

# Aquatic Plant Management Plan

## Balsam Lake

Polk County, Wisconsin

September 2015

Sponsored By

Balsam Lake Protection and Rehabilitation District

### Aquatic Plant Advisory Committee

#### Lake Resident Members

Philip Burt

Thera Burt

Dan Kraft

Doug McElrath

Karen McElrath

Carl Pentland

Caroline Rediske

Laura Sloss

#### Commissioners

Carl Holmgren

Glen Jones

Ed McGlynn

Bill Mork

Rod Preble

Howard Seim

Ray Sloss

#### DNR Advisor

Alex Smith

Prepared By

Harmony Environmental

Endangered Resource Services, LLC

Plan Writing and Facilitation

Aquatic Plant Surveys and Mapping

Funded By

Balsam Lake Protection and Rehabilitation District

A Wisconsin Department of Natural Resources Grant

# Table of Contents

Executive Summary .....	1
Introduction.....	2
Public Input for Plan Development.....	2
Lake Information .....	5
The Lake .....	5
Watershed Description.....	12
Internal Sediment Load.....	15
Balsam Branch Priority Watershed Project .....	16
Balsam Lake Protection and Rehabilitation District (BLPRD) Activities.....	21
A Timeline of BLPRD Efforts .....	23
Aquatic Habitats.....	24
Primary Human Use Areas .....	24
Functions and Values of Native Aquatic Plants .....	24
Aquatic Invasive Species Status .....	25
Sensitive Areas.....	26
Sensitive Area Guidelines for Walleye Spawning Areas .....	27
Sensitive Area Guidelines to Protect Fish and Wildlife Habitat.....	27
Rare and Endangered Species Habitat .....	29
Fishery.....	30
Plant Community .....	32
Aquatic Plant Survey Results .....	32
Invasive Species.....	44
Aquatic Plant Management.....	50
Discussion of Management Methods.....	50
Previous Aquatic Plant Management Plans .....	61
Current and Past Aquatic Plant Management .....	62
Curly Leaf Pondweed Early Season Herbicide Treatment .....	63
AIS Prevention Efforts.....	75
Plan Goals and Strategies.....	77
Monitoring and Assessment.....	90

# Tables

Table 1. Lake Information .....	5
Table 2. Balsam Lake Basin Water Quality Summary .....	11
Table 3. Balsam Branch Priority Watershed Cost Share Projects with BLPRD Contributions ...	17
Table 4. Natural Heritage Species in the Balsam Lake Area.....	29
Table 5. Spawning Temperatures and Substrate Needs.....	31
Table 6. Aquatic Macrophyte Survey Summary Statistics 2009 and 2014 .....	36
Table 7. Balsam Lake Species Frequency and Mean Rake Fullness 2014.....	38
Table 8. CLP Bed Summary - Balsam Lake, Polk County (2009 – 2014) .....	46
Table 9. Herbicides Used to Manage Aquatic Plants in Balsam Lake (2006-2009) .....	58
Table 10. Past Waterfront Herbicide Treatments on Balsam Lake .....	63
Table 11. CLP Treatment Summary (2009-2014).....	64
Table 12. CLP Turion Survey Summary Results November 2014.....	74
Table 13. CBCW Summary Statistics.....	76
Table 14. WDNR Aquatic Invasive Species Grants to BLPRD .....	76

# Figures

Figure 1. Survey Response: Indicate your degree of participation in the following activities at Balsam Lake.....	3
Figure 2. Survey Response: Indicate how much each of the following negatively impacts your use of the lake. ....	4
Figure 3 Survey Response: What aquatic plant management actions should the Lake District pursue? .....	4
Figure 4. Balsam Lake Map.....	6
Figure 5. Main Basin Summer Average Secchi Depths 1987-2008 .....	8
Figure 6. Main Basin Trophic State Index 1987-2013 .....	8
Figure 7. Little Balsam Secchi Depths 1987-2014 .....	9
Figure 8. Little Balsam Trophic State Index 1987-2014 .....	9
Figure 9. East Balsam Secchi Depth 1987-2014 .....	10
Figure 10. East Balsam Trophic State Index 1987-2014 .....	10
Figure 11. Sources of Water to Balsam Lake (from Barr 2011).....	11
Figure 12. Balsam Lake Phosphorus Budget (from Barr 2011) .....	12
Figure 13. Balsam Lake Watershed and Drainage Area (from Barr 2011) .....	13

Figure 14. Balsam Lake Land Use (from Barr 2011) .....	14
Figure 15. Soil Loss in the Balsam Lake Watershed .....	18
Figure 16. Balsam Lake Watershed and Drainage Areas .....	19
Figure 17. Balsam Lake Highway 46 Landing Rock Infiltration Pit .....	21
Figure 18. Balsam Lake Sensitive Area/Critical Habitat Area Designations .....	28
Figure 19. Sampling Point Grid .....	32
Figure 20. Balsam Lake Littoral Zone 2009 .....	33
Figure 21. Balsam Lake Littoral Zone 2014 .....	33
Figure 22. Balsam Lake Bottom Sediment Type .....	34
Figure 23. Native Species Richness 2009 and 2014 .....	35
Figure 24. Total Rake Fullness 2009 and 2014 .....	35
Figure 25. Balsam Lake Areas .....	38
Figure 26. Coontail Density and Distribution 2009 and 2014 .....	41
Figure 27. Forked Duckweed Density and Distribution 2009 and 2014 .....	41
Figure 28. Small Pondweed Density and Distribution 2009 and 2014 .....	42
Figure 29. Flat-stem Pondweed Density and Distribution 2009 and 2014 .....	42
Figure 30. Wild Rice Beds at the Rice Creek Harder Creek Inlets August 2014 .....	44
Figure 31. Balsam Lake CLP Density 2009 and 2014 .....	45
Figure 32. Balsam Lake CLP Beds 2014 (Following East Balsam Lake Herbicide Treatment)..	47
Figure 33. Bay Southeast of the Big Narrows Pre/Post CLP Distribution 2009 .....	64
Figure 34. Balsam Lake CLP Treatment Beds 2010 .....	65
Figure 35. Balsam Lake CLP Treatment Beds 2011 .....	65
Figure 36. Balsam Lake CLP Treatment Beds 2012 .....	66
Figure 37. Balsam Lake CLP Treatment Beds 2013 .....	66
Figure 38. Balsam Lake CLP Treatment Beds 2014 .....	67
Figure 39. 2013 CLP Herbicide Concentration Monitoring Sites and Treatment Beds .....	68
Figure 40. Endothall Concentrations Following CLP Treatment 2013 .....	69
Figure 41. 2014 CLP Herbicide Concentration Monitoring Sites and Treatment Beds .....	70
Figure 42. Endothall Concentrations Following CLP Treatment Bed 13 2014 .....	71
Figure 43. Endothall Concentrations Following CLP Treatment Bed 12 2014 .....	71
Figure 44. Endothall Concentrations Following CLP Treatment Bed 14 2014 .....	72
Figure 45. Coontail Rake Fullness Pre and Posttreatment Survey Results .....	72
Figure 46. Germinating CLP Turion .....	73

Figure 47. CLP Turion Survey Results November 2014.....	74
Figure 48. Balsam Lake Curly Leaf Pondweed Beds 2014.....	85
Figure 49. Areas of Potential Navigation Concern.....	G-4
Figure 50. Potential Harvesting Lanes August 2015 .....	G-5
Figure 51. Potential CLP Harvesting Areas .....	G-6

## Appendices

Appendix A. Public Opinion Survey Results .....	A -1
Appendix B. Invasive Species Information.....	B -1
Appendix C. Aquatic Plant Management Strategy Northern Region WDNR .....	C -1
Appendix D. References.....	D -1
Appendix E. Rapid Response for Early Detection of AIS.....	E -1
Appendix F. Management Options for Aquatic Plants.....	F -1
Appendix G. Harvesting Considerations .....	G-1
Appendix H. Implementation Plan for 2015-2017 <sup>2</sup> .....	H-1

---

<sup>2</sup> Costs are annual costs estimated for initial implementation. These costs will be reviewed each year during the lake district budgeting process.

## Executive Summary

This Aquatic Plant Management Plan for Balsam Lake presents a strategy for managing aquatic plants by protecting native plant populations, managing curly leaf pondweed, and preventing establishment of invasive species through the year 2019. The plan includes data about the plant community, watershed, and water quality of the lakes. It also reviews a history of aquatic plant management on Balsam Lake.

An aquatic plant point intercept survey and curly leaf pondweed bed mapping was completed for Balsam Lake in 2014. The aquatic plant survey found that Balsam Lake has a healthy, abundant, and diverse plant community. However, reductions in native plant diversity and abundance have occurred in East Balsam since 2009. Native plants provide fish and wildlife habitat, stabilize bottom sediments, reduce the impact of waves against the shoreline, and prevent the spread of non-native invasive plants – all critical functions for the lake.

This aquatic plant management plan, developed with input from an advisory committee including lake property owners, will help the Balsam Lake Protection and Rehabilitation District choose methods to meet plan aquatic plant management goals. The implementation plan describes the actions that will be taken toward achieving these goals.

A special thank you is extended to the aquatic plant advisory committee for assistance with plan development.

### Plan Goals

1. Manage established invasive species and eradicate newly introduced invasive species to reduce their impacts to the lake.
2. Prevent and detect the introduction of aquatic invasive species.
3. Maintain navigation for fishing and boating, access to lake residences, and comfortable swimming at the village beach.
4. Engage lake residents and visitors in reaching aquatic plant management goals.
5. Preserve the diverse native aquatic plant community in Balsam Lake.

## Introduction

The Aquatic Plant Management Plan for Balsam Lake is sponsored by the Balsam Lake Protection and Rehabilitation District (BLPRD). The planning project is funded by a Wisconsin Department of Natural Resources Aquatic Invasive Species Planning and Education grant and the BLPRD.

This aquatic plant management plan presents a strategy for managing aquatic plants by protecting native plant populations, managing curly leaf pondweed, and preventing the establishment of additional invasive species. The plan includes data about the plant community, watershed, and water quality of the lakes. Based on this data and public input, goals and strategies for the sound management of aquatic plants in the lakes are presented. This plan will guide the BLPRD and the Wisconsin Department of Natural Resources in aquatic plant management for Balsam Lake over the next five years (from 2015 through 2019).

## Public Input for Plan Development

The BLPRD Aquatic Plant Management (APM) Advisory Committee provided input for the development of this plan. The APM Advisory Committee met three times. At the first meeting on March 7, 2015, the committee reviewed aquatic plant management planning requirements, plant survey results, and discussed aquatic plant management concerns. At a second meeting on March 28, 2015, and a third meeting on April 18, 2015, the committee reviewed aquatic plant management efforts to date, drafted goals, and developed objectives and action steps.

The BLPRD board announced the availability of the draft Aquatic Plant Management Plan for review with a public notice in the Polk County Ledger the week of July 13, 2015. Copies of the plan were made available to the public on the BLPRD web site: BLPRD.com and at the Balsam Lake Public Library. Content was reviewed at the BLPRD annual meeting July 18, 2015. Comments were accepted through July 31, 2015. The BLPRD board approved the plan at a board meeting September 19, 2015.

The final draft plan was forwarded to staff of the St. Croix Tribe Environmental Department and the Voigt Intertribal Task Force for review. Final copies will be distributed to these entities as well.

## Resident Concerns

The APM Committee expressed a variety of concerns that are reflected in the objectives for plan development and in the goals for aquatic plant management in this plan. Management concerns ranged from considering harvesting as a management method to remove nuisance aquatic plants that impede navigation, to prevention of invasive species establishment and spread, and maintaining a natural lake environment and fishery.

## Property Owner Surveys

Surveys of lake residents were completed in 2007 and 2010. Results of the 2010 survey are discussed below and are found in Appendix A.

Popular lake activities, rated in the chart below by degree of participation from 0 (none) to 4 (a great deal), demonstrate potential conflicts for aquatic plant management. Enjoying the view, appreciating peace and tranquility, and observing wildlife are the highest ranked activities (3.69, 3.48, and 3.13 respectively). These activities are supported by aquatic plants in the lake. However, motor boating and swimming - which may be limited by aquatic plant growth - follow with rankings of 2.82 and 2.33 respectively.

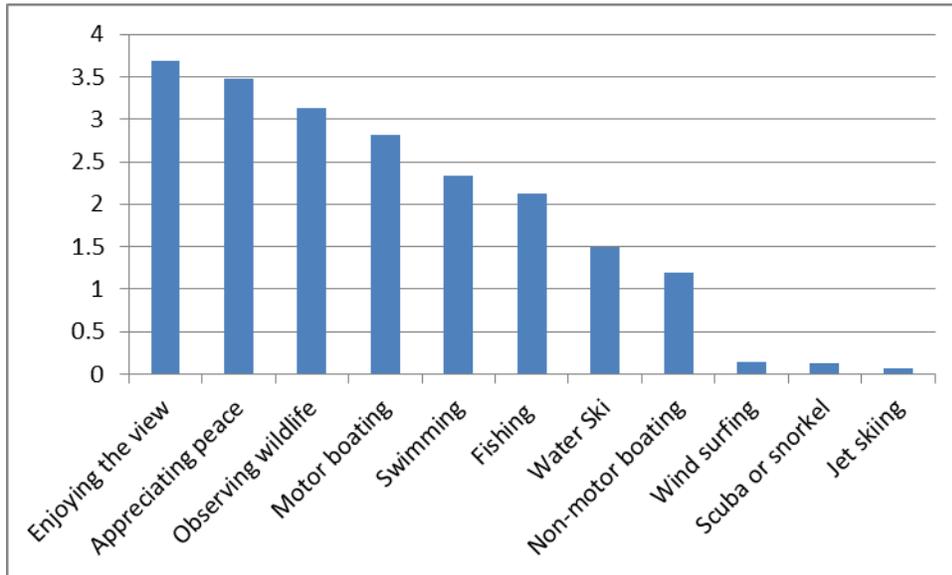


Figure 1. Survey Response: Indicate your degree of participation in the following activities at Balsam Lake.

