2015

Lost Lake Management Plan

Prepared by staff from the Center for Watershed Science and Education
University of Wisconsin-Stevens Point.

Center for Watershed Science and Education
College of Natural Resources
University of Wisconsin-Stevens Point

Lost Lake Management Plan

The Lost Lake Management Plan was prepared after obtaining input from residents and lake users at a series of four public planning sessions held at the Reid Town Hall in Hatley, Wisconsin in October, November, December 2014 and January 2015. The inclusive community sessions were designed to learn about and identify key community opportunities, assets, concerns, and priorities. Representatives of state and local agencies, as well as nonprofit organizations, also attended the planning sessions to offer their assistance to the group in developing a strategic lake management plan (LMP).

The plan was adopted by the Town of Elderon on: July 7, 2015
Date

The plan was adopted by Marathon County on: August 18, 2015
Date

The plan was approved by the Wisconsin Department of Natural Resources on: _____
Date

A special thanks to all who helped to create the Lost Lake Management Plan and provided guidance during the plan's development.

Lost Lake Management Planning Committee Members and Resources

Planning Committee
Robert Oelke

Marathon County
Conservation, Planning, and Zoning Department Administrative Manager
—Diane Hanson

University of Wisconsin – Stevens Point
Water Resource Specialist – Ryan Haney
Water Resource Scientist – Nancy Turyk
Center for Watershed Science and Education

Wisconsin Department of Natural Resources
Fisheries Biologist – Tom Meronek
Water Resources Management Specialist – Scott Provost
Lake Planning Specialist – Buzz Sorge

Golden Sands Resource Conservation & Development, Inc.
Regional Aquatic Invasive Species Education Specialist – Paul Skawinski
Regional Aquatic Invasive Species Specialist – Kaycie Stushek

We are grateful to many for providing insight, enthusiasm, and funding:

Marathon County Concerned Citizens and Property Owners
Mayflower Lake District, Pike Lake Sportsman Club, and Wadley Lake Sportsman Club
Marathon County Environmental Fund
Wisconsin Department of Natural Resources Lake Protection Grant

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Overarching Vision for Lost Lake

Lost Lake will remain a place of solitude with minimal development, where the sounds of wildlife dominate. The weeds and muck will be controlled to an extent that allows for good swimming and navigation while still providing essential habitat and water quality functions.

Lost Lake is a 43 acre lake with a maximum depth of 28 feet located south of rural Hatley, Wisconsin. A relatively undeveloped lake, it's the shores of the lake are surrounded largely by wetland and forest, with small developments on the very eastern and the western ends of the lake and one boat landing on the southeast end. The lake is located entirely within the Town of Elderon, but the lake's surface watershed extends into both the Town of Norrie and the Town of Reid. The Lost Lake community to came together in partnership with local experts and professionals in the fall and winter of 2014-2015 to participate in the formation of a lake management plan for Lost Lake.

Based on discussions throughout the planning process, Lost Lake planning session participants identified some key issues and goals that they would like to focus on in upcoming years:

- Lake users and residents - capacity building and stewardship
- Protect the natural beauty of the lake

Introduction and Background

This lake management plan (LMP) and its planning process allow the community to guide the fate of its lake. The LMP is a dynamic document that identifies goals and action items for the purpose of maintaining, protecting and/or creating desired conditions in a lake for within given period of time. It can correct past problems, improve on current conditions, and provide guidance for future boards, lake users, and technical experts by identifying which issues have been addressed and how successful previous efforts were. Each plan is unique, dependent upon the conditions of the lake, its watershed, and the interests of the stakeholders involved. The actions identified in this LMP serve as a gateway for obtaining grant funding and other resources to help implement activities outlined in the plan. Because many entities are involved in lake and land management, it can be challenging to navigate the roles, partnerships, and resources that are available. The planning process and content of this plan have been designed to identify where some of the key assistance exists.

Many individuals and organizations are involved in assuring that the Lost Lake ecosystem is healthy. It is essential for key partners who are responsible for lake and land management work together to achieve this goal. The planning process and content of this plan have been designed to identify where some of the key assistance exists. Following is a list of key partners; this list is not all inclusive.

- **Individuals**: Individuals can use this plan to learn about the lake they love and their connection to it. People living near Lost Lake can have the greatest influence on the lake by understanding and choosing lake-friendly options to manage their land and the lake.
- **A future Lost Lake Association or District:** This plan provides lake groups with a well thought out plan for the whole lake and lists options that can easily be prioritized. Annual review of the plan will also help the lake group to realize its accomplishments. Resources and funding opportunities for management activities are made more available by placement of goals into the lake management plan, and the lake group can identify partners to help achieve their goals for Lost Lake.
- **Neighboring lake groups, sporting and conservation clubs**: Neighboring groups with similar goals for lake stewardship can combine their efforts and provide each other with support, improve competitiveness for funding opportunities, and make efforts more fun.
- **The Towns of Elderon, Reid and Norrie**: The Towns can utilize the visions, wishes, and goals documented in this lake management plan when considering town-level management planning or decisions within the watershed that may affect the lake.
- **Marathon County:** County professionals will better know how to identify needs, provide support, base decisions, and allocate resources to assist in lake-related efforts documented in this plan. This plan can also inform county board supervisors in decisions related to Eastern Marathon County lakes, streams, wetlands, and groundwater.
- **Wisconsin Department of Natural Resources**: Professionals working with lakes in Marathon County can use this plan as guidance for management activities and decisions related to the management of the resource, including the fishery, and invasive species. Lake management plans help the WDNR identify and prioritize needs within Wisconsin's lake community, and decide where to best apply resources and funding. A well thought out lake management plan increases an application's competitiveness for funding from the State – if multiple Marathon County lakes have similar goals in their lake management plans, they can join together when seeking grant support to increase competitiveness for statewide

resources. Information about WDNR grants is located on their website http://dnr.wi.gov/lakes/grants/. Grant contacts are also listed in Appendix A.

One of the first steps in creating the Lost Lake management plan was to gather and compile data about the lake and its ecosystem to understand past and current lake conditions. The Eastern Marathon County Lakes Project was initiated by citizens who encouraged Marathon County to work in partnership with personnel from UW-Stevens Point to assess 11 lakes located in the eastern portion of the county. Finding for this effort was provided by the WDNR Lake Protection Grant program, the county's environmental fund, and monetary and in-kind contributions from citizens. One of the first steps of the project was the Eastern Marathon County Lakes Study (2010-12), which gathered and compiled data about the 11 lakes and their ecosystems in order to understand past and current lake conditions. Many of the lakes had insufficient data available to help evaluate current water quality concerns, aquatic plant communities, invasive species, or fisheries. Professionals and students from UW-Stevens Point conducted the study and interpreted the data for use in lake management planning. The results of this project (including this document) will assist citizens, municipalities, Marathon County, and State staff to efficiently manage their water resources and help make informed decisions and policies that affect their lakes.

The purpose of this plan is to learn about Lost Lake, identify factors important to lake residents and users, and develop goals to protect and improve Lost Lake for future generations.

In addition to the Eastern Marathon County Lakes Study, data collected by citizens, consultants, and professionals from the WDNR were incorporated into the planning process to provide a robust set of information from which informed decisions were made in this plan. Sources of information used in the planning process are listed at the end of this document for future reference.

Several reports from the Lost Lake Study and the materials associated with the planning process and reports can be found on the Marathon County website: http://www.co.marathon.wi.us/Departments/ConservationPlanningZoning/ConservationServices/LakePrograms.aspx.

The purpose of this plan is to learn about Lost Lake and identify features important to the Lost Lake community in order to provide a framework for the protection and improvement of the lake. This framework, or lake management plan, will enable citizens and other supporters to achieve the vision for Lost Lake now and in the years to come. The planning process included a series of four public planning sessions which were held at the Reid Town Hall to assist area residents, lake users, and representatives of local municipalities with the development of the lake management plan. These meetings took place between October 2014 and January 2015.

Participation in the planning process was open to everyone and was encouraged by letters sent directly to Lost Lake waterfront property owners and by press releases in local newspapers. In addition, members of the planning committee were provided with emails about upcoming meetings which could be forwarded to others.

Guest experts and professionals were invited to attend the planning sessions. They presented information and participated in discussions with participants to provide context, insight and recommendations for the lake management plan, including environmental and regulatory considerations. Information provided by the professionals was organized with the survey results into discussion topics, which included: the fishery and recreation; the aquatic plant community; water quality and land use; shoreland health; and communication. After learning about the current conditions of each topic, participants identified goals, objectives, and actions for the lake management plan that were recorded by professionals from UW-Stevens Point. Planning session notes and presentations were posted to the Marathon County website.

The Lost Lake Planning Committee consisted primarily of property owners and recreational users. Technical assistance during the planning process was provided by the Marathon County Conservation, Planning, and Zoning Department (CPZ) and professionals from the Wisconsin Department of Natural Resources (WDNR), Golden Sands Resource Conservation & Development, Inc. (RC&D), and the University of Wisconsin-Stevens Point Center for Watershed Science and Education (CWSE).

