Okauchee Lake

Aquatic Plant Management Plan
2009

Aron & Associates

30910 Royal Hill Rd
Burlington, WI 53105
(262) 514-3234
aronasoc@tds.net

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CHAPTER 1

INTRODUCTION

Okauchee Lake is located in the Towns of Merton and Oconomowoc, Waukesha County in Southeast Wisconsin. Discussions of Okauchee Lake include Lower Okauchee and Upper Oconomowoc Lakes. All three are managed by the Okauchee Lake Management District (OLMD).

This plan presents an inventory of the aquatic plant communities in Okauchee Lake and discussions with respect to the various options for long term management of the aquatic plants. This plan is a re-assessment of the previous plan. This plan may also be used as a component of a comprehensive lake management plan.

The difficult task facing those who attempt to manage aquatic plants is that user needs often conflict. Fish and wildlife need aquatic plants to thrive. Boaters and swimmers desire relief from nuisance aquatic plants. Those using the lake for “aesthetic viewing” desire an undisturbed lake surface. Balancing all of these user needs takes a continuous effort.

The OLMD was created in 1977 and began harvesting the same year. Prior to 1977, the Okauchee Lake Civic Association performed harvesting operations on Okauchee Lake. The harvesting program under the District has operated effectively and efficiently in providing nuisance relief.

The District’s harvesting program keeps the lake free from nuisance aquatic plants for the enjoyment and safety of all recreational users. The OLMD intends to use this plan to effectively manage the lake’s aquatic plant management program, and to define educational opportunities for lake residents and users.

The harvesting program on Okauchee Lake is considered essential by many to maintain a reasonable level of recreational use by the community. It has been fully supported by the local citizens and may be helping to minimize the further spread of Eurasian watermilfoil and wild celery.

The District’s program has been supervised by the OLMD board and a program manager. The property owners and lake users are satisfied with the operation, and responsiveness of the aquatic plant management program, although annual variabilities in aquatic plants and densities can lead to complaints by residents and lake users.

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

The management of non-native plants, specifically, Eurasian watermilfoil (*Myriophyllum spicatum*), curly-leaf pondweed (*Potamogeton crispus*), and wild celery (*Vallisneria americana*) are of great concern to the District. The District has a long aggressive history of battling nuisance exotic species. Controlling the exotic plants and protecting and increasing the native plant population is crucial to the long range goals of the District.

- Restore native plant communities and ecologically valuable areas to maximize diversity and the stability of the aquatic ecosystem.
    - —Encourage landowners to protect native species.
    - —Use chemical treatments in small bays and shoreline areas where appropriate.
    - —Minimize fragments of aquatic plants.
    - —Keeping Eurasian watermilfoil and curly-leaf pondweed from expanding their range.
    - —Conducting regular monitoring of water quality and aquatic plant communities.

- Maintain navigational access:
    - — Aggressively manage Eurasian watermilfoil, curly-leaf pondweed, and wild celery to prevent them from increasing their range in the Lake.
    - — Maintain navigational access by controlling plants as necessary to maintain access.
- Preserve and enhance the natural lake environment by:
    - —Educating landowners and lake users in lake ecology using various means, including newsletters, public meetings, and other lake-oriented events.
- Work with the Towns, County and State governments (WDNR, WDATCP, etc) to:
    - —Review existing ordinances, and if necessary, develop and enforce ordinances to protect Okauchee Lake.
    - —Continue to improve the watershed to protect Okauchee Lake.
    - —Identify and expand local educational efforts to improve the public's understanding of lake issues
    - —Encourage community participation in lake management activities.
- Conduct in-lake management activities with the long-range goal of minimizing the management as much as possible by:
    - —Conducting year-end evaluations as to the success of plant management activities and the community reaction to the activities.
    - —Tracking annual progress of lake management activities.

To measure whether the District has met the goals and objectives, the following parameters should be used:

- Whether recreational access to the open water speed boat area has been maintained.
- Whether property owner access to the open water speed boat area has been maintained.
- Whether plant survey data in 3 to 5 years shows a decrease in Eurasian watermilfoil and curly-leaf pondweed frequency and density.
- Whether plant survey data in 3 to 5 years shows an increase in diversity, frequency, and density of native aquatic plants.
- If in-lake shoreline emergent vegetation has been established.
- If residents have created any shoreline buffer zones.
- Whether or not surveys have shown that additional aquatic invasive species have been identified as present in Okauchee Lake.
- Whether secchi measurements and/or water quality measurements have shown an improvement.

CHAPTER 2

BACKGROUND

Physical Description

The Okauchee Lake watershed is divided into two portions. The direct tributary drainage area, as delineated by the Southeastern Wisconsin Regional Planning Commission (SEWRPC, 1981) is 5.26 square miles. The total drainage area is 70.19 sq. miles. Using the direct drainage area, Okauchee Lake has a low watershed to lake surface area ration of 2.6:1. However, using the total drainage area, the ratio increases to 35:1. Lakes with low ratios are typically found to have better water quality because there is less opportunity for negative impacts from nonpoint source pollution problems.

The hydrographic and morphologic data for Okauchee Lake is shown in Table 1. The lake is 1198 acres and has a maximum depth of 115 feet.

The shore development factor is 3.1 which means the lake has 3 times as much frontage as a circular lake of the same area.

Table 1

Hydrography and Morphology of Okauchee Lake Waukesha County, Wisconsin, 2008
Area = 1198 acres
Shore length = 15.2 miles
Shore development factor* = 3.1
Maximum depth = 115 feet
Mean depth = 25 feet
Volume = 29,788 acre feet
Maximum length = 2.2 miles
Maximum width = 1.4 miles
Watershed area = 70.19 sq. miles
Ratio of watershed area to lake area = 2.6 for direct drainage area = 35 total drainage area.

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

Source: Wisconsin Department of Natural Resources.

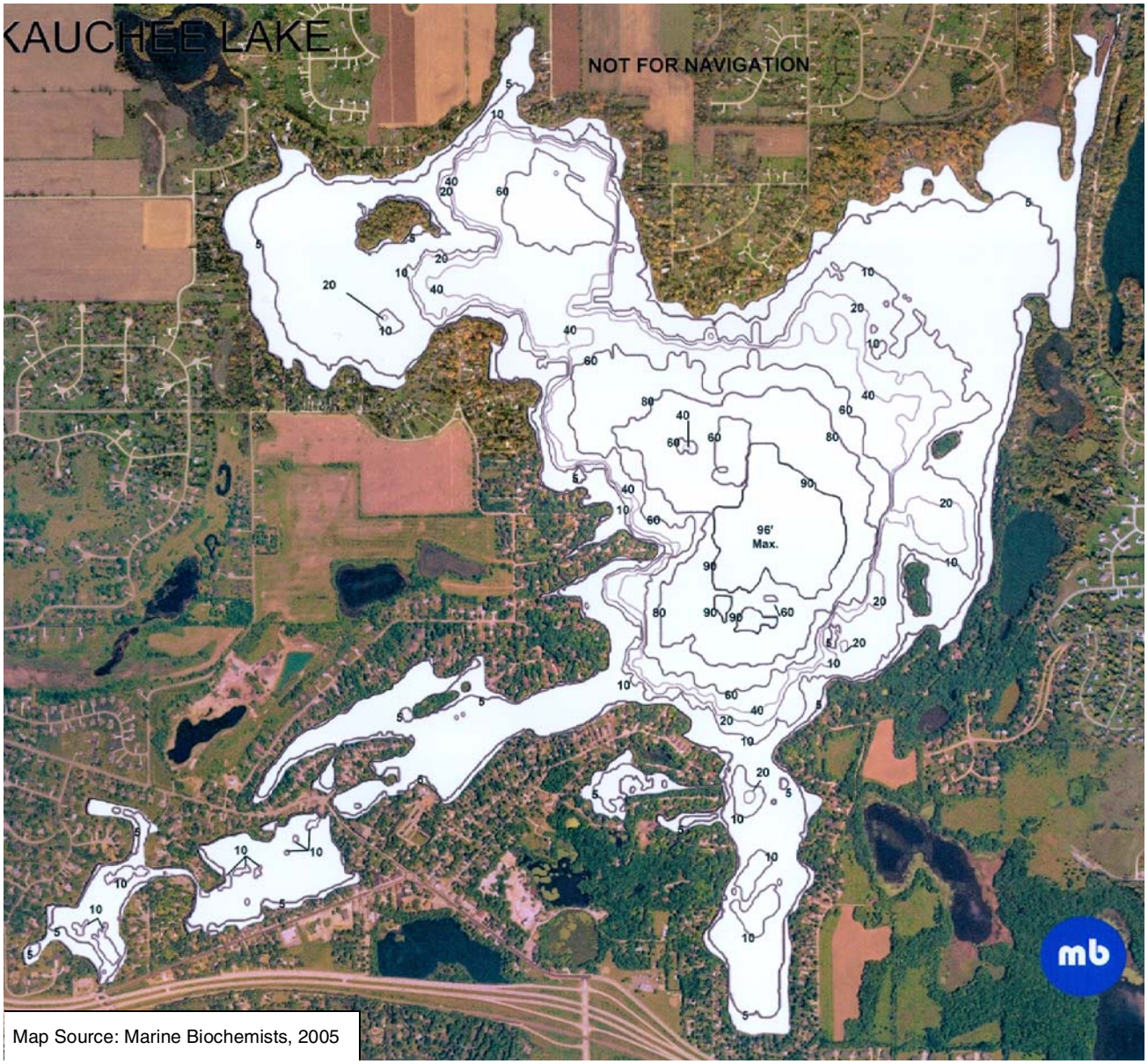

Figure 1. Okauchee Lake Depth Map.

Watershed

The Okauchee Lake shoreline is primarily dense urban residential land use, while the outlying areas of the watershed are in primarily agricultural land uses. For more specific details on land use within the Okauchee Lake watershed, refer to *A Water Quality Management Plan for Okauchee Lake,* Waukesha County Wisconsin, Community Assistance Planning Report No. 53, by SEWRPC, 2003.

Land use activities can directly affect plant growth patterns in the lake. The runoff from individual homesites, development, and agricultural lands adds to the nutrients and sediments in a lake. That in turn contributes to the plant growth, sometimes to nuisance conditions. To see this affect, it is helpful to look at storm drain outlets that may exist to see the more concentrated effects of rural and urban impacts. Often, the lake area near storm drains has different plant and sediment characteristics than other areas of the lake. Nutrients, sediments and other materials entering the lake can severely impact the plants, fish and wildlife. Some of the negative results can produce lower oxygen levels, fish kills and sediment filling in spawning beds and macro invertebrate habitat. Public and property owner education should focus on activities to minimize their impact on the lake.

Aesthetic Features

Although most of the shoreline of Okauchee Lake is developed, there are a number of wooded and natural areas that are aesthetically pleasing to lake users. Wittegers Bay and the Northeastern shoreline provide wildlife habitat and more pleasurable visual experiences. The limited adjacent wetlands, in Cranes Nest Bay and the Inlet area, provide wildlife habitat and important fish habitat. The small islands also provide natural relief from the developed shorelines. The naturalness of these areas provides lake users and residents with relief from the urban landscape.

