# Paddock Lake Aquatic Plant Management Plan 2004

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# Chapter I

# INTRODUCTION

In 1989 the State of Wisconsin enacted the Lake Management Planning Grant program. The program was designed to provide cost-sharing assistance and incentives to local communities because they are the front line for lake management activities. The development of this Aquatic Plant Management Plan is one part of a continued effort by local residents to improve Paddock Lake. Paddock Lake is a 132 acre lake located in the Village of Paddock Lake, Kenosha County, Wisconsin. The lake has a maximum depth of 32 feet and 3.4 miles of shoreline. The land area immediately surrounding the lake is primarily residential.

The Paddock Lake Rehabilitation and Protection District (District) was created in 1975. The lake was experiencing nuisance levels of aquatic plants and the District purchased aquatic plant harvesting equipment. The purchase included one harvester and support equipment. Harvesting began in 1981. The District has continued to operate the harvester on a full time basis throughout the summer months.

A very important component of the program is that the District has a good working relationship with the Village of Paddock Lake. The two entities have invested in a storage facility and the District rents a truck from the Village. The Village recognizes the value of the lake, and the District's programs. The District's harvesting program keeps the beaches free from nuisance aquatic plants for the enjoyment and safety of the swimmers.

The harvesting program on Paddock Lake is considered essential to maintaining a reasonable level of recreational use by the community and has been fully supported by the local citizens.

## PUBLIC INTERACTION

The plant management plan was developed by Aron & Associates, in cooperation with the District, the WDNR, and the public. Public input and historical records are an important part in the development of this plan. Discussions, comments, and communications received over the past 5 years, were considered in the development of this plan. Comments and information were solicited from:

- residents and board members,
- lake users,
- community meetings,
- WDNR resource managers,
- WDNR records, and
- SEWRPC records.

The District intends to use this plan to guide future plant management decisions, and to educate the residents on the merits of the issues addressed in the plan.

## GOALS & OBJECTIVES

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

The District's goal is to optimize the preservation and enhancement of aquatic systems that include water quality, fisheries, and wildlife while minimizing the conditions resulting from aquatic nuisances and to preserve and maintain safe recreational uses of Paddock Lake. To achieve the goal, the development of this plan is one component of an effort that has included water quality monitoring, aquatic vegetation surveys, watershed inventories, and watershed improvement activities.

The District desires to (listed in order of local importance):

- Control exotic and nuisance plant species by:
  - —harvesting.
  - —encouraging landowners to protect native species.
  - —using chemical treatments of nuisance species in shoreline areas if needed.
- Preserve and enhance the natural lake environment by:
  - —educating landowners and lake users in lake ecology.
  - —working with Village and County governments to develop and enforce ordinances to protect Paddock Lake.
  - —continuing to improve the watershed to protect Paddock Lake.
- Identify and expand local educational efforts that the District may undertake to improve the public's understanding of lake issues by:
  - —conducting community survey of residents and landowners within the next four years.
  - —distributing at least 1 newsletter per year and maintaining public tv and website information.
  - —encouraging community participation in lake management activities.
- Conduct in-lake management activities with the long-range goal of minimizing management to the extent 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.
  - —continue water quality monitoring efforts to assist in the documentation of results.

# Chapter II

# BACKGROUND

## PHYSICAL DESCRIPTION

Paddock Lake is a kettle lake formed during the Lake Michigan glacier as many as 13,000 years ago. Hydrographic and morphologic data are provided in Table 1. Gravel and sand dominates the near shore lakebed where the lowest densities of aquatic vegetation are found.

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

**Table 1 Hydrography and Morphology of Paddock Lake**
**Kenosha County, Wisconsin, 2003**

Area = 132 acres
Shore length = 3.42 miles
Shore development factor* = 2.12
Maximum depth = 32 feet
Mean depth = 9.9 feet
Volume = 1,281 - acre feet
Watershed area = 393 acres
Ratio of watershed area to lake area = 2.9:1

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

Sources: WDNR

**Civil Divisions**

Paddock Lake is entirely within the Village of Paddock Lake in Kenosha County. The Paddock Lake Rehabilitation & Protection District boundary includes all of the Village. The county owns and operates a park on the Southeast side of the lake.

**Watershed**

Paddock Lake and it's watershed is heavily developed. The drainage area to Paddock Lake is primarily urban, comprising 85 percent of the watershed. The remaining 15 percent is in rural uses. The majority of rural land use is agricultural. Residential land use comprises the majority of the urban land uses (Figure 2). Because the watershed is so small (393 acres), there is little room for change in the land uses. The annual phosphorus load to Paddock Lake is estimated at 200 pounds. Urban runoff contributes 98% of that annual total phosphorus load.

In 1993, the District contracted to have a management plan developed. The report, Paddock Lake Investigations and Management Plan[1] presents the findings of the study. The findings were further refined in the report, Water Quality Review and Nonpoint Source Control Alternatives[2]. As a result of the studies, the District obtained a Lake Protection Grant in 2002 to engineer and install two Stormceptor ®[3] systems. The Stormceptors provide sediment and oil and grease removal from the Hwy 50 subwatershed into Paddock Lake. The phosphorus attached to that sediment is prevented from entering Paddock Lake. Figure 2 shows the watershed of Paddock Lake.

**Soils**

The predominant soils in the watershed are Morley series. These soils usually have a silt-loam top layer with silty-clay beneath. The clay soils in this area are very deep. The clay soils prevent or minimize groundwater movement through the soils and minimize percolation down through the soils. This produces more runoff and less infiltration in the watershed.

1. Woodward-Clyde Consultants, February, 1994
2. Rust Environment and Infrastructure, April 1994
3. Stormceptor is a registered trademark of Cretex Companies, Inc

