

# 2016

## Curtis Lake, Waushara County, Wisconsin 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**



## Lake Management Plan for Curtis Lake, Waushara County, Wisconsin

The Curtis Lake Management Plan was developed with input from residents and lake users at a series of four public planning sessions held at the Wild Rose Community Center in Wild Rose, Wisconsin and the Dakota Town Hall in Wautoma, Wisconsin from August 2015 - January 2016. 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 Curtis Lake Planning Committee on:

February 8, 2016 .  
Date

The plan was accepted by the Town of Richford on:

April 3, 2017 .  
Date

The plan was accepted by Waushara County on:

June 1, 2016 .  
Date

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

October 17, 2016 .  
Date

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

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## Overarching Vision for Curtis Lake

*Curtis Lake will remain a local's favorite, where the natural sounds of wildlife and the tradition of swimming or fishing amongst family and friends perseveres.*

### Introduction

Curtis Lake is located in the township of Richford, southwest of the City of Wautoma and south of Highway 21. There is one public boat launch located on its eastern side. Curtis Lake is a 35-acre drainage lake fed by a small inlet on the northwest side of the lake, as well as by surface runoff, groundwater, and direct precipitation. The maximum depth in Curtis Lake is 45 feet; the lakebed has a gradual slope. Its bottom sediments are mostly muck. In 2015, community members around Curtis Lake came together in partnership with Waushara County and technical professionals to develop this lake management plan.

The purpose of this plan is to provide a framework for the protection and improvement of Curtis Lake. Implementing the content of this lake management plan (LMP) will enable citizens and other supporters to achieve the vision for Curtis Lake now and in the years to come. The plan was developed by community members who learned about the lake and identified features important to the Curtis Lake community to help guide the fate of the lake. It is a dynamic document that identifies goals and action items for the purpose of maintaining, protecting and/or creating desired conditions in a lake and identifies steps to correct past problems, improve on current conditions, and provide guidance for future boards, lake users, and technical experts. 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 key assistance exists. The actions identified in this LMP can serve as a gateway for obtaining grant funding and other resources to help implement activities outlined in the plan.

Who can use the Curtis Lake Management Plan, and how can it be used?

- **Individuals:** Individuals can use this plan to learn about the lake they love and their connection to it. People living near Curtis 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 lake group:** This plan would provide a lake group with a well thought out plan for the whole lake and lists options that can easily be prioritized. Annual review of the plan would also help the group to realize its accomplishments. Resources and funding opportunities for group management activities are made more available by placement of goals into the lake management plan, and the group can identify partners to help achieve their goals for Curtis 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 Town of Richford:** The Town 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.
- **Waushara 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 Waushara County lakes, streams, wetlands, and groundwater.
- **Wisconsin Department of Natural Resources:** Professionals working with lakes in Waushara 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 Wisconsin Department of Natural Resources to identify and prioritize needs within Wisconsin’s lake community, and decide where to apply resources and funding. A well thought out lake management plan increases an application’s competitiveness for funding from the State – if multiple Waushara County lakes have similar goals in their lake management plans, they can join together when seeking grant support to increase competitiveness for statewide resources.

## Background

One of the first steps in creating this plan was to gather and compile data about the lake and its ecosystem to understand past and current lake conditions. This was done alongside 32 other lakes as part of the Waushara County Lakes Project. The Waushara County Lakes Project was initiated by citizens in the Waushara County Watershed Lakes Council who encouraged Waushara County to work in partnership with personnel from UW-Stevens Point to assess 33 lakes in the county. This effort received funding from the Wisconsin Department of Natural Resources’ Lake Protection Grant Program. There was insufficient data available for many of the lakes to evaluate current water quality, aquatic plant communities, invasive species, and shorelands. The data that were available had been collected at differing frequencies or periods of time, making it difficult to compare lake conditions. Professionals and students from UW-Stevens Point and the Waushara County Land Conservation Department conducted the Waushara County Lakes Study and interpreted data for use in the development of lake management plans. Data collected by citizens, consultants, and Wisconsin Department of Natural Resources professionals were also incorporated into the planning process, helping to create a robust set of information from which informed decisions could be made. Sources of information used in the planning process are listed at the end of this document.

Several reports from the Curtis Lake Study and the materials associated with the planning process and reports can be found on the Waushara County website: <http://www.co.waushara.wi.us/> (select “Departments”, “Zoning and Land Conservation”, “Land Conservation”, and “Lake Management Planning”). Unless otherwise noted, the data used in the development of this plan were detailed in the 2014 report *Waushara County Lakes Study – Curtis Lake*, University of Wisconsin-Stevens Point.

## The Planning Process

The planning process included a series of four public planning sessions held between August and November 2015 at the Wild Rose Community Center. The Curtis Lake Planning Management Committee consisted of property owners and recreational users. Technical assistance during the planning process was provided by the Waushara County Conservationist, the Waushara County Community, Natural Resources and Economic Development Extension Agent, and professionals from the Wisconsin Department of Natural Resources (WDNR), Golden Sands Resource Conservation & Development Council, Inc. (RC&D), University of Wisconsin-Extension (UWEX), and the University of Wisconsin-Stevens Point Center for Watershed Science and Education (CWSE).

Participation in the planning process was open to everyone and was encouraged by letters sent directly to Curtis 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. To involve and collect input from as many people as possible, a topic-specific survey related to the subject of each upcoming planning session was made available prior to each planning session. Property owners and interested lake users were notified about the surveys and how to access them (via postcards mailed to waterfront property owners and press releases in local newspapers). The surveys could be filled out anonymously online, or paper copies were available upon request. Survey questions and responses were shared at the planning sessions and can be found in Appendix F.

Guest experts and professionals attended 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. This information 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, planning committee members identified goals, objectives, and actions for the lake management plan that were recorded by professionals from UW-Stevens Point. Planning session notes and presentations are available on the Waushara County website.

*Implementing the content within this lake management plan will enable citizens and other supporters to achieve the vision for Curtis Lake now and in the years to come.*

## Goals, Objectives and Actions

The following goals, objectives, and associated actions were derived from the values and concerns of citizens and members of the Curtis Lake Management Planning Committee, and the known science about Curtis Lake, its ecosystem and the landscape within its watershed. Implementing and regularly updating the goals and actions in the Curtis 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, lake association*

## List of Goals

- Goal 1. Support the fishery in Curtis Lake.
- Goal 2. Protect native plants in Curtis Lake.
- Goal 3. Prevent AIS from becoming established in Curtis Lake.
- Goal 4. Identify and inform others of quality habitat in and near Curtis Lake.
- Goal 5. Learn more about water quality in Curtis Lake and reduce nutrient input to the lake.
- Goal 6. Protect and restore healthy, stable shoreland habitats in and around Curtis Lake.
- Goal 7. Explore and utilize resources for healthy lake management.
- Goal 8. Users of Curtis Lake will appreciate and respect the lake and recreate responsibly.
- Goal 9. Provide opportunities for communication with lake users to keep visitors and residents informed about responsible lake stewardship and encourage involvement.
- Goal 10. Curtis Lake will have an up-to-date, accurate and comprehensive lake management plan that is reviewed annually and documents all management activities and effects.

### **2016 Priority Goals:**

#### **Goal 1. Support the fishery in Curtis Lake.**

**Objective 1.2.** Consider recommendations by WDNR fisheries biologist.

1. Discuss results of 2016 spring electrofishing with WDNR fisheries biologist and consider recommendations.

#### **Goal 2. Protect native plants in Curtis Lake.**

**Objective 2.2.** Periodically monitor macrophyte distribution and abundance and evaluate options.

1. Verify species of milfoil present in Curtis Lake. Most recent plant survey did not characterize milfoil abundance as perceived by residents.
2. Conduct informal aquatic plant surveys to qualitatively monitor macrophyte abundance (particularly milfoil).

**Goal 5. Learn more about water quality in Curtis Lake and reduce nutrient input to the lake.**

**Objective 5.1.** Routinely monitor water quality for lake and human health. Maintain median summer phosphorus concentrations less than 20 ug/L and inorganic nitrogen concentrations will be less than 0.3 mg/L in the spring.

1. Disseminate information to Curtis Lake residents regarding water quality.
2. Encourage Curtis Lake residents to test their drinking/well water. Consider a group sample submission.

**Goal 6. Protect and restore healthy, stable shoreland habitats in and around Curtis Lake.**

**Objective 6.1.** Shoreland property owners will protect healthy shorelands around Curtis Lake and restore in areas in need.

1. Provide information to property owners about the importance of maintaining vegetation/trees on the shoreline. Include technical and financial sources.
2. Provide information to property owners about proper erosion control methods on steep shorelines during new construction or lake access design.

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.

<b>Resource</b>	<b>Acronym</b>
<b>Clean Boats, Clean Waters</b>	<b>CBCW</b>
<b>Citizen Lake Monitoring Network</b>	<b>CLMN</b>
<b>UWSP Center for Watershed Science and Education</b>	<b>CWSE</b>
<b>Wisconsin Department of Agriculture, Trade and Consumer Protection</b>	<b>DATCP</b>
<b>North Central Conservancy Trust</b>	<b>NCCT</b>
<b>USDA Natural Resources Conservation Service</b>	<b>NRCS</b>
<b>Golden Sands Resource Conservation &amp; Development Council, Inc.</b>	<b>RC&amp;D</b>
<b>University of Wisconsin Extension</b>	<b>UWEX</b>
<b>University of Wisconsin-Stevens Point</b>	<b>UWSP</b>
<b>Waushara County Land Conservation Department</b>	<b>WCLCD</b>
<b>Waushara County Parks Department</b>	<b>WCPD</b>
<b>Waushara County Watershed Lakes Council</b>	<b>WCWLC</b>
<b>Wisconsin Department of Natural Resources</b>	<b>WDNR</b>
<b>Wisconsin Department of Transportation</b>	<b>WDOT</b>
<b>UWSP Water and Environmental Analysis Laboratory</b>	<b>WEAL</b>

Contact information for organizations and individuals who support lake management in Waushara County can be found in Appendix A. Waushara County Lake Information Directory.

## In-Lake Habitat and a Healthy Lake

Many lake users value Curtis Lake for its fishing, wildlife, and good water quality. These attributes are all interrelated; 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 Curtis 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.