Access Locations

Okauchee Lake meets the Wisconsin Department of Natural Resources (WDNR) standards for public access to an inland lake. There are two public boat access sites. One is located at the Southwest end of Lower Okauchee Lake. This access is owned by the Wisconsin Department of Natural Resources (WDNR). The second access point is located at the Northwestern end of the lake just South of Stumpy Bay and is owned and operated by the Town of Ocnomowoc. There are also multiple privately owned and operated access points.

Lake Use

Okauchee Lake receives a high degree of recreational pressure because of its size, quality, and proximity to large urban areas. The majority of recreational uses are scenic viewing, power boating, water skiing, swimming and fishing. The lake receives its greatest use during the weekends and holidays. During the weekdays the lake usually has relatively light traffic and there is plenty of room for all activities to take place.

Boating Ordinance

Okauchee Lake lies within the municipal boundaries of the Towns of Merton and Oconomowoc. The Towns have adopted boating ordinances that are periodically updated. Some of the major points of the boating ordinance are:

- 10 mph speed limit from sunset to 8 am.
- 40 mph speed limit from 8 am to sunset
- Slow no wake from Little Okauchee Lake extending Eastward to the mouth of the channel, including Bay Five and Park Bay.
- Slow no wake zone 100 feet South of the Oconomowoc River.

Ordinances are enforced by the lake patrol that is operated by the Town. During high lake use time periods, the WDNR and Waukesha County provide assistance. The Lake Patrol provides an annual report to the OLMD.

Fishery

Okauchee Lake has good largemouth bass, true muskellunge, northern pike, walleye, and panfish populations. The high degree of development and lack of natural shoreline limit the area available for spawning and nursery habitat for game fish. The wetland area at the northeastern end of the lake and the small quiet bays provide habitat for fish.

Wildlife

Okauchee Lake shoreline is developed and receives a high level of use. This restricts the value of the resource to wildlife during the summer months. Waterfowl frequent the lake mostly during spring and fall migration.

Okauchee lake has a significant amount of muskgrass and wild celery that are valued as good food sources for waterfowl. The wetland areas along the Northern shore where the Oconomowoc River enters Okauchee Lake provides good habitat for wildlife.

Environmentally Valuable 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.

Because of the development around Okauchee Lake and the amount of recreational use the lake receives, the potential value of the resource to fish and wildlife is restricted.

The WDNR administers a Sensitive Area Designation under NR 107 which guides their aquatic plant management program. The program seeks to protect native vegetation that is important to fish and wildlife. The WDNR may also request that other limitations be placed on activities that would prove detrimental to the native plants. These restricted activities may include dredging, filling, shoreline alterations or sand blankets.

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, and native species re-introductions, among others.

WDNR has conducted some field assessments on Okauchee Lake. The preliminary results show that three areas were determined by WDNR to be environmentally valuable. The first area is the confluence of Okauchee Lake, the Oconomowoc River and Crane's Nest Bay. This area is of particular importance during spawning season. The second area is Whittegers Bay. The third area is along the Eastern shore around the island. WDNR has also indicated that Tierney Bay is especially important to the fisheries on Okauchee Lake.

There has been much debate in the community about the WDNR Sensitive Areas, the potentially affected areas on Okauchee Lake, and what should or shouldn't be done. In part becase of the debate, the formal process to designate areas on Okauchee Lake has not been completed. In addition, there has been a significant change in the aquatic plant communities in some of these areas which could affect the area's values. It is recommended that before WDNR completed Sensitive Area designations on Okauchee Lake, a re-evaluation of the lake should be conducted by the appropriate WDNR staff to confirm the initial determinations.

Water Quality

Okauchee Lake has a volunteer water quality monitor collecting data working in cooperation with WDNR's volunteer program. In addition, the USGS conducts a baseline water quality monitoring program on the lake on a rotating basis.

The USGS North sampling site shows the lake is mesotrophic/eutrophic. The USGS South sampling site shows a slightly higher quality lake in the mesotrophic range.

Water quality data are available online through the WDNR website at the following link:

//dnr.wi.gov/lakes/CLMN/reportsanddata/reports

The District should continue to monitor Okauchee Lake, and should maintain a core of trained volunteers to ensure continued data collection. The 2008 DNR Water Quality report is included in the Appendix, along with the 2005 USGS report.

Exotic Species

During the aquatic plant survey, Okauchee Lake was evaluated for exotic species. 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.

Zebra mussels have been found in Okauchee Lake since 2004. Educational programs should focus on the preventative actions that can be taken by lake users to prevent the introduction of invasive, exotic species. This can include newsletters and boat launch signage and programs that explain how exotics are transferred from lake to lake and what actions can be undertaken by individuals to prevent infestation.

CHAPTER 3

AQUATIC PLANTS

Background

Aquatic plants are very important to the health of the lake. They provide food and cover for fish and wildlife as well as contributing to dissolved oxygen production. Invertebrates, upon which fish depend 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 bind 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 or recreational use activities. Loss of diversity or an increase in nuisance species can signal the existence of watershed problems.

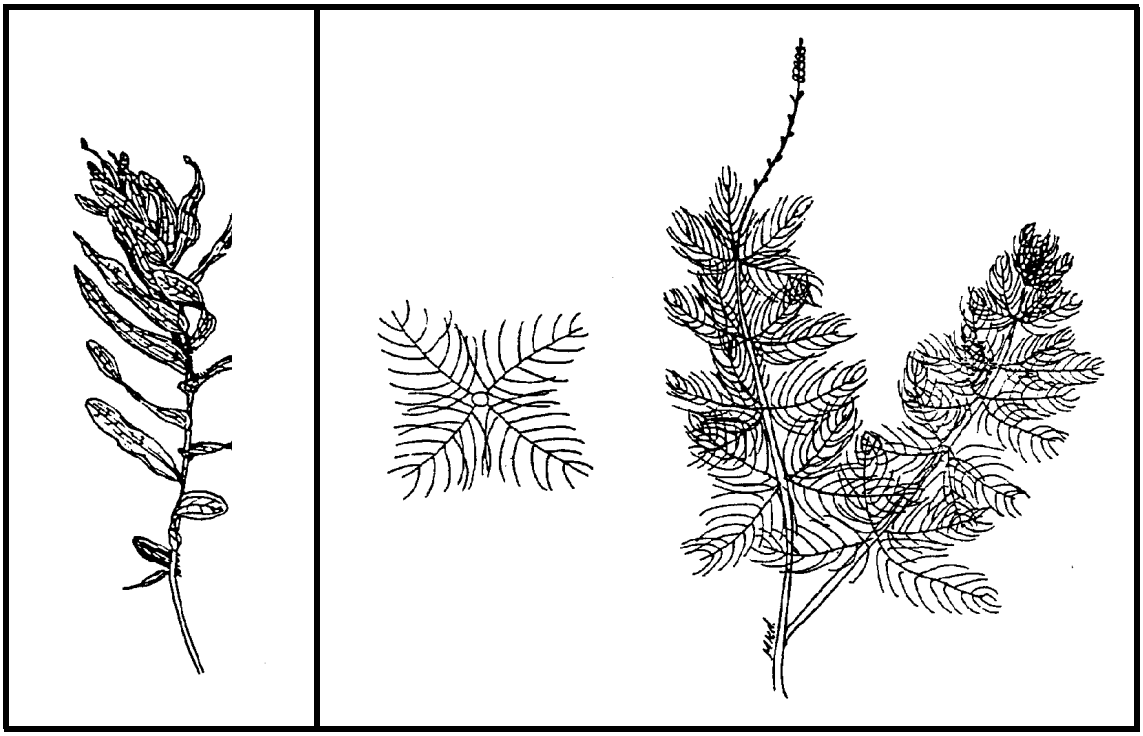

Figure 2. Two exotic species: Curly-leaf Pondweed and Eurasian Watermilfoil.

Many aquatic plants are important food sources for waterfowl. Others provide habitat, spawning and shelter areas for fish and amphibians. Exotic plants 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 stressing the plants. Protection of native species is an important means of reducing problems from exotic species. Just as crabgrass and dandelions are the first plant to invade a disturbed area of a backyard, Eurasian watermilfoil 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, muskgrass, and others. 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, duckweed, and water hyacinth. Freely-floating plants are found where ever the winds and water current takes 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 is well lit with coarse sediments and fluctuating water temperatures.

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

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

Aquatic Plant Surveys

Determining what plants are present in a lake can be done a number of different ways. One method, which includes transect or point-intercept surveys, is to measure the species composition, frequency, and densities of aquatic plants at a number of points around a lake. Another method, 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. Transect or point-intercept surveys usually include a general survey.

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.

It is unlikely that surveys, even those conducted the same year, will produce the exact same plant list. The time of year, method used, and variation in GPS will all contribute to differences in results. What is important is that overall trends be evaluated, as well as data on the spread of exotic species.

The aquatic vegetation of Okauchee Lake was previously surveyed by various entities, including Environmental Resource Assessments (1977), Aron and Associates, (1992 and 1998), SEWRPC (2000).

During the 2008 survey, a total of 24 species were observed in Okauchee Lake. The maximum rooting depth was determined to be 15 feet. The dominant species was sago pondweed (*Stuckenia pectinata*) with Muskgrass (*Chara* sp.) having moderate to heavy abundance in near shore areas.

Plant Descriptions

Pondweeds

Pondweeds are important species of plants for a lake. Pondweeds do not grow as dense and they do not create a dense canopy like 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 like Eurasian watermilfoil. Plant management on lakes should focus on protection and enhancement of the pondweeds, while controlling nuisance species. Okauchee Lake has a good variety of pondweeds.

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.

The Wisconsin Legislature sought to protect native pondweeds in 1989 with the passage of NR107. That legislation names 12 aquatic plant species that should be protected and enhanced. Those protected plants that are found in Okauchee Lake include *Potamogeton amplifolius*, *P. richardsonii*, *P. praelongus*, *P. illinoensis, Stuckenia pectinata,* and *Vallisneria americana*. Other high value plants in Okauchee Lake include *P. gramineus, P zosterformis*, and *Utricularia vulgaris*.

Coontail (*Ceratophyllum demersum*)

Coontail is a freely floating plant that has no roots. The plant is similar in appearance to Eurasian watermilfoil. Coontail is tolerant of low light conditions and will drift around a lake. It grows year-round. The plant can reach densities that impair recreational use. The plant provides good habitat for invertebrates. The foliage and fruit are a source of food for waterfowl. Coontail is present in Okauchee Lake.

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 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.

Two of the most effective means of control of 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 could be used. 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. Curly-leaf pondweed is present in Okauchee Lake. In the 2008 survey, it was only found in one sample point, but the District should watch for any spread of the plant and react quickly to control it.

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 (WND, 1988). Eurasian watermilfoil stands have been found to support fewer macroinvertebrates 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 a dominant plant in Okauchee Lake. Because it is unknown how long the plant has been in Okauchee Lake, total elimination of the plant from the system is unlikely. However, management activities should focus on protection of native plants, and management of Eurasian watermilfoil to minimize the spread of the plant. Non-management of Eurasian watermilfoil will lead to a decline in the density and frequency of native plants and possibly a loss of species diversity.

Eurasian watermilfoil is a problem on Okauchee Lake. Eurasian watermilfoil grows throughout the littoral zone dominating the 4 to 15 foot zones.