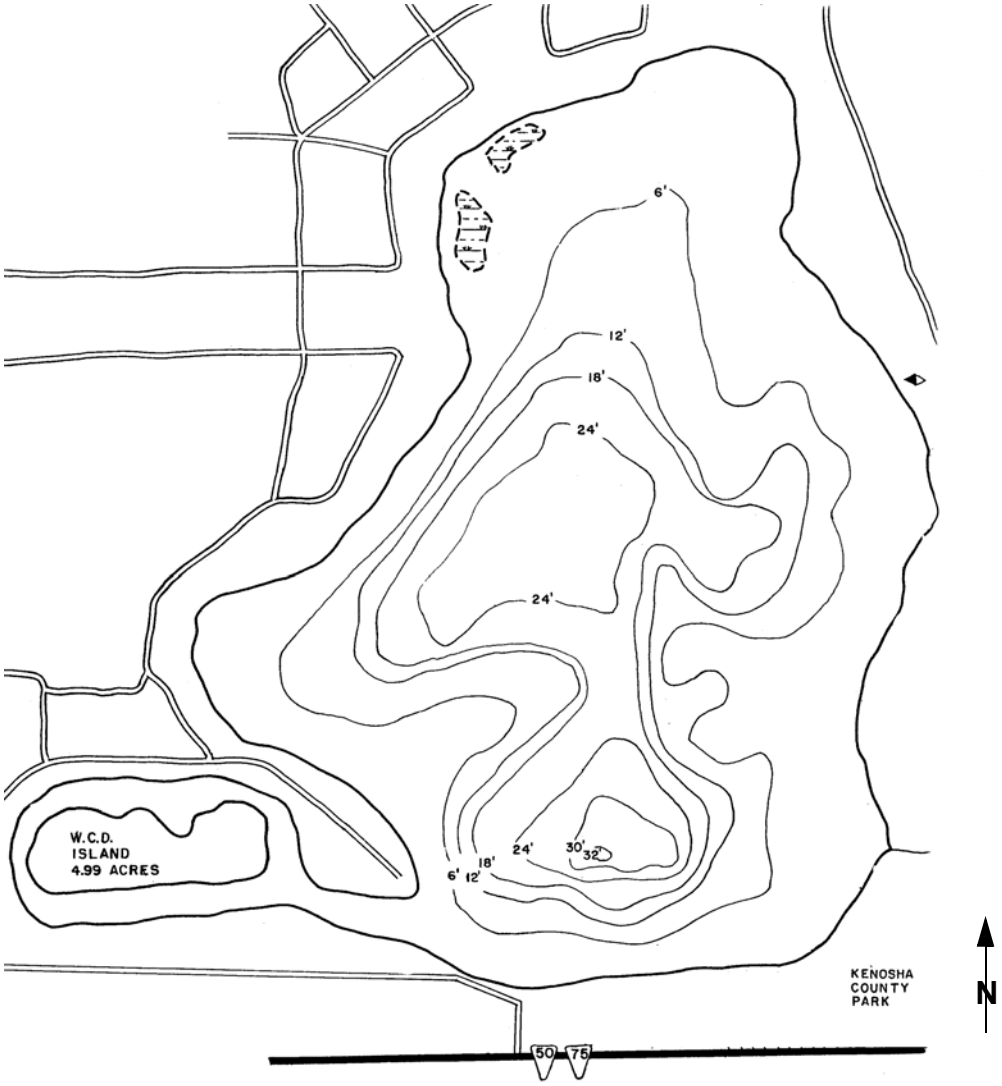


Figure 1. Paddock Lake

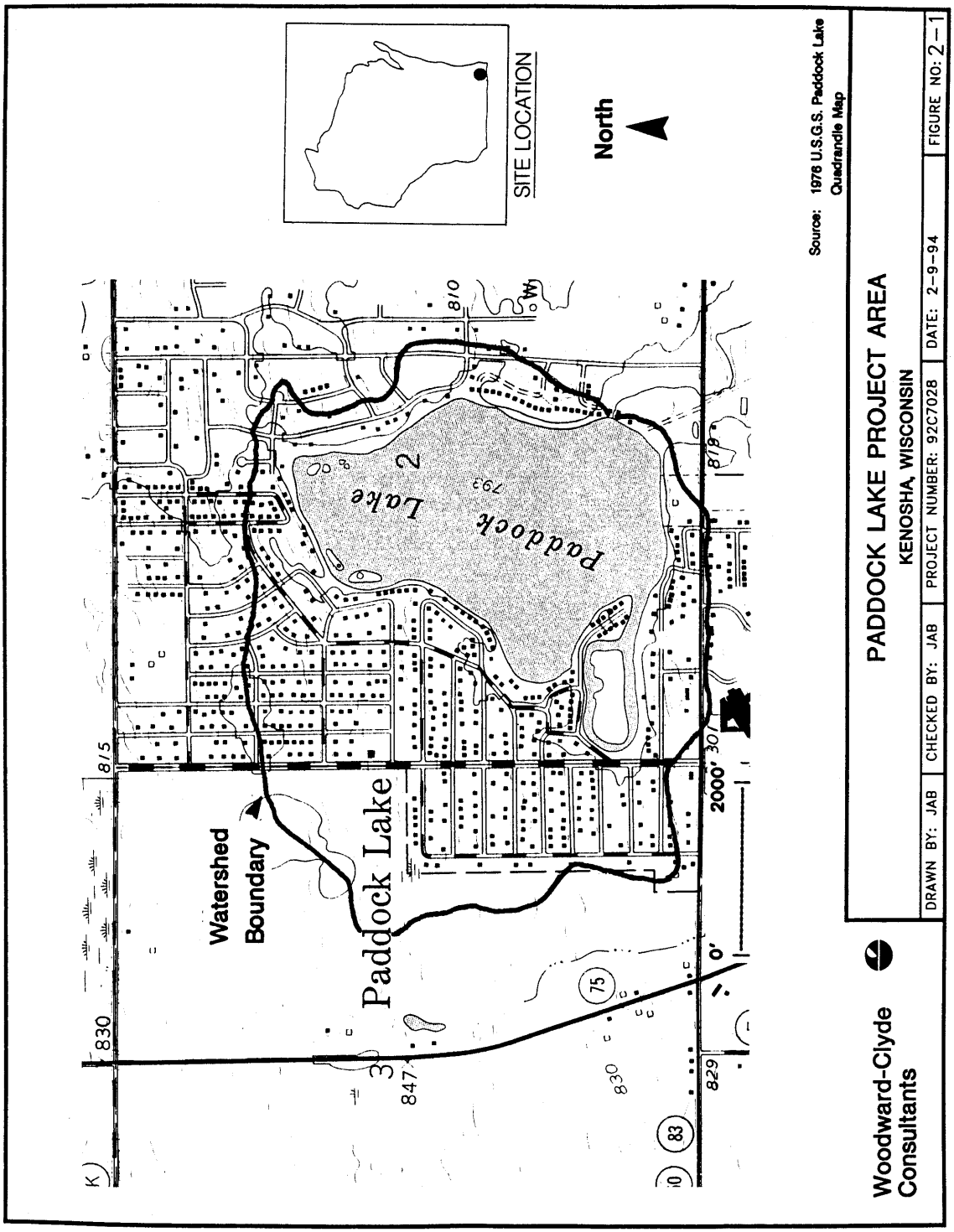


Figure 2. Paddock Lake Watershed, source: Woodward-Clyde Consultants

## SHORELINE DEVELOPMENT & AESTHETIC FEATURES

Paddock Lake and its watershed are highly developed. The island area and channel offer relief from open water to provide refuge for fish, wildlife and humans seeking an area for quiet reflection. Most of the lake shoreline is developed with single-family residential. The sloping shorelines can contribute significant problems for the lake. Disturbances by residents can result in erosion if preventive steps are not taken.

Although most of the shoreline of Paddock Lake is developed, there are a number of wooded and natural areas that are aesthetically pleasing to lake users. The channel area around the large island in the southwest corner is a serene place where a wide variety of wildlife abound. The island is owned by the DNR. The Kenosha County Park on the southeast end of the lake, also provides open space relief from the urban shorelines. Three small wetlands on the northwest shoreline provide wildlife a quiet, natural area.

## HISTORICAL CONDITIONS

The aquatic vegetation of Paddock Lake was previously surveyed by the Office of Inland Lake Renewal in 1951 and 1971. Another survey was performed by Environmental Resource Assessments (ERA) in 1978. Table 4 shows those findings.

During the 1951 survey, a total of 18 species were observed in Paddock Lake. The 1970 survey observed 12 species. According to the 1979 Paddock Lake Feasibility Study results completed by the Office of Inland Lake Renewal, Paddock Lake had a trend of milfoil dominance between the years of 1951 through 1970. The report further notes that there was a disappearance of pondweed species during these years. Survey methodology was not included in the 1979 report.

The 1978 ERA survey observed 16 plant species using a line-intersect survey. Of particular importance is the identification of two different milfoil species. Eurasian watermilfoil (*Myriophyllum spicatum*) and whorled water milfoil *(Myriophyllum verticullatum*). ERA reported that the dominant species were Chara, Eurasian watermilfoil and curly-leaf pondweed.

A general aquatic plant survey was conducted in 1993 and a plant management plan was developed. Another general aquatic plant survey was conducted in 2003 to guide the development of this Aquatic Plant Management Plan. The 2003 survey found many more species of aquatic plants than was documented in the 1969 report. The data from that survey is included in the Aquatic Plant Chapter.

## SENSITIVE AREAS

The level of development around lakes and the amount of recreational use lakes receive often diminish the value of the resources to fish and wildlife. Often, people tend to underestimate the affect they have on the rest of their environment. But their 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 shelter or shade for wildlife. Retaining walls do not provide areas for small invertebrates, an essential element in the

food supply for fish. Spawning areas can be disrupted by propellers or personal watercraft. Migrating birds and waterfowl seek quiet resting places or nesting areas.

In March 1989, the State enacted legislation to protect special or 'Sensitive' lake areas from some negative impacts. The WDNR was charged to administer an aquatic nuisance control program which includes Sensitive Area Designation. Administrative Code NR 107 provides the guidance used to administer the WDNR's aquatic plant management program. The program seeks to protect native vegetation that is important to fish and wildlife. The WDNR may also restrict other 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. Legislation that was recently passed requires permits for activities including chemical treatment, aquatic plant harvesting, native species re-introductions, among others.

The WDNR has not conducted a Sensitive Area designation on Paddock Lake. Map 3 shows the areas of the lake that have the greatest aquatic plant diversity, one important component in the Sensitive Area program. The large island in the extreme southwestern bay should be considered a high value area. This area has the greatest diversity of plants and provides excellent habitat for fish and wildlife. The three small islands located in the northern bay should also be considered high value. These areas provide suitable habitat for fish and other wildlife. Areas such as these can also be a native aquatic plant seed source for the rest of the lake. The native species in these areas are extremely important to the long term health of the fisheries and vegetation diversity on Paddock Lake and should be protected.

Paddock Lake has very limited areas of natural shoreline. Residents should be encouraged to naturalize their shorelines. Aquatic vegetation in the nearshore areas stabilize soft sediments, preventing them from becoming resuspended into the water column because of wind or boating. The shallow areas of native aquatic plants should be preserved.

## FISH AND WILDLIFE

Paddock Lake maintains a warm water fishery. Northern pike, largemouth bass, and panfish are plentiful. Carp and other rough fish are also in the lake. Detailed surveys of the fisheries are valuable tools for assessing the health of the Paddock Lake fishery. The District should work with WDNR fisheries to ensure regular surveys take place to protect the quality of the fisheries.

The high level of residential development around the lake restricts the value of the resource to wildlife. The lake may be used by ducks, geese and other waterfowl primarily during migration. Shorelines that are highly developed, especially those with retaining walls, create problems and barriers for frogs and turtles that need access to land. Retaining walls have few, if any, spaces and cavities for small creatures to hide. This can impact the food source for fish.

A problem facing many lakes in Southeast Wisconsin is the non-migratory Canada goose. These geese are an entirely different species than the migratory goose and cause significant problems, both for residents and for the water quality of the lake. The non-migratory geese remain in an area

year-round. They especially like mowed lawns and open water, making lakeshore areas prime targets. People often enjoy watching a few of these geese, but the problems arise as the numbers increase.

## WATER QUALITY

Water quality studies on Paddock Lake have been limited to Volunteer Self Help Monitoring, under guidance from the WDNR, and the collection of data during the development of the watershed studies. Volunteers have collected data since 1989. According to the 2002 Annual Report[1], the lake is considered mesotrophic, with an average Trophic State Index of 43. Mesotrophic lakes are moderately fertile systems that support abundant aquatic plant growth and productive fisheries. The average Chlorophyll was 3 ug/l, ranging from a low of 1 ug/l on May 31, 2002 to a high of 19 ug/l on April 27, 1993. Total Phosphorus averaged 22 ug/l, with a low of 12 ug/l on Aug 28, 1996 to a high of 43 ug/l on Oct 6, 2003. Clarity of the lake is measured by use of a secchi disk, and readings ranged from a low of 4.5 feet on August 16, 2003 to a high of 16.5 feet on May 18, 2001. The highest clarity readings are typically found in May, with the lowest being found in July.

The Self-Help data may be accessed on the WDNR website by going to: www.dnr.state.wi.us/LakesSelfHelp/lakeshome.asp. Then select ”Annual Report” or “Download Chemistry and Secchi Data”. Then enter “PADDOCK” and Kenosha County. The lake entry is case sensitive so be sure to enter PADDOCK, or you may not reach the proper site. The 2002 annual report is included in the Appendix.

