Wind Lake

Aquatic Plant Management Plan, 2018

December 15, 2017

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CHAPTER I - INTRODUCTION

Wind Lake is a 936 acre lake located in the Town of Norway, Racine County, Wisconsin. The lake has an average depth of 9.6 feet and a maximum depth of 52 feet. Wind Lake has a watershed area of 25,379 acres.

The Wind Lake Management District (District) was created in 1985 in response to growing concerns regarding the quality of Wind Lake. Following the formation of the District, they undertook the preparation and implementation of a comprehensive management plan. Along with the District, the US Geological Survey (USGS), Racine County, the Southeastern Wisconsin Regional Planning Commission (SEWRPC), and private consultants were involved in various aspects of the project. This plant management plan will guide aquatic plant management activities over the next 5 or 6 years. This will be especially important because a newly-discovered, aggressive exotic species, Starry stonewort (*Nitellopsis obtusa* L.) has been found in over 50 acres of Wind Lake.

WHY BOTHER?

Some may ask why aquatic plant management, and plant management planning, are important. Some say just cut it, or just spray it, or just pull it out.

Some answers to this question are more obvious than others:

- Recreational use impairments because of a nuisance plant condition, lead to pressures by constituents to "do something".
- Anglers who don't catch fish, or can't boat through weed masses, push for action.
- An algae problem may be extensive and smelly.
- Lake users cannot get their boats out from their piers.
- If your community wants to obtain grants to manage the nuisance conditions, a plan must first be developed to analyze the specific conditions, and possible management activities, prior to being awarded a grant.

Other answers to this question are more subtle:

- There may be significant economic impacts arising from a nuisance aquatic vegetation problem. Lakes that are popular fishing destinations may see businesses suffer as anglers stay away.
- Residential property values will decline on lakes with severe plant problems. An Army Corps of Engineering study on Lake Guntersville Alabama showed that property values declined 17% because of a Hydrilla infestation.
- It may be necessary to manage the lake to prevent the spread of exotic species to other lakes. This is particularly important because prevention and public education are the most successful ways to minimize the spread of exotic species.

It may be necessary to protect the plant diversity in the lake. Lakes with increased infestations of exotic species, lose diversity and density of native species over time. As diversity declines, the entire food chain may be affected.

Management of the nuisance may be the only way to bring the lake back into "balance".

The various exotic species can completely disrupt the natural processes in the lake. Native plants are low growing while exotic plants tend to form canopies. A major shift then takes place because light penetration cannot occur, stunting native plants. Another major shift takes place because the exotic plant's canopies prevent the natural cooling effect that occurs in areas with native plant beds. When cooling and mixing are blocked, the temperature near the surface increases. Exotic, aggressive species impact the entire aquatic ecosystem, from native plant communities, to the fisheries, to waterfowl and water quality.

PUBLIC INTERACTION

The plant management plan was developed by Aron & Associates in cooperation with the District, the WDNR, and the public. Public input and historical records are an important part in the continual refinement of this plan. Important sources of information and comments include:

- Residents, board members and lake users,
- Community meetings
- WDNR resource managers,
- WDNR records and Southeastern Wisconsin Regional Planning Commission (SEWRPC) records

GOALS & OBJECTIVES

The goals and objectives on Wind Lake continue to focus on balancing the various uses and needs. The difficult task facing those who attempt to manage their lake is that user needs often conflict. Fish and wildlife need aquatic plants to thrive. Boaters and swimmers desire relief from nuisance aquatic plants. Those depending on the lake for "aesthetic viewing" desire an undisturbed lake surface.

The non-native plants in the lake, Eurasian watermilfoil (*Myriophyllum spicatum*) curly-leaf pondweed (*P. crispus*), and now Starry stonewort (*Nitellopsis obtusa* L.), are of great concern to the District. The annual variability of the nuisance conditions and the unknown impact of Starry stonewort makes the management of the conditions difficult.

The goals of the District, board statements of long range desires, are outlined below. The goals are followed by objectives to be used to accomplish each of the goals.

The District desires to:

- Minimize fragments of aquatic plants that are caused by the high volume of boating traffic and natural processes.
- Control exotic and nuisance plant species and maintain recreation access for lake users by:
    - ◊ Using selective chemical treatments
    - ◊ Harvesting
    - ◊ Encouraging landowners to protect native species.
- Preserve and enhance the natural lake environment by:
    - ◊ Educating landowners and lake users in lake ecology.
    - ◊ Working with the Town, County and State governments to review existing ordinances, and if necessary, develop and enforce ordinances to protect Wind Lake.
    - ◊ Continuing to improve the watershed to protect Wind Lake.
- Identify and expand local educational efforts that the District may undertake to improve the public's understanding of lake issues by:
    - ◊ Distributing at least 2 newsletters per year.
    - ◊ Encouraging community participation in lake management activities.

- Conduct in-lake management activities with the long-range goal of minimizing the management as much as possible by:
    - ◊ Conducting evaluations as to the success of plant management activities and the community reaction to the activities.
    - ◊ Tracking the annual progress of lake management activities.
    - ◊ Conducting water quality monitoring efforts to assist in the documentation of results.
    - ◊ Developing and implementing a plan for quick response to invasive species.

CHAPTER II - BACKGROUND

SHORELINE DEVELOPMENT & AESTHETIC FEATURES

Wind Lake and its watershed is moderately developed. The drainage area to Wind Lake is primarily rural comprising 75% of the drainage basin. Rural land uses are dominated by agricultural and other open space lands. Urban land uses account for 25% of the drainage area, the majority of which is in residential uses. The District owns approximately 80 acres of wetlands in the upper watershed.

With the exception of wetland areas, most of the shoreline is developed. The potential development of rural lands in the Wind Lake watershed elevates the importance of stormwater runoff management and non-point source pollution. Increases in impervious surfaces, runoff from construction sites, urban roads and parking lots, can all have devastating impacts on the quality of the lakes. The negative impacts then lowers the quality of life in a community that is centered around the lakes. These changes do not occur overnight and usually take years, even in the worst of situations. This time lapse increases the likelihood that the signs of damage are overlooked, minimized, or ignored.

Land use activities directly affects the chemical and biological components of a lake, as well as the plant growth patterns. To see a small sampling of negative impacts, it is helpful to look at lakes with storm drain outlets or inlet areas, where it is possible to see the more concentrated effects of rural and urban impacts. Often, the lakebed area near storm drains and inlets have different plant and sediment characteristics than other areas of the lake bottom. The runoff from individual homesites, development, and agricultural lands adds to the nutrients and sediments in a lake. That in turn increases the plant growth, sometimes to nuisance conditions. Nutrients, sediments and other materials entering the lake can severely impact the plants, fish and wildlife. Lower oxygen levels, fish kills, and sedimentation of spawning beds can result. Lake use activities, such as skiing and boating, that are conducted in areas of a lake with insufficient depths, can also result in the disruption of sediments. Education of the general public, especially the lake front property owners and landowners in the watershed, should focus on activities to minimize impact on the lake.

Although individual interpretations of aesthetics vary, the protection of the aesthetic qualities on the lakes' shorelines not only provide more natural views from on the water, but may also improve the quality of the resource when native, deep-rooted vegetation exists rather than manicured, fertilized lawns. Natural shorelines are also a natural deterrent to geese. Tall vegetation is less attractive to geese, who prefer neatly manicured lawns.

The quiet water adjacent to natural shorelines and wetland complexes, provide refuge for fish, wildlife and humans seeking an area for quiet reflection. Environmental corridors in the watershed provide benefits that are vital to maintaining a good quality of life. Some of these benefits include recharging the groundwater, maintenance of the groundwater and surface water quality, reduction of soil erosion and protection of plant and animal diversity.

The large expanses of agricultural lands protect the rural characteristic of the general area. Conversion of agricultural lands over time will change the rural small town atmosphere to a more urban community. Expanding urban densities are mirrored by increased demands and increased impacts on the lakes. Often the water quality of the lakes decline as development and recreational use increases. There are however, tools available to communities to minimize the negative impacts. These include stormwater management plans and ordinances; protection of green space; erosion control plans and ordinances; and lake use zoning.

ACCESS LOCATIONS

Wind Lake meets the WDNR standards for public access to an inland lake. Two access sites are owned by the Department of Natural Resources (WDNR) . A private business on the lake also provides access, however, it is not used in the WDNR calculations to assess adequate access.

One public access site is located on the Southwest side of the lake (20 parking spaces. The other is on the Muskego Canal (7 parking spaces).

Table 1. Hydrography and Morphology of Wind Lake
Racine County, Wisconsin, 2012

Area = 936 acres

Shore length = 9.3 miles

Shore development factor* = 2.17

Watershed area = 25,379 acres

Maximum depth = 52 feet

Mean depth = 9.6 feet

Volume = 8,995 acre feet

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

Sources: USGS, SEWRPC, WDNR

SENSITIVE AREAS

The level of development around lakes and the amount of recreational use lakes receive often diminish the value of the resources to fish and wildlife. Often, people tend to underestimate the affect they have on the rest of their environment. The affect can be significant. Wildlife will avoid areas frequented by boats and noisy lake users. Waves from the continuous use of watercraft can erode shorelines and drive furbearers from their nests. Neatly manicured urban lawns do not protect shorelines from the corrosive action of waves, nor do they provide wildlife with shelter or shade. Retaining walls do not provide areas for small invertebrates that are an essential element in the food supply for fish. Spawning areas can be disrupted by propellers or personal watercraft. Migrating birds and waterfowl seek quiet resting places or nesting areas.

In March 1989, the State enacted legislation to protect special or "Sensitive" lake areas from some negative impacts. The WDNR was charged to administer an aquatic nuisance control program which includes Sensitive Area Designation. Administrative Code NR 107 and NR 109 provide the guidance used to administer the WDNR's aquatic plant management (APM) program. The APM program seeks to protect native vegetation that is important to fish and wildlife. The WDNR may restrict activities that would prove detrimental to the native plants. These restricted activities may include dredging, filling, shoreline alterations or sand blankets. Many plant management activities are now regulated by the state. Administrative rules require permits for activities including chemical treatment, aquatic plant harvesting, native species re-introductions, among others.

The WDNR has conducted a Sensitive Area designation on Wind Lake. These areas include valuable aquatic plant communities that support fish or are adjacent to riparian wetland areas. These areas provide spawning habitat; provide habitat for hunting and foraging; and are a good source and provide cover for waterfowl, songbirds, shorebirds, and muskrat (WDNR, 1990).

Diverse aquatic vegetation stabilizes soft sediments, preventing them from becoming re- suspended into the water column by wind action or boating activities. The natural cover, native plants, and minimal interaction with humans in these areas should be preserved. Maintaining the aquatic plant diversity will help keep invasions of exotic plant species to a minimum. The use of chemical treatment and mechanical harvesting are allowed in the Wind Lake Sensitive Areas to maintain navigational access.

Also, aquatic vegetation stabilizes soft sediments, preventing them from becoming resuspended into the water column because of wind or boating. The natural cover, native plants, and minimal interaction with humans in these areas should be preserved.

FISH AND WILDLIFE

Wind Lake is considered a quality fishing lake that supports both predator and panfish populations. Predator fish include northern pike, walleyed pike, and large mouth bass. Panfish include crappie, bluegill, pumpkinseed, green sunfish, largemouth bass, rock bass, yellow perch, and bullhead (WDNR 2000).

The extensive natural shoreline and sedges provide areas that are available for spawning and nursery habitat. Protection of emergent vegetation such as rushes, sedges, and cattails will improve spawning habitat available for game fish. Control of Starry stonewort in the shoreline spawning habitat will be important.

A WDNR fish survey conducted in October 2011, indicated there were extensive beds of aquatic vegetation, and low water levels. This required the survey to be done out from shore. WDNR also indicated at that time that the Eurasian watermilfoil density will make it difficult for the game fish to prey on the panfish. This may result in lower overall lengths of panfish.

According to the WDNR Fisheries Manager for Wind Lake:

> *"Wind Lake is stocked with walleye and northern pike in even years (stocking records are available at: https://cida.usgs.gov/wdnr/apex/f?p=220:1:0::NO::P1_COUNTY_NAME:RACINE). Recent fall electrofishing surveys have captured a moderate number of walleye from the 2014 stocking class, all of which have shown very good growth rates in comparison to statewide average. Recent fishing reports have echoed these results, with walleye becoming more common in the lake. Other fishing reports indicate good success rates and size structure for bluegill, largemouth bass, northern pike and channel catfish. Wind Lake is currently scheduled for a comprehensive fisheries survey in the spring of 2019, at which point I will have up-to-date and well-rounded data on all gamefish and panfish species in the lake."*

Although it is considered an urbanized lake, the extensive natural areas on Wind Lake are important to wildlife, providing nursery and habitat areas. Migratory waterfowl frequent the lake during spring and fall migration.

A problem facing many lakes in Southeast Wisconsin is the non-migratory Canada goose. These geese are an entirely different species than the migratory goose and they cause significant problems, both for residents and for the water quality of the lake. The non-migratory geese remain in the area year-round. They especially like mowed lawns and open water, making lakeshore areas prime targets. People often enjoy watching a few of the geese, especially when there are goslings, but the problems arise as the numbers increase. Non-migratory Canadian geese are abundant on Wind Lake, even though annual efforts to remove them continue.

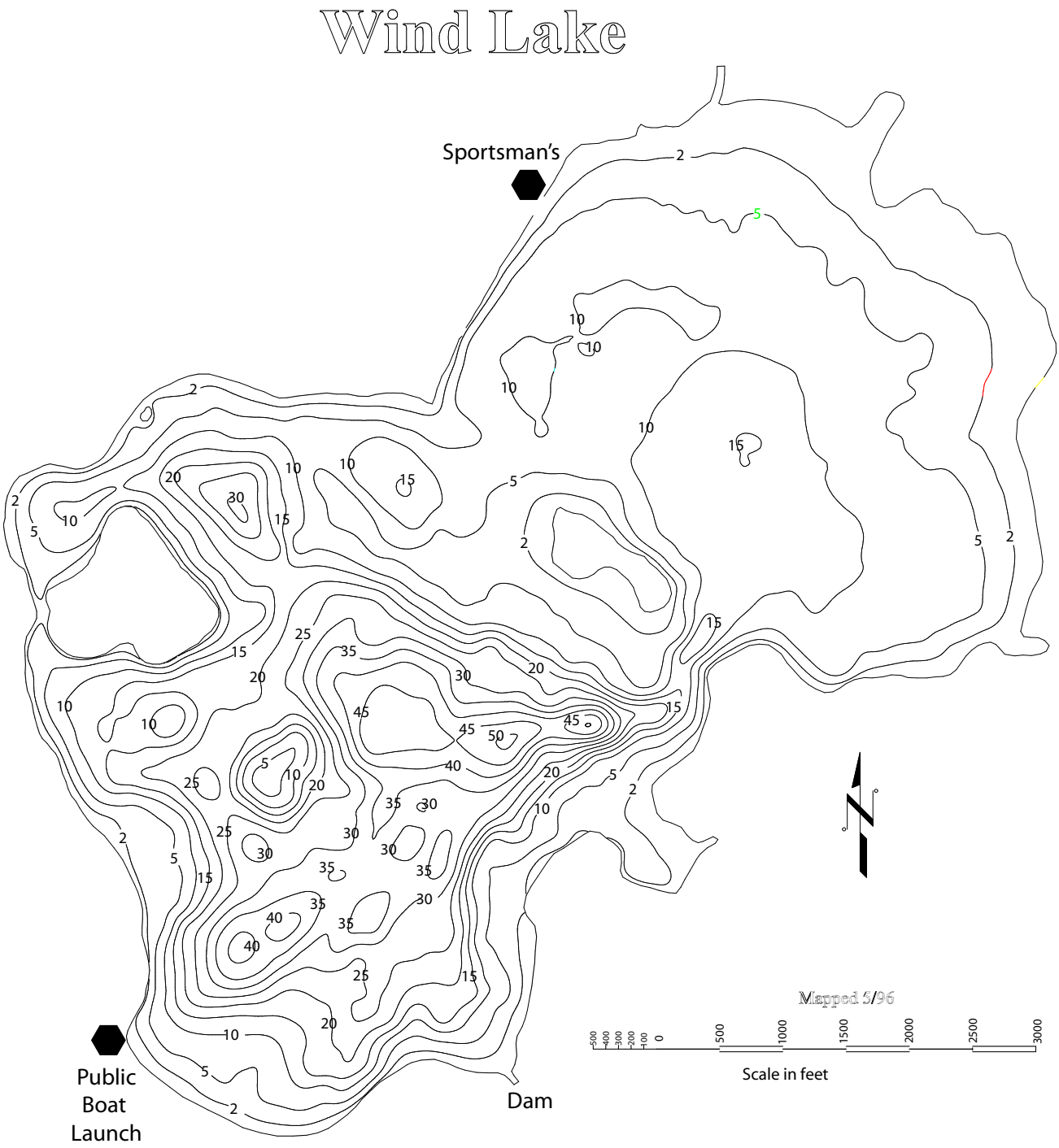


Figure 1 Base Map of Wind Lake

WATER QUALITY

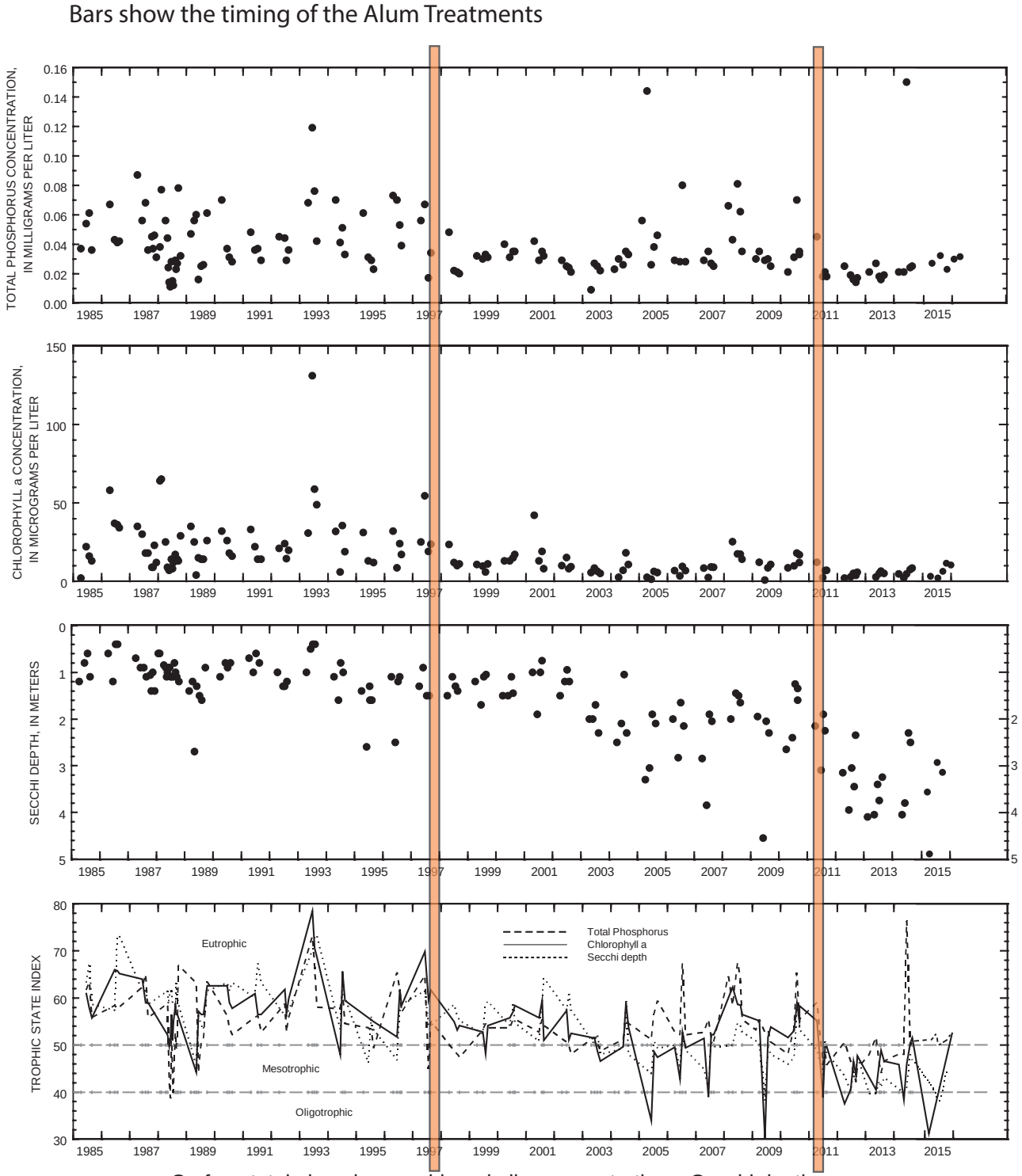
Water quality impacts many aspects of a lake. Excessive nutrients contribute to the growth of plants and algae. The types and densities of aquatic plants and algae affects water clarity, fisheries, and lake use. Suspended sediment that enters a lake also carries nutrients that contribute to water quality problems.

Collection of water quality data is a very important tool for lake managers. The information is critical to document changes in the lake over time, the impact of ongoing management activities, and the planning of future management actions. Water quality in a lake changes over time, so it is important to undertake and maintain a monitoring program.

Wind Lake is now considered to be a meso-eutrophic lake, that is, a lake with moderately clear water, abundant nutrients, and with low dissolved oxygen in the deep parts of the lake during the summer.

The District contracts with the US Geological Survey (USGS) to conduct water quality monitoring. Monitoring by USGS has been done since 1985, so a good database of information has been acquired. The USGS contract includes the operation of a gauge at Big Muskego Dam, and a rain gauge at the Wind Lake Dam. Results are available real-time on the USGS website. A link is available on the Wind Lake website (www.wlmd.org).

Because of a court-order, the District is required to maintain real-time gauges to measure lake level. The District should also continue the water quality monitoring program through the USGS. If a volunteer is available, the District should also take part in the Self-Help Monitoring Program through WDNR.



Surface total phosphorus, chlorophyll a concentrations, Secchi depths, and TSI data for Wind Lake, Deep Hole, at Wind Lake, Wisconsin.

Figure 2 Wind Lake Water Quality Chart 1985 through 2015, Source: USGS

EXOTIC SPECIES

Starry Stonewort, Eurasian watermilfoil, curly-leaf pondweed, purple loosestrife, zebra mussels, chinese mystery snail and reed canary grass (*Pragmites australis*) are exotic species currently present in and around Wind Lake. Exotic species do not provide the benefits the native species provide and can significantly impact native species.

Starry stonewort was recently discovered in Wind Lake. It is a highly invasive algal specie that spreads very easily during recreational use. It often comes in through boat landings and its discovery in Wind Lake also appears to be a result of that.

Purple loosestrife is an exotic perennial wetland herb located in the wetlands around Wind Lake. It is a prolific seed-producer that grows 3 to 7 feet tall, with purple flower spikes that bloom from July to September. This plant can quickly invade wetlands, crowding out more beneficial, native plants. The Cella beetles have been planted by volunteers to help control purple loosestrife.

Figure 3 Four Exotic Aquatic Plant Species (from left to right): Starry Stonewort, Curly-leaf Pondweed, Eurasian Watermilfoil, and Purple Loosestrife.

Hydrilla is a nuisance exotic plant that has not yet been located in Wind Lake, but has been found in Iowa, Indiana, and a pond in Wisconsin. The plant causes severe impairments that are very costly to combat. Because Wind Lake is a popular lake with heavy fishing pressure, it will be at risk for Hydrilla infestation. Regular inspections for the species should be conducted at the launch sites.

Reed canary grass and non-native phragmites are highly aggressive plants that forms dense stands, crowding out more valuable plants. These wetland invaders now inhabit almost the entire state. They should be controlled where possible but the extent of the infestations and the speed with which it spreads makes control very difficult. limited resources or both time and money add to the difficulties. Based on the infested area, controls plans may be developed and implemented. A permit is needed if the area is wet at time of treatment. No permit is needed if the area is dry. The WDNR website has more specific information on the range, control and treatment of the plants.

LAKE USE

Wind Lake receives a moderately high degree of recreational pressure. The majority of recreational uses are: water-skiing, personal watercrafting, scenic viewing, sailing, swimming, and fishing. There are no public swimming beaches on Wind Lake, however, a popular area for swimming is located on the SW side of the cattail island. Another areas for swimming are the East side of the cattail island and the shore at the end of Sandy Point Rd. In those areas, families can enjoy sandy lake bottom, fewer weeds, and varying

depths. Two WDNR public boat launches and one private launch provide the public with boating access to Wind Lake. The lake has moderate lake use during weekdays, however, weekends and holidays have much higher use levels. As traffic increases, the opportunity for use conflicts increase when those seeking a peaceful scenic vista, those desiring a speed boating experience, and those looking for game fish all seek to use the same area at the same time.

