The Limnological Institute

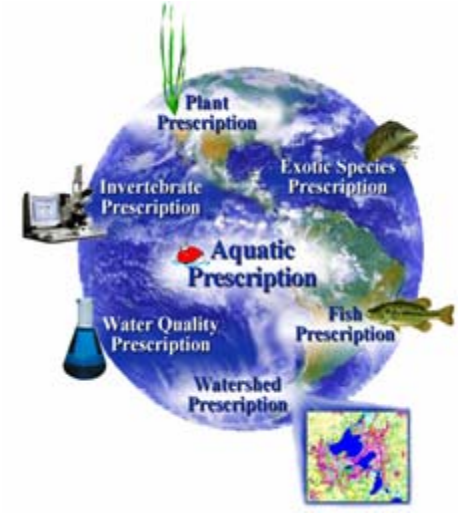
A conservation organization providing research and solutions for the preservation of our inland waters.

2004 Lake Lorraine Aquatic Plant Management Plan

Prepared by:

Aquatic Engineering

Post Office Box 3634
La Crosse, WI 54602-3634
Phone: 866-781-8770
Fax: 608-781-8771
E-mail: info@aquaticengineering.org
Web Site: www.aquaticengineering.org



2004 Lake Lorraine Aquatic Plant Management Plan

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By J. E. Britton[1] and The Limnological Institute[2]

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

1 Aquatic Engineering, Inc.; jbritton@aquaticengineering.org
PO Box 3634, La Crosse, WI 54602-3634
Phone: 866-781-8770
www.aquaticengineering.org

Signature Date

2 The Limnological Institute; info@thelimnologicalinstitute.org
PO Box 304, La Crosse, WI 54602-3634
Phone: 800-485-1772
www.thelimnologicalinstitute.org

Signature Date

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Lake Lorraine Restoration and Protection Association Commissioners

Neil Sawyer	Director
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Wisconsin Department of Natural Resources

Heidi Bunk	Lake Coordinator
Andrew Hudak	Water Resources Specialist
Mary Ellen Franson	Environmental Grant Specialist
Rick Dauffenbach	Fisheries Biologist
Doug Welch	Fisheries Biologist

Walworth County Land Use & Resource Management Department

Audrey Greene	Lakes Specialist

Executive Summary[1]

Lake Lorraine is a 133–acre eutrophic seepage lake with moderate-to-poor water quality and clarity located in Walworth County, Wisconsin. The watershed for Lake Lorraine is largely agricultural with some development directly adjacent to the lake. Lake Lorraine experiences dense macrophyte growth throughout the summer caused primarily by two invasive species, curly-leaf pondweed (CLP) and Eurasian water-milfoil (EWM). Lake Lorraine also experiences frequent algal blooms and has experienced problems caused by the floating bog located in the southwestern corner of the lake.

Lake Lorraine residents understand that a healthy aquatic plant community plays a vital role within the lake community due to the role plants play in improving water quality: providing valuable habitat resources for fish and wildlife, resisting invasions of non-native species, and checking excessive growth of tolerant species that could crowd out the more sensitive species, thus reducing diversity.

As such, the Lake Lorraine Restoration and Protection Association, Inc. (LLR&PA) has attempted to manage nuisance aquatic vegetation, algae, and the floating bog in the past, with very limited success. In 1996, Lake Lorraine was included in a milfoil weevil study conducted by the WDNR. The weevil stocking efforts were not successful in that the weevil density never maintained at target levels and no noticeable milfoil reduction occurred. The efforts to maintain an effective weevil population have since ceased.

In the past, several property owners contracted herbicide application companies to help provide relief from nuisance vegetation and algae. The lake is now almost completely overgrown with CLP in the spring and EWM and coontail in the summer. Recreational opportunities are limited in the summer, when most residents prefer to use the lake, because of dense week growth. The Association decided in 2003 to improve their plant management activities by contracting with The Limnological Institute (TLI), who wrote two grant applications in 2004 on behalf of the Association. One grant was submitted to

[1] Prepared by the Lake Lorraine Restoration and Protection Association

conduct a formal aquatic plant survey, and the other was submitted to conduct a season of water quality monitoring. The results of the work performed under those grants are summarized in the "2004 Lake Lorraine Aquatic Plant Survey Technical Report" and the "2004 Lake Lorraine Water Quality Monitoring Technical Report".

The purpose of this report is to gather all past management data, including the 2004 monitoring data, and put forth an Aquatic Plant Management (APM) Plan for Lake Lorraine. This APM Plan will provide the Association with a unified plant management plan that is backed by public support, Walworth County, and the WDNR. This plan will also help the Association maximize its resources and organize its ongoing efforts.

2004 Lake Lorraine Aquatic Plant Management Plan

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1.0 Introduction

1.1 Overview of 2004 Surveys and Monitoring

In the summer of 2004, Aquatic Engineering, Inc., performed water quality and aquatic plant monitoring activities on Lake Lorraine (Walworth County, Wisconsin). Analyses in the water quality report included baseline water chemistry, Secchi depths, chlorophyll-*a*, phytoplankton analysis, zooplankton analysis, watershed delineation, land use analysis, TSI calculations, and phosphorus load estimates.

The results of the water quality monitoring and analysis show that Lake Lorraine is a shallow, eutrophic lake that experiences dense macrophyte growth and algal blooms due to elevated nutrient levels. The composite TSI value in 2004 was 55.3, which indicates Lake Lorraine is a eutrophic system. A complete summary of the water quality monitoring activities can be found in the "2004 Lake Lorraine Water Quality Technical Report".

Aquatic plant monitoring activities in 2004 included whole lake qualitative and quantitative surveys. In addition to sampling the plant community, the surveys also included analyses of sediment type and riparian land use.

The results of the plant surveys show that Lake Lorraine has a plant community that is dominated by only a few species. Two of the three most dominant species are non-native species, Eurasian water-milfoil (EWM) and curly-leaf pondweed (CLP), and the other is a disturbance-tolerant species (coontail). These three dominant species create nuisance conditions throughout the spring and summer. Diversity indices show that the plant community within Lake Lorraine is in the lower quartile (at least 75% of lakes have more diversity in their plant community) for lakes in Wisconsin and the region.

This document compiles information regarding the Lake Lorraine ecosystem and outlines an Aquatic Plant Management (APM) plan. The plan considers objective information regarding inventory data, public input, historical conditions, and current plant and water

quality conditions. The plan reviews management options and follows WDNR recommendations for managing aquatic plants within Wisconsin. The APM plan can be used to update or create a Lake Management Plan (LMP).

Purpose Statement[2]

The purpose of the Lake Lorraine Restoration and Protection Association, hereinafter referred to as "Association," is to preserve and protect Lake Lorraine, its shorelines and its surroundings, and to enhance the water quality, fishery, boating safety, and aesthetic values of Lake Lorraine as a public recreational facility for today and for future generations.