Muskgrass (*Chara* sp.)

Muskgrass 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 will not thrive in lakes with high turbidity problems. Muskgrass is more commonly found in areas with firm substrates. Muskgrass is an excellent producer of fish food for large and small mouth bass (Fasset 1985). When commonly found in a lake, muskgrass is often a dominant plant in shallow, firm bottom areas of a lake. However, it can reach nuisance conditions, especially if a lake level drops during the summer. When the muskgrass beds become very large and dense, they can “break away” from the sediments and rise to the surface, blocking boating access and collecting debris. Muskgrass is a dominant plant in Okauchee Lake dominating the 1 to 5 foot contours.

Wild Celery (*Vallisneria americana*)

Wild celery is a perennial plant that prefers hard substrates. The seeds and foliage are considered an excellent food source for waterfowl. Wild celery provides prime spawning habitat for northern

pike. In late March to early April, the northern pike spawn on 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. As part of its natural life cycle, wild celery will release from the sediments and float to the surface of the lake. The plant is then able to establish in new areas. Wild celery may grow to nuisance levels. In lakes with such a high density of wild celery such as Okauchee Lake, the floating plants are a large part of the aquatic plant problems on the lake. The plants create large floating mats and can collect in very large quantities along the shorelines. Wild celery is a dominant plant in Okauchee Lake.

Sago Pondweed

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

Sago pondweed is present in Okauchee Lake.

Coontail

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

Okauchee Lake Aquatic Plants

An aquatic plant survey was conducted by Aron & Associates in July of 2008. The aquatic plants observed in Okauchee Lake during the survey are listed in Table 2. A total of 24 aquatic plant species were observed. The survey was a transect survey, duplicating sample points done by SEWRPC in 2000.

Eurasian watermilfoil was not growing above the surface anywhere on the lake and so appears to be effectively controlled by the management efforts of the District.

In general, the aquatic macrophyte population of Okauchee Lake is dominated primarily by Eurasian watermilfoil (*Myriophyllum spicatum*), Muskgrass (*Chara* sp.), and wild celery (*Vallisneria americana*). The maximum rooting depth was determined to be 15 feet, similar to previous years. Muskgrass dominated the plant populations at depths of 1 to 5 feet while Eurasian watermilfoil was most commonly found in depths of 4 to 15 feet. In the small shallow bays, the soft sediments support the high populations of Eurasian watermilfoil.

A comparison of the 2008 survey to those of the earlier surveys reveals that in general the species have not changed significantly.

Chara, Eurasian watermilfoil, and wild celery are the dominant species in the lake. Nine pondweed species are present. A total of 24 species were documented in 2008. Okauchee Lake has a Floristic Quality Index (FQI) for 2008 of 27.3. The higher the FQI numbers for a site, the higher floristic quality, biological integrity, and the lower level of disturbance impacts.

In 2008, a larger scale chemical treatment was conducted in Bay Five on Okauchee Lake. This bay is a shallow bay with lots of diverse native plants and Eurasian watermilfoil. As Eurasian watermilfoil has increased in some years, native plant diversity and coverage has declined. The 2008 treatment effectively controlled Eurasian watermilfoil in most of the bay, with the exception of the North end, near the island. Other than the island area of the bay where large areas of Eurasian watermilfoil still remained, only occasional isolated stems remained in the bay during the follow-up inspection. Eurasian watermilfoil dropped from 84% frequency to 30% frequency.

Table 2 Percent Frequency of Plants in Bay Five, Pre-and Post Chemical Treatment for EWM

Plant Species	% Frequency Pre-Treatment	% Frequency Post-Treatment
Ceratophyllum demersum	21	20
Chara sp.	79	85
M. spicatum	84	30
Najas flexilis	32	50
P. gramineus	37	50
P. illinoensis	5	10
P. praelongus	11	10
P. zosteriformis	32	35
Stuckenia pectinata	16	10
Utricularia vulgaris	21	20
Vallisneria americana	58	65

This is similar to the results seen in previous “test” treatments. Tierney Bay, Whittegers Bay, among others have been successfully treated for Eurasian watermilfoil. Some of these areas have seen two years of results from the treatments. Native plants in Tierney Bay respond very well to efforts to keep the Eurasian watermilfoil in check. The other shallow bays tend to collect Eurasian milfoil fragments from the open water areas, where they root and spread. The chemical treatments allow the District to minimize the Eurasian watermilfoil problems, lessening the times needed to go into the bays with the large harvesters. The treatments have provided better opportunities for growth of native plants. The smaller skimmer is then used to collect fragments in the bays.

Discrepancies in the species lists over time occur for a variety of reasons. Some of the differences between the survey results can be attributed to differences in survey methodology. The size of the lake makes it impossible to identify each plant present. Also, a variety of survey techniques have been used over the years, from detailed transect surveys to a limited inspection of parts of the lake. This adds to the possibility of discrepancies. Many records of the early surveys identify only the species present and the perceived density of the plant species, without detailed descriptions of the survey techniques that were followed. Another factor influencing species diversity may be the actual identification of the various species, especially the difficult to identify narrow-leafed pondweeds.

Table 3

Value of the Aquatic Plant Species in Okauchee Lake, 2008		
Scientific Name	**Common Name**	**Ecological Significance**
Ceratophyllum demersum	Coontail	Provides good shelter for young fish. Supports insects valuable as food for fish and waterfowl.
Chara sp.	Muskgrass	Excellent producer of fish food, especially young bass and trout. Stabilizes bottom sediments.
Elodea canadensis	Elodea	Provides shelter for insects. Valuable as fish food.
Lemna minor	Duckweed	Provides food for waterfowl, muskrat, beaver, and fish. Provides shade for fish and inverbrates. Large mats Inhibit mosquito breeding.
Myriophyllum spicatum	Eurasian Watermilfoil	A non-native, exotic plant species. No ecological significance known.
Najas flexilis	Slender Naiad	Stems, foliage and seeds important waterfowl food. Produces food and shelter for fish.
Najas marina	Spiny Naiad	Provides food for waterfowl.
Nitella sp.	Nitella	Provides food for fish.
Nuphar sp.	Yellow Water Lily	Leaves, stems, and flowers are eaten by deer. Roots eaten by beavers. Seeds eaten by waterfowl. Leaves provide harbor to insects, and shade and shelter for fish.
Nymphaea sp.	White Water Lily	Provides shade and shelter for fish. Seeds eaten by waterfowl. roots and stalks eaten by muskrats. Roots eaten by beaver and deer.
Potamogeton amplifolius	Large-leaf Pondweed	Provides support for insects. Produces food supply for fish and waterfowl.
P. crispus	Curly-leaf Pondweed	A non-native, exotic plant species. Provides food, shelter, and shade for some fish and waterfowl.
P. friesii	Fries Pondweed	Fruit is used by waterfowl. The plant provides food for muskrat, beaver, deer and moose. The plant provides habitat for invertebrates and foraging opportunity for fish.
P. gramineus	Variable Pondweed	Fruits and tubers are used by waterfowl. Foliage and fuit provides food for muskrat, beaver, deer and moose. The branching of leaves provides habitat for invertebrates and foraging opportunity for fish.
P. illinoensis	Illinois Pondweed	Provides some food for waterfowl and shelter for fish.
P. natans	Floating-leaf Pondweed	Roots and nutlets provide food for ducks. Provides good habitat for fish.
P. richardsonii	Clasping-leaf Pondweed	Fruit is used by waterfowl. The plant provides food for muskrat, beaver, deer and moose. The plants provides habitat for invertebrates and foraging opportunity for fish.
P. zosteriformis	Flat-stem Pondweed	Provides food for waterfowl.

Table 3

Value of the Aquatic Plant Species in Okauchee Lake, 2008		
Scientific Name	**Common Name**	**Ecological Significance**
Zosterella dubia	Water stargrass	Provides food and spawning habitat for fish.
Stuckenia pectinata	Sago Pondweed	Is the most important pondweed for ducks. Provides food and shelter for fish.
Utricularia vulgaris	Bladderwort	Stems provide food and cover for fish.
Vallisneria americana	Water Celery, Eel Grass	Provides shade and shelter. Supports insects. Is valuable fish food. Provides food for turtles and shelter for frogs. Provides a food base for frogs and turtles.

Table 4 Aquatic Macrophytes Identified in Okauchee Lake, 1977, 1992, 1996 2000, 2008

Species	1977[a]	1992[a]	1996[b]	2000[c]	2008
Ceratophyllum demersum	X	X	X	X	X
Chara sp.	X	X	X	X	X
Elodea canadensis	X	X	X	X	X
Lemna minor		X	X	X	•[d]
Lemna trisulca				X	
Myriophyllum spp				X	
Myriophyllum exalbescens	X	X			
M. heterophyllum					X
M. spicatum	X	X	X	X	X
M. verticillatum	X	X			
Najas flexilis	X	X	X	X	X
N. marina	X	X	X	X	X
Nitella sp.				X	X
Nuphar sp.	X	X	X	X	X
Nyphaea sp.	X	X	X	X	X
Polygonatum natans	X	X			
P. amplifolius	X	X	X	X	X
P. berchtoldii	X	X			
P. crispus	X	X	X	X	X
P. filiformis		X	X		
P. friesii		X	X		X
P. gramineus	X	X	X	X	X
P. illinoensis	X	X	X	X	X
P. natans		X	X		•[δ]
P. praelongus	X	X			X
P. richardsonii		X	X	X	X
P. zosterformis	X	X	X	X	X
Ranunculus longirostris		X	X		
Spirodela polyrhiza				X	•[d]
Stuckenia pectinata	X	X	X	X	X
Utricularia vulgaris	X	X	X	X	X
Vallisneria americana	X	X	X	X	X
Zannichellia palustris		X	X		
Zosterella dubia	X				

a. Surveyed by Environmental Resource Assessments.
b. Surveyed by Aron & Associates.
c. Surveyed by SEWRPC.
d. Found only in the general survey.

CHAPTER 4

PROBLEMS

Even though Okauchee Lake is considered a quality water resource the waters and sediments 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 Okauchee 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 Okauchee 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.

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.

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

Dense Eurasian watermilfoil beds can contribute to stunted panfish populations by reducing opportunities for grazing by predators. Excessive curly-leaf pondweed can contribute to poor water clarity and algal problems, when these plants begin to die off in early summer, 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 is one of the plant species causing the concerns in Okauchee Lake and needs to be controlled to protect the native plant population on Okauchee Lake. Lakes with good clarity like seen on Okauchee Lake allow plants to grow in deep depths. The invasive species in these deep zones tend to spread at will, dominating the deep plant community. Control is important prior to these

invasives dominating the deep zones. This resource, and the diversity of the plant community, should be protected.

Wild celery is also a problem on Okauchee Lake. Although it is a native plant, it can become a problem when densities are high. It creates significant amounts of floating plant debris, which contributes to its spread. Controlling that debris is important to minimizing the further spread of the plant and enlisting property owner support for management activities.

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 $30 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.

Eurasian watermilfoil (*Myriophyllum spicatum*) and wild celery (*Vallisneria americana*) are the plant species creating the nuisance conditions in Okauchee Lake.

CHAPTER 5

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 Okauchee 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.