BOATING ORDINANCE

The Town of Norway has a boating ordinance and operates a boat patrol on the lake. Approximately 200 hours of enforcement occurs per month during the summer season between May and September. The ordinance is available for review on the Town of Norway and Wind Lake Management District websites, townofnorway.org and www.windlake.org. Enforcement of the boating ordinance should be a priority to protect the public safety and minimize use conflicts.

CHAPTER III - AQUATIC PLANTS

BACKGROUND

Aquatic plants are very important to the health of a lake. They provide food and cover for fish and wildlife. They also contribute to dissolved oxygen production. Invertebrates which fish depend on for food, spend much of their life cycle on or near plants. Young fish and wildlife use plants for shelter and protection from predators. Plants also stabilize sediments, helping control shoreline erosion, and turbidity. Without plants, nutrients in the water column are readily available to fuel algae blooms. Native plant beds rarely experience oxygen or pH problems that are often associated with exotic species. An aquatic plant monitoring program may also provide an early warning signal that the lake is reacting to negative impacts from the watershed. Loss of diversity or an increase in nuisance species can signal the existence of watershed problems.

Many aquatic plants are important food sources for waterfowl. Others provide habitat, spawning and shelter areas for fish and amphibians. Exotic plant species do not provide these benefits as well as the native plant species. Exotic plant species tend to grow more densely, and often grow to the surface where they interfere with recreational uses. Some exotic plant species will create "canopies" that prevent light from reaching native plants underneath, raising water temperatures, and stressing native plants. Protection of native species is important to help limit the spread of exotic species. Just as crabgrass and dandelions are the first plant to invade a disturbed area of a backyard, Eurasian watermilfoil and Starry stonewort will be one of the first to invade disturbed sediments in a lake.

TYPES OF AQUATIC PLANTS

There are four types of aquatic plants: emergents, floating-leaved, submergents, and freely-floating. Emergent plants are rooted in the lakebed with the tops of the plant extending out of the water. The sediments are either submersed or partially inundated with water. Common emergent species include bulrushes, cattails, and reeds. Floating-leaved plants are rooted in the lakebed and the leaves float on the waters surface. Floating-leaved plants usually have larger rhizomes. The most common of these plants are waterlilies. Floating- leaved plants are usually found in quieter, protected areas of a lake. Submergent plants grow completely submersed under the water, although flowering or seed portions may extend out of the water. These plants include pondweeds, Eurasian watermilfoil, and others. Muskgrass is an algae that is frequently discussed along with aquatic plants. Submersed plants are affected by the amount of light that can penetrate the water. Freely-floating plant species are entirely dependent on the water movement in a lake. These plants include coontail and duckweed. Freely-floating plants are found where ever the winds and water currents take them.

LITTORAL ZONE

The term littoral zone is commonly used to describe the area of the lake from the shore out to the depth where plants no longer grow. This area receives sufficient light to grow vegetation, with coarse sediments and fluctuating water temperatures. Depths of up to 18 feet are available for aquatic plant growth on Wind Lake.

Plants within the littoral zone are affected by a number of factors. Steeply sloping lake bed areas do not support the vegetation that flatter lakebed areas support. Soft sediments usually support more plants than hard sand or gravel areas. Exotic plants tend to favor soft sediments. Wind and wave action impacts plant growth.

Even the shape of the shoreline impacts plant growth. Interior bay areas of the shoreline collect sediments and debris, creating soft sediments that support abundant amounts of vegetation; while jutting shoreline areas tend to erode, sending their sediments into bays and depressional areas.

Wind Lake has large shallow areas which makes the lake susceptible to sediment resuspension by wind and waves and are all available for aquatic plant growth.

HISTORICAL PLANT MANAGEMENT

The District conducts regular chemical treatment of nuisance plants in the near-shore zone, targeting approximately 30 acres a season. Treatments for filamentous algae are conducted when needed, but most treatments target Eurasian watermilfoil and curly-leaf pondweed. A couple of the boat channels that provide access for residents are treated with contact herbicides to maintain access.

The District also manages the deeper boating zones by using contract aquatic plant harvesting to open up navigational channels when needed. There continues to be significant variation annually in the amount of harvesting needed.

Table 3. Harvesting on Wind Lake, 2003 through 2017

Year	Total Cost	Total Tons Removed*	Plants Harvested
2003	-	220	Eurasian watermilfoil
2004	$8,500	84	Eurasian watermilfoil
2005	$0	No harvesting needed	
2006	$14,190	214	Eurasian watermilfoil
2007	$19,005	104	Eurasian watermilfoil
2008	$13,500	87	Eurasian watermilfoil
2009	$15,780	150	Eurasian watermilfoil, coontail, wild celery
2010	$13,917	114	Eurasian watermilfoil, coontail, wild celery
2011	$31,645	312	Eurasian watermilfoil, coontail, wild celery
2012	$62,090	445	Eurasian watermilfoil, coontail, wild celery
2013	$46,300	353	Eurasian watermilfoil, coontail, wild celery
2014	$37,635	354	Eurasian watermilfoil, coontail, wild celery
2015	$0	No harvesting needed	
2016	$10,800	60	Eurasian watermilfoil, curly-leaf pondweed
2017	$16,350	156	Eurasian watermilfoil, coontail, wild celery

* Tons removed should only be used in a general sense to estimate the amount of plants removed, since the equipment used by the contractors, as well as the calculations, are different.

AQUATIC PLANT SURVEY - 2017

In August 2017, Aron & Associates conducted an aquatic plant survey on Wind Lake. This survey is part of ongoing efforts to improve the quality of Wind Lake. The information can be used to refine aquatic plant management activities. The information may also be used by future investigators to further document changes in the aquatic plant community and evaluate the impact of plant management and lake management techniques upon the plant communities.

Eurasian watermilfoil curly-leaf pondweed, and starry stonewort were the aquatic invasive plant species located in Wind Lake in 2017. In 2017, the maximum rooting depth in Wind Lake was 10 feet. This was far lower than the survey in 2011 when plants were found at 18 feet. Wild celery (*Vallisneria americana*) dominated the plant community, followed by coontail, Chara, and Eurasian watermilfoil. This is a shift from previous surveys which found Chara was the dominant plant, followed by Coontail. Wild celery has rapidly taken over the shallow water areas of the lake, dominating the 2 to 5 foot depths. It continues to increase its range in the lake, causing some lake access and lake management issues. When wild celery releases from the sediments in mid-July through August, the large floating mats clog the shallow shorelines, resulting in lots of work for property owners who want to maintain their shorelines.

Methodology - General Survey

A preliminary survey of the lake was made by boat. Nomenclature follows Fassett (1956) and Helquist and Crow (1980). The 2017 maximum rooting depth in Wind Lake was determined to be 10 feet.

Point Intercept Survey

The methodology for the point intercept survey follows the methods developed by the Wisconsin Department of Natural Resources (WDNR). WDNR provides gps coordinates for the lake which consist of 703 sample points for Wind Lake, approximately 150 feet apart. At each point, depth, sediment type, and plant information is recorded. A rake with a telescoping handle or a rope sampler is used to collect plant samples. Each plant species retrieved was recorded and given a density rating on a scale of 1 to 3 in accordance with the criteria established by WDNR.

The data collected is then entered into a spreadsheet and which calculates frequency of occurrence, and density ratings for each species along each transect at each sample depth.

Invasive Species Survey

Launch areas around the lake were inspected for signs of Starry stonewort, Hydrilla (*Hydrilla verticillata*), or waterweed (*Elodea canadensis*), a native plant but similar-looking to Hydrilla. None was found in these near-shore areas. Invasive species monitoring is especially important since early control is the only effective way conduct early eradication and to prevent the spread of the plants.

Survey Results

During the August 2017 survey, a total of twenty aquatic plant species were observed, growing out to 18 feet in depth. In addition, emergent species were observed, and include bulrush (Scirpus sp.) and cattails (Typha sp.). The cattails are found around the lake, while the bulrushes are found primarily in the open water area on the East side of the lake.

Table 4. Aquatic Plant Species Observed in Wind Lake, 2011 and 2017.

		2011		2017	
Scientific Name	**Common Name**	**% Frequency**	**Density (Max 3)**	**% Frequency**	**Density (Max 3)**
Brasenia schreberi	Watershield	-	-	0.50	1.00
	Bulrush sp.	*	*	*	*
Ceratophyllum demersum	Coontail	69.9	2.1	43.81	1.78
Chara sp.	Muskgrass	18	1.2	36.88	1.89
Elodea canadensis	Waterweed	6	1.2	0.50	1.00
Lemna minor	Duckweed	*	*	*	*
Myriophyllum sibiricum	Northern Watermilfoil	1.2	1.0	*	*
Myriophyllum spicatum	Eurasian Watermilfoil	63.9	1.5	20.05	1.4
M. sibiricum	Northern watermilfoil	1.2	1.0	-	-
Najas flexilis	Slender Naiad	2.4	1.5	10.89	1.23
Najas guadalupensis	Southern Naiad	-	-	0.25	1
Najas marina	Spiny Naiad	10.8	1.7	3.22	1.23
Nitella sp.	Nitella	-	-	12.87	1.25
Nitellosis obtusa L.	Starry Stonewort	-	-	10.64	1.98
Nymphaea sp.	White Water Lily	2.4	2.0	3.47	2.07
Potamogeton amplifolius	Large-leaf Pondweed	-	-	6.68	1.33
P. crispus	Curly-leaf Pondweed	8.4	1	-	-
P. foliosus	Leafy Pondweed	-	-	0.50	1.00
P. gramineus	Variable Pondweed	4.8	1.3	1.49	1.33
P. Illinoensis	Illinois Pondweed	19.3	1.1	11.63	1.43
P. natans	Floating-leaf Ponweed	-	-	0.50	2
P. nodosus	Long-leaf Pondweed	1.2	1.0	1.24	1.4
P. praelongus	White-stem Pondweed	3.6	1.0	0.25	1.00
P. Richardsonii	Richardson's Pondweed	3.6	1.7	4.21	1.18
P. zosterformis	Flat-stem Pondweed	1.2	1.0	1.24	1.40
Stuckenia pectinata	Sago Pondweed	36.1	1.0	15.10	1.23
Typha sp.	Cattail	*	*	*	*
Utricularia vulgaris	Common Bladderwort	-	-	0.50	1.00
Vallisneria americana	Wild Celery	47	1.7	45.79	1.94
Wolffia columbiana	Common Watermeal	-	-	*	*
Zannicheliia pulastris	Horned Pondweed	6.0	1.2	-	-
Zosterella dubia	Water Star Grass	24.1	1.6	1.98	1.38
Total Species		23		29	

* Found only in the general survey.

- Not found.

Wind Lake has undergone a rather dramatic shift in the aquatic plant community over recent years. Maximum rooting depths have historically been in the 8 and 9 foot range, until 2011, where plants were found at 18 feet. This corresponded with a second Alum treatment conducted in the lake. The 10 foot rooting depth in 2017 is comparable to that found prior to 2011.

Since the second alum treatment, native plant density and diversity have improved. Historically the lake was dominated by Eurasian watermilfoil and curly-leaf pondweed. These plants were most commonly found in the 4 to 8 foot contour in 2018. In 2011, the deep water zones, 6 to 18 feet were dominated by a combination of Eurasian watermilfoil and coontail. However, since 2015, Eurasian watermilfoil has declined significantly. In 2017, Eurasian watermilfoil was 66% down from 2011 survey levels.

2017 REVIEW OF CONDITIONS

The nearshore areas of Wind Lake had a mix of Chara, native pondweeds, some Eurasian watermilfoil, and wild celery. The shallow water zone, 0 to 3 feet, is dominated by Chara. The 3 to 5 feet zone is dominated by wild celery. Various pondweeds are also very common in the 3 to 6 foot zone. Plant beds to the surface with primarily Eurasian watermilfoil were found in the NorthEast corner of the lake, from the 3 foot to the 8 foot depths.

Harvesting efforts focused on cutting navigational channels through the large plant beds so landowners could access the open water areas of the lake.

Chemical treatments took place, targeting nearshore and channel areas. In August, five isolated locations of Starry stonewort were treated to try to stem the spread of the invasive.

Table 5. Aquatic Plant Species Observed in Wind Lake, 1967 - 2017

Scientific Name	Common Name	1967	1988	1990	2005	2011	2017
Brasenia schreberi	Watershield						X
	Bulrush sp.						X
Ceratophyllum demersum	Coontail	X	X	X	X	X	X
Chara sp.	Muskgrass	X	X	X	X	X	X
Elodea canadensis	Waterweed	X	X		X	X	X
Lemna minor	Duckweed			X		X	X
Lemna trisulca	Star Duckweed			X			
Myriophyllum sp.		X					
Myriophyllum spicatum	Eurasian Watermilfoil		X	X	X	X	X
M. sibiricum	Northern watermilfoil				X	X	X
Najas flexilis	Slender Naiad		X		X	X	X
Najas guadalupensis	Southern Naiad						X
Najas marina	Spiny Naiad	X	X		X	X	X
Nitella sp	Nitella						X
Nitellopsis obtusa L.	Starry Stonewort						X
Nuphar variegatum	Yellow Water Lily	X	X	X			
Nymphaea sp.	White Water Lily	X	X	X		X	X
Potamogeton sp.		X					
Potamogeton amplifolius	Large-leaf pondweed						X
P. crispus	Curly-leaf Pondweed	X	X	X	X	X	
P. foliosis	Leafy Pondweed				X		X
P. gramineus	Variable Pondweed		X	X	X	X	X
P. Illinoensis	Illinois Pondweed	X	X	X	X	X	X
P. natans	Floating-leaf Pondweed			X			X
P. nodosus	Long-leaf Pondweed			X	X	X	X
P. praelongus	White-stem Pondweed	X			X	X	X
P. pusillus	Small Pondweed			X	X	X	
P. Richardsonii	Richardson's Pondweed				X	X	X
P. zosterformis	Flat-stem Pondweed		X	X	X	X	X
Stuckenia pectinata	Sago Pondweed		X	X	X	X	X
	Cattail sp.		X	X	X	X	X
Utricularia vulgaris	Great Bladderwort			X	X		X
Vallisneria americana	Wild Celery	X	X	X	X	X	X
Wolffia columbiana	Common watermeal						X
Zannicheliia pulastris	Horned Pondweed					X	
Zosterella dubia	Water Star Grass			X		X	X
TOTAL SPECIES		12	15	19	20	22	29

1967 - WDNR
1988 - Steve McComas
1990 - SEWRPC
2005 SEWRPC
2011 Aron & Associates
2017 Aron & Associates and Marine Biochemists