Goals, Objectives and Actions

The following goals, objectives, and associated actions were derived from the values and concerns of citizens and members of the Lost Lake Management Planning Committee, and the known science about Lost Lake, its ecosystem and the landscape within its watershed. Implementing and regularly updating the goals and actions in the Lost Lake Management Plan will ensure that the vision is supported and that changes or new challenges are incorporated into the plan. A management plan is a living document that changes over time to meet the current needs, challenges and desires of the lake and its community. **The goals, objectives and actions listed in this plan should be reviewed annually and updated with any necessary changes.**

Although each lake is different, to ensure a lake management plan considers the many aspects associated with a lake, the Wisconsin Department of Natural Resources requires that a comprehensive lake management plan address, at a minimum, a list of topics that affect the character of a lake, whether each topic has been identified as a priority or as simply something to preserve. These topics comprise the chapters in this plan. For the purposes of this plan, the chapters have been grouped as follows:

In-Lake Habitat and a Healthy Lake

Fish Community—fish species, abundance, size, important habitat and other needs
Aquatic Plant Community—habitat, food, health, native species, and invasive species
Critical Habitat—areas of special importance to the wildlife, fish, water quality, and aesthetics of the lake

Landscapes and the Lake

Water Quality and Quantity—water chemistry, clarity, contaminants, lake levels
Shorelands—habitat, erosion, contaminant filtering, water quality, vegetation, access
Watershed Land Use—land use, management practices, conservation programs

People and the Lake

Recreation—access, sharing the lake, informing lake users, rules
Communication and Organization—maintaining connections for partnerships, implementation, community involvement
Updates and Revisions—continuing the process
Governance—protection of the lake, constitution, state, county, local municipalities

Lead persons and resources are given under each objective of this plan. These individuals and organizations are able to provide information, suggestions, or services to accomplish objectives and achieve goals. The following table lists organization names and their common acronyms used in this plan. This list should not be considered all-inclusive – assistance may also be provided by other entities, consultants, and organizations.

Acronym	Organization/Resource
CBCW	Clean Boats Clean Waters
CLMN	Citizen Lake Monitoring Network
CWSE	UWSP Center for Watershed Science and Education
CPZ	Marathon County Planning and Zoning (includes Land Conservation Department)
MC	Marathon County
NCCT	North Central Conservancy Trust
NRCS	USDA Natural Resources Conservation Service
RC&D	Golden Sands Resource Conservation and Development Council, Inc.
UWSP	University of Wisconsin-Stevens Point
UWEX	UW-Extension
WEAL	UWSP Water and Environmental Analysis Lab
WDNR	Wisconsin Department of Natural Resources
WDOT	Wisconsin Department of Transportation

Contact information for organizations and individuals who support lake management in Marathon County can be found in Appendix A.

In-Lake Habitat and a Healthy Lake

Many lake users value Lost Lake for its fishing and wildlife. The health of one part of the lake system affects the health of the rest of the plant and animal community, the experiences of the people seeking pleasure at the lake, and the quality and quantity of water in the lake. Habitat is the structure for a healthy fishery and wildlife community. It can provide shelter for some animals and food for others.

Lake habitat occurs within the lake, along all of its shorelands, and even extends into its watershed for some species. Many animals that live in and near the lake are only successful if their needs – food, a healthy environment, and shelter – are met. Native vegetation including wetlands along the shoreline and adjacent to the lake provides habitat for safety, reproduction, and food, and can improve water quality and balance water quantity. Some lake visitors such as birds, frogs, and turtles use limbs from trees that are sticking out of the water for perches or to warm themselves in the sun. Aquatic plants infuse oxygen into the water and provide food and shelter for waterfowl, small mammals, and people. The types and abundance of plants and animals that comprise the lake community also vary based on the water quality, and the health and characteristics of the shoreland and watershed. Healthy habitat in Lost Lake includes the aquatic plants, branches, and tree limbs above and below the water.

The Fish Community

A balanced fish community has a mix of predator and prey species, each with different food, habitat, nesting substrate, and water quality needs in order to flourish. Activities in and around a lake that can affect a fishery may involve disturbances to the native aquatic plant community or substrate, excessive additions of nutrients or harmful chemicals, removal of woody habitat, shoreline alterations, and/or an imbalance in the fishery. Shoreland erosion can cause sediment to settle onto the substrate, causing the deterioration of spawning habitat. Habitat can be improved by allowing shoreland vegetation to grow, minimizing the removal of aquatic plants, providing fallen trees or limbs in suitable areas, and protecting wetlands and other areas of critical habitat.

People are an important part of a sustainable fish community; their actions on the landscape and the numbers and sizes of fish taken out of the lake can influence the entire lake ecosystem. Putting appropriate fishing regulations in place and adhering to them can help to balance the fishery with healthy prey and predatory species, can be adjusted as the fish community changes, and can provide for excellent fishing.

Managing a lake for a balanced fishery can result in fewer expenses to lake stewards and the public. While some efforts may be needed to provide a more suitable environment to meet the needs of the fish, they usually do not have to be repeated on a frequently reoccurring basis. Protecting existing habitat such as emergent, aquatic, and shoreland vegetation, and allowing trees that naturally fall into the lake to remain in the lake are free of cost. Alternatively, restoring habitat in and around a lake can have an up-front cost, but the effects will often continue for decades. Costs in time, travel, and other expenses are associated with routine efforts such as fish stocking and aeration. Ideally, a lake contains the habitat, water quality, and food necessary to support the fish communities that are present within the lake and provide fishing opportunities for people without a lot of supplemental effort and associated expenses to maintain these conditions.

Lost Lake supports a warm water fish community. In 2011, ten fish species were sampled and identified. Since 1949, fourteen species have been recorded in surveys conducted by the Wisconsin Department of Natural Resources. Although most species identified in 2011 had been previously reported, the Iowa darter (*Etheostoma exile*) was newly documented. Fish species documented previously but not detected during the 2011 survey included black bullhead (*Ameiurus melas*), common shiner (*Luxilus cornutus*), white sucker (*Catostomus commersoni*), and pumpkinseed x bluegill hybrid.

Bluegill (*Lepomis macrochirus*) were most abundant during the 2011 survey, with a maximum length of 10.1 inches. Yellow bullhead (*Ameiurus natalis*) were also abundant, with lengths reaching 13.7 inches. Least common in the samples were the black crappie (*Pomoxis nigromaculatus*), Iowa darter (*Etheostoma exile*), golden shiner (*Notemigonus crysoleucas*) and pumpkinseed (*Lepomis gibbosus*). Although infrequently encountered, walleye (*Sander vitreus*) were the largest fish caught in Lost Lake, reaching 22.8 inches.

A review of Wisconsin Department of Natural Resources records revealed little management information for Lost Lake. Public access permits were approved in 1960, leading to the land acquisition and development of the current boat launch and parking area. In 1982, dissolved oxygen concentrations in Lost Lake fell below optimal conditions for fish survival, and a temporary dip-netting permit was approved. During the winterkill of 1982, many black bullhead along with a few white sucker, pumpkinseed, and central mudminnow (*Umbra lima*) were reported dead. Bullhead abundance is another indication of winterkill, as they are more tolerant of low dissolved oxygen concentrations than many other species. Fish stocking records for Lost Lake date back to 1941 in Wisconsin Department of Natural Resources files. Historic stocking primarily consisted of adult northern pike and fingerling largemouth bass. Early efforts to stock bluegill and black crappie were abandoned prior to 1950. More recently, yellow perch and walleye have been stocked by the Pike Lake Fishing Club. Recommendations from the WDNR Fisheries Biologist at the January 6, 2015 planning session included continuing private stocking of walleye (to maintain the sport fishery) and possibly revisiting stocking of northern pike.

Guiding Vision for the Fish Community

Lost Lake will have a healthy, well-balanced fish community.

Goal 1. Support conditions that provide a healthy fishery.

Objective 1.1. Enhance and improve fish habitat and fishery structure.

Actions	Lead person/group	Resources	Timeline
Maintain woody structure already present in the lake, and inform residents and anglers of the importance of coarse woody habitat.	Shoreland property owners	WDNR Fisheries Biologist	
Secure permit to enhance the variety and complexity of woody structure by adding tree drops or “fish sticks” placed offshore.	Mud Lake Committee	WDNR Fisheries Biologist	
Continue private stocking of walleye.		Pike Lake Fishing Club	
Explore stocking of northern pike.		WDNR Fisheries Biologist Pike Lake Fishing Club	

Aquatic Plants

Aquatic plants provide the forested landscape within Lost Lake. They provide food and habitat for spawning, breeding, and survival for a wide range of inhabitants and lake visitors including fish, waterfowl, turtles, amphibians, as well as invertebrates and other animals. They improve water quality by releasing oxygen into the water and utilizing nutrients that would otherwise be used by algae. A healthy lake typically has a variety of aquatic plant species which creates diversity that makes the aquatic plant community more resilient and can help to prevent the establishment of non-native aquatic species.

Aquatic plants near shore and in shallows provide food, shelter and nesting material for shoreland mammals, shorebirds and waterfowl. It is not unusual for otters, beavers, muskrats, weasels, and deer to be seen along a shoreline in their search for food, water, or nesting material.

During the 2012 aquatic plant survey of Lost Lake, eighteen species of aquatic plants were found, with the greatest diversity located in the shallows on the eastern side of the lake. The number of species within Lost Lake was below average compared with other lakes in the Eastern Marathon County Lakes Study. Forty-four percent (68 of 153) of the sampled sites had vegetative growth.

The dominant plant species in the survey was coontail (*Ceratophyllum demersum*), followed by common waterweed (*Elodea canadensis*) and spiny hornwort (*Ceratophyllum echninatum*). Coontail and spiny hornwort are both important food sources for a wide range of waterfowl species. A number of invertebrate and fish species use the bushy stems and stiff whorls of leaves on these plants as habitat, especially in the winter when other aquatic plants have died back. Spiny hornwort is also a species of special concern in Wisconsin. Common waterweed also provides food and habitat to waterfowl, fish, and invertebrates. This aquatic species is resistant to many diseases and can tolerate low light conditions in deeper water (Borman et al., 2001).

More detailed information can be found in the Lost Lake 2011 Aquatic Plant Report or the Lost Lake 2010-2012 Lake Study Report.

Guiding Vision for Aquatic Plants in Lost Lake

Lost Lake will have an aquatic plant community that supports a healthy fishery and good water quality.

Goal 2. Protect and enhance the existing native plant community.

Objective 2.1. Protect native plant populations.

Actions	Lead person/group	Resources	Timeline
Minimize disturbance of lakebed from raking or plant removal. Distribute information to shoreland owners on importance of native plants.	Shoreland property owners	UWEX Lakes (educational materials)	Ongoing

Aquatic Invasive Species (AIS)

Aquatic invasives species are non-native aquatic plants and animals that are most often unintentionally introduced into a lake by lake users. This most commonly occurs on trailers, boats, equipment, and from the release of bait. In some lakes, aquatic invasive plant species can exist as a part of the plant community, while in other lakes populations explode, creating dense beds that can damage boat motors, make areas non-navigable, inhibit activities like swimming and fishing, and disrupt the lakes' ecosystems.

