PRICE LAKE [LOWER] WISCONSIN

Excerpted, Summarized, and Commentary by: Ed Newren

RESULTS: from the 2007 NATIONAL LAKE SURVEY

September 1, 2009

SOME THOUGHTS AND NOTIONS TO PONDER

Nature is not something that is just "out there!" Nature is the giant web which we are all a part. Nature has its own order and is not therefore "there" for our personal glorification. We must give up trying to "conquer" it and try our best to live in harmony with it!

We threaten and destroy all that is about us . . . nature.

Man was least destructive when he was a "hunter/gatherer." He perceived nature as "Sacred" and was a part of it. Then man, rather than competing with his environment in order to survive, used the intelligence that set him apart from all other creatures and invented tools. With tools he was no longer just another part of his surroundings but a force which began to alter these surroundings. He progressed (or is it regressed) to an agrarian state and next came industrialization which sped up the cannibalization of the land. Most recently we have moved into the MOST innocent sounding "knowledge/consumer" era which relies on digitization (electronic chips) and packaging almost everything we produce.

The waste from our current trends are not only threatening to take over our world (land and water) but are polluting us to near extinction. Our task (to use a current and popular euphemism) is to try to leave a smaller "ecological footprint."

Nature IS sacred and we must each honor it and each other in our commitment to do everything in our power to preserve it.

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PRICE LAKE [LOWER], WISCONSIN
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PROLOGUE

I have divided the following report into a verbal triangle with three basic parts. The first part, the top of the triangle, titled *In A "Nut Shell",* is a bare-bones, simply stated overview of the National Lake Survey findings as they relate to Price Lake. In the second part, *Taking a little "Bigger Bite",* I have added more details about the study, it's findings and I have incorporated some personal commentaries. The third part, the base of the triangle, is the *"Appendices"* materials. In this section is the foundation where you will find the scientific data—I have, as much as was possible, included descriptions and definitions to help all of us better understand the terminology used by the scientists, the limnologists (those who study the biological, chemical, and physical features of lakes and other bodies of fresh water); for it is they who have collected the data and written the original accounts of the investigation. I have combined a variety of information from a range of sources concerning the lake study findings as I have put this report together—I have also tried to include as many sources, "links," for those of you who may wish to dig deeper. I hope you find all the information offered below to be of interest; it is, in my estimation, certainly of importance to each of us as we engage in our responsibility of the stewardship of Price Lake and the surrounding woodlands. I offer this information in thanksgiving and honor of the Great Spirit who has given all of this to us and who watches over us and Price Lake . . . and also in honor of the "Price Lake Triangle and their predecessors."

Ed Newren

IN A "NUT SHELL"

The 2007 Lake Survey was a national study. In Wisconsin—and more particularly in Price County two lakes were selected for inclusion. One of the lakes was our Price Lake [Lower]. Our lake is called a drainage lake with not only an outlet but also an inlet (Price Creek).

Water quality is more than just, "How is the fishing?" Scientists look at water clarity through the use of a Seechi Disc. They look at water chemistry by studying such things as the algae and chlorophyll/ plankton, sediment invertebrates, diatoms, mercury, and shoreline habitat. As far as the recreational quality of the lake the concerns are primarily fecal bacteria (E. coli [or Enterococci] bacteria) and algae toxins. Also of interest is to determine if any exotic (invasive) species—plant or animal—are present and threatening the natural plants.

Some of the findings for Price Lake [Lower] suggest: that the water is slightly alkaline; it is 7.84. Neutral would be 7.0 whereas acidic would be around 6 and below. The alkalinity measure 38.2 (total $CaCO_3$ in mg/L) indicates that Price Lake is a soft water lake. Apparently our lake is not likely to contain mercury poisoning. The water is not very clear—several factors may account for this; one such is the tannin run-off from the forests. And there does not seem to be any indication of exotic, invasive aquatic plant species on our lake.

TAKING A LITTLE "BIGGER BITE": AN EXPANDED PEEK AT THE LAKE STUDY INFORMATION AND SOME PERSONAL COMMENTS

Introduction to and Importance of the Lake Survey Results to *EACH* of Us

What If YOU were told . . . you can't fish, or swim in Price Lake anymore? Think about what it would be like if there were no more loons providing their eerie call, nor bald eagle diving for fish, Or how would you feel if no more fish rings could be viewed in the evening nor croaking frogs heard along the shoreline? *Not a very pleasant thought*!

Back in 2007, I received a telephone call seeking permission from the DNR to launch, from our property, lake survey teams and their boats onto Lower Price Lake. The purpose was to gather information which would help the DNR study the various elements of our lake. On several occasions different DNR teams arrived early in the morning to spend several hours collecting data from our lake.

The composition of our lake was being studied as part of a larger national survey of lakes. The findings from these investigations are important to each of us because they explain the current status of our lake and suggest the part we can all play in helping to keep our lake and the surrounding land a viable, living part of our lives.

The Wisconsin Association of Lakes calls our lakes "jewels in the landscape." This organization characterizes the lakes as, "beautiful natural resources. They are also places where we gather together to watch sunsets of piers, tell fish stories, and enjoy fun in the sun and tranquil moments. Our collective memories 'at the lake' are an important part of why so many of us are interested in lake protection." [1]

Before any of us ever laid eyes on Price Lake . . . it existed. Hopefully our lake will flourish long after all of us have departed this earth. However, it is my belief, that the condition in which the lake is able to continue its existence, depends, to a great degree, on each of us. We have been fortunate enough to have been entrusted with the "stewardship" of this wonderful gift. It is only "ours" for a brief time. I believe it is our responsibility—individually . . . and collectively . . . to leave Price Lake [Lower] and its surroundings in a better condition than we received it.

As a part of my self perceived stewardship, I have taken on the task of summarizing, and trying to put in everyday layman's terms, the findings of the lake survey materials as they apply to our Lower Price Lake. To do this I have made use of explanative footnotes and appendix materials. To be sure, the major work has been done by the DNR survey teams and analysts. I have tried to place a brief, "in-a-nut-shell" summary in the beginning with longer and more technical explanations toward the rear. I hope you find this information useful in helping you, and those who come to visit you on the lake, to be better stewards of our lake. If we all work together the lake should be able to exist in an ecologically sound manner for generations to come. I too, in no small way, have had a *lot* of significant assistance in assembling and presenting this information to you. [2]

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[1] **For more (and additional—interesting) information see the Wisconsin Association of Lakes** website http://www.wisconsinlakes.org/aboutlakes.html

[2] My sincere thanks and appreciation for the help they extended goes to: DNR representatives, Jeff B. Bode, DNR, Water Resources Management Supervisor, Madison; Diane Daulton,U.W. Ext., Upper Chippewa Basin Educator, Park Falls; Patrick Goggin, Lake Specialist, UW, Stevens Point; James Kreitlow, DNR Regional Lake Coordinator; and Scott J. Van Egeren, DNR, Madison.

SOME RELATED REMARKS

In terms of biological, physical, and human factors which can affect a lake, our Lower Price Lake, in comparison to some other lakes, seems to be fairing pretty well. Price Lake, as of 2007—and to the extent this study's data suggest—has, thus far, been able to elude the invasion of some of the most prevalent of the AIS (Aquatic Invasive Species)—Eurasian water-milfoil (EWM), rusty crayfish, zebra mussels, curly-leaf pondweed, and purple loosestrife.

There is no direct public access to our lake, since all of our lake's shoreline is privately owned, thus, we are in an enviable position for protecting our lake. However, each of us has the duty to inform any and all persons (who we allow to bring watercraft onto our property and permit to place such watercraft or children's inflatable water toys into our lake) about AIS and what is necessary to DO with such watercraft/toys BEFORE placing them in the water.

Certainly most of us, with all the fish we catch and eat out of Price Lake must have wondered, at one time or another, if we have mercury in our lake and thus, if we are ingesting mercury when we eat fish caught in these waters. I asked such a question of James Kreitlow located in Rhinelander, WI. He is the DNR Regional Lake Coordinator for Price, Sawyer, Ashland, Iron, Rusk, and Taylor Counties, a Water Resources Management Specialist with the Division of Water (Watershed Mgt.), Oneida County; Northern Region and member of the Upper Chippewa Basin Team (Price Lake falls within the Upper Chippewa Basin [3] region). Specifically

I asked him, "Is there **NOW** **<u>or</u>** has there **EVER** been a record of **mercury** on <u>Price Lake [Lower</u>] in Price County?" <u>AND</u> "What about any record of **mercury** on OTHER lakes in the **northern part** (upper tier) of the state (say on an east/west line across the state Wausau/Marshfield and NORTH to Lake Superior?"

His response was: "It is my guess that Price Lake(s) water has not been analyzed for mercury. The reason for this is that the necessary testing requires a special [and quite involved] sampling technique [which] must be used to prevent contamination of the sample. Mercury is analyzed at very low levels. Usually the department looks at mercury through fish bioaccumulation and impacts on public health. [Thus, since the potential effects of mercury would not likely be expected to affect a much larger population—since the public does not have ready access to the lake—expenditures for such sampling are not likely to have been made.] We [Wisconsin] have a fish health advisory program where we collect and analyze mercury concentrations in fish on a routine basis. I'm checking to see if we have any data for the Price Lakes, but I'm not to hopeful because of . . . the lake's limited public access. [Generally,] we [DNR] only collect fish from lakes where there is sufficient boat trailer access. I checked with Candy Schrank. The department [DNR] has no fish data (Mercury concentrations) for the Price Lakes."

"I'm sure there is mercury data for some other lakes in the geographical area you describe. I am carbon copying [your question to] Dr. Carl Watras who may be able to send you some summary statistics of mercury concentrations in Northern lakes." A reply from Carl Watras was received and he indicated, "I am not aware of any data on Hg [mercury] in water, sediments or the lower food web of Price Lake."

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[3] **Basin** is defined as: the tract of country that is drained by a river and its tributaries or drains into a lake or sea. The Upper Chippewa Basin drains through the Chippewa River into the Mississippi River.

Scott Van Egeren's response was similar to the one above. He comments: " All lakes contain some mercury naturally, but mercury becomes a problem for people when it is methylated and then can bioaccumulate in the aquatic food chain. Below is a link to the DNR website about mercury consumption advisories for fish in Wisconsin. [4] The lakes on the advisory list have been tested for mercury. For additional information about mercury in Wisconsin lakes contact Candy Shrank at candy.schrank@wi.gov "

Is there anything we can do to assist in keeping mercury levels from reaching unacceptable levels? First, if we understand that mercury is a natural occurring chemical, then, from that standpoint, there is probably very little that we can do to affect those natural levels.

It is my (EN) personal belief, given the facts that "water specialists" do not feel that Price Lake is likely to have mercury and given also that throughout the upper tier of Wisconsin there would seem to be very little evidence of **mercury** presence, that it is safe to say, with a high degree of probability, that Price Lake—up to this date—does **not** have any mercury.

However, beyond this there are a few things we can personally do and inform others about so that they will assist us in keeping Price Lake's water clean and in relatively good shape. We can all work toward keeping the the lake from being lead poisoned. We can help avoid lead poisoning by: **(1)** use of non-lead *fishing equipment* (e.g., jigs and sinkers) and **(2)** use of non-lead *hunting ammunition* (e.g., shot gun loads and rifle/muzzle-loader shells or slugs). Not only the water can be affected by these products but the wildlife too is subjected to degradation through the use of these products (e.g., loons, ducks, eagles, fish, frogs). If frogs or fish ingest lead products we may end up eating those fish. Also loons and eagles may feed on these lower food chain morsels and thus become infected. The presence of loons on northern lakes is considered an indicator of good environmental health.

Another concern arises from a careless or uncaring use of herbicides and pesticides. Something as innocent as eradicating weeds with herbicides or ridding our households of insects with pesticides may lead to dangerous conditions for amphibians . . . since there is always the possibility that these common household aides will find their way into our lake or onto our property. Even those small puddles or moist areas in our landscapes and roadways, into which these ". . . cides" may find their way, can lure frogs and toads into a trap which can lead to malformations (deformities) in offspring or even death. Such amphibian deformities have been documented in 44 states and involve nearly 60 species. [5]

Additionally, we must all be extremely judicious in our use of fertilizers and the phosphorous which may be incorporated in these fertilizers. Run off into the lake, which can easily result from such use, can, in sufficient quantity, be disastrous as you will learn later in this report. [6]
Although not covered as part of the Lake Survey, many of us have no doubt wondered and frequently commented on the "drop" in the water level of Price Lake. We have witnessed over the past five or

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[4] DNR mercury consumption advisories for fish in Wisconsin website: http://dnr.wi.gov/fish/consumption/

[5] A more descriptive and startling account may be found by Michael J. Lannoo, Indiana University, School of Medicine, Terre Haute, IN,, "Amphibian Malformations . . . ." ***Lake Tides*** newsletter, Vol. 33, No. 2, Spring, 2008, pp. 1-3.

[6] Note: It should be mentioned that new Wisconsin laws prohibit the incorporation of phosphorous in fertilizers. What about fertilizer bags that we have purchased previously and are still lying around waiting to be used?

six years a recession of the shoreline waters by probably as much as four feet, or so. Summarizing his interesting article on lake water levels, John Lenters, School of Natural Resources and Department of Geosciences, University of Nebraska-Lincoln had the following to say. "Variations in lake levels in northern Wisconsin are primarily driven by changes in precipitation. For example, the recent trend toward lower water levels is largely the result of a downward trend in annual precipitation of about 0.5 centimeters per year. Although this may seem small, when each year's precipitation deficit is added up over the 23-year period, this leads to a 1.3 meter [or about 3.96 feet] drop in accumulated water input to Sparkling Lake [a lake in Vilas County, Wisconsin where water levels had been tracked from 1984 through 2007]. On top of this, northern Wisconsin lakes are getting warmer, and summertime evaporation has been increasing since 1994. This can only exacerbate the ongoing trend toward drier conditions. Unless we see a reversal in one or both of these trends in coming years, we can expect low lake levels to be the "norm" for quite some time." This deduction by Dr. Lenters can, in most likelihood, be extended to other lakes in the northern tier of Wisconsin which are experiencing similar drops in water levels—just as is our Price Lake. [7]

Even though lake water levels was not part of the lakes survey, they can have an effect on the quality of water. There is a concern all across the upper mid-West because of the lowered water levels. It has recently been discovered that engineers/scientists who had studied the drop of water levels in the great lakes—and such a drop can affect water levels on rivers and lakes all across the upper mid-west—had made serious errors in their judgements about how much water was passing over Niagara Falls. The water from Niagara Falls empties out of Lake Erie and its flow was misjudged by some nine feet because of miscalculations about how much silt the flowing river had dredged as it carries the water to Canada and eventually the ocean. "Lake levels fluctuate naturally due to precipitation which varies widely from season to season and year to year. While some lakes with stream inflows show the effect of rainfall almost immediately, others, such as seepage lakes, do not reflect changes in precipitation for months. For example, heavy autumn rains often cause water levels to rise in the winter when rain enters the lake as groundwater. Water level fluctuations affect lake water's quality. Low levels may cause stressful conditions for fish and increase the number of nuisance aquatic plants. High water levels can boost the amount of nutrients from runoff and flooded lakeshore soils. Yet another consequence of fluctuating water levels is shoreline erosion. [8]

THE LAKE SURVEY AND THE RESULTS FROM PRICE LAKE

Background: In the summer (July and August) of 2007, a team of (WDNR) Wisconsin Department of Natural Resources came out to [Lower] Price Lake three or four times to survey the various components of our lake. This was part of a national EPA study to assess the percentage of lakes in good, fair, or poor condition. In Wisconsin, several enhancements were performed in addition to the standard national protocol. The study is known as the ***2007 National Lake Survey***. The findings

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[7] Lenters, John D., "Low Water Levels in the North: Are They Driven by Precipitation or Evaporation?", ***Lake Tides***, Vol. 34, No. 2, Spring, 2009. pp. 4-6. (*Lake Tides* is the Wisconsin Lakes Partnership newsletter—
e-mail: uwexlakes@uwsp.edu ; internet: www.uwsp.edu/cnr/uwexlakes 715-346-2116)

[8] Shaw, Byron, Mechenich, Christine, and Klessig, Lowell, **Understanding lake data**, Publication G3582, University of Wisconsin System, 2004, p. 4. (To order a copy www.cecommerce.uwex.edu or call 877-947-7827

from this study [9] have been synthesized and offered at the back of this report. [10] Also I have gathered some explanations and definitions (not offered in the original reports) and have provided these in footnotes and appendices.

Lastly, I have attempted to provide citations for items that you may be interested in requesting copies of for yourself concerning the survey results and related information.

Lakes Studied: Lakes throughout the United States were studied—a total of 909— These lakes representing five size classes (ranging from one meter [3.28 feet] deep and over ten acres in size) were randomly selected from the lower forty-eight states to be included in the survey. Out of the 29 lakes selected from Wisconsin's 15,081, **our Price Lake** was one of only two lakes in Price County picked to be in the study (the other being Schnur which is northwest of Park Falls and less than a quarter mile from the eastern edge of Butternut Lake).

AN OVERVIEW OF WHAT THE SURVEY SAYS ABOUT OUR PRICE LAKE

THE WATER and ITS QUALITY

"A lake's water quality can refer to water clarity—Secchi disk depth, turbidity, color, how many particles are suspended in the water and how far light can penetrate down into the water. Water clarity affects the ability of fish to find food, how deep aquatic plants can grow, dissolved oxygen content, and water temperature. Water quality can also be used to describe how well the lake can support plants, fish, and other parts of a healthy lake ecosystem. Nutrients—like phosphorus—can dramatically affect water quality and what species can survive in the lake.

Water clarity can be influenced by polluted runoff from across a lake's watershed and from decisions made on the lake's shoreline. How lake front property owners take care of their shorelines can dramatically effect whether a lake will be prone to algae blooms, invasive species, and what types of fish can survive in the lake." [11]

Water: remember as a child . . . it was always there. We never thought much about it or where it came from. We'd marvel at a thunder storm and run out in a sprinkle with our faces turned skyward—eyes closed . . . and probably tongues stuck way out . . . to catch a few drops? Or maybe we'd stomp our foot down in a little puddle to see it spurt out in all directions. If we grew up in a town or city we never wondered when we reached up over that big, cold, white edge and turned a knob or lever, water was just there . . . and it was good!

Then we came up to Price Lake and to get water out of a spigot we had to install a well and operate a pump. Or maybe some of us had the experience of pumping the lever on a pitcher pump . . . or, if we visited our lake during the winter but didn't have our "water systems" *winterized,* we might have even

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[9] Copies of Study reports were initially hunted down and obtained by Tom Griffith and Carol Swenson and are available at: http://dnr.wi.gov/lake/nls/plantsurveys/2234600.pdf (for aquatic plant survey findings); http://dnr.wi.gov/lakes/nls/indexresults.asp?wbic=2234600 (for water chemistry profiles); http://dnr.wi.gov/lakes/nls/WI_data.asp?topic=habitatsumm (for shoreline habit profiles).

[10] See: **Appendix A "The Survey Objectives, Design, and Sampling"** for a more detailed description of the study's organization and procedures.

[11] **For more (and additional—interesting) information see the Wisconsin Association of Lakes** website http://www.wisconsinlakes.org/aboutlakes.html

had to chop a hole in the ice and carry a bucket of water up to our cabins to flush the toilet or to boil so we could wash dishes and ourselves. Transporting a plastic “Gerry-can” with potable water for drinking and cooking was another method of having “good” water. And, even then, we probably didn’t question much about our water except maybe the way it would taste or smell (e.g., irony or like sulfur)—did it make “good” coffee—or did it stain our dishes, bathroom facilities, or clothes?

When we look out at Price Lake we probably seldom wonder about its “quality”; generally we’re thinking how beautiful it is, or curious about the location and depth of the fish that day, or maybe even tempted to bodily explore its wetness and coolness. But what is the quality of the water in Price Lake? Knowing how to judge the “quality” of our lake is an elusive quest.

To measure and answer the “quality” question is not so easy . . . as you will learn. The answer to such a question is not just “good or bad”—“black or white”—it can be any number of gray shades in between. These “shades or measures” are dependent upon a variety of factors—usually interrelated—not easily judged and usually requiring repeated measuring over a time-line of years in order to obtain a truer portrait of the water’s quality.

For instance, if someone asks about the clarity of our lake we might not think it is very clear . . . especially if we have just come back from fishing on Bass Lake—on the eastern edge of the Flambeau River State Forest over to our northwest about a mile—where a person can see down 15 to 20 feet or so. However, several factors may account for the turbidity we find in our Price Lake water. One such factor is the tannin which is leached or runs–off into the water from the surrounding woodlands. However, the muddy appearance may also be caused by phosphorus and/or chlorophyll-*a*; two important parameters of lake ecology. And these two factors affect algal abundance which corresponds to the particulates that are suspended in the water and thus can influence its clarity.

The limnologists collected samples from our lake including such standard water quality constituents as nutrients, pH, color, chlorophyll-a. They also acquired specimens in water clarity, physical profiles, phytoplankton and zooplankton, a sediment core, algal toxins, pathogens, and benthos (lake-bottom organisms). In addition, a comprehensive shoreline assessment was conducted at 10 sites around each lake. These core indicators were examined and diagnosed to determine the lake’s water quality, ecological integrity, and recreational value. [12]

Thus you see, for most of us—laypersons, without benefit of limnology degrees—to understand all of that which constitutes and is used to measure lake water is not easily accomplished. And then, one time measures of anything—which has multiple, interrelated, factors—are “ify” at best but can become more reliable when such measurements are compiled over longer periods of time. Thus, measures which were taken in 2007 for Price Lake can be used as “indicators” but should probably not be relied upon as the “last word.” [13, 14]

In order to obtain a “feel” for what our lake’s data probably mean, I decided to attempt to contact some water specialists (limnologists) in this state who might shed some light on the survey’s findings as well as answer questions which I had had or had heard from some of you.

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[12] **“What did researchers measure?” See:** http://DNR.WI.gov/lakes/nls/

[13] **See: Appendix I: “Assessment of Price Lake Water Chemistry”** for the measurements of pertinent chemicals in Price Lake.

[14] **See: Appendix J: “Assessment of Price Lake Water Column Profiles”** for measures of interactive elements found in Price Lake.