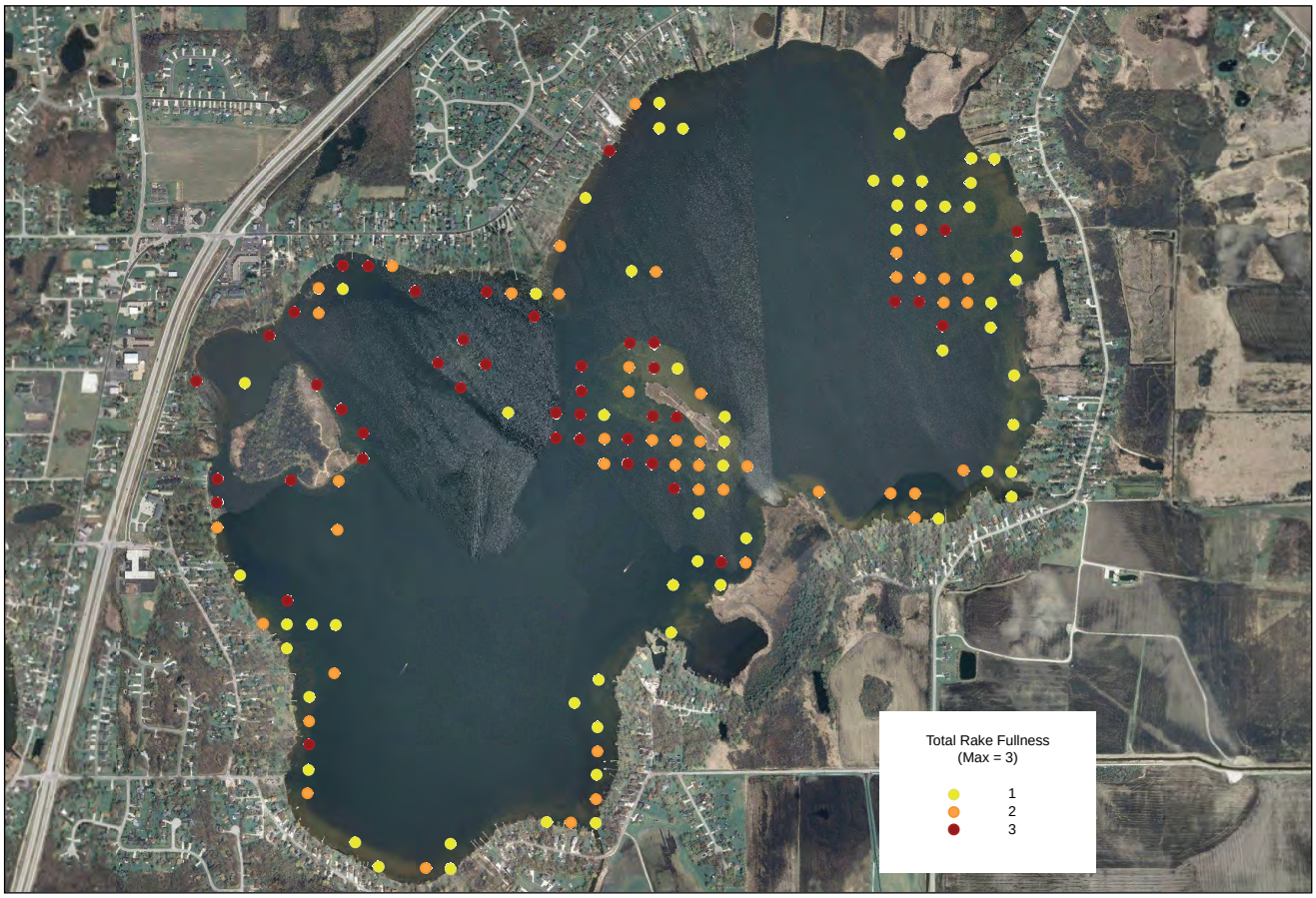


Figure 5 Chara - Wind Lake, 2017

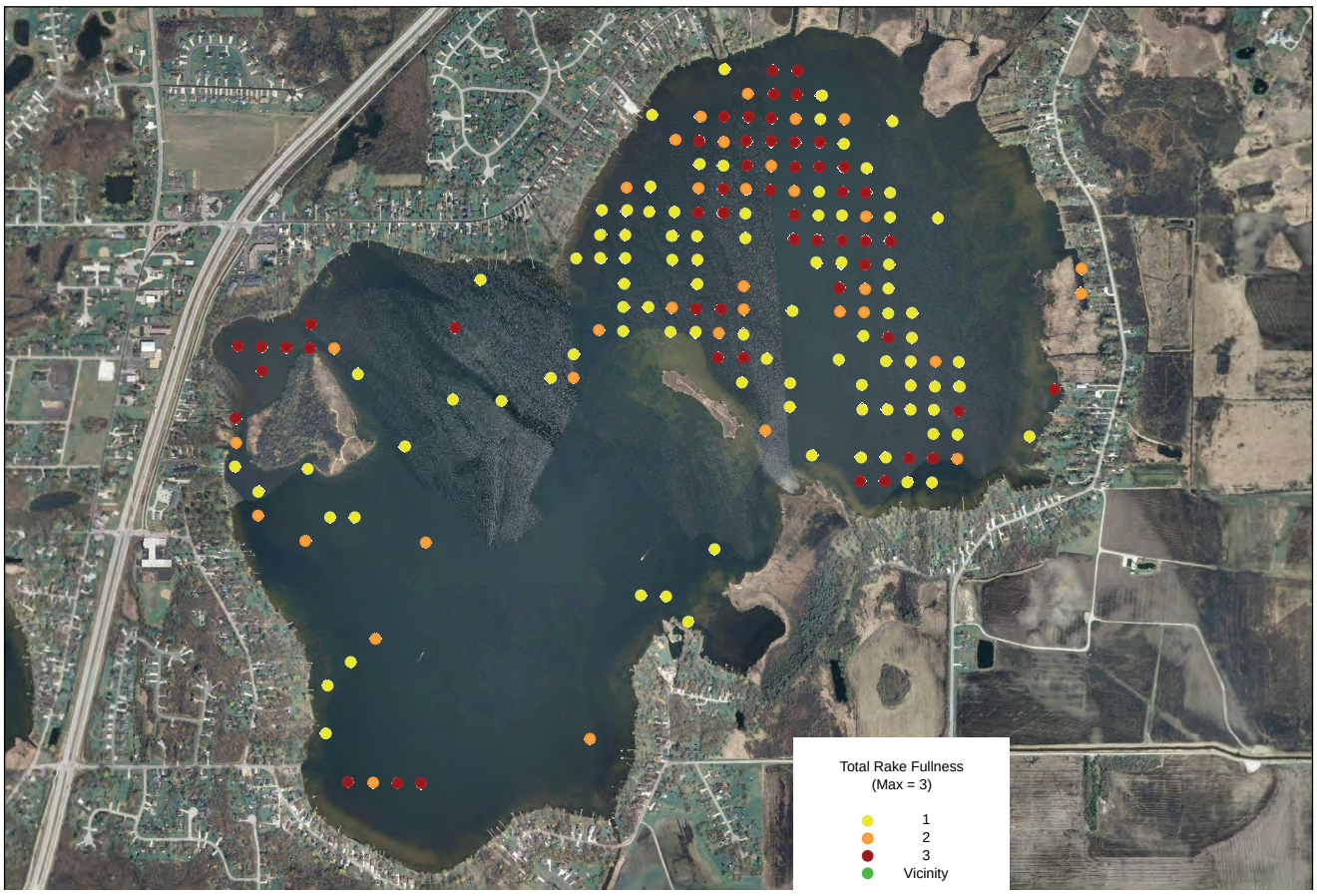


Figure 6 Coontail - Wind Lake, 2017

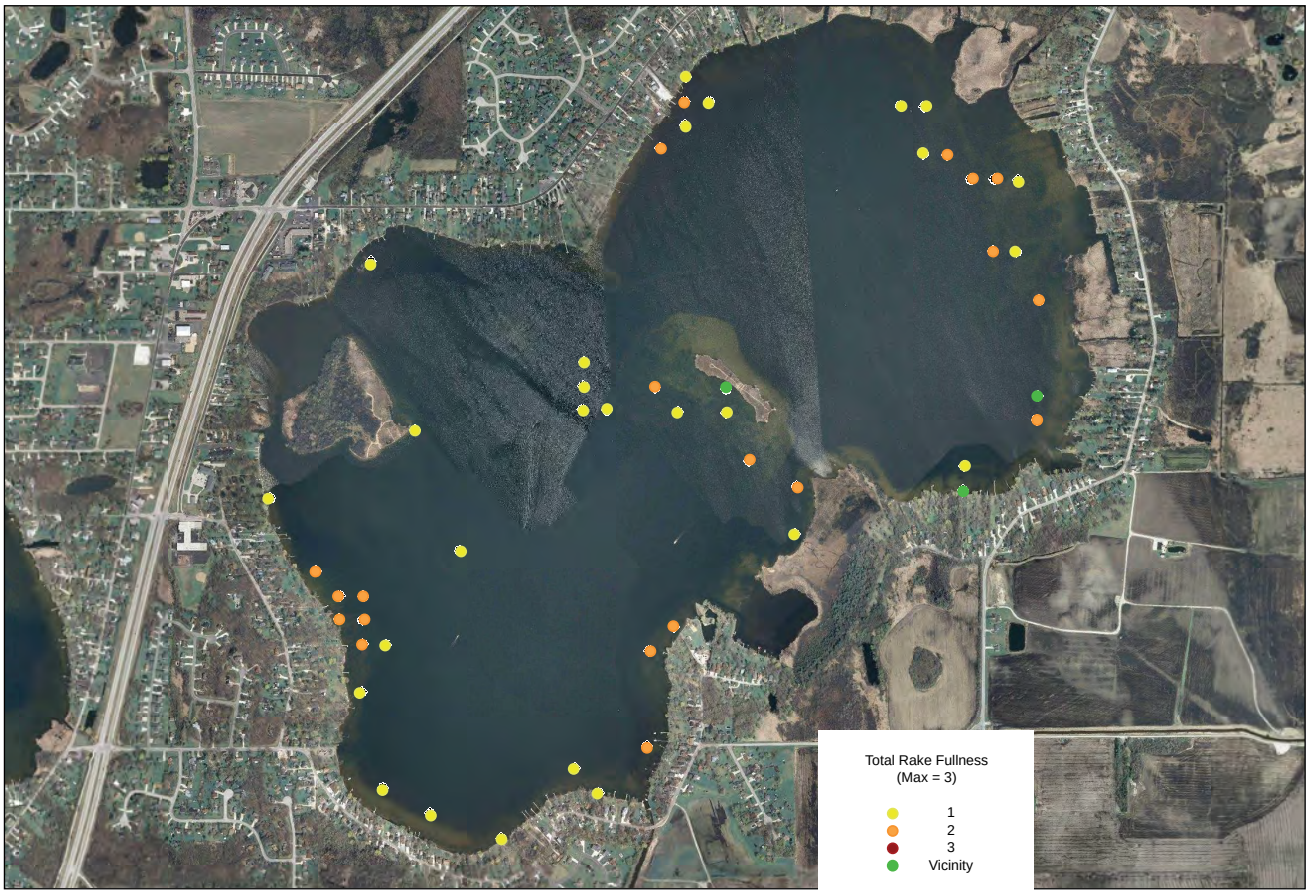


Figure 7 Illinois Pondweed - Wind Lake, 2017

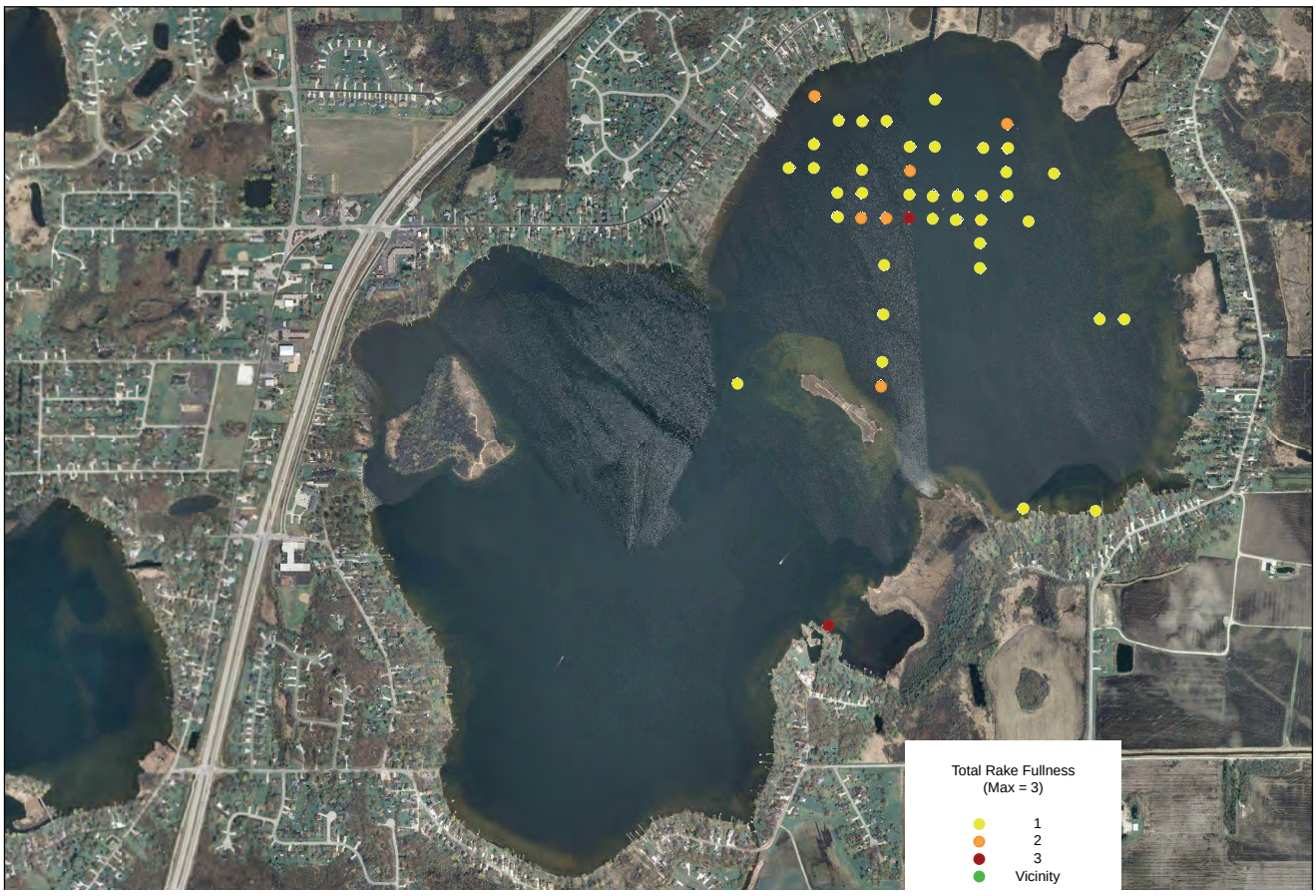


Figure 8 Slender Naiad - Wind Lake, 2017

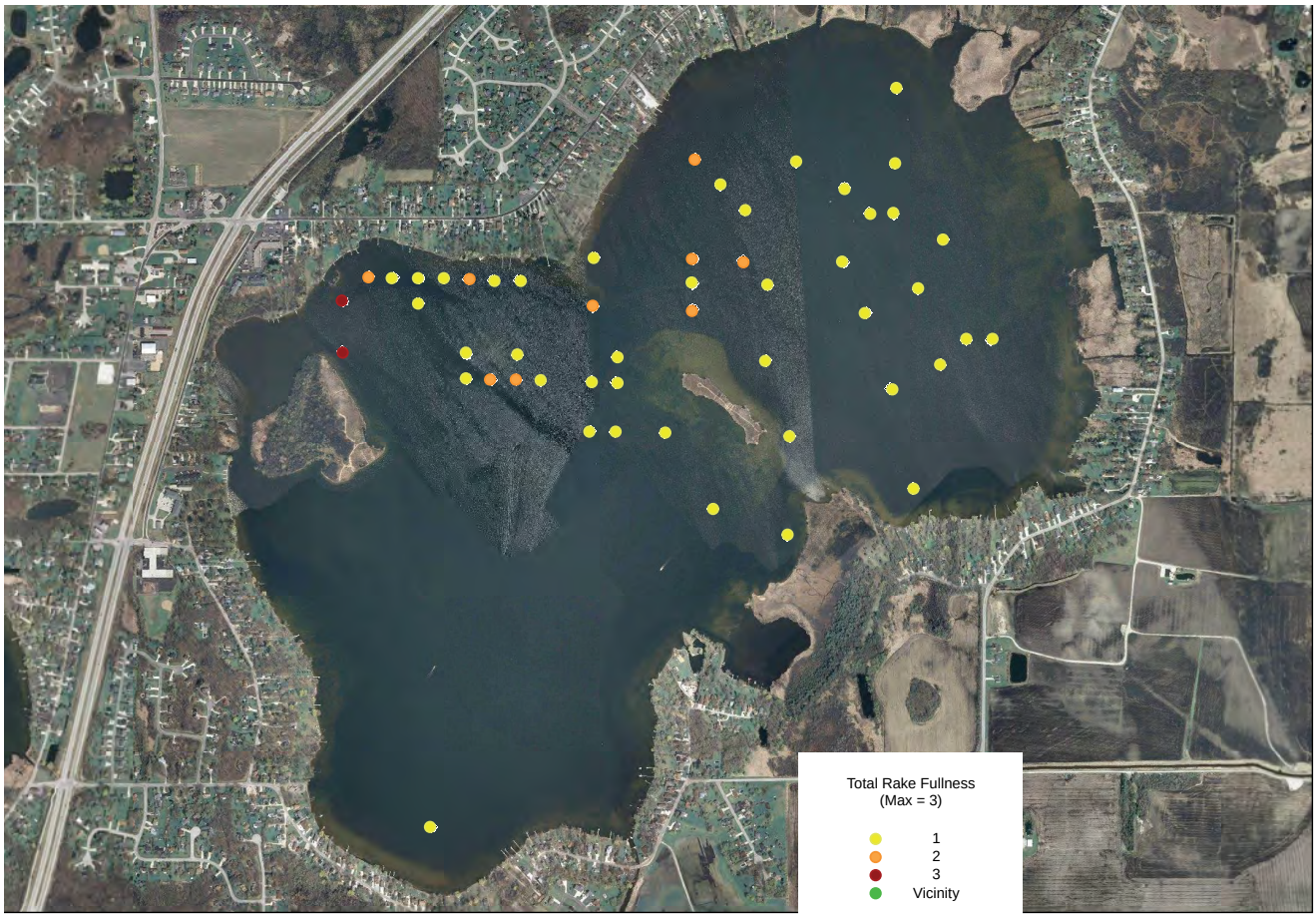


Figure 9 Nitella Sp.- Wind Lake, 2017

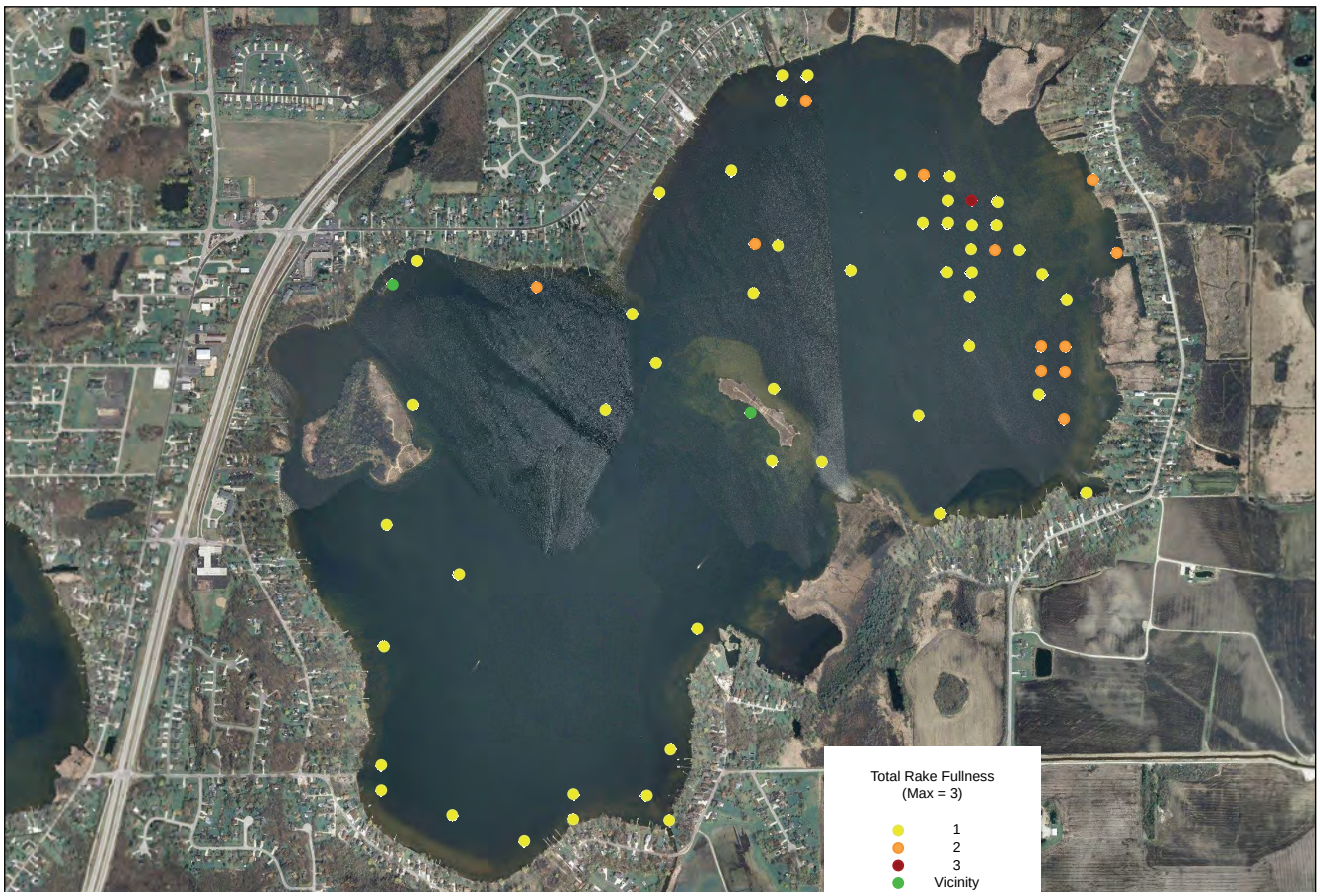


Figure 10 SSago Pondweed - Wind Lake, 2017

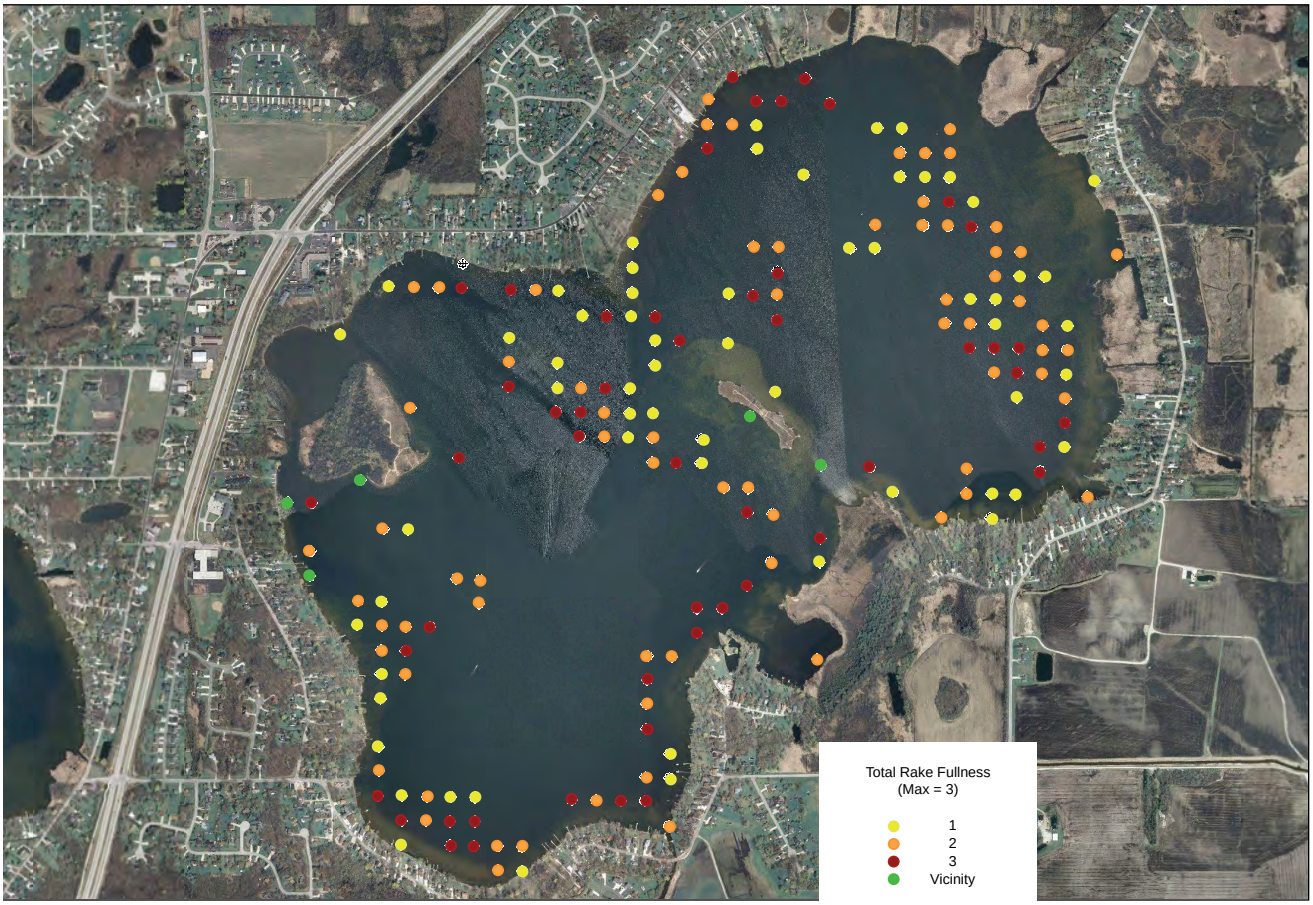


Figure 11 Wild Celery (Eel Grass) - Wind Lake, 2017

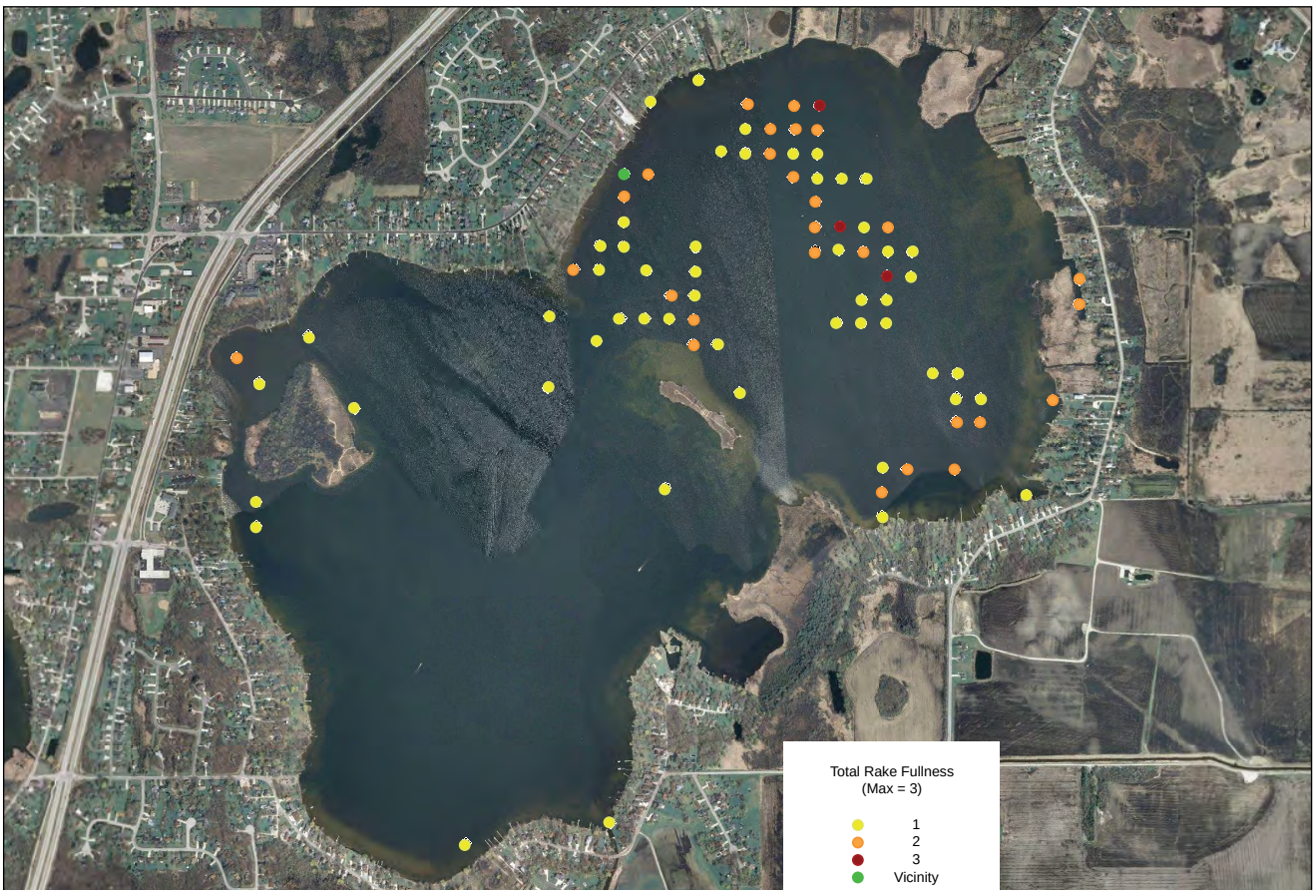


Figure 12 Eurasian Watermilfoil - Wind Lake, 2017

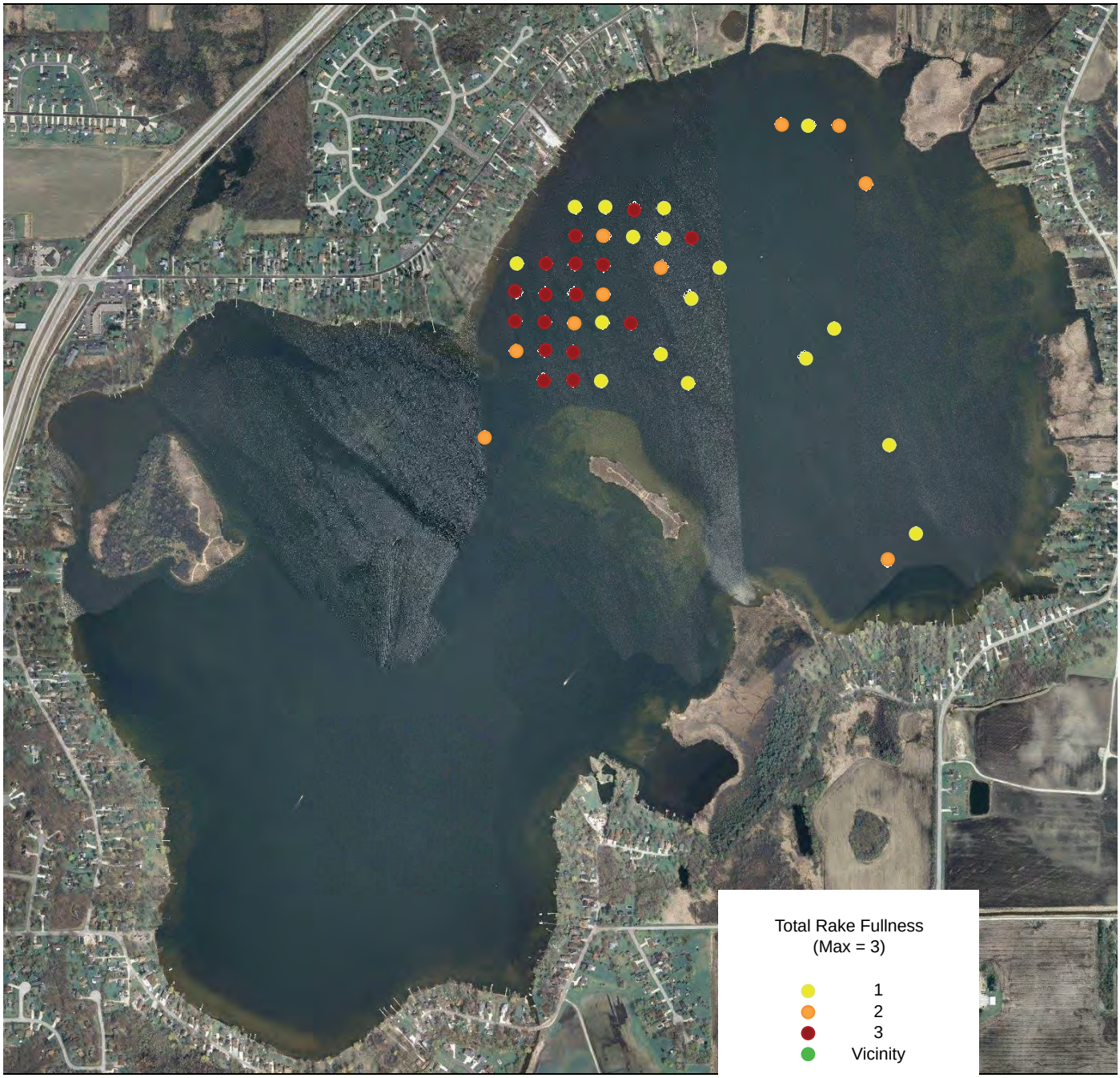


Figure 13 Starry Stonewort - Wind Lake, 2017

PLANT SPECIES DESCRIPTIONS

PONDWEEDS

Pondweeds are important species of plants for a lake. Pondweeds do not grow as quickly or as dense as exotic species. They do not create a dense canopy like exotic species such as Eurasian watermilfoil. Pondweeds support food and provide cover for fish. Most pondweeds provide good to excellent food for waterfowl. Different species of pondweeds become important at different times of the year. Pondweeds support much greater populations of macroinvertebrates than exotic plant species such as Eurasian watermilfoil. Plant management on lakes should focus on protection and enhancement of the pondweeds, while controlling nuisance species.