No non-native aquatic plant species were observed during the aquatic plant survey of Lost Lake. This is a good indicator of overall aquatic health within the lake. The lack of non-native species may also demonstrate diligence by lake users in cleaning watercraft before entering the lake to prevent non-native species transfer.

Guiding Vision for Aquatic Invasive Species

Lost Lake will remain free of aquatic invasive species.

Goal 3. Prevent aquatic invasive species from becoming established in Lost Lake.

Objective 3.1. Educate and encourage visitors to Lost Lake about controlling the transport of invasive species between water bodies.

Actions	Lead person/group	Resources	Timeline
Include information about the threat of aquatic invasive species in a welcome packet or newsletter and remind lake users to clean plants off trailers, drain motors and live wells, and wash boats before and after entering/leaving the lake.		UWEX Lakes (educational materials) CPZ	
Develop signage at the boat landing to inform users about aquatic invasive species concerns and the importance of cleaning plants off trailers, draining motors and live wells, and washing boats before and after entering/leaving the lake.		Town of Elderon UWEX Lakes (educational materials)	

Objective 3.2. Be proactive in preventing establishment of AIS at Lost Lake.

Actions	Lead person/group	Resources	Timeline
Protect and leave in place as much native aquatic vegetation as possible.	Shoreland property owners		
Closely monitor for and take immediate action if AIS is observed in the lake.	Lake users	RC&D*	
Develop rapid response plan and publish in local papers like Community Shopper and Northerner (both in Wittenberg) and notify Town Chair/Clerk.		Town of Elderon	
Provide letter to Golden Sands RC&D* in support of their work to assist communities in AIS identification, monitoring and eradication.	Interested citizen	Town of Elderon	
Refer to the Lost Lake Rapid Response Plan (Appendix).			
Learn about identification and proper manual removal techniques for AIS.	Interested citizen	RC&D*	

***** Note: Services offered by RC&D are dependent on available funds through grants or lake groups.

Critical Habitat

Special areas harbor habitat that is essential to the health of a lake and its inhabitants. In Wisconsin, critical habitat areas are identified by biologists and other lake professionals from the Wisconsin Department of Natural Resources in order to protect features that are important to the overall health and integrity of the lake, including aquatic plants and animals. While every lake contains important natural features, not all lakes have official critical habitat designations. Designating areas of the lake as critical habitat enables these areas to be located on maps and information about their importance to be shared. Having a critical habitat designation on a lake can help lake groups and landowners plan waterfront projects that will minimize impact to important habitat, ultimately helping to ensure the long-term health of the lake.

Although Lost Lake does not have an official critical habitat area designation, there are areas within Lost Lake that are important for fish and wildlife. Natural, minimally impacted areas with woody habitat such as logs, branches, and stumps; areas with emergent and other forms of aquatic vegetation; areas with overhanging vegetation; and wetlands are elements of good quality habitat. Identifying other important areas around the lake that are important habitat and informing lake users of their value can help raise awareness for the protection of these areas.

Guiding Vision Lost Lake's Critical Habitat

Sensitive areas on Lost Lake will be enhanced and protected from degradation.

Goal 4. Preserve and redevelop high quality habitat for fish and wildlife.

Objective 4.1. Identify potentially critical habitat on Lost Lake.

Actions	Lead person/group	Resources	Timeline
Request critical habitat designations.	Interested citizen	WDNR Aquatic Biologist and Lake Managers	
Once identified, help others understand the value of these areas.	Interested citizen	UWEX Lakes (educational materials) WDNR Aquatic Biologist and Lake Managers	

Landscapes and the Lake

Land use and land management practices within a lake's watershed can affect both its water quantity and quality. While forests, grasslands, and wetlands allow a fair amount of precipitation to soak into the ground, resulting in more groundwater and good water quality, other types of land uses may result in increased runoff and less groundwater recharge, and may also be sources of pollutants that can impact the lake and its inhabitants. Areas of land with exposed soil can produce soil erosion. Soil entering the lake can make the water cloudy and cover fish spawning beds. Soil also contains nutrients that increase the growth of algae and aquatic plants. Development on the land may result in changes to natural drainage patterns and alterations to vegetation on the landscape, and may be a source of pollutants. Impervious (hard) surfaces such as roads, rooftops, and compacted soil prevent rainfall from soaking into the ground, which may result in more runoff that carries pollutants to the lake. Wastewater, animal waste, and fertilizers used on lawns, gardens and crops can contribute nutrients that enhance the growth of algae and aquatic plants in our lakes. Land management practices can be put into place that better mimic some of the natural processes, and reduction or elimination of nutrients added to the landscape will help prevent the nutrients from reaching the water. In general, the land nearest the lake has the greatest impact on the lake water quality and habitat.

Shoreland vegetation is critical to a healthy lake's ecosystem. It helps improve the quality of the runoff that is flowing across the landscape towards the lake. It also provides habitat for many aquatic and terrestrial animals including birds, frogs, turtles, and many small and large mammals. Healthy shoreland vegetation includes a mix of tall grasses/flowers, shrubs, and trees which extend at least 35 feet landward from the water's edge. Shorelands include adjacent wetlands, which also serve the lake by allowing contaminants to settle out, providing shelter for fish and wildlife, and decreasing the hazard of shoreline erosion by providing a shoreland barrier from waves and wind.

The water quality in Lost Lake is the result of many factors, including the underlying geology, the climate, and land management practices. Since we have little control over the climate and cannot change the geology, changes to land management practices are the primary actions that can have positive

impacts on the lake's water quality. The water quality in Lost Lake was assessed by measuring different characteristics including temperature, dissolved oxygen, water clarity, water chemistry, and algae. All of these factors were taken into consideration when management planning decisions were made.

Water Quality

A variety of water chemistry measurements were used to characterize the water quality in Lost Lake. Water quality was assessed during the 2010-2012 lake study and involved a number of measures including temperature, dissolved oxygen, water chemistry, and nutrients (phosphorus and nitrogen). Nutrients are important measures of water quality in lakes because they are used for growth by algae and aquatic plants. Each of these interrelated measures plays a part in the lake's overall water quality. In addition, water quality data collected in past years was also reviewed to determine trends in Lost Lake's water quality.

One pound of phosphorus entering a lake can result in up to 500 pounds of algal growth!
(Vallentyne, 1974)

Dissolved oxygen is an important measure in Lost Lake because a majority of organisms in the water depend on oxygen to survive. Oxygen is dissolved into the water from contact with air, which is increased by wind and wave action. Algae and aquatic plants also produce oxygen when sunlight enters the water, but the decomposition of dead plants and algae reduces oxygen in the lake. During the course of the study, some samples taken during winter and summer stratification (layering), showed that the lake is lacking sufficient oxygen to maintain an unstressed fish community. A partial winter fish kill may have occurred in late winter 2011 as dissolved oxygen concentrations, even near the surface, remained below 4 mg/L. In contrast, winter 2012 maintained dissolved oxygen concentrations above 5 mg/L in the upper 12 feet of the lake. Oxygen is quickly consumed early in the growing season; by June, as little as the top 7 or 8 feet of water contains sufficient oxygen concentrations to maintain fisheries. Lake water commonly loses oxygen by 8 to 10 feet in depth.

The water clarity measured in Lost Lake was considered poor. The average water clarity measurements during the study were poorest in June and best in July. Past water clarity data was collected sporadically between 1999 and 2010. When compared with this historic data, the average water clarity measured during the study was slightly better in August and worse in July and September.

Chloride, sodium and potassium concentrations are commonly used as indicators of how a lake is being impacted by human activity. The presence of these compounds where they do not naturally occur indicates sources of water contaminants. Over the monitoring period, Lost Lake had low average chloride and sodium concentrations, and potassium was slightly elevated. Although these elements are not detrimental to the aquatic ecosystem, they can indicate that sources of contaminants such as road salt, fertilizer, animal waste and/or septic system effluent may be entering the lake from either surface runoff or via groundwater.

Phosphorus is an element that is essential in trace amounts to most living organisms, including aquatic plants and algae. Sources of phosphorus can include naturally-occurring phosphorus in soils and wetlands, and groundwater. Common sources from human activities include soil erosion, animal waste, fertilizers, and septic systems. Although a variety of compounds are important to biological growth, phosphorus receives so much attention

because it is commonly the "limiting nutrient" in many Wisconsin lakes. Due to its relatively short supply compared to other substances necessary for growth, relatively small increases in phosphorus result in significant increases in aquatic plants and algae.

Total phosphorus concentrations in Lost Lake ranged from a high of 108 µg/L in April 2012 to a low of 35 µg/L in August 2012. The summer median total phosphorus was 43.5 ug/L and 39 ug/L in 2011 and 2012, respectively. This is well above Wisconsin's phosphorus standard of 20 ug/L for deep seepage lakes.

During the study, inorganic nitrogen concentrations in samples collected during the spring averaged 0.67 mg/L. Concentrations above 0.3 mg/L are sufficient to enhance algal blooms throughout the summer (Shaw et al., 2000). Inorganic nitrogen typically moves to lakes with groundwater; however, ammonium (the largest form of inorganic nitrogen in Lost Lake samples) may be released from lake sediments when dissolved oxygen concentrations are low.

Managing nitrogen, phosphorus and soil erosion throughout the Lost Lake watershed is one of the keys to protecting the lake itself. Near shore activities that may increase the input of phosphorus to the lake include applying fertilizer, removing native vegetation (trees, bushes and grasses), mowing vegetation, and increasing the amount of exposed soil. Nitrogen inputs to Lost Lake can be controlled by using lake-friendly land management decisions, such as the restoration of shoreland vegetation, elimination/reduction of fertilizers, proper management of animal waste and septic systems, and the use of water quality-based management practices.

Guiding Vision for Water Quality in Lost Lake

Lost Lake will have water quality that supports a healthy lake ecosystem.

