 1 L volumetric flask dissolve 65 g of NaOH and 6.0 g disodium EDTA in about 500 mL of ASTM Type I water. Dilute to mark and invert to mix. Store in a dark plastic bottle. Holding time = 6 months.

6.10. Stock phosphorus standard: Dissolve 0.4393 g of potassium phosphate monobasic (KH_2PO_4) (dried at 105°C for 1 h) in 900 mL ASTM Type I water. Add 1.0 mL of concentrated H_2SO_4 and dilute to 1 L: 1.0 mL = 0.100 mg P (100 mg P/L) and refrigerate at 4°C. Holding time = 6 months.

6.11. Working standard solutions: Prepare the following standards by diluting suitable volumes of standard solution (6.10) to 1 L with ASTM Type I water. Preserve standards with 1 mL/L concentrated H_2SO_4 before diluting to the mark and refrigerate at 4°C. Holding time = 28 days.

Concentration of Standard (mg P/L)	**Volume of stock standard 6.10 (mL)**
0.00 (and Reagent Blank)	0.0 (1 L)
0.016	0.16 (1 L)
0.050	0.50 (1 L)
0.250	2.5 (1 L)
0.500	5.0 (1 L)
1.00	10.0 (1 L)
30 Spike Solution	30.0 (100 mL)

Note:

1) Digest three to five tubes (depending on length of run) of each the zero (i.e. reagent blank) and 0.5 mg/L standards because they are used for the CBs and IPCs (8.7).
2) All working, stock, and QCS standards must be entered into the Standards Log located in the Wet Chemistry Laboratory.
3) All Stock and QCS standards must be entered into the Standards Log located in Horizon (15.17).

6.12 Quality Control Standard (QCS): The stock solution used to prepare the QCS must originate from a different source than the calibration standards. A pre-made stock solution may be obtained from vendors like LabChem or VWR. Stock is refrigerated at 4°C. Holding time = 6 months after opening if no manufacturers expiration date is given.

6.12.1 Quality Control Working Standard (QCS): Dilute 4.0 mL of 50 mg/L Lab Chem Stock Standard (6.12) to 500 mL. 1.0 mL = 0.0004 mg P (0.4 mg P/L) (Add 0.5 mL of conc. H_2SO_4 before diluting to 500 mL). Holding time = 28 days.

7. Apparatus

7.1. Digestion tubes, 20 x 150 mm, disposable borosilicate glass.

7.2. Autoclave.

7.3. Lachat 8000 System.

7.3.1. Multichannel proportioning pump

7.3.2. Injection module with a 150 cm x 0.8 mm i.d. sample loop.

7.3.3. Reaction unit or manifold (Figure 1)

7.3.4. Colorimetric detector

7.3.5. Colorimeter equipped with 10 mm path length flow cell and 880 nm interference filter.

7.3.6. Data system

7.3.7. Heating unit: 37°C; use the 350 cm length tubing rather than 175 cm for better sensitivity.

7.4. Motorized pipette: 10 mL, 1.0 mL, and 0.1 mL (15.10).

7.5. Disposable culture tubes: 13 x 100 mm disposable glass.

7.6. Polypropylene caps for disposable digestion tubes.

7.7. Vortex mixer.

7.8. Autosampler.

8. Quality Control

8.1. Please refer to the Environmental Health Division Quality Assurance Manual (15.6) for general information on Quality Control Procedures. Important specifics include:

8.1.1. Accuracy and precision calculations.

8.1.2. Corrective action procedures (including documentation requirements) for instrument problems or analytical problems.

8.2. **An instrument logbook** is maintained for each Autoanalyzer. Maintenance, performance problems, date calibrated, analyst, and other pertinent information are documented in the logbook.

8.3. **A Quality Control Standard (QCS)** is digested with each run (6.12). The analytical result must be within ±10% of the true value to continue the analysis. If the QCS exceeds the recommended recovery limits, corrective action includes reanalyzing the QCS, recalibrating, or redigesting and reanalyzing the run.

8.4. **A Laboratory Reagent Blank (LRB)** is digested and analyzed initially for the first 20 samples and for every 20 samples thereafter. The LRB must meet one of three criteria listed in the Wisconsin Department of Natural Resources Lab Certification Program (15.5). 1) Lab Reagent Blank must be less than the detection limit of the method (0.005 mg/L). 2) Lab Reagent Blank must be <5% of sample concentration. 3) Reagent Blank must be <5% of the regulatory limit. If the LRB does not meet one or more of these criteria, the recommended corrective action is re-digestion of the samples associated with the LRB in question. If the measured concentration of the LRB is more negative in magnitude than -LOD and there is no apparent source causing the problem (e.g., baseline drift, improper y-intercept, poor source material used to prepare the LRB, etc.) then the LRB may be accepted as having an estimated concentration of "zero" providing the logic supporting this decision is well documented.

8.5. **A Laboratory Fortified Blank (LFB)** is digested and analyzed initially for the first 20 samples and for every 20 samples thereafter. Exception to this frequency: If the acceptance criteria for the Matrix Spikes (8.6) are equal to or more stringent than the LFB, digestion and analysis of one LFB per analytical batch is adequate. Prepare a LFB by spiking 7.92 mL of LRB with 0.08 mL of spike solution (6.11). The spike recovery must be within ±10% of the true value to proceed. If the LFB exceeds the recommended recovery limits, corrective action includes reanalyzing the LFB, recalibrating, or redigesting and reanalyzing the run.

8.6. **Matrix Spikes (MS) and Laboratory Duplicates (LD):** Prepare a **minimum of 10%** of the samples, per matrix, with duplicates and spikes. Spikes are prepared by mixing 7.92 mL of a sample with 0.08 mL of spike solution (6.11). If the duplicate acceptance criteria (precision QA) is not met, the matrix group (including spike and duplicate) should be redigested and reanalyzed with the next analytical batch. If the duplicate limits are exceeded a second time, qualify all results within the matrix group. If the spike recovery (accuracy QA) does not fall within the specified control limits, the matrix group (including spike and duplicate) should be redigested and reanalyzed with the next analytical batch. If it fails a second time, qualify all results within the matrix group.

8.7. **An Instrument Performance Check (IPC)** and **Calibration Blank (CB)** must be analyzed immediately after calibration and then after every 10 cups. The IPC must be within ±10% of true value. Choose a standard with a concentration near the middle of the calibration range to use as the IPC. The CB must be less than the LOD (0.005 mg/L). In general, a CB is within acceptable QC limits if the observed concentration is less than the LOD, but greater than the negative LOD (<LOD and >-LOD). However, if the measured concentration of the CB is less than the negative LOD (<-LOD) and there is no apparent source causing the problem (e.g., baseline drift, improper-Y intercept, poor source material used to prepare the CB, etc.), then the CB may be accepted as "zero" providing the logic supporting this decision is well documented. All data reported from each analytical batch must be bracketed by acceptable IPCs and CBs. If an IPC or CB fails, corrective action is to reanalyze all samples back to the last acceptable IPC and CB.

8.8. **Demonstration of Capability (DOC)**: An Initial DOC and annual continued proficiency checks are performed according to ESS INO QA 115 (15.8).

8.9. **Limit of Detection (LOD)**: The LOD must be verified every six months or reestablished whenever there is a significant change in the method or instrumentation. Verify or establish the method LOD using the procedure outlined in ESS INO QA 116 (15.9).

8.10. **Linear Calibration Range (LCR)**: The LCR must be verified every six months or whenever there is a significant change in the method or instrumentation. The initial demonstration of linearity must use sufficient standards to insure that the curve is linear. The verification of linearity must use a minimum of a blank and three standards. If any verification data exceeds the initial values by more than ±10%, linearity must be re-established. If any portion of the range is shown to be nonlinear, a sufficient number of standards must be used to clearly define the nonlinear portion.

8.11. **Sample Dilution**: If the estimated concentration of analyte in a sample exceeds the highest calibration standard a bench dilution should be performed. Dilutions at the bench are typically performed by diluting an appropriate volume of sample with the digested reagent blank. Motorized pipettes may be used to deliver/dilute volumes up to 10 mL. For volumes greater than 10 mL, Class A glass, volumetric pipettes should be used. Diluted samples should be mixed thoroughly prior to analysis. Samples may also be diluted prior to digestion.

8.11.1. Samples diluted prior to digestion should be edited in the **prep batch** (10.2) in Horizon. Double click on the CC section of the sample that was diluted. Change the Initial Volume amount to reflect the diluted sample.

- Ex: 0.8 mL in initial volume and 8 mL in final volume for a 10:1 dilution

8.11.2. Samples diluted at the bench should be edited in the **analytical batch** (12.2) in Horizon. Double click on the CC section of the sample that was diluted. Change the Dilution factor in the upper right hand corner of the box that opens.

9. Method Calibration

9.1. Working standards (6.11) are digested along with the samples as described in section 10.

9.2. Calibration curve is a linear, 1st-order polynomial curve.

9.3. Set the data system parameters and operating conditions for the Lachat 8000 with the Omnion software (15.12).

9.4. The instrument is calibrated according to section 10.9.4. A minimum correlation coefficient (r) of 0.995 is required to continue with sample analysis. If this is not met, use an appropriate corrective action to diagnose possible causes and recalibrate.

10. Procedure

10.1. See also Instrument Operating Procedure (15.12).

10.2. Create a worklist using Horizon and download it to the Lachat instrument as explained in the Horizon Procedures (15.17).

10.3. Load the test tube racks with disposable digestion tubes (7.1) so you have enough for your samples, standards, duplicates, spikes and blanks according to the analytical run.

10.3.1. Transfer 8 mL of each sample to a digestion tube with a 10 mL motorized pipette.

10.3.2. The LFB and spiked samples should be prepared according to 8.5 and 8.6.

10.4. Standards rack should be set up as shown below.

	0.5	**0.5**	**0.5**				**0**	**0**	**0**
1.0	**0.5**	**0.5**	**0.5**	**0.25**	**0.05**	**0.016**	**0**	**0**	**0**
1.0	**0.5**	**0.5**	**0.5**	**0.25**	**0.05**	**0.016**	**0**	**0**	**0**
1.0	**0.5**	**0.5**	**0.5**	**0.25**	**0.05**	**0.016**	**0**	**0**	**0**

10.5. All digestion tubes should have 8 mL of liquid before the addition of digestion acid. Add 0.5 mL of working digestion acid solution (6.3) to each tube, vortex, and cover with caps (7.6) (do not press caps down).

10.6. Autoclave the digestion tubes for 30 minutes at 121°C, 15-20 psi.

10.7. Remove the tubes from the autoclave, press caps down securely, and allow them to cool.

10.8. Allow any particulate matter to settle overnight.

10.9. Calibration Procedure and Sample Analysis:

10.9.1. Turn on the instrument by flipping the switch on the back left corner of the machine.

10.9.2. Set up the manifold as shown in Figure 1.

10.9.3. The Color Reagent (6.6) and Carrier Reagent (6.8) need to be degassed prior to being pumped through the manifold.

- Wand is in the drawer across from the machine and needs to be rinsed with 10% HCl followed by MQ water before being used.

- Degas each reagent using helium gas for 5-10 minutes. Be sure to rinse the wand between reagents.

10.9.4. Pump ASTM Type I water through all reagent lines and check for leaks. Switch to reagents and allow the system to equilibrate (about five minutes).

10.9.5. Open Omnion software on Lachat computer.

10.9.6. Open Total Phos. Template in Omnion.

10.9.7. Place samples and standards in the appropriate place on the autosampler racks. Import the sample worklist that was created in Horizon (10.2) by selecting Import Worksheet Data.

10.9.8. After the worklist has been imported, insert IPC and CB after every 10 samples. Highlight the IPC and CB in the template and right click to select Define DQM. Check the box for “After Every N” and type in 10. Make sure the box for “Close Run” is also checked.

10.9.9. Calibrate the instrument by analyzing the standards in order of decreasing concentration. The data system will associate the concentrations with the instrument responses for each standard and plot the calibration curve.

10.9.10. After the calibration passes (see section 9.4) the samples may be analyzed.

10.9.11. Watch for samples that have air spikes or necessary dilutions which would need to be rerun. Dilutions (8.11) should be added to the end of the run and inserted as the sample number followed by an X and the dilution factor.

10.9.11.1. ex: 123456789 X5

10.10. Shutdown procedure:

10.10.1. After the run is complete, switch reagent lines to the NaOH-EDTA solution (6.9) for approximately five minutes, then rinse with ASTM Type I water for five minutes.

10.10.2. Remove reagent lines from ASTM Type I water and pump air through in order to dry. Release pump-tubes from cartridges and turn off instrument.

10.10.3. Waste disposal: The waste will be acidic and will need to be neutralized according to the Laboratory Safety Guide (15.4).

11. Calculations

11.1. The phosphorus concentration in the unknown samples is calculated by the instrument software based on the standard calibration curve. The phosphorus concentration result is obtained by transferring the data from the Lachat instrument to Horizon (12.2) and can also be obtained directly from the *Run Time Report*, which should be printed for a hard copy.

11.2 If the estimated phosphorus concentration exceeds the highest calibration standard, a manual dilution should be performed prior to digestion and documented on the benchsheet (8.11). The Lachat 8000 software does not incorporate the dilution correction into the result. The dilution factor and diluted result will be documented in Horizon. The result must also be calculated manually by the analyst and documented on the *Run Time Report*. The final result will be verified mathematically, by an experienced chemist who did not perform the original analysis, when the batch is checked for quality control (15.13).

12. Data Management

12.1. The analytical run, the *Run Time Report*, and the QC Parameters section in Horizon, where all quality control is calculated for pass/fail criteria, will be reviewed for quality control prior to accepting results (see section 8). The reviewer must be an experienced chemist who did not perform the original analysis (15.13). The reviewer must initial and date the analytical run.

12.2. Export results from Lachat 8000 to Horizon (see Horizon Procedures 15.17).

12.2.1. Review results by selecting Data Review under Batching.

12.2.2. Review QC Results by selecting QC Parameters under Batching.

13. Definitions

13.1 Definitions of terms in this SOP may be found in the reference method (EPA Method 365.1). General definitions of other terms that may be used in this method are found in the EHD Quality Assurance Manual (15.6).

14. Method Performance

14.1 Where applicable, the laboratory's initial accuracy and precision data (MDLs and IDOCs) are generated in compliance with the reference method and the Inorganic Chemistry Department’s standard operation procedures: ESS INO QA 115 (15.8) and ESS INO QA 116 (15.9). Data generated within the last two years will be kept on file within the Inorganic Chemistry Department. Data older than two years may be archived in the basement.

15. References

15.1. U.S. Environmental Protection Agency, Methods for the Determination of Inorganic Substances in Environmental Samples, EPA/600/R-93/100, Revised August 1993, Method 365.1

15.2. QuikChem Method 10-115-01-1-F Determination of Total Phosphorus by Flow Injection Analysis Colorimetry (Acid Persulfate Digestion Method), Revised October, 1994.

15.3. AD Safety GENOP 102, Chemical Hygiene Plan and General Laboratory Safety Plan for the Agriculture Drive Facility, State Laboratory of Hygiene.

15.4. University of Wisconsin-Madison, Chemical & Radiation Protection Office, Safety Department (262-8769), "Laboratory Safety Guide," 2004. http://www.fpm.wisc.edu/safety

15.5. Wisconsin Administrative Code NR149, Department of Natural Resources Lab Certification Program, effective Sept. 1, 2008.

15.6. Quality Assurance Manual, Environmental Health Division, Wisconsin State Laboratory of Hygiene.

15.7. 2009 TNI Standard, Volume 1: Management and Technical Requirements for Laboratories Performing Environmental Analysis, The NELAC Institute, 2009.

15.8. Wisconsin State Laboratory of Hygiene, ESS INO QA 115, *Initial DOC and Annual Continued Proficiency Check Procedures*.

15.9. Wisconsin State Laboratory of Hygiene, ESS INO QA 116, *LOD Procedures*.

15.10. Wisconsin State Laboratory of Hygiene, ESS INO GENOP 200, *Pipette Performance Checks*.

15.11. Wisconsin State Laboratory of Hygiene, ESS INO QA 101, *Bottle Check Procedure*.

15.12. Wisconsin State Laboratory of Hygiene, ESS INO IOP 105, *Instrument Operating Procedure for QuikChem 8000, Automated Ion Analyzer and Computer Protocol*.

15.13. Wisconsin State Laboratory of Hygiene, ESS INO QA 107, *Q.C. Audits of Analytical Runs for ESS Wet Chemistry Area*.

15.14. QuikChem 8000, Automated Ion Analyzer Continuum Series, Flow Injection Analyzer, Hardware Installation and System Operation Manual, Zellweger Analytics, Inc., Lachat Instruments Division, Milwaukee, WI, April 30, 1998.

15.15. Software User Guide, Omnion 3.0, Lachat Instruments, Hach Co., 2004.

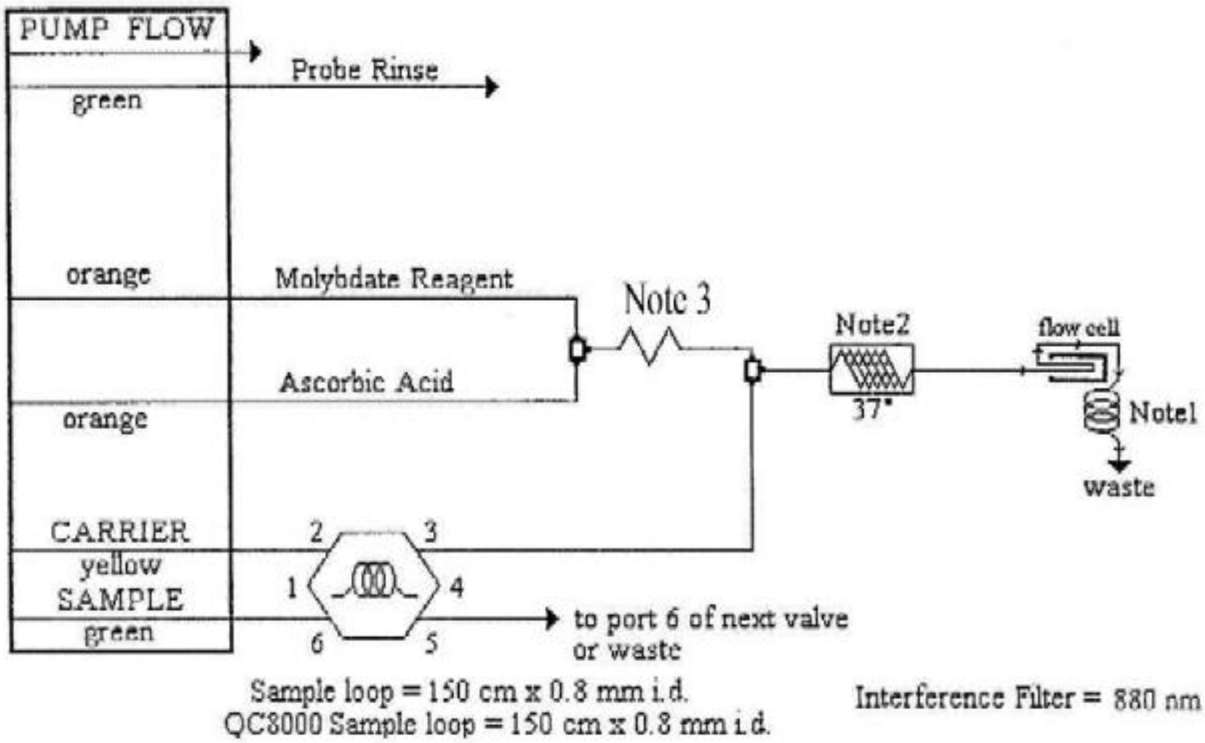
15.16. QuikChem 8000 Automated Ion Analyzer Training Manual for Omnion 3.0, Lachat Instruments, Hach Co., 2002.

15.17. Wisconsin State Laboratory of Hygiene, ESS INO GENOP 113, *HORIZON Procedures for EHD Inorganic Chemistry*

16. Revision Tracking Table:

Revision #	Revision date	Changes Made	Revision author
4	Sept. 2014	Updated for Horizon	WK

PHOSPHORUS MANIFOLD DIAGRAM



CARRIER is 0.16 M sulfuric acid (6.8).

All manifold tubing is **0.8 mm (0.032 in) i.d**. Lachat Part No. 50928. This is **5.2 µL/cm**.

APPARATUS: An injection valve, a 10 mm path length flow cell, and a colorimetric detector module is required.

Note 1: 2 meter back pressure loop, 0.52 mm (0.022 in.) i.d.
Note 2: 350 cm of 0.8 mm (0.032 in) i.d. tubing wrapped around the heater block..
Note 3: 70 cm of tubing on 5 cm coil support.

Signature Page:

Written by: Wes Kotila Date: 09/10/14

Title: Project Chemist

Unit: EHD Inorganic Chemistry

Reviewed by: Graham Anderson Date: 09/16/2014

Title: Advanced Chemist

Unit: EHD Inorganic Chemistry

Approved by: ___Tracy Hanke_______ Date: _09/16/2014__

Title: _Chemist Supervisor_____

Unit: EHD Inorganic Chemistry

Certification Statements Received From:
Graham Anderson
Wes Kotila
Jordan Montpetit
Tony Plourde
Jenny Thorngate

Microscopic Examination of Algae

Materials

Bright-field microscope of magnification 400x
Digital camera
Glass slide and cover glass

Procedure

A fresh sample of lake water, algal tissue, or metaphyton should be examined as soon as possible or else preserved frozen for later examination. A needle can be used to transfer a small amount of the sample to a glass slide, then covered. A small amount means about 1 microliter of liquid or about 1 milligram of wet tissue. Under the microscope, objects of interest are brought into focus with adjustment of illumination. When the view is as good as it gets, the digital camera is held over the eyepiece for an exposure.

Identification of Algae

Often algae are seen together with unrelated zooplankton and phytoplankton. Identification is work for experts and specialists. But an amateur can at least make an attempt or guess at identification by comparison with reference photomicrographs of known species.

ON LAKE PROCEDURES

How to Collect Water Samples

Integrated Water Sampler

The integrated water sampler is used to collect the water sample for phosphorus and chlorophyll analysis on lakes that are deeper than ten feet. Chemistry volunteers collecting water samples on lakes less than ten feet in depth will use a Van Dorn sampling bottle to prevent getting bottom sediments mixed in with the water sample.

STEP 1. Before using the integrated sampler rinse with lake water three times. Fill the sampler with lake water and empty the water out of the top of the sampler. This will clean out any dirt or dust that may have gotten in the sampler.

STEP 2. The water collection bottle should also be rinsed with lake water three times. Once it is clean, remove the cap and place it in an accessible spot. Always place the cap top side down to prevent contamination of the inside of the cap.

STEP 3. While holding onto the rope end (top) of the integrated water sampler, slowly lower the collection end (bottom) of the sampler tube vertically into the water column until the water level reaches the six-foot mark on the sampler. Raise the sampler out of the water.

STEP 4. Drain the integrated water sampler by touching the collection end of the sampler to the rod in the neck of the water collection bottle. Water will drain from the integrated water sampler tube into the water collection bottle. This water is used for your phosphorus and chlorophyll samples.

STEP 5. Keep your water sample in a cool place and out of direct sunlight until you return to shore. A cooler is an ideal place to keep it. Algae in the lake water will continue to grow if the bottle remains in the sun.

STEP 6. Your integrated sampler should be rinsed out with distilled water after use and stored topside down. This will prevent algal growth between the ball and the collection end of the sampler.

DNR PHOTOS

Before you start processing the sample(s), be sure to read the following pages to familiarize yourself with the equipment and the procedures that you will be using. *All of the procedures that you will follow in sampling your lake are done for specific reasons. It is very important that you follow the sampling procedures exactly as they are laid out in the following pages to ensure good, consistent, high quality data. The following pages will provide you with sufficient background on the design of the equipment and proper procedures to use.*

ON SHORE PROCEDURES

Before you begin processing your water samples and preparing them for the State Laboratory of Hygiene, here is a quick checklist to make sure that you have everything you will need.

- ☑ Manual
- ☑ Field Data Sheets
- ☑ State Laboratory of Hygiene slip for your phosphorus and chlorophyll samples
- ☑ Pencil and waterproof pen
- ☑ Safety gloves
- ☑ Safety goggles
- ☑ Phosphorus sample sticker
- ☑ Chlorophyll sample sticker
- ☑ "Acid added" stickers (optional)
- ☑ Three trays of ice cubes (you provide)
- ☑ Styrofoam® mailer kit
- ☑ Ziploc® bags
- ☑ Packaging tape
- ☑ Merchandise return label and priority mail stickers
- ☑ Magnetic Filter Funnel (2 pieces)
- ☑ Chlorophyll tube
- ☑ Hand pump with plastic tubing
- ☑ 500 or 1000 ml plastic flask
- ☑ 250 or 500 ml graduated cylinder
- ☑ Membrane filters
- ☑ Test tubes
- ☑ 2 Tweezers
- ☑ Paper towels (you provide)
- ☑ Squeeze bottle filled with distilled water (you provide distilled water)
- ☑ Acid vial
- ☑ Phosphorus sample
- ☑ Water sample in the 2-quart water collection bottle

ON SHORE PROCEDURES

Phosphorus Sample Preparation

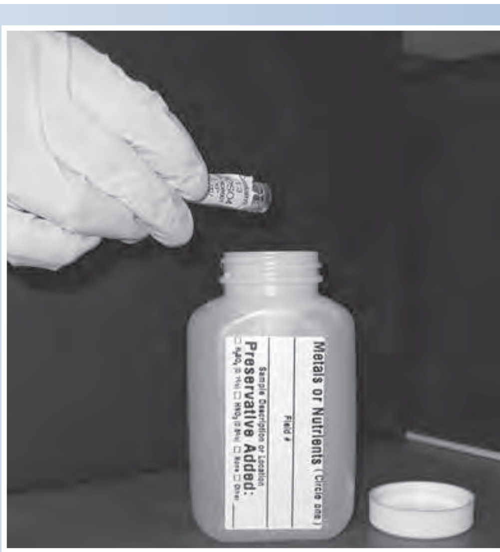
Be sure to put on your gloves and safety goggles before beginning your phosphorus sample preparation!

STEP 1. To prepare your phosphorus sample, remove the cap from your 250 ml State Laboratory of Hygiene bottle. Place cap topside down to prevent contamination. Gently mix the water in the water collection bottle and pour the water from the water collection bottle into the 250 ml bottle. Fill to the neck. Avoid touching the mouth of the water collection bottle and the phosphorus bottle lip to prevent contamination.

STEP 2. Remove the sulfuric acid vial from your kit.

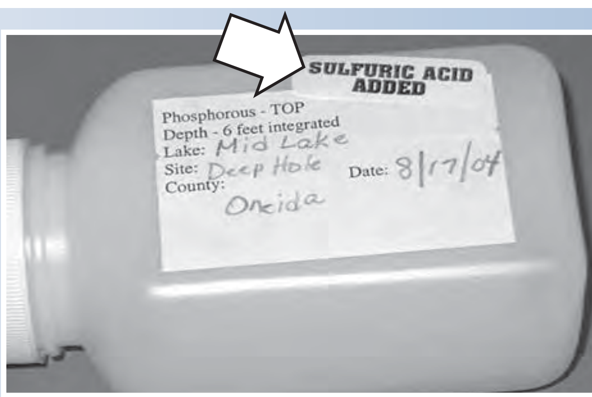
STEP 3. Uncap your phosphorus bottle and empty contents of one acid vial into your phosphorus sample. This will "fix" your sample by inhibiting bacterial growth and keeping the phosphorus from sticking to the sides of the bottle.

Always place the cap topside down to prevent contamination.



STEP 4. Replace lid on acid vial and the cap on your phosphorus sample. Mix your sample by inverting the bottle several times.

Attach a completed label with the name of your lake, site, county, and date. Don't forget to mark on your bottle that it is preserved with H_2SO_4 (sulfuric acid), or as an option, attach the acid-added sticker to your bottle.



DNR PHOTOS

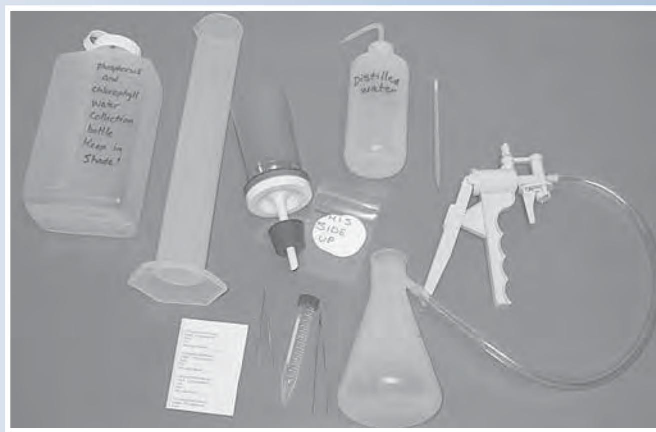
STEP 5. When you are done adding the sulfuric acid, rinse and dispose of the used vials in the garbage. Store unused vials out of the reach of children!

STEP 6. Refrigerate phosphorus sample until ready to mail.

ON SHORE PROCEDURES
Chlorophyll Sample Preparation

Since light can cause the algae to grow and alter your sample, this on shore procedure for preparing your chlorophyll sample should be conducted in the shade and out of direct sunlight.

STEP 1. Place all the parts of your chlorophyll filtering equipment at your work area.

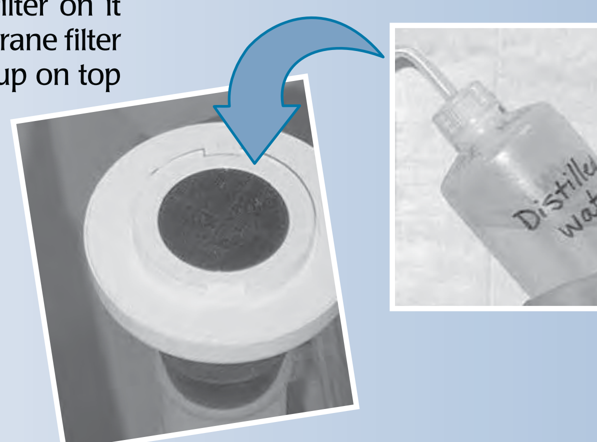


STEP 2. Attach the plastic tubing of the hand pump to the spout of the 500 or 1000 ml plastic flask.

STEP 3. Insert the stopper of the filtering cup into the flask. You may want to moisten the stopper first to ensure a good seal.

STEP 4.

Squirt a small amount of distilled water on the black filter base **before** placing the membrane filter on it (see Step 5). This will help to hold the membrane filter in place until you can place the magnetic cup on top of it (see Step 6).



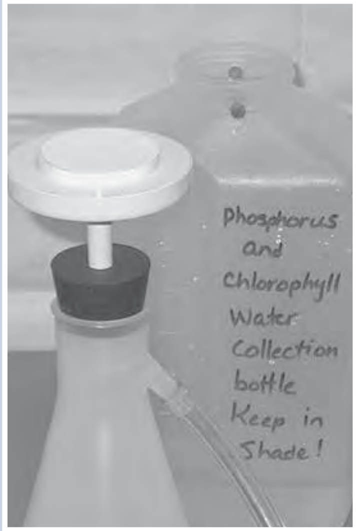
DNR PHOTOS

ON SHORE PROCEDURES

Chlorophyll Sample Preparation (continued)

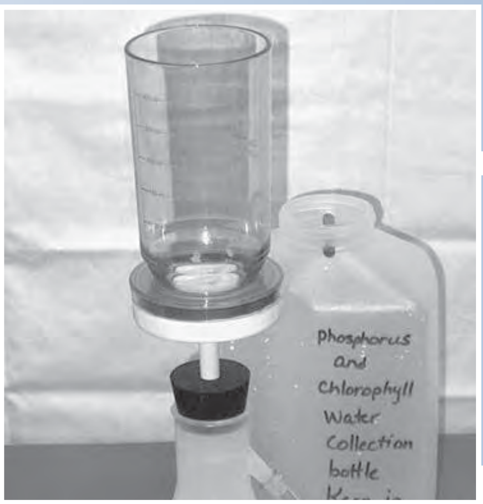
STEP 5. Use the tweezers to pick up one membrane filter and place it on the center of the filter cup base (i.e. the black screen). Note that filters are white and the divider sheets are blue. Make sure you use a white filter and not a blue divider sheet!

Note: Never touch the filter with your fingers! Always use tweezers when removing it from the Ziploc® bag or when placing it on the black screen.



DNR PHOTOS

STEP 6. Carefully place the magnetic cup on top of the filter base. Be sure that the filter does not move! If the filter moves, wrinkles, or tears, remove the filter cup and discard the torn/wrinkled filter. Repeat steps 4 and 5 with a new filter.



DNR PHOTO

STEP 7. Using the table on the right, look up the Secchi depth you measured earlier in the day. Use this to determine the volume of water that you need to filter to obtain your chlorophyll sample. Please be aware that this amount may change each time you sample. In general, the better the water clarity (i.e. deep Secchi depth), the fewer algae there are in the water, and the more water you need to filter in order to collect enough algae for analysis.

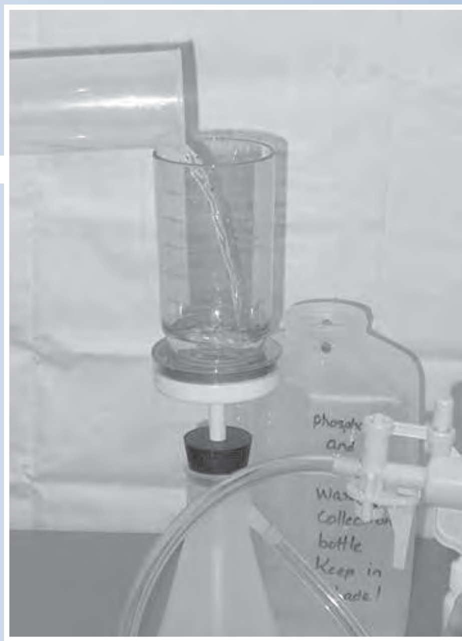
Volume of water to filter as determined by Secchi depth.

Secchi Depth (ft)	Volume of Water to Filter (ml)
Less than 1	50
1 to 1.5	100
Greater than 1.5	200

ON SHORE PROCEDURES

Chlorophyll Sample Preparation (continued)

STEP 8. Take out the plastic water collection bottle filled with water for your chlorophyll sample. Gently mix the water in the bottle by turning it upside down several times. Fill your 250 ml or 500 ml graduated cylinder with the appropriate volume of water needed to filter your sample (Refer to step 7). *Note that although the upper cup of the filtering apparatus can be used to measure water volume, it is not an accurate measuring device and should **not** be used to measure the volume of water you need to filter.*



STEP 9. To begin filtering, pour some of the measured water from the graduated cylinder into the filter apparatus. You don't want to pour the full amount into the filter cup all at once. If your lake contains lots of algae or sediment, the filter will become clogged and you will not be able to empty the filter cup easily.

If the filter becomes clogged, try to filter the remaining water from the filter cup. You should remove the used filter using the filter forceps and place it in the chlorophyll tube provided by the WSLH. Put a new filter on the magnetic filter cup apparatus, replace the cup and continue to filter. You can send more than one filter successfully. **OR:** Try to filter as much water from the cup as possible and record only the amount of water you were able to filter.

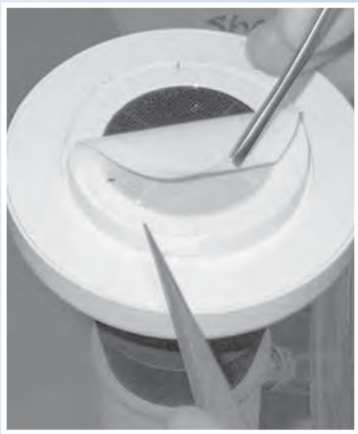
STEP 10. Squeeze the hand pump to move the water through the filter. Once all the water has been filtered, wash down the sides of the filter cup with distilled water to ensure that all of the algae are washed onto the filter paper.

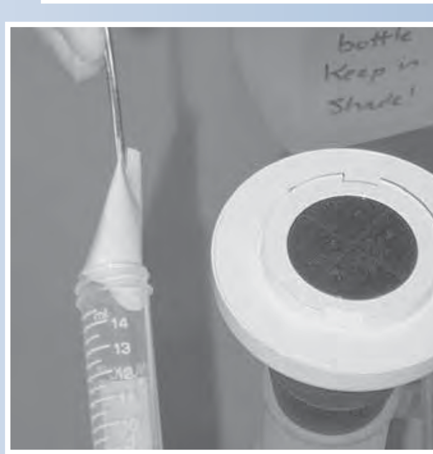
DNR PHOTOS

ON SHORE PROCEDURES
Chlorophyll Sample Preparation (continued)

STEP 11. After you have filtered the appropriate volume of water, separate the filter apparatus by removing the top cup from the filter base.

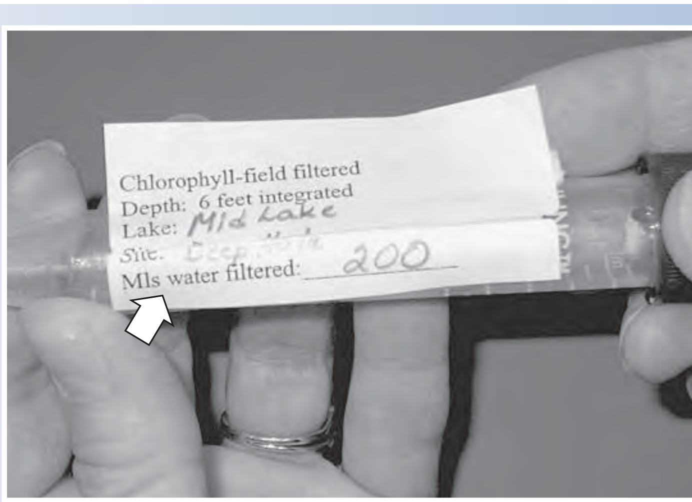
STEP 12. Using tweezers, place the filter into the chlorophyll tube that came in the mailer from the WSLH. If the filter tears while you are removing it, it is okay to place it in the tube. Make sure that the algae that is on the filter does not get lost during transfer to the tube.





STEP 13. Fill out the chlorophyll label and place it on the tube containing your chlorophyll sample. Be sure to include the volume filtered (mls) on the label.

STEP 14. Don't forget to write the volume of water that you filtered for your chlorophyll sample on your lab slip.



DNR PHOTOS

IT IS BEST TO MAIL YOUR SAMPLE ON THE DAY YOU COLLECT IT. But, if it has to be mailed the next day, place your chlorophyll sample in the freezer until you're ready to mail it!

How to Fill Out Your Lab Sheet

When filling out your lab sheet, please make sure the following information listed is completed.

- ☑ ***WBIC*** (should already be pre-filled in on your lab sheet)
- ☑ ***Station ID (Storet #)*** (should already be pre-filled in on your lab sheet)
- ☑ ***Collected By*** (name or names of all who sampled)
- ☑ ***Phone*** (your phone number)
- ☑ ***Begin or Grab Date*** (the date your sample was collected)
- ☑ ***Begin Time*** (list this time in 24 hour or military time)
- ☑ ***Depth of Sample or Sample Location*** (6 feet if you used the integrated water sampler; 3 feet if you used the Van Dorn sampling bottle.)
- ☑ ***mls filtered*** (amount of water filtered for your chlorophyll sample in mls)

Do not forget to fill in the *"Tot. Phosphorus"* area of the lab sheet. Enclose the completed lab sheet in your sample mailer box.

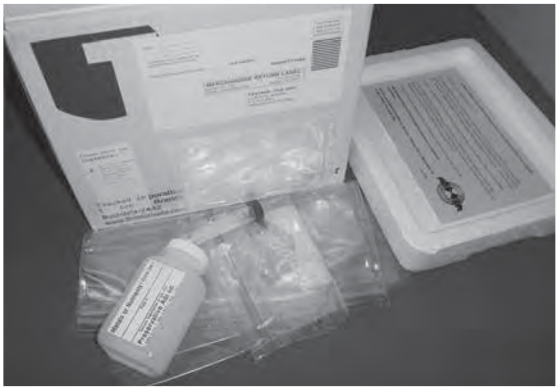
Mailing Your Samples

For the lab to get an accurate analysis of the phosphorus and chlorophyll in your lake, your samples must be handled and shipped properly. Try to collect your samples early in the week so that you are able to put them in the mail on a Monday, Tuesday, or Wednesday. You want your samples to reach the WSLH by Friday so they do not sit in the post office over the weekend. If you collect your samples on a Friday, Saturday, or Sunday put your chlorophyll sample in the freezer and keep your phosphorus sample in the refrigerator until you are able to mail them on Monday. ***Do not put your phosphorus sample in the freezer!*** Keep in mind that the sooner the lab is able to analyze your samples, the more accurate your results will be. The following steps are an efficient way to make sure that your samples are packaged properly and prepared to ship to the State Laboratory of Hygiene safely.

MAILING YOUR SAMPLES

STEP 1. Complete the laboratory data sheet for your phosphorus and chlorophyll samples. All information must be complete for the lab to analyze the samples. If you are unsure of how to fill out your data sheet see the previous section "How to Fill Out Your Lab Sheet".

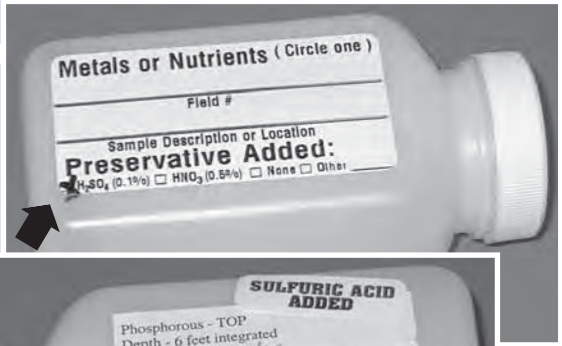
STEP 2. Gather all the materials you will need to mail your samples: Styrofoam® mailer, completed lab sheet, merchandise return label (mailing label), three trays of ice cubes, one sandwich-size Ziploc® bag, 2 one-gallon Ziploc® bags, and Priority Mail® stickers.



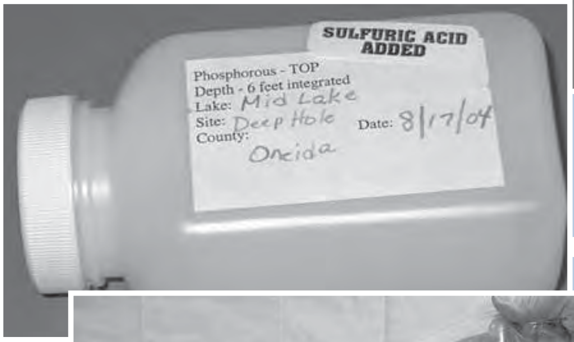
DNR PHOTOS

MAILING YOUR SAMPLES (continued)

STEP 3. Prepare to mail your chlorophyll sample by making sure that the chlorophyll sticker is filled out completely and attached to the tube. Don't forget to include the volume of water that you filtered! Put your chlorophyll filter tube in the gallon Ziploc® bag.

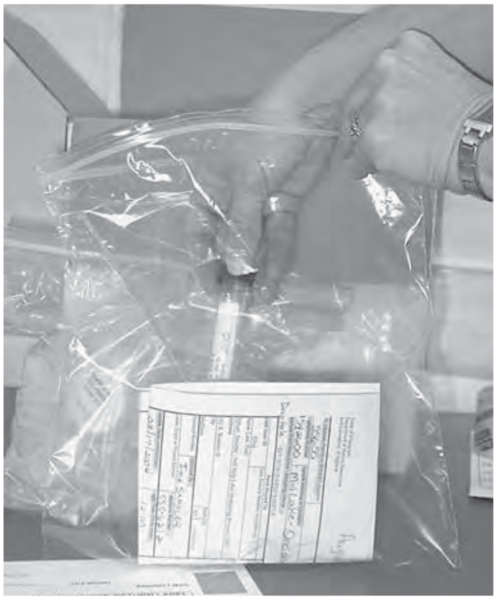


STEP 4. Prepare to mail your phosphorus sample by making sure that your sample was preserved with sulfuric acid and that you've checked the acidity. Attach the completed label with the name of your lake, site, county, and date. Don't forget to mark on your bottle that it is preserved with H_2SO_4 (sulfuric acid), or as an option, attach the acid-added sticker to your bottle.



STEP 5. Place your phosphorus sample in the sandwich-size Ziploc® bag, seal the bag, and then put it in a one-gallon Ziploc® bag with three trays of ice cubes. Make sure this bag is sealed tightly or it will leak. If this bag leaks during mailing, the Post Office will not deliver it to the lab and your sample will be ruined.

STEP 6. Put your completed lab sheet in the one-gallon Ziploc® bag with your chlorophyll tube. Seal the bag.



DNR PHOTOS

NOTE: Always mail the lab slip with your samples!

