2004 Little Blake Lake Aquatic Plant Management Plan

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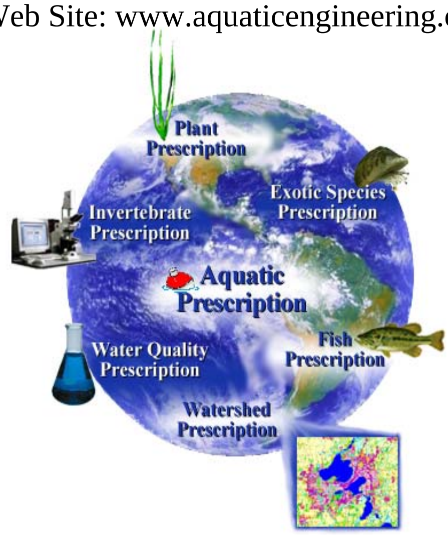

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In cooperation with the Wisconsin Department of Natural Resources and the Polk County Land and Water Resources Department

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Wisconsin Department of Natural Resources

Danny Ryan	Lake Coordinator
Jane Malishke	Environmental Grants Specialist
Heath Benike	Fish Biologist

Polk County Land and Water Resources

Jeremy Williamson	Water Quality Specialist
Amy Kelsey	Information and Education Coordinator

Executive Summary

Little Blake Lake (WBIC #2627300) is an 85-acre drainage lake with a 6-foot average depth and a 10-foot maximum depth that is located in Polk County, Wisconsin. The watershed includes the Straight River and Big Round Lake and is a mix of forest, agriculture, and rural development.

The Little Blake Lake patrons have not historically managed the aquatic plants within the lake. However, individual property owners have chosen to manage their private shorelines. In 2003, The Limnological Institute (TLI) applied for state grants to conduct baseline inventory information regarding aquatic plants and water quality. The grants were awarded, and monitoring began in the spring of 2004.

The 2004 aquatic plant monitoring activities identified curly-leaf pondweed (CLP) and coontail as the primary plants impacting recreation. Curly-leaf pondweed is a non-native plant species that begins growing in the fall, overwinters as an evergreen, and finishes its life cycle in the spring and releases large amounts of phosphorus during its spring senescence. The late spring and early summer influx of nutrients is then used by plants and algae, with algae typically using up the available nutrients first. However, true plants that can grow quickly and absorb nutrients from the water column (eg. coontail) also benefit with coontail becoming the dominant summer plant once CLP senesces.

Water quality monitoring identified elevated nutrient levels and decreased water clarity, which contributed to the eutrophic classification of the lake. Algal blooms impacted water clarity and the public’s perception of water quality and lake value.

The balance of this report will serve as the Little Blake Lake Aquatic Plant Management Plan. Upon completion, the plan will be submitted to the Polk County Land and Water Resource Department (LWRD) and WDNR for approval and plan adoption. The finished plan will guide the management of the aquatic plants of Little Blake Lake over the next several years.

2004 Little Blake Lake Aquatic Plant Management Plan

Table of Contents

1.0 Introduction

Little Blake Lake is an 85-acre drainage lake with a mean depth of 6 feet and a maximum depth of 10 feet, located in Polk County, Wisconsin (WBIC #2627300). The major inflow is located in the northeast corner of the lake and comes directly from Big Round Lake. The outflow is a continuation of Fox Creek, which flows into Little Blake Lake. The Little Blake Lake watershed is part of the Upper Apple River watershed in the Saint Croix River Basin, which was designated as a priority for non-point source pollution control by the Saint Croix Water Quality Management Plan (WDNR 1994) and included in the Polk County Land and Water Resource Plan (Bursik 2001).

In 2003, The Limnological Institute (TLI) wrote a grant for WDNR funding to conduct a macrophyte survey and update the Lake Management Plan. With this grant, TLI, Aquatic Engineering, Inc. (AEI), and Polk County were contracted for technical guidance and ecological field services. Concurrent with the aquatic plant surveys, a second grant was awarded for the evaluation of water quality. The results of water quality monitoring are included in a separate report (2004 Little Blake Lake Water Quality Technical Report). This report is a summary of the aquatic plant assessment activities that took place during 2004, which were partially funded by monies awarded through the WDNR Lake Planning and Protection Grant program.

As part of the grant, TLI outlined the activities necessary to perform an adequate macrophyte survey. Aquatic Engineering, Inc. and Polk County also suggested water quality monitoring and macroinvertebrate sampling. Invertebrates have been monitored for decades to assess ecosystem health because they respond to a myriad of environmental conditions, including habitat complexity and water chemistry. The findings of the macroinvertebrate survey provide baseline data of community composition and can be used as an indicator of water quality and habitat conservation.

Water quality parameters, such as phosphorous concentrations, were used to classify nutrient levels in the water, determine trophic status, and determine localized effects of monotypic stands of CLP on water quality.

The Aquatic Plant Monitoring Technical Report recommended that the residents of Little Blake Lake create a state approved aquatic plant management plan. The balance of this document is intended to become the resident's Aquatic Plant Management Plan.

Purpose Statement[1]

The Little Blake Lake group should determine a purpose statement for projects to be done on Little Blake Lake. *e.g.* the purpose of the Little Blake Lake group is to organize human resources to facilitate the protection and improvement of the Little Blake Lake natural resources.

[1] Has yet to be prepared by the Little Blake Lake Management Lake group.

2.0 Description of Problems

2.1 Aquatic Plants

The aquatic plant monitoring activities performed in 2004 revealed that the major plant problem facing the residents of Little Blake Lake is the native plant coontail. In addition to this nuisance native plant, the invasive plant CLP was found at high densities only in the spring. The impacts and management strategies related to these two plants are discussed individually in the next two sub-sections.