Doing nothing can be costly for a lake community. In 1990, plant surveys on Powers Lake in Kenosha County found Eurasian watermilfoil in only 3 or 4 small areas. The lake had a high quality plant community. Reluctance to use chemicals and a failure to hand remove the Eurasian watermilfoil led to increasing populations over the years. Now, based on 2006 survey data, the lake has Eurasian watermilfoil throughout the 8 to 20-foot depths of the lake. Because $1000 was not spent in 1990, and because aggressive control efforts were not taken, Powers Lake is now spending tens of thousands of dollars to try to control the nuisance, a task made all the more difficult by the depths in which the nuisance grows.

Conclusion—Although No Management is technically a possibility for Okauchee Lake, it should not be considered in the best, long term interest of the water resource. Aggressively keeping the nuisance species under control, will protect the native aquatic plants and the water quality in Okauchee Lake.

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 of the recreational demands on the lake, because of a lack of operational control structure, because the exotic species are located throughout the lake (not just in the shallow zones), drawdown for the purpose of aquatic plant control on Okauchee 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 flock 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.

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. Waters deeper than five feet are usually treated with Alum. WDNR approval is required. The large volume of water in Okauchee Lake would make this a costly alternative. The cost of an alum treatment would be in excess of $300,000.

Conclusion— This is not a viable alternative for plant management on Okauchee 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 13 feet deep, the maximum rooting depth. It is the most costly form of plant management control. WDNR approval is required. Costs range from $5 to $15 per cubic yard depending upon site conditions, method used, and disposal costs. A WDNR permit is required. There are areas on Okauchee Lake that have considered dredging to improve navigation.

Conclusion— Dredging for the purposes of aquatic plant control is not viable alternative for plant management on Okauchee 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. Water quality problems may result from improperly sized aeration systems, so initial planning and engineering must be done carefully to prevent creating greater problems. Annual maintenance and operational problems and costs are difficult for smaller lake organization budgets and staff. There has been no documented effect of aeration on plant growth. WDNR approval is required.

Conclusion— Okauchee Lake has good water clarity. Aeration is not considered a viable alternative for plant management on Okauchee Lake.

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 will reduce the opportunity for damage by outboard motors. Screens cost approximately $300 for a 700 sq. ft. roll. Screens may be used by individual home owners along their shorelines or piers. WDNR approval 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 Okauchee 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 Okauchee 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 Okauchee 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. Although an established buffer will require less work than a lawn, there will be maintenance required. This may include cutting, mowing, or elimination of exotic species such as purple loosestrife. Landowners should consult with a professional to determine specific maintenance requirements and scheduling for their shoreline buffers. Permits will be needed for aquatic plantings and the County should be consulted 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. 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.

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 Okauchee 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 Okauchee 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 Okauchee Lake. Because of the size of the lake, the developed shorelines, and the harvsting program, the milfoil weevil is not a viable management tool for Okauchee Lake. The purple loosestrife beetle, as well as hand and chemical controls may be used to control purple loosestrife around Okauchee Lake.

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. The EPA and DATCP evaluate test results and determine suitability in Wisconsin. Product labels contain the requirements for use. Approved labels state that "there is reasonable certainty that the pesticide can be used with no unreasonable adverse affect on human health or the environment". Material safety data sheets are available for all herbicides approved for use in Wisconsin. Chemicals must be used according to the approved use applications listed on the labels. Application rates, as well as any use restrictions, are indicated on the product labels. Licensed applicators must follow the label requirements.

Shoreline treatments may need to be repeated at least annually. Shoreline treatments will likely not eliminate the nuisance, especially when the deep water 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 fisheries 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 provide 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 are 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 be carefully evaluated for 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. WDNR is beginning to evaluate the use of this chemical.

Conclusion— There may be consideration given to treating Eurasian watermilfoil with the appropriate herbicide. Chemical treatment of Eurasian watermilfoil should focus on shallow shoreline areas and bays in which harvesting is difficult because of depth or congestion. Chemicals should be applied following label restrictions and if so, resistance to the chemical would not be expected. Chemical treatment of the remaining plant communities would not be advised on Okauchee Lake. Destruction of any native plant species' populations will increase potential problems from Eurasian watermilfoil.

Harvesting

Harvesting of aquatic plants 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 must 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 pickups. Debris that includes rocks, sticks, gravel, or other such material 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. If a shoreline pickup program is considered, plant debris should be placed on the ends of piers whenever possible.

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. If allowed by WDNR permit, natives may be harvested to provide navigational access.

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.

Okauchee Lake has over 15 miles of shoreline and only one off-load site. The District's current methods of harvesting, often working in groups on an area before moving to another, working their way around the lake, seems to be an effective method of keeping the lake open for recreational use.

Harvesting is a very costly management alternative. Purchase of equipment usually exceeds $100,000 in capital costs. State grants are only eligible to lakes which harvest a minimum of 30 acres, and have adequate public access.

Conclusion—Harvesting has been shown to be effective at improving recreational use and aquatic plant diversity by controlling nuisance species on Okauchee Lake. Landowners should be encouraged to assist by removing floaters from their shorelines.

- The program should emphasize reducing nuisances and providing navigational access, rather than clear cutting.
- In general, harvesting should be used on large stands of Eurasian watermilfoil and curly-leaf pondweed, opening up the understory for native plants.
- Harvesting may be used to cut boat lanes through dense vegetation to provide access.
- Harvesting should begin with the boat lanes to ensure access for riparians, then work should begin on large dense stands of exotic plants.
- The current system of harvesting in groups may continue.
- Collection of floating plants and fragments should continue to be a priority.

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 develop ordinances.

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

- Any proposed 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. Limiting speeds close to shore at night won't prevent shoreline damage if speeds are not restricted during the day.

- 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 economic impacts. It is well documented that those most involved with lakes and lake protection are those same people who spend the most time on or around lakes. They either live on or have easy access to a lake. It is very difficult to convince outsiders that lake quality is a concern or that funds should be spent because they do not have a personal involvement. They have other priorities. Reducing public use of a lake will have a direct affect on their involvement and possibly their social and economic concern about a lake.
- Lake ordinances should be developed to protect health or safety, not to restrict a specific user group.
- Ordinances should not duplicate state laws.

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

CHAPTER 6

HISTORICAL PLANT MANAGEMENT

Chemical Treatment

Okauchee Lake has been treated with herbicides from the mid 1950's through 2008. Recent chemical treatments on Okauchee Lake focus on controlling Eurasian watermilfoil in the near shore shallow areas that are inaccessible to the harvesters, or in keeping Eurasian watermilfoil under control in Tierney Bay to protect native plants. The treatments are effectively reducing Eurasian watermilfoil, allowing the harvesters to work efficiently in other areas, limiting harvesting to opening up boating lanes through native plants.

Harvesting Program

The harvesting program on Okauchee Lake has been operated effectively for many years. The OLMD's policy on the harvesting program, developed in discussions with WNDR, is included in the Appendix. The harvesting program is administered by the District. The District treasurer takes care of payroll and bookkeeping for the harvesting program. The District board consists of three members that are appointed by the Town chairman. A harvesting foreman is responsible for the day to day operations of the District and the harvesting program and reports regularly to the OLMD board. The harvesting program uses seasonal help for the harvesting operations.

Currently, the harvesting program's intent is to harvest Eurasian watermilfoil and wild celery floaters. The majority of harvesting is conducted outside the pier line to the maximum rooting depth where plant growth ceases. Harvesting between piers is only done where conditions and depths allow. Harvesting operations begin in the areas of highest plant growth and then continues around the rest of the lake. Harvesting begins in May with a skeleton crew and reaches full operation by Memorial Day. Harvesting operations are conducted Monday through Friday, for 12 to 14 hours per day.

All equipment is removed from the lake in October. All equipment is winterized and stored in a maintenance building where general repairs are made.

All equipment is greased and checked for proper operation at the start-up of each day. All fluid levels and proper function of moving parts are checked. The harvester operators keep records of total hours worked, harvested areas, loads, equipment breakdowns and repairs. Shoreline pickups are done every day.

Each year an effort is made to rehire past operators thereby limiting training time and reducing operator mishaps. Employee training emphasizes proper equipment use and preventive maintenance. Safety is also stressed and all employees are required to be good swimmers. New personnel are trained by an experienced operator until they feel comfortable running the equipment. The District also trains employees in aquatic plant identification.

The District owns four aquatic plant harvesters, one skimmer, three transport barges, a claw to offload harvested plants, a dump truck, miscellaneous spare parts and a variety of tools.

The District is responsible for season start up, maintenance, repairs and post seasonal storage of the equipment.

The District carries an insurance umbrella of one million dollars. The insurance policy covers workers compensation, errors and omissions, equipment, and health.

CHAPTER 7

PLANT MANAGEMENT PLAN

Goals and Objectives

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

The management of non-native plants, specifically, Eurasian watermilfoil (*Myriophyllum spicatum*), curly-leaf pondweed (*Potamogeton crispus*), and wild celery (*Vallisneria americana*) are of great concern to the District. The District has a long aggressive history of battling nuisance exotic species. Controlling the exotic plants and protecting and increasing the native plant population is crucial to the long range goals of the District.

- Restore native plant communities and ecologically valuable areas to maximize diversity and the stability of the aquatic ecosystem.
    - —Encourage landowners to protect native species.
    - —Use chemical treatments in small bays and shoreline areas where appropriate.
    - —Minimize fragments of aquatic plants.
    - —Keeping Eurasian watermilfoil and curly-leaf pondweed from expanding their range.
    - —Conducting regular monitoring of water quality and aquatic plant communities.
- Maintain navigational access:
    - — Aggressively manage Eurasian watermilfoil, curly-leaf pondweed, and wild celery to prevent them from increasing their range in the Lake.
    - — Maintain navigational access by controlling plants as necessary to maintain access.
- Preserve and enhance the natural lake environment by:
    - —Educating landowners and lake users in lake ecology using various means, including newsletters, public meetings, and other lake-oriented events.
- Work with the Town, County and State governments (WDNR, WDATCP, etc) to:
    - —Review existing ordinances, and if necessary, develop and enforce ordinances to protect Okauchee Lake.
    - —Continue to improve the watershed to protect Okauchee Lake.
    - —Identify and expand local educational efforts to improve the public's understanding of lake issues
    - —Encourage community participation in lake management activities.
- Conduct in-lake management activities with the long-range goal of minimizing the management as much as possible by:
    - —Conducting year-end evaluations as to the success of plant management activities and the community reaction to the activities.
    - —Tracking annual progress of lake management activities.

Discussion

Management efforts should be directed toward protection and maintenance of the resource with a focus on controlling Eurasian watermilfoil and wild celery. Control of any other native plants is not an objective of the plan but will be done when it is necessary to maintain recreational access, or if unavoidable when controlling exotic plant species. Chemical treatment of riparian shoreline areas and harvesting may be used to control nuisance aquatic plants.

Decisions about where and when to harvest must be established based on the existence of a nuisance. If plants are sparsely populated, are not to the surface, or consist of non-nuisance native plants, then harvesting in the area should not be conducted, unless it is primarily Eurasian watermilfoil. Harvesters should not cruise the shorelines looking for plants to cut. Plants must be of sufficient density and height to warrant use of the equipment. There are currently no approved guidelines available to dictate when to harvest an area. Whether to harvest a specific area depends on the plants present and their growth habit, in relation to the schedule of the program and the growth patterns in other areas.