## EXOTIC SPECIES

During the aquatic plant survey, Paddock 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.

No zebra mussels have been found in Paddock Lake to date. WDNR collected water samples in 2003 which also indicated the zebra mussels were not yet present. 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.

1. 2002 Self-Help Lake Monitoring Results For Paddock Lake (Kenosha County) Deep Hole, Wisconsin Department of Natural Resources

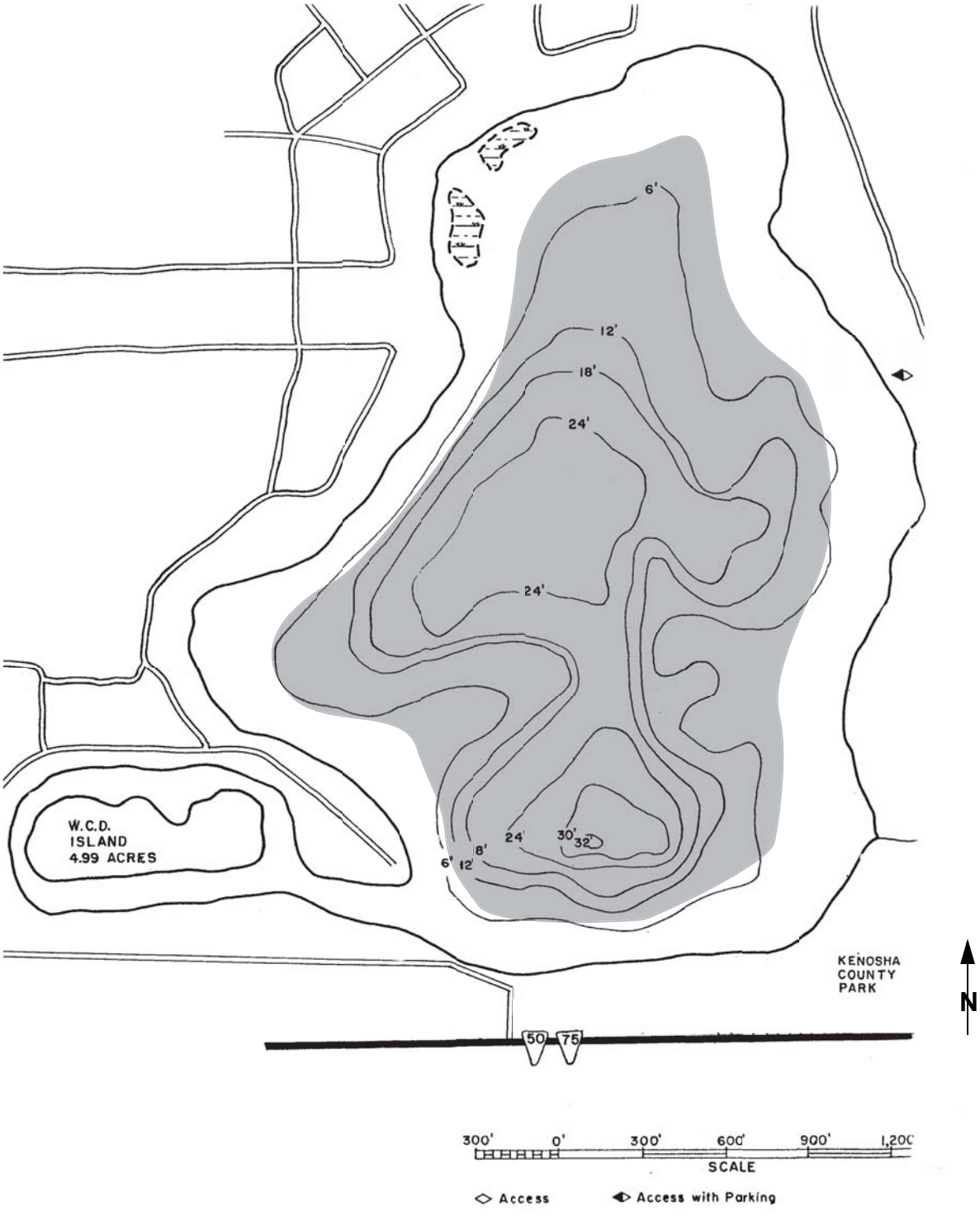


Figure 3. Speed Boating Areas, Paddock Lake, 2003

## ACCESS LOCATIONS

Paddock Lake meets the Wisconsin Department of Natural resources (WDNR) standards for public access to an inland lake. There is one public boat access on Paddock Lake. It is located on the East shore of the lake, off 238th Avenue (Figure 1). Parking is available for 15 cars and trailers approximately one block from the boat ramp. Handicap parking is available at the boat ramp. This access is owned and maintained by the Village of Paddock Lake. Two private boat ramps are located along the north and south shores.

There are two public beaches on Paddock Lake. The first is located at Old Settlers Park on the southeast end of the lake and is owned and operated by Kenosha County. The second is located along the northeast shore and is owned and operated by the Village. The fishing pier is located in the southwestern corner of the island channel. The pier was built by the Village of Paddock Lake in cooperation with the District.

In addition to the two public beaches, there are two private beaches. The first is located along the north shore and is associated with the private boat ramp. The second beach is located on the peninsula along the southwest shore and also has a boat ramp. Both these beaches are owned by the Paddock Lake North and South Associations, respectively. The South Association also owns land along the western shore within the channel area. This area has several piers where boats may be moored. The association charges a small yearly fee for these piers. Also located along the channel area is a handicap fishing pier. This pier was built by the Village of Paddock Lake in cooperation with the District. The District also conducts swimming lessons on Paddock Lake.

## LAKE USE

Because of its proximity to the downtown Village of Paddock Lake, Paddock Lake receives a high degree of recreational pressure. The majority of recreational uses are water-skiing, personal watercrafting, scenic viewing, swimming and fishing. Figure 3 shows the area used for speed boating. The Kenosha County park, and a number of private swimming beaches around Paddock Lake provide swimming and lounging opportunities for residents and lake users. Swimming conditions are affected by nuisance quantities of aquatic plants, which are mechanically harvested. Swimming is also limited by water quality problems which may be caused or exacerbated by geese. High coliform readings taken in the area of beaches results in beach closings.

The small size of the lake restricts the area available for high speed boating activities. Nuisance aquatic plant problems further restrict the area available for boating activities. Because of the highly urbanized setting of Paddock Lake, hunting is not allowed.

## BOATING ORDINANCE

The Village of Paddock Lake has a boating ordinance in effect on Paddock Lake. The local ordinances are occasionally reviewed and modified. A copy of the ordinance is included in the Appendix. In addition to the local ordinances, state laws are in effect on the lake and are enforced by the Conservation Wardens. The Village operates a boat patrol on Paddock Lake. The stated intent of the Paddock Lake Boating Ordinance is “to provide safe and healthful conditions for the enjoyment of aquatic recreation consistent with public rights and interests”.

Paddock Lake has adopted special slow no wake restrictions, (Table 2) during certain times, to provide pleasurable lake use experiences for a wide variety of users.

**Table 2 - Slow No Wake Hours on Paddock Lake**

| | |
|---|---|
| Monday | 7 P.M. to 10 A.M. |
| Tuesday | Sunset to 10 A.M. |
| Wednesday | 7 P.M. to 10 A.M. |
| Thursday | Sunset to 10 A.M. |
| Friday | 7 P.M. to 10 A.M. |
| Saturday | 7 P.M. to 10 A.M. |
| Sunday | 6 P.M. to 10 A.M. |

Other special restrictions are associated with the harvesting equipment which include:

- No persons or mechanically powered watercraft shall come within a thirty foot radius of the harvester when it is positioned in the lake either in an operating or stationary manner
- The weed harvester while in operation shall have the right-of-way above all other powered watercraft.

The Village of Paddock Lake has also approved a pier ordinance to regulate buoys, piers and rafts. The purpose of the ordinance is to minimize the adverse affects of the construction of buoys, piers and rafts on the ecologically significant areas of Paddock Lake, to reduce conflicts by neighbors, promote public safety, and protect navigation and other public interests.

The boating ordinances and the pier ordinance is included in the Appendix.

# Chapter III

# AQUATIC PLANTS

## BACKGROUND

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

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, raising water temperatures, and 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 and duckweed. Freely-floating plants are found where ever the winds and water current take them.

### Littoral Zone

The term littoral zone is commonly used to describe the area of the lake from the shore out to the depth where plants no longer grow. This area receives sufficient light to grow vegetation, with coarse sediments and fluctuating water temperatures.

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.

## PLANT DESCRIPTIONS

### Pondweeds

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

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

### Curly-leaf Pondweed (*Potamogeton crispus*)

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

Curly-leaf pondweed is present in Paddock Lake. 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 turi-

ons. 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 common in Paddock Lake.

**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 macro invertebrates than comparable stands of pondweeds and wild celery (Smith and Barko, 1990). This in turn affects the fisheries that can be supported by the plants. Eurasian watermilfoil has been thought to spread primarily by fragmentation, however, there is now evidence that seeds play a much more important role than previously believed (Aron, 2002).

Eurasian watermilfoil is a dominant plant in Paddock Lake. Because it is unknown how long the plant has been in Paddock 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.

Because a transect survey was not conducted as part of this plant management plan development, it is difficult to say with certainty that Eurasian watermilfoil has not expanded its range. However, a number of observations were used to make the evaluation:

- The native species have increased their range and densities.
- Numbers of harvested loads have declined the past 10 years.
- Eurasian watermilfoil beds are less dense.
- Hours of harvesting have not changed over past 10 years.
- Eurasian watermilfoil is more evenly interspersed in plant beds, rather that dominating them.
- Lake users and residents are expressing greater satisfaction with the lake conditions.