1.2 Ecological Role of Aquatic Plants[3]

All life in the lake depends on the plant life - the beginning of the food chain. Aquatic plants and algae provide food and oxygen for fish, wildlife, and invertebrates, that in turn provide food for other organisms. Plants provide habitat, improve water quality, protect shorelines and lake bottoms, add to the aesthetic quality of the lake, and impact recreation.

1.3 Water Quality Characteristics[4]

Aquatic plants serve as indicators of water quality because of their sensitivity to water quality parameters, such as water clarity and nutrient levels (Dennison et. al. 1993).

The present study will provide information that is important for effective management of the lake, including fish habitat improvement, protection of sensitive habitat, aquatic plant management, and water quality protection. The baseline data that it provides will be compared to future aquatic plant inventories and offer insight into changes occurring in the lake.

[2] Excerpt from the Lake Lorraine Restoration and Protection Association by-laws
[3] Prepared by the Lake Lorraine Restoration and Protection Association
[4] Prepared by the Lake Lorraine Restoration and Protection Association

1.4 Background and History[5]

Lake Lorraine is a 133-acre seepage lake in southwest Walworth County, Wisconsin. Lake Lorraine has a maximum depth of 10 to 12 feet and a mean depth of 4 feet.

There have been herbicide treatments in the past for aquatic plant control, in addition to participation in the milfoil weevil study. Herbicide treatments met with low success, and in the weevil study, weevil stem densities did not reach levels high enough for noticeable control of EWM.

[5] Prepared by the Lake Lorraine Restoration and Protection Association

2.0 Description of Problems

Water Quality

The findings of the 2004 water quality monitoring show that Lake Lorraine is a eutrophic system that experiences nuisance algal blooms and elevated nutrient levels. Results of the public use survey back up the objective findings, showing a majority opinion that water clarity and algal blooms have worsened over time. The public also believes that water quality is an important aspect of the ecosystem and needs to be managed.

The source of excessive nutrients has not yet been identified. It is likely that surface runoff, ground water interactions, and septic leachate (all non-point sources) are the major sources of nutrients. A complete hydrologic budget, which is currently not available, is required to create a detailed nutrient budget.

Aquatic Vegetation

The findings of the 2004 aquatic plant monitoring show that Lake Lorraine experiences nuisance weed growth that is caused by three main species. CLP dominates the aquatic plant community in the spring and senesces in early summer. After CLP senesces, EWM and coontail dominate the plant community. Both EWM and coontail are known to create nuisance conditions in many Wisconsin lakes. The public opinion is that excessive weed growth inhibits enjoyment of the lake, is worse in some areas than others, and is not being managed effectively.

Public Perception

The public survey shows that most people believe fluctuating water levels, fertilizer and pesticide use, and inappropriate lake management are causing the undesirable plant, algae, and water clarity concerns within the lake. In addition to the perceived causes, the respondents were evenly split when asked if they felt they had a voice in making decisions regarding lake management activities. It is clear that in order for a management plan to be successful, the Association will have to solicit public opinion and gain public support for the plan.

3.0 Review of Management Options

3.1 Options for Managing Aquatic Macrophytes

The following subsections provide an overview of management strategies that are commonly used to manage eutrophic effects in 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. Practices that are relevant to Lake Lorraine 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 until they can be unloaded by 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 in removing plants that are in three to six feet of water and 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. WDNR 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 methods 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 and 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. WDNR 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. WDNR 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 in 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 may 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. 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.

WDNR 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. 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. WDNR 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 as to which plants they will control. Others control a wide variety of vegetation. In some cases, the precision and concentration of herbicide applied will determine which species are controlled.

Chemical application is designed to control vegetation that is already present and rarely addresses the underlying nutrient problem associated with nuisance plants and algae. It is 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. WDNR 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 higher numbers in the absence of panfish, more algae is consumed, and water clarity is increased. This method is generally used only to improve water clarity, however improved water clarity has a significant impact on plant distribution within the lake. WDNR permits are required for biomanipulation. Contact the local APM coordinator for more information regarding permitting requirements.

Biological Control Agents is a term used to describe organisms capable of controlling other organisms within their ecosystem by various methods. For example, loosestrife weevils have been used to control the exotic purple loosestrife plant. The weevils are tiny insects that use the plants for food, shelter, and reproduction. Weevil larvae consume plant material and make plant growth and reproduction difficult, if not impossible. A similar situation is suggested to occur for EWM, an aquatic exotic plant. There are no known biological control agents that would improve conditions within Lake Lorraine 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 will be regained naturally.

3.2 Discussion of Management Options

Aquatic Plant Management

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 because of their size limitations. Biomanipulation will not help the plant community unless grass carp are stocked. Stocking weed-eating fish would disrupt the ecology of the lake and is illegal in Wisconsin, and therefore it is not a practical option. Biological control for EWM was attempted from 1996 to 1998 by the WDNR but was unsuccessful.

The four most applicable management options for the aquatic plant concerns facing Lake Lorraine are (1) mechanical harvesting, (2) chemical control, (3) dredging, and (4) no management. Of the four options, dredging is a long-term management goal, which may never be permitted, and "no management" is not practical. Mechanical harvesting and chemical applications are the most practical short-term plant management practices from a financial and ecological standpoint.

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

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. New herbicides have been designed to provide large-scale relief of all aquatic vegetation at low doses.

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.

Water Quality Management

Stocking/promoting top-end predator fish can improve water quality. This concept is called "top-down management," which works because top-end predators control panfish and baitfish populations, which reduce predation on zooplankton, which graze on phytoplankton (planktonic algae). The result is fewer phytoplankton and thus clearer water.

Managing fish populations is only one way to improve water quality. Most water quality management practices focus on improving the watershed. Watershed management focuses on correcting the source of water quality impairment and therefore takes longer to realize results. Because managing the watershed corrects the source of impairment, results tend to last longer than those gained by directly manipulating conditions within the lake.

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 subsections is to provide the Association with an overview of each step, explain what measures the Association has already taken towards completing the step, and explain what, if any, additional action the Association must take to complete the step.

4.1 Setting Goals

Overview

In order to set goals for aquatic plant management, the Association must identify problems facing lake users and what endpoint is desired through management efforts. Setting goals involve the following three steps: 1) Develop a goal statement, 2) Create a plan of work, and 3) Create a communication and education strategy.

Completed

The first step to improving aquatic plant conditions within Lake Lorraine is to complete the APM Plan. Public interest in improving conditions is high, but funding is scarce. The majority of action toward improving Lake Lorraine will come from volunteer work and public support.

The Lake Lorraine Restoration and Protection Association will continue to hold regular meetings throughout the planning and implementation of the APM Plan. Special meetings may be called when certain topics warrant immediate attention. In addition, TLI will provide educational materials and an informal presentation of the preliminary findings so that the Association may make a well-informed decision regarding future management activities.

Goal Statement[6]

The goals of the Lake Lorraine APM Plan are:

1. To rehabilitate the health of the native plant and animal communities and ecosystems, protect valuable habitat, and restore lake clarity, while drastically reducing the growth and distribution of non-native macrophytes.
2. To inform the public of lake management issues and to solicit aid and input on how best to correct these problems.