Partick Goggin, a lake specialist with the University of Wisconsin, Stevens Point—in responding to several questions I had e-mailed him concerning our lake and its water—suggested, “The kinds of questions and answers you are looking to complete are often pulled together by consultants who work with lake groups to help them understand the data for their lake.”

Although not studied as a part of the “Lakes Survey,” lake water levels can have an effect on the quality of water. There is a concern all across the upper mid-West because of the lowered water levels. It has recently been discovered that engineers/scientists who had studied the drop of water levels in the great lakes—and such a drop can affect water levels on rivers and lakes all across the upper mid-west—had made serious errors in their judgements about how much water was passing over Niagara Falls. The water from Niagara Falls empties out of Lake Erie and its flow was misjudged by some nine feet because of miscalculations about how much silt the flowing river had dredged as it carries the water to Canada and eventually the ocean. “Lake levels fluctuate naturally due to precipitation which varies widely from season to season and year to year. While some lakes with stream inflows show the effect of rainfall almost immediately, others, such as seepage lakes, do not reflect changes in precipitation for months. For example, heavy autumn rains often cause water levels to rise in the winter when rain enters the lake as groundwater. Water level fluctuations may affect lake water’s quality. Low levels may cause stressful conditions for fish and increase the number of nuisance aquatic plants. High water levels can boost the amount of nutrients from runoff and flooded lakeshore soils. Yet another consequence of fluctuating water levels is shoreline erosion. [15]

“When water levels drop because of human reasons—such as groundwater removal—there can be long term effects that can be devastating to an ecosystem. However, water level fluctuations are also a part of natural cycle, and temporarily lower water levels can benefit the lake. Factors that influence lake water levels include the source of a lake’s water—lake type or category—the depth of the lake, precipitation, and evaporation, over pumping of groundwater, and the amount of impervious surfaces within the lake’s watershed. Lakes can be divided into three categories, “trophic states,” based on a lake’s water clarity and nutrient levels. These trophic states can give you an idea of what features a lake is likely to have: clear waters, supportive of many, or few aquatic plants or fish.” [16]

THE PLANTS: A SUMMARY LOOK AT THE AQUATIC PLANT TYPES

“Native aquatic plants are at the root of healthy lakes, and are essential for good fishing and clean water. Plants provide a place to live and food for fish, birds, frogs, turtle, insects, and many other kinds of wildlife. They also produce the oxygen needed by fish and other kinds of wildlife. They also produce the oxygen needed by fish and other underwater animals. They also help preserve water quality by using nutrients—like phosphorous—that would otherwise be available for algae growth, protecting shorelines from erosion, and holding down lake-bottom sediments with their roots.

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[15] Shaw, Byron, Mechenich, Christine, and Klessig, Lowell, **Understanding lake data**, Publication G3582, University of Wisconsin System, 2004, p. 4. (To order a copy www.cecommerce.uwex.edu or call 877-947-7827

[16] **For more (and additional—interesting) information see the Wisconsin Association of Lakes** website at http://www.wisconsinlakes.org/aboutlakes.html

The Most Frequently Encountered Plants on Price Lake [Lower] *

Plant Name	**Frequency of Occurrence within Vegetated Areas (%) ****	**Relative Frequency (%) *****	**Number of Sites Where Found *******	**Highest Number of Visual Sightings*********
filamentous algae	28.95	11.7	11	
Brasenia schreberi (Watershield)	13	5.3	5	11
Ceratophyllum demersum (Coontail)	34.21	13.8	13	
Equisetum fluviatile (Water horsetail)	28.95	11.7	11	
Nitella sp (Nitella)	13.6	5.3	5	
Nuphar variegata (Spatterdock)	21.05	8.5	8	12
Nymphaea odorata (White water lily)	26.32	10.5	10	19
Potamogeton amplifoilus (Largeleaf pondweed)	28.95	11.7	11	
Potamogeton epihydrus (Ribbonleaf pondweed)	15.79	6.4	6	

* Note**:** *For a complete listing of the survey's aquatic plants findings* See: **Appendix E**.

** "Rake Fullness" was basis used for all species.

*** Frequency of occurrence within vegetated areas (%) is the number of times a species was seen in a vegetated area divided by the total number of vegetated site.

**** Relative Frequency is not sensitive to whether all sampled sites, including non-vegetated sites, are included. The relative frequency is not change by inclusion of non-vegetated sites.

***** Names and Numbers in these columns reflect *only* those species most frequently encountered on our lake.

Identifying the Price Lake Aquatic Plants.

* IMPORTANT NOTE: The **good news** for our Price Lake [Lower] is that, as of the summer of 2007, ***NONE*** of the exotic and invasive aquatic plant species were identified on our lake! This does not mean that we should not be vigilant and develop methods for protecting our lake [17]

"Plant and Sediment Types As Relate to Property Owner Shorelines," Appendix G, offers a method to looking up your name (in the order your property appears along the shoreline), and finding out which aquatic plants and lake bottom sediments were found at the plot points adjacent to your

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[17] **Exotic Plants** (See: **Appendix D "Aquatic Plant Species Statistics and Related Information**")

shoreline. It might be a good idea to go out on the lake and identify those plants and learn about them (what they look like, how to identify them, what their growth patterns are at various seasons of the year, etc.) so that you can spot if some new species should ever sneak into (read that as “invade”) your water garden! You are one of the first lines of defense to keeping exotic, invasive, aquatic species from infesting our lake . . . and woods . . . and we all need each other’s help in defending our lake! You may notice, as you scan the various plants listed as having been identified in a plot area, that some of the plants were not listed by the DNR in their listing on page 2 of Appendix E—such omissions have been noted in Appendix G. Also to aid you in identifying the aquatic plants, I was able to locate pictures (line drawings) with brief descriptions of some (not all) of the plants found on Price Lake. These appear at the end of Appendix E and can be checked against plants on our lake by using the scientific name which appears in parenthesis under the enlarged “common name.”

While you’re back in **Appendix G** find out what kind of aquatic plants were discovered just off the shore of the neighboring properties on either side of yours. Then, of course, you might want to look up the kind of aquatic plants that grow closest to your favorite fishing spot(s) on the lake—maybe by finding similar growth in other locations on the lake you can discover some new fishing haunts?

Learning to identify “out-of-place”—exotic, invasive—plants is the first line of defense . . . we should all seek to educate ourselves about these flora interlopers. If you encounter an invasive species of plant: **(1)** dig it up then dry it out—away from the lake—and burn it; **(2)** notify your neighbors to check their areas; and **(3)** inform the person at the nearest DNR service center office whose responsibility is invasive plant species. Early detection and eradication of small infestations and prevention of new infestations are the most cost-effective ways to manage invasive plants. [18]

THE SHORELINE

The Shoreline Assessment of Price Lake [Lower]

The shoreline assessment consisted of a survey observing structures (natural and man made) along the shoreline as well as the growth of trees and shrubbery and the restructuring of natural growth for what may be considered by some as property enhancement (i.e., maintained lawns). For the Lake Study’s complete descriptions See: **Appendix L “The Statistical Depiction of Price Lake’s Shoreline”**.

Concerning lake shorelines the following has been suggested. People come up to the northwoods to get away from the cities and towns so that they can enjoy nature . . . then they commence to turn their lake shores and woods into citified properties. They clear the weeds out of lakes so they can swim and beach their boats, they clear the brush off of the banks and shores and run concrete stairways down to the the water’s edge. They cut nearby trees and bushes and plant lawns—then put nitrogen (phosphorous) on the land to make the lawns grown . . . and it washes/leeches into the lakes thus causing more plants to grow along the shores. And now they have recreated miniature (or not so miniature) copies of their city and town properties . . . and altered nature’s way of providing for

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[18] More information may be found in this report in **Appendix D** and these locations: Midwest Invasive Plant Network (www.mipn.org); Bureau of Endangered Resources, WI DNR (608-267-5066, (www.dnr,state.wi.us/invasives/ and 608-266-9270, (www.dnr.wi.gov/invasives); Invasive Plants Association of Wisconsin (www.ipaw.org); University of Wisconsin–Extension 608-261-1092 or 608-267-3531 (www.uwex.edu/erc/invasives.html)

its flora and fauna. And here on Price Lake? Well, I think most of us would have to admit, “That pretty closely portrays how we have treated our shorelines along Price Lake!”

It has been estimated that “citified” lawns create much more run-off of water (as much as eight times) than do naturally established lots of grasses and brush. However, the run-off is usually associated with the lawn care use of more phosphorous fertilizers. (in some cases four times the required amount to maintain a healthy lawn). This phosphorous cascade into lakes results in the promotion of weeds and algae growth in the lakes and streams, thus, oxygen is depleted, and fish can no longer thrive,

THE “WHOLE ENCHILADA”

A simplified form of the Lake Study findings as relates to our Price Lake has been presented above, with some interpretations, comments, and possible applications. What follows is the interestin scientific version of the investigation’s collected information. I have placed these findings at the rear in appendices and have included as much explanatory definitions as I could locate.

A CONCLUDING QUESTION

IS IT YOU WHO WILL HELP YOUR LAKE? WHO ELSE WILL “STEWARD AND ASSURE A LEGACY OF HEALTHY ECOSYSTEMS FOR FUTURE GENERATIONS?

APPENDIX A

THE SURVEY OBJECTIVES, DESIGN, AND SAMPLING

Objectives of Study Design and Sampling Considerations [19]**:** The study set out to determine: **(1)** the proportion of lakes (+/- 5%) in the U.S. that exceed a threshold of concern using selected indicators with 95% confidence and **(2)** the proportion of lakes (+/- 15%) in a specific eco-region grouping that exceed a threshold of concern using selected indicators with 95% confidence. Sampling was completed using a probability based design and using rules developed to meet distribution criteria that ensured the yield of a set of lakes that would provide for statistically valid conclusions. Using input from the states and other partners, EPA carried out a framework that incorporated the following to guide its site selection: **(1)** use of the National Hydrographic Dataset (NHD) to identify a list of lakes for potential inclusion; **(2)** for purposes of this survey "lakes" was interpreted to mean natural and manmade freshwater lakes, ponds, and reservoirs greater than ten (10) acres in the conterminous U.S. (excluding the Great Lakes); **(3)** sample size was set at 1,000 lakes which resulted in 909 discrete lakes—with 91 of the lakes scheduled for revisits; **(4)** included were a representative subset of lakes that were used in the National Lake Eutrophication Study (NES), conducted by the EPA in 1972, thus, allowing for an extrapolation of changes to the full set of NES lakes; **(5)** this survey's selection process provided for five lake size classes as well as spatial distribution across the lower 48 states and nine (9) aggregated Omernik Level 3 ecoregions.

Lakes Studied: Lakes throughout the United States were studied—a total of 909— These lakes representing five size classes (ranging from one meter [3.28 feet] deep and over 10 acres in size) were <u>randomly</u> selected from the lower forty-eight states to be included in the survey. Out of the 29 lakes selected from Wisconsin's 15,081, **Our Price Lake** was one of only two lakes in Price County picked to be in the study (the other being Schnur which is northwest of Park Falls and less than a quarter mile from the eastern edge of Butternut Lake). **Purpose/Procedure** [20]: The national study looked at the relative importance of key lake stressors by collecting samples which included: standard

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[19] Taken from: ***Site Selection for the Survey of the Nation's Lakes: Technical Fact Sheet*** (EPA 841-F-06-002) e-mail: lakessurvey@epa.gov

[20] More information available from: ***Survey of the Nation's Lakes: Fact Sheet*** (EPA 841-F-06-006, Nov. 2006) e-mail: lakessurvey@epa.gov

water constituents (i.e., nutrients, pH [21], color, chlorophyll *a* [22]), water clarity, phytoplankton [23], zooplankton [24], sediment core, algal toxins [25], pathogens [26], and benthos [27]—includes non-native species) and a physical profile (i.e., comprehensive shoreline assessment performed at ten sites around each lake). The examination of these core indicators should provide a diagnosis of the lake's water quality, ecological integrity, and recreational value.

Additional Enhancements Performed on Wisconsin Lakes: The state of Wisconsin enlarged their part of the study to include: **(1)** the aquatic plant community, **(2)** an expanded plot of the shoreline plots so as to provide more detail on woody debris for fish habitat, invasive species specific to Wisconsin, and to better document the presence and density of human development, plus **(3)** the inclusion of water samples. These were scrutinized for total–and methyl [28] –mercury to provide a better understanding of how mercury loading rates and ecosystem factors (such as water quality, hydrology, and food web characteristics) control the magnitude of mercury levels in fish [this is also part of an Upper Midwest mercury study conducted by the USGS].

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[21] **pH** = a phosphate; essential nutrient for plant growth, usually limited (too much encourages algae and rooted plant growth just like fertilizer).

[22] **chlorophyll a** = [**chloro** = pale green / **phyll** = leaf: The amount of algae and phytoplankton in water column. The green pigment or coloring mater in plants– in the presence of sunlight it converts carbon dioxide and water into carbohydramtes]. A primary nutrient for aquatic vegetation. By measuring chlorophyll a in lake water, you can indirectly measure the amount of photosythesizing algae and phytoplankton in the water column,

[23] **phytoplankton** [**phyto** = a plant, vegetation / **plankton** = wandering algal, microorganisms that float in the water and photosynthesize like land plants. They form the base of the food chain in most lakes and are usually limited to the photoic zone, or the depth to which sunlight penetrates. They are short-lived and highly responsive to changes in water clarity and nutrients. This microscopic plant life is used as food by fish.

[24] **zooplankton** [**zoo** = animal / **plankton**: The microscopic animal life found floating/drifting or weakly-swimming animal microorganisms that live in bodies of water and are found in the water column—they are used as food by fish. They have the ability to jump in water and eat algae. Like phytoplankton, zooplankton make excellent indicators of environmental conditions in a lake because of their sensitivity to changes in water quality. (Note: In a healthy lake system they can filter the water every 15 days.)

[25] **algal toxins (*Microcystis*)** [**algae** = a group of plants, one celled, colonial, or many celled, containing chlorophyll and having no true root, stem, or leaf / **toxin** = any various poisonous compound produced by some micro-organisms and causing certain diseases. This is a type of photosynthesizing blue-green algae (also referred to as cyanobacteria) that is found naturally in low concentrations in freshwater lakes. At even higher nutrient concentrations, *Microcystis* blooms are so dense that they resemble bright green paint spilled into the water.

[26] **pathogens** the development of disease

[27] **benthos** lake bottom organisms. Benthic macroinvertebrates are insects and small animals without backbones that live in the lake sediments or on the lake bottom. Benthos can be used to determine the type of stress, such as pollution.

[28] **methal mercury =** formed by mercury combining with bacteria to make it more toxic (a process called methalization - $HgCH_3$). May enter into the fishery and can affect humans who consume fish.

APPENDIX B

DIATOMS

A Definition and the Part Diatoms Play

Diatoms are a major group of eukaryotic algae, and are one of the most common types of phytoplankton. They are delicate unicellular organisms that have a yellow-brown chloroplast that enables them to photosynthesize. Their cell walls are made of silica almost like a glass house. They are unique forms of algae that grow a silica shell that is preserved in underwater sediments after they die. The diatom shell, called a frustule, is different for each species. Diatoms may be extremely abundant in both freshwater and marine ecosystems; it is estimated that 20% to 25% of all organic carbon fixation on the planet (transformation of carbon dioxide and water into sugars, using light energy) is carried out by diatoms. [29]

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[29] Received from: Diane Daulton, Upper Chippewa Basin Educator, Park Falls, WI - DNR Office

APPENDIX C

DO **DEFINITION** [30]

Why Dissolved Oxygen (DO) Is Important

Like terrestrial animals, fish and other aquatic organisms need oxygen to live. As water moves past their gills (or other breathing apparatus), microscopic bubbles of oxygen gas in the water, called dissolved oxygen (DO), are transferred from the water to their blood. Like any other gas diffusion process, the transfer is efficient only above certain concentrations. In other words, oxygen can be present in the water, but at too low a concentration to sustain aquatic life. Oxygen also is needed by virtually all algae and all macrophytes, and for many chemical reactions that are important to lake functioning.

Mid-summer, when strong thermal stratification develops in a lake, may be a very hard time for fish. Water near the surface of the lake - the epilimnion - is too warm for them, while the water near the bottom - the hypolimnion - has too little oxygen. Conditions may become especially serious during a spate of hot, calm weather, resulting in the loss of many fish. You may have heard about summertime fish kills in local lakes that likely results from this problem.

Reasons for Natural Variation

Oxygen is produced during photosynthesis and consumed during respiration and decomposition. Because it requires light, photosynthesis occurs only during daylight hours. Respiration and decomposition, on the other hand, occur 24 hours a day. This difference alone can account for large daily variations in DO concentrations. During the night, when photosynthesis cannot counterbalance the loss of oxygen through respiration and decomposition, DO concentration may steadily decline. It is lowest just before dawn, when photosynthesis resumes.

Other sources of oxygen include the air and inflowing streams. Oxygen concentrations are much higher in air, which is about 21% oxygen, than in water, which is a tiny fraction of 1 percent oxygen. Where the air and water meet, this tremendous difference in concentration causes oxygen molecules in the air to dissolve into the water. More oxygen dissolves into water when wind stirs the water; as the waves create more surface area, more diffusion can occur. A similar process happens when you add sugar to a cup of coffee - the sugar dissolves. It dissolves more quickly, however, when you stir the coffee.

Another physical process that affects DO concentrations is the relationship between water temperature and gas saturation. Cold water can hold more of any gas, in this case oxygen, than warmer water. Warmer water becomes "saturated" more easily with oxygen. As water

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[30] Definition provided by: Patrick Goggin, Lake Specialist, WI Lakes Partnership, UW-Extension, Lakes College of Natural Resources, UW-Stevens Point

becomes warmer it can hold less and less DO. So, during the summer months in the warmer top portion of a lake, the total amount of oxygen present may be limited by temperature. If the water becomes too warm, even if 100% saturated, O^2 levels may be suboptimal for many species of trout.

Dissolved oxygen concentrations may change dramatically with lake depth. Oxygen production occurs in the top portion of a lake, where sunlight drives the engines of photosynthesis. Oxygen consumption is greatest near the bottom of a lake, where sunken organic matter accumulates and decomposes. In deeper, stratified, lakes, this difference may be dramatic—plenty of oxygen near the top but practically none near the bottom. If the lake is shallow and easily mixed by wind, the DO concentration may be fairly consistent throughout the water column as long as it is windy. When calm, a pronounced decline with depth may be observed.

Seasonal changes also affect dissolved oxygen concentrations. Warmer temperatures during summer speed up the rates of photosynthesis and decomposition. When all the plants die at the end of the growing season, their decomposition results in heavy oxygen consumption. Other seasonal events, such as changes in lake water levels, volume of inflows and outflows, and presence of ice cover, also cause natural variation in DO concentrations.

APPENDIX D

INVASIVE SPECIES AND RELATED INFORMATION

Exotic Plants/Animals, etc., and Price Lake—Some "Dos and Don'ts"

" 'Exotic' species [frequently referred to as "Invasive Species"]—organisms introduced into habitats where they are **not native**—are severe world-wide agents of **habitat alteration and degradation**. . . . they are considered "biological pollutants. . . . Freed from the predators, parasites, pathogens, and competitors that have kept their numbers in check, species introduced into new habitats often overrun their new home and crowd out native species. . . . Once established, exotics rarely can be eliminated." [31], [32] ***Some exotics which we should be aware of, able to identify, and take precautionary steps to prevent from ever reaching our lake and its surroundings are: Eurasian watermilfoil, curly-leaf pondweed; purple loosestrife,*** [33] ***and their seeds or small fragments; as well as such exotic animals as: rusty crayfish; zebra mussels and their larvae (invisible to naked eye); eggs of fish, and other small aquatic animals carried in water***. [34]

Another invasive concern is VHS (viral hemorrhagi septicemia virus). VHS is not a threat to people who handle fish or want to eat their catch. However, it can spread easily to healthy fish that eat infected fish or absorb water carrying the virus. VHS a vicious disease that can wipe out a lake's fishery, is now in several Wisconsin inland lakes as well as the great Lakes and the Mississippi. Infected fish excrete the virus in their urine and reproductive fluids. The blood vessels become weak, causing hemorrhages in the internal organs, muscles and skin. Infected fish often show bleeding through the skin and swollen eyes. Moving water (VHS can remain infective up to 14 days in water) and/or live fish from a waterbody is the means of transmission (drinking water or up to two (2) gallons of water being used to hold minnows is the legal exception). There are many, and specific, rules for handling fish, fishing equipment, boats and using baits. Most of what appears immediately below are included—plus additional procedures are required. For specific regulations and additional information on the VHS virus there are web sites anglers can consult. [35]

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[31] "A Field Guide to Aquatic Exotic Plants and Animals." A leaflet available from the Minnesota Department of Natural Resources, Exotic Species Programs, 500 Lafayette Road, St. Paul, MN 55155-4025 (612) 296-8712. Provides pictures and text descriptions of species.

[32] Other contacts include: Great Lakes Indian Fish & Wildlife Commission: www.glifwc.org/invasives ; Invasive Plants Association of Wisconsin: www.ipaw.org ; Wisconsin Association of Lakes: www.wisconsinlakes.org/AboutLakes/invasives ; Wisconsin DNR Invasive Species: www.dnr.wi.gov/invasives/ .

[33] "***Eurasian watermilfoil, curly-leaf pondweed; purple loosestrife***"*:* See pp. 3, 4, & 5 of this appendix for visual and text descriptions, methods of transmission, and means for controlling. Gingras, MaryJo, ***Shoreline Restoration Guide,*** A publication of the Ashland, Bayfield, Douglas, Iron Counties, Land Conservation Department, 2nd. Ed. 2006. pp. 16-18.