Additional survey results indicated a range of concerns and priorities from lake residents (Figure 2). In terms of what negatively impacts use and enjoyment of the lake, algae growth and invasive aquatic plant growth ranked above native plant growth (these are the top three negative impacts on the lake).

Managing invasive aquatic plants in Balsam Lake was generally supported in survey results, with most categories ranking somewhere between “unsure” and “probably yes.” Residents were most supportive of preventing invasive species introduction, educating lake residents, and protecting sensitive habitat areas. There was also strong support for encouraging residents to hand pull or rake to remove invasive aquatic plants. More intensive management of native plants is not as strongly supported.

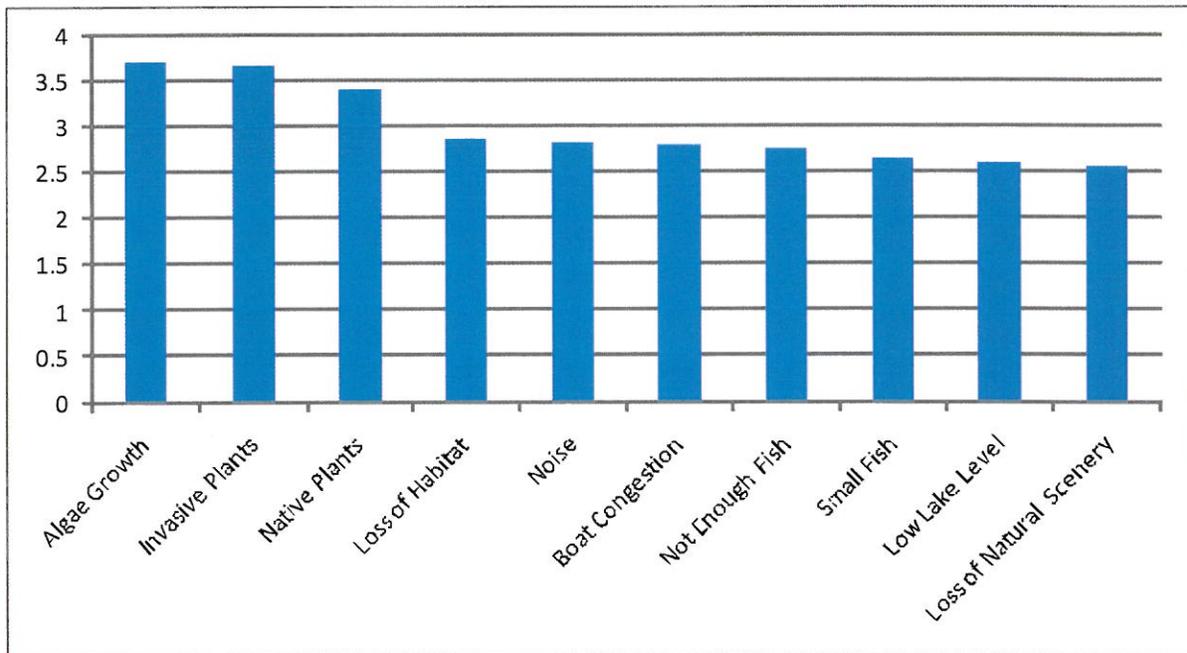


Figure 2. Survey Response: Indicate how much each of the following negatively impacts your use of the lake.

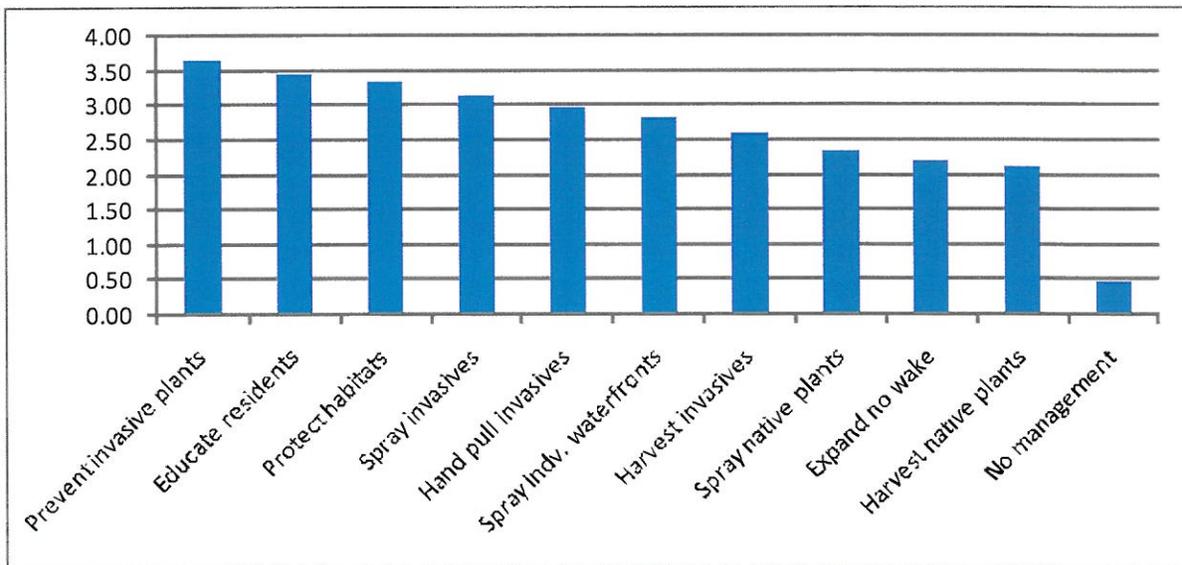


Figure 3 Survey Response: What aquatic plant management actions should the Lake District pursue?

# Lake Information

## The Lake

Balsam Lake (WBIC 2656200) is located in central Polk County, Wisconsin in the towns of Balsam Lake, Milltown, Georgetown, and Apple River. The lake has a surface area of 2,054 acres and a maximum depth of 37 feet. The average depth is 16.8 feet. Little narrows in the northwestern part of the lake and big narrows in the eastern part separate the lake into three basins.<sup>2</sup>

Balsam Lake is a stratified, drainage lake. Two main streams enter Balsam Lake. Rice Creek originates north of and flows through Rice Lake, is joined by Otter Creek, then flows into the northwestern end of Little Balsam. Harder Creek flows from Half Moon Lake into the north side of Balsam Lake's main basin to the Stumps area.

Balsam Lake is mesotrophic to slightly eutrophic with Secchi depths averaging 8 feet in the Main Basin, 7 feet in Little Balsam, and 6 feet in East Balsam.<sup>3</sup> See Table 1 below for further information. The littoral zone (the depth at which plants grow) remained at a similar depth between 2009 and 2014 except in East Balsam where it decreased from 19 feet in 2009 to 15 feet in 2014.<sup>4</sup> (Berg, 2015). The bottom substrate is variable with muck bottoms in most bays and rock and sand bars in the narrows and around the lake's many islands.

*Table 1. Lake Information*

	Main Basin	Little Balsam	East Balsam	Total
Size (acres)	1,270	86	550	2,054
Mean depth (feet)				16.8
Maximum depth (feet)	37			37
Average summer secchi depth (feet)	8	7	6	NA
Trophic state	Mesotrophic	Mesotrophic	Eutrophic	

A lake map is found on the following page as Figure 4. Boat landings are indicated with an "L" on the lake map.

<sup>2</sup> *Water and Phosphorus Budgets and Trophic State, Balsam Lake, Northwestern Wisconsin*. 1987 – 1989. U. S. Geological Survey. Water Resources Investigations Report 91-4125.

<sup>3</sup> Based on July and August averages from 1987-2009, although citizen lake monitoring reports are not included for every year at each location. [dnr.wi.gov/lakes/CLMN/reportsanddata](http://dnr.wi.gov/lakes/CLMN/reportsanddata).

<sup>4</sup> Berg, Matthew. *Warm Water Point Intercept Macrophyte Survey Balsam Lake Polk County, Wisconsin*. 2015.

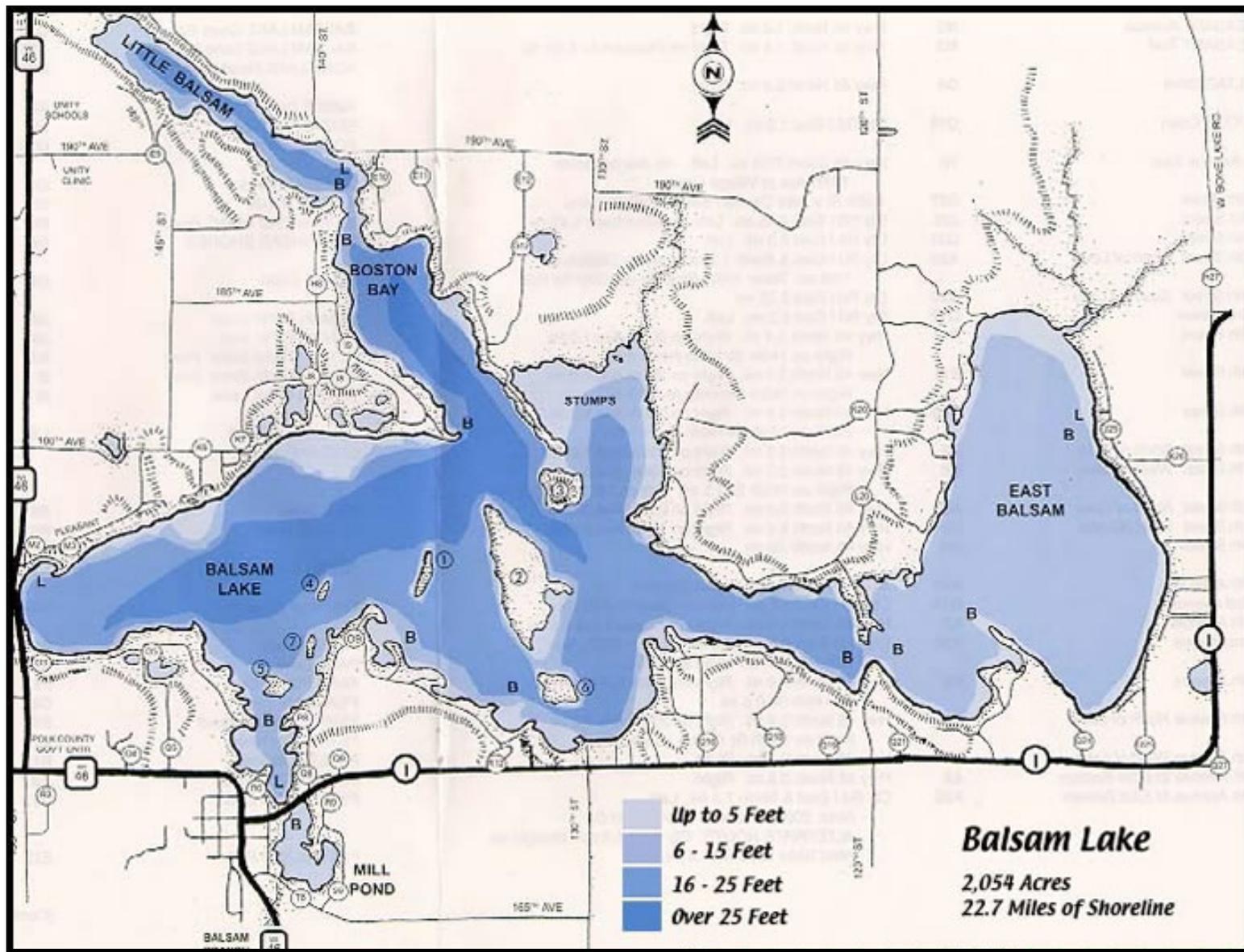


Figure 4. Balsam Lake Map

## Water Quality

Water quality is frequently reported by the trophic state or nutrient level of the lake. Nutrient-rich lakes are classified as eutrophic. These lakes tend to have abundant aquatic plant growth and low water clarity due to algae blooms. Mesotrophic lakes have intermediate nutrient levels and only occasional algae blooms. Oligotrophic lakes are nutrient-poor with little growth of plants and algae.

Secchi depth readings are one way to assess the trophic state of a lake. The Secchi depth is the depth at which the black and white Secchi disk is no longer visible when it is lowered into the water. Greater Secchi depths occur with greater water clarity. Secchi depth readings, phosphorus concentrations, and chlorophyll measurements can each be used to calculate a Trophic State Index (TSI) for lakes. TSI values range from 0 – 110. Lakes with TSI values greater than 50 are considered eutrophic. Those with values in the 40 to 50 range are mesotrophic. Lakes with TSI values below 40 are considered oligotrophic.

