White River Lake

Aquatic Plant Management Plan, 2000

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Chapter I

INTRODUCTION

White River Lake (also known as West Branch Mill Pond) is a 64 acre lake located in the Town of Deerfield, Waushara County. The lake has a maximum depth of 29 feet. The White River Lake Management District (District) was created approximately 20 years ago, in response to growing concerns regarding the quality of White River Lake. The District acquired an aquatic plant harvester approximately 15 years ago to control *Chara* sp. Aron & Associates was contracted in 2000 to conduct an aquatic plant survey and management plan.

GOALS & OBJECTIVES

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

The increasing threat from non-native plants, specifically, Eurasian watermilfoil (*Myriophyllum spicatum*), is of great concern to the District. Controlling the exotic plant and protecting the native plant population is crucial to the ecological balance of the resource.

The District desires to:

- Preserve native plants
- Protect sensitive areas
- Control exotic and nuisance plant species
- Provide improved navigation
- Educate district members on the value of aquatic plants and the threats to a balanced population.

Chapter II

BACKGROUND

SHORELINE DEVELOPMENT & AESTHETIC FEATURES

White River Lake and its watershed is comprised of mostly rural land uses. The lakeshore riparian area is residential. Rural land uses are dominated by agricultural and other open space lands—including wetlands and woodlands. Because the watershed is dominated by rural uses, there are opportunities for further development.

Land use activities can directly affect plant growth patterns in the lake. The runoff from individual homesites adds to the nutrients and sediments in a lake. Overloaded holding tanks and sewer systems in the watershed can also greatly increase the nutrient loading to the lake. That in turn increases the plant growth, sometimes to nuisance conditions. While the loadings may occur in relatively small doses, over time, the impact can be significant. This affect may be seen near the outfall of storm drains. These areas frequently show the concentrated effects of urban impacts. Often, the lake area near a storm drain outfall has different plant and sediment characteristics than other areas of the lake. Nutrients, sediments and other materials entering the lake can severely impact the plants, fish and wildlife. Lower oxygen levels, fish kills, and sedimentation of spawning beds can result. Public and property owner education should focus on activities that will minimize their impact on the lake.

RECREATIONAL USES

White River Lake serves a variety of recreational opporutnities, including boating, fishing, swimming, ice fishing. More passive forms of recreation, such as walking, picnicking, and wildlife watching, are also popular.

White River Lake has a public access, see Map 1. State boating laws apply on White River Lake.

