Hooker Lake

Aquatic Plant Management Plan
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Chapter I
Introduction 1
Why Bother? 1
Goals & Objectives 2

Chapter II
Shoreline Development & Aesthetic Features 3
Access Locations 4
Sensitive Areas 6
Fish And Wildlife 7
Cattails 7
Water Quality 7
Exotic Species 8
Lake Use 8
Boating Ordinance 8

Chapter III - Aquatic Plants
Background 9
- Types Of Aquatic Plants 10
- Littoral Zone 10

Plant Species Descriptions 11
- Pondweeds 11
- Curly-leaf Pondweed (*Potamogeton crispus*) 11
- Eurasian Watermilfoil (*Myriophyllum spicatum*) 12
- Muskgrass 12
- Coontail 12
- Wild Celery 12
- Sago Pondweed 12

Aquatic Plant Surveys 13
Hooker Lake Aquatic Plants - 2008 14
- General Survey 14
- Point Intercept Survey 14
- Historical Plant Management 21
- General Conclusions 21

Chapter IV - Problems 22

Chapter V - Plant Management Alternatives 24
- No Management 24
- Nutrient Inactivation 25
- Dredging For Aquatic Plant Control 26
- Aeration 27
- Screens 27
- Biomanipulation 27
- Native Species Reintroduction-Shoreline Edges And Adjacent Uplands 28
- Hand Controls 29

Chemical Treatment 30
Harvesting 34
Local Ordinances And Use Restrictions 36

Chapter VI - Plant Management Plan 38
Goals & Objectives 38
Recommendations 39

Chapter VII - Plan Reassessment/Finding of Feasibility 44

Chapter VIII - Grants 45

Chapter IX - Summary 47

Glossary

Appendix

CHAPTER I

INTRODUCTION

Hooker Lake is an 87 acre lake located in the Town of Salem, Kenosha County, Wisconsin. The lake has a mean depth of 11.3 feet and a maximum depth of 27 feet. Hooker Lake has a watershed area of 1133 acres, giving it a high watershed to lake surface ratio (13:1). Lakes with ratios greater than 10:1 tend to develop water quality problems.

The Hooker Lake Management District (District) was created in June 1990 to provide a stable taxing authority to fund aquatic plant management and other activites to improve Hooker Lake. The District boundaries include the area around Hooker Lake. Aron & Associates was contracted in 2008 to conduct an aquatic plant survey and to create an Aquatic Plant Management Plan in compliance with the Aquatic Invasive Species (AIS) program under a grant awarded by the Wisconsin Department of Natural Resources (WDNR) Lakes program.

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 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.

GOALS & OBJECTIVES

The goals and objectives on Hooker Lake are centered around the aquatic plant community and water quality. 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.

Eurasian watermilfoil (*Myriophyllum spicatum*) and curly-leaf pondweed (*Potamogeton crispus*) are the problem species. The invasive plants can restrict recreational use and damage native aquatic plant communities. Controlling the exotic plants and protecting the native plant population is crucial to the ecological balance of the resource.

The District desires to:

- Protect native plant communities and ecologically valuable areas by:
  - —Educating landowners.
  - —Using chemical treatments to control nuisance exotic species.
  - —Minimizing fragments of aquatic plants.
- Preserve and enhance the natural lake environment by:
  - —Educating landowners and lake users in lake ecology.
- Work with the Town, County and State governments to:
  - —Review existing ordinances, and if necessary, develop and enforce ordinances to protect Hooker Lake.
  - —Continue to improve the watershed to protect Hooker Lake, including developing solutions to problems from the Highway expansion.
  - —Encourage community participation in lake management activities.
  - —Seek grant funds to assist with the projects.
- Conduct in-lake management activities with the long-range goal of minimizing the management as much as possible by:
  - —Conducting year-end evaluations as to the success of plant management activities and the community reaction to the activities.
  - —Tracking the annual progress of lake management activities.
  - —Regulate and and maintain a stable lake level.

CHAPTER II - BACKGROUND

SHORELINE DEVELOPMENT & AESTHETIC FEATURES

Hooker Lake and its watershed is highly developed. The drainage area to Hooker Lake is **p**rimarily rural comprising 74% of the drainage basin. Rural land uses are dominated by agricultural and other open space lands. Urban land uses account for 26% of the drainage area, the majority of which is in residential uses. Because the watershed is dominated by rural uses, there are opportunities for further development.

With the exception of wetland areas, most of the shoreline is developed. The expansion of Highway 83 West of the lake has increased the amount and velocity of runoff into Hooker Lake.

The potential development of the rural lands in the 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 lower the quality of life in a community 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 affect 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. Steeply-sloped lands extend into steeply-sloped lakebeds. These steep shorelines can also become significant problems for the lake. Disturbances by residents can result in serious erosion if preventative steps are not taken.

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, mainte-

nance of the groundwater and surface water quality, reduction of soil erosion and protection of plant and animal diversity.

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

Hooker Lake meets the WDNR standards for public access to an inland lake. One public access site is on the West shore of the lake and a second access is on the North shore.

Table 1 Hydrography and Morphology of Hooker Lake

Kenosha County, Wisconsin, 2008

Area	87 acres
Shoreline Length	1.9 miles
Shore development factor*	1.31
Watershed area	1133 sq. miles
Maximum depth	24 feet
Mean depth	11.3 feet
Volume	983 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

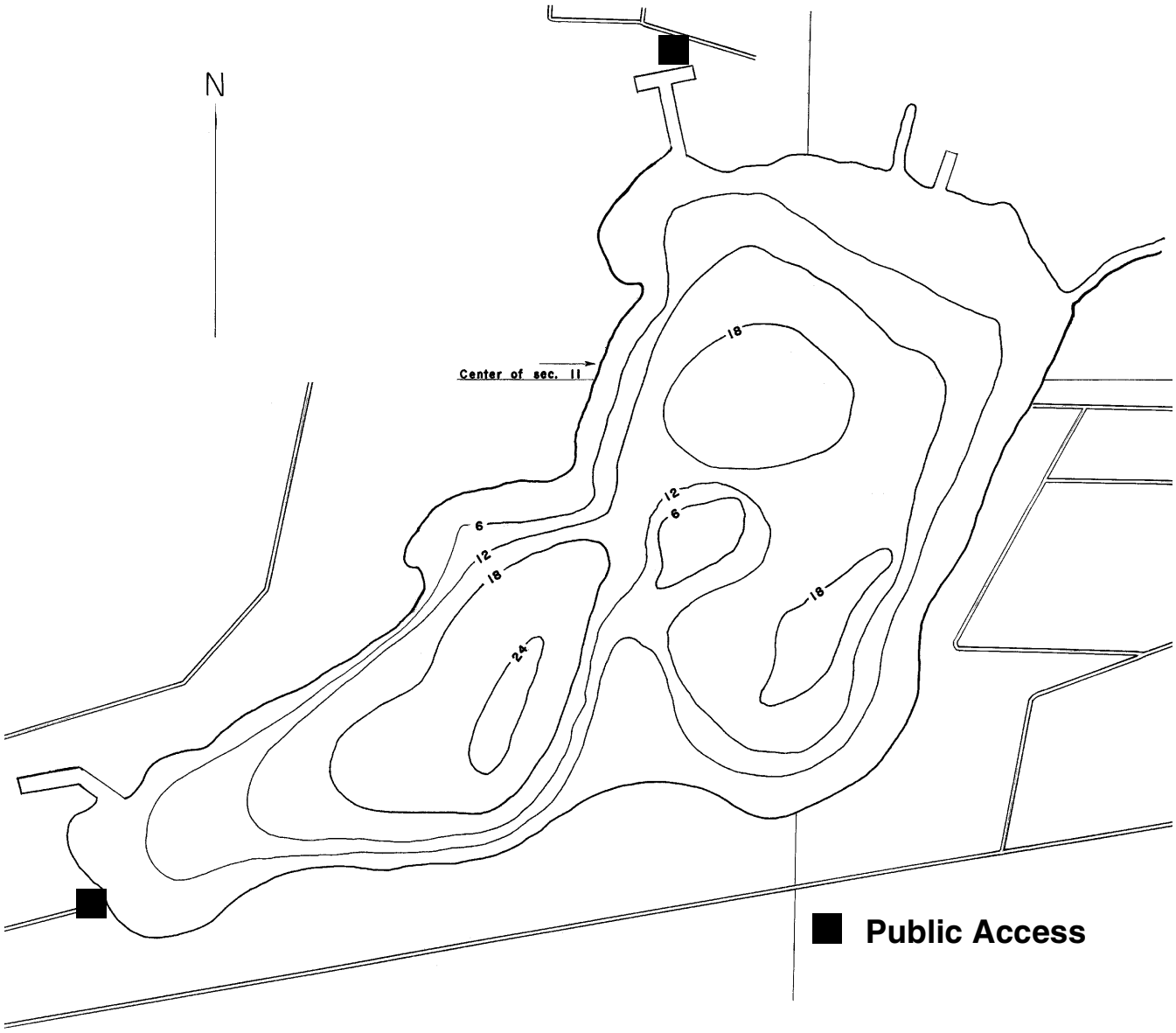

Figure 1 Hooker Lake, Wisconsin

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 Hooker Lake. Wisconsin Admin. Code 107 defines Sensitive Areas as those "*offering critical or unique fish and wildlife habitat, including seasonal or lifestage requirements, or offering water quality or erosion control benefits to the body of water*". These include valuable and diverse aquatic plant communities that support fish, riparian wetland areas, spawning habitat, and habitat for waterfowl.