MAILING YOUR SAMPLES (continued)

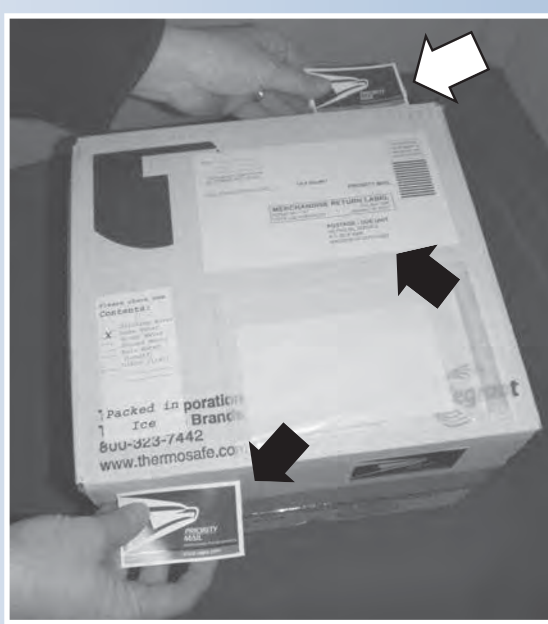
STEP 7. Place your bagged phosphorus sample containing the ice in the Styrofoam® mailer. Then place the bagged lab sheet with your chlorophyll sample and tube in the inside of the Styrofoam® mailer. Make sure that the chlorophyll sample is against the ice in the bag with your phosphorus sample!

STEP 8. Gently fold the bagged lab sheet over the ice, close the Styrofoam® lid, and tape the cardboard mailing box shut.

STEP 9. Tape once around the cardboard sleeve. Attach the 4 inch x 6 inch white merchandise return label to the top of the mailer. Attach *one* priority mail sticker to the top of the package and *one* to the bottom. The mailer card should have your postal address on one side. The other side should be **BLANK**. You want the blank side facing out when the sample is sent to the WSLH.

STEP 10. Put your samples in the mail with your regular outgoing mail or at the post office. The mailing label is postage paid, so you will not need any stamps.

STEP 11. Once the WSLH has received your samples, they will send you a new mailer to use for your next collection of samples.



DNR PHOTOS

Quality Assurance Sampling Protocol

In 2007, the Citizen Lake Monitoring Network implemented procedures to document the accuracy and precision of the field data collected by volunteers. These procedures are a way to look at natural variability and sampling error. The protocol that was designed mimicked the Quality Assurance/Quality Control (QA/QC) methods used by the Wisconsin Department of Natural Resources (Wisconsin DNR) water quality staff.

Approximately ten percent of the total phosphorus (TP) and chlorophyll stations are randomly selected each year to participate in collection of QA/QC samples. The Wisconsin DNR asks volunteers who are chosen to participate to collect two additional phosphorus samples – a field blank and a duplicate (also called a replicate) sample. Volunteers also collect a duplicate chlorophyll sample.

The phosphorus field blank is prepared using deionized water – this water is provided to the volunteer and comes from the State Lab of Hygiene (WSLH). Deionized water contains no nutrients. The blank phosphorus sample that the volunteer submits should be a "clean" sample – there should be no nutrients in it (which means your equipment is clean and does not have residual phosphorus). The blank sample is processed the same way that you process your regular phosphorus sample except that you are using deionized water instead of lake water. The QA/QC procedures are meant to "mimic" the collection procedures that are used in phosphorus collection and processing.

Before going out in the field, you will prepare your blank sample by rinsing your Van Dorn or integrated sample with deionized water, and then placing deionized water in your integrated sampler or Van Dorn sampling bottle. This water will then be placed in the water collection bottle that you normally use. From the water collection bottle the water sample goes to a "phosphorus bottle" – the same kind you use to mail your water sample to the WSLH. This water sample is preserved with sulfuric acid. Ideally, when analyzed by WSLH, the sample will have no detectible phosphorus. If the blank sample does contain phosphorus it could be that your equipment contains residual amounts of phosphorus or that the sampling technique is faulty – for instance, phosphorus could show up in a blank sample if you used your finger to release the ball of your integrated sampler to release water. The field blank also tests laboratory processing once the sample arrives at the WSLH.

The duplicate phosphorus sample is taken from the same site, at the same time, using the same method as your normal phosphorus sample. The only difference is that you will use a separate water collection bottle for each sample collected using your integrated sampler. Your CLMN regional coordinator provides an extra water collection bottle for you to use. The original and duplicate samples are independently analyzed in the same manner. The duplicate sample can be used to detect both the natural variability in the environment and that caused by your collection method in the field.

(continued on next page)

ON LAKE PROCEDURES

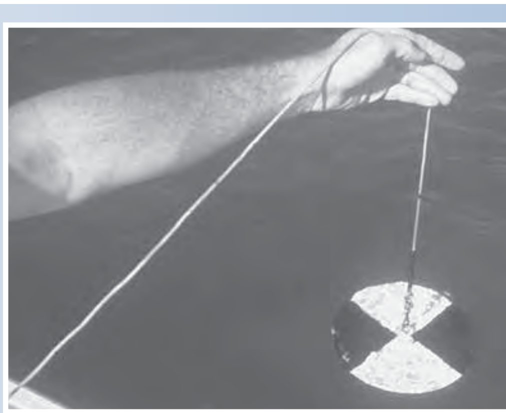
How to Use the Secchi Disk

STEP 1. Before going out to take your Secchi disk readings, be sure the conditions are right for sampling. Ideal weather conditions include sunny or partly sunny/cloudy skies; wind-calm to breezy (there should be no whitecaps on the lake). Collect Secchi measurements between 10 am and 4 pm. If possible, try to collect Secchi readings when the satellite is overhead. Satellite paths are available at **http://dnr.wi.gov/lakes/CLMN/**.

STEP 2. Your CLMN regional coordinator will provide you with a lake map with the sampling site marked. Be sure you have a station id number for each site you are monitoring.

STEP 3. Anchor your boat at your sampling site to prevent drifting. Be careful not to disturb the sediments on the lake bottom when anchoring since this could cloud the water. ***Remove your sun glasses.*** **Wearing sun glasses will give you an unnatural reading.** Unwind the Secchi disk rope from the holder.

STEP 4. Lean over the shady side of the boat and slowly lower the Secchi disk into the water until you can no longer see it. If you are sampling in a pontoon boat, be sure to kneel down on the floor of the boat when you take your readings so you are closer to the surface of the water. Be as close to the surface of the water as you can safely be. Secchi disk readings are taken on the shady side of the boat to reduce glare.



STEP 5. When the Secchi disk barely disappears from your view, mark the rope at the surface of the water with a clothespin.

- **Secchi values vary by about 6% due to change in sun's angle in midsummer.**
- **5" waves can decrease Secchi reading by 10%.**

DNR PHOTOS

ON LAKE PROCEDURES

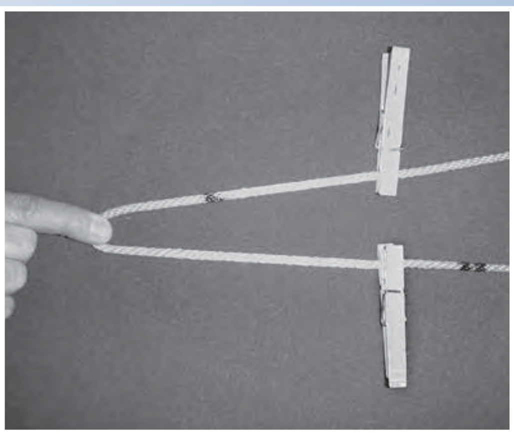
How to Use the Secchi Disk (continued)

STEP 6. After you have marked this spot with the clothespin, lower the disk a few more feet into the water. Slowly raise the disk. When the Secchi disk reappears, mark the rope at the surface of the water with the second clothespin. The clothespin marks may be at the same spot, several inches or even several feet apart. The purpose of lowering the Secchi disk and raising it back into view is so your eyes become accustomed to looking into the water. The average of the two readings will be a more accurate result.

DNR PHOTO

STEP 7. Bring the Secchi disk back into the boat.

STEP 8. Average your two Secchi disk readings by forming a loop between the two clothespins. Slide one clothespin into the center of the loop to mark it. Remove the other clothespin. The remaining clothespin mark will be your Secchi reading.



JIM KLOSIEWSKI

STEP 9. Your rope is marked in foot increments. The red lines indicate five, fifteen, and twenty-five feet. The double black lines indicate ten, twenty, and thirty feet. Carefully measure the number of feet from the disk until you reach your clothespin mark. Round off to the nearest quarter foot.

STEP 10. Record this measurement on your data sheet and then fill out the rest of your data sheet.

(continued on next page)

ON LAKE PROCEDURES
How to Use the Secchi Disk (continued)

STEP 11. Record your perception of water color and water appearance. Hold the Secchi disk **one foot** under the surface of the water to determine color and appearance. Record perception. This is your perception of the amount of algae that is in the water at the deep hole.

Perception Numbers

1 - Beautiful, could not be any nicer.

2 - Very minor aesthetic problems, excellent for swimming and boating.

3 - Swimming and aesthetic enjoyment of lake slightly impaired.

4 - Desire to swim and level of enjoyment of lake substantially reduced because of algae (would not swim, but boating is okay).

5 - Swimming and aesthetic enjoyment of the lake substantially reduced because of algal level.

STEP 12. If you are taking Secchi readings at more than one site or lake, proceed to your next location and repeat steps 1 through 10 above (step 11, perception, is recorded at the deep hole only.)

STEP 13. Report your data. Data can be submitted on the Internet at **http://dnr.wi.gov/lakes/**. Internet instructions are found in Appendix 2, page 50. If you enter data online, you do not need to submit data sheets by mail.

For those without Internet access – data sheets can be mailed to your CLMN regional coordinator to be entered into the database or mailed to the central office in Madison:

Department of Natural Resources, Lakes WT/4
101 S. Webster St.
P.O. Box 7921
Madison, WI 53791-9087

How Do You Prepare to Sample?

The Day You Sample

On the day you plan to sample, complete the top portion of your field data sheet by filling in the Waterbody # (or WBIC), Station # (or Storet #), and Volunteer IDs (or names). If you do not know what these numbers are, contact your regional coordinator. Check your monitoring equipment to make sure it is good working condition. If you have an electronic temperature meter, make sure the 9-volt battery is working. Before you launch your boat, make sure you have an anchor, sufficient gas, and personal flotation devices in your boat.

Sampling Overview

Temperature Readings

Some limnologists believe that lake temperature profile data are very important to document the effects of climate change. Keep this in mind, as the accuracy of the data you collect is critical. Temperature readings are easy to take. When using a digital temperature meter, a measured cable with a probe is lowered into the water and a hand-held digital meter records the temperature. The cable is marked in one foot increments. Your regional coordinator will give you the depths at which the temperature should be recorded for your particular lake.

Your temperature profile will also tell you if your lake stratifies. You will be able to determine the depth of the epilimnion and where the thermocline is. Temperature profiles will also help determine if a fish kill is a possibility on your lake.

ON LAKE PROCEDURES

Temperature Monitoring

Temperature Probe Method

STEP 1. Your regional coordinator will assign you 5 to 10 depths at which you should sample the temperature of your lake. List these pre-determined depths on your field data sheet.

STEP 2. Plug cable into unit.

STEP 3. Lower the probe to your assigned depths and note the corresponding temperatures from the meter onto your data sheet.

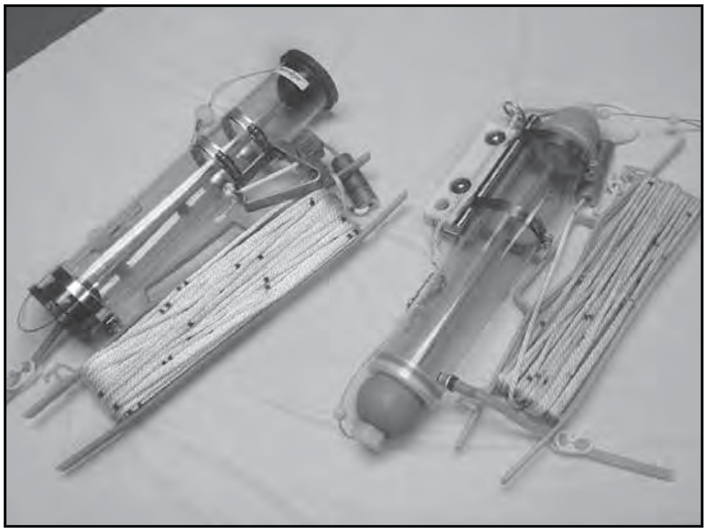
DNR PHOTO

STEP 4. Once you are finished, raise probe and unplug the cable from unit to conserve the battery. Be sure to store the digital meter out of direct sunlight.

3. TEMPERATURE MONITORING:

Using a Van Dorn Sampling Bottle with a Thermometer

Before you start sampling, be sure to read the following pages to familiarize yourself with the equipment and the procedures that you will be using. *All of the procedures that you will follow in sampling your lake are done for specific reasons. It is very important that you follow the sampling procedures exactly as they are laid out in the following pages to ensure good, consistent, high quality data. The following pages will provide you with sufficient background on the design of the equipment and proper procedures to use.*



DNR PHOTO

After sampling, it is very important to rinse and thoroughly air dry all of the equipment that you used. As always keep paperwork and envelopes separate from equipment.

What Equipment Will You Need?

At your training session, your CLMN regional coordinator will outline and provide all of the equipment that you will need to successfully monitor your lake.

- ☑ Manual
- ☑ Lake map with sampling site marked
- ☑ Van Dorn sampling bottle with thermometer
- ☑ Lifejackets (you provide)
- ☑ Anchor and rope (you provide)
- ☑ Field data sheets
- ☑ Pencil and waterproof pen

Appendix: Random Lake Plant Surveys

RANDOM LAKE
Aquatic Plant Survey
Whole Lake Demonstration Project/AIS Grant - 2005 Report

INTRODUCTION

In 2003, the Village of Random Lake received an Aquatic Invasive Species Grant from the Wisconsin Department of Natural Resources (WDNR) to conduct a demonstration whole-lake chemical treatment on Random Lake. The Grant application included the project plan upon which the WDNR treatment permit will be based. That plan, and the subsequent grant, requires extensive monitoring to be conducted: the year prior to treatment, the year of treatment, and three years post treatment. The aquatic plant community and the water quality (Self-Help Volunteer Monitoring Program) are to be monitored.

A local volunteer collected the water quality samples throughout the summer of 2005. The results are included in this report.

In July of 2005, Aron & Associates conducted the aquatic plant survey on Random Lake. This survey is part of an ongoing demonstration project to document changes in the aquatic plant community of Random 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 Random Lake.

Random Lake is located in the Village of Random Lake, Sheboygan County, in Southeast Wisconsin. Hydrographic and morphometric data are presented in Table 2. A map of Random Lake showing depth contours is presented in Map 1.

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 Random Lake in 2005 was determined to be 13 feet, that is, no plants were found growing in water deeper than 13 feet.

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 Random Lake.

The initial grid established 146 sample points. Of those, 13 were on land and were eliminated from the list, resulting in 133 sample points.
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. 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.

The abundance of each species was determined using four estimates:

1) The frequency is the rating of how often a species occurs <u>in the sample points</u>.
2) The average density rating, or the average density of a species <u>in the sample point where it occurred</u>.
3) The relative density rating, or the average density of a species <u>averaged over all sample points</u> whether or not any species were present.
4) The relative density rating <u>averaged over all sample points in which any species occurred.</u>

EARLIER STUDIES

In October 1999, a whole-lake chemical treatment was conducted on Random 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 was conducted in 1999 and continued through 2002. The results of that monitoring are provided in Table 1. The monitoring in 1999 through 2002 was conducted using the line-intercept method for the establishment of sample points.

As Eurasian watermilfoil re-infested Random Lake, the Village has used harvesting and 2-4,D chemical spot treatments to slow the return of Eurasian watermilfoil. Curly-leaf pondweed (*Potamogeton crispus*) increased significantly between 1999 and 2002. Long-

term historical data on the aquatic plant community is not available. It is, therefore unclear if this is a new increase or the continuation of a longer trend.
A re-treatment of Random Lake was conducted in 2005 using fluridone. This survey is the first post-treatment survey following treatment.
The 2005 treatment was done in spring 2005 while the 1999 treatment was conducted in fall. It is not yet known if this will influence the results of the treatment.

RESULTS OF THE PRESENT STUDY

A total of 8 aquatic macrophytes were found during the survey in 2005, down from 16 species in 2004. All of the plants were found during the grid survey. No additional species were located during the general survey even though specific plant beds were searched for signs of additional pondweeds. Wetland fringe species are not included in the list of species. It should be noted that large stands of bulrush are present in Random Lake. The bulrushes were abundant and healthy.

The plants found in the lake in 2005 are listed in Table 2. Chara (*Chara* sp.) dominated the plant community, throughout the depths. Water lilies (*Nuphar* and *Nymphaea* sp.) were common in the shallow areas, while sago pondweed (*Stuckenia pectinata*) was found in the deeper depths, from 6 to 11 feet deep. Two species were found that had not been previously identified in Random Lake, small duckweed (*Lemna minor*) and Nitella (*Nitella* sp.). Eleven species found in 2004, could not be located in the 2005 survey, including two nuisance, exotic species, Eurasian watermilfoil and curly-leaf pondweed.

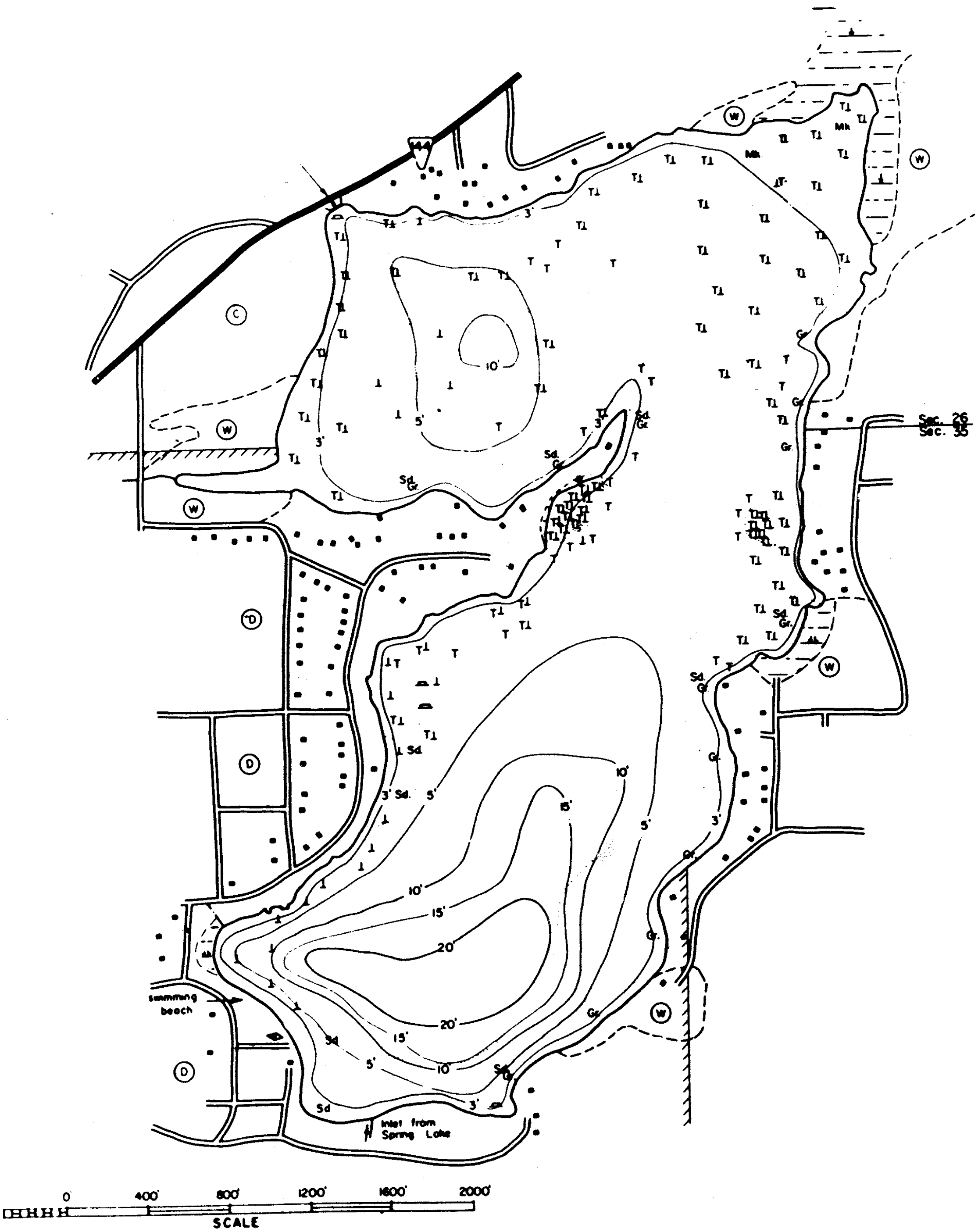
The results of the survey data for the July 2005 survey for all species at each sample depth are included at the end of this report.

The maximum rooting depth in 2005 was 13 feet. Sediments in Random Lake range from sand and gravel to muck. At 1.5 feet the substrate is primarily sand and gravel. At 15 feet the substrate is muck.

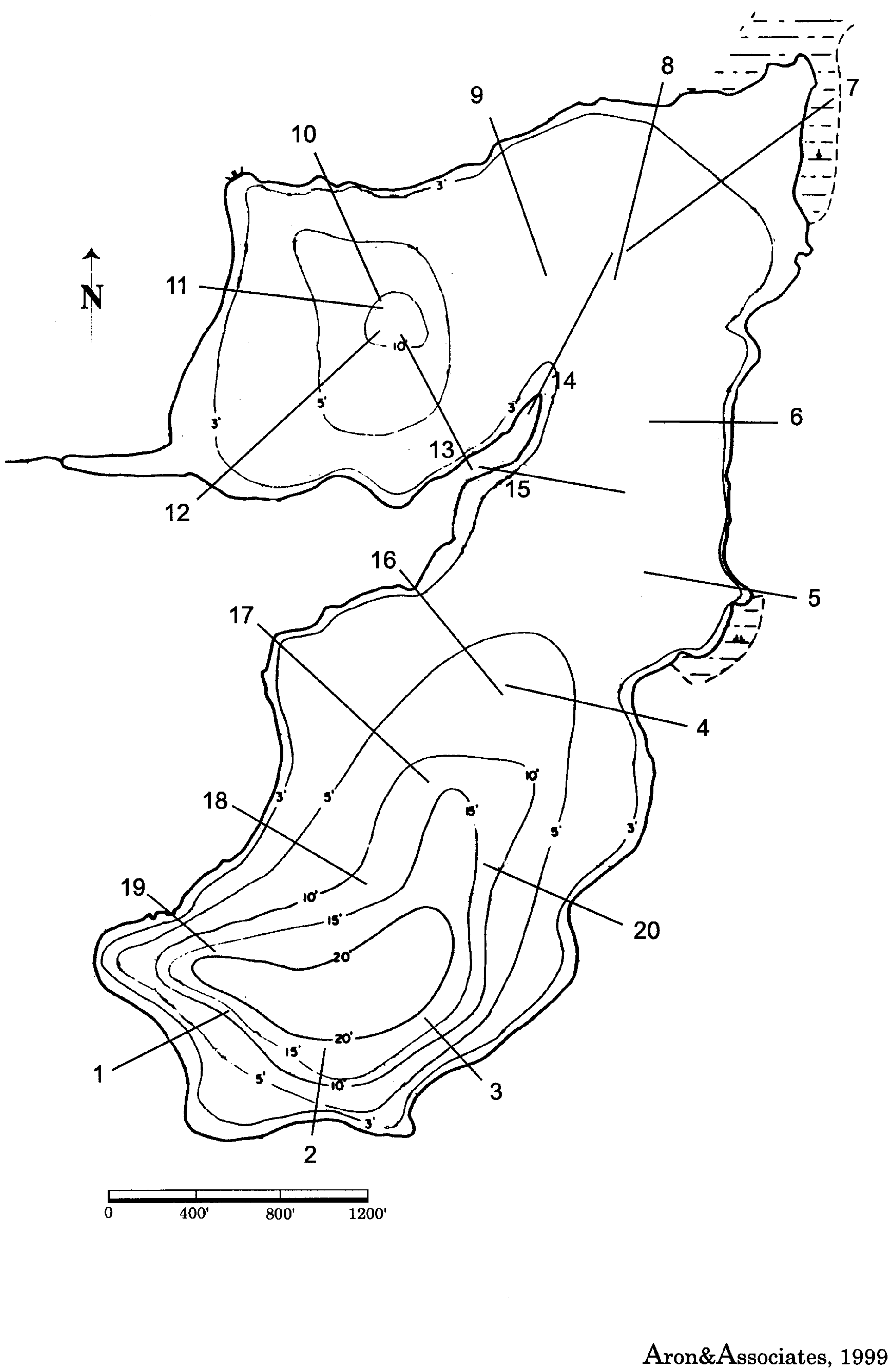
Table 1. Hydrographic and Morphometric Data Random Lake

Size of Lake	209 acres
Lake Volume	1279 acre feet
Length of Shoreline	3.6 miles
Maximum Depth	21 feet
Mean Depth	6 feet
Percent of area less than 3 feet deep	14%
Percent of area greater than 20 feet deep	4%

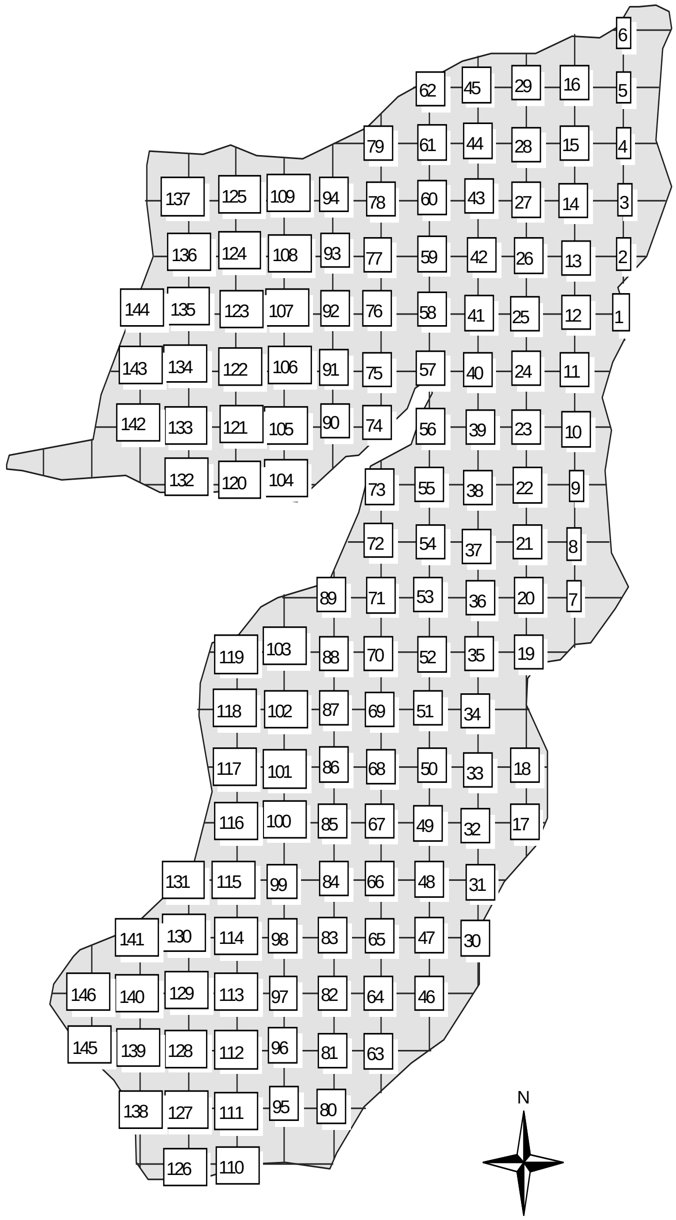
Source: WDNR



Map 1 - Bathymetric Map, Random Lake, Wisconsin.



Map 2 - Line Transect Survey Locations, Random Lake, Wisconsin, 1999.



Map 3 - Point Intercept Survey Sample Points on Random Lake, 2005.

Table 2. Random Lake Aquatic Plant Species - 1999 to 2005

		% Frequency					
Species	**Common Name**	**1999**	**2000**	**2001**	**2002**	**2004**	**2005**
Chara sp.	Muskgrass, Chara	34	57	43	49	50	64
Elodea canadensis	Waterweed				3	1	
Lemna minor	Small Duckweed						1[a]
Myriophyllum spicatum	Milfoil	60	1[a]	9	69	8	
Najas flexilis	Slender Naiad	1		X	2	10	
Najas marina	Spiny Naid	10			X	13	
Nitella sp.	Nitella						10
Nuphar advena	Yellow Water Lily	5	5	6	7	4	3
Nymphaea sp.	White Water Lily	5	5	0	4	2	10
Potamogeton crispus	Curly-leaf Pondweed	1	4	19	25	1	
P. amplifolius	Large-leaf Pondweed			1	3	6	
P. Illinoensis	Illinois Pondweed	14	18	17	34	8	
P. foliosus	Leafy Pondweed				X	1	
P. natans	Floating-leaf Pondweed	1	5	5	7	6	5
P. zosterformis	Flat-stem Pondweed	X		10	7	X	
Stuckenia pectinata	Sago Pondweed	33	57	48	56	37	12
Utricularia vulgaris	Great Bladderwort	1		2	3	9	
Vallisneria americana	Wild Celery, Eel Grass				X	X	

Notes: [a] Found in only one sample point.
X Found only in the general survey.

WATER QUALITY 2005

The water quality on Random Lake was monitored under the Self-Help Volunteer Monitoring Program. The volunteer, Wayne Stroessner, collected the samples following the Self-Help protocol. Complete results are available on the WDNR website, http://dnr.wi.gov/org/water/fhp/lakes/lakesdatabase.asp.

Table 3 is a summary of the results for 2005. Table 4 is a comparison of the summary results for both 2004 and 2005. 2005 data are included in the Appendix.

Table 3. Random Lake Water Quality Data Summary for 2005*

Sampling Date	Secchi (ft)	Total Phosphorus (mg/l)	DO at surface (mg/l)	Temp at surface (^oF)	Chlorophyll A (ug/l)
5/17/06	7	22	9.93	54.5	
5/31/06	4.25		10.89	67.5	
6/14/06	5.5	19	7.73	78.6	3.21
6/23/06	5		8.91	75.9	
7/8/06	5.25		8.05	75.2	
7/28/06	5.75	19	7.44	76.3	7.43
8/10/06	5		6.78	79.2	
8/23/06	4.5	23	7.35	73	9.2
9/6/06	3.5		7.95	74.8	
9/16/06	4.5		6.23	72	
10/1/06	4.5		7.45	61.2	
10/17/06	4.25	25	7.81	56.7	9.23
10/26/06	4.25		8.27	48.4	

*Complete data are provided in the Appendix or are available at www.dnr.state.wi.us.

Table 4. Comparison of 2004 and 2005 Water Quality Data on Random Lake

Sampling Date	Average Secchi (ft)	Average Total Phosphorus (mg/l)	Average Chlorophyll A (ug/l)
2004	5.2	26.8	5.2
2005	4.9	21.6	7.3

SUMMARY

The Village of Random Lake has conducted significant aquatic plant management activities over the years to keep Random Lake open to recreational use. As Eurasian watermilfoil expanded its range, the management efforts have not always been able to keep pace with the growth of the exotic plant. A demonstration chemical treatment was conducted using Sonar in October 1999. Since 2002, the Village has used a combination of harvesting and chemical treatment (using 2,4-D products) to control Eurasian watermilfoil. A second Sonar treatment was conducted in spring 2005.

A comparison of 2005 data with the 1999 through 2004 project shows a number of differences:

— The 2004 and 2005 surveys were done using point-intercept while earlier surveys were done using the line-transect method.

— Significant differences in frequency over the years are present. The reasons for the disparity are unclear. It could be simply the difference in sampling protocols used, or other factors could come into play. Actual reasons are most likely a combination of factors.

— There is significant difference in the lake's response following the 2005 Sonar treatment to that following the 1999 Sonar treatment. The fall 1999 treatment, conducted at a higher rate, produced little impact on the native species. The Eurasian watermilfoil treatment in 1999 was not 100%. The spring 2005 treatment was done at a much lower rate, yet the impact on natives, at least the season of treatment, was significant. Whether that will result in long term impacts is unknown. The timing of the treatment may have been a factor in this difference. The native plants may already have started their seasonal growth when the May 5, 2005 treatment was conducted.

—Clarity and Chlorophyll A concentrations increased from 2004 to 2005 while total phosphorus concentrations decreased (Table 4).

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.

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.

RANDOM LAKE
Aquatic Plant Survey
Whole Lake Demonstration Project/AIS Grant - 2006 Report

INTRODUCTION

In 2003, the Village of Random Lake received an Aquatic Invasive Species Grant from the Wisconsin Department of Natural Resources (WDNR) to conduct a demonstration whole-lake chemical treatment on Random Lake. The Grant application included the project plan upon which the WDNR treatment permit will be based. That plan, and the subsequent grant, requires extensive monitoring to be conducted: the year prior to treatment, the year of treatment, and three years post treatment. The aquatic plant community and the water quality (Self-Help Volunteer Monitoring Program) are to be monitored.

A local volunteer collected the water quality samples throughout the summer of 2006. The results are included in this report.

In July of 2006, Aron & Associates conducted the aquatic plant survey on Random Lake. This survey is part of an ongoing demonstration project to document changes in the aquatic plant community of Random 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 Random Lake.

Random Lake is located in the Village of Random Lake, Sheboygan County, in Southeast Wisconsin. Hydrographic and morphometric data are presented in Table 2. A map of Random Lake showing depth contours is presented in Map 1.

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 Random Lake in 2006 was determined to be 13.5 feet, that is, no plants were found growing in water deeper than 13.5 feet.

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 Random Lake.

The initial grid established 146 sample points. Of those, 13 were on land and were eliminated from the list, resulting in 133 sample points.
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. 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.

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.

EARLIER STUDIES

In October 1999, a whole-lake chemical treatment was conducted on Random 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 was conducted in 1999 and continued through 2002. The results of that monitoring are provided in Table 1. The monitoring in 1999 through 2002 was conducted using the line-intercept method for the establishment of sample points.

As Eurasian watermilfoil re-infested Random Lake, the Village has used harvesting and 2-4,D chemical spot treatments to slow the return of Eurasian watermilfoil. Curly-leaf pondweed (*Potamogeton crispus*) increased significantly between 1999 and 2002. Long-

term historical data on the aquatic plant community is not available. It is, therefore unclear if this is a new increase or the continuation of a longer trend.
A re-treatment of Random Lake was conducted in 2005 using fluridone. This survey is the second post-treatment survey following treatment.
The 2005 treatment was done in spring 2005 while the 1999 treatment was conducted in fall. It is not yet known if this will influence the results of the treatment.

RESULTS OF THE PRESENT STUDY

A total of 14 aquatic macrophytes were found during the survey in 2006, up from the 8 found in 2005, but down from 16 species in 2004. Ten of the plants were found during the grid survey and four were found during the general survey. Wetland fringe species are not included in the list of species. It should be noted that large stands of bulrush are present in Random Lake. The bulrushes were abundant and healthy.

The plants found in the lake in 2006 are listed in Table 2. Chara (*Chara* sp.) and sago pondweed (*Stuckenia pectinata*) dominated the plant community, throughout the depths. Water lilies (*Nuphar* and *Nymphaea* sp.) were common in the shallow areas, Two species were found that had not been previously identified in Random Lake, small duckweed (*Lemna minor*) and Nitella (*Nitella* sp.). Curly-leaf pondweed (*P. crispus*), an exotic species, was found in nine sample points. Eurasian watermilfoil (*Myriophyllum spicatum*) was not found in 2006. A native milfoil, whorled watermilfoil (*Myriophyllum verticillatum*) was found in one area, on the Northeast side of the lake near the bulrushes.

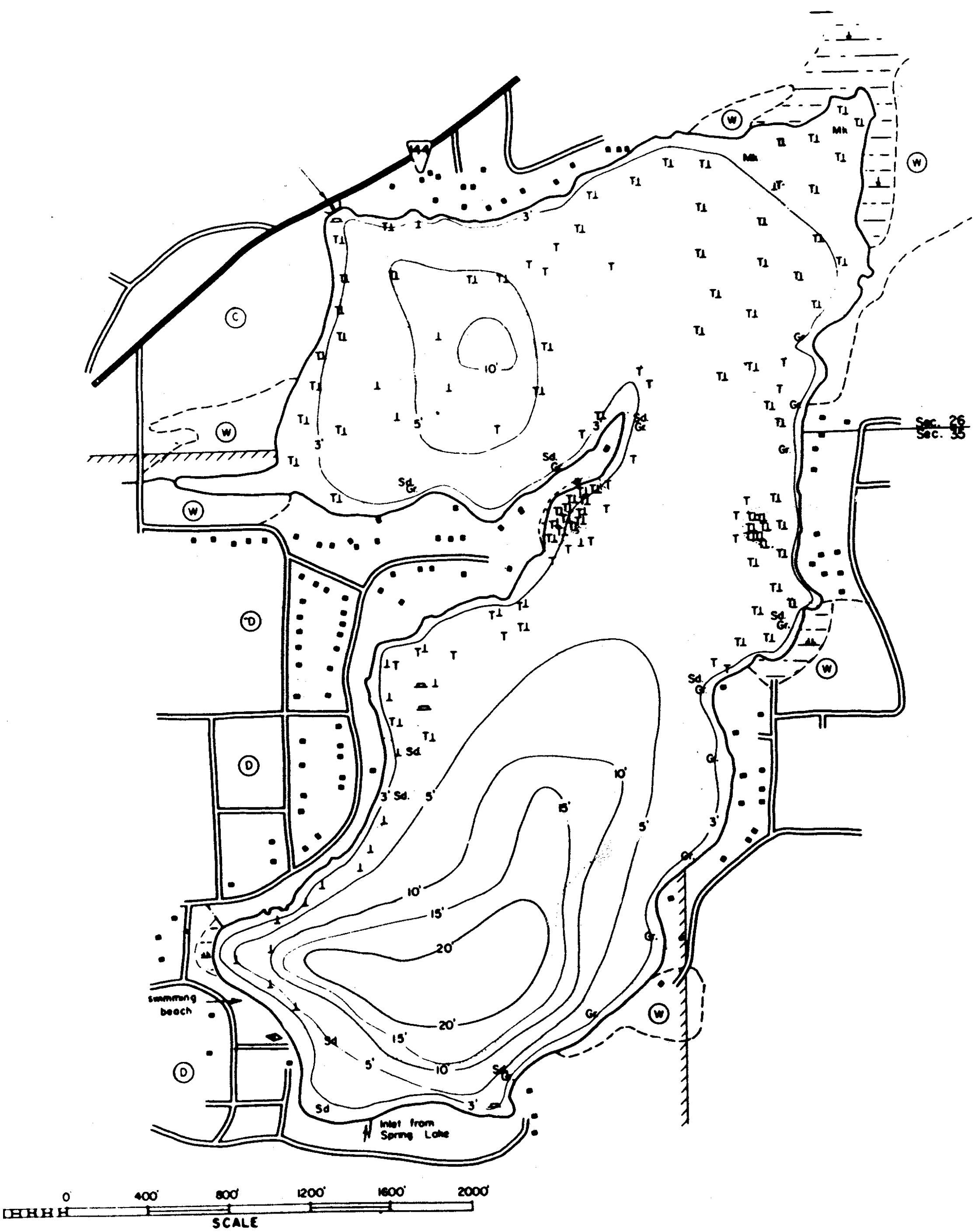
The results of the survey data for the July 2006 survey for all species at each sample depth are included at the end of this report.

The maximum rooting depth in 2005 was 13.5 feet. Sediments in Random Lake range from sand and gravel to muck. At 1.5 feet the substrate is primarily sand and gravel. At 15 feet the substrate is muck.

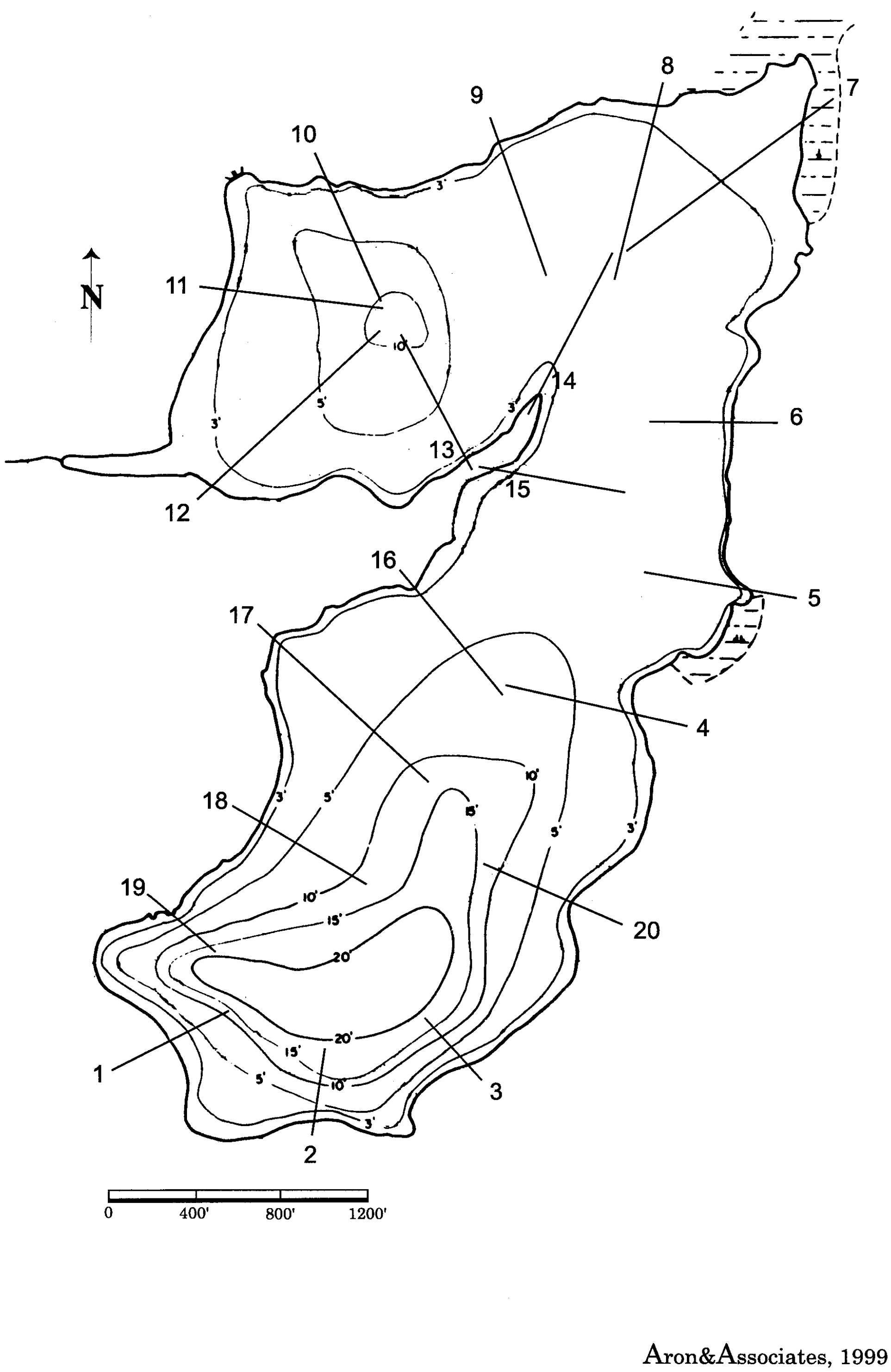
Table 1. Hydrographic and Morphometric Data Random Lake

Size of Lake	209 acres
Lake Volume	1279 acre feet
Length of Shoreline	3.6 miles
Maximum Depth	21 feet
Mean Depth	6 feet
Percent of area less than 3 feet deep	14%
Percent of area greater than 20 feet deep	4%

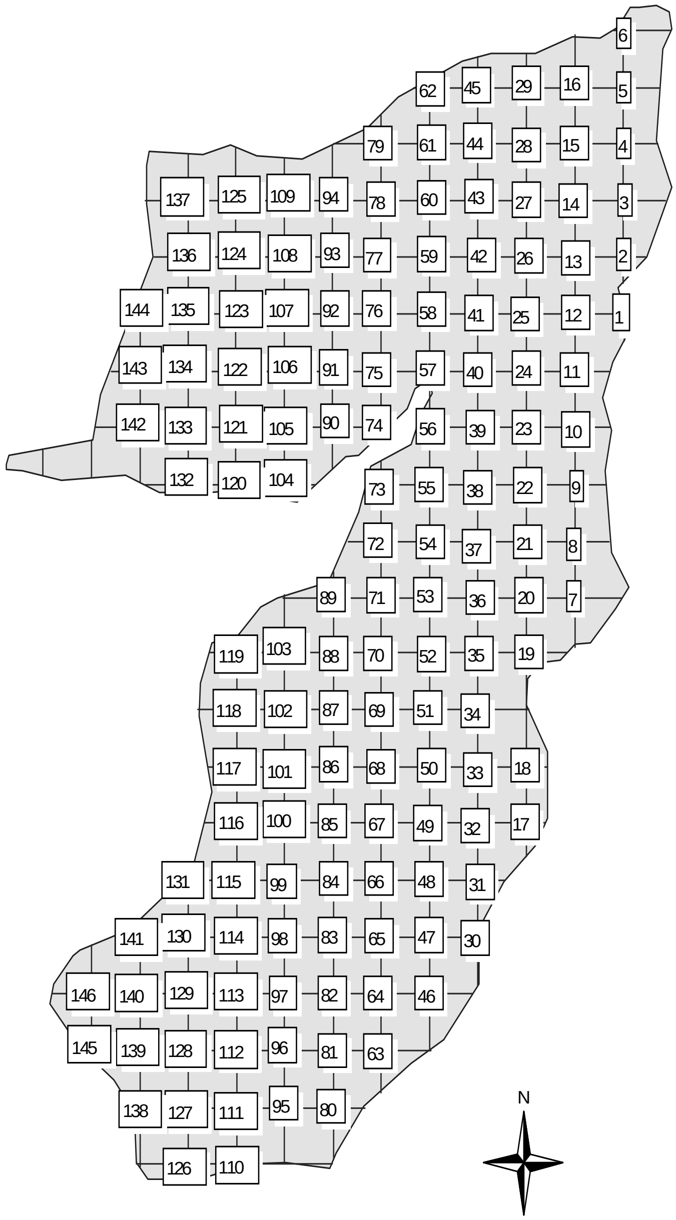
Source: WDNR



Map 1 - Bathymetric Map, Random Lake, Wisconsin.