2.1.1 Coontail

Coontail, also called coon’s tail, is a native plant of Wisconsin which often causes nuisance conditions in small, shallow lakes and bays. Coontail prefers soft sediments because it does not posses true roots. Instead, it has modified leaves that can weakly anchor the plant. Relatively small disturbances (*e.g.* windy conditions, boat traffic, and current) can uproot the plant and redistribute it throughout the lake. For this reason, coontail is most likely to create nuisance conditions where calm conditions and soft substrate prevail.

Coontail can overwinter as an evergreen, actively photosynthesizing under ice cover. In the spring it begins actively growing, which gives the plant an advantage over plants that germinate from seed each season. Coontail reproduces primarily by fragmentation and, although flowers can be present, rarely reproduces by seed. In addition, coontail is tolerant of low light conditions often associated with disturbance conditions such as increased suspended solids caused by boating traffic or sediment delivery from a river or runoff.

Managing coontail presents a particular problem because the plant often moves from one site to another when it becomes uprooted by wind and wave action. For this reason, it is hard to predict when and where it will need management. Coontail is susceptible to selective herbicides and can also be harvested. Because the plant reproduces by fragmentation, it is wise to limit the amount of fragmentation when attempting to remove the plant.

2.1.2 CLP

Curly-leaf pondweed is also a cold water specialist. Unlike coontail, CLP has a life cycle that begins in the fall and ends in the spring, when it can germinate sexually from seed or asexually by turion (hard, pinecone-like seed structures). The amount of germination occurring from seed and turion is under debate, but it is thought that seeds play a relatively small role in reproduction. Regardless of the method of reproduction, CLP begins to grow in the fall, overwinters while actively photosynthesizing, and begins growing rapidly in the spring. Once full grown, the plants produce turions and often spread across the water surface. When CLP senesces (dies off) in the spring, turions become detached and can float around the lake that eventually settle to the bottom of the lake, where they germinate in the fall. Well established stands of CLP can contain plants which produce many turions each. Studies of CLP beds in lakes have shown as many as 1,600 turions in just a square meter plot (Borman et. al., 1997).

Curly-leaf pondweed does have well developed roots and prefers sand and mud substrates. For this reason, established stands of CLP do not move like coontail. The spread of CLP is primarily by turion production, which makes their process of spreading annual. Managing CLP should occur before turions are present so that current and future plants are managed.

Recent studies have also shown that CLP can contribute a significant amount of phosphorus to a lake when it senesces and decays in the summer. The extra phosphorus load in the summer usually creates algae blooms (because algae reproduce and assimilate nutrients faster than plants), which result in decreased water clarity (pea soup effect).

Harvesting CLP helps remove the plant biomass, and therefore the nutrients are bound in the plant material. If the plants are moved out of the immediate watershed after being harvested, the nutrients are permanently removed from the system. Harvesting is a good option for lakes overgrown with CLP because immediate relief can be created and large amounts of biomass can be removed.

In addition to harvesting, CLP can also be managed with selective herbicide applications. The timing of herbicide treatments is essential because the herbicide used can also affect the growth of high value native pondweeds. For this reason, treatments should occur early in the spring prior to native plants germinating. An early treatment will also help reduce the phosphorus load caused by decaying CLP in the summer.

2.2 Water Quality

Problems associated with water quality of Little Blake Lake include elevated nutrient levels (total phosphorus, TP), decreased water clarity (measured by Secchi depth) and algal blooms (measured by chlorophyll *a* concentrations). Each of these contributed to an elevated trophic status index (TSI) value in 2004. Of the three parameters measured, water clarity was the least impacted; many of the Secchi readings from 2004 indicated that the lake was actually mesotrophic. However, the TP and chlorophyll *a* concentrations suggest the lake was eutrophic.

Past studies have shown that water leaving Big Round Lake and water entering Big Blake Lake is eutrophic based on total phosphorus concentrations. One can assume that the water entering Little Blake Lake from the Straight River also contains high concentrations of phosphorus. In addition to elevated nutrient levels, the Straight River also transports sediment to Little Blake Lake. The rate of sedimentation is unknown and would likely be difficult to study because a floating bog is present at the confluence of the Straight River and Little Blake Lake.

Watershed analysis and phosphorus modeling revealed that the bulk of phosphorus from the immediate watershed originated from pasture and grasslands and the lake surface itself. It is likely that the single largest source phosphorus for Little Blake Lake is the Straight River. Further analysis could prove this theory and determine the actual annual load originating from the Straight River, but the cost of conducting such a study is not warranted at this time. Rather, estimates could be made based on the studies performed on Big Blake Lake and Big Round Lake.

3.0 Review of Management Options

3.1 Managing Aquatic Macrophytes

The following subsections provide an overview of management strategies that are commonly used to manage eutrophic effects on lakes. The purpose of this section is to provide a general introduction to popular management strategies for future reference and consideration. Methods described are derived from the *Managing Lakes and Reservoirs* manual prepared by the North American Lake Management Society (North American Lake Management Society, 2001). Practices that are relevant to Little Blake Lake are described in more detail in the following sections.

Mechanical weed harvesting can be used to remove the upper portion of rooted vegetation. Weed harvesters are low-draft barges that cut and remove vegetation growing at or near the water surface. A harvester can generally operate at a rate of approximately 0.2 to 0.6 acres per hour, depending on the equipment. Once cut, the plants are moved via conveyer to a holding area on the barge itself until they can be unloaded, via a second conveyer, at the shore. Plants are usually transported away from the lake to a compost site or a landfill. The physical removal of plant material means that the nutrients trapped in the plants are also removed from the lake ecosystem.