[34] "Why Should I Care About Invasive Plants?" explains how invasive plants affect hunting, fishing boating, gardening, and so forth. This as well as other information available from the Midwest Invasive Plant Network www.mipn.org

[35] The Wisconsin DNR, Bureau of Fisheries Management: www.fishingwisconsin.org

INSPECT and REMOVE, DRAIN, DISPOSE, WASH & DRY [36]

What can we do? Each of us can: **(1)** **inspect** boats, canoes, and other water craft including trailers

and such boating equipment as: anchors, oars and paddles, centerboards, rollers, axles, outboard and electric trolling motors) *and* **remove** any plants, mud, and animals that are "hitchhiking" and visible before leaving any body of water access; **(2)** **drain** water from the boat, motor, live wells, outboard motor cooling chambers, bilge, and transom wells *and* bait containers while on land ***and before*** leaving any waterbody; **(3)** **dispose** of unwanted bait as well as other aquatic plants and animals **in the trash**. To release live plants and animals in a lake, river or even along a shore often assists invasive species to become established. [37] **(4)** **wash/dry** boats, canoes, and other water craft including trailers and other boating equipment (e.g., anchors, oars and paddles, centerboards, rollers, axles, outboard and electric trolling motors). This is accomplished with hot—104 + degree heated tap water—***and/or*** by spraying with a high-pressure water stream. Alternatively one can dry boats and equipment for at least 5 days. This is done **to kill** harmful species that are not visible at the boat launch (this can be completed on your way home or once you have returned home). Either or both of the preceding methods should be accomplished before transporting to another body of water. ***Be aware*** *that some aquatic nuisance species can survive more than two weeks out of water!*

- * The **good news** for our Price Lake [Lower] is that, as of the summer of 2007, ***NONE*** of the exotic and invasive aquatic plant species were identified on Price Lake!

A POSTSCRIPT

Our local newspaper in Phillips published the following article. "Invasive species report: public awareness and increased efforts to fight their spread is paying off. The 2007-08 report is available on the DNR Web site. Work in this effort is evidently slowing their spread. The vast majority of Wisconsin waters are still free from the most problematic species and no new waters were reported infested with VHS. In '07-'08 (years covering the report) there were half as many waters reported with new infestations of **zebra mussels** and **Eurasian water milfoil** as had been reported in the previous two years. (It should be noted that more than 180 non-native fish, plants, insects, and organisms have entered the Great Lakes since the early 1800's.)" [38]

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[36] "Help Stop Aquatic Hitchhikers." A leaflet plus other information available from the Wisconsin Department of Natural Resources (DNR) PUB-WT-801 2006 (608) 266-9270 / http://dnr.wi.gov/invasives

[37] It is often difficult to identify fish when they are small—merely minnows. Thus, we cannot be absolutely sure we are not releasing invasive species from our bait buckets. Pet store purchased fish or animals should never be used or released into the waters or woods. Likewise, earthworms dug or obtained from northern states or bought for bait are ***not*** native and ***must not*** be dumped or released on the ground.

[38] *Above excerpted from the Phillips **Bee**, June 11, 2009, p. 6-B*

EURASIAN WATER MILFOIL

DESCRIPTION

- Long, spaghetti-like stems up to 6 ½ feet or more in length.
- Stems branch rapidly at water's surface.
- Leaves divided like a feather with 12-21 leaflet pairs per leaf.
- Leaves in whorls of 3-5 leaves around the stem
- There are also 7 native water milfoil species in this region.
- To learn the differences between native and non-native milfoil, go to: www.dnr.state.wi.us/org/land/er/invasive/factsheets/milfoil.htm

HABITAT

- Usually grows in 3-12 feet deep water.
- Found in a variety of sediment; thrives in fine textured inorganic sediment.
- Thrives in nutrient rich lakes and areas where native vegetation has been removed.

SPREAD

- Reproduces through stem fragmentation and stem segments.
- Mechanical clearing from boats, docks, etc. creates new stem fragments
- Entanglement in boat props, trailers, or equipment disperses stem segments and allows for transport of plants to a new lake if fragments are not removed.

CONTROL

There are a variety of control methods depending on the extent:

Manual (hand harvesting)

- Pull or rake weeds in water less than 4 feet; removing roots, stems, and leaves.
- Wisconsin law states that plants must be removed from the water
- Pile harvested plants or compost away from water to prevent nutrient leakage into lake.
- Remove all plants from boats, motors, and trailers before leaving the boat landing.

Mechanical DNR PERMIT REQUIRED

- Machine harvest may remove large areas of invasive plants.
- Contact local Water Management Specialist for permit (see page 21).

Herbicide DNR PERMIT REQUIRED

- Apply an herbicide approved for use in water.
- Contact local Water Management Specialist for permit (see page 21).

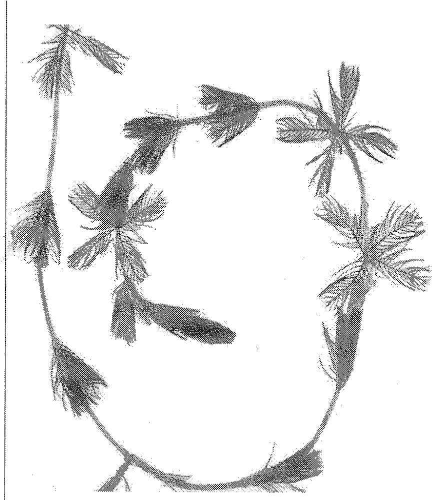
Biological DNR PERMIT REQUIRED

- A native weevil is being used to eat and control this invasive. Contact DNR (see page 21).

Eurasian water-milfoil

(Myriophyllum spicatum)

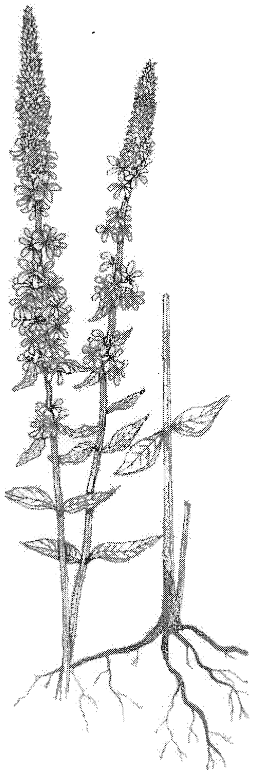
Eurasian water milfoil is a submerged aquatic weed from Europe and Asia that is rapidly spreading through the Midwest United States.



Courtesy of Wisconsin DNR

Purple loosestrife
(Lythrum salicaria)

Purple Loosestrife, originating in Europe and Asia, commonly invades wetlands and forms dense stands. Although purple loosestrife is attractive, it displaces native plants that provide habitat for wildlife.



Courtesy of Canadian Wildlife Service & Manitoba Purple Loosestrife Project

PURPLE LOOSETRIFE

DESCRIPTION

- Stout, perennial herb with woody-like ridged stems, up to 6 ½ feet tall.
- Leaves are 1-4 inches long and either opposite or whorled on the stem.
- Spikes are packed with purple-red flowers composed of 6 petals.
- Flowers from June-September.

HABITAT

- Emergent, found in shallow wetlands, stream banks, and lakeshores.
- Thrives on moist soils and found along roadsides.

SPREAD

- Flowering stems produce as many as two to three million seeds annually.
- Reproduces by underground stems at a rate of one foot per year.
- May spread by floating seeds or root fragments.

CONTROL

There are a variety of control methods:

Small Patches: ALWAYS remove infestations if they are small and controllable.

Mechanical

- Pull young plants by hand before the plant flowers.
- Remove the entire plant; any remaining root fragments will develop into new plants.
- Bag the plant and dispose of it at a dump, or burn the plants.

Herbicide DNR PERMIT REQUIRED (if using in, or near, open water)

- Cut plant about knee high during early flowering, bag flowering parts, and properly dispose.
- Apply concentrated herbicide to cut stem according to professional recommendations.

Large Patches:

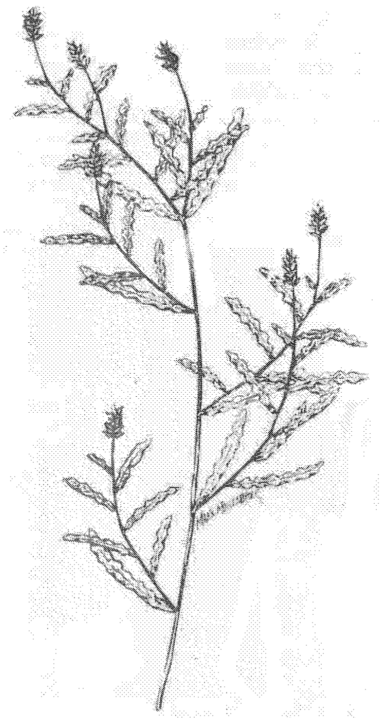
Biological

- Several European beetle species have been released to eat and control this invasive.
- The beetles feed only on Purple Loosestrife.
- This method may be successful on both large and small sites that are
- Contact Great Lakes Indian Fish & Wildlife Commission or local DNR office for more information on biological control (page 21).

Curly-leaf pondweed

(Potamogeton crispus)

Curly-leaf pondweed is a submerged, aquatic exotic plant that originated in Europe and first appeared in the United States in the mid-1800s. Curly-leaf pondweed was found in Wisconsin in 1905, and is now common throughout the state. The range now includes most of the U.S.



Courtesy of Minnesota DNR

CURLY-LEAF PONDWEED

DESCRIPTION

- Flattened, spaghetti-like stems grow out of a slender rhizome.
- Submerged, oblong leaves attached alternately on the stem.
- Wavy, serrated leaves are 1-3 inches long and ¼-½ inch wide.
- Flower spikes (1-2 inches long) emerge from water surface in the spring.
- Summer buds germinate in the fall, producing winter foliage.
- Winter foliage allows the plant to photosynthesize under the ice, giving it a head start on native plants emerging in the spring.

HABITAT

- Found in soft substrate in water from 1 foot to several feet deep.
- Can tolerate low light and will tolerate turbid water.

SPREAD

- Spreads by the same methods as Eurasian water-milfoil, although not as aggressive.
- Reproduces through stem fragmentation and stem segments.
- Mechanical clearing from boats, docks, etc. creates new stem fragments.
- Entanglement in boat props, trailers, or equipment disperses stem segments and allows for transport of plants to a new lake. Be sure to remove ALL vegetation from your equipment.

CONTROL

There are a variety of control methods depending on the extent:

Manual (hand harvesting)

- Pull or rake weeds in water less than 4 feet;
  removing roots, stems, and leaves.
- Wisconsin law states that plants must be removed from the water.
- Pile harvested plants or compost away from water to prevent nutrient leakage into lake.

Mechanical DNR PERMIT REQUIRED

- Machine harvest may remove large areas of invasive plants.
- Contact local Water Management Specialist for permit (see page 21).

Herbicide DNR PERMIT REQUIRED

- Chemical treatment applied for extreme plant-growth management.
- Contact local Water Management Specialist for permit (see page 21).

APPENDIX E

AQUATIC PLANT SUMMARIES

Importance of Aquatic Plants [39]

Native aquatic plants are at the root of healthy lakes, and are essential for good fishing and clean water. Plants provide a place to live and food for fish, birds, frogs turtles, insects, and many other kinds of wildlife. They also produced the oxygen needed by fish and other underwater animals. As important, they help preserve water quality by using nutrients—like phosphorus—that would otherwise be available for algae growth, protecting shorelines from erosion, and holding down lake-bottom sediments with their roots. [40]

A Numerical Portrait of Plot Sites [41] *and* the Aquatic Plants Encountered

(Survey Date 07/24/07)

Summary of Plot Sites Findings:

Total number of points sampled: 130 out of 263 possible

Total number of sites with vegetation: 38

Total number of sites shallower than maximum depth of plants: 50 (approx. 39%)

Frequency of occurrence at sites shallower than maximum depth of plants: 76.00

Maximum depth of plants (ft): 6.50

Number of sites sampled using rake on Rope (R): 5

Number of sites sampled using rake on Pole (P): 108

Average number of all species per site (shallower than max depth): 1.88

Average number of all species per site (vegetative sites only): 2.47

Average number of native species per site (shallower than max depth): 1.88

Average number of native species per site (vegetative sites only): 2.47

Species Richness (including visuals): 25
(Species richness includes filamentous algae and moss)

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[39] See: **Appendix F "Plant Growth and Its Importance"** for supportive information

[40] **For more (and additional—interesting) information see the Wisconsin Association of Lakes** website http://www.wisconsinlakes.org/aboutlakes.html

[41] See: **Appendix F "Map of Price Lake"** on which the "plot sites" on Price Lake are indicated.

Individual Aquatic Plant Species and Amounts Encountered on Price Lake:

	Number of Sites Where Species Found	**Average Rake Fullness**	**Number of Visual Sightings** ✓ ✓
✓ **Filamentous algae**	11	1.55	3
Brasenia schreberi (Watershield)	5	1.60	11
Ceratophyllum demersum (Coontail)	13	2.00	1
Eleocharis palustris (Creeping spikerush)	1	2.00	1
Elodea canadensis (Common waterweed)	1	2.00	4
Equisetum fluviatile (Water horsetail)	11	1.91	
Isoetes sp (Quilwort)	1	1.00	1
Lemna minor (Small duckweed)	1		
moss	1	1.00	
Najas flexilis (Bushy pondweed)	3	1.00	1
Nitella sp. (Nitella)	5	1.00	
Nuphar variegata (Spatterdock)	8	1.75	12
Nymnphaea odorata (White water lily)	10	1.90	19
Potamogeton amplifolius (Largeleaf pondweed)	11	1.64	9
Potamogeton epihydrus (Ribbonleaf pondweed)	6	1.67	4
Potamogeton zosteriformis (Flat-stem pondweed)	1	1.00	
Schoenoplectus tabernaemontani (Softstem bulrush)	4		
Spirodela polyrhiza (Large Duckweed)	1		
Utricularia vulgaris (Common bladderwort)	1	1.00	1
sp1 - Potamogeton diversifolius?/ Water-thread pondweed? vouchered as AM19)	2	1.00	4
sp2 - Carex sp., (Sedge)	1		
sp3 - Sparganium angustifolim OR S. natans? (Thin floating leaved bur-reed)	1	1.00	
sp4 - Sagittaria rigida (Sessile-fruited arrowhead)	1	2.00	2
sp5 - Typha sp. (Cattail)	1	1.00	
sp6 - Carex utriculata (Common yellow lake sedge)	1		

✓ = Plant Names shown in **bold face** are those aquatic plants ***most*** frequently encountered on Price Lake [Lower]. See p. 8 of the report for summary statistic for frequently encountered plants.

✓ ✓ = While at a site we sample a small area using a rake on a long pole. We also look for any other plants (not already recorded) at that site within 6 ft (2m) of the boat. These species are recorded as a “visual” (V) on the data sheet and will be included in total number of species seen but not be included in summary statistics.

AQUATIC PLANT AND DOMINANT SEDIMENT TYPE SURVEY RESULTS [42]

When I (EN) asked, "What do these findings tell us about Price Lake)?" This is what I was told, "Although some lake users consider aquatic macrophytes to be "weeds" and a nuisance to the recreational use of the lake, they are actually an essential element in a healthy and functioning lake ecosystem. It is very important that the lake stakeholders understand the importance of lake plants and the many functions they serve in maintaining and protecting a lake ecosystem. With increased understanding and awareness, most lake users will recognize the importance of the aquatic plant community and their [own] potential negative affects on it. Diverse aquatic vegetation provides habitat and food for many kinds of aquatic life, including fish, insects, amphibians, waterfowl, and even terrestrial wildlife.

Importance of Aquatic Plants

Aquatic plants are a fundamental element in every healthy lake. Changes in lake ecosystems are often first seen in the lake's plant community. Whether these changes are positive, like variable water levels or negative, like increased [human] shore-land development or the introduction of an exotic species, the plant community will respond. Plant communities respond in a variety of ways; there may be a loss of one or more species, certain life forms, such as emergents or floating-leaf communities may disappear from certain areas of the lake, or there may be a shift in plant dominance between species. With periodic monitoring and proper analysis, these changes are relatively easy to detect and provide critical information for management decisions.

Species List

The species list is simply a list of all of the species that were found within the lake, both exotic and native. The list also contains the life-form of each plant found, its scientific name, and its coefficient of conservatism. The latter is discussed in more detail below. Changes in this list over time, whether it is differences in total species present, gains and loses of individual species, or changes in life-forms that are present, can be an early indicator of changes in the health of the lake ecosystem.

Frequency of Occurrence

Frequency of occurrence describes how often a certain species is found within a lake.
Obviously, all of the plants cannot be counted in a lake, so samples are collected from pre-determined areas. Plant samples can be collected from plots laid out on in a grid system over the lake with random points selected within that grid to get a statistically good representation of the plant community found on the lake. Using the data collected from these plots, an estimate of occurrence of each plant species can be determined. In this section, relative frequency of occurrence is used to describe how often each species occurred in the plots that contained vegetation. These values are presented in percentages and if all of the values were added up, they would equal 100%. For example, if water lily had a relative frequency of 0.1 and we described that value as a percentage, it would mean that water lily made up 10% of the population.

In the end, this analysis indicates the species that dominate the plant community within the lake.

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[42] The explanatory information above was supplied by Partrick Goggin, Lake Specialist, Lakes Partnership; UW-Extension, Lakes College of Natural Resources at UW-Stevens Point.

Shifts in dominant plants over time may indicate disturbances in the ecosystem. For instance, low water levels over several years may increase the occurrence of emergent species while decreasing the occurrence of floating-leaf species. Introductions of invasive exotic species may result in major shifts as they crowd out native plants within the system.

Species Diversity

Species diversity is probably the most misused value in ecology because it is often confused with species richness. Species richness is simply the number of species found within a system or community. Although these values are related, they are far from the same because diversity also takes into account how evenly the species occur within the system. A lake with 25 species may not be more diverse than a lake with 10 if the first lake is highly dominated by one or two species and the second lake has a more even distribution.

A lake with high species diversity is much more stable than a lake with a low diversity. This is analogous to diverse financial portfolio in that a diverse lake plant community can withstand environmental fluctuations much like a diverse portfolio can handle economic fluctuations. For example, a lake with a diverse plant community is much better suited to compete against exotic infestation than a lake with a lower diversity.

Floristic Quality Assessment

Floristic Quality Assessment (FQA) is used to evaluate the closeness of a lake's aquatic plant community to that of an undisturbed, or pristine lake. The higher the floristic quality, the closer a lake is to an undisturbed system. FQA is an excellent tool for comparing individual lakes and the same lake over time. Lakes within the same ecoregion are often compared. Ecoregions are areas related by similar climate, physiography, hydrology, vegetation and wildlife potential. Comparing ecosystems in the same ecoregion is sounder than comparing systems within manmade boundaries such as counties, towns, or states.

The floristic quality of a lake is calculated using its species richness and average species conservatism. As mentioned above, species richness is simply the number of species that occur in the lake, for this analysis, only native species are utilized. Average species conservatism utilizes the coefficient of conservatism values for each of those species in its calculation. A species' coefficient of conservatism value indicates that species' likelihood of being found in an undisturbed (pristine) system. The values range from one to ten. Species that are normally found in disturbed systems have lower coefficients, while species frequently found in pristine systems have higher values. For example, cattail, an invasive native species, has a value of 1, while common hard and softstem bulrush have values of 5, and Oakes pondweed, a sensitive and rare species, has a value of 10. On their own, the species richness and average conservatism values for a lake are useful in assessing a lake's plant community; however, the best assessment of the lake's plant community health is determined when the two values are used to calculate the lake's floristic quality.

A key component of the aquatic plant survey can be the creation of an aquatic plant community map. The map represents a snapshot of the important plant communities in the lake as they existed during the survey and is valuable in the development of the management plan and in comparisons with future surveys. A mapped community can consist of submergent, floating-leaf, or emergent plants, or a combination of these life-forms. Examples of submergent plants include wild celery and pondweeds; while emergents include cattails, bulrushes, and arrowheads, and floating-leaf species include white and yellow pond lilies. Emergents and floating-leaf communities lend themselves well to mapping because there are distinct boundaries between communities. Submergent species are often mixed throughout large areas of the lake and are seldom completely visible from the surface; therefore, mapping of submergent communities is more difficult and often impossible.

PLANT IDENTIFICATION

To help you in identifying the aquatic plants, pictures (line drawings) with brief descriptions of some (not all) of the plants found on Price Lake are presented on the pages which follow. These can be checked against plants on the lake by using the scientific name which appears in parenthesis under the enlarged "common name." [43]

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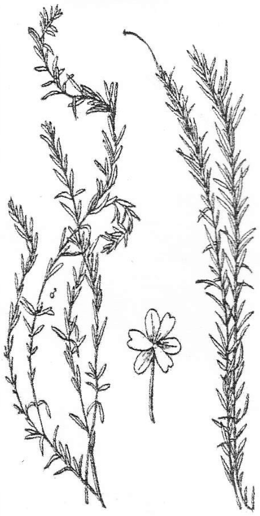
[43] Two additional sources for plant information are: (1) ***Through the Looking Glass***, a book with line drawings and descriptions of aquatic plants; and (2) ***Water Plants***, a DVD with photographic pictures of aquatic plants. Both of these items are available the University of Wisconsin Extension at Stevens Point, (715) 346-4116 or www.uwexlakes@uwsp.edu



ELODEA

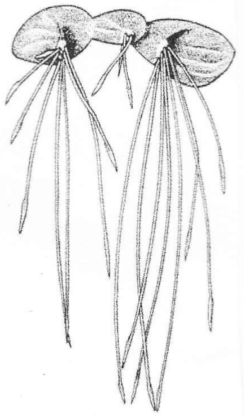
(*Elodea canadensis*)

This submersed weed with broad oval leaves at first glance appears very similar to Hydrilla, however this plant usually contains its leaves in whorls of 3 around the stem. Whorls are compact near the growth tip with spacing between the whorls gradually increasing as you go down the stem. This plants leaves have smooth edges and lack the spine on the underside of the leaf that Hydrilla has.

DUCKWEED

(*Lemnaceae spp.*)

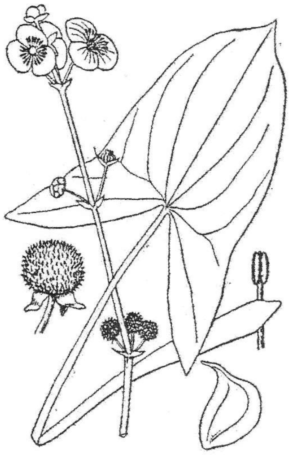
Duckweeds are members of the family containing the world's smallest flowering plants. They are generally a very small floating green plant, usually smaller than your smallest fingernail. Often mistaken for algae, this plant floats on the surface of the water and reproduces very rapidly. This plant may or may not have a 'root' extending from the underside, but the plant is not rooted to the soil.