Additional Action

A communication and education strategy will be developed by the ASSOCIATION and will include goals, methods, and specific details on how the activities will be carried out. The plan will 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 Association.

[6] Prepared by the Lake Lorraine Restoration and Protection Association

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 describes 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 the Association
- ✓ Examples of other lake APM plans

Additional information may have to be reviewed depending on the goals of the Association. 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 this study, TLI has collected and organized historical data regarding the aquatic plant community, fishery and wildlife, and water quality of Lake Lorraine. A current plant community inventory was collected as part of this study in addition to water quality data and public opinion.

Additional Action

The Association should have a single location and method for storing all information regarding their lake management activities. The Association needs to decide what information will be kept, how it will be organized/stored, who will be responsible for organizing/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, that a certain amount of vegetation is necessary to sustain fish and wildlife, and that vegetation 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 4th 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 may be used to compare past conditions to the current state.

Completed – Analysis Report

An analysis of past and current conditions is covered in sections 3, 4 and 5 of this report. The nature of peoples' concerns is genuine and in the best interest of the lake resource. The Association is unified in its efforts and use conflicts are not an issue.

Lake Lorraine is used by the area residents as a recreational asset year round. Recreational activities consist of:

- Fishing
- Canoeing
- Kayaking
- Swimming
- Leisure boating (pontoon boats)
- Water skiing
- Jet skiing
- Paddle boating
- Bird watching
- Protect natural habitat for Sand Hill Cranes, snapping turtles, painted turtles, muskrat, etc.

There are no water intakes for public water supply or irrigation.

Additional Action

There is no additional action required of the Lake Lorraine Restoration and Protection Association regarding the analysis step other than to attend regular Association meetings and participate in the creation of subsequent APM Plans.

4.4 Alternatives

Overview

It is hard to conduct an analysis without simultaneously considering alternative management techniques. So, these portions of the plan may be merged into an "Alternatives Analysis". However, it is important that the need for and 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.

Completed

The Association has been presented with several alternatives for aquatic plant and water quality management. The Association has also been active in soliciting and procuring additional informational resources to aid in their decision making process.

Additional Action

The Association will continue to evaluate potential management tools as their needs dictate. The Association feels they have done due diligence to make decisions regarding their current management.

	Benefits	Drawbacks	Applicable	Recommended	Costs[7]	Longevity
Mechanical Harvesting	Removes plants and nutrients	Small areas controlled	Yes	Yes	$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	Yes	$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	Yes	$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	Yes	$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	?	?	?	?
	Self sustaining	Alters habitat				
	No chemicals	May have negative impacts on habitat				
	Improves water quality	Can be irreversible				
	Improves fishery					

[7] 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 is to evaluate the action plan, organize resources such as volunteer time and Association budget, and identify and meet legal obligations prior to implementing the plan. Such legal obligations may include 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

Primary Management Tool Selected[8]

The Association has chosen their primary short-term management tool(s). For lake-wide aquatic plant management, the Association would like to implement a mechanical harvesting program and implement chemical control measures. For localized weed control (i.e., around docks) the Association will promote the use of manual or mechanical harvesting.

Additional Action

The next logical step for the Lake Lorraine Association is to outline the steps necessary to implement their recommended management tools. In addition to creating a plan for their chosen management tools, the Association will continue to investigate the following management options:

- ✓ Reducing nutrient inputs from sources such as agricultural runoff, leaking septic systems, and lawn fertilizers
- ✓ Conducting a full hydrologic study by students at the University of Wisconsin-Whitewater to pinpoint nutrient inputs
- ✓ Dredging to increase recreational access and habitat diversity and to remove nutrients
- ✓ Introduction of milfoil weevils and/or chemical controls once conditions in the lake's ecosystem are conducive to their effectiveness.

[8] Prepared by the Lake Lorraine Restoration and Protection Association

4.6 Implementation

Overview

Implementation can be broken down into three steps. The first step is to adopt the plan. The plan should be adopted by the Association first. The Association 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, or long-range.

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[9]

The Association has arranged for TLI to distribute a draft version of this document, including the APM Plan specific elements listed in section 5, to the vested parties for review. The 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 Association and WDNR. The Association will adopt the plan and request support from the WDNR and Walworth County LWRD.

The following are management recommendations made by the Lake Lorraine Restoration and Protection Association.

[9] Prepared by the Lake Lorraine Restoration and Protection Association

Short-term Implementation Actions

1) The Wisconsin Department of Natural Resources should designate sensitive areas within Lake Lorraine. These are areas within the lake that are most important for habitat and maintaining water quality and for preserving endangered and rare species.

2) The Association will investigate regulation of boat speed in the shallow water areas to reduce disturbance to the plant beds.

Immediate Implementation Actions

3) All lake residents will practice best management on their lake properties. Lake Lorraine is eutrophic; a small increase in nutrients could push the lake further into a eutrophic state resulting in noticeably worse water quality. Conversely, reducing nutrients could have a noticeably favorable impact on water quality. To this end, we recommend:

   a) Keep septic systems cleaned and in proper condition

   b) Use phosphorus-free lawn fertilizers

   c) Clean up pet wastes

   d) Do not compost near the water or allow yard wastes and clippings to enter the lake. Riparians could create and maintain natural vegetative buffer strips between manicured lawns and the lake.

4) Residents will become involved in the Self-Help Volunteer Lake Monitoring Program, monitoring water quality to track seasonal and year-to-year changes.

5) Lake residents will embark on an aggressive Eurasian water-milfoil and curly-leaf pondweed removal project. These exotic species should be controlled and eliminated. Hand-pulling along the shore along with mechanical harvesting and spot chemical treatments should be employed to control these two plant species.

6) In partnership with the University of Wisconsin-Whitewater, a watershed study will be performed in the summer and fall of 2007. The purpose of the study is to determine if there are any unknown inputs into the lake, such as drainage ditches, drain tile, etc.

Long-term Implementation Actions

7) Lake residents will protect natural shoreline around Lake Lorraine. Evidence that disturbance on shore is impacting the aquatic plant community is the lower FQI, lack of endangered and many sensitive species, and higher abundance of the most tolerant species at disturbed sites.

8) All lake users will protect the native aquatic plant community in Lake Lorraine.

Funding Sources and Association Budget[10]

A majority of the funding for the initiatives identified in this plan come from fund raising events and donations. The Association will more than likely seek grant money to help defray the cost of the APM activities.

Additional Action

There is no additional action required by the Association to implement this management plan.

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 for the Association to realize that effective monitoring will be the result of clearly defined performance objectives.

[10] Prepared by the Lake Lorraine Restoration and Protection Association

Based on the level of disturbance caused by EWM and CLP, this report will be written to satisfy the requirements for the highest level of management described – Level III. The WDNR APM guidelines outline the necessary monitoring and background information needed to perform Level III aquatic plant management activities in Wisconsin lakes. The methods for monitoring and tracking management progress occur annually. The guidelines also recommend calculating the FQI 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. The methods for calculating the FQI is explained in the WDNR's Aquatic Plant Management in Wisconsin guidelines.