Lake users report that the fishery is strong with no recollection of any winter fish kills. Based on the shoreland survey results, the shoreland habitat ranked high. At the time of the development of this plan, Curtis Lake did not have any recent information or management plan related to the fish community. The lake was last surveyed in 1987, using large lake seining. The Fishery Biologists with the WDNR conducted an electrofishing survey of Curtis Lake in May 2016. During communication with the biologists they indicated that the fishery is dominated by largemouth bass and bluegill, but they also caught a fair number of pumpkinseeds (panfish). All had decent size structure but densities were a little on the low side. In addition they black crappie, yellow perch, rock bass, yellow bullhead, green sunfish and northern pike. A report of the summarized data can be found in Appendix E. 2016 Fishery Survey Results.

According to WDNR records, trout were stocked between 1957 and 1962. Northern pike originating from Rush Lake were stocked in Curtis Lake in the early 1970s until 1981. There is no indication that additional stocking would be necessary.

### Guiding Vision for the Fish Community

*Curtis Lake will have a robust, healthy and sustainable fishery.*

#### Goal 1. Support the fishery in Curtis Lake.

##### Objective 1.1. The near shore areas of Curtis Lake should provide sufficient habitat to support a healthy fishery.

Actions	Lead person/group	Resources	Timeline
Work with lakefront property owners to install additional woody habitat around the lake such as tree drops, fish sticks, and Christmas trees/brush bundles beneath docks.	Shoreland property owners Fishing clubs Lake users	WDNR Fisheries Biologist UWEX Lakes	Ongoing
Lakefront property owners will work to maintain healthy shorelands (see <b>Shorelands</b> section).	Shoreland property owners	WDNR Fisheries Biologist	Ongoing

##### Objective 1.2. Consider recommendations by WDNR fisheries biologist.

Actions	Lead person/group	Resources	Timeline
Discuss results of spring electrofishing with WDNR fisheries biologist and consider recommendations.	Interested individual(s)	WDNR Fisheries Biologist	2016

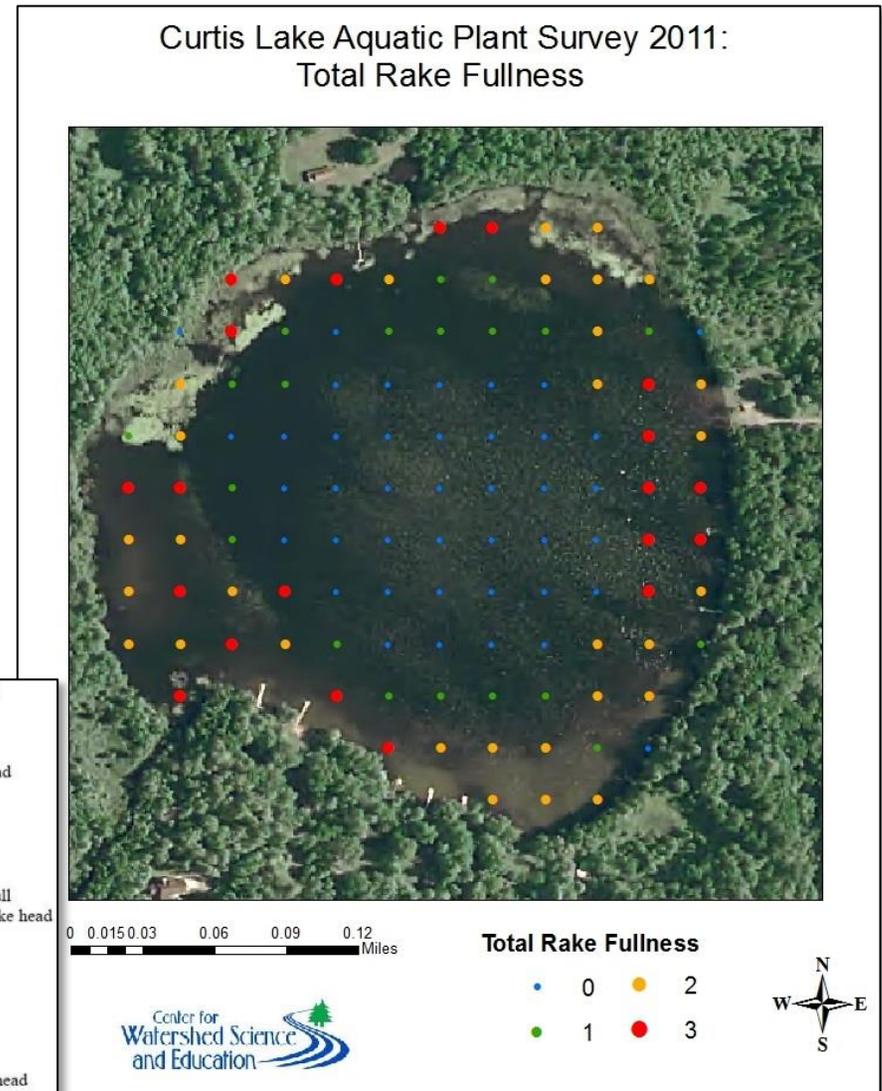
## Aquatic Plants

Aquatic plants provide the forested landscape within Curtis 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. The aquatic plants that attract the animals to these areas contribute to the beauty of the shoreland and lake.

An aquatic plant survey was conducted on Curtis Lake on July 20 and 21, 2011 by staff from UWSP. Seventeen species of aquatic plants were observed, which is average when compared with other Waushara County lakes in the study. The greatest diversity occurred in the northeastern part of the lake. Eighty percent (71 of 89) of the sites sampled had vegetative growth with the average depth of plants located at 9 feet and the deepest plants found at 22 feet. The dominant plant species in the survey were muskgrass (*Chara* spp.) which occurred at 59% of the sites, southern naiad (*Najas guadalupensis*) which occurred at 42% of the sites, and coontail (*Ceratophyllum demersum*) which occurred at 24% of the vegetated sites. More detailed information

Rating	Coverage	Description
1		A few plants on rake head
2		Rake head is about 1/2 full Can easily see top of rake head
3		Overflowing Cannot see top of rake head



can be found in Appendix D. Aquatic Plants; *Aquatic Plant Survey of Curtis Lake, Waushara County*; and, *Waushara County Lakes Study – Curtis Lake*.

Most survey respondents do not feel that the plant growth present in Curtis Lake limited their recreational opportunities and almost two-thirds felt that any active aquatic plant control was not necessary. All survey respondents recognized the native plants’ benefit to erosion control, fish habitat and water quality. Their biggest concern was potential infestation by aquatic invasive species.

### Guiding Vision for Aquatic Plants in Curtis Lake

*Curtis Lake will have a healthy and diverse native aquatic plant community that provides habitat and clean water.*

#### Goal 2. Protect native plants in Curtis Lake.

**Objective 2.1.** Avoid disturbing native aquatic plants as much as possible.

Actions	Lead person/group	Resources	Timeline
Refrain from removing vegetation in and around the lake. If removal is necessary, approach with limited hand pulling in small areas around a dock. Closely monitor any disturbed areas for establishment of invasive species.	Shoreland property owners	WCWLC UWEX Lakes	Ongoing
Minimize removal and disturbance of native vegetation by providing informational materials (in an annual mailing, website re: mitigation methods available).	Shoreland property owners	WCWLC WC UWEX UWEX Lakes	Ongoing
Inform property owners to refrain from using fertilizers and implement runoff management techniques such as rain gardens, rain barrels and increased shoreland vegetation on shoreland properties to prevent the growth of dense plant beds and algae (see Shoreland Section of this plan).	Shoreland property owners	UWEX Lakes WCWLC	Ongoing

**Objective 2.2.** Periodically monitor aquatic plant distribution and abundance and evaluate options.

Actions	Lead person/group	Resources	Timeline
Verify species of milfoil present in Curtis Lake. Most recent plant survey did not characterize EWM overabundance as perceived by residents.	Individuals	WDNR Lake Manager RC&D WCLCD	Annually
Conduct informal aquatic plant surveys to qualitatively monitor aquatic plant abundance (particularly milfoil).	Individuals	WDNR Lake Manager RC&D WCLCD	As needed

### ***Aquatic Invasive Species (AIS)***

Aquatic invasive 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. If an invasive plant species not previously documented in Curtis Lake is suspected or observed by any lake user, the lake user is encouraged to refer to Appendix C for more information on how to report it.

#### **Examples of AIS found in some Waushara County Lakes.**

##### **Curly-leaf pondweed and Eurasian watermilfoil**



## Guiding Vision for Aquatic Invasive Species

*Curtis Lake will be free of aquatic invasive species due to proactive actions.*

### Goal 3. Prevent AIS from becoming established in Curtis Lake.

#### Objective 3.1. Promote community awareness about AIS.

Actions	Lead person/group	Resources	Start/end dates
Organize educational AIS identification program. Explore working with local school groups including Amish children.	Individuals	RC&D	2016 and ongoing
Ensure signage at the boat launch includes information about preventing AIS spread.	Town of Dakota Individuals	RC&D UWEX Lakes	Ongoing
Distribute information door-to-door about keeping AIS out of Curtis Lake.	Individuals	RC&D CBCW	Ongoing
Include information about the threat of AIS 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 Curtis Lake.	WCWLC Individuals	WCEX RC&D CBCW	Ongoing

#### Objective 3.2. Monitor for AIS in Curtis Lake.

Actions	Lead person/group	Resources	Start/end dates
Learn how to identify and monitor for aquatic invasive species (AIS).	Individuals	RC&D	Ongoing
Monitor routinely for early AIS outbreaks. Explore working with local school and Amish groups.	Individuals	RC&D Consultants	Ongoing
Host a Clean Boats, Clean Waters workshop to organize volunteers to monitor boat launch during busy boating weekends.	Individuals WC Parks Dept.	RC&D CBCW	Ongoing

#### Objective 3.3. Be prepared to respond to AIS outbreaks.

Actions	Lead person/group	Resources	Start/end dates
If AIS is suspected, act quickly and Refer to the AIS Rapid Response Plan (Appendix C).	Individuals	WDNR Lake Manager RC&D Consultants	Ongoing

## 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 Curtis Lake does not have an official critical habitat area designation, there are areas within Curtis 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.