ARROWHEAD

(*Sagittaria spp.*)

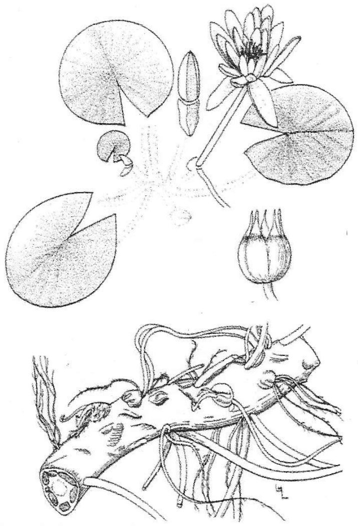
This plant is named for its arrow shaped leaf. This emergent plant may also have some elliptical emergent leaves and sometimes will also have ribbon, or tongue-like submersed leaves. This plant has underground rootstocks with tubers and may have tiny white flowers sometimes present.



LARGELEAF POND-WEED

(*Potamogeton amplifolius*)

Thick, large stems and broad leaves aid in identification of Largeleaf pondweed. The submerged leaves appear wavy and taper toward the stem. Floating leaves are egg shaped. Rarely is this pondweed found branching.



WATER LILY

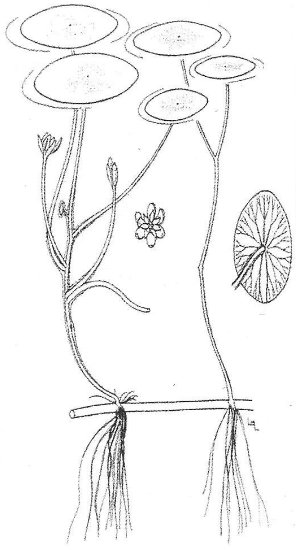
(*Nymphaea spp.*)

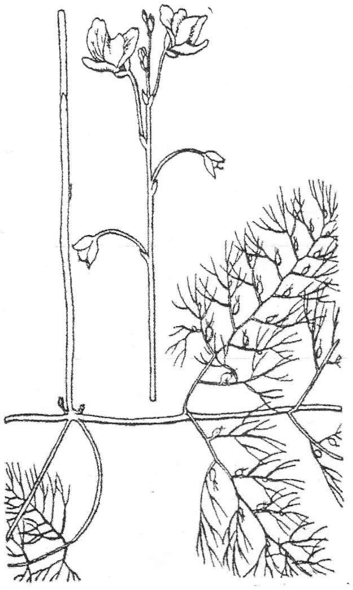
Large round pad with a cleft running almost to mid-vein. Leaves are usually 6-8 inches in diameter and the leaf veins radiate outward from the petiole. The underside of the leaf is a purplish red color and the flower is white with many rows of petals. This plant has a thick, fleshy rhizome network buried in the mud

WATERSHIELD

(*Brasenia schreberi*)

Also known commonly as Dollar Bonnet. This plants leaves are oval to elliptical with a smooth edge. The stem (petiole) is attached to the middle of the leaf. Leaves are 2-5 inches in length. Mature plants will have a slimy, gelatinous coating on the leaf underside. Produces a dull purple flower in late summer, grows from roots.





BLADDERWORT

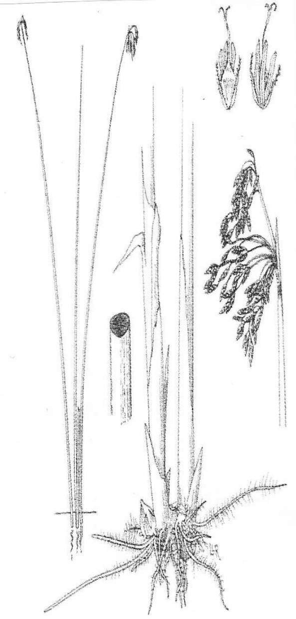
(*Utricularia spp.*)

This plant is free floating and does not utilize a standard root system. There are finely divided leaves scattered along the stem with many small structures that look like bladders attached to the leaves. These bladders act as traps to capture small aquatic invertebrates. Due to this plant not being rooted, floating plants may re-infest treated areas.

BULRUSH

(*Scirpus spp.*)

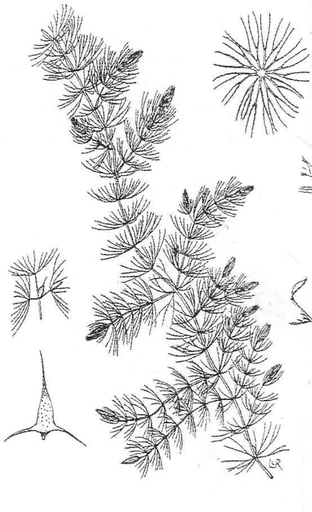
This plant has a long, tall triangular or round stem that may or may not contain leaves. This plant has a cluster of brownish flowers and seeds located at the end of the stem. This plant will generally be found along the shoreline or in shallow waters.



COONTAIL

(*Ceratophyllum demersum*)

Supporting waterfowl, fish, and insects, Coontail can be a desirable aquatic plant. However, thick growths around shore can be problematic. Lacking true roots, it commonly floats near the surface later in summer. Stiff leaves are whorled around a hollow stem in groups of five to twelve. Coontail can be differentiated from milfoils by forked, not feathery leaves. Leaf spacing is highly variable, but the ends are often bushy, like a raccoons tail.



COMMON NAIAD

(*Najas flexilis*)

Leaves of the Common Naiad may occur in pseudo-whorls or oppositely positioned pairs (whorls tend to occur at the end of the stems). The ribbon like leaves are submersed with variable spacing between nodes. The edges may or may not appear spiny and the leaf tips taper to a fine point. Naiads are annual plants, growing from seed each year, and can form dense, bushy masses by midsummer.

ALL AQUATIC PLANTS, NATIVE OR INVASIVE, CAN REACH NUISANCE LEVELS AND MAY REQUIRE MANAGEMENT

FOR MORE INFORMATION CONTACT: MIDWEST AQUATIC PLANT MANAGEMENT SOCIETY www.mapms.org

(Revised 2009)

MAPMS would like to thank many sources for their support providing these educational drawings, including: "Plant line drawings are the copyright property of the University of Florida Center for Aquatic and invasive Plants (Gainesville). Used with permission."

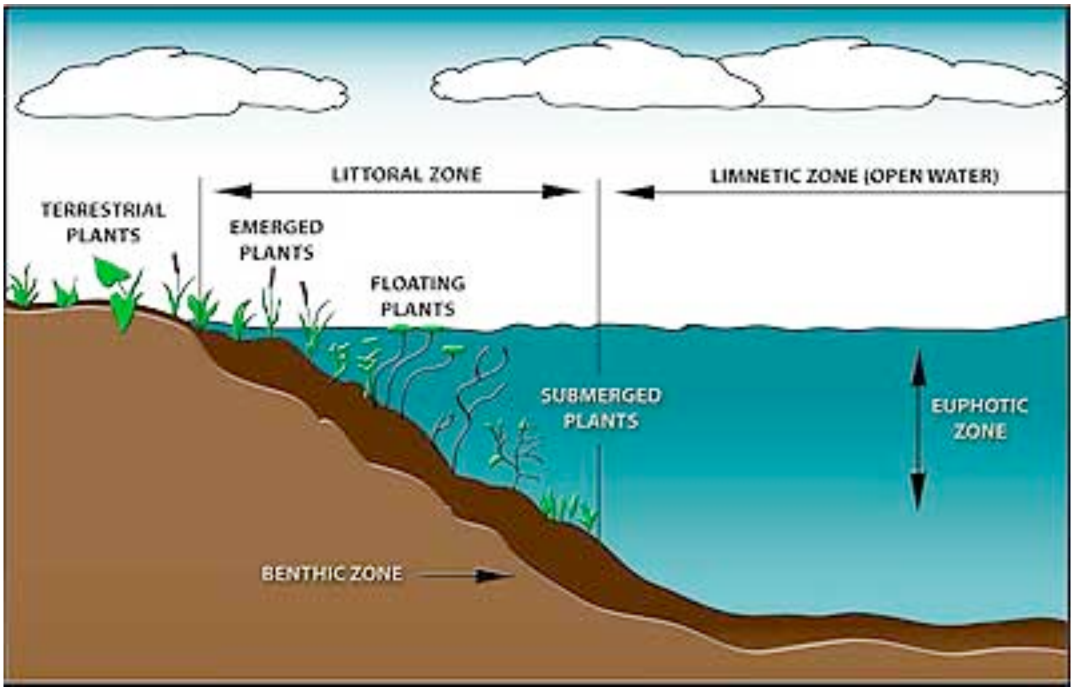
APPENDIX F

PLANT GROWTH AND ITS IMPORTANCE [44]

Plant growth is important to the character of the lake, and to all other organisms that live in the lake. Emergent and floating-leafed plants are valued for their aesthetic qualities and help provide a more “natural” buffer between a developed shoreline and the open water.

Plants are primary producers, that is, they take sunlight and nutrients in the water and covert them into energy to grow and produce oxygen—necessary for fish and many other underwater creatures—as a byproduct.

A lake's "littoral zone" describes the shallow water area where rooted and floating aquatic plants (also called macrophytes) can grow because sunlight can penetrate to the lake bottom. Large algae are also included in the macrophyte community. In lakes where the lake bed is too rocky or sandy for rooted plants to anchor themselves, or wave action is too severe, there may be few macrophytes.



Algae constitute the other main group of primary producers. Algae come in countless forms and live in nearly all kinds of environments. Most are microscopic, growing as single cells, small colonies, or filaments of cells. Algae suspended in the water are called phytoplankton. Phytoplankton grow suspended in open water by taking up nutrients from the water, and energy from sunlight. If their

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[44] **Appendix F Taken from the Wisconsin Association of Lakes** website at: uwextension

populations are dense, the water will become noticeably green or brown and will be turbid (have low transparency). Sunlight may not reach the lake bed bottom even in shallow areas if the concentration of algae or silt is high.

In many lakes (especially shallow ones) submerged plants grow in abundance, performing a critical role: they compete with algae for nutrients and help maintain better water clarity. In shallow, clear lakes, macrophytes may represent most of the green plant material present and may account for most of the photosynthesis. The major threat to lakes involves the excessive growth of primary producers due to excessive nutrients entering lakes in polluted runoff.

APPENDIX G

MAP of PRICE LAKE [LOWER]

A Few Descriptive Features of Price Lake [Lower]

Price Lake [Lower] is a glacial lake connected, by a creek to the north, to Middle and Upper Price Lakes. There is a widening in the creek (known as Price Creek) between Middle and Upper Price Lakes which has been dubbed with the name, Little Papoose Lake. Several creeks feed Price Lake via Price Creek and its sister lakes to the north; the closest is Beaver Creek which empties out of the Kimberly Clark area and into Price Creek just a little north of the northern edge of Price Lake. Waters from Price Lake [Lower] eventually empty into the Mississippi River. Price Creek, as it empties out of Price Lake [Lower] at the south end, travels for about thirteen miles until it runs into the South Fork of the Flambeau River. The Flambeau River connects to the Wisconsin River which in turn connects to the Mississippi River.

Price Lake [Lower] is between an 89 and 91.8 acre lake (depending on which source you use). Price Lake [Lower], north to south, at its longest points—shore to shore—is about 2548.56 feet long and east to west, it is approximately 1,941.76 feet wide at its widest locations—shore to shore. Or about one half (1/2) mile long by a little more than a third (1/3) mile wide. It has a shoreline of approximately 1 and a half miles (1 1/2). The lake's maximum depth is 27 feet; with a little over 18 percent being 15 feet or deeper. The deepest location plot point #176, in the southeast portion of the lake—during the winter, at freeze-up, this is the last place on the lake to freeze solid. At freeze-up you will notice a round, brown patch at that location of the lake—I always thought there was probably a spring at that place.

The Lake Survey Sampling Map for Price Lake

On the next page is the the lake survey map used for sampling Price Lake. It shows the 263 sampling plots which were used (with longitude and latitude addresses for each plot point.

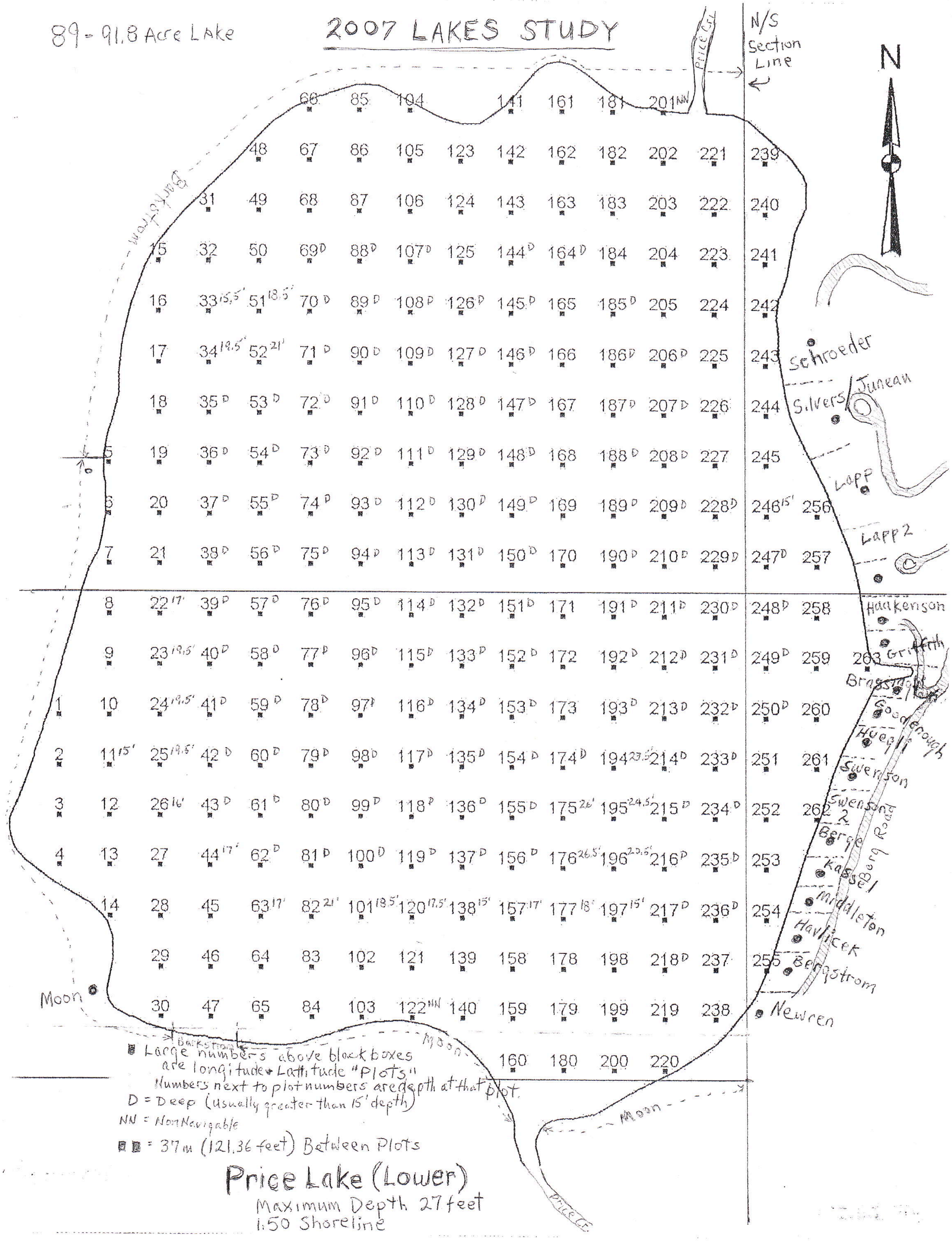
The plot points are indicated with black boxes. There are 37 meters, or 121.36 feet between plot points. I have entered the handwritten numbers and letters after the plot addresses. Numbers to the right of the plot address numbers are indications of depth at that location—in feet. Many plot address numbers are followed by a "D" which represents "deep"—usually greater than fifteen feet (15'). To survey the aquatic plants the "point-Intercept" method was use to identify macrophyte (lake weeds). At each plot, or intercept point, researchers look in four different directions–think of a giant **X** on the plot point as the "directions."

Along the shoreline of the lake I have introduced two other features to the survey map: **(1)** property lines—within which I have denoted the property owner's name, and **(2)** dots representing the property owner's cabin/cottage.

Please understand, that in perspective, the size of the black, square, plot marks—as indicated on the lake—are shown several times larger than the actual, birds-eye view, outline of your cabin would be. Also, the reader will easily surmise the property lines shown on the shore of
the lake, as well as the "dots" representing the locations of cabins on each of the lots, are <u>estimated approximations</u> of the true locations.

89-91.8 Acre Lake

2007 LAKES STUDY



■ Large numbers above black boxes are longitude + Latitude "Plots"
Numbers next to plot numbers are depth at that plot.
D = Deep (usually greater than 15' depth)
NN = NonNavigable
■ ■ = 37 m (121.36 feet) Between Plots

Price Lake (Lower)

Maximum Depth 27 feet
1.50 Shoreline

APPENDIX H

AQUATIC PLANT AND DOMINANT SEDIMENT TYPE SURVEY RESULTS AS RELATES TO PROPERTY OWNER SHORELINES

Sampling Procedure: Points were established in a grid pattern covering the entire lake (See: **Appendix F "Price Lake Map"**). At each point on this grid pattern (known as a plot) a sample was taken with a rake on a long pole (15'). All plant species were identified and abundance on the rake was estimated. If the water was too deep for the pole, a weighted rake head attached to a rope was used. You will note that many of the "plot" points were too deep and thus did not support any plant life.

Dominant Sediment Type (i.e., Muck, Sand, and Rock): Like any body of standing water, a lake serves as the repository for materials carried into it by water, wind, ice, and the activities of living creatures. These materials include fine particles of minerals, rock fragments, and organics and are referred to as sediments. They influence the microflora and fauna, the plant and animal communities, seen in the aquatic system, as well as nitrogen and carbon cycling.

When I (EN) asked, "Is the term "Rock" synonymous with gravel/pebbles/stones? Patrick Goggin, Lake Specialist, Lakes Partnership; UW-Extension, Lakes College of Natural Resources at UW-Stevens Point, responded, "Yes, in our Wisconsin point-intercept aquatic plant survey monitoring we do not distinguish between the size of the rocks, but just categorize each point as Muck, Sand or Rock."

FINDINGS:

Sampling Points and Retrieved Discoveries:

Plots: 201 Approximate Relationship to Land/CPTS [45] (owner: **BARKSTROM)**;
Latitude–45.7677211; Longitude– -90.6585616;
Depth (ft.)–None Indicated;
Dominant Sediment Type (Muck, Sand, or Rock)–**None Indicated**;
Total Rake Fullness—**Non-navigable (Plants)**;
Aquatic Plants:
Nuphar variegata (Spatterdock)–Visual;
Nymnphaea odorata (White water lily)–Visual;

Plots: 202 Approximate Relationship to Land/CPTS (owner: **BARKSTROM)**;
Latitude–45.7673881; Longitude– -90.6585577;
Depth (ft.)–1.5;
Dominant Sediment Type (Muck, Sand, or Rock)**–Muck;**
Total Rake Fullness–**Full**;
Aquatic Plants:
Filamentous algae [46] –**Medium**;
Brasenia schreberi (Watershield)–Visual;
Ceratophyllum demersum (Coontail)– High;
Elodea canadensis (Common waterweed)–**Medium**;
Lemna minor (Small duckweed)–Visual;

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[45] **CPTS** = Closest Point to Shoreline

[46] **Filamentous algae** = single **algae** cells that form long visible chains, threads, or filaments. These filaments intertwine forming a mat that resembles wet wool. **Filamentous algae** starts growing along the bottom in shallow water or attached to structures in the water (like rocks or other aquatic plants).

Najas flexilis (Bushy pondweed)–<u>Low</u>;
Nymnphaea odorata (White water lily)–<u>Visual</u>;
Potamogeton amplifolius (Largeleaf pondweed)–<u>Low</u>;

Plots: 181 <u>Approximate Relationship to Land/CPTS (owner</u>: **BARKSTROM)**;
<u>Latitude</u>–45.7677184; <u>Longitude</u>– -90.6590374;
<u>Depth</u> (ft.)–2;
Dominant Sediment Type (Muck, Sand, or Rock)–**<u>Muck</u>**;
Total Rake Fullness–**<u>High</u>**;
Aquatic Plants:
Ceratophyllum demersum (Coontail)–<u>High</u>;
Nuphar variegata (Spatterdock)–<u>Low</u>;
Nymnphaea odorata (White water lily)–<u>Visual</u>;
Potamogeton amplifolius (Largeleaf pondweed)–<u>Low</u>;
Potamogeton epihydrus (Ribbonleaf pondweed)–<u>Visual</u>;
√ Sparganium American (Bur Reed)–<u>Low</u>;

√ = Not listed on the *Aquatic Plant Summaries* list for Price Lake.

Plots: 182 <u>Approximate Relationship to Land/CPTS (owner</u>: **BARKSTROM)**;
<u>Latitude</u>–45.7673854; <u>Longitude</u>– -90.6590335;
<u>Depth</u> (ft.)–3;
Dominant Sediment Type (Muck, Sand, or Rock)–**<u>Sand</u>**;
Total Rake Fullness–**<u>Full</u>**;
Aquatic Plants:
Ceratophyllum demersum (Coontail)–<u>Medium</u>;
Nitella sp. (Nitella)–<u>Low</u>;
Nymnphaea odorata (White water lily)–<u>High</u>;
√ Sparganium Sp.–<u>Low</u>;

√ = Not listed on the *Aquatic Plant Summaries* list for Price Lake.

