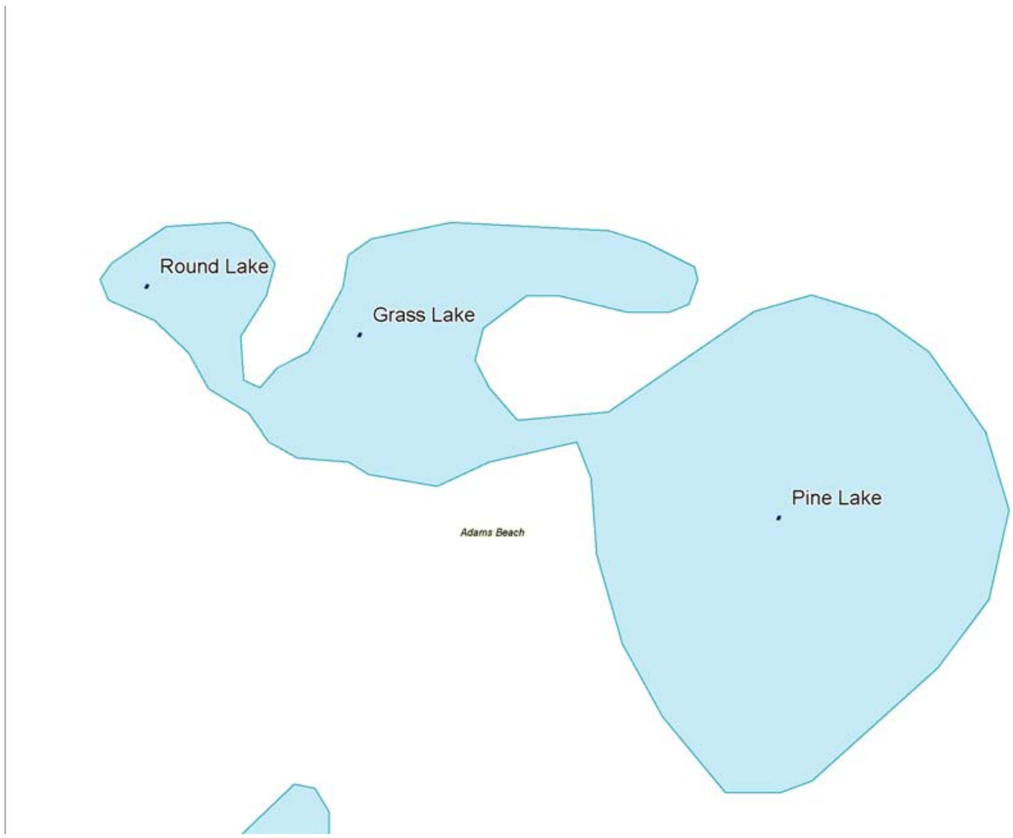
AQUATIC PLANT MANAGEMENT PLAN
for the
CLOVERLEAF LAKES
SHAWANO COUNTY, WISCONSIN



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Summary

The Cloverleaf Lakes are comprised of Grass, Pine, and Round Lakes and are located about 5 miles northeast of Clintonville, in Shawano County, Wisconsin. The lakes are deep overall (limited littoral zone), highly developed, and mesotrophic.

The Cloverleaf Lakes Protective Association, the main steward for the resource has recently become concerned because of increasing nuisance aquatic plant growth on the lakes. Their previous management activities have been related to water quality sampling, fish stocking, nuisance aquatic plant control, and water level control. Concerns about nuisance aquatic plant growth led to this study and production of this Aquatic Plant Management Plan.

Aquatic plants were sampled on each lake, along the same transects as in a previous study of the lakes. Species observed included (in order of abundance) Muskgrass, Water Celery, and Eurasian Water Milfoil (EWM). Plants were confined to often narrow bands of littoral zone around the perimeter of each lake.

Management recommendations target reestablishment of a healthy native aquatic plant community, continuation of water quality monitoring, and fishery improvement activities.

- Eurasian Water Milfoil should be managed for reduction to assist in the return of more beneficial species at greater abundances. There is a good abundance and diversity of native plants in the Cloverleaf Lakes. Preliminary findings show an EWM reduction project in Round Lake to be successful, though follow up survey is necessary. The prognosis for control in Grass and Pines Lakes appears good.

- Regular water quality monitoring (including water chemistry and Self-Help observations) should be continued as well as monitoring for exotic species.

- Fishery enhancement activities should be continued with guidance from the Wisconsin Department of Natural Resources area fisheries manager.

- Protection and/or purchase of undeveloped lands around the lakes should be pursued to limit the impacts of development on the lakes. The creation and/or enhancement of buffer strips for already developed areas should be encouraged.

Introduction

Description of Study Area

The Cloverleaf Lakes consist of Grass, Pine and Round Lakes (Table 1) and are located between Shawano and Clintonville off Highway 22 in Shawano County, Wisconsin (Figure 1). The lakes are described as drainage lakes with small inlets on the north shores of Grass and Round Lakes, and a permanent outlet at the south end of Pine Lake.

Table 1. Physical Characteristics, Cloverleaf Lakes, Shawano County (1).

Lake Name	Size (acres)	Max Depth (ft)	Average Depth (ft)
Grass Lake	87	52	14
Pine Lake	209	35	8
Round Lake	27	39	26

Previous Study

The Cloverleaf Lakes Protective Association (CLPA) completed a study of the lakes through the Wisconsin Department of Natural Resources (WDNR) Lake Management Planning Program in 1992. Those studies (one each for Grass, Pine, and Round Lakes) included watershed delineation, historic data review, public involvement activities, water chemistry sampling, and aquatic plant surveys. A summary was provided in separate reports for each lake (2,3,4).

Watershed Characteristics

The Cloverleaf Lakes watersheds consist of loamy sand soils with little or no slope (2,3,4). Land uses in the watershed include wooded residential (45%), forested (35%), wetlands (17%), and agricultural (2%).

The Cloverleaf Lakes benefit from a small watershed. The watershed to lake ratio is only about 3.1 to 1. This means that only 3.1 times more land than lake surface area drains to the Cloverleaf Lakes. A typical watershed to lake ratio for drainage lakes would be much higher (50 to 100 to 1).

Water Quality Characteristics

While there is potential for some runoff to the lakes, the mainly sandy, highly permeable soils filter much of the water before reaching the lakes as groundwater. Water quality parameters were fair to good for all parameters sampled in 1992 and indicated a mesotrophic condition. Self help readings from 1995 to present indicated oligotrophic to mesotrophic conditions which defines relatively good water quality for phosphorus, chlorophyll a, and secchi readings Table 2.