Map 2 - Line Transect Survey Locations, Random Lake, Wisconsin, 1999.



Map 3 - Point Intercept Survey Sample Points on Random Lake, 2005.

Table 2. Random Lake Aquatic Plant Species - 1999 to 2006

	% Frequency						
Species	**1999**	**2000**	**2001**	**2002**	**2004**	**2005**	**2006**
Chara sp.	34	57	43	49	50	64	50
Elodea canadensis				3	1		
Lemna minor						1[a]	X
Myriophyllum spicatum	60	1[a]	9	69	8		
Myriophyllum verticillatum							X
Najas flexilis	1		X	2	10		2
Najas marina	10			X	13		6
Nitella sp.						10	
Nuphar advena	5	5	6	7	4	3	1
Nymphaea sp.	5	5	0	4	2	10	5
Potamogeton crispus	1	4	19	25	1		7
P. amplifolius			1	3	6		X
P. Illinoensis	14	18	17	34	8		X
P. foliosus				X	1		
P. natans	1	5	5	7	6	5	2
P. zosterformis	X		10	7	X		
Stuckenia pectinata	33	57	48	56	37	12	40
Utricularia vulgaris	1		2	3	9		1
Vallisneria americana				X	X		

Notes: [a] Found in only one sample point.
X Found only in the general survey.

WATER QUALITY 2006

The water quality on Random Lake was monitored under the Self-Help Volunteer Monitoring Program. The volunteer, Wayne Stroessner, collected the samples following the Self-Help protocol. Complete results are available on the WDNR website, http://dnr.wi.gov/org/water/fhp/lakes/lakesdatabase.asp.

Table 3 is a summary of the results for 2006. Table 4 is a comparison of the summary results for both 2004, 2005, and 2006. 2006 data are included in the Appendix.

Table 3. Random Lake Water Quality Data Summary for 2006*

Sampling Date	Secchi (ft)	Total Phosphorus (mg/l)	DO at surface (mg/l)	Temp at surface (^oF)	Chlorophyll A (ug/l)
5/29/06	4.25	8	5.55	70.8	
6/13/06	3.51	21	7.57	69.9	10.7
6/21/06	3.5		6.51	73.7	
6/30/06	3.75		7.98	76.2	
7/07/06	3.5		7.92	78.1	
7/15/06	4.75		7.03	79.2	
7/23/06	3.5	23	6.8	77	8.13
7/31/06	3.51		6.44	81.1	
8/16/06	3.75	25	7.11	75.9	7.41
8/24/06	3.75		7.1	74.6	
9/01/06	4		6.76	71.9	
9/14/06	4.25		6.52	63.7	
9/17/06	4		7.48	67.3	
9/25/06	4.25		7.31	60.9	
10/06/06	4.25	25	7.68	59.8	7.18
10/20/06	5.51		8.21	46	

*Complete data are provided in the Appendix or are available at www.dnr.state.wi.us.

Table 4. Comparison of 2004, 2005, and 2006 Water Quality Data on Random Lake

Sampling Date	Average Secchi (ft)	Average Total Phosphorus (mg/l)	Average Chlorophyll A (ug/l)
2004	5.2	26.8	5.2
2005	4.9	21.6	7.3
2006	4.0	20.4	8.4

SUMMARY

The Village of Random Lake has conducted significant aquatic plant management activities over the years to keep Random Lake open to recreational use. As Eurasian watermilfoil expanded its range, the management efforts have not always been able to keep pace with the growth of the exotic plant. A demonstration chemical treatment was conducted using Sonar in October 1999. Since 2002, the Village has used a combination of harvesting and chemical treatment (using 2,4-D products) to control Eurasian watermilfoil. A second Sonar treatment was conducted in spring 2005.

A comparison of 2006 plant data with the 1999 through 2005 project shows a number of differences:

— The 2004, 2005, and 2006 surveys were done using point-intercept while earlier surveys were done using the line-transect method.

— Significant differences in frequency over the years are present. The reasons for the disparity are unclear. It could be simply the difference in sampling protocols used, or other factors could come into play. Actual reasons are most likely a combination of factors.

— There is significant difference in the lake's response following the 2005 Sonar treatment to that following the 1999 Sonar treatment. The fall 1999 treatment, conducted at a higher rate, produced little impact on the native species. The Eurasian watermilfoil treatment in 1999 was not 100%. The spring 2005 treatment was done at a much lower rate, yet the impact on natives, at least the season of treatment, was significant. Whether that will result in long term impacts is unknown. The timing of the treatment may have been a factor in this difference. The native plants may already have started their seasonal growth when the May 5, 2005 treatment was conducted.

—More native plant species were found in 2006 than were found in 2005

—Clarity and Chlorophyll A concentrations increased from 2004 to 2006 while total phosphorus concentrations decreased (Table 4).

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.

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.

RANDOM LAKE AQUATIC PLANT SURVEY - 2006

Plants

Transect #	Depth	CHARA	NITELA	MYRSP	STUPE	POTFO	NAJFL	NAJMA	NUPHAR	NYMPH	POTIL	POTAM	POTGR	POTNA	UTRIVU	POTCR	LEMNA	ELOCA
5	1.5				2					4								
73	1.5	4			3			2		2						2		
144	1.5				4					V								
19	2	4																
18	2.5																	
7	2.75	4			1			1		V								
10	2.75	5			V													
11	2.75	4			3													
4	3	1			2					4								
8	3	5			3								1			1		
9	3	5			2					V								
45	3	1			3													
137	3				4					1								
138	3.25	V			V							V				V		
143	3.25				V					V				V				
3	3.5	2			4													
13	3.5	4			3													
62	3.5	4			3					V				2		2		
142	3.5				4				2					2				
119	3.75	2			V					V								
12	4	4			3													
15	4				4					3								
16	4	2			3								1		1	1		
29	4	V			1				V	1								
31	4	1																
72	4	4																
79	4	V			V								V					
89	4	4			2													
94	4												2					
133	4	2			2					1								
14	4.5	1			4								1					
131	4.5	3								V								
134	4.5				2													
22	4.75	4														1		
24	4.75	4																
20	5	3																
21	5	5																
23	5	4																
25	5	5																
27	5				3													
28	5				V													
35	5	4																
39	5	5			3													
44	5	1																
54	5	5																

Transect #	Depth	CHARA	NITELA	MYRSP	STUPE	POTFO	NAJFL	NAJMA	NUPHAR	NYMPH	POTIL	POTAM	POTGR	POTNA	UTRIVU	POTCR	LEMNA	ELOCA
55	5	3																
61	5	4			4													
70	5	4						2										
77	5	4			1											1		
103	5	5																
118	5				1													
135	5	5			2			1										
136	5				4					V								
38	5.25	5																
40	5.25	4			2													
71	5.25	5														1		
75	5.25	5			2													
121	5.25				1			2										
26	5.5	1																
41	5.5	5																
76	5.5	3																
78	5.5	4			1								3					
80	5.5	2																
90	5.5																	
105	5.5	1						2										
117	5.75	1			1			3										
34	6	5					2											
36	6	5																
37	6	5																
43	6				3					1								
58	6	4			3													
59	6	4			4													
60	6	5																
116	6	5																
125	6	4			3													
126	6				1					1						1		
88	6.25	4																
32	6.5	1																
33	6.5	5			2		1											
48	6.5																	
109	6.5	1			2													
141	6.5				3													
42	7																	
46	7																	
53	7	5			2													
93	7	2			3			1										
122	7.5	5			3			2										
52	8	2														1		
123	8	1			4													
124	8	4			4													
49	8.25																	
63	8.5																	
69	8.75																	
102	8.75	2			3													

Transect #	Depth	CHARA	NITELA	MYRSP	STUPE	POTFO	NAJFL	NAJMA	NUPHAR	NYMPH	POTIL	POTAM	POTGR	POTNA	UTRIVU	POTCR	LEMNA	ELOCA
87	9				3													
115	9																	
127	9	4			4													
146	9				2											1		
51	9.25																	
111	9.25																	
47	9.5																	
139	9.5																	
99	10.25																	
50	10.75																	
86	11																	
101	11				2													
100	11.25				1													
108	11.5				4													
130	12.25																	
95	12.5								V			V						
114	13																	
85	13.25																	
98	13.25				2													
106	13.25																	
68	13.5																	
92	14.25																	
84	14.75																	
91	14.75																	
67	15.75																	
66	16.25																	
83	17.75																	
107	17.75																	
65	18.25																	
140	19																	
64	19.25																	
81	19.25																	
128	19.25																	
97	19.5																	
129	19.5																	
113	19.75																	
112	20																	
96	20.25																	
82	20.5																	
1	ON LAND																	
2	ON LAND																	
6	ON LAND																	
17	ON LAND																	
30	ON LAND																	
56	ON LAND	V								V	V		V					
57	ON LAND	V			V				V							V		
74	ON LAND																	
104	ON LAND																	
110	ON LAND																	

Transect #	Depth	CHARA	NITELA	MYRSP	STUPE	POTFO	NAJFL	NAJMA	NUPHAR	NYMPH	POTIL	POTAM	POTGR	POTNA	UTRIVU	POTCR	LEMNA	ELOCA
120	ON LAND																	
132	ON LAND																	
145	ON LAND																	

Total Sample Sites (146 - 13 on land) = 133
Sample Sites w/ No Plants 44

	CHARA	NITELLA	MYRSP	STUPE	POTFO	NAJFL	NAJMA	NUPHAR	NYMPH	POTIL	POTAM	POTGR	POTNA	UTRIVU	POTCR	LEMNA	ELOCA
Sites found(Frequency)	68	0	0	55	0	2	9	1	9	0	0	5	2	1	10	0	0
% Frequency	51.13	0.00	0.00	41.35	0.00	1.50	6.77	0.75	6.77	0.00	0.00	3.76	1.50	0.75	7.52	0.00	0.00
Density (Max = 5) at sites found	3.47	#DIV/0!	#DIV/0!	2.55	#DIV/0!	1.50	1.56	2.00	1.33	#DIV/0!	#DIV/0!	1.60	2.00	1.00	1.00	#DIV/0!	#DIV/0!
Relative Density (Max = 5) Whole Lake	1.77	0.00	0.00	1.05	0.00	0.02	0.11	0.02	0.09	0.00	0.00	0.06	0.03	0.01	0.08	0.00	0.00
Found Visually	V			V			V	V		V	V	V	V			V	

Lake Water Quality 2006 Annual Report

RANDOM LAKE
Sheboygan County
Waterbody Number: 30300

Lake Type: DRAINAGE
DNR Region: SE
GEO Region:SW

Site Name	Storet #
RANDOM LAKE - DEEP HOLE	603312

Date	SD (ft)	SD (m)	Hit Bottom	CHL	TP	TSI (SD)	TSI (CHL)	TSI (TP)	Lake Level	Clarity	Color	Perception
05/29/2006	4.25	1.3	N		8	56		44	HIGH	CLEAR	GREEN	3
06/13/2006	3.5	1.1	N	10.7	21	59	53	52	HIGH	MURKY	GREEN	3
06/21/2006	3.5	1.1	N			59			HIGH	MURKY	GREEN	3
06/30/2006	3.75	1.1	N			58			HIGH	MURKY	GREEN	3
07/07/2006	3.5	1.1	N			59			NORMAL	MURKY	GREEN	3
07/15/2006	4.75	1.4	N			55			NORMAL	MURKY	GREEN	3
07/23/2006	3.5	1.1	N	8.13	23	59	51	52	NORMAL	MURKY	BROWN	3
07/31/2006	3.5	1.1	N			59			NORMAL	MURKY	BROWN	3
08/16/2006	3.75	1.1	N	7.41	25	58	50	53	LOW	MURKY	BROWN	3
08/24/2006	3.75	1.1	N			58			LOW	MURKY	GREEN	3
09/01/2006	4	1.2	N			57			LOW	MURKY	GREEN	3
09/14/2006	4.25	1.3	N			56			LOW	CLEAR	GREEN	3
09/17/2006	4	1.2	N			57			LOW	MURKY	GREEN	3
09/25/2006	4.25	1.3	N			56			NORMAL	CLEAR	GREEN	3
10/06/2006	4.25	1.3	N	7.18	25	56	50	53	NORMAL	CLEAR	BROWN	3
10/20/2006	5.5	1.7	N			53			HIGH	CLEAR	BROWN	3

05/29/2006		
Depth FEET	Temp. DEGREES F	D.O. mg/l
0	70.8	5.55
2	69.9	6.52
4	69.1	7.25
6	67.5	7.12
8	64.6	7.48
10	62.1	7.31
12	60	6.72
14	58.4	5.71
16	57.4	4.82
18	56.2	1.02
20	55.7	.35
22.2	55.1	.1

06/13/2006		
Depth FEET	Temp. DEGREES F	D.O. mg/l
0	69.9	7.57
2	69.1	8.01
4	68.5	8.17
6	68.2	8.09
8	67.6	8
10	66.9	7.74
12	65.8	7.35
14	63.1	4
16	59.8	.11
18	57	.02
20	56.1	.01
22	55.5	.01
22.2	55.1	0

06/21/2006		
Depth FEET	Temp. DEGREES F	D.O. mg/l
0	73.7	6.51
2	73.5	7.16
4	73.3	7.28
6	73.2	7.41
8	72.4	7.13
10	71.3	6.88
12	69.7	6.4
14	64.9	1.62
16	61.3	.14
18	58.8	.08
20	57.4	.06
22	56.4	.04
22.2	56.1	.03

06/30/2006		
Depth FEET	Temp. DEGREES F	D.O. mg/l
0	76.2	7.98
2	75.9	8.08
4	75	8.2
6	74.3	8.26
8	73.3	8.38
10	72.1	7.64
12	70.1	5.54
14	67.5	.59
16	65.1	.1
18	61.5	.07
20	59.2	.06
22	57.5	.04
22.2	56.8	.02

07/07/2006		
Depth FEET	Temp. DEGREES F	D.O. mg/l
0	78.1	7.92
2	78.1	7.95
4	77.9	8.02
6	77.5	7.99
8	76.6	7.77
10	75.5	6.89
12	74.1	5.41
14	71.2	.9
16	66.7	.07
18	62.6	.06
20	59.8	.03
22	58.4	.02
22.2	57.9	0

07/15/2006		
Depth FEET	Temp. DEGREES F	D.O. mg/l
0	79.2	7.03
2	78.8	7.16
4	78.4	7.09
6	77.7	7.02
8	76.4	7.03
10	75	6.55
12	73.3	4.94
14	71.3	2.85
16	69.1	.11
18	64.4	.07
20	61	.06
22	59.6	.04
22.2	59	.02

07/23/2006		
Depth FEET	Temp. DEGREES F	D.O. mg/l
0	77	6.8
2	77	6.86
4	77	6.89
6	76.8	6.89
8	76.8	6.83
10	76.4	6.69
12	75.2	5.73
14	73	1.51
16	68.9	.11
18	66	.11
20	63.1	.14
22	61.7	.16

07/31/2006		
Depth FEET	Temp. DEGREES F	D.O. mg/l
0	81.1	6.44
2	81	6.56
4	80.4	6.63
6	80.1	6.5
8	79.9	6.3
10	79.3	5.68
12	77.3	3.93
14	74.4	.93
16	70.6	.04
18	67.3	.03
20	64.6	.02
22	62.6	.01
22.1	62.1	.01

08/16/2006		
Depth FEET	Temp. DEGREES F	D.O. mg/l
0	75.9	7.11
2	75.9	7.13
4	75.5	7.18
6	75.5	7.19
8	75.2	7.17
10	75.2	7.08
12	74.8	6.87
14	74.3	6.93
16	73.2	4.69
18	70.1	.06
20	66	.03
22	63.9	.03
22.1	63	.02

08/24/2006		
Depth FEET	Temp. DEGREES F	D.O. mg/l
0	74.6	7.1
2	74.4	7.18
4	74.4	7.2
6	74.3	7.17
8	74.1	7.08
10	73.9	6.51
12	73.7	5.91
14	73.3	4.79
16	72.8	3.71
18	71	.04
20	67.6	.02
22	64.9	.01

09/01/2006		
Depth FEET	Temp. DEGREES F	D.O. mg/l
0	71.9	6.76
2	72.1	6.8
4	72.1	6.82
6	71.9	6.84
8	71.9	6.85
10	71.9	6.84
12	71.9	6.85
14	71.9	6.86
16	71.7	6.8
18	71	5.39
20	69.4	.6
22	67.5	.01

09/14/2006		
Depth FEET	Temp. DEGREES F	D.O. mg/l
0	63.7	6.52
2	63.3	6.57
4	63	6.65
6	62.8	6.58
8	62.8	6.52
10	62.6	6.43
12	62.6	6.41
14	62.6	6.42
16	62.6	6.36
18	62.4	6.26
20	62.4	5.73
22	62.6	.07
22.1	62.6	.03

09/17/2006		
Depth FEET	Temp. DEGREES F	D.O. mg/l
0	67.3	7.48
2	66.7	7.59
4	66.2	7.55
6	65.3	7.24
8	64	7.29
10	63.7	6.81
12	63.1	6.63
14	62.8	5.9
16	62.8	5.49
18	62.6	5.19
20	62.4	4.48
22	62.4	.09
22.1	62.4	.05

09/25/2006		
Depth FEET	Temp. DEGREES F	D.O. mg/l
0	60.9	7.31
2	60.7	7.38
4	60.7	7.45
6	60.7	7.51
8	60.5	7.54
10	60.5	7.55
12	60.5	7.55
14	60.3	7.52
16	60.3	7.49
18	60.1	7.43
20	60	7.31
22	60	.13
22.1	59.8	.05

10/06/2006		
Depth FEET	Temp. DEGREES F	D.O. mg/l
0	59.8	7.68
2	59.8	7.72
4	59.8	7.78
6	58.6	7.9
8	58.6	7.9
10	58.4	7.8
12	58.4	7.72
14	58.3	7.74
16	58.3	7.64
18	58.1	7.5
20	57.9	7.43
22	57.9	.16
22.2	58.1	.03

10/20/2006		
Depth FEET	Temp. DEGREES F	D.O. mg/l
0	46	8.21
2	46	8.32
4	46	8.38
6	46	8.45
8	46	8.48
10	46	8.52
12	46	8.53
14	46	8.55
16	46	8.56
18	46	8.55
20	46.2	8.49
22	46.2	6.1
22.2	46.6	.2

Date	Collector Comments
06/21/2006	Fish (small) between 10-14'; Sprigs of curly leaf pondweed; pH=7; Satellite day; pH = 7.0
06/30/2006	Fish between 10-15'; much curly leaf- broad leaf and Sago pondweeds- much Chara; heavy traffic on lake; pH = 6.8; (1 day after Satellite day
07/07/2006	Fish between 11-13'; much debris at surface (Potamogeton sprigs + grasslike leaves (not Aphanazomena); clumps of filamentous algae appox. 30 cm diam; Satellite day; pH - 6.8
07/15/2006	Fish between 10-18'; much Sago pondweed; Satellite day; pH = 7.1
07/23/2006	Fish between 9-19'; much Sago pondweed; warm weather; Chlorophyll + Phosphorus samples sent; Satellite day; pH = 6.9
07/31/2006	Fish between 10-18'; mostly Sago Pondweed; hot weather; Satellite day; pH = 7.3
08/16/2006	Fish between 7-17'; residents have asked for spraying of weeds - much Potamegeton but no Eurasian Water Milfoil; warm- dry-but cool nights; Satellite day; pH = 7.0; Chlorophyll + Phosphorus samples sent in;
08/24/2006	Fish between 7-17'; many pondweed varieties; Satellite day; pH = 6.9; low water level - deepest point = 22'
09/01/2006	Fish between 9-18'; Satellite day; pondweed going to seed + turning brown however- at north end - still green; pondweed spikes above water surface; one "whorled" water milfoil plant discovered on 8/25/06; pH = 7.1; low water- bottom = 22'
09/14/2006	Fish between 10-19'; mostly Sago and other pondweed abundant; pH = 7.1

09/17/2006	Fish between 6-17'; satellite day; no visible Eurasian Water Milfoil - same as rest of summer; pH = 6.9
09/25/2006	Fish between 11-19'; much Sago Pondweed 6-12" below surface; Village piers removed at park; maple leaves turning red; Satellite day; pH = 7.1
10/06/2006	Fish between 9-19'; Sago Pondweed not as apparent + not at surface; Canada Geese population is high (maybe migration); Phosphorus + Chlorophyll samples sent in; pH = 6.9; D.O. is very good down to 20'; no temmperature stratification since Sept 14th
10/20/2006	Fish between 9-15'; Mudhens migrating thru; new sprouts of Lily Pads + Cattails; Rushes = brown; Pondweeds = deep; good traveling + fishing

Date	Lab Comments
05/29/2006	METHOD BLANK EXCEEDED LOD CRITERIA

Date	Data Collectors	Project
05/29/2006	Wayne Stroessner	CLMN AT RANDOM LAKE; DEEP HOLE
06/13/2006	Wayne Stroessner	CLMN AT RANDOM LAKE; DEEP HOLE
06/21/2006	Wayne Stroessner	CLMN AT RANDOM LAKE; DEEP HOLE
06/30/2006	Wayne Stroessner	CLMN AT RANDOM LAKE; DEEP HOLE
07/07/2006	Wayne Stroessner	CLMN AT RANDOM LAKE; DEEP HOLE
07/15/2006	Wayne Stroessner	CLMN AT RANDOM LAKE; DEEP HOLE
07/23/2006	Wayne Stroessner	CLMN AT RANDOM LAKE; DEEP HOLE
07/31/2006	Wayne Stroessner	CLMN AT RANDOM LAKE; DEEP HOLE
08/16/2006	Wayne Stroessner	CLMN AT RANDOM LAKE; DEEP HOLE
08/24/2006	Wayne Stroessner	CLMN AT RANDOM LAKE; DEEP HOLE
09/01/2006	Wayne Stroessner	CLMN AT RANDOM LAKE; DEEP HOLE
09/14/2006	Wayne Stroessner	CLMN AT RANDOM LAKE; DEEP HOLE
09/17/2006	Wayne Stroessner	CLMN AT RANDOM LAKE; DEEP HOLE
09/25/2006	Wayne Stroessner	CLMN AT RANDOM LAKE; DEEP HOLE
10/06/2006	Wayne Stroessner	CLMN AT RANDOM LAKE; DEEP HOLE
10/20/2006	Wayne Stroessner	CLMN AT RANDOM LAKE; DEEP HOLE

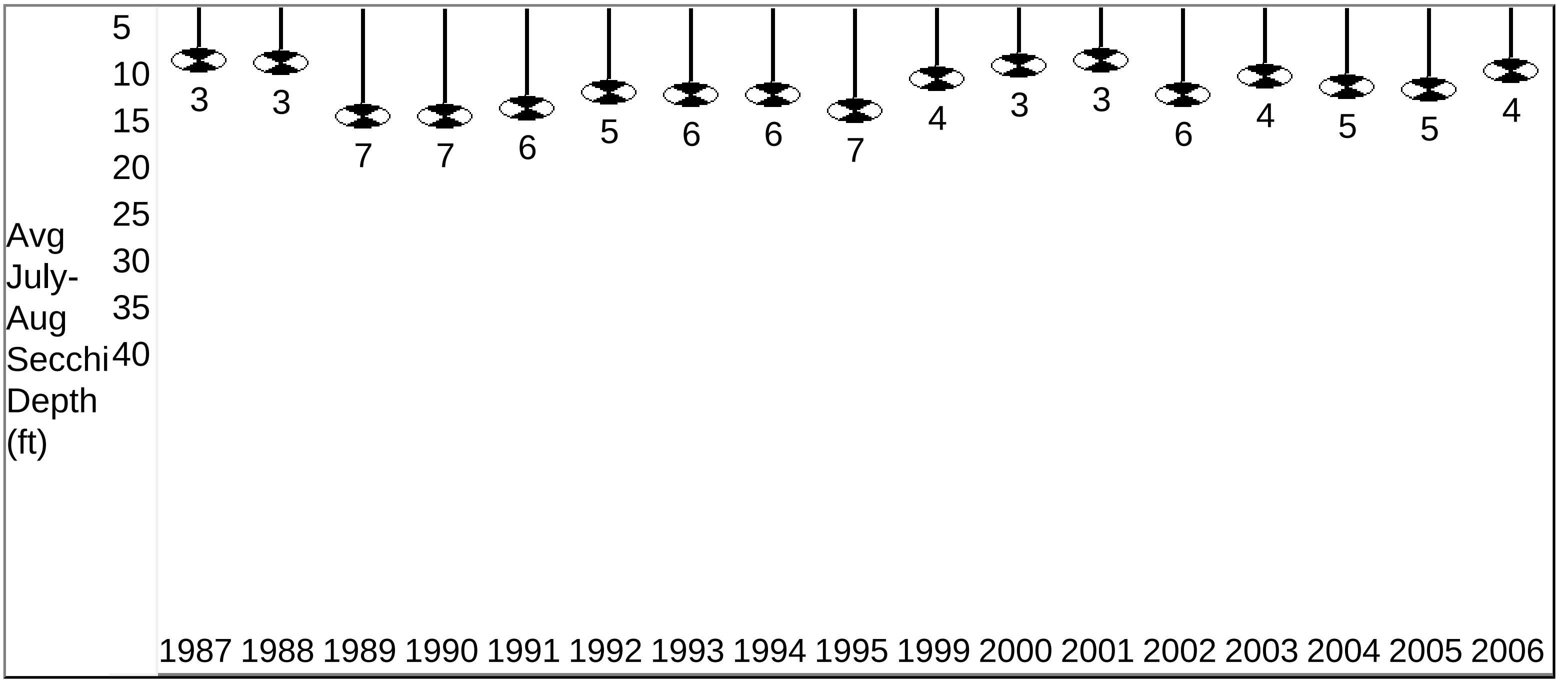
SD = Secchi depth measured in feet converted to meters; Chl = Chlorophyll a in micrograms per liter(ug/l); TP = Total phosphorus in ug/l, surface sample only; TSI(SD), TSI(CHL), TSI(TP) = Trophic state index based on SD, CHL, TP respectively; Depth measured in feet.

Wisconsin Department of Natural Resources **Wisconsin Lakes Partnership**

Report Generated: 08/03/2007

RANDOM LAKE
Sheboygan County
Waterbody Number: 30300

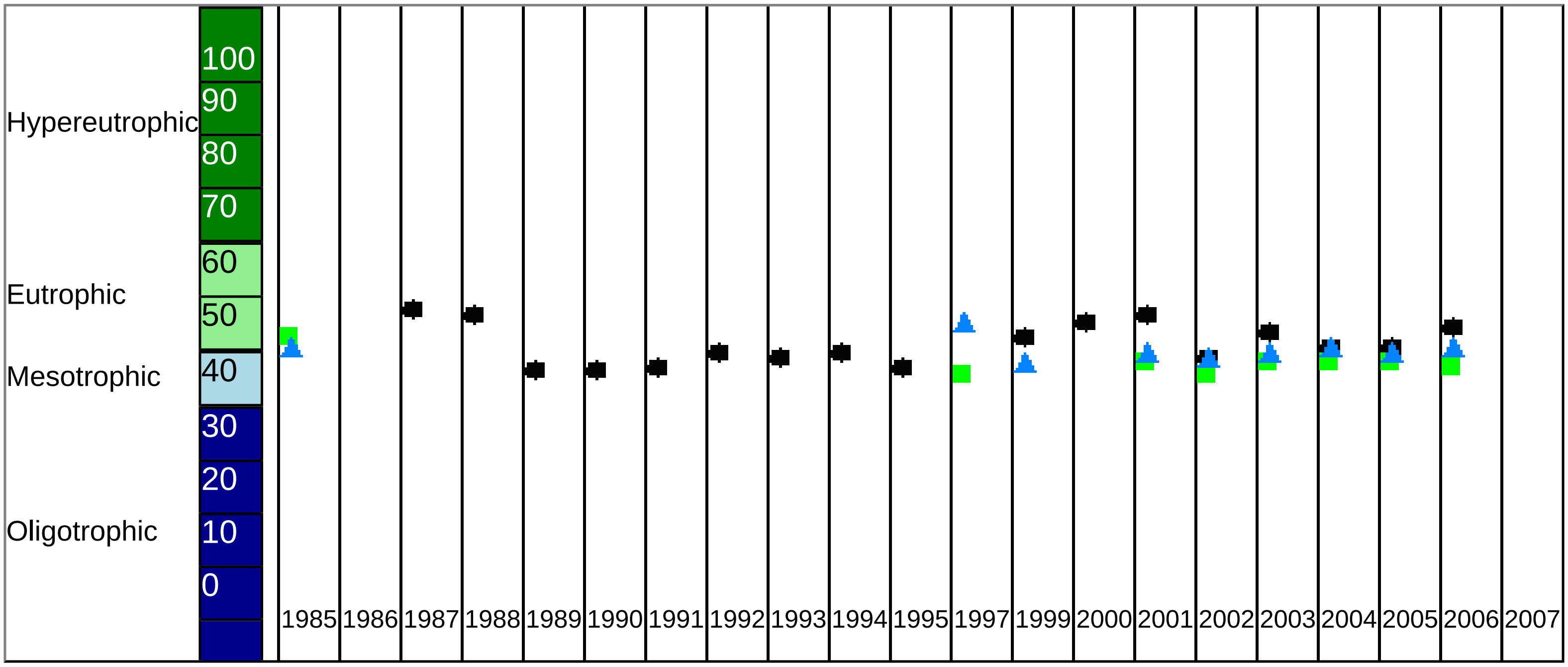
Lake Type: DRAINAGE
DNR Region: SE
GEO Region:SW



Past secchi averages in feet (July and August only).

Report Generated: 08/03/2007

Trophic State Index Graph



Monitoring Station: RANDOM LAKE - DEEP HOLE, Sheboygan County

Past Summer (July-August) Trophic State Index (TSI) averages.

= Secchi	= Chlorophyll	= Total Phosphorus

TSI(Chl) = TSI(TP) = TSI(Sec)	It is likely that algae dominate light attenuation.
TSI(Chl) > TSI(Sec)	Large particulates, such as Aphanizomenon flakes dominate
TSI(TP) = TSI(Sec) > TSI(Chl)	Non-algal particulate or color dominate light attenuation
TSI(Sec) = TSI(Chl) >= TSI(TP)	The algae biomass in your lake is limited by phosphorus
TSI(TP) > TSI(Chl) = TSI(Sec)	Zooplankton grazing, nitrogen, or some factor other than phosphorus is limiting algae biomass

TSI	TSI Description
TSI < 30	Classical oligotrophy: clear water, many algal species, oxygen throughout the year in bottom water, cold water, oxygen-sensitive fish species in deep lakes. Excellent water quality.
TSI 30-40	Deeper lakes still oligotrophic, but bottom water of some shallower lakes will become oxygen-depleted during the summer.
TSI 40-50	Water moderately clear, but increasing chance of low dissolved oxygen in deep water during the summer.
TSI 50-60	Lakes becoming eutrophic: decreased clarity, fewer algal species, oxygen-depleted bottom waters during the summer, plant overgrowth evident, warm-water fisheries (pike, perch, bass, etc.) only.
TSI 60-70	Blue-green algae become dominant and algal scums are possible, extensive plant overgrowth problems possible.
TSI 70-80	Becoming very eutrophic. Heavy algal blooms possible throughout summer, dense plant beds, but extent limited by light penetration (blue-green algae block sunlight).

TSI > 80	Algal scums, summer fishkills, few plants, rough fish dominant. Very poor water quality.

Trophic state index (TSI) is determined using a mathematical formula (Wisconsin has its own version). The TSI is a score from 0 to 110, with lakes that are less fertile having a low TSI. We base the overall TSI on the Chlorophyll TSI when we have Chlorophyll data. If we don't have chemistry data, we use TSI Secchi. We do this rather than averaging, because the TSI is used to predict biomass. This makes chlorophyll the best indicator. Visit Bob Carlson's website, dipin.kent.edu/tsi.htm, for more info.

101 S. Webster Street . PO Box 7921 . Madison, Wisconsin 53707-7921 . 608.266.2621

RANDOM LAKE
Aquatic Plant Survey
Whole Lake Demonstration Project/AIS Grant - 2008 and Final Report

INTRODUCTION

In 2003, the Village of Random Lake received an Aquatic Invasive Species Grant from the Wisconsin Department of Natural Resources (WDNR) to conduct a demonstration whole-lake chemical treatment on Random Lake. The Grant application included the project plan upon which the WDNR treatment permit will be based. That plan, and the subsequent grant, requires extensive monitoring to be conducted: the year prior to treatment, the year of treatment, and three years post treatment. The aquatic plant community and the water quality (Self-Help Volunteer Monitoring Program) are to be monitored.

A local volunteer collected the water quality samples throughout the summer of 2008. The results are included in this report.

In July of 2008, Aron & Associates conducted the aquatic plant survey on Random Lake. This survey is part of an ongoing demonstration project to document changes in the aquatic plant community of Random 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 Random Lake.

Random Lake is located in the Village of Random Lake, Sheboygan County, in Southeast Wisconsin. Hydrographic and morphometric data are presented in Table 2. A map of Random Lake showing depth contours is presented in Map 3.

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 Random Lake in 2008 was determined to be 13 feet, that is, no plants were found growing in water deeper than 11 feet. This is an improvement from the 11 feet maximum rooting depth in 2007.

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 Random Lake.

The initial grid established 146 sample points. Of those, 13 were on land and were eliminated from the list, resulting in 133 sample points. In 2008, because of the high water levels, one sample point was inundated and had aquatic plants present.
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 current WDNR criteria, between 1 and 3. 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.

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.

EARLIER STUDIES

In October 1999, a whole-lake chemical treatment was conducted on Random 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 was conducted in 1999 and continued through 2002. The results of that monitoring are provided in Table 1. The monitoring in 1999 through 2002 was conducted using the line-intercept method for the establishment of sample points.

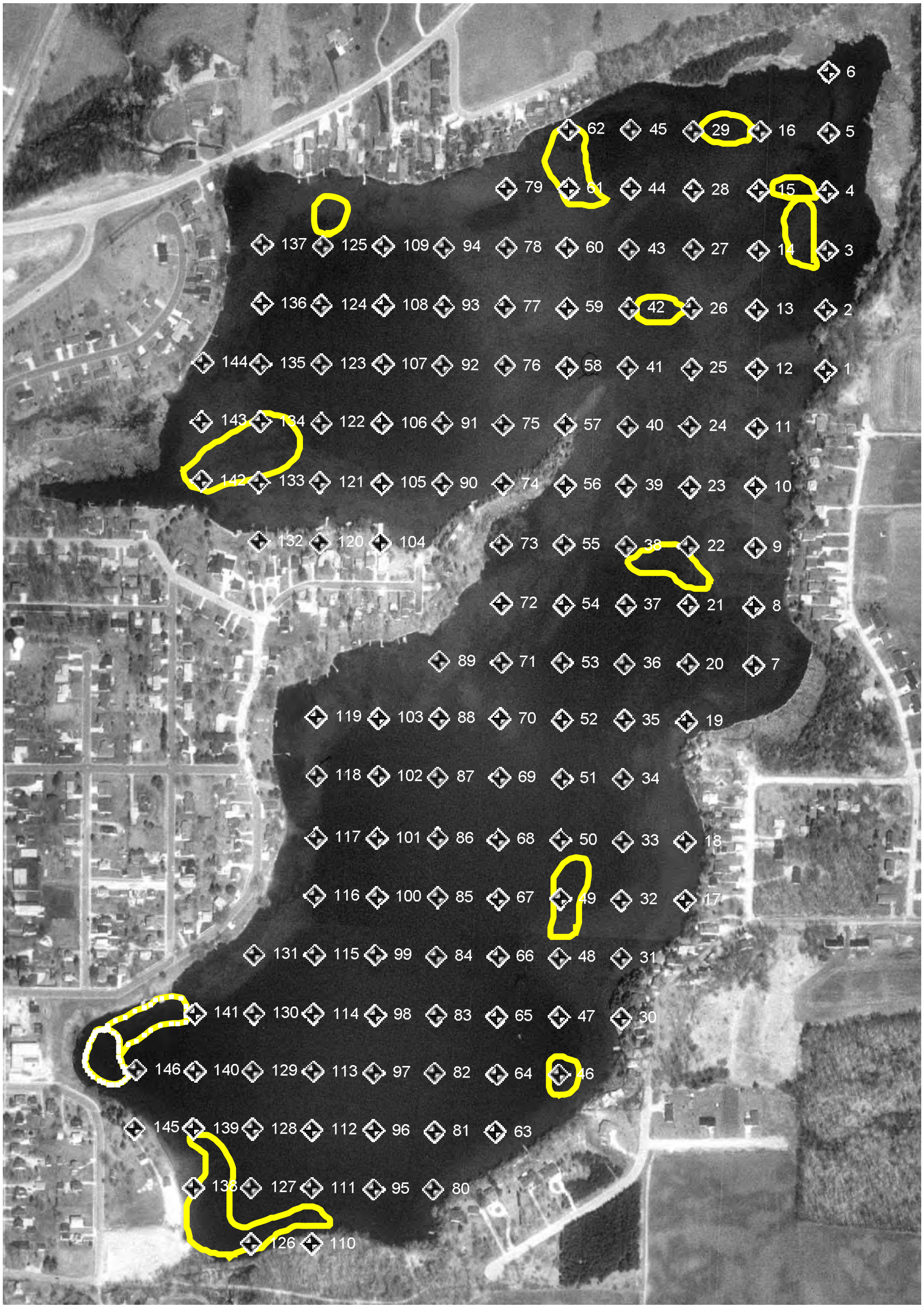
As Eurasian watermilfoil re-infested Random Lake, the Village used harvesting and 2-4,D chemical spot treatments to slow the return of Eurasian watermilfoil. Curly-leaf pondweed (*Potamogeton crispus*) increased significantly between 1999 and 2002. Long-term historical data on the aquatic plant community is not available. A second whole-lake treatment of Random Lake was conducted in 2005 using Sonar (active ingredient, fluridone). This survey is the third post-treatment survey following treatment.
The 2005 treatment was conducted in spring 2005 while the 1999 treatment was conducted in fall. It is not yet known if this will influence the results of the treatment.

RESULTS OF THE 2008 SURVEY

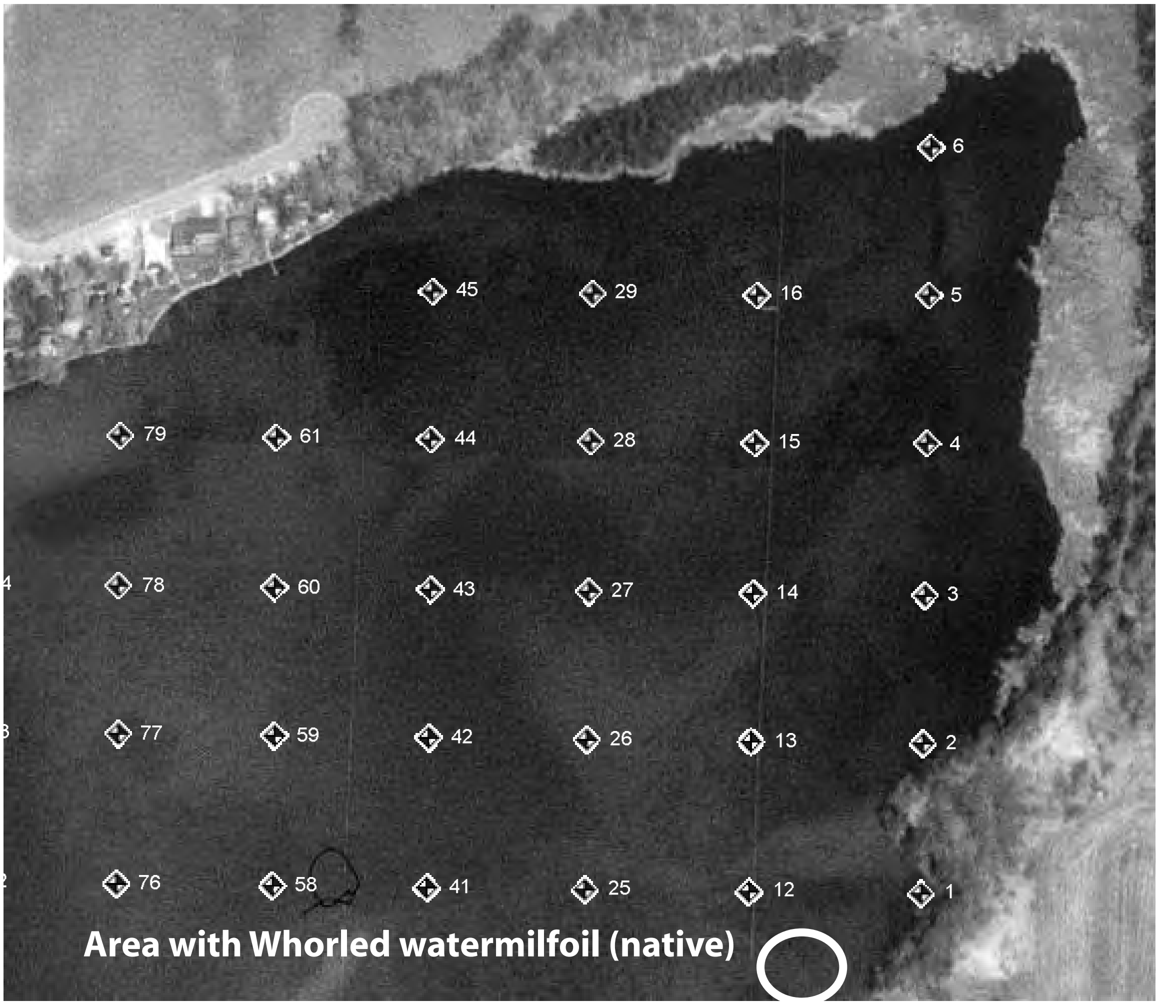
A total of 12 aquatic macrophytes were found during the survey in 2008, similar to that seen in 2006 and 2007 (Table 2). Eleven of the plants were found during the grid survey and one was found during the general survey. Wetland fringe species are not included in the list of species. It should be noted that large stands of bulrush are present in Random Lake. In 2008, the bulrushes were abundant and healthy.

The plants found in the lake in 2008 are listed in Table 2. Chara (*Chara* sp.), sago pondweed (*Stuckenia pectinata*), and spiny naiad (*Najas marina*) dominated the plant community, throughout the depths. Water lilies (*Nuphar* and *Nymphaea* sp.) were common in the shallow areas. Curly-leaf pondweed (*P. crispus*), an exotic species, was not found in 2008. Eurasian watermilfoil (*Myriophyllum spicatum*) was found throughout the lake in 2008 (Map 1). It should be expected that because of its distribution in the lake, Eurasian watermilfoil will continue its spread throughout the lake unless aggressive control measures are undertaken. A native milfoil, whorled watermilfoil (*Myriophyllum verticillatum*) was found in one area, on the Northeast side of the lake near the bulrushes (Map 2).

2008 was a very unusual year, with record rains in June and high water levels through July. High water levels and runoff that contributed to more suspended sediment, may have influenced the plant growth of various species throughout the region, including that on Random Lake.