Table 1. Hydrography and Morphology of White River Lake

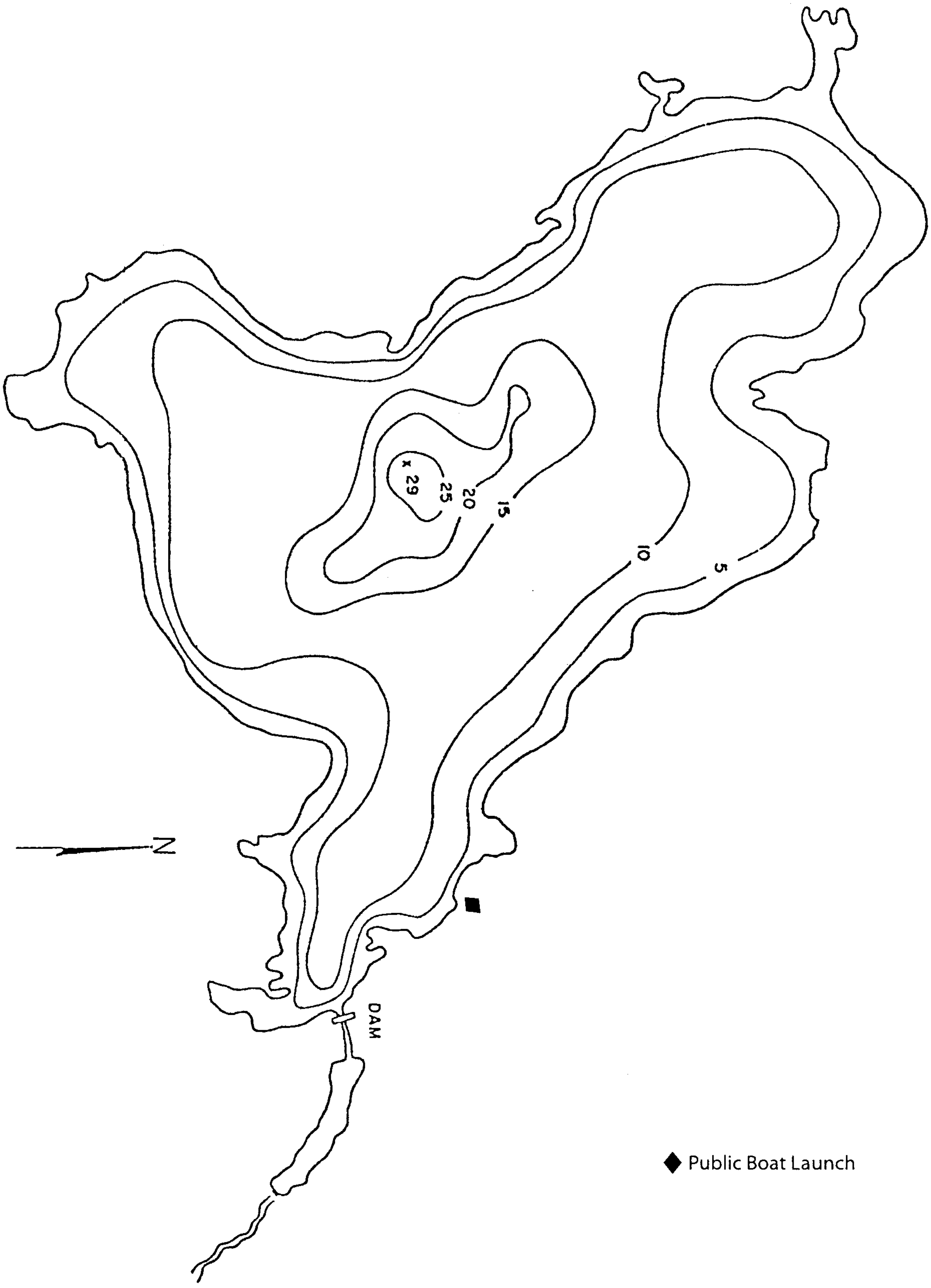
Waushara County, Wisconsin, 2000

Area = 64 acres

Shore length = 2.1 miles

Maximum depth = 29 feet

Map 1 - White River Lake, 2000



VALUE OF AQUATIC PLANTS

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

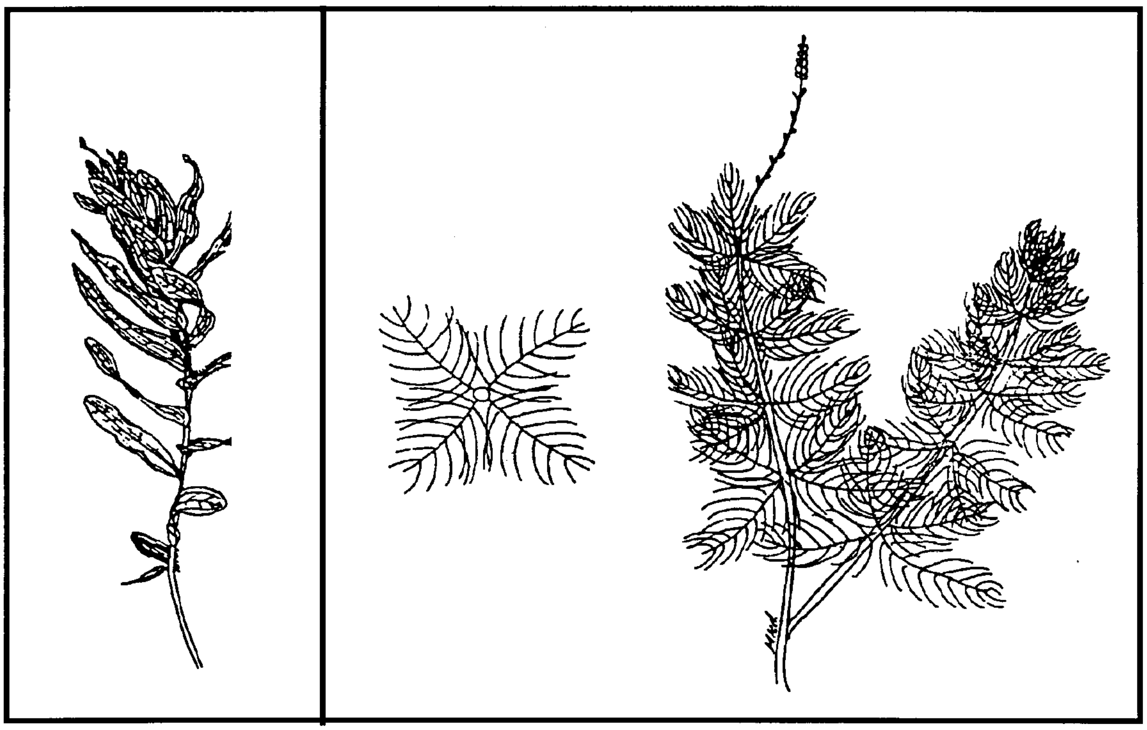


Figure 1. Two exotic species: curly-leaf pondweed (left) and Eurasian watermilfoil.

Many aquatic plants are important food sources for waterfowl. Others provide habitat, spawning and shelter areas for fish. Exotic plant species do not provide these benefits as well as the native plant species. Exotic plant species tend be more dense, and often grow to the surface where they interfere with recreational uses. Some exotic plant species will create 'canopies' that prevent light from reaching native plants underneath. Protection of native species is an important means of reducing problems from exotic species.

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 can reach nuisance levels when the beds become very large and dense. The Chara beds "break away" from the sediments and rise to the surface where they collect debris and algae.

Muskgrass is a dominant plant in White River Lake. It covers much of the littoral zone. Muskgrass presents a management problem which the District addresses with its harvesting program. When possible. muskgrass should be protected to help reduce infestations of other potential nuisances such as Eurasian watermilfoil. Using the harvester control Chara increases the opportunity for the invasive species. Extra care should be taken to locate and remove exotic plants.

Eurasian watermilfoil (*Myriophyllum spicatum*), Figure 1, 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 also can contribute to stunted panfish populations by providing too much protection from predator fish (WDNR 1988). Eurasian watermilfoil stands have been found to support fewer macroinvertebrates than comparable stands of pondweeds and wild celery (Smith & Barko 1990). This in turn affects the fisheries that can be supported by the plants. Eurasian watermilfoil was found in a couple of locations on the lake. Small infestations should be quickly located and destroyed to prevent the spread throughout the lake. Eurasian watermilfoil has been found in White River Lake. Two areas with Eurasian watermilfoil were chemically treated in 2000. A survey of those areas in 2001 found they were still free of Eurasian watermilfoil. A local resident has now been trained to identify Eurasian watermilfoil and regularly looks for the plants. When they are found, the resident digs the plants out by the roots and destroys them.

Curly-leaf pondweed (*Potamogeton crispus*), also shown in Figure 1, tends to be more dominant in early summer, dying off in mid-July and August. Like Eurasian watermilfoil, curly-leaf pondweed is an exotic plant species. It has several advantages over native plants that allows it to become established early in the season. Curly-leaf produces dormant structures called turions by the end of June and early July. These turions rest on the bottom until fall when they begin to germinate and produce small plants. The fall growth then over-winters in a green condition (Nichols and Shaw, 1990). In spring, when water temperature and light intensities increase curly-leaf is ready to grow thereby out competing other plants that must germinate from seeds or re-establish rootstocks. Curly-leaf dies back in mid-July when other plants are beginning their peak growth periods. The die-off can create algae problems when the decaying plants release nutrients that fuel algae blooms. This can be very severe if curly-leaf dominates the plant community. Curly-leaf pondweed provides a good food source for waterfowl, especially as an invertebrate substrate, which is also used by fish. Curly-leaf may provide good cover for fish as long as densities do not reach a nuisance level. White River Lake has only a few curly-leaf pondweed plants.

Coontail (*Ceratophyllum demersum*) is a somewhat bushy plant that prefers soft sediments. The plants do not have a root system and float in the water column. The seeds and foliage are used by waterfowl as a source of food. Coontail also provides good spawning habitat and cover for young fish. Coontail provides a source of food either directly or by supporting fish food fauna. Coontail is able to draw nutrients from the water column. Coontail may grow to nuisance conditions. Coontail was found in 10 sample points in White River Lake.