Plots: 161 <u>Approximate Relationship to Land/CPTS (owner</u>: **BARKSTROM)**;
<u>Latitude</u>–45.7677156; <u>Longitude</u>– -90.6595132;
<u>Depth</u> (ft.)–3;
Dominant Sediment Type (Muck, Sand, or Rock)**–<u>Sand</u>**;
Total Rake Fullness**–<u>High</u>**;
Aquatic Plants:
Brasenia schreberi (Watershield)–<u>Low</u>;
Ceratophyllum demersum (Coontail)–<u>High</u>;
Nuphar variegata (Spatterdock)–<u>Visual</u>;
Nymnphaea odorata (White water lily)–<u>Low</u>;
Potamogeton zosteriformis (Flat-stem pondweed)–<u>Low</u>;

Plots: 162 <u>Approximate Relationship to Land/CPTS (owner</u>: **BARKSTROM)**;
<u>Latitude</u>–45.7673826; <u>Longitude</u>– -90.6595093;
<u>Depth</u> (ft.)–4;
Dominant Sediment Type (Muck, Sand, or Rock)**–<u>Sand</u>**;
Total Rake Fullness**–<u>High</u>**;
Aquatic Plants:

Brasenia schreberi (Watershield)–Visual;
Nitella sp. (Nitella)–Low;
Nymnphaea odorata (White water lily)–Visual;

Plots: 141 Approximate Relationship to Land/CPTS (owner: **BARKSTROM)**;
Latitude–45.7677129; Longitude– -90.659989;
Depth (ft.)–0.5;
Dominant Sediment Type (Muck, Sand, or Rock)**Rock**;
Total Rake Fullness–**None Indicated**;
Aquatic Plants:
Filamentous algae–Visual;
Myriophyllum verticillatum, (Whorled water milfoil)–Visual;
Sparganium Fluctuns (Floating-Leaved Bur-reed)–Visual;

Plots: 142 Approximate Relationship to Land/CPTS (owner: **BARKSTROM)**;
Latitude–45.7673799; Longitude– -90.6599851;
Depth (ft.)–4.5;
Dominant Sediment Type (Muck, Sand, or Rock)**–Muck**;
Total Rake Fullness–**None Indicated**;
Aquatic Plants:
Nuphar variegata (Spatterdock)–Visual;

Plots: 123 Approximate Relationship to Land/CPTS (owner: **BARKSTROM)**;
Latitude–45.7673771; Longitude– -90.6604609;
Depth (ft.)–3;
Dominant Sediment Type (Muck, Sand, or Rock)**–Rock**;
Total Rake Fullness**–High**;
Aquatic Plants:
Filamentous algae–High;
Ceratophyllum demersum (Coontail)–Low;
√ **Nuphar advena (Yellow pond lily)-–Visual**;
Nuphar variegata (Spatterdock)–Low;
Potamogeton alpinus (Alpine pondweed)–Medium;

√ = Not listed on the *Aquatic Plant Summaries* list for Price Lake.

Plots: 124 Approximate Relationship to Land/CPTS (owner: **BARKSTROM)**;
Latitude–45.7670441; Longitude– -90.660457;
Depth (ft.)–8;
Dominant Sediment Type (Muck, Sand, or Rock)**–Muck**;
Total Rake Fullness–**None Indicated**;
Aquatic Plants**–None Indicated**;

Plots: 104 Approximate Relationship to Land/CPTS (owner: **BARKSTROM)**;
Latitude–45.7677074; Longitude– -90.6609407;
Depth (ft.)–1;
Dominant Sediment Type (Muck, Sand, or Rock)**–Rock**;
Total Rake Fullness**–Low**;
Aquatic Plants:

Filamentous algae–**<u>Low</u>**;
Brasenia schreberi (Watershield)–**<u>Visual</u>**;
Eleocharis palustris (Creeping spikerush)–**<u>Visual</u>**;
Isoetes sp (Quilwort)–**<u>Low</u>**;
Nuphar variegata (Spatterdock)–**<u>Visual</u>**;

Plots: 105 <u>Approximate Relationship to Land/CPTS (owner</u>: **BARKSTROM)**;
<u>Latitude</u>–45.7673744; <u>Longitude</u>– -90.6609367;
<u>Depth</u> (ft.)–8;
Dominant Sediment Type (Muck, Sand, or Rock)**–<u>Muck</u>**;
Total Rake Fullness**–<u>None Indicated</u>**;
Aquatic Plants**–<u>None Indicated</u>**;

Plots: 85 <u>Approximate Relationship to Land/CPTS (owner</u>: **BARKSTROM)**;
<u>Latitude</u>– 45. 7677046; <u>Longitude</u>– -90.6614165;
<u>Depth</u> (ft.)–2.5;
Dominant Sediment Type (Muck, Sand, or Rock)**–<u>Sand</u>**;
Total Rake Fullness**–<u>High</u>**;
Aquatic Plants:
Brasenia schreberi (Watershield)–<u>High</u>;
Nuphar variegata (Spatterdock)–<u>Visual</u>;
Nymnphaea odorata (White water lily)–<u> Visual</u>;

Plots: 86 <u>Approximate Relationship to Land/CPTS (owner</u>: **BARKSTROM)**;
<u>Latitude</u>–45.7673716; <u>Longitude</u>– -90.6614125;
<u>Depth</u> (ft.)–9;
Dominant Sediment Type (Muck, Sand, or Rock)**–<u>Muck</u>**;
Total Rake Fullness**–<u>None Indicated</u>**;
Aquatic Plants**–<u>None Indicated</u>**;

Plots: 66 <u>Approximate Relationship to Land/CPTS (owner</u>: **BARKSTROM)**;
<u>Latitude</u>–45.7677019; <u>Longitude</u>– -90.6618923;
<u>Depth</u> (ft.)–0.5;
Dominant Sediment Type (Muck, Sand, or Rock)**–<u>Rock</u>**;
Total Rake Fullness**–<u>High</u>**;
Aquatic Plants:
Filamentous algae–<u>Visual</u>;
Brasenia schreberi (Watershield)–<u>Visual</u>;
Equisetum fluviatile (Water horsetail)–<u>High</u>;
Nymnphaea odorata (White water lily)–<u>Visual</u>;
Schoenoplectus Tabernaemontani (Softstem Bulrush)–<u>Visual</u>;
Floating-Leaved-Bur-reed–<u>Visual</u>;

Plots: 67 <u>Approximate Relationship to Land/CPTS (owner</u>: **BARKSTROM)**;
<u>Latitude</u>–45.7673688; <u>Longitude</u>– -90.6618884;
<u>Depth</u> (ft.)–9.5;
Dominant Sediment Type (Muck, Sand, or Rock)**–<u>Muck</u>**;
Total Rake Fullness**–<u>None Indicated</u>**;
Aquatic Plants**–<u>None Indicated</u>**;

Plots: 48 Approximate Relationship to Land/CPTS (owner: **BARKSTROM)**;
Latitude–45.7673661; Longitude– -90.6623642;
Depth (ft.)–1.5;
Dominant Sediment Type (Muck, Sand, or Rock)**–Sand**;
Total Rake Fullness**–Medium**;
Aquatic Plants;
Equisetum fluviatile (Water horsetail)–Medium;
Nuphar variegata (Spatterdock)–Medium;
Potamogeton epihydrus (Ribbonleaf pondweed)–Low;
Schoenoplectus tabernaemontani (Softstem bulrush)–Visual;

Plots: 49 Approximate Relationship to Land/CPTS (owner: **BARKSTROM)**;
Latitude–45.7670331; Longitude– -90.6623602;
Depth (ft.)–11;
Dominant Sediment Type (Muck, Sand, or Rock)**–Muck**;
Total Rake Fullness**–None Indicated**;
Aquatic Plants**–None Indicated**;

Plots: 15 Approximate Relationship to Land/CPTS (owner: **BARKSTROM)**;
Latitude–45.7666946; Longitude– -90.6633079;
Depth (ft.)–6.5;
Dominant Sediment Type (Muck, Sand, or Rock)–**Sand**;
Total Rake Fullness–**Low**;
Aquatic Plants—Sighted OR Abundance Estimate:
Ceratophyllum demersum **(Coontail)**–**Low**;

Plots: 31 Approximate Relationship to Land/CPTS (owner: **BARKSTROM)**;
Latitude–45.7670303; Longitude– -90.662836;
Depth (ft.)–7;
Dominant Sediment Type (Muck, Sand, or Rock)–**Sand**;
Total Rake Fullness**–None Indicated**;
Aquatic Plants**–None Indicated**;

Plots: 32 Approximate Relationship to Land/CPTS (owner: **BARKSTROM)**;
Latitude–45.7666973; Longitude– -90.6628321;
Depth (ft.)–13;
Dominant Sediment Type (Muck, Sand, or Rock)–**Muck**;
Total Rake Fullness**–None Indicated**;
Aquatic Plants**–None Indicated**;

Plots: 16 Approximate Relationship to Land/CPTS (owner: **BARKSTROM)**;
Latitude–45.7663616; Longitude– -90.663304;
Depth (ft.)–11;
Dominant Sediment Type (Muck, Sand, or Rock)–**Muck**;
Total Rake Fullness– **None Indicated**
Aquatic Plants— **None Indicated**

Plots: 33 Approximate Relationship to Land/CPTS (owner: **BARKSTROM)**;
Latitude–45.7663643; Longitude– -90.6628282;
Depth (ft.)–15.5 (Comment DEEP);
Dominant Sediment Type (Muck, Sand, or Rock)**–None Indicated**;
Total Rake Fullness–**None Indicated**;
Aquatic Plants–**None Indicated**;

Plots: 17 Approximate Relationship to Land/CPTS (owner: **BARKSTROM)**;
Latitude–45.7660286; Longitude– -90.6633;
Depth (ft.)– 12;
Dominant Sediment Type (Muck, Sand, or Rock)**–Muck**;
Total Rake Fullness–**None Indicated**;
Aquatic Plants–**None Indicated**;

Plots: 34 Approximate Relationship to Land/CPTS (owner: **BARKSTROM)**;
Latitude–45.7660313; Longitude– -90.6628242;
Depth (ft.)–19.5 (Comment DEEP);
Dominant Sediment Type (Muck, Sand, or Rock)–**None Indicated**;
Total Rake Fullness–**None Indicated**;
Aquatic Plants–**None Indicated**;

Plots: 18 Approximate Relationship to Land/CPTS (owner: **BARKSTROM**)**;**
Latitude–457656955; Longitude– -90. 6632961;
Depth (ft.)–13;
Dominant Sediment Type (Muck, Sand, or Rock)**–Muck;**
Total Rake Fullness–**None Indicated**;
Total Rake Fullness–**None Indicated**;
Aquatic Plants–**None Indicated**;

Plots: 35 Approximate Relationship to Land/CPTS (owner: **BARKSTROM**)**;**
Latitude–45.7656983; Longitude– -90.6628203;
Depth (ft.)—None Indicated (Comment DEEP);
Dominant Sediment Type (Muck, Sand, or Rock)–**None Indicated**;
Total Rake Fullness–**None Indicated**;
Aquatic Plants—Sighted OR Abundance Estimate:

Plot: 5 Approximate Relationship to Land/CPTS (owner: **MOON**)**;**
Latitude–45.7653598; Longitude– -90.6637679; **Depth (ft.)–1.5**;
Dominant Sediment Type (Muck, Sand, or Rock)–**Sand**
Total Rake Fullness–**Medium**
Aquatic Plants—Sighted OR Abundance Estimate:
***Brasenia schreberi* (Watershield)**–**Visual;**
Najas flexilis (Bushy pondweed)–**Low**
Nuphar variegata (Spatterdock)–Medium
Nymnphaea odorata (White water lily)–**Visual**

Plot: 19 Approximate Relationship to Land/CPTS (owner: **MOON**);
Latitude–45.7653625; Longitude–-90.6632921;
Depth (ft.)–11.5;
Dominant Sediment Type (Muck, Sand, or Rock)–**Sand**
Aquatic Plants—Sighted: **None Indicated**

Plots: 6 Approximate Relationship to Land/CPTS (owner: **MOON**);
Latitude–45.7650268; Longitude– -90.663764; **Depth (ft.)–3**;
Dominant Sediment Type (Muck, Sand, or Rock)–**Sand**
Total Rake Fullness–**High**
Aquatic Plants—Sighted OR Abundance Estimate:
Brasenia schreberi **(Watershield)–Low**
Equisetum fluviatile (Water horsetail)–Low
Nuphar variegata (Spatterdock)–Medium
Nymnphaea odorata (White water lily)–Visual;
Potamogeton amplifolius (Largeleaf pondweed)–Medium

Plot: 20 Approximate Relationship to Land/CPTS (owner: **MOON**);
Latitude–45.7650295; Longitude– -90.6632882;
Depth (ft.)–12;
Dominant Sediment Type (Muck, Sand, or Rock)–**Sand**;
Total Rake Fullness–**High**;
Aquatic Plants—Sighted OR Abundance Estimate–**None Indicated;**

Plots: 7 Approximate Relationship to Land/CPTS (owner: **MOON**);
Latitude–45.7646938; Longitude– -90.66376;
Depth (ft.)–5;
Dominant Sediment Type (Muck, Sand, or Rock)–**Rock**;
Total Rake Fullness– **Medium;**
Aquatic Plants:
Potamogeton amplifolius (Largeleaf pondweed)–Medium;
Potamogeton epihydrus (Ribbonleaf pondweed)–Low;

Plot: 21 Approximate Relationship to Land/CPTS (owner: **MOON**);
Latitude–45.7646965; Longitude–-90.6632842;
Depth (ft.)–13.5;
Dominant Sediment Type (Muck, Sand, or Rock)-**Muck;**
Total Rake Fullness– **None Indicated;**
Aquatic Plants—Sighted Or Abundance Estimate-**None Indicated;**

Plot: 8 Approximate Relationship to Land/CPTS (owner: **MOON**);
Latitude–45.7643608; Longitude–- -90.6637561;
Depth (ft.)–9.5;
Dominant Sediment Type (Muck, Sand, or Rock)–**Sand.**
Total Rake Fullness– **None Indicated;**
Aquatic Plants—Sighted OR Abundance Estimate: **None Indicated;**

Plot: 22 <u>Approximate Relationship to Land/CPTS (owner</u>: **MOON**);

<u>Latitude</u>–45.7643635; <u>Longitude</u>– -90.6632803;

<u>Depth</u> (ft.)–17; (indicated as "DEEP");

Dominant Sediment Type (Muck, Sand, or Rock)–**<u> None Indicated;</u>**

Total Rake Fullness–**<u> None Indicated</u>**

Aquatic Plants—Sighted Or Abundance Estimate: **<u>None Indicated;</u>**

Plot: 9 <u>Approximate Relationship to Land/CPTS (owner</u>: **MOON**);

<u>Latitude</u>–45.7640278; <u>Longitude</u>–-90.6637521;

<u>Depth</u> (ft.)–11.5;

Dominant Sediment Type (Muck, Sand, or Rock)–**<u>Muck;</u>**

Total Rake Fullness—**<u>None Indicated</u>;**

Aquatic Plants–**<u>None Indicated</u>;**

Plot: 23 <u>Approximate Relationship to Land/CPTS (owner</u>: **MOON**);

<u>Latitude</u>–45.7640305; <u>Longitude</u>– -90.6632763;

<u>Depth</u> (ft.)–19.5 (indicated as "DEEP");

Dominant Sediment Type (Muck, Sand, or Rock)–**<u>None Indicated</u>;**

Total Rake Fullness—**<u>None Indicated</u>;**

Aquatic Plants–**<u>None Indicated</u>;**

Plot: 1 <u>Approximate Relationship to Land/CPTS (owner)</u>: **MOON**);

<u>Latitude</u>–45.763692; <u>Longitude</u>– -90.664224; **<u>Depth</u> (ft.)–3**;

Dominant Sediment Type (Muck, Sand, or Rock)–**<u>Rock</u>** [47];

Total Rake Fullness–**<u>Low</u>**<u>;</u>

Aquatic Plants—Sighted OR Abundance Estimate:

Filamentous algae [48] –**<u>Low</u>**;
Brasenia schreberi [49] **–<u>Visual</u>**;
Equisetum fluviatile–(Water horsetail)–<u>Visual</u>;
Nuphar variegata (Spatterdock)–<u>Visual</u>;
Nymnphaea odorata (White water lily)–<u>Visual</u>;
Potamogeton amplifolius (Largeleaf pondweed)–<u>Low</u>;

Plot: 10 <u>Approximate Relationship to Land/CPTS (owner)</u>: **MOON**

<u>Latitude</u>–45.7636948; <u>Longitude</u>– -90.6637482;

<u>Depth</u> (ft.)–13.5

Dominant Sediment Type (Muck, Sand, or Rock)–**<u>Muck</u>;**

Total Rake Fullness–**<u> None Indicated</u>;**

Aquatic Plants—**<u> None Indicated;</u>**

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[47] **Rock** = In this survey, under the "Dominent Sediment Type" category, the term "Rock" is synonymous with gravel, pebbles, and stones—Wisconsin's point-intercept aquati plant survey monitoring does not distinguish between the size of the rocks.

[48] **Filamentous algae** = single **algae** cells that form long visible chains, threads, or filaments. These filaments intertwine forming a mat that resembles wet wool. **Filamentous algae** starts growing along the bottom in shallow water or attached to structures in the water (like rocks or other aquatic plants).

[49] **Brasenia schreberi** = common name "Watershield"

Plot: **24** Approximate Relationship to Land/CPTS (owner:)
Latitude–45.7636975; Longitude–-90.6632724;
Depth (ft.)–19.5 (indicated as “DEEP”);
Dominant Sediment Type (Muck, Sand, or Rock)–**None Indicated;**
Total Rake Fullness—**None Indicated;**
Aquatic Plants–**None Indicated;**

Plot: 2 Approximate Relationship to Land/CPTS (owner): **MOON;**
Latitude–45.763359; Longitude– -90.66422;
Depth (ft.)–**7;**
Dominant Sediment Type (Muck, Sand, or Rock)–**Muck;**
Total Rake Fullness– **None Indicated;**
Aquatic Plants–**None Indicated;**

Plot: 11 Approximate Relationship to Land/CPTS (owner): **MOON;**
Latitude–45.7633618; Longitude– -90.6637442;
Depth (ft.)–15 (indicated as “DEEP”);
Dominant Sediment Type (Muck, Sand, or Rock)– **None Indicated;**
Total Rake Fullness– **None Indicated;**
Aquatic Plants–**None Indicated;**

Plot: 3 Approximate Relationship to Land/CPTS (owner): **MOON;**
Latitude–45.763026; Longitude–-90.664224-
Dominant Sediment Type (Muck, Sand, or Rock)–**Muck;**
Total Rake Fullness–**None;**
Aquatic Plants–**None Indicated;**

Plot: 12 Approximate Relationship to Land/CPTS (owner): **MOON;**
Latitude–45.7630288; Longitude– -90.6637403;
Depth (ft.)–14.5;
Dominant Sediment Type (Muck, Sand, or Rock)–**Muck;**
Total Rake Fullness– **None Indicated;**
Aquatic Plants—**None Sighted;**

Plot: 26 Approximate Relationship to Land/CPTS (owner:)
Latitude–45.7630315; Longitude– -90.6632645;
Depth (ft.)–16;
Dominant Sediment Type (Muck, Sand, or Rock)–**Muck**;
Total Rake Fullness—**None Indicated;**
Aquatic Plants–**None Indicated;**

Plots: 4 Approximate Relationship to Land/CPTS (owner): **MOON**;
Latitude–45.762693; Longitude– -90.6642121;
Depth (ft.)–4;
Dominant Sediment Type (Muck, Sand, or Rock)–**Muck;**
Total Rake Fullness–**High;**
Aquatic Plants—Sighted OR Abundance Estimate:
Ceratophyllum demersum [50] **(Coontail)**–**High;**

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[50] **Ceratophyllum demersum** = common name “Coontail”

Plot: 13 Approximate Relationship to Land/CPTS (owner:) **MOON**;
Latitude–45.7626957; Longitude– -90.6637363;
Depth (ft.)–11;
Dominant Sediment Type (Muck, Sand, or Rock)–**Muck;**
Total Rake Fullness–**None Indicated;**
Aquatic Plants–**None Indicated;**

Plot: 27 Approximate Relationship to Land/CPTS (owner: **MOON**);
Latitude–7626985; Longitude–6632605;
Depth (ft.)–13;
Dominant Sediment Type (Muck, Sand, or Rock)–**Muck;**
Total Rake Fullness–**None Indicated;**
Aquatic Plants–**None Indicated;**

Plots: 14 Approximate Relationship to Land/CPTS (owner: **MOON**);
Latitude–45.7623627; Longitude– -90.6637324;
Depth (ft.)–1.5;
Dominant Sediment Type (Muck, Sand, or Rock)–**Muck**
Total Rake Fullness–**High**
Aquatic Plants—Sighted OR Abundance Estimate:
Filamentous algae–**Visual**;
Equisetum fluviatile (Water horsetail)–High;

Plots: 28 Approximate Relationship to Land/CPTS (owner: **MOON**);
Latitude–45.7623655; Longitude–-90.6632566;
Depth (ft.)–9.5;
Dominant Sediment Type (Muck, Sand, or Rock)–**Muck**
Total Rake Fullness–**None Indicated;**
Aquatic Plants–**None Indicated;**

Plots: 29 Approximate Relationship to Land/CPTS (owner: **MOON);**
Latitude–45.7620325; Longitude– -90.6632842;
Depth (ft.)–5;
Dominant Sediment Type (Muck, Sand, or Rock)–**Muck**;
Total Rake Fullness—**None Indicated**;
Aquatic Plants–**None Indicated**;

Plots: 30 Approximate Relationship to Land/CPTS (owner: **MOON);**
Latitude–45.7616995; Longitude– -90.6632487;
Depth (ft.)–1;
Dominant Sediment Type (Muck, Sand, or Rock)–**Sand**;
Total Rake Fullness—**High**;
Aquatic Plants:
Filamentous algae–Low;
***Brasenia schreberi* (Watershield)–Visual**;
Elodea Canadenis (Common waterweed)–Visual;
Equisetum fluviatile (Water horsetail)–High;
Nuphar variegata (Spatterdock)–Low;
Nymnphaea odorata (White water lily)–Low;
Potamogeton amplifolius (Largeleaf pondweed)–Visual;
√ **Sparganium fluctuans (Floating Leaved bur-reed)–Visual**;

Footnote √ **= Not listed on the *Aquatic Plant Summaries* list.**

Plots: 47 Approximate Relationship to Land/CPTS (owner: **BARKSTROM)**;
Latitude–45.7617023; Longitude– -90.6627729;
Depth (ft.)–1;
Dominant Sediment Type (Muck, Sand, or Rock)**–Sand**;
Total Rake Fullness–**Full**;
Aquatic Plants:
Equisetum fluviatile (Water horsetail)–**Low**;
Nuphar variegata (Spatterdock)–Medium;
Nymnphaea odorata (White water lily)– **Visual**;
Potamogeton amplifolius (Largeleaf pondweed)–Visual;
Sparganium fluctuans (Floating Leaved b**ur-reed)– Low**;