Map 1 - Location of Re-Infestation of Eurasian Watermilfoil, July 2008



Map 2 - Location of Whorled Watermilfoil, 2008

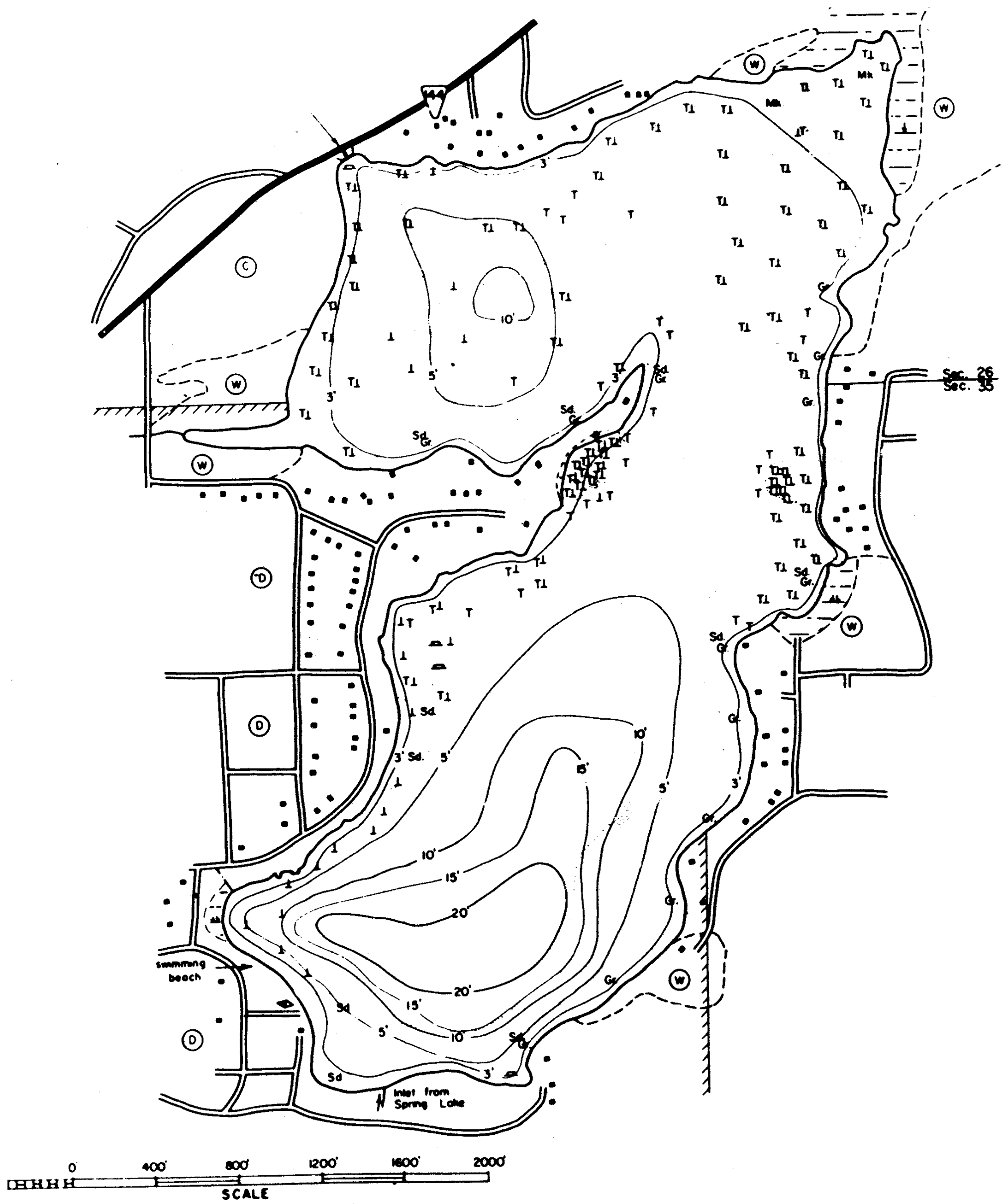
The results of the survey data for the July 2008 survey for all species at each sample depth are included at the end of this report.

The maximum rooting depth in 2008 was 13 feet. Sediments in Random Lake range from sand and gravel to muck. At 1.5 feet the substrate is primarily sand and gravel. At 15 feet the substrate is muck.

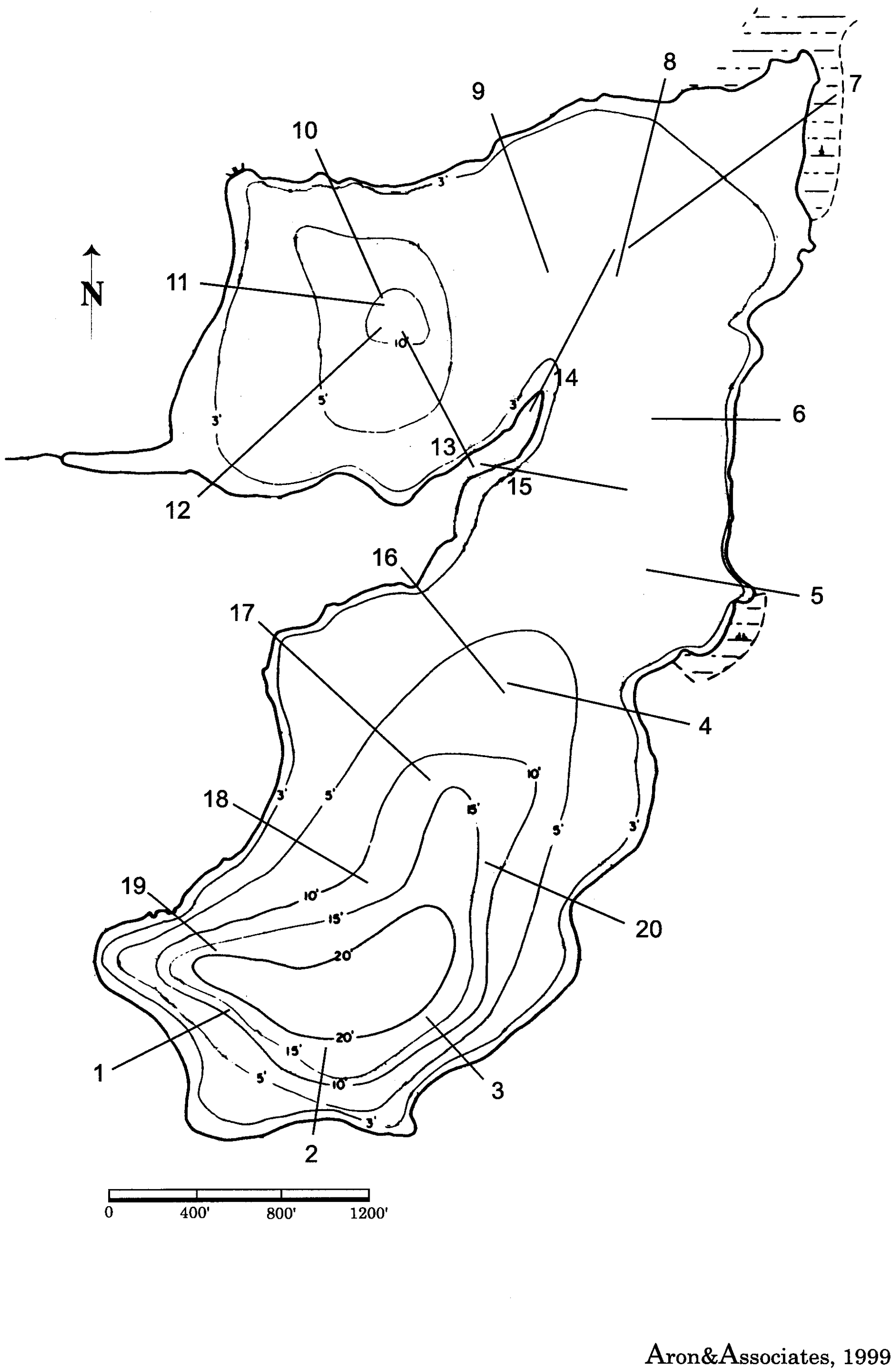
Table 1. Hydrographic and Morphometric Data Random Lake

Size of Lake	209 acres
Lake Volume	1279 acre feet
Length of Shoreline	3.6 miles
Maximum Depth	21 feet
Mean Depth	6 feet
Percent of area less than 3 feet deep	14%
Percent of area greater than 20 feet deep	4%

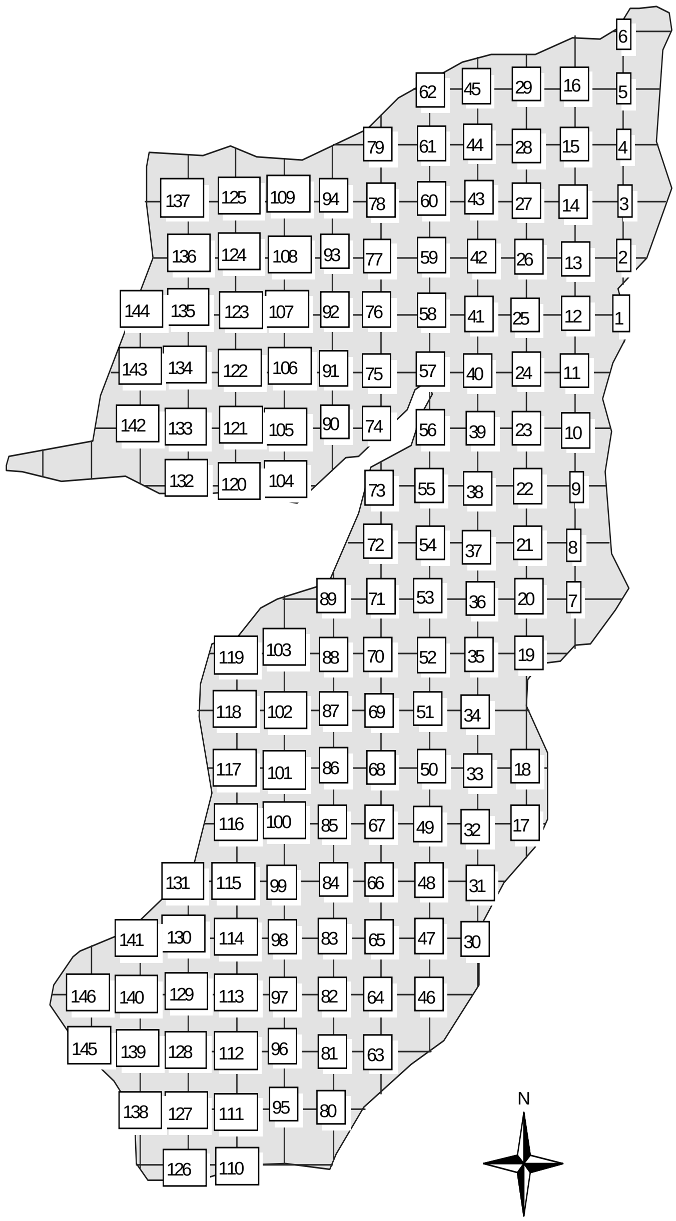
Source: WDNR



Map 3 - Bathymetric Map, Random Lake, Wisconsin.



Map 4 - Line Transect Survey Locations, Random Lake, Wisconsin, 1999.



Map 5 - Point Intercept Survey Sample Points on Random Lake, 2005-2008.

Table 2. Random Lake Aquatic Plant Species - 1999 to 2008

	% Frequency								
Species	**1999[b]**	**2000**	**2001**	**2002**	**2004**	**2005[c]**	**2006**	**2007**	**2008**
Chara sp.	34	57	43	49	50	64	50	56	53
Elodea canadensis				3	1				
Lemna minor						1[a]	X	X	
Myriophyllum spicatum	60	1[a]	9	69	8			X	5
Myriophyllum verticillatum							X	X	X
Najas flexilis	1		X	2	10		2	2	2
Najas marina	10			X	13		6	11	20
Nitella sp.						10			
Nuphar advena	5	5	6	7	4	3	1	X	2
Nymphaea sp.	5	5	0	4	2	10	5	1	1
Potamogeton crispus	1	4	19	25	1		7	6	
P. amplifolius			1	3	6		X	3	1
P. Illinoensis	14	18	17	34	8		X	1	9
P. foliosus				X	1				
P. natans	1	5	5	7	6	5	2	1	1
P. zosterformis	X		10	7	X				
Stuckenia pectinata	33	57	48	56	37	12	40	32	27
Utricularia vulgaris	1		2	3	9		1	4	8
Vallisneria americana				X	X				
Total Species	12	8	11	16	16	7	13	14	12

Notes: [a] Found in only one sample point.
[b] Fall 1999 whole lake treatment.
[c] Spring 2005 whole lake treatment.
X Found only in the general survey.

WATER QUALITY 2008

The water quality on Random Lake was monitored under the Self-Help Volunteer Monitoring Program. The volunteer, Wayne Stroessner, collected the samples following the Self-Help protocol. Complete results are provided in the appendix and are available on the WDNR website, http://dnr.wi.gov.

Random Lake is considered eutrophic, with decreased clarity, warm-water fisheries, oxygen-depleted bottom waters during summer, dense plant growth.

Table 3. Random Lake Water Quality Data Summary for 2008*

Sampling Date	**Secchi (ft)**	**Total Phosphorus (mg/l)**	**DO at surface (mg/l)**	**Temp at surface (^oF)**	**Chlorophyll A (ug/l)**
5/09/08	4.25		6.8	60	
5/28/08	3.5		6.76	63	
6/18/08	3.25	33			5.43
7/21/08		17			.98
8/05/08	4		11.46	79	
8/13/08	3.75	22	12	74	9.55
8/21/08	4.25		11.06	74	
8/29/08	3.75		11.95	76	
9/06/08	4.25		9.29	70	
9/15/08	4.5		9.88	65	
9/22/08	5		11.6	70	
9/30/08	5.5				
10/11/08	6.25				

*Complete 2008 report is provided in the Appendix or are available at www.dnr.state.wi.us.

Table 4. Comparison of 2004 through 2008 Water Quality Data on Random Lake

Sampling Date	Average Secchi (ft)	Average Total Phosphorus (mg/l)	Average Chlorophyll A (ug/l)
2004	5.2	26.8	5.2
2005	4.9	21.6	7.3
2006	4.0	20.4	8.4
2007	3.89	24.5	9.5
2008	3.9	24	5.32

SUMMARY

The Village of Random Lake has conducted significant aquatic plant management activities over the years to keep Random Lake open to recreational use. As Eurasian watermilfoil expanded its range, the management efforts have not always been able to keep pace with the growth of the exotic plant. A demonstration chemical treatment was conducted using Sonar in October 1999. Since 2002, the Village has used a combination of harvesting and chemical treatment (using 2,4-D products) to control Eurasian watermilfoil. A second Sonar treatment was conducted in spring 2005.

An analysis of 2008 plant data from the 1999 through 2007 project shows a number of differences:

— The 2004 through 2008 surveys were done using point-intercept while earlier surveys were done using the line-transect method.

— Significant differences in frequency over the years are present. The reasons for the disparity are unclear. It could be simply the difference in sampling protocols used, or other factors could come into play, such as weather, treatments, etc. Actual reasons are most likely a combination of factors.

— There is significant difference in the lake's response following the 2005 Sonar treatment to that following the 1999 Sonar treatment. The fall 1999 treatment, conducted at a higher rate, produced significant impact on native species immediately after treatment, but showed little impact long term as plants species increased 4 years post-traetment.

— The Eurasian watermilfoil treatment in 1999 was not 100% successful, but the spring 2005 treatment appeared to be.

— The spring 2005 treatment was done at a much lower rate yet the impact on natives, the season of treatment was significant.

— The number of plant species has returned to the pre-1999 treatment levels, but not the pre-2005 treatment level. Whether that will result in long term impacts is unknown. The timing of the treatment may have been a factor in this difference. The native plants may already have started their seasonal growth when the May 5, 2005 treatment was conducted.

— Fewer native plant species were found in 2008 than were found in 2005 survey following the whole-lake treatment.

— Water clarity continues to be poor with a low of 3.25 feet and a high of 6.25 feet in 2008.

— Random Lake stratifies during the summer months, with the bottom waters, usually those below 14-15 feet, being anoxic (devoid of oxygen).

— Eurasian watermilfoil has re-entered the lake even though spot treatments were conducted in 2007 and 2008. Fragments were found throughout the lake during the survey, and were reported frequently by the volunteer monitor.

— After the fall 1999 treatment, there was a significant amount of Eurasian watermilfoil back in the lake in 2002, while after the spring 2005 treatment Eurasian watermilfoil was just beginning to spread throughout the lake in 2008.

— The Village should aggressively locate and chemically treat Eurasian watermilfoil early in the season, as early as May 1 to May 15. This would allow control while the plant biomass is low and before susceptible native species such as bladderwort begin to grow. The treatment should be done as soon as the plants are showing signs of active growth. The treatment should cover the areas identified in 2008 and any other areas where Eurasian watermilfoil was found by the end of 2008. The North end of the lake and the public boat launch and beach should be thoroughly checked and treated.

DEFINITION OF A PROJECT'S SUCCESS

How one perceives whether or not a project is successful depends upon one's perspective. A skier or swimmer may not like aquatic plants to the surface and will deem an eradication successful. An angler may consider any plant beneficial and will deem a Eurasian watermilfoil eradication of Eurasian watermilfoil a failure.

On Potters Lake, an early whole-lake treatment for Eurasian watemilfoil was considered by WDNR to be unsuccessful because the number of plant species failed to increase post-treatment. What was unknown going in to the project was whether there was ever much diversity in the lake that might rebound. The community considered the treatment a huge success because recreational opportunities improved, plant debris declined and the community saved ten's of thousands of dollars in plant management funds which they used to fund wetland acquisitions.

Going into this multi-year project on Random Lake, much discussion took place on how to better define success. WDNR set forth the following criteria to use to evaluate the success. These criteria are all based on the lake resource, and not on the communities quality-of-life considerations.

WDNR Criteria for Success

1 *There shall be a reduction in the Eurasian watermilfoil frequency and/or density from pretreatment survey conditions until August 2007.*

2 *There shall be no net reductions (+/-20%) in the frequency and or density of the native plant community, with the exception of Elodea sp. and Najas sp.*

3 *There shall be no documented overall negative impacts to the fish population or other aquatic organisms either directly or indirectly related to the use of herbicides in the lake.*

4 *There shall be no reductions (+/-20%) in water quality trends throughout the study.*

Evaluation of the criteria

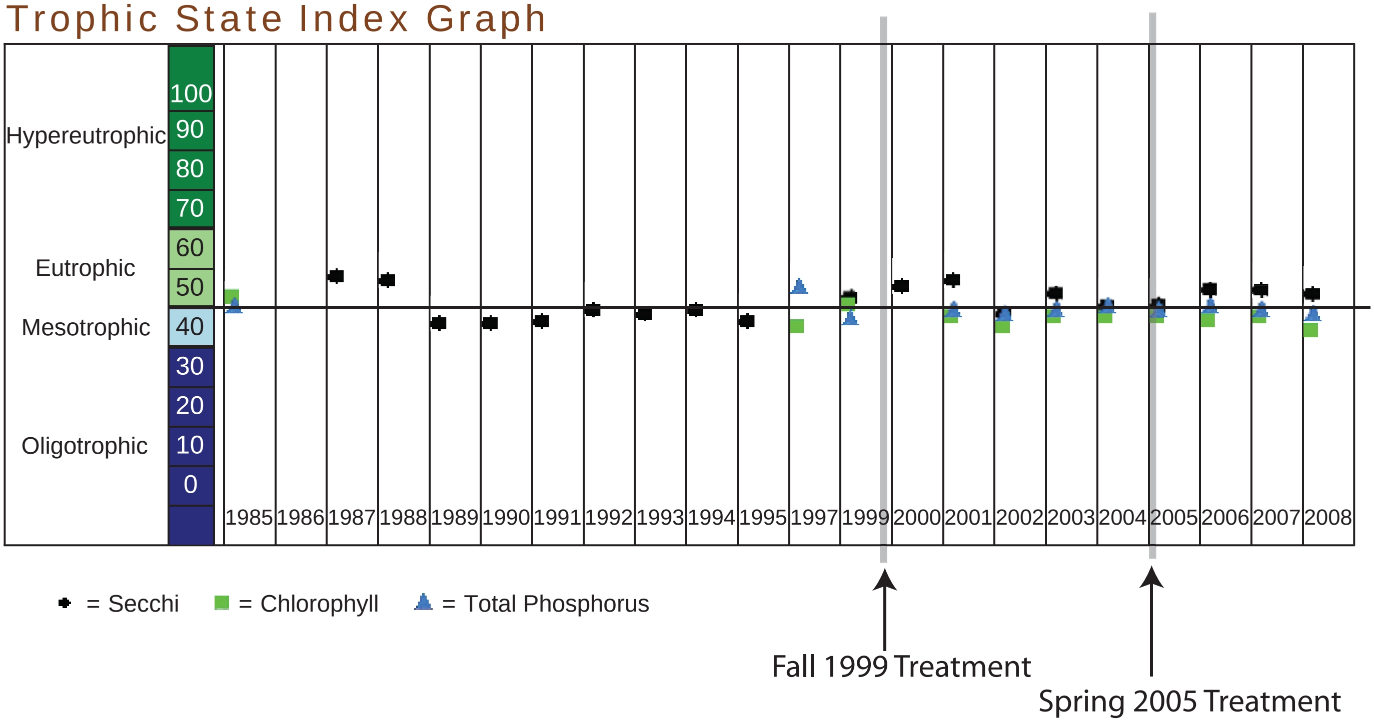
1. Eurasian watermilfoil has dropped post treatment regardless of which year starting point is used (Table 2).
2. Using number of native species (16), minus Elodea and Najas (2), in 2004 as a starting point (14), means up to a shift of +/-2.8 species is allowable. In 2006, and 2007 there were 13 and 14 species respectively. In 2008, there were 12 species, for a drop of 15%.
3. There were no documented overall negative impacts to the fish or other aquatic organisms reported.
4. Two of the water quality parameters, total phosphorus and Chlorophyll A improved or remained the same post treatment. Water clarity, measured by a Secchi disk, dropped from 5.2 to 3.9 feet, approximately 25% reduction. Graph 1 shows the Trophic State Index for Random Lake from 1985 through 2008

Determination

Based on all four criteria, the project met or exceeded the expectations in all but a single portion of one criteria, the secchi disk measurements. This project has been successful in reducing the significant problems caused by Eurasian watermilfoil in Random Lake.

The DNR permit (which includes the evaluation criteria), the aquatic plant data, and the water quality report for 2008, are included in the Appendix.

Trophic State Index Graph



Graph 1 - Trophic State Index, Random Lake, 1985 through 2008.

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.

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.

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

WISCONSIN
DEPT. OF NATURAL RESOURCES

Jim Doyle, Governor
Scott Hassett, Secretary
Gloria L. McCutcheon, Regional Director

Plymouth Service Center
1155 Pilgrim Road
Plymouth, WI 53073
Telephone 920-892-8756
FAX 920-892-6638

April 28, 2005

Bob McDermott – Village President
Village of Random Lake
96 Russell Drive
Random Lake, WI 53075

Subject: 2005 Random Lake Whole-Lake Treatment Amendment

Dear Mr. McDermott:

Per your request, here is the permit amendment for chemical aquatic plant control on 209 acres in Random Lake in the Town of Sherman, Sheboygan County. The permit has been approved with a few conditions. This permit is valid from April 28, 2005 to December 31, 2008.

The permit conditions that you requested an amendment for were conditions 2, 5, 6, 7, 8, and 9. The Department has amended permit conditions 6, 7, and 8.

Condition 2 references our authority through Wis. Admin. Code NR 107 and remains the same. Condition 5 and 9 also remain the same because these are included in the overall goals of the project. Condition 6 has been changed to remove any responsibility by the Village for restocking of aquatic native plants negatively impacted by the treatment and states that there shall be no net reductions in the frequency and/or density of the native plant community (+/- 20%), with the exception of *Najas* sp. and *Elodea* sp. because of the documented impacts to these two species at the proposed treatment dosage. The original condition 7 has been omitted and the original permit condition 8 has been changed to state there shall be no documented overall negative impacts to fish and other aquatic organisms.

Due to the deletion of permit condition 7 from the original permit, original permit conditions 8 through 14 have been changed to permit conditions 7 through 13.

During the optional written comment period to request a public information meeting, the Department did not receive any letters or phone calls concerning the proposed treatment.

Attached is a copy of your permit amendment, which lists the conditions that must be followed. In addition, I have included a copy of our findings of fact, conclusions of law and your rights to appeal our action. A copy of the permit amendment must be kept and be present on site during the application. Please read your permit conditions carefully so that you are fully aware of what is expected of you.

Your next step will be to notify me of the date on which you plan to perform the application; NR 107.07(1) states that the permit holder shall notify the Department four working days in advance of the anticipated treatment.

It is not necessary to mail this amended version of the permit to Village residents because overall changes were relatively minor. If you have any questions about your permit, please call me at (920) 892-8756.

Sincerely,

John Masterson

John Masterson
Water Quality Biologist

STATE OF WISCONSIN
DEPARTMENT OF NATURAL RESOURCES

The Village of Random Lake is hereby granted under Section 281.17(2) Wisconsin Statutes and Administrative Code NR107, a permit to conduct an herbicide application in Random Lake, Town of Sherman, Sheboygan County, Section 26 and 35, Township 13 North, Range 21 East, subject to the following conditions:

PERMIT CONDITIONS

1. The Village must follow all aspects of the department approved plan for the project and the grant agreement for Lake Protection Grant #ALPT-003-04.

2. DNR oversight and approval will be required for any herbicide treatments through the year 2008.

3. Conditions of this permit are stated in Wisconsin Administrative Code NR 107.08. These conditions must be followed.

4. You must notify Water Quality Biologist, John Masterson, 1155 Pilgrim Road, Plymouth, WI 57073, Phone (920) 892-8756, 4 working days prior to anticipated treatment date to schedule supervision.

5. There shall be a reduction in the Eurasian Water Milfoil (EWM) frequency and/or density from pretreatment survey conditions until August 2007.

6. There shall be no net reductions (+/- 20%) in the frequency and/or density of the native plant community, with the exception of *Elodea* sp. and *Najas* sp. These two species may be susceptible to Fluridone at a treatment dosage of six (6) parts per billion.

7. There shall be no documented overall negative impacts to the fish population or other aquatic organisms either directly or indirectly related to the use of herbicides in the lake.

8. There shall be no reductions (+/- 20 %) in water quality trends throughout the study.

9. Posting signs shall be provided at the public boat launch, which will include a map of the treatment area. Posting requirements listed in NR 107 must also be followed.

10. A copy of this decision and the enclosed permit must be provided to riparian property owners in the treatment area before the treatment may occur. The Department also requires the District to have several copies of the decision and enclosed permit available for public inspection.

11. This permit includes the authorization to treat with the selective herbicides Fluridone (Trade name: Sonar A.S.) and 2,4-D (Trade names: Weedar 64 and/or Navigate). The initial 6 ppb whole-lake treatment with Fluridone to reduce EWM may follow with a second whole-lake treatment to bump the concentration back up to 6 ppb to accomplish the required concentration time for Fluridone effectiveness. The second "bump" treatment concentration and timing will be based on the FasTEST results, which will be taken 3, 15, 30, 45, 60, and 75 days post-treatment. 2,4-D spot treatments are authorized during 2006, 2007, and 2008 to maintain a reduction in EWM.

12. All herbicide treatments shall be performed in a manner consistent with the product label; Wis. Admin. Code NR 107; the department approved project plan; and this permit.

13. All aspects of the year-end reports and the overall project final report are the sole responsibility of the Village of Random Lake.

FINDINGS OF FACT (Facts which were considered in making this decision.)

1. The Village of Random Lake has filed an application for a permit to conduct an herbicide application in the Town of Sherman, Sheboygan County, in Sections 26 and 35, Township 13 North, Range 21 East. This permit application specifically addresses the herbicide applications to 209 acres on Random Lake.

2. The proposed chemical to be used, Fluridone (Sonar A.S.) and 2,4-D (Weedar 64 and Navigate) are registered for aquatic use by the United States Environmental Protection Agency and both labeled and registered by a firm licensed as a pesticide manufacturer and labeler with the Wisconsin Department of Agriculture, Trade and Consumer Protection.

3. The chemicals Fluridone and 2,4-D does have current Department aquatic chemical fact sheets.

4. The Department has determined the proposed treatment will provide selective relief of Eurasian Water Milfoil and will not place unreasonable restrictions on existing water uses.

5. The Department relies on the Environmental Protection Agency and the Department of Agriculture Trade and Consumer Protection to register these chemical products for aquatic use. The Environmental Protection Agency (EPA) has determined that "no unreasonable adverse effects" will occur as a result of using Fluridone and 2,4-D according to label instructions. "Unreasonable" in the EPA definition means the risk of using a pesticide exceeds the benefits. The selectivity of Fluridone and 2,4-D to control Eurasian Water Milfoil and not harm native aquatic plants is considered to be important to the Department. Diverse native aquatic plant habitats are preferred to mono-typical stands of Eurasian Water Milfoil. Native stands of aquatic plants tend not to grow to nuisance levels and provide better more diverse habitats for a number of aquatic species including fish, invertebrates, waterfowl, and amphibians.

6. The Department has determined that there will be no significant adverse effects resulting from the treatment of Random Lake.

7. The Department chooses to waive the restriction on treating 150 feet from shore. This code requirement is being waived due to the objective of this project, which is to selectively control Eurasian Water Milfoil on a whole lake scale. An aquatic plant species shift from EWM to one dominated by native aquatic plants is considered beneficial for the Random Lakes ecosystem.

8. The Department has determined that there will be no significant injuries to fish, fish eggs, fish larvae, essential fish food organisms or wildlife, either directly or through habitat destruction in the proposed treatment area. The Eurasian Water Milfoil now present in Random Lake is considered poor habitat for most fish when in a canopy growth condition. Canopy growth can create conditions, which are unfavorable for fish predation and respiration.

9. The Department has determined that there are no known populations of endangered or threatened species that will be affected by the Fluridone and 2,4-D applications in Random Lake.

10. The Department has determined that the Fluridone application will occur in a designated sensitive area. The sensitive area designations on Random Lake include a provision in the management plan for chemical treatment when targeting Eurasian Water Milfoil.

CONCLUSIONS OF LAW (These are the legal reasons why the Department can make these decisions)

1. The Department has authority under the above indicated Statutes and Administrative Codes, to issue a permit for the use of aquatic herbicides in this area.

NOTICE OF APPEAL RIGHTS

If you believe that you have a right to challenge this decision, you should know that Wisconsin Statutes and Wisconsin Administrative Code establish time periods within which requests to review Department decisions must be filed.

For judicial review of a decision pursuant to ss. 227.52 and 227.53, Wis Stats., you have 30 days after the decision is mailed or otherwise served by the Department, to serve a petition within the appropriate circuit court and serve the petition on the Department. Such a petition for judicial review shall name the Department of Natural Resources as the respondent.

To request a contested case hearing pursuant to Section 227.42, Wisconsin Statutes, you have 30 days after the decision is mailed or otherwise served by the Department, to serve a petition for hearing on the Secretary of the Department of Natural Resources. The filing of a request for a contested case hearing is not a prerequisite for judicial review and does not extend the 30-day period for filing a petition for judicial review. This notice is provided pursuant to Section 227.48(2), Wisconsin Statutes.

Dated at Plymouth, Wisconsin on April 28, 2005

STATE OF WISCONSIN DEPARTMENT OF NATURAL RESOURCES
For the Secretary

By John Masterson

John Masterson
Water Quality Biologist

cc: Vic Pappas – Sheboygan Basin Water Team Leader
John Nelson – Senior Fish Biologist
Warden Mike Clutter
Random Lake Association
Marine Biochemists
Aron & Associates

State of Wisconsin
Department of Natural Resources
Aquatic Plant Manager

PERMIT APPLICATION FOR CHEMICAL AQUATIC PLANT CONTROL

Form 3200-4 Rev. 3-99

DNR USE ONLY
ID Number
County Code
Waterbody Number

NOTE: Use of this form is required by the Department for any application filed pursuant to s. 281.17(2), Wis. Stats., and Chapter NR 107, Wis. Adm. Code. The Department will not consider your application unless you complete and submit this application form. Personally identifiable information requested on this form is not likely to be used for purposes other than that for which it is originally being collected.

SECTION I, APPLICANT DATA

Name of Permit Applicant. (Also indicate names and addresses of all individuals, associations, communities or town sanitary districts sponsoring treatment. Attach additional sheets if necessary.)

HOME ADDRESS

Name: Village of Random Lake
PO Box 344 — Fire Number:
City, State, Zip Code: Random Lake WI 53075
Telephone Number (include area code) Home: Business: 920 994-4852

LAKE ADDRESS

Name: Same
Street or Route: — Fire Number:
City, State, Zip Code:
Telephone Number (include area code) Home: Business:

SECTION II, LOCATION OF AQUATIC PLANT CONTROL

Waterbody To Be Treated (waterbody where treatment area is located): Random Lake

Lake Surface Area: 209 acres

Estimated Surface Area That Is 10 Feet or Less in Depth: ~150 acres

County: SHEBOYGAN

Town 13 Range 21 E Section S 26

Names of Adjacent Riparian Property Owners (use additional sheet if necessary)

1. SEE ATTACHED
2.
3.

Name of Applicator or Firm: Marine Biochem

Street or Route: 6316 W. Eastwood Ct

City, State, Zip Code: MeQuon WI 53092

Telephone Number (include area code) Home: Business: 262 238 0406

Name of Lake Property Owners' Association Representative or Lake District Representative (if none, please indicate): Bob McDermott

Applicator Certification Number for Category 5, Aquatic Pesticide Application: 001517

Business Location License Number (if applicable): 93-001282-001282

Restricted Use Pesticide License Number (if applicable):

DNR USE ONLY	
Date Verified w/DATCP	
Certification Expiration	
Date Verified w/DATCP	
Expiration Date	
Date Verified w/DATCP	
Expiration Date	

Area(s) Proposed for Control (Note details in permit cover letter for final permitted sizes of treatment areas.)

Whole Lake

A. Shoreline Length ______ ft. X Distance From Shore ______ ft. + 43,560 ft. = ______ Estimated Acreage. Average Depth ____ ft.

B. Shoreline Length ______ ft. X Distance From Shore ______ ft. + 43,560 ft. = ______ Estimated Acreage. Average Depth ____ ft.

C. Shoreline Length ______ ft. X Distance From Shore ______ ft. + 43,560 ft. = ______ Estimated Acreage. Average Depth ____ ft.

D. Shoreline Length ______ ft. X Distance From Shore ______ ft. + 43,560 ft. = ______ Estimated Acreage. Average Depth ____ ft.

E. Shoreline Length ______ ft. X Distance From Shore ______ ft. + 43,560 ft. = ______ Estimated Acreage. Average Depth ____ ft.

Total Estimated Acreage 209

If the estimated acreage is greater than 10 acres, or is greater than 10 percent of the estimated area 10 feet or less in depth in Section II, please complete and attach Form 3200-4A, Large-Scale Treatment Worksheet. Private pond treatments are exempted from this requirement.

Is this area within or adjacent to a sensitive area designated by the Department of Natural Resources?

☒ Yes ☐ No

SECTION IV, REASONS FOR AQUATIC PLANT CONTROL

Purpose of Aquatic Plant Control

- [x] 1. Reduce nuisance algae accumulation Filamentous
- [ ] 2. Maintain navigational channel for common use
- [ ] 3. Maintain private access for boating
- [ ] 4. Maintain private access for fishing
- [ ] 5. Improve swimming
- [ ] 6. Control of purple loosestrife
- [x] 7. Other: Eliminate EWM Reduce Curly-Leaf

Nuisance Caused By

- [x] 1. Algae
- [ ] 2. Emergent water plants (majority of leaves and stems growing above water surface, e.g. cattails, bulrushes)
- [ ] 3. Floating water plants (majority of leaves floating on water surface, e.g., waterlilies, duckweed)
- [x] 4. Submerged water plants (leaves and stems below water surface, flowering parts may be exposed, e.g., milfoil, coontail)
- [ ] 5. Other: ______

Name of Plants, if known

Filamentous Algae
Eurasian Watermilfoil

NOTE: Different plants require different chemicals for effective treatment. Do not purchase chemical before identifying plants.

SECTION V, CHEMICAL CONTROL – See Project Plan attached

Alternatives to Chemical Control	Feasible?	If No, Why Not?
Mechanical harvesting	☐ Yes ☐ No	
Hand pulling	☐ Yes ☒ No	too widespread
Hand raking	☐ Yes ☒ No	" " "
Hand cutting	☐ Yes ☒ No	not appropriate Control
Sediment screens/covers	☐ Yes ☒ No	too widespread
Dredging	☐ Yes ☒ No	not appropriate
Lake drawdown	☐ Yes ☒ No	" "
Nutrient controls in watershed	☐ Yes ☒ No	not effective
Other:	☐ Yes ☐ No	

NOTE: If proposed treatment involves multiple properties, please consider feasibility of EACH alternative for EACH property owner. If you checked yes to any of the alternatives listed above, please explain your decision to use chemical controls:

Trade Name of Proposed Chemical(s)	Method of Application
Sonar AS (2) Weedar 64 (4) Cutrine Plus (3) Navigate (5) Clearigate	(1) sub surface injection (2)(3) sprayer (4)(5) Sprayer

Which Chemicals or Other Control Options Have Been Tried Before On The Proposed Site, and What Were the Results?

Sonar – Effective – see treatment plan & 2004 Report

NOTE: Chemical fact sheets for aquatic pesticides used in Wisconsin are available from the Department of Natural Resources upon request.

SECTION III. FEES

1. s. NR 107.11(1), Wis. Adm. Code, lists the conditions under which the permit fee is limited to the $20 minimum charge.
2. s. NR 107.11(4), Wis. Adm. Code, lists the uses that are exempt from permit requirements.
3. s. NR 107.04(2), Wis. Adm. Code, provides for a refund of acreage fees if the permit is denied or if no treatment occurs.
4. Fee calculations:

Basic Permit Fee (non-refundable) .... $ 20.00

If proposed treatment is over 0.25 acre, calculate acreage fee:
(round up to nearest whole acre, to maximum of 50 acres.)
209 acres X $25 per acre = $ 1250

If proposed treatment is ≤ 0.25 acre, acreage fee is $0.
Enter Acreage Fee (from above) 1250

Total Fee Enclosed .... $ 1270

Please include a sketch and/or a printed map of lake indicating area and dimensions of each individual area where plant control is desired. Also show location of property owners riparian to and adjacent to the treatment area. You may use the space below to sketch a map. Attach a separate list of owners and corresponding treatment dimensions coded to the lake map, if necessary.

N

See attached

SECTION VI, APPLICANT'S RESPONSIBILITIES

1. The applicant has prepared a detailed map which shows the length, width and average depth of each area proposed for the control of rooted vegetation and the surface area in acres or square feet for each proposed algae treatment.

2. The applicant understands that the Department of Natural Resources may require supervision of any aquatic plant management project involving chemicals. Under s. NR 107.07, Wis. Adm. Code, supervision may include inspection of the proposed treatment area, chemicals and application equipment before, during or after treatment. The applicant is required to notify the regional office 4 working days in advance of each anticipated treatment with the date, time, location and size of treatment unless the Department waives this requirement. Do you request the Department to waive the advance notification requirement? ☐ Yes ☒ No

3. The applicant agrees to comply with all terms or conditions of this permit, if issued, as well as all provisions of Chapter NR 107, Wis. Adm. Code. The required application fee is attached.

4. The applicant has provided a copy of the current application to any affected property owners' association, inland lake district and, in the case of chemical applications for rooted aquatic plants, to all owners of property riparian or adjacent to the treatment area. The applicant has also provided a copy of the current chemical fact sheet for the chemicals proposed for use to any affected property owner's association or inland lake district.

I hereby certify that the above information is true and correct and that copies of this application have been provided to the appropriate parties named in Section II and that the conditions of the permit and pesticide use will be adhered to.

X Robert J McDermott
Applicant's Signature

X 2-11-05
Date Signed

All portions of this permit, map and accompanying cover letter must be in possession of the chemical applicator at time of treatment. During treatment all provisions of Chapter NR 107, specifically ss. NR 107.07 and NR 107.08, Wis. Adm. Code, must be complied with, as well as the specific conditions contained in the permit cover letter.

SECTION VII, PERMIT TO CARRY OUT CHEMICAL TREATMENT (LEAVE BLANK-DNR USE ONLY)

The foregoing application is approved. Permission is hereby granted to the applicant to chemically treat the waters described in the application during the season of 2005.

Application fee received? ☒ Yes ☐ No

Advance notification of treatment required? ☒ Yes ☐ No

State of Wisconsin
Department of Natural Resources
For the Secretary

By John Masterson
Regional Director or Designee

4/4/05
Date Signed

4/4/05
Date Mailed

Please NOTE:

If you believe that you have a right to challenge this decision, you should know that Wisconsin statutes and administrative rules establish time periods within which requests to review Department decisions must be filed.

For judicial review of a decision pursuant to ss. 227.52 and 227.53, Wis. Stats., you have 30 days after the decision is mailed or otherwise served by the Department, to file your petition with the appropriate circuit court and serve the petition on the Department. Such a petition for judicial review shall name the Department of Natural Resources as the respondent.

To request a contested case hearing pursuant to s. 227.42, Wis. Stats., you have 30 days after the decision is mailed, or otherwise served by the Department, to serve a petition for hearing on the Secretary of the Department of Natural Resources. The filing of a request for a contested case hearing is not a prerequisite for judicial review and does not extend the 30-day period for filing a petition for judicial review.

This notice is provided pursuant to s. 227.48(2), Wis. Stats.

County of Sheboygan
STATE OF WISCONSIN } ss.

Gary J. Feider, being duly sworn on oath deposes and says that he is the general manager of The Sounder, a weekly newspaper published in the Village of Random Lake, Sheboygan County, Wisconsin, and that a notice, of which the annexed is a printed copy, taken from said paper, has been published in said newspaper on the following dates:

March 10, 2005

Gary Feider

Subscribed and sworn to before me this 10th day of March, 2005

Rita Horstmeier

Notary Public, Sheboygan County, Wis.
My commission expires February 22, 2009.

NOTICE OF APPLICATION FOR AQUATIC PLANT MANAGEMENT PERMIT

The Village of Random Lake intends to apply for a permit from the WDNR to treat up to 209 acres (entire lake) on Random Lake with aquatic pesticides. The treatment(s) will take place between April 1, 2005 and October 15, 2005.

The Village will conduct a public informational meeting on the proposed treatment if five or more individuals, organizations, units of government request one. The meeting will give citizens a chance to learn more about the proposed treatment.

Any request for a public meeting on this proposed treatment must be made within five days of this published notice. The request must specify the topics to be discussed, including problems and alternatives, and must be sent in writing to the Village of Random Lake, P.O. Box 344, Random Lake, WI 53075, and copied to John Masterson, DNR, P.O. Box 408, Plymouth, WI 53073.

This notice is required by NR 107, Wisc. Admin. Code.