Wild celery (*Vallisneria americana*) is a perennial plant that prefers hard substrates. The seeds and foliage are considered an excellent food source for waterfowl. Wild celery is a prime spawning habitat for northern pike. In late March to early April, the northern pike spawn on the wild celery that is left from the previous summers growth. Wild celery also provides cover for fish as well as supporting fauna that are utilized by fish for food. Wild celery may also grow to nuisance levels. Wild celery was found in only 6 sample points in White River Lake.

Pondweeds are important species of plants for a lake. Pondweeds do not grow as dense nor create a dense canopy as does Eurasian watermilfoil. Pondweeds support food and provide cover for fish. Most pondweeds provide good to excellent food for waterfowl, and different species of pondweeds become important at different times of the year. As indicated earlier, pondweeds support much greater populations of macroinvertebrates than Eurasian watermilfoil. Plant management should focus on protection and enhancement of the pondweeds, while controlling the nuisance populations of milfoil. The Wisconsin Legislature has attempted to protect native pondweeds with the passage of NR 107 in 1989. That legislation specifies that 'high' value species' should be protected and includes 12 aquatic plant species by name. Those specifically mentioned protected plants that are found in White River Lake include sago pondweed (Stuckenia pectinata), Richardsons pondweed (P. Richardsonii), and wild celery (Vallisneria americana). Another high value species in White River Lake that should be protected include Fries pondweed (P. Freissii).

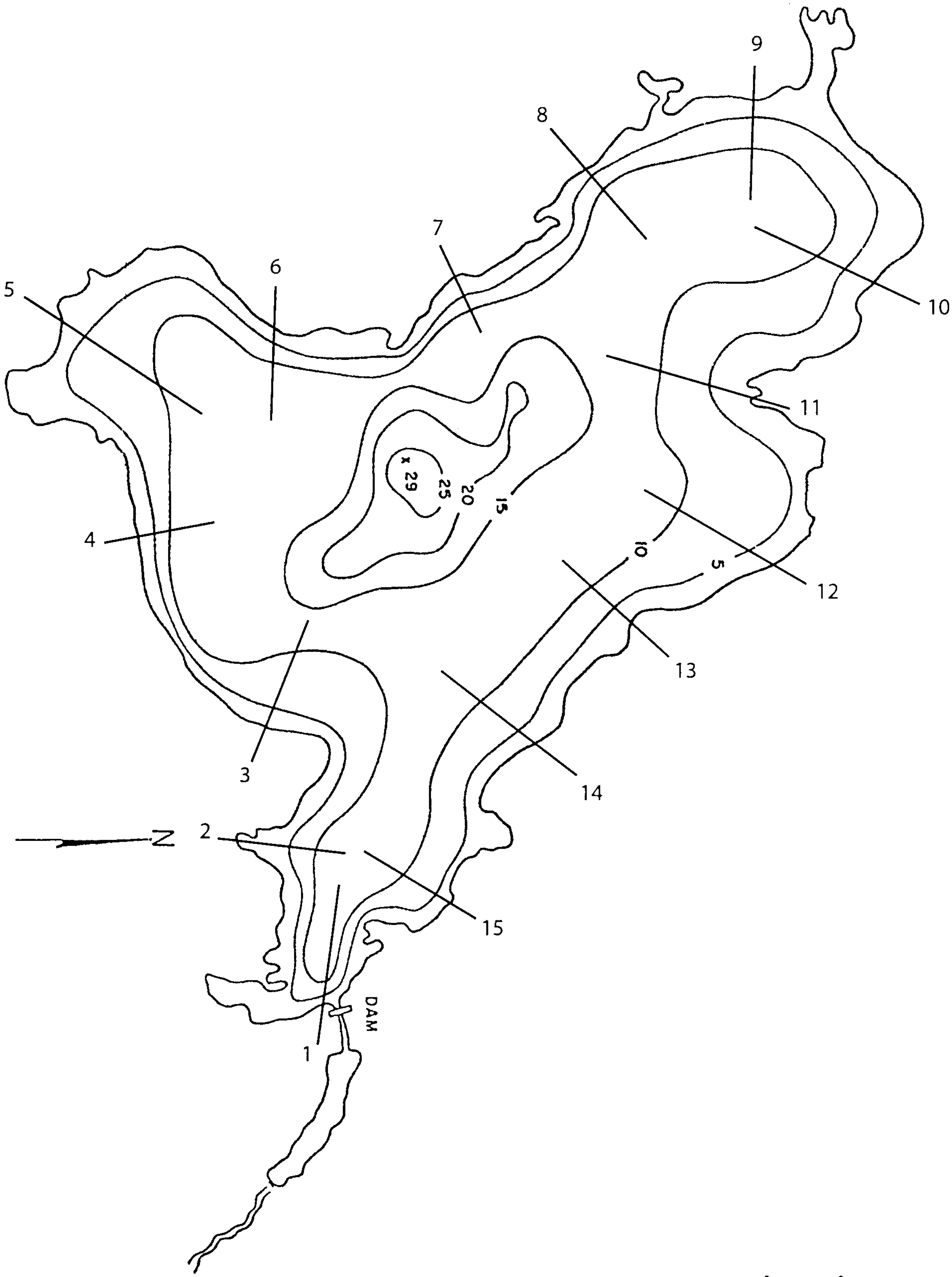
White River Lake has a good variety of pondweeds and other native plants (see Table 2).

Table 2. List of Plant Species in White River Lake, 2000

Scientific Name	Common Name
Ceratophyllum demersum	Coontail
Chara sp.	Muskgrass
Elodea canadensis	Elodea
Zosterella dubia*	Water Star Grass
Myriophyllum hererophyllum	Various-leaved Milfoil
Myriophyllum spicatum	Eurasian Watermilfoil
Najas flexilis	Slender Naiad
Nymphaea sp.*	White Water Lily
Polygonum amphibium	Water Smartweed
Potamogeton amplifolius	Large-leaf Pondweed
P. crispus	Curly-leaf Pondweed
P. Friesii*	Fries Pondweed
P. Richardsonii*	Richardson's Pondweed
P. zosterformis	Flat-stem Pondweed
Stuckenia pectinata	Sago Pondweed
Utricularia vulgaris	Great Bladderwort
Vallisneria americana	Water Celery, Eel Grass