In addition, general monitoring methods are outlined in the WDNR's Aquatic Plant Management in Wisconsin manual. Specific monitoring is required for herbicide applications, draw-downs, and harvesting, while other recommendations exist for monitoring current exotic species and preventing others. The current version of the manual is a draft and is not available for distribution. Once the manual is made available, the Association will receive a copy. The Association 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.

Additional Action

No additional action is required in order to implement the plan outlined in Section 5 of this document.

5.0 Lake Lorraine APM Plan

5.1 Specific Elements of the Lake Lorraine 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, previous studies, or planned future studies (black items) or still need to be fulfilled or planned (red items).

Goals

- ✓ Purpose Statement *(Section 1.0)*
- ✓ Goal Statement *(Section 4.1)*

Management History

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

Plant Community

- ✓ Comprehensive species list and review growth cycles of dominant species *(Section 5.1 Aquatic Plant Survey Technical Report)*
- ✓ Total surface area covered by aquatic vegetation *(Appendix A&C Aquatic Plant Survey Technical Report)*
- ✓ Highlight rare, threatened or endangered species and species of concern *(Appendix A&C Aquatic Plant Survey Technical Report)*
- ✓ Highlight invasive and non-native species, map, and compare to native community *(Appendix A&C Aquatic Plant Survey Technical Report)*
- ✓ Describe beneficial use of plants as well as nuisance or use conflicts associated with plant community *(Section 2.3 Aquatic Plant Survey Technical Report)*
- ✓ Describe vegetative characteristics of near shore or shoreland areas *(Section 5.6 Aquatic Plant Survey Technical Report)*
- ✓ Collect quantitative data of the lake's aquatic plant community *(Appendix B&D Aquatic Plant Survey Technical Report)*
- ✓ Determine the percent frequency of each species present *(Section 5.1 Aquatic Plant Survey Technical Report)*
- ✓ Determine the lake's FQI *(Section 5.2 Aquatic Plant Survey 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 Survey Technical Report)*
- ✓ Map areas to show dominant species type and aquatic invasive species *(AIS)(Appendix A&C Aquatic Plant Survey Technical Report)*
- ✓ Maintain plant information in database or GIS including species name, location, and date sampled *(Appendix A&C Aquatic Plant Survey Technical Report)*
- ✓ Create map depicting proposed management areas and affect of management *(Section 5.2)*

- ✓ Map coordinates to be recorded on GIS map

Lake Map

- ✓ Obtain map with accurate scale *(Appendix A&C Aquatic Plant Survey Technical Report)*
- ✓ Determine township, range and section of lake *(Section 1.0 Aquatic Plant Survey Technical Report)*
- ✓ Tabulate lake surface area, and maximum and mean depths *(Section 1.0 Aquatic Plant Survey Technical Report)*
- ✓ Find Water Body Identification Code (WBIC) assigned by WDNR *(Section 1.0 Aquatic Plant Survey Technical Report)*
- ✓ Obtain aerial photos of lake *(Appendix A&C Aquatic Plant Survey Technical Report)*
- ✓ Obtain bathymetric map of lake *(Not available)*
- ✓ Identify sediment characteristics *(Section 5.5 Aquatic Plant Survey Technical Report)*
- ✓ Use GPS to record locations of specific sites of interest such as plant sampling locations *(Section 4.0 and Appendix A&C Aquatic Plant Survey Technical Report)*

Fishery & Wildlife

- ✓ Prepare a narrative describing the fish and wildlife community and its relationship to the plant community *(Section 2.0 Aquatic Plant Survey Technical Report)*
- ✓ Identify any areas designated as "Sensitive Areas" by the WDNR *(Section 3.5)*
- ✓ Identify areas where rare, threatened, or endangered species or species of special concern exist *(Section 5.0 and Appendix A&C Aquatic Plant Survey 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 *(Not available)*
- ✓ Prepare summary of historical data *(Section 3.2)*
- ✓ Measure the temperature and dissolved oxygen at one-meter intervals at the deepest point of the lake during the summer *(Lake Lorraine Water Quality Report, 2004)*
- ✓ Measure nutrient levels for TP, TKN, nitrate, ammonium and nitrite throughout the summer and obtain nutrient budget if available *(Lake Lorraine Water Quality Report, 2004)*
- ✓ Measure chlorophyll-*a* concentrations, turbidity, alkalinity, and pH throughout the summer *(Lake Lorraine Water Quality Report, 2004)*

Water Use

- ✓ Note primary human use patterns in the lake and on shore *(Section 4.3)*
- ✓ Note areas where use is restricted for any reason *(Section 3.1 Aquatic Plant Survey Technical Report)*

- ✓ Collect public survey to gather opinions and perceptions on plant and water conditions *(Section 5.9 Aquatic Plant Survey Technical Report)*
- ✓ Note water intakes for public water supply or irrigation *(Section 4.3)*
- ✓ Include the above information on GIS map

Watershed Description

- ✓ Provide topographical map showing watershed boundaries, inflows and outflows
- ✓ Determine watershed area *(Section 3.6 Water Quality Monitoring Technical Report)*
- ✓ Quantify land use areas within watershed *(Section 3.6 Water Quality Monitoring Technical Report)*
- ✓ Calculate nutrient loading by area *(to be completed in 2007)*
- ✓ Locate all inputs into lake including streams, drainage ditches, drain tile, etc. *(none identified)*
- ✓ Include the above information on GIS map
- ✓ Model the lake and watershed to develop annual nutrient budget *(to be completed in 2007)*

Analysis

- ✓ Identify management objectives needed to maintain and restore beneficial uses of the lake *(Section 5.2)*
- ✓ Create maps and overlays of the information from the inventory and interpret the results *(Section 6.0 and Appendix A&C Aquatic Plant Survey Technical Report)*
- ✓ Identify target levels or intensity of manipulations *(Section 4.5)*
- ✓ Map areas proposed for management *(Section 5.2)*
- ✓ Mapping coordinates should be recorded on a GIS map *(Appendix A)*

Alternatives

- ✓ Plans should include 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 *(Section 4.5)*
- ✓ Discuss most common plant control techniques, benefits, 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 3.1 and 3.2)*

Recommendations

- ✓ Develop an invasive species prevention program including education and monitoring *(Section 5.2 through 5.4)*
- ✓ Implement "Clean Boats, Clean Waters" program *(Section 5.2)*
- ✓ Involve the public in keeping the lake healthy by finding ways to decrease harmful watershed inputs *(Section 5.2 through 5.4)*