Photo: NPS

## Guiding Vision Curtis Lake’s Critical Habitat

*Curtis Lake’s sensitive areas will be enhanced and protected from degradation.*

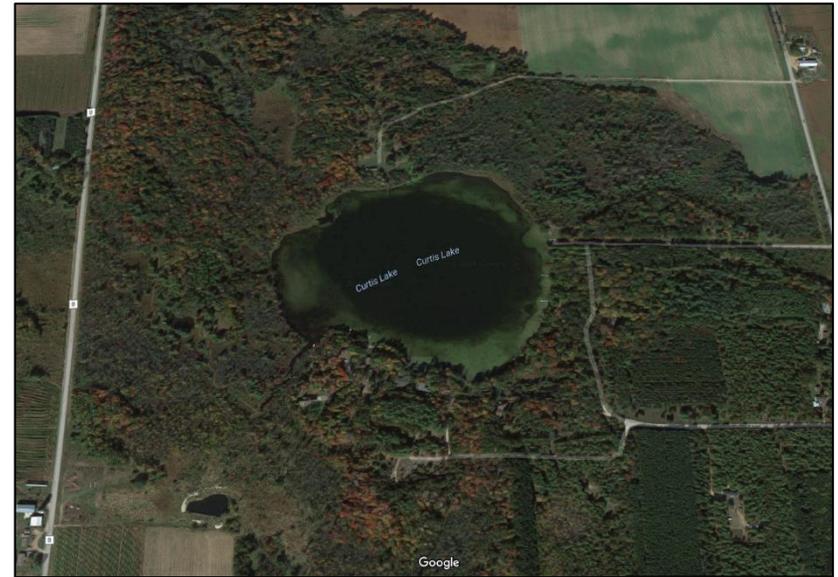
### Goal 4. Identify and inform others of quality habitat in and near Curtis Lake.

**Objective 4.1.** Explore options for official identification of important habitat areas to inform others and to better protect habitat in Curtis Lake.

Actions	Lead person/group	Resources	Timeline
Request critical habitat designations from WDNR.	Individuals	WDNR Lake Specialists	
If critical habitat is designated on Curtis Lake, communicate to property owners, visitors, and Town Board as to why these areas are important.	Individuals	WDNR Critical Habitat Report	Ongoing

## 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 Curtis 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 Curtis Lake was assessed by measuring different characteristics including temperature, dissolved oxygen, water clarity, and water chemistry. All of these factors were taken into consideration when management planning decisions were made.

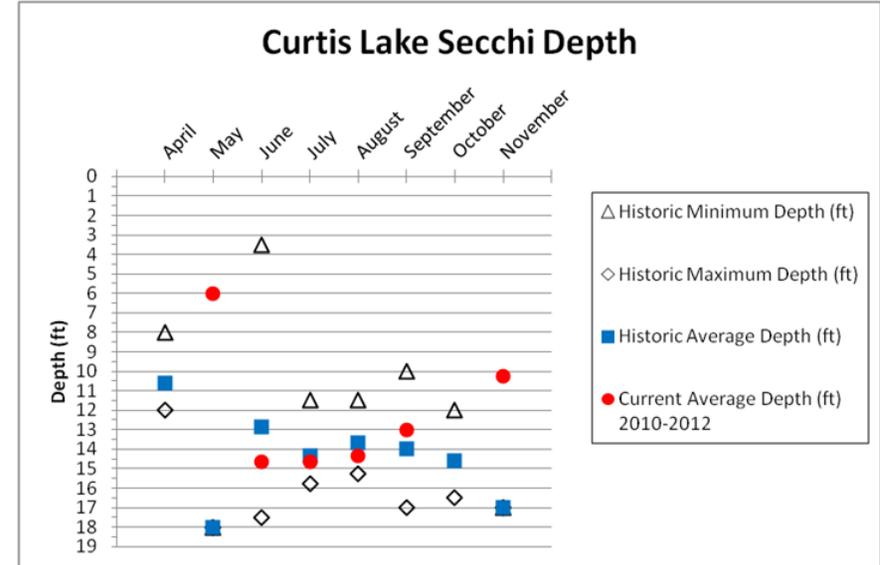
## Water Quality

A variety of water chemistry measurements were used to characterize the water quality in Curtis 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 Curtis Lake's water quality.

Dissolved oxygen is an important measure in Curtis 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 study, dissolved oxygen in Curtis Lake was uniform from surface to bottom when the fall 2011 concentrations were measured. The dissolved oxygen in Curtis Lake was greater at the surface and declined with depth. Concentrations fell below 5 mg/L at depths of approximately 17 feet. Over winter (February 2011), dissolved oxygen concentrations also declined with depth and fell below 5 mg/L at depths near 10 feet.

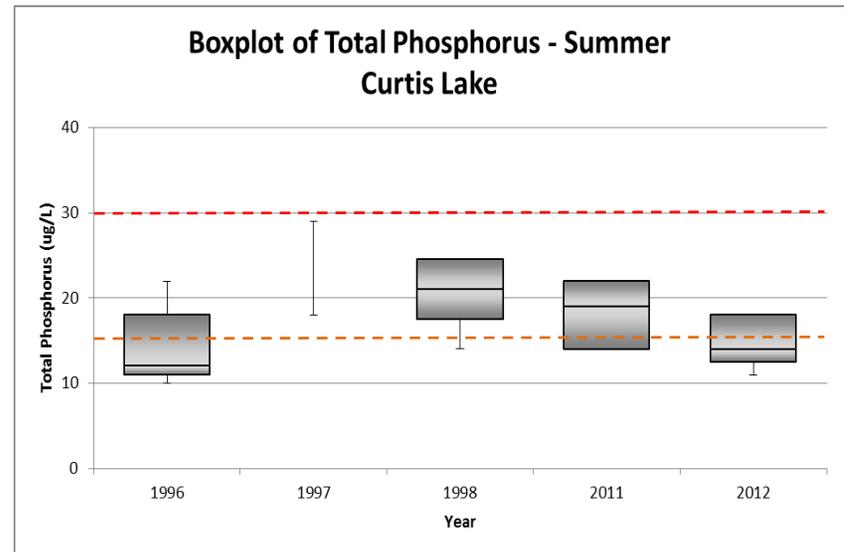
The water clarity measured in Curtis Lake during the study was considered good. For Curtis Lake, water clarity ranged from 6 to 17.5 feet during the two-year monitoring period. Water clarity in Curtis Lake is typically slightly poorer during the summer months with the shallowest Secchi depth reading recorded in late summer. When compared with historic data, the average water clarity measured during the study was slightly better in June and August, slightly poorer in May, September, and November, and the same in July. Historic data utilized in this analysis was collected between 1992 and 1998.

Chloride, sodium and potassium 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. Curtis Lake had moderate average chloride, potassium, and sodium concentrations over the monitoring period, which indicates that the water quality in Curtis Lake is influenced by activities in its watershed. Although these elements are not detrimental to the aquatic ecosystem, they 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.

Over the 2010-2012 monitoring period, total phosphorus concentrations for Curtis Lake ranged from a high of 50 ug/L in May 2012 to a low of 11 ug/L in August 2012. The summer median total phosphorus for Curtis Lake was 19 and 14 ug/L in 2011 and 2012, respectively. This is below Wisconsin’s phosphorus standard of 30 ug/L for deep drainage lakes such as Curtis Lake.



Of the lakes in the Waushara County Lakes Study, Curtis Lake had some of the highest nitrate (NO<sub>2</sub>+NO<sub>3</sub>-N) concentrations. In a lake, nitrate can be readily used by plants, thereby increasing the growth of aquatic plants and some types of algae. These concentrations were high enough in all seasons to enhance algal blooms throughout the summer (Shaw et al., 2000). Sources of nitrate include fertilizers, septic systems, and animal waste. The nitrate is likely moving to the lake in groundwater. Water users around and upgradient of Curtis Lake should have water from their private wells tested to determine if nitrate levels exceed the federal drinking water standard.

Managing nitrogen, phosphorus and soil erosion throughout the Curtis Lake watershed is one of the keys to protecting the lake itself. Nitrogen inputs to Curtis 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. 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.

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

## Guiding Vision for Water Quality in Curtis Lake

*Curtis Lake will have good water quality and water clarity.*

### Goal 5. Learn more about water quality in Curtis Lake and reduce nutrient input to the lake.

**Objective 5.1.** Routinely monitor water quality for lake and human health. Maintain median summer phosphorus concentrations less than 20 ug/L and inorganic nitrogen concentrations will be less than 0.3 mg/L in the spring.

Actions	Lead person/group	Resources	Timeline
Disseminate information to Curtis Lake residents regarding water quality.	Individuals	UWEX Lakes UWSP CWSE	Ongoing
Encourage Curtis Lake residents to test their drinking/well water. Consider a group sample submission.	Individuals	WEAL Certified Labs	Annually
In early spring, have sample lake water for analysis of inorganic nitrogen.	Individuals	WEAL Certified labs	As needed
Establish a volunteer water quality monitoring program to include water clarity measurements from spring to fall and analysis of total phosphorus (May-Sept) to evaluate changes over time. Phosphorus samples should be collected according to WisCALM guidance.	Individual	CLMN Coordinator	2016 and ongoing
Monitor dates of ice on/ice off.	Individuals	CLMN Coordinator	Annually
Submit all lake data to the WDNR's SWIMS database for use and storage.	Individuals	CLMN Coordinator	As collected
Explore possibilities for further monitoring initiatives such as surface and groundwater monitoring for contaminants and other Waushara County lakes through public/government sector with findings provided to stakeholders.	Individuals	WDNR Lake Manager WEAL	Ongoing

**Objective 5.2.** Develop strategies to ensure healthy land management within the Curtis Lake watershed.

Actions	Lead person/group	Resources	Timeline
See <b>Watershed</b> section.			