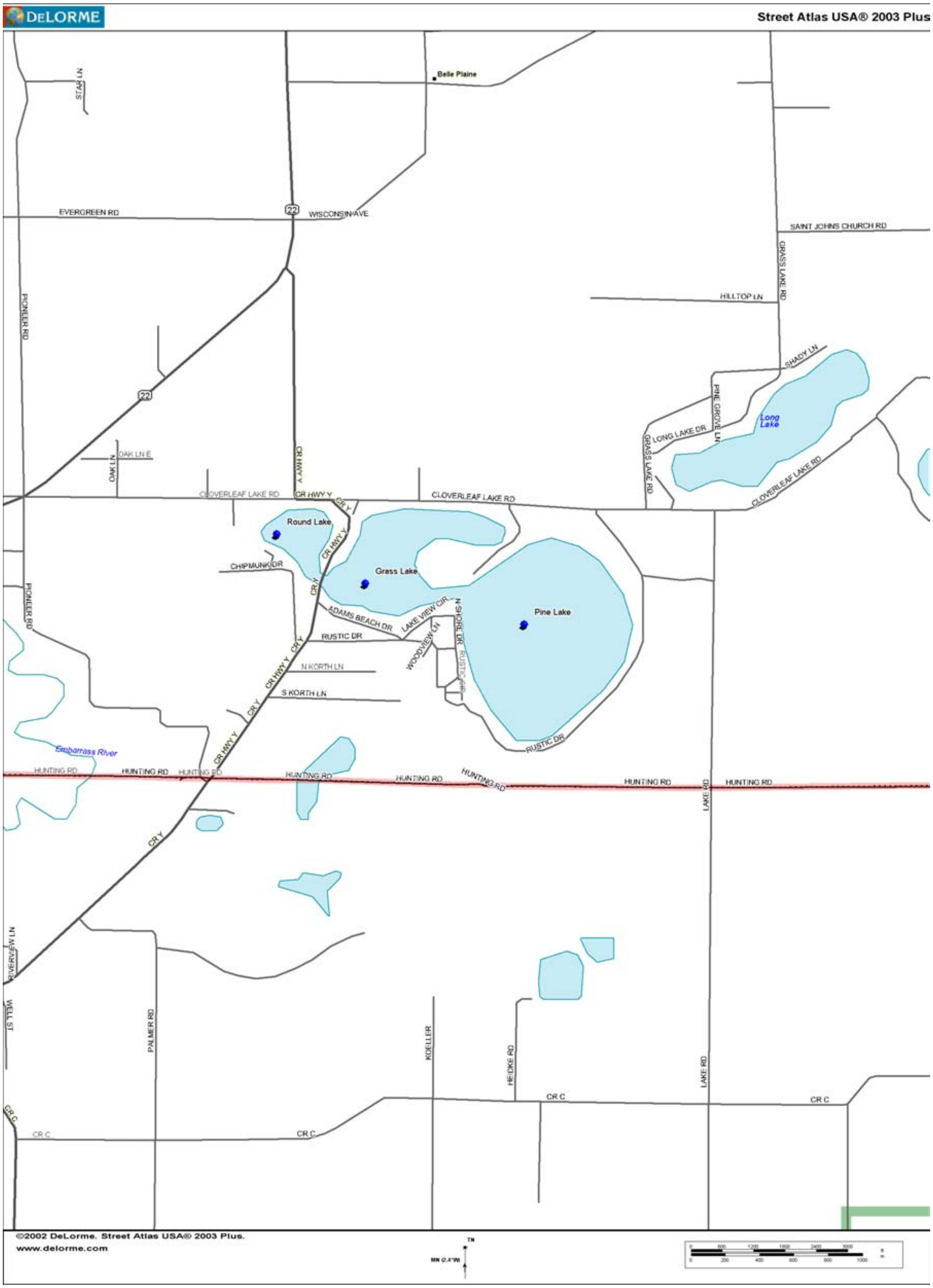


Figure 1. Location Map, Cloverleaf Lakes, Shawano County, Wisconsin.

Table 2. Self-Help Monitoring Data Summary, 1995 – 2003, Grass Lake, Shawano County, Wisconsin.

	Secchi Depth (feet)	**Phosphorus ug/l**	**Chlorophyll a ug/l**
Number of Readings	176	34	29
Minimum	3	9	0
Maximum	20	31	19
Average	9.66	16.94	5.33
St. Deviation	2.35	5.87	3.62

Aquatic Plant Characteristics

Aquatic plants varied slightly between the Cloverleaf Lakes. Round Lake had softer sediments but a very narrow littoral zone; Grass Lake had similar sediment to Grass Lake but with a larger littoral zone; Pine Lake had generally harder substrates, but an extensive littoral zone. All lakes had an unidentified Milfoil species which was likely Eurasian Water Milfoil (EWM).

Historical Management

Management of the Cloverleaf Lakes has included fish stocking, nuisance aquatic plant management, and water level control. There is also a current effort to purchase undeveloped lands around at last on of the lakes.

Extensive fish stocking has been performed on the Cloverleaf Lakes. A summary of stocking efforts since 1991 is outlined in Table 2; prior stocking information is included in the Lake Management Plans for Grass (2), Pine (3), and Round (4) Lakes.

Table 3. WDNR Fish Stocking, Cloverleaf Lakes, Shawano County, Wisconsin (5).

Year	**Species**	**Length (inches)**	**Number**
2002	Walleye	6.0	1150
1998	Walleye	1.7	8850
1997	Walleye	2.7	11000
1996	Yellow Perch	6.0	2900
1995	Musky	14.0	200
1994	Walleye	3.6	16303
1992	Walleye	2.8	8120

Nuisance aquatic plant growth was treated with herbicides in 1983 and 2003 by the CLPA. The 1983 treatment targeted Coontail, Elodea, Large-leaf Pondweed, and Naiad and included much of Grass Lake and the western shore of Pine Lake; the 2003 treatment targeted EWM only and took place in Grass (2.5 acres), Pine (2.0 acres) and Round (5.5 acres).

To establish and maintain a proper water level, the dam at the outlet of Pine Lake (outlet for all of the Cloverleaf Lakes) was rebuilt in 2000.