Harvesting is most effective for removing plants in three to six feet of water growing in dense beds. Harvesting can be used to open navigational channels, remove weedy obstructions from highly used recreational areas, or to produce relief for fish in weed-choked areas of a lake. Harvesting is non-specific and will remove all plants within the harvested area. Sometimes fish become trapped in harvested plants and end up being removed from the lake as well. Harvesting equipment is usually expensive, and operational costs vary depending on the harvesting effort required. Effects of harvesting are immediate, and there is no use restriction during operations. Wisconsin DNR permits are required for mechanical harvesting. Contact the local APM coordinator for more information regarding permitting requirements.

Manual weed harvesting is a scaled-down method of mechanical harvesting. In manual weed harvesting, weeds can be uprooted completely or simply cut close to the sediment using a variety of equipment from drag lines and garden rakes to specially designed weed cutters. This method is the most species-specific mechanical method of plant removal since an individual can physically see which plants are going to be removed and which will be missed. This method, however, is also the most labor-intensive means of controlling plants, and its feasibility is directly affected by the available labor force. This method is most applicable to individual property owners who wish to maintain clear areas for swimming, fishing, and for boat access to their dock. And since many times plants are not removed from the root, repeated efforts are needed to maintain the benefits. Wisconsin DNR permits may be required for manual harvesting. Contact the local APM coordinator for more information regarding permitting requirements.

Sediment screens range from fiberglass or plastic mesh screens to simply sand or gravel, and are placed on the existing sediment and plants to block light and suppress growth. While the synthetic barriers make better screens, they are the most difficult to install and maintain. The screens must be installed early in the year and securely anchored to the sediment to prevent them from being disturbed. The screens must be removed and cleaned periodically to prevent sediment from building up on top of them.

Sand and gravel are more natural means of suppressing aquatic vegetation and are less expensive, but they also require maintenance on an annual basis and are less effective. Wisconsin DNR permits are required for sediment screening. Contact the local APM coordinator for more information regarding permitting requirements.

Water level manipulation, commonly referred to as "draw-down", is a useful way to control nuisance vegetation that occurs in the shallow regions of a lake. This method is typically applied in the fall and over winter. Cold, dry conditions are best for a draw-down event because frozen sediments will kill most of the seed bank and compress soft sediments. Both of these conditions prevent plant growth the following spring when the water level is brought back up to normal conditions. This method severely impacts recreational uses, while the water level is lowered and has the potential to trap fish and other wildlife in shallow areas that may not become completely dry but do freeze from top to bottom over the winter.

Drawing the water level down in the summer has the opposite effect on plant growth. Lowering the water level generally increases the wetland area, and the littoral zone of a lake becomes larger. This provides more habitat for plants to become established. This is a low-labor option but can become expensive if power is generated at the dam. As a result, the power company may be entitled to compensation for loss of power generated during the draw-down.

Raising the water level in the summer can also suppress aquatic vegetation by limiting the amount of light penetrating to the bottom, thereby making the littoral zone smaller.

Wisconsin DNR permits are required for water-level manipulations. Contact the local APM coordinator for more information regarding permitting requirements.

Dredging sediments and plants is usually only performed when an increase in depth is a required part of the management outcome. If the depth is increased sufficiently, light penetration is limited in the dredged area and plant growth is suppressed. However, dredging an entire lake bed is very rarely performed. Dredging small areas for boat access and other recreational uses is a cheaper and more applicable compromise. Wisconsin DNR permits are required for dredging. Contact the local APM coordinator for more information regarding permitting requirements.

Chemical control of aquatic plants and algae is often used in areas where vegetation has created nuisance conditions. Herbicides and algaecides are used to control a wide variety of plant and algae species. Some herbicides and application methods are very specific for which plants they will control, while others control a wide variety of vegetation. In some cases, the precision and concentration of herbicide applied will also determine which species are controlled.

Chemical applications are designed to control vegetation that is already present and rarely address the underlying nutrient problem associated with nuisance plants and algae. They are sometimes the only economically feasible method for creating recreational relief. Recent advances in technologies have made chemical control a more favorable tool for managing exotic species selectively while restoring native habitats. Wisconsin DNR permits are required for aquatic herbicide applications. Contact the local APM coordinator for more information regarding permitting requirements.

Biomanipulation refers to altering a food web in order to obtain a desired end result. In the case of controlling algae, a "top-down" approach is taken. Promoting top-level predator fish like muskellunge, walleye, largemouth bass, and northern pike naturally reduces the panfish population. Panfish typically graze on zooplankton (algae eaters). When zooplankton reach high numbers, more algae is consumed and the water clarity is increased. This is generally used only to improve water clarity, however improved water clarity has a significant impact on plant distribution within the lake. Wisconsin DNR permits are required for biomanipulation. Contact the local APM coordinator for more information regarding permitting requirements.

Biological Control Agents are organisms capable of controlling other organisms within their ecosystem by various methods. For example, loosestrife weevils have been used to control the exotic plant purple loosestrife. The weevils are tiny insects that use the plants for food, shelter and to reproduce. The weevil larvae consume plant material and make growth and reproduction difficult, if not impossible, for the plant. A similar situation is suggested to occur for Eurasian water-milfoil, an aquatic exotic plant. However, there are no known biological control agents that would improve conditions within Little Blake Lake with respect to CLP and nuisance natives.

No-management means that the lake resources are not actively managed but are monitored on a regular basis. Monitoring results are tracked and compared from year to year. When conditions that warrant management are discovered, a management tool is selected. In some cases, the plant community will face a natural obstruction and balance is regained naturally.

3.2 Discussion of Management Options

Of the listed management options, lake level manipulation is not an option because there is no method of manipulating the water level. Sediment screens and manual removal will not create noticeable improvements due to their size limitations. Biomanipulation would not help the plant community unless grass carp are stocked. Stocking weed-eating fish would disrupt the ecology of the lake and is not a practical option. There is no known biological control for CLP, therefore, biological control is not a viable option.