(Published March 10, 2005)

RANDOM LAKE AQUATIC PLANT SURVEY - 2008

Plants

Transect #	Depth	CHARA	NITELA	MYRSP	STUPE	POTFO	NAJFL	NAJMA	NUPHAR	NYMPH	POTIL	POTAM	POTGR	POTNA	UTRIVU	POTCR	LEMNA	ELOCA	MYRVE
1	1	3			1			v	v			v							
2	ON LAND																		
3	3.5			v															
4	3	1		v	2			1			1				1				
5	1.5			v															
6	ON LAND																		
7	2.75	1			1		v	1				1							
8	3	3			v						1								
9	3	3									1								
10	2.75	3			1				v	v									
11	2.75				2						v				v				
12	4	2			v						1				v				v
13	3.5	3			v						1								
14	4.5	3		v	v					v					1				
15	4	2		v	2			1		v	1				1				
16	4	3			v														
17	ON LAND																		
18	2.5																		
19	2	1									2								
20	5																		
21	5	2						1							1				
22	4.75	3		v															
23	5	3													1				
24	4.75	3																	
25	5	2																	
26	5.5			v				1											
27	5														1				
28	5	1							2										
29	4	3			v				v	v					1				
30	ON LAND																		
31	4	3																	
32	6.5																		
33	6.5	3			1														
34	6	3																	
35	5	1																	
36	6	3																	
37	6	3			v														
38	5.25	3			v														
39	5	3													1				
40	5.25	2			1														
41	5.5	3																	
42	7			v															
43	6				2			1											
44	5	1		2	1														
45	3	2		1				1							v				
46	7			2							1								

Transect #	Depth	CHARA	NITELA	MYRSP	STUPE	POTFO	NAJFL	NAJMA	NUPHAR	NYMPH	POTIL	POTAM	POTGR	POTNA	UTRIVU	POTCR	LEMNA	ELOCA	MYRVE
47	9.5	2			1														
48	6.5	3																	
49	8.25	2		1															
50	10.75																		
51	9.25																		
52	8				1														
53	7	3			1														
54	5	3			v														
55	5	1					1				2								
56	ON LAND																		
57	ON LAND																		
58	6	3																	
59	6	3			1														
60	6	2						1											
61	5			v	1		1												
62	3.5	1			1														
63	8.5																		
64	19.25																		
65	18.25																		
66	16.25																		
67	15.75																		
68	13.5																		
69	8.75																		
70	5	1						1											
71	5.25	3																	
72	4	3			v						v								
73	1.5	3			1				1										
74	ON LAND																		
75	5.25	3																	
76	5.5	1			1														
77	5	1			2														
78	5.5	1																	
79	4																		
80	5.5	1			1			1			1	v							
81	19.25																		
82	20.5																		
83	17.75																		
84	14.75																		
85	13.25																		
86	11																		
87	9	1						1											
88	6.25	1																	
89	4	2			1														
90	5.5				1			1											
91	14.75																		
92	14.25																		
93	7																		
94	4																		
95	12.5										1								
96	20.25																		

Transect #	Depth	CHARA	NITELA	MYRSP	STUPE	POTFO	NAJFL	NAJMA	NUPHAR	NYMPH	POTIL	POTAM	POTGR	POTNA	UTRIVU	POTCR	LEMNA	ELOCA	MYRVE
97	19.5																		
98	13.25																		
99	10.25																		
100	11.25																		
101	11																		
102	8.75	2																	
103	5							1											
104	ON LAND																		
105	5.5							1											
106	13.25																		
107	17.75																		
108	11.5																		
109	6.5				1														
110	ON LAND																		
111	9.25	1																	
112	20																		
113	19.75																		
114	13																		
115	9	1			v														
116	6	3																	
117	5.75	v			1			1	v										
118	5	3			2			1											
119	3.75				1				v						1				
120	ON LAND																		
121	5.25				1			2											
122	7.5			3				1											
123	8				2			2											
124	8				2			2							1				
125	6	3		v															
126	6			1					v										
127	9			v	1						1								
128	19.25																		
129	19.5																		
130	12.25	1																	
131	4.5	1					1												
132	ON LAND																		
133	4	3								1				v					
134	4.5	1						1											
135	5	1			1			1											
136	5	2			1			1		v	v								
137	3	1			v			1	v	v									
138	3.25																		
139	9.5																		
140	19																		
141	6.5	2			1			1		v	v								
142	3.5	3		v	1				v	v				2					
143	3.25	1			1														
144	1.5	3						1				v							
145	ON LAND																		
146	9				1														

Transect #	Depth	CHARA	NITELA	MYRSP	STUPE	POTFO	NAJFL	NAJMA	NUPHAR	NYMPH	POTIL	POTAM	POTGR	POTNA	UTRIVU	POTCR	LEMNA	ELOCA	MYRVE

Total Sample Sites (146 - 12 on land) = 134 Note: because of high water, sample point 1 was accessible with plants.
Sample Sites w/ No Plants 38

	CHARA	NITELLA	MYRSP	STUPE	POTFO	NAJFL	NAJMA	NUPHAR	NYMPH	POTIL	POTAM	POTGR	POTNA	UTRIVU	POTCR	LEMNA	ELOCA	MYRVE
Sites found(Frequency)	70	0	6	36	0	3	26	2	1	12	1	0	1	10	0	0	0	0
% Frequency	52.63	0.00	4.51	27.07	0.00	2.26	19.55	1.50	0.75	9.02	0.75	0.00	0.75	7.52	0.00	0.00	0.00	0.00
Density (Max = 3) at sites found	2.11	#DIV/0!	1.67	1.19	#DIV/0!	1.00	1.12	1.50	1.00	1.17	1.00	#DIV/0!	2.00	1.00	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Relative Density (Max = 3) /hole Lake	1.11	0.00	0.08	0.32	0.00	0.02	0.22	0.02	0.01	0.11	0.01	0.00	0.02	0.08	0.00	0.00	0.00	0.00
Found visually in vicinty			12	12		1	1	7	8	4	2		2	3				1

Lake Water Quality 2008 Annual Report

Random Lake
Sheboygan County
Waterbody ID Number: 30300

Lake Type: DRAINAGE
DNR Region: SE
GEO Region: SW

Site Name	Station ID
Random Lake - Deep Hole	603312

Date	SD (feet)	SD (meters)	Hit Bottom?	CHL	TP	TSI (SD)	TSI (Chl)	TSI (TP)	Lake Level	Staff Gauge	Clarity	Color	Perception
05/09/2008	4.25	1.3	NO			56			HIGH	0.27	MURKY	GREEN	2-Very minor aesthetic problems
05/28/2008	3.5	1.1	NO			59			HIGH	0.17	MURKY	GREEN	2-Very minor aesthetic problems
06/18/2008				5.43	33		48	55					
07/21/2008				.98	17		35	50					
08/05/2008	4	1.2	NO			57			HIGH	.44	MURKY	BROWN	2-Very minor aesthetic problems
08/13/2008	3.75	1.1	NO	9.55	22	58	52	52	NORMAL	.15	MURKY	GREEN	2-Very minor aesthetic problems
08/21/2008	4.25	1.3	NO			56			NORMAL	.1	MURKY	GREEN	2-Very minor aesthetic problems
08/29/2008	3.75	1.1	NO			58			NORMAL	.1	MURKY	GREEN	2-Very minor aesthetic problems
09/06/2008	4.25	1.3	NO			56			HIGH	.16	MURKY	BROWN	2-Very minor aesthetic problems
09/15/2008	4.5	1.4	NO			55			HIGH	0.23	CLEAR	GREEN	2-Very minor aesthetic

SD = Secchi depth measured in feet converted to meters; Chl = Chlorophyll a in micrograms per liter (ug/l); TP = Total phosphorus in ug/l, surface sample only; TSI(SD),TSI(CHL),TSI(TP) = Trophic state index based on SD, CHL, TP respectively; Depth measured in feet; Temp = Temperature in degrees Fahrenheit; D.O. = Dissolved Oxygen in parts per million.

Wisconsin Department of Natural Resources * Wisconsin Lakes Partnership
Report Generated: 04/01/2009

Date	SD (feet)	SD (meters)	Hit Bottom?	CHL	TP	TSI (SD)	TSI (Chl)	TSI (TP)	Lake Level	Staff Gauge	Clarity	Color	Perception
													problems
09/22/2008	5	1.5	NO			54			HIGH	0.17	CLEAR	GREEN	2-Very minor aesthetic problems
09/30/2008	5.5	1.7	NO			53			NORMAL	0.1	CLEAR	BROWN	2-Very minor aesthetic problems
10/11/2008	6.25	1.9	NO			51			HIGH	0.17	CLEAR	BROWN	2-Very minor aesthetic problems

05/09/2008		
Depth	Temp.	D.O.
FEET	DEGREES C	MG/L
0	15.6	6.8
2	15.5	6.84
4	15.3	6.83
6	15	6.81
8	14.7	6.79
10	14.4	6.68
12	13.8	6.49
14	12.9	6.1
16	12.1	5.78
18	11.7	5.49
20	11.4	4.9
22	11.1	2.94
22.3	11	2.77

05/28/2008		
Depth	Temp.	D.O.
FEET	DEGREES C	MG/L
0	17.2	6.76
2	17.1	6.79
4	16.5	6.81
6	15.8	6.8
8	15.6	6.8
10	15.3	6.61
12	15.1	6.5
14	15.1	6.42
16	15	6.25
18	14.9	6.12
20	14.7	6.06
22	14.6	5.57
22.2	14.6	3.18

08/05/2008		
Depth	Temp.	D.O.
FEET	DEGREES C	MG/L
0	25.9	11.46
2	25.9	11.46
4	25.8	11.53
6	25.6	11.28
8	25.5	10.35
10	25.3	10.01
12	25	9.3
14	24.6	5.79
16	23.9	1.83
18	22.3	.89
20	21	.84
22	20	.85
22.3	19.5	.92

08/13/2008		
Depth	Temp.	D.O.
0	23.4	12
2	23.4	11.94
4	23.4	11.9
6	23.4	11.8
8	23.3	11.32
10	23.2	11.45
12	23.1	10.72

08/21/2008		
Depth	Temp.	D.O.
0	23.5	11.06
2	23.5	11.04
4	23.5	10.98
6	23.4	11.04
8	23.4	11.04
10	23.2	10.78
12	23.1	9.93

08/29/2008		
Depth	Temp.	D.O.
0	24.6	11.95
2	24.4	12.1
4	24.3	12.35
6	24	12.54
8	23.5	12.21
10	23.2	11.41
12	23	11.14

SD = Secchi depth measured in feet converted to meters; Chl = Chlorophyll a in micrograms per liter (ug/l); TP = Total phosphorus in ug/l, surface sample only; TSI(SD),TSI(CHL),TSI(TP) = Trophic state index based on SD, CHL, TP respectively; Depth measured in feet; Temp = Temperature in degrees Fahrenheit; D.O. = Dissolved Oxygen in parts per million.

Wisconsin Department of Natural Resources * Wisconsin Lakes Partnership
Report Generated: 04/01/2009

08/13/2008		
Depth	Temp.	D.O.
14	22.8	8.5
16	22.6	7.97
18	22.1	6.59
20	21.2	.68
22	20	.62
22.2	19.8	.64

08/21/2008		
Depth	Temp.	D.O.
14	22.9	8.95
16	22.3	3.85
18	21.8	.58
20	21.1	.49
22	20.3	.48
22.2	20	.51

08/29/2008		
Depth	Temp.	D.O.
14	22.8	9.37
16	22.4	5.36
18	21.9	.45
20	21.2	.36
22	20.4	.35
22.2	20.3	.35

09/06/2008		
Depth	Temp.	D.O.
0	21.2	9.29
2	21.2	9.35
4	21.2	9.49
6	21.2	9.55
8	21.2	9.57
10	21.1	9.41
12	21	9.3
14	21	8.86
16	20.9	8.17
18	20.6	8.35
20	20.5	8.17
22	20.4	.71
22.3	20.3	.51

09/15/2008		
Depth	Temp.	D.O.
0	18.5	9.88
2	18.6	9.96
4	18.7	10.05
6	18.7	10.1
8	18.7	10.09
10	18.7	10.06
12	18.7	10.01
14	18.7	9.89
16	18.6	9.6
18	18.5	9.6
20	18.4	9.44
22	18.3	6.79
22.4	18.3	.93

09/22/2008		
Depth	Temp.	D.O.
0	21	11.6
2	20.9	11.77
4	20.8	12.03
6	20.6	12.22
8	20.1	12.2
10	19.8	12.04
12	19.3	9.89
14	18.9	8.49
16	18.5	7.76
18	18.2	4.97
20	18.1	1.43
22	18	0
22.3	18	0

Date	Fieldwork Comment
05/09/2008	Fish between 13' to 19'; No ducks; 1 pr. geese w/5 babies; 2 more pr. geese - no offspring; No new plants visible from surface for reeds- cattails- lily pads- pondweeds except EWM (Eurasian Water Milfoil) and bladderworts; cloudy day; air temp = 55#F;
05/28/2008	pH = 7.2; Fish from 10' - 18'; 2 families of geese w/12 goslings; lily pads- reeds + cattails getting green; EWM more abundant near fish refuge and Neitzki home; Very windy yesterday; 80#F two days ago then cooler (64#F today) and dry.
06/10/2008	Landsat; pH = 7.0; Fish from 9'-19-; Rained heavily Sat + Sun - Lake Delton collapse;Reeds + Cattails are green + healthy; Lily pads blossoming; Eurasian Water Milfoil abundant w/sprigs floating in many areas; Air temp @ 65#F. Landsat; pH = 7.0; Fish from 9'-19-; Rained heavily Sat + Sun - Lake Delton collapse;Reeds + Cattails are green + healthy; Lily pads blossoming; Eurasian Water Milfoil abundant w/sprigs floating in many areas; Air temp @ 65#F.
06/18/2008	Landsat; pH=6.9; Fish between 9'-20'; water level @ 15" above normal on June 13-14-15 - highest since July 12- 2004 @ +17.75"; "No wake" traffic on lake; Phosphate + Chlorophyll samples sent in.
06/26/2008	Landsat; pH = 7.1; Fish between 11'-19'; 16 geese (8 adults- 8 younger); EWM increasing- numerous pondweeds esp. Sago- curly leaf- bladderwort; more algae than usual; Warm- dry weather.
07/04/2008	Landsat; pH = 7.2; Fish between 6'-19'; Sago Pondweed floaters; Much debris 2mm + less; EWM

SD = Secchi depth measured in feet converted to meters; Chl = Chlorophyll a in micrograms per liter (ug/l); TP = Total phosphorus in ug/l, surface sample only; TSI(SD),TSI(CHL),TSI(TP) = Trophic state index based on SD, CHL, TP respectively; Depth measured in feet; Temp = Temperature in degrees Fahrenheit; D.O. = Dissolved Oxygen in parts per million.

Wisconsin Department of Natural Resources * Wisconsin Lakes Partnership
Report Generated: 04/01/2009

Date	Fieldwork Comment
	spreading near swim area + boat launch east; Milfoil sprayed 3 days prior by DNR; Dry weather w/cool nights.
07/12/2008	Landsat; pH = 7.0; Fish between 10'-19'; Many 1mm particulates; EWM treated 12 days prior; White Lily pads flowering; Reeds turning brown; Some green EWM at swimming area and Conger's property; No geese observed; Rainy and warm. Landsat; pH = 7.0; Fish between 10'-19'; Many 1mm particulates; EWM treated 12 days prior; White Lily pads flowering; Reeds turning brown; Some green EWM at swimming area and Conger's property; No geese observed; Rainy and warm.
07/21/2008	One day after Landsat; pH = 7.1; Fish between 9'-19'; Much debris 1-2mm in diameter; Some EWM is dying but new plants @ N.W. swimming area- DeLuca- Meekins- N. of Public Pier- NW end in North Basin; Much Sago- Bladderwort. One day after Landsat; pH = 7.1; Fish between 9'-19'; Much debris 1-2mm in diameter; Some EWM is dying but new plants @ N.W. swimming area- DeLuca- Meekins- N. of Public Pier- NW end in North Basin; Much Sago- Bladderwort.
07/28/2008	Landsat; pH = 7.2; Fish between 9'-19'; Yellow Lily pads blossoming; EWM appears dead at NE portion but alive at swimming area and Conger property; Pleasant weather.
08/05/2008	Landsat; pH = 7.1; Fish between 9'-19'; Many EWM sprigs floating; 16 geese flew in; 9 crows chasing hawk at SE side; Yellow + White lily pads flowering; EWM same prior locations; Warm + rainy weather. Landsat; pH=7.1; fish 9'->19' deep; many EWM sprigs floating; 16 geese flew in; 9 crows chasing hawk; yellow + white lily pad blossoms; EWM in same locations as prior report; weather warm + rainy; 70% Cumulo-Nimbus cloud cover; WNW winds at 5-10 MPH; light traffic on lake
08/13/2008	Landsat; pH = 6.9; Fish between 10'-15'; EWM still spreading: north of public pier- DeLucas- N+S Zimmermans- Meekins- Congers- Harden east- NW in N. Basin; Yellow lily pad flowers; warm + rainy. Landsat; pH = 6.9; Fish between 10'-15'; EWM still spreading: north of public pier- DeLucas- N+S Zimmermans- Meekins- Congers- Harden east- NW in N. Basin; Yellow lily pad flowers; warm + rainy. Landsat; pH = 6.9; Phosphate + Chlorophyll samples sent in; Fish between 10'-15'; EWM slowly spreading more: north of public pier - similar to last monitoring; Yellow lily pad flowers; Reeds turning brown; Light rain in AM. Landsat; pH = 6.9; Phosphate + Chlorophyll samples sent in; Fish between 10'-15'; EWM slowly spreading more: north of public pier - similar to last monitoring; Yellow lily pad flowers; Reeds turning brown; Light rain in AM.
08/13/2008	Landsat; pH=6.9; Fish 10'->15'; EWM still spreading - North of public pier- Delucas N+S- Zimmermans- Meakins- Congers- Hardens - E- NW Basin; yellow lily pads blossoming; rain in AM; 80% cumulo-nimbus cloud cover w/WNW winds at 5MPH; traffic = 1 fisherman; Phosphate and Chlorophyll sample sent in.
08/21/2008	Landsat; pH=7.3; weather warm + dry; 10% cirrus cloud cover w/SE winds @ 5MPH; traffic = 3 quiet fishing boats; fish 9'->19'; 1 mm suspended particulate matter scattered throughout; healthiest EWM @ DeLucas property - others less green; no geese.
08/29/2008	Landsat; pH=7.1; 20% cumulus cloud cover w/NW winds at 5+MPH; warm dry weather; several watercraft + tubers; fish 10'->18'; EWM growing @ DeLucas and swimming area + still present at prior sites; no geese or ducks observed.
09/06/2008	Landsat; pH=7.0; 50% cirrus cloud cover w/SSW wind @ 5MPH; rainy + cool weather; traffic = several fishing boats; fish 9'->19'; EWM - same as last week; one large EWM plant floated by at sampling site.
09/15/2008	One day after Landsat; pH=6.9; 100% cumulo-nimbus but some clearing earlier; NNE wind @ 5-10 MPH; recent weather was rain + cloudy; traffic = 1 canoe; fish 9'-19'; surveyed for EWM with Village President and certified weed applicator - found in prior locations plus more in shallow part of refuge; large flock of geese flew over; some lilies still blooming.
09/22/2008	Landsat; pH=7.1; 10% cirrus cloud cover plus very hazy; ESE winds at 5 MPH; warm + dry weather; 2 fishing boats; fish 9'->20' w/biggest fish at 11'; deciduous leaves beginning to fall; no ducks or geese seen.
09/30/2008	Landsat; pH=7.1; 50% cirrus + cumulus cloud cover w/WNW winds from 15-20 MPH; seasonal weather

SD = Secchi depth measured in feet converted to meters; Chl = Chlorophyll a in micrograms per liter (ug/l); TP = Total phosphorus in ug/l, surface sample only; TSI(SD),TSI(CHL),TSI(TP) = Trophic state index based on SD, CHL, TP respectively; Depth measured in feet; Temp = Temperature in degrees Fahrenheit; D.O. = Dissolved Oxygen in parts per million.

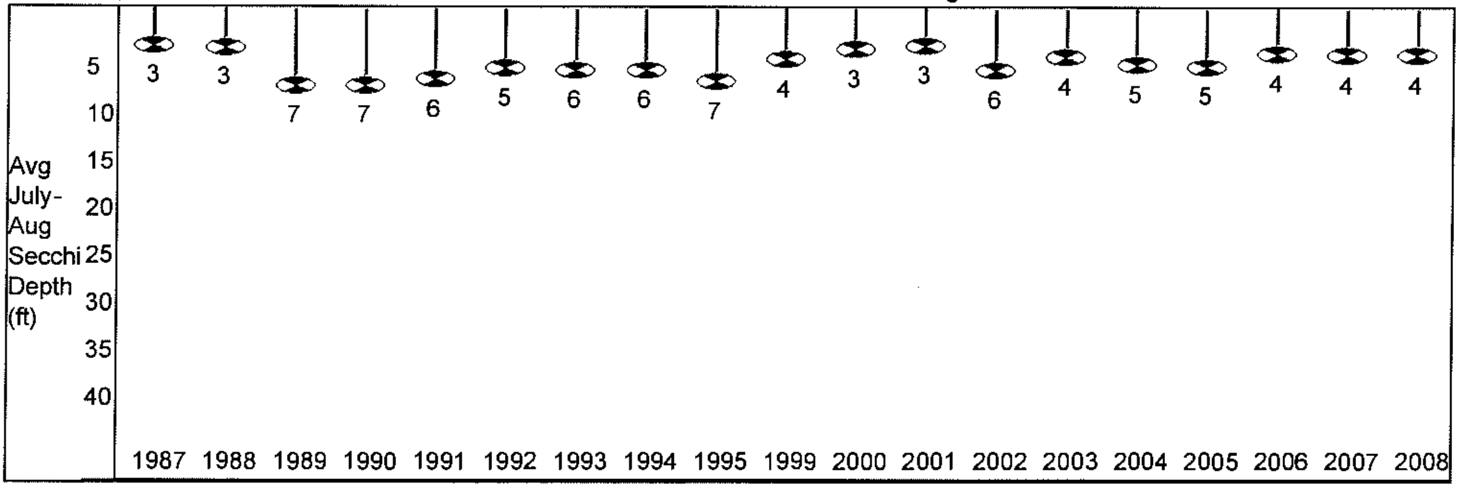
Date	Fieldwork Comment
	with some light rain; no traffic except monitor; air temperature @ 54#F; fish 9'->19' (mostly 10' -> 15'); inconsistent readings because wind shifted boat even with three anchors; EWM still prevalent; reeds and cattails turning brown; maples turning red/orange.
10/11/2008	No Landsat today; pH=7.1; 1% cirrus cloud cover w/ E wind from 0-5 MPH; seasonal weather; six fishing boats other boater- but no jet skis; air temp 60#F; fish 10'->16'(mostly 12'-14'); many gulls; dozens of geese in refuge; EWM in same areas but gray in color; lily pads NOT flowering; a busy kindfisher catching food at lake surface.

Date	Data Collectors	Project
05/09/2008	Wayne Stroessner	Citizen Lake Monitoring - Water Quality - Random Lake; Deep Hole
05/28/2008	Wayne Stroessner	Citizen Lake Monitoring - Water Quality - Random Lake; Deep Hole
06/10/2008	Wayne Stroessner	Citizen Lake Monitoring - Water Quality - Random Lake; Deep Hole
06/18/2008	Wayne Stroessner	Citizen Lake Monitoring - Water Quality - Random Lake; Deep Hole
06/26/2008	Wayne Stroessner	Citizen Lake Monitoring - Water Quality - Random Lake; Deep Hole
07/04/2008	Wayne Stroessner	Citizen Lake Monitoring - Water Quality - Random Lake; Deep Hole
07/12/2008	Wayne Stroessner	Citizen Lake Monitoring - Water Quality - Random Lake; Deep Hole
07/21/2008	Wayne Stroessner	Citizen Lake Monitoring - Water Quality - Random Lake; Deep Hole
07/28/2008	Wayne Stroessner	Citizen Lake Monitoring - Water Quality - Random Lake; Deep Hole
08/05/2008	Wayne Stroessner	Citizen Lake Monitoring - Water Quality - Random Lake; Deep Hole
08/13/2008	Wayne Stroessner	Citizen Lake Monitoring - Water Quality - Random Lake; Deep Hole
08/21/2008	Wayne Stroessner	Citizen Lake Monitoring - Water Quality - Random Lake; Deep Hole
08/29/2008	Wayne Stroessner	Citizen Lake Monitoring - Water Quality - Random Lake; Deep Hole
09/06/2008	Wayne Stroessner	Citizen Lake Monitoring - Water Quality - Random Lake; Deep Hole
09/15/2008	Wayne Stroessner	Citizen Lake Monitoring - Water Quality - Random Lake; Deep Hole
09/22/2008	Wayne Stroessner	Citizen Lake Monitoring - Water Quality - Random Lake; Deep Hole
09/30/2008	Wayne Stroessner	Citizen Lake Monitoring - Water Quality - Random Lake; Deep Hole
10/11/2008	Wayne Stroessner	Citizen Lake Monitoring - Water Quality - Random Lake; Deep Hole

SD = Secchi depth measured in feet converted to meters; Chl = Chlorophyll a in micrograms per liter (ug/l); TP = Total phosphorus in ug/l, surface sample only; TSI(SD),TSI(CHL),TSI(TP) = Trophic state index based on SD, CHL, TP respectively; Depth measured in feet; Temp = Temperature in degrees Fahrenheit; D.O. = Dissolved Oxygen in parts per million.

Random Lake
Sheboygan County
Waterbody Number: 30300

Lake Type: DRAINAGE
DNR Region: SE
GEO Region:SW

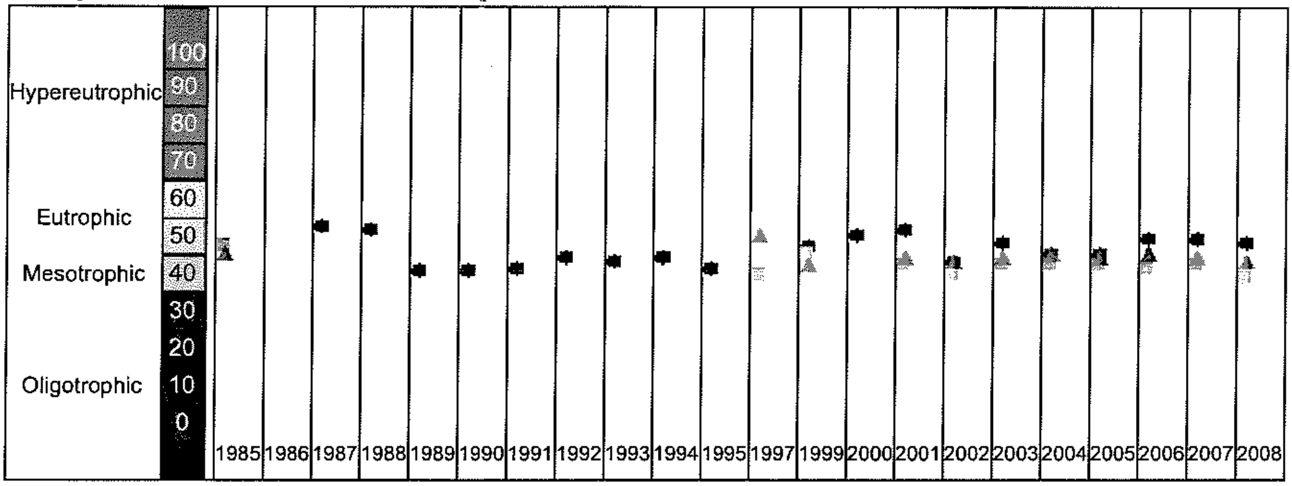


Past secchi averages in feet (July and August only).

Year	Secchi Mean	Secchi Min	Secchi Max	Secchi Count
1987	2.9	2.25	3.25	3
1988	3.1	2.5	3.5	6
1989	7.1	5.25	8	4
1990	7.1	5.5	10	6
1991	6.5	5	8	6
1992	5.4	4.25	6	4
1993	5.6	3.75	7.75	6
1994	5.5	5.5	5.5	1
1995	6.8	6.75	6.75	1
1999	4.4	4	5	11
2000	3.4	3.25	3.75	4
2001	3	2.4	4	12
2002	5.6	5	6.25	10
2003	4.1	2.75	5.25	5
2004	4.9	4.592	5.5	6
2005	5.1	4.5	5.75	4
2006	3.8	3.5	4.75	6
2007	3.9	3.25	4.5	7
2008	3.9	3.75	4.25	4

Report Generated: 04/01/2009

Trophic State Index Graph



Monitoring Station: Random Lake - Deep Hole, Sheboygan County

Past Summer (July-August) Trophic State Index (TSI) averages.

◆ = Secchi ▣ = Chlorophyll ▲ = Total Phosphorus

TSI(Chl) = TSI(TP) = TSI(Sec)	It is likely that algae dominate light attenuation.
TSI(Chl) > TSI(Sec)	Large particulates, such as Aphanizomenon flakes dominate
TSI(TP) = TSI(Sec) > TSI(Chl)	Non-algal particulate or color dominate light attenuation
TSI(Sec) = TSI(Chl) >= TSI(TP)	The algae biomass in your lake is limited by phosphorus
TSI(TP) > TSI(Chl) = TSI(Sec)	Zooplankton grazing, nitrogen, or some factor other than phosphorus is limiting algae biomass

TSI	TSI Description
TSI < 30	Classical oligotrophy: clear water, many algal species, oxygen throughout the year in bottom water, cold water, oxygen-sensitive fish species in deep lakes. Excellent water quality.
TSI 30-40	Deeper lakes still oligotrophic, but bottom water of some shallower lakes will become oxygen-depleted during the summer.
TSI 40-50	Water moderately clear, but increasing chance of low dissolved oxygen in deep water during the summer.
TSI 50-60	Lakes becoming eutrophic: decreased clarity, fewer algal species, oxygen-depleted bottom waters during the summer, plant overgrowth evident, warm-water fisheries (pike, perch, bass, etc.) only.
TSI 60-70	Blue-green algae become dominant and algal scums are possible, extensive plant overgrowth problems possible.
TSI 70-80	Becoming very eutrophic. Heavy algal blooms possible throughout summer, dense plant beds, but extent limited by light penetration (blue-green algae block sunlight).
TSI > 80	Algal scums, summer fishkills, few plants, rough fish dominant. Very poor water quality.

Trophic state index (TSI) is determined using a mathematical formula (Wisconsin has its own version). The TSI is a score from 0 to 110, with lakes that are less fertile having a low TSI. We base the overall TSI on the Chlorophyll TSI when we have Chlorophyll data. If we don't have chemistry data, we use TSI Secchi. We do this rather than averaging, because the TSI is used to predict biomass. This makes chlorophyll the best indicator. Visit Bob Carlson's website, dipin.kent.edu/tsi.htm, for more info.

RANDOM LAKE
Aquatic Plant Survey
Whole Lake Demonstration Project/AIS Grant - 2005 Report

INTRODUCTION

In 2003, the Village of Random Lake received an Aquatic Invasive Species Grant from the Wisconsin Department of Natural Resources (WDNR) to conduct a demonstration whole-lake chemical treatment on Random Lake. The Grant application included the project plan upon which the WDNR treatment permit will be based. That plan, and the subsequent grant, requires extensive monitoring to be conducted: the year prior to treatment, the year of treatment, and three years post treatment. The aquatic plant community and the water quality (Self-Help Volunteer Monitoring Program) are to be monitored.

A local volunteer collected the water quality samples throughout the summer of 2005. The results are included in this report.

In July of 2005, Aron & Associates conducted the aquatic plant survey on Random Lake. This survey is part of an ongoing demonstration project to document changes in the aquatic plant community of Random 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 Random Lake.

Random Lake is located in the Village of Random Lake, Sheboygan County, in Southeast Wisconsin. Hydrographic and morphometric data are presented in Table 2. A map of Random Lake showing depth contours is presented in Map 1.

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 Random Lake in 2005 was determined to be 13 feet, that is, no plants were found growing in water deeper than 13 feet.

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 Random Lake.

The initial grid established 146 sample points. Of those, 13 were on land and were eliminated from the list, resulting in 133 sample points.
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. 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.

The abundance of each species was determined using four estimates:

1) The frequency is the rating of how often a species occurs <u>in the sample points</u>.
2) The average density rating, or the average density of a species <u>in the sample point where it occurred</u>.
3) The relative density rating, or the average density of a species <u>averaged over all sample points</u> whether or not any species were present.
4) The relative density rating <u>averaged over all sample points in which any species occurred.</u>

EARLIER STUDIES

In October 1999, a whole-lake chemical treatment was conducted on Random 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 was conducted in 1999 and continued through 2002. The results of that monitoring are provided in Table 1. The monitoring in 1999 through 2002 was conducted using the line-intercept method for the establishment of sample points.

As Eurasian watermilfoil re-infested Random Lake, the Village has used harvesting and 2-4,D chemical spot treatments to slow the return of Eurasian watermilfoil. Curly-leaf pondweed (*Potamogeton crispus*) increased significantly between 1999 and 2002. Long-

term historical data on the aquatic plant community is not available. It is, therefore unclear if this is a new increase or the continuation of a longer trend.
A re-treatment of Random Lake was conducted in 2005 using fluridone. This survey is the first post-treatment survey following treatment.
The 2005 treatment was done in spring 2005 while the 1999 treatment was conducted in fall. It is not yet known if this will influence the results of the treatment.

RESULTS OF THE PRESENT STUDY

A total of 8 aquatic macrophytes were found during the survey in 2005, down from 16 species in 2004. All of the plants were found during the grid survey. No additional species were located during the general survey even though specific plant beds were searched for signs of additional pondweeds. Wetland fringe species are not included in the list of species. It should be noted that large stands of bulrush are present in Random Lake. The bulrushes were abundant and healthy.

The plants found in the lake in 2005 are listed in Table 2. Chara (*Chara* sp.) dominated the plant community, throughout the depths. Water lilies (*Nuphar* and *Nymphaea* sp.) were common in the shallow areas, while sago pondweed (*Stuckenia pectinata*) was found in the deeper depths, from 6 to 11 feet deep. Two species were found that had not been previously identified in Random Lake, small duckweed (*Lemna minor*) and Nitella (*Nitella* sp.). Eleven species found in 2004, could not be located in the 2005 survey, including two nuisance, exotic species, Eurasian watermilfoil and curly-leaf pondweed.

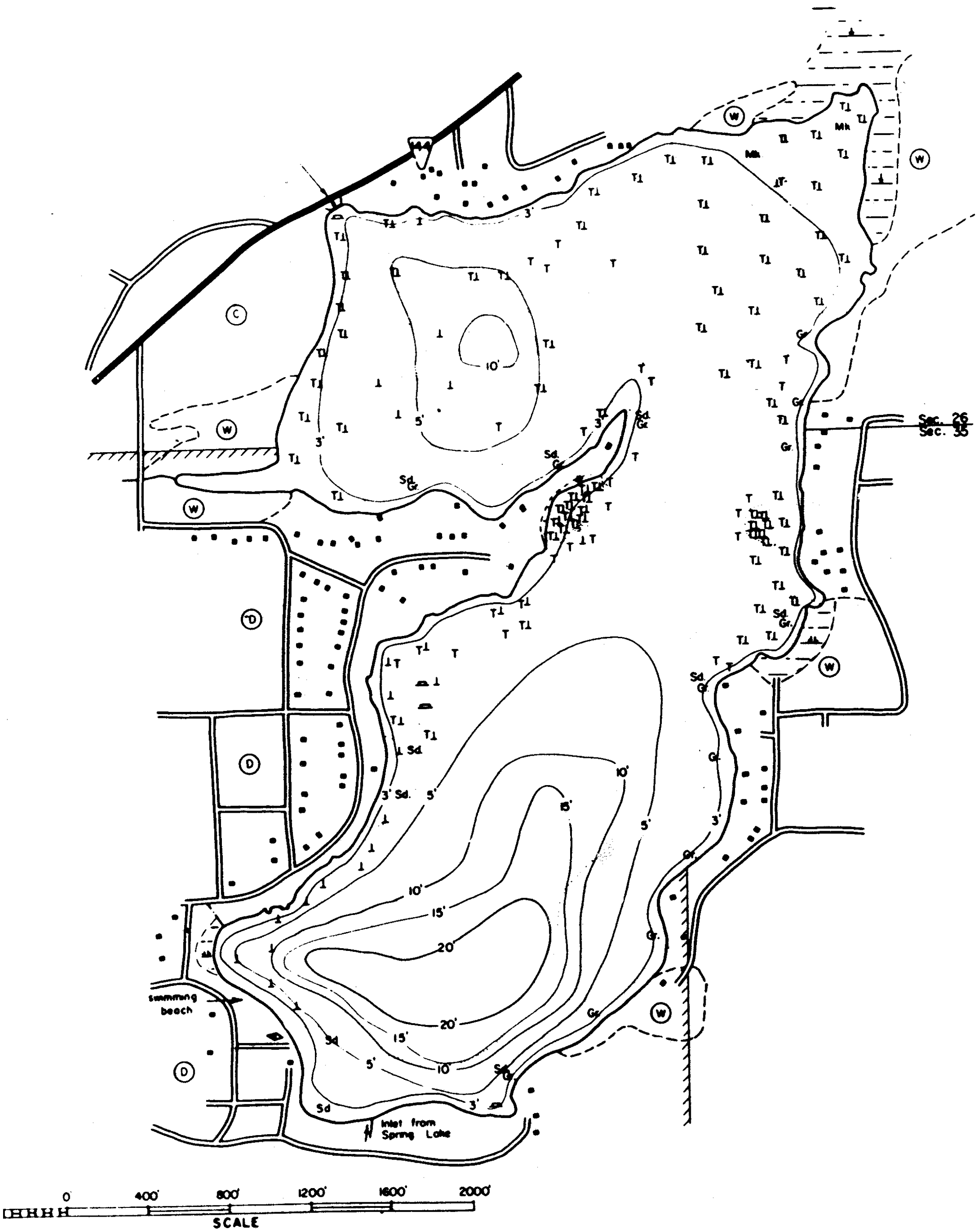
The results of the survey data for the July 2005 survey for all species at each sample depth are included at the end of this report.

The maximum rooting depth in 2005 was 13 feet. Sediments in Random Lake range from sand and gravel to muck. At 1.5 feet the substrate is primarily sand and gravel. At 15 feet the substrate is muck.

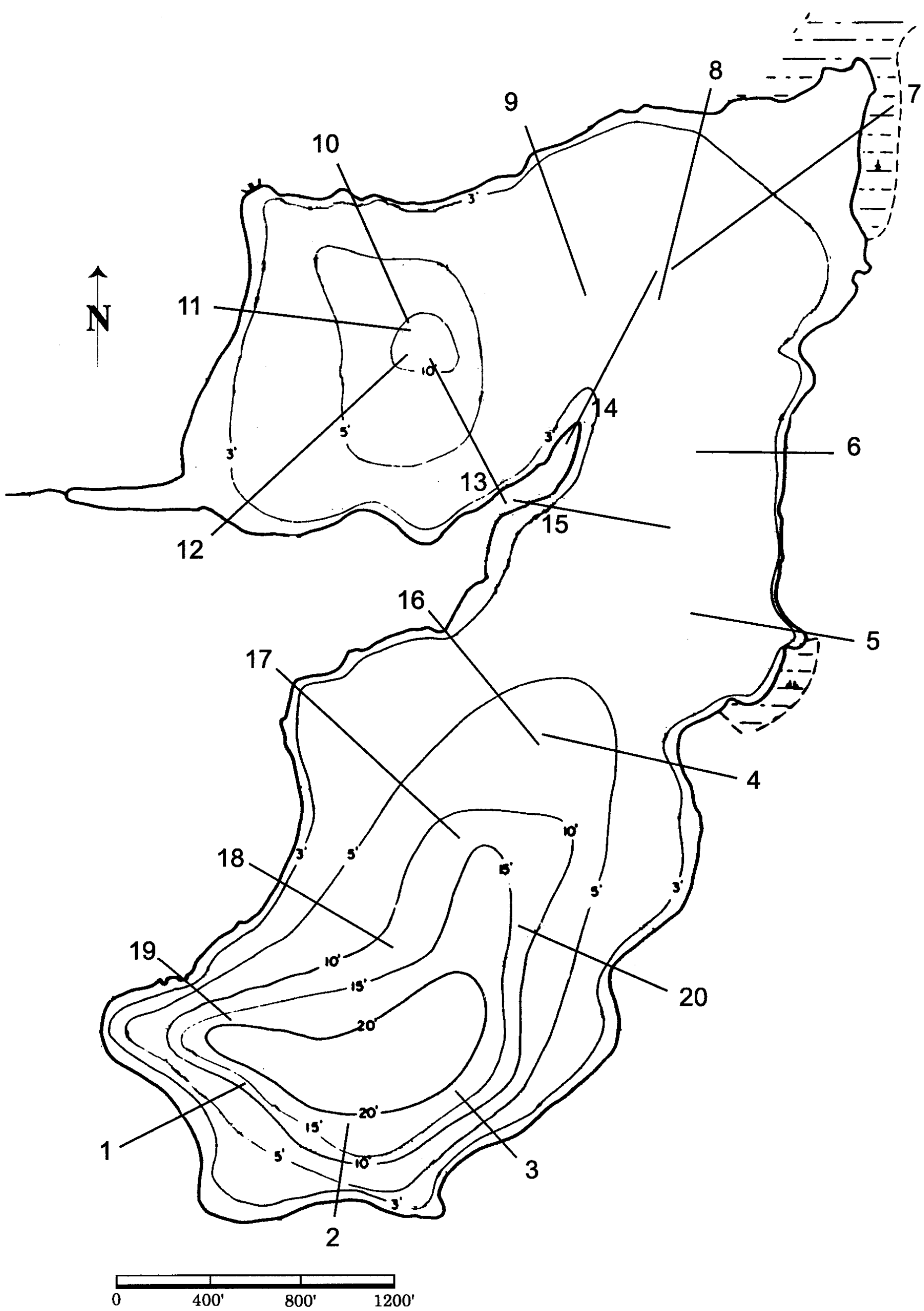
Table 1. Hydrographic and Morphometric Data Random Lake

Size of Lake	209 acres
Lake Volume	1279 acre feet
Length of Shoreline	3.6 miles
Maximum Depth	21 feet
Mean Depth	6 feet
Percent of area less than 3 feet deep	14%
Percent of area greater than 20 feet deep	4%

Source: WDNR

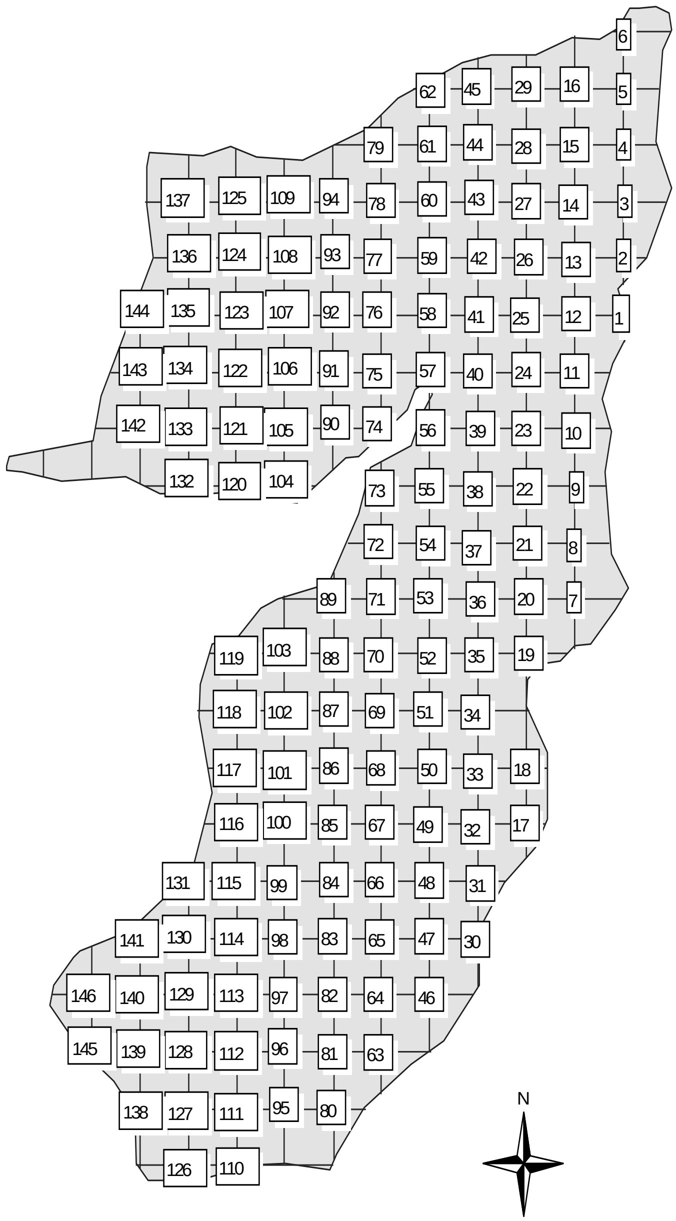


Map 1 - Bathymetric Map, Random Lake, Wisconsin.



Aron&Associates, 1999

Map 2 - Line Transect Survey Locations, Random Lake, Wisconsin, 1999.



Map 3 - Point Intercept Survey Sample Points on Random Lake, 2005.

Table 2. Random Lake Aquatic Plant Species - 1999 to 2005

		% Frequency					
Species	**Common Name**	**1999**	**2000**	**2001**	**2002**	**2004**	**2005**
Chara sp.	Muskgrass, Chara	34	57	43	49	50	64
Elodea canadensis	Waterweed				3	1	
Lemna minor	Small Duckweed						1[a]
Myriophyllum spicatum	Milfoil	60	1[a]	9	69	8	
Najas flexilis	Slender Naiad	1		X	2	10	
Najas marina	Spiny Naid	10			X	13	
Nitella sp.	Nitella						10
Nuphar advena	Yellow Water Lily	5	5	6	7	4	3
Nymphaea sp.	White Water Lily	5	5	0	4	2	10
Potamogeton crispus	Curly-leaf Pondweed	1	4	19	25	1	
P. amplifolius	Large-leaf Pondweed			1	3	6	
P. Illinoensis	Illinois Pondweed	14	18	17	34	8	
P. foliosus	Leafy Pondweed				X	1	
P. natans	Floating-leaf Pondweed	1	5	5	7	6	5
P. zosterformis	Flat-stem Pondweed	X		10	7	X	
Stuckenia pectinata	Sago Pondweed	33	57	48	56	37	12
Utricularia vulgaris	Great Bladderwort	1		2	3	9	
Vallisneria americana	Wild Celery, Eel Grass				X	X	

Notes: [a] Found in only one sample point.
X Found only in the general survey.