Sensitive Areas

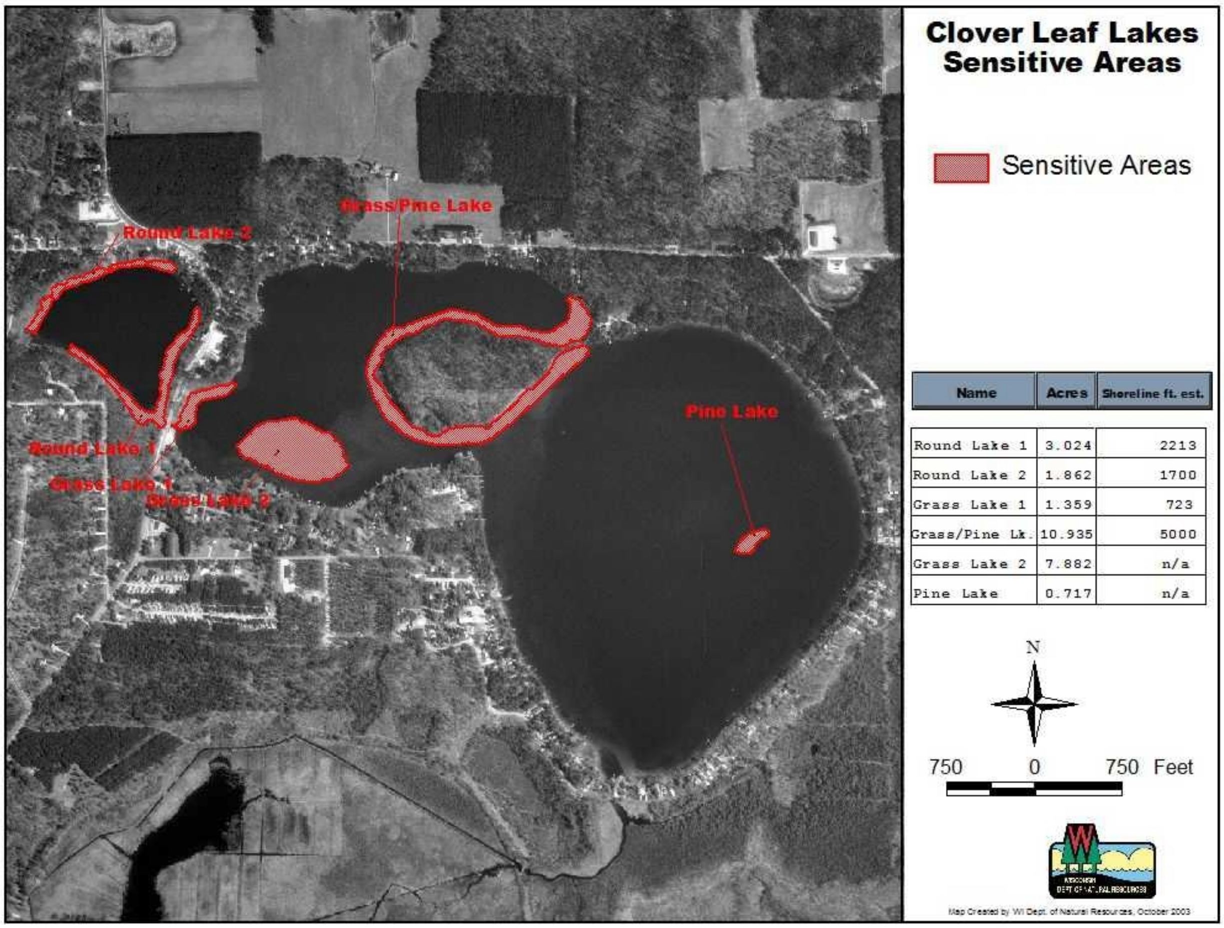
In 2003 the DNR performed a “Sensitive Area Survey” for the Cloverleaf Lakes. Over 25 acres of Grass, Pine, and Round Lakes were determined to be Sensitive Areas (Figure 2). Sensitive areas are those that might provide unique and/or critical ecological habitat. These areas are mainly undisturbed shoreline areas.

Project Goals

It is the goal of this project to develop an Aquatic Plant Management Plan to guide the Cloverleaf Lakes Protective Association in future aquatic plant and lake management decisions. The Cloverleaf Lakes Aquatic Plant Management Plan is also a necessary part of the application for funds for Eurasian Water Milfoil (EWM) control through the Wisconsin Waterways Commission.

The goal is to provide nuisance aquatic plant management decisions based on science, current research, and past success and failure of management options. Further, the Plan should be distributed to all interested parties to provide the means for the community at large to make appropriate management decisions.

With regard to EWM management in the Cloverleaf Lakes, the goal is to reduce the total acreage of EWM by 50% annually in areas with established native plants. In dense stands of only EWM, the goal is to reduce overall density of EWM by 50% annually.



Name	Acres	Shoreline ft. est.
Round Lake 1	3.024	2213
Round Lake 2	1.862	1700
Grass Lake 1	1.359	723
Grass/Pine Lk.	10.935	5000
Grass Lake 2	7.882	n/a
Pine Lake	0.717	n/a

Figure 2. WDNR Designated Sensitive Areas, Cloverleaf Lakes, Shawano County, Wisconsin.

Methods

Aquatic Plant Survey

Aquatic plants on the Cloverleaf Lakes were surveyed in August, 2003 using the line transect method recommended by WDNR. In this method, transects (lines of observation) are selected around the perimeter of the lake from various physical locations, differing habitats, and areas of interest. Five transects were established in a previous studies of the lakes (2,3,4) and were duplicated in 2003.

Shore locations and transect distance and bearing were determined using GPS (Figure 2). From shore locations the transects were broken up into several depth ranges: 0 to 1.5 feet in lake depth; 1.6 to 5.0; 5.1 to 10.0; and beyond 10 feet in lake depth (2,3,4). For each depth range the substrate was recorded, the distance from shore, aquatic plant species present, and a relative density for each species. Plants were observed *in situ* with the use of SCUBA and snorkeling equipment.

Figure 3. Aquatic Plant Transect Sites, Cloverleaf Lakes, Shawano County, Wisconsin.

Results and Discussion

Aquatic Plants Present

The August, 2003 survey indicated 23 species of aquatic plants present in the Cloverleaf Lakes (Table 3). Species present and relative abundance varied from lake to lake, but was similar for Grass, Pine and Round Lakes. Most notably, EWM was not present in Round Lake and appears to have been eradicated by way of herbicide control performed in July, 2003.