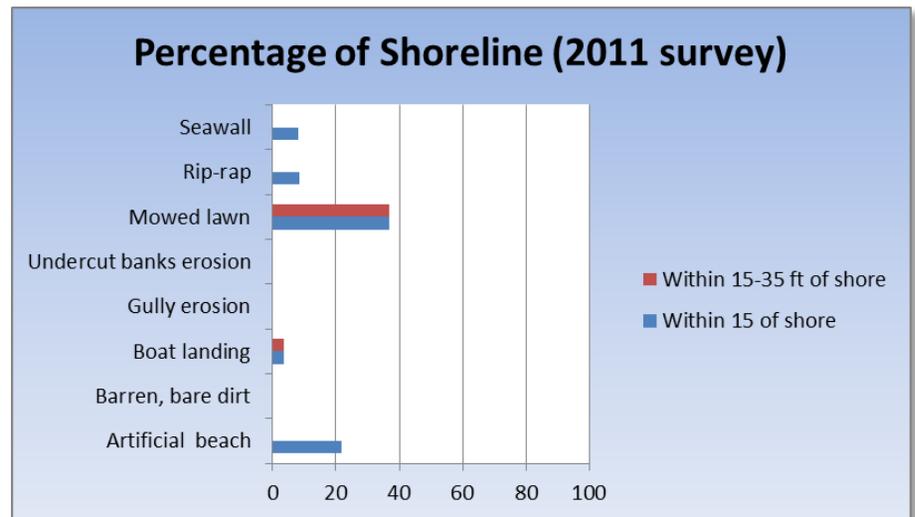
## Shorelands

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 Waushara County lakes, shorelands were evaluated. The survey inventoried the type and extent of shoreland vegetation. Areas with erosion, rip-rap, barren ground, sea walls, structures and docks were also inventoried. A scoring system was developed for the collected data to provide a more holistic assessment. Areas that are healthy will need strategies to keep them healthy, and areas with potential problem areas and where management and conservation may be warranted may need strategies for improvement. The scoring system is based on the presence/absence and abundance of shoreline features, as well as their proximity to the water's edge. Values were tallied for each shoreline category and then summed to produce an overall score. Higher scores denote a healthier shoreline with good land management practices. These are areas where protection and/or conservation should be targeted. On the other hand, lower scores signify an ecologically unhealthy shoreline. These are areas where management and/or mitigation practices may be desirable for improving water quality and habitat.

The summary of scores for shorelands around Curtis Lake is displayed on the map in Appendix B. Shoreland Survey – 2011. Long stretches of Curtis Lake's shorelands are in good shape, but a few segments have challenges that should be addressed. There were no stretches of Curtis Lake's shoreland ranked as poor.

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 wide 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 Curtis Lake’s Shorelands

*Curtis Lake will have shorelands that provide privacy, aesthetics, quality habitat and water quality benefits.*

### Goal 6. Protect and restore healthy, stable shoreland habitats in and around Curtis Lake.

**Objective 6.1.** Shoreland property owners will protect healthy shorelands around Curtis Lake and restore in areas in need.

Actions	Lead person/group	Resources	Timeline
Provide information to property owners about the importance of maintaining vegetation/trees on the shoreline. Include technical and financial sources.	Individuals	UWEX Lakes WCLCD WCWLC	Ongoing
Provide information to shoreland property owners about proper erosion control methods on steep shorelines during new construction or lake access design.	Individuals	WCLCD WC UWEX	Ongoing
Ensure the shoreland on the County land is managed in a way that reduces runoff and provides habitat while providing public use.	WC Parks	WCLCD WDNR Healthy Lakes Grants	
Explore strengthening language about near shore protection in zoning regulations around Curtis Lake.	Individuals	WCWLC Wisconsin Lakes	When allowable

## Watershed Land Use

It is important to understand where Curtis 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 Curtis 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.

The surface watershed for Curtis Lake is 804 acres. Primary land use is agriculture and forests (Figure 1). The lake's shoreland is surrounded primarily by forests, wetlands and residences. In general, the land closest to the lake has the greatest immediate impact on water quality.

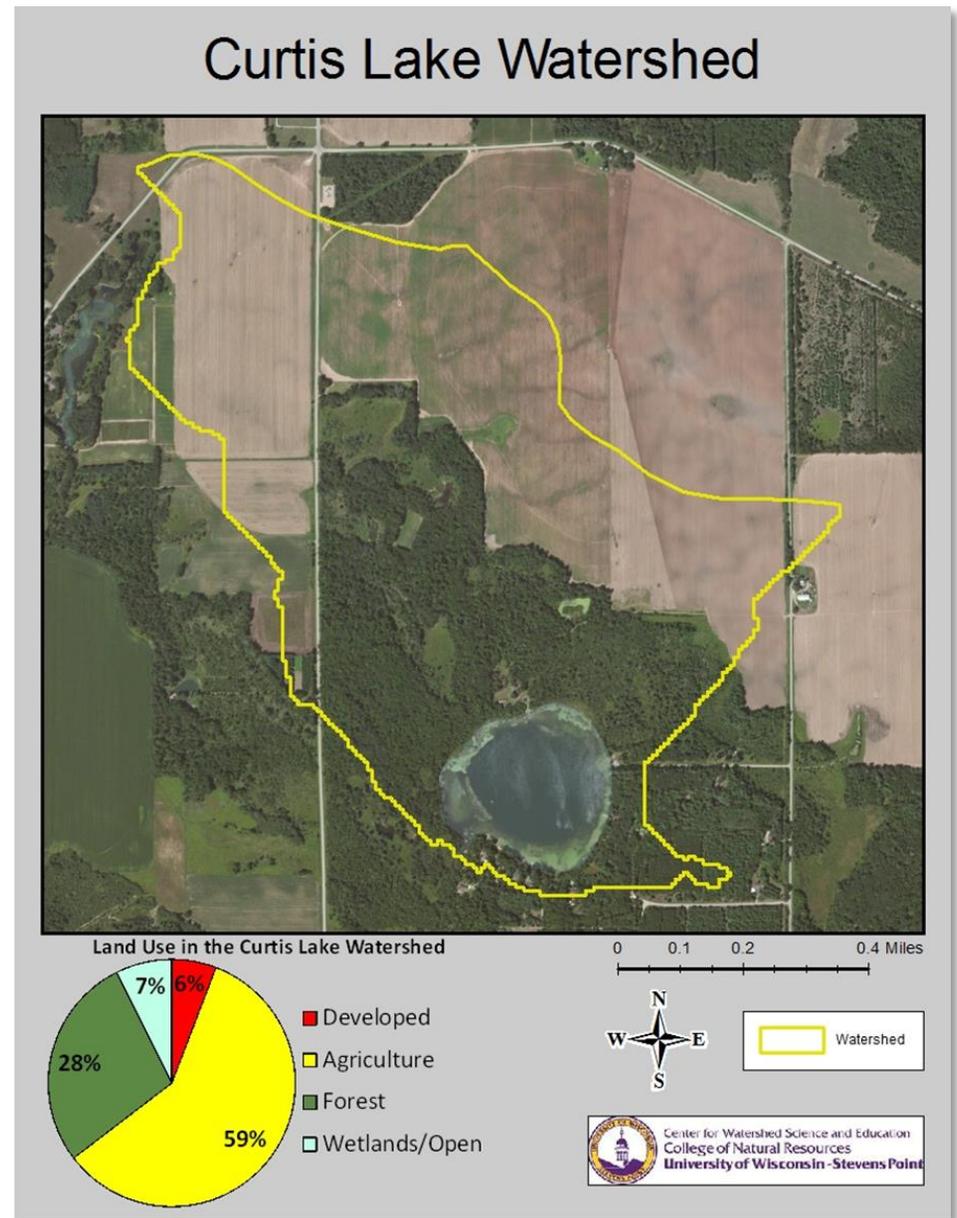
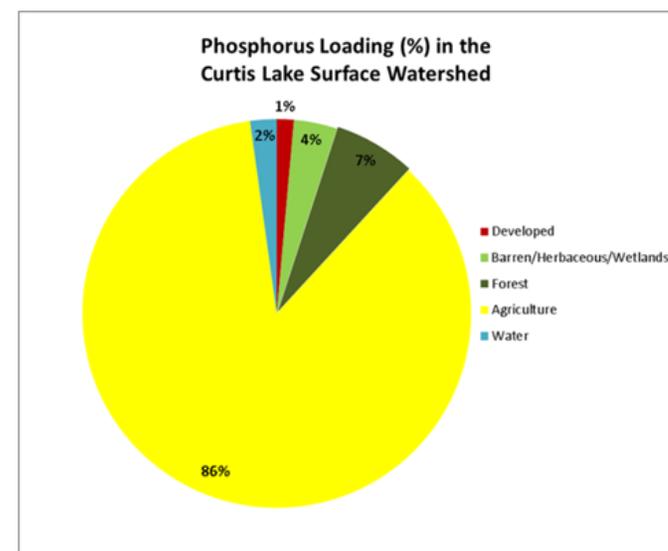


Figure 1. Surface watershed of Curtis Lake.

Estimates of phosphorus from the landscape can help to understand the phosphorus sources to Curtis Lake. 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 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. Based on modeling results, developed land and agriculture had the greatest percentages of phosphorus contributions from the watershed to Curtis Lake. The phosphorus export coefficients have been obtained from studies throughout Wisconsin (Panuska and Lillie, 1995). Modeling results indicate that agriculture contributes approximately 86% of the phosphorus load to the lake.



### Guiding Vision for Curtis Lake’s Watershed

*Land within the Curtis Lake watershed will be managed in a way that supports clean water and a healthy lake.*

#### Goal 7. Explore and utilize resources for healthy lake management.

**Objective 7.1.** Support healthy land management activities around Curtis lake.

Actions	Lead person/group	Resources	Timeline
The County will support property owners with water quality based Best Management Practices (BMPs) within the watershed, especially those that lead to reduced leaching of nitrogen to groundwater.	WCLCD	NRCS WC Board	Ongoing
Continue to use WCLCD as a resource for good land management practices.	Watershed property owners	WCLCD	Ongoing
Support landowners interested in the protection of their land via a conservation program (i.e. Conservation Easement or Purchase of Development Rights).		NCCT NRCS WDNR Lake Protection Grants	Ongoing

## 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 positive impacts on the lake and on those who enjoy this common resource. Collaborative efforts may have bigger positive impacts; 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

Curtis Lake is enjoyed by people who swim, boat, fish, and appreciate its beauty. Participants at the planning sessions and survey respondents indicated that the quiet and solitude is what they appreciate most about Curtis Lake. Curtis Lake Road leads to the County Park on the east side of the lake. The park provides visitors access to the lake to swim and via a boat landing. The park offers picnic tables, grills, playground equipment, and a restroom. Curtis Lake is a “no wake” lake and if motors are used on the lake they must be electric. Some of the planning participants inquired about the removal of electric motors from the lake to help maintain its peaceful setting.