These all point to a situation where Eurasian watermilfoil does not completely dominate the plant community on Paddock Lake. More specific information can be acquired by conducting a transect survey to obtain density and frequency data. This should be considered for future evaluation on Paddock Lake.

Eurasian watermilfoil is a problem on Paddock Lake. Eurasian watermilfoil grows primarily in the deeper areas of the lake.

**Muskgrass**

Muskgrass (*Chara* sp.) is actually an algae, but is usually included in discussions of aquatic plant management.  Muskgrass is low growing and can help prevent or reduce the growth of Eurasian

watermilfoil. It can also protect lake sediments from the effects of boaters. Muskgrass will not thrive in lakes with high turbidity problems. Muskgrass is an excellent producer of fish food for large and small mouth bass (Fassett 1985).

Muskgrass is a very important asset for Paddock Lake and should be protected to help reduce infestations of other potential nuisances such as Eurasian watermilfoil. However, in some lakes, muskgrass can become very dense and problematic, prompting management actions to improve recreational access to waterways.

Muskgrass is abundant on Paddock Lake.

## PADDOCK LAKE AQUATIC PLANTS AND HIGH VALUE AREAS

A general aquatic plant survey was conducted by Aron & Associates (A&A) in July of 2003. The aquatic macrophytes observed in Paddock Lake during the survey are listed in Table 3. A total of 23 species were observed. In general, the aquatic macrophyte population of Paddock Lake is dominated primarily by *Myriophyllum spicatum*. (Eurasian Watermilfoil) and *Chara*. The maximum rooting depth was determined to be 15 feet, the same as was found in 1993 Figure 5 shows the area of Paddock Lake that was able to support aquatic plants in 2003. *Chara*, frequently interspersed with pondweeds, dominated the plant populations at depths of five feet or less. Milfoil, interspersed with an occasional curly-leaf pondweed, coontail, and sago pondweed, dominated the deeper areas.

The island and channel area on the Southwest side of the lake had the greatest species diversity where 18 of the 23 species observed were located. These species included: Chara, coontail, cattails, elodea, wild celery, curly-leaf pondweed, Fries pondweed, variable pondweed, Illinois pondweed, sago pondweed, great bladderwort, bulrush, Eurasian watermilfoil, yellow water lily, white water lily, water star grass, and arrowhead.

Another area with very good diversity was the high value area on the Northwest side of the lake. The area around the small islands included yellow and white water lilies, large-leaf pondweed, Eurasian watermilfoil, slender naiad, Chara, sago pondweed, horned pondweed, Fries pondweed, elodea, wild celery, water star grass and flat-stem pondweed. Figure 6 shows the high value areas present on Paddock Lake.

The Northeast bay had Chara, variable-leaf pondweed, white-stem pondweed, water star grass and wild celery.

During the general survey plants were inspected for signs of the "milfoil weevil". Damaged, blackened stems, and stressed plants were not located. Random bucket tests of milfoil were also done, but no weevils were found. Lakes with harvesting programs are not expected to support the weevil because harvesting removes the portions of the plant that the weevil needs. The “milfoil weevil” was not found in Paddock Lake during the 2003 aquatic plant survey (see BIOMANIPULATION on page 30).

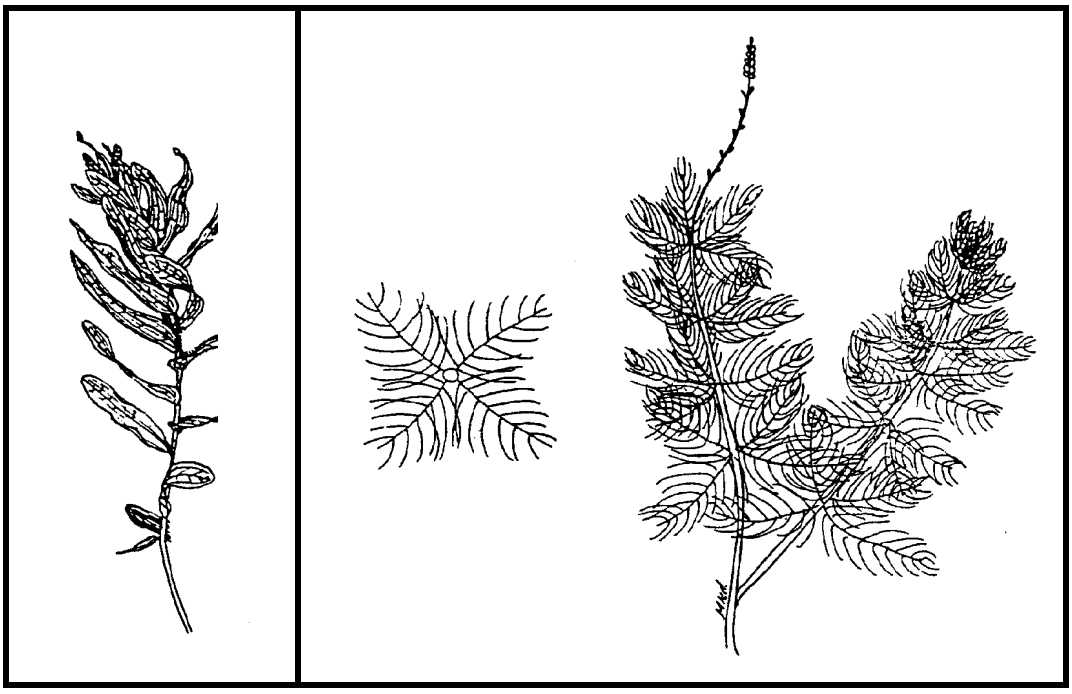

Figure 4. Curly-leaf Pondweed and Eurasian Watermilfoil.

**General Conclusions**

- The area available for aquatic plant growth in Paddock Lake was the same as in 1993: 15 feet.
- Eurasian watermilfoil does not appear to have expanded its range from 1993 to 2003.
- Chara is doing well throughout the lake, and is likely helping to restrict Eurasian watermilfoil growth.
- The aquatic plant management activities on the lake do not appear to be negatively impacting the native plant growth. Native plants appear frequently throughout the lake and appear strong and healthy.
- Current aquatic plant management activities appear to be effectively managing the nuisance plant conditions.