- ✓ List proposed control actions beyond those strictly necessary for aquatic plant management that will be implemented to achieve desired level of control *(Section 5.2 through 5.5)*
- ✓ 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 5.2 through 5.5)*
- ✓ 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 the roles and responsibilities of the persons and/or organizations involved in the management process *(Section 5.2)*
- ✓ Describe how the public will be involved *(Section 5.2 through 5.4)*
- ✓ Prepare a budget and identify funding sources, including plans for grant application *(Appendix B)*
- ✓ 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 5.7)*
- ✓ Contract for a professional survey every 3 to 5 years for the presence of exotic species and for updating the native plant list *(Section 5.7)*
- ✓ For lakes with known exotics, sample more often, use the rake method, and sample areas of know infestation, major inlets, and boat launches *(Section 5.3)*
- ✓ 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 5.4)*

5.2 Integrated Management Strategy[11]

The objectives of the Aquatic Plant Management Plan are to accommodate a range of recreational uses of the lake to the extent practicable and to enhance the public perception of the lake as a centerpiece of the Township of Richmond and the City of Whitewater, without inflicting irreparable damage to the ecosystem of Lake Lorraine and its structure and functioning. To accomplish this, specific control measures will be applied in various areas of

[11] Prepared by the Lake Lorraine Restoration and Protection Association

the lake. The Lake Lorraine aquatic plant management measures are summarized in the table below and are graphically summarized in Figure 1. The Association will continue to take the lead in implementing the APM plan.

On an annual basis, the Association will perform the following lake management activities.

Plan Element	Sub-element	Location	Management Measures	Initial Estimated Cost	Management Responsibility
Recreational Use Management	Recreational use zoning	Entire Lake	Protect native aquatic plant communities, fish breeding and habitat areas, marshlands that are breeding and habitat areas to Sand Hill Cranes, Wood Ducks and other water fowl.	$ 500.00	Lake Lorraine Restoration and Protection Assoc., Inc. the Township of Richmond, the County of Walworth and WDNR
	Lake-wide nonnative species management program	Eurasian water milfoil control zone, curly leaf pond weed control	Prevent the spread of nonnative plants and animals through the implementation of "Clean Boats, Clean Waters" Program, the setup of a boat and trailer cleaning station (sprayer filled with 1 part chlorine bleach and 10 parts water) at the boat launch, use of herbicides in spring, mechanical harvesting, and manual removal during summer and fall.	--	Lake Lorraine Restoration and Protection Assoc., Inc. the Township of Richmond, the County of Walworth and WDNR
	Public informational programming		Continue public awareness and information programming regarding riparian buffers, proper disposal of lake weeds, use of non-phosphate fertilizers, clean boats and benefits of a clean lake.	- -	Lake Lorraine Restoration and Protection Assoc., Inc.

Plan Element	Sub-element	Location	Management Measures	Initial Estimated Cost	Management Responsibility
Aquatic Plant Management	Manual harvesting	Localized areas of shoreline	Harvest nuisance plants, including Eurasian water milfoil, cat tails, white water lilies and curly leaf pond weed as required around docks and piers; collect plant fragments arising from boating and harvesting activities	- --	Lake Lorraine Restoration and Protection Assoc., Inc., lake front property owners and individuals
	Mechanical harvesting	Major and minor channel harvesting	Harvest nuisance plants, including Eurasian water milfoil, to maintain public recreational boating access promote public safety and convenience, and enhance angling opportunities	$20,000	Lake Lorraine Restoration and Protection Assoc., Inc.
	Chemical controls	Localized areas of the Lake, especially in proximity to docks and piers	Control aquatic plants through use of herbicides in spring; manual removal, as noted above, is recommended during summer and fall	$ 5,000	Lake Lorraine Restoration and Protection Assoc., Inc.
	Eurasian water milfoil control	Lakewide	Control nonnative, invasive species as required to prevent the spread of nuisance species within the Lake; use of herbicides in specific areas in the spring to limit the volume of decomposing biomass and quantity of herbicides required is recommended	$10,000	Lake Lorraine Restoration and Protection Assoc., Inc.
	Public informational programming		Continue public awareness and information programming; continue	$ 1,500b,c	Lake Lorraine Restoration and Protection Assoc., Inc.

Plan Element	Sub-element	Location	Management Measures	Initial Estimated Cost	Management Responsibility
			monitoring of aquatic plant communities		
Self Monitoring	Monitoring	Specific monitoring points	Continue to monitor plant species and population through out the lake in order to determine effectiveness of management programs and to make the necessary modifications to the APM as needed.	$500.00	Lake Lorraine Restoration and Protection Assoc., Inc.
Annual APM review			The APM plan will be reviewed on an annual basis in order to insure that it is continuing to help LLR&PA meet its stated objectives, meet the needs of Lake Lorraine and area residents	---	Lake Lorraine Restoration and Protection Assoc., Inc.

Manual and Mechanical Aquatic Removal

Individual property owners can manually remove nuisance aquatic plants in the lake offshore from their property. Manual removal of all plants can be completed to a maximum width of 30 feet to provide pier, swim raft, or boat hoist access. Manual removal of EWM and CLP can be completed beyond 30 feet without a permit as long as the entire plant, including fragments, are removed from the water. Removal of any native vegetation beyond 30 feet does require a permit under NR 109, Wis. Adm. Code. Native plant removal is not recommended because it could actually facilitate the spread of EWM.

Landowners should know the difference between EWM, CLP and native species. If an individual has questions about a particular aquatic plant or what manual removal is allowed, they should talk to the Walworth County and/or the WDNR.

Mechanical harvesting should be used to maintain navigational channels as determined necessary by the LLRPA and the WDNR. Monotypic stands of EWM and CLP should be mechanically harvested more aggressively. Specifically, harvesting the top 2 feet of EWM will decrease the canopy while leaving the natives to grow underneath. Additionally, beds of CLP should be harvested (early in the season) once the plants reach the surface but prior to the release of its turions.

Selective Herbicide Treatments

Nuisance EWM and CLP beds beyond the 30 foot manual removal zone or too dense for effective hand removal efforts should be treated with an aquatic herbicide containing 2,4-D (EWM) or Endothall (CLP) that is registered with the State of Wisconsin for use on public waters. 2,4-D and Endothall products have demonstrated selective control of EWM, if applied correctly. Diquat products are only to be used in areas that have a mix of Eurasian water milfoil, curly leaf pondweed and coontail. 2, 4 D products are to be used in areas where there is mainly Eurasian water milfoil. The Endothall products should be used in areas where there is mainly Curly Leaf Pondweed. In some instances, Diquat may be used in situations where you have a heavy coontail/EWM/CLP mix in the near shore area that cannot be reached by harvesters. The purpose of using the Diquat would be to provide navigational relief in a very specific plant community situation with heavy densities of coontail, which is a native plant but can reach nuisance conditions which obstruct recreation. Once more desirable natives start reappearing in the near shore area, the use of Diquat should be discontinued and the treatment should revert back to 2,4 D and Endothall, based upon the specific exotic specie present. All treatments will need to be completed in accordance with a permit issued under NR 107, Wis. Adm. Code. No nuisance levels of native plants should be treated on a large scale. A commercial aquatic pesticide applicator, certified with the Wisconsin Department of Agriculture and Consumer Protection (DATCP) and licensed by the WDNR should be hired to treat nuisance EWM beds as local funding allows. The applicator will specify in the NR 107 permit application the chemical application size, rate, and location of proposed treatment areas.