Goal 5. Improve current water quality conditions in Lost Lake.

Objective 5.1. Work toward lowering median summer phosphorus concentrations to 20 ug/L or less and springtime inorganic nitrogen concentrations 0.3 mg/L or less.

Actions	Lead person/group	Resources	Timeline
Decrease or eliminate use of fertilizers containing phosphorus on shoreland properties and throughout the watershed by providing educational material about the effects of phosphorus on water quality via newsletters and e-mail.	Interested citizen	MC Extension WDNR	
Encourage the county to work with landowners to implement water quality-based best management	Interested citizen	CPZ State grant programs	

practices (BMPs) throughout the watershed.		NRCS	
Encourage the CPZ to work with area shoreland landowners and farmers to test soil before applying fertilizers.	Interested citizen	MC Extension	
Enhance shoreland vegetation around the lake (see Shorelands section).	Shoreland property owners	CPZ Consultants	
Begin annual summer phosphorus monitoring and water clarity measurements.	Interested citizen	CLMN coordinator WDNR Lakes Manager	
Conduct ice-on/ice-off monitoring each fall and spring. Submit the information to the WDNR database.	Interested citizen	CLMN coordinator	

Shorelands

Shoreland vegetation is critical to a healthy lake ecosystem. It provides habitat for many aquatic and terrestrial animals including birds, frogs, turtles, and small and large mammals. It also helps to improve the quality of the runoff that is flowing across the landscape towards the lake. Healthy shoreland vegetation includes a mix of unmowed grasses/flowers, shrubs, trees, and wetlands which extends at least 35 feet landward from the water's edge.

To better understand the health of the Eastern Marathon County lakes, shorelands were evaluated. Lost Lake had adequate shoreland vegetation along most of the lake shore. The overall findings showed that 5,218 linear feet of shoreline were classified as having a grass/forb buffer depth greater than 50 feet. Like the grass/forbs layer, the tree layer was also abundant, with nearly 80 percent of the shoreline classified as having buffer depth greater than 50 feet. Less abundant was the shrub layer, in which a majority of the shoreline was classified as 5-15 feet, which is less than the 35 feet minimum depth required by Wisconsin and Marathon County shoreland zoning ordinances. Although Lost Lake's shoreland was in good condition, changes can easily occur as development takes place. Minimizing impacts to Lost Lake from future development should include planning to ensure that perspective developers have the right information to make informed decisions and that zoning is in place to achieve habitat, water quality, and aesthetic goals.

Docks and artificial beaches can result in altered in-lake habitat; denuded lakebeds provide good prospects for invasive species to become established and reduce habitat that is important to fish and other lake inhabitants. Erosion can contribute sediment to the lake, which can alter spawning habitat and carry nutrients into the lake. Unmanaged runoff from the rooftops of structures located near shore can also contribute more sediment to the lake. Alone, each human-made feature is likely not a large problem to a lake, but on developed lakes where these features occur around the lake, their impacts can add up to be a problem for lake habitat and water quality. Lost Lake is currently relatively undeveloped, but in the case of further development of the lake, efforts should be made to reduce these influences to the lake.

Shoreland ordinances were enacted to improve water quality and habitat, and to protect our lakes. To protect our lakes, county and state (NR 115) shoreland ordinances state that vegetation should extend at least 35 feet inland from the water's edge, with the exception of an optional 30 foot viewing

corridor for each shoreland lot. Although some properties were grandfathered in when the ordinance was initiated in 1966, following this guidance will benefit the health of the lake and its inhabitants.

Guiding Vision for Lost Lake's Shorelands

Lost Lake will have shorelands that provide aesthetic beauty and quality habitat.

Goal 6. Maintain natural shoreland around Lost Lake.

Objective 6.1. Protect healthy, stable shoreland habitat near and around Lost Lake.

Actions	Lead person/group	Resources	Timeline
Explore strengthening buffer language in zoning regulations around Lost Lake.		Town of Elderon	
Participate in Marathon County Comprehensive Planning process especially as related to updating shoreland zoning ordinances.	Interested citizen		
Provide information packets regarding shoreland regulations and shoreland management practices to existing lakefront property owners.		CPZ	

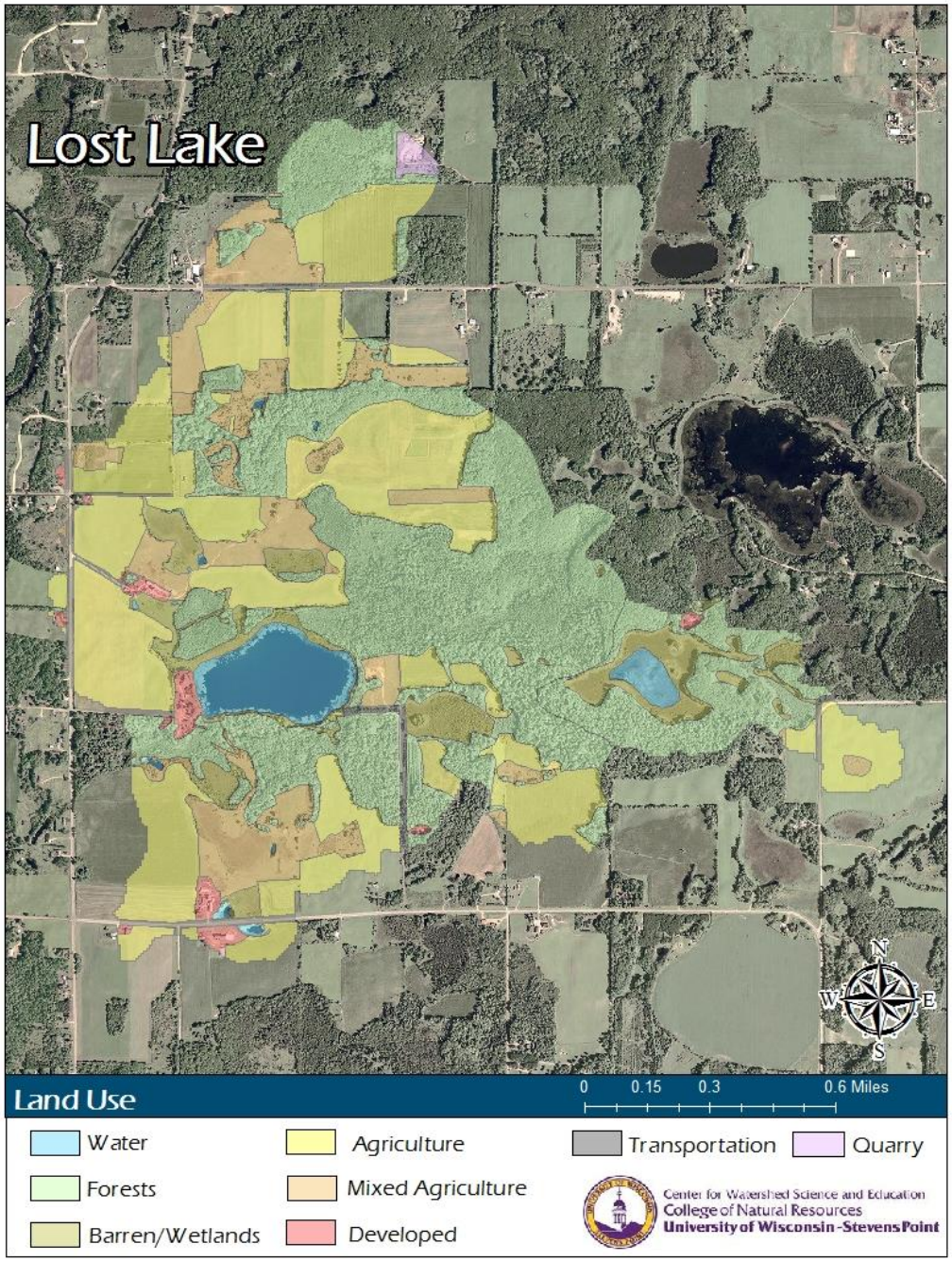

Figure 1. Surface watershed of Lost Lake.

Watershed Land Use

It is important to understand where Lost Lake's water originates in order to understand the lake's health. During snowmelt or rainstorms, water moves across the surface of the landscape (runoff) towards lower elevations such as lakes, streams, and wetlands. The land area that contributes runoff to a lake is called the surface watershed. Groundwater also feeds Lost Lake; its land area may be slightly different than the surface watershed.

The capacity of the landscape to shed or hold water and contribute or filter particles determines the amount of erosion that may occur, the amount of groundwater feeding a lake, and ultimately, the lake's water quality and quantity. Essentially, landscapes with greater capacities to hold water during rain events and snowmelt slow the delivery of the water to the lake. Less runoff is desirable because it allows more water to recharge the groundwater, which feeds the lake year-round - even during dry periods or when the lake is covered with ice. A variety of land management practices can be put in place to help reduce impacts to our lakes. Some practices are designed to reduce runoff. These include protecting/restoring wetlands, installing rain gardens, swales, rain barrels, and routing drainage from pavement and roofs away from the lake. Some practices are used to help reduce nutrients from moving across the landscape towards the lake. Examples include manure management practices, eliminating/reducing the use of fertilizers, increasing the distance between the lake and a septic drainfield, protecting/restoring wetlands and native vegetation in the shoreland, and using erosion control practices.