### Guiding Vision for Recreation

*Curtis Lake will remain a place of solitude and quiet recreation.*

**Goal 8. Users of Curtis Lake will appreciate and respect the lake and recreate responsibly.**

**Objective 8.1.** Provide lake users with information and rules necessary to make responsible decisions.

<b>Actions</b>	<b>Lead person/group</b>	<b>Resources</b>	<b>Timeline</b>
Maintain signage at boat landings and around the lake with important lake, recreation, and habitat information.	Waushara County Parks Town of Richford	WDNR	Ongoing
Support enforcement of current fishing regulations (i.e. valid fishing license, bag limits, ice fishing regulations re: fish shanties, bag limit, tip-ups, etc.).	Lake users	WDNR Warden	Ongoing
Work with WCPD to play a larger role in lake stewardship including assisting with CBCW inspection and monitoring park usage.	Individuals	WCPD	Ongoing
Explore ordinances that would restrict the use of electric motors on Curtis Lake.	Individuals	Town of Richford	

## Communication and Organization

Working together on common values will help to achieve the goals that are outlined in this plan. To date, no formal group of lake stewards has been formed for Curtis Lake, which may lead to impediments in tackling some of the actions in this plan. Therefore, developing a means for locals to communicate about Curtis Lake is strongly advised. 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 Curtis Lake enjoyed by many people.

### Guiding Vision for Communication

*Curtis Lake residents will maintain and build communications internally and within the community.*

#### Goal 9. Provide opportunities for communication with lake users to keep visitors and residents informed about responsible lake stewardship and encourage involvement.

**Objective 9.1.** Distribute important lake information to residents and lake visitors.

Actions	Lead person/group	Resources	Timeline
Have door-to-door conversations with neighbors to help develop communication around the lake.	Individuals	WC UWEX	Ongoing
Have an annual meeting of Curtis Lake area residents initiated by the Town.	Town of Richford	WC UWEX	2016 and ongoing
Continue distribution of a welcome packet to all new shoreland owners via WC or WCWLC.	WCWLC	WC	As needed.

**Objective 9.2.** Keep informed about lake-related topics and communicate with other lake stewards and professionals.

Actions	Lead person/group	Resources	Timeline
Network, learn, and work with other lake groups in Waushara County. Consider membership with the WCWLC or attending meetings of interest.	Individuals	WC UWEX WCWLC	Ongoing
Encourage shoreland property owners and elected officials to keep current about lake topics by receiving "Lake Tides" newsletter.	Individuals	UWEX Lakes	Ongoing
Attend the Wisconsin Lakes Convention to continue learning about lake-related topics and network with others.	Individuals Elected officials		Annually in spring
Attend the Wisconsin Lake Leader's Institute.	Individuals	UWEX Lakes	Typically in even numbered years.

## 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

*The lake management plan for Curtis Lake will be reviewed annually and updated as needed.*

**Goal 10. Curtis Lake will have an up-to-date, accurate and comprehensive lake management plan that is reviewed annually and documents all management activities and effects.**

**Objective 10.1.** Communicate updates to community members and lake users.

Actions	Lead person/group	Resources	Timeline
Residents gather once a year to review and update the lake management plan.	Individuals	Town of Richford WC UWEX	Annually

## **Governance**

*Written by Patrick Nehring, Community Agent, UW-Extension Waushara County.*

### **Lake Management Plan Approval**

The draft lake management plan will be completed by the lake association/district board, a committee, or a committee of the whole. The final draft of the lake management plan will be approved through a vote of the lake association/district membership or board. The final draft will be approved by the Wisconsin Department of Natural Resources (DNR) to have met the lake management plan requirements and grant requirements. If the DNR requires modifications or additional information before approving the plan, the plan will be changed to meet DNR requirements that are acceptable to the lake association/district. The completed plan that has been approved by the lake association/district and the DNR will be presented to the municipalities containing the lake and Waushara 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/>. Waushara County offers technical and financial assistance through the Land Conservation 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.

### **Lake Regulations**

The lake management plan is superseded by federal, state, county, and municipal laws and court rulings. However, the lake management plan may influence county and municipal ordinances and enforcement, which is why the lake management plan will be reviewed and included or referenced in the county and related municipal comprehensive plans. 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 court system interprets these rules and regulations. The rules and regulations are primarily enforced by the US Army Corps of Engineers, the Wisconsin Department of Natural Resources, the Waushara County Sheriff Department, and the Waushara County Land Conservation and Zoning Office. If considering development near or on a lake, addressing problem plants or animals, or changing the lake bottom contact the Waushara County Land Conservation & Zoning Department at the Waushara County Courthouse (920) 787-0443 and/or the Wisconsin Department of Natural Resources (888) 936-7463.

## Comprehensive Plans

The lake management plan and changes to the plan will be presented to the County and the Municipality for review and possible incorporation into their comprehensive plans. The comprehensive plan is intended to be used to guide future decision. Zoning, subdivision, and official mapping decisions must be consistent with the comprehensive plan.

### Process for Inclusion in the Municipal Comprehensive Plan

The Municipal Plan Commission will review the lake management plan to determine if it is consistent with the municipality's comprehensive plan. If the lake management plan is found by the Municipal Plan Commission to not be consistent with the municipality's comprehensive plan, the plan commission may (a) recommend changes to the comprehensive plan or (b) ask that an aspect of the lake management plan be revisited. When the Municipal Plan Commission has reached a consensus that the lake management plan aligns with the municipality's vision, the Municipal Plan Commission will develop an amendment to the comprehensive plan referencing the lake management plan. This could include a reference to the lake management plan under local policies in the agricultural, natural and cultural resources background information and the addition of a recommendation to support the lake management plan and to implement the applicable recommendations contained in the lake management. The Municipal Plan Commission will recommend by resolution that the amendment to the comprehensive plan be adopted by the Municipal Board. A public hearing on the changes to the comprehensive plan will be held with a thirty-day class one notice. The Municipal Board will consider the recommendations from the Municipal Plan Commission. The Municipal Board may (a) adopt the recommendations to the comprehensive plan by ordinance, (b) adopt by ordinance the recommendations with changes, or (c) request the plan commission revisit the changes to the comprehensive plan.

### Process for Inclusion in the County Comprehensive Plan

Waushara County Land Use Committee will review the updates to the municipality's comprehensive plan and the lake management plan as referenced by the municipality's comprehensive plan to determine if they are consistent with the County's comprehensive plan. If they are found by the land use committee to not be consistent with the municipality's comprehensive plan, the land use committee may (a) recommend changes to the County's comprehensive plan or (b) ask that an aspect of the lake management plan or municipality's comprehensive plan be revisited. When the Land Use Committee has reached a consensus that the updates to the municipality's comprehensive plan and the lake management plan aligns with the county's vision, and if it is not already consistent, it will develop an amendment to the County's comprehensive plan. The amendment may include a reference to the lake management plan under local policies in the agricultural, natural and cultural resources background information and the addition of a recommendation to support the lake management plan and to implement the applicable recommendations contained in the lake management. The Land Use Committee will recommend the amendment to the comprehensive plan to the Land, Water, and Education Committee.

The Land, Water, and Education Committee will review the amendment and if it concurs with the recommendation from the Land Use Committee, it will make a recommendation to the Planning & Zoning Committee. The Planning & Zoning Committee will hold a public hearing with a thirty-day class one notice. The Planning & Zoning Committee will recommend by resolution the amendment to the comprehensive plan or the amendment with changes be adopted by the County Board.

The County Board will consider the recommendations from the Planning & Zoning Committee. The County Board may (a) adopt the amendment to the comprehensive plan by ordinance, (b) adopt the amendment with changes, or (c) request the Land Use Committee or Planning & Zoning Committee revisit the changes to the comprehensive plan.

#### **Use of the Comprehensive Plan**

The lake management plans as referenced in the comprehensive plans will be used by the County and the Municipality to consider certain actions or in the implementation of zoning and other applicable regulations. The County Board of Adjustments and the County Planning and Zoning Committee may reference the lake management plans as referenced in the comprehensive plan when considering zone changes, variances, conditional uses, and suitable mitigation measures. The Municipality and County may take action as called for in the lake management plan as referenced in the comprehensive plan, including changes to zoning and other applicable regulations, shortly after the County's comprehensive plan has been updated or may take action as needed.

The lake organization, lake residents, riparian property owners, or other citizens may request that the Municipality or County take a specific action to implement aspects of the lake management plan as referenced in the comprehensive plan. The lake organization lake residents, riparian property owners, or other citizens may provide written or oral support to encourage the Municipality and County to reference the lake management plan when considering regulation or action that may impact the lake. The lake organization will inform the Municipality and the County when the lake management plan is updated and allow the Municipality and County an opportunity to participate in the update process.

## References

- Boat Ed, 2013. The Handbook of Wisconsin Boating Laws and Responsibilities. Approved by Wisconsin Department of Natural Resources. [www.boat-ed.com](http://www.boat-ed.com)
- Borman, Susan, Robert Korth, and Jo Temte, 2001. Through the looking glass, a field guide to aquatic plants. Reindl Printing, Inc. Merrill, Wisconsin.
- Bunde, Scott, 2015. *Fish Community, Habitat and Fishery of Curtis and Witters Lakes*. Presentation given December 3, 2015 at the Dakota Town Hall.
- Haney, Ryan, 2016. *Water Quality in Curtis and Witters Lakes*. Presentation given January 14, 2016 at the Dakota Town Hall.
- Kraft, George, 2015. *Groundwater Withdrawal and Lake Levels*. Presentation given December 3, 2015 at the Dakota Town Hall.
- Panuska and Lillie, 1995. Phosphorus Loadings from Wisconsin Watershed: Recommended Phosphorus Export Coefficients for Agricultural and Forested Watersheds. Bulletin Number 38, Bureau of Research, Wisconsin Department of Natural Resources.
- Shaw, B., C. Mechenich, and L. Klessig, 2000. *Understanding Lake Data*. University of Wisconsin-Extension, Stevens Point. 20 pp.
- Turyk, Nancy, 2015. *Aquatic Plants and Invasive Species in Curtis and Witters Lake*. Presentation given October 29, 2015 at the Dakota Town Hall.
- Turyk, Nancy, 2015. *Healthy Shorelands*. Presentation given December 3, 2015 at the Dakota Town Hall.
- Turyk, Nancy, 2016. *Healthy Land = Healthy Water*. Presentation given January 14, 2016 at the Dakota Town Hall.
- UW-Stevens Point Center for Watershed Science and Education, 2014. Waushara County Lake Study - Curtis Lake 2010-2012. Final Report to Waushara County and Wisconsin Department of Natural Resources.
- UW-Stevens Point Center for Watershed Science and Education, 2013. Waushara County Lake Study - Curtis Lake 2010-2012 Mini-Report. Report to Waushara County and Wisconsin Department of Natural Resources. Planning Meeting Presentations
- Vallentyne, J.R., 1974. The Algal Bowl-Lakes and Man. Ottawa Department of the Environment.
- Wetzel, R.G., 2001. Limnology, Lake and River Ecosystems, Third Edition. Academic Press. San Diego, California.