Aggressive management may prevent the spread of EWM and get the infestation under control, whereas subsequent year's treatments could be reduced in size ("spot treatments").

Public Education

The Association has a number of public awareness/educational initiatives that have been underway since June 2004. Among them is the LLR&PA newsletter that offers educational information with regard to native and non-native plant species, what property owners can do to help control the spread of non-natives, etc. The Association also has a web site dedicated to educating the public with regard to ensuring that our lakes are maintained as viable recreational assets and native breeding/habitation areas, see http://llrpa.cjscsg.net. In addition, the Association sponsors several annual events where guest speakers are invited to speak about our lakes and what we can do to protect them. The Association is also an active member of the Walworth County Lakes Association and the Wisconsin Lakes Association.

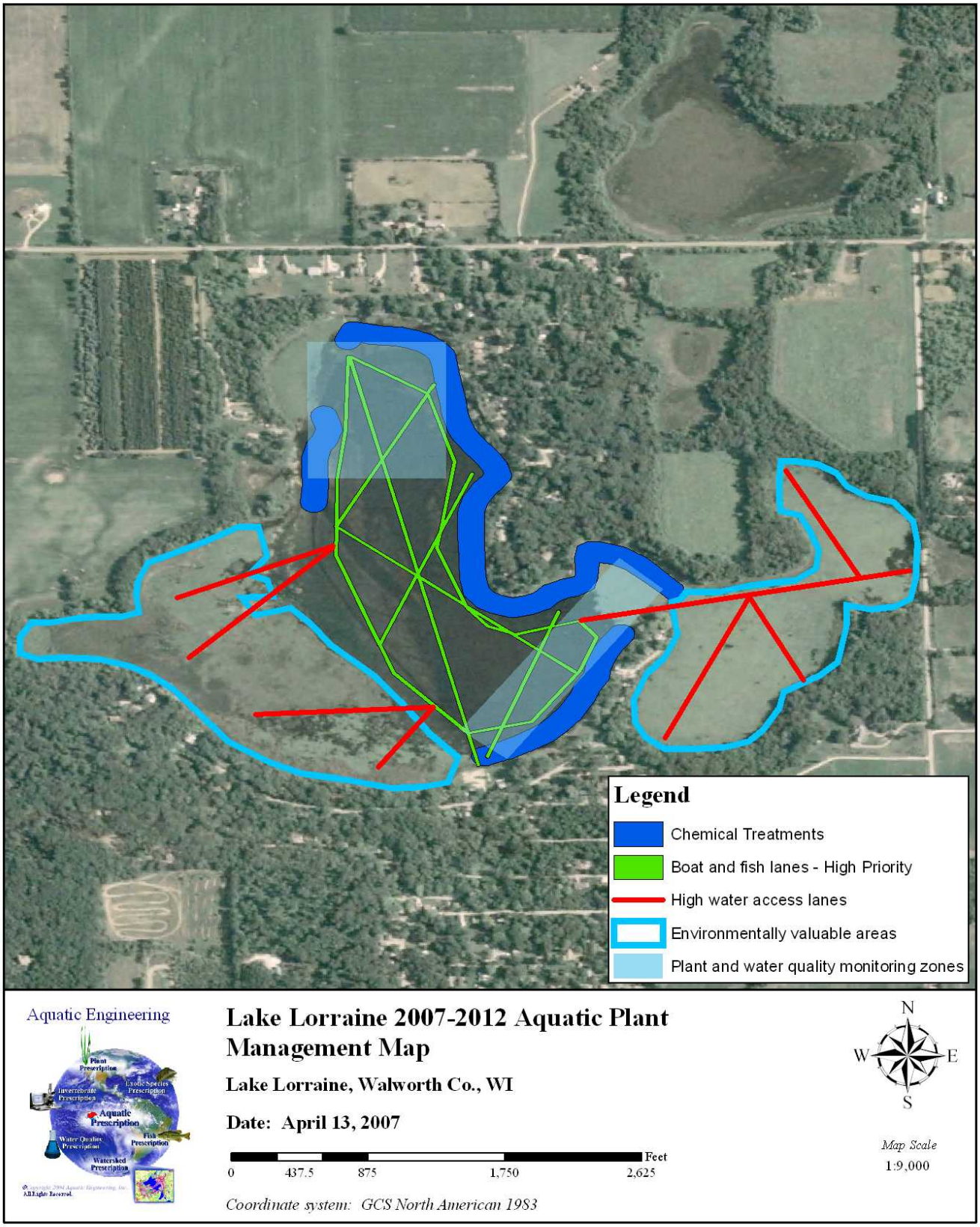

Figure 1. Lake Lorraine aquatic plant management map.

5.3 Fishery Management

The WDNR continues to manage the fish populations within Lake Lorraine through monitoring and stocking. Stocking efforts are required due to frequent fish kills and poor reproductive success. Eutrophic lakes typically support fish that are tolerant of warm water. Largemouth bass, bluegills, and panfish will become the dominant species. Rough fish populations usually increase as predator fish populations decrease. Panfish will also become stunted in the absence of predator fish due to increased competition for space and resources.

The Association is interested in managing the current fish population through a top-down management approach. This approach requires the promotion of top-end predators already present and may require additional stocking in order to maintain the number of predators necessary to meet their goals. Harvesting will also aid this effort by creating fish cruising lanes, which should promote predation.

5.4 Monitoring

Since the summer of 2006, the Association has been collecting basic water chemistry and physical parameters, such as TP, TKN, temperature, pH, dissolved oxygen at various points within the management zone. The Association will also survey for non-native species once each spring and twice each summer. The main target plant in the spring will be CLP, while the target plants in the summer will be EWM and purple loosestrife. These findings are shared with the WDNR.

Primary management tools (mechanical harvesting, manual harvesting, and herbicides) will be evaluated each season. More specifically, a lakewide qualitative plant survey will occur each year at the peak of plant growth in June or July. Lakewide quantitative surveys will occur at least one year out of every five and will follow WDNR plant survey guidelines. The surveys will be used to gauge the success of each management technique and to calculate the lake's FQI.

The Association will continue to monitor the aquatic macrophyte community qualitatively every year and quantitatively every five years. The purpose of qualitative surveys will be to

monitor the locations of exotic species (CLP and EWM), locate and map areas where aquatic plants create nuisance conditions, and maintain a current inventory of aquatic species. The FQI will be calculated after each qualitative survey and compared to previous values. This assessment will give the Association a strong record of baseline plant community data and could 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 will be used as the indicator of a changing plant community.