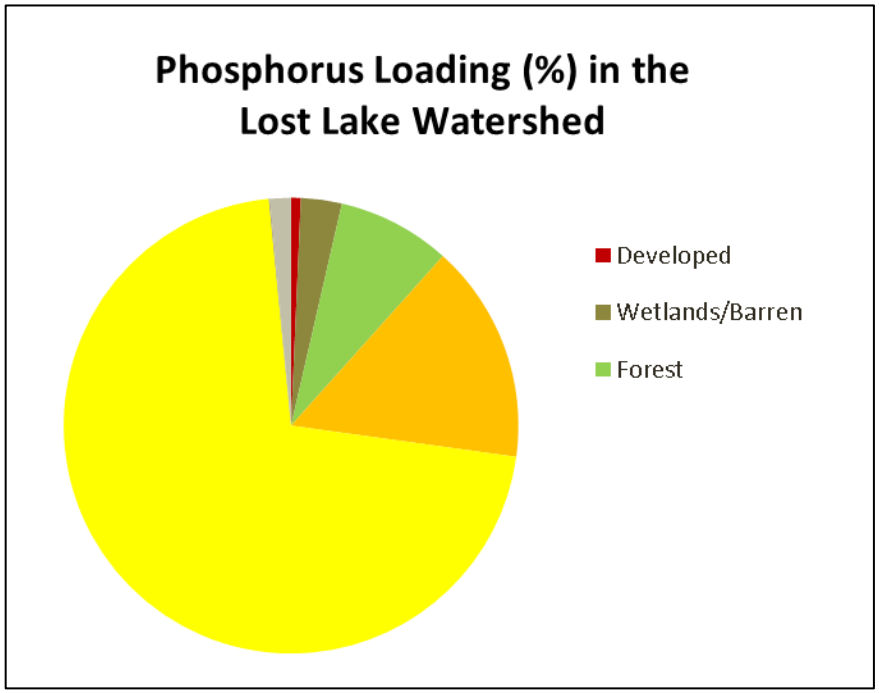

Figure 2 Estimated phosphorus loads from land uses in the Lost Lake watershed.

The surface watershed for Lost Lake is approximately 1,195 acres. Primary land use is agriculture and forest land (Figure 1). The lake's shoreland is surrounded primarily by forests, wetlands, and residential development. In general, the land closest to the lake has the greatest immediate impact on water quality.

Lost Lake's groundwater watershed includes approximately 177 acres to the northeast of the lake; this is the area from which Lost Lake receives most of its groundwater.

Land use in the surface watershed was evaluated and used to populate the Wisconsin Lakes Modeling Suite (WILMS) model. In general, each type of land use contributes different amounts of phosphorus in runoff and through groundwater. The types of land management practices that are used and their distances from the lake also affect the contributions to the lake from a parcel of land. While forests comprised the greatest amount of land in the watershed, modeling results indicated that agriculture had the greatest percentage (88%) of phosphorus contributions from the watershed to Lost Lake.

Guiding Vision for Lost Lake's Watershed

Lost Lake will have a watershed that minimizes adverse impacts to the lake.

Goal 7. Support efforts within the watershed that improve lake health.

Objective 7.1. Be involved in activities that can influence land management in the lake's watershed.

Actions	Lead person/group	Resources	Timeline
Participate in future planning activities with the County and the Town in regard to revisions to zoning decisions than may affect Lost Lake. Development and shoreland practices are a few examples.	Interested citizen	Town of Elderon MC Supervisor CPZ	
Participate in County and local comprehensive planning processes.	Interested citizen	Town of Elderon MC Supervisor CPZ	

Explore overlay zoning to better protect the lake and its shorelands around the lake which may not be covered by the existing zoning ordinances.	Interested citizen	CPZ	
Encourage County staff to support the installation and maintenance/follow-up of water quality-based best management practices (BMPs) within the watershed (see Water Quality section).	Interested citizen	CPZ NRCS	
Raise awareness about the importance of wetlands and explore options with the County or Town to better protect, enhance, or restore wetlands in the watershed.	Interested citizen	Town of Elderon CPZ MC Supervisor Wisconsin Wetlands Association	
Encourage protection of land in the watershed by supporting property owners that seek conservation easements. Inform property owners of their options.	Interested citizen	NCCT CPZ	
Explore County communication options for the District to receive notifications of projected road/development projects near the lake (prior to design) to provide input on road/development drainage directed away from the lake.		CPZ	

People and the Lake

The people that interact with the lake are a key component of the lake and its management. In essence, a lake management plan is a venue by which people decide how they would like people to positively impact the lake. The plan summarizes the decisions of the people to take proactive steps to improve their lake and their community. Individual decisions by lake residents and visitors can have a positive impact on the lake and on those who enjoy this common resource. Collaborative efforts may have a bigger positive impact; therefore, communication and cooperation between a lake district, community, and suite of lake users are essential to maximize the effects of plan implementation.

Boating hours, regulations, and fishing limits are examples of principles that are put into place to minimize conflicts between lake users and balance human activities with environmental considerations for the lake.

Recreation

There is one boat landing on the southeast end of Lost Lake, which does not have any high-speed boating hours. The lake is enjoyed by people who fish and enjoy its beauty.

Guiding Vision for Recreation

Lost Lake will be a place for swimming, fishing or hunting in a place of serenity.

Goal 8. Preserve the solitude found at Lost Lake.

Objective 8.1. Work with municipality and County to protect the lake.

Actions	Lead person/group	Resources	Timeline
Upgrade/replace signs at boat landing (No Wake, etc.)	Town of Elderon	UWEX Lakes	

Communication and Organization

Many of the goals outlined in this plan focus on distributing information to lake and watershed residents and lake users in order to help them make informed decisions that will result in a healthy ecosystem in Lost Lake enjoyed by many people. Working together on common values will help to achieve the goals that are outlined in this plan.

Guiding Vision for Communication

Changes and updates to the Lost Lake management plan will be communicated to those that live around the lake, the township and lake users.

Goal 9. Provide open and easily accessed opportunities for communicating lake information, recommendations and educational materials.

Objective 9.1. Communicate important lake information in a variety of venues.

Actions	Lead person/group	Resources	Timeline
Inform property owners within the watershed about the effects of fertilizers, impervious surfaces, and septic systems on the lake.	Interested citizen	CPZ UWEX Lakes Wisconsin Lakes	
Inform property owners within the watershed about the importance of shoreland vegetation and information about shoreland restoration.	Interested citizen	CPZ UWEX Lakes Wisconsin Lakes	
Inform the County about issues that may lead to problems within the lake community, i.e. activities that may lead to erosion like residents clear cutting shorelines, dumping sand on shorelines or other shoreline disturbance; septic failures; non-compliance with setbacks; new construction, and/or new irrigation wells. Encourage lake residents to call in concerns to the County to provide "extra eyes" on the landscape.	Interested citizen	CPZ	
Work with County to ensure the distribution of welcome packets to new residents. Consider a Lake District or watershed welcome packet.	Interested citizen	CPZ UWEX Lakes Wisconsin Lakes Realtors	

Explore the formation of a lakes subcommittee on the town board, and/or a county-wide lake group.	Interested citizen	Town of Bevent CPZ MC Extension	
Encourage attendance at the Lakes Convention and Lake Leaders Institute, and announce educational events such as these.	Interested citizen	UWEX Lakes	

Updates and Revisions

A management plan is a living document that changes over time to meet the current needs, challenges and desires of the lake and its community. The goals, objectives and actions listed in this plan should be reviewed annually and updated with any necessary changes.

Guiding Vision for Updates and Revisions

Lost Lake will have an up-to-date and accurate lake management plan that is regularly reviewed and documents all management activities and results.

Goal 10. Review plan annually and update as needed.

Objective 10.1. Communicate updates with community members and members of the Town, County and State.

Actions	Lead person/group	Resources	Timeline
Notify the Town, the County, and WDNR of any potential changes in the management plan.			

Governance

This section will identify plans, ordinances, and regulations that affect the lake and responsible authorities including the local municipalities, state, and federal agencies.

Marathon County Strategic Plan: Marathon County's strategic plan states a clear intent to provide leadership and services focusing on improving land use and resource planning. This will assure the orderly development of retail and manufacturing business, agriculture/agribusiness, and residential growth while retaining the rural character of Marathon County. Specific objectives to support this leadership role are as follows:

- Develop comprehensive planning and zoning ordinances that provide towns with value so that 100% request participation in county planning and zoning.
- Improve water quality and residential, commercial, and industrial waste management resulting in 100% of all households, businesses, and industry sites meeting water quality standards.
- Inventory water resources, determine where we have adequate supplies, and encourage development in those areas.
- Develop an educational program on the quantity and quality of water supplies for local and state policy makers.

Comprehensive Plans – Marathon County and the Town of Elderon: Marathon County as well as the Town of Elderon adopted Comprehensive Plans in 2006/2007. These plans outline the direction of future growth within the County and Town.

During the planning process, a set of guiding principles that describe broad characteristics of a desired future for local communities and Marathon County were developed. These guiding principles were used to provide a general framework for developing local and countywide goals and objectives. The guiding principles outlined in the Marathon County Comprehensive Plan are:

1. Respect Local Governance - Planning in Marathon County should build on local town, village and city government as a system that is unique, has served residents well, and is a strong component of local identity.

2. Preserve Working Agriculture - Agriculture has been central to the culture and economy of Marathon County for over 100 years. Farming has been a way of life for generations of county residents and is fundamental to both community and individual identity. Efforts such as protecting prime farmland from development, exploring niche markets, and supporting cooperative practices can be implemented at the local level to help maintain and preserve working agriculture.

3. Maintain a Sense of Place - As Marathon County's population grows and changes, communities will need to ensure that important physical features, buildings, and landscapes that exemplify their local identity are retained. These features provide a sense of heritage and continuity that contribute to a community's identity and sense of place.

4. Preserve Rural Character - Shifts in the farm economy and urban expansion are altering the County's rural landscape characterized by working farms, woodlands, rolling hills, marsh areas, and plentiful water bodies. As open spaces, farms, and woodlands are being lost or fragmented by development, Marathon County communities will need to make some important choices in order to preserve the qualities and character of the rural landscape.

5. Safeguard Natural Resources - Marathon County is graced with abundant natural resources including numerous rivers, wetlands, forests, and wildlife. Careful stewardship of natural resources is essential to protect against fragmentation and degradation and ensure these resources continue to contribute to the ecology, character, quality of life, and economy of Marathon County into the future.

6. Foster Managed Growth and Coordinated Development - Managing growth is important to ensure that no area is overwhelmed by development, land use conflicts are minimized, and development occurs in a quality manner that minimizes impacts on natural resources. Managing growth requires coordination of land uses and infrastructure, within and between communities.