# Appendices

## Appendix A. Waushara County Lake Information Directory

### Algae - Blue-Green

Contact: Ted Johnson  
Wisconsin Department of Natural Resources  
Phone: 920-424-2104  
E-mail: [TedM.Johnson@wisconsin.gov](mailto:TedM.Johnson@wisconsin.gov)  
Website: <http://dnr.wi.gov/lakes/bluegreenalgae/>

Contact: Wisconsin Department of Health Services  
1 West Wilson Street, Madison, WI 53703  
Phone: 608-267-3242  
Website:  
<http://www.dhs.wisconsin.gov/eh/bluegreenalgae/contactus.htm>

### Aquatic Invasive Species/Clean Boats Clean Water

Contact: Golden Sands RC&D  
1100 Main St., Suite 150, Stevens Point, WI 54481  
Phone: 715-343-6215  
Websites: [www.goldensandsrcd.org](http://www.goldensandsrcd.org)  
<http://dnr.wi.gov/invasives/>

### Aquatic Plant Management (Native and Invasive)

Contact: Ted Johnson  
Wisconsin Department of Natural Resources  
Phone: 920-424-2104  
E-mail: [TedM.Johnson@wisconsin.gov](mailto:TedM.Johnson@wisconsin.gov)  
Website: <http://dnr.wi.gov/lakes/plants/>

### Aquatic Plant Identification

Contact: Golden Sands RC&D  
1100 Main St., Suite 150, Stevens Point, WI 54481  
Phone: 715-343-6215  
Website: [www.goldensandsrcd.org](http://www.goldensandsrcd.org)

Contact: Dr. Emmet Judziewicz  
UWSP Freckmann Herbarium  
TNR 301, 800 Reserve St., Stevens Point, WI 54481  
Phone: 715-346-4248  
E-mail: [ejudziew@uwsp.edu](mailto:ejudziew@uwsp.edu)

Contact: Ted Johnson  
Wisconsin Department of Natural Resources  
Phone: 920-424-2104  
E-mail: [TedM.Johnson@wisconsin.gov](mailto:TedM.Johnson@wisconsin.gov)

### Aquatic Plant Surveys/Management

Contact: Ted Johnson  
Wisconsin Department of Natural Resources  
Phone: 920-424-2104  
E-mail: [TedM.Johnson@wisconsin.gov](mailto:TedM.Johnson@wisconsin.gov)  
Website: <http://dnr.wi.gov/lakes/plants/>

### Best Management Practices (rain gardens, shoreland buffers, agricultural practices, runoff controls)

Contact: Ed Hernandez  
Waushara County Land Conservation Department  
PO Box 1109, Wautoma, WI 54982  
Phone: 920-787-0453  
E-mail: [lcdzoning.courthouse@co.waushara.wi.us](mailto:lcdzoning.courthouse@co.waushara.wi.us)  
Website: <http://www.co.waushara.wi.us/zoning.htm>

### Boat Landings, Signage, Permissions (County)

Contact: Scott Schuman  
Waushara County Parks  
PO Box 300, Wautoma, WI 54982  
Phone: 920-787-7037  
E-mail: [wcparks.parks@co.waushara.wi.us](mailto:wcparks.parks@co.waushara.wi.us)  
Website: <http://www.co.waushara.wi.us/parks.htm>

### Boat Landings (State)

Contact: Dave Bartz  
Wisconsin Department of Natural Resources  
Hwy 22N, Box 430, Montello, WI 53949  
Phone: 608-635-4989  
E-mail: [David.Bartz@wisconsin.gov](mailto:David.Bartz@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.

### Citizen Lake Monitoring Network

Contact: Brenda Nordin  
Wisconsin Department of Natural Resources  
Phone: 920-662-5141  
E-mail: [brenda.nordin@wisconsin.gov](mailto:brenda.nordin@wisconsin.gov)

## Conservation Easements

Contact: Gathering Waters Conservancy  
211 S. Paterson St., Suite 270, Madison, WI 53703  
Phone: 608-251-9131  
E-mail: [info@gatheringwaters.org](mailto:info@gatheringwaters.org)  
Website: <http://gatheringwaters.org/>

Contact: Ted Johnson  
Wisconsin Department of Natural Resources  
Phone: 920-424-2104  
E-mail: [TedM.Johnson@wisconsin.gov](mailto:TedM.Johnson@wisconsin.gov)

Contact: Patrick Sorge  
Wisconsin Department of Natural Resources  
PO Box 4001, Eau Claire, WI 54702  
Phone: 715-839-3794  
E-mail: [Patrick.Sorge@wisconsin.gov](mailto:Patrick.Sorge@wisconsin.gov)

Contact: North Central Conservancy Trust  
PO Box 124, Stevens Point, WI 54481  
Phone: 715-344-1910  
E-mail: [info@ncctwi.org](mailto:info@ncctwi.org)  
Website: <http://www.ncctwi.org/>

Contact: NRCS Stevens Point Service Center  
1462 Strongs Ave., Stevens Point, WI 54481  
Phone: 715-346-1325

## Critical Habitat and Sensitive Areas

Contact: Ted Johnson  
Wisconsin Department of Natural Resources  
Phone: 920-424-2104  
E-mail: [TedM.Johnson@wisconsin.gov](mailto:TedM.Johnson@wisconsin.gov)  
Website: <http://dnr.wi.gov/lakes/criticalhabitat/>

## Dams

Contact: Joe Behlen  
Wisconsin Department of Natural Resources  
473 Griffith Ave., Wisconsin Rapids, WI 54494  
Phone: 715-421-9940  
E-mail: [joseph.behlen@wisconsin.gov](mailto:joseph.behlen@wisconsin.gov)  
Website: <http://dnr.wi.gov/org/water/wm/dsfm/dams/>

## Fertilizers/Soil Testing

Contact: Ken Williams  
Waushara County UW- Extension  
209 S St. Marie St, PO Box 487, Wautoma, WI 54982  
Phone: 920-787-0416  
E-mail: [ken.williams@ces.uwex.edu](mailto:ken.williams@ces.uwex.edu)  
Website: <http://waushara.uwex.edu/agriculture/services>

## Fisheries Biologist (management, habitat)

Contact: Dave Bartz  
Wisconsin Department of Natural Resources  
Hwy 22N, Box 430, Montello, WI 53949  
Phone: 608-635-4989  
E-mail: [David.Bartz@wisconsin.gov](mailto:David.Bartz@wisconsin.gov)  
Website: <http://dnr.wi.gov/fish/>

## Frog Monitoring—Citizen Based

Contact: Andrew Badje  
Wisconsin Department of Natural Resources  
Phone: 608-266-3336  
E-mail: [Andrew.badje@wisconsin.gov](mailto:Andrew.badje@wisconsin.gov)  
E-mail: [WFTS@wisconsin.gov](mailto:WFTS@wisconsin.gov)

## Grants

Contact: Ted Johnson  
Wisconsin Department of Natural Resources  
Phone: 920-424-2104  
E-mail: [TedM.Johnson@wisconsin.gov](mailto:TedM.Johnson@wisconsin.gov)  
Website: <http://dnr.wi.gov/Aid/Grants.html#tabx8>

Contact: Ed Hernandez  
Waushara County Land Conservation Department  
PO Box 1109, Wautoma, WI 54982  
Phone: 920-787-0453  
E-mail: [lcdzoning.courthouse@co.waushara.wi.us](mailto:lcdzoning.courthouse@co.waushara.wi.us)  
Website: <http://www.co.waushara.wi.us/zoning.htm>

## Groundwater Quality

Contact: Kevin Masarik  
UWSP Center for Watershed Science & Education  
TNR 224, 800 Reserve St., Stevens Point, WI 54481  
Phone: 715-346-4276  
E-mail: [kmasarik@uwsp.edu](mailto:kmasarik@uwsp.edu)  
Website: <http://www.uwsp.edu/cnr/watersheds/>

## Groundwater Levels/Quantity

Contact: Ed Hernandez  
Waushara County Land Conservation Department  
Address: PO Box 1109 Wautoma, WI 54982  
Phone: 920-787-0453  
E-mail: [lcdzoning.courthouse@co.waushara.wi.us](mailto:lcdzoning.courthouse@co.waushara.wi.us)

Contact: George Kraft  
UWSP Center for Watershed Science & Education  
TNR 224, 800 Reserve St., Stevens Point, WI 54481  
Phone: 715-346-2984  
E-mail: [george.kraft@uwsp.edu](mailto:george.kraft@uwsp.edu)

### **Groundwater Levels/Quantity (cont'd)**

Contact: Scott Provost  
Wisconsin Department of Natural Resources  
473 Griffith Ave., Wisconsin Rapids, WI 54494  
Phone: 715-421-7881  
E-mail: [scott.provost@wisconsin.gov](mailto:scott.provost@wisconsin.gov)  
Website:  
[http://prodoasext.dnr.wi.gov/inter1/hicap\\$.st  
artup](http://prodoasext.dnr.wi.gov/inter1/hicap$.startup)

### **Informational Packets**

Contact: UWSP Center for Watershed Science &  
Education  
TNR 224, 800 Reserve St. Stevens Point, WI 54481  
Phone: 715-346-2497  
E-mail: [pclakes@uwsp.edu](mailto:pclakes@uwsp.edu)

### **Lake Groups – Friends, Associations, Districts**

Contact: Patrick Nehring  
UWEX Economic Resource Development Agent  
PO Box 487, Wautoma, WI 54982  
Phone: 920-787-0416  
E-mail: [Patrick.nehring@ces.uwex.edu](mailto:Patrick.nehring@ces.uwex.edu)

Contact: Patrick Goggin  
UWEX Lakes  
TNR 203, 800 Reserve St., Stevens Point, WI 54481  
Phone: 715-365-8943  
E-mail: [pgoggin@uwsp.edu](mailto:pgoggin@uwsp.edu)  
Website:  
[http://www.uwsp.edu/cnr/uwexlake  
s/organizations/](http://www.uwsp.edu/cnr/uwexlakes/organizations/)