The current equipment appears to be adequate to maintain a nuisance-free condition on the lake. Equipment should be reviewed regularly and evaluated under the District's replacement policy.

It is difficult to operate an efficient program on a lake which is so large and has such extensive shoreline zones. The travel times between areas to harvest are great. The harvesters should remain in a specific area until that area is harvested. Then the harvesters should move to the next area needing attention.

Shoreline pickup may be continued, with plant debris placed on the ends of the piers to minimize damage to riparian property and the harvesting equipment.

Recommendations

Water Quality Monitoring

The District should continue to support the monitoring of water quality on Okauchee Lake, both volunteer monitoring and USGS monitoring. A recruitment/training plan should be developed to ensure a continuous source of volunteers. Volunteers should collect clarity data at least twice a month, preferably once a week, 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 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 encourage landowners to use hand controls to manage the aquatic nuisances. Small swimming areas can be manually cleared without damaging the resource. The District may wish to consider acquiring rakes and cutters to loan to lake residents. Another idea the District may consider is to match energetic teens seeking summer help with those physically unable to do hand clearing.

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.

Handpulling is recommended to control small new infestations of curly-leaf pondweed and Eurasian watermilfoil.

There is no cost associated with this component unless the District wants to hire students to assist landowners in this option.

Education and Information

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

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

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

The OLMD 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.

These activities and their associated costs are highly variable. Clean Boats Clean Waters should cover approximately 200 hours per season. Other activities' costs will depend upon the frequency of the mailings and the availability of existing materials.

Watershed Controls

The District should continue aggressive improvement of water runoff into Okauchee Lake. All areas of the watershed should be toured regularly for identification of new problems.

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

The District should also work with the County Conservation Department and the Natural Resource Conservation Department to improve participation in programs such as the Conservation Rehabilitation and Enhancement Program (CREP) that will protect Okauchee Lake.

Land Use Planning

The District should take an active role in land use planning decisions in the Towns. 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 also involve the District to ensure that future development includes lake protection.

Storm Water Planning

The District should review any new development proposals 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 assist the County and Towns to develop and implement storm water ordinances. Another option to consider is the use of phosphorus-free or no phosphorus fertilizers. Some communities are considering fertilizer restrictions to protect their lakes.

Ordinances

The District may consider the development of ordinances. It should be noted that passing an ordinance does not in and of itself, correct a problem. Enforcement is a key component of any ordinance development.

Chemical Treatment

- The scope of the District-sponsored treatment should focus on Eurasian watermilfoil and curly-leaf pondweed. Residents may "opt out" of the chemical treatment. In other words, their shorelines should not be treated if they so request. Residents may also conduct individual chemical treatments, however, WDNR permits must be obtained prior to any treatments.
- The District may use chemicals to control nuisance plants in the shoreline areas and shallow bays. Treatments should minimize the effects on non-target plants. Care should be taken to avoid treating too much plant material at a time. Earlier, rather than later season treatments will accomplish this. Waiting until there are high densities to treat could place undue stress on the fish community by reducing oxygen concentrations post treatment.
- Areas which are chemically treated should not be harvested until the appropriate time has passed to allow the chemicals to impact the plants.
- The District may continue to use chemical treatment to minimize Eurasian watermilfoil in mono-typic stands to try to shift the plant community toward native plants. One area that may be considered is a bed of Eurasian watermilfoil just outside of Crane's Nest. Because of its location in an open water area, this bed contributes to the ongoing spread of Eurasian water-milfoil in the lake. As has been required in other areas, WDNR may require pre- and post-treatment monitoring of the treatment area.
- The District may include all the shoreline and shallow bays in the chemical permit application, but should be prepared to indicate which areas are to be treated on the day of treatment.

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 the District when preparing to conduct chemical treatments.

- Complete and submit the WDNR permit application forms. Include treatment map, area sizes and name and addresses of all affected riparian landowners.
- Contact licensed firm to coordinate proposed treatment.
- When treatment areas will be greater than 10 acres, a public notice should be placed in the local paper informing the public about the proposed treatment. This will also inform those who may be using the public beaches.
- 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.

Harvesting

- The District may continue to use harvesting to provide relief from nuisance conditions.
- Harvesting should avoided in areas that are treated with herbicides until the appropriate time has passed to allow the herbicides to work.
- Any harvesting done should be carefully planned to avoid native plants as much as possible.
- No harvesting should be done in shallow waters less than three feet deep.
- Native plants may be harvested if necessary to open access lanes trying to avoid any flowering native plants.
- Pre-dominantly Eurasian watermilfoil areas should be “topped”. The top 4 or 5 feet of plant material should be harvested in deep water, the top 2 to 3 feet in shallower water, cutting above any native plants. This will allow light to reach the natives and will encourage their growth.
- Educational efforts should be developed to inform the public about the benefits of a comprehensive plant management program, that gives equal consideration to fish and wildlife, while reducing recreational nuisances and unsafe situations.

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

- Complete WDNR permit application forms. Include map, area sizes and name and addresses of all affected riparian landowners.
- Current administrative codes should be reviewed annually to ensure compliance.
- The District should concentrate harvesting efforts on Eurasian Water Milfoil and nuisance concentrations of wild celery. Efforts should be made to eliminate “shading” of other lower growing native plants and to reduce floaters.

- The harvester should be evaluated to ensure the storage bed will adequately contain the material being removed.
- Daily records should be kept documenting loads, maintenance, downtime, and other pertinent information. The District should stress to the operators the importance of keeping accurate records.
- Harvesting operators should be trained to identify “good” plants from Eurasian watermilfoil. This would allow the operators to avoid areas with high numbers of pondweeds that should not be cut.
- Operators should not cut plants in less than three feet of water.
- The District may continue its current harvesting schedule. Harvesting may be done for eight hours a day. Shoreline pick up may be done as needed.
- Any fish or turtles that may be harvested with the plants should be returned to the lake.
- Avoid areas with spawning fish.
- Disposal of cut plants may continue to be disposed of locally.
- The District should continue its practice of hiring experienced operators as well as the comprehensive training in equipment operation and maintenance.
- The District should summarize its harvesting records into an annual report.
- The District should review the plant management plan and operations every three to five years.
- The District should distribute informational materials to its members that include such topics as proper lawn and garden practices, land use impacts, the importance and value of aquatic plants, and septic system maintenance.

General Harvesting Recommendations

Emphasis of harvesting program should be placed on removal of plants necessary to facilitate recreational use, rather than simply 100% removal. The emphasis should be placed on providing access rather than clear cutting.

Staff needs to make sure that cutter bars are kept out of the sediments or to cut one foot above the plant beds, especially within the 0 to 6 feet zone where muskgrass tends to dominate the plant community. Harvesting in shallow water depths should be restricted to Eurasian watermilfoil infested areas, or areas with nuisance levels of wild celery, thereby further protecting the muskgrass beds and the pondweeds dispersed among the muskgrass.

Staff should concentrate harvesting efforts on the Eurasian watermilfoil and areas where wild celery is a problem (especially to help reduce the amount of floaters). Eurasian watermilfoil should be harvested before a canopy, and flowers, begin to form. Attempts should be made to avoid cutting areas that have desirable native plant species especially when native pondweeds are in seed. Where Eurasian watermilfoil is present along with native plants, cutting above the native plants will open up more sunlight to the natives, will encourage native plant growth, and will remove any flowering portions of Eurasian watermilfoil.

Staff should maintain an aggressive program to reduce the amount of “floaters” and to remove them as soon as they occur. Equipment should be operated so that cut plant material does not fall off the harvester. Deep water areas that need to be harvested for access purposes should be cut to depths between five and six feet to prevent boating activity from cutting plants.

Off-load sites must be cleaned of plant debris following each off-load. This will help to prevent Eurasian watermilfoil infestations along the neighboring shoreline.

Comprehensive and detailed records should continue to be kept documenting:

1. Date
2. Hours worked - including harvest and down time
3. Loads harvested - including plant types and densities
4. Areas harvested - located on a map
5. Other pertinent information, including an estimation of numbers, species, and area of incidental turtle and fish captures.

Site Specific Recommendations

Some areas of Okauchee Lake should continue to be given special consideration. Each of the following recommendations expand upon the previous recommendations.

1. Crane's Nest and Inlet: Do not clear cut. Provide 10 to 12 foot wide navigational channels alongside individual piers, and out into the navigational lanes. In the inlet, harvest existing navigational channels. Harvest these areas after June 15 only. This will provide access for boaters while protecting important fish habitat. Don't harvest where there are no homes.
2. Whittegers Bay: Harvest the pier zone to provide access.
3. Stumpy Bay and Bay Five: Harvest the pier zone to provide access. Restrict depth of harvesting to three feet.
4. East Shore area: Harvest navigational channels into individual piers avoiding natural shoreline areas.
5. Tierney Bay: Because of the ecological importance of Tierney Bay and the multiple discussions with WDNR over the appropriate management of the bay, WDNR provided the Map shown in Figure 4. to show the limitations of harvesting in the bay. The pier-zone channel should not exceed 75 ft in width and the center channels should not exceed 15 ft in width.

Schedule For Harvesting

Harvesting should only be conducted when a nuisance exists. This will vary from year to year. Past harvesting records should be reviewed in conjunction with a pre-harvest survey each spring to determine which areas need attention and which areas are undergoing change. The District's evaluation process for determining the harvesting schedule is effective and may continue. The current schedule of harvesting weekdays for approximately 12 to 14 hours a day should be sufficient.

Harvested Fish & Wildlife

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

1. Reduce the operating speed of the harvester to give fish a chance to flee.
2. If that does not help then reduce cutting depth and see if the problem is resolved.
3. If fish are still being harvested in large numbers, refrain from cutting area and consult with WDNR or private consultant for further recommendations.

Off-Loading & Disposal Sites

Current disposal practices should continue. Care should be taken to keep areas adjacent to disposal site clean of cut vegetation. Staff should be instructed to remove any vegetative debris immediately upon off-loading the harvester.

Operator Training

The District should continue its practice of hiring experienced operators, as well as comprehensive training in equipment operation, maintenance and safety. All employees should be trained in the identification of the plants in Okauchee Lake. This will help protect beneficial plant beds and will ensure accurate documentation of changes that may occur in the aquatic plant community as part of their daily program.

The district should develop a plan to train new employees so they can understand the Districts' approach to harvesting and get experience while under the direction of the long-term employees.

Maintenance Program & Downtime

Maintenance should continue as is currently done. The focus should continue to be on preventive methods, rather than reactive. The use of synthetic, biodegradable hydraulic fluids in the harvester will reduce the adverse impacts to the lake from spills. A small spill kit should kept on the equipment to efficiently deal with any spills that may occur.

Storage

The harvesting staging area property is a residential location. Out of consideration for the neighbors, all equipment used by the District to harvest aquatic plants is stored off-site at a commercial location.

Insurance

Insurance coverage should remain the same unless conditions should prompt a review.

Recommended Record Keeping

Staff should continue to fill out the daily operation log detailing harvesting hours. The District should consider entering the information into a database to provide ready access and evaluation.