WATER QUALITY 2005

The water quality on Random Lake was monitored under the Self-Help Volunteer Monitoring Program. The volunteer, Wayne Stroessner, collected the samples following the Self-Help protocol. Complete results are available on the WDNR website, http://dnr.wi.gov/org/water/fhp/lakes/lakesdatabase.asp.

Table 3 is a summary of the results for 2005. Table 4 is a comparison of the summary results for both 2004 and 2005. 2005 data are included in the Appendix.

Table 3. Random Lake Water Quality Data Summary for 2005*

Sampling Date	Secchi (ft)	Total Phosphorus (mg/l)	DO at surface (mg/l)	Temp at surface (^oF)	Chlorophyll A (ug/l)
5/17/06	7	22	9.93	54.5	
5/31/06	4.25		10.89	67.5	
6/14/06	5.5	19	7.73	78.6	3.21
6/23/06	5		8.91	75.9	
7/8/06	5.25		8.05	75.2	
7/28/06	5.75	19	7.44	76.3	7.43
8/10/06	5		6.78	79.2	
8/23/06	4.5	23	7.35	73	9.2
9/6/06	3.5		7.95	74.8	
9/16/06	4.5		6.23	72	
10/1/06	4.5		7.45	61.2	
10/17/06	4.25	25	7.81	56.7	9.23
10/26/06	4.25		8.27	48.4	

*Complete data are provided in the Appendix or are available at www.dnr.state.wi.us.

Table 4. Comparison of 2004 and 2005 Water Quality Data on Random Lake

Sampling Date	Average Secchi (ft)	Average Total Phosphorus (mg/l)	Average Chlorophyll A (ug/l)
2004	5.2	26.8	5.2
2005	4.9	21.6	7.3

SUMMARY

The Village of Random Lake has conducted significant aquatic plant management activities over the years to keep Random Lake open to recreational use. As Eurasian watermilfoil expanded its range, the management efforts have not always been able to keep pace with the growth of the exotic plant. A demonstration chemical treatment was conducted using Sonar in October 1999. Since 2002, the Village has used a combination of harvesting and chemical treatment (using 2,4-D products) to control Eurasian watermilfoil. A second Sonar treatment was conducted in spring 2005.

A comparison of 2005 data with the 1999 through 2004 project shows a number of differences:

— The 2004 and 2005 surveys were done using point-intercept while earlier surveys were done using the line-transect method.

— Significant differences in frequency over the years are present. The reasons for the disparity are unclear. It could be simply the difference in sampling protocols used, or other factors could come into play. Actual reasons are most likely a combination of factors.

— There is significant difference in the lake's response following the 2005 Sonar treatment to that following the 1999 Sonar treatment. The fall 1999 treatment, conducted at a higher rate, produced little impact on the native species. The Eurasian watermilfoil treatment in 1999 was not 100%. The spring 2005 treatment was done at a much lower rate, yet the impact on natives, at least the season of treatment, was significant. Whether that will result in long term impacts is unknown. The timing of the treatment may have been a factor in this difference. The native plants may already have started their seasonal growth when the May 5, 2005 treatment was conducted.

—Clarity and Chlorophyll A concentrations increased from 2004 to 2005 while total phosphorus concentrations decreased (Table 4).

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.

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.

RANDOM LAKE
Aquatic Plant Survey
Whole Lake Demonstration Project/AIS Grant - 2006 Report

INTRODUCTION

In 2003, the Village of Random Lake received an Aquatic Invasive Species Grant from the Wisconsin Department of Natural Resources (WDNR) to conduct a demonstration whole-lake chemical treatment on Random Lake. The Grant application included the project plan upon which the WDNR treatment permit will be based. That plan, and the subsequent grant, requires extensive monitoring to be conducted: the year prior to treatment, the year of treatment, and three years post treatment. The aquatic plant community and the water quality (Self-Help Volunteer Monitoring Program) are to be monitored.

A local volunteer collected the water quality samples throughout the summer of 2006. The results are included in this report.

In July of 2006, Aron & Associates conducted the aquatic plant survey on Random Lake. This survey is part of an ongoing demonstration project to document changes in the aquatic plant community of Random 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 Random Lake.

Random Lake is located in the Village of Random Lake, Sheboygan County, in Southeast Wisconsin. Hydrographic and morphometric data are presented in Table 2. A map of Random Lake showing depth contours is presented in Map 1.

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 Random Lake in 2006 was determined to be 13.5 feet, that is, no plants were found growing in water deeper than 13.5 feet.

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 Random Lake.

The initial grid established 146 sample points. Of those, 13 were on land and were eliminated from the list, resulting in 133 sample points.
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. 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.

The abundance of each species was determined using four estimates:

1) The frequency is the rating of how often a species occurs <u>in the sample points</u>.
2) The average density rating, or the average density of a species <u>in the sample point where it occurred</u>.
3) The relative density rating, or the average density of a species <u>averaged over all sample points</u> whether or not any species were present.
4) The relative density rating <u>averaged over all sample points in which any species occurred.</u>

EARLIER STUDIES

In October 1999, a whole-lake chemical treatment was conducted on Random 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 was conducted in 1999 and continued through 2002. The results of that monitoring are provided in Table 1. The monitoring in 1999 through 2002 was conducted using the line-intercept method for the establishment of sample points.

As Eurasian watermilfoil re-infested Random Lake, the Village has used harvesting and 2-4,D chemical spot treatments to slow the return of Eurasian watermilfoil. Curly-leaf pondweed (*Potamogeton crispus*) increased significantly between 1999 and 2002. Long-

term historical data on the aquatic plant community is not available. It is, therefore unclear if this is a new increase or the continuation of a longer trend.
A re-treatment of Random Lake was conducted in 2005 using fluridone. This survey is the second post-treatment survey following treatment.
The 2005 treatment was done in spring 2005 while the 1999 treatment was conducted in fall. It is not yet known if this will influence the results of the treatment.

RESULTS OF THE PRESENT STUDY

A total of 14 aquatic macrophytes were found during the survey in 2006, up from the 8 found in 2005, but down from 16 species in 2004. Ten of the plants were found during the grid survey and four were found during the general survey. Wetland fringe species are not included in the list of species. It should be noted that large stands of bulrush are present in Random Lake. The bulrushes were abundant and healthy.

The plants found in the lake in 2006 are listed in Table 2. Chara (*Chara* sp.) and sago pondweed (*Stuckenia pectinata*) dominated the plant community, throughout the depths. Water lilies (*Nuphar* and *Nymphaea* sp.) were common in the shallow areas, Two species were found that had not been previously identified in Random Lake, small duckweed (*Lemna minor*) and Nitella (*Nitella* sp.). Curly-leaf pondweed (*P. crispus*), an exotic species, was found in nine sample points. Eurasian watermilfoil (*Myriophyllum spicatum*) was not found in 2006. A native milfoil, whorled watermilfoil (*Myriophyllum verticillatum*) was found in one area, on the Northeast side of the lake near the bulrushes.

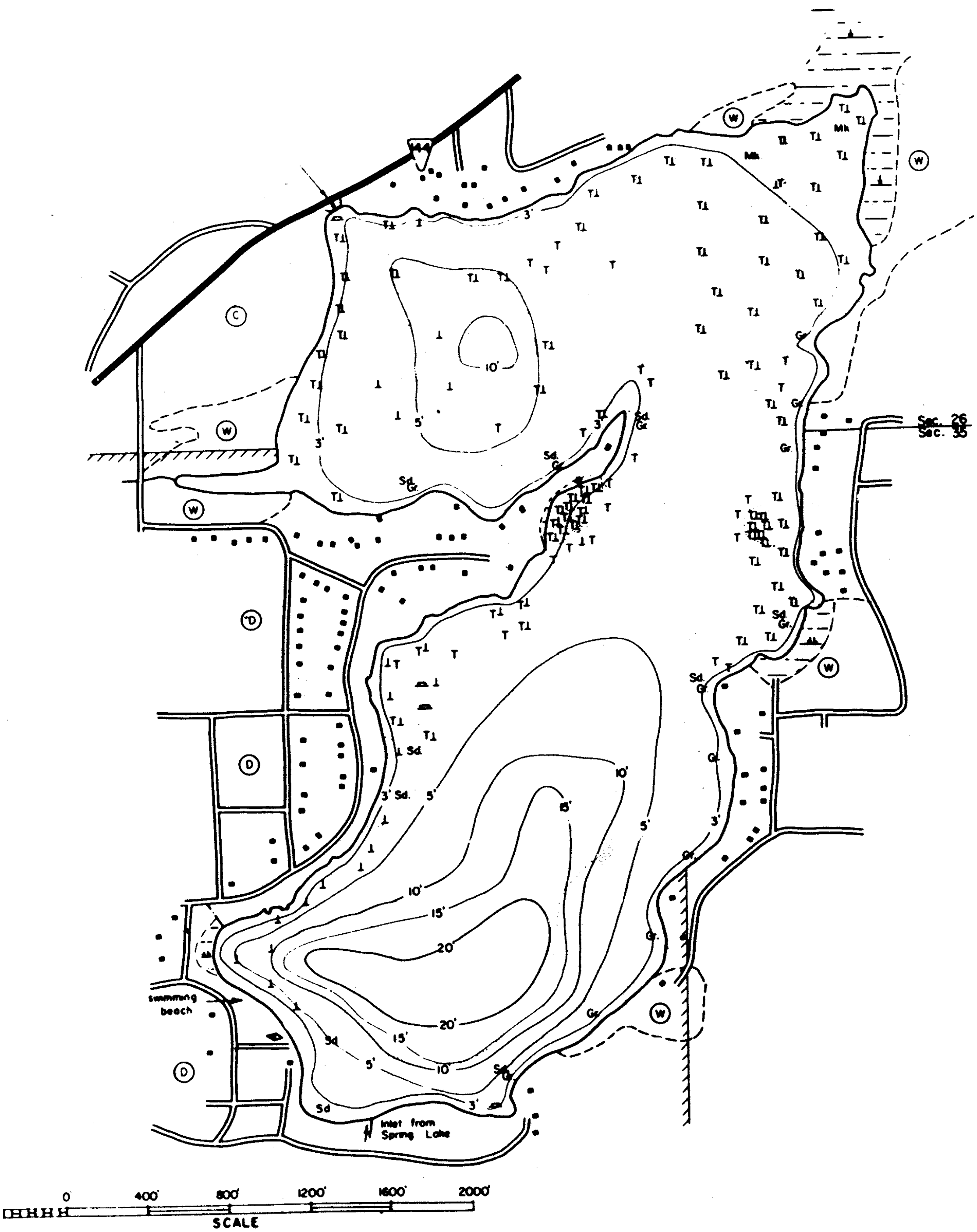
The results of the survey data for the July 2006 survey for all species at each sample depth are included at the end of this report.

The maximum rooting depth in 2005 was 13.5 feet. Sediments in Random Lake range from sand and gravel to muck. At 1.5 feet the substrate is primarily sand and gravel. At 15 feet the substrate is muck.

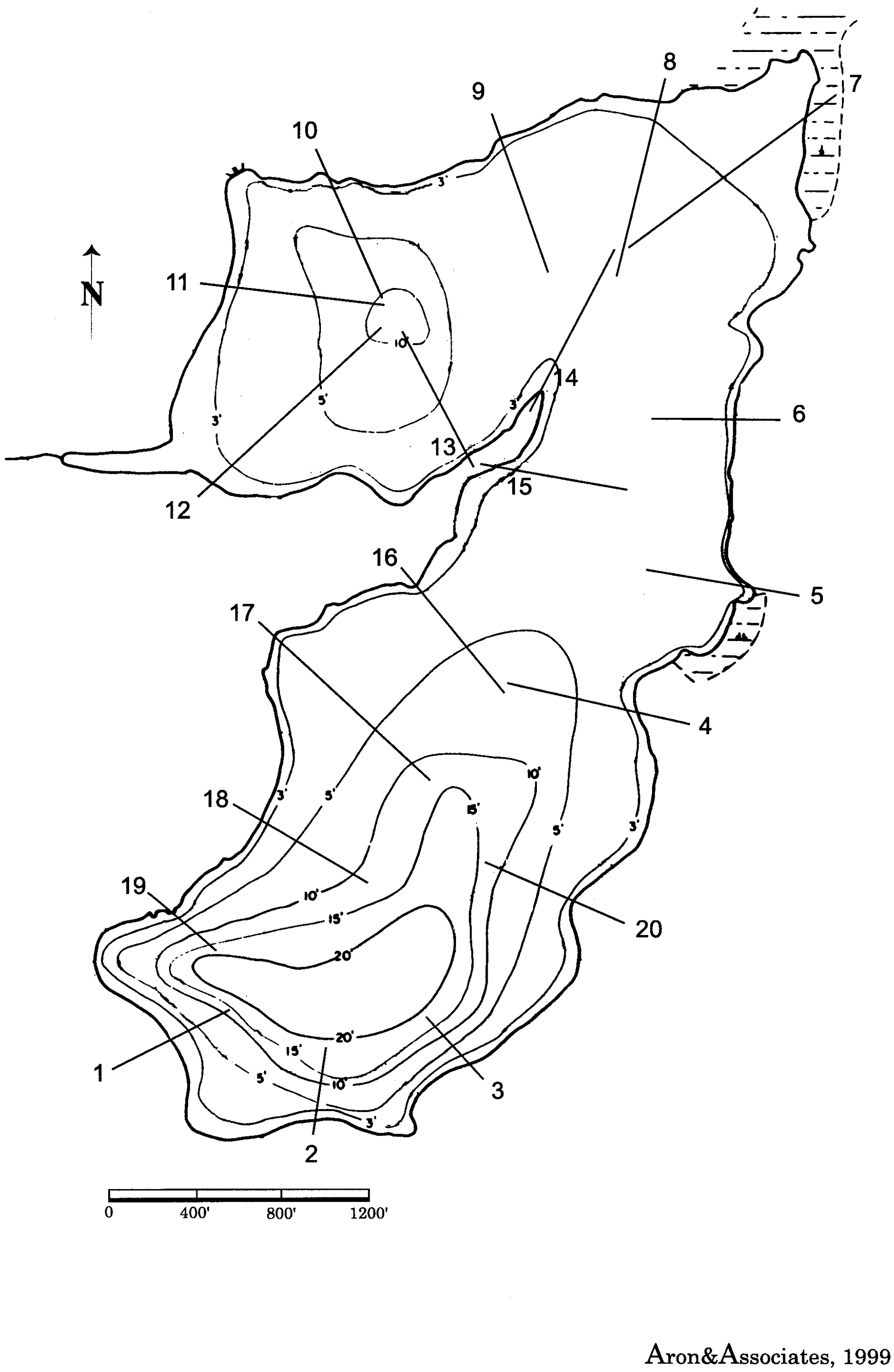
Table 1. Hydrographic and Morphometric Data Random Lake

Size of Lake	209 acres
Lake Volume	1279 acre feet
Length of Shoreline	3.6 miles
Maximum Depth	21 feet
Mean Depth	6 feet
Percent of area less than 3 feet deep	14%
Percent of area greater than 20 feet deep	4%

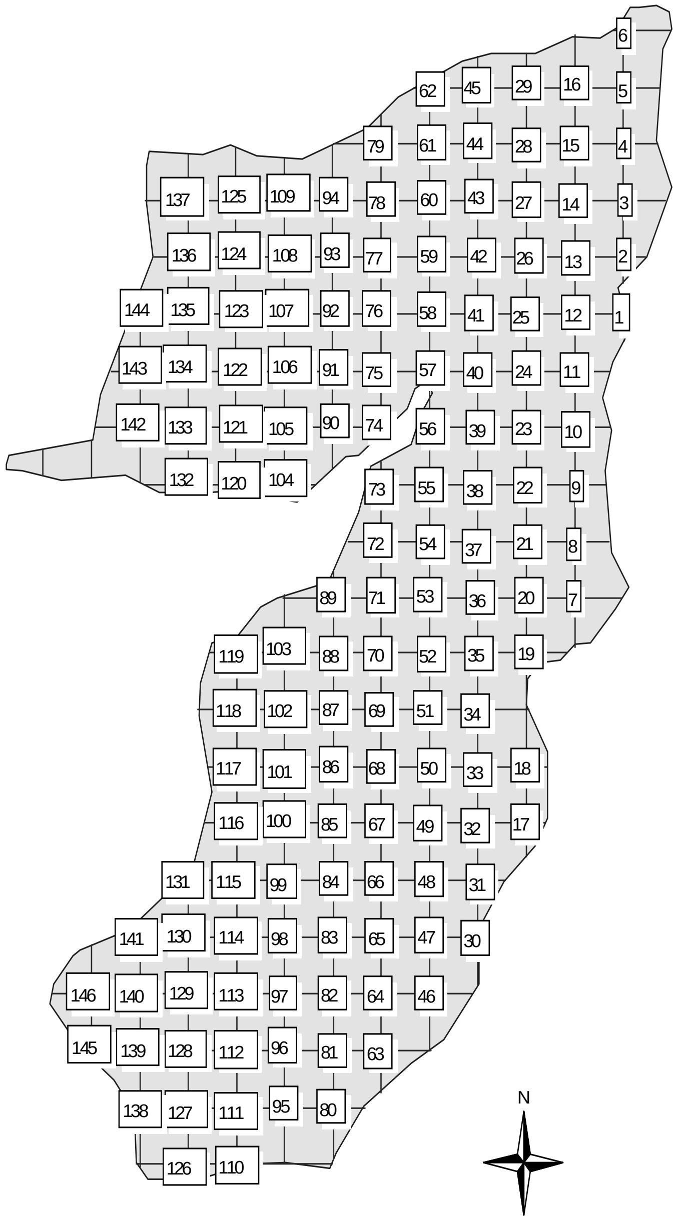
Source: WDNR



Map 1 - Bathymetric Map, Random Lake, Wisconsin.



Map 2 - Line Transect Survey Locations, Random Lake, Wisconsin, 1999.



Map 3 - Point Intercept Survey Sample Points on Random Lake, 2005.

Table 2. Random Lake Aquatic Plant Species - 1999 to 2006

	% Frequency						
Species	**1999**	**2000**	**2001**	**2002**	**2004**	**2005**	**2006**
Chara sp.	34	57	43	49	50	64	50
Elodea canadensis				3	1		
Lemna minor						1[a]	X
Myriophyllum spicatum	60	1[a]	9	69	8		
Myriophyllum verticillatum							X
Najas flexilis	1		X	2	10		2
Najas marina	10			X	13		6
Nitella sp.						10	
Nuphar advena	5	5	6	7	4	3	1
Nymphaea sp.	5	5	0	4	2	10	5
Potamogeton crispus	1	4	19	25	1		7
P. amplifolius			1	3	6		X
P. Illinoensis	14	18	17	34	8		X
P. foliosus				X	1		
P. natans	1	5	5	7	6	5	2
P. zosterformis	X		10	7	X		
Stuckenia pectinata	33	57	48	56	37	12	40
Utricularia vulgaris	1		2	3	9		1
Vallisneria americana				X	X		

Notes: [a] Found in only one sample point.
X Found only in the general survey.

WATER QUALITY 2006

The water quality on Random Lake was monitored under the Self-Help Volunteer Monitoring Program. The volunteer, Wayne Stroessner, collected the samples following the Self-Help protocol. Complete results are available on the WDNR website, http://dnr.wi.gov/org/water/fhp/lakes/lakesdatabase.asp.

Table 3 is a summary of the results for 2006. Table 4 is a comparison of the summary results for both 2004, 2005, and 2006. 2006 data are included in the Appendix.

Table 3. Random Lake Water Quality Data Summary for 2006*

Sampling Date	Secchi (ft)	Total Phosphorus (mg/l)	DO at surface (mg/l)	Temp at surface (^oF)	Chlorophyll A (ug/l)
5/29/06	4.25	8	5.55	70.8	
6/13/06	3.51	21	7.57	69.9	10.7
6/21/06	3.5		6.51	73.7	
6/30/06	3.75		7.98	76.2	
7/07/06	3.5		7.92	78.1	
7/15/06	4.75		7.03	79.2	
7/23/06	3.5	23	6.8	77	8.13
7/31/06	3.51		6.44	81.1	
8/16/06	3.75	25	7.11	75.9	7.41
8/24/06	3.75		7.1	74.6	
9/01/06	4		6.76	71.9	
9/14/06	4.25		6.52	63.7	
9/17/06	4		7.48	67.3	
9/25/06	4.25		7.31	60.9	
10/06/06	4.25	25	7.68	59.8	7.18
10/20/06	5.51		8.21	46	

*Complete data are provided in the Appendix or are available at www.dnr.state.wi.us.

Table 4. Comparison of 2004, 2005, and 2006 Water Quality Data on Random Lake

Sampling Date	Average Secchi (ft)	Average Total Phosphorus (mg/l)	Average Chlorophyll A (ug/l)
2004	5.2	26.8	5.2
2005	4.9	21.6	7.3
2006	4.0	20.4	8.4

SUMMARY

The Village of Random Lake has conducted significant aquatic plant management activities over the years to keep Random Lake open to recreational use. As Eurasian watermilfoil expanded its range, the management efforts have not always been able to keep pace with the growth of the exotic plant. A demonstration chemical treatment was conducted using Sonar in October 1999. Since 2002, the Village has used a combination of harvesting and chemical treatment (using 2,4-D products) to control Eurasian watermilfoil. A second Sonar treatment was conducted in spring 2005.

A comparison of 2006 plant data with the 1999 through 2005 project shows a number of differences:

— The 2004, 2005, and 2006 surveys were done using point-intercept while earlier surveys were done using the line-transect method.

— Significant differences in frequency over the years are present. The reasons for the disparity are unclear. It could be simply the difference in sampling protocols used, or other factors could come into play. Actual reasons are most likely a combination of factors.

— There is significant difference in the lake's response following the 2005 Sonar treatment to that following the 1999 Sonar treatment. The fall 1999 treatment, conducted at a higher rate, produced little impact on the native species. The Eurasian watermilfoil treatment in 1999 was not 100%. The spring 2005 treatment was done at a much lower rate, yet the impact on natives, at least the season of treatment, was significant. Whether that will result in long term impacts is unknown. The timing of the treatment may have been a factor in this difference. The native plants may already have started their seasonal growth when the May 5, 2005 treatment was conducted.

—More native plant species were found in 2006 than were found in 2005

—Clarity and Chlorophyll A concentrations increased from 2004 to 2006 while total phosphorus concentrations decreased (Table 4).

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.

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.

RANDOM LAKE AQUATIC PLANT SURVEY - 2006

Transect #	Depth	CHARA	NITELA	MYRSP	STUPE	POTFO	NAJFL	NAJMA	NUPHAR	NYMPH	POTIL	POTAM	POTGR	POTNA	UTRIVU	POTCR	LEMNA	ELOCA
		Plants																
5	1.5				2					4								
73	1.5	4			3			2		2						2		
144	1.5				4					V								
19	2	4																
18	2.5																	
7	2.75	4			1			1		V								
10	2.75	5			V													
11	2.75	4			3													
4	3	1			2					4								
8	3	5			3								1			1		
9	3	5			2					V								
45	3	1			3													
137	3				4					1								
138	3.25	V			V							V				V		
143	3.25				V					V				V				
3	3.5	2			4													
13	3.5	4			3													
62	3.5	4			3					V				2		2		
142	3.5				4				2					2				
119	3.75	2			V					V								
12	4	4			3													
15	4				4					3								
16	4	2			3								1		1	1		
29	4	V			1				V	1								
31	4	1																
72	4	4																
79	4	V			V								V					
89	4	4			2													
94	4												2					
133	4	2			2					1								
14	4.5	1			4								1					
131	4.5	3								V								
134	4.5				2													
22	4.75	4														1		
24	4.75	4																
20	5	3																
21	5	5																
23	5	4																
25	5	5																
27	5				3													
28	5				V													
35	5	4																
39	5	5			3													
44	5	1																
54	5	5																

Transect #	Depth	CHARA	NITELA	MYRSP	STUPE	POTFO	NAJFL	NAJMA	NUPHAR	NYMPH	POTIL	POTAM	POTGR	POTNA	UTRIVU	POTCR	LEMNA	ELOCA
55	5	3																
61	5	4			4													
70	5	4						2										
77	5	4			1											1		
103	5	5																
118	5				1													
135	5	5			2			1										
136	5				4					V								
38	5.25	5																
40	5.25	4			2													
71	5.25	5														1		
75	5.25	5			2													
121	5.25				1			2										
26	5.5	1																
41	5.5	5																
76	5.5	3																
78	5.5	4			1								3					
80	5.5	2																
90	5.5																	
105	5.5	1						2										
117	5.75	1			1			3										
34	6	5					2											
36	6	5																
37	6	5																
43	6				3					1								
58	6	4			3													
59	6	4			4													
60	6	5																
116	6	5																
125	6	4			3													
126	6				1					1						1		
88	6.25	4																
32	6.5	1																
33	6.5	5			2		1											
48	6.5																	
109	6.5	1			2													
141	6.5				3													
42	7																	
46	7																	
53	7	5			2													
93	7	2			3			1										
122	7.5	5			3			2										
52	8	2														1		
123	8	1			4													
124	8	4			4													
49	8.25																	
63	8.5																	
69	8.75																	
102	8.75	2			3													

Transect #	Depth	CHARA	NITELA	MYRSP	STUPE	POTFO	NAJFL	NAJMA	NUPHAR	NYMPH	POTIL	POTAM	POTGR	POTNA	UTRIVU	POTCR	LEMNA	ELOCA
87	9				3													
115	9																	
127	9	4			4													
146	9				2											1		
51	9.25																	
111	9.25																	
47	9.5																	
139	9.5																	
99	10.25																	
50	10.75																	
86	11																	
101	11				2													
100	11.25				1													
108	11.5				4													
130	12.25																	
95	12.5								V			V						
114	13																	
85	13.25																	
98	13.25				2													
106	13.25																	
68	13.5																	
92	14.25																	
84	14.75																	
91	14.75																	
67	15.75																	
66	16.25																	
83	17.75																	
107	17.75																	
65	18.25																	
140	19																	
64	19.25																	
81	19.25																	
128	19.25																	
97	19.5																	
129	19.5																	
113	19.75																	
112	20																	
96	20.25																	
82	20.5																	
1	ON LAND																	
2	ON LAND																	
6	ON LAND																	
17	ON LAND																	
30	ON LAND																	
56	ON LAND	V								V	V		V					
57	ON LAND	V			V				V							V		
74	ON LAND																	
104	ON LAND																	
110	ON LAND																	

Transect #	Depth	CHARA	NITELA	MYRSP	STUPE	POTFO	NAJFL	NAJMA	NUPHAR	NYMPH	POTIL	POTAM	POTGR	POTNA	UTRIVU	POTCR	LEMNA	ELOCA
120	ON LAND																	
132	ON LAND																	
145	ON LAND																	

Total Sample Sites (146 - 13 on land) = 133
Sample Sites w/ No Plants 44

	CHARA	NITELLA	MYRSP	STUPE	POTFO	NAJFL	NAJMA	NUPHAR	NYMPH	POTIL	POTAM	POTGR	POTNA	UTRIVU	POTCR	LEMNA	ELOCA
Sites found(Frequency)	68	0	0	55	0	2	9	1	9	0	0	5	2	1	10	0	0
% Frequency	51.13	0.00	0.00	41.35	0.00	1.50	6.77	0.75	6.77	0.00	0.00	3.76	1.50	0.75	7.52	0.00	0.00
Density (Max = 5) at sites found	3.47	#DIV/0!	#DIV/0!	2.55	#DIV/0!	1.50	1.56	2.00	1.33	#DIV/0!	#DIV/0!	1.60	2.00	1.00	1.00	#DIV/0!	#DIV/0!
Relative Density (Max = 5) 'hole Lake	1.77	0.00	0.00	1.05	0.00	0.02	0.11	0.02	0.09	0.00	0.00	0.06	0.03	0.01	0.08	0.00	0.00
Found Visually	V			V			V	V		V	V	V	V			V	

Lake Water Quality 2006 Annual Report

RANDOM LAKE
Sheboygan County
Waterbody Number: 30300

Lake Type: DRAINAGE
DNR Region: SE
GEO Region:SW

Site Name	Storet #
RANDOM LAKE - DEEP HOLE	603312

Date	SD (ft)	SD (m)	Hit Bottom	CHL	TP	TSI (SD)	TSI (CHL)	TSI (TP)	Lake Level	Clarity	Color	Perception
05/29/2006	4.25	1.3	N		8	56		44	HIGH	CLEAR	GREEN	3
06/13/2006	3.5	1.1	N	10.7	21	59	53	52	HIGH	MURKY	GREEN	3
06/21/2006	3.5	1.1	N			59			HIGH	MURKY	GREEN	3
06/30/2006	3.75	1.1	N			58			HIGH	MURKY	GREEN	3
07/07/2006	3.5	1.1	N			59			NORMAL	MURKY	GREEN	3
07/15/2006	4.75	1.4	N			55			NORMAL	MURKY	GREEN	3
07/23/2006	3.5	1.1	N	8.13	23	59	51	52	NORMAL	MURKY	BROWN	3
07/31/2006	3.5	1.1	N			59			NORMAL	MURKY	BROWN	3
08/16/2006	3.75	1.1	N	7.41	25	58	50	53	LOW	MURKY	BROWN	3
08/24/2006	3.75	1.1	N			58			LOW	MURKY	GREEN	3
09/01/2006	4	1.2	N			57			LOW	MURKY	GREEN	3
09/14/2006	4.25	1.3	N			56			LOW	CLEAR	GREEN	3
09/17/2006	4	1.2	N			57			LOW	MURKY	GREEN	3
09/25/2006	4.25	1.3	N			56			NORMAL	CLEAR	GREEN	3
10/06/2006	4.25	1.3	N	7.18	25	56	50	53	NORMAL	CLEAR	BROWN	3
10/20/2006	5.5	1.7	N			53			HIGH	CLEAR	BROWN	3

05/29/2006		
Depth FEET	Temp. DEGREES F	D.O. mg/l
0	70.8	5.55
2	69.9	6.52
4	69.1	7.25
6	67.5	7.12
8	64.6	7.48
10	62.1	7.31
12	60	6.72
14	58.4	5.71
16	57.4	4.82
18	56.2	1.02
20	55.7	.35
22.2	55.1	.1

06/13/2006		
Depth FEET	Temp. DEGREES F	D.O. mg/l
0	69.9	7.57
2	69.1	8.01
4	68.5	8.17
6	68.2	8.09
8	67.6	8
10	66.9	7.74
12	65.8	7.35
14	63.1	4
16	59.8	.11
18	57	.02
20	56.1	.01
22	55.5	.01
22.2	55.1	0

06/21/2006		
Depth FEET	Temp. DEGREES F	D.O. mg/l
0	73.7	6.51
2	73.5	7.16
4	73.3	7.28
6	73.2	7.41
8	72.4	7.13
10	71.3	6.88
12	69.7	6.4
14	64.9	1.62
16	61.3	.14
18	58.8	.08
20	57.4	.06
22	56.4	.04
22.2	56.1	.03

06/30/2006		
Depth FEET	Temp. DEGREES F	D.O. mg/l
0	76.2	7.98
2	75.9	8.08
4	75	8.2
6	74.3	8.26
8	73.3	8.38
10	72.1	7.64
12	70.1	5.54
14	67.5	.59
16	65.1	.1
18	61.5	.07
20	59.2	.06
22	57.5	.04
22.2	56.8	.02

07/07/2006		
Depth FEET	Temp. DEGREES F	D.O. mg/l
0	78.1	7.92
2	78.1	7.95
4	77.9	8.02
6	77.5	7.99
8	76.6	7.77
10	75.5	6.89
12	74.1	5.41
14	71.2	.9
16	66.7	.07
18	62.6	.06
20	59.8	.03
22	58.4	.02
22.2	57.9	0

07/15/2006		
Depth FEET	Temp. DEGREES F	D.O. mg/l
0	79.2	7.03
2	78.8	7.16
4	78.4	7.09
6	77.7	7.02
8	76.4	7.03
10	75	6.55
12	73.3	4.94
14	71.3	2.85
16	69.1	.11
18	64.4	.07
20	61	.06
22	59.6	.04
22.2	59	.02

07/23/2006		
Depth FEET	Temp. DEGREES F	D.O. mg/l
0	77	6.8
2	77	6.86
4	77	6.89
6	76.8	6.89
8	76.8	6.83
10	76.4	6.69
12	75.2	5.73
14	73	1.51
16	68.9	.11
18	66	.11
20	63.1	.14
22	61.7	.16

07/31/2006		
Depth FEET	Temp. DEGREES F	D.O. mg/l
0	81.1	6.44
2	81	6.56
4	80.4	6.63
6	80.1	6.5
8	79.9	6.3
10	79.3	5.68
12	77.3	3.93
14	74.4	.93
16	70.6	.04
18	67.3	.03
20	64.6	.02
22	62.6	.01
22.1	62.1	.01

08/16/2006		
Depth FEET	Temp. DEGREES F	D.O. mg/l
0	75.9	7.11
2	75.9	7.13
4	75.5	7.18
6	75.5	7.19
8	75.2	7.17
10	75.2	7.08
12	74.8	6.87
14	74.3	6.93
16	73.2	4.69
18	70.1	.06
20	66	.03
22	63.9	.03
22.1	63	.02

08/24/2006		
Depth FEET	Temp. DEGREES F	D.O. mg/l
0	74.6	7.1
2	74.4	7.18
4	74.4	7.2
6	74.3	7.17
8	74.1	7.08
10	73.9	6.51
12	73.7	5.91
14	73.3	4.79
16	72.8	3.71
18	71	.04
20	67.6	.02
22	64.9	.01

09/01/2006		
Depth FEET	Temp. DEGREES F	D.O. mg/l
0	71.9	6.76
2	72.1	6.8
4	72.1	6.82
6	71.9	6.84
8	71.9	6.85
10	71.9	6.84
12	71.9	6.85
14	71.9	6.86
16	71.7	6.8
18	71	5.39
20	69.4	.6
22	67.5	.01

09/14/2006		
Depth FEET	Temp. DEGREES F	D.O. mg/l
0	63.7	6.52
2	63.3	6.57
4	63	6.65
6	62.8	6.58
8	62.8	6.52
10	62.6	6.43
12	62.6	6.41
14	62.6	6.42
16	62.6	6.36
18	62.4	6.26
20	62.4	5.73
22	62.6	.07
22.1	62.6	.03

09/17/2006		
Depth FEET	Temp. DEGREES F	D.O. mg/l
0	67.3	7.48
2	66.7	7.59
4	66.2	7.55
6	65.3	7.24
8	64	7.29
10	63.7	6.81
12	63.1	6.63
14	62.8	5.9
16	62.8	5.49
18	62.6	5.19
20	62.4	4.48
22	62.4	.09
22.1	62.4	.05

09/25/2006		
Depth FEET	Temp. DEGREES F	D.O. mg/l
0	60.9	7.31
2	60.7	7.38
4	60.7	7.45
6	60.7	7.51
8	60.5	7.54
10	60.5	7.55
12	60.5	7.55
14	60.3	7.52
16	60.3	7.49
18	60.1	7.43
20	60	7.31
22	60	.13
22.1	59.8	.05

10/06/2006		
Depth FEET	Temp. DEGREES F	D.O. mg/l
0	59.8	7.68
2	59.8	7.72
4	59.8	7.78
6	58.6	7.9
8	58.6	7.9
10	58.4	7.8
12	58.4	7.72
14	58.3	7.74
16	58.3	7.64
18	58.1	7.5
20	57.9	7.43
22	57.9	.16
22.2	58.1	.03

10/20/2006		
Depth FEET	Temp. DEGREES F	D.O. mg/l
0	46	8.21
2	46	8.32
4	46	8.38
6	46	8.45
8	46	8.48
10	46	8.52
12	46	8.53
14	46	8.55
16	46	8.56
18	46	8.55
20	46.2	8.49
22	46.2	6.1
22.2	46.6	.2

Date	Collector Comments
06/21/2006	Fish (small) between 10-14'; Sprigs of curly leaf pondweed; pH=7; Satellite day; pH = 7.0
06/30/2006	Fish between 10-15'; much curly leaf- broad leaf and Sago pondweeds- much Chara; heavy traffic on lake; pH = 6.8; (1 day after Satellite day
07/07/2006	Fish between 11-13'; much debris at surface (Potamogeton sprigs + grasslike leaves (not Aphanazomena); clumps of filamentous algae appox. 30 cm diam; Satellite day; pH - 6.8
07/15/2006	Fish between 10-18'; much Sago pondweed; Satellite day; pH = 7.1
07/23/2006	Fish between 9-19'; much Sago pondweed; warm weather; Chlorophyll + Phosphorus samples sent; Satellite day; pH = 6.9
07/31/2006	Fish between 10-18'; mostly Sago Pondweed; hot weather; Satellite day; pH = 7.3
08/16/2006	Fish between 7-17'; residents have asked for spraying of weeds - much Potamegeton but no Eurasian Water Milfoil; warm- dry-but cool nights; Satellite day; pH = 7.0; Chlorophyll + Phosphorus samples sent in;
08/24/2006	Fish between 7-17'; many pondweed varieties; Satellite day; pH = 6.9; low water level - deepest point = 22'
09/01/2006	Fish between 9-18'; Satellite day; pondweed going to seed + turning brown however- at north end - still green; pondweed spikes above water surface; one "whorled" water milfoil plant discovered on 8/25/06; pH = 7.1; low water- bottom = 22'
09/14/2006	Fish between 10-19'; mostly Sago and other pondweed abundant; pH = 7.1

09/17/2006	Fish between 6-17'; satellite day; no visible Eurasian Water Milfoil - same as rest of summer; pH = 6.9
09/25/2006	Fish between 11-19'; much Sago Pondweed 6-12" below surface; Village piers removed at park; maple leaves turning red; Satellite day; pH = 7.1
10/06/2006	Fish between 9-19'; Sago Pondweed not as apparent + not at surface; Canada Geese population is high (maybe migration); Phosphorus + Chlorophyll samples sent in; pH = 6.9; D.O. is very good down to 20'; no temmperature stratification since Sept 14th
10/20/2006	Fish between 9-15'; Mudhens migrating thru; new sprouts of Lily Pads + Cattails; Rushes = brown; Pondweeds = deep; good traveling + fishing

Date	Lab Comments
05/29/2006	METHOD BLANK EXCEEDED LOD CRITERIA

Date	Data Collectors	Project
05/29/2006	Wayne Stroessner	CLMN AT RANDOM LAKE; DEEP HOLE
06/13/2006	Wayne Stroessner	CLMN AT RANDOM LAKE; DEEP HOLE
06/21/2006	Wayne Stroessner	CLMN AT RANDOM LAKE; DEEP HOLE
06/30/2006	Wayne Stroessner	CLMN AT RANDOM LAKE; DEEP HOLE
07/07/2006	Wayne Stroessner	CLMN AT RANDOM LAKE; DEEP HOLE
07/15/2006	Wayne Stroessner	CLMN AT RANDOM LAKE; DEEP HOLE
07/23/2006	Wayne Stroessner	CLMN AT RANDOM LAKE; DEEP HOLE
07/31/2006	Wayne Stroessner	CLMN AT RANDOM LAKE; DEEP HOLE
08/16/2006	Wayne Stroessner	CLMN AT RANDOM LAKE; DEEP HOLE
08/24/2006	Wayne Stroessner	CLMN AT RANDOM LAKE; DEEP HOLE
09/01/2006	Wayne Stroessner	CLMN AT RANDOM LAKE; DEEP HOLE
09/14/2006	Wayne Stroessner	CLMN AT RANDOM LAKE; DEEP HOLE
09/17/2006	Wayne Stroessner	CLMN AT RANDOM LAKE; DEEP HOLE
09/25/2006	Wayne Stroessner	CLMN AT RANDOM LAKE; DEEP HOLE
10/06/2006	Wayne Stroessner	CLMN AT RANDOM LAKE; DEEP HOLE
10/20/2006	Wayne Stroessner	CLMN AT RANDOM LAKE; DEEP HOLE

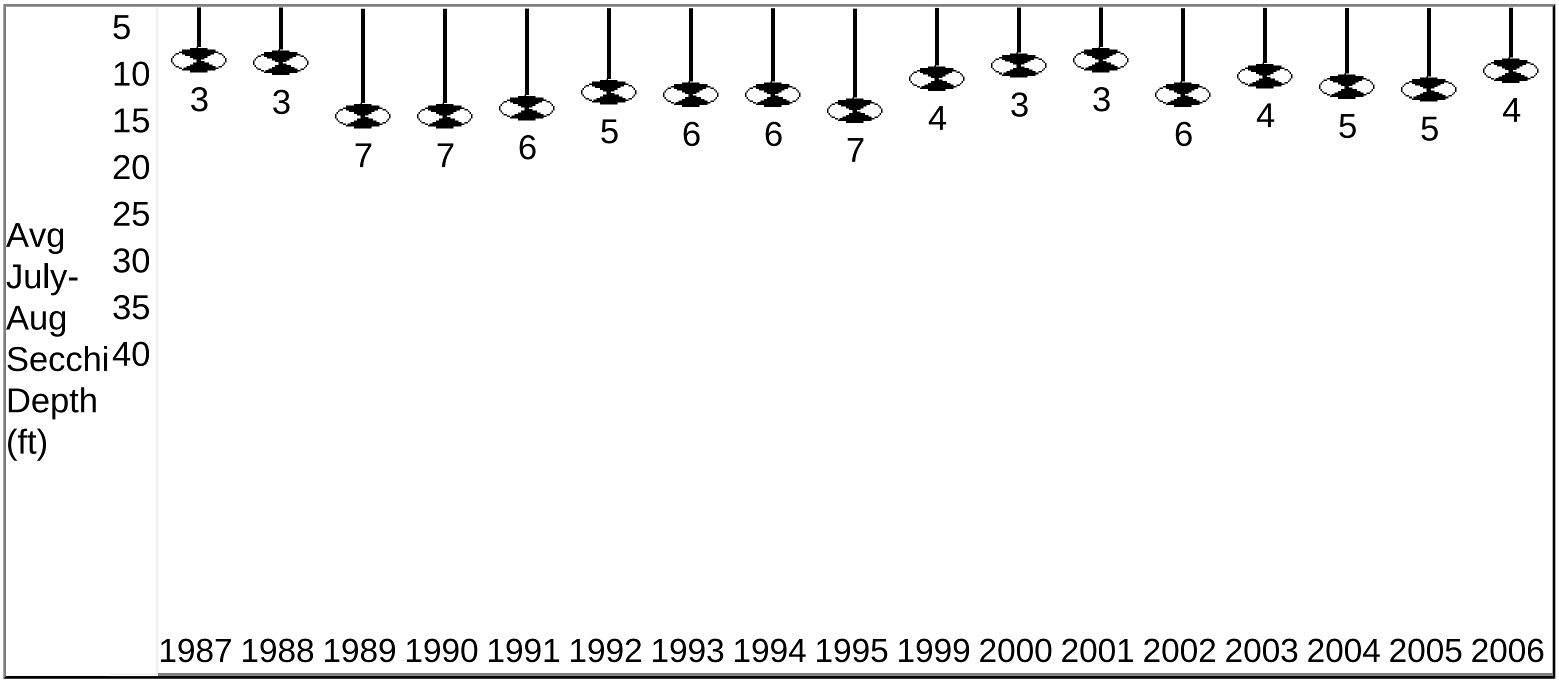
SD = Secchi depth measured in feet converted to meters; Chl = Chlorophyll a in micrograms per liter(ug/l); TP = Total phosphorus in ug/l, surface sample only; TSI(SD), TSI(CHL), TSI(TP) = Trophic state index based on SD, CHL, TP respectively; Depth measured in feet.