The most common species was Muskgrass (*Chara* sp.), followed by Water Celery (*Vallisneria americana*), Eurasian Water Milfoil (*Myriophyllum spicatum*), Naiad (*Najas* sp.), and Richardson's Pondweed (*Potamogeton richardsonii*). EWM populations are significant, but overall there are good species diversity and levels of native and beneficial aquatic plants.

Aquatic plant species and populations were similar to those found in the 1992 survey (2,3,4). The four most abundant species in 2003 were also the most abundant in 1992 (see Appendix for survey data). There were 23 species observed in 2003 versus 28 species in 1992 (Table 4). Most of the species that appeared in the 1992 survey and not in the 2003 survey were observed in the lakes, but not in the sampled transects.

Table 4. Aquatic Plant Species Observed, Cloverleaf Lakes, Shawano County, August, 2003.

Taxa	Code
Coontail (*Ceratophyllum demersum*)	CERDE
Muskgrass (*Chara* sp.)	CHASP
Common waterweed (*Elodea canadensis*)	ELOCA
Eurasian water milfoil (*Myriophyllum spicatum*)	EWM
Filamentous algae	FILAL
Small duckweed (*Lemna minor*)	LEMMI
Water milfoil (various milfoils other than Eurasian Water Milfoil) (*Myriophyllum* sp.)	MYRSP
Bushy pondweed (*Najas* sp.)	NAJSP
Yellow pond lily (*Nuphar* sp.)	NUPSP
White water lily (*Nymphaea* sp.)	NYMSP
Pickerel-weed (*Pontedaria cordata*)	PONCO
Alternate-leafed pondweed (*Potamogeton natans*)	POTAL
Large-leaf pondweed (*Potamogeton amplifolious*)	POTAM
Leafy pondweed (*Potamogeton foliosus*)	POTFO
Sago pondweed (*Potamogeton pectinatus*)	POTPE
Clasping-leaf Pondweed (*Potamogeton richardsonii*)	POTRI
Flat-stem pondweed (*Potamogeton zosteriformis*)	POTZO
White water crowfoot (*Ranunculus acris*)	RANAC
Triangle stem bulrush *(Schoenoplectus pungens)*	SCHPU
Rush (*Scirpus* sp.)	SCISP
Broad-leaf cattail (*Typha latifolia*)	TYPLA
Eel Grass (water celery) (*Vallisneria americana*)	VALAM
Watermeal (*Wolffia columbiana*)	WOLCO

Table 5. Unique Species Composition Comparison (1992 and 2003), Cloverleaf Lakes, Shawano County, Wisconsin.

Species	Present in 1992 Survey	Present in 2003 Survey
Watershield Brasenia schreberi	X	
Water Arum Calla palustris	X	
Forked Duckwed Lemna trisulca	X	
Nitella Nitella sp.	X	
Alternate-Leaf Pondweed Potamogeton natans		X
Curly-Leaf Pondweed Potamogeton crispus	X	
Illinois Pondweed Potamogeton illinoensis	X	
White-Stem Pondweed Potamogeton praelongus	X	
Small Pondweed Potamogeton pusilllus	X	
Triangle-Stem Bulrush Schoenoplectus pungens		X
Watermeal Wolffia columbiana		X

Important Native Species

A healthy population of native plants is an important component of a healthy aquatic ecosystem. Native aquatic plants provide shoreline stabilization and erosion control; fish habitat for feeding, spawning, and refuge; as well as important habitat for terrestrial and amphibious species. A few species particularly important to the Cloverleaf Lakes are outlined below.

Large-Leaf Pondweed

Large-leaf pondweed has a large thick stem with wavy, re-curved, oblong, submersed leaves, which taper to the stem. There is a solid, tightly packed spike of nutlets at the tip of the plant, which poke out of the water. Into the growing season the leaves often develop a brown color from mineral deposits. It is common in hard water throughout the northern half of the U.S. Reproduction is by way of seeds. .

Water Lilies

Water lilies have floating leaves and are found throughout the U.S. Water lily leaves are either circular (white water lily) or oblong (yellow water lily) and are notched to the center. The leaves arise on stalks from long rhizomes and grow best in soft sediment. Water lilies are perennial reproduce mainly by root growth.

Chara

Because of its size and complex structure, Chara or muskgrass (named for its strong odor) may look like a higher plant, however, it is actually a genus of algae. Muskgrass grows attached usually in firm sediment in hard water ponds, lakes, and rivers. Lakes with a significant amount of Chara tend to have very clear water. This macro-alga has no true "leaves", only branches and branchlets. Muskgrass is relatively rough to the touch. During times of reproduction, dark, ball-like sporangia appear seed-like along the branchlets.

Exotic Species

Exotic species are those that have been introduced to a new area. They often are harmful to the new ecosystem because they lack the predation present in their native habitats. Exotic species often can then increase in numbers and thus alter the native community. Just a few of the exotic species of concern to the Cloverleaf Lakes are outline below.

Eurasian Water Milfoil

In 2003 surveys it was observed that much of the perimeters of Grass and Pine Lakes have at least some EWM. Grass Lake is estimated to have 20.51 acres of EWM, and Pine Lake 35.75 acres (Figure 3). Perimeter SCUBA observations showed EWM absent from Round Lake. Five and a half acres of EWM (nearly the entire perimeter) of Round Lake was treated with an herbicide for EWM control in July, 2003.

Acreage of EWM was determined with the use of SCUBA to mark the distance out into the lake that EWM was present, and Geological Positioning System (GPS) to mark those points and determine area. Acreage was verified using Garmin Mapsource lake maps and GPS coordinates taken at the lake.

Purple Loosestrife

Purple loosestrife (*Lythrum salicaria*) was not observed as part of the aquatic plant surveys in 2003. Purple Loosestrife is a perennial plant native to Europe. It was brought to the U.S. by immigrants who valued its striking purple flowers. Seeds were also unintentionally transported to the shores of North America in the ballast water of ships. Since then, purple loosestrife has expanded its range. It is now a serious pest of wetlands and pastures.

Once purple loosestrife enters a wetland, it takes over. Common native wetland plants, such as cattails and sedges, cannot compete with purple loosestrife. Once these native plants are choked out, the wildlife that depends on them for food and shelter are also eliminated. Purple loosestrife has little value as food for animals, and populations of the plant become so thick that they cannot serve as cover for wildlife. Purple loosestrife also invades the shallow waters used for northern pike spawning, ruining these areas as spawning grounds.