Staff should make sure that information recorded is complete, including hours worked in each area, equipment used, numbers of harvester loads removed, and hours spent on maintenance and repair. Any obvious changes seen during the course of the summer should be noted, including regrowth patterns and densities.

Operator Summary

Harvester operators should be provided with the Daily Log Sheet as well as a summary of the areas to be treated and methods to be followed.

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.

- ***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 the 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.

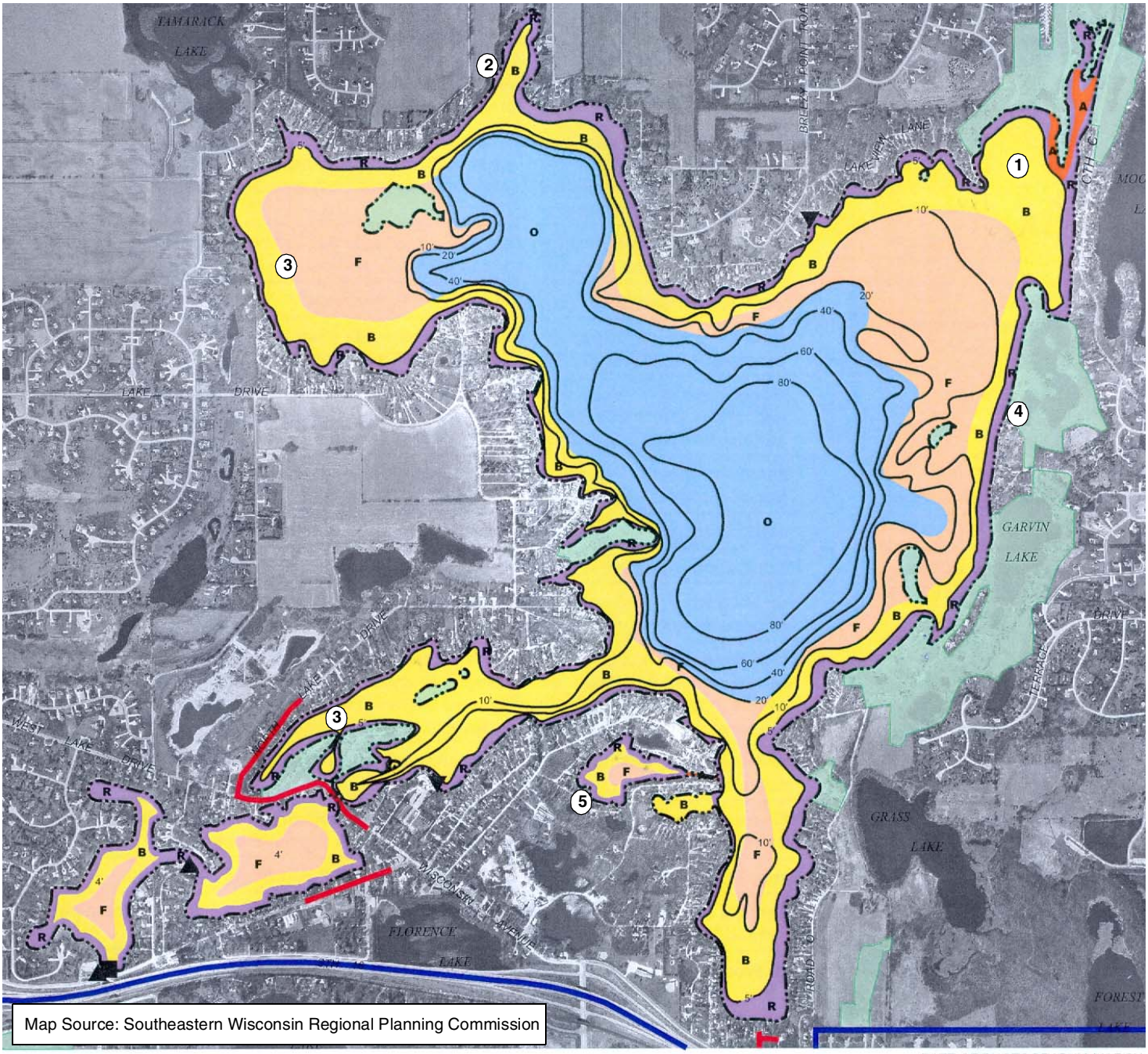

Figure 3. Aquatic Plant Management Plan, Okauchee Lake, 2009

NOTE: See next page for map legend and Site Specific Area Designations.

Map Legend

Area	Management Actions
R (purple)= Riparian/Pier Zone	Hand control of vegetation by riparians Chemical treatment of Eurasian watermilfoil or curly-leaf pondweed. Shoreline/pier pickups of plant debris.
B = (yellow) = Boating Access	Control floaters in open water. Harvest Eurasian watermilfoil and maintain open water conditions above native understory.
F (peach) = Fisheries Areas	No active management during fish breeding season prior to June 15. Control floaters in open water.
A (orange) = Inlet area	Harvest recreational boating access.
O (blue) = Open water area	No aquatic plant mangement needed - beyond the maximum depth of plants.
Other action items:	Maintain public informational newsletters and website. Monitor water quality and fisheries.

Site Specific Recommendations

Area	Management Actions
1 - Cranes Next and Inlet	Do not clear cut. Provide 10 to 12 foot wide navigational channels alongside individual piers. In the inlet harvest navigational channels. Harvest these areas after June 15. Chemical treatment of EWM allowed.
2 - Whittegers Bay	Harvest the pier zone. Chemical treatment of EWM allowed.
3 - Stumpy Bay and Bay Five	Harvest the pier zone. Chemical treatment of EWM allowed.
4 - East Shore Area	Harvest navigational channels in to individual piers. Avoid natural shoreline.
5 - Tierney Bay	Follow guidelines in Map 4. Pier zone channels not to exceed 75 feet wide, Center channels not to exceed 15 feet wide. Chemical treatment of EWM allowed.

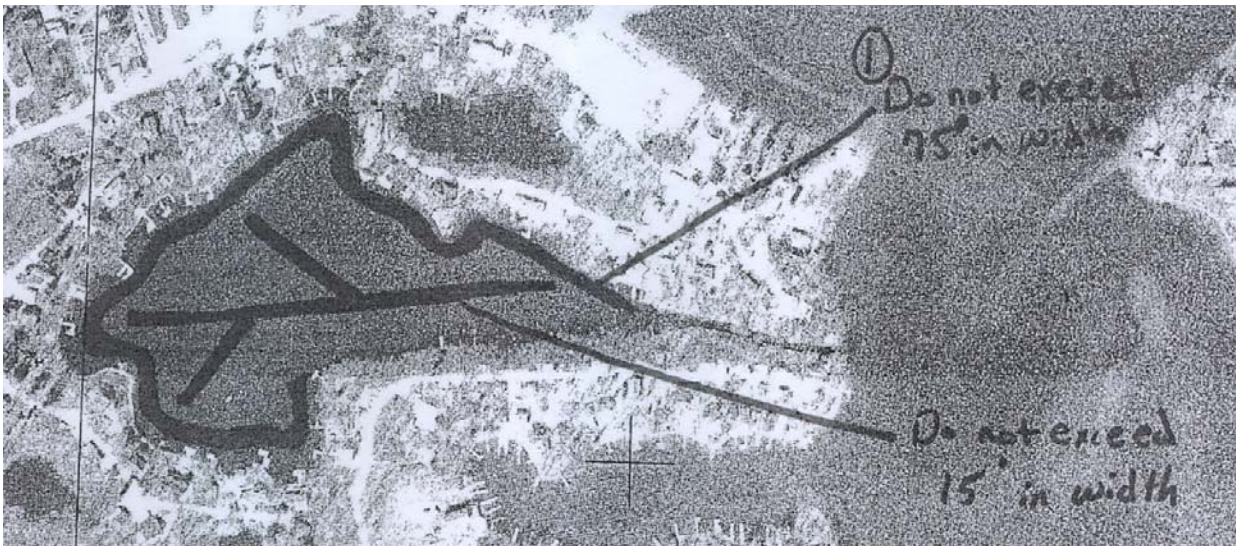

Figure 4. Tierney Bay Harvesting Restrictions

CHAPTER 8

EQUIPMENT - FEASIBILITY

Equipment

To date the current equipment consists of:

- Four aquatic plant harvesters
- One skimmer
- Three transport barges
- Claw to offload harvested plants
- A dump truck
- Miscellaneous spare parts and a variety of tools.

The District is investigating the replacement of the oldest harvester and plans to replace the machine for 2010.

Feasibility

The District's program is a well-run, well-maintained program that manages the aquatic plant nuisances and improves conditions on Okauchee Lake. The District has a proven track record of proper maintenance and service of equipment.

Any planned equipment purchases are feasible from both a financial responsibility perspective, as well as the aquatic resource perspective. The District has consistently shown an ability to maintain and operate an effective plant management program.

CHAPTER 9

PLAN EVALUATION AND REASSESSMENT

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

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

- Have native aquatic plants increased in densities and diversity;
- Have nuisance species decreased in densities and coverage;
- Has water quality improved;
- Does the general public, and more specifically, do the District residents, have a better understanding of the lake, its environment, and the impacts on the resource;
- Do the District residents support the plant management activities of the District;
- Has the District been able to prevent exotic species invasions;
- Are there ongoing public education efforts such as newsletters, websites, public meetings, etc; and are they being used by the public.

The District should review or contract to review, the plant populations of Okauchee Lake every three to five years. This will provide necessary data that can be used to document the success of management activities that are undertaken.

A summary of the past years management activities should be developed annually to facilitate comprehensive review of the entire program and effectiveness. The District should then review the Plant Management Plan every three to five years to ensure its appropriateness to the changing conditions.

CHAPTER 10

SUMMARY

- The District should encourage landowners to provide 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, especially on the steeper shorelines.
- The District may continue to use harvesting to manage exotic species.
- Every effort should be made to reduce the amount of floating plant debris, especially Eurasian watermilfoil fragments and wild celery plants. This will help 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 the importance and value of aquatic plants, and proper septic system maintenance.
- 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.
- Any early season chemical treatments should be conducted targeting Eurasian watermilfoil, and where necessary, curly-leaf pondweed. Treatments may 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 harvesting, chemical treatment to maintain desired control levels; hand removal of any new small patches; and public informational programs to prevent re-infestations.
- The District should contract to conduct a quantitative plant survey every 3 to 5 years, as well as a refinement of the Plant Management Plan.
- The District should concentrate harvesting efforts on Eurasian watermilfoil. Efforts should be made to eliminate “shading” of lower growing native plants and to reduce floaters.
- Daily records should be kept documenting loads, maintenance, downtime, and other pertinent information. The District should stress to the operators the importance of keeping accurate records.
- Harvesting operators should be trained to identify "good" plants from Eurasian watermilfoil. This would allow the operators to avoid areas of pondweeds that should not be cut.
- Operators should not cut plants in less than three feet of water.
- Any fish or turtles that may be harvested with the plants should be returned to the lake at the capture point.
- Disposal of cut plants may continue to be disposed of locally.