Diverse aquatic vegetation stabilizes soft sediments, preventing them from becoming resuspended 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 in Sensitive Areas is currently the only specific plant management activity that is regulated by the state, although there is growing desire for expansion of the program. A report to the legislature written by the WDNR in 1993, Eurasian Water Milfoil in Wisconsin: A Report to the Legislature, called for expanded controls on harvesting and planting in Wisconsin lakes. The report addresses the increasing spread of Eurasian watermilfoil and other exotics. Because protection of native plants appears to provide some protection against milfoil invasions, protection is a logical first step. The WDNR report mentioned above indicates that because so few lakes in southeast Wisconsin have undeveloped shorelines and wetlands, areas such as these that do still exist should be preserved and protected.

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.

The Sensitive Areas Report for Hooker Lake is included in the Appendix.

FISH AND WILDLIFE

Hooker Lake is considered a high quality fishing lake that supports both predator and panfish populations. Predator fish include northern pike, and large mouth bass. Panfish include crappie, bluegill, yellow bass, and yellow bullhead. Warmouth, bowfin and lake chubsuckers were also found in an electrofishing survey done by WDNR in April 2008. WDNR stocks northern pike and walleye on a rotational basis.

The plentiful native aquatic vegetation provides spawning and nursery habitat. The extensive wetland shoreline edges provide important habitat for the fisheries.

Although the amount of developed shoreline does affect use by wildlife, the adjacent wetlands provide valuable habitat. Waterfowl frequent the lake primarily during spring and fall migration. Non-migratory Canadian geese are a problem on the lake, affecting the aquatic plants and water quality.

CATTAILS

Cattails are abundant on the shores of Hooker Lake. There have been a concerns about the cattails over the years. In the early 1990's, a study was conducted to see if the cattails were increasing their range. The study showed that the cattail boundary has remained consistent over time.

During periods of high water levels, cattail bogs break off and end up caught on the dam at the lake's outlet. The District has a procedure in place to watch for the bogs, and then respond by cutting them up.

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. Without water quality data, it is impossible to determine the affect a source of pollution may have on a lake.

Hooker Lake is considered to be a eutrophic lake, that is a nutrient-rich lake that supports large numbers of aquatic plants and fish. In 2004, the average secchi disk reading taken in the deepest part of the lake were 3.9 and 5.2 feet. The 2004 water quality report is included in the Appendix. The District should try to find a volunteer to take secchi disk readings every two weeks.

The district should begin a water quality monitoring program. At a minimum, the program should include water clarity monitoring (secchi monitoring) every two weeks throughout the summer. Assistance in developing a program is available from WDNR.

EXOTIC SPECIES

During an aquatic plant survey in 2008, Hooker Lake was evaluated for exotic species. Curly-leaf pondweed and Eurasian watermilfoil are present in Hooker Lake. Zebra mussels have not been confirmed in Hooker Lake.

Eurasian watermilfoil and curly-leaf pondweed are exotic plant species present in the lake. Exotic plant species do not provide the benefits the native plant species provide. Exotic plant species tend to be more dense, 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. These canopies also raise the temperature of the water beneath the canopies.

Purple loosestrife is an exotic perennial wetland herb. 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. Local efforts to minimize the spread of purple loosestrife have included hand removal and the development and release of the Cella beetle to graze on the loosestrife plants. Any purple loosestrife found around Hooker Lake should be removed to prevent its spread.

Hydrilla is a nuisance exotic plant that has not yet been located in Wisconsin. The plant causes severe impairments that are very costly to combat. Although a Southern plant, it has been found as far North as Northern Indiana. All lakes in this region will be at risk for Hydrilla infestation as the plant acclimates to the Northern climates.

The District should enlist volunteers into the Clean Lakes Clean Water program and should begin an active boat launch program.

LAKE USE

Hooker Lake receives a moderate degree of recreational pressure. The majority of recreational uses are: water-skiing, scenic viewing, swimming, and fishing. Private beaches provide swimming opportunities. A WDNR public boat launch with parking has made boat access more accessible. The lake has moderate lake use during weekdays, however, weekends and holidays have higher use levels on Hooker Lake. As traffic increases, the opportunity for use conflicts increase when those seeking a peaceful scenic vista, those desiring a speedy boating experience, and those looking for game fish all seek to use the same area at the same time.

BOATING ORDINANCE

The Town of Salem has a local boating ordinance that is in force on Hooker Lake. Patrol is often on a complaint basis. Enforcement of the boating ordinance will help 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.

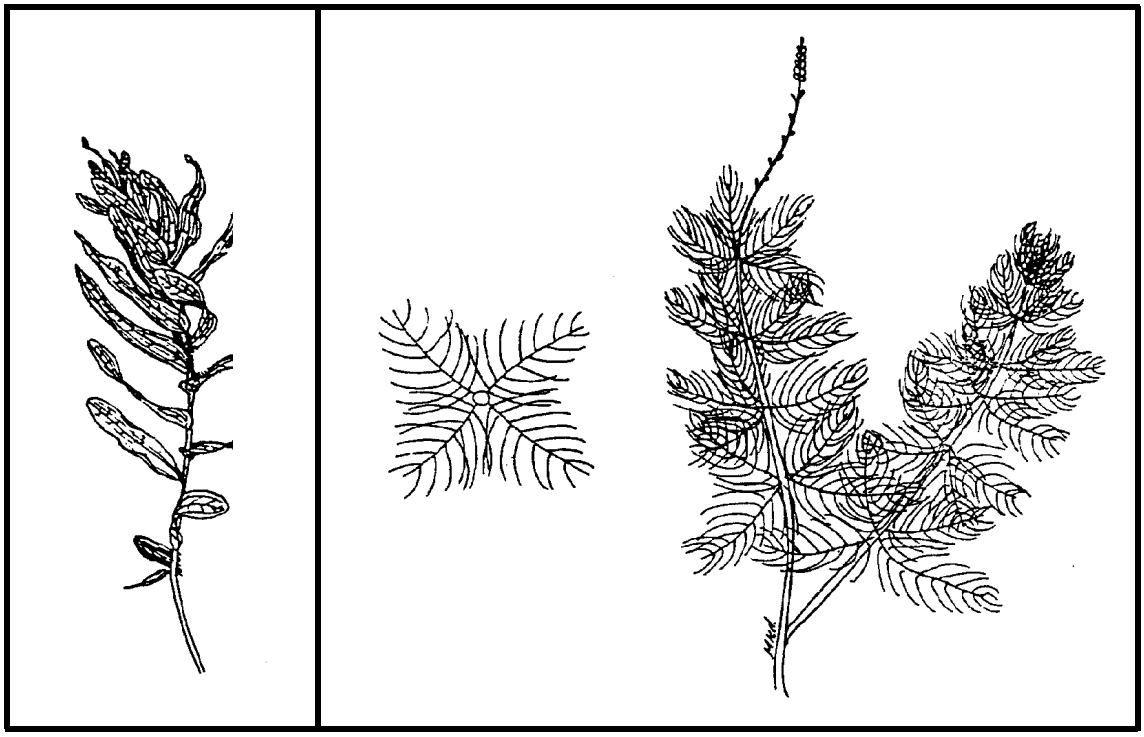

Figure 1. Two exotic species: curly-leaf pondweed (left) and Eurasian watermilfoil.

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 reduce problems from exotic species. Just as crabgrass and dandelions are the first plant to invade a disturbed area of a backyard, Eurasian watermil-

foil is 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 current 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. In 2008, plants on Hooker Lake were found in depths up to 14 feet.

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 The shallow shoreline zones, especially on the North and East shorelines are underlain by sand and gravel. In the deeper depths, the sediments are predominantly muck. Exotic species growing in deep water complicates their management, so it is very important that exotic species be managed aggressively.

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 3 aquatic plant species that should be protected and enhanced. The protected plants that are found in Hooker Lake are sago pondweed (*Stuckenia pectinata)*, wild celery (*Vallisneria americana),* Richardson's pondweed (*P. Richardsonii*)*,* White-stem pondweed *(P. praelongus),* and Illinois pondweed *(P. Illinoensis)*. Other high value plants in Hooker Lake include: variable-leaf pondweed (*P. gramineus*) and flat-stem pondweed (*P. zosterformis*).

Curly-leaf Pondweed (*Potamogeton crispus*)

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. 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 Hooker Lake. Surveys conducted earlier in the season may 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 should be used because native pondweeds may be impacted by some management techniques that target curly-leaf pondweed.

Eurasian Watermilfoil (*Myriophyllum spicatum*)

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 restricted and 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 now evidence that seeds play a much more important role than previously believed (Aron, 2002).

Eurasian watermilfoil is present in Hooker Lake. It is was found in 22% of the sample points in 2008.

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). Nitella is a similar species of algae that shares Chara's characteristics and is usually found in the deeper water areas of the lake. Chara is found in Hooker Lake. Chara is the dominant species in the lake, found in 46% of the sample points.

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 was found in 23% of the sample points on Hooker 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.

Wild celery is present in Hooker Lake and was found in 6% of the sample points.

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 was found in 5% of the sample points in Hooker Lake.

Many aquatic plants are important food sources for waterfowl. Others provide habitat, spawning and shelter areas for fish. Exotic plant species do not provide these benefits as well as the native plant species. Exotic plant species tend be more dense, 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. Protection of native species is an important means of reducing problems from exotic species.

AQUATIC PLANT SURVEYS

Determining what plants are present in a lake can be done a number of different ways. One method, which includes transect and point-intercept surveys, is to measure the species composition, frequency, and densities of aquatic plants at a number of points around a lake. Another, called a general survey, is to traverse the area of the lake that is available for plant growth, called the littoral zone, covering all the depths and as much of the littoral zone as possible, to develop a species composition list. Surveys usually include a general survey along with the more detailed transect or point-intercept surveys.

Aquatic plants are very important to the health of a lake. They provide food and cover for fish and wildlife as well as contribute to dissolved oxygen production. Plants also stabilize sediments, helping control shoreline erosion, and turbidity. An aquatic plant monitoring program may also provide an early warning signal that the lake is reacting to negative impacts from the watershed.