Contact: Eric Olson  
UWEX Lakes  
TNR 206, 800 Reserve St., Stevens Point, WI 54481  
Phone: 715-346-2192  
E-mail: [eolson@uwsp.edu](mailto:eolson@uwsp.edu)  
Website:  
[http://www.uwsp.edu/cnr/uwexlake  
s/organizations/](http://www.uwsp.edu/cnr/uwexlake/s/organizations/)

Contact: Susan Tesarik  
Wisconsin Lakes  
4513 Vernon Blvd., Suite 101, Madison, WI 53705  
Phone: 1-800-542-5253  
E-mail: [lakeinfo@wisconsinlakes.org](mailto:lakeinfo@wisconsinlakes.org)  
Website: <http://wisconsinlakes.org/>

### **Lake Levels**

See: Groundwater

### **Lake-Related Law Enforcement (no-wake, transporting invasives, etc.)**

Contact: Ben Mott, State Conservation Warden  
Wisconsin Department of Natural Resources  
427 E. Tower Drive, Suite 100, Wautoma, WI 54982  
Phone: 920-896-3383  
Website: <http://www.wigamewarden.com/>

### **Land Use Plans and Zoning Ordinances**

Contact: Terri Dopp-Paukstat  
Waushara County Planning and Zoning  
PO Box 1109, Wautoma, WI 54982  
Phone: 920-787-0453  
E-mail: [lcdzoning.courthouse@co.waushara.wi.us](mailto:lcdzoning.courthouse@co.waushara.wi.us)  
Website: <http://www.co.waushara.wi.us/zoning.htm>

### **Land Use Plans and Zoning Ordinances (cont'd)**

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

### **Nutrient Management Plans**

Contact: Ed Hernandez  
Waushara County Land Conservation Department  
PO Box 1109, Wautoma, WI 54982  
Phone: 920-787-0453  
E-mail: [lcdzoning.courthouse@co.waushara.wi.us](mailto:lcdzoning.courthouse@co.waushara.wi.us)  
Website: <http://www.co.waushara.wi.us/zoning.htm>

Contact: NRCS Stevens Point Service Center  
1462 Strongs Ave., Stevens Point, WI 54481  
Phone: 715-346-1325

### **Parks (County)**

Contact: Scott Schuman  
Waushara County Parks  
PO Box 300, Wautoma, WI 54982  
Phone: 920-787-7037  
E-mail: [wcparks.parks@co.waushara.wi.us](mailto:wcparks.parks@co.waushara.wi.us)  
Website: <http://www.co.waushara.wi.us/parks.htm>

### **Purchase of Development Rights**

Contact: North Central Conservancy Trust  
PO Box 124, Stevens Point, WI 54481  
Phone: 715-341-7741  
E-mail: [info@ncctwi.org](mailto:info@ncctwi.org)  
Website: <http://www.ncctwi.org/>

### **Purchase of Land**

Contact: Ted Johnson  
Wisconsin Department of Natural Resources  
Phone: 920-424-2104  
E-mail: [TedM.Johnson@wisconsin.gov](mailto:TedM.Johnson@wisconsin.gov)  
Website: <http://dnr.wi.gov/topic/stewardship/>

### **Rain Barrels – Order**

Contact: Golden Sands RC&D  
1100 Main St., Suite 150, Stevens Point, WI 54481  
Phone: 715-343-6215  
Website: <http://www.goldensandsrcd.org/store>

### **Rain Gardens and Stormwater Runoff**

Contact: Ed Hernandez  
Waushara County Land Conservation Department  
PO Box 1109, Wautoma, WI 54982  
Phone: 920-787-0453  
E-mail: [lcdzoning.courthouse@co.waushara.wi.us](mailto:lcdzoning.courthouse@co.waushara.wi.us)  
Website: <http://www.co.waushara.wi.us/zoning.htm>

### **Septic Systems/Onsite Waste**

Contact: Terri Dopp-Paukstat  
Waushara County Planning and Zoning  
PO Box 1109, Wautoma, WI 54982  
Phone: 920-787-0453  
E-mail: [lcdzoning.courthouse@co.waushara.wi.us](mailto:lcdzoning.courthouse@co.waushara.wi.us)  
Website: <http://www.co.waushara.wi.us/zoning.htm>

### **Shoreland Management**

Contact: Ed Hernandez  
Waushara County Land Conservation Department  
PO Box 1109, Wautoma, WI 54982  
Phone: 920-787-0453  
E-mail: [lcdzoning.courthouse@co.waushara.wi.us](mailto:lcdzoning.courthouse@co.waushara.wi.us)  
Website: <http://www.co.waushara.wi.us/zoning.htm>

### **Shoreland Vegetation**

<http://dnr.wi.gov/topic/ShorelandZoning/>

### **Shoreland Zoning Ordinances**

See: Land Use Plans and Zoning Ordinances

### **Soil Fertility Testing**

Contact: Ken Williams  
Waushara County UW- Extension  
209 S St. Marie St, PO Box 487, Wautoma, WI 54982  
Phone: 920-787-0416  
E-mail: [Ken.williams@ces.uwex.edu](mailto:Ken.williams@ces.uwex.edu)  
Website: <http://waushara.uwex.edu/index.html>

### **Water Quality Monitoring**

Contact: Ted Johnson  
Wisconsin Department of Natural Resources  
Phone: 920-424-2104  
E-mail: [TedM.Johnson@wisconsin.gov](mailto:TedM.Johnson@wisconsin.gov)

### **Water Quality Problems**

Contact: Ted Johnson  
Wisconsin Department of Natural Resources  
Phone: 920-424-2104  
E-mail: [TedM.Johnson@wisconsin.gov](mailto:TedM.Johnson@wisconsin.gov)

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

### **Wetlands**

Contact: Keith Patrick  
Wisconsin Department of Natural Resources  
5301 Rib Mountain Drive, Wausau, WI 54401  
Phone: 715-241-7502  
E-mail: [keith.patrick@wisconsin.gov](mailto:keith.patrick@wisconsin.gov)  
Website: <http://dnr.wi.gov/wetlands/>

Contact: Wisconsin Wetlands Association  
214 N. Hamilton Street, #201, Madison, WI 53703  
Phone: 608-250-9971  
Email: [info@wisconsinwetlands.org](mailto:info@wisconsinwetlands.org)

### **Wetland Inventory**

Contact: Dr. Emmet Judziewicz  
UWSP Freckmann Herbarium  
TNR 301, 800 Reserve St., Stevens Point, WI 54481  
Phone: 715-346-4248  
E-mail: [ejudziew@uwsp.edu](mailto:ejudziew@uwsp.edu)

## Woody Habitat

Contact: Dave Bartz, Wisconsin Department of  
Natural Resources

Phone: 608-635-4989

Address: Hwy 22N Box 430, Montello, WI 53949

E-mail: [David.Bartz@wisconsin.gov](mailto:David.Bartz@wisconsin.gov)

If you are looking for any information that is not  
listed in this directory, please contact:  
Ryan Haney ([wclakes@uwsp.edu](mailto:wclakes@uwsp.edu))  
UWSP Center for Watershed Science and  
Education  
TNR 224, 800 Reserve St., Stevens Point, WI 54481  
Phone: 715-346-2497

## Appendix B. Shoreland Survey – 2011

A scoring system was developed for the collected data to provide a more holistic assessment. Areas that are healthy will need strategies to keep them healthy, and areas with potential problem areas and where management and conservation may be warranted may need a different set of strategies for improvement. The scoring system is based on the presence/absence and abundance of shoreline features, as well as their proximity to the water's edge. Values were tallied for each shoreline category and then summed to produce an overall score. Higher scores denote a healthier shoreline with good land management practices. These are areas where protection and/or conservation should be targeted. On the other hand, lower scores signify an ecologically unhealthy shoreline. These are areas where management and/or mitigation practices may be desirable for improving water quality.

The summary of scores for shorelands around Curtis Lake are displayed below. The shorelands were color-coded to show their overall health based on natural and physical characteristics. Blue shorelands identify healthy shorelands with sufficient vegetation and few disturbances. Red shorelands indicate locations where changes in management or mitigation may be warranted. Long stretches of Curtis Lake's shorelands are in good shape, but a few segments have challenges that should be addressed. There were no stretches of Curtis Lake's shoreland ranked as poor.

### Waushara County Shoreline Assessment *CURTIS LAKE*

Map Date -- July, 2011  
Aerial Date -- April, 2010



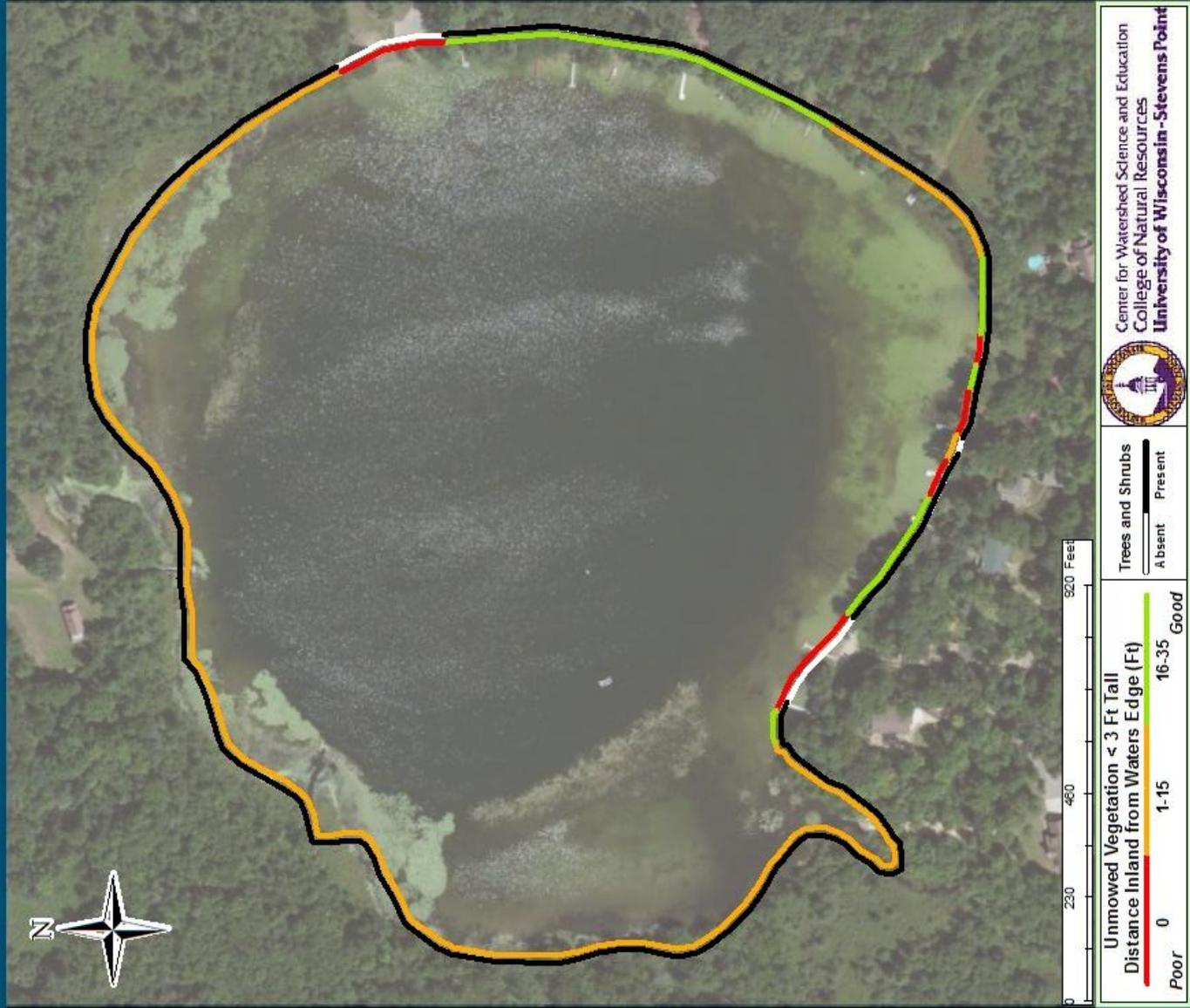
**Summary**  
Shorelines are color-coded to show their overall health based on natural and physical characteristics. For example, shorelines shown in red indicate locations where management or mitigation may be warranted. Blue shorelines mark healthy riparian areas with natural vegetation and few human influences.