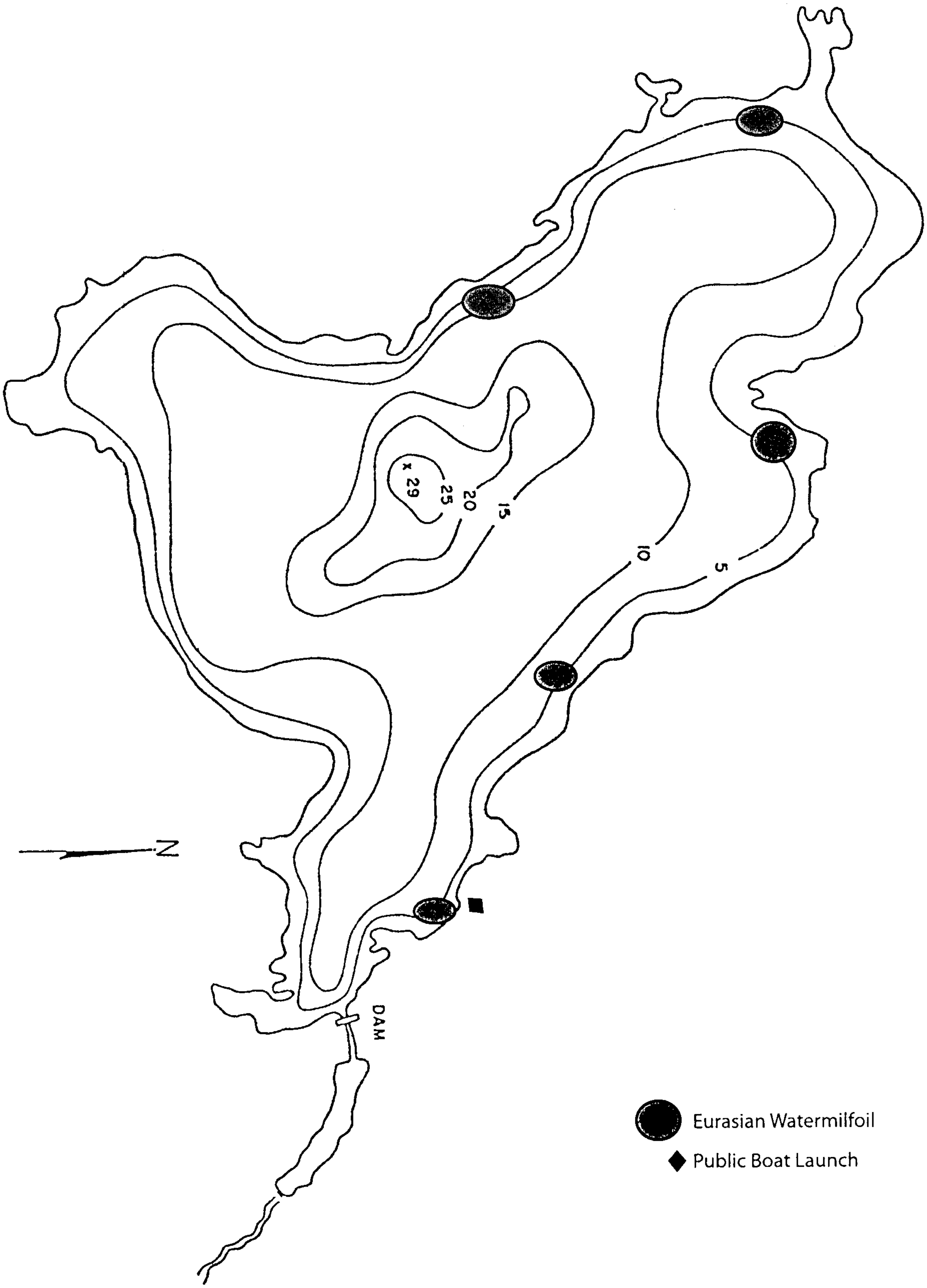
* Species found only in the general survey.