2008 SURVEY METHODOLOGY

General Survey

A preliminary survey of the lake was made by boat. An attempt was made to locate all plant communities on the lake by region. Nomenclature follows Crow & Hellquist (2000).

Point Intercept Survey

The point intercept methodology for the 2008 survey on Hooker Lake was used, following points established by WDNR Bureau of Research (Figure 2). Samples points on the transects were located using a 2004 Garmin GPS LMS330 with an LGC-2000 Receiver. A telescoping rake or a rake with a rope, was used at each sample point. Each plant species retrieved was recorded and given a density rating between 1 and 3.

The data collected were then entered into the spreadsheet. Lake depth at each sample point was recorded. The data are available in the Appendix of this Plan.

HOOKER LAKE AQUATIC PLANTS - 2008

An aquatic plant survey was conducted by Aron & Associates in July 2008. The aquatic macrophytes observed in Hooker Lake during the survey are listed in Table 2.

The maximum rooting depth, the greatest depth at which rooted aquatic plants were found on Hooker Lake, was 14 feet. A total of 20 species were found in Hooker Lake during the survey. Four of the species were located during the general survey while the remaining 16 were found during the point-intercept sampling. The most abundant species in Hooker Lake are Chara, Eurasian watermilfoil, and coontail. Eurasian watermilfoil was found in 22% of the sample points. Hooker Lake has good plant diversity.

Table 2 shows the plant species identified in plant surveys in 2003 and 2008. Table 3 shows the percent frequency of the plants.

During the general survey plants were inspected for signs of the "milfoil weevil" (*Euhrychiopsis lecontei*). Damaged, blackened stems, and stressed plants were not located. Random bucket tests of milfoil were also done, but no weevils were found. Lakes with highly developed shorelines may not support the weevil because of a lack of leaf litter and shoreline debris. The weevils overwinter in leaf litter and shoreline debris. The “milfoil weevil” was not found in Hooker Lake during the aquatic plant survey. Table 4 lists the value of the aquatic plants in Hooker Lake.

2008 was an unusual year, with lower plant densities than seen in other years. In June of 2008 severe storms produced floods in many areas in SE Wisconsin. It is suspected that the combination of the increased runoff and lower water clarity kept Eurasian watermilfoil levels low. The levels of Eurasian watermilfoil will likely increase to levels seen in other years. In 2003, Eurasian watermilfoil was found in 78% of the sample points.

Figure 2 2008 Survey Points, Hooker Lake, Kenosha County Wisconsin

Figure 3 Sites with Eurasian Watermilfoil, Hooker Lake, 2008

Figure 4 Sites with Curly-leaf Pondweed, Hooker Lake, 2008

Figure 5 Sites with Chara, Hooker Lake, 2008

Figure 6 Site with Coontail, Hooker Lake, 2008

Table 2 Aquatic Plant Species Observed in Hooker Lake, July 2008.

Scientific Name	Common Name	Aron & Associates 1992	Aron & Associates 2008
Ceratophyllum demersum	Coontail	X	X
Chara sp.	Muskgrass	X	X
Elodea canadensis	Elodea	X	X
Lemna minor	Duckweed	X	X
Myriophyllum spicatum	Eurasian watermilfoil	X	X
Myriophyllum verticillatum	Native milfoil		X
Najas flexilis	Slender naiad	X	X
N. marina	Brittle naiad	X	X
Nitella sp.	Nitella	X	
Nuphar advena	Yellow water lily	X	X
Nymphaea odorata	White water lily	X	X
P. crispus	Curly-leaf pondweed	X	X
P. foliosis	Leafy Pondweed		X
P. Illinoensis	Illinois pondweed	X	X
P. praelongus	White-stem pondweed		X
P. richarsonii	Richardson's pondweed	X	X
P. zosterformis	Flat-stem pondweed	X	X
Stuckenia pectinata	Sago Pondweed	X	X
Utricularia vulgaris	Bladderwort	X	X
Vallisneria americana	Eel grass, Wild Celery	X	X
Zosterella dubia	Water stargrass		X
	TOTAL # SPECIES	17	20

Table 3 Percent Frequency of Aquatic Plants, Hooker Lake, 2008

Scientific Name	Common Name	Percent Frequency (Number of Points)
Ceratophyllum demersum	Coontail	23.08 (15)
Chara sp.	Muskgrass	46.15 (30)
Elodea canadensis	Elodea	6.15 (4)
Lemna minor	Duckweed	*
Myriophyllum spicatum	Eurasian watermilfoil	21.54 (14)
Myriophyllum verticillatum	Native milfoil	13.85 (9)
Najas flexilis	Slender naiad	*
N. marina	Brittle naiad	7.69 (5)
Nuphar advena	Yellow water lily	1.54 (1)
Nymphaea odorata	White water lily	*
P. crispus	Curly-leaf pondweed	1.54 (1)
P. foliosis	Leafy Pondweed	*
P. Illinoensis	Illinois pondweed	1.54 (1)
P. praelongus	White-stem pondweed	1.54 (1)
P. richarsonii	Richardson's pondweed	4.62 (3)
P. zosterformis	Flat-stem pondweed	15.38 (10)
Stuckenia pectinata	Sago Pondweed	4.62 (3)
Utricularia vulgaris	Bladderwort	1.54 (1)
Vallisneria americana	Eel grass, Wild Celery	6.15 (4)
Zosterella dubia	Water stargrass	15.38 (10)

Table 4 Value of Aquatic Plants in Hooker Lake.

Scientific Name	Common Name	Value[a]
Ceratophyllum demersum	Coontail	• Good shelter for fish. • Supports insects which are food for fish and waterfowl.
Chara sp.	Muskgrass	• Excellent producer of fish food for bluegill and bass. • Stabilizes bottom sediments. • Has softening effect on water by removing lime and carbon dioxide.
Elodea canadensis	Elodea	• Supports insects which are food for fish.
Myriophyllum spicatum	Eurasian Water Milfoil	• Exotic invasive plant that contributes to declines in native plants. • Can provide cover for some invertebrates.
Nuphar sp.	Yellow Water Lily	• Provides shade and shelter for fish. • Leaves support insects. • Leaves, stems, and flowers eaten by deer. • Roots eaten by beaver.
Nymphaea sp.	White Water Lily	• Provides shade and shelter for fish. • Seeds eaten by waterfowl. • Roots and stalks eaten by muskrat. • Roots eaten by deer and beaver.
Stuckenia pectinata	Sago Pondweed	• Good food and shelter for fish. • A very important plant for waterfowl.
Vallisneria americana	Water Celery, Eel Grass	• Good shade and shelter for fish. • Valuable fish food. • Supports insects which are food for fish and waterfowl.

a. Sources: Fasset, 1969. A Manual of Aquatic Plants and Nichols, 1991, Attributes of Wisconsin Lake Plants.

Historical Plant Management

The District does conduct limited chemical treatment of Eurasian watermilfoil, but does not conduct any aquatic plant harvesting. Table 5 shows the treatment information since 2004.

Table 5 Chemical Treatment Records, 2004 - 2008

Treatment Date	Area Treated (Acres)	Material Used
6/28/2004	16	1600 lbs, granular 2,4-D
6/10/2005	6.5	650 lbs, granular 2,4-D
6/19/2006	4	400 lbs, granular 2,4-D
8/21/2006	5	510 lbs, granular 2,4-D
6/6/2007	9	900 lbs, granular 2,4-D
7/14/2008	2.15	215 lbs, granular 2,4-D
9/2/2008	5	500 lbs, granular 2,4-D

General Conclusions

- Hooker Lake has good aquatic plant diversity for this area of SE Wisconsin.
- The area available for aquatic plant growth in Hooker Lake is up to 14 feet in depth.
- Twenty aquatic plant species were found including two exotic plant species, Eurasian watermilfoil and curly-leaf pondweed.
- Steps should continue to eradicate any Purple Loosestrife around the lake.
- The agressive plant mangement efforts should be taken to control the amount of Eurasian watermilfoil and curly-leaf pondweed in Hooker Lake.
- 2008 was an unusual year for aquatic plant growth in Hooker Lake.

CHAPTER IV - PROBLEMS

The waters and sediments of Hooker 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 Hooker Lake.

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

Dense plant beds interfere with scuba divers, 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 Hooker 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. 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.

The District has been dealing with more complaints from residents about runoff problems during storms. Highway 83 was recently widened as it passes Hooker Lake to the East. The four lane highway has significantly more impervious surface area than the previous road. The District is concerned that unfiltered runoff and flooding will increase problems on Hooker Lake.

Recent 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 Salem may consider enacting a no-phosphorus fertilizer ordinance for residential properties.

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 sum-

mer, releasing nutrients into the water column. Both of these exotic species has the potential to impact native plants, by reducing the availability of light that can reach the native plants and by crowding out native plants.

Eurasian watermilfoil and curly-leaf pondweed are the plant species causing the concerns in Hooker Lake and need to be controlled to protect the native plant population on Hooker Lake. The invasive species in these deep zones tend to spread at will, dominating the deep plant community, so control is important before it dominates the deep zones.

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 over $1000. 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. It is now suspected that Eurasian watermilfoil can spread significantly through seeds as well as fragments (Aron, 2002). 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.

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 Hooker 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.

Conclusion—Although No Management is technically feasible for Hooker lake, it should not be considered in the best, long term interest of the water resource.

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 requires costs for equipment, electricity and staff. Costs can be minimal if the lake can be lowered by opening a gate.

Conclusion— Because Hooker Lake has a fixed outlet structure, because the exotic species are located throughout the lake, and because it is not always effective for controlling milfoil, drawdown for the purpose of aquatic plant control on Hooker Lake is not recommended.