Wisconsin Department of Natural Resources **Wisconsin Lakes Partnership**

Report Generated: 08/03/2007

RANDOM LAKE
Sheboygan County
Waterbody Number: 30300

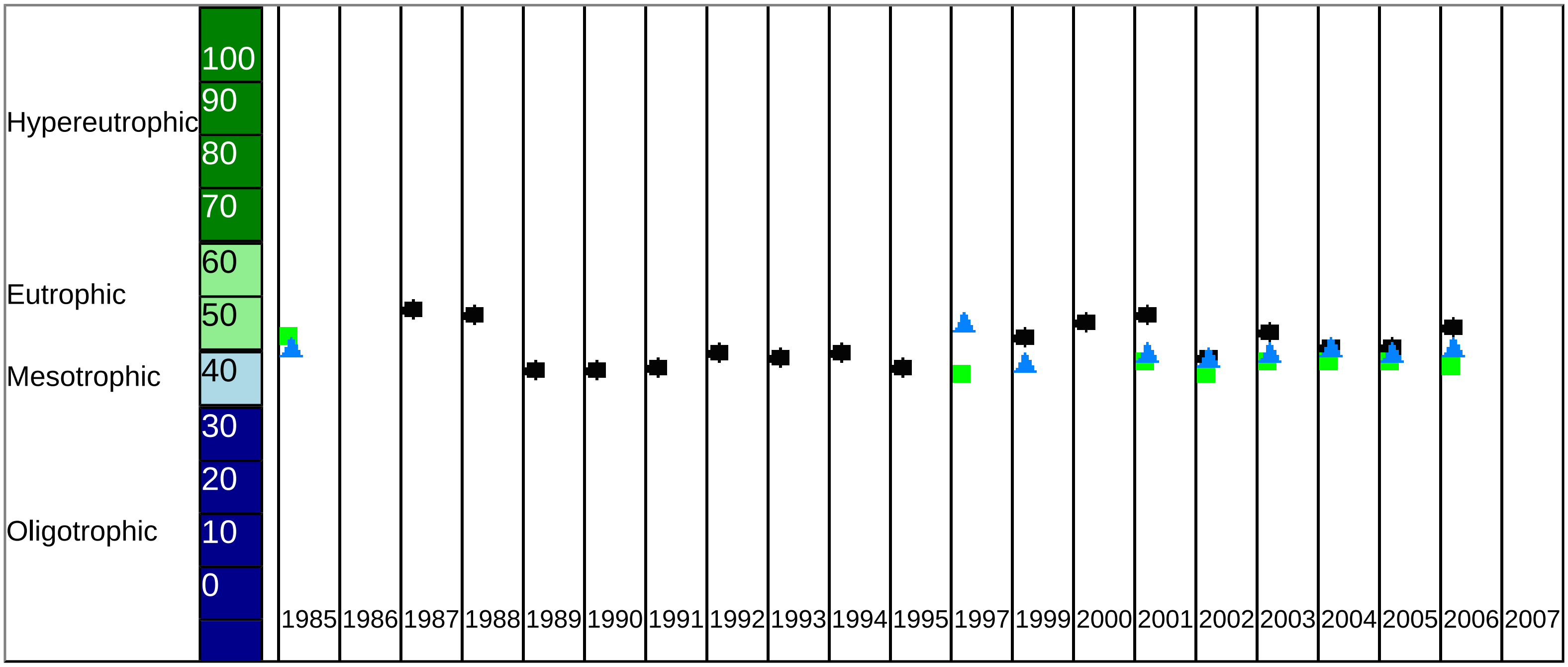
Lake Type: DRAINAGE
DNR Region: SE
GEO Region:SW



Past secchi averages in feet (July and August only).

Report Generated: 08/03/2007

Trophic State Index Graph



Monitoring Station: RANDOM LAKE - DEEP HOLE, Sheboygan County

Past Summer (July-August) Trophic State Index (TSI) averages.

= Secchi = Chlorophyll = Total Phosphorus

TSI(Chl) = TSI(TP) = TSI(Sec)	It is likely that algae dominate light attenuation.
TSI(Chl) > TSI(Sec)	Large particulates, such as Aphanizomenon flakes dominate
TSI(TP) = TSI(Sec) > TSI(Chl)	Non-algal particulate or color dominate light attenuation
TSI(Sec) = TSI(Chl) >= TSI(TP)	The algae biomass in your lake is limited by phosphorus
TSI(TP) > TSI(Chl) = TSI(Sec)	Zooplankton grazing, nitrogen, or some factor other than phosphorus is limiting algae biomass

TSI	TSI Description
TSI < 30	Classical oligotrophy: clear water, many algal species, oxygen throughout the year in bottom water, cold water, oxygen-sensitive fish species in deep lakes. Excellent water quality.
TSI 30-40	Deeper lakes still oligotrophic, but bottom water of some shallower lakes will become oxygen-depleted during the summer.
TSI 40-50	Water moderately clear, but increasing chance of low dissolved oxygen in deep water during the summer.
TSI 50-60	Lakes becoming eutrophic: decreased clarity, fewer algal species, oxygen-depleted bottom waters during the summer, plant overgrowth evident, warm-water fisheries (pike, perch, bass, etc.) only.
TSI 60-70	Blue-green algae become dominant and algal scums are possible, extensive plant overgrowth problems possible.
TSI 70-80	Becoming very eutrophic. Heavy algal blooms possible throughout summer, dense plant beds, but extent limited by light penetration (blue-green algae block sunlight).

TSI > 80	Algal scums, summer fishkills, few plants, rough fish dominant. Very poor water quality.

Trophic state index (TSI) is determined using a mathematical formula (Wisconsin has its own version). The TSI is a score from 0 to 110, with lakes that are less fertile having a low TSI. We base the overall TSI on the Chlorophyll TSI when we have Chlorophyll data. If we don't have chemistry data, we use TSI Secchi. We do this rather than averaging, because the TSI is used to predict biomass. This makes chlorophyll the best indicator. Visit Bob Carlson's website, dipin.kent.edu/tsi.htm, for more info.

RANDOM LAKE
Aquatic Plant Survey
Whole Lake Demonstration Project/AIS Grant - 2008 and Final Report

INTRODUCTION

In 2003, the Village of Random Lake received an Aquatic Invasive Species Grant from the Wisconsin Department of Natural Resources (WDNR) to conduct a demonstration whole-lake chemical treatment on Random Lake. The Grant application included the project plan upon which the WDNR treatment permit will be based. That plan, and the subsequent grant, requires extensive monitoring to be conducted: the year prior to treatment, the year of treatment, and three years post treatment. The aquatic plant community and the water quality (Self-Help Volunteer Monitoring Program) are to be monitored.

A local volunteer collected the water quality samples throughout the summer of 2008. The results are included in this report.

In July of 2008, Aron & Associates conducted the aquatic plant survey on Random Lake. This survey is part of an ongoing demonstration project to document changes in the aquatic plant community of Random 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 Random Lake.

Random Lake is located in the Village of Random Lake, Sheboygan County, in Southeast Wisconsin. Hydrographic and morphometric data are presented in Table 2. A map of Random Lake showing depth contours is presented in Map 3.

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 Random Lake in 2008 was determined to be 13 feet, that is, no plants were found growing in water deeper than 11 feet. This is an improvement from the 11 feet maximum rooting depth in 2007.

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 Random Lake.

The initial grid established 146 sample points. Of those, 13 were on land and were eliminated from the list, resulting in 133 sample points. In 2008, because of the high water levels, one sample point was inundated and had aquatic plants present.
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 current WDNR criteria, between 1 and 3. 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.

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.

EARLIER STUDIES

In October 1999, a whole-lake chemical treatment was conducted on Random 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 was conducted in 1999 and continued through 2002. The results of that monitoring are provided in Table 1. The monitoring in 1999 through 2002 was conducted using the line-intercept method for the establishment of sample points.

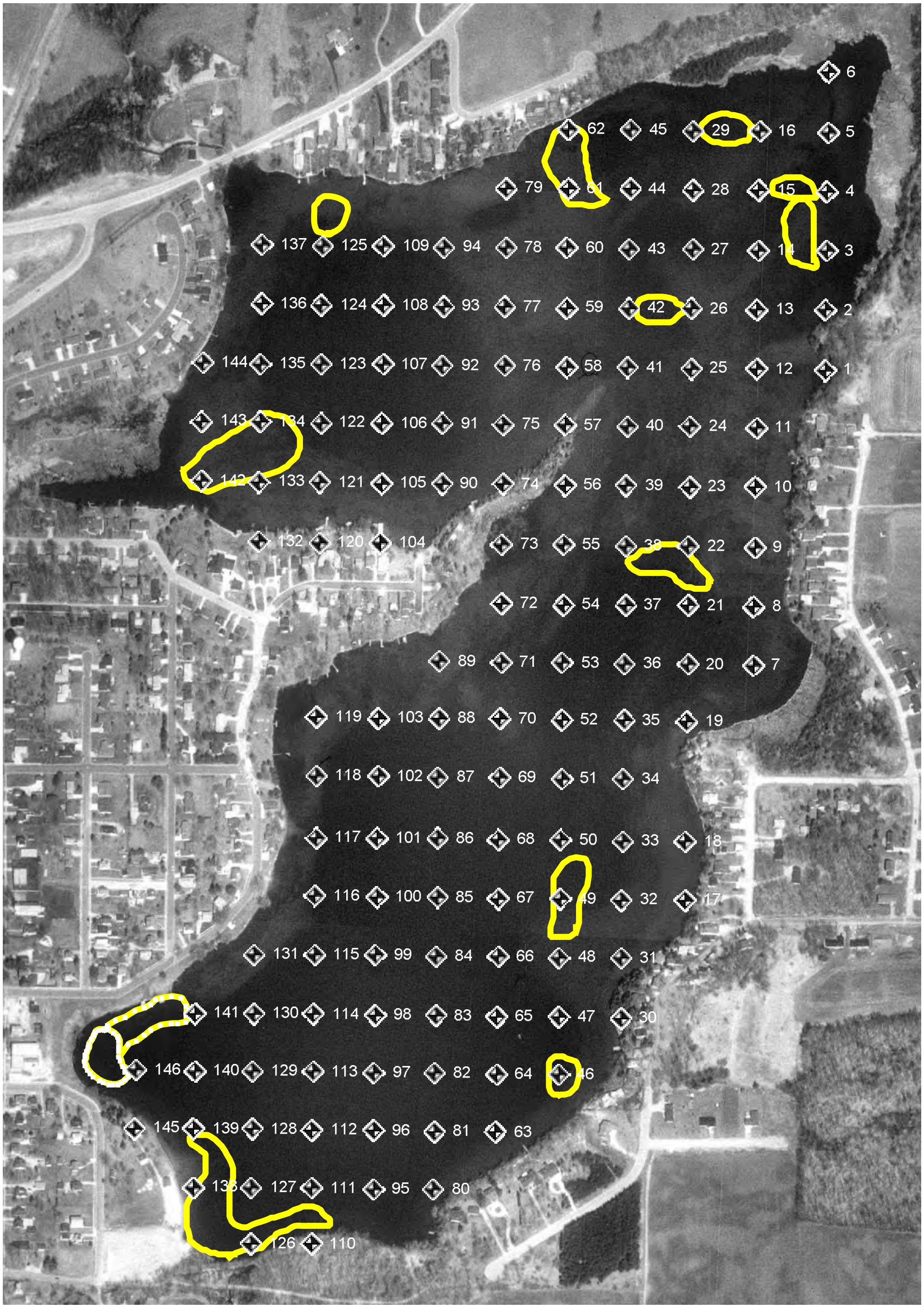
As Eurasian watermilfoil re-infested Random Lake, the Village used harvesting and 2-4,D chemical spot treatments to slow the return of Eurasian watermilfoil. Curly-leaf pondweed (*Potamogeton crispus*) increased significantly between 1999 and 2002. Long-term historical data on the aquatic plant community is not available. A second whole-lake treatment of Random Lake was conducted in 2005 using Sonar (active ingredient, fluridone). This survey is the third post-treatment survey following treatment.
The 2005 treatment was conducted in spring 2005 while the 1999 treatment was conducted in fall. It is not yet known if this will influence the results of the treatment.

RESULTS OF THE 2008 SURVEY

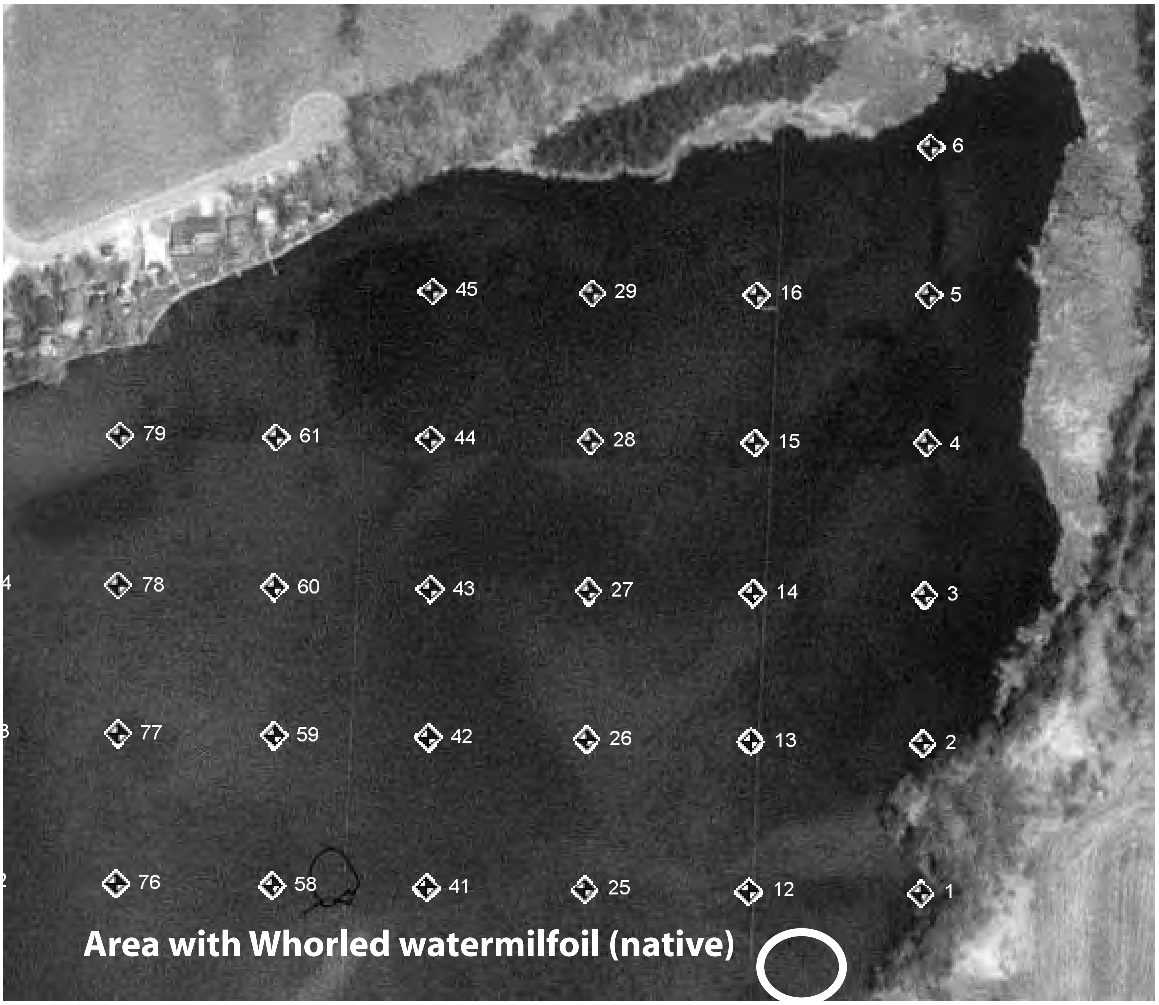
A total of 12 aquatic macrophytes were found during the survey in 2008, similar to that seen in 2006 and 2007 (Table 2). Eleven of the plants were found during the grid survey and one was found during the general survey. Wetland fringe species are not included in the list of species. It should be noted that large stands of bulrush are present in Random Lake. In 2008, the bulrushes were abundant and healthy.

The plants found in the lake in 2008 are listed in Table 2. Chara (*Chara* sp.), sago pondweed (*Stuckenia pectinata*), and spiny naiad (*Najas marina*) dominated the plant community, throughout the depths. Water lilies (*Nuphar* and *Nymphaea* sp.) were common in the shallow areas. Curly-leaf pondweed (*P. crispus*), an exotic species, was not found in 2008. Eurasian watermilfoil (*Myriophyllum spicatum*) was found throughout the lake in 2008 (Map 1). It should be expected that because of its distribution in the lake, Eurasian watermilfoil will continue its spread throughout the lake unless aggressive control measures are undertaken. A native milfoil, whorled watermilfoil (*Myriophyllum verticillatum*) was found in one area, on the Northeast side of the lake near the bulrushes (Map 2).

2008 was a very unusual year, with record rains in June and high water levels through July. High water levels and runoff that contributed to more suspended sediment, may have influenced the plant growth of various species throughout the region, including that on Random Lake.



Map 1 - Location of Re-Infestation of Eurasian Watermilfoil, July 2008



Map 2 - Location of Whorled Watermilfoil, 2008

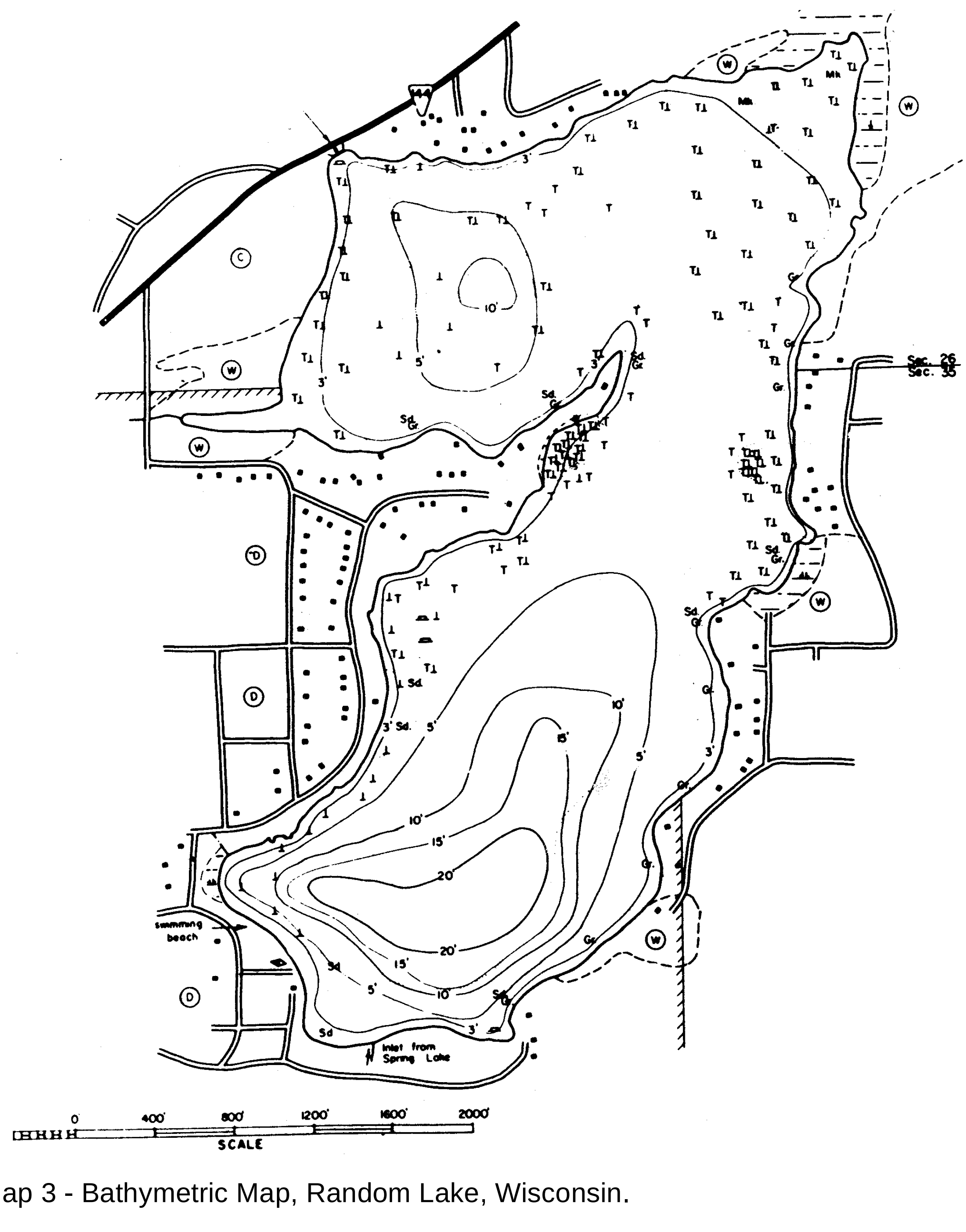
The results of the survey data for the July 2008 survey for all species at each sample depth are included at the end of this report.

The maximum rooting depth in 2008 was 13 feet. Sediments in Random Lake range from sand and gravel to muck. At 1.5 feet the substrate is primarily sand and gravel. At 15 feet the substrate is muck.

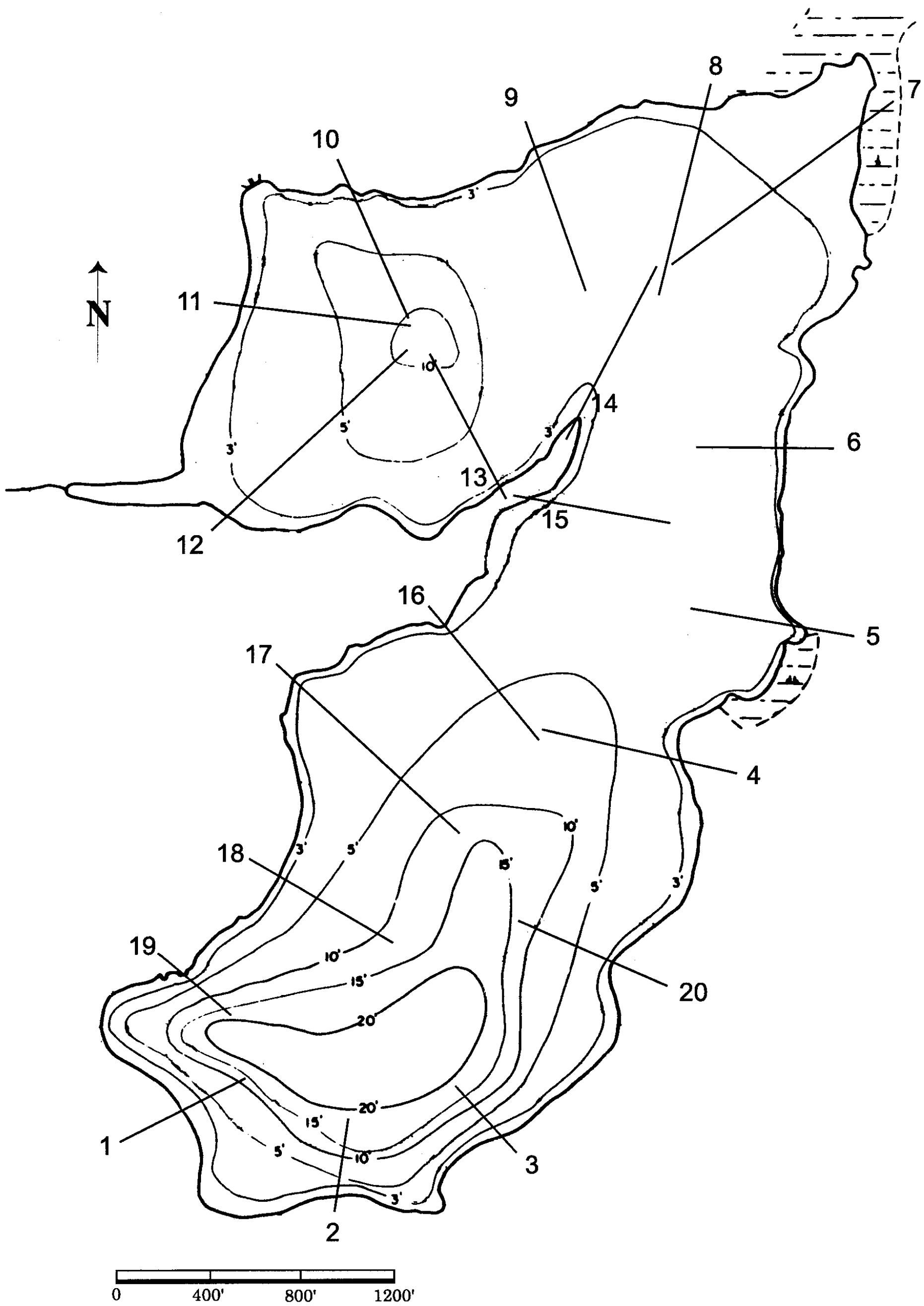
Table 1. Hydrographic and Morphometric Data Random Lake

Size of Lake	209 acres
Lake Volume	1279 acre feet
Length of Shoreline	3.6 miles
Maximum Depth	21 feet
Mean Depth	6 feet
Percent of area less than 3 feet deep	14%
Percent of area greater than 20 feet deep	4%

Source: WDNR

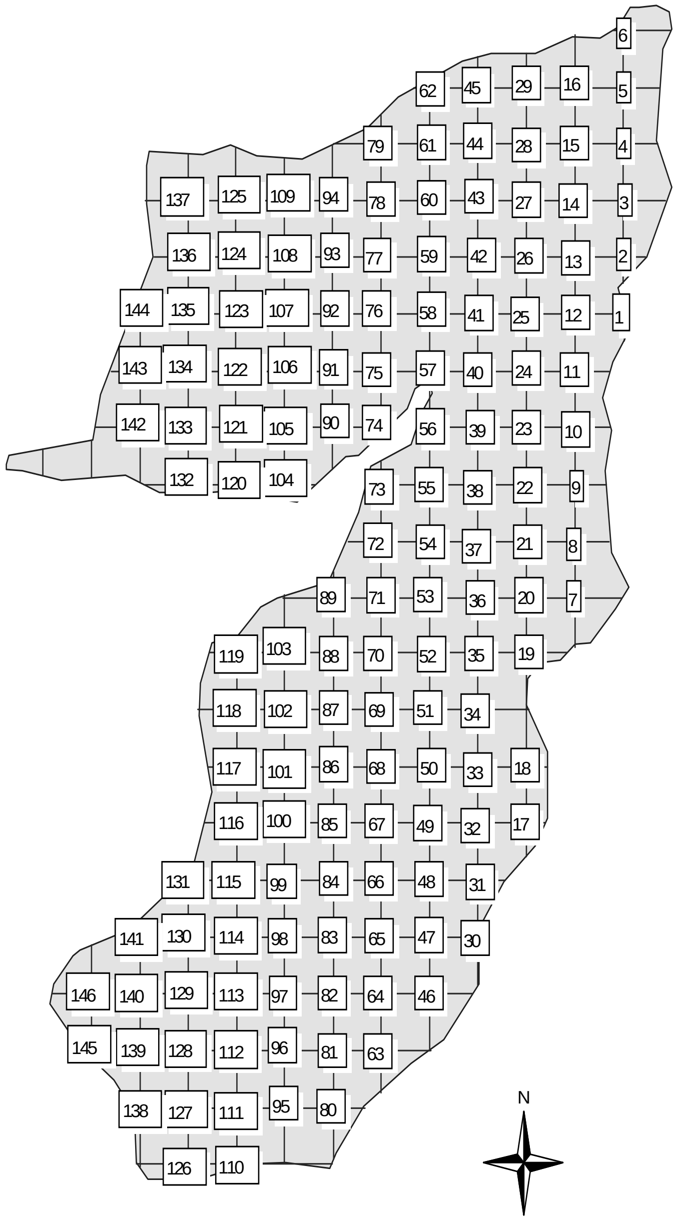


Map 3 - Bathymetric Map, Random Lake, Wisconsin.



Aron&Associates, 1999

Map 4 - Line Transect Survey Locations, Random Lake, Wisconsin, 1999.



Map 5 - Point Intercept Survey Sample Points on Random Lake, 2005-2008.

Table 2. Random Lake Aquatic Plant Species - 1999 to 2008

Species	% Frequency								
	1999[b]	2000	2001	2002	2004	2005[c]	2006	2007	2008
Chara sp.	34	57	43	49	50	64	50	56	53
Elodea canadensis				3	1				
Lemna minor						1[a]	X	X	
Myriophyllum spicatum	60	1[a]	9	69	8			X	5
Myriophyllum verticillatum							X	X	X
Najas flexilis	1		X	2	10		2	2	2
Najas marina	10			X	13		6	11	20
Nitella sp.						10			
Nuphar advena	5	5	6	7	4	3	1	X	2
Nymphaea sp.	5	5	0	4	2	10	5	1	1
Potamogeton crispus	1	4	19	25	1		7	6	
P. amplifolius			1	3	6		X	3	1
P. Illinoensis	14	18	17	34	8		X	1	9
P. foliosus				X	1				
P. natans	1	5	5	7	6	5	2	1	1
P. zosterformis	X		10	7	X				
Stuckenia pectinata	33	57	48	56	37	12	40	32	27
Utricularia vulgaris	1		2	3	9		1	4	8
Vallisneria americana				X	X				
Total Species	12	8	11	16	16	7	13	14	12

Notes: [a] Found in only one sample point.
[b] Fall 1999 whole lake treatment.
[c] Spring 2005 whole lake treatment.
X Found only in the general survey.

WATER QUALITY 2008

The water quality on Random Lake was monitored under the Self-Help Volunteer Monitoring Program. The volunteer, Wayne Stroessner, collected the samples following the Self-Help protocol. Complete results are provided in the appendix and are available on the WDNR website, http://dnr.wi.gov.

Random Lake is considered eutrophic, with decreased clarity, warm-water fisheries, oxygen-depleted bottom waters during summer, dense plant growth.

Table 3. Random Lake Water Quality Data Summary for 2008*

Sampling Date	Secchi (ft)	Total Phosphorus (mg/l)	DO at surface (mg/l)	Temp at surface (°F)	Chlorophyll A (ug/l)
5/09/08	4.25		6.8	60	
5/28/08	3.5		6.76	63	
6/18/08	3.25	33			5.43
7/21/08		17			.98
8/05/08	4		11.46	79	
8/13/08	3.75	22	12	74	9.55
8/21/08	4.25		11.06	74	
8/29/08	3.75		11.95	76	
9/06/08	4.25		9.29	70	
9/15/08	4.5		9.88	65	
9/22/08	5		11.6	70	
9/30/08	5.5				
10/11/08	6.25				

*Complete 2008 report is provided in the Appendix or are available at www.dnr.state.wi.us.

Table 4. Comparison of 2004 through 2008 Water Quality Data on Random Lake

Sampling Date	Average Secchi (ft)	Average Total Phosphorus (mg/l)	Average Chlorophyll A (ug/l)
2004	5.2	26.8	5.2
2005	4.9	21.6	7.3
2006	4.0	20.4	8.4
2007	3.89	24.5	9.5
2008	3.9	24	5.32

SUMMARY

The Village of Random Lake has conducted significant aquatic plant management activities over the years to keep Random Lake open to recreational use. As Eurasian watermilfoil expanded its range, the management efforts have not always been able to keep pace with the growth of the exotic plant. A demonstration chemical treatment was conducted using Sonar in October 1999. Since 2002, the Village has used a combination of harvesting and chemical treatment (using 2,4-D products) to control Eurasian watermilfoil. A second Sonar treatment was conducted in spring 2005.

An analysis of 2008 plant data from the 1999 through 2007 project shows a number of differences:

— The 2004 through 2008 surveys were done using point-intercept while earlier surveys were done using the line-transect method.

— Significant differences in frequency over the years are present. The reasons for the disparity are unclear. It could be simply the difference in sampling protocols used, or other factors could come into play, such as weather, treatments, etc. Actual reasons are most likely a combination of factors.

— There is significant difference in the lake’s response following the 2005 Sonar treatment to that following the 1999 Sonar treatment. The fall 1999 treatment, conducted at a higher rate, produced significant impact on native species immediately after treatment, but showed little impact long term as plants species increased 4 years post-traetment.

— The Eurasian watermilfoil treatment in 1999 was not 100% successful, but the spring 2005 treatment appeared to be.

— The spring 2005 treatment was done at a much lower rate yet the impact on natives, the season of treatment was significant.

- The number of plant species has returned to the pre-1999 treatment levels, but not the pre-2005 treatment level. Whether that will result in long term impacts is unknown. The timing of the treatment may have been a factor in this difference. The native plants may already have started their seasonal growth when the May 5, 2005 treatment was conducted.
- Fewer native plant species were found in 2008 than were found in 2005 survey following the whole-lake treatment.
- Water clarity continues to be poor with a low of 3.25 feet and a high of 6.25 feet in 2008.
- Random Lake stratifies during the summer months, with the bottom waters, usually those below 14-15 feet, being anoxic (devoid of oxygen).
- Eurasian watermilfoil has re-entered the lake even though spot treatments were conducted in 2007 and 2008. Fragments were found throughout the lake during the survey, and were reported frequently by the volunteer monitor.
- After the fall 1999 treatment, there was a significant amount of Eurasian watermilfoil back in the lake in 2002, while after the spring 2005 treatment Eurasian watermilfoil was just beginning to spread throughout the lake in 2008.
- The Village should aggressively locate and chemically treat Eurasian watermilfoil early in the season, as early as May 1 to May 15. This would allow control while the plant biomass is low and before susceptible native species such as bladderwort begin to grow. The treatment should be done as soon as the plants are showing signs of active growth. The treatment should cover the areas identified in 2008 and any other areas where Eurasian watermilfoil was found by the end of 2008. The North end of the lake and the public boat launch and beach should be thoroughly checked and treated.

DEFINITION OF A PROJECT'S SUCCESS

How one perceives whether or not a project is successful depends upon one's perspective. A skier or swimmer may not like aquatic plants to the surface and will deem an eradication successful. An angler may consider any plant beneficial and will deem a Eurasian watermilfoil eradication of Eurasian watermilfoil a failure.

On Potters Lake, an early whole-lake treatment for Eurasian watemilfoil was considered by WDNR to be unsuccessful because the number of plant species failed to increase post-treatment. What was unknown going in to the project was whether there was ever much diversity in the lake that might rebound. The community considered the treatment a huge success because recreational opportunities improved, plant debris declined and the community saved ten's of thousands of dollars in plant management funds which they used to fund wetland acquisitions.

Going into this multi-year project on Random Lake, much discussion took place on how to better define success. WDNR set forth the following criteria to use to evaluate the success. These criteria are all based on the lake resource, and not on the communities quality-of-life considerations.

WDNR Criteria for Success

1 *There shall be a reduction in the Eurasian watermilfoil frequency and/or density from pretreatment survey conditions until August 2007.*

2 *There shall be no net reductions (+/-20%) in the frequency and or density of the native plant community, with the exception of Elodea sp. and Najas sp.*

3 *There shall be no documented overall negative impacts to the fish population or other aquatic organisms either directly or indirectly related to the use of herbicides in the lake.*

4 *There shall be no reductions (+/-20%) in water quality trends throughout the study.*

Evaluation of the criteria

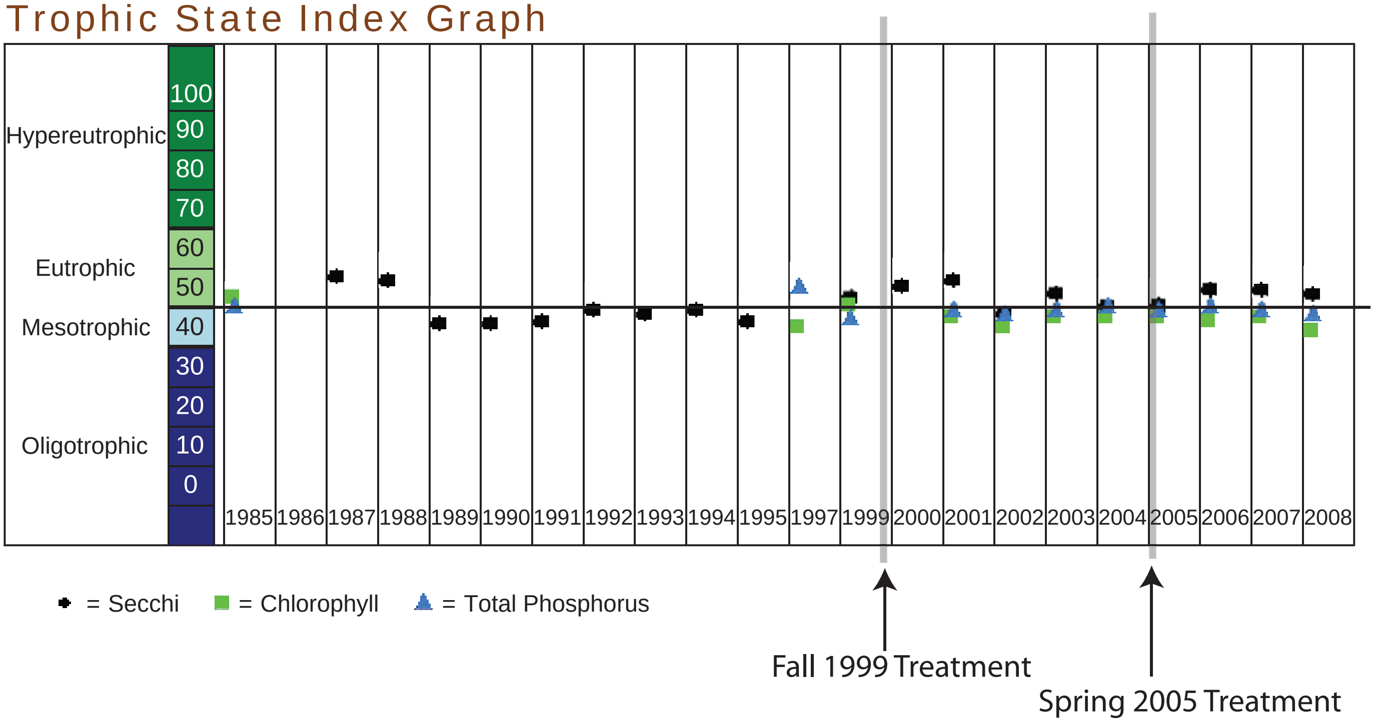
1. Eurasian watermilfoil has dropped post treatment regardless of which year starting point is used (Table 2).
2. Using number of native species (16), minus Elodea and Najas (2), in 2004 as a starting point (14), means up to a shift of +/-2.8 species is allowable. In 2006, and 2007 there were 13 and 14 species respectively. In 2008, there were 12 species, for a drop of 15%.
3. There were no documented overall negative impacts to the fish or other aquatic organisms reported.
4. Two of the water quality parameters, total phosphorus and Chlorophyll A improved or remained the same post treatment. Water clarity, measured by a Secchi disk, dropped from 5.2 to 3.9 feet, approximately 25% reduction. Graph 1 shows the Trophic State Index for Random Lake from 1985 through 2008

Determination

Based on all four criteria, the project met or exceeded the expectations in all but a single portion of one criteria, the secchi disk measurements. This project has been successful in reducing the significant problems caused by Eurasian watermilfoil in Random Lake.

The DNR permit (which includes the evaluation criteria), the aquatic plant data, and the water quality report for 2008, are included in the Appendix.

Trophic State Index Graph



Graph 1 - Trophic State Index, Random Lake, 1985 through 2008.

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.

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.

WISCONSIN DEPT. OF NATURAL RESOURCES

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

Jim Doyle, Governor
Scott Hassett, Secretary
Gloria L. McCutcheon, Regional Director

Plymouth Service Center
1155 Pilgrim Road
Plymouth, WI 53073
Telephone 920-892-8756
FAX 920-892-6638

April 28, 2005

Bob McDermott – Village President
Village of Random Lake
96 Russell Drive
Random Lake, WI 53075

Subject: 2005 Random Lake Whole-Lake Treatment Amendment

Dear Mr. McDermott:

Per your request, here is the permit amendment for chemical aquatic plant control on 209 acres in Random Lake in the Town of Sherman, Sheboygan County. The permit has been approved with a few conditions. <u>This permit is valid from April 28, 2005 to December 31, 2008.</u>

The permit conditions that you requested an amendment for were conditions 2, 5, 6, 7, 8, and 9. The Department has amended permit conditions 6, 7, and 8.

Condition 2 references our authority through Wis. Admin. Code NR 107 and remains the same. Condition 5 and 9 also remain the same because these are included in the overall goals of the project. Condition 6 has been changed to remove any responsibility by the Village for restocking of aquatic native plants negatively impacted by the treatment and states that there shall be no net reductions in the frequency and/or density of the native plant community (+/- 20%), with the exception of *Najas* sp. and *Elodea* sp. because of the documented impacts to these two species at the proposed treatment dosage. The original condition 7 has been omitted and the original permit condition 8 has been changed to state there shall be no documented overall negative impacts to fish and other aquatic organisms.

Due to the deletion of permit condition 7 from the original permit, original permit conditions 8 through 14 have been changed to permit conditions 7 through 13.

During the optional written comment period to request a public information meeting, the Department did not receive any letters or phone calls concerning the proposed treatment.

Attached is a copy of your permit amendment, which lists the conditions that must be followed. In addition, I have included a copy of our findings of fact, conclusions of law and your rights to appeal our action. A copy of the permit amendment must be kept and be present on site during the application. Please read your permit conditions carefully so that you are fully aware of what is expected of you.

Your next step will be to notify me of the date on which you plan to perform the application; NR 107.07(1) states that the permit holder shall notify the Department four working days in advance of the anticipated treatment.

It is not necessary to mail this amended version of the permit to Village residents because overall changes were relatively minor. If you have any questions about your permit, please call me at (920) 892-8756.

Sincerely,

John Masterson

John Masterson
Water Quality Biologist

STATE OF WISCONSIN
DEPARTMENT OF NATURAL RESOURCES

The Village of Random Lake is hereby granted under Section 281.17(2) Wisconsin Statutes and Administrative Code NR107, a permit to conduct an herbicide application in Random Lake, Town of Sherman, Sheboygan County, Section 26 and 35, Township 13 North, Range 21 East, subject to the following conditions:

PERMIT CONDITIONS

1. The Village must follow all aspects of the department approved plan for the project and the grant agreement for Lake Protection Grant #ALPT-003-04.

2. DNR oversight and approval will be required for any herbicide treatments through the year 2008.

3. Conditions of this permit are stated in Wisconsin Administrative Code NR 107.08. These conditions must be followed.

4. You must notify Water Quality Biologist, John Masterson, 1155 Pilgrim Road, Plymouth, WI 57073, Phone (920) 892-8756, 4 working days prior to anticipated treatment date to schedule supervision.

5. There shall be a reduction in the Eurasian Water Milfoil (EWM) frequency and/or density from pretreatment survey conditions until August 2007.

6. There shall be no net reductions (+/- 20%) in the frequency and/or density of the native plant community, with the exception of *Elodea* sp. and *Najas* sp. These two species may be susceptible to Fluridone at a treatment dosage of six (6) parts per billion.

7. There shall be no documented overall negative impacts to the fish population or other aquatic organisms either directly or indirectly related to the use of herbicides in the lake.

8. There shall be no reductions (+/- 20 %) in water quality trends throughout the study.

9. Posting signs shall be provided at the public boat launch, which will include a map of the treatment area. Posting requirements listed in NR 107 must also be followed.

10. A copy of this decision and the enclosed permit must be provided to riparian property owners in the treatment area before the treatment may occur. The Department also requires the District to have several copies of the decision and enclosed permit available for public inspection.

11. This permit includes the authorization to treat with the selective herbicides Fluridone (Trade name: Sonar A.S.) and 2,4-D (Trade names: Weedar 64 and/or Navigate). The initial 6 ppb whole-lake treatment with Fluridone to reduce EWM may follow with a second whole-lake treatment to bump the concentration back up to 6 ppb to accomplish the required concentration time for Fluridone effectiveness. The second "bump" treatment concentration and timing will be based on the FasTEST results, which will be taken 3, 15, 30, 45, 60, and 75 days post-treatment. 2,4-D spot treatments are authorized during 2006, 2007, and 2008 to maintain a reduction in EWM.

12. All herbicide treatments shall be performed in a manner consistent with the product label; Wis. Admin. Code NR 107; the department approved project plan; and this permit.

13. All aspects of the year-end reports and the overall project final report are the sole responsibility of the Village of Random Lake.

FINDINGS OF FACT (Facts which were considered in making this decision.)

1. The Village of Random Lake has filed an application for a permit to conduct an herbicide application in the Town of Sherman, Sheboygan County, in Sections 26 and 35, Township 13 North, Range 21 East. This permit application specifically addresses the herbicide applications to 209 acres on Random Lake.

2. The proposed chemical to be used, Fluridone (Sonar A.S.) and 2,4-D (Weedar 64 and Navigate) are registered for aquatic use by the United States Environmental Protection Agency and both labeled and registered by a firm licensed as a pesticide manufacturer and labeler with the Wisconsin Department of Agriculture, Trade and Consumer Protection.

3. The chemicals Fluridone and 2,4-D does have current Department aquatic chemical fact sheets.

4. The Department has determined the proposed treatment will provide selective relief of Eurasian Water Milfoil and will not place unreasonable restrictions on existing water uses.

5. The Department relies on the Environmental Protection Agency and the Department of Agriculture Trade and Consumer Protection to register these chemical products for aquatic use. The Environmental Protection Agency (EPA) has determined that "no unreasonable adverse effects" will occur as a result of using Fluridone and 2,4-D according to label instructions. "Unreasonable" in the EPA definition means the risk of using a pesticide exceeds the benefits. The selectivity of Fluridone and 2,4-D to control Eurasian Water Milfoil and not harm native aquatic plants is considered to be important to the Department. Diverse native aquatic plant habitats are preferred to mono-typical stands of Eurasian Water Milfoil. Native stands of aquatic plants tend not to grow to nuisance levels and provide better more diverse habitats for a number of aquatic species including fish, invertebrates, waterfowl, and amphibians.

6. The Department has determined that there will be no significant adverse effects resulting from the treatment of Random Lake.