Map 2 - Transect Locations on White River Lake

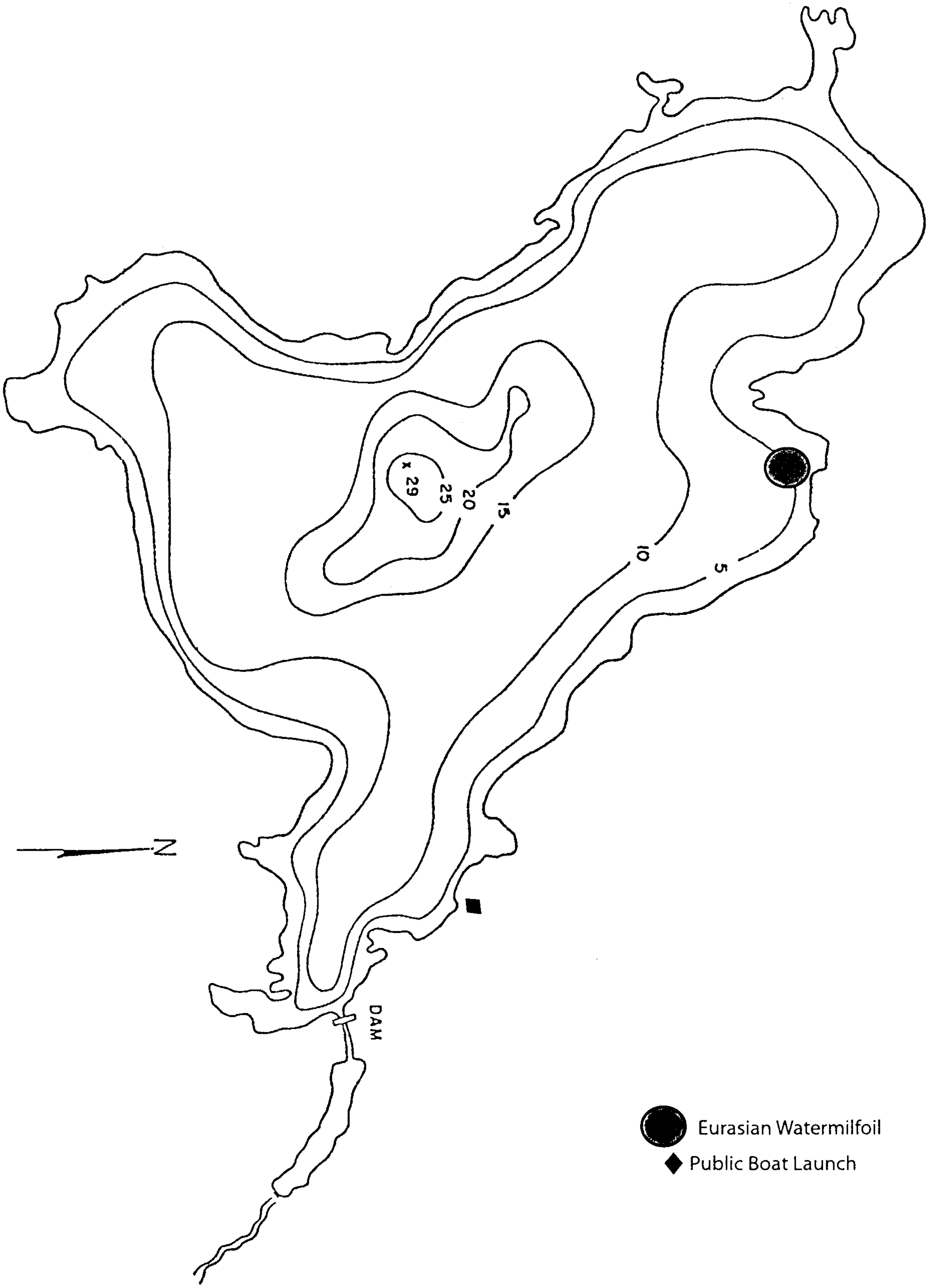


Aron & Associates, 2001

Map 3 - Distribution of Eurasian Watermilfoil - White River Lake, 2000



Map 4 - Distribution of Eurasian Watermilfoil on White River Lake, 2001



CURRENT CONDITIONS

A general aquatic plant survey was conducted on White River Lake in July 2000. Plants were found up to the maximum rooting depth of 17 feet. A transect survey was also conducted to document densities and to provide a basis for comparisons with future conditions.

The plant community in White River Lake is diverse and relatively free of non-native or exotic plant species. Chara is the dominant plant in the lake, found in 55 of the 60 sample points. Chara is estimated to cover 85% of the littoral zone of the lake. Chara is also the plant that the District controls by aquatic plant harvesting.

Flat-stem pondweed and Sago pondweed are the next most common plants found in White River Lake. Both of these plants provide excellent habitat and food source for waterfowl and shelter for fish.

A native milfoil is present in the lake, as is Eurasian watermilfoil. During a site visit in 2001, areas documented to have the nuisance species Eurasian watermilfoil, were clear. The District obtained a chemical treatment permit and treated the Eurasian watermilfoil. A District resident is obtaining certification to apply aquatic herbicides and is also making regular inspections of the lake to remove any watermilfoil plants found. Based on the site visit in 2001, these efforts to control Eurasian watermilfoil are very effective.

The shallow areas of the lake are dominated by Chara, Flat-stem pondweed, and Slender naiad. The mid-zones of the lake are dominated by Chara, Flat-stem pondweed, Sago pondweed, and Coontail. The deep areas of the lake are dominated by Chara, Flat-stem ponddweed, Sago pondweed, and native milfoil.

Sediments in White River Lake are primarily sandy/gravel on the near shore areas, changing to soft sediments in the deeper areas of the lake.

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 indeed, the affect can be significant. Wildlife will avoid areas frequented by boats and noisy lake users. Waves from the continuous use of watercraft can erode shorelines and drive furbearers from their nests. Neatly manicured urban lawns do not protect shorelines from the corrosive action of waves, nor do they provide wildlife with shelter or shade. Retaining walls do not provide areas for small invertebrates that are an essential element in the food supply for fish. Spawning areas can be disrupted by propellers or personal watercraft. Migrating birds and waterfowl seek quiet resting places or nesting areas. Also, aquatic vegetation stabilizes soft sediments, preventing them from becoming resuspended into the water column because of wind or boating.

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 are 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.

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

The WDNR has not conducted a Sensitive Area designation on White River Lake. The natural cover on some of the shoreline, and the native aquatic plants should be preserved.

FISH AND WILDLIFE

White River Lake is considered a quality fishing lake that supports both predator and pan-fish populations. The fish population includes northern pike, walleyed pike, large mouth bass, crappie, bluegill, pumpkinseed, rock bass, and yellow perch.

Natural shorelines, including tree falls and aquatic vegetation such as Wild Celery, provide spawning and rearing habitat for the fisheries. Protection of these areas is important to the overall health of the fish population.

Wildlife are affected by developed shorelines and intensive lake use. Waterfowl frequent the lake primarily during spring and fall migration.

Chapter III

PROBLEMS

Although White River Lake is considered a quality water resource, its waters and sediments contain sufficient amounts of nutrients to promote aquatic plant growth. Phosphorus and nitrogen have been determined to be the most critical components that drive aquatic plant growth. Phosphorus is likely that limiting nutrient in White River Lake.

Control of nuisance levels of Chara has been the focus of plant management activities on White River Lake. However, the increasing threat of Eurasian watermilfoil has raised the awareness of the District. Local efforts to identify and remove Eurasian watermilfoil as soon as possible should continue to be a priority.

Eurasian watermilfoil control is much more effective when the plants represent only a small portion of the aquatic plant population. Once the plant dominates the plant community, control is more difficult and native plant communities begin to decline in species diversity and densities.

Developing and maintaining a watermilfoil control program over the long term is difficult but should be a District priority.

Chapter IV

HISTORICAL PLANT MANAGEMENT

Historical plant management on lakes generally consists of chemical treatment or harvesting. Until the year 2000, White River Lake has relied upon harvesting to manage Chara. Eurasian watermilfoil was treated with an aquatic 2,4-D product under permit from the DNR.

The District owns a small harvester, a truck and a conveyor. The harvester is approximately 12 years old. The harvester is operated and maintained by District volunteers. The harvested plant material is disposed onto a local farm field. Approximately 60 acres (94%) of the lake are available for aquatic plant growth and potential harvesting.

Based on the existing plant community and the lakebed composition, the harvesting program appears to be operating without damage to the lake. The was no evidence of sediment disruption or scouring of the lakebed from the harvester. Also, the plant community was consistant around the lake, with native plants abundant and thriving.

Chapter V

PLANT MANAGEMENT ALTERNATIVES

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 at least 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 raises the cost for equipment, electricity and staff. Costs can be minimal if the lake can be lowered by opening a gate.

Drawdown for the purpose of aquatic plant control on White River 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 White River Lake would cost at least $40,000. This treatment will not prevent plant growth but will reduce problems from algae growth. Improved water clarity achieved with an alum treatment may increase aquatic plant densities. WDNR approval is required. Only waters deeper than five feet are usually treated with Alum.

Nutrient release from the sediments has not been determined to be a problem on White River 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. It is the most costly form of plant management control. Costs range from $5.00 per cubic yard up to $15.00 per cubic yard depending on site conditions, method used and disposal costs. A WDNR permit is required.