The four most applicable management options for the issues facing Little Blake Lake are (1) mechanical harvesting; (2) chemical control; (3) dredging; and (4) no-management. Of the four listed options, dredging would be an expensive and long-term management goal, and no-management is not practical because it does not meet the residents' needs. Mechanical harvesting and chemical applications are the most practical short and medium-term management practices from a financial, recreational, and ecological standpoint.

Mechanical weed harvesters and associated equipment can be purchased or rented. Purchasing equipment would quality the lake group to apply for a 50% cost share from the Recreational Boating Facilities Fund. Purchasing equipment would allow the lake group to perform harvesting "in house" but will still cost maintenance and upkeep costs on an annual basis. Whether the lake group purchases or rents harvesting equipment, annual operational costs will likely range from $5,000 to $20,000.

The neighboring lake, Big Blake Lake, is applying for funding assistance to purchase a harvester. There is a chance that the Big Blake Lake District and Little Blake Lake residents may be able to work cooperatively to manage CLP in both lakes. The residents of Little Blake Lake should take the initiative to locate harvesting equipment, keeping the option of sharing with Big Blake Lake open. In either case, any harvesting operations will need to be permitted by the WDNR under state statutes NR 107 and NR 109.

Herbicide applications can provide relief for several weeks up to a full season or longer. Typical applications are designed to provide relief approximately one week post-application and last approximately one month. Herbicides would work well for managing the CLP population but may be difficult to use to control coontail, since coontail can become uprooted and move to other areas of the lake. Herbicide applications also don't remove any nutrients from the lake and therefore don't address the underlying problems associated with nutrient rich-lakes.

New herbicides have been designed to provide large-scale relief of all aquatic vegetation at low doses but are rarely permitted because of their wide-spread effects and non-selectiveness. All aquatic herbicide use requires a WDNR permit per state statutes NR 107 and NR 109.

In most cases, integrated approaches produce the best results. Regardless of the selected management activities, the goal of the plan should be to rehabilitate the native plant community and protect valuable habitat while limiting non-native growth and distribution.

3.3 Additional Management Techniques

Land acquisition refers to the setting aside of land within the watershed and allowing it to develop naturally. Land can be purchased, donated, or signed into easement. The WDNR has purchased thousands of acres of lake shoreline over the past several years.

Public education and participation can change the way people view their aquatic ecosystems and ultimately change their behaviors. Many lake associations begin their public education campaigns at boat launches where various signs inform the public about current topics ranging from fish and plants to water quality. The WDNR solicits public involvement through programs like "Self-Help Monitoring" and "Clean Boats, Clean Waters", which promote individual and group efforts for monitoring various aspects of the lake.

Watershed restoration/management involves either returning disturbed land to a pre-disturbance condition or implementing best management practices (BMP) within the current watershed. Examples of restoration would be restoring grazed grassland to prairie or woodland. In general, current land use is discontinued in favor of historical conditions. Activities that incorporate BMPs into the landscape are considered management activities. On a small scale, individual riparian property owners can allow their property immediately adjacent to the lake to grow naturally, creating what is commonly referred to as shoreline buffers.

4.0 Aquatic Plant Management Overview

A complete aquatic macrophyte management plan follows a series of steps. A plan organizes labor and resources for a clearly defined mission and outlines a way to measure success. The WDNR is currently in the process of creating a manual for aquatic plant management in Wisconsin. The manual outlines a seven-step process for managing aquatic plants. The steps to completing a plant management plan are:

- Setting Goals. . .Why are We Doing This
- Inventory. . .Gather Information
- Analysis. . .Synthesis of the Information
- Alternatives. . .Providing Choices
- Recommendations. . .Completing the Plan for a Formal Decision
- Implementation. . .Taking Action
- Monitor and Modify. . .So How are We Doing?

The purpose of the following sub-sections is to provide an overview of each step, explain what measures are already done towards completing the step, and explain what, if any, additional actions must be taken to complete the step.

4.1 Setting Goals

Overview

In order to set goals for aquatic plant management, problems must be identified that face lake users as well as endpoints that are desired through management efforts. Setting goals involve the following three steps: 1) Develop a goal statement; 2) Create a plan of work; 3) Create a communication and education strategy.

Completed

Goal Statement[2]

A goal statement should be developed by the Little Blake Lake Management Lake Group. Some suggested goals of the APM Plan could be:

1. Educate residents about APM activities and planning processes.
2. Monitor for and prevent aquatic invasive species.
3. Manage nuisance plant growth in areas where recreational use is impaired.
4. Promote the growth and spread of high value native plants, especially in and around designated sensitive areas.
5. Protect the current water quality so that further degradation of the plant community is prevented.

Additional Action

A communication and education strategy should be developed by the lake patrons and should include goals, methods, and specific details on how the activities will be carried out. The plan should focus on informing the public of lake management issues and soliciting public input on how best to correct any problems that may be facing the lake patrons.

4.2 Inventory

Overview

In this step of the plan, information regarding several aspects of the lake and surrounding area need to be collected and analyzed. Examples of information that should be gathered include:

- ✓ Existing plans and studies
- ✓ Data regarding plants, fish, wildlife, and water quality within the lake
- ✓ Maps and historical documentation that describe past conditions of the lake
- ✓ Aerial photographs of the lake
- ✓ State and local regulations and ordinances
- ✓ Technical information or research on the topics of concern to lake patrons
- ✓ Examples of other lake APM plans

[2] Has yet to be developed by the Little Blake Lake Management Lake group.