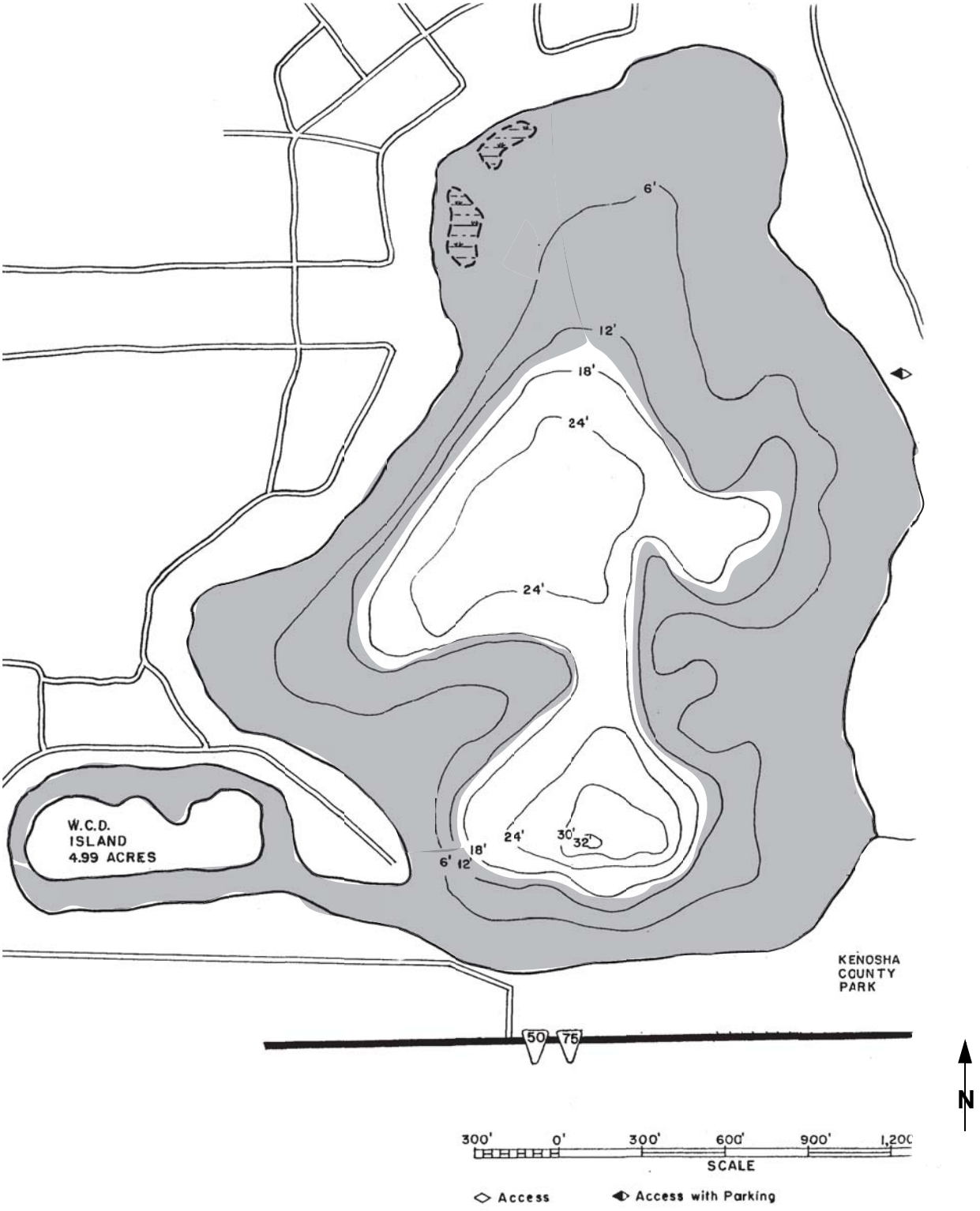


Figure 5. Maximum Rooting Depth, Paddock Lake, 2003

**Table 3 - Aquatic Plants in Paddock Lake, 2003**

| Scientific Name | Common Name |
|---|---|
| *Ceratophyllum demersum* | Coontail |
| *Chara* sp. | Muskgrass |
| *Elodea canadensis* | Elodea |
| *Heteranthera dubia* | Water star grass |
| *Myriophyllum spicatum* | Eurasian watermilfoil |
| *Najas flexilis* | Slender naiad |
| *Nuphar* sp. | Yellow water lily |
| *Nyphaea* sp. | White water lily |
| *Potamogeton amplifolius* | Large-leaf pondweed |
| *P. crispus* | Curly-leaf pondweed |
| *P. friesii* | Fries pondweed |
| *P. gramineus* | Variable pondweed |
| *P. illinoensis* | Illinois pondweed |
| *P. praelongus* | White-stem pondweed |
| *P. richardsonii* | Richardson's pondweed |
| *P. zosterformis* | Flat-stem pondweed |
| *Sagittaria* sp. | Arrowhead |
| *Scirpus.* sp. | Bulrush |
| *Stuckenia pectinatus* | Sago pondweed |
| *Typha* sp. | Cattail |
| *Utricularia vulgaris* | Great Bladderwort |
| *Vallisneria americana* | Water celery, Eel grass |
| *Zannichellia palustris* | Horned pondweed |

**Table 4 - Aquatic Macrophytes Identified in Paddock Lake, 1951, 1970, 1978, 1993, and 2003**
(X indicates presence)

| Species | 1951 | 1970 | 1978 | 1993 | 2003 |
|---|---|---|---|---|---|
| *Ceratophyllum demersum* | X | X | X | X | X |
| *Chara* sp. | X | X | X | X | X |
| *Elodea canadensis* | | | | | X |
| *Heteranthera dubia* | | | X | X | X |
| *Myriophyllum* sp. | X | X | X | X | |
| *Myriophyllum spicatum* | | | X | X | X |
| *Najas flexilis* | X | | X | X | X |
| *Nuphar sp.* | X | X | X | X | X |
| *Nyphaea sp.* | X | X | X | X | X |
| *Potamogeton amplifolius* | X | | X | | X |
| *P. berchtoldii* | | | X | | |
| *P. crispus* | | | X | X | X |
| *P. friesii* | | | | X | X |
| *P. gramineus* | | | X | X | X |
| *P. illinoensis* | | | | X | X |
| *P. longiligulatus* | X | | | | |
| *P. natans* | X | | | X | X |
| *P. obtusifolius* | X | | | | |
| *P. pectinatus* | X | X | X | X | X |
| *P. praelongus* | X | | X | X | X |
| *P. richardsonii* | | | | X | X |
| *P. robbinsii* | X | | | | |
| *Ranunculus longirostris* | | | | X | X |
| *Sagittaria* sp. | | X | | X | X |
| *Utricularia vulgaris* | | | | X | X |
| *Vallisneria americana* | X | | | X | X |
| *Zannichellia palustris* | | | X | X | X |

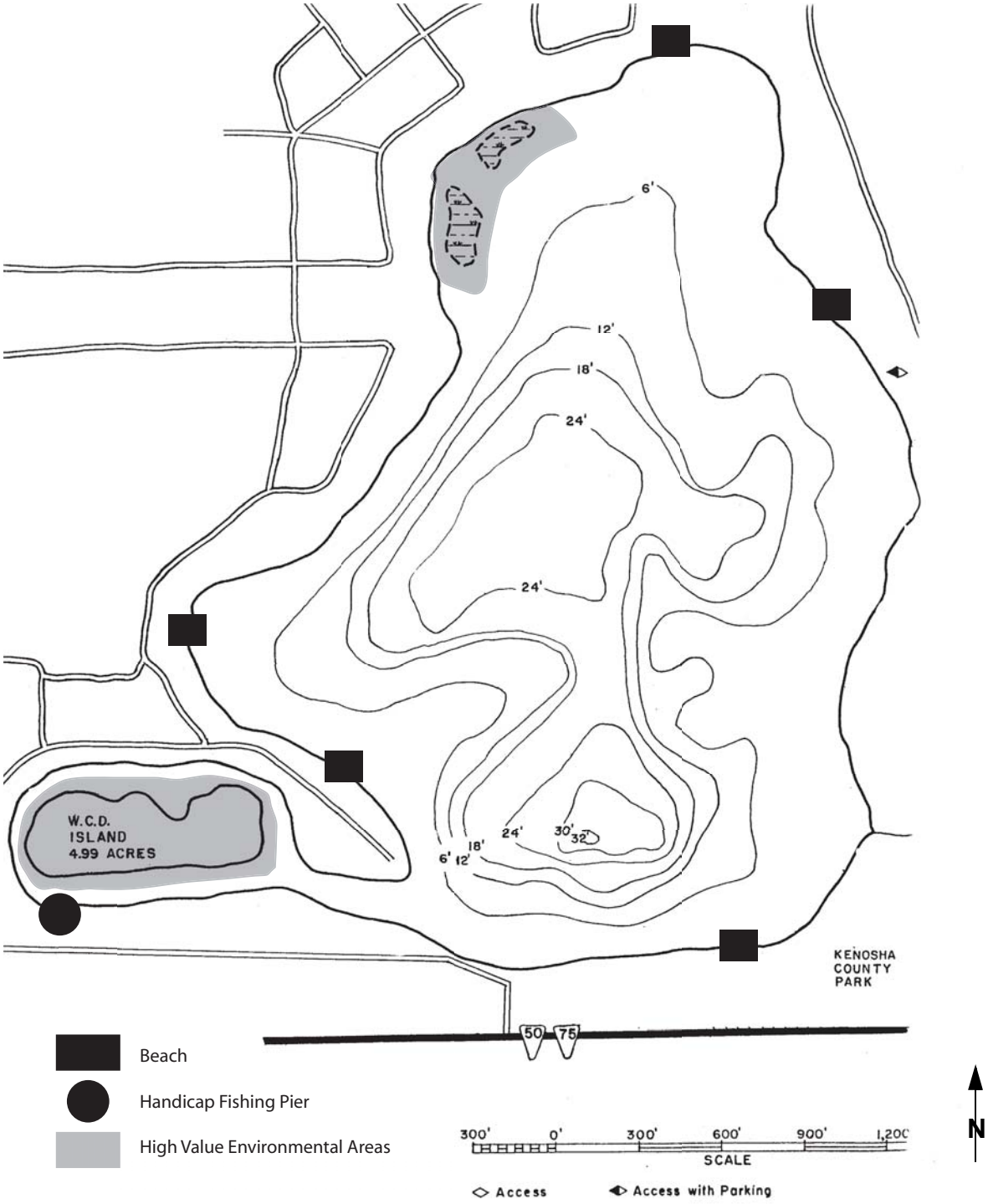


Figure 6. High Value Areas and Beach Locations, Paddock Lake, 2003

# Chapter IV

# PROBLEMS

Paddock Lake is considered a quality water resource even though its 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 Paddock Lake.

The good water clarity contributes to plants thriving in depths of 15 feet. The fertile soils in the region contribute to the excessive plant problems in Paddock Lake. Carp also create problems in lakes, disrupting game fish spawning areas, suspending sediments, reducing water clarity, and negatively impacting the aquatic plant conditions.

Although the Paddock Lake area is now sewered, for many years it was not, creating an additional contribution of nutrients which may have come from improperly maintained or malfunctioning individual septic systems. This is common in densely populated, older lake communities with septic systems.

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. However, 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.

When nuisance conditions exist, dense plant beds can limit boating. Dense plant beds may also impair swimming and contribute to stunted panfish populations by reducing opportunities for grazing by predators. Also, the canopies created by Eurasian watermilfoil collect debris and are unsightly and sometimes odiferous, for those desiring a pleasing scenic view. Parts of plants broken by wind and wave action, or by motors (even electric ones), float around the lake, create shoreline debris, and reroot into new areas. Also, swimming perils exist in long Eurasian watermilfoil and curly-leaf pondweed strands.

Eurasian watermilfoil is causing the aquatic plant nuisance problems in Paddock Lake.

The District has been working to improve the quality of the watershed runoff. In 1993, the District hired engineers to study the watershed and to develop designs for catch basins. The goal was to divert sediment-laden runoff into the basins where the sediment drops out.

The catch basins, Stormceptors, have been installed and are removing sediment from inflowing stormwater.

It is important to remember that it is far cheaper to prevent a problem than it is to correct a problem. A cars' oil change costs only $20 but a new engine costs over $1000. The same holds true for lakes. Public information efforts to prevent problems and the cost of annual monitoring programs are much cheaper than major lake restoration projects. Stopping erosion and nutrients from entering the lake is much more cost effective than attempting to dredge or correct plant and algae problems.

# Chapter V

# HISTORICAL PLANT MANAGEMENT

## CHEMICAL TREATMENT

The District has not used chemical treatment to control plants and algae. District residents to date have preferred to manage nuisance vegetation using harvesting, and have been satisfied with the program.