Citizen lake monitoring volunteers and staff have collected data from the lake almost annually since 1987. Citizen lake monitoring generally includes secchi depth and may also include chorophylla (a measure of algae growth), total phosphorus, and temperature and oxygen profiles. There are three data collection sites on Balsam Lake, one each in the Main Basin, East Balsam, and Little Balsam. Data collection is inconsistent. For example, secchi data was last collected in the main basin in 2008. Total phosphorus has not been recently sampled in Little Balsam or East Balsam.

Balsam Lake is classified as mesotrophic to eutrophic. A eutrophic TSI usually suggests decreased clarity, fewer algal species, oxygen-depleted bottom waters during the summer, evident plant overgrowth, and only warm-water fisheries (pike, perch, bass, etc.).<sup>5</sup>

---

<sup>5</sup> Reports and Data: Polk County. WDNR website. February 2014.  
<<http://www.dnr.state.wi.us/lakes/CLMN/reportsanddata/>>

Figure 5 illustrates the Secchi depth averages for the main basin which is only available through 2008. Figure 6 graphs the Trophic State Index for the main basin, based upon Secchi depth, chlorophyll, and total phosphorus results. Figures 7 and 8 depict Little Balsam's Secchi depth and Trophic State Index, respectively. Figures 9 and 10 show East Balsam results.

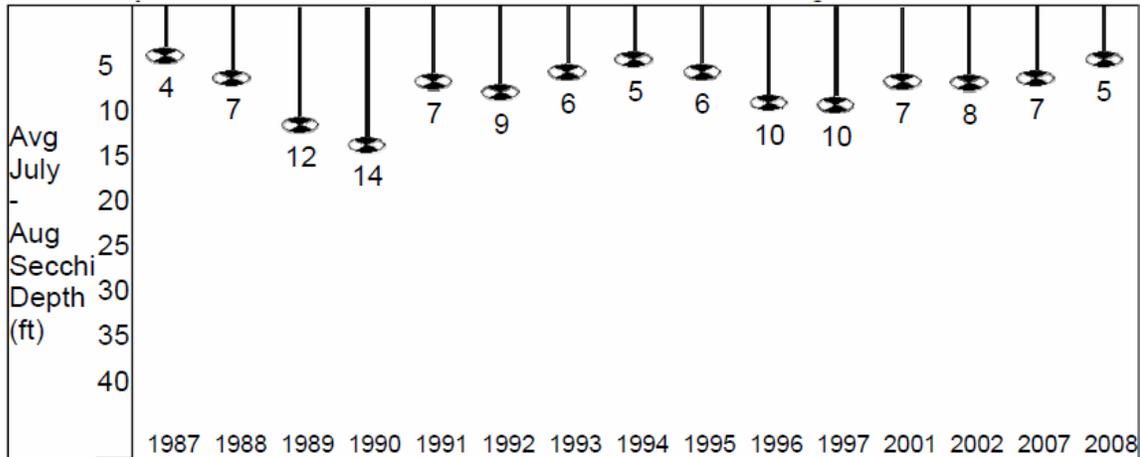


Figure 5. Main Basin Summer Average Secchi Depths 1987-2008

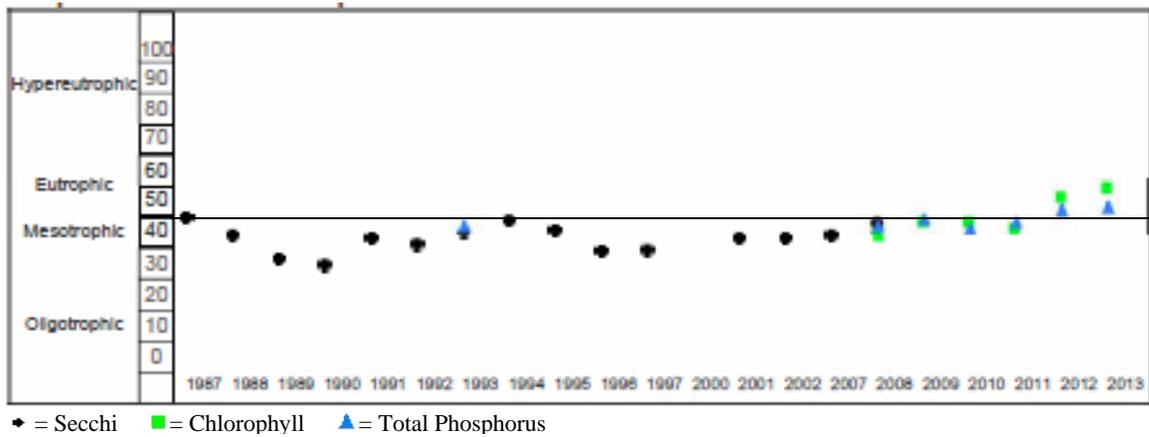


Figure 6. Main Basin Trophic State Index 1987-2013

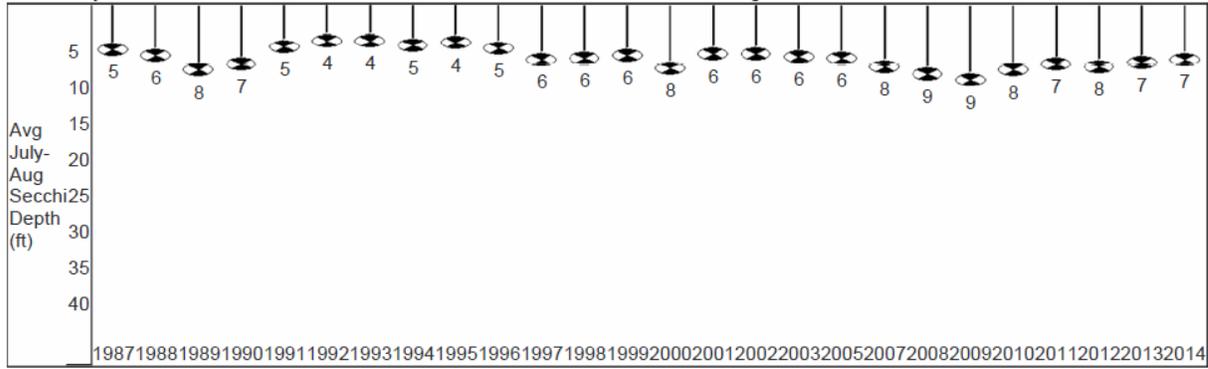


Figure 7. Little Balsam Secchi Depths 1987-2014

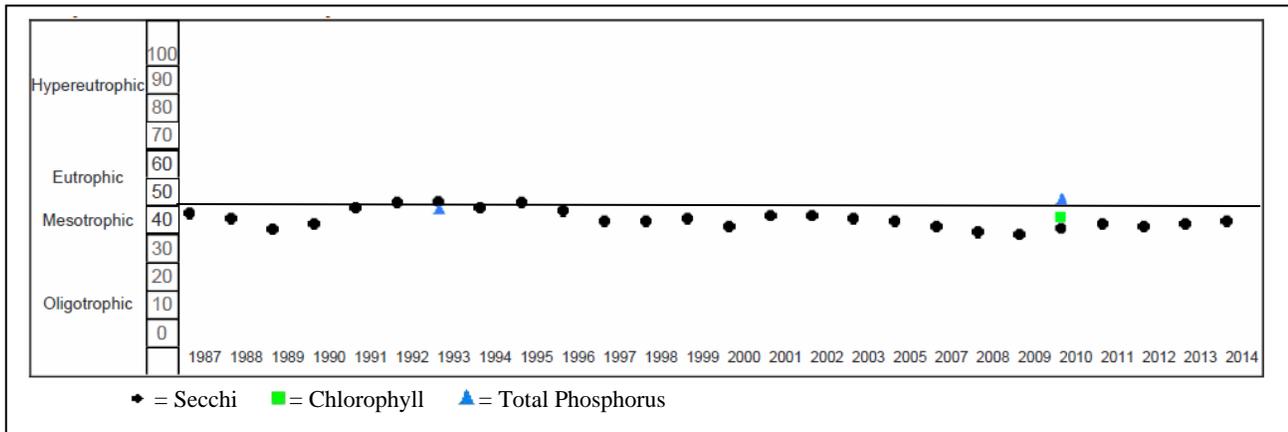


Figure 8. Little Balsam Trophic State Index 1987-2014

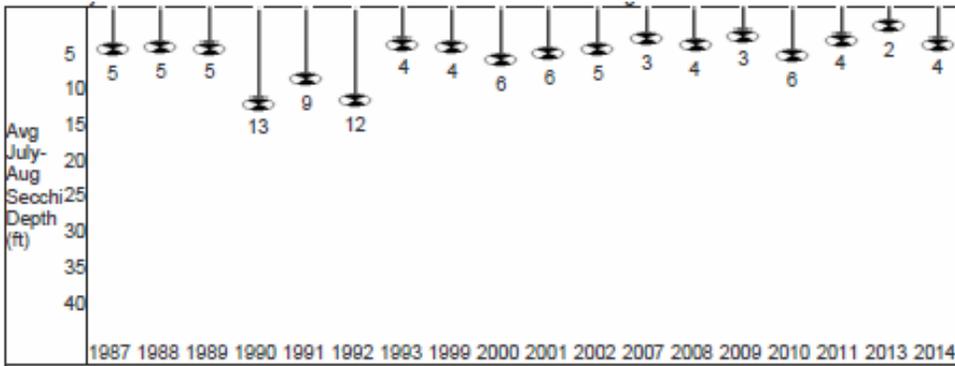


Figure 9. East Balsam Secchi Depth 1987-2014

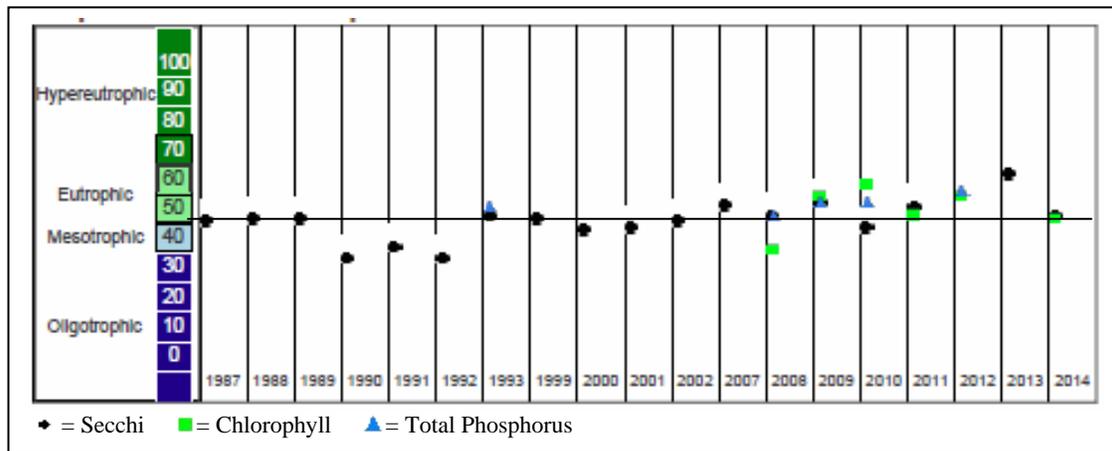


Figure 10. East Balsam Trophic State Index 1987-2014

### Impaired Waters

Every two years, Section 303(d) of the Clean Water Act requires states to publish a list of all waters that *do not meet* water quality standards. The list, also known as the Impaired Waters List, is updated to reflect waters that are newly added or removed based on new information or changes in water quality status.

In the 2014 draft list update, DNR proposed to add 192 new waters. A majority of the listing additions are waters that exceed total phosphorus criteria. A significant number of new listings are also based on poor biological condition. East Balsam Lake is proposed for addition to the 2014 list for excess algae growth. The pollutant causing algae growth is not identified in the listing.<sup>6</sup>

<sup>6</sup> <http://dnr.wi.gov/topic/ImpairedWaters/> February 2015.

## Water and Phosphorus Budget

The Balsam Lake hydrologic budget is an accounting of the water inflows to, outflow and evaporation from, and storage in Balsam Lake. Barr Engineering completed a water quality study for the BLPRD in 2011.<sup>7</sup> Sources of water to Balsam Lake are shown in Figure 11. The numbers S-1 through 6 refer to the watershed area draining to a particular basin as described in Table 2. The lake residence time in 2010 was 1½ years. Lake residence time is the time required for a volume equal to the full lake volume to be replaced by inflowing waters. Hence, it would take 1½ years to fully replace the water in the lake.