Additional information may have to be reviewed depending on the goals for the lake. The WDNR, UW-Extension, and regional resources such as county zoning, town clerk, and planning offices are great places to gather most of this information. Past consulting firms may also be able to provide some information specific to their findings.

Completed

As part of the 2004 aquatic plant and water quality monitoring activities and this report, TLI has collected and organized historical data with regards to the aquatic plant community, fishery and wildlife, and water quality of Little Blake Lake.

Additional Action

There should be a single location and method for storing all information regarding lake management activities. Pertinent information needs to be determined, including how information will be kept, how it will be organized and stored, who will be responsible for organizing and storing the information, and where the information will be kept. Examples of this information include:

- Past Management Plans
- Public Surveys
- Contracts/Agreements with Consulting Firms
- Management Activity Reports

4.3 Analysis

Overview

The analysis step is the most critical step in the management process. It is during this step that the information gathered in the previous step is thoroughly analyzed and compared to the initial issues voiced. The information should provide an objective view of the perceived problems and be summarized in an "Analysis Report". Individuals dedicated to completing this step need to approach the analysis with open and objective minds so that decisions are based on fact and not emotion or public pressure. To create an objective Analysis Report, consider these three variables: 1) What is the nature of people's concerns; 2) Where do conflicts occur; 3) Has the problem changed over time.

(1) Considering the nature of people's concerns involves dissecting public input to decide if opinions genuinely have the health of the resource in mind. People must understand that not all plants are nuisances and that a certain amount of vegetation is necessary to sustain fish and wildlife and also helps improve water quality and general aesthetics.

(2) Identifying areas where conflicts regarding lake use and proposed management may occur will help create a more detailed management plan. Areas that will have restricted use based on management activities need to be identified and management activities timed according to expected lake use. For example, one would not propose to perform a large scale herbicide treatment prior to the 4^{th} of July when use restrictions may prevent activities such as swimming or fishing over the holiday weekend.

(3) Determining whether the problem has changed over time involves reviewing objective information gathered regarding the problem. A previous study or plan may contain objective findings regarding the problem and can be used to compare past conditions to the current state.

4.4 Alternatives

Overview

It is hard to conduct an analysis without simultaneously considering alternative management techniques. So, these portions of the plan may become merged into an “Alternatives Analysis”. However, it is important that the need for control and the level of control be established independent of choosing the control method. The amount of discussion on alternatives will correspond with the level of control proposed.

The lake group has not been presented with alternatives suitable for Little Blake Lake and is not aware of the costs and benefits of each. In addition, the lake group members have not reviewed the table on the following page. Also, they may not have a clear understanding of the problems facing their lake. The reason for the lack of communication is because the lake group is unorganized.

Completed

Because of the lake groups lack of organization, there is nothing completed in this section thus far.

Additional Action

Additional action has to be determined by an active and organized lake group.

	Benefits	Drawbacks	Applicable	Recommended	Costs[3]	Longevity
Mechanical Harvesting	Removes plants and nutrients	Small areas controlled	Yes	Conditionally	$200,000 equipment and $200-600 per acre	1-3 Weeks
	Immediate relief	Can not reach shallow areas				
	No use restrictions	Not species selective				
	No potentially harmful chemicals	Promotes growth of opportunistic plants				
Manual Harvesting	Species specific	Labor intensive	Yes	Conditionally	$100-? per acre	1-3 Weeks
	Shallow areas affected	Very small areas controlled				
	No chemicals	Slow				
	Removes plants and nutrients	Correct plant ID required				
Sediment Screens	Little negative impact to whole lake	Harms benthic invertebrates	Yes	No	$20,000-50,000 per acre	Months to Years
	No chemicals	Difficult to install				
	Site specific control	Permit required				
	Reversible	Expensive				
Water Level Manipulation	Controls plants in shallows	Restricts recreational use during	No	No	$1,000-2,000 per acre	1-2 Years
	2 years of control	Perfect weather conditions required				
	Sediment compaction	Disrupts wildlife				
	Inexpensive (maybe)	Expensive (maybe)				
Dredging	Improves navigation	Very expensive	Yes	No	$20,000-80,000 per acre	Depends on sedimentation rate
	Removes plants and nutrients	Releases toxic contaminants				
		Destroys habitat				
		Increases turbidity				
Chemical Control	Quick relief	Repeat treatments required	Yes	Yes	$1,000-2,000 per acre	Months to Years
	Species specific	Does not remove nutrients				
	2 months of relief	Promotes aggressive species				
	Cost effective	Can increase algal blooms				
Biomanipulation	Long lasting	Hard to start	?	No	?	?
	Self sustaining	Alters habitat				
	No chemicals	May have negative impacts on habitat				
	Improves water quality	Can be irreversible				
	Improves fishery					

[3] Cost range per acre treated without consideration of longevity of effects (Holdren et al. 2001)

4.5 Recommendations

Overview

In this step of the plan, a preferred management tool is selected. This requires reviewing the goals and objectives set in step one, reviewing existing conditions from step two, reviewing the level of management decided in step three, and reviewing management alternatives from step four. The next step in the recommendations is to evaluate the action plan, organize resources such as volunteer time and budget, and identify and meet legal obligations prior to implementing the plan. Such legal obligations may be obtaining state permits for managing plants or informing the public of herbicide applications. Many of the requirements are listed in Wisconsin state statutes NR107 and NR109.

Completed

A primary management tool needs to be selected by the lake group.

Additional Action

The next logical step for the lake group is to become organized.

4.6 Implementation

Overview

Implementation can be broken into three steps. The first step is to adopt the plan. The plan should be adopted first by TLI, who should then present the adopted plan to local units of government for additional support. In the case of creating ordinances as part of the plan, government bodies will be essential in creating and enforcing laws.

The second step to implementation is to prioritize and schedule actions. Actions can be immediate, short-range, medium-range, and long-range. The following three subsections outline an implementation plan suitable for Little Blake Lake.