## HARVESTING

Paddock Lake has been harvesting aquatic plants since 1981. The program was supported entirely by the local community through donations and tax revenue, until 1993. At that time, the District applied for and received a cost-sharing grant from the Wisconsin Waterways Commission. The grant was used to purchase the current equipment. The local share of the grant was handled by tax revenues of the District.

Paddock Lake harvests aquatic plants throughout the summer. The program is operated by the District.

## OTHER MANAGEMENT ACTIVITIES

Individual landowners have maintained their own immediate shorelines using low intensive activities such as raking and pulling plants.

# Chapter V

# PLANT MANAGEMENT ALTERNATIVES

Control of exotic or nuisance plant species is an uphill battle. The very nature of the plant species survival provides the means to spread rapidly. Fragmentation is important for Eurasian watermilfoil. Wild celery can spread by releasing from the sediments and floating to new areas in late summer and fall. Curly-leaf pondweed spreads by creating turions from which new plants grow. It is now suspected that Eurasian watermilfoil can spread significantly through seeds as well as fragments (Aron, 2002).

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 will continue to expand its range in Paddock 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 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-established a balanced plant population.

***Conclusion—***Although No Management is technically a possibility for Paddock Lake, it should not be considered for the best, long term interest of the water resource.

## DRAWDOWN

Drawdown can be used to control some plant growth. Use of this method entails dropping the lake X number of feet for a period of time. This exposes the plants to extreme temperatures, drying and freezing. Some plants respond very favorably to drawdown, while other plants react negatively, or unpredictably. Eurasian water milfoil and coontail react unpredictably (Nichols 1991). 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 reachable by 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 high recreational demands on the lake and because it is not effective for controlling milfoil, drawdown for the purpose of aquatic plant control on Paddock Lake is not recommended.

## NUTRIENT INACTIVATION

Nutrient inactivation is used to control the release of nutrients, primarily phosphorus, from the sediments. One of the most common substances used is aluminum sulfate, or alum. The alum treatment creates a floc formation covering the bottom sediments, preventing phosphorus from being released into the water. Nonpoint source pollution controls must be implemented prior to the use of alum, or the floc will be covered with newer nutrients. Based on the volume of the lake and the cost of alum, an alum treatment on Paddock Lake would cost approximately $25,000.

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

***Conclusion—***Although surface water quality is available, data are not available regarding phosphorus levels in bottom water. Therefore, without a more thorough review of water quality that demonstrates nutrient release from the sediments is a problem on Paddock Lake, nutrient inactivation is not recommended at this time.

## DREDGING FOR AQUATIC PLANT CONTROL

Dredging is most often used to increase depths for navigation in shallow waters, especially for channels, rivers, and harbors. Dredging for the sole purpose of plant control has met with mixed success. To be considered successful for aquatic plant control, dredging would need to bring the lake bed to depths beyond 15 feet deep, the maximum rooting depth in the lake. Eurasian watermilfoil prefers soft sediments. To minimize rapid re-infestation of the remaining sediments, dredging would need to be done to a hard pan layer. Dredging is the most costly form of plant management control. Costs range from $5.00 per cubic yard up to $20.00 per cubic yard depending on site conditions, method used and disposal costs. A WDNR permit is required.

***Conclusion—***Dredging for aquatic plant control would not be considered a viable alternative for Paddock Lake because of the very high cost and considerable disruption of the aquatic environment.

## AERATION

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

Aeration is an expensive lake management technique. Initial capital costs for a lake this size is approximately $30,000 to $40,000 and an annual maintenance and operational cost of at least $5,000. Water quality problems may result with improperly sized aeration systems so initial planning and engineering must be done carefully to prevent creating greater problems. Annual operational problems and costs are difficult for small lake organization budgets and staff.

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

***Conclusion—***Paddock Lake has good water clarity, and good dissolved oxygen levels so aeration should not be considered at this time, without further study.

## 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 to create swimming areas. A negative impact of using screens is that all plant species are affected by the installation of screens, even native plants. WDNR permit is required.

***Conclusion—***Screens may be a viable alternative for the limited applications by individual property owners to improve conditions in swimming areas, however, they are contradictory to the WDNR's stated goal of protecting native plants. They not viable for use on Paddock Lake.

## BIOMANIPULATION

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

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

In British Columbia, Canada, the larval stage of two aquatic insects, the caddis fly (*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) 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 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). Additional research is needed before many of the biomanipulation techniques can be commonly implemented in lake management. Of greatest importance is the need to establish whether a given biological control organism will not become a nuisance itself.

***Conclusion—***Neither the Grass Carp, insects, nor fungus are viable alternatives for Paddock Lake. No signs of the milfoil weevil have been found in Paddock Lake. Because of the intensive

harvesting program of Eurasian watermilfoil, and the cost of the weevils, introduction of the milfoil weevil are not a feasible management option at this time.

## 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.

Due to the species diversity, and abundance of aquatic plants in Paddock Lake, native species reintroduction or expansion has very limited application as a plant management alternative. Small, isolated destruction or removal of Eurasian watermilfoil beds could be combined with planting or transplanting Chara, water lilies or a number of different pondweeds. The planting of native emergent plant species such as bulrushes and associated upland plantings along developed shorelines could be considered. The emergent plant species will provide a buffer zone between the water and shoreline thereby reducing the effects of wave action upon the shore, and therefore reducing erosion. The emergent plants also provide important habitat for fish and macro invertebrates as well as increase the aesthetic value of Paddock 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 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 Village 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. These 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 are very inexpensive when compared to other techniques. Various rakes and cutters are available for under $100. However, hand control is labor intensive and cutters pose risks to users because of their extreme sharpness.

NR 109 allows riparian landowners to remove Eurasian watermilfoil and curly-leaf pondweed plants within their “riparian zone” without permit. 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. It is illegal to remove native plants outside the 30-foot wide area.

***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. The District may consider acquiring some rakes and cutters to loan out to property owners.

Riparian landowners may remove Eurasian watermilfoil and curly-leaf pondweed plants within their “riparian zone” without permit. 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.

## CHEMICAL TREATMENT

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. 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 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.

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.

Chemical treatment has the advantage of being 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. It may also be the method of choice to treat early infestations of Eurasian watermilfoil when hand-pulling cannot be used. Another advantage of the use of chemical control is that it is economical and very effective.

Modern herbicides have been tested extensively to be sure they can be used safely. Tests include determining toxicity levels to be sure that humans, animals and fish are not affected. Test results must also show that the herbicides do not bioaccumulate in fish or other organisms and that their persistence in the environment is low. Product labels contain the requirements for use. 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.

Treatments will likely need to be repeated at least annually. A single season treatment will not permanently eliminate the nuisance. Unless the entire lake is treated, invasive plant material will quickly re-enter the area. Although “mail order” chemicals can be purchased, their use is strongly discouraged and should not 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. Under current laws, chemical treatments are issued for the shoreline areas, 150 feet out. It is possible to get a permit to treat beyond the shoreline, however extra planning and preparation will be required. For instance, a whole-lake treatment will require a detailed plan that should include timing of treatment, dosage planned, pre-treatment data collection, and a re-infestation plan.

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 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.

***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 it comes into contact with. They are not translocated to roots and will only rarely kill entire plants. Herbicides with

the active ingredients of diquat and endothall are common contact herbicides. Contact herbicides are frequently used to provides short-term nuisance relief.

***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 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.

***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.

***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.

***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.

***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 takes at least 30 to 45 days 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. 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.

***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.

***Conclusion—*** Chemical treatment may be conducted on Paddock Lake. Treatments may be undertaken by individuals or the district. Native aquatic plant beds should not be chemically treated without a thorough review of the existing conditions. Changing plant conditions that create new shoreline nuisances may warrant chemical treatment of exotics. **Any chemical treatment conducted on Paddock Lake should only target the exotic species.**

- There may be consideration given to treating Eurasian watermilfoil and curly-leaf pondweed with the appropriate herbicides. Chemical treatment of the remaining plant communities would not be advised on Paddock Lake. It should be remembered that destruction of any native plant species populations will increase potential problems from Eurasian watermilfoil.
- Treatments should be planned to treat early enough in the season to eliminate the nuisance with the least amount of herbicide and before the native plants have been impacted by dense growths of nuisance plants.
- Proposed chemical treatments should be developed based on the existing nuisance.
- If conducted, curly-leaf pondweed treatments should be planned to try to prevent the production of turions, an important method of reproduction for the plant. The chemical treatment would help reduce the dormant apices[1] of the plant, another primary means of early season reproduction (Nichols & Shaw 1986). These treatments would allow native plants a better opportunity for growth in the area.
- Beach areas on Paddock Lake (see Figure 6), may be treated with contact herbicides.

## HARVESTING

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.

1. The apex of a plant is the end farther from the stem (Fassett 1957)

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.

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

Harvesting is a very costly management alternative. Purchase of equipment can exceed $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 by controlling nuisance species on Paddock Lake. Landowners should be encouraged to remove floaters from their shorelines. Material can be mulched or used in plant beds.

- The program should emphasize reducing nuisances rather than clear cutting.
- Harvesting should be used to remove large stands of Eurasian watermilfoil and curly-leaf pondweed.
- 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.