From these Guiding Principles, the following goals were developed that are directly related to lake management planning and protection:

Goal 1: Enhance the natural character of Marathon County.

Objective: To encourage establishment of an open space network connecting woodlands, wetlands, shorelands, grasslands, and other natural areas.

Goal 2: Protect and enhance surface water resources and natural habitat areas.

Objective: To minimize development impacts that could affect the water quality and habitat of rivers, floodplains, and wetlands.

Objective: To provide leadership in disseminating information about shoreland, floodplain, and wetland preservation and management to County residents.

Goal 3: Protect and enhance the quantity and quality of potable groundwater and potable surface water supplies.

Objective: To continue to enforce, and update as necessary, ordinances and development standards to protect the quantity and quality of groundwater resources.

Objective: To continue to encourage local municipalities to protect groundwater quality and quantity.

Objective: To continue to work with the WDNR and others to address known contamination problems and ensure that sufficient measures are taken to prevent additional groundwater contamination.

Goal 7: Improve coordination regarding natural resource protection.

Objective: To foster coordinated and effective enforcement of the various regulations aimed at protecting natural resources.

Objective: To continue to serve as a liaison between State and Federal agencies and local municipalities regarding natural resource regulations and permitting procedures.

Objective: To ensure timely and effective communication of changes to natural resource regulations and permitting procedures.

The Town of Elderon adopted a Comprehensive Plan to guide the community's physical, social, and economic development. The Comprehensive Plan also serves to identify important physical and cultural resources that need to be protected and enhanced to maintain a desired quality of life. Comprehensive plans are not meant to serve as land use regulations in themselves; instead, they provide a rational basis for local land use decisions with a twenty-year vision for future planning and community decisions.

Town of Elderon residents place a high priority on protection of its agriculture, forestry and water resources and wishes to protect these resources from intensive development. The Town of Elderon has developed the following goal, objectives, and policy recommendations to demonstrate its support:

Goal: Protect the aesthetic and environmental qualities of Elderon's lakes.

- Objective: To minimize intensive development around Elderon's lakes that could affect water quality, habitat or natural vegetation near the lakes.

Goal: Protect natural resources, including forest, wetland and lake communities from intensive development.

- Objective: To continue working with Marathon County to ensure appropriate preservation of wetlands and shorelines.

The lake management plan, along with any proposed changes to the comprehensive plan, will be presented to the local municipality for review and possible incorporation into their comprehensive plans. Zoning, subdivision, and official mapping decisions must be consistent with the comprehensive plan.

Marathon County Land & Water Resource Management Plan

The Conservation, Planning and Zoning Department's mission is to create, advocate, and implement strategies to conserve natural and community resources. The department administers programs to implement the Land and Water Resource Management Plan which includes the Farmland Preservation Program, Managed Intensive Grazing, Lake Districts, Wildlife Damage and Abatement, as well as regulatory activities associated with the Waste Storage Facility and Nutrient Management Ordinance and the Livestock Facilities Licensing Ordinance.

The Land & Water Resource Management Plan outlines the following goals, objectives, programs, and regulations to support the implementation of the Lake Management Plan:

A. Goals and Objectives

1. **Reduce Agricultural Nonpoint Runoff.** Reduce the discharge of soil sediment, organic materials, pesticides and nutrients into surface and ground waters.

2. **Groundwater Protection.** Educate the public and users about groundwater use and resource management challenges. In April 2001, the Marathon County Groundwater Guide was updated to reflect the changing programs and policies within the county as well as to acknowledge the increased level of regulation by state agencies to protect the groundwater resources of Marathon County.

3. **Forestry.** Sustain private and public forests. The Marathon County Forest Comprehensive Land Use Plan (2006-2020) includes recommendations to guide management of forest land in Marathon County in accordance with the Parks, Recreation and Forestry Department's mission to manage and protect the county forest on a sustainable basis for ecological, economic, educational, recreational, and research needs of present and future generations.

4. **Land Conversion**. Minimize the conversion of prime agricultural lands and forests to other land uses to support watershed management and to maintain economic value of the working lands.

5. **Lake and Reservoir Management.** Support local communities to understand the environmental opportunities and challenges facing lakes. This resource concern encompasses the areas of wetland management and aquatic invasive species. There is a great participation by local landowners in securing information and resources to better protect our water resources.

B. Conservation Programs and Partnerships

1. **Aquatic Invasive Species.** In 2010, Marathon County has entered into a working relationship with the Golden Sands Resource Conservation & Development agency to conduct an inventory of lakes and flowages unassociated with the Wisconsin River for aquatic species. The inventory efforts involve educational outreach efforts to Park Department employees and students.

2. **Managed Grazing Project.** Marathon County Conservation, Planning and Zoning Department, UW-Extension, and the Natural Resources Conservation Service have joined forces to support the Central Wisconsin River Graziers Network. The Network promotes the feasibility of grazing-based farming as a profitable way of farming that enhances lifestyles and protects and improves the environment.

3. **Managed Forest Law (MFL) Program.** The MFL program provides incentives to protect privately owned woodlands from destructive timber cutting practices and over-harvesting and prevents land from becoming developed and/or converted to agricultural land use.

4. **Farmland Preservation Program.** Marathon County adopted its Farmland Preservation Plan in 2013. The goals of the program are twofold: to preserve Wisconsin farmland for production of commodities by means of local land use planning and soil conservation practices, and; to provide tax relief to landowners. For the landowner to receive tax credits they must be in compliance with current and applicable State Agricultural Performance Standards.

5. **Nutrient Management Program.** Nutrient management is defined as managing the amount, form, placement, and timing of applications of plant nutrients. The purpose of this program is to ensure a proper supply of plant nutrients for crop production while minimizing the entry of nutrients to surface water and groundwater. Marathon County requires nutrient management plans for landowners constructing and operating waste storage facilities.

6. **Federal Soil and Water Conservation Programs.** The Conservation, Planning and Zoning (CPZ) Department works closely with the United States Department of Agriculture through the Natural Resources Conservation Service (NRCS) and the Farm Service Agency (FSA). The NRCS, FSA, UW-Extension and CPZ staffs work together in the Local Work Group to identify program and funding priorities for federal and local conservation programs such as the Environmental Quality Incentive Program, Comprehensive Nutrient Management Planning, Conservation Reserve Enhancement Program and grazing initiatives.

C. Regulations: The lake management plan is superseded by federal, state, county, and municipal laws and court rulings; however, the plan may influence county and municipal ordinances and enforcement. Federal laws contain regulations related to water quality, wetlands, dredging, and filling. State laws contain regulations related to water quality, water and lake use, aquatic plants and animals, shoreline vegetation, safety, and development. County laws contain regulations related to development, safety, use, and aquatic plants and animals. Municipal laws contain regulation of use and safety. The rules and regulations are primarily enforced by the US Army Corps of Engineers, the Wisconsin Department of Natural Resources, the Marathon County Sheriff's Department, and the Marathon County Conservation, Planning and Zoning (CPZ) Department. If considering development near or on a lake, addressing problem plants or animals, or altering the lake bottom contacts the Marathon County CPZ Department and/or the Wisconsin Department of Natural Resources.

1. **Waste Storage Facility and Nutrient Management Ordinance.** Dairy cattle in the county produce over 4,000,000 gallons of manure per day. To assure that this organic matter and nutrient source is contained and managed with sound practices, Marathon County has regulated these activities since 1985.

2. **Marathon County Livestock Siting Ordinance.** In October 2006, Marathon County adopted the General Code of Ordinances for Marathon County Chapter 13.01 Livestock Facilities Licensing Ordinance. The purpose of the ordinance is to establish the authority, technical standards, performance standards, and monitoring protocols necessary to protect public health, safety, and the environmental resources in Marathon County.

3. **Marathon County Zoning Ordinance (Chapter 17) and Land Division and Surveying Regulations (Chapter 18).** The Marathon County Zoning Ordinance (Chapter 17) is adopted to promote and protect public health, safety, comfort, convenience, aesthetics and other aspects of the general welfare of the population. More specifically, the ordinance establishes standards for buildings, structures, setbacks, lot coverage, land uses, streets and highways and other land use aspects. These regulations apply to all unincorporated areas that have adopted Marathon County Zoning. However, where a town has not adopted Marathon County Zoning but has adopted local regulations, the local regulations apply. In addition, the County regulates the division of land in accordance with Chapter 18 Land Division and Surveying Regulations. The County's land division regulations apply in all unincorporated areas of the County. However, where a town has land division regulations that are more restrictive than the County's, the local regulations apply.

4. **Floodplain and Shoreland Ordinance**. Shoreland, wetland, and floodplain regulations are applicable in all unincorporated areas of the County. Wisconsin law mandates counties to adopt and administer a zoning ordinance that regulates land use in shoreland/wetland and floodplain areas for the entire area of the county outside of villages and cities.

5. **Nonmetallic Mining Reclamation Ordinance**. Marathon County adopted the General Code of Ordinances for Marathon County Chapter 21 Nonmetallic Mining Reclamation Code in 1989. The ordinance applies to approximately 400 operating or abandoned excavations of sand, gravel, decomposed granite and stone. The ordinance requires restoration of the site to a purposeful and acceptable landscape appearance and use.

6. **Private Sewage System Ordinance**. Marathon County adopted Marathon County General Code of Ordinances Chapter 15 Private Sewage Systems in 1968. This ordinance is adopted to promote and protect public health and safety by assuring the proper siting, design, installation, inspection, and management of private sewage systems and non-plumbing sanitation systems, and to assure the timely repair or replacement of failing private sewage systems. All structures or premises in the County that are permanently or intermittently intended for human habitation or occupancy, which are not serviced by a public sewer or a privately owned wastewater treatment facility regulated by the Department of Natural Resources, shall have a system for holding or treatment and dispersal of sewage and wastewater which complies with the provisions of this ordinance.