Purple loosestrife reproduces prolifically -- one plant can produce several million seeds in a single summer. In addition, root or stem fragments can take root and form new plants. River water and floods are the primary ways that seeds and plant fragments are transported to new areas.

Over 100 insect species feed on purple loosestrife in Europe and Asia. These insects, along with disease, keep purple loosestrife growth under control in its natural habitat. None of these natural enemies are native to North America.

Curly-Leaf Pondweed

Curly-leaf pondweed (*Potamogeton crispus*) was not present in the 2003 survey, but is probably present in the Cloverleaf Lakes system. It is an exotic plant that forms surface mats that interfere with aquatic recreation. The plant usually drops to the lake bottom by early July. Curly-leaf pondweed was the most severe nuisance aquatic plant in the Midwest until Eurasian watermilfoil appeared. It was accidentally introduced along with the common carp.

Zebra Mussels

The zebra mussel (*Dreissenia polymorpha*) is a tiny (1/8-inch to 2-inch) bottom-dwelling clam native to Europe. The Cloverleaf Lakes were not sampled for the veliger stage of growth and no adults were noticed in 2003. The mussel takes its name from its striped shell. Zebra mussels were introduced into the Great Lakes system in 1985 or 1986 and first turned up in Lake St. Clair. They have spread throughout the Great Lakes and are now found in Green Bay, Sheboygan and Kenosha counties. Zebra mussels were first found in Wisconsin waters of Lake Michigan in 1989. Zebra mussels are also negatively impacting native mussel populations in the Mississippi River. Native mussels are being smothered by high concentrations of mussels that attach themselves to their shells. Ecological studies have recently been completed on two inland Wisconsin lakes where zebra mussels first invaded in 1994. The results of these studies should provide more information on the ecological impacts.

Methods of Controlling Nuisance Aquatic Plants

Physical Controls

Manual Cutting / Raking.

Mechanical cutters and rakes are commonly used for controlling nuisance aquatic plant growth. They work best inshore, where they complement hand pulling and bottom screening. The cost of this option can be the cost only of the cutter or rake (about $100 - $200). A permit is now required if more than 30 feet of frontage is manually harvested. Additional information is outlined in Table 6. Hand cutting and raking is non-selective and should be coupled with native aquatic planting (see below).

Table 6. Comparison of Aquatic Plant Control Techniques for Cloverleaf Lakes, Shawano County, Wisconsin.

Method	Species Selective	Permit Required	Native Plantings also Required	Labor Intensive	Cost per Acre	Labor per Acre	Notes
Manual Cutting/Raking	No	No	Yes	Yes	$125	$0	Small scale applications only
Harvester	No	Yes	Yes	Yes	$160	Included	Large scale applications only
SCUBA Hand Pulling	Yes	No	No	Yes	$0	$0	Small scale applications only
Bottom Barrier	No	No	Yes	Yes	$1,740	$300	Must be removed annually
Dredging	No	Yes	Yes	Yes	Varies	Varies	Radical habitat alteration
Drawdown	Yes/No	Yes	Yes/No	No	Permit	$0	Not effective on EWM
Milfoil Weevils	Yes	No	No	Yes	$500?	$250?	Not effective on EWM
Navigate Herbicide	Yes	Yes	No	No	$350	$100	Up to 14 day irrigation restriction
Native Plantings	Yes	No	n/a	Yes	$400	$200	Must accompany other methods

Harvesters.
Most aquatic plant harvesters consist of a paddle wheel propelled barge with an adjustable sickle cutter (up to 6 feet in depth maximum) and a conveyor/storage area. Cut plants are picked up on the conveyor and when the storage area is full, the harvester off loads the plants to a transport barge or to a conveyor on shore. Plants are then taken to a compost area or farmers field. Harvesting operations usually cost about $150 per hour and are able to cover 1 – 3 acres per hour in open water.

While harvesting may clear out beaches and boat landings by breaking up the canopy, the method is not selective, removing beneficial aquatic vegetation as well as forage fish and invertebrates. Harvesters create shoot fragments, which contributes to EWM dispersal. Harvesting should be used only after colonies have become widespread and alternative eradication attempts have failed.

Hand Pulling.

Hand pulling is a preferred control method for localized nuisance growth. A SCUBA diver or snorkeler selectively removes the problem plants and places them on shore or in a floating net. When done properly, the plant and the root can be removed on a plant by plant basis. This method can be at no cost but is labor intensive.

The process can be thorough and selective; special care must be taken to collect all roots and plant fragments during removal. In areas where more than 50% of the plants are removed in an area, this method should be couple with native plantings (see below).

Bottom Barriers.

Bottom screening can be used for localized infestations that are remote from boat traffic. Screens weighted to the lake bed prevent plants from getting sunlight and/or growing up from the lake bottom. The cost of sediment covers is $400 per 1000 square feet plus anchoring and labor.

Bottom screening is very labor intensive and non-selective. They must be placed, anchored, monitored for gas bubbling, removed, and cleaned annually. After bottom screening, the screened area should be replanted with native aquatic plants (see below).

Dredging.

Dredging is a radical form of habitat manipulation. In order for dredging to be successful for aquatic plant control, the depth of the lake must be increased to a depth at which sunlight no longer reaches the lake bottom.

Dredging costs can run anywhere from $1.75 to $7.50 per cubic yard of sediment removed. The permitting process is also a lengthy and expensive one. And since the Cloverleaf Lakes already have a fairly limited littoral zone, dredging should not be considered for the Cloverleaf Lakes. Dredging should also be accompanied by native aquatic planting (see below).

Drawdown.

By modifying lake levels (usually by lowering levels in the fall), some plants can be encouraged to grow while retarding the growth of others.

The cost of drawdown would be only the cost of any permits needed and native aquatic plantings (see below). However, EWM is not always negatively affected by drawdown and is very effective at taking over disturbed areas. Drawdown should also be accompanied by native aquatic plantings.

Native Aquatic Plantings.

Most physical control of aquatic plants where EWM is present should be accompanied with replanting altered areas. Because EWM is so effective at repopulating disturbed areas, any areas disturbed should be immediately planted with healthy native plants. Native plants should include those that have grown well in the past. Typical native stock for the Cloverleaf Lakes would include Chara sp., Water Celery, Naiad, Richardson's Pondweed, and Big Leaf Pondweed. The cost for native aquatic plantings can be up to $400 per acre per species planted plus labor.