## 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. If boating damages a sensitive area of the lake, allowing boats in the area on alternating days does not achieve the protection sought.
- An ordinance must be reasonable and realistic. An ordinance that creates a slow no wake zone that affects all of the lake area less than three feet deep may not be enforceable. The general public could not know the extent of that area. A more reasonable approach would be to review the desired area and develop a plan based on a specific distance from shore. Buoys could then be used to identify that area.
- Any proposed ordinance should be studied to ensure that it does not aggravate a different problem. For example, many communities have shoreline slow no wake zones that exceed that of state law. On a small lake, enlarging that shoreline zone may provide more resource protection. It may also further concentrate other lake use activities such as skiing into an area too small to be safe.
- Any attempts to restrict lake use should be weighed along with the social and 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 Paddock Lake, however, they should be carefully developed and studied to ensure that they address the problems without undue restrictions and that they will actually be enforced.

# Chapter VI

# PLANT MANAGEMENT PLAN

## GOALS AND OBJECTIVES

The District's goal is to optimize the preservation and enhancement of aquatic systems that includes water quality, fisheries, and wildlife while minimizing the conditions resulting from aquatic nuisances and to preserve and maintain safe recreational uses of Paddock Lake. To achieve the goal, the development of this plan is one component of an effort that may include water quality monitoring, community input, aquatic vegetation surveys, watershed inventories, and stormwater management activities.

- Control exotic and nuisance plant species by:
  - —harvesting.
  - —using chemical treatments to control exotic species in shoreline areas if needed.
  - —encouraging landowners to protect native species.
- Preserve and enhance the natural lake environment by:
  - —educating landowners and lake users in lake ecology.
  - —working with Village and county governments to develop and enforce ordinances to protect Paddock Lake.
  - —continuing to improve the watershed to protect Paddock Lake.
- Identify and expand local educational efforts that the District may undertake to improve the public's understanding of lake issues by:
  - —conducting community survey of residents and landowners within the next four years.
  - —distributing at least 1 newsletter per year and maintaining public tv and website information.
  - —encouraging community participation in lake management activities.
- Conduct in-lake management activities with the long-range goal of minimizing management to the extent 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.
  - —continue water quality monitoring efforts to assist in the documentation of results.
  - —conduct quantitative aquatic plant survey.

## RECOMMENDATIONS

### ***Chemical Treatment***

- The scope of any District-sponsored treatment should be small at first because chemical treatment has not been used in recent years. This will require the consent of a majority of District residents. Residents may "opt out" of the chemical treatment. In other words, their shorelines would not be treated. Residents may also conduct individual chemical treatments, however, WDNR permits must be obtained prior to any treatments.
- The District may decide to use chemicals to control nuisance plants in the shoreline areas. 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.
- In the most diverse areas of the lake, treatment should focus only on Eurasian watermilfoil.
- The swimming beaches may be treated with non-selective, contact herbicides to provide safe swimming conditions.
- Depending upon conditions, targets species for chemical treatment include: Eurasian watermilfoil and curly-leaf pondweed. Curly-leaf pondweed treatments should be conducted very early in the season, but only in areas where native pondweeds are not present to be impacted by the treatment.
- Areas which are chemically treated should not be harvested.

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 extreme nuisance conditions.
- Harvesting should only be done in areas that are not treated with herbicides.
- 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.
- Pre-dominantly Eurasian watermilfoil areas should be “topped”, that is, the top 4 or 5 feet of plant material should be harvested, 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. Efforts should be made to eliminate “shading” of 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 and the importance and value of aquatic plants.

**General Recommendations**

The District staff should continue to harvest areas of the lake on an as needed basis, prioritizing the areas as follows (refer to Figure 6 on page 23):

—Open main recreational channels.
—Harvest buoyed swimming areas.
—Harvest to remove tops of Eurasian watermilfoil to prevent seed production and to open native understory to sunlight.

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

Staff needs to make sure that cutter bars are kept out of the sediments and to cut at least one foot above the native plant beds, being especially careful within the 0 to 6 feet zone where *Chara* tends to dominate the plant community. Nuisance aquatic plants, especially Eurasian watermilfoil, will likely expand their range if this recommendation is not followed.

Public acceptance and continual support are critical components to a successful program. Continue to harvest outside the piers to allow for satisfactory recreational use and public satisfaction. Harvesting should focus on removal of top portions of plants, approximately 3 feet down, or to the top of the native plants, which ever is less. This will allow light to reach the native understory. If chemical treatment is not used, harvesting may be used to relieve the nuisances up to the pier zone area as long as access is not restricted by depth.

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

Staff should continue an aggressive program to reduce the amount of “floaters” and if they do occur, should be removed immediately. 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 areas should be kept free of plant debris. Any debris in the lake should be removed each time the harvester unloads.

Comprehensive and detailed records should 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. Weather conditions
6. Other relevant information

## SITE SPECIFIC RECOMMENDATIONS

Some areas of Paddock Lake need to be given special consideration. Each of the following recommendations expand upon the previous recommendations.

1. North Bay

The emphasis here should be to facilitate navigational access to the deeper areas of the lake. Harvesting should parallel the shoreline outside the pier zone, avoiding back-and-forth motions to minimize sediment disruption from the paddle wheels. Minimizing harvesting impacts in this area will encourage native plants to inhabit the area. This will improve the fish and wildlife benefits, and will reduce the long term costs of aquatic plant control for the district.

Harvesting should not take place near the islands except to provide access to those landowners directly behind the islands. The area harvested should be minimized to the extent needed to facilitate access for those land owners, approximately the width of the harvester.

The buoyed swimming area should be harvested to allow swimming and boating, harvesting only to the tops of native plants or 3 feet deep, whichever is less.

2. Southwest Bay

This bay has a buoyed swimming area. The beach area should be harvested to facilitate safe swimming conditions, harvesting only to the tops of native plants or 3 feet deep, whichever is less. Near shore areas within the bay are dominated by Chara with a few pondweed species located intermittently within the Chara. Harvesting should be concentrated in the deeper water areas, 5 to 15 feet, where Eurasian watermilfoil dominates. Unless Eurasian watermilfoil invades the near shore, areas outside the beach should be left to minimal hand control.

3. Old Settlers Park

Old Settlers Park is located in the southeast bay and contains a buoyed, public swimming beach. This area should be harvested to provide a safe and pleasurable swimming opportunities, harvesting only to the tops of native plants or 3 feet deep, whichever is less.

4. Island Channel

The island and associated channel is located in the extreme southwest bay. The island is owned by the WDNR. The channel provides access to 86 pier owners. This area has the greatest diversity of plants in any one area. Harvesting should be limited to a single 15-foot wide channel allowing access to the main lake for those home owners in this channel. The channel should be maintained away from the island near-shore area. Harvesting should be conducted only along the developed shore. Also harvesting this area should be restricted to June 15 to August 15, unless Eurasian

watermilfoil densities and growths are such that access is restricted and plant fragments are being created.

**Schedule For Harvesting**

The District should continue to follow their present schedule. Past harvesting records in conjunction with a pre-harvest survey should be done each spring to determine which areas need attention and which areas are undergoing a change from the previous year. If plants become a nuisance in mid-May begin harvesting but note previous recommendations. The current schedule of harvesting weekdays for approximately 8 hours a day should be sufficient. Shoreline pickup should be continued as currently done.

Staff and operator time not directed to harvesting could be routed to additional lake work, such as shoreline erosion prevention, monitoring and documenting plant growth changes and educational programs.

Since most of the harvesting is done outside the pier zone, spawning habitat should not be impacted. Near-shore areas, especially those with fish spawning habitat, should not be harvested prior to June 1st of each year.

**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 few 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 problem is resolved.
3. If fish are still being harvested, refrain from cutting area and consult with WDNR or private consultant for further recommendations.

**Shoreline Pickup**

Areas requiring shoreline pickup have been predictable from year to year (Arnison, pers. comm.). Many firm sandy or gravel areas do not requires nor want shoreline pickup. Shoreline depositional zones with primarily soft sediments require more frequent shoreline pickup of weeds. During pickup, the harvester noses into the shoreline area with the paddle wheels remaining 30 feet from shore. The cutter bars are in the raised position and are not cutting. Any shoreline pickup in fish spawning areas should be avoided until after June 15th.

**Off-Loading and Disposal Sites**

Current disposal practices should continue. The District should review the sites periodically to ensure these sites remain available long term. Care should be taken to keep lake areas adjacent to disposal sites clean of cut vegetation. Staff should be instructed to remove any vegetation 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. Employees should be trained in the identification of the plants in Paddock Lake. This will help protect beneficial plant beds and will ensure accurate documentation of changes that may occur in the aquatic plant community as a part of their daily program.

**Maintenance Program & Downtime**
Maintenance should continue as is currently done. The focus should continue to be on preventive methods, rather than reactive. The District should use synthetic, biodegradable hydraulic fluids in the harvester to reduce the adverse impacts to the lake from spills. In the event this is not possible, a small spill kit should be acquired to immediately and efficiently deal with any spills that may occur.

**Storage**
All equipment used by the District to harvest aquatic plants is stored in the Village department of public works building. The storage building was built in part by funds provided by the District, so access to the building for equipment storage is ensured.

**Insurance**
Insurance coverage should remain the same unless conditions or equipment should prompt a review. Acquisition of new equipment will require an insurance review.

**Recommended Record Keeping**
District staff should continue to fill out the daily operation log. When a computer becomes available, the information should be entered 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 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.

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

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

## ***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. 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.

### ***Education and Information***

The District should take steps to educate property owners regarding their activities and how they may affect the plant community in Paddock 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 District should also enlist the participation of the local schools. The schools could use Paddock Lake as the base for their environmental education programs. Some schools have a mandatory community service requirement that may be tapped to assist with lake management activities. Regular communication with residents will improve their understanding of the lake ecosystem and should lead to long term protection.

The District should continue to use public TV to broadcast meetings, and should continue to use the website to provide information, including this Plant Management Plan.