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 be in excess of $125,000.

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.

Conclusion—Without further studies and evaluation to verify a problem with nutrient release from the sediments, nutrient inactivation is not recommended for Hooker Lake.

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 15 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 $20.00 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.

***Conclusion*—**Dredging may be considered to improve navigational access**.** Because of the very high costs, and considerable disruption of the aquatic environment, dredging for aquatic plant control would not be considered a viable alternative for Hooker 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 is approximately $75,000 to $100,000 and an annual maintenance and operational cost of approximately $15,000 to $20,000. 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*—**Unless Hooker Lake shows depleted oxygen levels to be a problem, aeration 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 may be a viable alternative for the limited applications by individual property owners to improve conditions in swimming areas, however, they are contradictory to the WDNR's stated goal of protecting native plants. They not viable for use on Hooker Lake.

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 Hooker 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 (*Eurhychiopsis 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. In Wind Lake in Racine County, 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. This time lag can negatively affect the riparians 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 Hooker 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 WDNR website http://dnr.wi.gov/org/land/er/invasive/factsheets/loosecontrol.htm has specific information on purple loosestrife control, including manual, chemical, and biological.

***Conclusion*—**Neither the Grass Carp, insects, nor fungus are viable alternatives for Hooker Lake. The milfoil weevil may be considered on Hooker Lake. The purple loosestrife beetle, as well as hand and chemical controls, has been, and may continue to be used to control purple loosestrife around Hooker Lake.

NATIVE SPECIES REINTRODUCTION-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 limited application as a plant management alternative for Hooker Lake. The planting of native emergent plant species such as bulrushes and associated upland plantings along developed shorelines could be considered. The emergent plant species would provide a buffer zone between the water and shoreline thereby reducing the effects of wave action upon the shore, and erosion. The emergent plants would also provide important habitat for fish and macro invertebrates as well as increase the aesthetic value of Hooker Lake. Emergent plants should blend into shoreline buffer zones to further enhance their environmental 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. Al-

though 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 for the need for upland restoration permits.

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, is an effective way 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 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 or curly-leaf pondweed. 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 and curly-leaf pondweed plants 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. WDNR should be consulted for any hand removal in the Sensitive Areas. However, because of the ease with which Eurasian watermilfoil spreads, landowners should not attempt to remove native plants. Doing so will create a far worse condition when Eurasian watermilfoil fills 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, very high 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 la-

bels 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 areas have high densities of Eurasian watermilfoil. 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 fishers on lakes using whole-lake treatments are scarce. To date, there have been some documented negative impacts on water quality following whole-lake treatments (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.

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 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. Although 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 chopper 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 restictions, 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. Without this information, applied material can be quickly flushed from a system or rendered ineffective. 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 Hooker Lake. Treatments may be undertaken by individuals or the District with WDNR approval. Native aquatic plant beds should not be chemically treated without a thorough review of the existing conditions. Changing plant conditions that create new shoreline nuisances may warrant chemical treatment of exotics. Chemical treatments conducted on Hooker Lake should only target exotic species, Eurasian watermilfoil and curly-leaf pondweed.

- Eurasian watermilfoil should be treated using the appropriate selective chemicals. It should be remembered that destruction of any native plant species populations will increase the potential for problems from Eurasian watermilfoil and curly-leaf pondweed. Curly-leaf pondweed should be treated to prevent the spread of the plant.
- 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. Curly-leaf pondweed treatments should be conducted in mid-April to early May, prior to the development of other native pondweeds.
- Proposed chemical treatments should be developed based on the current nuisance conditions and the applicable Sensitive Area Restrictions.
- If conducted, 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.

- The chemical should be chosen based on the nuisance:
  For areas with a combination of Eurasian watermilfoil and curly-leaf pondweed, Endothal (trade name Aquathol K) should be used at 1 ppm in late April, early May.
  For areas with only Eurasian watermilfoil, 2,4-D (trade name Navigate or Weedar) may be used at a rate of up to 2 ppm.
  For areas with only curly-leaf pondweed, Endothol may be used at 0.5 ppm in late April, early May.
- The District should attempt to control Eurasian watermilfoil to less than 15% frequency and curly-leaf pondweed to less than 10%**.**
- The District should expect to pay between $350 and $500 per acre (applied costs). Costs provided here are estimates only based on fall 2008 prices.
  For Eurasian watermilfoil: from $360 per acre (liquid) to $540 per acre (granular).
  For curly-leaf pondweed: $500 per acre (Endothal).

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.

Shoreline pickup programs can help control floating plant material (floaters) and plant debris, however, they are labor, and time intensive. They 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. When a shoreline pickup program is used, plant debris should be placed on the ends of piers for retrieval.
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 milfoil beds, winds, and waves can create large amounts of "floaters" that can increase the spread of milfoil. 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 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.

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, a conveyor or claw 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 man the equipment, most often that does not work over time. Even paid staff are difficult to find. Daily and seasonal maintenance, as well as repairs, require at least one staff experienced in large equipment. Purchase of the harvester alone can exceed $120,000 in capital costs. State grants for the acquisition of the harvester, conveyor and trailer are eligible to lakes which harvest a minimum of 30 acres, and have adequate public access.

Conclusion— Landowners should be encouraged to remove floaters from their shorelines. Material can be mulched or used in plant beds. Because of the lack of acreage of nuisance plants, the diversity of the aquatic plants, the very limited ability to hire a contract harvester, and because of the cost of equipment acquisition, harvesting is not a viable alternative for Hooker Lake.

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 DNR for review to be sure they comply with State Statutes. Ordinances must address issues that threaten public health, safety and welfare. Once approved by DNR, 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 boating 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 DNR) 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 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 too small to be safe.
- Any attempts to restrict lake use should be weighed along with the social and eco-

nomic 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 Hooker 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 & OBJECTIVES

The goals and objectives on Hooker Lake are centered around the aquatic plant community and water quality. 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.

Eurasian watermilfoil (*Myriophyllum spicatum*) and curly-leaf pondweed (*Potamogeton crispus*) are the problem species. The invasive plants can restrict recreational use and damage native aquatic plant communities. Controlling the exotic plants and protecting the native plant population is crucial to the ecological balance of the resource.

The District desires to:

- Protect native plant communities and ecologically valuable areas by:
  - —Educating landowners.
  - —Using chemical treatments to control nuisance exotic species.
  - —Minimizing fragments of aquatic plants.
- Preserve and enhance the natural lake environment by:
  - —Educating landowners and lake users in lake ecology.
- Work with the Town, County and State governments to:
  - —Review existing ordinances, and if necessary, develop and enforce ordinances to protect Hooker Lake.
  - —Continue to improve the watershed to protect Hooker Lake, including developing solutions to problems from the Highway expansion.
  - —Encourage community participation in lake management activities.
  - —Seek grant funds to assist with the projects.
- Conduct in-lake management activities with the long-range goal of minimizing the management as much as possible by:
  - —Conducting year-end evaluations as to the success of plant management activities and the community reaction to the activities.
  - —Tracking the annual progress of lake management activities.
  - —Regulate and and maintain a stable lake level.

RECOMMENDATIONS

Chemically treat up to 45 acres (red area) for Eurasian Watermilfoil.

Treat for curly-leaf pondweed in same area as needed.

Figure 7 Aquatic Plant Management Plan, Hooker Lake, 2009

Water Quality Monitoring

The District should support the monitoring of water quality on Hooker Lake. A recruitment/ training plan should be developed to ensure a continuous source of volunteers. Volunteers should collect clarity data at least twice a month, and nutrient data monthly.

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 or curly-leaf pondweed. 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.

Education and Information

The District should take steps to educate property owners regarding their activities and how they may affect the plant community in Hooker 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 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 District should inform residents and the public about the lake management activities that are undertaken and the reasons behind the activities. Regular communication with the residents and property owners will improve their understanding of the lake ecosystem and should lead to long term protection.

The District should consider participating in the Wisconsin Adopt A Lake and the Clean Lakes Clean Waters programs sponsored by the WDNR.

The District should also enlist the participation of the local schools. The schools could use Hooker Lake as the base for their environmental education programs.

The District should consider public meetings, lake conventions, and lake fair-type activities to educate the board, the public and to improve the likelihood of success for lake management activities.

Watershed Controls

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

The District should conduct stormwater runoff analysis of the Highway 83 area of the watershed and, based on that analysis, should develop plans to minimize runoff and the pollutants that are transported.

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

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 District may consider applying for grants to assist with land use and storm water planning. The District may work with the Town and County to develop, refine, and implement storm water ordinances. The District should support regional or statewide efforts to restrict the use of phosphorus in fertilizer.

Chemical Treatment

- Eurasian watermilfoil should be treated using the appropriate chemicals. Chemical treatment of the remaining plant communities would not be advised on Hooker Lake. It should be remembered that destruction of any native plant species populations will increase the potential for problems from Eurasian watermilfoil and curly-leaf pondweed. Curly-leaf pondweed should be treated to prevent the spread of the plant.
- 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. Curly-leaf pondweed treatments should be conducted in mid-April to early May, prior to the development of other native pondweeds.
- In Sensitive Areas, no chemical treatment of Eurasian watermilfoil should occur adjacent to stands of susceptible aquatic plant species such as bladderwort or Northern watermilfoil. Early season treatment may be a method to try to control Eurasian watermilfoil before susceptible species begin growing.
- Proposed chemical treatments should be developed based on the current nuisance conditions.
- If conducted, 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 navigational channel, broad-spectrum contact herbicides may be used. These treatment areas would not be grant eligible.
- In the lake, the chemical should be chosen based on the nuisance:
  - For areas with a combination of Eurasian watermilfoil and curly-leaf pondweed, Endothal (trade name Aquathol K) should be used at 1 ppm in late April, early May.
  - For areas with only Eurasian watermilfoil, 2,4-D (trade name Navigate or Weedar) may be used at a rate of up to 2 ppm.
  - For areas with only curly-leaf pondweed, Endothol may be used at 0.5 ppm in late April, early May.
- Chemical treatments for Eurasian watermilfoil and curly-leaf pondweed are eligible for funding under the Aquatic Invasive Species (AIS) grant program. When the District applies for AIS funding, the following should be incorporated into the grant application:
  - Areas to be treated, which nuisance(s) are targeted.
  - Chemical to be used.
  - Identify non-eligible treatments that may take place outside of the grant project.
  - Include monitoring pre- and post-treatments to document the effectiveness of the treatments.