Plots: 46 Approximate Relationship to Land/CPTS (owner: **BARKSTROM)**;
Latitude–45.7620353; Longitude– -90.6627769;
Depth (ft.)–9;
Dominant Sediment Type (Muck, Sand, or Rock)–**Muck**;
Total Rake Fullness–**None Indicated**;
Aquatic Plants–**None Indicated**;

Plots: 65 Approximate Relationship to Land/CPTS (owner: **MOON)**;
Latitude–45.761705; Longitude– -66.22972;
Depth (ft.)–3;
Dominant Sediment Type (Muck, Sand, or Rock)–**Rock**;
Total Rake Fullness–**Medium**;
Aquatic Plants:
Equisetum fluviatile (Water horsetail)–Low;
Nuphar variegata (Spatterdock)–Visual;
Nymnphaea odorata (White water lily)–**Low**;
Potamogeton amplifolius (Largeleaf pondweed)–Medium;

Plots: 64 Approximate Relationship to Land/CPTS (owner: **MOON)**;
Latitude–45.762038; Longitude– -99.6623011;
Depth (ft.)–11;
Dominant Sediment Type (Muck, Sand, or Rock)–**Muck**;
Total Rake Fullness–**None Indicated**;
Aquatic Plants–**None Indicated**;

Plots: 84 Approximate Relationship to Land/CPTS (owner: **MOON)**;
Latitude–45.7617078; Longitude– -90.6618214;
Depth (ft.)–3;
Dominant Sediment Type (Muck, Sand, or Rock)–**Rock**;
Total Rake Fullness–**Low**;
Aquatic Plants:
Equisetum fluviatile (Water horsetail)–Low;
Nuphar variegata (Spatterdock)–Visual;

Plots: 83 Approximate Relationship to Land/CPTS (owner: **MOON)**;
Latitude–457620408; Longitude– -90.6618253;
Depth (ft.)–14;
Dominant Sediment Type (Muck, Sand, or Rock)–**Muck**;
Total Rake Fullness–**None Indicated**;
Aquatic Plants–**None Indicated**;

Plots: 103 Approximate Relationship to Land/CPTS (owner: **MOON)**;
Latitude–45.7617105; Longitude–-0.6613456;
Depth (ft.)–1;
Dominant Sediment Type (Muck, Sand, or Rock)–**Sand**;
Total Rake Fullness–**Full**;
Aquatic Plants:
Equisetum fluviatile (Water horsetail)–High;
Nuphar variegata (Spatterdock)–Visual;
Nymnphaea odorata (White water lily)–**Visual**;

Plots: 102 Approximate Relationship to Land/CPTS (owner: **MOON)**;
Latitude–45.7620435; Longitude– -90.6613496;
Depth (ft.)–11;
Dominant Sediment Type (Muck, Sand, or Rock)–**Sand**;
Total Rake Fullness–**None Indicated**;
Aquatic Plants–**None Indicated**;

Plots: 122 Approximate Relationship to Land/CPTS (owner: **MOON)**;
Latitude–45.7617133; Longitude– -90.6608699;
Depth (ft.)–None Indicated;
Dominant Sediment Type (Muck, Sand, or Rock)–**None Indicated**;
Total Rake Fullness–**Nonnavigable (Plants)**;
Aquatic Plants:
Equisetum fluviatile (Water horsetail)–Visual;
Schoenoplectus tabernaemontani (Softstem bulrush)–Visual;
Sparganium natans (Small Bur-reed)–Visual;

Plots: 121 Approximate Relationship to Land/CPTS (owner: **MOON)**;
Latitude–45.7620463; Longitude– -90.6608738;
Depth (ft.)–13;
Dominant Sediment Type (Muck, Sand, or Rock)–**Muck**;
Total Rake Fullness–**None Indicated**;
Aquatic Plants–**None Indicated**;

Plots: 140 Approximate Relationship to Land/CPTS (owner: **MOON**;
Latitude–45.761716; Longitude– -90.6603941;
Depth (ft.)–2;
Dominant Sediment Type (Muck, Sand, or Rock)–**Sand**;
Total Rake Fullness–**Full**;
Aquatic Plants:
Brasenia schreberi (Watershield)–Low;
Equisetum fluviatile (Water horsetail)–**Medium**;
Moss–Low;
Nuphar variegata (Spatterdock)–Medium;
Nymnphaea odorata (White water lily)–**Visual**;
Potamogeton amplifolius (Largeleaf pondweed)–Visual;

Plots: 139 Approximate Relationship to Land/CPTS (owner: **MOON**;
Latitude–45.762049; Longitude– -90.660398;
Depth (ft.)–12;
Dominant Sediment Type (Muck, Sand, or Rock)–**Muck**;
Total Rake Fullness– **None Indicated**;
Aquatic Plants–**None Indicated**;

Plots: 160 Approximate Relationship to Land/CPTS (owner: **MOON)**;
Latitude–45.7613858; Longitude– -90.6599144; (Near mouth of creek at South)
Depth (ft.)–4.5;
Dominant Sediment Type (Muck, Sand, or Rock)–**Rock**;
Total Rake Fullness– **None Indicated**;
Aquatic Plants:
Equisetum fluviatile (Water horsetail)–Visual;

Plots: 159 Approximate Relationship to Land/CPTS (owner: **MOON)**;
Latitude–45.7617188; Longitude– -90.6599183;
Depth (ft.)–11.5;
Dominant Sediment Type (Muck, Sand, or Rock)–**Muck**;
Total Rake Fullness–**None Indicated**;
Aquatic Plants–**None Indicated**;

Plots: 180 Approximate Relationship to Land/CPTS (owner: **MOON)**;
Latitude–45.7613885; Longitude–-90.6594387;
Depth (ft.)–7;
Dominant Sediment Type (Muck, Sand, or Rock)–**Sand**;
Total Rake Fullness–**None Indicated**;
Aquatic Plants–**None Indicated**;

Plots: 179 Approximate Relationship to Land/CPTS (owner: **MOON)**;
Latitude–45.7617215; Longitude– -90.6594426;
Depth (ft.)–12;
Dominant Sediment Type (Muck, Sand, or Rock)–**Muck**;
Total Rake Fullness–**None Indicated**;
Aquatic Plants–**None Indicated**;

Plots: 200 Approximate Relationship to Land/CPTS (owner: **MOON)**;
Latitude–45.7613913; Longitude– -90.6589629;
Depth (ft.)–3.5;
Dominant Sediment Type (Muck, Sand, or Rock)–**Rock**;
Total Rake Fullness–**None Indicated**;
Aquatic Plants:
Equisetum fluviatile (Water horsetail)–Visual;
Nuphar variegata (Spatterdock)–Visual;

Plots: 199 Approximate Relationship to Land/CPTS (owner: **MOON)**;
Latitude–45.7617243; Longitude– -90.6589668;
Depth (ft.)–11.5;
Dominant Sediment Type (Muck, Sand, or Rock)–**Muck**;
Total Rake Fullness–**None Indicated**;
Aquatic Plants—Sighted OR Abundance Estimate–**None Indicated**;

Plots: 220 Approximate Relationship to Land CPTS (Owner: **MOON)**;
Latitude–45.761394; Longitude– -90.6584871;
Depth (ft.)–0.5;
Dominant Sediment Type (Muck, Sand, or Rock)–**Sand**;
Total Rake Fullness–**None Indicated**;
Aquatic Plants—Sighted OR Abundance Estimate–**None Indicated**;

Plots: 219 Approximate Relationship to Land CPTS (Owner: **MOON)**;
Latitude–45.761727; Longitude– -90.658491;
Depth (ft.)–7;
Dominant Sediment Type (Muck, Sand, or Rock)–**Sand**;
Total Rake Fullness–**None Indicated**;
Aquatic Plants:
Nymnphaea odorata (White water lily)–Visual;
Potamogeton amplifolius (Largeleaf pondweed)–Visual;

Plots: 239 Approximate Relationship to Land/CPTS (owner: **SCHROEDER)**;
Latitude–45.7673936; Longitude– -90.657606;
Depth (ft.)–1;
Dominant Sediment Type (Muck, Sand, or Rock)–**Sand**;
Total Rake Fullness–**Low**;
Aquatic Plants:
Filamentous algae–High;
Ceratophyllum demersum (Coontail)–Low;
Nuphar variegata (Spatterdock)–Visual;

Plots: 221 Approximate Relationship to Land/CPTS (owner: **SCHROEDER)**;
Latitude–45.7673908; Longitude– -90.6580818;
Depth (ft.)–2;
Dominant Sediment Type (Muck, Sand, or Rock)–**Muck**;
Total Rake Fullness–**High**;
Aquatic Plants:
***Filamentous algae*–Medium**;
***Brasenia schreberi* (Watershield)–Medium**;
Ceratophyllum demersum (Coontail)–Medium;
Potamogeton amplifolius (Largeleaf pondweed)–Medium;

Plots: 240 Approximate Relationship to Land/CPTS (owner: **SCHROEDER)**;
Latitude–45.7670606; Longitude– -90.6576021;
Depth (ft.)–4;
Dominant Sediment Type (Muck, Sand, or Rock)–**Muck**;
Total Rake Fullness–**High**;
Aquatic Plants:
Ceratophyllum demersum (Coontail)–Medium;
Nymnphaea odorata (White water lily)–Visual;
Potamogeton epihydrus (Ribbonleaf pondweed)–High;

Plots: 222 Approximate Relationship to Land/CPTS (owner: **SCHROEDER)**;
Latitude–45.7670578; Longitude– -90.6580779;
Depth (ft.)–3;
Dominant Sediment Type (Muck, Sand, or Rock)**–Muck**;
Total Rake Fullness**–High**;
Aquatic Plants:
Nitella sp. (Nitella)–Low;
Nymnphaea odorata (White water lily)–High;

Plots: 241 Approximate Relationship to Land/CPTS (owner: **SCHROEDER)**;
Latitude–45.7667276; Longitude– -90.6575982;
Depth (ft.)–3;
Dominant Sediment Type (Muck, Sand, or Rock)**–Sand**;
Total Rake **Fullness**–**High**;
Aquatic Plants:
***Filamentous algae*–Low**;
***Brasenia schreberi* (Watershield)–Visual**;
Ceratophyllum demersum (Coontail)–Medium;
Nymnphaea odorata (White water lily)–High;
Potamogeton amplifolius (Largeleaf pondweed)–Visual;

Plots: 223 Approximate Relationship to Land/CPTS (owner: **SCHROEDER)**;
Latitude–45.7667248; Longitude– -90.658074;
Depth (ft.)–5.5;
Dominant Sediment Type (Muck, Sand, or Rock)**–Muck**;
Total Rake Fullness–**None Indicated**;
Aquatic Plants:
Nymnphaea odorata (White water lily)–Visual;

Plots: 242 Approximate Relationship to Land/CPTS (owner: **SCHROEDER)**;
Latitude–45.7663946; Longitude– -90.6575943;
Depth (ft.)–0.5;
Dominant Sediment Type (Muck, Sand, or Rock)**–Rock**;
Total Rake Fullness**)–Medium**;
Aquatic Plants:
Nuphar variegata (Spatterdock)–Visual;
Potamogeton epihydrus (Ribbonleaf pondweed)–Visual;

Plots: 224 Approximate Relationship to Land/CPTS (owner: **SCHROEDER)**;
Latitude–45.7663918; Longitude– -90.6580701;
Depth (ft.)–7;
Dominant Sediment Type (Muck, Sand, or Rock)**–Muck**;
Total Rake Fullness–**None Indicated**;
Aquatic Plants–**None Indicated**;

Plots: 243 Approximate Relationship to Land/CPTS (owner: **SCHROEDER)**;
Latitude–45.7660616; Longitude– -90.6575904;
Depth (ft.)–1;
Dominant Sediment Type (Muck, Sand, or Rock)**–Sand**;
Total Rake Fullness–**Medium**;
Aquatic Plants:
Potamogeton amplifolius (Largeleaf pondweed)–**Medium**;

Plots: 225 Approximate Relationship to Land/CPTS (owner: **SCHROEDER)**;
Latitude–45.76660588; Longitude– -90.6580662;
Depth (ft.)– 10.5;
Dominant Sediment Type (Muck, Sand, or Rock)**–Muck**;
Total Rake Fullness–**None Indicated**;
Aquatic Plants–**None Indicated**;

Plots: 244 Approximate Relationship to Land/CPTS (owner: **SILVERS/JUNEAU)**;
Latitude–45.7657286; Longitude– -90.6575865;
Depth (ft.)–8;
Dominant Sediment Type (Muck, Sand, or Rock)**Sand**;
Total Rake Fullness**–Low**;
Aquatic Plants–**None Indicated**;

Plots: 226 Approximate Relationship to Land/CPTS (owner: **SILVERS/JUNEAU)**;
Latitude–45.7657258; Longitude– -90.6580623;
Depth (ft.)–(indicated as “DEEP”);
Dominant Sediment Type (Muck, Sand, or Rock)–**None Indicated**;
Total Rake Fullness–**None Indicated**;
Aquatic Plants–**None Indicated**;

Plots: 245 Approximate Relationship to Land/CPTS (owner: **SILVERS/JUNEAU)**;
Latitude–45.7653955; Longitude– -90.6575825;
Depth (ft.)–12;
Dominant Sediment Type (Muck, Sand, or Rock)**Muck**;
Total Rake Fullness–**None Indicated**;
Aquatic Plants–**None Indicated**;

Plots: 227 Approximate Relationship to Land/CPTS (owner: **SILVERS/JUNEAU)**;
Latitude–45.7653928; Longitude– -90.6580583;
Depth (ft.)–(indicated as “DEEP”);
Dominant Sediment Type (Muck, Sand, or Rock)–**None Indicated**;
Total Rake Fullness–**None Indicated**;
Aquatic Plants–**None Indicated**;

Plots: 256 Approximate Relationship to Land/CPTS (owner: **LAPP)**;
Latitude–45.7650653; Longitude– -90.6571028;
Depth (ft.)–3.5;
Dominant Sediment Type (Muck, Sand, or Rock)**Rock**;
Total Rake Fullness**–Low**;
Aquatic Plants:
Potamogeton amplifolius (Largeleaf pondweed)–Low;

Plots: 246 Approximate Relationship to Land/CPTS (owner: **LAPP)**;
Latitude–45.7650625; Longitude– -90.6575786;
Depth (ft.)–15;
Dominant Sediment Type (Muck, Sand, or Rock)**–Muck**;
Total Rake Fullness–**None Indicated**;
Aquatic Plants–**None Indicated**;

Plots: 257 Approximate Relationship to Land/CPTS (owner: **LAPP)**;
Latitude–45.7647323; Longitude– -90.6570989;
Depth (ft.)–6;
Dominant Sediment Type (Muck, Sand, or Rock)**–Sand**;
Total Rake Fullness–**None Indicated**;
Aquatic Plants–**None Indicated**;

Plots: 247 Approximate Relationship to Land/CPTS (owner: **LAPP)**;
Latitude–45.7647295; Longitude– -90.6575747;
Depth (ft.)—(indicated as "DEEP");
Dominant Sediment Type (Muck, Sand, or Rock)–**None Indicated**;
Total Rake Fullness–**None Indicated**;
Aquatic Plants–**None Indicated**;

Plots: 258 Approximate Relationship to Land/CPTS (owner: **HAAKENSON)**;
Latitude–45.7643993; Longitude– -90.657095;
Depth (ft.)–11;
Dominant Sediment Type (Muck, Sand, or Rock)**–Muck**;
Total Rake Fullness–**None Indicated**;
Aquatic Plants–**None Indicated**;

Plots: 248 Approximate Relationship to Land/CPTS (owner: **HAAKENSON)**;
Latitude–45.7643965; Longitude– -90.6575708;
Depth (ft.)—(indicated as "DEEP");
Dominant Sediment Type (Muck, Sand, or Rock)–**None Indicated**;
Total Rake Fullness–**None Indicated**;
Aquatic Plants–**None Indicated**;

Plots: 263 Approximate Relationship to Land/CPTS (owners: **GRIFFITH/BRASSINGTON)**;
Latitude–45.764069; Longitude– -90.6566153;
Depth (ft.)– 2;
Dominant Sediment Type (Muck, Sand, or Rock)**–Rock**;
Total Rake Fullness–**None Indicated**;
Aquatic Plants:
Filamentous algae–Low;
Potamogeton amplifolius (Largeleaf pondweed)–Visual;

Plots: 259 Approximate Relationship to Land/CPTS (owners: **GRIFFITH/BRASSINGTON)**;
Latitude–45.7640663; Longitude– -90.6570911;
Depth (ft.)–11.5;
Dominant Sediment Type (Muck, Sand, or Rock)**–Muck**;
Total Rake Fullness–**None Indicated**;
Aquatic Plants–**None Indicated**;

Plots: 260 Approximate Relationship to Land/CPTS (owners: **GOODENOUGH/HUEGLI)**
Latitude–45.7637333; Longitude– -90.6570872;
Depth (ft.)– 11;
Dominant Sediment Type (Muck, Sand, or Rock)**–Muck**;
Total Rake Fullness–**None Indicated**;
Aquatic Plants–**None Indicated**;

Plots: 261 Approximate Relationship to Land/CPTS (owner: **SWENSON)**;
Latitude–45.7634003; Longitude– -90.6570833;
Depth (ft.)–4;
Dominant Sediment Type (Muck, Sand, or Rock)**–Rock**;
Total Rake Fullness–**None Indicated**;
Aquatic Plants:
Potamogeton amplifolius (Largeleaf pondweed)–Visual;

Plots: 251 Approximate Relationship to Land/CPTS (owner: **SWENSON)**;
Latitude–45.7633975; Longitude– -90.6575591;
Depth (ft.)– 11;
Dominant Sediment Type (Muck, Sand, or Rock)**–Rock**;
Total Rake Fullness–**None Indicated**;
Aquatic Plants–**None Indicated**;

Plots: 262 Approximate Relationship to Land/CPTS (owners: **SWENSON/BERGE)**;
Latitude–45.7630673; Longitude– -90.6570794;
Depth (ft.)–0.5;
Dominant Sediment Type (Muck, Sand, or Rock)**–Sand**;
Total Rake Fullness**–Low**;
Aquatic Plants:
Filamentous algae–Low;
Najas flexilis (Bushy pondweed)–Low;
Potamogeton amplifolius (Largeleaf pondweed)–Visual;

Plots: 252 Approximate Relationship to Land/CPTS (owners: **SWENSON/BERGE)**;
Latitude–45.7630645; Longitude– -90.6575552;
Depth (ft.)– 11.5;
Dominant Sediment Type (Muck, Sand, or Rock)**–Sand**;
Total Rake Fullness–**None Indicated**;
Aquatic Plants–**None Indicated**;

Plots: 253 Approximate Relationship to Land/CPTS (owner: **KASSEL)**;
Latitude–45.7627315; Longitude– -90.6575512;
Depth (ft.)–6;
Dominant Sediment Type (Muck, Sand, or Rock)**–Rock**;
Total Rake Fullness–**None Indicated**;
Aquatic Plants–**None Indicated**;

Plots: 235 Approximate Relationship to Land/CPTS (owner: **KASSEL)**;
Latitude–45.7627288; Longitude– -90.658027;
Depth (ft.)—(indicated as “DEEP”);
Dominant Sediment Type (Muck, Sand, or Rock)–__
Total Rake Fullness–**None Indicated**;
Aquatic Plants–**None Indicated**;

Plots: 254 Approximate Relationship to Land/CPTS (owners: **MIDDLETON/HAVLICEK)**;
Latitude–45.7623985; Longitude– -90.6575473;
Depth (ft.)–2;
Dominant Sediment Type (Muck, Sand, or Rock)**–Rock**;
Total Rake Fullness**–Medium**;
Aquatic Plants:
Filamentous algae–Low;
Brasenia schreberi (Watershield)–**Visual**;
Nymnphaea odorata (White water lily)–**Visual**;
Potamogeton amplifolius (Largeleaf pondweed)–Medium;
Potamogeton epihydrus (Ribbonleaf pondweed)–**Visual**;

Plots: 236 Approximate Relationship to Land/CPTS (owners: **MIDDLETON/HAVLICEK)**;
Latitude–45.7623958; Longitude– -90.6580231;
Depth (ft.)—(indicated as “DEEP”);
Dominant Sediment Type (Muck, Sand, or Rock)–__
Total Rake Fullness–**None Indicated**;
Aquatic Plants–**None Indicated**;

Plots: 255 Approximate Relationship to Land/CPTS (owner: **BERGSTROM)**;
Latitude–45.7620655; Longitude– -90.6575434;
Depth (ft.)–0.25;
Dominant Sediment Type (Muck, Sand, or Rock)**–Sand**;
Total Rake Fullness**–Medium**;
Aquatic Plants:
Brasenia schreberi (Watershield)–**Visual**;
Eleocharis palustris (Creeping spikerush)–Medium;
Isoetes sp (Quilwort)–**Visual**;
Nuphar variegata (Spatterdock)–**Visual**;
Nymnphaea odorata (White water lily)–**Visual**;
Potamogeton epihydrus (Ribbonleaf pondweed)–**Visual**;
Schoenoplectus tabernaemontani (Softstem bulrush)–Visual;

Plots: 237 Approximate Relationship to Land/CPTS (owner: **BERGSTROM)**;
Latitude–45.7620628 ; Longitude– -90.6580192;
Depth (ft.)–10;
Dominant Sediment Type (Muck, Sand, or Rock)**–Sand**;
Total Rake Fullness–**None Indicated**;
Aquatic Plants–**None Indicated**;

Plots: 238 Approximate Relationship to Land/CPTS (owner: **NEWREN)**;
Latitude–45.7617298; Longitude– -90.80153;
Depth (ft.)–1;
Dominant Sediment Type (Muck, Sand, or Rock)–**Sand**;
Total Rake Fullness–**Low**;
Aquatic Plants**:**
Brasenia schreberi (Watershield)–**Visual**;
Equisetum fluviatile (Water horsetail)–Low;
Nymnphaea odorata (White water lily)–Low;
Potamogeton amplifolius (Largeleaf pondweed)–**Visual**;

Plots: 219 Approximate Relationship to Land/CPTS (owner: **NEWREN)**;

Latitude–45.761727658491; Longitude– -90.;

Depth (ft.)– 7;

Dominant Sediment Type (Muck, Sand, or Rock)–**Sand**;

Total Rake Fullness–**None Indicated**;

Aquatic Plants:

Nymnphaea odorata (White water lily)–**Visual**;

Potamogeton amplifolius (Largeleaf pondweed)–**Visual**;

APPENDIX I

WHAT ARE “microSiemens per centimeter (µS/cm)”? * √

These are the units for electrical conductivity (EC) which is comparable to the total dissolved ion content of water (also routinely called the TDS or total dissolved salt concentration). The sensor simply consists of two metal electrodes that are exactly 1.0 cm apart and protrude into the water. A constant voltage (V) is applied across the electrodes. An electrical current (I) flows through the water due to this voltage and is proportional to the concentration of dissolved ions in the water - the more ions, the more conductive the water resulting in a higher electrical current which is measured electronically. Distilled or deionized water has very few dissolved ions and so there is almost no current flow across the gap (low EC). As an aside, fisheries biologists who electroshock know that if the water is too soft (low EC) it is difficult to electroshock to stun fish for monitoring their abundance and distribution.