Figure 4. Areas Infested With Eurasian Water Milfoil, Cloverleaf Lakes, Shawano County, Wisconsin.

Biological Controls

Milfoil Weevils.

Eurhychiopsis lecontei, an herbivorous weevil native to North America, has been found to feed on Eurasian water milfoil. Adult weevils feed on the stems and leaves, and females lay their eggs on the apical meristem (top-growing tip); larvae bore into stems and cause extensive damage to plant tissue before pupating and emerging from the stem. Three generations of weevils hatch each summer, with females laying up to two eggs per day. It is believed that these insects are causing substantial decline in some milfoil populations. Because this weevil prefers Eurasian water milfoil, other native aquatic plant species, including northern watermilfoil, are not at risk from the weevil's introduction.

A study on the effectiveness of the weevil in Loon and Lulu Lakes, Shawano County showed poor control of EWM (6). Herbicide controls have since been employed on both. Additionally, 12 Wisconsin lakes part of a UW-Stevens Point and DNR project studying the weevil's effectiveness showed EWM unaffected by weevil stocking in any of the lakes (5).

Herbicide Controls

Eurasian Water Milfoil can be selectively controlled using a granular formulation containing the active ingredient 2,4-D (trade name Navigate). For EWM control Navigate is applied using a granular broadcast spreader at a rate of 100 pounds per surface acre. Navigate is the recommended treatment option for EWM infestations where a good amount of native species exist. Surveys indicate that Navigate was used successfully on EWM in the Cloverleaf Lakes (Round Lake) earlier in 2003 as well on many other lakes throughout Wisconsin.

Another benefit of selective herbicide control (Navigate) is that it does not need to be coupled with native aquatic plantings like many of the options above. The Cloverleaf Lakes at this point have good levels of native plants and native plants should increase in numbers to occupy areas where EWM is managed.

Drawbacks to herbicide application include water use restrictions and the inherent effects of adding a foreign agent to a lake. There is no swimming or fish consumption restriction for an area treated with Navigate. The irrigation restriction indicates water treated with Navigate should not be used for potable (drinking) water until an assay indicates that the level of 2,4-D is less than 70 parts per billion (ppb). Also, water from the treatment area should not be used to irrigate food or ornamental crops until the level is determined to be 100 ppb or less. Complete decomposition of Navigate takes place in 3 weeks but may be as early as 1 week. Navigate degrades into naturally occurring compounds (7).

Conclusion and Recommendations

The Cloverleaf Lakes are currently in relatively good condition. The lakes benefit from a small watershed with little overland runoff. Steps are being taken to protect undeveloped areas in the watershed. Water quality parameters are at levels expected and sampling is ongoing to track changes. The fishery appears to be healthy and being augmented to remain that way. Aquatic plant growth is diverse and healthy with the exception of an expanding population of Eurasian Water Milfoil (EWM). With proper management, EWM can be eliminated from the system. In short, the Cloverleaf Lakes and the Cloverleaf Lakes Protective Association are working well together.

Management recommendations for the resource include management and reduction of EWM and other exotic species, continued water quality monitoring, continuation of the fish stocking program, and purchase / protection of lands influencing the Cloverleaf Lakes.

Eurasian Water Milfoil must be dealt with while there is still a diverse and healthy native aquatic plant base. Prompt action will minimize the cost and impact of selectively removing EWM, but also maximize the positive native plant response to this invasive species. In this case, the benefits of herbicide application outweigh the potential for negative effects on the resource. Any treatment program should include input from lake property owners, lake association members, and the general public.

An herbicide program appears to have the most cost effective potential for the Cloverleaf Lakes. Also, there are funds available (from the Waterways Commission) to cover up to 50% of the cost of herbicide application. There is also the potential for funding through a new aquatic invasive species grant program. Both programs should be assessed for their timeliness and level of support.

A pre-treatment survey should be conducted in May, 2004 to better determine EWM locations and track its spread from current locations. Before any large-scale treatment, spot treatments should be performed to ensure effectiveness on a larger scale. Spot treatments may indicate the need for higher treatment rates or areas with plant resistant to Navigate. With successful spot treatments, EWM could then be treated. Treatment should include the use of GPS to determine both the locations with regard to previous surveys and to evenly spread product.

A follow-up EWM survey should be conducted 3 weeks after treatment to determine the effectiveness of the treatment and treat missed or unaffected areas. Also, the CLPA should appoint and/or promote an “Exotic Species Watch Group” comprised of individuals who are familiar with management strategies, can identify exotic species, and spend a lot of time on lakes. The group should log specifics of EWM, Curly Leaf Pondweed, Purple Loosestrife, and Zebra Mussel sightings and report regularly to the CLPA board. The watch group should also be educated on other exotic species and observe for them as well.

Water quality monitoring should be continued and include at minimum Self-Help secchi readings, but perhaps be expanded to include Self-Help chlorophyll a and phosphorus sampling. Spring and fall multi-parameter testing is also recommended.

The fish stocking program for the Cloverleaf Lakes should be continued under the direction of the WDNR Shawano Area fish manager. Population sampling should be requested and/or undertaken as necessary.

Undeveloped lands (most of which are sensitive areas) should be protected and/or purchased to minimize future impacts on the lakes, but also to provide fish and wildlife refuge and wild shorelines.

Developed shoreline owners should be educated on the benefits of buffer strips and other land use practices that can positively impact the lakes. Some information/education steps would be inclusion of tips/methods in their newsletter, a presentation at the annual meeting, a field day at properties with and without buffer strips, and getting the CLPA membership on the “Lake Tides” mailing list.