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

### ***Watershed Controls***

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

The District should work with the Village 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 Paddock Lake.

### ***Land Use Planning***

The District should take an active role in land use planning decisions in the Village. 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 Village 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.

### ***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.

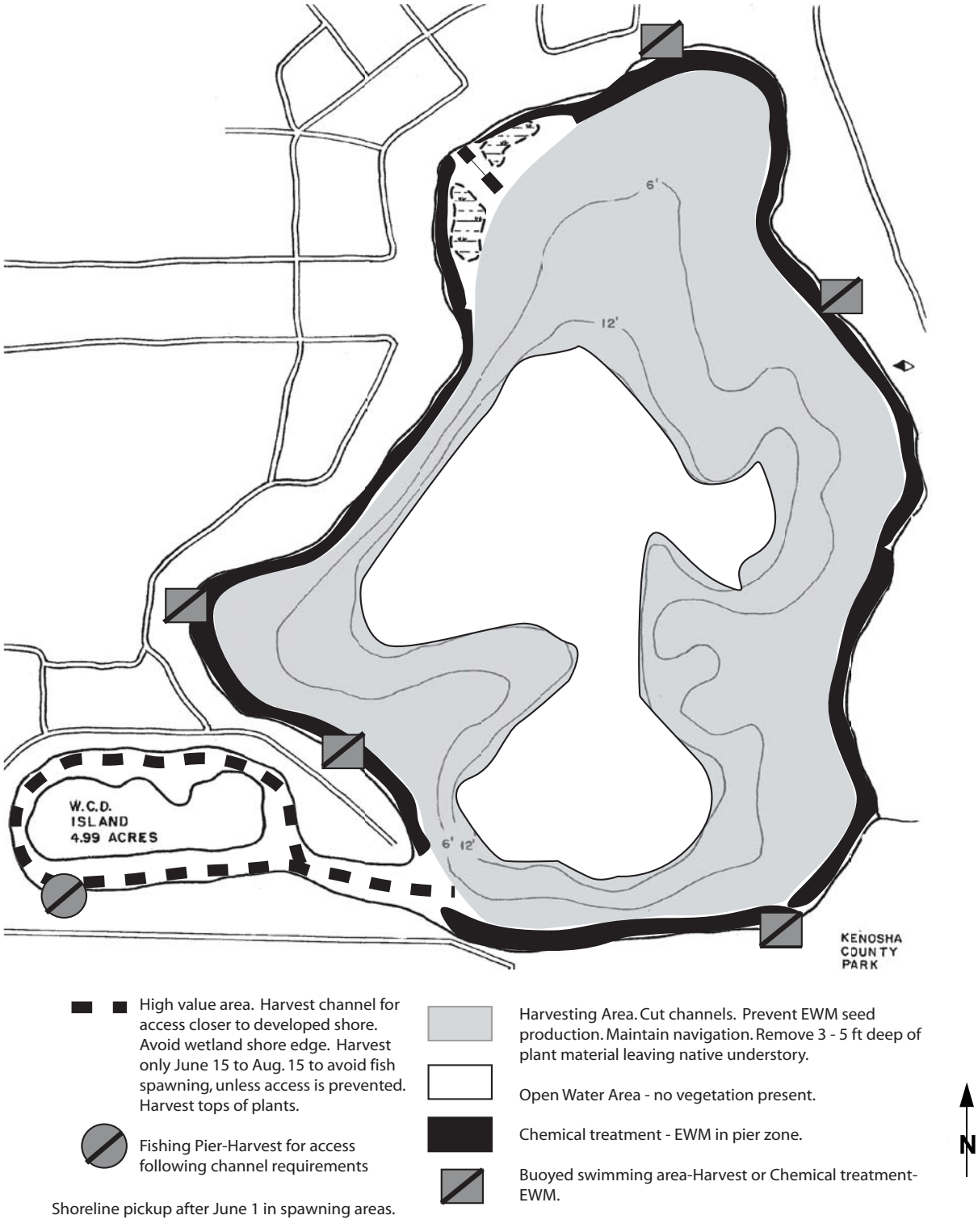


Figure 7. Paddock Lake Plant Management Plan

# Chapter VII

# EQUIPMENT - FEASIBILITY

## CURRENT EQUIPMENT

To date the District's current equipment is as follows:

- H-650 series Aquarius aquatic plant harvester.
- Shore conveyer
- Trailer
- Miscellaneous spare parts and a variety of tools

The District rents the dump truck used to transport cut plant material from the village of Paddock Lake.

In light of the size and scope of the program, the current equipment is appropriately sized to provide the relief desired.

## NEEDED EQUIPMENT

The District residents have approved the replacement of the existing equipment. The District will replace the harvester with a similarly sized harvester.

- Harvester with stainless steel mesh bed and hull
- Shore conveyor
- Trailer with brakes

The District is seeking a Wisconsin Waterways Commission grant to fund 50% of the cost of the equipment. The District maintains a lake improvement fund and has sufficient funds to cover the local share of the equipment purchase.

## FEASIBILITY

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

The planned equipment purchase is feasible from both a financial responsibility perspective, as well as the aquatic resource perspective.

# Chapter VIII

# 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 quantitatively review or contract to review, the plant populations of Paddock 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 IX

# SUMMARY

- The management of aquatic plants on Paddock Lake should focus on management of exotic species.
- The District may continue to use harvesting to manage exotics.
- The District may elect to use chemical treatment to control nuisances in shallow near shore areas if residents approve.
- The District should encourage landowners to grow more natural shorelines and emergents to minimize the areas disturbed for lake use.
- The District should provide landowners with information on erosion control, especially on the steeper shorelines.
- The District should distribute informational materials regularly to residents on such topics as proper lawn and garden practices, land use impacts and the importance and value of aquatic plants.
- Property owners should restrict the use of hand controls to Eurasian watermilfoil and curly-leaf pondweed only. They should minimize the size of any areas that are cleared.
- Property owners should keep their shorelines free of floating plant debris to prevent spreading nuisance plants.
- Chemical treatments may be used, planning each treatment to ensure that only the target plants are affected.
- Conduct a quantitative aquatic plant survey every 3 to 5 years.

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# LOCAL CONTACTS

## KENOSHA COUNTY

| | |
|---|---|
| County Web Site | www.co.kenosha.wi.us |
| County Executive | Phone: 262-636-3273 |
| Office of the County Clerk<br>1010 56th St.<br>Kenosha, WI 53140 | Phone: 262-653-2552 |
| Clerk of Circuit Court | Phone: 262-653-2810 |
| Human Services Department | Phone: 262-697-4509 |
| Public Works<br>19600 75th St<br>Bristol, WI 53104 | Phone: 262-857-1870 |
| Register of Deeds | Phone: 262-653-2444 |
| Racine/Kenosha UW Extension Service<br>14200 Washington Ave<br>Sturtevant, WI 53177 | Phone: 262-886-8470 |
| Kenosha County Planning and Development<br>19600 75th St<br>Bristol, WI 53104 | Phone: 262-857-1895 |
| Kenosha Historical Center<br>220 51st Place<br>Kenosha, WI 53140 | Phone: 262-654-5770 |

## Wisconsin Department of Natural Resources

| | | |
|---|---|---|
| Water Resources and Chemical Permit Applications | Craig Helker | (262) 884-2357 |
| Lake Planning Grant and Lake Protection Grant Applications | Heidi Bunk | (262) 574-2130 |
| Fisheries | Doug Welch | (262) 884-2364 |
| Water Regulation and Zoning | | (262) 884-2356 |

## University of Wisconsin Stevens Point

| | | |
|---|---|---|
| Lake Specialists | Tamara Dudiak | (715) 346-4744 |
| | Bob Korth | (715) 346-2192 |
| Project WET Coordinator | Mary Pardee | (715) 346-4978 |
| Adopt-A-Lake | Laura Felda | (715) 346-3366 |

## Wisconsin Association of Lakes (608) 662-0923

# 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.

**basic**

Alkaline.

**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.

**clear cutting**

Used to describe the removal of most or all of aquatic plants in a specific area.

**conductivity (specific conductance)**

Is the waters ability to conduct an electric current.

**cultural eutrophication**

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

**decompose**

Breakdown of organic materials to inorganic materials.

**dissolved oxygen (DO)**

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

**diversity**

Number of species in a particular community or habitat.

**drainage basin**

The total land area that drains toward the lake.

**drainage lakes**

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

**ecosystem**

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

**epilimnion**

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

**erosion**

Movement of soil by water and wind.

**eutrophication**

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

**exotic**

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

**filamentous algae**

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

**food chain**

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

**groundcover**

Plants grown to keep soil from eroding.

**habitat**

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

**herbicides**

Chemicals designed to kill a variety of undesired plant species.

**hydrologic (water) cycle**

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

**hydrology**

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

**hypolimnion**

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

**impervious surface**

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

**limiting factor**

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

**limnology**

The study of inland lakes and waters.

**littoral**

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

**macrophytes**

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

**marl**

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

**metalimnion**

This is the thin layer in a stratified lake that lies between the hypolimnion and the epilimnion.

**non-point source**

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

**nutrients**

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

**pH**

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

**phosphorus**

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

**photosynthesis**

The process by which green plants create food and oxygen.

**phytoplankton**

Microscopic plants and algae found in the water.

**plankton**

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

**point source pollution**

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

**pollution**

The contamination of water and other natural resources by the release of harmful substances into the environment.

**ppm**

Parts per million.

**retention time**

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

**runoff**

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

**seepage lakes**

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

**thermocline**

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

**trophic state**

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

**turbidity**

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

**turnover**

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

**watershed**

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

**wetlands**

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

**zooplankton**

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

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