The Wisconsin Legislature sought to protect native pondweeds in 1989 with the passage of NR107. That legislation names aquatic plant species that should be protected and enhanced. The protected plants that are found in Wind Lake are large-leaf pondweed (*P. amplifolius*), sago pondweed (*Stuckenia pectinata*), wild celery (*Vallisneria americana*), Illinois pondweed (*P. Illinoensis*), Richardson's pondweed (*P. Richardsonii*), white-stem pondweed (*P. praelongus*) and watershield (*Brasenia schreberi*). Other high value plants in Wind Lake include: floating-leaf pondweed (*P. natans*), leafy pondweed (*P. foliosis*), variable-leaf pondweed (*P. gramineus*), flat-stem pondweed (*P. zosterformis*), and long-leaf pondweed (*P. nodosis*).

CURLY-LEAF PONDWEED

Curly-leaf pondweed is an exotic plant species. It gains an advantage over native plants by becoming established very early in the season. Curly-leaf pondweed tends to be more dominant in early summer, dying off in mid-July and August. Curly-leaf pondweed produces dormant structures called turions by the end of June and early July. The turions rest on the bottom until fall, when they begin to germinate and produce small plants. The fall growth over-winters in a green condition (Nichols and Shaw, 1990). In spring, when water temperatures and light intensities increase, Curly-leaf is ready to grow, out-competing other plants that must germinate from seeds or re-establish rootstocks. Curly-leaf reaches the peak of its life-cycle in June and July. Then it dies back in mid-July when other plants are beginning their peak growth periods. If curly-leaf pondweed dominates the plant community in a lake, the die-off can create algae blooms when the decaying plants release the nutrients that are readily available for use by algae. Curly-leaf pondweed provides a good food source for waterfowl, especially as an invertebrate substrate, which is also used by fish. Curly-leaf pondweed may provide good cover for fish as long as densities do not reach nuisance levels.

Curly-leaf pondweed is present in Wind Lake, although because of the timing of the survey, it did not show up in the PI survey. Surveys conducted earlier in the season will provide a better picture of its range in the lake. Two of the most effective means of controlling curly-leaf pondweed is to protect the native plants and to prevent turion production on the curly-leaf plants. This would mean conducting plant management activities prior to the formation of the turions. Early season, low-dose chemical treatments is one option available. Exercise caution when determining which plant management technique (and when its conducted) should be used because native pondweeds may be impacted by some management techniques that target curly-leaf pondweed. Early season chemical treatment will minimize damage to native pondweeds.

EURASIAN WATERMILFOIL

Eurasian watermilfoil is an exotic plant that quickly takes advantage of opportunities for growth. In many lakes it can become a severe nuisance, creating dense plants with large canopies on the surface that shade out other more desirable plant species. Fishing and boating is impaired or completely restricted. Swimming becomes dangerous in the long, stringy plants. Eurasian watermilfoil can contribute to stunted panfish populations by providing too much protection from predator fish (WDNR, 1988). Eurasian watermilfoil stands have been found to support fewer macro invertebrates than comparable stands of pondweeds and wild celery (Smith and Barko, 1990). This in turn affects the fisheries that can be supported by the plants. Eurasian watermilfoil has been thought to spread primarily by fragmentation, however, there is evidence that seeds play a much more important role than previously believed (Aron, 2002).

Eurasian watermilfoil is very common in Wind Lake. The plant distribution and density of the plant are highly variable. Some years, the plant is dominant and grows to the surface over many acres, while other years it is rarely found. This complicates planning the management activities and budgets to control the nuisance. For the past few years, Eurasian watermilfoil has been less prevalent than previously seen.

STARRY STONEWORT

Starry stonewort is a non-native algae species. It is an algae, but behaves more like an aquatic plant. It has rhizoids that look like very fine monofilament line on which it produces bulbils. The bulbils are tiny, star-shaped, and starchy, about 4-5 mm. They appear to be produced in the later part of the summer. The bulbils and fragmentation drives the spread of the plant. Fragments are easily created and can be transported on boats trailers, anchors, etc. The bulbils produce the next season's growth. Starry stonewort is extremely prolific. Recent monitoring in Long Lake in the Town of Norway has found that it can produce more than a million bulbils an acre. Starry stonewort is much more robust than Muskgrass and can quickly grow more than 6 feet tall and will thrive in water deeper than other aquatic plants in a lake. Its rapid growth and dense structure makes eradication impossible and control difficult. Research is trying to determine what works and what doesn't. Control seems to depend on quick response and treatment when the algae is low and has not formed large mats.

Starry stonewort is in Wind Lake and currently inhabits almost 50 acres.

MUSKGRASS

Muskgrass (Chara sp.) is actually an algae, but is usually included in discussions of aquatic plant management. Muskgrass is low growing and can help prevent or reduce the growth of Eurasian watermilfoil. It can also protect lake sediments from the effects of boaters. Muskgrass can be a problem for some lakes, becoming very dense with large mats lifting off the lakebed and up into the boating areas. Muskgrass will not thrive in lakes with high turbidity problems. Muskgrass is an excellent producer of fish food for large and small mouth bass (Fassett, 1985).

Muskgrass is common in Wind Lake. In some areas, muskgrass may limit navigational access when water levels are low.

COONTAIL

Coontail (Ceratophyllum demersum) is a somewhat bushy plant that prefers soft sediments. The plants do not have a root system and float in the water column. The seeds and foliage are used by waterfowl as a source of food. Coontail also provides good spawning habitat and cover for young fish. Coontail provides a source of food either directly or by supporting fish food fauna. Coontail is able to draw nutrients from the water column. Coontail may grow to nuisance conditions. It is frequently found in among the Eurasian watermilfoil in the deeper zones of the lake.

Coontail is very common in Wind Lake.

WILD CELERY

Wild celery (Vallisneria americana) is a perennial plant that prefers hard substrates. The seeds and foliage are considered an excellent food source for waterfowl. Wild celery is a prime spawning habitat for northern pike. In late March to early April, the northern pike spawn on the wild celery that is left from the previous summers growth. Wild celery also provides cover for fish as well as supporting fauna that are utilized by fish for food. Wild celery may also grow to nuisance levels. When there are large areas covered by wild celery, the problem occurs as the plant releases from the sediment in July and August.

Wild celery is very common and continues to increase its range in Wind Lake.

SAGO PONDWEED

Sago pondweed (*Stuckenia pectinata)*, formerly known as *Potamogeton pectinatus*) is an excellent food source, and cover, for fish. Sago pondweed has narrow leaves that create an open structure, reducing the likelihood of becoming a nuisance. The plant has the ability to survive in low light conditions. Because of its value to wildlife, sago is often planted in ponds and shallow lakes.

Sago pondweed is common in Wind Lake.

IN-LAKE INVASIVE SPECIES

As Eurasian watermilfoil, curly-leaf pondweed and starry stonewort increase in Wind Lake, the native plant diversity is threatened. Dense beds of exotic species outcompete native plants, and cause their decline. As the diversity declines, the rest of the ecosystem upon which it depends, declines. Fisheries are often negatively affected by exotic aquatic plant species. As panfish are able to evade predation by game fish by hiding in the dense milfoil beds, their consumption of zooplankton increases. That in turn allows algae to increase, affecting water clarity, which then affects sight-feeding predator fish. This can begin a shift towards an algae-based system and away from a clear-water system. Other exotic species like starry stonewort, smother shallow lakebed areas, smothering spawning and rearing areas. To protect the native plants and fisheries, the exotic species must be minimized as much as possible.

Recreational interests are also negatively affected by exotic species. Zebra mussel invasions means that lake users must wear water shoes to protect from the sharp shells. Boaters must work to remove mussels from boats, motors, and piers. Transient boaters must conduct regular disinfections to prevent transporting exotics between lakes. Exotic plant species can choke waters and prevent boating activities. Long plant stems can entangle swimmers and have caused drownings. Plants covering the lake surfaces collect algae, and debris, increase water temperatures, and lead to unsightly, smelly waters. Starry stonewort can completely block areas of the lake from use by boaters and other recreational users.

Invasive species also have a financial impact. Property values are affected and homes may not sell as quickly. Resort owners may experience a decline in revenues if launches are closed, or lake use is severly restricted by the invasive species.

TARGET LEVELS OF CONTROL - NEW INFESTATIONS

New infestations should be aggressively managed to eradicate the species from the system. Depending on the species, different levels of response may be needed. A reaction to a Hydrilla invasion, should warrant a “top level” response of closing access sites, treating the invasion and surrounding areas, and surveying the lake continuously. This approach has worked in Indiana to eradicate a new infestation of Hydrilla. Starry stonewort (SSW) presents a much different threat. To date, it is not been eradicated from any lake it has invaded. The aggressive nature of SSW, has so far been only minimally been controlled by any control method. This may be a reflection of the control methods attempted and/or the response, or lack thereof in conducting the controls. Control of SSW is very much a work-in-progress as the technology struggles to keep up with the advance of the spread of the algae.

Steps should be taken to work with the private launch owners, Town, WDNR and Legislators to facilitate rapid response:

- The Town should be approached to develop a local ordinance to close all access ramps should an infestation be found.
- The Legislature should be approached to develop state laws to allow local rapid response to take place, including closing access sites.

- The WDNR should be approached to develop an emergency access plan to close the WDNR site should an infestation be found.
- Materials should be developed and produced to use in the event of an invasion. These would include press releases, public informational materials about the cause and effect of the invasion, and access site notices.

If a new exotic species is found, the following steps should be taken immediately:

- WDNR should be notified of the invasion.
- WDNR should be contacted and requested to close the access site immediately if warranted by the species (such as Hydrilla).
- The Town should be contacted to close all access sites.
- The District's chemical treatment contractor should be contacted to schedule an immediate treatment of the area where the exotic was found. States with experience in reacting to new invasions (for instance Hydrilla) recommend treating a 5 acre area surrounding the site.
- A full, point-intercept survey of the lake should be conducted to determine the extent of the invasion.
- The treatment site should be inspected throughout the season to ensure efficacy of the treatment.
- The survey and treatments should continue for at least three consecutive seasons to ensure eradication.
- Surrounding lakes should be notified of the infestation and advised to begin surveying.

GENERAL CONCLUSIONS

- Wind Lake has very good aquatic plant diversity.
- Wind Lake has high densities of native vegetation protecting the 0 to 5 foot depths of the lake.
- Eurasian watermilfoil is in a decline but can still be a threat to the ecological balance in the lake.
- The annual variability of plant growth in Wind Lake complicates management activities.
- The new infestation of SSW creates a challenge for the District and WDNR since so much is unknown about the potential spread, and possible control of SSW.
- Steps should be taken to eradicate Purple Loosestrife and Phragmites around the lake.
- Regular inspections should be done to identify and react to new invasives early.
- Protection of native aquatic plants will help minimize the spread of invasive species like starry stonewort.

CHAPTER IV - PROBLEMS

The waters and sediments of Wind Lake contain sufficient amounts of nutrients to promote aquatic plant and algae growth. Phosphorus and nitrogen have been determined to be the most critical components that drive aquatic plant growth. Phosphorus is likely the limiting nutrient in Wind Lake.

The perceptions of the severity of problems by individuals are often dependent on their personal experiences. The management of lake problems is directly correlated with the management of expectations by individuals.

Dense plant beds interfere with boat motors, and swimmers. Dense plants also contribute to stunted panfish populations by reducing opportunities for grazing by predators. Additionally, the excessive plants diminish the aesthetic value of a lake as shoreline debris increases.

The fertile soils in the region may contribute to the excessive plant problems experienced in Wind Lake. As the amount of impervious surfaces increase in the watershed of the lake, the potential for water quality problems, and the resulting aquatic plant problems, increases. Without adequate buffers, runoff carries sediment, and nutrients that fuel aquatic plant growth. The extensive shallow lake areas and high levels of recreational use also create problems in the lake, disrupting game fish spawning areas, suspending sediments, reducing water clarity, and negatively impacting aquatic plant conditions.

A number of publications also point to the role of various lake-side living activities as a significant source of nutrients. Maintenance of golf course-type lawns, with high doses of fertilizers and pesticides are a big contributor of nutrients to lakes. A recent USGS publication, USGS Water-Resources Investigation Report 02-4130, cites a study conducted on Lauderdale Lakes in Walworth County. In that study, the quality of runoff from the use of no-phosphorus fertilized areas was nearly identical to that from non-fertilized areas, indicating the advantages of limiting phosphorus application. In addition, nitrogen also plays an important role in plant growth and should also be avoided. Other human activities that negatively impact water quality include the excess use of salt in winter, pet waste, and discharges from automobiles. To reduce phosphorus runoff, the Town of Norway now has a no-phosphorus fertilizer ordinance.

Recreational boating use, coupled with dense plant beds increase the amount of plants cut by boats, known as floaters, that wash up on shorelines and re-root. Parts of plants broken by wind and wave action, or by motors (even electric motors), float around the lake, create shoreline debris, and reroot into new areas. Also, perils to swimmers exist in long Eurasian watermilfoil and curly-leaf pondweed strands.

Dense Eurasian watermilfoil beds can contribute to stunted panfish populations by reducing opportunities for grazing by predators. Excessive curly-leaf pondweed can contribute to poor water clarity and algal problems. When these plants begin to die off in early summer they release nutrients into the water column.

Plant growth on Wind Lake is highly variable from one year to another. Some years plant conditions are such that no harvesting is required and chemical treatments are minimal. Other years harvesting and chemical treatments are conducted to the limits of the District-approved budget.

Eurasian watermilfoil and starry stonewort are the plant species causing the nuisance conditions in Wind Lake. The newly found infestation of starry stonewort is a real concern for the lake, the native plant population, the fisheries, and the management of aquatic plants.

It is important to remember that it is far cheaper to prevent a problem than it is to correct a problem. An oil change of a car costs only $20 but a new engine costs thousands of dollars. The same holds true for lakes. Public information efforts to prevent problems and the cost of annual monitoring programs are much cheaper than major lake restoration projects. Preventing soil erosion, nutrients, and exotic species from entering the lake are much more cost effective than attempting to dredge or correct plant and algae problems.

CHAPTER V - PLANT MANAGEMENT ALTERNATIVES

Control of exotic or nuisance plant species is an uphill battle. The very nature of all aquatic plant species survival provides the means to spread. For instance, wild celery can spread by releasing from the sediments and floating to new areas in late summer and fall. With exotic or nuisance plants, the growth and spread of the plants is more prolific. Fragmentation is important for Eurasian watermilfoil. The recent documentation of hybrid species of milfoil confirms the importance of seeds in its reproduction. Curly-leaf pondweed spreads by creating turions from which new plants grow. Starry stonewort creates turion-like structures called bulbils which attach to the algae by rhizoids. The bulbils as well as fragments help the algae spread quickly.

Realistic expectations are important in aquatic plant management. It is unlikely that exotic plants species can ever be completely removed from a lake. It is more likely that a combination of lake management techniques, along with public education, are most effective in minimizing the long-term impact of exotic plant species in a lake.

A discussion of a variety of plant management alternatives follows.

NO MANAGEMENT

Nuisance levels of aquatic plants can be left to do what they will with no active management from people. Under this alternative, it should be expected that Eurasian watermilfoil and curly-leaf pondweed will continue to expand their range in Wind Lake. While the firm, sandy shorelines will not see much Eurasian watermilfoil growth, the soft sediment portions of the lake will likely see expanded areas of Eurasian watermilfoil. The downside of this is that the more shading from Eurasian watermilfoil, the less light can reach the native understory, further increasing water temperatures and reducing the native plant community, allowing Eurasian watermilfoil even more opportunity for growth. Expanded areas of Eurasian watermilfoil may impact the fisheries, increasing the areas for small panfish to hide from predators. While the short term cost of the No Management option is nothing, the long term cost may be much higher than if even minimal management occurred. Once seed beds are established, and the nuisance plants shade out the natives, it may take aggressive, costly activities to re-establish a balanced plant population. Although the budget line for “no-management” is low, the long term cost in lost recreational use and lower property values is high.

Conclusion—No Management is technically feasible for Wind Lake and no direct cost comes with that choice. However, it is not in the best, long term interest of the water resource. No Management would be expected to result in increase exotic and nuisance aquatic plant levels. No Management would allow starry stonewort to spread uncontrollably throughout the lake, damaging the fisheries and the native plant population.

DRAWDOWN

Drawdown can be used to control some plant growth. Use of this method entails dropping the lake X number of feet for a period of time. This exposes the plants to extreme temperatures, drying and freezing. Some plants respond very favorably to drawdown, while other plants react negatively, or unpredictably. Eurasian water milfoil and coontail react unpredictably (Nichols 1991). Locally, Big Muskego Lake was drawn down for a lake restoration plan. While Eurasian watermilfoil was reduced for a while, the plant returned to a level requiring aggressive management. Other lakes have had good success with extended drawdowns that thoroughly freeze the lakebed, especially those areas with soft sediments in shallow shoreline areas.

A source of water to refill the lake, and a means to draw the lake down, are also important considerations. The procedure is rarely effective. Some valuable plants can be destroyed while more nuisance plants can be encouraged. Time is also a factor in drawdowns. Usually a lake is drawn down for 4 to 6 months

and often needs to be repeated for maximum effectiveness. Drawdown also reduces the recreational opportunities on the lake. Timing of a drawdown can have a negative impact on fisheries if spawning areas are no longer accessible to fish. Turtles and frogs hibernate in shoreline muds and can also be affected by drawdowns.

Costs associated with drawdowns depend on the outlet control structure. Pumping to lower the lake can mean high costs for equipment, electricity and staff. Costs can be minimal if the lake can be lowered by simply opening a gate. New studies are being conducted on Little Muskego Lake, trying to freeze out the starry stonewort bulbils by dropping the lake 7 feet during winter to freeze them out. The deep water infestation of SSW in Wind Lake makes this option less likely because of the limitations of the control structure.

The dam on Wind Lake has two operable tainter gates that are regulated to control the water levels. Each gate is approximately 10 feet wide and 7 feet tall. The County adjusts the gates to comply with the operational order that exists for Wind Lake.

Conclusion— Because of the recreational demands on the lake, because of the limitations of the control structure and outlet area of the lake, because the exotic species are located throughout the lake, drawdown for the purpose of aquatic plant control on Wind Lake is not recommended at this time. The use of drawdown on Wind Lake would require artificial pumping to reduce the lake level below the growing depth of exotic species and depending on the species desired to be controlled, may not produce the desired results. If the invasive species spread significantly to the shallow water zones, drawdown may be considered.

NUTRIENT INACTIVATION

Nutrient inactivation is used to control the release of nutrients, primarily phosphorus, from the sediments. One of the most common substances used is aluminum sulfate, or alum. The alum treatment creates a floc formation covering the bottom sediments, preventing phosphorus from being released into the water. Nonpoint source pollution controls must be implemented prior to the use of alum, or the floc will be covered with newer nutrients. The cost of an alum treatment would is in excess of $300,000.

This treatment will not prevent plant growth but will reduce problems from algae growth. Improved water clarity from an alum treatment may increase aquatic plant densities. Water chemistry information must be collected prior to use to ensure sufficient buffering exists to prevent acidification and aluminum toxicity. Waters deeper than five feet are usually treated with Alum. WDNR approval is required. Many of the areas with the existing nuisance conditions would not be treated with alum, so localized problems would not be corrected and in fact may be increased.

Alum treatments were conducted in 1996 and 2011 to deal with internal loading in Wind Lake and to prevent blue-green algae blooms. The treatment is expected to have a 7 to 10 year life span and it has successfully reduced nutrient levels in the lake.

Conclusion—While nutrient inactivation is a viable tool for nutrient control in Wind Lake, it is not a viable tool for managing aquatic plants in Wind Lake. Prior use of alum on Wind Lake for nuisance algae control, may be contributing to the rapid growth of starry stonewort in the treated areas of the lake, providing starry stonewort with easy access to nutrient-enhanced sediments.

DREDGING FOR AQUATIC PLANT CONTROL

Dredging is most often used to increase depths for navigation in shallow waters, especially for channels, rivers, and harbors. Dredging for the sole purpose of plant control has met with mixed success. To be considered successful for aquatic plant control, dredging would need to bring the lake bed to depths beyond 10 feet deep, the maximum rooting depth in the lake. Eurasian watermilfoil prefers soft sediments. To minimize rapid re-infestation of the remaining sediments, dredging would need to be done to a hard pan

layer. Dredging is the most costly form of plant management control. Costs range from $5.00 per cubic yard up to $30.00 or more per cubic yard depending on site conditions, method used and disposal costs. A WDNR permit is required. The availability of disposal sites often restrict the size and scope of dredging projects.

Dredging was used on Wind Lake in 1993 to open up five navigational areas for boating.

Small scale dredging projects, less than 25 cubic yards over 5 years, can be conducted by individual landowners under a WDNR permit. Property owners should consult the WDNR website.

Conclusion—Dredging may be considered in Wind Lake. Extra precautions should then be taken to protect the rest of the lake from impacts caused during the dredging. Because of the very high costs, and considerable disruption of the aquatic environment, dredging for aquatic plant control purposes would not be considered a viable alternative for Wind Lake.

AERATION

Aeration entails installation, operation and maintenance of a system to artificially pump oxygen into the lake depths. Artificial aeration has been used to correct oxygen deficiency problems in lakes that produce numerous algae blooms and subsequent fish kills. Aeration is used when internal nutrient sources are high compared to external sources, if nuisance algae conditions exist, or if low oxygen levels are a problem. It is most useful on lakes with low dissolved oxygen levels and large internal releases of phosphorus.

Aeration is an expensive lake management technique. Initial capital costs for a lake this size would run more than $400,000 and an annual maintenance and operational cost of approximately $50,000 to $60,000. Problems frequently result with improperly sized aeration systems so initial planning and engineering must be done carefully to prevent creating greater problems. Annual operational problems and costs are difficult for small lake organization budgets and staff.

There has been no documented effect of aeration on plant growth. WDNR approval is required.

Conclusion—Aeration on Wind Lake should not be considered at this time.

SCREENS

Light screens are similar to window screens that are placed on the lake bottom to control plant growth. Screens come in rolls that are spread out along the bottom and anchored by stakes, rods, or other weights.

Screens create little environmental disturbance if confined to small areas that are not important fish or wildlife habitat. Although they are relatively easy to install over small areas, installation in deep water may require SCUBA. Screens must be removed each fall and reinstalled in spring. Care must be taken to use screens where sufficient water depth exists, reducing the opportunity for damage by outboard motors. Screens cost more than $300 for a 700 sq. ft. roll. Screens may be used by individual home owners along their shorelines or piers to create swimming areas. A negative impact of using screens is that all plant species are affected by the installation of screens, even native plants. WDNR permit is required.

Conclusion—Screens are contradictory to the WDNR's stated goal of protecting native plants. Where used previously on Wind Lake, they were not effective in minimizing nuisance conditions. They are not viable for use on Wind Lake.

WEED ROLLERS

Weed rollers are a mechanical device that can control weed growth in shallow areas. A post attaches to a pier. At the end of the post is a roller that moves in a slow arc, up to about 270 degrees. The roller agitates the top layer of sediment, preventing plants from growing. There have been discussions with WDNR about allowing the use of the weed roller in Wisconsin lakes, but WDNR currently does not allow their use. According to the manufacturer's website, Illinois does not require a permit to use a weed roller. Indiana requires a permit it if affects more than 625 sq ft. Minnesota and Michigan require a permit to use a weed roller.

Conclusion—The weed roller may be another viable alternative for riparian landowners if the WDNR will allow their use.

BIOMANIPULATION

The use of biological controls for aquatic plant management purposes is currently limited to the grass carp and a few species of insects. Most of these controls are theoretically possible, however they have limited application. Non-native biological controls are risky: there are a number of instances where the solution caused new problems when a non-target organism was preferred. Biological controls also produce slower, less reliable, and less complete control than mechanical or chemical control activities.