Quantitative surveys will occur every five years and should be performed concurrently with qualitative surveys. These surveys will provide objective values the Association can use to evaluate the condition of the aquatic plant community within the lake. Only the quantitative surveys will be used to determine if a shift in the aquatic plant community has occurred.

5.6 Develop Lake Management Plan

A comprehensive lake management plan (LMP) will organize resources to meet the water quality, aquatic plant, and wildlife goals of the Association. Many of the key components of a comprehensive plan have already been completed as part of the 2004 monitoring and reporting activities. This APM plan would be a large component of the LMP.

6.0 References

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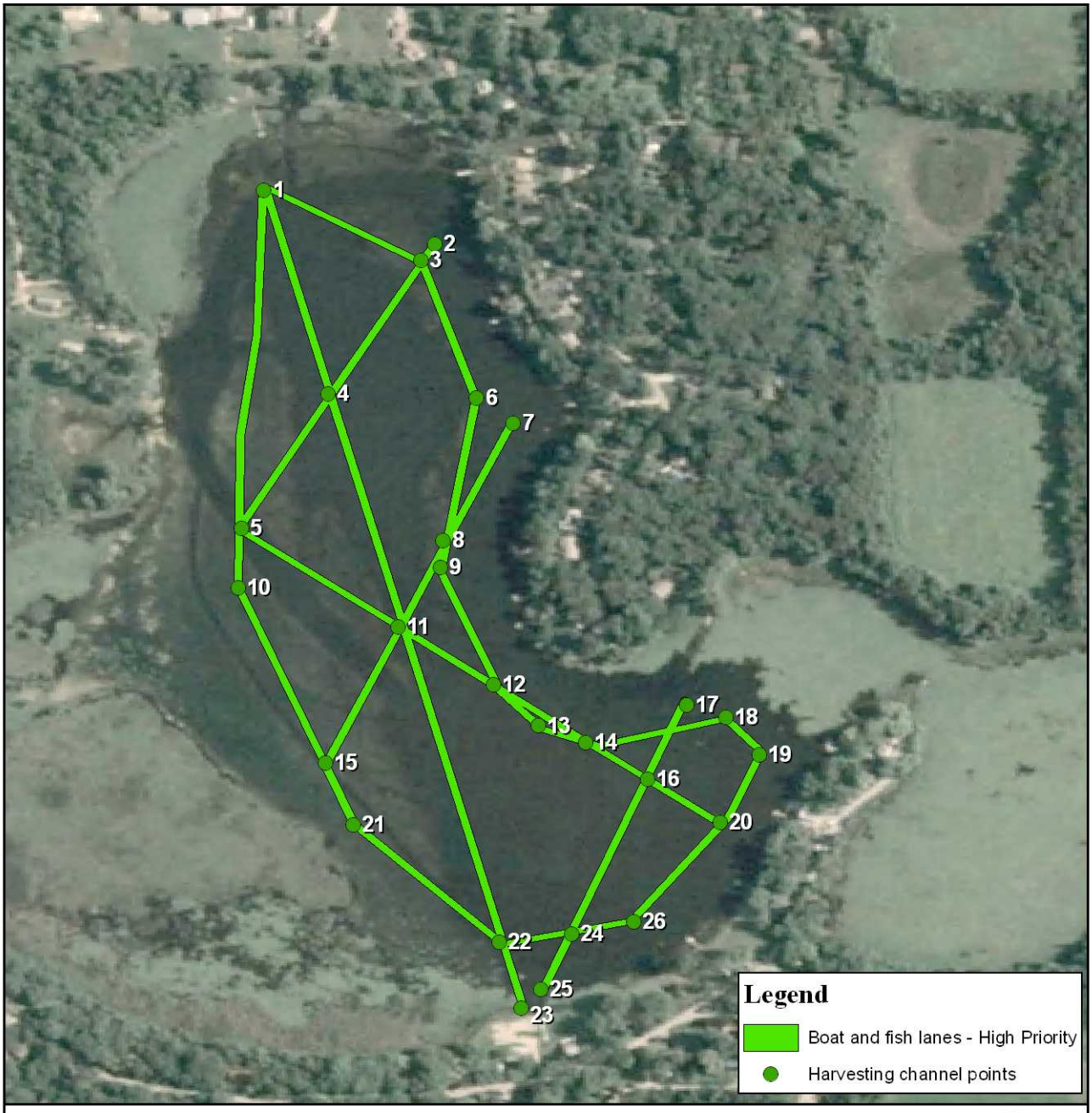
Appendix A – GIS Maps and Coordinates of Major Features



Aquatic Engineering

Lake Lorraine 2007-2012 Aquatic Plant Management Map - Harvesting Channel Points

Lake Lorraine, Walworth Co., WI

Date: April 13, 2007

0 262.5 525 1,050 1,575 Feet

Coordinate system: GCS North American 1983

N W E S

Map Scale
1:5,000

AUTO_ID	WGS84_LON	WGS84_LAT
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7	-88.7330526	42.7362348
8	-88.7336658	42.7352050
9	-88.7336904	42.7349702
10	-88.7354568	42.7347896
11	-88.7340584	42.7344462
12	-88.7332242	42.7339404
13	-88.7328318	42.7335790
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19	-88.7308936	42.7333262
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21	-88.7344510	42.7327118
22	-88.7331752	42.7316820
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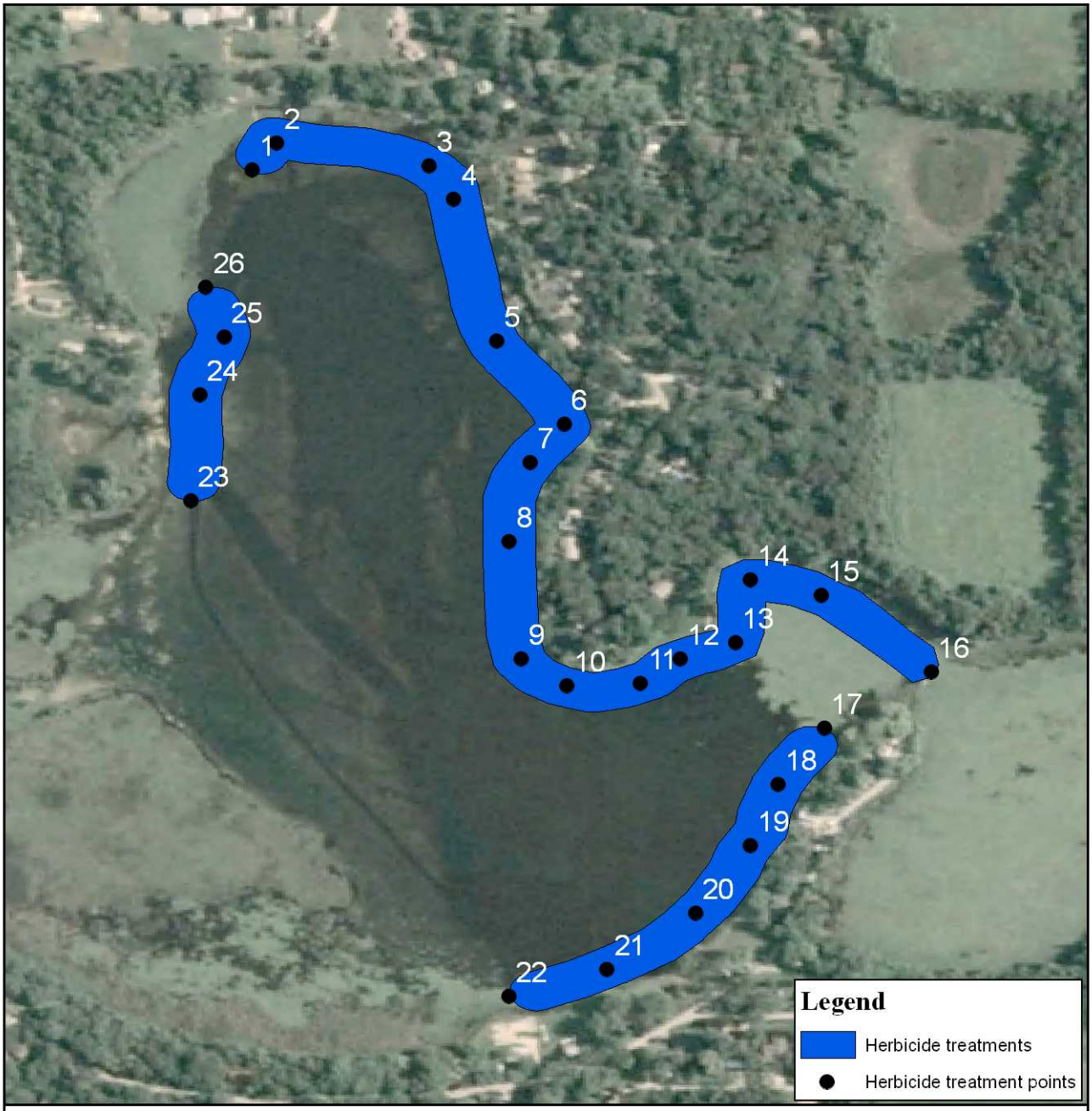