7. The Department chooses to waive the restriction on treating 150 feet from shore. This code requirement is being waived due to the objective of this project, which is to selectively control Eurasian Water Milfoil on a whole lake scale. An aquatic plant species shift from EWM to one dominated by native aquatic plants is considered beneficial for the Random Lakes ecosystem.

8. The Department has determined that there will be no significant injuries to fish, fish eggs, fish larvae, essential fish food organisms or wildlife, either directly or through habitat destruction in the proposed treatment area. The Eurasian Water Milfoil now present in Random Lake is considered poor habitat for most fish when in a canopy growth condition. Canopy growth can create conditions, which are unfavorable for fish predation and respiration.

9. The Department has determined that there are no known populations of endangered or threatened species that will be affected by the Fluridone and 2,4-D applications in Random Lake.

10. The Department has determined that the Fluridone application will occur in a designated sensitive area. The sensitive area designations on Random Lake include a provision in the management plan for chemical treatment when targeting Eurasian Water Milfoil.

<u>CONCLUSIONS OF LAW</u> (These are the legal reasons why the Department can make these decisions)

1. The Department has authority under the above indicated Statutes and Administrative Codes, to issue a permit for the use of aquatic herbicides in this area.

<u>NOTICE OF APPEAL RIGHTS</u>

If you believe that you have a right to challenge this decision, you should know that Wisconsin Statutes and Wisconsin Administrative Code establish time periods within which requests to review Department decisions must be filed.

For judicial review of a decision pursuant to ss. 227.52 and 227.53, Wis Stats., you have 30 days after the decision is mailed or otherwise served by the Department, to serve a petition within the appropriate circuit court and serve the petition on the Department. Such a petition for judicial review shall name the Department of Natural Resources as the respondent.

To request a contested case hearing pursuant to Section 227.42, Wisconsin Statutes, you have 30 days after the decision is mailed or otherwise served by the Department, to serve a petition for hearing on the Secretary of the Department of Natural Resources. The filing of a request for a contested case hearing is not a prerequisite for judicial review and does not extend the 30-day period for filing a petition for judicial review. This notice is provided pursuant to Section 227.48(2), Wisconsin Statutes.

Dated at Plymouth, Wisconsin on <u>April 28, 2005</u>

STATE OF WISCONSIN DEPARTMENT OF NATURAL RESOURCES
For the Secretary

By John Masterson
John Masterson
Water Quality Biologist

cc: Vic Pappas – Sheboygan Basin Water Team Leader
John Nelson – Senior Fish Biologist
Warden Mike Clutter
Random Lake Association
Marine Biochemists
Aron & Associates

State of Wisconsin
Department of Natural Resources
Aquatic Plant Manager

PERMIT APPLICATION FOR CHEMICAL AQUATIC PLANT CONTROL

Form 3200-4 Rev. 3-99

DNR USE ONLY
ID Number
County Code
Waterbody Number

NOTE: Use of this form is required by the Department for any application filed pursuant to s. 281.17(2), Wis. Stats., and Chapter NR 107, Wis. Adm. Code. The Department will not consider your application unless you complete and submit this application form. Personally identifiable information requested on this form is not likely to be used for purposes other than that for which it is originally being collected.

SECTION I, APPLICANT DATA

Name of Permit Applicant. (Also indicate names and addresses of all individuals, associations, communities or town sanitary districts sponsoring treatment. Attach additional sheets if necessary.)

HOME ADDRESS

Name: Village of Random Lake
PO Box 344 Fire Number:
City, State, Zip Code: Random Lake WI 53075
Telephone Number (include area code) Home: Business: 920 994-4852

LAKE ADDRESS

Name: Same
Street or Route: Fire Number:
City, State, Zip Code:
Telephone Number (include area code) Home: Business:

SECTION II, LOCATION OF AQUATIC PLANT CONTROL

Waterbody To Be Treated (waterbody where treatment area is located): Random Lake

Lake Surface Area: 209 acres

Estimated Surface Area That Is 10 Feet or Less in Depth: ~150 acres

County: SHEBOYGAN

Town 13 Range 21 E Section S 26

Names of Adjacent Riparian Property Owners (use additional sheet if necessary)
1. SEE ATTACHED
2.
3.

Name of Applicator or Firm: Marine Biochem

Street or Route: 6316 W. Eastwood Ct

City, State, Zip Code: MeQuon WI 53092

Telephone Number (include area code) Home: Business: 262 238 0406

Name of Lake Property Owners' Association Representative or Lake District Representative (if none, please indicate): Bob McDermott

Applicator Certification Number for Category 5, Aquatic Pesticide Application: 001517

Business Location License Number (if applicable): 93-001282-001282

Restricted Use Pesticide License Number (if applicable):

DNR USE ONLY	
Date Verified w/DATCP	
Certification Expiration	
Date Verified w/DATCP	
Expiration Date	
Date Verified w/DATCP	
Expiration Date	

Area(s) Proposed for Control (Note details in permit cover letter for final permitted sizes of treatment areas.)
Whole Lake

A. Shoreline Length ______ ft. X Distance From Shore ______ ft. ÷ 43,560 ft. = ______ Estimated Acreage. Average Depth ____ ft.

B. Shoreline Length ______ ft. X Distance From Shore ______ ft. ÷ 43,560 ft. = ______ Estimated Acreage. Average Depth ____ ft.

C. Shoreline Length ______ ft. X Distance From Shore ______ ft. ÷ 43,560 ft. = ______ Estimated Acreage. Average Depth ____ ft.

D. Shoreline Length ______ ft. X Distance From Shore ______ ft. ÷ 43,560 ft. = ______ Estimated Acreage. Average Depth ____ ft.

E. Shoreline Length ______ ft. X Distance From Shore ______ ft. ÷ 43,560 ft. = ______ Estimated Acreage. Average Depth ____ ft.

Total Estimated Acreage 209

If the estimated acreage is greater than 10 acres, or is greater than 10 percent of the estimated area 10 feet or less in depth in Section II, please complete and attach Form 3200-4A, Large-Scale Treatment Worksheet. Private pond treatments are exempted from this requirement.

Is this area within or adjacent to a sensitive area designated by the Department of Natural Resources?
☒ Yes ☐ No

SECTION IV, REASONS FOR AQUATIC PLANT CONTROL

Purpose of Aquatic Plant Control

- [x] 1. Reduce nuisance algae accumulation
  Filamentous
- [ ] 2. Maintain navigational channel for common use
- [ ] 3. Maintain private access for boating
- [ ] 4. Maintain private access for fishing
- [ ] 5. Improve swimming
- [ ] 6. Control of purple loosestrife
- [x] 7. Other: Eliminate EWM
  Reduce Curly-Leaf

Nuisance Caused By

- [x] 1. Algae
- [ ] 2. Emergent water plants (majority of leaves and stems growing above water surface, e.g. cattails, bulrushes)
- [ ] 3. Floating water plants (majority of leaves floating on water surface, e.g., waterlilies, duckweed)
- [x] 4. Submerged water plants (leaves and stems below ~~water surface~~, flowering parts may be exposed, e.g., milfoil, coontail)
- [ ] 5. Other: __________

Name of Plants, if known

Filamentous Algae
Eurasian Watermilfoil

NOTE: Different plants require different chemicals for effective treatment. Do not purchase chemical before identifying plants.

SECTION V, CHEMICAL CONTROL – See Project Plan attached

Alternatives to Chemical Control	Feasible?	If No, Why Not?
Mechanical harvesting	☐ Yes ☐ No	
Hand pulling	☐ Yes ☒ No	too widespread
Hand raking	☐ Yes ☒ No	" " "
Hand cutting	☐ Yes ☒ No	not appropriate Control
Sediment screens/covers	☐ Yes ☒ No	too widespread
Dredging	☐ Yes ☒ No	not appropriate
Lake drawdown	☐ Yes ☒ No	" "
Nutrient controls in watershed	☐ Yes ☒ No	not effective
Other:	☐ Yes ☐ No	

NOTE: If proposed treatment involves multiple properties, please consider feasibility of EACH alternative for EACH property owner. If you checked yes to any of the alternatives listed above, please explain your decision to use chemical controls:

Trade Name of Proposed Chemical(s)

Sonar AS (2) Weedar 64 (4) Cutrine Plus (3) Navigate (5) Cleargate

Method of Application

(1) Sub surface injection (2)(3) Sprayer (4)(5) Sprayer

Which Chemicals or Other Control Options Have Been Tried Before On The Proposed Site, and What Were the Results?

Sonar – Effective – see treatment plan & 2004 Report

NOTE: Chemical fact sheets for aquatic pesticides used in Wisconsin are available from the Department of Natural Resources upon request.

SECTION III. FEES

1. s. NR 107.11(1), Wis. Adm. Code, lists the conditions under which the permit fee is limited to the $20 minimum charge.
2. s. NR 107.11(4), Wis. Adm. Code, lists the uses that are exempt from permit requirements.
3. s. NR 107.04(2), Wis. Adm. Code, provides for a refund of acreage fees if the permit is denied or if no treatment occurs.
4. Fee calculations:

Basic Permit Fee (non-refundable)	$ 20.00
If proposed treatment is over 0.25 acre, calculate acreage fee: (round up to nearest whole acre, to maximum of 50 acres.) 209 acres X $25 per acre = $ 1250	
If proposed treatment is ≤ 0.25 acre, acreage fee is $0. Enter Acreage Fee (from above)	1250
Total Fee Enclosed	$ 1270

Please include a sketch and/or a printed map of lake indicating area and dimensions of each individual area where plant control is desired. Also show location of property owners riparian to and adjacent to the treatment area. You may use the space below to sketch a map. Attach a separate list of owners and corresponding treatment dimensions coded to the lake map, if necessary.

N

See attached

SECTION VI, APPLICANT'S RESPONSIBILITIES

1. The applicant has prepared a detailed map which shows the length, width and average depth of each area proposed for the control of rooted vegetation and the surface area in acres or square feet for each proposed algae treatment.

2. The applicant understands that the Department of Natural Resources may require supervision of any aquatic plant management project involving chemicals. Under s. NR 107.07, Wis. Adm. Code, supervision may include inspection of the proposed treatment area, chemicals and application equipment before, during or after treatment. The applicant is required to notify the regional office 4 working days in advance of each anticipated treatment with the date, time, location and size of treatment unless the Department waives this requirement. Do you request the Department to waive the advance notification requirement? ☐ Yes ☒ No

3. The applicant agrees to comply with all terms or conditions of this permit, if issued, as well as all provisions of Chapter NR 107, Wis. Adm. Code. The required application fee is attached.

4. The applicant has provided a copy of the current application to any affected property owners' association, inland lake district and, in the case of chemical applications for rooted aquatic plants, to all owners of property riparian or adjacent to the treatment area. The applicant has also provided a copy of the current chemical fact sheet for the chemicals proposed for use to any affected property owner's association or inland lake district.

I hereby certify that the above information is true and correct and that copies of this application have been provided to the appropriate parties named in Section II and that the conditions of the permit and pesticide use will be adhered to.

X Robert J McDermott — Applicant's Signature

X 2-11-05 — Date Signed

All portions of this permit, map and accompanying cover letter must be in possession of the chemical applicator at time of treatment. During treatment all provisions of Chapter NR 107, specifically ss. NR 107.07 and NR 107.08, Wis. Adm. Code, must be complied with, as well as the specific conditions contained in the permit cover letter.

SECTION VII, PERMIT TO CARRY OUT CHEMICAL TREATMENT (LEAVE BLANK-DNR USE ONLY)

The foregoing application is approved. Permission is hereby granted to the applicant to chemically treat the waters described in the application during the season of 2005.

Application fee received? ☒ Yes ☐ No

Advance notification of treatment required? ☒ Yes ☐ No

State of Wisconsin
Department of Natural Resources
For the Secretary

By John Masterson
Regional Director or Designee

4/4/05 — Date Signed

4/4/05 — Date Mailed

Please NOTE:

If you believe that you have a right to challenge this decision, you should know that Wisconsin statutes and administrative rules establish time periods within which requests to review Department decisions must be filed.

For judicial review of a decision pursuant to ss. 227.52 and 227.53, Wis. Stats., you have 30 days after the decision is mailed or otherwise served by the Department, to file your petition with the appropriate circuit court and serve the petition on the Department. Such a petition for judicial review shall name the Department of Natural Resources as the respondent.

To request a contested case hearing pursuant to s. 227.42, Wis. Stats., you have 30 days after the decision is mailed, or otherwise served by the Department, to serve a petition for hearing on the Secretary of the Department of Natural Resources. The filing of a request for a contested case hearing is not a prerequisite for judicial review and does not extend the 30-day period for filing a petition for judicial review.

This notice is provided pursuant to s. 227.48(2), Wis. Stats.

County of Sheboygan
STATE OF WISCONSIN } ss.

Gary J. Feider, being duly sworn on oath deposes and says that he is the general manager of The Sounder, a weekly newspaper published in the Village of Random Lake, Sheboygan County, Wisconsin, and that a notice, of which the annexed is a printed copy, taken from said paper, has been published in said newspaper on the following dates:

March 10, 2005

Gary Feider

Subscribed and sworn to before me this 10th

day of March, 2005

Rita Horstmeier

Notary Public, Sheboygan County, Wis.
My commission expires February 22, 2009.

NOTICE OF APPLICATION FOR AQUATIC PLANT MANAGEMENT PERMIT

The Village of Random Lake intends to apply for a permit from the WDNR to treat up to 209 acres (entire lake) on Random Lake with aquatic pesticides. The treatment(s) will take place between April 1, 2005 and October 15, 2005.

The Village will conduct a public informational meeting on the proposed treatment if five or more individuals, organizations, units of government request one. The meeting will give citizens a chance to learn more about the proposed treatment.

Any request for a public meeting on this proposed treatment must be made within five days of this published notice. The request must specify the topics to be discussed, including problems and alternatives, and must be sent in writing to the Village of Random Lake, P.O. Box 344, Random Lake, WI 53075, and copied to John Masterson, DNR, P.O. Box 408, Plymouth, WI 53073.

This notice is required by NR 107, Wisc. Admin. Code.

(Published March 10, 2005)

RANDOM LAKE AQUATIC PLANT SURVEY - 2008

Plants

Transect #	Depth	CHARA	NITELA	MYRSP	STUPE	POTFO	NAJFL	NAJMA	NUPHAR	NYMPH	POTIL	POTAM	POTGR	POTNA	UTRIVU	POTCR	LEMNA	ELOCA	MYRVE
1	1	3			1			v	v			v							
2	ON LAND																		
3	3.5			v															
4	3	1		v	2			1			1				1				
5	1.5			v															
6	ON LAND																		
7	2.75	1			1		v	1				1							
8	3	3			v						1								
9	3	3									1								
10	2.75	3			1				v	v									
11	2.75				2						v				v				
12	4	2			v						1				v				v
13	3.5	3			v						1								
14	4.5	3		v	v					v					1				
15	4	2		v	2			1		v	1				1				
16	4	3			v														
17	ON LAND																		
18	2.5																		
19	2	1									2								
20	5																		
21	5	2						1							1				
22	4.75	3		v															
23	5	3													1				
24	4.75	3																	
25	5	2																	
26	5.5			v				1											
27	5														1				
28	5	1							2										
29	4	3			v				v	v					1				
30	ON LAND																		
31	4	3																	
32	6.5																		
33	6.5	3			1														
34	6	3																	
35	5	1																	
36	6	3																	
37	6	3			v														
38	5.25	3			v														
39	5	3													1				
40	5.25	2			1														
41	5.5	3																	
42	7			v															
43	6				2			1											
44	5	1		2	1														
45	3	2		1				1							v				
46	7			2							1								

Transect #	Depth	CHARA	NITELA	MYRSP	STUPE	POTFO	NAJFL	NAJMA	NUPHAR	NYMPH	POTIL	POTAM	POTGR	POTNA	UTRIVU	POTCR	LEMNA	ELOCA	MYRVE
47	9.5	2			1														
48	6.5	3																	
49	8.25	2		1															
50	10.75																		
51	9.25																		
52	8				1														
53	7	3			1														
54	5	3			v														
55	5	1					1				2								
56	ON LAND																		
57	ON LAND																		
58	6	3																	
59	6	3			1														
60	6	2						1											
61	5			v	1		1												
62	3.5	1			1														
63	8.5																		
64	19.25																		
65	18.25																		
66	16.25																		
67	15.75																		
68	13.5																		
69	8.75																		
70	5	1						1											
71	5.25	3																	
72	4	3			v						v								
73	1.5	3			1				1										
74	ON LAND																		
75	5.25	3																	
76	5.5	1			1														
77	5	1			2														
78	5.5	1																	
79	4																		
80	5.5	1			1			1			1	v							
81	19.25																		
82	20.5																		
83	17.75																		
84	14.75																		
85	13.25																		
86	11																		
87	9	1						1											
88	6.25	1																	
89	4	2			1														
90	5.5				1			1											
91	14.75																		
92	14.25																		
93	7																		
94	4																		
95	12.5										1								
96	20.25																		

Transect #	Depth	CHARA	NITELA	MYRSP	STUPE	POTFO	NAJFL	NAJMA	NUPHAR	NYMPH	POTIL	POTAM	POTGR	POTNA	UTRIVU	POTCR	LEMNA	ELOCA	MYRVE
97	19.5																		
98	13.25																		
99	10.25																		
100	11.25																		
101	11																		
102	8.75	2																	
103	5							1											
104	ON LAND																		
105	5.5							1											
106	13.25																		
107	17.75																		
108	11.5																		
109	6.5				1														
110	ON LAND																		
111	9.25	1																	
112	20																		
113	19.75																		
114	13																		
115	9	1			v														
116	6	3																	
117	5.75	v			1			1	v										
118	5	3			2			1											
119	3.75				1				v						1				
120	ON LAND																		
121	5.25				1			2											
122	7.5			3				1											
123	8				2			2											
124	8				2			2							1				
125	6	3		v															
126	6			1					v										
127	9			v	1						1								
128	19.25																		
129	19.5																		
130	12.25	1																	
131	4.5	1					1												
132	ON LAND																		
133	4	3								1				v					
134	4.5	1						1											
135	5	1			1			1											
136	5	2			1			1		v	v								
137	3	1			v			1	v	v									
138	3.25																		
139	9.5																		
140	19																		
141	6.5	2			1			1		v	v								
142	3.5	3		v	1				v	v				2					
143	3.25	1			1														
144	1.5	3						1				v							
145	ON LAND																		
146	9				1														

Transect #	Depth	CHARA	NITELA	MYRSP	STUPE	POTFO	NAJFL	NAJMA	NUPHAR	NYMPH	POTIL	POTAM	POTGR	POTNA	UTRIVU	POTCR	LEMNA	ELOCA	MYRVE

Total Sample Sites (146 - 12 on land) = 134 Note: because of high water, sample point 1 was accessible with plants.
Sample Sites w/ No Plants 38

	CHARA	NITELLA	MYRSP	STUPE	POTFO	NAJFL	NAJMA	NUPHAR	NYMPH	POTIL	POTAM	POTGR	POTNA	UTRIVU	POTCR	LEMNA	ELOCA	MYRVE
Sites found(Frequency)	70	0	6	36	0	3	26	2	1	12	1	0	1	10	0	0	0	0
% Frequency	52.63	0.00	4.51	27.07	0.00	2.26	19.55	1.50	0.75	9.02	0.75	0.00	0.75	7.52	0.00	0.00	0.00	0.00
Density (Max = 3) at sites found	2.11	#DIV/0!	1.67	1.19	#DIV/0!	1.00	1.12	1.50	1.00	1.17	1.00	#DIV/0!	2.00	1.00	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Relative Density (Max = 3) /hole Lake	1.11	0.00	0.08	0.32	0.00	0.02	0.22	0.02	0.01	0.11	0.01	0.00	0.02	0.08	0.00	0.00	0.00	0.00
Found visually in vicinty			12	12		1	1	7	8	4	2		2	3				1

Lake Water Quality 2008 Annual Report

Random Lake
Sheboygan County
Waterbody ID Number: 30300

Lake Type: DRAINAGE
DNR Region: SE
GEO Region: SW

Site Name	Station ID
Random Lake - Deep Hole	603312

Date	SD (feet)	SD (meters)	Hit Bottom?	CHL	TP	TSI (SD)	TSI (Chl)	TSI (TP)	Lake Level	Staff Gauge	Clarity	Color	Perception
05/09/2008	4.25	1.3	NO			56			HIGH	0.27	MURKY	GREEN	2-Very minor aesthetic problems
05/28/2008	3.5	1.1	NO			59			HIGH	0.17	MURKY	GREEN	2-Very minor aesthetic problems
06/18/2008				5.43	33		48	55					
07/21/2008				.98	17		35	50					
08/05/2008	4	1.2	NO			57			HIGH	.44	MURKY	BROWN	2-Very minor aesthetic problems
08/13/2008	3.75	1.1	NO	9.55	22	58	52	52	NORMAL	.15	MURKY	GREEN	2-Very minor aesthetic problems
08/21/2008	4.25	1.3	NO			56			NORMAL	.1	MURKY	GREEN	2-Very minor aesthetic problems
08/29/2008	3.75	1.1	NO			58			NORMAL	.1	MURKY	GREEN	2-Very minor aesthetic problems
09/06/2008	4.25	1.3	NO			56			HIGH	.16	MURKY	BROWN	2-Very minor aesthetic problems
09/15/2008	4.5	1.4	NO			55			HIGH	0.23	CLEAR	GREEN	2-Very minor aesthetic

SD = Secchi depth measured in feet converted to meters; Chl = Chlorophyll a in micrograms per liter (ug/l); TP = Total phosphorus in ug/l, surface sample only; TSI(SD),TSI(CHL),TSI(TP) = Trophic state index based on SD, CHL, TP respectively; Depth measured in feet; Temp = Temperature in degrees Fahrenheit; D.O. = Dissolved Oxygen in parts per million.

Wisconsin Department of Natural Resources * Wisconsin Lakes Partnership
Report Generated: 04/01/2009

Date	SD (feet)	SD (meters)	Hit Bottom?	CHL	TP	TSI (SD)	TSI (Chl)	TSI (TP)	Lake Level	Staff Gauge	Clarity	Color	Perception
													problems
09/22/2008	5	1.5	NO			54			HIGH	0.17	CLEAR	GREEN	2-Very minor aesthetic problems
09/30/2008	5.5	1.7	NO			53			NORMAL	0.1	CLEAR	BROWN	2-Very minor aesthetic problems
10/11/2008	6.25	1.9	NO			51			HIGH	0.17	CLEAR	BROWN	2-Very minor aesthetic problems

05/09/2008		
Depth	Temp.	D.O.
FEET	DEGREES C	MG/L
0	15.6	6.8
2	15.5	6.84
4	15.3	6.83
6	15	6.81
8	14.7	6.79
10	14.4	6.68
12	13.8	6.49
14	12.9	6.1
16	12.1	5.78
18	11.7	5.49
20	11.4	4.9
22	11.1	2.94
22.3	11	2.77

05/28/2008		
Depth	Temp.	D.O.
FEET	DEGREES C	MG/L
0	17.2	6.76
2	17.1	6.79
4	16.5	6.81
6	15.8	6.8
8	15.6	6.8
10	15.3	6.61
12	15.1	6.5
14	15.1	6.42
16	15	6.25
18	14.9	6.12
20	14.7	6.06
22	14.6	5.57
22.2	14.6	3.18

08/05/2008		
Depth	Temp.	D.O.
FEET	DEGREES C	MG/L
0	25.9	11.46
2	25.9	11.46
4	25.8	11.53
6	25.6	11.28
8	25.5	10.35
10	25.3	10.01
12	25	9.3
14	24.6	5.79
16	23.9	1.83
18	22.3	.89
20	21	.84
22	20	.85
22.3	19.5	.92

08/13/2008		
Depth	Temp.	D.O.
0	23.4	12
2	23.4	11.94
4	23.4	11.9
6	23.4	11.8
8	23.3	11.32
10	23.2	11.45
12	23.1	10.72

08/21/2008		
Depth	Temp.	D.O.
0	23.5	11.06
2	23.5	11.04
4	23.5	10.98
6	23.4	11.04
8	23.4	11.04
10	23.2	10.78
12	23.1	9.93

08/29/2008		
Depth	Temp.	D.O.
0	24.6	11.95
2	24.4	12.1
4	24.3	12.35
6	24	12.54
8	23.5	12.21
10	23.2	11.41
12	23	11.14

SD = Secchi depth measured in feet converted to meters; Chl = Chlorophyll a in micrograms per liter (ug/l); TP = Total phosphorus in ug/l, surface sample only; TSI(SD),TSI(CHL),TSI(TP) = Trophic state index based on SD, CHL, TP respectively; Depth measured in feet; Temp = Temperature in degrees Fahrenheit; D.O. = Dissolved Oxygen in parts per million.

Wisconsin Department of Natural Resources * Wisconsin Lakes Partnership
Report Generated: 04/01/2009

08/13/2008		
Depth	Temp.	D.O.
14	22.8	8.5
16	22.6	7.97
18	22.1	6.59
20	21.2	.68
22	20	.62
22.2	19.8	.64

08/21/2008		
Depth	Temp.	D.O.
14	22.9	8.95
16	22.3	3.85
18	21.8	.58
20	21.1	.49
22	20.3	.48
22.2	20	.51

08/29/2008		
Depth	Temp.	D.O.
14	22.8	9.37
16	22.4	5.36
18	21.9	.45
20	21.2	.36
22	20.4	.35
22.2	20.3	.35

09/06/2008		
Depth	Temp.	D.O.
0	21.2	9.29
2	21.2	9.35
4	21.2	9.49
6	21.2	9.55
8	21.2	9.57
10	21.1	9.41
12	21	9.3
14	21	8.86
16	20.9	8.17
18	20.6	8.35
20	20.5	8.17
22	20.4	.71
22.3	20.3	.51

09/15/2008		
Depth	Temp.	D.O.
0	18.5	9.88
2	18.6	9.96
4	18.7	10.05
6	18.7	10.1
8	18.7	10.09
10	18.7	10.06
12	18.7	10.01
14	18.7	9.89
16	18.6	9.6
18	18.5	9.6
20	18.4	9.44
22	18.3	6.79
22.4	18.3	.93

09/22/2008		
Depth	Temp.	D.O.
0	21	11.6
2	20.9	11.77
4	20.8	12.03
6	20.6	12.22
8	20.1	12.2
10	19.8	12.04
12	19.3	9.89
14	18.9	8.49
16	18.5	7.76
18	18.2	4.97
20	18.1	1.43
22	18	0
22.3	18	0

Date	Fieldwork Comment
05/09/2008	Fish between 13' to 19'; No ducks; 1 pr. geese w/5 babies; 2 more pr. geese - no offspring; No new plants visible from surface for reeds- cattails- lily pads- pondweeds except EWM (Eurasian Water Milfoil) and bladderworts; cloudy day; air temp = 55#F;
05/28/2008	pH = 7.2; Fish from 10' - 18'; 2 families of geese w/12 goslings; lily pads- reeds + cattails getting green; EWM more abundant near fish refuge and Neitzki home; Very windy yesterday; 80#F two days ago then cooler (64#F today) and dry.
06/10/2008	Landsat; pH = 7.0; Fish from 9'-19-; Rained heavily Sat + Sun - Lake Delton collapse;Reeds + Cattails are green + healthy; Lily pads blossoming; Eurasian Water Milfoil abundant w/sprigs floating in many areas; Air temp @ 65#F. Landsat; pH = 7.0; Fish from 9'-19-; Rained heavily Sat + Sun - Lake Delton collapse;Reeds + Cattails are green + healthy; Lily pads blossoming; Eurasian Water Milfoil abundant w/sprigs floating in many areas; Air temp @ 65#F.
06/18/2008	Landsat; pH=6.9; Fish between 9'-20'; water level @ 15" above normal on June 13-14-15 - highest since July 12- 2004 @ +17.75"; "No wake" traffic on lake; Phosphate + Chlorophyll samples sent in.
06/26/2008	Landsat; pH = 7.1; Fish between 11'-19'; 16 geese (8 adults- 8 younger); EWM increasing- numerous pondweeds esp. Sago- curly leaf- bladderwort; more algae than usual; Warm- dry weather.
07/04/2008	Landsat; pH = 7.2; Fish between 6'-19'; Sago Pondweed floaters; Much debris 2mm + less; EWM

SD = Secchi depth measured in feet converted to meters; Chl = Chlorophyll a in micrograms per liter (ug/l); TP = Total phosphorus in ug/l, surface sample only; TSI(SD),TSI(CHL),TSI(TP) = Trophic state index based on SD, CHL, TP respectively; Depth measured in feet; Temp = Temperature in degrees Fahrenheit; D.O. = Dissolved Oxygen in parts per million.

Wisconsin Department of Natural Resources * Wisconsin Lakes Partnership
Report Generated: 04/01/2009

Date	Fieldwork Comment
	spreading near swim area + boat launch east; Milfoil sprayed 3 days prior by DNR; Dry weather w/cool nights.
07/12/2008	Landsat; pH = 7.0; Fish between 10'-19'; Many 1mm particulates; EWM treated 12 days prior; White Lily pads flowering; Reeds turning brown; Some green EWM at swimming area and Conger's property; No geese observed; Rainy and warm. Landsat; pH = 7.0; Fish between 10'-19'; Many 1mm particulates; EWM treated 12 days prior; White Lily pads flowering; Reeds turning brown; Some green EWM at swimming area and Conger's property; No geese observed; Rainy and warm.
07/21/2008	One day after Landsat; pH = 7.1; Fish between 9'-19'; Much debris 1-2mm in diameter; Some EWM is dying but new plants @ N.W. swimming area- DeLuca- Meekins- N. of Public Pier- NW end in North Basin; Much Sago- Bladderwort. One day after Landsat; pH = 7.1; Fish between 9'-19'; Much debris 1-2mm in diameter; Some EWM is dying but new plants @ N.W. swimming area- DeLuca- Meekins- N. of Public Pier- NW end in North Basin; Much Sago- Bladderwort.
07/28/2008	Landsat; pH = 7.2; Fish between 9'-19'; Yellow Lily pads blossoming; EWM appears dead at NE portion but alive at swimming area and Conger property; Pleasant weather.
08/05/2008	Landsat; pH = 7.1; Fish between 9'-19'; Many EWM sprigs floating; 16 geese flew in; 9 crows chasing hawk at SE side; Yellow + White lily pads flowering; EWM same prior locations; Warm + rainy weather. Landsat; pH=7.1; fish 9'->19' deep; many EWM sprigs floating; 16 geese flew in; 9 crows chasing hawk; yellow + white lily pad blossoms; EWM in same locations as prior report; weather warm + rainy; 70% Cumulo-Nimbus cloud cover; WNW winds at 5-10 MPH; light traffic on lake
08/13/2008	Landsat; pH = 6.9; Fish between 10'-15'; EWM still spreading: north of public pier- DeLucas- N+S Zimmermans- Meekins- Congers- Harden east- NW in N. Basin; Yellow lily pad flowers; warm + rainy. Landsat; pH = 6.9; Fish between 10'-15'; EWM still spreading: north of public pier- DeLucas- N+S Zimmermans- Meekins- Congers- Harden east- NW in N. Basin; Yellow lily pad flowers; warm + rainy. Landsat; pH = 6.9; Phosphate + Chlorophyll samples sent in; Fish between 10'-15'; EWM slowly spreading more: north of public pier - similar to last monitoring; Yellow lily pad flowers; Reeds turning brown; Light rain in AM. Landsat; pH = 6.9; Phosphate + Chlorophyll samples sent in; Fish between 10'-15'; EWM slowly spreading more: north of public pier - similar to last monitoring; Yellow lily pad flowers; Reeds turning brown; Light rain in AM.
08/13/2008	Landsat; pH=6.9; Fish 10'->15'; EWM still spreading - North of public pier- Delucas N+S- Zimmermans- Meakins- Congers- Hardens - E- NW Basin; yellow lily pads blossoming; rain in AM; 80% cumulo-nimbus cloud cover w/WNW winds at 5MPH; traffic = 1 fisherman; Phosphate and Chlorophyll sample sent in.
08/21/2008	Landsat; pH=7.3; weather warm + dry; 10% cirrus cloud cover w/SE winds @ 5MPH; traffic = 3 quiet fishing boats; fish 9'->19'; 1 mm suspended particulate matter scattered throughout; healthiest EWM @ DeLucas property - others less green; no geese.
08/29/2008	Landsat; pH=7.1; 20% cumulus cloud cover w/NW winds at 5+MPH; warm dry weather; several watercraft + tubers; fish 10'->18'; EWM growing @ DeLucas and swimming area + still present at prior sites; no geese or ducks observed.
09/06/2008	Landsat; pH=7.0; 50% cirrus cloud cover w/SSW wind @ 5MPH; rainy + cool weather; traffic = several fishing boats; fish 9'->19'; EWM - same as last week; one large EWM plant floated by at sampling site.
09/15/2008	One day after Landsat; pH=6.9; 100% cumulo-nimbus but some clearing earlier; NNE wind @ 5-10 MPH; recent weather was rain + cloudy; traffic = 1 canoe; fish 9'-19'; surveyed for EWM with Village President and certified weed applicator - found in prior locations plus more in shallow part of refuge; large flock of geese flew over; some lilies still blooming.
09/22/2008	Landsat; pH=7.1; 10% cirrus cloud cover plus very hazy; ESE winds at 5 MPH; warm + dry weather; 2 fishing boats; fish 9'->20' w/biggest fish at 11'; deciduous leaves beginning to fall; no ducks or geese seen.
09/30/2008	Landsat; pH=7.1; 50% cirrus + cumulus cloud cover w/WNW winds from 15-20 MPH; seasonal weather

SD = Secchi depth measured in feet converted to meters; Chl = Chlorophyll a in micrograms per liter (ug/l); TP = Total phosphorus in ug/l, surface sample only; TSI(SD),TSI(CHL),TSI(TP) = Trophic state index based on SD, CHL, TP respectively; Depth measured in feet; Temp = Temperature in degrees Fahrenheit; D.O. = Dissolved Oxygen in parts per million.

Date	Fieldwork Comment
	with some light rain; no traffic except monitor; air temperature @ 54#F; fish 9'->19' (mostly 10' -> 15'); inconsistent readings because wind shifted boat even with three anchors; EWM still prevalent; reeds and cattails turning brown; maples turning red/orange.
10/11/2008	No Landsat today; pH=7.1; 1% cirrus cloud cover w/ E wind from 0-5 MPH; seasonal weather; six fishing boats other boater- but no jet skis; air temp 60#F; fish 10'->16'(mostly 12'-14'); many gulls; dozens of geese in refuge; EWM in same areas but gray in color; lily pads NOT flowering; a busy kindfisher catching food at lake surface.

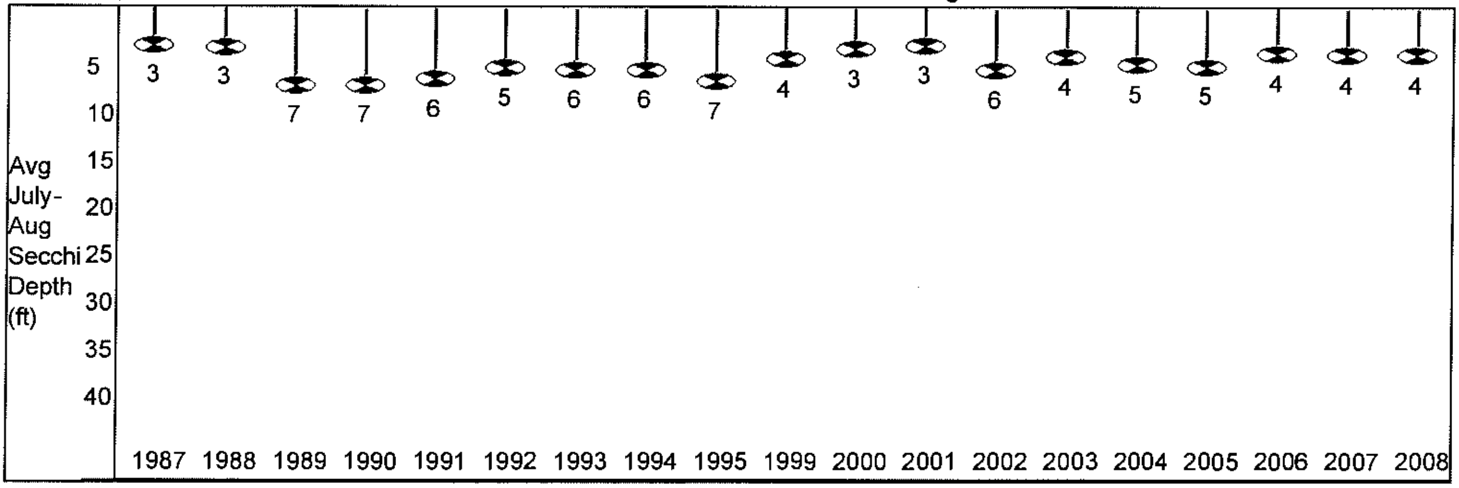
Date	Data Collectors	Project
05/09/2008	Wayne Stroessner	Citizen Lake Monitoring - Water Quality - Random Lake; Deep Hole
05/28/2008	Wayne Stroessner	Citizen Lake Monitoring - Water Quality - Random Lake; Deep Hole
06/10/2008	Wayne Stroessner	Citizen Lake Monitoring - Water Quality - Random Lake; Deep Hole
06/18/2008	Wayne Stroessner	Citizen Lake Monitoring - Water Quality - Random Lake; Deep Hole
06/26/2008	Wayne Stroessner	Citizen Lake Monitoring - Water Quality - Random Lake; Deep Hole
07/04/2008	Wayne Stroessner	Citizen Lake Monitoring - Water Quality - Random Lake; Deep Hole
07/12/2008	Wayne Stroessner	Citizen Lake Monitoring - Water Quality - Random Lake; Deep Hole
07/21/2008	Wayne Stroessner	Citizen Lake Monitoring - Water Quality - Random Lake; Deep Hole
07/28/2008	Wayne Stroessner	Citizen Lake Monitoring - Water Quality - Random Lake; Deep Hole
08/05/2008	Wayne Stroessner	Citizen Lake Monitoring - Water Quality - Random Lake; Deep Hole
08/13/2008	Wayne Stroessner	Citizen Lake Monitoring - Water Quality - Random Lake; Deep Hole
08/21/2008	Wayne Stroessner	Citizen Lake Monitoring - Water Quality - Random Lake; Deep Hole
08/29/2008	Wayne Stroessner	Citizen Lake Monitoring - Water Quality - Random Lake; Deep Hole
09/06/2008	Wayne Stroessner	Citizen Lake Monitoring - Water Quality - Random Lake; Deep Hole
09/15/2008	Wayne Stroessner	Citizen Lake Monitoring - Water Quality - Random Lake; Deep Hole
09/22/2008	Wayne Stroessner	Citizen Lake Monitoring - Water Quality - Random Lake; Deep Hole
09/30/2008	Wayne Stroessner	Citizen Lake Monitoring - Water Quality - Random Lake; Deep Hole
10/11/2008	Wayne Stroessner	Citizen Lake Monitoring - Water Quality - Random Lake; Deep Hole

SD = Secchi depth measured in feet converted to meters; Chl = Chlorophyll a in micrograms per liter (ug/l); TP = Total phosphorus in ug/l, surface sample only; TSI(SD),TSI(CHL),TSI(TP) = Trophic state index based on SD, CHL, TP respectively; Depth measured in feet; Temp = Temperature in degrees Fahrenheit; D.O. = Dissolved Oxygen in parts per million.

Wisconsin Department of Natural Resources * Wisconsin Lakes Partnership
Report Generated: 04/01/2009

Random Lake
Sheboygan County
Waterbody Number: 30300

Lake Type: DRAINAGE
DNR Region: SE
GEO Region:SW

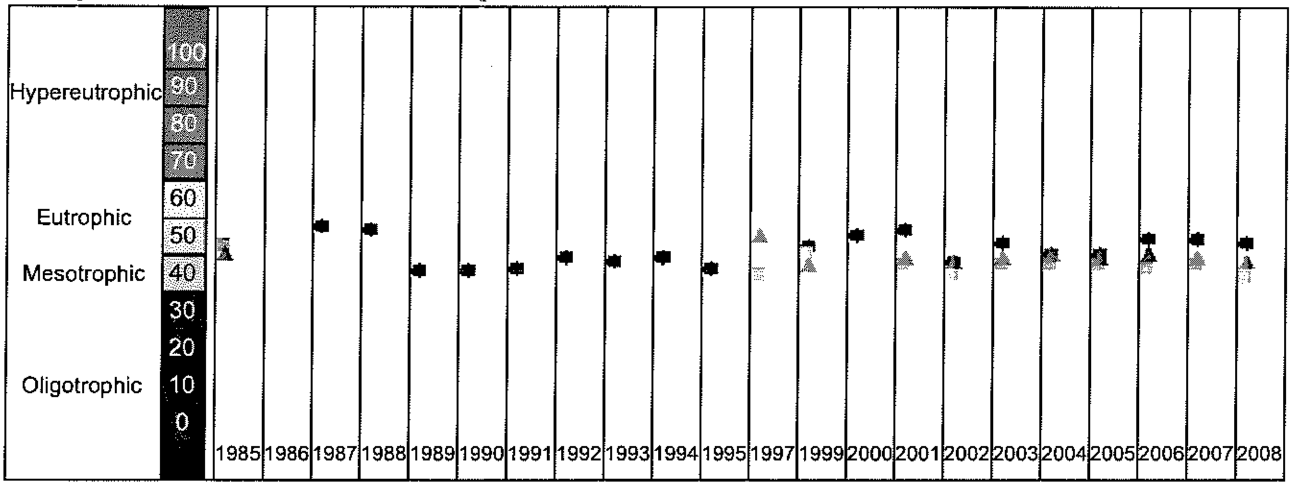


Past secchi averages in feet (July and August only).

Year	Secchi Mean	Secchi Min	Secchi Max	Secchi Count
1987	2.9	2.25	3.25	3
1988	3.1	2.5	3.5	6
1989	7.1	5.25	8	4
1990	7.1	5.5	10	6
1991	6.5	5	8	6
1992	5.4	4.25	6	4
1993	5.6	3.75	7.75	6
1994	5.5	5.5	5.5	1
1995	6.8	6.75	6.75	1
1999	4.4	4	5	11
2000	3.4	3.25	3.75	4
2001	3	2.4	4	12
2002	5.6	5	6.25	10
2003	4.1	2.75	5.25	5
2004	4.9	4.592	5.5	6
2005	5.1	4.5	5.75	4
2006	3.8	3.5	4.75	6
2007	3.9	3.25	4.5	7
2008	3.9	3.75	4.25	4

Report Generated: 04/01/2009

Trophic State Index Graph



Monitoring Station: Random Lake - Deep Hole, Sheboygan County
Past Summer (July-August) Trophic State Index (TSI) averages.

• = Secchi ▪ = Chlorophyll ▲ = Total Phosphorus

TSI(Chl) = TSI(TP) = TSI(Sec)	It is likely that algae dominate light attenuation.
TSI(Chl) > TSI(Sec)	Large particulates, such as Aphanizomenon flakes dominate
TSI(TP) = TSI(Sec) > TSI(Chl)	Non-algal particulate or color dominate light attenuation
TSI(Sec) = TSI(Chl) >= TSI(TP)	The algae biomass in your lake is limited by phosphorus
TSI(TP) > TSI(Chl) = TSI(Sec)	Zooplankton grazing, nitrogen, or some factor other than phosphorus is limiting algae biomass

TSI	TSI Description
TSI < 30	Classical oligotrophy: clear water, many algal species, oxygen throughout the year in bottom water, cold water, oxygen-sensitive fish species in deep lakes. Excellent water quality.
TSI 30-40	Deeper lakes still oligotrophic, but bottom water of some shallower lakes will become oxygen-depleted during the summer.
TSI 40-50	Water moderately clear, but increasing chance of low dissolved oxygen in deep water during the summer.
TSI 50-60	Lakes becoming eutrophic: decreased clarity, fewer algal species, oxygen-depleted bottom waters during the summer, plant overgrowth evident, warm-water fisheries (pike, perch, bass, etc.) only.
TSI 60-70	Blue-green algae become dominant and algal scums are possible, extensive plant overgrowth problems possible.
TSI 70-80	Becoming very eutrophic. Heavy algal blooms possible throughout summer, dense plant beds, but extent limited by light penetration (blue-green algae block sunlight).
TSI > 80	Algal scums, summer fishkills, few plants, rough fish dominant. Very poor water quality.

Trophic state index (TSI) is determined using a mathematical formula (Wisconsin has its own version). The TSI is a score from 0 to 110, with lakes that are less fertile having a low TSI. We base the overall TSI on the Chlorophyll TSI when we have Chlorophyll data. If we don't have chemistry data, we use TSI Secchi. We do this rather than averaging, because the TSI is used to predict biomass. This makes chlorophyll the best indicator. Visit Bob Carlson's website, dipin.kent.edu/tsi.htm, for more info.