The final step of implementation is to assign roles and responsibilities for the various agencies involved in the management activities. The responsibilities need to be clearly defined and recognized by the individuals and organizations responsible for carrying them out. Formal resolutions and contracts are usually adequate in covering these responsibilities.

Completed

Plan Adoption

The Limnological Institute will distribute a draft version of this document, including the APM Plan in section 5, to vested parties for review. Vested parties have the opportunity to make suggestions for revisions to TLI. The document will then be revised and a final draft will be distributed to the WDNR. The Limnological Institute will adopt the plan and request support from the WDNR and Polk County LWRD.

Immediate Implementation Actions

Educational campaigns designed to inform property owners about the value of aquatic plants and what they can do to help improve the water quality should start immediately. Information on how property owners and lake patrons can help protect water quality should also be included in the campaign. There should be a person responsible for carrying out the educational campaign. Information and resources can be gathered from the WDNR, Polk County, and the local UW-extension office. Educational materials may be typed and distributed, posted in a public place, or presented. The reason for the campaign is to raise awareness, solicit involvement, and promote action.

Short-term Implementation Actions

Short-term plant management actions should include mechanical harvesting and/or herbicide applications. Integrated management strategies provide the flexibility to manage different areas of the lake in different ways. Mechanical harvesting could be used to create navigational channels for access to most areas of the lake. Herbicide treatments can provide relief for individual property owners. An integrated approach would combine the two management practices and would result in clear navigational channels with access to private piers and docks.

Another short-term action should be for the lake group to organize their District. Running a District offers financial benefits such as taxing and grant funding eligibility.

The lake group may also want to consider forming a joint District with members of the Big Blake Lake District.

Another short-term goal may be to protect valuable aquatic habitat by promoting the growth of high value native plant species and protect the designated sensitive areas by minimizing impacts from management practices as well as recreationists.

Long-term Implementation Actions

A long-range plan may include improving water quality (gauged by annual average Secchi depth) by implementing certain BMPs throughout the watershed. Protecting water quality is a fundamental aspect of lake improvement projects.

Another long-range implementation goal may be dredging. Dredging is an expensive and ecologically disruptive alternative but usually provides years of control and can address many of the concerns in one management activity.

Additional Action

A primary management tool needs to be selected, and immediate, short term, and long term goals need to be determined. In addition, the level of management and funding needs to determined to meet the required goals. Some possible funding sources include lake fundraisers, federal and state grants, and/or charitable contributions from lake property owners.

4.7 Monitor and Modify

Overview

Monitoring the plant community with methods outlined by the WDNR ensures that objective values are obtained and that management activities are evaluated without bias. Future decisions concerning the plant community will be based on objective data gathered annually throughout implementation of the plan. It is important to realize that effective monitoring will be the result of clearly defined performance objectives.

The WDNR APM guidelines outline the necessary monitoring and background information needed to perform Level III aquatic plant management activities in Wisconsin lakes. The method for tracking progress occurs annually prior to and after management activities. The WDNR recommends calculating the FQI value annually. The FQI should increase if the frequency of exotic species decreases and/or the frequency of native species, especially those designated as "sensitive species" increases. Calculating the FQI is explained in the WDNR's Aquatic Plant Management in Wisconsin manual.

In addition, general monitoring methods are also outlined in the WDNR's Aquatic Plant Management in Wisconsin manual. Specific monitoring is required for herbicide applications while other recommendations exist for the monitoring of current exotic species and prevention of others. The current version of the manual is a draft and is not available for distribution. The Limnological Institute should insist that all management and monitoring activities follow the recommendations within the current draft of the manual.

Completed

The current expectations regarding monitoring pre- and post-management activities, monitoring for known exotics, and monitoring for preventing others is outlined in sections 5.2 and 5.3 of this report but should be finalized and adopted based on the management actions selected and the WDNR requirements for implementing those actions.

Additional Action

Additional action will be required as the plan is finalized, adopted and approved by the WDNR and TLI agrees to carry out the WDNR requirements for the chosen management actions.

5.0 Little Blake Lake APM Plan

5.1 Specific Elements of the Little Blake Lake APM Plan

This section lists the specific recommendations of the WDNR for Level III management. The recommendations have either been satisfied based on information gathered during the 2004 Aquatic Engineering, Inc. study (black items) or still need to be fulfilled (red items).

Goals

- ✓ Purpose Statement
- ✓ Goal Statement

Management History

- ✓ Summary of past management activities *(Section 3.0 Aquatic Plant Monitoring Technical Report)*

Plant Community

- ✓ Comprehensive species list and review growth cycles of dominant species *(Section 5.1 Aquatic Plant Monitoring Technical Report)*
- ✓ Total surface area covered by aquatic vegetation *(Appendix A&C Aquatic Plant Monitoring Technical Report)*
- ✓ Highlight rare, threatened or endangered species and species of concern *(Appendix A&C Aquatic Plant Monitoring Technical Report)*
- ✓ Highlight invasive and non-native species, map, and compare to native community *(Appendix A&C Aquatic Plant Monitoring Technical Report)*
- ✓ Describe beneficial use of plants as well as nuisance or use conflicts associated with plant community *(Section 2.3 Aquatic Plant Monitoring Technical Report)*
- ✓ Describe vegetative characteristics of near shore or shoreland areas *(Section 5.5 Aquatic Plant Monitoring Technical Report)*
- ✓ Collect quantitative data of the lake's aquatic plant community *(AIE 2004 and Appendix B&D Aquatic Plant Monitoring Technical Report)*
- ✓ Determine the percent frequency of each species present *(Section 5.2 Aquatic Plant Monitoring Technical Report)*
- ✓ Determine the lake's FQI *(Section 5.2 Aquatic Plant Monitoring Technical Report)*
- ✓ Collect three samples of each species for herbarium specimens *(AEI 2004)*
- ✓ Label sites where rare, threatened, endangered, special concern, invasive, and non-native plants were found *(Appendix A&C Aquatic Plant Monitoring Technical Report)*
- ✓ Map areas to show dominant species type and aquatic invasive species *(AIS)(Appendix A&C Aquatic Plant Monitoring Technical Report)*
- ✓ Maintain plant information in database or GIS including species name, location, and date sampled *(Appendix A&C Aquatic Plant Monitoring Technical Report)*