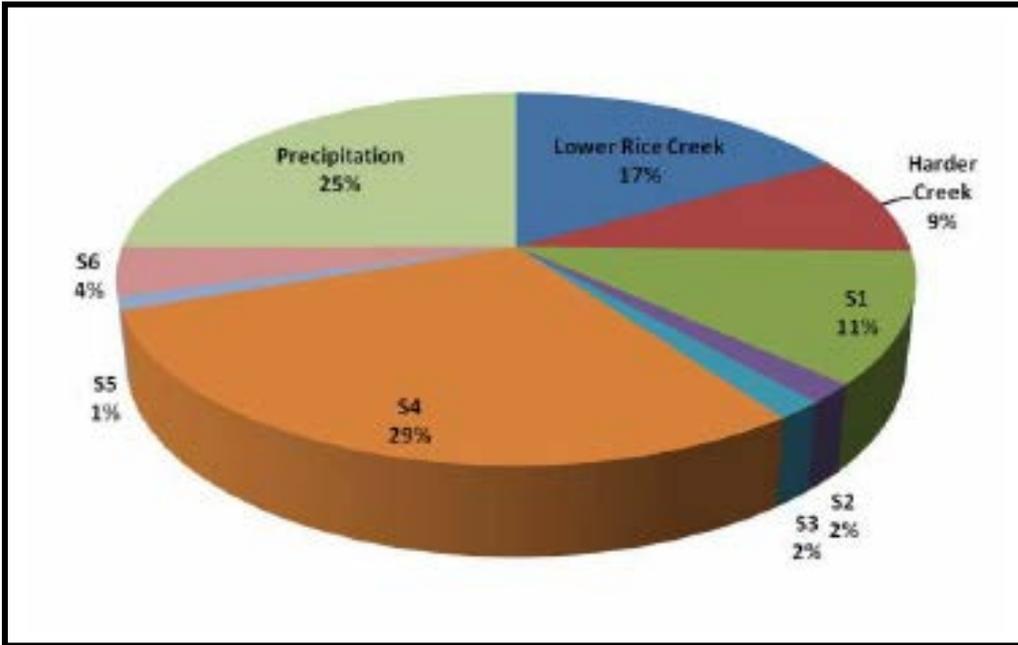


Figure 11. Sources of Water to Balsam Lake (from Barr 2011)

Table 2. Balsam Lake Basin Water Quality Summary

Study Basin ID	Commonly Used Name	Trophic State Summer 2010 (TP)	Trophic State Summer 2010 (Chl a)	Water Clarity Trend (1987-2010)	Watershed Phosphorus Release
S-1	East Balsam	Eutrophic	Hypereutrophic	Unchanged	Not measured
S-2	Stump Bay	Mesotrophic	Eutrophic	Unchanged	Low
S-3	Main Basin (East)	Mesotrophic	Eutrophic	Unchanged	Not measured
S-4	Main Basin (West)	Mesotrophic	Eutrophic	Unchanged	Not measured
S-5	Boston Bay	Mesotrophic	Eutrophic	Unchanged	Not measured
S-6	Little Balsam	Mesotrophic	Eutrophic	Improved	Low

<sup>7</sup> Barr Engineering. *Balsam Lake Water Quality Study*. Prepared for Balsam Lake Protection and Rehabilitation District. June 2011.

Figure 12 shows an overall lake phosphorus budget with S1-6 referring to the respective watersheds of each basin. Phosphorus budgets are available for each basin. The internal load from lake sediments is described on a following page.

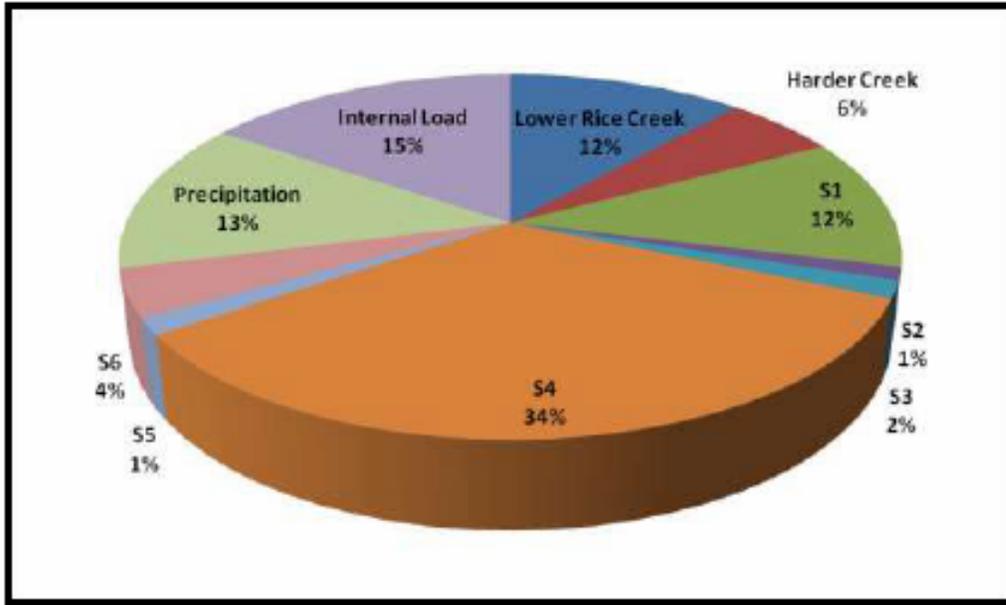


Figure 12. Balsam Lake Phosphorus Budget (from Barr 2011)

### Watershed Description

The Balsam Lake watershed is a portion of the Balsam Branch watershed in the St. Croix Basin. The 2011 study delineated a watershed area of 26,691 acres which includes the area draining to Rice Lake and Half Moon Lake which eventually flow to Balsam Lake (Figure 13). Rice Lake and Half Moon Lake areas were treated as separate subwatersheds in the Balsam Branch Priority Watershed Project.

The land use in the entire watershed area is shown in Figure 14. Of the entire watershed, 36 percent is cropland, 31 percent is forested, 8 percent is wetland, 5 percent is grassland, 4 percent is open water, and 3 percent is pasture. Residential and commercial lands make up the remaining area (11 percent). “Other” uses are listed as 2 percent.

The Balsam Lake watershed is found in an area of glacial end moraine composed of till and stratified sand and gravel to the north and south of the lake. Glacial drift in areas east and west of the lake is pitted outwash composed of stratified sand and gravel. A thin (0.5 feet to 2 feet) thick layer of loess overlying the drift is the parent material for most topsoil. Most soils are loams, silt loams, or peat. Much of the watershed area drains to wetlands and small pothole lakes.<sup>8</sup> These areas of closed depressions result in water that is temporarily captured before it drains to the lake.

<sup>8</sup> *Water and Phosphorus Budgets and Trophic State, Balsam Lake, Northwestern Wisconsin*. 1987 – 1989. U. S. Geological Survey. Water Resources Investigations Report 91-4125.

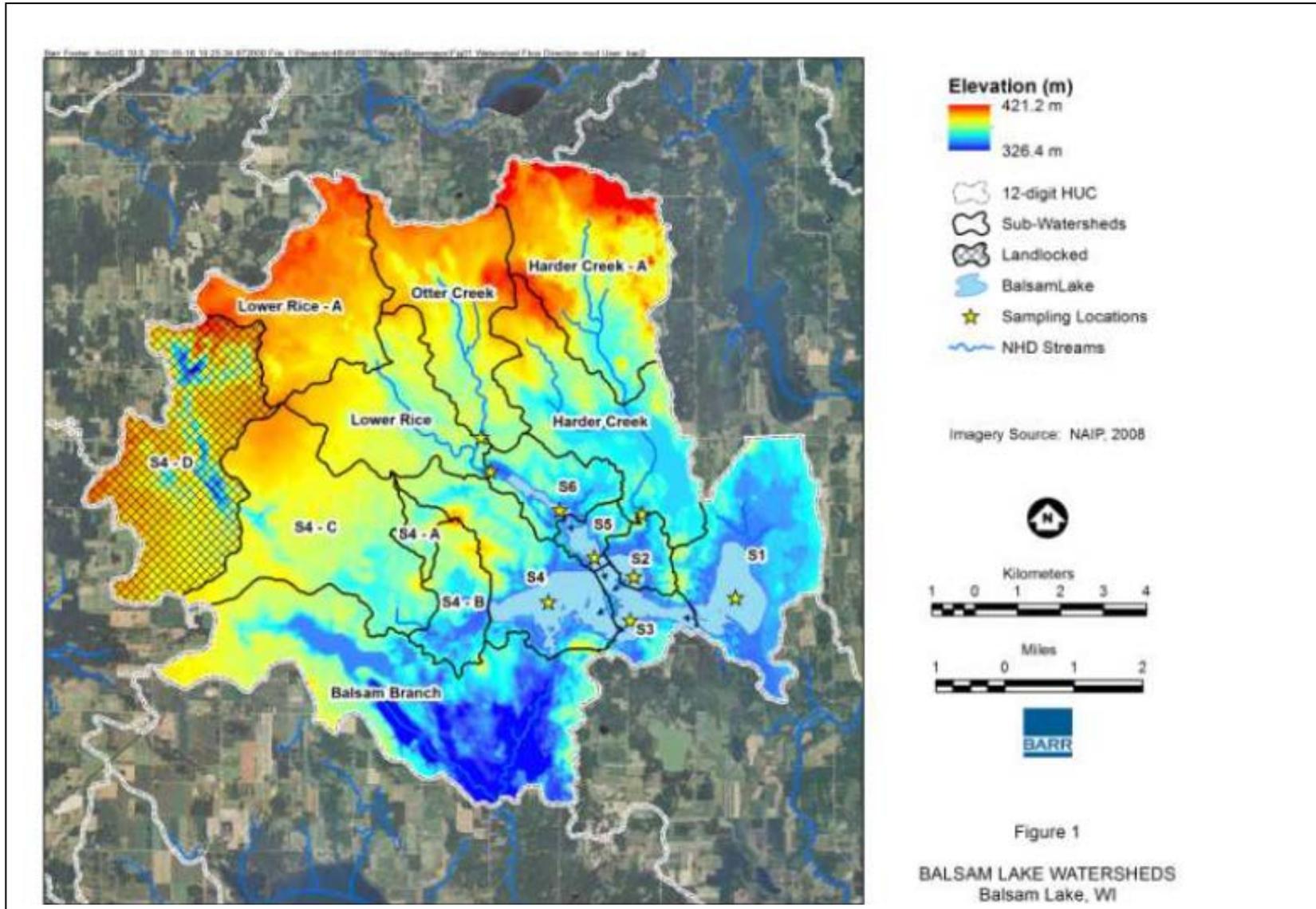


Figure 13. Balsam Lake Watershed and Drainage Area (from Barr 2011)

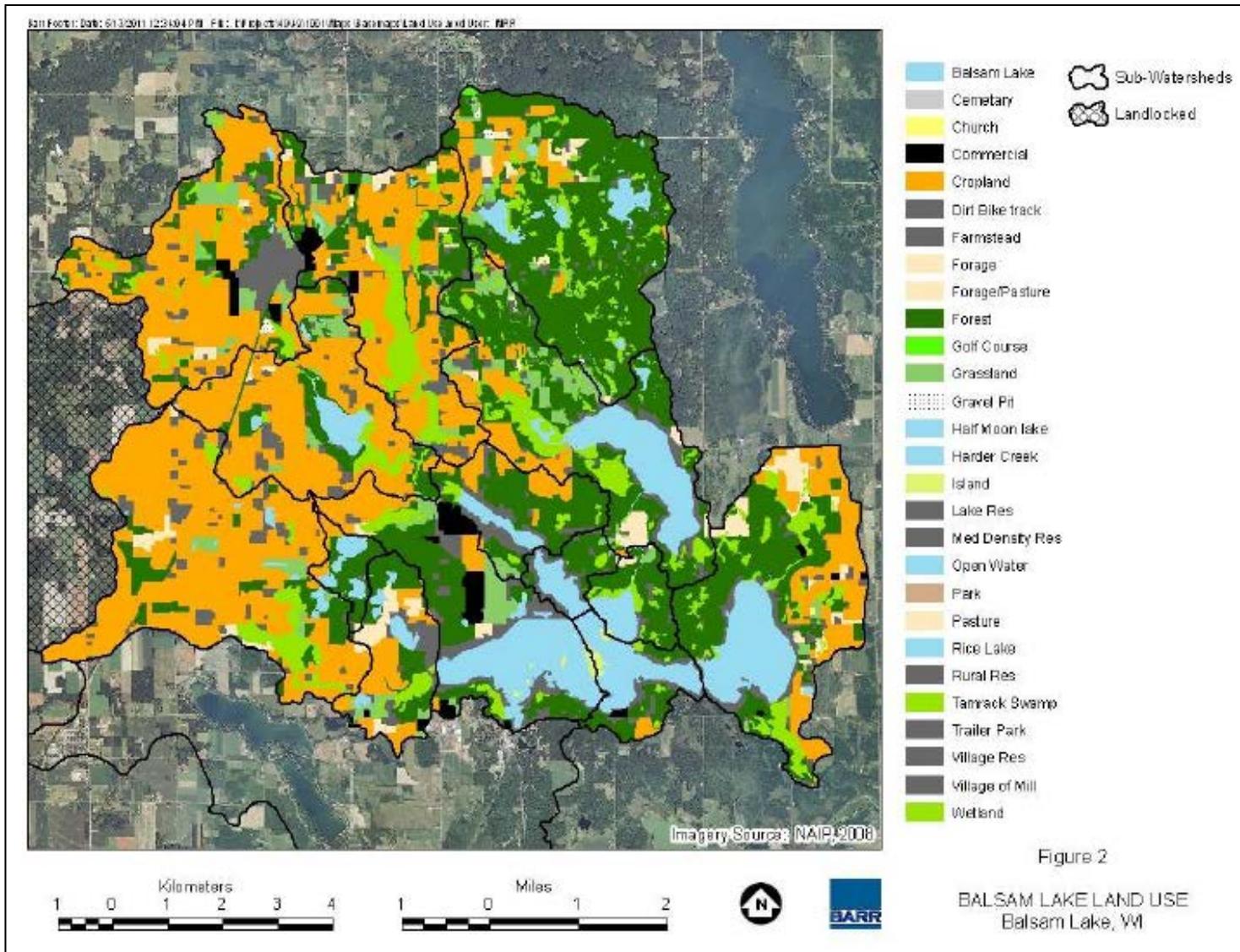


Figure 14. Balsam Lake Land Use (from Barr 2011)

## Internal Sediment Load

Lake sediments release phosphorus when bottom layers of water are devoid of oxygen. This phosphorus is in a form readily available for algae growth. Areas of the lake with deep water tend to stratify into warm top waters and cold bottom waters. This stratification holds phosphorus-rich waters at the lake bottom. However, when high winds occur in areas with shallow waters, temperature stratification weakens and water with high phosphorus concentration is brought to the surface.