Grass Carp (*Ctenopharyngodon idella Val*.) is an exotic species originally imported from Malaysia. It is considered to be a voracious eater of aquatic plants and prefers elodea, pondweeds and hydrilla. Studies have shown that Grass Carp can reduce or eliminate vegetation at low densities. Grass Carp generally will graze on more beneficial plants before going after Eurasian watermilfoil, thereby compounding nuisance problems. Overstocking can eliminate all plants. In the United States, only a few states allow the use of a sterile form of Grass Carp. Grass Carp are illegal in the State of Wisconsin and are not an option on Wind Lake.

In British Columbia, Canada, the larval stage of two aquatic insects, the caddisfly (*Triaenodes tarda Milne*.) and the chironomid larvae (*Cricotopus* sp.) have been observed to graze on Milfoil plants. These two insect species are currently being studied as forms of biological controls.

Recently, a naturally occurring fungus (*Mycoleptodiscus terredtris*) has been observed to effectively control a species of milfoil in New Hampshire.

A weevil (E*urhychiopsis lecontei*) has been found to help control Eurasian watermilfoil in some lakes in Wisconsin and Illinois. The weevil does major damage to the milfoil plant as it is closely associated with it during its entire life cycle. The adult female lays eggs on the tips of the milfoil. When the larvae hatch, they feed in the growing tips and then burrow into the stem. Pupation (when the larvae changes to an adult) occurs in the stem. In fall, adult weevils burrow into the shoreline litter and remain until spring. Weevils mature from egg to adult within 30 days and reproduce from May through September. Lakes with intensive management using harvesters or chemicals are less likely to support good populations of the weevil. Weevils do not usually like other plants so it does not affect other plant species. Weevils are now available commercially.

Although the weevils can dramatically impact milfoil beds, it may not be enough to control the nuisance. Wind Lake has the weevils. The milfoil beds frequently reach the surface by mid-June, but the weevils' life-cycle on the lake does not begin to drop the milfoil until the beginning of July and many areas with the weevil show minimal signs of impact. This time lag and lack of more complete control, can negatively affect the riparian's acceptance of the weevil as a management technique.

Efforts to introduce the weevil into new lakes has not been successful enough to justify the expense of the weevils ($1.00 per weevil). As the technology, and science, as well as the experiences with

weevils improve, the weevils may be a viable option for management of Eurasian watermilfoil on Wind Lake. Additional research is needed before many of the biomanipulation techniques can be commonly implemented in lake management (AERF, 2005).

Another beetle, *Galerucella calmariensis* (commonly referred to as Cella Chow), is being used around Wisconsin to combat the spread of purple loosestrife. Purple loosestrife is a wetland invasive species that is a prolific seed producer. Plants produce over 2 million seeds per season and can quickly take over a wetland, displacing native plants. It is illegal to sell or cultivate purple loosestrife in Wisconsin. The Cella beetle is being distributed into infested areas, especially those too large for manual control. Volunteers obtain incubator populations of the beetle, raise them through the beetles' four life-stages, and then release the new beetles into established purple loosestrife areas. The beetles have been introduced into purple loosestrife areas around Wind Lake. The WDNR website has specific information on purple loosestrife control, including manual, chemical, and biological.

Conclusion—Neither the Grass Carp, insects, nor fungus are viable alternatives for Wind Lake. The milfoil weevil may be considered on Wind Lake should it become cost effective to use. The purple loosestrife beetle, as well as hand and chemical controls, may be used to control purple loosestrife around Wind Lake.

NATIVE SPECIES INTRODUCTION-SHORELINE EDGES AND ADJACENT UPLANDS

Native plants are being re-introduced into lakes to try to diminish the spread of exotics and to try to reduce the need for other, more costly, plant management tools. Native plants are usually less of a management problem because they tend to grow in less dense populations and are more often low-growing. Native plants also provide better food and habitat for fish and wildlife.

Careful consideration of the species introduced needs to be given to avoid creating another problem.

Native species re-introduction or expansion has only limited application as a plant management alternative for Wind Lake. Wind Lake has extensive natural shoreline areas which provide a buffer zone between the open water and shoreline thereby reducing the effects of wave action upon the shore, and erosion. The emergent plants also provide important habitat for fish and macro invertebrates as well as increase the aesthetic value.

Costs to conduct plantings vary with the number and type of plants, and whether volunteers or paid staff do the work. Successful plantings can be affected by a number of factors, including health of the new plants, weather, timing, bottom substrate, water clarity, and waterfowl grazing. The WDNR should be consulted before conducting any planting activities to ensure the protection of the resource, the necessity for a permit, and the likelihood of success.

Conclusion—Shoreline plantings and upland restoration may be considered by the District or individual landowners. Landowners should be encouraged to allow the upland shoreline edge to re-vegetate into a stable buffer zone. This could be done as simply as not mowing. This, along with supplemental plantings of native upland plants, would provide habitat for birds, turtles, frogs, and other wildlife, while helping to filter out nutrients and sediments. This will indirectly help with the in-lake nuisance aquatic plants by reducing the nutrients in the lake used by the plants, and by creating a more stable near-shore area. Natural shoreline vegetation also provides a natural barrier that Canadian geese avoid. Although an established buffer will require less work than a lawn, there will be maintenance required. This may include cutting, mowing, or elimination of exotic species such as purple loosestrife. Landowners should consult with a professional to determine specific maintenance requirements and scheduling for their shoreline buffers. Permits will be needed for aquatic plantings and the County should be consulted to determine if upland restoration permits are needed.

HAND CONTROLS

A method of aquatic plant control on a small scale is hand or manual control. This can consist of hand pulling or raking plants. A rake with a rope attached is thrown out into the water and dragged back into shore. Plants are then removed and disposed of. Skimmers or nets can be used to scrape filamentous algae or duckweed off the lake surface. These methods are more labor intensive and should be used by individuals to deal with localized plant problems such as those found around individual piers and swimming areas. Hand controls cannot include the use of auxiliary power. For instance, a boat motor cannot be used to drag a rake. Hand controls are very inexpensive when compared to other techniques. Various rakes and cutters are available for under $100. Cutters pose risks to users because of their extreme sharpness. Although labor intensive, hand controls, especially using rakes, are effective ways to remove plants from a small area.

NR 109 allows riparian landowners to manually remove Eurasian watermilfoil and curly- leaf pondweed plants within their “riparian zone” without permits. Residents may remove other plants in a single area that is not more than 30 feet wide as measured parallel to the shoreline, including any swimming and pier areas, as long as the area is not a WDNR Sensitive Area. The 30-foot area must remain the same each year. It is illegal to remove native plants outside the 30-foot wide area without a permit.

Conclusion—Hand controls may be used by individual landowners to clear swimming areas. Landowners should be encouraged to be selective in their clearing, again focusing on Eurasian watermilfoil, curly-leaf pondweed, or starry stonewort. It should be understood that shoreline management using hand controls will continue to be a labor intensive, on-going management activity. Landowners should maintain a natural area of vegetation both on their shoreline and in the water.

Riparian landowners may manually (without any auxiliary power) remove Eurasian watermilfoil, curly-leaf pondweed or starry stonewort within their “riparian zone” without permits. Residents may remove plants in a single area that is not more than 30 feet wide, including any swimming and pier areas, as long as the area is not a WDNR Sensitive Area. However, because of the ease with which the exotic species spread, landowners should not attempt to remove native plants. Doing so will create a far worse condition when the nuisance species fill the void created by removing the native plants. Consult WDNR regarding any permits needed for removal of plants.

CHEMICAL TREATMENT

Chemical treatment of aquatic plants in lakes is governed by WDNR under Wisc. Admin Code NR107. Chemical treatment for the control of aquatic plants is one of the more controversial methods of aquatic plant control. Debate over the toxicity and long term effects of chemicals continues in many communities. Many changes have occurred over the years. Today, the half-life of the herbicides is days and weeks, rather than months and years. Instead of broadcast applications, todays treatments are targeted. Very low application rates are used today, where in the past, much higher rates were used. A WDNR permit is required prior to any chemical treatment.

With chemical treatments, the plant material impacted by the treatment dies and contributes to the sediment accumulation on the lake bed. When plants are treated, the decaying process of the plants uses oxygen. Depending on the chemical used, if too much plant material is treated at once, oxygen depletion may occur, stressing or killing fish.

Another concern about the use of chemical treatments is the ability to quickly shift a lake from one dominated by aquatic plants to one dominated by algae. This shift can occur if most or all of the vegetation is treated. The algae then use all the available nutrients, creating algal blooms.

The importance of aquatic plants to the fisheries community is another reason to use caution when conducting chemical treatment or other management activities that remove large amounts of plant material. If too much plant material is removed, fisheries food and habitat are negatively affected.

Identification of the target species is very important. Different chemicals should be used for different plant species. Dosage also affects the results. Too little chemical may stunt growth but not kill the plant. Too much chemical may negatively impact fish, amphibians, or invertebrates. If native plant communities are destroyed by chemicals, the areas may be invaded by exotic plants such as Eurasian watermilfoil and curly-leaf pondweed. The formulation of the chemical, whether liquid or granular, is a factor to consider. Another factor to consider is the contact period the chemical would have with the vegetation.

Care should be taken to alternate the chemicals used whenever possible. This will help minimize the chance of the nuisance species developing a resistance to the chemical. Currently, there are only two documented species in Florida which have developed a resistance. However, the very nature of aquatic plant control reduces the options when resistance does occur.

Chemical treatment is more selective than harvesting. Chemical treatment may also be more appropriate in some situations, especially where mono-typic stands of exotics exist in shallow water where harvesters cannot work, such as in marina areas. It may also be the method of choice to treat early infestations of Eurasian watermilfoil when hand-pulling cannot be used. When used appropriately, chemical treatment can be economical and effective.

Modern herbicides have been tested extensively. Tests include determining toxicity levels to be sure that humans, animals and fish are not affected. Test results must also show that the herbicides do not bioaccumulate in fish or other organisms and that their persistence in the environment is low. Product labels contain the requirements for use. Approved labels state that “there is reasonable certainty that the pesticide can be used with no unreasonable adverse affect on human health or the environment”. Material safety data sheets are available for all herbicides approved for use in Wisconsin. Chemicals must be used according to the approved use applications listed on the labels. Application rates, as well as any use restrictions, are indicated on the product labels. Licensed applicators must follow the label requirements.

Shoreline treatments may need to be repeated at least annually. Shoreline treatments will likely not eliminate the nuisance, especially when the deep water untreated areas have high densities of Eurasian watermilfoil or starry stonewort. Invasive plant material from elsewhere in the lake may quickly re-enter the area. Shoreline treatments are usually spot treatments to alleviate a nuisance condition, whereas whole-lake treatments are usually lake restoration-based treatments.

Whole-lake treatments have been used to eliminate Eurasian watermilfoil from a lake for at least three years (Aron, 2003). Large-area treatments (greater than 10 acres) have been used to dramatically reduce curly-leaf pondweed problems. Lake Barrington in northern Illinois has been successfully treated with Sonar™ as part of a multi-faceted approach to shift the lake from one dominated entirely by curly-leaf pondweed, to one with a more diverse plant community. Long term studies of water quality and fisheries on lakes using whole-lake treatments are scarce. To date, there have been some documented negative impacts on water quality following some of the first whole-lake treatments in Wisconsin (Hauxwell et al, 2006). Whole-lake treatments are not appropriate for all lakes. Extensive studies must be conducted prior to requesting a permit for a whole-lake treatment.

Large-area treatments have been used to effectively reduce Eurasian watermilfoil and curly-leaf pondweed, without the whole-lake impacts. These treatments are done early in the season, just as the plants begin to grow, usually in early April. When both curly-leaf pondweed and Eurasian watermilfoil are present, Aquathol K has been used to target both. 2,4-D products have been used when only Eurasian watermilfoil is present.

Although “mail order” chemicals can be purchased, their use is strongly discouraged and should never be used without a permit from WDNR. They may be completely ineffective if they are used to try to treat the wrong plant species. Unregulated, uneducated use may result in overuse of a chemical and cause damage to the “good” weeds, fish and wildlife, and humans.

Prior to any chemical treatment, a permit is required from WDNR. Only Wisconsin and EPA approved herbicides may be used, following all label directions and restrictions. In most situations, herbicides may only be applied by licensed applicators certified in aquatic application by the Wisconsin Department of Agriculture, Trade, and Consumer Protection. Proper handling and application techniques must be

followed, including those to protect the applicators. All applications must comply with current laws in the State of Wisconsin.

Although individuals may apply for permits to apply aquatic herbicides, residents are strongly encouraged to work with the District on any questions or concerns about aquatic plants prior to undertaking any plant management activities.

Systemic Herbicides — Systemic herbicides are translocated throughout the entire plant, including the roots. Examples of systemic herbicides are 2,4-D, Fluridone, and trichlopyr. 2,4-D and trichlopyr are used to control Eurasian watermilfoil in localized areas. Fluridone is primarily used in Wisconsin to control Eurasian watermilfoil in whole-lake, or large area situations.

Contact Herbicides — Contact herbicides kill the exposed portions of the plant that they come into contact with. They are not translocated to roots and will only rarely kill entire plants. Herbicides with the active ingredients of diquat and endothall are common contact herbicides. Contact herbicides are frequently used to provides short-term nuisance relief. Contact herbicides may be affected by high levels of suspended sediment in the water column.

Copper Compounds — Copper sulfate is used for the control of algae. Cutrine Plus is an herbicide that uses copper as its active ingredient. This is used to control various types of algae. In some regions it can sometimes control Chara (also known as muskgrass), a more desirable algae, it is more commonly used to control filamentous, green and blue-green algae. Liquid formulations, especially the copper chelated products (those combined with other compounds that help prevent the loss of active copper from the water) are more effective. These tend to remain in solution longer, allowing more contact time between soluble copper and the algae cells. Cutrine Plus and Cleargate have no restrictions on lake use following a treatment.

Aquathol — Super K is a formulation containing the active ingredient endothall. This is a contact herbicide that prevents certain plants from producing needed proteins for growth. It is used to control certain pondweeds, coontail, and Eurasian watermilfoil. The timing of an application affects what plants are impacted. Aquathol has use restrictions including 1 day for swimming; 3 days for fish consumption and 7 to 25 days for irrigation and human and animal drinking.

Reward — Reward, previously known as Diquat, is a non-selective contact herbicide that is used to control a wide variety of plants. It is absorbed by plants and damages cell tissues. Reward kills the parts of the plants that it comes into contact with directly. Reward loses its effectiveness in muddy, silt-laden waters. If too much plant material is killed in an area, the decomposing vegetation may result in very low oxygen levels that may be harmful or fatal to fish. Areas that are treated with Reward cannot be used for activities requiring full or partial body contact for at least 24 hours after treatment. Animal consumption, irrigation, and other domestic uses require waiting at least 14 days after treatment. Reward works quickly, with results usually seen in 6 to 10 days. Reward has use restrictions including 1 day for swimming and 14 days for drinking or irrigation.

2,4-D (2,4-dichlorophenoxyacetic acid) — 2,4-D is a systemic herbicide which interferes with normal cell growth and division. Plants begin to die within a few days of liquid formulation treatments, and within a week to 10 days when granular formulations are used. The aquatic formulations of 2,4-D are only effective on certain species of aquatic plants. It is most commonly used to treat Eurasian watermilfoil. The timing and the dosage rate of an application is important to avoid impacting native plant species. Because it also impacts several desirable species including bladderwort, water lilies, and watershield, care should be taken to ensure that only the target nuisance plant species are present before treatment or that the dosage is low enough to protect natives.

2,4-D products have no swimming or fish consumption restrictions, but treated water should not be used for irrigation until herbicide residues as less than 1 ppm.

Fluridone — Fluridone is an herbicide that inhibits the plant's ability to make food. Without that ability, the plant dies. The visual symptom of the effects of fluridone is bleaching of the terminal buds, or growing points, on the plant. This herbicide requires at least 30 to 45 days of contact time to kill the plant. This prevents problems with low dissolved oxygen in treated areas. Fluridone is rapidly diluted and best used in larger treatment areas, generally 5 acres or more in size, preferably on a whole-lake basis. Prior to treatment there should be good flow data for the proposed treatment area. Rates of inflow, outflows, and ground water sources should be known prior to treatment. New fluridone formulations are effective at remaining in the water column for long periods of time, even during relatively high flow. The WDNR has questions about the long term impact of Fluridone on water quality and fisheries since most available information is anecdotal. Fluridone can be used for a range of plant control, from species specific control to general control. Fluridone achieves its selectivity by the use of varying dosages. High treatment dosages control a wide variety of aquatic plants, while low dosages maintained over long periods of time have been used to control Eurasian watermilfoil with minimal impact on native plants. A couple of important plant species, specifically naiads and elodeas are highly susceptible to Fluridone. Lakes with an abundant amount of susceptible species should carefully evaluate the use of Fluridone. Fluridone has no use restrictions except for irrigation. Irrigation restrictions range from 7 to 30 days.

Trichlopyr — Trichlopyr is a newly-approved herbicide which kills the entire plant, and is effective at treating Eurasian watermilfoil. Trichlopyr is more suited to moving water applications than slow-acting herbicides such as fluridone. Trichlopyr has a 120-day use restriction for irrigation.

Conclusion— Chemical treatment may be conducted on Wind Lake. Treatments may be undertaken by individuals or the District with WDNR approval. Native aquatic plant beds that restrict navigational access to the main lake may be treated. Changing plant conditions that create new shoreline nuisances may warrant chemical treatment. Large-area treatments may also be conducted targeting Eurasian watermilfoil, curly-leaf pondweed and starry stonewort. Any other chemical treatments conducted on Wind Lake should target exotic species and will need to be repeated regularly. It may take multiple years of management to result in any change in the density and aerial coverage.

- Eurasian watermilfoil, curly-leaf pondweed and starry stonewort may be treated with the appropriate herbicides. It should be remembered that destruction of any native plant species populations will increase potential problems from nuisance exotic species. However, native plants can be expected to decline as exotic species invade the areas.
- Treatments should be planned to treat early enough in the season to eliminate the nuisance with the least amount of herbicide and before the native plants have been impacted by dense growths of nuisance plants.
- The growth cycle of the exotic species should be a factor in the consideration of chemical treatment project.
- Large scale, open water treatments may be considered to treat large areas of Eurasian watermilfoil, curly-leaf pondweed and starry stonewort.
- Proposed chemical treatments should be developed based on the current nuisance conditions.
- When conducted, curly-leaf pondweed and starry stonewort treatments should be planned to try to prevent the production of turions and bulbils, important methods of reproduction for the species. These treatments would allow native plants a better opportunity for growth in the area.
- Wind Lake should be regularly surveyed for new invasions of exotic species, including Hydrilla. If found, the plants, and a larger surrounding area should be aggressively treated to eliminate the plants. The lake should then be aggressively surveyed and treated for at least three years to ensure the nuisance has been eliminated.

HARVESTING

Harvesting of aquatic plants in lakes is governed by WDNR under Wisc. Admin Code NR109. Harvesting is another lake management tool that is frequently used to control aquatic plants. Plants are cut off about five feet below the surface and conveyed to shore where they are then trucked to a disposal site. Harvesting aquatic plants removes biomass from the lake as well as nutrients. In the past, the presumption was that eventually plant growth in a lake with harvesting would cease to be a problem when nutrients have been removed. However, a lack of plant growth after harvesting will not normally be seen because incoming nutrients from the watershed will usually offset any nutrients removed during harvesting (Engel, 1990). The remaining plant material, that material below the cutting depth, will continue its life cycle. The decomposing material will contribute to the sedimentation in the lake, however, wind and wave action will move the material into deposition zones: usually the deep hole.

Harvesting should only be done in waters deeper than three feet. Harvesting should not be done in shallower areas because it will increase damage to the equipment, will disrupt bottom sediments and plants, and will open up lake sediments to invasion by exotic plant species. Skimming may be done in shallower waters, taking care to minimize disruption of the lake bed.

Shoreline pickup programs can help control floating plant material (floaters) and plant debris, however, they are labor, and time intensive. Shoreline pickup programs are very difficult to eliminate once the residents are used to the service. Debris such as rocks, sticks, gravel, or other such material that may be in debris piles will damage the equipment. When plant debris is on shore, the equipment must go up to shore to retrieve it, disrupting the sediments and rooted plants in the process. Harvesters are very large pieces of equipment that are highly susceptible to wind and waves, and are difficult to maneuver. This increases the chances for damage to riparians' piers and boats.

Off-load sites are very important to the continued operation of a harvesting program. There are various options for removing harvested plants from the lake, including conveyors, clams, and trailers. Equipment must be able to pull in to shore with full loads. A lake as large as Wind Lake must have multiple off-load sites or the harvester will spend valuable, expensive time carrying full loads to shore. Multiple transport barges can be used when sites are limited, but that greatly increase equipment and staff costs.

Disposal sites are needed to put the harvested plants. Disposal sites cannot be in or near a flood plain, wetland or lake.

Harvesting of fish lanes can open up areas so game fish can feed upon panfish. It also helps increase the size of panfish that remain, and can increase the size of the predator fish (Nichols, 1988).

Harvesting can reduce the recreational boating's impact on aquatic plants by opening navigation lanes and lessening the amount of plants that are cut off by boating activities.

Recreational use in dense Eurasian watermilfoil or starry stonewort beds, winds, and waves can create large amounts of fragments that can increase the spread of the species. Collection of the floaters as part of a harvesting program can help minimize the spread of the nuisance. Plant fragments that are not removed from a lake can settle into new areas, regrow, and spread the problem. This creates a greater problem on lakes which do not conduct chemical shoreline treatments for Eurasian watermilfoil.

Harvesting can also cause problems if it is not done properly. Machines that are not properly maintained can discharge gas, oils and grease into lakes. Cutting too close to shore or into the bottom sediments can disrupt fish spawning and nursery areas. The sediments are also very damaging to the harvesting equipment and will increase maintenance costs significantly. Attempting to operate the equipment in shallow water (less than three feet deep) will disrupt the sediments and aquatic plants.

Harvesting is non-selective, that is, it harvests all plants in its path. Areas with native plants should be avoided whenever possible. In an area with a mix of plant species, including Eurasian watermilfoil,

harvesting favors the species that grow quickly. Because this is usually Eurasian watermilfoil, it leads to re-harvesting areas often over the summer season. Harvesting also removes fish, turtles and invertebrates.

In a mixed plant bed with both Eurasian watermilfoil and natives, cutting above the native plants will open up more sunlight to the understory, will encourage the native plant growth, and will remove any flowering portions of the Eurasian watermilfoil.

Harvesting is not effective in trying to manage Starry stonewort because it grows so quickly. The amount of biomass can quickly fill a harvester or transporter. Transporting the Starry stonewort to the off-load site will spread it into new areas of the lake. Harvesting Starry stonewort may be used to increase the effectiveness of herbicide treatments by reducing the amount of biomass to be treated.

Because of the increasing concern of the role seeds play in the spread of Eurasian watermilfoil, areas dominated by Eurasian watermilfoil should be harvested early enough to prevent seed development.

Harvesting is a very costly management alternative. To begin a harvesting program, a number of pieces of equipment are needed including the harvester, a trailer, a truck to haul cut plants, and a conveyor, claw or trailer to move plants from the harvester to the truck. A location to dump cut vegetation is needed in close proximity to the lake. Another major component is staffing the program. Although some groups successfully use volunteers to operate and maintain the equipment, most often that does not work well over time. A secure storage site is also needed for the equipment. Most lake districts with experience in harvesting have found it needs to be indoor storage to ensure the equipment lasts. Wisconsin winters are extremely damaging to the working components of the equipment.

A number of lake districts report that even paid staff are difficult to find and keep. Daily and seasonal maintenance, as well as repairs, require at least one staff experienced in large equipment. Purchase of the harvester alone can exceed $250,000 in capital costs. State grants for the acquisition of the harvester, conveyor and trailer are eligible for lakes which harvest a minimum of 30 acres, and have adequate public access. As of this plan development, grants for harvesters on inland lakes only provide funds for between 25-35% of the cost.

Contract Harvesters - If a lake uses a contract harvester, the contractor must ensure that the equipment is sanitized prior to launching and upon removal from a lake. The WDNR protocol for vehicles that are transported between lakes should be followed. Contract harvesting has been used on Wind Lake. Improved access to the lake in proximity of the areas to be harvested is needed. Only two sites are available on Wind Lake for large harvesters: the WDNR boat launch on S Wind Lake Rd, and the private resort on W. Loomis Rd. Two additional sites are available for smaller harvesters: one on Breezy Point Rd, and on West Wind Lake Rd. The District has investigated and determined that at this time, no other access is possible because of the developed shorelines and the shallow depths along shore.