Dredging for aquatic plant control would not be considered a viable alternative for White River Lake because of its 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. 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. Unless White River Lake shows depleted oxygen levels to be a problem, aeration should not be considered at this time.

SCREENS

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

Screens create little environmental disturbance if confined to small areas that are not important fish or wildlife habitat. Although they are relatively easy to install over small areas, installation in deep water may require SCUBA. Screens must be removed each fall and reinstalled in spring. Care must be taken to use screens where sufficient water depth will reduce the opportunity for damage by outboard motors. Screens cost approximately $250 for a 700 sq. ft. roll. Screens may be used by individual home owners along their shorelines or piers to create swimming areas. WDNR approval is required.

Screens are a viable alternative for the limited applications by individual property owners to improve conditions in swimming areas, however, they are not viable for White River Lake as a whole.

CHEMICAL TREATMENT

Chemical treatment for the control of aquatic plants is a controversial method of aquatic plant control. Debate over the toxicity and long term effects of chemicals continues. 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. The decaying process of the plants uses oxygen. Depending upon the chemical used, if too much plant matter is treated at once, oxygen depletion may occur, stressing or killing fish.

Identification of the target species is very important. Different chemicals must be used for different plants. Dosage also affects the results. Too little chemical may stunt growth but not kill the plant. Too much chemical may negatively impact fish 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 another factor to consider.

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. It may also be the method of choice to treat early infestations of Eurasian watermilfoil when hand-pulling cannot be used.

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, including muskgrass, a more desirable algae. Liquid formulations, especially the copper chelated products (those combined with other compounds that help prevent the loss of active copper from the water) are more effective. These tend to remain in solution longer, allowing more contact time between soluble copper and the algae cells.

Aquathol K is a formulation containing the active ingredient endothall. This is a contact herbicide that prevents certain plants from producing needed proteins for growth. Aquathol K is used to control certain pondweeds, coontail, and water milfoil.

Reward, previously called 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 plants that it directly comes into contact with. 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. There are public use restrictions that apply when Reward has been used. The treated areas cannot be used for activities requiring full or partial body contact for 24 hours. Animal consumption, irrigation, and other domestic purposes require waiting 14 days. Reward works relatively quickly, with results usually seen in 6 to 10 days.

2,4-D (2,4-dichlorophenoxyacetic acid) 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 ten 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 water milfoil. Because it can treat several desirable species including bladderwort, water lilies and watershield, care should be taken to ensure that only the target nuisance is present before treatment.

Fluridone is a herbicide which 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 approximately 30 to 45 days 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. There are no swimming, fishing, or lake use restrictions with Fluridone. Fluridone achieves its selectivity by the use of various 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 without impacting native plants.

Native aquatic plants should not be chemically treated without a thorough review of the existing conditions, or by WDNR personnel. Changing plant conditions that create significant shoreline nuisances may warrant chemical treatment of exotics even if with a harvesting program. If the decision is made to use chemical treatment, it should be carefully conducted so that it only targets the immediate nuisance.

Prior to any treatment, a permit is required from the DNR. 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. Proper handling and application techniques must be followed, including those to protect applicators. All applications must comply with current laws in the State of Wisconsin.

Chemical treatment on White River Lake should be restricted to the control of exotic plant species, specifically, Eurasian watermilfoil.

NATIVE SPECIES REINTRODUCTION

Area lakes are beginning to experiment with aquatic plant management. Native plants are being reintroduced 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 in that they tend to grow in less dense populations and are more 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 good species diversity in White River Lake, native species reintroduction or expansion has limited application as an alternative. Small, isolated destruction or removal of Eurasian watermilfoil and curly-leaf pondweed could be combined with planting muskgrass or a number of different pondweeds. The planting of native emergent plant species and the protection of existing emergents along developed shorelines should be considered, either by individuals or in cooperation with the District. The emergent plant species would provide a buffer zone between the water and shoreline thereby reducing the damaging effects of wave action upon the shore. The emergent plants not only provide important habitat for fish and macroinvertebrates, they increase the aesthetic value of White River Lake. The emergent plants should blend into shoreline buffer zones to further enhance the environmental value.

Costs to conduct plantings vary with the number and type of plants, and whether volunteers or paid staff do the work. Successful planting can be affected by a number of factors, including health of the plant, weather, timing, and waterfowl grazing. Planting may be considered by the District or individual landowners. Landowners may contact a water resources biologist at DNR for more information.

HARVESTING

Selective harvesting is used by many lakes to control aquatic plants. Plants are cut off about five to six 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. This will not normally be seen because incoming nutrients from the watershed will usually offset any nutrients removed during harvesting (Engel, 1990).

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

Harvesting can reduce the impact from recreational boating 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 can create large amounts of "floaters" that can increase the spread of milfoil. Careful collection of these floaters by harvesters can help reduce the spread of milfoil.

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. Harvesting is non-selective, that is, it harvests all plants in its path. Areas with 'good' plants must be avoided to prevent damage to the plants.

The sediments are also very damaging to the harvesting equipment and will increase maintenance cost significantly. Attempting to operate the equipment in shallow water (less than two feet) will disrupt the sediments and the plants.

New harvester costs range from $80,000 to $120,000. Used equipment is also available in a wide range of costs.

On White River Lake, Chara is the species that grows to nuisance levels. With continued efforts to protect the lakebed sediments, and early removal and control of Eurasian watermilfoil, harvesting will continue to be a viable aquatic plant management tool.

HAND CONTROLS

A method of aquatic plant control on a small scale is hand or manual controls. 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 very labor intensive.

Hand controls should be used by individual landowners to clear swimming areas. Landowners should be encouraged to be selective in their clearing, again focusing on Eurasian water milfoil or curly-leaf pondweed. Landowners should maintain a natural area of vegetation both on their shoreline and in the water. The District may wish to acquire some rakes and cutters to loan out to property owners. Landowners should be cautious to collect all plant fragments to prevent spreading the nuisance problem.

BIOMANIPULATION

The use of biological controls for aquatic plant management purposes is currently limited to the grass carp and a few species of insects.

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 water milfoil, 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 (WDNR, 1988). Grass Carp are illegal in the State of Wisconsin and should not be used.

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 will not affect other plant species. Weevils are now available commercially. There is a statewide research project involving introduction of weevils to attempt to control Eurasian watermilfoil.