According to the Barr study, East Balsam (S1) demonstrated release of phosphorus from lake sediments with mixing of the water column during the summer months. This resulted in very high levels of phosphorus and algae growth in this basin. The internal load of phosphorus from lake sediments for East Balsam has a significant effect on summer water quality, comprising half of the basin's annual phosphorus load in 2010. The watershed contributed 37 percent of the load and atmospheric deposition on the lake contributed 13 percent of the basin's annual phosphorus load. While the other lake basins have sediment release of phosphorus during the summer, it is not mixed into the lake water column until the fall when the water cools and mixes.<sup>9</sup>

Curly leaf pondweed, an invasive aquatic plant species which dies back in late June and early July, can also contribute to phosphorus in the water column. It is possible that curly leaf dieback contributed to spikes in phosphorus in East Balsam (Basin S-1) that occurred during this time period.

While curly leaf pondweed beds were not measured in 2010, they covered 56 acres of this 550 acre basin in June 2011.<sup>10</sup>

### **Sediment Analysis for Potential Alum Application**

Balsam Lake's Long Range Plan recommended analysis of East Balsam Lake sediments in order to assess appropriate means to control the East Balsam internal phosphorus load.

The BLPRD contracted with limnologist, Dr. Bill James from University of Wisconsin, Stout to complete this analysis. The study will complete the following:

1. Measure rates of phosphorus (P) release from East Balsam sediments under aerobic and anaerobic conditions in the laboratory,
3. Quantify the thickness of the excess mobile P layer in the sediment that could be controlled by alum,
4. Estimate the dosage of alum required to bind mobile P fractions in this active sediment layer,
5. Provide cost estimates for alum application based on treatment areas in the lake,
6. Evaluate management of internal P loading via de-stratification and alum application to East Balsam Lake.

---

<sup>9</sup> Barr. 2011.

<sup>10</sup> Berg, Matthew S. *Curly-leaf Pondweed P/I, Bed Mapping, and Pre/Post Herbicide Surveys Balsam Lake, Polk County, Wisconsin*. Endangered Resource Services, LLC. June 2009.

### **Phosphorus from Watershed Runoff**

Phosphorus is a primary nutrient, essential for healthy plant and algae growth. However, increased phosphorus levels speed up the process of eutrophication - where excess nutrients stimulate plant growth and cause extensive algae blooms. Prolific plant growth may lower dissolved oxygen levels when plants decay and consume oxygen.

Phosphorus loading in Balsam Lake is the result of non-point sources. Non-point sources include rain falling on the lake and runoff from within the watershed. Phosphorus can be dissolved in the runoff water as well as carried in soil particles that erode from bare soil.

The amount of phosphorus runoff from the watershed is determined by land use in the lake's watershed along with watershed soils and topography. Agricultural and residential development tends to increase runoff and the amount of phosphorus that makes its way to the lake as a result. Land maintained in a natural, vegetated state, on the other hand, is beneficial to soil and water quality. With natural vegetation, soil erosion is reduced and fewer pollutants are able to enter and impact the lake via runoff. Tall vegetation slows the flow of water, while forest groundcover and fallen leaves allow runoff water to soak into the soil.

### **Balsam Branch Priority Watershed Project**

The Balsam Branch Priority Watershed Project was a project of the Polk County Land and Water Resources Department (LWRD) supported by state Department of Natural Resources (DNR) and Department of Agriculture, Trade, and Consumer Protection (DATCP) funding. BLPRD commissioners provided input as part of the citizen's advisory committee that assisted with plan development. The BLPRD also assisted with landowner cost sharing in implementation of conservation best management practices. Discussion of the watershed project is included here because of the importance of watershed management for lake water quality.

The Balsam Branch Priority Watershed Project provided an opportunity to identify and address sources of watershed pollution entering Balsam Lake. The Balsam Branch Priority Watershed Project plan examined the sources of nonpoint pollution in the watershed and guides the implementation of pollution control measures. Funding was available for installation of water quality conservation best management practices from 1996 – 2006. The watershed plan established an in-lake summer phosphorus concentration goal of 16 ug/l. A total phosphorus reduction of 26.7 percent was needed to reach the in-lake phosphorus goal.<sup>11</sup>

The Department of Natural Resources conducted a water quality appraisal as background for the priority watershed project. The appraisal identified the primary phosphorus

---

<sup>11</sup> Nonpoint Source Control Plan for the Balsam Branch Priority Watershed Project. Wisconsin Department of Natural Resources, et al. April 1995.

sources to Balsam Lake as agricultural runoff (37 percent) and Rice Lake (via Rice Creek) (18 percent).<sup>12</sup> Recommendations from the appraisal:

- Target a 60 percent phosphorus loading reduction in the areas draining directly to surface water flowing to Balsam Lake (a whole lake reduction of 42 percent);
- Conduct an intensive urban nutrient reduction program;
- Consider in-lake remediation (alum treatment) for Little Balsam; and
- Reduce nutrients from Rice Creek tributary.

**Watershed Project Results**

Landowners installed many best management practices for the watershed project. The state/county share of practice installation amounted to \$171,663. The total amount provided for the whole project area (the entire Balsam Branch watershed) was \$811,234. Conservation best management practices were aimed at reducing runoff from agricultural areas and improving habitat and reducing runoff from waterfront property.

The BLPRD encouraged participation in the project by paying a portion of the landowner share for watershed practices. The BLPRD provided the entire 30 percent landowner share for projects within the district and 22.5 percent (or 75 percent of the landowner share) for projects within the Balsam Lake subwatershed. State and county cost sharing and the landowners paid the remaining costs. Some of the projects in the Balsam Lake subwatershed were completed before the BLPRD made the offer to pay a portion of the landowner share.

*Table 3. Balsam Branch Priority Watershed Cost Share Projects with BLPRD Contributions*

<b>Project</b>	<b>Year</b>	<b>BLPRD Contribution</b>
Little Balsam Gully #1	2003	\$9,585
Little Balsam Gully #2	2003	\$3,559
Barnyard Fencing and Watering	2004	\$2,230
Otter Creek Bank Stabilization	2003	\$2,587
Manure Pit Closure	2002	\$2,893
<b>TOTAL BLPRD</b>		<b>\$20,854</b>

The BLPRD met periodically with Polk County Land and Water Resources Department (LWRD) staff to review priorities for watershed practice installation. Polk County LWRD staff identified priorities for conservation best management practice installation, met with landowners to encourage participation, and provided technical assistance and cost sharing for practice installation.

Changing agricultural practices have also influenced sediment and phosphorus delivery to Balsam Lake, although it is uncertain whether this change was positive or negative. There are currently fewer dairy farms (a potential source of nutrients from animal manures)

<sup>12</sup> *An Appraisal of the Surface Water Resources of the Balsam Branch Priority Watershed*. The Wisconsin Nonpoint Source Priority Watershed Program. Wisconsin Department of Natural Resources. August 1989.

than when the watershed inventory occurred in 1994. In 1994 there were 29 barnyards. Retirement and economic attrition had claimed 15 of these originally inventoried farms by 2005. Of the 14 active farms in 2005, 7 had developed and implemented nutrient management plans by 2011.

Phosphorus loading reductions from fewer barnyards may be negated because of increases in soil erosion. Fields that grew hay for dairy cattle in the past are now used for row crop production. Row crop production generally results in higher soil erosion rates and nutrient and sediment delivery to water bodies. Nutrient management plans which require incorporation of manure lead to fall plowing which also results in higher erosion rates because of less residue left on crop fields. Crop residues help to decrease soil erosion from fields. Soil erosion has also increased as fields are removed from the Conservation Reserve Program.

Some tillage changes have slowed soil loss. These include increased use of no-till with technology improvements and declines in tillage frequency because of high fuel prices.

Transect surveys, used by the Polk County Land and Water Resources Department to monitor soil erosion, document these changes. The Balsam Lake watershed transect survey found that erosion increased in the watershed from 1999 to 2011. There are more sample sites above T, the tolerable soil loss rate. The graph below illustrates the percentage of crop fields sampled with various multiples of T, which is generally a loss of 4 to 5 tons of soil per acre per year in Polk County.<sup>13</sup>

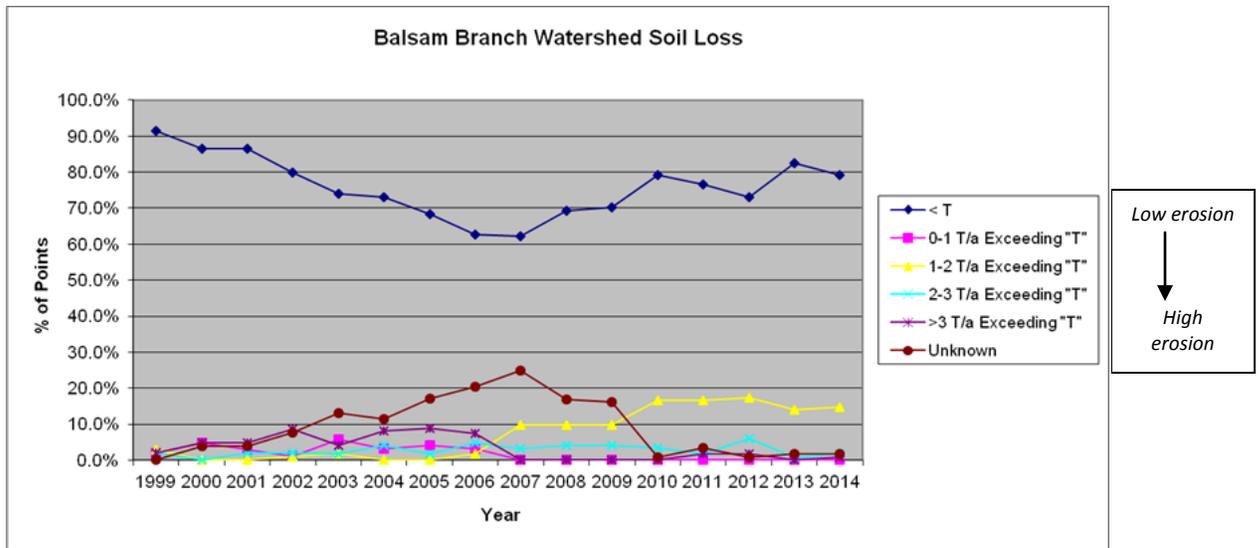


Figure 15. Soil Loss in the Balsam Lake Watershed

<sup>13</sup> Information provided by Eric Wojchik, Polk County Land and Water Resources Department. February 2015. Note that a change in measurement methods occurred in 2007 which makes data from 1999 to 2006 and from 2007 to 2011 less directly comparable. Beginning in 2010 “unknown” points decreased because some data points formerly identified as unknown were eliminated because they were no longer crop fields.