- ✓ Create map depicting proposed management areas and effect of management
- ✓ Record map coordinates on a GIS map *(Appendix A&C Aquatic Plant Monitoring Technical Report)*

Lake Map

- ✓ Obtain map with accurate scale *(Appendix A&C Aquatic Plant Monitoring Technical Report)*
- ✓ Determine township, range and section of lake *(Section 1.0 Aquatic Plant Monitoring Technical Report)*
- ✓ Tabulate lake surface area, maximum and mean depths *(Section 1.0 Aquatic Plant Monitoring Technical Report)*
- ✓ Find Water Body Identification Code (WBIC) assigned by WDNR *(Section 1.0 Aquatic Plant Monitoring Technical Report)*
- ✓ Obtain aerial photos of lake *(Appendix A&C Aquatic Plant Monitoring Technical Report)*
- ✓ Obtain bathymetric map of lake *(Section 1.0 Aquatic Plant Monitoring Technical Report)*
- ✓ Identify sediment characteristics *(Section 5.4 Aquatic Plant Monitoring Technical Report)*
- ✓ Use GPS to record locations of specific sites of interest such as plant sampling locations *(Section 4.0 Aquatic Plant Monitoring Technical Report)*

Fishery & Wildlife

- ✓ Prepare a narrative describing the fish and wildlife community and their relationship to the plant community *(Section 2.0 Aquatic Plant Monitoring Technical Report)*
- ✓ Identify any areas designated as "Sensitive Areas" by the WDNR *(Section 3.9 Aquatic Plant Monitoring Technical Report)*
- ✓ Identify areas where rare, threatened, or endangered species or species of special concern exist *(Appendix A Aquatic Plant Monitoring Technical Report)*
- ✓ Conduct specific surveys as required (NA)

Water Quality

- ✓ Obtain one year of current water quality, including a minimum of five Secchi disk readings from June 1 to August 31 *(Section 4.4 Water Quality Monitoring Technical Report)*
- ✓ Prepare summary of historical data *(Section 2.0 Water Quality Monitoring Technical Report)*
- ✓ Measure the temperature and dissolved oxygen at one meter intervals at the deepest point of the lake during the summer *(Section 4.5 Water Quality Monitoring Technical Report)*
- ✓ Measure nutrient levels for TP, TKN, nitrate, ammonium and nitrite throughout the summer and obtain nutrient budget if available *(Barr 1999 Big Blake Lake report and Section 4.0 Water Quality Monitoring Technical Report)*
- ✓ Measure chlorophyll-*a* concentrations, turbidity, alkalinity and pH throughout the summer *(Section 4.0 Water Quality Monitoring Technical Report)*

Water Use

- ✓ Note primary human use patterns in the lake and on shore *(Section 5.8 Aquatic Plant Monitoring Technical Report)*
- ✓ Note areas where use is restricted for any reason *(Section 3.9 Aquatic Plant Monitoring Technical Report)*
- ✓ Collect public survey to gather opinions and perceptions on plant and water conditions (*Section 5.8 Aquatic Plant Monitoring Technical report*)
- ✓ Note water intakes for public water supply or irrigation
- ✓ Include the above information on GIS map

Watershed Description

- ✓ Provide topographical map showing watershed boundaries, inflows and outflows *(Section 1.0 Aquatic Plant Monitoring Technical Report)*
- ✓ Determine watershed area *(Section 4.7 Water Quality Monitoring Technical Report)*
- ✓ Quantify land use areas within watershed *(Section 4.7 Water Quality Monitoring Technical Report)*
- ✓ Calculate nutrient loading by area *(Section 5.4 Water Quality Monitoring Technical Report)*
- ✓ Locate all inputs into lake including streams, drainage ditches, drain tile, etc.
- ✓ Include the above information on GIS map
- ✓ Model the lake and watershed to develop annual nutrient budget *(Section 5.4 Water Quality Monitoring Technical Report)*

Analysis

- ✓ Identify management objectives needed to maintain and restore beneficial uses of the lake *(Section 4.5)*
- ✓ Create maps and overlays of the information from the inventory and interpret the results *(Appendix A&C Aquatic Plant Monitoring Technical Report)*
- ✓ Identify target levels or intensity of manipulations
- ✓ Map areas proposed for management
- ✓ Record mapping coordinates on a GIS map

Alternatives

- ✓ Include in plan measures to protect the valuable elements of the aquatic plant community as well as measures to control nonnative and invasive plants, plants that interfere with beneficial lake uses, and plants that enhance habitat for fish and aquatic life
- ✓ Discuss most common plant control techniques, benefits, and drawbacks with vested parties *(Section 3.2 and 4.4)*
- ✓ Provide sufficient information regarding the feasibility, costs, and duration of control expected of each alternative *(Section 4.4)*
- ✓ Discuss the potential adverse impacts of each alternative *(Section 3.2 and 4.4)*