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 coordinate 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 newsletter, or box drops.
- 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.

Boat Launch Activities

The District should enlist volunteers or students to remove debris regularly in the nearshore and shoreline areas of the boat launch. This will minimize the amount of plant fragments that are moved by trailers.

Contingency Plans

The District should be prepared for changing aquatic plant conditions that may fall outside the 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. In this instance 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

PLAN REASSESSMENT
FINDING OF FEASIBILITY
PUBLIC INPUT

PLAN REASSESSMENT

The District should review or contract to review, the plant populations of Hooker Lake at least every five years. A grant, such as the AIS grant program, may require annual monitoring as a condition of the grant. A summary of the chemical treatments conducted should be compiled to facilitate evaluation of the management activities. The management plan should also be reviewed every three to five years.

FINDING OF FEASIBILITY

The District should conduct aquatic plant management to control exotic species. The District has a stable board, and is financially secure to undertake such projects, including multi-year projects.

PUBLIC INPUT

The District held a public informational meeting on April 23, 2009 to solicit comments on their draft plant management plan. The notice was published locally. Comments included questions and discussion on:

- The process used to develop the plan
- Concern over the ability to treat milfoil in Sensitive Areas
- Maintaining the ability to have access to the lake in the areas affected by the Sensitive Area designation regulations
- How to have the ability to treat areas with milfoil without spending a lotof funds on permitted areas which aren't treated
- The ability to maintain the lake with limited financial resources

At the meeting, the District board stated their intent to implement the recommendations in this Plant Management Plan.

CHAPTER VIII
GRANTS

There are a number of grants available for lake groups trying to manage their lakes.

- Aquatic Invasive Species Grants (AIS) - Potential projects include education, prevention and planning projects, control projects and early detection and rapid response projects.
- Lake Protection Grants - Potential projects include land acquisition, restoration of wetlands, development of lake management plans, and development of local regulations.
- Lake Planning Grants - Potential projects include education, monitoring, data collection, and plan development.
- Waterways Commission Grants - Potential projects include public access development, dredging to improve public access, harvesting equipment acquisition, and chemical treatment (note: this chemical treatment fund is very small and at this time is unfunded.)

Each grant has specific requirements and uses. The WDNR website should be consulted to review the various grant requirements and uses.

The development of this plant management plan was funded under the Lake Planning Grant program's Small Scale Grant. The District will likely seek grants under the Aquatic Invasive Species Grants to assist with funding the control of Eurasian watermilfoil and curly-leaf pondweed.

AIS grants would be appropriate to assist with controlling the current aquatic invasive species on Hooker Lake. These grants can help the District control Eurasian watermilfoil and curly-leaf pondweed to the levels desired in this plan. The District should include pre- and post-treatment monitoring (and the associated costs) in any AIS grant application submitted since documenting the results is an important, eligible component of the grant program.

AIS GRANT REQUIREMENTS

The AIS Grants require a long term committment from grant sponsors. This increases the probability that the projects will be successful and it provides data that is important to evaluate the overall success of the grant program as well as the specific treatments.

The District's grant application should include the following work efforts:

- Chemical treatment of Eurasian watermilfoil and curly-leaf pondweed.
- A public education program such as Clean Boats Clean Waters program, especially at the boat launch.
- The distribution of newsletters to lake residents and property owners about the in-

vasive plants and measure to prevent their spread.

- The conduct of plant surveys - pre and post treatments. This will include a general survey prior to each year of treatment, and point intercept surveys repeating the 2008 survey points in mid-summer.
- The District's commitment to hand pull any new small patches of Eurasian water-milfoil and curly-leaf pondweed, even beyond the grant period.
- The District may develop a multi-year program to reduce exotic species.

CHAPTER IX - 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 waterlilies and floating-leaf pondweeds.
- The District should 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.
- The District may consider acquiring hand rakes and cutters to loan to property owners for localized control of nuisance species, taking care to remove all cut plant fragments.
- Early season chemical treatments should be conducted targeting Eurasian watermilfoil, and where necessary, curly-leaf pondweed. Treatments should be done in spring, 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.
- The District should use a variety of means to control Eurasian watermilfoil and curly-leaf pondweed. This should include chemical treatment to maintain desired control levels; hand removal of any new small patches; and public informational programs to prevent re-infestations.

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 multicellular 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 presence 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 epilimnion.

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 substances 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	E	I	K	R	W	AA	AM	AN
1		**STATS**	Total vegetation	*Myriophyllum spicatum*,Eurasian water mil	*Potamogeton crispus*,Curly-leaf pondweed	Ceratophyllum demersum,Coontail	Chara ,Muskgrasses	Elodea canadensis,Common waterweed	Heteranthera dubia,Water star-grass	Lemna minor,Small duckweed	Myriophyllum verticill milfoil	Najas fl
2	**Lake Name**	Hooker Lake										
3	**County**	Kenosha										
4	**WBIC**											
5	**Survey Date**											
6		**INDIVIDUAL SPECIES STATS:**										
7		**Frequency of occurrence within vegetated areas (%)**		21.54	1.54	23.08	46.15	6.15	15.38		13.85	
8		**Frequency of occurrence at sites shallower than maximum depth of plants**		12.73	0.91	13.64	27.27	3.64	9.09		8.18	
9		**Relative Frequency (%)**		12.5	0.9	13.4	26.8	3.6	8.9		8.0	
10		Relative Frequency (squared)	0.13	0.02	0.00	0.02	0.07	0.00	0.01		0.01	
11		**Number of sites where species found**		14	1	15	30	4	10		9	
12		**Average Rake Fullness**		1	1	2	1	2	1		1	
13		**#visual sightings**		6	8		2		1	3		3
14		**present (visual or collected)**		present	present	present	present	present	present	present	present	present
15												
16		**SUMMARY STATS:**										
17		**Total number of points sampled**	**225**									
18		**Total number of sites with vegetation**	**65**									
19		**Total number of sites shallower than maximum depth of plants**	**110**									
20		**Frequency of occurrence at sites shallower than maximum depth of plants**	**59.09**									
21		**Simpson Diversity Index**	**0.87**									
22		**Maximum depth of plants (ft)**	**13.50**									
23		**Number of sites sampled using rake on Rope (R)**	**102**									
24		**Number of sites sampled using rake on Pole (P)**	**122**									
25		**Average number of all species per site (shallower than max depth)**	**0.94**									
26		**Average number of all species per site (veg. sites only)**	**1.72**									
27		**Average number of native species per site (shallower than max depth)**	**0.83**									
28		**Average number of native species per site (veg. sites only)**	**1.59**									
29		**Species Richness**	**16**									
30		**Species Richness (including visuals)**	**20**									

	AP	AR	AT	BE	BI	BN	BP	BU	CQ	CZ	DA	DD	DE	DF	DG	DH	DI	DJ	DK	DL	DM	DN
1	ettum,Whorled water	exilis,Bushy pondweed	Najas marina,Spiny naiad	Nuphar advena,Yellow pond lily	Nymphaea odorata,White water lily	Potamogeton foliosus,Leafy pondweed	Potamogeton illinoensis,Illinois pondweed	Potamogeton praelongis,White-stem pondweed	Potamogeton richardsonii,Clasping-leaf pondweed	Potamogeton zosteriformis,Flat-stem pondweed	Stuckenia pectinata,Sago pondweed	Utricularia vulgaris,Common	Vallisneria americana,Wild celery	Zizania palustris,Northern wild rice	sp1	sp2	sp3	sp4	sp5	sp6	sp7	sp8	sp9	sp10
2																						
3																						
4																						
5																						
6																						
7	7.69	1.54			1.54	1.54	4.62	15.38	4.62	1.54	6.15											
8	4.55	0.91			0.91	0.91	2.73	9.09	2.73	0.91	3.64											
9	4.5	0.9			0.9	0.9	2.7	8.9	2.7	0.9	3.6											
10	0.00	0.00			0.00	0.00	0.00	0.01	0.00	0.00	0.00											
11	5	1			1	1	3	10	3	1	4											
12	1	1			1	1	1	1	1	2	1											
13		11	8	1	3			11	1		2											
14	present	present	present	present	present	present	present	present	present	present	present											
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Hooker Lake (Kenosha County, Wisconsin)
Integrated Sensitive Area Report

Date of Original Assessment: September 4, 2001
Date of Reassessment: June 12th, 2007

Number of Sensitive Areas Surveyed: 2

Site Evaluators: Doug Welch, Fisheries Biologist
Heidi Bunk, Lakes Biologist
Marty Johnson, Wildlife Biologist
Heidi Hopkins, Water Management Specialist
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General Lake Information

Hooker Lake is an 87-acre lake with a maximum depth of 24 feet. The lake is located in south central Kenosha County, Township 1 North, Range 20 East, Section 11. Hooker Lake is characterized as a drainage lake. The lake receives its water from two tributaries, groundwater seepage, precipitation, and runoff. An outlet connects the lake to Salem Brook which ultimately discharges to the Des Plaines River.