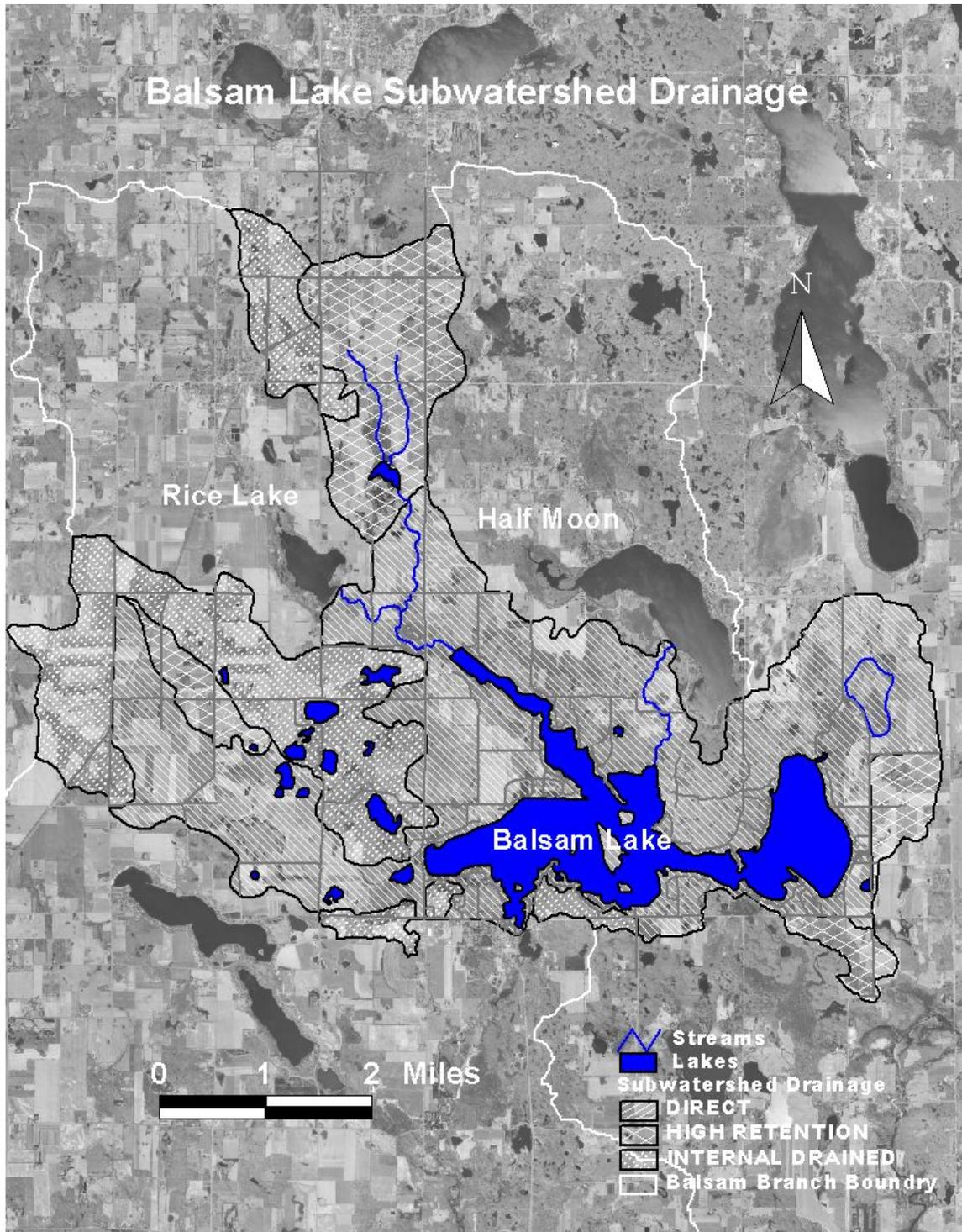


Figure 16. Balsam Lake Watershed and Drainage Areas

### East Balsam Lake Agricultural Assessment

The BLPRD contracted with the Polk County Land and Water Resources Department to assess farm field runoff in the East Balsam Lake subwatershed in 2014. The assessment includes the following:

- Soil tests for participating farmers
- Estimates of phosphorus runoff from specific farm fields
- Identification of sources of agricultural runoff
- Proposed best management practices to address runoff sources
- Evaluation of nutrient management plans.

As of mid-November 2014, soil samples results were available for almost 50% of field acres. Owners have agreed to test additional fields which will include 76% of farm field acres in the study. The assessment will be completed in 2015.

## Balsam Lake Protection and Rehabilitation District (BLPRD) Activities

The Balsam Lake Protection and Rehabilitation District has been active in water quality monitoring and implementing water quality improvements for Balsam Lake since its formation in 1976. A timeline of BLPRD activities is included on a following page.

### Waterfront Runoff Program

The BLPRD initiated the Waterfront Runoff Program in 2008. The program offered technical assistance, education, and limited cost sharing for installation of waterfront water quality practices. Free site visits were provided to residents interested in correcting erosion problems and reducing runoff from their property. Workshops provided information about rain gardens and native plants and highlighted installed demonstration practices. Educational materials developed for this program, including a waterfront runoff self-evaluation checklist and waterfront runoff guide for waterfront property owners, are available to other lake organizations to use with similar programs.

Many projects have been installed under the BLPRD waterfront runoff project. They include 5 shoreland buffers, 5 rain gardens, and 7 rock infiltration pits. All of these projects were installed from 2009-2013. An example project at the Village of Balsam Lake boat landing is a rock infiltration pit installed in 2012 shown in the photo below.



*Figure 17. Balsam Lake Highway 46 Landing Rock Infiltration Pit*

### Conservancy Properties

Conservancy properties can be established through outright ownership or by establishing conservation easements. Conservancy properties allow preservation of critical habitat and watershed areas. They also provide the ability to install conservation practices. The BLPRD currently owns title to six conservancy properties.

Conservation easements may be used as a tool in the future. Conservation easements are property deed restrictions that limit the uses of the property in perpetuity. They are voluntary agreements between the easement holder and the landowner that generally limit development of commercial or residential buildings and related structures. Conservation easements may place additional restrictions on how the property is used.

### Millpond Bridge Replacement

The BLPRD worked with Polk County, the Village of Balsam Lake, the Balsam Lake Area Chamber of Commerce, and the DNR to develop a plan to replace the box culvert under County Highway I. This culvert separated the Mill Pond from Town Bay of Balsam Lake. A replacement bridge installed in the fall of 2013 allows more boat access between the Mill Pond and Town Bay. It was installed at a cost of \$486,400 with funding from the BLPRD, the Village of Balsam Lake, and Polk County.

## A Timeline of BLPRD Efforts

- 1974 Balsam Lake Homeowners Association formed
- 1976 Balsam Lake Protection and Rehabilitation District established
- 1977 Aquatic plant harvesting began – contract with Aquatic Nuisance Control
- 1983 BLPRD spent \$9,000 to assist with clean-up of Glenna Farm<sup>14</sup>
- 1985 Sanitary sewer feasibility study (SEH, Inc.)
- 1986 Sanitary sewer study completed. Board decided not to proceed with sewer system
- 1988 Portable toilets installed at boat landings  
Boat and boat lift purchased for water safety patrol
- 1994 80 acre Glenna Farm purchased and named property Balsam Acres  
Animals removed from farm and ended farming operations  
(reduced nutrient and sediment loading to Rice Creek and Balsam Lake)
- 1995 Balsam Acres uplands seeded to prairie  
Dockside newsletter began
- 1998 Sewer feasibility study completed (Cedar Corporation)
- 1999 Flyover study completed (A.W. Research)  
Sanitary district formed within boundaries of the lake district  
Sediment basin constructed on Balsam Acres
- 2000 Water quality testing of some streams initiated  
Ground-truthing for flyover study completed  
Web site established  
Macrophyte management plan (Barr Engineering) adopted  
Application of herbicide to lake navigational channels began; ended harvesting  
Cost-share plan with Village of Balsam Lake for dam operation began
- 2002 Sewer feasibility study results presented(Cedar Corporation)  
Sanitary sewer system proposal rejected at annual meeting  
Four survey monuments to monitor lake levels and better manage dam installed  
Five contiguous Deaver Trust parcels on south shore of Balsam Lake acquired  
Water quality testing around lake completed  
Phosphorus-free fertilizer \$2 coupons distributed
- 2003 Lake level monitoring began  
Acquisition of Stumps properties pursued  
Grant for acquisition of lot next to Deaver property received  
Auto sampler on Harder Creek installed  
Portion of the cost to install conservation practices provided:
  - 1) stabilized two gullies on Little Balsam
  - 2) cleaned-up gravel pit on Otter Creek
  - 3) fenced cattle from pond adjacent to East Balsam
- 2004 Park Drive (Lot 77) property acquired
- 2005 Peterson property acquired in the Stumps area
- 2007 Clean Boats, Clean Waters Program began
- 2008 Waterfront Runoff Program began
- 2011 Soltau acquisition
- 2013 Millpond bridge replacement
- 2013 Rice Creek acquisition/donation

---

<sup>14</sup> The property was eventually purchased by the BLPRD, and conservation practices were installed here.

# Aquatic Habitats

## Primary Human Use Areas

Residential development generally surrounds the lake. Waterfront property owners and the general public utilize Balsam Lake for a wide variety of activities including fishing, boating, swimming, and viewing wildlife.

Balsam Lake is a highly-used lake for fishing, and is the location for professional and amateur fishing tournaments (10 – 12 per year). There are four main boat landings for public use: the Highway 46 landing just north of the Village of Balsam Lake, the County I landing in the Village of Balsam Lake, the East Balsam landing off of County I (North), and the Town of Milltown landing on Little Balsam. All of these landings are marked with an “L” on the map in Figure 4. There are a total of 46 parking spaces for boats and trailers at these landings. Public boat landings increase the use of the lakes, and therefore increase the risk of introduction of invasive species.

## Functions and Values of Native Aquatic Plants

Naturally occurring native plants are extremely beneficial to the lake. They provide a diversity of habitats, help maintain water quality, sustain fish populations, and support common lakeshore wildlife such as loons and frogs.

### **Water Quality**

Aquatic plants can improve water quality by absorbing phosphorus, nitrogen, and other nutrients from the water that could otherwise fuel nuisance algal growth. Some plants can even filter and break down pollutants. Plant roots and underground stems help to prevent re-suspension of sediments from the lake bottom. Stands of emergent plants (whose stems protrude above the water surface) and floating plants help to blunt wave action and prevent erosion of the shoreline. The rush, reed, and rice populations around Balsam Lake are particularly important for reducing erosion along the shoreline, but these populations are also vulnerable to the nutrient loading and the resultant algae growth in the lakes. Northern wild rice (*Zizania palustris*) is present at the Rice Creek and Harder Creek inlets.

### **Fishing**

Habitat created by aquatic plants provides food and shelter for both young and adult fish. Invertebrates living on or beneath plants are a primary food source for many species of fish. Other fish, such as bluegills, graze directly on the plants themselves. Plant beds in shallow water provide important spawning habitat for many fish species.

## **Waterfowl**

Plants offer food, shelter, and nesting material for waterfowl. Birds eat both the invertebrates that live on plants and the plants themselves.<sup>15</sup>

## **Protection against Invasive Species**

Non-native invasive species threaten native plants in Northern Wisconsin. The most common are Eurasian water milfoil (EWM) and curly leaf pondweed (CLP). These species are described as opportunistic invaders. This means that they take over openings in the lake bottom where native plants have been removed. Without competition from other plants, these invasive species may successfully become established and spread in the lake. This concept of opportunistic invasion can also be observed on land, in areas where bare soil is quickly taken over by weeds.

Removal of native vegetation not only diminishes the natural qualities of a lake, but it increases the risk of non-native species invasion and establishment. The presence of invasive species can change many of the natural features of a lake and often leads to expensive annual control plans. Allowing native plants to grow may not guarantee protection against invasive plants, but it can discourage their establishment. Native plants may cause localized concerns to some users, but as a natural feature of lakes, they generally do not cause harm.<sup>16</sup>

## **Aquatic Invasive Species Status**

Purple loosestrife (*Lythrum salicaria*), reed canary grass (*Phalaris arundinacea*), giant and Japanese knotweed, and curly leaf pondweed (*Potamogeton crispus*) have been observed on Balsam Lake. More information about invasive species is found in Appendix B. Curly leaf pondweed is found in many locations around the lake.

Purple loosestrife has been present in Balsam Lake for many years. Plant surveyor, Matt Berg, first documented purple loosestrife near the village beach in 2009. The BLPRD referred this location to the Polk County Land and Water Resources Department who removed the plants and treated the stems with herbicide.<sup>17</sup> Since 2009 it has been repeatedly found and removed (dug up) from this area. In 2013 Matt documented many plants further north in the same bay (below the bank and gas station on Highway 46). The Polk County Land and Water Resources Department released beetles used to control purple loosestrife in 2014 and plans to release more in 2015.

There is a high risk that Eurasian water milfoil and other aquatic invasive species may become established in Balsam Lake. As described previously, there are four heavily used boat landings on the lake. The lake is a popular lake for bass fishing – including tournament fishing. Many fishermen travel from the Twin Cities, Minnesota area, and

---

<sup>15</sup> Above paragraphs summarized from *Through the Looking Glass*. Borman et al. 1997.

<sup>16</sup> *Aquatic Plant Management Strategy*. DNR Northern Region. Summer 2007.

<sup>17</sup> Jeremy Williamson, Polk County LWRD Personal communication. October 2009.

access the lake at the boat landings. With Eurasian water milfoil present in many urban Twin Cities lakes, the danger of transporting plant fragments on boats and motors is very real. Department of Natural Resource scientists have also found Eurasian water milfoil in the nearby Wisconsin counties of Burnett (Ham, Shallow, and Round Lakes), Barron (Beaver Dam, Horseshoe, Sand, Kidney, Shallow, Duck, and Echo Lakes), and St. Croix (Bass Lake, Cedar Lake, Goose Pond, Little Falls Lake, Lake Mallalieu, and Perch Lake). In Polk County, EWM is found in Long Trade, Horseshoe and Pike Lakes.

## Sensitive Areas

The Wisconsin Department of Natural Resources has completed sensitive area surveys to designate areas within aquatic plant communities that provide important habitat for game fish, forage fish, macroinvertebrates, and wildlife, as well as important shoreline stabilization functions. The Department of Natural Resources has transitioned to designations of *critical habitat areas* that include both *sensitive areas* and *public rights features*. The *critical habitat area* designation provides a holistic approach to ecosystem assessment and protection of those areas within a lake that are most important for preserving the very character and qualities of the lake. Protecting these *critical habitat areas* requires the protection of shoreline and in-lake habitat. The *critical habitat area* designation provides a framework for management decisions that impact the ecosystem of the lake.