Additional research is needed before biomanipulation techniques can be implemented in lake management. Of greatest importance is the need to establish whether a given biological control organism will become a nuisance itself.

At this time neither the Grass Carp, insects, nor fungus are viable alternatives in White River Lake. No signs of the weevil were identified in White River Lake in 2000.

Chapter VI

PLANT MANAGEMENT PLAN

RECOMMENDATIONS

White River Lake continues to have an excellent aquatic plant community with a wide range of diversity. Eurasian watermilfoil was only found in isolated patches.

Management efforts should be directed toward protection and maintenance of the resource with a focus on controlling Eurasian watermilfoil.

Small patches of Eurasian watermilfoil should be eradicated using hand-raking, pulling, or chemical treatment. Additionally, signs should be placed at all access locations that describe this species and asks boaters to remove all plant material from their boats and trailers prior to and after using White River Lake.

OTHER RECOMMENDATIONS

Education and Information:

The District should take steps to educate property owners regarding their activities and how they may affect the plant community in White River Lake. Informational material should be distributed regularly to residents, landowners, and lake users and local government officials. A newsletter, biannually or quarterly, distributed to landowners and residents should be part of the plant management budget. Topics should include information relating to lake use impacts, importance and value of aquatic plants, land use impacts, etc. 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 White River Lake as the base for their environmental education programs. Regular communication with residents will improve their understanding of the lake ecosystem and should lead to long term protection.

Chemical Treatment

If there is local public acceptance, the District may continue selective chemical treatment to control Eurasian watermilfoil. If conducted, a WDNR permit must be obtained and selective herbicides should be used to protect native aquatic plant species.

Riparian Controls

Riparians should be encouraged to use the least intensive method to remove nuisance vegetation. This could include minimal raking and pulling. 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 and minimize shoreline erosion.

Harvesting

The District may continue to harvest as needed to control the nuisances. The equipment should be maintained regularly. Operators should be trained in aquatic plant identification to help protect native non-target plants.

Plant management should be avoided in areas with species of special interest such as wild celery. Operators needs to make sure that cutter bars and the paddle wheels are kept out of the sediments or to cut one foot above the plant beds when possible.

Operators should operate equipment at speeds only sufficient to harvest the plant material. Excessive speeds will increase the inefficiency of the harvester, causing plants to lay over rather than be cut, and it will increase the numbers of fish trapped.

Operators should work to aggressively control the number 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.

Procedures

At the start-up of each day all equipment should be greased and checked for proper operation. All hydraulic and oil levels should be checked, fittings greased and a visual inspection should be performed. All fluid levels and proper function of moving parts should be checked. Harvester operators should fill out a daily log that includes hours worked, time start, mileage start, harvested loads, dump truck loads, shoreline pick-up loads, gas used on all equipment, breakdowns, and bulk motor oil and hydraulic fluid used if necessary.

Operator Training

Each harvester operator should be properly trained on the equipment. The training should consist of a combination of "classroom training" and hands-on training. The training should focus on equipment operation and maintenance procedures. Training should also be provided for the identification of aquatic plants.

Record Keeping

Comprehensive and detailed records should be kept documenting:

1. Date
2. Hours worked -including harvesting and equipment down time
3. Loads harvested -including plant types and densities
4. Areas harvested -located on a map
5. Weather conditions
6. Other pertinent information

Storage

The equipment should be properly winterized by a trained serviceman. This will extend the life of the equipment.

Equipment Needs

The District will soon need to obtain a harvester. An eight foot harvester should be sufficient to accomplish the goals of the District.

Plan Reassessment

The District should review or contract to review, the plant populations of White River Lake every three to five years. Eurasian watermilfoil removal efforts should be reviewed for effectiveness. The management plan should also be reviewed, and if necessary modified, every three to five years. This will be especially important to determine the continued health of the aquatic plant population.

Finding Of Feasibility

The harvesting program is necessary to maintain minimal recreational access to White River Lake. It is necessary to maintain a stable clearwater condition for the lake.

The District has shown the ability to maintain and operate an effective harvesting program. The District harvests approximately 50% (30 acres) of White River Lake. Approximately 60 acres (94%) of the lake is available for aquatic plant growth.

Chapter VII

SUMMARY

- The District should work with landowners' education to encourage protection of natural shorelines and emergent plant species such as sedges and rushes and floating leaf species like waterlilies.

- The District should provide landowners with information on erosion control, especially on the steeper shorelines.

- Every effort should be made to reduce the amount of floating plant debris.

- 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 and bottom barriers to control Eurasian watermilfoil and curly-leaf pondweedand should minimize the size of any native plant areas that are cleared.

- The District may consider acquiring hand rakes and cutters to loan to property owners for localized control.

- The removal of Eurasian watermilfoil should be continued using small scale management efforts.

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WHITE RIVER AQUATIC PLANT SURVEY, JULY 2000

YEAR	TRAN	DEPT	CHARA	MYRSPI	POTZO	VALAM	POTRI	NAJFL	STUPE	CERDE	RANLO	MYRHE	ELOCA	POTAM	POLAM
00	1	2	5		1			1							
00	2	2				2	2	2							
00	3	2	2			2		3							
00	4	2	2			4		3	2						
00	5	2													
00	6	2	3		1					3					
00	7	2	5	1	3						2	2			
00	8	2	5						1						
00	9	2	4	2	2								2		
00	10	2	3												
00	11	2	4		1						1			1	
00	12	2	4									1			2
00	13	2	1		3										
00	14	2	4	1					1						
00	15	2	2												

	CHARA	MYRSPI	POTZO	VALAM	POTRI	NAJFL	STUPE	CERDE	RANLO	MYRHE	ELOCA	POTAM	POLAM
FREQUENCY	13	3	6	3	1	4	3	1	2	2	1	1	1
% FREQUENCY	86.67	20.00	40.00	20.00	6.67	26.67	20.00	6.67	13.33	13.33	6.67	6.67	6.67
SUM DENSITY	44	4	11	8	2	9	4	3	3	3	2	1	2
SPEC MEAN DENSITY	3.38	1.33	1.83	2.67	2.00	2.25	1.33	3.00	1.50	1.50	2.00	1.00	2.00
TOT MEAN DENSITY	2.93	0.27	0.73	0.53	0.13	0.60	0.27	0.20	0.20	0.20	0.13	0.07	0.13
TMD W/PLANTS	3.14	0.29	0.79	0.57	0.14	0.64	0.29	0.21	0.21	0.21	0.14	0.07	0.14