Two public boating access sites are located on Hooker Lake. One access meets the requirements of "adequate public access" as defined by NR 1.91(11), Wis. Adm. Code. Hooker Lake is host to a variety of recreational uses including, but not limited to fishing, hunting, canoeing, kayaking, boating and swimming. The Department of Natural Resources and Kenosha County both own land along the shoreline of Hooker Lake.

The mix of wetlands and submergent vegetation present on Hooker Lake provides critical habitat for a variety of fish and wildlife species. According to the DNR Fish Master File, 25 fish species have been documented in Hooker Lake. These species include: northern pike, largemouth bass, smallmouth bass, walleye, yellow perch, bluegill, pumpkinseed, black crappie, green sunfish, warmouth, grass pickerel, common carp, yellow bullhead, black bullhead, brown bullhead, channel catfish, Iowa darter, golden shiner, white sucker, common shiner, spotted sucker, emerald shiner, bluntnose minnow, central mudminnow and a State Special Concern species, lake chubsucker.

The aquatic plant management on Hooker Lake consists only of selective treatment of eurasian water milfoil with 2,4-D products. No mechanical harvesting takes place. Manual harvesting is conducted by many riparian landowners. The Hooker Lake Management District oversees aquatic plant management activities for Hooker Lake. In 2007, 9 acres in Hooker Lake were chemically treated for eurasian water milfoil.

Exotic Species

Exotic species, most notably curly leaf pondweed, eurasian water milfoil, and purple loosestrife have invaded southeastern Wisconsin lakes. Boaters traveling from lake to lake often facilitate the propagation of exotic species. The introduction of exotic species into a lake ecosystem can lead to a decline in the native plant population and cause problems with nutrient loading. Also, the disturbance of lake bottoms from human activity (boating, plant harvesting, chemical treatments, etc.) enhances the colonization and/or expansion of exotic species. Two simple steps to prevent the spread of exotic species include 1) Removing aquatic plants, animals, and mud from trailers and boats before leaving the water access; and 2) Draining water from boats, motors, bilges, live wells, and bait containers before leaving the water access.

Eurasian water milfoil is present in Hooker Lake. Eurasian water milfoil is one of eight milfoil species currently found in Wisconsin. It is often misidentified as one of its seven native cousins, and vice versa. In many areas within the Lakes, this non-native milfoil has established large monotypic stands that out compete many native plants. These dense beds of milfoil not only impede the growth of native plant species but also inhibit fish movement and create navigational problems for boaters.

The regenerative ability of eurasian water milfoil is another obstacle when attempting to control this species. Fragments of eurasian water milfoil detached by harvesting, boating, and other recreational activities can float to non-colonized areas of the lake or downstream to additional lakes in the drainage system and create new colonies. Therefore, when controlling eurasian water milfoil, selective chemicals and harvesting, coupled with skimming, often produces the best results. In some lakes, biological agents such as the milfoil weevil have helped suppress milfoil populations. However, the most effective “treatment” of exotic milfoil is prevention through public education.

Curly leaf pondweed is another submerged, exotic species found Hooker Lake. Like eurasian water milfoil, curly-leaf often grows into large, homogenous stands. It can crowd out native vegetation, create navigational problems, and limit fish movement. Curly-leaf pondweed dies off in mid-summer, increasing nutrient availability in the water column. This often contributes to summer algal blooms and decreasing water quality.

The unusual life cycle of curly leaf pondweed makes management difficult. The plant germinates as temperatures decrease in fall. Curly leaf is highly tolerant of cold temperatures and reduced sunlight, continuing to grow under lake ice and snow cover. With ice off and increasing water temperatures in the spring, the plant produces fruit, flowers, and buds (turions). Turions are the main reproductive mechanism of curly leaf. To control the species in lakes, the plant must be combated before turions become viable. Most plant harvesters have not started cutting when curly leaf is most susceptible and a small window of opportunity exists for chemical treatment. Therefore, prevention through public education is once again very important.

Purple loosestrife, a hardy perennial native to Europe, is another exotic species common to Wisconsin. Since its introduction to North America in the early 1800s, purple loosestrife has become common in gardens and wetlands, and around lakes, rivers, and roadways. The species is highly invasive and thrives in disturbed areas. Purple loosestrife plants often outcompete native plants, resulting in the destruction of food, cover, and nesting sites for wildlife and fish. Several stands of purple loosestrife have been documented on Hooker Lake.

Purple loosestrife most often spreads when seeds adhere to animals. Humans should be aware of picking up seeds on clothing and equipment when in the vicinity of the plant. Loosestrife can be controlled manually, biologically, or with a broad-leaf herbicide. Young plants can be pulled, but adult plants have large root structures and must be excavated with a garden fork. Biological control is most effective on large stands of purple loosestrife. Five different insects are known to feed on this plant. Four of those have been used as control agents in the United States. Of the five species, *Galerucella pusilla* and *G. calmariensis* are leaf-eating beetles; *Nanophyes brevis* and *N. marmoratus* are flower-eating beetles; and *Hylobius trasversovittatus* is a root-boring weevil. Only *N. brevis* has not been released in the United States (WDNR 2003). Lastly and most importantly, prevention through public education plays an important role in the management of this species.

Zebra mussels are native to the Baltic and Caspian Sea region or Eastern Europe, and were introduced to the great lakes via ballast water discharged from ocean-going vessels. These mussels attach to nearly every available surface – boats, docks, intake pipes, and are a great threat to native mussel populations. They are filter feeders, and thus eat plankton in the water column that many young fish and native mussels rely on for food. Zebra mussels begin their life cycle at a microscopic level. This stage of life stage is called a veliger. Water that is transferred from water body to water body can lead to new infestations by these veligers. Adults may also hitch a ride on aquatic plants that are transported from one body of water to another by means of boat trailers, river flow, or animal dispersion. Zebra mussels have not been documented in Hooker Lake.

Shoreland Management

Wisconsin's Shoreland Management Program, a partnership between state and local governments, works to protect clean water, habitat for fish and wildlife, and natural scenic beauty. The program establishes minimum standards for lot sizes, structural setbacks, shoreland buffers, vegetation removal, and other activities within the shoreland zone. The shoreland zone includes land within 1000 feet of lakes, 300 feet of rivers, and floodplains. Current research shows that present standards are probably inadequate for the protection of water resources. (Woodford and Meyer 2003, Garn 2002) Therefore, many communities have chosen to go beyond minimum standards to ensure protection of our natural resources. This report provides management guidelines for activities within the lake and in the immediate shoreland areas. Before any recommendations in this

report are completed, please check with the Department of Natural Resources and local units of government for required approvals.

A vital step in protecting our water resources is to maintain effective vegetative buffers. A shoreland buffer should extend from the water onto the land at least 35 to 50 feet. Studies have shown that buffers less than 35 feet are not effective in reducing nutrient loading. (Wenger, 1999) Wider buffers of 50 feet or more can help provide important wildlife habitat for songbirds, turtles, frogs, and other animals, as well as filter pollutants from runoff. (Castelle 1994) In general, no mowing should occur in the buffer area, except perhaps in a viewing access corridor. The plant composition of a buffer should match the flora found in natural Wisconsin lakeshores. A buffer should include three layers - herbaceous, shrub, and tree.

In addition, citizens living around Hooker Lake and the community at large should investigate other innovative ways to reduce the impacts of runoff flowing into the lake while improving critical shoreline habitat. (A. Greene 2003) This may include the use of phosphorus-free fertilizers, installing rain gardens, setting the lawnmower at a higher mower height, decreasing the area of impervious surfaces, or restoring aquatic plant communities.

Introduction

Department personnel conducted sensitive area designation surveys on Hooker Lake both on September 4th, 2001 and June 12th, 2007 following the Wisconsin Department of Natural Resources' sensitive area survey protocol. This study utilized an integrated team of DNR resource managers with input from multiple disciplines: water regulation and zoning, fisheries, lake biology, wildlife, and aquatic plant management. Two sites were identified on Hooker Lake as containing critical habitat and were therefore designated as sensitive areas. Map 1 provides the boundaries of each sensitive area.

Department biologists observed fifteen native aquatic plant species in sensitive area #1 and ten native aquatic plant species in sensitive area #2. Three exotic aquatic plant species were observed in these sensitive areas as well. These included eurasian water milfoil (*Myriophyllum spicatum*), curly leaf pondweed (*Potamogeton crispus*) and purple loosestrife (*Lythrum salicaria*).

Overview of Sensitive Area Designations

Sensitive areas have aquatic or wetland vegetation, terrestrial vegetation, gravel or rubble lake substrate, or areas that contain large woody cover (fallen trees or logs). These areas provide water quality benefits to the lake, reduce shoreline erosion, and provide habitat necessary for seasonal and/or life stage requirements of fish, invertebrates, and wildlife. A sensitive area designation alerts interested parties (i.e., DNR personnel, county zoning personnel, lake associations, etc.) that the area contains critical habitat vital to sustaining a healthy lake ecosystem, or may feature an endangered

plant or animal. Information presented in a sensitive area report is often utilized in the process of making Chapter 30 (Wisconsin State Statutes) permit decisions.

Sensitive areas are defined in Wisconsin Administrative Code NR 107.05 (3)(i)(1) as *areas of aquatic vegetation identified by the department as offering critical or unique fish and wildlife habitat, including seasonal or life stage requirements, or offering water quality or erosion control benefits to the body of water*. **Department resource managers determined that two areas of Hooker Lake met the criteria.**

Whole Lake Recommendations

These recommendations apply to Hooker Lake as a whole rather than a specific sensitive area.