7. **Construction Site Erosion – WI Administrative Code NR 216.** Construction site erosion and uncontrolled storm water runoff from land disturbing activities can have significant adverse impacts upon local water resources. Under subchapter III of NR 216, Wis. Adm. Code, a notice of intent shall be filed with the DNR by any landowner who disturbs one or more acres of land.

Lake Management Plan Approval

The final draft of the lake management plan will be approved through consensus of local citizens involved in the planning process. The final draft will be approved by the Wisconsin Department of Natural Resources (DNR) to ensure compliance lake management plan requirements and grant requirements. The completed plan that has been approved by the DNR will be presented to the municipalities containing the lake and Marathon County. The municipality may reference the lake management plan or parts of the plan in their comprehensive plan to guide municipal or county decisions.

Lake Assistance

The lake management plan will enhance the ability of the lake to apply for financial assistance. The lake management plan will be considered as part of the application for grants through the Wisconsin Department of Natural Resources. Current listings of grants available from the DNR can be found at http://dnr.wi.gov/aid/. Marathon County offers technical and financial assistance through the Conservation, Planning and Zoning Department and University of Wisconsin-Extension Department. Additional assistance may be available from other agencies and organizations, including DNR, UW-Extension Lakes Program, Golden Sands RC&D, Wisconsin Wetlands Association, and Wisconsin Trout Unlimited. Etc.

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Wetzel, R.G., 2001. Limnology, Lake and River Ecosystems, Third Edition. Academic Press. San Diego, California.

Appendices

Appendix A: Marathon County Lake Information Directory

Algae - Blue-Green
Contact: Scott Provost, WI Dept. of Natural Resources
Phone: 715-421-7881
Address: 473 Griffith Ave,. Wisconsin Rapids, WI 54494
E-mail: scott.provost@wisconsin.gov
Website: http://dnr.wi.gov/lakes/bluegreenalgae/

Contact: Wisconsin Department of Health Services
Phone: 608-267-3242
Address: PO Box 2659, Madison, WI 53701
E-mail: dhswebmaster@dhs.wisconsin.gov
Website:
www.dhs.wisconsin.gov/eh/bluegreenalgae/index.htm

Aquatic Invasive Species /Clean Boats Clean Water
Contact: Golden Sands RC&D
Phone: 715-343-6215
E-mail: info@goldensandsrcd.org
Address: 1100 Main Street, Suite #150
Stevens Point, WI 54481
Websites:
http://www.goldensandsrcd.org/
http://dnr.wi.gov/invasives/

Aquatic Plant Management
(Native and Invasive)
Contact: Scott Provost, WI Dept. of Natural Resources
Phone: 715-421-7881
Address: 473 Griffith Ave., Wisconsin Rapids, WI 54494
E-mail: scott.provost@wisconsin.gov
Website: http://dnr.wi.gov/lakes/plants/

Aquatic Plant Identification
Contact: Golden Sands RC&D
Phone: 715-343-6215
E-mail: info@goldensandsrcd.org
Address: 1100 Main Street, Suite #150
Stevens Point, WI 54481
Website: http://www.goldensandsrcd.org/

Contact: Scott Provost, WI Dept. of Natural Resources
Phone: 715-421-7881
Address: 473 Griffith Ave., Wisconsin Rapids, WI 54494
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Aquatic Plant Management
Contact: Scott Provost, WI Dept. of Natural Resources
Phone: 715-421-7881
Address: 473 Griffith Ave,. Wisconsin Rapids, WI 54494
E-mail: scott.provost@wisconsin.gov
Website: http://dnr.wi.gov/lakes/plants/

Best Management Practices (Rain gardens, shoreland buffers, agricultural practices, runoff controls)
Contact: Marathon County CPZ
Phone: 715-261-6000
Address: 210 River Dr., Wausau, WI 54403
E-mail: cpz@co.marathon.wi.us
Website:
http://www.co.marathon.wi.us/Departments/ConservationPlanningZoning.aspx

Boat Landings (County)
(Signage, permissions, etc.)
Contact: William Duncanson
Phone: 715-261-1550
Address: 212 River Dr., Suite 2, Wausau, WI 54403
E-mail: parkforestry@co.marathon.wi.us
Website:
http://www.co.marathon.wi.us/Departments/ParksRecreationForestry.aspx

Boat Landings (State)
Contact: Tom Meronek, WI Dept. of Natural Resources
Phone: 715-359-7582
Address: 5103 Rib Mt. Drive, Wausau, WI 54401
E-mail: Thomas.Meronek@wisconsin.gov
Website:
http://dnr.wi.gov/org/land/facilities/boataccess/

Boat Landings (Town)
Contact the clerk for the specific town/village in which the boat landing is located.

Conservation Easements
Contact: Gathering Waters Conservancy
Phone: 608-251-9131
Address: 211 S. Paterson St., Suite 270, Madison, WI 53703
E-mail: info@gatheringwaters.org
Website: http://gatheringwaters.org/

Contact: Buzz Sorge, WI Dept. of Natural Resources
Phone: 715-839-3794
Address: PO Box 4001, Eau Claire, WI 54702
E-mail: Patrick.Sorge@wisconsin.gov
Website: http://dnr.wi.gov/aid/easements.html

Contact: North Central Conservancy Trust
Phone: 715-341-7741
Address: PO Box 124, Stevens Point, WI 54481
E-mail: info@ncctwi.org
Website: http://www.ncctwi.org/

Contact: NRCS Wausau Service Center
Phone: 715-848-2330
Address: 326 River Dr., Wausau, WI 54403

Critical Habitat and Sensitive Areas
Contact: Buzz Sorge, WI Dept. of Natural Resources
Phone: 715-839-3794
Address: PO Box 4001, Eau Claire, WI 54702
E-mail: Patrick.Sorge@wisconsin.gov
Website: http://dnr.wi.gov/lakes/criticalhabitat/

Dams (Pike Lake) Town of Reid and Elderon
Contact: Town of Reid (Kittie Milanowski, Clerk)
Phone: 715-446-3767
Address: 7089 Plover River Rd., Hatley, WI 54440
E-mail: kitmil46@yahoo.com
Website:
http://www.co.marathon.wi.us/Home/AboutMarathonCounty/Municipalities/Towns.aspx

Contact: Town of Elderon (Mary Ostrowski, Clerk)
Phone: 715-454-6845
Address: 2021 Cherry Dr., Eland, WI 54427
E-mail: tnelderon@aol.com
Website:
http://www.co.marathon.wi.us/Home/AboutMarathonCounty/Municipalities/Towns.aspx

Fertilizers/Soil Testing
Contact: Marathon County UW Extension
Phone: 715-261-1230
Address: 212 River Drive, Suite 3, Wausau, WI 54403-5476
Website:
http://marathon.uwex.edu/agriculture/agriculture-news-in-marathon-county/

Contact: NRCS Wausau Service Center
Phone: 715-848-2330
Address: 326 River Dr., Wausau, WI 54403

Fisheries Biologist (management, habitat)
Contact: Tom Meronek, WI Dept. of Natural Resources
Phone: 715-359-7582
Address: 5103 Rib Mt. Drive, Wausau, WI 54401
E-mail: Thomas.Meronek@wisconsin.gov
Website: http://dnr.wi.gov/fish/

Frog Monitoring—Citizen Based
Contact: Andrew Badje, WI Dept. of Natural Resources
Phone: 608-266-3336
E-mail: Andrew.badje@wisconsin.gov
E-mail: WFTS@wisconsin.gov

Grants
Contact: Buzz Sorge, WI Dept. of Natural Resources
Phone: 715-839-3794
Address: PO Box 4001, Eau Claire, WI 54702
E-mail: Patrick.Sorge@wisconsin.gov

Contact: Marathon County CPZ
Phone: (715)261-6000
Address: 210 River Dr., Wausau, WI 54403
E-mail: cpz@co.marathon.wi.us
Website:
http://www.co.marathon.wi.us/Departments/ConservationPlanningZoning.aspx

Groundwater Quality
Contact: Kevin Masarik,UWSP Center for Watershed Science and Education
Phone: 715-346-4276
Address: TNR 224, 800 Reserve St., Stevens Point, WI 54481
E-mail: kmasarik@uwsp.edu
Website: http://www.uwsp.edu/cnr/watersheds/

Groundwater Quantity
Contact: George Kraft, UW-Stevens Point
Phone: 715-346-2984
Address: TNR 224C, 800 Reserve St., Stevens Point, WI 54481
E-mail: George.kraft@uwsp.edu

Contact: Scott Provost, WI Dept. of Natural Resources
Phone: 715-421-7881
Address: 473 Griffith Ave., Wisconsin Rapids, WI 54494
E-mail: scott.provost@wisconsin.gov
Website:
http://prodoasext.dnr.wi.gov/inter1/hicap$.startup

Informational Packets
Contact: Ryan Haney, UWSP Center for Watershed Science and Education
Phone: 715-346-2497
Address: TNR 224A, 800 Reserve St., Stevens Point, WI 54481
E-mail: mclakes@uwsp.edu

Lake Groups – Friends, Associations, Districts
Contact: Patrick Goggin, UWEX Lakes
Phone: 715-365-8943
Address: 107 Sutliff Ave., Rhinelander, WI 54501
E-mail: pgoggin@uwsp.edu
Website:
http://www.uwsp.edu/cnr/uwexlakes/

Contact: Eric Olson, UWEX Lakes
Phone: 715-346-2192
Address: 800 Reserve St., Stevens Point, WI 54481
E-mail: eolson@uwsp.edu
Website: http://www.uwsp.edu/cnr/uwexlakes/

Contact: Susan Tesarik, Wisconsin Lakes
Phone: 1-800-542-5253
Address: 4513 Vernon Blvd., Suite 101, Madison, WI 53705
E-mail: lakeinfo@wisconsinlakes.org
Website: http://wisconsinlakes.org/

Lake Levels
See: Groundwater

Lake Related Law Enforcement (No-wake, transporting invasives, etc.)
Contact: Ben Harzfeldt or Paul Leezer, WI Dept. of Natural Resources State Conservation Wardens
Phone: 715-359-1030 or 715-401-0644
Website: http://dnr.wi.gov/org/es/enforcement/