Up until about the late 1970's the units of EC were micromhos per centimeter (µmhos/cm) after which they were changed to microSiemens/cm (1µS/cm = 1 µmho/cm). You will find both sets of units in the published scientific literature although their numerical values are identical. Interestingly, the unit "mhos" derives from the standard name for electrical resistance reflecting the inverse relationship between resistance and conductivity - the higher the resistance of the water, the lower its conductivity. This also follows from Ohm’s Law, V = I x R where R is the resistance of the centimeter of water.

Since the electrical current flow (I) increases with increasing temperature, the EC values are automatically corrected to a standard value of 25°C and the values are then technically referred to as specific electrical conductivity.

All National Lakes Survey conductivity data were temperature compensated to 25°C (usually called specific EC). This is done because the ability of the water to conduct a current is very temperature dependent. We reference all EC readings to 25°C to eliminate temperature differences associated with seasons and depth. Therefore EC 25°C data reflect the dissolved ion content of the water.

* **(modified from:** http://lakeaccess.org/russ/conductivity.htm**)**

√ = Received from Scott J. Van Egeren, DNR, Madison Office

APPENDIX J

ASSESSMENT OF PRICE LAKE: WATER CHEMISTRY

Water Chemistry (August 9, 2007)

	The Parameter/Measurement Unit
Secchi [51] Depth (meters / feet)	1.15 m. / approx. 4.92 ft.
Hit Bottom [52]	No (y/n)
Chl a [53] (ug/L [54])	20 / approx. 0.7054 of an ounce
TP [55] (mg/L [56])	0.024 / approx. 2.7518 of an ounce
TSI [57] (Secchi)	58
TSI (Chl a) [58]	60
TSI (TP) [59]	50
pH	7.84 (Describes the acidity in lake; the scale is 1-14 with 7 being neutral)
Dissolved Silica [60] (ug/L)	2.91 (Approx. 0.000227 of an ounce indicates Price Lake is a soft water lake)

I (EN) asked Partrick Goggin, Lake Specialist, Lakes Partnership; UW-Extension, Lakes College of Natural Resources at UW-Stevens Point, “Looking at the [Lower] Price Lake findings for **Water Chemistry**, **what do these mean** for our lake as relates to whatever “standard” or “baseline” DNR uses (**What do these findings tell us about Price Lake**)? This is what he said, Judging the quality of lake water can be difficult because lakes display problems in many different ways. However, focusing on specific aspects or parameters that are important to lake ecology, comparing those values to similar lakes within the same region, and historical data from the study lake provides an

---

[51] **Seechi Depth** = A relative measure of the water’s clarity. [Seechi = the name of an Italian scientist.] Note: a black and white disk is suspended from a line to a depth at which it is no longer visible to the naked human eye—the “Seechi Depth”] (for a more in-depth explanation, See: **Appendix K “The Seechi Disc and Water Clarity Readings”**)

[52] **Hit Bottom** = This indicates “depth” vs. “clarity”

[53] **Chi a** *See: **Footnote #6** on preceding page*

[54] **ug/L** = measured in milligrams (thousands) per liter ?

[55] **TP** = total phosphorus in water

[56] **mg/L** = milligrams (thousand) per liter ?

[57] **TSI (Secchi)** = Tropic Site Index (How productive–green–a lake is; water turning in response to a specific kind of stimulus. Used in summer.)

[58] **TSI** (Chl a) = Tropic Site Index for chlorophyll a (How productive–green–a lake is; water turning in response to the ‘chlorophyll a’ stimulus—used in summer—*the “gold standard”*)

[59] **TSI (TP)** = Tropic Site Index (How productive–green–a lake is; water turning in response to the total phosphorus stimulus—used in spring and fall.

[60] **Diss. Si** or Dissolved Silica = In systems where the amount of silica is extremely low it may become a limiting nutrient to diatom growth. Diatoms (any of the various microscopic one-celled algae whose walls contain silica) are highly nutritional and are an important base for most aquatic food webs. (See: **Appendix B “Diatoms”** for explanation of Diatoms)

excellent method to evaluate the quality of a lake's water. To complete this task, three water quality parameters are focused upon within [the National Lake Survey]:

> **Phosphorus** is a nutrient that controls the growth of plants in the vast majority of Wisconsin lakes. It is important to remember that in lakes, the term "plants" includes both *algae* and *macrophytes*. Monitoring and evaluating concentrations of phosphorus within the lake helps to create a better understanding of the current and potential growth rates of the plants within the lake.
>
> **Chlorophyll-*a*** is the green pigment in plants used during *photosynthesis*. Chlorophyll-*a* concentrations are directly related to the abundance of free-floating algae in the lake. Chlorophyll-*a* values increase during algal blooms.
>
> **Secchi disk transparency** is a measurement of water clarity. Of all limnological parameters, it is the most used and the easiest for non-professionals to understand. Furthermore, measuring Secchi disk transparency over long periods of time is one of the best methods of monitoring the health of a lake. (**See: Appendix K "The Seechi Disc and Water Clarity Readings"** for a description of this procedure.)

The parameters described above are interrelated. Phosphorus controls algal abundance, which is measured by chlorophyll-*a* levels. Water clarity, as measured by Secchi disk transparency, is directly affected by the particulates that are suspended in the water. In the majority of natural Wisconsin lakes, the primary particulate matter is algae; therefore, algal abundance directly affects water clarity. In addition, studies have shown that water clarity is used by most lake users to judge water quality – clear water equals clean water.

Each of these parameters is also directly related to the *trophic state* of the lake. As nutrients, primarily phosphorus, accumulate within a lake, its productivity increases and the lake progresses through three trophic states: *oligotrophic*, *mesotrophic*, and finally *eutrophic*. Every lake will naturally progress through these states; however, under natural conditions (i.e. not influenced by the activities of humans) this progress can take tens of thousands of years. Unfortunately, human influence has accelerated this natural aging process in most Wisconsin lakes.

Monitoring the trophic state of a lake gives stakeholders a method by which to gauge the productivity of their lake over time. Yet, classifying a lake into one of three trophic states does not give clear indication of where a lake really exists in its trophic progression. To solve this problem, the parameters described above can be used in an index that will specify a lake's trophic state more clearly and provide a means for which to track it over time

TROPHIC STATES

[These terms,] trophic states, describe the lake's ability to produce plant matter (production) and include three continuous classifications: *Oligotrophic* lakes are the least productive lakes and are characterized by being deep, having cold water, and few plants. *Eutrophic* lakes are the most productive and normally have shallow depths, warm water, and high plant biomass. *Mesotrophic* lakes fall between these two categories.

Trophic classification of Wisconsin Lakes is based on chlorophyll a, water clarity measurements, and total phosphorus values. (Adapted from Lillie and Mason, 1983.)

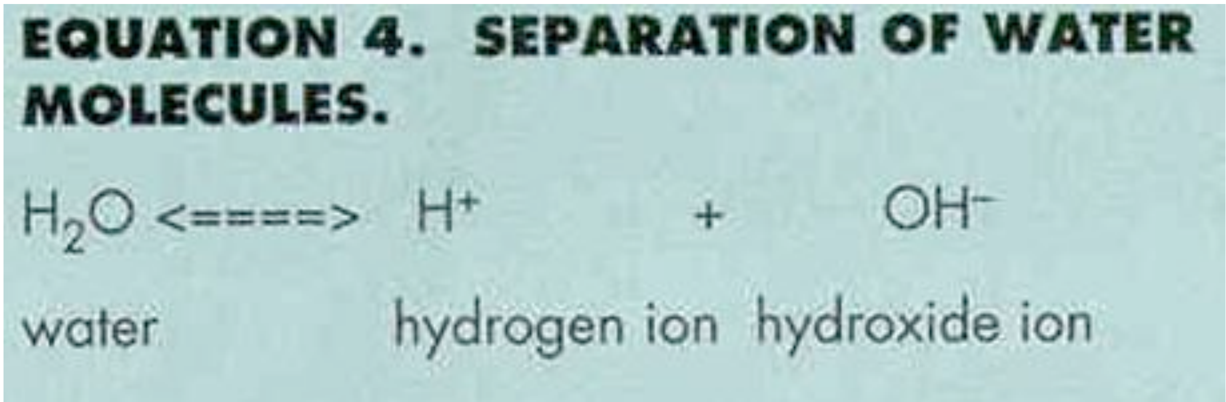
Determining Trophic Class

	Total phosphorus ug/l	**Chlorophyll a** ug/l	**Secchi Disc** feet
Oligotrophic	3	2	12
	10	5	8
Mesotrophic	18	8	6
	27	10	6
Eutrophic	30	11	5
	50	15	4

Water Clarity Index.

Water clarity	**Secchi depth (ft.)**
Very poor	3
Poor	5
Fair	7
Good	10
Very good	20
Excellent	32

As regards the pH “***Parameter/Measurement Unit”*** Price Lake’s pH is 7.84 or how acidic the lake is—the scale being 1-14 with 7 equalling neutral. Thus this 7.84 acidity is an index of lake water's acid level. pH is an important component of the carbonate system. It is the negative logarithm of the hydrogen ion (H+) concentration and therefore inversely related to the amount of hydrogen ion in the water. Lower pH waters have more hydrogen ions and are more acidic than higher pH waters.
With a pH of 7 being neutral—water with a pH of 7 has equal amounts of hydrogen ions and hydroxide ions (OH-) from the natural separation of a tiny fraction of water molecules as shown in “Equation 4” below. _Pure, distilled water without any carbon dioxide has a pH value of 7.

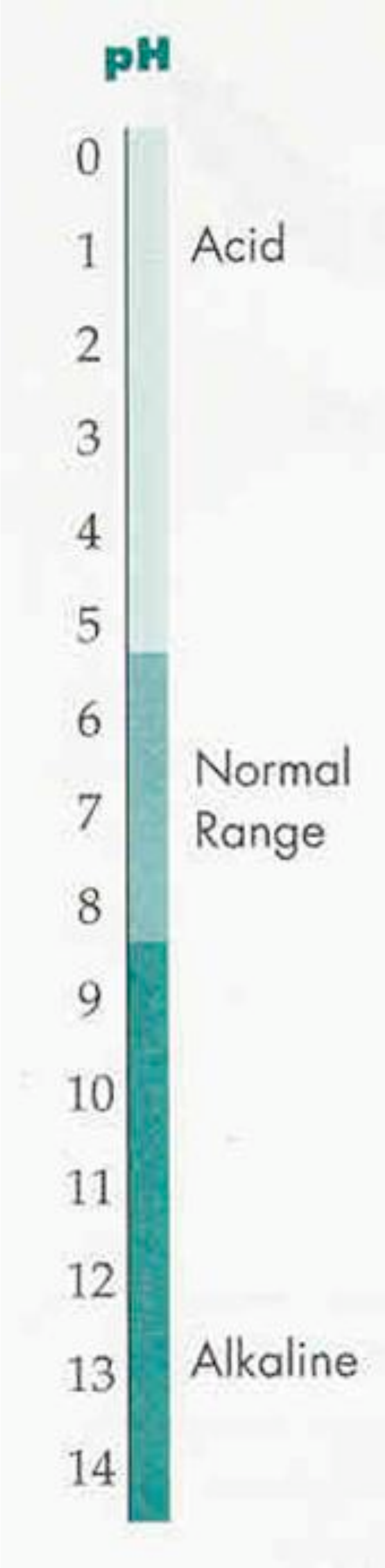


EQUATION 4. SEPARATION OF WATER MOLECULES.

H_2O <====>	H^+	+	OH^-
water	hydrogen ion		hydroxide ion

In Wisconsin, pH ranges from 4.5 in some acid bog lakes to 8.4 in hard water, marl lakes. For every 1.0 pH unit, the hydrogen ion concentration changes tenfold. Therefore, a lake with a pH of 6 is ten times more acid (ten times as much H+) than a lake with a pH of 7. Water with a pH of 5 has 100 times as many hydrogen ions (H+) as pH 7. Lakes with a pH of 8 have one-tenth as many hydrogen ions as water with a pH of 7.

THUS, OUR PRICE LAKE, with a pH of 7.84 has about 16 hundredths less (H+), acidity, than neutral, thus it is slightly more alkaline. Values above 7 are alkaline or basic. Those below 7 are acidic. Iron may also be found in high levels in acidic water.



While moderately low pH does not usually harm fish, the metals that become soluble under low pH can be important. In low pH water, aluminum, zinc and mercury concentrations increase if they are present in lake sediment or watershed soils. The tables below shows the effects commonly found in lakes acidified by acid rain or experimentally acidified.

Effects of Acidity on Fish Species (Olszyk, 1980)

Water pH	**Effects**
6.5	Walleye spawning inhibited
5.8	Lake trout spawning inhibited
5.5	Smallmouth bass disappear
5.2	Walleye, burbot, lake trout disappear
5.0	Spawning inhibited in many fish
4.7	Northern pike, white sucker, brown bullhead, pumpkinseed, sunfish and rock bass disappear
4.5	Perch spawning inhibited
3.5	Perch disappear
3.0	Toxic to all fish

Solubility of Aluminum at Various pH Levels

pH	Aluminum (mg/l)
4	4.8
5	.0048
6	.0000048
7	.0000000048
8	.0000000000048

Aluminum has been blamed for many of the problems associated with acidification of lakes and streams in certain areas of North America and Europe. Mercury levels in fish are high in acidified lakes. While not usually toxic to fish, high aluminum and mercury levels pose a health problem for loons, eagles, osprey and humans who eat chemically tainted fish. Some aquatic organisms appear unable to maintain calcium levels when pH is low, and consequently develop weak bones and shells.

Rainfall in Wisconsin varies from a pH of 4.4 in southeastern Wisconsin to nearly 5.0 in northwestern Wisconsin. Natural rainfall, exposed to C02 in the atmosphere, maintains a pH of 5.6. Thus, most fish could not reproduce in even the best rainfall if rainwater pH were not raised by the chemical buffering of the carbonate system in streams, lakes and the surrounding watershed.

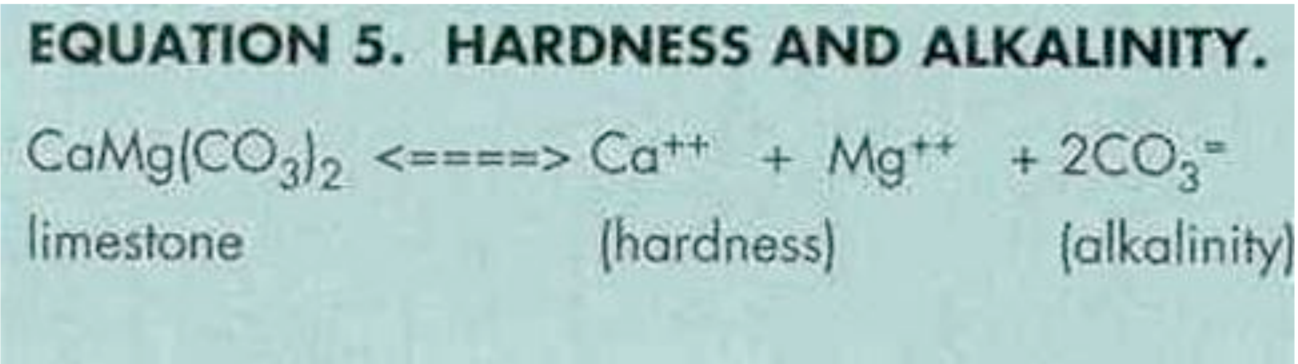
Dissolved Silica (ug/L) 2.91 / approx. 0.000227 of an ounce

Alkalinity 38.2 (Total CaCO3 in mg/L. This measure indicates Price Lake is a soft water lake)

- **CARBONATE SYSTEMS**
  - **Alkalinity and hardness**

The carbonate system provides acid buffering through two alkaline compounds: bicarbonate (HC03-) and carbonate (CO3--). These compounds are usually found with two hardness ions: calcium (Ca++) and magnesium (Mg++).

A lake's hardness and alkalinity are affected by the type of minerals in the soil and watershed bedrock, and by how much the lake water comes into contact with these minerals. If a lake gets groundwater from aquifers containing limestone minerals such as calcite (CaCO3) and dolomite (CaMgCO3), hardness and alkalinity will be high (See table under Equation 5).



EQUATION 5. HARDNESS AND ALKALINITY.

$$\underset{\text{limestone}}{CaMg(CO_3)_2} \Longleftrightarrow \underbrace{Ca^{++} + Mg^{++}}_{\text{(hardness)}} + \underset{\text{(alkalinity)}}{2CO_3^{=}}$$

Categorization of Hardness by mg/l of Calcium Carbonate (CaCO3).

Level of hardness	**Total hardness as mg/l CaCO3**
soft	0-60 mg/l
moderately hard	61-120 mg/l
hard	121-180 mg/l
very hard	>180 mg/l

High levels of hardness (greater than 150 mg/l) and alkalinity can cause marl (CaCO3) to precipitate out of the water. Hard water lakes tend to produce more fish and aquatic plants than soft water lakes. Such lakes are usually located in watersheds with fertile soils that add phosphorus to the lake. As a balancing mechanism, however, phosphorus precipitates with marl, thereby controlling algae blooms.

If the soils are sandy and composed of quartz or other insoluble minerals, or if direct rainfall is a major source of lake water, hardness and alkalinity will be low. This is the case in much of northern Wisconsin, where glacial deposits contain little limestone or other soluble minerals. Lakes with low amounts of alkalinity are more susceptible to acidification by acid rain and are generally unproductive.

APPENDIX K

ASSESSMENT OF PRICE LAKE: WATER COLUMN PROFILES

<u>Mid-Lake Water Column Profiles</u> (August 9, 2007)

Depth (Meters)	Depth (Feet)	Temp. (Cent.)	Temp. (Fahren.)	DO [61] (mg/L) [63]	Conductivity [62] (µS/em) [64]	pH	Secchi	Secchi (Meters)	(Feet)
0	0						0	0	
.5	1.640	25	77	9.1	83	8.3	.5	1.64	
1.0	3.2808	25	77	9	83	8.3	1.0	3.28	
1.1	3.6089	24+	75.2				1.1	3.35	
2	6.5616	25	77	8.2	83	7.7			
3	9.8425	21.8	71.24	0.5	68	6			
4	13.1233	17	62.6	0.3	93	6.3			
5	15.4042	13.4	56.12	0.3	118	6.6			
6	19.6850	11.6	52.88	0.3	131	6.7			
7	22.9658	11.1	51.98	0.3	146	6.8			

I (EN) asked Partrick Goggin, Lake Specialist, Lakes Partnership; UW-Extension, Lakes

College of Natural Resources at UW-Stevens Point, "Looking at the [Lower] Price Lake <u>findings</u> for **Water Chemistry**, **<u>what do these mean</u>** for our lake as relates to whatever "standard" or "baseline" DNR uses (**What do these findings tell us about Price Lake**)? He sent the following information.

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[61] **DO** = Dissolved Oxygen; fish and other aquatic animals require a certain level of oxygen for survival (**See: Appendix C** "DO **DEFINITION"** for explanation of Dissolved Oxygen)

[62] **Conductivity** = electrolytes: any substance which in solution is dissociated into ions [electrically charged atom or group of atoms] and thus made capable of conducting an electric current which produces a gas or solid deposited at the electrodes

[63] **mg/L** *See: **Footnote #9** on preceding page*

[64] µ**S/em** = units of electrical conductivity (EC) which is comparable to the total dissolved ion content of water (also routinely called TDS or total dissolved salt concentration). The higher the resistance of the water, the lower its conductivity. (See: **Appendix D "Aquatic Plant Species Statistics and Related Information"** for an explanation of µ**S/em**)

DISSOLVED GASES

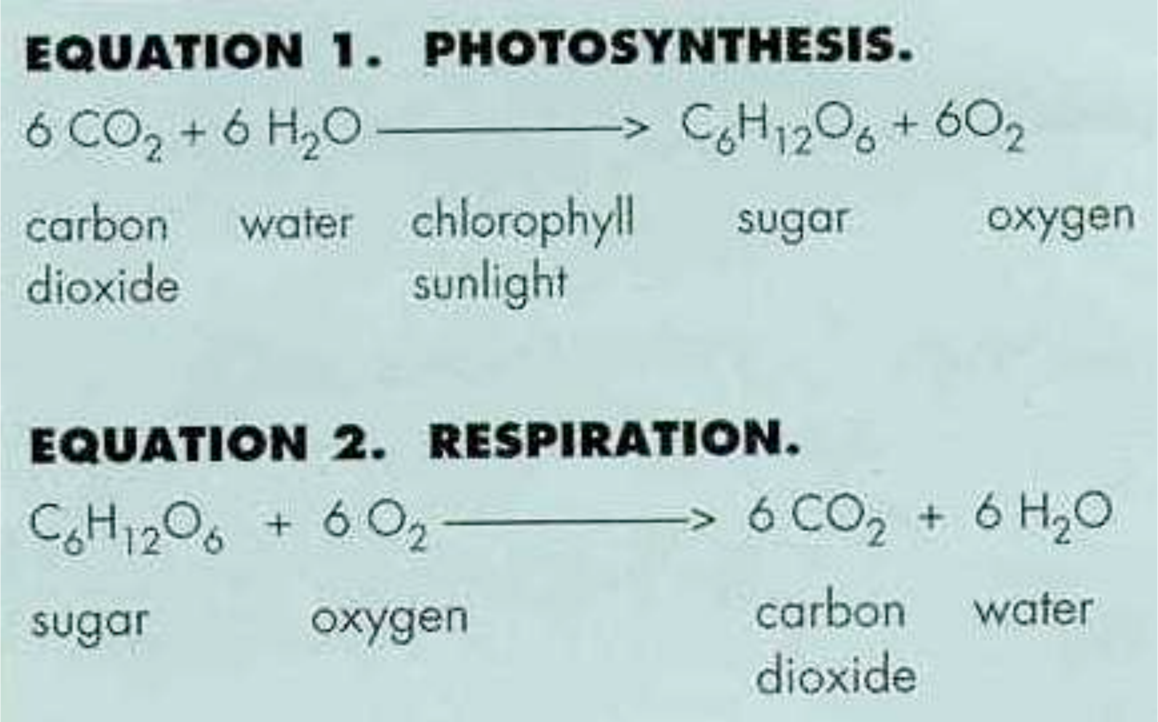
Oxygen (O2) is undoubtedly the most important of the gases, since most aquatic organisms need it to survive. The solubility of oxygen and other gases depends on water temperature. The colder the water, the more gases it can hold. Boiling water removes all gases. The table below shows this effect for oxygen in typical lake water temperatures.