*Critical habitat areas* include *sensitive areas* that offer critical or unique fish and wildlife habitat (including seasonal or life stage requirements) or offer water quality or erosion control benefits to the area (Administrative code 107.05(3)(1)(1)). The Wisconsin Department of Natural Resources is given the authority for the identification and protection of sensitive areas of the lakes. *Public rights features* are areas that fulfill the right of the public for navigation, quality and quantity of water, fishing, swimming, or natural scenic beauty.

## Sensitive Area Study

The Wisconsin Department of Natural Resources completed an Aquatic Plant Management Sensitive Area Assessment in 1989. The assessment identified 26 areas on the lake with aquatic plant values and described management requirements for each sensitive area. These areas are mapped in the sensitive area assessment in Figure 18. The full report is found at <http://dnr.wi.gov/lakes/criticalhabitat/>.

Twenty-four of the areas contain aquatic plant communities that provide important fish and wildlife habitat. Certain areas (11 out of 26) provide gravel and coarse rock rubble habitat important for walleye spawning. The report describes the sensitive area guidelines on the following page as good recommendations for the entire lake.

The BLPRD purchased two properties along Park Drive to protect one sensitive area and the 18.5-acre Peterson property and the 34-acre Soltau property to protect another significant sensitive area. The acquisition of these parcels carries out a recommendation specifically mentioned in the DNR Balsam Lake Sensitive Area Study.

*This large, mostly undeveloped bay provides great aesthetic and fish and wildlife value to the Balsam Lake ecosystem. It should be zoned conservancy and should be considered for acquisition by the lake district or a conservation organization to ensure it remains in its present state.*

There are sensitive areas surrounding or very near each of the lake's four boat landings. Educational efforts and watercraft inspections take place at the boat landings. The BLPRD-owned Peterson and Soltau conservancy properties are near the boat landing on East Balsam.

### Sensitive Area Guidelines for Walleye Spawning Areas

1. No alterations to gravel and coarse rock substrate unless alterations are to improve walleye spawning.
2. Erosion control is especially critical.
3. Chemical treatment and mechanical removal of aquatic plants need not be quite as restrictive as in aquatic plant sensitive areas.

### Sensitive Area Guidelines to Protect Fish and Wildlife Habitat

1. Limit vegetation removal to navigation channels or to no removal at all.
2. Control purple loosestrife.
3. Prohibit alterations to the near shoreline (covered by Chapter 30 permits).
4. Leave large woody debris (logs and stumps) in the water near the shoreline.
5. Maintain a natural shoreline buffer.
6. Prevent erosion, especially from construction sites.
7. Strictly enforce zoning ordinances.
8. Eliminate nutrient inputs caused by lawn fertilizers, failing septic systems, and other sources.
9. Consider acquisition of property in the Stumps area.

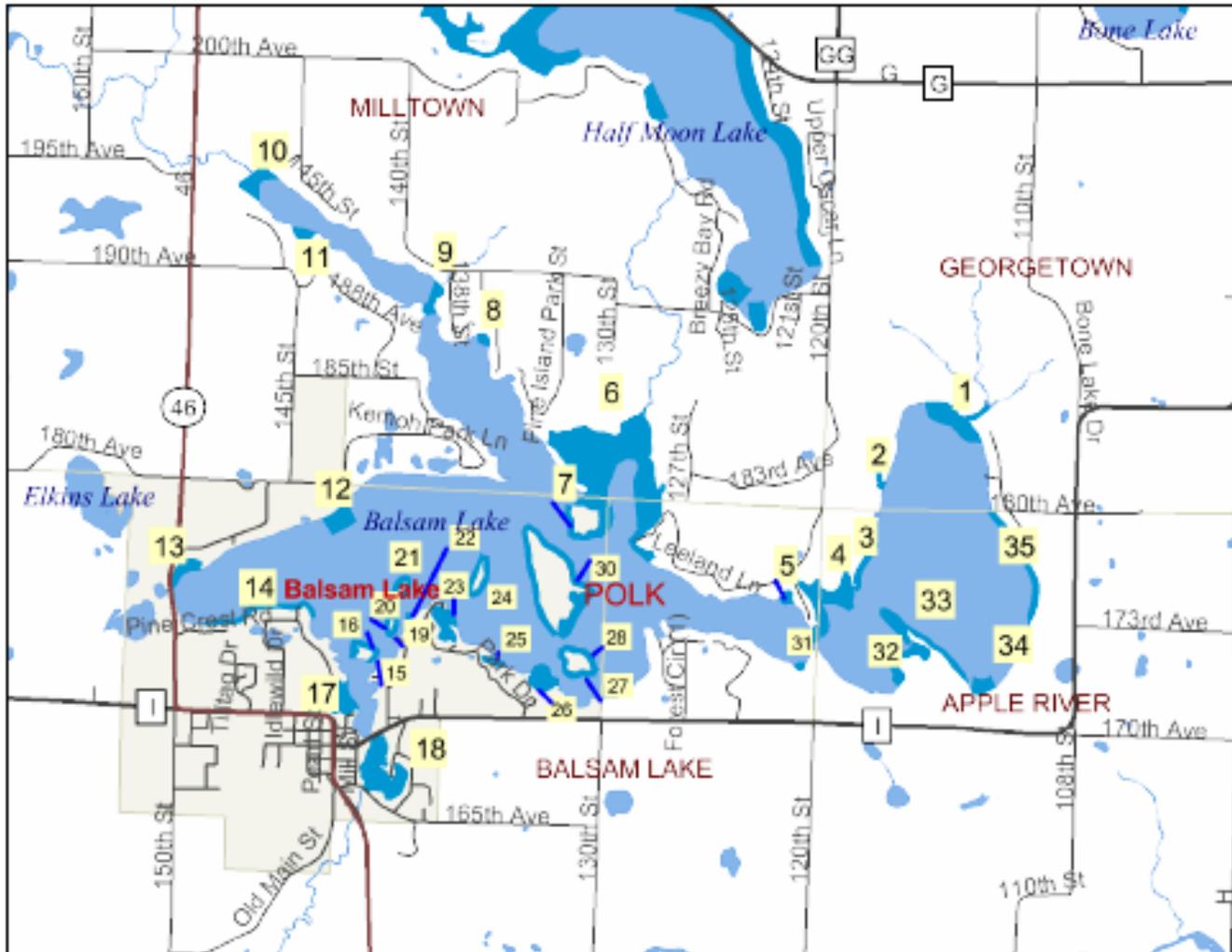


Figure 18. Balsam Lake Sensitive Area/Critical Habitat Area Designations

## Rare and Endangered Species Habitat

The Natural Heritage Inventory (NHI) species list is available to the public only by town and range. The towns included are as follows: Balsam Lake (T34N R17W), Milltown (T35N R17W), Georgetown (T35N R16W), and Apple River (T34N R16W).

Table 4. Natural Heritage Species in the Balsam Lake Area

Scientific Name	Common Name	Status	T34N R17W	T35N R17W	T34N R16W	T35N R16W
<i>Etheostoma microperca</i>	Least darter (fish)	SC/N			X	
<i>Cynus baccinator</i>	Trumpeter swan		X	X	X	X
<i>Plestiodon splanoides</i>	Prairie skink	SC/H	X			
<i>Potamogeton vaseyi</i>	Vaseys pondweed	SC		X		
<i>Myotis lucifugus</i>	Little brown bat	THR		X		

Key: **END** = endangered  
**THR** = threatened  
**SC** = special concern

WDNR and federal regulations regarding special concern species range from full protection to no protection. The current categories and their respective level of protection are as follows:

**SC/H** = take regulated by establishment of open and closed seasons

**SC/N** = no laws regulating use, possession, or harvesting

There are no aquatic communities listed in the NHI for the towns of Balsam Lake, Milltown, Georgetown, and Apple River.

The proposed actions within the plan are not anticipated to affect wildlife including the natural heritage species shown in Table 4.

## Fishery<sup>18</sup>

The Balsam Lake fishery consists of largemouth bass, walleye, northern pike, bluegill, black crappie, yellow perch, and pumpkinseed. According to Aaron Cole, WDNR fisheries biologist, Balsam Lake has always had a reputation of being a good fishing lake, but there have been some changes in the fish community. It had a better walleye population in the late 1980s. In 1989 the walleye population was 3.4 adults/acre. The walleye population has since declined, and in 2014 during the most recent survey, the walleye population had a density of 0.3 adults/acre. In 2011, there were 0.7 adults/acre. The decline of the walleye population has occurred despite extensive walleye stocking efforts with fry, small fingerlings, and low levels of large fingerlings.

Beginning in 2014, Balsam Lake will receive large fingerling walleye every other year at a rate of 10 fish/acre. The minimum length for walleye harvest is 15 inches, and bag limits vary each year.

The largemouth bass population has increased in Balsam Lake, and the lake currently has a high density, low size structure largemouth bass population. Largemouth bass have been managed with several regulations in recent years. In 2002, the WDNR liberalized bass regulations on Balsam Lake because bass growth rates declined, and the overall condition of bass was poor when compared to past fish surveys. Anglers were able to keep one bass less than 14 inches as part of their daily bag limit of five bass. This regulation sunset in 2012 and the limits reverted back to the statewide 14 inch minimum length limit regulation for the 2012 and 2013 fishing seasons. Beginning in spring 2014, largemouth bass were managed with a no minimum length limit and five fish daily bag limit regulation. Anglers are encouraged to harvest largemouth bass. If the bass population can be reduced, the size structure of largemouth bass should improve and walleye stocking success could potentially improve.

With the high density largemouth bass population, panfish populations are in good shape with many fish of desirable size. The majority of the angling effort on Balsam Lake is directed at panfish species. During the last two creel surveys (i.e., 2008 and 2011) anglers directed over 50% of the total effort towards panfish species, mainly bluegill and crappie. Anglers are allowed to harvest 25 panfish each day on Balsam Lake.

When considering fish in lake and watershed management, the following should be considered<sup>19</sup>:

1. Walleye spawn on clean gravel beds. Sedimentation can render these areas useless as spawning beds. It is important to keep sedimentation to these areas to a minimum. Waterfront runoff reduction projects and shoreline buffers of native vegetation can reduce sedimentation. The beds designated for walleye spawning areas (11 out of 35 total sensitive areas) include: 3, 7, 14, 16, 20, 21, 24, 28, 30, 33, and 35.

---

<sup>18</sup> *Balsam Lake Treaty Assessment Survey. Polk County, Wisconsin (MWBIC: 2620600)* Heath M. Benike. Senior Fisheries Biologist. Wisconsin DNR. April 2010. Updated by Aaron Cole, DNR Fisheries Biologist, February 2015.

<sup>19</sup> From *Aquatic Plant Management Plan Lake Wapogasset and Bear Trap Lake*. Ecological Integrity Services. August 2009.

2. Black crappie spawn when the water temperature is the same as that recommended for CLP treatment. This treatment would need to be timed accordingly prior to crappie spawning.
3. Since they spawn when water temperatures are in the 40's F, and herbicide treatments occur when the water temperatures are higher, herbicide application should not coincide with or disrupt northern pike spawning.

*Table 5. Spawning Temperatures and Substrate Needs*

<b>Fish species<sup>20</sup></b>	<b>Spawning Temp in °F</b>	<b>Spawning substrates</b>
Black crappie	Upper 50's to lower 60's	Build nests in 1-6 feet on hard bottom
Bluegill, Largemouth bass and Pumpkin seed	Mid 60's to lower 70's	Build nests in less than 3 feet on hard bottom
Northern pike	Upper 30's to mid 40's soon after ice-out	Broadcast eggs onto vegetation (eggs attach)
Smallmouth bass	Usually between 62 and 64 but recorded as low as 53	Nests in circular, clean gravel
Walleye	Low 40's to 50 degrees	Gravel/rocky shoals with moving or windswept water 1-6 feet deep
Yellow perch	Mid 40's to lower 50's	Broadcast eggs in submergent vegetation or large woody debris

---

<sup>20</sup> Information from Heath Benike. Wisconsin DNR Fisheries Biologist. 2006

# Plant Community

## Aquatic Plant Survey Results

Endangered Resource Services completed an aquatic plant inventory in June and August of 2014, according to the WDNR-specified point intercept method. A general boat survey was conducted prior to the point intercept survey to gain familiarity with the lake and the species present. An aquatic plant point intercept survey was also completed in 2009. A curly leaf pondweed (CLP) survey was conducted in June to confirm the locations of this aquatic invasive species. Since CLP typically dies in early July, CLP surveys are usually done in June while the CLP is robust.

The results discussed below, are summarized or taken directly from the aquatic plant survey. The survey and data analysis methods for the aquatic macrophyte survey are found in the report: *Curly-leaf Pondweed (Potamogeton crispus) Point-Intercept and Bed Mapping Surveys, and Warm Water Macrophyte Point/Intercept Survey, Balsam Lake – WBIC 2620600 Polk County, Wisconsin*, conducted and prepared by Matthew S. Berg of Endangered Resource Services, LLC.