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Appendix

Aquatic Plant Survey Data, Cloverleaf Lakes, 2003
Abundance Distribution and Substrate Relations for Selected Macrophytes, Round Lake, August 2003

		Species Code													
Transect	**Substrate**	CHASP	POTAM	NAJSP	VALAM	POTRI	NYMSP	POTPE	CERDE	MYRSI	SCISP	POTZO	TYPLA	FILAL	NUPSP
A1	MUCK/SAND	4	0	0	3	0	2	0	0	0	0	0	0	0	0
A2	MUCK	5	2	0	4	2	0	1	0	1	0	0	0	0	0
A3	MUCK	3	2	0	3	3	0	0	0	0	0	0	0	0	0
A4	MUCK	0	0	0	0	0	0	1	0	0	0	0	0	0	0
B1	SAND/MUCK	2	0	0	0	1	3	1	0	0	0	0	1	4	2
B2	SAND/MUCK	3	0	3	0	0	1	1	1	0	0	1	0	0	1
B3	MUCK	3	0	3	0	2	0	2	0	0	0	0	0	0	0
B4	MUCK	0	0	0	0	0	0	1	1	0	0	0	0	0	0
C1	MUCK	3	0	2	0	0	0	0	0	3	0	0	0	0	0
C2	MUCK	5	2	0	0	0	0	0	0	2	0	0	0	0	0
C3	MUCK	0	2	4	0	0	0	0	0	0	0	0	0	0	0
C4	MUCK	2	2	0	0	0	0	0	0	0	0	0	0	0	0
D1	SAND	0	0	2	3	1	3	1	1	0	2	1	4	0	0
D2	MUCK/SAND	4	2	0	2	2	2	0	1	0	0	1	0	0	0
D3	MUCK/SAND	0	3	0	3	3	0	2	0	0	0	0	0	0	0
D4	MUCK	0	2	0	1	1	0	1	2	0	0	0	0	0	0
E1	PEAT/MUCK	3	0	0	0	0	0	1	0	0	4	0	0	1	0
E2	MUCK	4	3	3	0	0	4	1	0	1	0	1	0	0	0
E3	MUCK	0	3	2	0	0	0	0	0	1	0	0	0	0	0
E4	MUCK/	0	1	1	0	0	0	0	0	0	0	1	0	0	0

Occurrence and Abundance of Macrophytes by Depth, Round Lake, August 2003
DEPTH RANGES

CODE	**1 (N=5)**		**2 (N=5)**		**3 (N=5)**		**4 (N=5)**	
	% of Sites	*Sum Abundance (range)*	*% of Sites*	*Sum Abundance (range)*	*% of Sites*	*Sum Abundance (range)*	*% of Sites*	*Sum Abundance (range)*
CERDE	20	1 (1)	40	2 (1)	0	0	40	3 (1-2)
CHASP	80	12 (2-4)	100	21 (3-5)	40	6 (3)	20	2 (2)
FILAL	40	5 (1-4)	0	0	0	0	0	0
MYRSI	20	3 (3)	60	4 (1-2)	20	1 (1)	0	0
NAJSP	40	4 (2)	40	6 (3)	60	9 (2-4)	20	1 (1)
NUPSP	20	2 (2)	20	1 (1)	0	0	0	0
NYMSP	60	8 (2-3)	60	7 (1-4)	0	0	0	0
POTAM	0	0	80	9 (2-3)	80	10 (2-3)	60	5 (1-2)
POTPE	60	3 (1)	60	3 (1)	40	4 (2)	60	3 (1)
POTRI	40	2 (1)	40	4 (2)	60	8 (2-3)	20	1 (1)
POTZO	20	1 (1)	60	3 (1)	0	0	20	1 (1)
SCISP	40	6 (2-4)	0	0	0	0	0	0
TYPLA	40	5 (1-4)	0	0	0	0	0	0
VALAM	40	6 (3)	40	6 (2-4)	40	6 (3)	20	1 (1)

Abundance Distribution and Substrate Relations for Selected Macrophytes, Grass Lake, August 2003

		Species Code																				
Transect	**Substrate**	EWM	CHASP	VALAM	POTRI	NYMSP	NAJSP	POTPE	POTZO	NUPSP	POTAM	SCISP	CERDE	TYPLA	POTFO	VRASC	FILAL	ELOCA	LEMMI	PONCO	POTAL	WOLCO
A1	SAND/GRAV	0	4	1	1	4	2	0	0	2	1	3	0	3	0	2	0	0	0	2	0	0
A2	SAND/GRAV	0	3	3	2	0	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B1	SAND	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
B2	SA/GRAV/MK	0	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B3	SILT/MUCK	4	3	3	3	0	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
B4	SILT	4	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0
C1	ROCK	0	5	1	0	4	0	0	0	0	0	3	0	0	0	2	2	0	0	0	0	0
C2	ROCK/MUCK	2	5	1	2	2	2	0	2	2	2	0	0	0	0	0	0	0	0	0	2	0
C3	SAND	5	0	1	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C4	MUCK	4	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
D1	SAND	0	2	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D2	SAND	4	2	3	3	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0
D3	SILT/MICK	2	0	3	3	0	0	0	3	0	0	0	0	0	0	0	0	2	0	0	0	0
D4	SAND	0	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E1	ROCK/GRAV/SA	0	2	0	0	3	0	0	0	3	0	0	0	3	0	0	2	0	2	0	0	2
E2	ROCK/GRAV/SA	2	2	3	0	2	0	3	2	2	0	0	3	0	2	0	0	0	0	0	0	0
E3	SILT/MUCK	3	0	3	0	0	1	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0
E4	MUCK	3	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0

Occurrence and Abundance of Macrophytes by Depth, Grass Lake, August 2003

DEPTH RANGES

CODE	**1 (N=5)**		**2 (N=5)**		**3 (N=5)**		**4 (N=5)**	
	% of Sites	*Sum Abundance (range)*	*% of Sites*	*Sum Abundance (range)*	*% of Sites*	*Sum Abundance (range)*	*% of Sites*	*Sum Abundance (range)*
CERDE	0	0	20	3 (3)	0	0	50	3 (1-2)
CHASP	80	13 (2-5)	100	14 (2-5)	25	3 (3)	0	0
ELOCA	0	0	0	0	25	2 (2)	0	0
EWM	0	0	60	8 (2-4)	100	14 (2-5)	75	11 (3-4)
FILAL	40	4 (2)	0	0	0	0	0	0
LEMMI	20	2 (2)	0	0	0	0	0	0
NAJSP	20	2 (2)	40	5 (2-3)	75	4 (1-2)	0	0
NUPSP	40	5 (2-3)	40	4 (2)	0	0	0	0
NYMSP	60	11 (3-4)	40	4 (2)	0	0	0	0
PONCO	20	2 (2)	0	0	0	0	0	0
POTNA	0	0	20	2 (2)	0	0	0	0
POTAM	20	1 (1)	20	2 (2)	50	4 (2)	25	1 (1)
POTFO	0	0	20	2 (2)	25	2 (2)	0	0
POTPE	20	3 (3)	60	6 (1-3)	0	0	25	1 (1)
POTRI	40	2 (1)	80	9 (2-3)	75	8 (2-3)	0	0
POTZO	0	0	60	6 (2)	25	3 (3)	0	0
SCISP	60	7 (1-3)	0	0	0	0	0	0
TYPLA	40	6 (3)	0	0	0	0	0	0
VALAM	40	2 (1)	100	12 (1-3)	100	10 (1-3)	25	2 (2)
VRASC	40	4 (2)	0	0	0	0	0	0
WOLCO	20	2 (2)	0	0	0	0	0	0