Conclusion— Harvesting is a viable tool for managing aquatic plants in Wind Lake. Harvesting may be needed to maintain recreational access and to allow predator fish to graze on panfish. The District may purchase equipment, however, landowners should be fully informed about the total short and long term impacts and costs of acquisition. Disposal must be done in an upland area, away from flood plains, wetlands and lakes. Landowners should be encouraged to remove floaters from their shorelines. Material can be mulched or used in plant beds. The District should pursue a long term agreement to ensure use of the private access on W. Loomis Rd. for harvesting access. Harvesting will be an ongoing, repetitive management activity. It will not result in change to the actual plant community unless conducted improperly, but can remove plant material from the area needed by boats for recreation access.

CONTRACT HARVESTING VS EQUIPMENT ACQUISITION

As weed problems have increased, there have been more calls for the District to purchase its own equipment, rather than using contracted harvesters. Table 6 below shows a comparison between a contractor and a district-run program.

Table 6. Contractor VS District-Run Harvesting Program

	Contracted Harvester	**District-Run Program**
Equipment	Contractor owns equipment	District must purchase equipment
Storage	No storage costs	Need to locate, purchase and maintain storage facility
Insurance	Contractor insures self and District	District insures equipment, staff, and liability
Staff and Maintenance	Contractor hires staff	District needs to hire and train staff to operate and maintain equipment
Program Management	Contractor works under schedule determined with the District	District must maintain staff schedule, payroll, taxes, etc.
Invasive Species	Contractor must be thorough about cleaning equipment between lakes or the lake may be at risk from invasives brought in with the equipment.	Equipment stays on a single lake and so would not likely be a cause of invasive species transport.
Pros and Cons	The District may have less flexibility when using a Contractor. The District may have problems supervising Contractor and communicating the desired results. The Contractor has all the responsibility for equipment maintenance, staffing, and downtime. The Contractor is responsible to comply with the permit requirements.	The District may be able to harvest more surface area if staff are available to work. The District may encounter problems with inexperienced staff and other staffing related issues. The District may have problems supervising staff and enforcing permit requirements. The District may receive more pressure from residents to "cut-no-matter-what" even when a nuisance does not exist.

A primary consideration before purchasing equipment and beginning a District-run program is cost. Table 7 shows a sample harvesting budget for a new program that purchases a single harvester, transporter and truck. Adding additional equipment will raise the costs.

Table 7. New Harvesting Program Budget*

	Category	Amount	Notes
Expense	Harvesting Equipment (1 harvester, transport and off-load equipment)	$322,760	Are usually paid over 10 years. Extending the loan to 20 years lowers annual payments, but increases total costs, and increases the risk the loan will outlast the equipment.
	Truck	$50,000+	Are usually paid over 10 years.
	Debt payments-Harvesting Equipment	$40,000	Each for 10 years
	Debt payments- truck	$5,000	Each for 10 years
	Staff wages	$75,000	Operators, a manager, for 5,000 hours, averaging $15/hr
	Taxes, insurance, withholding	$26,000	
	Legal, office, contingency	$5,017	
	Fuel, oil, grease	$5,000	
	Equipment expenses	$14,000	
	Disposal Site	??	
	Equipment Storage	??	
Total Expenses		$497,777	
Income To Support Budget	Harvesting Charge for Lakefront Owners	$447	When added to annual charge, total is $668
	Harvesting Charge for Canal Owners	$175	When added to Annual Charge, total is $305.
	Harvesting Charge for Off-lake Owners	0	When added to Annual Charge, total is $90
Total Income		$161,217	

* The amounts shown do not include any of the annual costs of the District beyond the harvesting program, such as water quality monitoring, chemical treatment of shoreline areas, road-side weed pickup, etc. Those costs are supported by the existing Annual Charges.

LOCAL ORDINANCES AND USE RESTRICTIONS

Lake use ordinances have long been used to control activities on lakes. Local communities may adopt ordinances to protect public health, safety and welfare. Any proposed ordinances are sent to the WDNR for review to be sure they comply with State Statutes. Ordinances must address issues that threaten public health, safety and welfare. Once approved by WDNR, communities may then finalize and enforce the ordinances.

Historically, public health, safety and welfare was interpreted to mean peoples' physical issues associated with using the lake. Speeding and reckless use endanger lives and are usually controlled through local ordinances.

Recently there has been a growing realization that the lake's health has a bearing on public welfare. Lake use activities conducted in inappropriate areas of lakes can be very damaging to the lake ecosystem. Spawning habitat can be destroyed. Wildlife can be chased away. Aquatic plant communities can be disrupted, shifting the communities to plants less beneficial than the original.

With the state's acceptance of the environmental health premise, communities are looking at lake use zoning. Some have shoreline zones that are no slow wake. Others have restricted some or all of the lake to

no-motors. Protection of specific species or valuable areas can be achieved by developing an ordinance to minimize intrusions.

Costs associated with ordinance development depends upon the problem, potential solutions, municipal cooperation, and municipal legal reviews. Grants are available through the WDNR to assist with the cost of developing ordinances.

It is important to keep in mind the following in the development of ordinances:

- Any proposed lake use ordinance must have prior review by the WDNR.
- An ordinance must not discriminate on a particular craft, ie if motors damage an area, all motors should be restricted, not just ski boats.
- An ordinance must be clearly understood and posted. Buoys (which must also be approved by the WDNR) should warn boaters of areas to avoid.
- Any ordinance should address a particular problem. If boating damages a sensitive area of the lake, allowing boats in the area on alternating days does not achieve the protection sought.
- An ordinance must be reasonable and realistic. An ordinance that creates a slow no wake zone that affects all of the lake area less than three feet deep may not be enforceable. The general public could not know the extent of that area. A more reasonable approach would be to review the desired area and develop a plan based on a specific distance from shore. Buoys could then be used to identify that area.
- Any proposed ordinance should be studied to ensure that it does not aggravate a different problem. For example, many communities, including the Town of Norway, have shoreline slow no wake zones that exceed that of state law. On a small lake, enlarging that shoreline zone may provide more resource protection. It may also further concentrate other lake use activities such as skiing into an area that is too small to be safe.
- Any attempts to restrict lake use should be weighed along with the social and economic impacts. It is well documented that those most involved with lakes and lake protection are those same people who spend the most time on or around lakes. They either live on or have easy access to a lake. It is very difficult to convince outsiders that lake quality is a concern or that funds should be spent because they do not have a personal involvement. They have other priorities. Reducing public use of a lake will have a direct affect on their involvement and possibly their social and economic concern about a lake.
- Lake ordinances should be developed to protect health or safety, not to restrict a specific user group.
- Ordinances should reference, not duplicate state laws.

Conclusion—Lake use ordinances may be considered for Wind Lake, however, they should be carefully developed and studied to ensure that they address the problems without undue restrictions and that they will actually be enforced.

CHAPTER VI - PLANT MANAGEMENT PLAN

GOALS AND OBJECTIVES

The goals and objectives on Wind Lake continue to focus on balancing the various uses and needs. The difficult task facing those who attempt to manage their lake is that user needs often conflict. Fish and wildlife need aquatic plants to thrive. Boaters and swimmers desire relief from nuisance aquatic plants. Those depending on the lake for “aesthetic viewing” desire an undisturbed lake surface.

The non-native plants in the lake, Eurasian watermilfoil (*Myriophyllum spicatum*) curly-leaf pondweed (*P. crispus*), and now Starry stonewort (*Nitellopsis obtusa* L.), are of great concern to the District. The annual variability of the nuisance conditions and the unknown impact of Starry stonework makes the management of the conditions difficult.

The goals of the District, board statements of long range desires, are outlined below. The goals are followed by objectives to be used to accomplish each of the goals.

The District desires to:

- Minimize fragments of aquatic plants that are caused by the high volume of boating traffic and natural processes.
- Control exotic and nuisance plant species and maintain recreation access for lake users by:
    - ◊ Using selective chemical treatments
    - ◊ Harvesting
    - ◊ Encouraging landowners to protect native species.
- Preserve and enhance the natural lake environment by:
    - ◊ Educating landowners and lake users in lake ecology.
    - ◊ Working with the Town, County and State governments to review existing ordinances, and if necessary, develop and enforce ordinances to protect Wind Lake.
    - ◊ Continuing to improve the watershed to protect Wind Lake.
- Identify and expand local educational efforts that the District may undertake to improve the public’s understanding of lake issues by:
    - ◊ Distributing at least 2 newsletters per year.
    - ◊ Encouraging community participation in lake management activities.
- Conduct in-lake management activities with the long-range goal of minimizing the management as much as possible by:
    - ◊ Conducting evaluations as to the success of plant management activities and the community reaction to the activities.
    - ◊ Tracking the annual progress of lake management activities.
    - ◊ Conducting water quality monitoring efforts to assist in the documentation of results.
    - ◊ Developing and implementing a plan for quick response to invasive species.

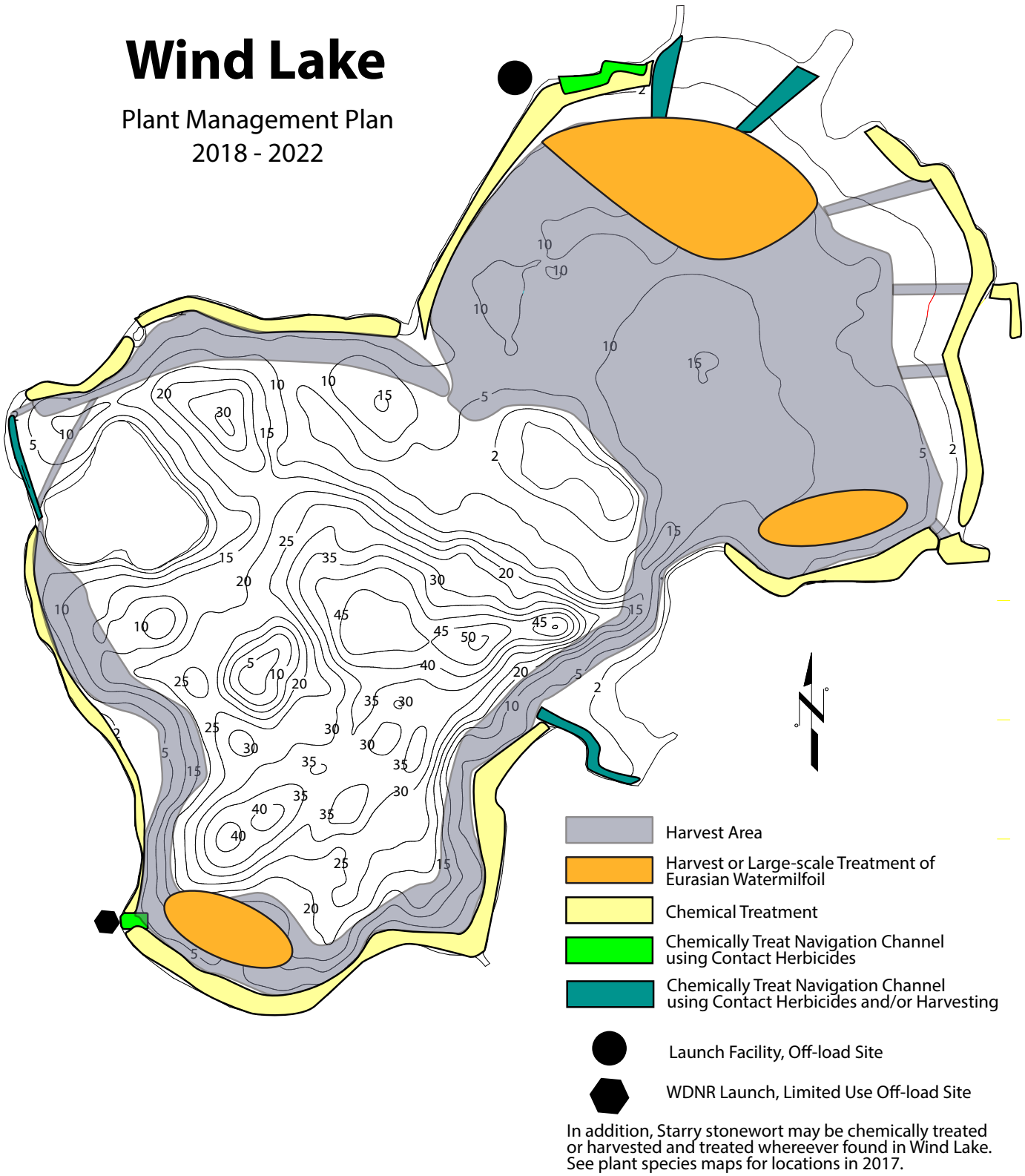


Figure 4 2018 - 2022 Plant Management Plan for Wind Lake, Racine County, Wisconsin

RECOMMENDATIONS

WATER QUALITY MONITORING

The District should continue to conduct water quality monitoring on Wind Lake. The stage recorder and rain gauge on the Wind Lake dam should be continued. Monitoring should continue to include nutrients as well as clarity.

HAND CONTROLS

Riparians should be encouraged to use the least intensive method to remove nuisance vegetation. This could include minimal raking and pulling. NR109 allows landowners to remove plants from an area up to 30 feet wide without a permit. The 30-foot area includes the swimming and pier areas. Landowners may manually remove Eurasian watermilfoil and curly-leaf pondweed from the remainder of their shorelines without a permit, without the use of auxiliary power. Removal of native plants beyond that allowed in the 30-foot area, will require a WDNR permit. If screens are considered by individuals, a WDNR permit will be required.

Riparians should be encouraged to allow native plants to remain. This will help prevent infestation of the areas by Eurasian watermilfoil, curly-leaf pondweed and starry stonewort. The native plants will also help stabilize the sediments.

The District should inform landowners about the importance of keeping their shorelines free of floating plant debris. Wave action can carry plant fragments into new areas, possibly aggravating nuisance conditions. Plant debris can be used in mulch piles or gardens.

The District should inform landowners about the importance of keeping their shorelines free of floating plant debris. Wave action can carry plant fragments into new areas, possibly spreading nuisance conditions. Plant debris can be used in mulch piles or gardens, or picked up in a roadside weed pickup program.

EDUCATION AND INFORMATION

The District should take steps to educate property owners regarding their activities and how they may affect the plant community in Wind Lake. Informational material should be distributed regularly to residents, landowners, and lake users and local government officials. A newsletter to landowners and residents should be part of the annual plant management budget. Topics should include information relating to lake use impacts, importance and value of aquatic plants, land use impacts, etc. Information on shoreline restoration and plantings can be provided. Publications are available that list sources of plants and methods of creating buffers. Other issues that should be addressed may include landscape practices, fertilizer use, and erosion control. Existing materials are available through the WDNR and the UWEX. Other materials should be developed as needed. The Town provides an informational materials rack in the Town Hall and should continue to stock various lake handouts.

District board members have participated in training for the Clean Boats Clean Waters programs sponsored by the WDNR.

The District should also enlist the participation of the local schools. The schools could use Wind Lake as the base for their environmental education programs. Some schools have a mandatory community service requirement that may be tapped to assist with lake management activities. Regular communication with residents will improve their understanding of the lake ecosystem and should lead to long term protection.

The District should inform residents about the lake management activities that are undertaken and the reasons behind the activities.

WATERSHED CONTROLS

The District should continue to work to improve the quality of water runoff into Wind Lake. The watershed should be toured regularly for identification of new problems.

The District should work with the Town and County officials to encourage rigid enforcement of erosion control in the watershed and consideration of lake-friendly methods of development and road construction.

The District should develop response plans for activities upstream that impact Wind Lake:

- A plan should be developed to ensure that upstream activities include the containment of nutrient and sediment to protect Wind Lake. This should include lake restoration activities on Big Muskego Lake that could impact Wind Lake by discharging sediments downstream.
- A plan and budget should be established to be able to react to unusual events such as cattail bogs coming downstream during high waters. The City of Muskego has cooperated by attempting to prevent the discharge of bogs from Big Muskego Lake by removing them upstream of the Big Muskego Dam.

LAND USE PLANNING

Development proposals should be analyzed with the lake in mind and revised if necessary to protect the lake from damaging runoff. Long range planning should ensure that future development includes lake protection.

STORM WATER PLANNING

The District should review any new development proposals in the watershed to ensure that the lake will not be damaged by changes in flows or quality of stormwater. The Town of Norway has applied for, and received grants to assist with their land use and storm water plans. The District may work with the Town and County to develop, refine, and implement storm water ordinances. The District should work with the Town to educate residents on the importance of the use of phosphorus-free fertilizer and the state and local ordinances that requires its use.

CHEMICAL TREATMENT

- Contact herbicides may be used in limited areas to reduce nuisance levels of native plants, including shallow navigational lanes.
- Eurasian watermilfoil and curly-leaf pondweed targeted treatments:
    - ◊ May be treated with the appropriate herbicides. It should be remembered that destruction of any native plant species populations will increase potential problems from Eurasian watermilfoil.
    - ◊ Treatments should be planned to treat early enough in the season or late enough in the fall to to achieve the goals with the least amount of herbicide and resulting in the least impact to native plants.
    - ◊ Proposed chemical treatments should be developed based on the current nuisance conditions.
    - ◊ Curly-leaf pondweed treatments should be planned to try to prevent the production of turions, an important method of reproduction for the plant. These treatments would allow native plants a better opportunity for growth in the area and will reduce the nutrient release that occurs when curly-leaf pondweed dies in mid-summer.

- Starry stonewort targeted treatments:
    - ◊ May be treated with the appropriate herbicides. Treatments should attempt to minimize damage to native species, evaluating whether that risk is less than the risk of not conducting the treatment and allowing starry stonewort to damage the natives.
    - ◊ The district should evaluate newly developed treatment protocols for starry stonewort control when planning a treatment. The information should be used to determine timing, herbicide use and areal control.
    - ◊ Treatments should be planned to minimize bulbil development. However, this should be done with the general understanding that Starry stonewort bulbil development occurs after mid-August. This recommendation is not to suggest that funds should be spent on bulbil data collection.
    - ◊ Treatments should be planned early in the growth cycle of Starry stonewort. Do not wait until it has grown to large mounds. Treating early will increase the effectiveness and therefore the costs of the treatment.
- Wind Lake should continue to be regularly surveyed for new invasions of exotic species, including Hydrilla. If found, the plants, and a larger surrounding area should be aggressively treated to eliminate the plants. The lake should then be aggressively surveyed for at least three years to ensure the nuisance has been eliminated. The District should follow recommendations in **New Infestations of Exotic Species** section below.
- WDNR Administrative Rule NR 107 should be consulted for the specific requirements for conducting a treatment. The following are some of the steps that should be followed by anyone preparing to conduct chemical treatments.
    - ◊ Complete and submit the WDNR permit application forms. Include treatment map, area sizes and names and addresses of all affected riparian landowners.
    - ◊ Contact a licensed firm to conduct the proposed treatment.
    - ◊ When treatment areas will be greater than 10 acres, a public notice must be placed in the local paper informing the public about the proposed treatment. This will also inform non-riparians who may be using the lake.
    - ◊ Provide a copy of the WDNR application to any riparian landowner who is adjacent to the proposed treatment areas. This may be done by direct mail, newsletter, box drops or posting on the WLMD website.
    - ◊ At the time of treatment, WDNR-approved yellow posting signs must be posted in and adjacent to treatment areas, at least every 300 feet. The signs must indicate what chemical has been used, and any use restrictions and must remain posted for at least the time of any restrictions.
    - ◊ Current administrative codes should be reviewed annually to ensure compliance.

HARVESTING

- The District may continue to use harvesting to provide relief from nuisance conditions.
- Harvesting should not be done in areas that are treated with herbicides.
- Any harvesting done should be carefully planned to avoid native plants as much as possible.
- Harvesting may be done in the channels to provide navigational access.
- No harvesting should be done in shallow waters less than three feet deep.

- Native plants may be harvested if necessary to open access lanes and to minimize disruption and cutting by boaters.
- The District may continue roadside pickup of plant debris.
- Educational efforts should be developed to inform the public about the benefits of a comprehensive plant management program, that gives equal consideration to fish and wildlife, while reducing recreational nuisances and unsafe situations.

WDNR Administrative Rule NR 109 should be consulted for the specific requirements for conducting harvesting. The following are some of the steps that should be followed by the District when preparing to harvest.

- Complete WDNR permit application forms. Include map, area sizes and name and addresses of all affected riparian landowners.
- Current administrative codes should be reviewed annually to ensure compliance.
- Records should be kept documenting loads and other pertinent information. The District should stress to the operators the importance of keeping accurate records.
- The District should provide operators with a copy of the harvesting permit and be sure it is read and understood, to ensure compliance with its provisions. The permit must be on board the harvester when working on the lake.
- Harvesting operators should be trained to identify target plant species.
- Operators should not cut plants in less than three feet of water.
- The District may continue its current harvesting schedule.
- Any turtles or game fish that may be harvested with the plants should be returned to the lake.
- Avoid harvesting in areas with spawning fish.
- Disposal of cut plants may continue to be disposed of locally, but must be on uplands and not in or adjacent to wetlands or floodplains..
- The District should summarize its harvesting records into an annual report to provide to WDNR by November 1 of each year.
- The District should conduct PI aquatic plants surveys and review the plant management plan and operations every three to five years.
- The District should distribute informational materials to its members that include such topics as proper lawn and garden practices, land use impacts and the importance and value of aquatic plants.

General Harvesting Recommendations

The District staff should continue to harvest areas of the lake on an as needed basis, prioritizing the areas as follows:

—Harvest main navigational channels through Eurasian watermilfoil/curly-leaf beds in open water areas.

—Harvest secondary navigation channels in open water areas.

—Skim surface plant debris, including wild celery.

Emphasis of the program should be to harvest plants necessary to facilitate recreational use and remove unsafe conditions, rather than simply 100% removal of plants. Focus on providing access rather than clear cutting (removal of most or all plants in an area).

Harvesting staff needs to make sure that cutter bars are kept out of the sediments and to cut at least one foot above the native plant beds, being especially careful where Chara tends to dominate the plant community. Nuisance aquatic plants, especially Eurasian watermilfoil, will likely expand their range if this recommendation is not followed.

Public acceptance and continual support are critical components to a successful program. Continue to harvest outside the piers to allow for satisfactory recreational use and public satisfaction. If chemical treatment is not used in specific areas, harvesting may be used to relieve the nuisances up to the pier zone area as long as access is not restricted by depth.

Staff should concentrate harvesting efforts on the Eurasian watermilfoil areas (especially to help reduce the amount of floaters that may be caused by boaters). Eurasian watermilfoil should be harvested before a canopy begins to form. No harvesting of areas that have only desirable native plant species.

Off-load areas should be kept free of plant debris. Any debris in the lake should be removed each time the harvester unloads.

Comprehensive and detailed records should be kept documenting:

◊ Date

◊ Hours worked - including harvest and down time

◊ Loads harvested - including plant types and densities

◊ Areas harvested - located on a map

◊ Weather conditions

◊ Other relevant information

Schedule For Harvesting

The District should establish a schedule based on the nuisance conditions, budget and the availability of the contractor. A review of past harvesting records in conjunction with a pre-harvest survey should be conducted each spring to determine which areas need attention and which areas are undergoing a change from the previous year. If plants become a nuisance in mid-May, begin harvesting but note previous recommendations, especially with regard to fish spawning areas.

Harvested Fish & Wildlife

Care should be given to returning any captured game fish and turtles to the lake. If game fish are caught in quantities of more than a few per area, the harvesting crew should take the following actions:

- Reduce the operating speed of the harvester to give fish a chance to flee.
- If that does not help, then reduce cutting depth and see if problem is resolved.
- If fish are still being harvested, move to another area to work and consult with WDNR or private consultant for further recommendations.

Roadside Weed Pickup

For the past seven years, the District has conducted a road-side weed pickup program. This program allows residents to place the weeds removed from their shorelines on the roadside. The District contracts to have the material removed and taken to the disposal site. This program has been very well received by residents who no longer have to find a way to take the material to the dump.

Off-Loading and Disposal Sites

Current disposal practices should continue. The District has entered into a contract with the Town of Norway to ensure that the disposal site remains available long term. Care should be taken to keep lake areas adjacent to off-load sites clean of cut vegetation. Staff should be instructed to remove any vegetation debris immediately upon off-loading the harvester.

Insurance

The District carries insurance, however, contractors are also required to carry insurance with the District named as additional insured.

Other Activities

Other administrative records should continue to be maintained as currently done.

- The District should ensure that any contractors are complying with the WDNR permits, and all laws associated with exotic species control.
- The District should file its annual report with WDNR in compliance with permit requirements.