WHITE RIVER AQUATIC PLANT SURVEY, JULY 2000

YEAR	TRAN	EPTH	CHARA	MYRSPI	POTZO	VALAM	POTRI	NAJFL	STUPE	CERDE	RANLO	MYRHE	ELOCA	POTAM	POLAM
00	1	5	3				4	2		1					
00	2	5	5			2									
00	3	5	4		2	2		4							
00	4	5	4		2				1	1					
00	5	5	2		3				1	1		1			
00	6	5	5		4				4	2					
00	7	5	5						2		2	1			
00	8	5	4									1			
00	9	5	3		1							1			
00	10	5	5		1										
00	11	5	5												
00	12	5	5		2				1					1	
00	13	5	5					3							
00	14	5	4		2										
00	15	5	1		4					2					

	CHARA	MYRSPI	POTZO	VALAM	POTRI	NAJFL	STUPE	CERDE	RANLO	MYRHE	ELOCA	POTAM	POLAM
FREQUENCY	15	0	9	2	1	3	5	5	1	4	0	1	0
% FREQUENCY	100.00	0.00	60.00	13.33	6.67	20.00	33.33	33.33	6.67	26.67	0.00	6.67	0.00
SUM DENSITY	60	0	21	4	4	9	9	7	2	4	0	1	0
SPEC MEAN DENSITY	4.00	#DIV/0!	2.33	2.00	4.00	3.00	1.80	1.40	2.00	1.00	#DIV/0!	1.00	#DIV/0!
TOT MEAN DENSITY	4.00	0.00	1.40	0.27	0.27	0.60	0.60	0.47	0.13	0.27	0.00	0.07	0.00
TMD W/PLANTS	4.00	0.00	1.40	0.27	0.27	0.60	0.60	0.47	0.13	0.27	0.00	0.07	0.00

WHITE RIVER AQUATIC PLANT SURVEY, JULY 2000

YEAR	TRAN	EPTH	CHARA	MYRSPI	POTZO	VALAM	POTRI	NAJFL	STUPE	CERDE	RANLO	MYRHE	ELOCA	POTAM	POLAM	UTRVU
00	1	9	3				4			2						2
00	2	9	4		1				1							
00	3	9	5		2											
00	4	9	5		1											
00	5	9	2		1											
00	6	9	5						1	2		1				
00	7	9	3						1		1			1		
00	8	9	4						1			2				
00	9	9	3	1					1							
00	10	9	4						1							
00	11	9	4		1				1							
00	12	9	5		3					5						
00	13	9	3													
00	14	9	4						1							
00	15	9														

	CHARA	MYRSPI	POTZO	VALAM	POTRI	NAJFL	STUPE	CERDE	RANLO	MYRHE	ELOCA	POTAM	POLAM	UTRVU
FREQUENCY	14	1	6	0	1	0	8	3	1	2	0	1	0	1
% FREQUENCY	93.33	6.67	40.00	0.00	6.67	0.00	53.33	20.00	6.67	13.33	0.00	6.67	0.00	6.67
SUM DENSITY	54	1	9	0	4	0	8	9	1	3	0	1	0	2
SPEC MEAN DENSITY	3.86	1.00	1.50	#DIV/0!	4.00	#DIV/0!	1.00	3.00	1.00	1.50	#DIV/0!	1.00	#DIV/0!	2.00
TOT MEAN DENSITY	3.60	0.07	0.60	0.00	0.27	0.00	0.53	0.60	0.07	0.20	0.00	0.07	0.00	0.13
TMD W/PLANTS	3.86	0.07	0.64	0.00	0.29	0.00	0.57	0.64	0.07	0.21	0.00	0.07	0.00	0.14

WHITE RIVER AQUATIC PLANT SURVEY, JULY 2000

YEAR	TRAN	EPTH	CHARA	MYRSPI	POTZO	VALAM	POTRI	NAJFL	STUPE	CERDE	RANLO	MYRHE	ELOCA	POTAM	POLAM	UTRVU
00	1	12	5													
00	2	12	5		2				2			1				
00	3	12	5													
00	4	12	5													
00	5	12	4													
00	6	12														
00	7	12	3						1							
00	8	12	3						4			3		2		
00	9	12	3									1				
00	10	12	5		2				3							1
00	11	12	4		1	1										
00	12	12	5		1					2						
00	13	12	4									1				
00	14	12	5													
00	15	12														

	CHARA	MYRSPI	POTZO	VALAM	POTRI	NAJFL	STUPE	CERDE	RANLO	MYRHE	ELOCA	POTAM	POLAM	UTRVU
FREQUENCY	13	0	4	1	0	0	4	1	0	4	0	1	0	1
% FREQUENCY	86.67	0.00	26.67	6.67	0.00	0.00	26.67	6.67	0.00	26.67	0.00	6.67	0.00	6.67
SUM DENSITY	56	0	6	1	0	0	10	2	0	6	0	2	0	1
SPEC MEAN DENSITY	4.31	#DIV/0!	1.50	1.00	#DIV/0!	#DIV/0!	2.50	2.00	#DIV/0!	1.50	#DIV/0!	2.00	#DIV/0!	1.00
TOT MEAN DENSITY	3.73	0.00	0.40	0.07	0.00	0.00	0.67	0.13	0.00	0.40	0.00	0.13	0.00	0.07
TMD W/PLANTS	4.31	0.00	0.46	0.08	0.00	0.00	0.77	0.15	0.00	0.46	0.00	0.15	0.00	0.08

COMBINED VALUES FOR ALL DEPTHS

	CHARA	MYRSPI	POTZO	VALAM	POTRI	NAJFL	STUPE	CERDE	RANLO	MYRHE	ELOCA	POTAM	POLAM	UTRVU
FREQUBMAX = 60	55	4	25	6	3	7	20	10	5	12	1	4	1	1
% FREQUENCY	92	7	42	10	5	12	33	17	8	20	2	7	2	2
SUM DBMAX = 300	210	5	47	13	10	18	31	21	6	16	2	5	2	2
SPEC MEAN DENSITY	3.82	1.25	1.88	2.17	3.33	2.57	1.55	2.10	1.20	1.33	2.00	1.25	2.00	2.00
TOT MEAN DENSITY	3.50	0.08	0.78	0.22	0.17	0.30	0.52	0.35	0.10	0.27	0.03	0.08	0.03	0.03
TMD W/PLANTS	3.50	0.08	0.78	0.22	0.17	0.30	0.52	0.35	0.10	0.27	0.03	0.08	0.03	0.03