Abundance Distribution and Substrate Relations for Selected Macrophytes, Pine Lake, August 2003

		Species Code														
Transect	**Substrate**	CHASP	EWM	VALAM	NAJSP	POTRI	POTAM	POTZO	POTFO	NUPSP	MYRNO	POTPE	CERDE	SCISP	SCHPU	RANAC
A1	SAND/GRAV	2	0	0	0	0	0	0	0	3	0	0	0	1	0	0
A2	SAND	4	2	2	2	0	0	0	0	0	0	2	0	0	0	0
A3	SILT	4	3	2	2	1	2	1	0	0	0	1	0	0	0	0
A4	SILT	0	4	1	0	1	0	1	0	0	0	0	1	0	0	0
B1	SAND	2	0	0	0	0	0	0	0	0	0	0	0	0	2	0
B2	SAND	5	2	0	2	0	2	1	0	0	0	0	0	0	0	0
B3	SAND	4	3	2	0	0	0	2	0	0	0	0	0	0	0	0
B4	SAND	0	4	2	0	0	0	0	0	0	0	0	2	0	0	1
C1	SAND	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C2	SAND	1	0	3	2	0	2	0	2	0	2	1	0	0	0	0
C3	SILT/SAND	2	0	2	2	2	3	2	0	0	3	0	0	0	0	0
C4	SAND	0	4	0	0	3	0	1	0	0	0	0	0	0	0	0
D1	SAND	3	0	0	0	0	0	0	3	0	0	0	0	2	0	0
D2	SAND	3	0	2	2	0	0	0	3	0	0	0	0	0	0	0
D3	SILT/SAND	3	3	3	3	2	2	2	0	0	0	0	0	0	0	0
D4	SILT/SAND	0	3	2	0	3	0	0	0	0	0	0	2	0	0	0
E1	SAND	3	0	0	2	0	0	0	0	3	0	1	0	0	0	0
E2	SAND	5	0	2	2	0	2	0	2	3	1	0	0	0	0	0
E3	SAND/SILT	0	3	2	2	3	2	0	0	0	2	1	0	0	0	0
E4	SAND/SILT	0	4	0	0	3	0	2	0	0	0	1	1	0	0	0

Occurrence and Abundance of Macrophytes by Depth, Pine Lake, August 2003

DEPTH RANGES

CODE	**1 (N=5)**		**2 (N=5)**		**3 (N=5)**		**4 (N=5)**	
	% of Sites	*Sum Abundance (range)*	*% of Sites*	*Sum Abundance (range)*	*% of Sites*	*Sum Abundance (range)*	*% of Sites*	*Sum Abundance (range)*
CERDE	0	0	0	0	0	0	80	6 (1-2)
CHASP	100	11 (1-3)	100	18 (1-5)	80	13 (2-4)	0	0
EWM	0	0	40	4 (2)	80	12 (3)	100	19 (3-4)
MYRSI	0	0	40	3 (1-2)	40	5 (2-3)	0	0
NAJSP	20	2 (2)	100	10 (2)	80	9 (2-3)	0	0
NUPSP	40	6 (3)	20	3 (3)	0	0	0	0
POTAM	0	0	60	6 (2)	80	9 (2-3)	0	0
POTFO	20	3 (3)	60	7 (2-3)	0	0	0	0
POTPE	20	1 (1)	40	3 (1-2)	40	2 (1)	20	1 (1)
POTRI	0	0	0	0	80	8 (1-3)	80	10 (1-3)
POTZO	0	0	20	1 (1)	80	7 (1-2)	60	4 (1-2)
RANAC	0	0	0	0	0	0	20	1 (1)
SCHPU	20	2 (2)	0	0	0	0	0	0
SCISP	40	3 (1-2)	0	0	0	0	0	0
VALAM	0	0	80	9 (2-3)	100	11 (2-3)	60	5 (1-2)

Action Steps
Cloverleaf Lakes
Shawano County, WI

January, 2004

1. The Cloverleaf Lakes Protection Association (CLPA) should pursue the acceptance of the Aquatic Plant Management Plan Draft. Upon acceptance, a request can be made to the DNR for final grant payment.
2. The CLPA should send in the *Permit Application for Chemical Aquatic Plant Chemical Control* to DNR-Shawano.
3. Upon receiving the above permit, the CLPA should then send in an application to the Wisconsin Waterways Commission to apply for 50% cost-share funds to treat Eurasian Water Milfoil (EWM).

February, 2004

1. The CLPA should apply for a DNR Aquatic Invasive Species Grant. The deadline for application is February 1, 1004.
2. The next meeting of the WWC is February 11th, 2004 and a member of the CLPA should be present to oversee the grant process.
3. The CLPA newsletter published in this time frame should inform all recipients (which includes members and non-members) of the board's intentions to control EWM. The community should be made aware that their input is welcomed and valuable to the process. Information about whom to call and how to express their opinion should be given.

May, 2004

1. In May's issue of the newsletter, the pertinent information of the Chemical Application Permit should be outlined. This information should include anticipated days of treatment, areas treated, water use restrictions, and contact numbers if people need more information.
2. The CLPA must take out an ad in the newspaper with largest circulation in the area stating details of the EWM control project.
3. A pre-treatment survey must be done to give a final estimate of the acreage to be treated and the extent of hybrid milfoils, if any.
4. A spot treatment of hybrid milfoils should be undertaken if they are found.

June, 2004

1. Large-scale treatment of EWM should be undertaken upon permitting from DNR and notification of landowners. Water temperature should be 60 degrees F. Treatment is usually scheduled for early in the week to avoid traffic and recreational conflicts. Includes posting of affected property.

June / July, 2004

1. Post treatment survey should be conducted to determine the success of treatment. Decisions should be made regarding re-treating or resurvey.
2. If treatment is thought to be necessary in 2005, another application to the WWC should be made for funds for EWM control in 2005.