1. Native aquatic plant beds should be protected and maintained for species diversity and to discourage invasion of exotic species.
2. Prevent the spread of exotic species through signage, education, etc. and control exotic species where established.
3. Compliance with Shoreland Zoning standards including setbacks, removal of nonconforming structures and limiting impervious surfaces.
4. Create shoreline buffers and maintain existing buffers, especially in areas not currently developed.
5. Monitor water quality for early detection of change and possible degradation.
6. Use phosphorus free lawn care to control nutrient runoff.
7. Establish a citizen lake monitor on Hooker Lake.

Resource Value of Sensitive Area #1

Sensitive Area #1 is located on the north side of Hooker Lake. The site is approximately 4000 feet long and has an average depth of 2 feet. Approximately two thirds of the frontage is owned by the Department of Natural Resources. This site was chosen because of the high value of the wetland plants for wildlife. Sensitive area #1 provides crucial habitat for many wildlife species. The aquatic bed/marsh wetland complex in this area provides quality habitat for marsh hawks, songbirds, ducks, geese, wading birds and some types of reptiles and amphibians. The wetland complex is important due to its relatively large size and adjacency to a large undeveloped upland corridor to the west.

The site was also chosen for the floating leaf and submergent aquatic vegetation, which provides spawning, nursery, feeding and protective habitat for northern pike, largemouth bass, panfish and minnow species. The aquatic plant diversity in this area is good with 16 native aquatic plant species documented as well 3 exotic aquatic plant species. Table 1 below lists the plant species observed and shows their relative abundance within sensitive area #1.

The plants create a nutrient buffer zone, utilizing lake nutrients (especially phosphorus) as part of their growth process, reducing the amount available for algal blooms. The root systems of the plants help stabilize the lake sediments. A biological and physical buffer zone is created by the dense plant beds. The dense beds reduce the ability for exotic plant species to invade Hooker Lake and protect properties from shoreline erosion. The shoreland buffer zone is wetland and dominated with herbaceous and shrub vegetation. The west half of the sensitive area's substrate is primarily silt, muck and detritus while the east portion is mostly sand. The natural scenic beauty in this area is average with minimal human impact.

Table 1. Plant Species Observed in Hooker Lake Sensitive Area #1

PRESENT (0-25%)	COMMON (26-50%)	ABUNDANT (51-75%)	DOMINANT (76-100%)
Shrubs *Salix* (willow)	**Emergents** *Impatiens* (jewelweed)	**Algae** Filamentous Algae	**Emergents** *Typha* (cattail)
Floating Leaf *Nuphar* (yellow water lily) *Nymphaea* (white water lilly)	**Pondweeds** *P. richardsonii* (clasping-leaf)	**Pondweeds** *Stuckenia pectinatus* (sago)	**Algae** *Chara* (muskgrass)
Submergents *Ceratophylum* (coontail) *Zosterella* (water stargrass) Native milfoil	**Exotics** *P. cripsus* (curly leaf) *Myriophyllum spicatum* (eurasian water milfoil)	**Submergents** *Vallisneria* (wild celery)	
Pondweeds *P.Illinoensis* (Illinois) *P. amplifolius* (Large-leaf pondweed) *P. Foliosus* (leafy pondweed)			
Exotics *Lythrum salicaria* (purple loosestrife)			

The vegetation and substrates in this area provide excellent spawning, nursery, feeding and protective habitat for northern pike and yellow perch. Largemouth bass and other sunfish will utilize this area for feeding, nursery and protective cover. In areas where the sunfish species can locate sand or sand/gravel bars under the fine substrates associated with this area, they too will use this area for establishing spawning nests. Table 2 below portrays the habitat each species relies on for the different stages of their respective life cycles.

Table 2. Sensitive Area #1 Plant Species and Substrates (Habitat) Utilized by Hooker Lake Resident Fish Species (2002 Survey)				
Fish Species	**Spawning**	**Nursery**	**Feeding**	**Protective Cover**
Walleye	Habitat lacking	Cattail, water lily, chara, coontail, wild celery, milfoil, pondweeds	Coontail, wild celery, milfoil, pondweeds	Coontail, milfoil, pondweeds
Northern Pike	Cattail, chara	Cattail, water lily, chara, coontail, wild celery, milfoil, pondweeds	water lily, coontail, wild celery, milfoil, pondweeds	Water lily, coontail, wild celery, milfoil, pondweeds
Smallmouth Bass	Habitat lacking	Cattail, water lily, chara, coontail, wild celery, milfoil, pondweeds	milfoil, pondweeds	Milfoil, pondweeds
Largemouth Bass	Coontail, watermilfoil Sand/gravel	Cattail, water lily, chara, coontail, wild celery, milfoil, pondweeds	Water lily, coontail, wild celery, milfoil, pondweeds, woody debris	Water lily, coontail, wild celery, milfoil, pondweeds, woody debris
Bluegill and Pumpkinseed	Sand/gravel	Cattail, water lily, chara, coontail, wild celery, milfoil, pondweeds	Water lily, coontail, wild celery, milfoil, pondweeds	Water lily, coontail, wild celery, milfoil, pondweeds
Black Crappie	*Chara* (muskgrass) Fine gravel and sand	Water lily, chara, coontail, wild celery, milfoil, pondweeds	pondweeds, milfoil, woody debris	pondweeds, milfoil, woody debris
Yellow Perch	woody debris, cattail, coontail, milfoil, pondweeds	Water lily, chara, coontail, wild celery, milfoil, pondweeds	pondweeds, milfoil	pondweeds, milfoil
Golden Shiner	Submergent vegetation (coontail, milfoil, pondweeds)	Submergent vegetation (coontail, *Chara*, milfoil, pondweeds)	Submergent vegetation (coontail, *Chara*, milfoil, pondweeds)	Submergent vegetation (coontail, *Chara*, milfoil, pondweeds)

Bluntnose Minnow	Underside of submerged objects (logs, rocks, bark or mussel shells) Sand/gravel shoals	Submergent vegetation (coontail, *Chara*, milfoil, pondweeds)	Submergent vegetation (coontail, *Chara*, milfoil, pondweeds)	Submergent vegetation (coontail, *Chara*, milfoil, pondweeds)

Management Recommendations for Sensitive Area #1

1. Do not remove fallen trees along shoreline, except where navigation is impaired. If navigation is impaired by a fallen tree, cut into smaller pieces and place outside of boating lane.

2. No chemical treatment should be allowed except to target an infestation of an exotic species such as purple loosestrife, eurasian water milfoil or curly leaf pondweed. Biological controls such as the purple loosestrife beetle and the milfoil weevil should be considered where appropriate.

3. No chemical treatment of eurasian water milfoil should occur adjacent to stands of susceptible aquatic plant species such as bladderwort or northern water milfoil.

4. Maintain the "Slow, No Wake" ordinance in this area of Hooker Lake. This ordinance minimizes boat motor disturbance of aquatic plants, fish and wildlife.

5. Minimize disturbance of the diverse stands of native aquatic vegetation.

6. Provide seasonal protection of fish spawning habitat.

7. Minimize disturbance of herbs, shrubs and trees on the shoreline to maintain wildlife habitat.

8. Mechanical harvesting should not be permitted.

9. New piers may be considered for a permit. However, additional piers are restricted to the existing, privately owned, developed shoreline. The number of moorings allowed will be less than listed in State Statutes 30.12 (1g) (f). The number of moorings permitted will be limited and based on the carrying capacity of the resource.

10. Limit manual harvesting to minimal swim/wading areas along the privately owned frontage. No manual harvesting should take place along the frontage of the state owned property. (*Manual removal of aquatic plants in Sensitive Areas must be permitted by DNR according to Wis. Adm. Code NR 109*).

11. Shoreline stabilization should not be needed in most areas of Sensitive Area # 1. If shoreline stabilization is needed, it must be accomplished by bioengineering.

12. A DNR permit should not be issued for any of the following:

Dredging	Pea gravel/sand blankets
Filling of wetlands	Recreational floating devices
Aquatic plant screens	Boat Ramps
Sea Walls/Retaining Walls/Riprap	Boardwalks

Resource Value of Site #2

Sensitive Area #2 is located in the southwestern corner of Hooker Lake. The approximate length of this site is 1000 ft with an average water depth of 4.5 ft. Kenosha County owns a small parcel on the north/northwest part of the bay. The location of the sensitive area habitat is the shoreline and littoral zone. The lake bed substrate consists of sand and muck. The shoreland area is approximately 33% wetland and 66% developed land with an abundance of lawns, some trees and herbaceous plants as well as a few shrubs. The natural scenic beauty rating in this area is poor, with major human disturbance. Important habitat components present at this site are emergent and submergent aquatic vegetation, floating leaf vegetation, and over-hanging vegetation.

This site was chosen due to the value of the aquatic plants for fish, amphibians and reptiles, as well as migratory waterfowl. The emergent vegetation is utilized by birds, frogs and turtles. Floating vegetation provides overhanging cover and shading for fish species and resting areas for frogs. Insect larvae hide underneath the blades of the plants, providing food for fish, frogs, turtles and birds. Table 3 below exhibits the plant species observed in sensitive area # 2 on Hooker Lake.

Table 3. Plant Species Observed in Sensitive Area # 2

PRESENT (0-25%)	COMMON (26-50%)	ABUNDANT (51-75%)	DOMINANT (76-100%)
Emergents *Impatiens* (jewelweed)	**Emergents** *Typha* (cattail)	**Floating Leaf** *Nuphar variegata* (spatterdock) *Nymphaea odorata* (white water lily)	**Submergents** *Ceratophylum* (coontail) *Ranunculus longirostris* (white water crowfoot)
Submergents *Myriophylum sibiricum* (northern water milfoil)	**Pondweeds** *P. richarsonii* (clasping-leaf pondweed)	**Pondweeds** *P. illinoensis* (Illinois pondweed) P. zosteriformis (Flat stem pondweed)	**Exotics** *Myriophylum spicatum* (Eurasian Water milfoil)
		Exotics *P. cripsus* (curly leaf)	

The combination of emergent vegetation and the silt/muck substrate provide an ideal spawning habitat for northern pike. Largemouth bass and other sunfish species will seek out sand and gravel areas for placement of spawning nests. Yellow perch will drape fertilized egg masses over woody debris and existing vegetation where available. All fish species can utilize the vegetative cover in sensitive area #2 for feeding, cover and resting areas. Table 4 below illustrates how some of resident fish species on Hooker Lake utilize the habitat in sensitive area #2.