- The District should hire experienced operators as well as conduct comprehensive training in equipment operation and maintenance.
- The District should summarize its harvesting records into an annual report. This report should include information regarding types of plants harvested, any changes in plant community composition, and any regrowth patterns observed.
- The District should use synthetic fluids and oils in the harvesting equipment.

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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.

	A	B	C	D	E	I	K	R	AJ	AN	AP	AQ	AR	AT
1		**STATS**	Total vegetation	*Myriophyllum spicatum*,Eurasian water mil	*Potamogeton crispus*,Curly-leaf pondweed	Ceratophyllum demersum,Coontail	Chara ,Muskgrasses	Elodea canadensis,Common waterweed	Myriophyllum heterophyllum,Various-leaved water milfoil	Najas flexilis,Bushy pondweed	Najas marina,Spiny naiad	Nitella sp.,Nitella	Nuphar advena,Yello	Nympha
2	**Lake Name**	Okauchee Lake												
3	**County**	Waukesha												
4	**WBIC**													
5	**Survey Date**													
6		**INDIVIDUAL SPECIES STATS:**												
7		**Frequency of occurrence within vegetated areas (%)**		55.60	0.39	22.01	56.76	1.16	7.34	19.31	2.70	0.77	0.77	
8		**Frequency of occurrence at sites shallower than maximum depth of plants**		49.15	0.34	19.45	50.17	1.02	6.48	17.06	2.39	0.68	0.68	
9		**Relative Frequency (%)**		21.1	0.1	8.3	21.5	0.4	2.8	7.3	1.0	0.3	0.3	
10		Relative Frequency (squared)	0.14	0.04	0.00	0.01	0.05	0.00	0.00	0.01	0.00	0.00	0.00	
11		**Number of sites where species found**		144	1	57	147	3	19	50	7	2	2	
12		**Average Rake Fullness**		2	1	2	2	2	1	1	1	3	1	
13		**#visual sightings**		29		2	1		5			1	1	8
14		**present (visual or collected)**		present	present	present	present	present	present	present	present	present	present	present
15														
16		**SUMMARY STATS:**												
17		**Total number of points sampled**	**293**											
18		**Total number of sites with vegetation**	**259**											
19		**Total number of sites shallower than maximum depth of plants**	**293**											
20		**Frequency of occurrence at sites shallower than maximum depth of plants**	**88.40**											
21		**Simpson Diversity Index**	**0.86**											
22		**Maximum depth of plants (ft)**	**12.00**											
23		**Number of sites sampled using rake on Rope (R)**	**0**											
24		**Number of sites sampled using rake on Pole (P)**	**293**											
25		**Average number of all species per site (shallower than max depth)**	**2.33**											
26		**Average number of all species per site (veg. sites only)**	**2.64**											
27		**Average number of native species per site (shallower than max depth)**	**1.84**											
28		**Average number of native species per site (veg. sites only)**	**2.13**											
29		**Species Richness**	**21**											
30		**Species Richness (including visuals)**	**22**											

	AZ	BF	BG	BI	BN	BP	BU	CQ	CZ	DA	DB	DC	DD
1	ow pond lily	dea odorata,White water lily	Potamogeton amplifolius,Large-leaf pondweed	Potamogeton friesii,Frie's pondweed	Potamogeton gramineus,Variable 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	Wolffia columbiana,Common wat	Zannichellia palustris	Zizania
2															
3															
4															
5															
6															
7	2.70	1.54	9.27	3.47	1.16	1.54	3.86	8.88	13.90	49.42					
8	2.39	1.37	8.19	3.07	1.02	1.37	3.41	7.85	12.29	43.69					
9	1.0	0.6	3.5	1.3	0.4	0.6	1.5	3.4	5.3	18.7					
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04					
11	7	4	24	9	3	4	10	23	36	128					
12	1	1	1	1	1	1	1	1	1	2					
13	9		9	7		6	1	12	4	6					
14	present	present	present	present	present	present	present	present	present	present					
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30															

	A	B	C	D	I	J	K	AN	BG	BH	BI	BN	BU	CQ
1		**STATS**	Total Vegetation	*Myriophyllum spicatum*,Eurasian water mil	Ceratophyllum demersum,Coontail	Ceratophyllum echinatum,Spiny hornwort	Chara ,Muskgrasses	Najas flexilis,Bushy pondweed	Potamogeton gramineus,Variable pondweed	Potamogeton hillii,Hill's pondweed	Potamogeton illinoensis,Illinois pondweed	Potamogeton praelongis pondweed	Potamogeton zoster pondweed	Stucke
2	**Lake Name**	Okauchee Lake - Bay Five												
3	**County**	Waukesha												
4	**WBIC**	Pre-treatment												
5	**Survey Date**													
6		**INDIVIDUAL SPECIES STATS:**												
7		**Frequency of occurrence within vegetated areas (%)**		84.21	21.05		78.95	31.58	36.84		5.26	10.53	31.58	15.79
8		**Frequency of occurrence at sites shallower than maximum depth of plant**		80.00	20.00		75.00	30.00	35.00		5.00	10.00	30.00	15.00
9		**Relative Frequency (%)**		21.3	5.3		20.0	8.0	9.3		1.3	2.7	8.0	4.0
10		Relative Frequency (squared)	0.14	0.05	0.00		0.04	0.01	0.01		0.00	0.00	0.01	0.00
11		**Number of sites where species found**		16	4		15	6	7		1	2	6	3
12		**Average Rake Fullness**		2	1		2	1	1		1	1	1	1
13		**#visual sightings**		2							1			
14		**present (visual or collected)**		present	present		present	present	present		present	present	present	present
15														
16		**SUMMARY STATS:**												
17		**Total number of points sampled**	**20**											
18		**Total number of sites with vegetation**	**19**											
19		**Total number of sites shallower than maximum depth of plants**	**20**											
20		**Frequency of occurrence at sites shallower than maximum depth of plants**	**95.00**											
21		**Simpson Diversity Index**	**0.86**											
22		**Maximum depth of plants (ft)**	**1.00**											
23		**Number of sites sampled using rake on Rope (R)**	**0**											
24		**Number of sites sampled using rake on Pole (P)**	**20**											
25		**Average number of all species per site (shallower than max depth)**	**3.75**											
26		**Average number of all species per site (veg. sites only)**	**3.95**											
27		**Average number of native species per site (shallower than max depth)**	**2.95**											
28		**Average number of native species per site (veg. sites only)**	**3.11**											
29		**Species Richness**	**11**											
30		**Species Richness (including visuals)**	**11**											

	CZ	DA	DB	DC	DD	DE	DF	DG	DH	DI	DJ	DK	DL	DM	DN
1	em	formis,Flat-stem	ia pectinata,Sago pondweed	Utricularia vulgaris,Common	Vallisneria americana,Wild celery	Wolffia columbiana,Common watermeal	Zannichellia palustris,Horned pondweed	Zizania palustris,Northern wild rice	sp1	sp2	sp3	sp4	sp5	sp6	sp7	sp8	sp9	sp10
2																		
3																		
4																		
5																		
6																		
7	21.05	57.89																
8	20.00	55.00																
9	5.3	14.7																
10	0.00	0.02																
11	4	11																
12	1	1																
13																		
14	present	present																
15																		
16																		
17																		
18																		
19																		
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22																		
23																		
24																		
25																		
26																		
27																		
28																		
29																		
30																		

	A	B	C	D	I	J	K	AN	BG	BH	BI	BN	BU
1		**STATS**	Total vegetation	*Myriophyllum spicatum*,Eurasian water mil	Ceratophyllum demersum,Coontail	Ceratophyllum echinatum,Spiny hornwort	Chara ,Muskgrasses	Najas flexilis,Bushy pondweed	Potamogeton gramineus,Variable pondweed	Potamogeton hillii,Hill's pondweed	Potamogeton illinoensis,Illinois pondweed	Potamogeton praelo pondweed	Potamo p
2	**Lake Name**	Okauchee Lake - Bay Five Post-treatment											
3	**County**	Waukesha											
4	**WBIC**												
5	**Survey Date**												
6		**INDIVIDUAL SPECIES STATS:**											
7		**Frequency of occurrence within vegetated areas (%)**		30.00	20.00		85.00	50.00	50.00		10.00	10.00	35.00
8		**Frequency of occurrence at sites shallower than maximum depth of plant**		30.00	20.00		85.00	50.00	50.00		10.00	10.00	35.00
9		**Relative Frequency (%)**		7.8	5.2		22.1	13.0	13.0		2.6	2.6	9.1
10		Relative Frequency (squared)	0.13	0.01	0.00		0.05	0.02	0.02		0.00	0.00	0.01
11		**Number of sites where species found**		6	4		17	10	10		2	2	7
12		**Average Rake Fullness**		1	1		2	1	1		2	2	1
13		**#visual sightings**		4					1				
14		**present (visual or collected)**		present	present		present	present	present		present	present	present
15													
16		**SUMMARY STATS:**											
17		**Total number of points sampled**	**20**										
18		**Total number of sites with vegetation**	**20**										
19		**Total number of sites shallower than maximum depth of plants**	**20**										
20		**Frequency of occurrence at sites shallower than maximum depth of plants**	**100.00**										
21		**Simpson Diversity Index**	**0.87**										
22		**Maximum depth of plants (ft)**	**1.00**										
23		**Number of sites sampled using rake on Rope (R)**	**0**										
24		**Number of sites sampled using rake on Pole (P)**	**20**										
25		**Average number of all species per site (shallower than max depth)**	**3.85**										
26		**Average number of all species per site (veg. sites only)**	**3.85**										
27		**Average number of native species per site (shallower than max depth)**	**3.55**										
28		**Average number of native species per site (veg. sites only)**	**3.55**										
29		**Species Richness**	**11**										
30		**Species Richness (including visuals)**	**11**										

	CQ	CZ	DA	DB	DC	DD	DE	DF	DG	DH	DI	DJ	DK	DL	DM	DN
1	ondweed	ngis,White-stem	geton zosteriformis,Flat-stem	Stuckenia pectinata,Sago pondweed	Utricularia vulgaris,Common	Vallisneria americana,Wild celery	Wolffia columbiana,Common watermeal	Zannichellia palustris,Horned pondweed	Zizania palustris,Northern wild rice	sp1	sp2	sp3	sp4	sp5	sp6	sp7	sp8	sp9	sp10
2																			
3																			
4																			
5																			
6																			
7	10.00	20.00	65.00																
8	10.00	20.00	65.00																
9	2.6	5.2	16.9																
10	0.00	0.00	0.03																
11	2	4	13																
12	1	1	1																
13	1																		
14	present	present	present																
15																			
16																			
17																			
18																			
19																			
20																			
21																			
22																			
23																			
24																			
25																			
26																			
27																			
28																			
29																			
30																			

Lake Water Quality 2008 Annual Report

Okauchee Lake
Waukesha County
Waterbody ID Number: 850300

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

Site Name	Station ID
Okauchee Lake - Deep Hole	683142

Date	SD (feet)	SD (meters)	Hit Bottom?	CHL	TP	TSI (SD)	TSI (Chl)	TSI (TP)	Lake Level	Staff Gauge	Clarity	Color	Perception
04/23/2008				9.8	30		52	54					
05/31/2008	10.75	3.3	NO			43			NORMAL		CLEAR	BROWN	2-Very minor aesthetic problems
05/31/2008					14			49					
06/24/2008				9.56	31		52	55					
06/24/2008				10.4	19		53	51					
06/24/2008	7.75	2.4	NO			48			HIGH		MURKY	BROWN	2-Very minor aesthetic problems
07/24/2008				8.42	25		51	53					
07/27/2008				5.68	27		48	54					
07/27/2008	7.5	2.3	NO			48			HIGH		MURKY	GREEN	2-Very minor aesthetic problems
08/25/2008				12.7	20		54	51					
09/09/2008				10.7	25		53	53					