**Calculating Shoreline Scores**  
Scores are based on the presence/absence of:  
+ Natural vegetation  
+ Human influences (docks, boathouses, etc)  
+ Erosion  
+ Structures

**Center for Land Use Education**  
Map created by Dan McFarlane  
Center for Land Use Education

# Curtis Lake Shoreland Vegetation

Waushara Co. Wisconsin



## Appendix C. Rapid Response Plan

### SURVEY/MONITOR

#### 1. Learn how to survey/monitor the lake.

##### Contacts:

##### **Water Resource Management Specialist**

Wisconsin Department of Natural Resources

Phone: 920-424-2104

E-Mail: [TedM.Johnson@wisconsin.gov](mailto:TedM.Johnson@wisconsin.gov)

##### **Regional Aquatic Invasive Species (AIS)**

##### **Coordinator**

Golden Sands RC&D

1100 Main St., Suite #150

Stevens Point, WI 54481

Phone: 715-343-6278

E-Mail: [info@goldensandsrccd.org](mailto:info@goldensandsrccd.org)

#### 2. Survey/monitor the lake monthly/seasonally/annually.

If you find a suspected invasive species, report it as soon as possible using the procedure below.

### REPORTING A SUSPECTED INVASIVE SPECIES

#### 1. Collect specimens or take photos.

Regardless of the method used, provide as much information as possible. Try to include flowers, seeds or fruit, buds, full leaves, stems, roots and other distinctive features. In photos, place a coin, pencil or ruler for scale. Deliver or send specimen ASAP.

Collect, press and dry a complete sample. This method is best because a plant expert can then examine the specimen.

**-OR-**

Collect a fresh sample. Enclose in a plastic bag with a moist paper towel and refrigerate.

**-OR-**

Take detailed photos (digital or film).

#### 2. Note the location where the specimen was found.

If possible, give the exact geographic location using a GPS (global positioning system) unit, topographic map, or the Wisconsin Gazetteer map book. If using a map, include a photocopy with a dot showing the plant's location. You can use [TopoZone.com](http://TopoZone.com) to find the precise location on a digital topographic map. Click the cursor on the exact collection site and note the coordinates (choose UTM or Latitude/Longitude).

Provide one or more of the following:

- Latitude & Longitude
- UTM (Universal Transverse Mercator) coordinates
- County, Township, Range, Section, Part-section
- Precise written site description, noting nearest city & road names, landmarks, local topography

**3. Gather information to aid in positive species identification.**

- Collection date and county
- Your name, address, phone, email
- Exact location (Latitude/Longitude or UTM preferred, or Township/Range/Section)
- Plant name (common or scientific)
- Land ownership (if known)
- Population description (estimated number of plants and area covered)
- Habitat type(s) where found (forest, field, prairie, wetland, open water)

**4. Mail or bring specimens and information to any of the following locations:**

Digital photos may be emailed.

**Wisconsin Dept. Natural Resources**  
427 E. Tower Drive, Suite 100  
Wautoma, WI 54982  
Phone: (920) 787-4686

**Regional AIS Coordinator**  
Golden Sands RC&D  
1100 Main St., Suite #150  
Stevens Point, WI 54481  
Phone: 715-343-6214  
E-Mail : [info@goldensandsrcd.org](mailto:info@goldensandsrcd.org)

**UW-Stevens Point Herbarium**  
301 Trainer Natural Resources Building  
800 Reserve Street  
Stevens Point, WI 54481  
Phone: 715-346-4248  
E-Mail: [ejudziej@uwsp.edu](mailto:ejudziej@uwsp.edu)

**Wisconsin Invasive Plants Reporting & Prevention Project**  
Herbarium-UW-Madison  
430 Lincoln Drive  
Madison, WI 53706  
Phone: (608) 267-7612  
E-Mail: [invasiveplants@mailplus.wisc.edu](mailto:invasiveplants@mailplus.wisc.edu)

**5. Once the specimen is dropped off or sent for positive identification, be sure to contact:**

**Regional AIS Coordinator**  
Golden Sands RC&D  
1100 Main St., Suite #150  
Stevens Point, WI 54481  
Phone: 715-343-6214  
E-Mail : [info@goldensandsrcd.org](mailto:info@goldensandsrcd.org)

**If an invasive species is confirmed, the Regional AIS Coordinator will make the following public information contacts:**

- **Wisconsin Department of Natural Resources**  
427 E. Tower Drive, Suite 100  
Wautoma, WI 54982  
Phone: (920) 787-4686

**The town board(s)** in which the water body is located

Town of: Richford

- **University of Wisconsin-Stevens Point**  
Water Resource Scientist  
Nancy Turyk  
Trainer Natural Resources Building  
800 Reserve Street  
Stevens Point, WI 54481 Telephone: 715-346-4155  
E-mail: [nturyk@uwsp.edu](mailto:nturyk@uwsp.edu)

- **Local Residents**

**If an invasive species is confirmed the Waushara County Land Conservation Department will make the following public information contacts:**

- **Newspapers:** The Argus, The Resorter

**Contact the WDNR to post notice(s) at the access point(s) to the water body.**

## Appendix D. Aquatic Plants

### Curtis Lake aquatic plant survey summary, 2011.

	Lake Average	Statewide Average	North Central Hardwood Forests Ecoregion Average
Littoral Frequency of Occurrence (%)	93.42	74.3	76
Maximum Depth of Plant Growth (ft)	22	15.3	15.9
Species Richness (Including visuals)	17	16.8	16.2
Floristic Quality Index (FQI)	21.95	24.1	23.3

### Frequency of occurrence of aquatic plant species observed in Curtis Lake, 2011.

Scientific Name	Common Name	Coefficient of Conservatism Value (C Value)	2011 % Frequency of Occurrence
<b>Free-floating Species</b>			
<i>Lemna minor</i>	Small duckweed	4	1.41
<b>Submergent Species</b>			
<i>Chara</i>	Muskgrasses	7	59.15
<i>Najas guadalupensis</i>	Southern naiad	8	42.25
<i>Ceratophyllum demersum</i>	Coontail	3	23.94
<i>Vallisneria americana</i>	Wild celery	6	21.13
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	6	18.31
<i>Potamogeton illinoensis</i>	Illinois pondweed	6	15.49
<i>Stuckenia pectinata</i>	Sago pondweed	3	12.68
<i>Nuphar variegata</i>	Spatterdock	6	9.86
<i>Najas flexilis</i>	Slender naiad	6	8.45
<i>Schoenoplectus acutus</i>	Hardstem bulrush	6	5.63
<i>Potamogeton natans</i>	Floating-leaf pondweed	5	4.23
<i>Myriophyllum sibiricum</i>	Northern water-milfoil	6	2.82
<i>Potamogeton foliosus</i>	Leafy pondweed	6	1.41
<i>Utricularia vulgaris</i>	Common bladderwort	7	1.41

**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

- \* No associated cost.
- \* Least disruptive to lake ecosystem.

LIMITATIONS

- \* May not be effective in achieving aquatic plant management objectives.

**Hand Pulling**

---

ADVANTAGES

- \* 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.
- \* If aquatic invasive species are not pulled properly, could worsen the problem.

- \* No associated cost.

LIMITATIONS

- \* Removes near-shore wildlife and fish habitat.
- \* Opens up areas where invasives to become established.

## Hand Pulling Using Suction

---

### ADVANTAGES

- \* 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.

### LIMITATIONS

- \* 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

- \* Removes plant material and nutrients.
- \* Can target specific locations.
- \* Used to manage larger areas for recreational access or fishery management.

### LIMITATIONS

- \* 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

- \* Controls aquatic plants in shallower, near-shore areas.
- \* Can be low cost.

### LIMITATIONS

- \* Requires a controlling structure on the lake.
- \* May cause undesired stress on ecosystem.
- \* Cannot be used frequently.

## Milfoil Weevils

---

### ADVANTAGES

- \* Natural, native maintenance of native and exotic milfoils.
- \* Prefers the aquatic invasive Eurasian Watermilfoil.
- \* Some lakes may already have a native population; need a professional stem count and assessment of shoreland health, structure of fishery, etc.
- \* Doesn't harm lake ecosystem.

### LIMITATIONS

- \* 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**

- \* May be less destructive to lake ecosystem than lake-wide treatment.

#### **LIMITATIONS**

- \* 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**

- \* May reduce aquatic invasives for a time.
- \* Treatment not needed as frequently.

#### **LIMITATIONS**

- \* 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.

## **Appendix E. 2016 Fishery Survey Results**

## **Appendix F. Lake User Survey Results**