Land Use Planning and Shoreland Zoning
Contact: Dean Johnson, Marathon County CPZ
Phone: 715-261-6000
Address: 210 River Dr., Wausau, WI 54403
E-mail: dean.johnson@co.marathon.wi.us
Website:
http://www.co.marathon.wi.us/Departments/ConservationPlanningZoning.aspx

Contact: Marathon County CPZ
Phone: 715-261-6000
Address: 210 River Dr., Wausau, WI 54403
Website:
http://www.co.marathon.wi.us/Departments/ConservationPlanningZoning.aspx

Contact: UWSP Center for Land Use Education
Phone: 715-346-3783
Address: TNR 208, 800 Reserve St., Stevens Point, WI 54481
E-mail: Center.for.Land.Use.Education@uwsp.edu
Website: http://www.uwsp.edu/cnr/landcenter/

Nutrient Management Plans
Marathon County Conservation, Planning, and Zoning
Contact: Kirk Langfoss
Phone: 715-261-6008
Address: 210 River Dr., Wausau, WI 54403
E-mail: kirk.langfoss@co.marathon.wi.us
Website:
http://www.co.marathon.wi.us/Departments/ConservationPlanningZoning.aspx
http://dnr.wi.gov/runoff/ag/manure.html

Parks (County)
Contact: William Duncanson
Phone: 715-261-1550
Address: 212 River Drive, Suite #2, Wausau, WI 54403
E-mail: parkforestry@co.marathon.wi.us
Website:
http://www.co.marathon.wi.us/Departments/ParksRecreationForestry.aspx

Purchase of Development Rights
Contact: North Central Conservancy Trust
Phone: 715-341-7741
Address: PO Box 124, Stevens Point, WI 54481
E-mail: info@ncctwi.org
Website: http://www.ncctwi.org/

Purchase of Land
Contact: Buzz Sorge, WI Dept. of Natural Resources
Phone: 715-839-3794
Address: PO Box 4001, Eau Claire, WI 54702
E-mail: Patrick.Sorge@wisconsin.gov
Website:
http://dnr.wi.gov/org/land/facilities/realestate/acquire.html

Rain Barrels – Order
Contact: Golden Sands RC&D
Phone: 715-343-6215
Address: 1462 Strongs Ave., Stevens Point, WI 54481
Website:
http://www.goldensandsrcd.org/downloads/rain_barrel_order_form.pdf

Rain Gardens and Runoff
Marathon County Conservation, Planning, and Zoning
Phone: 715-261-6000
Address: 210 River Dr., Wausau, WI 54403
E-mail: cpz@co.marathon.wi.us
Website:
http://www.co.marathon.wi.us/Departments/ConservationPlanningZoning.aspx

Septic Systems
Marathon County Conservation, Planning, and Zoning
Contact: Dale Dimond
Phone: 715-261-6028
Address: 210 River Dr., Wausau, WI 54403
E-mail: dale.dimond@co.marathon.wi.us
Website:
http://www.co.marathon.wi.us/Departments/ConservationPlanningZoning.aspx

Shoreland Management
Marathon County Conservation, Planning, and Zoning
Phone: 715-261-6000
Address: 210 River Dr., Wausau, WI 54403
E-mail: cpz@co.marathon.wi.us
Website:
http://www.co.marathon.wi.us/Departments/ConservationPlanningZoning.aspx
http://www.uwsp.edu/cnr/uwexlakes/ecology/shorelands/default.asp

Shoreland Zoning Ordinances
See: Land Use Planning and Shoreland Zoning Ordinances

Soil Fertility Testing
See Fertilizers/Soil Testing

Water Quality Monitoring
Contact: Buzz Sorge, WI Dept. of Natural Resources
Phone: 715-839-3794
Address: PO Box 4001, Eau Claire, WI 54702
E-mail: Patrick.Sorge@wisconsin.gov
Website:
http://dnr.wi.gov/environmentprotect/water.html
http://watermonitoring.uwex.edu/index.html

Water Quality Problems
Contact: Buzz Sorge, WI Dept. of Natural Resources
Phone: 715-839-3794
Address: PO Box 4001, Eau Claire, WI 54702
E-mail: Patrick.Sorge@wisconsin.gov
Website:
http://dnr.wi.gov/environmentprotect/water.html

Contact: Nancy Turyk, UWSP Center for Watershed Science and Education
Phone: 715-346-4155
Address: TNR 216, 800 Reserve St., Stevens Point, WI 54481
E-mail: nturyk@uwsp.edu

Wetlands
Contact: Wisconsin Wetland Association
Phone: 608-250-9971
Address: 214 N. Hamilton St., #201, Madison, WI 53703
E-mail: info@wisconsinwetlands.org
Website: www.wisconsinwetlands.org
http://dnr.wi.gov/wetlands/

Wetland Inventory
Contact: Emmet Judziewicz, UWSP Freckmann Herbarium
Address: TNR 310, 800 Reserve St., Stevens Point, WI 54481
E-mail: ejudziewica@uwsp.edu

Woody Habitat
Contact: Tom Meronek, WI Dept. of Natural Resources
Phone: 715-359-7582
Address: 5103 Rib Mt. Drive, Wausau, WI 54401
E-mail: Thomas.Meronek@wisconsin.gov

If you are looking for any information that is not listed in this directory please contact:

Ryan Haney, **UWSP Center for Watershed Science and Education**
TNR 224, 800 Reserve St., Stevens Point, WI 54481
Phone: 715-346-2497
E-mail: mclakes@uwsp.edu

Or **Marathon County Conservation, Planning and Zoning**
210 River Dr., Wausau, WI 54403
Phone: 715-261-6000
E-mail: cpz@co.marathon.wi.us

Appendix B: Aquatic Plant Management Strategies

General recommendations:

- Reduce nutrients traveling to the lake from the landscape.
- Avoid increasing algal blooms by maintaining a healthy amount of aquatic plants.
- Don't denude the lakebed.
    - Increases potential for aquatic invasive species establishment.
    - Sediments can add phosphorus to the water which may lead to increased algal growth.
- Choose options that are appropriate for your lake's situation.
- Monitor and adjust your strategies if you are not making headway!

List of Aquatic Plant Management Options (selection of options varies with situation):

No Action

ADVANTAGES	LIMITATIONS
∗ No associated cost. ∗ Least disruptive to lake ecosystem.	∗ May not be effective in achieving aquatic plant management objectives.

Hand Pulling

ADVANTAGES	LIMITATIONS
∗ Can be used for thinning aquatic plants around docks. ∗ Can target specific plants - with proper training. ∗ Can be effective in controlling small infestations of aquatic invasive species. ∗ No associated cost.	∗ Removes near-shore wildlife and fish habitat. ∗ Opens up areas where invasives to become established. ∗ If aquatic invasive species are not pulled properly, could worsen the problem.

Hand Pulling Using Suction

ADVANTAGES	LIMITATIONS
∗ Can be used for thinning plants around docks. ∗ Can be used in deeper areas (with divers). ∗ Can target specific plants with proper training. ∗ Can be effective in controlling small infestations of aquatic invasive species. ∗ May be useful in helping to remove upper root mass of aquatic invasive species.	∗ Costs associated with hiring a diver may be comparable to chemical treatment expenses. ∗ Currently an experimental treatment – not readily available. ∗ If aquatic invasive species are not pulled properly, could worsen the problem.

Mechanical Harvesting

ADVANTAGES	LIMITATIONS
∗ Removes plant material and nutrients. ∗ Can target specific locations. ∗ Used to manage larger areas for recreational access or fishery management.	∗ Not used in water depths less than 3 feet. ∗ Some harm to aquatic organisms. ∗ Is a temporary control. ∗ Risk of introduction of new aquatic invasive species (on a hired harvester) or spread of some existing invasive species. ∗ Hired cost at least $150/hr.

Water Level Manipulation

ADVANTAGES	LIMITATIONS
∗ Controls aquatic plants in shallower, near-shore areas. ∗ Can be low cost.	∗ Requires a controlling structure on the lake. ∗ May cause undesired stress on ecosystem. ∗ Cannot be used frequently.

Milfoil Weevils

ADVANTAGES	LIMITATIONS
∗ Natural, native maintenance of native and exotic milfoils. ∗ Prefers the aquatic invasive Eurasian Watermilfoil. ∗ Some lakes may already have a native populations; need a professional stem count and assessment of shoreland health, structure of fishery, etc. ∗ Doesn't harm lake ecosystem.	∗ Require healthy shoreline habitat for overwintering. ∗ Cannot survive in areas of mechanical harvesting or herbicide application. ∗ Effectiveness highly variable between lakes (only works well for some lakes). ∗ Limited access to weevils for purchase in WI. ∗ Still considered experimental.

Chemical Treatment: Spot

ADVANTAGES	LIMITATIONS
∗ May be less destructive to lake ecosystem than lake-wide treatment.	∗ Only considered in lakes with aquatic invasive plants. ∗ Usually not fully effective in eradicating target species. ∗ Contaminants may remain in sediment. ∗ Effects on lake ecosystem not fully understood. ∗ Does not remove dead vegetation, which depletes oxygen and releases nutrients, adds to build-up of muck. ∗ Extra nutrients may spur additional aquatic plant and algae growth.

Chemical Treatment: Lake-wide

ADVANTAGES	LIMITATIONS
∗ May reduce aquatic invasives for a time. ∗ Treatment not needed as frequently.	∗ Only considered in lakes with aquatic invasive plants. ∗ Usually not fully effective in eradicating target species. ∗ Contaminants may remain in sediment. ∗ Does not remove dead vegetation, which depletes oxygen and releases nutrients, adds to build-up of muck. ∗ Extra nutrients may spur additional aquatic plant and algae growth. ∗ Negatively affects native vegetation.Effects on lake ecosystem not fully understood. ∗ Opens up space once taken up by natives for invasive species to colonize once again. ∗ ~$4000 per 5 acres.