BOAT LAUNCH ACTIVITIES

The District should enlist property owners, volunteers, students or hired help to remove debris regularly in the near-shore and shoreline areas, especially at the boat launches. This will minimize the amount of plant fragments that are moved by trailers and will increase the chances of noticing new invasions of exotic species.

The District should continue to pursue efforts to minimize/prevent introductions of exotic species. This can include signage at boat launches and public recreational facilities. This might include developing volunteer or staffing for launch sites to educate boaters using the sites. The WDNR currently inspects contract harvesting equipment prior to their launching to work on Wind Lake. That should continue to minimize the possibility of transferring exotic species between lakes.

NEW INFESTATIONS OF EXOTIC SPECIES

New infestations should be aggressively managed to eradicate the species from the system. Depending on the species, different levels of response may be needed. A reaction to a Hydrilla invasion, should warrant a “top level” response of closing access sites, treating the invasion and surrounding areas, and surveying the lake.

Steps should be taken to work with the Town, WDNR and Legislators to facilitate rapid response:

- The Town should be approached to develop a local ordinance that would allow the closure of all access ramps should an infestation be found.
- The Legislature should be approached to develop state laws to allow local rapid response to take place, including closing access sites.

- The WDNR should be approached to develop an emergency access plan should an infestation be found.
- Materials should be developed and produced to use in the event of an invasion. These would include press releases, public informational materials about the cause and effect of the invasion, and access site notices.
- If a new exotic species is found, the following steps should be taken immediately:
    - ◊ Take a digital photo of the plant in the setting where it was found and mark with a GPS. Then collect 5 – 10 intact specimens. Try to get the root system, all leaves as well as seed heads and flowers where present. Place in a Ziploc bag with no water. Place on ice.
    - ◊ Fill out form http://dnr.wi.gov/lakes/forms/3200-125-plantincident.pdf
    - ◊ Contact the DNR Aquatic Invasive Species Contact (currently Heidi Bunk, WDNR Lakes Biologist) and deliver the specimens, report, digital photo, and coordinates. Do this as soon as possible, but no later than four days after the plant is discovered. A board member and lake consultant should also be notified.
    - ◊ Upon determination of species, a coordinated response plan should be developed in consultation with the WDNR, the County, and lake consultants as needed.
    - ◊ WDNR should be contacted and requested to close the access site immediately if warranted by the species (such as Hydrilla).
    - ◊ The Town should be contacted to close all access sites.
    - ◊ The District's chemical treatment contractor should be contacted to schedule an immediate treatment of the area where the exotic was found. States with experience in reacting to new invasions recommend treating a five acre area surrounding the site.
    - ◊ A full, point-intercept survey of the lake should be conducted to determine the extent of the invasion.
    - ◊ The site should be inspected throughout the season to ensure efficacy of the treatment.
    - ◊ The survey and treatments should continue for at least three consecutive seasons to ensure eradication.
    - ◊ Surrounding lakes should be notified of the infestation and advised to begin surveying.

CONTINGENCY PLANS

The District should be prepared for changing aquatic plant conditions that may fall outside the specific recommendations in this Plant Management Plan. While the final determination will be permitted by WDNR, developing local consensus on possible solutions is often needed. In evaluating whether to treat or harvest a “new” nuisance condition, the following should be considered:

- ***Are the plants native or exotic species?***

  If unsure, consult WDNR or an aquatic plant specialist to determine the species.

- ***Is the area in shallow or deep water?***

  This quickly limits some of the options. Harvesting, for instance, cannot be used in water less than 3 feet deep. Different chemicals may be needed for deep water treatments.

- ***Is the condition impeding or preventing recreational use, or is something else a factor?***

  Access channels may be created either by harvesting or chemical treatment. However, if water depth prevents access during a drought, chemical treatment will not open up boating access. However, chemical treatment may eliminate a filamentous algae that is causing odor problems.

- ***Is the situation creating unsafe conditions?***

  Dense, stringy weeds in a beach area, for instance, could create dangerous conditions for young swimmers.

- ***Will the considered option improve the situation long term, short term, or both?***

  The short term solution may eliminate the problem this summer, but make it worse in future years, while the long term solution may be the best over the long haul.

- ***Is the considered option detrimental to fish, wildlife, or humans?***

  If it is, maybe there are other options to solve the problem that would be safer.

- ***Will the considered option increase invasion by other nuisance species?***

  Consider whether the option will create “bare” lakebed that will quickly be invaded by weedy species, or whether the option will protect desirable vegetation while removing the nuisance.

CHAPTER VII - AIS GRANT

The Wind Lake Management District has invested countless hours, funds, and resources to the improvement of Wind Lake. This Chapter will summarize the discussion points that are provided elsewhere in this Aquatic Plant Management Plan that are part of the requirements of NR 198 of the Wisconsin Administrative Code for Established Population Control Projects.

NR198 AIS ESTABLISHED POPULATION CONTROL PROJECT REQUIREMENTS

Eligible Activities

This project will consist of Department-approved control activities recommended in a control plan, this Aquatic Plant Management Plan.

Plan Approval

This Plan has been submitted to WDNR SE District regional staff prior to December 1, 2017.

Plan Includes (NR 198.43):

(a) An identification of the problems or threat to the aquatic ecosystem presented by the aquatic invasive species including recreational uses and other beneficial functions up to the time of application, and how these uses and functions may have changed because of the presence of aquatic invasive species.

Wind Lake is an important regional ecosystem. The proximity to a large urban area makes Wind Lake a favorite destination of many in SE Wisconsin. Wind Lake, WDNR and local citizens have invested hundreds of thousands of dollars in management efforts over the years. Activities have included the development of the Wind Lake Management Plan (SEWRPC, 1991), the Lake Management Plan Reassessment (SEWRPC, 2008), and the implementation of numerous projects identified within each of those plans.

The AIS grant project will attempt to control/reduce Starry stonewort, thereby protecting native plants and habitat for the fisheries. In addition, lake users will have a more pleasant experience on Wind Lake, with the ability to use the lake without the dangers that dense exotic plants present.

(b) A description of the historical control actions taken or those that are in progress.

Wind Lake has had Eurasian watermilfoil and curly-leaf pondweed. These two species have been heavily managed over the years. A combination of harvesting channels through the dense vegetation, and chemically treating them to provide opportunities for native plants, have been used for years. Two alum treatments were conducted on Wind Lake over a 15 year period that reduced the algae blooms, including blue-green blooms, and provided clear water conditions that led to much more frequent and diverse, native aquatic plants. For the past three years, large dense beds of Eurasian watermilfoil that grew in large bands around the South and Northwest ends of Wind Lake, no longer exist. Instead, wild celery, chara, and a variety of pondweeds have taken over those areas.

The new invasive was found August 16, 2017 during a PI survey conducted as part of NR109 harvesting program. As soon as starry stonewort was found, WDNR was contacted and provided a sample for identification purposes. The PI survey was completed as soon as possible so as to identify the full extent of the problem as quickly as possible.

Data were entered into the WDNR-provided spreadsheet and proofed. Maps showing the aerial extent of starry stonewort were created, as well as for all other primary plant and algae species. Final data confirmed that in addition to the approximately 50 acre block of starry stonewort, an additional five PI locations had starry stonewort. WLMD consulted with a number of experts on possible treatment protocols including WDNR, Lake & Ponds Solutions, Lonza Corp., and Marine Biochemists, among others.

On August 24, 2017, WLMD provided the final map showing the infestation and requested to treat the starry stonewort. On August 27, 2017, WDNR approved the treatment of the five satellite PI points that had starry stonewort. The treatment was conducted on August 30, 2017. The large area treatment request was denied pending an upcoming starry stonewort conference on September 7, 2017 and then to wait for a WDNR internal phone conference scheduled for September 21, 2017. Those delays meant that conducting a treatment would not achieve the positive results and so we had to postpone the treatment until spring 2018.

The WLMD and its contractors responded with record turn-around of the work required and did everything within its powers to conduct a rapid response treatment. WDNR's bureaucratic procedures however, prevented a rapid response on the 50 acre starry stonewort population.

(c) A thorough characterization of the waterbody's aquatic ecosystem's historical and current condition, including at least one year of current base line survey data quantifying the extent of the population.

When the District was created in 1985, Wind Lake had poor water quality, dense nuisance aquatic vegetation, and impassable navigational channels. An aggressive, long-term program of monitoring, and then implementation led to the current conditions: mesotrophic water quality, very diverse aquatic plants, navigable channels and a healthy fish population. Refer to Chapter II, page 8, for more details. Wind Lake has now collected water quality data using the USGS program, annually since 1985, and plans to continue that monitoring indefinitely.

(d) An assessment of the sources of watershed pollution and a strategy for their prevention and control.

A comprehensive Lake Management Plan, created originally in 2001 and then updated in 2008 identified areas that presented a concern for Wind Lake. Most of that was from the watershed to the North. A Priority Watershed designation and implementation activities that included land acquisition and a restoration of the upstream lake, led to a much improved watershed. Local stormwater efforts are now being developed through a new planning effort by the Town of Norway. Local efforts to prevent erosion and other watershed problems are ongoing.

(e) An assessment of the fishery, wildlife and aquatic plant community.

The WLMD has been monitoring, and managing the aquatic plant population of Wind Lake for many years. The District has conducted plant surveys at least every five years.

When starry stonewort was found in the area, additional surveys were conducted on Wind Lake in 2015. Aron & Associates conducted detailed PI surveys every 70 feet in the vicinity of both boat launches on the lake and in the inlet area. In addition, general, or meander surveys were also conducted looking for SSW. None was found. Contractors were instructed to watch for any possible signs of SSW. WDNR conducted an AIS survey in August 2015. A meander survey, along with samples at specific, pre-determined points were conducted. No SSW was found.

One of the problems, identified in hind-sight, was that all the surveys in 2015 were done in the proximity to the launches and the shorelines. No additional survey work was done in the deep water zone of Wind Lake, which was found to have SSW less than 1 year later.

Historical management efforts have been designed to enhance the native plants, while controlling the nuisance species. Efforts to date have been very successful with native plants dominating the littoral zone and the nuisance species requiring far less management.

Wind Lake continues to be popular for waterfowl and hunters, and the fisheries is in good condition. Chapter II, page 8, includes additional information on the fisheries and wildlife and Chapter III, page 15, has the latest information on the aquatic plants as well as historical information.

(f) An identification of the need for the protection and enhancement of fish and wildlife habitat, endangered resources, and other local natural resource concerns.

Because of the high value aquatic plants, and the strong, healthy fisheries, protection of both is vital. Starry stonewort can singlehandedly ruin the diversity, density and frequency of the native aquatic plants. The lost of habitat because of starry stonewort will threaten the fisheries. The impact on wildlife, especially waterfowl is unknown, but as the waterfowl's plant sources, like sago pondweed and wild celery, are diminished by starry stonewort, there will be a negative impact. Protection of the diverse native plant community in the 0 to 4 foot zone in Wind Lake is very important. Wind Lake has an FQI of over 29, very good for SE Wisconsin.

(g) Identification of the management objectives needed to maintain or restore the beneficial resources of the aquatic ecosystem including shoreland and shallow area protection and restoration.

The protection of the shallow water aquatic plants is crucial to the health of Wind Lake. A large fetch and a very large shallow (<3 feet deep) zone produces damaging waves, that disturb and resuspend soft sediments when not stabilized with native plants. One of the reasons Wind Lake has such clear water now, is not just due to the Alum treatments that reduced nutrients. Its because almost all of the water that is less than three feet deep has dense native aquatic plants covering the area. In addition, the healthy fisheries in Wind Lake needs the near shore zones, critical for spawning, shelter and food. If this zone is damaged and destroyed by the spread of starry stonewort, clarity will suffer and the fisheries will decline. The project objectives are designed to minimize the introduction of SSW into the shallow zones.

(h) Identification of target levels of control needed to meet the objectives.

The objective of the Starry Stonewort AIS Project is to reduce or at the very least, maintain the existing frequency at which it is found in Wind Lake. This involves treatment of satellite PI points to prevent new large areas, and treatments in the 4 to 8 foot contours to keep starry stonewort out of the native plant beds.

A second objective is to keep the SSW out of the top 3 feet of the water column. This will prevent fragmentation and will diminish the spread of the invasion.

A third objective is to ensure that any management protocol is affordable over time. When grants and financial assistance are no longer available, the control of SSW must be affordable.

If, at the end of the 2-year treatment project, SSW has decreased in frequency or is found less frequently in the 0 to 4 foot depths than was found in 2017, the project will have been successful.

(i) Identification and discussion of the alternative management actions considered and proposed for aquatic invasive species control including expected results.

As starry stonewort has been found close to Wisconsin, WLMD has been following the activities to document its spread and methods used to attempt to control it. When found literally up the road, the District, along with other non-infected lakes in the area, held a Summit to bring together WDNR, UWEX, SEWRPC, and corporations who have had direct experience with starry stonewort. The summit was designed to improve procedures for those wanting to control SSW and to brainstorm ideas for possible consideration, both procedurally and in the treatments.

Many alternatives have been considered and are outlined in Chapter V, page 31. A number of alternatives were dismissed outright, including No Action, Dredging, Biomanipulation, Nutrient Inactivation, Drawdown, Weed Rollers, Screens, Aeration, and Hand Controls.

Harvesting is only a possible alternative if used in combination with chemical treatment. Harvesting SSW on its own cannot keep up with the growth rate of the species and will create more fragments, leading to spreading the invasion. That is contrary to the WLMD's goal of preventing the spread of SSW.

This AIS project approach poses the best alternative to achieve the goals identified in (h).

(j) An analysis of the need for and a list of the proposed actions that will be implemented to achieve the target level of control.

The need for the project has been identified through process of surveying, analyzing and studying the impacts of starry stonewort. This is an invasive species that must to be controlled in order to protect the quality of Wind Lake, and to minimize the likelyhood of spreading to other lakes. The proposed actions are outline in the **Ais Grant Project Description** section, page 59.

(k) A discussion of the potential adverse impacts the project may have on non-targeted species, drinking water or other beneficial waterbody uses.

Like any other project, this project may have adverse impacts on non-targeted species. Native aquatic plants may be reduced in treated areas, depending on the herbicide combinations used. However, the impacts from the herbicide treatments on native aquatic plants is expected to be less than the impacts of not treating the SSW. SSW will reduce and eventually eliminate the native plant community, so even a No Management alternative will damage the plant community. Drinking water will not be impacted because treatment areas are well away from any wells. Beneficial waterbody uses will be positively impacted by the SSW AIS Project, by protecting the native food sources of fish and wildlife, and minimizing the impact on recreational uses.

(L) A strategy for effectively monitoring and preventing the re-introduction of the aquatic invasive species after the initial control and to reasonably assure that new introductions of aquatic invasive species will not populate the waterbody.

WLMD will continue to monitor aquatic plants. Depending on the success of the SSW AIS Project, the level of monitoring will be at least partly dependent on budgets. At a minimum, the intensive PI survey, done at 150 foot intervals, will be conducted every 5 years. It is the hope of the District that other entities, such as WDNR, ACOE, a University system, or private corporation will use Wind Lake in their research and assist with monitoring.

The starry stonewort invasion into SE Wisconsin has made it quite apparent than AIS invasions cannot be stopped. Logistic, budgetary and other considerations make it impossible. The best hope is to educate the lake-using population and hope that they are inclined to do what is needed to prevent the transport of invasive species from lake to lake. The WLMD uses its newsletters and website to continue to encourage lake users to be vigilant in cleaning boat and equipment when moving from lake to lake.

(m) A contingency strategy for effectively responding to the re-introduction of the aquatic invasive species after the initial control.

Unfortunately there seems to be no evidence that a lake has successfully eliminated SSW once it was in a lake. However, the WLMD is prepared to continue the battle against SSW long after the SSW AIS Project is complete. The Project though, will provide additional information to use in identifying the most effective and cost effective control measures over the long-term. Continued assessment of the areal coverage of SSW in Wind Lake, and management to contain SSW using the most appropriate, current management actions available, will be conducted.

(n) Sufficient information for determining the feasibility of alternative control measures, including: costs; the relative permanence of the control; the potential for long-term control of the causes of infestation; and the baseline data required to measure subsequent change.

Because of the recent introduction of starry stonewort in Wisconsin, not enough is known about the species, the possible controls, and how it will respond in this region. We have only a couple of years of information so we don't know the long term results of conducting these types of projects. Based on the results in other states, we are pretty confident that once in a lake, it will not be eradicated. So the challenge becomes trying to keep it from taking over the entire lake and to keep it from spreading to other lakes. Maintaining clean boat launches and keeping starry stonewort out of the boat launch areas will help. Keeping the invasive out of the shallow zones and attempting to confine it to the deep water will help minimize the fragmentation and spread. Because the District has the PI data from August 2017, we have a foundation against which to compare newly acquired data. Conducting PI surveys, or as modified in this project, will provide the information to analyze changes.

AIS GRANT PROJECT DESCRIPTION

Project Timeline:

Pre-application work 2017 - Completed

2018 - 2020

Goals:

To prevent the spread of starry stonewort into the shallow water zones of Wind Lake and to prevent isolated, satellite populations to expand.

To analyze a couple of possible methods of control.

To have data to suggest options for long term management options that are financially affordable for Wind Lake and other affected lake groups into the future.

Permits:

This project will include the permits and necessary paperwork for each of the 2 years of treatments.

Aquatic Plant Surveys:

Point-intercept aquatic plant surveys will be conducted in mid- August in each of the two project years. The survey methodology will follow a modified version WDNR protocol and will include over 700 sample points, approximately 150 feet apart. Surveys should be completed early enough in the year to ensure that data will be available to show where treatments should be conducted before the end of August.

- Each point in the littoral zone will be sampled.
- If a sample point ***does not*** have SSW, it will be recorded as NP (Not Present). No other data will be collected.
- If a sample point ***does*** have SSW, the full WDNR protocol will be followed and all information will be recorded.
- Results will be tabulated in xls and included in the final report.

The modified PI survey will reduce the cost of the survey work, especially important for Districts facing costly management measures. The five-year full survey will still be conducted for purposes of the NR109 harvesting permits, but the modified survey will allow the documentation of the spread of SSW, while controlling consts.

It has been argued that without a full PI survey each time, we will not have an indication of unintended impacts on native plants from the herbicides. Wind Lake has conducted extensive herbicides over the years in an attempt to shift the plant community. Back in the mid 1980s, Wind Lake had a much different aquatic plant community. Wild celery, sago and chara were rarely found. In fact, a planting program took place in the late 1980s to introduce chara and wild celery on the NW shoreline of Wind Lake. There is limited data to document the changes as the District was spending its resources on the actual management rather than the studies. However, the author has 35 years of experience of working on Wind Lake and has personally witnessed the changes that have occured.

Herbicide treatments have not negatively impacted native plant communities. As they have been done over the years, the same native plant species come up the following seasons. The native plant community in the 0 to 4 foot depths of Wind Lake have been at their highest density and diversity since prior to 1985.

Satellite SSW PI Locations:

In spring of each project year, the prior year's satellite PI points that had SSW will be inspected. Multiple rakes casts will be used at each PI point. If SSW is present, that PI point will be chemically treated as part of the satellite portion of the SSW AIS Project.

Satellite SSW PI Treatments:

In spring of each Project year, after the PI locations have been inspected, herbicide treatments will be conducted using Cutrine Ultra (0.8 ppm) and Hydrothol 191 (0.17 ppm). This treatment will be used unless the treatment protocol is modified by mutual agreement of WDNR and WLMD. The area at least one acre in size (>200 ft x 200 ft) will be treated at each Satellite PI point. This will ensure that the treatment hits the intended target. Drop line application will be used.

Large-Scale Treatments:

Large-scale herbicide treatments will be conducted twice in each of the 2 years. Treatments will be conducted in early summer and late August. Treatments will target starry stonewort. Proposed for the first treatment is a combination of Cutrine Ultra (0.8 ppm) and Hydrothol 191 (0.17 ppm). Dropline application will be used. Discussions will continue with industry and governmental leaders in case a more effective herbicide combination is recommended. Otherwise, the Cutrine Ultra/Hydrothol 191 combination will be used. Discussions will continue throughout the SSW AIS Project to ensure the best possible herbicide combination is being used. However, very expensive herbicides, or herbicide combinations will not be considered.

Spring treatment area will be determined based on prior year's survey results.

August treatment area will be determined based on prior year and current year survey results.

Public Education:

A newsletter will be sent at least annually to property owners. The project and interim results will be discussed at the annual meetings. The Project will also be discussed at board meetings throughout the Project (at least 10 per year). Reports and other information will be available on the District's website.

Deliverables:

An annual report will provide the data collected in the plant survey, the public education activities, and a summary of the results.

An excel file will be provided annually with the plant survey data.

Public Input:

The Wind Lake community has been very concerned since the first report of SSW in Little Muskego Lake. The community has reaffirmed at each Annual Meeting (2015, 2016, and 2017) that it directs the Board to take "swift and immediate action if / when invasive species such as starry stonewort are found in Wind Lake". Lake users have contacted the District to check out "suspicious" plants and to find out what the District is doing to keep it out of Wind Lake.

The tone at the 2017 Annual Meeting was somber and unhappy to learn that SSW had been found in Wind Lake. District residents expressed their support for swift action and were pleased to hear that the Satellite treatment had already been conducted. They were not pleased to hear that the large-area treatment was delayed.

Clean Boats Clean Waters:

The District will attempt to implement the Clean Boats Clean Water program on the two launches on Wind Lake. Up to 200 hours for the public launch, and 100 hours for the private launch is the target participation if the District is able to find a contractor to conduct the program.

Additional Information:

The District has conducted large-scale treatments, plant surveys, sediment surveys, public education activities, shoreline restoration, wetland restoration, streambank stabilization, streambank buffers, aquatic plant introductions, aquatic plant harvesting, water quality monitoring, dredging, alum treatments and other projects to improve the quality of Wind Lake. Many of these have been done with grant support from WDNR, but quite a few other projects were funded by the local community.

It should also be noted that prior to the grant deadline of February 1, 2018, discussions with industry experts will continue as the results of 2017 research and treatment work becomes available for review for their applicability to the situation in Wind Lake. The proposal here for the specific herbicide mix is being proposed as the most financially possible mix found to date, that may produce the results needed. Should another option be available by spring, that can be considered.

AIS GRANT BUDGET

Starry Stonewort AIS Grant - Feb 1, 2018 through June 2020

Year of Activity	Task	Cost
2018	Chemical treatment permit	$1,270
2018	1st Chemical treatment-50 acres	$50,000
2018	2nd Chemical treatment-50 acres	$50,000
2018	Inspection of Isolated 2017 treatment areas	$1,000
2018	Followup spot treatments of isolated populations treated in 2017	$5,000
2018	Educational meeting/newsletter-spring 2019	$750
2018	Modified PI Survey-mid-late August	$2,500
2018	Generate new maps, plan for 2019	$2,750
2019	Chemical treatment permit	$1,270
2019	1st Chemical treatment-50 acres	$60,000
2019	2nd Chemical treatment-50 acres	$60,000
2019	Inspection of Isolated 2018 treatment areas	$1,000
2019	Followup spot treatments of isolated populations treated in 2018	$15,000
2018	Educational meeting/newsletter-spring 2020	$750
2019	Modified PI Survey-mid-late August (provides for additional costs if SSW is found in more sample points)	$4,000
2019-2020	Create AIS Project report	$5,000
2018-2019	Clean Boats Clean Waters (2 launch sites, 200 hours at public launch, 100 hours at private launch)	$7,500
	Project Total Cost	$266,520
	AIS grant	$199,890
	Local Share	$66,630

CHAPTER VIII - PLAN REASSESSMENT/PUBLIC INPUT

This plant management plan provides options for plant management from which the community may select to accomplish their goals.

Future evaluation of the effectiveness of this plant management plan and the subsequent implementation efforts undertaken by the District should be based on whether the lake is in "better condition" from an aquatic plant nuisance situation:

- **Have native aquatic plants increased in densities and diversity?** The aquatic plant community in Wind Lake is far different today than it was 5 years ago. Native plants have increased their coverage.
- **Have nuisance species decreased in densities and coverage?** Eurasian watermilfoil and curly-leaf pondweed have declined significantly, resulting in more native plants, and less cost for management of aquatic plants.
- **Has the water quality improved?** Water quality in Wind Lake has improved as a direct results of the activities undertaken over 35 years, and because of the locally-funded Alum treatments conducted to reduce algae problems.
- **Does the general public, and more specifically, do the District residents have a better understanding of the lake, its environment, and the impacts on the resource?** Residents in and around Wind Lake do seem to have a better understanding of the lake. Over 100 residents and property owners attend the annual meeting each year and provide quality input on the state of the lake. Questions from the audience always shows an good understanding of the intricacies of lake management.
- **Do the District residents support the plant management activities of the District?** The residents do support the activities. They approve the budget without any modifications to cut plant management. They have expressed concerns and shown concern and involvement in the introduction of invasive species.
- **Has the District been able to prevent exotic species invasions?** Apparently not.
- **Are there ongoing public education efforts such as newsletters, websites, public meetings, etc, and are they being used by the public.** Yes. The statistics show that the WLMD website gets regular use by the property owners and the general public, from all over the world.