Aquatic Engineering

Lake Lorraine 2007-2012 Aquatic Plant Management Map - Herbicide Treatment Points

Lake Lorraine, Walworth Co., WI

Date: April 13, 2007

0 262.5 525 1,050 1,575 Feet

Coordinate system: GCS North American 1983

N W E S

Map Scale
1:5,000

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8	-88.7330884	42.7351962
9	-88.7329812	42.7341700
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12	-88.7315876	42.7341700
13	-88.7311052	42.7343082
14	-88.7309712	42.7348606
15	-88.7303548	42.7347226
16	-88.7293900	42.7340516
17	-88.7303280	42.7335582
18	-88.7307300	42.7330650
19	-88.7309712	42.7325322
20	-88.7314536	42.7319402
21	-88.7322308	42.7314468
22	-88.7330884	42.7312100
23	-88.7358756	42.7355514
24	-88.7357952	42.7364788
25	-88.7355808	42.7369918
26	-88.7357416	42.7374260

Aquatic Engineering

Lake Lorraine 2007-2012 Aquatic Plant Management Map - High Water Lane Points

Lake Lorraine, Walworth Co., WI

Date: April 13, 2007

0 445 890 1,780 2,670 Feet

Coordinate system: GCS North American 1983

N W E S

Map Scale
1:9,000

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6	-88.7347242	42.7310868
7	-88.7311770	42.7336476
8	-88.7282138	42.7340922
9	-88.7296746	42.7316082
10	-88.7272332	42.7326048
11	-88.7262524	42.7344142
12	-88.7275670	42.7362848
13	-88.7253968	42.7345368

Aquatic Engineering

Lake Lorraine 2007-2012 Aquatic Plant Management Map - Monitoring Zone Points

Lake Lorraine, Walworth Co., WI

Date: April 13, 2007

0 437.5 875 1,750 2,625 Feet

Coordinate system: GCS North American 1983

N W E S

Map Scale
1:9,000

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7	-88.7324750	42.7312030
8	-88.7332792	42.7317384

Aquatic Engineering

Lake Lorraine 2007-2012 Aquatic Plant Management Map - Valuable Area Points

Lake Lorraine, Walworth Co., WI

Date: April 13, 2007

0 437.5 875 1,750 2,625 Feet

Coordinate system: GCS North American 1983

N W E S

Map Scale
1:9,000

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6	-88.7363026	42.7338912
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9	-88.7333406	42.7312216
10	-88.7334938	42.7308080
11	-88.7295872	42.7339476
12	-88.7293064	42.7341732

Appendix B – Association Budget

LLR&PA Proposed Annual Budget

Income	**2007**	**2008**	**2009**
Contributions	$ 3,500.00	$ 4,200.00	$ 5,040.00
Fund Raising Events	$ 4,500.00	$ 5,400.00	$ 6,480.00
Grants	$ 7,500.00	$ 9,000.00	$ 10,800.00
Membership Dues	$ 2,000.00	$ 2,400.00	$ 2,800.00
Misc. Income	$ -	$ -	$ -
Program Fees	$ -	$ -	$ -
Reimbursed Exp.	$ -	$ -	$ -
TOTAL Income	$ 17,500.00	$ 21,000.00	$ 25,120.00
Expenses			
Amortization Exp	$ -	$ -	$ -
Bank Service Charge	$ -	$ -	$ -
Cash Discounts	$ -	$ -	$ -
Contributions	$ -	$ -	$ -
Dues and Subscriptions	$ 100.00	$ 100.00	$ 100.00
Equipment Rental	$ -		
Insurance	$ 300.00	$ 300.00	$ 300.00
Licenses and Permits	$ 600.00	$ 600.00	$ 600.00
Lake Management			
Herbicides	$ 3,000.00	$ 3,000.00	$ 3,000.00
Mechanical Harvesting	$ 12,000.00	$ 12,000.00	$ 12,000.00
Office Supplies	$ 150.00	$ 150.00	$ 150.00
Postage and Delivery	$ 200.00	$ 200.00	$ 200.00
Printing and Reporoduction	$ 250.00	$ 250.00	$ 250.00
Professional Fees	$ -	$ -	$ -
Repairs			
Hockney Cutter	$ -	$ -	$ -
Maintenance	$ 200.00	$ 200.00	$ 200.00
Program Expense	$ -	$ -	$ -
Miscellaneous	$ -	$ -	$ -
TOTAL Expenses	$ 16,800.00	$ 16,800.00	$ 16,800.00
Income after Expenses	$ 700.00	$ 4,200.00	$ 8,320.00
Other Income and Expenses			
Interest Income	$ -	$ -	$ -
Other Income	$ -	$ -	$ -
Other Expenses	$ -	$ -	$ -
TOTAL Other Income and Expenses	$ -	$ -	$ -
Net Income	$ 700.00	$ 4,200.00	$ 8,320.00