Date	Lab Comment
04/23/2008	LRB EXCEEDS LOD CRITERIA BY 0.00128 MG/L
04/23/2008	MATRIX SPIKE QC EXCEEDED 1.2%
04/23/2008	MATRIX SPIKE QC EXCEEDED BY 1.2%

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

Date	Data Collectors	Project
04/23/2008	USGS	USGS LAKE SAMPLES
05/31/2008	Mary Miller	Citizen Lake Monitoring - Water Quality - Okauchee Lake; Deep Hole
05/31/2008	Mary and James Miller	Citizen Lake Monitoring - Water Quality - Okauchee Lake; Deep Hole
06/24/2008	Data Collectors Unknown	Citizen Lake Monitoring - Water Quality - Okauchee Lake; Deep Hole
06/24/2008	Mary Miller	Citizen Lake Monitoring - Water Quality - Okauchee Lake; Deep Hole
06/24/2008	USGS	USGS LAKE SAMPLES
07/24/2008	USGS	USGS LAKE SAMPLES
07/27/2008	Data Collectors Unknown	Citizen Lake Monitoring - Water Quality - Okauchee Lake; Deep Hole
07/27/2008	Mary Miller	Citizen Lake Monitoring - Water Quality - Okauchee Lake; Deep Hole
08/25/2008	USGS	USGS LAKE SAMPLES
09/09/2008	Data Collectors Unknown	Citizen Lake Monitoring - Water Quality - Okauchee Lake; Deep Hole
09/09/2008	Mary Miller	Citizen Lake Monitoring - Water Quality - Okauchee Lake; Deep Hole

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

WISCONSIN
DEPT. OF NATURAL RESOURCES

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

Jim Doyle, Governor
Scott Hassett, Secretary
Gloria L. McCutcheon, Regional Director

Waukesha Service Center
141 NW Barstow
Waukesha, Wisconsin 53188
Telephone 262-574-2100
FAX 262-574-2117
TTY Access via relay - 711

December 1, 2004

Carol A. Wilson
Chairperson, Okauchee Lake Management District
P.O. Box 526
Okauchee, WI 53069

RE: Amendments to the 2003-2007 Okauchee Lake Harvesting Permit

Dear Ms. Wilson:

This letter serves as a formal amendment to the Okauchee Lake harvesting permit issued on June 4, 2003. All other original permit conditions remain the same and the permit remains valid until December 31, 2007. A copy of the original permit is attached for your reference.

1. The aquatic plant harvesting policy/resolution passed by the Okauchee Lake Management District Board on September 9th, 2004 shall become a binding permit condition to the Okauchee Lake Harvesting permit. Violations of the resolution will be enforceable under Wisconsin Administrative Code NR 109.11. A copy of the resolution is attached to this document.

2. Harvesting shall be allowed to occur until October 31 of any given calendar year within the permit expiration timeframes and according the permit and aquatic plant management plan. This amendment is granted because of a request received by the Okauchee Lake Management District.

If you have any question regarding the permit amendments, please contact us at 262-574-2124.

Sincerely,

Shelley Warwick

Shelley Warwick
Aquatic Plant Management Specialist

CC: Deb Roszak, DNR Enforcement Specialist

September 12, 2004

Department of Natural Resources
Madison, Wisconsin

To Whom It May Concern:

Enclosed is a cover letter, resolution, and the policy and procedures of harvesting plants on Okauchee Lake which was approved by all five commissioners on September 9, 2004.

We also appointed Dennis Johnson as our aquatic plant supervisor for the next year (2005). His cell phone number is 414-828-5461 and he lives at N65 W34608 Whitaker Road, Oconomowoc 53066 and his home phone number is 262-966-0653.

Please feel free to contact me if you have any further questions or concerns.

Thank you.

Sincerely,

Carol A Wilson

Carol A. Wilson
Chairperson, Okauchee Lake Management District
262-367-7363

Okauchee Lake Management District
P.O. Box 526
Okauchee, WI 53069

September 13, 2004

Wisconsin Department of Natural Resources

Re: Okauchee Lake Management District Aquatic Plant Harvesting Policy

The Okauchee Lake Management District ("District") committed to crafting and approving an aquatic plant harvesting policy during our August 12, 2004 meeting with the Wisconsin Department of Natural Resources ("WDNR"). At the District's meeting on September 9, 2004, the Board did pass a Resolution and adopted a Policy which we believe will enhance and solidify our efforts to participate as careful stewards of the Okauchee Lake resources. The Resolution and Policy are attached.

More specifically, this Policy has been established to address concerns raised by the WDNR regarding aquatic plant harvesting activities in 2004. In August, 2004, the WDNR issued a Notice of Violation which was followed by a public meeting with the District Board. One important result of that meeting was that all commissioners present agreed that the harvesting program must be under the direct supervision of only one commissioner to prevent miscommunication and the possible misdirection of staff. Proper training of staff was also noted as being important.

The attached Policy establishes the position of Aquatic Plant Harvesting Supervisor ("Supervisor") and details the Supervisor's responsibility to assure that the aquatic plant harvesting permit issued by the WDNR and the Okauchee Lake Aquatic Plant Management plan will be followed by the District. It also outlines the training responsibility of the Harvesting Foreman.

The District is proud of its long history of management and stewardship of the Okauchee Lake resource. However, it fully recognizes a responsibility to continue and improve management of that effort and will do all it can to eliminate any possibility of miscommunication or human error.

We are pleased to work with the WDNR to meet this goal, and trust that the actions taken by the District will enhance our success and stewardship in the future.

Sincerely,

Carol A Wilson

Carol Wilson, Chairperson

cc: District Board Members

RESOLUTION

WHEREAS, it is necessary that the Okauchee Lake Management District Board of Commissioners adopt a policy so as to eliminate confusion with regard to the operation of the aquatic plant harvesting program.

NOW THEREFORE BE IT HEREBY RESOLVED that the attached aquatic plant harvesting policy hereby becomes effective as of the 9th day of September 2004.

BE IT FURTHER RESOLVED that the adopted policy shall remain effective unless subsequently amended by formal action of the Okauchee Lake Management District Board of Commissioners.

DATED: 9-12-04

OKAUCHEE LAKE MANAGEMENT DISTRICT

By: Carol A Wilson
Chairman

ATTEST:

Secretary

OKAUCHEE LAKE MANAGEMENT DISTRICT
AQUATIC PLANT HARVESTING POLICY
EFFECTIVE DATE: SEPTEMBER 9, 2004

Reason for Policy

This policy establishes the position of Aquatic Plant Harvesting Supervisor (the "Supervisor") and details the Supervisor's responsibilities to ensure that the Aquatic Plant Harvesting Permit issued by the WDNR and the Okauchee Lake Aquatic Plant Management Plan will be followed by the District.

Statement of Purpose

The District has worked cooperatively with the WDNR to improve the resource known as Okauchee Lake. The working relationship has been built on trust and a mutual desire to protect Okauchee Lake while reducing aquatic nuisances for residents and property owners.

This policy will continue the effort of the District to maintain the relationship with the WDNR.

Chain of Command

The District Board of Commissioners shall appoint annually a member to act as the Aquatic Plant Harvesting Supervisor. This appointment shall be made as soon after the annual meeting as possible. The Chairman of the Board of Commissioners shall notify the WDNR of the name, address and telephone number of the Supervisor so appointed.

Responsibilities of Aquatic Plant Harvesting Supervisor

- Review the WDNR Aquatic Plant Harvesting Permit and the Okauchee Lake Aquatic Plant Management Plan. The Supervisor shall oversee all aquatic plant harvesting operations and shall ensure that the provisions of the WDNR permit are followed. There shall be no harvesting performed contrary to the terms of the Aquatic Plant Harvesting Permit without the permission of the WDNR first being obtained.

- All District aquatic plant harvesting procedures implemented by the Board of Commissioners shall be communicated by the Supervisor to the aquatic plant harvesting crew foreman. The Supervisor shall maintain regular contact with the foreman during the aquatic plant harvesting season.

- Before aquatic plant harvesting commences, the Supervisor shall review with the foreman the terms of the WDNR permit and the provisions of the Okauchee Lake Aquatic Plant Management Plan, together with any other procedures adopted by the Board of Commissioners. The foreman shall then be responsible for disseminating said information to all District aquatic plant harvesting employees.

- The Supervisor shall notify the WDNR when training has been completed and the date aquatic plant harvesting is to begin.

- The Supervisor shall provide a full report of aquatic plant harvesting activities to the Board of Commissioners at each monthly meeting during the aquatic plant harvesting season.

Responsibilities of Aquatic Plant Harvesting Foreman

After receiving and reviewing the WDNR permit, the Okauchee Lake Aquatic Plant Management Plan, and the procedures adopted by the Board of Commissioners with regard to aquatic plant harvesting, the foreman shall be responsible for the following:

- Conduct annual training of all aquatic plant harvesting employees prior to commencement of aquatic plant harvesting.

- Annual training shall consist of the following:

    - Complete review of the terms of the WDNR permit to give an understanding of the requirements and harvesting limitations.

    - Instruction as to the chain of command as to the aquatic plant harvesting program.

    - Training and identification of aquatic plants, especially the importance of native plants versus exotic plant species.

    - Instruction as to the importance of specific permit conditions and the necessity that they comply therewith in order to protect ecologically valuable plant communities.

    - Clearly define terms to be used to identify harvesting methods, specifically defining for the employees the meaning of clear cut, channel cutting, topping, etc.

    - Instruction as to safety procedures as to the use of equipment.

    - Instruction as to how to complete the daily forms which detail work performed, plants harvested, and areas harvested.

- Identify the Aquatic plant Harvesting Supervisor for the employees should contact be necessary because of unavailability of the foreman.

- Instruction as to public relations in the event of individual requests of property owners. Such requests should be directed to the foreman, who shall direct the requests to the Supervisor if necessary.

- Specific instruction regarding the requirements for harvesting in Tearney Bay. These instructions shall include the necessity to empty the harvester prior to entering Tearney Bay, restricting cutting to areas and to depths as indicated in the WDNR permit, completion of forms identifying the date, staff, plants harvested, and areas harvested, and the depth and times of harvest.

General

Only the Supervisor shall give direction to the foreman or the aquatic plant harvesting employees. If any commissioner wishes information disseminated to the foreman and ultimately to the employees, such request shall be channeled through the Supervisor.

Summary

In summary, employees shall take direction from the foreman, the foreman shall take direction from the Aquatic Plant Harvesting Supervisor, and the Aquatic Plant Harvesting Supervisor shall carry out the policies of the District Board of Commissioners consistent with the Okauchee Lake Aquatic Plant Management Plan and in compliance with the WDNR Aquatic Plant Harvesting Permit.