OxygenSolubility at Different Temperatures.

Temperature		Oxygen Solubility
Deg.C	Deg.F	(mg/l)
0	32	15
5	41	13
10	50	11
15	59	10
20	68	9
25	77	8

The values in the above table are found in lakes where continuous mixing occurs, allowing free oxygen exchange between water and the atmosphere. (The atmosphere contains about 21 % oxygen.) However, such levels often differ greatly from the values found in table because mixing is seldom complete. Ice cover dramatically reduces mixing. In addition, biological reactions in the lake consume or release oxygen.

Oxygen is produced whenever green plants grow. Plants use carbon dioxide and water to produce simple sugars and oxygen, using sunlight as the energy source. Chlorophyll, the green pigment in plants, absorbs sunlight and serves as the oxygen production site. This process is called photosynthesis (See Equation 1 below).



EQUATION 1. PHOTOSYNTHESIS.

$$\underset{\text{carbon dioxide}}{6\,CO_2} + \underset{\text{water}}{6\,H_2O} \xrightarrow[\text{sunlight}]{\text{chlorophyll}} \underset{\text{sugar}}{C_6H_{12}O_6} + \underset{\text{oxygen}}{6O_2}$$

EQUATION 2. RESPIRATION.

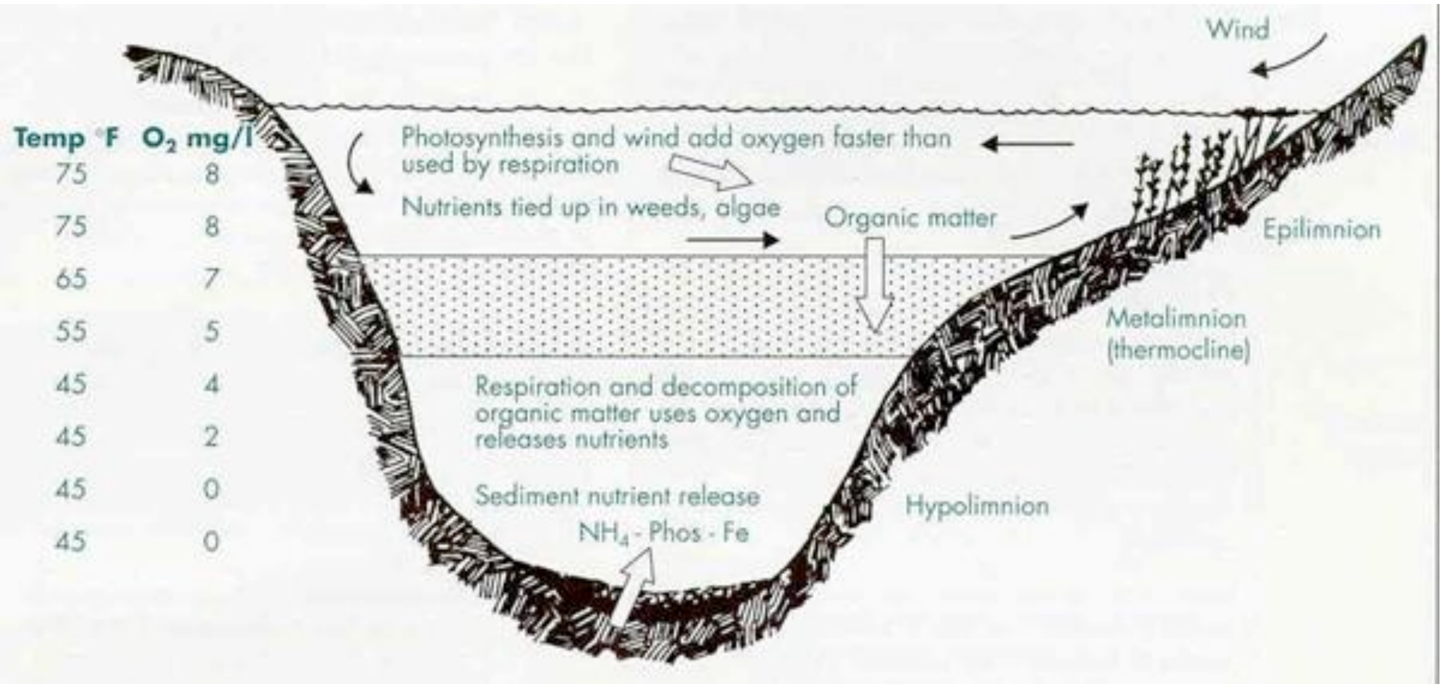
$$\underset{\text{sugar}}{C_6H_{12}O_6} + \underset{\text{oxygen}}{6\,O_2} \longrightarrow \underset{\text{carbon dioxide}}{6\,CO_2} + \underset{\text{water}}{6\,H_2O}$$

Photosynthesis occurs only during daylight hours and only to the depths where sunlight penetrates. The amount of photosynthesis depends on the quantity of plants, nutrient availability, and water temperature. Higher temperatures speed up the process. Plants and animals also constantly use oxygen to break down sugar and obtain energy by a process called **respiration**, basically the reverse of the photosynthetic reaction (this is shown in Equation 2 above). Burning fossil fuels or other organic matter produces the same chemical reactions shown for respiration, releasing more carbon dioxide (CO2) into the atmosphere.

The combination of these two reactions largely determines the amount of oxygen and carbon dioxide present in lakes at different times of day and at different depths. During daylight hours, it is not uncommon to find oxygen values in surface waters that exceed those listed in the table above (supersaturation), while at night or early morning before photosynthesis begins they may fall below those values. At lake depths below the reach of sunlight, the only reaction that occurs is oxygen-consuming respiration. The deep hypolimnic waters of productive lakes often experience oxygen depletion. Lakes with high biological activity undergo greater fluctuations than lakes with few plants and animals.

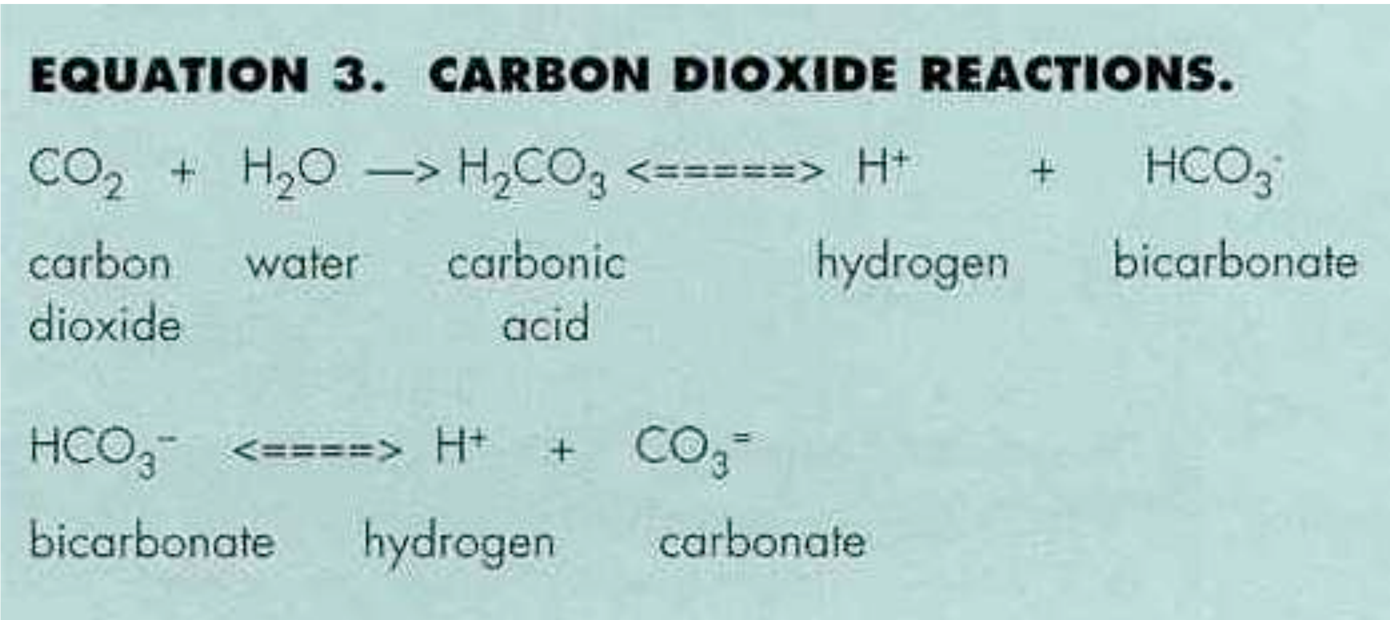
Typical oxygen levels in a productive lake following summer stratification are shown in the example below. Low oxygen levels in the hypolimnion mean that fish must live in the epilimnion and metalimnion. Fish (trout) that need high oxygen levels and cool water disappear from such lakes.

Shown below is the typical oxygen and nutrient status of mesotrophic and eutrophic lakes after summer stratification.



Winter oxygen depletion (winterkill) is a common problem in many shallow Wisconsin lakes. It happens in years when at least four inches of snow cover the lake, which prevents sunlight from reaching the water. All photosynthesis stops and plants begin to die and decompose. The extent of oxygen loss depends on the total amount of plant, algae and animal matter that decays. Drought increases the chance of winterkill by reducing the volume of water in the lake.

The water quality standard for oxygen in "warm water" lakes and streams is 5 mg/l. This is the minimum amount of oxygen needed for fish to survive and grow. The standard for trout waters is 7 mg/l. A smart angler would know that the lake in the example above contains no trout and that it would be silly to fish for walleye in the deep holes in late summer. (See Equation 3 below.)



EQUATION 3. CARBON DIOXIDE REACTIONS.

$CO_2 + H_2O \longrightarrow H_2CO_3 \Longleftrightarrow H^+ + HCO_3^-$

carbon dioxide water carbonic acid hydrogen bicarbonate

$HCO_3^- \Longleftrightarrow H^+ + CO_3^=$

bicarbonate hydrogen carbonate

APPENDIX L

THE SECCHI DISC and WATER CLARITY READINGS [65]

“Secchi disc readings are taken using an 8-inch diameter weighted disc painted black and white. The disc is lowered over the downwind, shaded side of the oat until it just disappears from sight, then raised until it is just visible. The average of the two depths is recorded. Sechi disc readings should be taken on calm sunny days between 10 a.m. and 2 p.m. since cloud cover, waves, and the sun’s angle can affect the reading.

Secchi disc value vary throughout the summer as algal populations increase and decrease. Measuring several sites may be useful in some lakes, depending upon the uniformity of the lake. Year to year changes result from weather and nutrient accumulation. Weekly or biweekly Secchi records (April-November) over a number of years provide an excellent and inexpensive way to document long term changes in water clarity.

The color of the water reflects the type and amount of dissolved organic chemicals it contains. Measured and reported as standard color units on filtered samples, color’s main significance is aesthetic. Color may also reduce light penetration, slowing weed and algae growth. Many lakes possess natural, tan-colored compounds (mainly humic and tannic acids) from decomposing plant materials in the watershed. Brown water can result from bogs draining into a lake. Before or during decomposition algae may impart a green, brown, or even reddish color to the water. Color can affect the Secchi disc reading.

Another measure of water clarity, turbidity is caused by particles of matter rather than dissolved organic compounds. Suspended particles dissipate light, which affects the depth at which plants can grow.

Turbidity affect the aesthetic quality of water. Lakes receiving runoff from silt or clay soils often possess high turbidities. These values vary widely with the nature of the seasonal runoff.

Suspended plants and animals also produce turbidity. Many small organisms have a greater effect than a few large ones. Turbidity caused by algae is the most common reason for low Secchi disc readings.”

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[65] Shaw, Byron, Mechenich, Christine, and Klessig, Lowell, ***Understanding Lake Data***, Publication G3582, University of Wisconsin System, 2004, pp. 4-5 (To order a copy www.cecommerce.uwex.edu or call 877-947-7827

APPENDIX M

THE STATISTICAL DEPICTION of PRICE LAKE'S SHORELINE

[LOWER] PRICE LAKE SHORELINE ASSESSMENT

Information on the characteristics of near-shore physical habitat ("P-Hab") was collected by the survey team at ten shoreline stations. These stations were spaced equidistantly around the lake shoreline. Information was collected from within a defined plot area that included the riparian, [66] shoreline, [67] and littoral [68] zones.

Percent of Shoreline with . . .

Docks/Boats	**20 %**
Buildings	**30 %**
Maintained Lawns	**20 %**
Emergent Aquatic Macrophytes [69]	**90 %**
Wood of Any Size [70]	**60 %**

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[66] **Riparian zone** = The land or wetlands adjacent to the lake shoreline. In this survey the riparian zone was measured from the land-water interface to 15 meters upland.

[67] **Shoreline Zone** = The interface between lake habitat and riparian or wetland habitat. In this survey the shoreline zone was measured as a one meter strip along the land-water interface.

[68] **Littoral Zone** = The portion of a lake that is shallow enough for aquatic plants growth. In this survey the littoral zone was measured to a distance of 10 meters from the shoreline at each of ten shoreline stations.

[69] **Emergent Aquatic Macrophytes** = long stemmed plants growing in a [specified] way or place; rooted aquatic plants requiring water to hold them up.

[70] **Wood of Any Size = includes both small (<0.3m diameter) and large (>0.3m diameter) live trees or logs in the littoral zone (a portion of the lake that is shallow enough for aquatic plant growth–usually the shore.** In this survey the littoral zone was measured to a distance of about 32.8 feet from the shoreline at each of the ten shoreline stations [plots])**. Each site is ranked from 0-4 based on the percentage of the littoral zone covered by wood, either live or dead, in the water. The value listed in the summary is the percentage of shoreline stations with any wood within the littoral zone. The "shoreline zone" is the interface between lake habitat and riparian or wetland habitat; in this survey the shoreline zone was measured as a 3.28 foot strip along the land-water interface. (<u>Note</u>: This woody habitat is important as it offers habitat for aquatic insects, fish, amphibians, reptiles and birds. In lakes without an abundance of aquatic plants this woody habitat is the greatest source of refuge for these species.)**

Percent of Shoreline Trees . . .[71]

Big[72]	**80 %**
Small[73]	**90 %**

THE IMPORTANCE OF THE PRICE LAKE SHORELINE AND A “BUFFER ZONE”

Above the statistics, a numerical portrait of the Price Lake shoreline, has been delineated. These are the “cold” facts. But what are their importance? What does this really tell us? How do these numbers impact on our lake ecology . . . and us?

To understand why something like this assessment is included in a study of lakes, might best be accomplished by reading the paper presented on the next two pages. I had the opportunity to hear these insightful words at the “Northwest Wisconsin Lakes Conference” held at the Telemark Resort and Conference Center in Cable, Wisconsin this past June 19, 2009.

To say that this person, the speaker and author of this paper, has shown wisdom beyond his years is, in my opinion, an understatement. He has displayed an intuitive and accurate understanding of the subject and has even hinted at the consequences of what may easily be if we do not wake up to what is happening . . . and what we are doing to our shorelines.

Please read the following two pages and what this young man—a seventh grader—is pleading for all of us to grasp **. . .** our generation as well as his own. This is a call for everyone to put the notion of “social status” behind us and to think critically with minds that love nature—the same minds that prompted us in the first place to want to be in the midst of all this beauty . . . rather than thinking with a “me first, social status counts, sentimental, romanticized, and “citified” tainted impairment.

Check out what this young man has to say, it will renew your faith in the younger generation and hopefully give you a reason to pass on to those who follow you a lake which has all the beauty and life you saw in it the first time you beheld Price Lake.

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[71] **At each plot a semi-quantitative ranking was done for each size class of trees within the riparian zone (the land or wetlands adjacent to the lake shoreline [typically the bank]; in this survey the riparian zone was measured from the land-water interface to about 49.2 feet in land). The ranking at each plot was scored from 0-4 (zero = no trees, one = <10%, two = >10 and <40%, three = >40 and <75%, and four = >75% coverage. The value listed in the summary denotes the percentage of shoreline stations with big or small trees (meaning that the value at the station was a one or higher).**

[72] **Big** = >5 m high and >0.3 m dia. at breast height (dbh) = Greater than about 16.5 feet tall and greater than about 1 foot in diameter

[73] **Small** = >5 m high and <0.3 m dbh = Greater than about 16.5 feet tall and less than about 1 foot in diameter

Balance and Harmony on the Shore

By: Lucas Stiemann

"The oldest task in human history: to live on a piece of land without spoiling it." Using words such as these as early as 1938, Aldo Leopold, commonly regarded as the father of wildlife ecology and a true Wisconsin hero, fought to preserve the harmony between developed land and nature. This balance is even more vital today as more and more green spaces and lakes are being used for urban development.

According to the Wisconsin DNR, 80% of endangered or threatened species found in Wisconsin spend all of part of their lives in shoreland areas. Until recent times, these wetland areas were viewed as wastelands. But, they are now recognized as providing crucial wildlife habitat, as well as providing water storage for flood prevention and water quality protection.

Many landowners, however, hold different views about wetlands and shoreline uses. Some expect open land, bare sand beaches, and a clear, unobstructed view of the lake. They don't value trees and vegetation as part of their "lakeshore." Unfortunately, this attitude is not in harmony with nature and the steps we need to take if we are going to live on our lakes without spoiling them.

Why are natural shorelines so important? Loons, ducks, geese and other water birds nest there. Pike, bass, bluegills and other fish spawn in these shallow waters, and overdeveloped shorelines cannot support fish, wildlife and clean water.

Piece by piece, the cumulative effects of landowners "fixing up" their waterfront properties are destroying one of our state's most valuable resources—its lake and stream habitats. When landowners bring in sand for swimming beaches, it covers gravel and silt which interferes with fish spawning, mayfly burrows and areas for frogs to lay eggs. According to Mike Staggs, DNR Fisheries Director, great fishing comes from great fish habitat. If the natural shoreline habitat is destroyed, the fishing will get worse. Removing vegetation for swimming and boating eliminates habitats for bass and other fish that hide among those plants, as well as destroying habitat for loons that nest there. Loss of vegetation results in loss of food for waterfowl and habitat for insects. Shrubs and trees that are removed for "perfect" lawns cut habitat for nesting birds, egg-laying ducks and bass and sunfish.

Clean lawns may look great in towns and next to golf courses, but they create big problems for shorelands. A perfectly mowed lawn sends rain runoff directly to the water. This runoff likely includes fertilizers, pet waste, and lawn clippings which fuel algae blooms. Removing shoreline plants such as bulrushes and cattails increase erosion. Fallen logs and tree branches may look unsightly along the shore, but according to the Wisconsin DNR, over 15 different fish species may inhabit a single downed tree at one time.

According to the UW-Extension Impact Report dated June 2005, Wisconsin has 15, 081 inland lakes, over 42,000 miles of rivers and streams and 5.3 million acres of wetlands. These great resources play a fundamental role in our economy, our environment and our communities.

How can we protect our shorelines and the valuable resources included in them? One way is to leave a buffer area of natural vegetation along the shoreline. The width of the buffer strip varies with the terrain of the land. Buffers work to reduce erosion, help maintain water quality and provide habitat for wildlife. Landowners will also benefit lake ecology by switching to native broadleaf and groundcover plants, canopy trees and native grasses instead of mowed lawns, especially close to the shoreline area. This will help wildlife and requires little to no maintenance. Leave aquatic plants along the shoreline, and only remove them if necessary for boat access. If plants have been removed, look for options to re-establish them. Don't fill or alter shoreline wetlands, even if they're only wet in the spring and consider restoring them. All states and counties have regulations that affect building and development along shorelines. Be sure to check with local zoning offices and local conservation departments before building.

Some Wisconsin counties, like Burnett County, have regulations specific to lake development. The Burnett County Land and Water Conservation Department administers landowner agreements for the county Natural Shorelines Program. A natural zone of vegetation at least 35 feet wide is required next to the water. For those properties on which the protective zone has been removed or previously altered, there is a voluntary restoration program in which owners are offered technical and financial assistance to restore the shoreline and establish a buffer zone.

Since its inception in 2000, the Burnett County Natural Shorelines Program has been a model of success for shoreline preservation. Based on information from the Burnett County Land and Water Conservation Department, as of December 21, 2007, 610 parcels are enrolled in the program which represents 226, 512 linear feet or the equivalent of 42.9 miles of protected waterfront. In addition, 104, 272 square feet or 2.39 acres of waterfront have been restored by conservation plantings. In only 8 short years, this program has made an immense impact on the shorelines of Burnett County.

With over 15,000 lakes in the state and up to 90% of living things in lakes and rivers found along the margins and shores, we all need to do our part to keep Wisconsin waters healthy. We need to embrace the possibility that we can balance the demands of shoreline development with shoreline practices that provide long-term benefits to aquatic and wildlife habitats and water quality before it's too late.

Lucas Stiemann attends Siren Middle School and is 13 years old. This speech was originally written for the Burnett County Soil and Water Conservation Speaking Contest. He received first place at the county level and at the area level in this contest. He then went on and placed second in the Junior Division at the State Contest. This piece of writing was also submitted to the Scholastic Art and Writing Awards sponsored by the Alliance for Young Artists and Writers. Lucas received a Gold Key at the Region-At-Large level and a Gold Medal at the National Level. He received his medal at a ceremony at Carnegie Hall in NYC in June, 2009. An excerpt of this piece of writing is published in Spark, a collection of award winning art and writing by America's most creative and original middle school students. A virtual gallery of Spark, and a list of national winners can be found at www.artandwriting.org