Table 4. Sensitive Area # 2 Plant Species and Substrates (Habitat) Utilized by Hooker Lake Resident Fish Species

Fish Species	Spawning	Nursery	Feeding	Protective Cover
Walleye	Habitat lacking	Cattail, water lily, coontail, milfoil, pondweeds	Coontail, milfoil, pondweeds	Coontail, milfoil, pondweeds
Northern Pike	Cattail	Cattail, water lily, coontail, milfoil, pondweeds	Water lily, coontail, milfoil, pondweeds	Water lily, coontail, wild celery, milfoil, pondweeds
Smallmouth Bass	Habitat lacking	Cattail, water lily, coontail, milfoil, pondweeds	Milfoil, pondweeds	Milfoil, pondweeds
Largemouth Bass	Coontail, watermilfoil Sand/gravel	Cattail, water lily, coontail, milfoil, pondweeds	Water lily, coontail, wild celery, milfoil, pondweeds, woody debris	Water lily, coontail, wild celery, milfoil, pondweeds, woody debris
Bluegill and Pumpkinseed	Sand/gravel	Cattail, water lily, coontail, milfoil, pondweeds	Water lily, coontail, wild celery, milfoil, pondweeds	Water lily, coontail, wild celery, milfoil, pondweeds
Black Crappie	*Chara* (muskgrass) Fine gravel and sand	Water lily, coontail, milfoil, pondweeds	pondweeds, milfoil, woody debris	pondweeds, milfoil, woody debris
Yellow Perch	woody debris, cattail, coontail, milfoil, sago, clasping leaf	Water lily, coontail, milfoil, pondweeds	pondweeds, milfoil	pondweeds, milfoil

Golden Shiner	Submergent vegetation (coontail, milfoil, pondweeds)	Submergent vegetation (coontail, milfoil, pondweeds)	Submergent vegetation (coontail, *Chara*, milfoil, pondweeds)	Submergent vegetation (coontail, *Chara*, milfoil, pondweeds)
Bluntnose Minnow	Underside of submerged objects (logs, rocks, bark or mussel shells) Sand/gravel shoals	Submergent vegetation (coontail, milfoil, pondweeds)	Submergent vegetation (coontail, *Chara*, milfoil, pondweeds)	Submergent vegetation (coontail, *Chara*, milfoil, pondweeds)

Management Recommendations for Sensitive Area #2

1. Do not remove fallen trees in the bay, except where navigation is impaired. If navigation is impaired by a fallen tree, cut into smaller pieces and place outside of boating lane.

2. No chemical treatment should be allowed except to target an infestation of an exotic species such as purple loosestrife, eurasian water milfoil or curly leaf pondweed. Biological controls such as the purple loosestrife beetle and the milfoil weevil should be considered where appropriate.

3. No chemical treatment of eurasian water milfoil should occur adjacent to stands of susceptible aquatic plant species such as bladderwort or northern water milfoil.

4. Maintain the "Slow, No Wake" ordinance in this area of Hooker Lake. This ordinance minimizes boat motor disturbance of aquatic plants, fish and wildlife.

5. Minimize disturbance of the diverse stands of native aquatic vegetation, especially the lily pads and bulrushes on the northern side of the bay.

6. Mechanical harvesting should not be permitted.

7. New piers may be considered for a permit. The number of moorings allowed will be equal to that listed in State Statutes 30.12 (1g) (f). The shoreline is already extensively developed. As a result, the number of additional moorings permitted will be limited and based on the carrying capacity of the resource.

8. Limit manual harvesting to minimal swim/wading areas along the privately owned frontage. (*Manual removal of aquatic plants in Sensitive Areas must be permitted by DNR according to Wis. Adm. Code NR 109*).

9. Any replacement of the existing shoreline stabilization practices must include an element of bioengineering such as vegetated rip rap and biologs.

10. Installation of buffer strips along the highly developed shoreline is strongly recommended.

11. A DNR permit should not be issued for any of the following:
    Dredging
    Filling of wetlands
    Pea gravel/sand blankets
    Aquatic plant screens

Conclusion

Two sensitive areas were designated on Hooker Lake. Three quarters of the shoreline is highly developed. The lake is heavily used for fishing and pleasure boating. The wetland complex located on the north and northwest shorelines of the lake provides a reasonably large refuge for wildlife. The protection of the submergent and floating leaf aquatic plants found in the two sensitive areas is critical to maintaining the fishery in Hooker Lake.

Eurasian water milfoil has increased in coverage and density in recent years. Boating disturbance through the milfoil beds is likely the cause of much of the spread of eurasian water milfoil. The Hooker Lake Management District is currently applying for a lake planning grant. The grant, if awarded, would be used to conduct a plant survey and develop an aquatic plant management plan.

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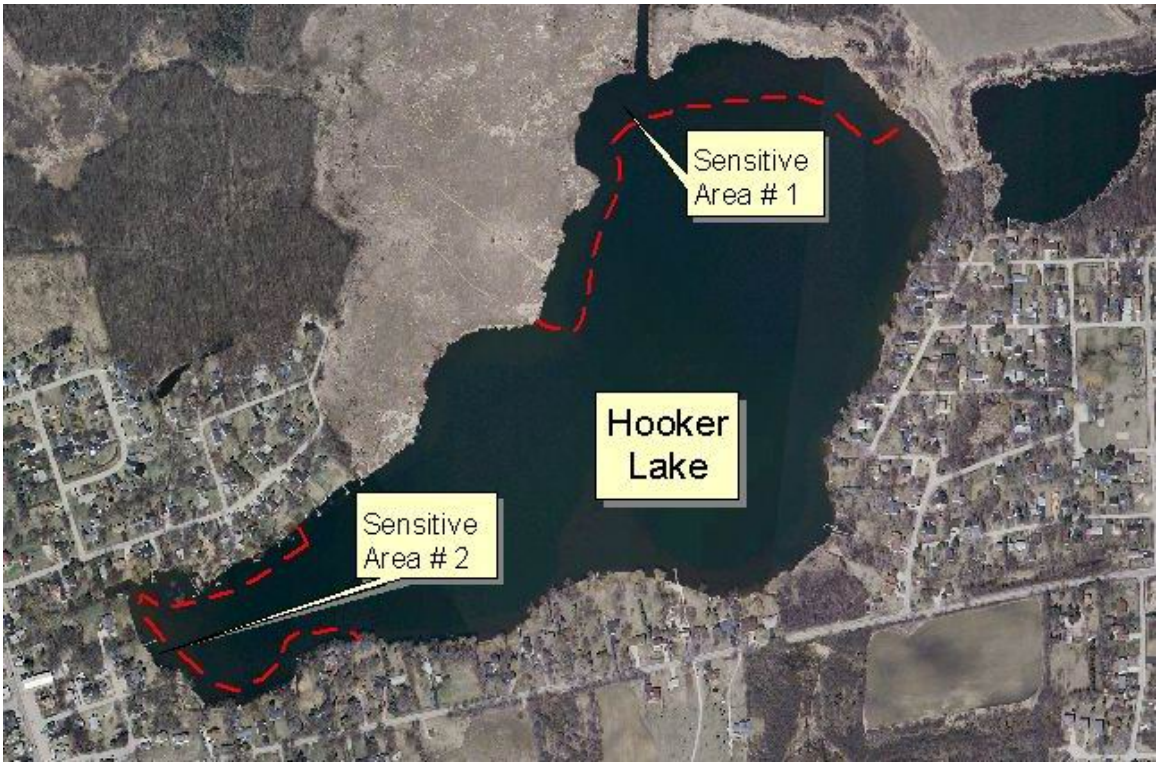
Sensitive
Area # 1
Hooker
Lake
Sensitive
Area # 2

Lake Water Quality 2004 Annual Report

Hooker Lake
Kenosha County
Waterbody ID Number: 738400

Lake Type: DRAINAGE
DNR Region: SE
GEO Region: SE

Site Name	Station ID
Hooker Lake - Deep Hole	303053

Date	SD (feet)	SD (meters)	Hit Bottom?	CHL	TP	TSI (SD)	TSI (Chl)	TSI (TP)	Lake Level	Staff Gauge	Clarity	Color	Perception
05/12/2004	3.9	1.2	NO		31	57		55					
08/17/2004	5.2	1.6	NO		31	53		55					

05/12/2004		
Depth	Temp.	D.O.
FEET		MG/L
1		12.4

Date	Fieldwork Comment
05/12/2004	DEEP HOLE
08/17/2004	DEEP SPOT @ 24FT - INTEGRATED WATER COLUMN

Date	Lab Comment
05/12/2004	Temp at lab - iced.

Date	Data Collectors	Project
05/12/2004	Heidi Bunk	BASELINE MONITORING
08/17/2004	Heidi Bunk	BASELINE MONITORING
08/17/2004	Heidi Bunk	Lakes Baseline and Trends Monitoring

SD = Secchi depth measured in feet converted to meters; Chl = Chlorophyll a in micrograms per liter (ug/l); TP = Total phosphorus in ug/l, surface sample only; TSI(SD),TSI(CHL),TSI(TP) = Trophic state index based on SD, CHL, TP respectively; Depth measured in feet; Temp = Temperature in degrees Fahrenheit; D.O. = Dissolved Oxygen in parts per million.