The District should review or contract to review, the plant populations of Wind Lake every five years. The chemical treatments that are conducted should be reviewed to facilitate evaluation of the management activities. The management plan should also be reviewed every five years.

The District plan has been developed as a result of public and local input. Community meetings have been held in the Town of Norway to discuss plant and lake management and solicit input. A District website has been developed and successfully used for the past 15 years to provide educational resources to the public, and to facilitate correspondence with the public. The majority of the comments and input received is about the need for the management of the nuisance plants and the need to maintain recreational access to the open water areas of the lake.

CHAPTER IX - FEASIBILITY

The District is financially capable of managing the public resource and conducting aquatic plant management activities. The annual budget currently supports all the water quality monitoring, chemical treatments, contract harvesting, and other activities that the District undertakes in managing the lake.

The District may seek grants to assist with the aquatic plant management program, using their taxing authority to provide funds for the local share of any grants.

The District has significant experience with managing contract harvesters and applicators, and has been a leader in innovative lake management activities. Should the District decide to purchase equipment to run their own harvesting program, it is recommended that at least two public informational meetings be held to discuss the potential budget ramifications. Notices for the meetings should be mailed to landowners and residents that would be affected by the program. These steps will ensure adequate public discussion and input about the program.

CHAPTER X - SUMMARY

- The District should work with landowners' education to encourage protection of natural shorelines and emergent plant species such as sedges and rushes and floating leaf species like water lilies and floating-leaf pondweeds.
- The District should be sure that the Town and County provide landowners with information on erosion control.
- Every effort should be made to reduce the amount of floating plant debris, especially Eurasian watermilfoil fragments, in order to reduce opportunities for establishment in other areas.
- The District should distribute informational materials regularly to residents on such topics as proper lawn and garden practices, land use impacts and the importance and value of aquatic plants.
- Property owners should restrict the use of hand controls to control only Eurasian watermilfoil and curly-leaf pondweed and should minimize the size of any native plant areas that are cleared.
- Early season chemical treatments should be conducted targeting Eurasian watermilfoil and curly-leaf pondweed. Treatments should be conducted in spring when possible, as soon as plants are beginning to grow. This will minimize the amount of chemical needed while increasing the effectiveness. Additional Eurasian watermilfoil treatments may be conducted in early summer or fall. Treatments may include open water, large-scale treatments to control Eurasian watermilfoil and curly-leaf pondweed.
- Contact herbicides may be use to reduce native plant problems in limited shoreline areas and in navigational channels.
- The District should regularly inspect for signs of new exotic species invasions such as Hydrilla. If found, the District should aggressively treat the plants and surrounding areas to eliminate the nuisance and prevent the spread to other lakes. Surveys should be conducted for at least three years following treatment to be sure the plants do not return. Additional activities identified in this plan for rapid response should be implemented.

GLOSSARY

acid

Corrosive substances with a pH of less than 7.0.

acid rain

A polluting rain in which sulfur oxides from fossil fuels react with water vapor in the environment to form sulfuric acid.

adaptation

Any structure, the means an organism has to make them more likely to survive.

aerobic

Processes requiring oxygen.

algae

Microscopic organisms/aquatic plants that use sunlight as an energy source (e.g., diatoms, kelp, seaweed). One-celled (phytoplankton) or multi-cellular plants either suspended in water (Plankton) or attached to rocks and other substrates (periphyton). Their abundance, as measured by the amount of chlorophyll a (green pigment) in an open water sample, is commonly used to classify the trophic status of a lake. Algae are an essential part of the lake ecosystem and provides the food base for most lake organisms, including fish.

algal bloom

Population explosion of algae in surface waters. This may be caused by an increase in nutrients.

alkalinity

The ability of water, or other substances, to absorb high concentrations of hydrogen ions. Substances with a pH greater than 7.0 are considered alkaline. Low alkalinity is the main indicator of susceptibility to acid rain.

ammonia

A form of nitrogen found in organic materials and many fertilizers.

anaerobic

Living or occurring without air or free oxygen.

annual

A plant that completes its life cycle in one year or one season.

annual turnover

This is when the lake mixes entirely from top to bottom.

aquatic

Organisms that live in or frequent water.

aquatic invertebrates

Aquatic animals without an internal skeletal structure such as insects, mollusks, and crayfish.

aquatic plants

Plants that grow and live in water. They may be floating, submerged or emergent.

asexual

Reproducing by fragmentation, turions, tubers, and/or other vegetative structures.

benthic zone

The bottom zone of a lake.

benthos

Organisms living on, or in, the bottom material of lakes and streams.

biomass

The total quantity of plants and animals in a lake. It indicates the degree of a lakes system's eutrophication or productivity.

blue-green algae

Algae that are associated with problem blooms in lakes. Some produce chemicals toxic to other organisms.

bog

An area characterized by soft, water-logged soil with mosses and other vegetation as the dominant plants.

calcium (Ca++)

The most abundant cation found in Wisconsin lakes. Its abundance is related to the pres-ence of calcium-bearing minerals in the lake watershed. Reported as milligrams per liter (mg/l) as calcium carbonate (CaCO3), or milligrams per liter as calcium ion (Ca++).

cation

This refers to chemical ions that carry a positive charge. Some cations present in lakes are calcium (Ca++), magnesium (Mg++), potassium (K+), sodium (Na+), ammonium (NH4+), ferric iron (Fe+++) or ferrous iron (Fe++), manganese (Mn++), and hydrogen (H+).

chloride (Cl-)

Is considered an indicator of human activity. Agricultural chemicals, human and animal wastes, and road salt are the major sources of chloride in lake water.

chlorophyll

A green pigment found in plants that is necessary for the process of photosynthesis.

clarity

Secchi disc is an 9-inch diameter plate with black and white painted sections that is used to measure water clarity (light penetration). The disc is lowered into water until it disappears from view. It is then raised until just visible. An average of the two depths, taken from the shaded side of the boat, is recorded as the Secchi disc reading. The readings should be taken on sunny, calm days.

conductivity (specific conductance)

Is the waters ability to conduct an electric current.

cultural eutrophication

Eutrophication that happens as a result of human activities when increased nutrients in runoff water drains into lakes.

decompose

Breakdown of organic materials to inorganic materials.

dissolved oxygen (DO)

The amount of free oxygen absorbed by the water and available to aquatic organisms for respiration.

diversity

Number of species in a particular community or habitat.

drainage basin

The total land area that drains toward the lake.

drainage lakes

Lakes fed primarily by streams and with outlets into streams or rivers. They are more subject to surface runoff problems but generally have shorter residence times than seepage lakes. Watershed protection is usually needed to manage lake water quality.

ecosystem

A system formed by the interaction of a community of organisms.

epilimnion

The epilimnion is the warm upper layer of a lake when the denser, colder water is on the bottom during stratification.

erosion

Movement of soil by water and wind.

eutrophication

The process by which lakes and streams are enriched by nutrients which results in increased plant and algae growth.

exotic

A non-native species of plant or animal that has been introduced.

filamentous algae

Algae that forms filaments or mats attached to sediment, weeds, piers, etc.

food chain

An arrangement of the organisms in an ecological community according to the order of predation in which each uses the next, usually lower, member as food source.

groundcover

Plants grown to keep soil from eroding.

habitat

The place where an animal or plant lives; its living and non-living surroundings.

herbicides

Chemicals designed to kill a variety of undesired plant species.

hydrologic (water) cycle

The process by which the earth's water is recycled. Atmospheric water vapor condenses into the liquid or solid form and falls as precipitation to the ground surface. This water moves along or into the ground surface and finally returns to the atmosphere through transpiration and evaporation.

hydrology

Study of the distribution, circulation, and properties of water.

hypolimnion

The lower, more dense, colder waters on the bottom of stratified lakes is the hypolimnion.

impervious surface

Ground cover that does not allow for infiltration of water, such as roads and parking lots, and increases the volume and speed of runoff after a rainfall or snow melt.

limiting factor

The nutrient or condition in shortest supply relative to plant growth requirements. Plants will grow until stopped by this limitation; for example, phosphorus in summer, temperature or light in fall or winter.

limnology

The study of inland lakes and waters.

littoral

The near shore shallow water zone of a lake, where aquatic plants grow.

macrophytes

Refers to plants growing in or near water. Macrophytes are beneficial to lakes because they produce oxygen and provide substrate for fish habitat and aquatic insects.

marl

White to gray accumulation on lake bottoms caused by precipitation of calcium carbonate (CaCO3) in hard water lakes. Marl may contain many snail and clam shells, which are also calcium carbonate. While it gradually fills in lakes, marl also precipitates phosphorus, resulting in low algae populations and good water clarity.

metalimnion

This is the thin layer in a stratified lake that lies between the hypolimnion and the epilim-nion.

non-point source

A source of pollution that comes from a variety of sources instead of a pipe.

nutrients

Elements or substances such as nitrogen and phosphorus that are necessary for plant growth. Large amounts of these substances promote excessive plant growth.

pH

The numerical value used to indicate how acid or alkaline a solution is. The number refers to the number of hydrogen ions in the solution. The pH scale ranges from 1 to 14 with 7.0 being neutral. Acid ranges from 0 to 6. Alkaline ranges from 8 to 14.

phosphorus

Key nutrient influencing plant growth in more than 80% of Wisconsin lakes. Soluble reactive phosphorus is the amount of phosphorus in solution that is available to plants. Total phosphorus includes the amount of phosphorus in solution (reactive) and in particulate form.

photosynthesis

The process by which green plants create food and oxygen.

phytoplankton

Microscopic plants and algae found in the water.

plankton

A small plant organisms and animal organisms that float or swim weakly through the water.

point source pollution

Air or water pollutants entering the environment from a specific point such as a pipe.

pollution

The contamination of water and other natural resources by the release of harmful sub-stances into the environment.

ppm

Parts per million.

retention time

(Turnover rate or flushing rate) The average length of time water resides in a lake. This can range from several days in small impoundments to many years in large seepage lakes.

runoff

The portion of rainfall, melted snow, or irrigation water that flows across the land surface or through pipes and eventually runs into lakes and streams.

seepage lakes

Lakes without a significant inlet or outlet, fed by rainfall and groundwater. Seepage lakes lose water through evaporation and groundwater moving on a down gradient. Lakes with little groundwater inflow tend to be naturally acidic and most susceptible to the effects of acid rain. Seepage lakes often have long residence times and lake levels fluctuate with local ground water levels. Water quality is affected by groundwater quality and the use of land on the shoreline.

thermocline

Stratification is the layering of water due to differences in density. Water's greatest density occurs at 39 °F (4 °C). As water warms during the summer, it remains near the surface while colder water remains near the bottom. Wind mixing determines the thickness of the warm surface water layer (epilimnion), which usually extends to a depth of about 20 feet. The narrow transition zone between the epilimnion and cold bottom water hypolimnion) is called the metalimnion or thermocline.

trophic state

Eutrophication is the process by which lakes are enriched with nutrients, increasing the production of rooted aquatic plants and algae. The extent to which this process has occurred is reflected in a lakes trophic classification or state: oligotrophic (nutrient poor), mesotrophic (moderately productive), and eutrophic (very productive and fertile).

turbidity

Degree to which light is blocked because water is muddy or cloudy.

turnover

Fall cooling and spring warming of surface water increases density, and gradually makes temperature and density uniform from top to bottom. This allows wind and wave action to mix the entire lake. Mixing allows bottom waters to contact the atmosphere, raising the water's oxygen content. However, warming may occur too rapidly in the spring for mixing to be effective, especially in small sheltered kettle lakes.

watershed

The land area draining into a specific stream, river, lake or other body of water. These areas are divided by ridges of high land.

wetlands

Low-lying lands in which the soil is saturated with water at some time during the year.

zooplankton

Microscopic or barely visible animals that eat algae. These suspended plankton are an important component of the lake food chain and ecosystem. They are the primary source of food for many fish.

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	A	B	C	D	J	Q	S	AC	AI	AQ	BD	BF	BG	BI	BN	BU	BZ
1		**STATS**	Total vegetation	*Myriophyllum spicatum*, Eurasian water milfoil	Brasenia schreberi, Watershield	Ceratophyllum demersum, Coontail	Chara sp., Muskgrasses	Elodea canadensis, Common waterweed	Heteranthera dubia, Water star-grass	Lemna minor, Small duckweed	Najas flexilis, Slender naiad	Najas guadalupensis, Southern naiad	Najas marina, Spiny naiad	Nitella sp., Nitella	Nymphaea odorata, White water lily	Potamogeton amplifolius, broadleaf pondweed	Potamo
2	**Lake**	Wind Lake															
3	**County**	Racine															
4	**WBIC**																
5	**Survey Date**	8/9/17-8/15/17															
6		**INDIVIDUAL SPECIES STATS:**															
7		**Frequency of occurrence within vegetated areas (%)**		20.05	0.50	43.81	36.88	0.50	1.98		10.89	0.25	3.22	12.87	3.47	6.68	0.50
8		**Frequency of occurrence at sites shallower than maximum depth of plants**		17.92	0.44	39.16	32.96	0.44	1.77		9.73	0.22	2.88	11.50	3.10	5.97	0.44
9		**Relative Frequency (%)**		8.5	0.2	18.7	15.7	0.2	0.8		4.6	0.1	1.4	5.5	1.5	2.8	0.2
10		Relative Frequency (squared)	0.12	0.01	0.00	0.03	0.02	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00
11		**Number of sites where species found**		81	2	177	149	2	8		44	1	13	52	14	27	2
12		**Average Rake Fullness**	2.41	1.40	1.00	1.78	1.89	1.00	1.38		1.23	1.00	1.23	1.25	2.07	1.33	1.00
13		**#visual sightings**		1	4				1	2			1		13	1	1
14		**present (visual or collected)**		present	present	present	present	present	present	present	present	present	present	present	present	present	present
15																	
16		**SUMMARY STATS:**															
17		**Total number of sites visited**	**650**														
18		**Total number of sites with vegetation**	**404**														
19		**Total number of sites shallower than maximum depth of plants**	**452**														
20		**Frequency of occurrence at sites shallower than maximum depth of plants**	**89.38**														
21		**Simpson Diversity Index**	**0.88**														
22		**Maximum depth of plants (ft)****	**10.00**														
23		**Number of sites sampled using rake on Rope (R)**	**482**														
24		**Number of sites sampled using rake on Pole (P)**	**0**														
25		**Average number of all species per site (shallower than max depth)**	**2.09**														
26		**Average number of all species per site (veg. sites only)**	**2.35**														
27		**Average number of native species per site (shallower than max depth)**	**1.88**														
28		**Average number of native species per site (veg. sites only)**	**2.12**														
29		**Species Richness**	**26**														
30		**Species Richness (including visuals)**	**31**														
31																	
32		****SEE "MAX DEPTH GRAPH" WORKSHEET TO CONFIRM**															

	CB	CD	CE	CF	CI	CL	CQ	DR	DV	ED	EE	EG	EN	EQ	ER	ES	ET	EU	EV	EW	EX	EY	EZ
1	...us, Large-leaf	...geton foliosus, Leafy pondweed	Potamogeton gramineus, Variable pondweed	Potamogeton illinoensis, Illinois pondweed	Potamogeton natans, Floating-leaf pondweed	Potamogeton nodosus, Long-leaf pondweed	Potamogeton praelongus, White-stem pondweed	Potamogeton richardsonii, Clasping-leaf pondweed	Potamogeton zosteriformis, Flat-stem pondweed	Stuckenia pectinata, Sago pondweed	Typha sp., Cattail	Utricularia vulgaris, Common bladderwort	Vallisneria americana, Wild celery	Wolffia columbiana, Common watermeal	Filamentous algae	Nitellopsis obtusa L. (Starry Stonewort	bulrush	sp3	sp4	sp5	sp6	sp7	sp8	sp9	
2																								
3																								
4																								
5																								
6																								
7	1.49	11.63	0.50	1.24	0.25	4.21	1.24	15.10		0.50	45.79		0.25	10.64										
8	1.33	10.40	0.44	1.11	0.22	3.76	1.11	13.50		0.44	40.93		0.22	9.51										
9	0.6	5.0	0.2	0.5	0.1	1.8	0.5	6.4		0.2	19.5			4.5										
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.04			0.00										
11	6	47	2	5	1	17	5	61		2	185		1	43										
12	1.33	1.43	2.00	1.40	1.00	1.18	1.40	1.23		1.00	1.94		1.00	1.98										
13		3		2	1	1		3	2		5	7	9		12									
14	present	present	present	present	present	present	present	present	present	present	present	present	present	present	present									
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Aquatic Plant Management Herbicide Treatment Record

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

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

Completion of this form along with the Permit satisfies the requirements of **WDNR (NR107, WPDES 5.1) and DATCP (ATCP 29.21 & 29.22)**

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

Permit Number	Waterbody name (including ponds, eg., Smith Pond and Address)	Treatment Date	Start Time	End Time
SE 2017 52 18	Wind Lake	8/30/17	1015	2:40
County	**Wind Lake Mgmt District**	**Water Temp (F)**	**Air Temp (F)**	**Wind Speed & Direction**
Racine		76°F	78°F	WNW 5-10

Treatment Area Size (Acres)	Avg. Depth (Ft.)	Water Volume	DO ppm	On Site DNR Supervision Present ☐ Yes ☒ No If yes, Supervisor Name:
5 acres				

Visual Observations/Notes: Treated 1 acre "Blocks" around each of the following PI Points

Waypoint	Depth	Cutrine Ultra (gal)	Hydrothol 191 gal
276	6	14.4	1.5
290	9	21.6	2.25
384	7	16.8	1.75
412	7	16.80	1.75
57	4	9.6	1.0

Lake very calm - no waves, Material applied via Drop lines

Water Use Restriction Signs Posted in Accordance with NR107? ☒ Yes ☐ No "No Restrictions" Posted at Launch

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

Name of Applicator(s)		Certification #	License #
Paul Hinterberg	☐	89833	440931
Jim Kannenberg	☐	28668	224269
Tom Lloyd	☐	53869	146250
Marc Schmitz	☐	77687	280174
Brian Suffern	☒	1517	142402
Erik Olsen	☒	97415	307554

No Adverse Conditions noted.

Application Business Information
Marine Biochemists
N173 W21440 Northwest Passage
Jackson, WI 53037
262-674-1781

Name of Person Completing Form: Brian Suffern

Date: 8/30/17

Pond	Product Used	E.P.A. Registration No.	Quantity Applied	Concentration (ppm) Or Rate (gal./acre) Applied
A. ☐ B. ☐ C. ☐ D. ☐	Aquathol-K	70506-176		
A. ☐ B. ☐ C. ☐ D. ☐	Clearigate	8959-51		
A. ☐ B. ☐ C. ☐ D. ☐	Copper Sulfate	46923-4		
A. ☐ B. ☐ C. ☐ D. ☐	Cutrine-Plus	8959-10		
A. ☐ B. ☐ C. ☐ D. ☐	DMA4-IVM	62719-3		
A. ☐ B. ☐ C. ☐ D. ☐	Harpoon	8959-54	☒	
A. ☐ B. ☐ C. ☐ D. ☐	Hydrothol 191	70506-175	8.25 gal	0.17 ppm to 5A/6.6' avg depth
A. ☐ B. ☐ C. ☐ D. ☐	Phycomycin SCP	68660-9-8959		
A. ☐ B. ☐ C. ☐ D. ☐	Tribune	100-1390		
A. ☐ B. ☐ C. ☐ D. ☐	Cutrine Ultra	8959-53	79.2 gal	0.8 ppm to 5 Acres/6.6 ft avg

Contract Type: ☐ Per Treatment ☐ Seasonal

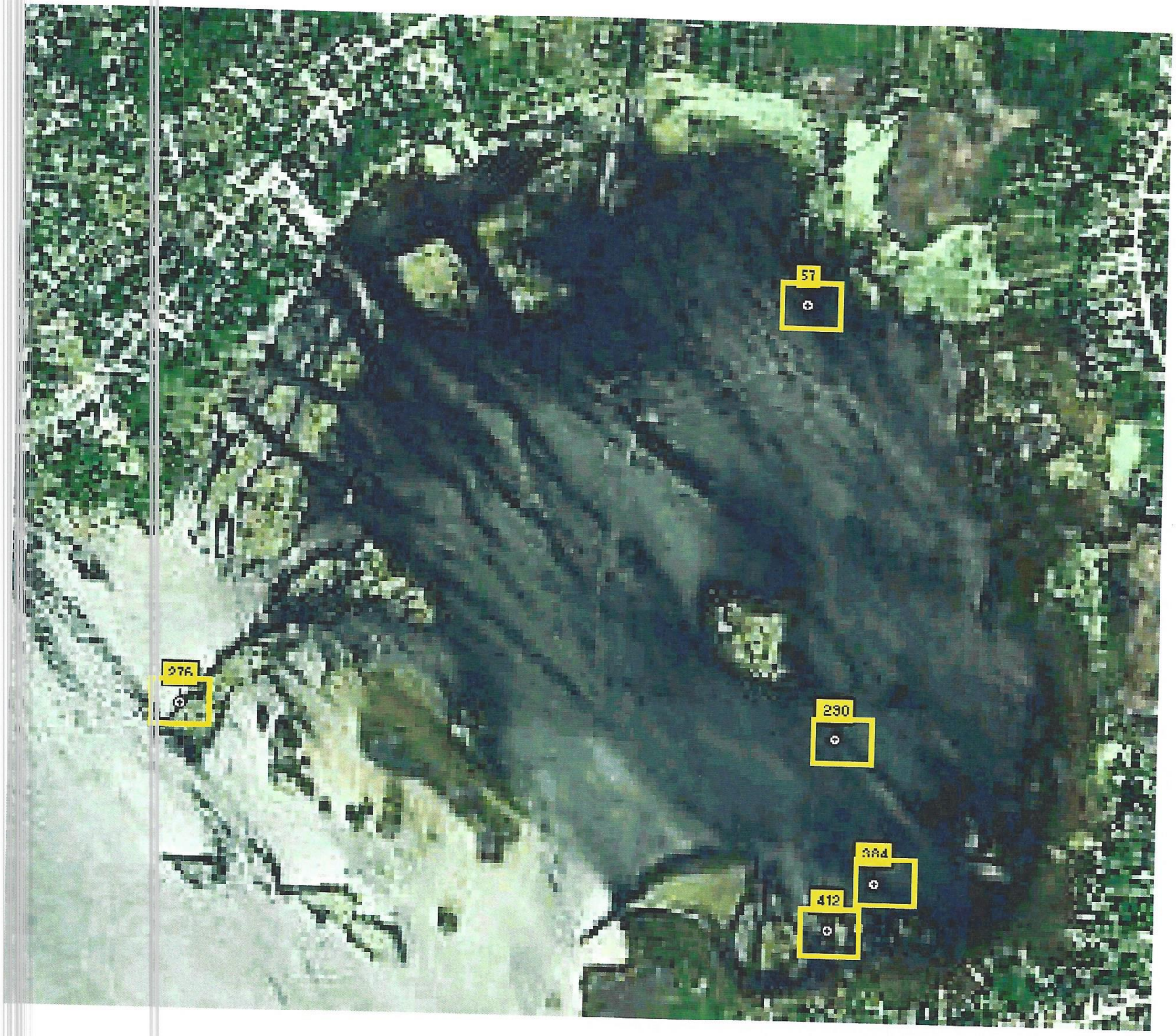
FOR OFFICE USE ONLY

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

Additional Instructions For Invoicing: _____

Wind Lake—Racine County

August 30, 2017 Starry Stonewort Treatment Areas



Note: Each 1 acre "Block" around each PI Point measured with GPS, with Cutrine-Ultra and Hydrothol 191 being applied at 0.8 ppm and 0.17 ppm respectively.

Total Area Treated/Avg. Depth: 5 acres/6.6 ft. (33 acre-ft. total)

Total Quantity of Product used: Cutrine Ultra 79.2 gal. Hydrothol 191 8.25 gal

Marine Biochemists
N173 W21440 Northwest Passage
Jackson, WI 53037
(888) 558-5106
www.marinebiochemists.com