Recommendations

- ✓ Develop an invasive species prevention program including education and monitoring *(Section 5.3)*
- ✓ Implement "Clean Boats, Clean Waters" program *(Section 5.3)*
- ✓ Involve the public in keeping the lake healthy by finding ways to decrease harmful watershed inputs *(Section 5.5)*
- ✓ List proposed control actions beyond those strictly necessary for aquatic plant management that will be implemented to achieve desired level of control *(Section 5.0)*
- ✓ Identify specific areas for control on a map and list the level of proposed management *(Section 5.2)*

Implementation

- ✓ Describe education or prevention strategies needed to maintain and protect the plant community *(Section 5.3)*
- ✓ Describe how all the management recommendations will be implemented, the methods and schedules applicable to the operation, including timing, capital, operational cost estimates, and maintenance schedules if applicable. Describe roles and responsibilities of the persons and/or organizations involved in the management process *(Section 5.0)*
- ✓ Describe how the public will be involved *(Section 5.3)*
- ✓ Develop a budget and identify funding sources, including plans for grant application *(Section 4.6)*
- ✓ Describe the process by which the plan will be adopted, revised, and coordinated, with WDNR approval *(Section 4.6)*

Monitoring and Evaluation *(Lakes with Known Invasive Populations and Following Management Actions)*

- ✓ Monitor for invasive aquatic plants in early spring and twice in the summer *(Section 5.3)*
- ✓ Perform quantitative plant survey at least once every five years. Track diversity indices such as FQI for early warning signs of decreasing diversity or water quality *(Section 5.2)*
- ✓ Contract a professional survey every three to five years for the presence of exotic species and for updating the native plant list *(Section 5.3)*
- ✓ For lakes with known exotics, sample more often, use the rake method, and sample areas of know infestation, major inlets, and boat launches *(Section 5.2)*
- ✓ Following management activities, collect basic water chemistry and physical parameters such as TP, TKN, temperature, pH, dissolved and dissolved oxygen at a mid lake site and within each management zone *(Section 5.5)*

5.2 Primary management tool

A primary management tool has yet to be selected by the lake group.

5.3 AIS Prevention Program

In addition to the primary management tool yet to be selected, monitoring for all non-native species is recommended. It is important that lake patrons take an active role in preventing the spread of invasive species both into and out of the lake. Monitoring for non-natives can be conducted by volunteers on a weekly basis. Volunteer training is available through the WDNR's Clean Boats, Clean Waters program. A network of representatives with addresses and phone numbers should be available to each person monitoring the launches in case of an invasive occurrence. The contact information for the local WDNR warden should also be provided to each volunteer monitor.

A professional management firm should be hired to perform a qualitative survey annually and a comprehensive quantitative plant survey every three to five years to monitor invasive species and update the plant inventory. The FQI should be calculated after every comprehensive survey and can indicate decreasing diversity or water quality. This assessment will result in a strong record of baseline plant community data and can be used in the future to objectively determine an improvement or decline in the general "disturbance" of the lake ecosystem. Although the FQI is a quick indicator of disturbance, quantitative surveys should be used as the indicator of a changing plant community.

Monitoring for CLP should occur in early spring and should follow WDNR recommendations for monitoring in lakes with known exotics. Areas of previous infestation, inlets, outlets, and boat launches are areas of special concern and require specific sampling methods under the current guidelines.

5.4 Individual Dock Treatment Programs

In addition to the chosen primary management tool selected, the lake group may wish to help individual property owners locate professional application services by keeping contact information for several application firms on record and available to members. For near-shore areas of high recreational use (around docks and beaches) the WDNR typically allows a 50-foot wide corridor through nuisance native aquatic vegetation. For areas with high value vegetation and areas designated as sensitive, a smaller corridor may be permitted. Management in these areas should be limited to hand removal or a site-specific herbicide management program permitted by the WDNR.

5.5 Water Quality Management

Water quality parameters such as Secchi depth, total phosphorus, and chlorophyll *a* should be monitored on a regular basis. Recent studies suggest that CLP may play an important role in nutrient cycling and water quality as it decays in the summer. Though more research needs to be conducted to determine the exact effects of monotypic CLP beds on water quality, it is widely recognized that the release of phosphorus from CLP in the summer can fuel local algae blooms and disrupt the annual cycling of phosphorus. By managing CLP and promoting the establishment of native macrophytes in CLP beds, the seasonal release of phosphorus would be curbed; a more natural cycle would result in less intense algal blooms in the middle of summer.

5.6 Fishery Management

A healthy fishery will be the result of good plant habitat, water quality, and invertebrate community. Northern pike, bass, and walleye help maintain good water clarity by consuming the fish that eat zooplankton. The past stocking efforts and size/bag limits imposed by the WDNR have helped maintain the fishery and should be continued in future management efforts. The WDNR is doing a good job of monitoring the fish population and has a good understanding of how the size limits affect abundance and occurrence of quality sized fish.

In addition to managing the fish population through stocking efforts, healthy aquatic plant communities promote the establishment of healthy fisheries. Aquatic plants provide cover and foraging opportunities for fish of all species and sizes. Studies are currently being conducted to assess the effects of monotypic stands of CLP on macroinvertebrate communities. The sampling performed by AEI in 2004 also takes into account the distinct differences between monotypic CLP beds and well-mixed areas of native plant species. The conclusions one can draw are that macroinvertebrate communities are, statistically, not impacted by monotypic CLP beds or that there is not enough difference in the plant community between sample points to notice an effect on the invertebrate community (*i.e.* there is no place in the lake were the macroinvertebrate community is not impacted by CLP).

6.0 References

Borman, S., R. Korth, and J. Temte. 1997. Through the Looking Glass; A Field Guide to Aquatic Plants. Reindl Printing, Inc. WI.

North American Lake Management Society. 2001. Managing Lakes and Reservoirs.

The Limnological Institute. 2006. 2004 Little Blake Lake Aquatic Plant Monitoring Technical Report.

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