Using a standard formula based on a lake's shoreline shape and length, islands, water clarity, depth, and size, the Wisconsin Department of Natural Resources (WDNR) generated the sampling point grid of 1,095 points. Figure 19 below shows the distribution of these sampling points used both in 2009 and 2014.

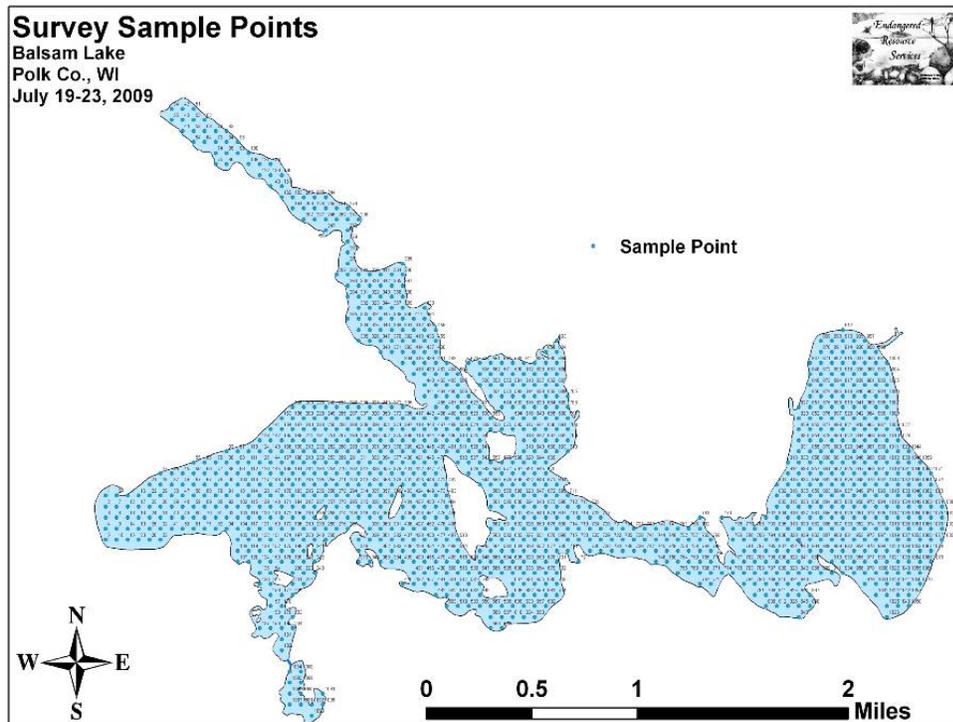


Figure 19. Sampling Point Grid

In August 2014, plants were found growing at 377 sites or on approximately 34.4% of the entire lake bottom and in 70.1% of the littoral zone (the depth at which plants can grow). This was a dramatic decrease from 2009 when plants were found at 600 points (54.8% of the total bottom and 88.8% in the littoral zone). Changes were not even throughout the lake. In both 2009 and 2014, the littoral zone in the main lake was essentially unchanged at approximately 15 feet. However, in East Balsam, rooted plants were consistently found to 18 feet and occasionally to 19 feet in 2009, but only to 10 feet in 2014.

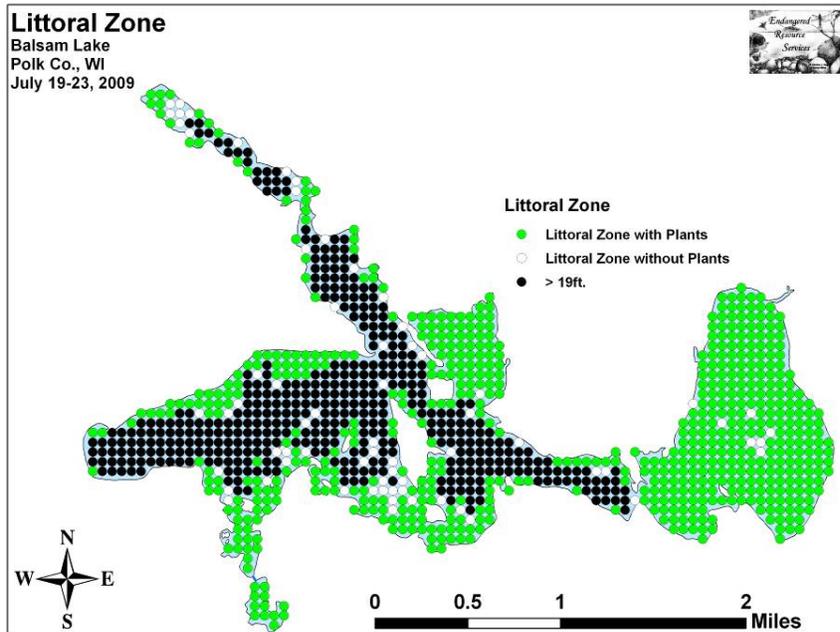


Figure 20. Balsam Lake Littoral Zone 2009

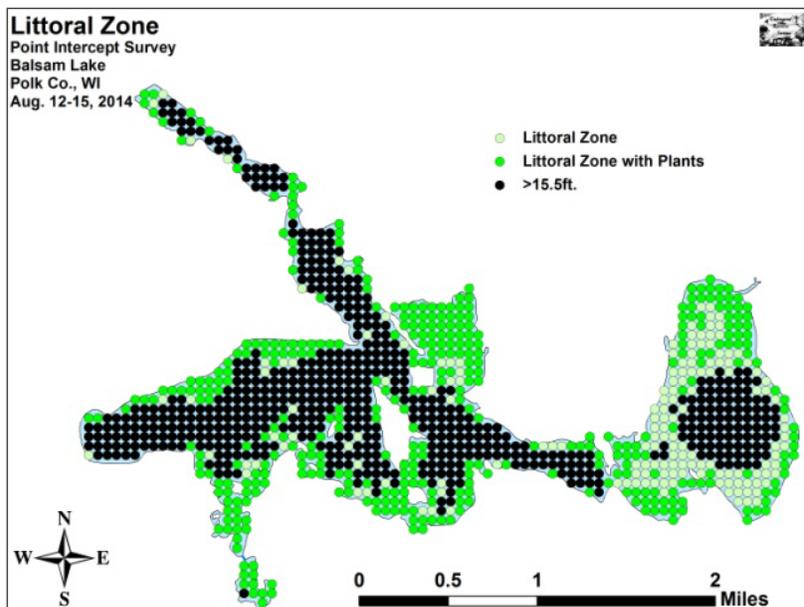


Figure 21. Balsam Lake Littoral Zone 2014

Bottom substrate is variable with muck bottoms in most bays, and rock/sand bars in the big and little narrows and around the lake's many islands

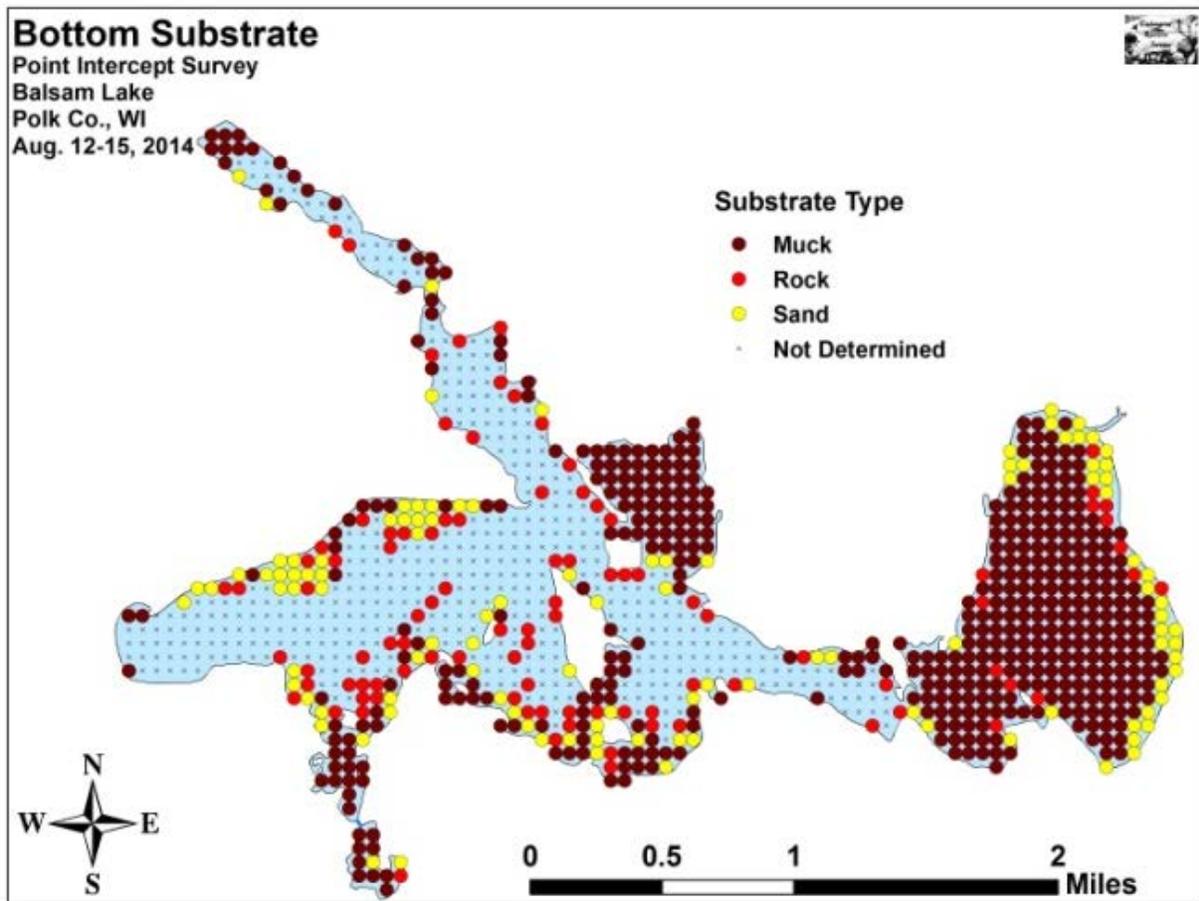


Figure 22. Balsam Lake Bottom Sediment Type

Plant diversity was exceptionally high in 2014 with a Simpson Diversity Index value of 0.92 - up slightly from 0.90 in 2009. Simpson Diversity Index is a measure of the likelihood that a different species of plant would be found each time a grab sample is taken. The highest Simpson Diversity Index is 1.0.

Species richness was also moderately high with 46 species found in and adjacent to the lake in 2014 – down from 47 in 2009. Mean native species richness at sites with vegetation was, however, up from 3.35/site in 2009 to 3.41/site in 2014 (Figure 23). Total rake fullness declined from a moderately high 2.32 in 2009 to a moderate 2.03 in 2014. This decline was most evident in East Balsam (Figure 24).

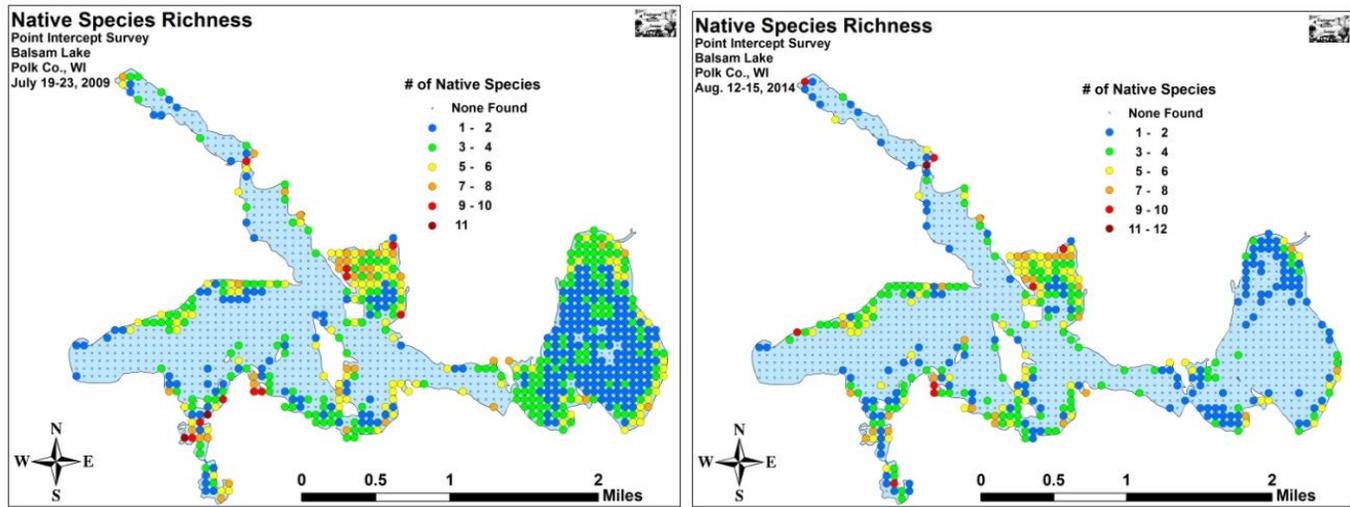


Figure 23. Native Species Richness 2009 and 2014

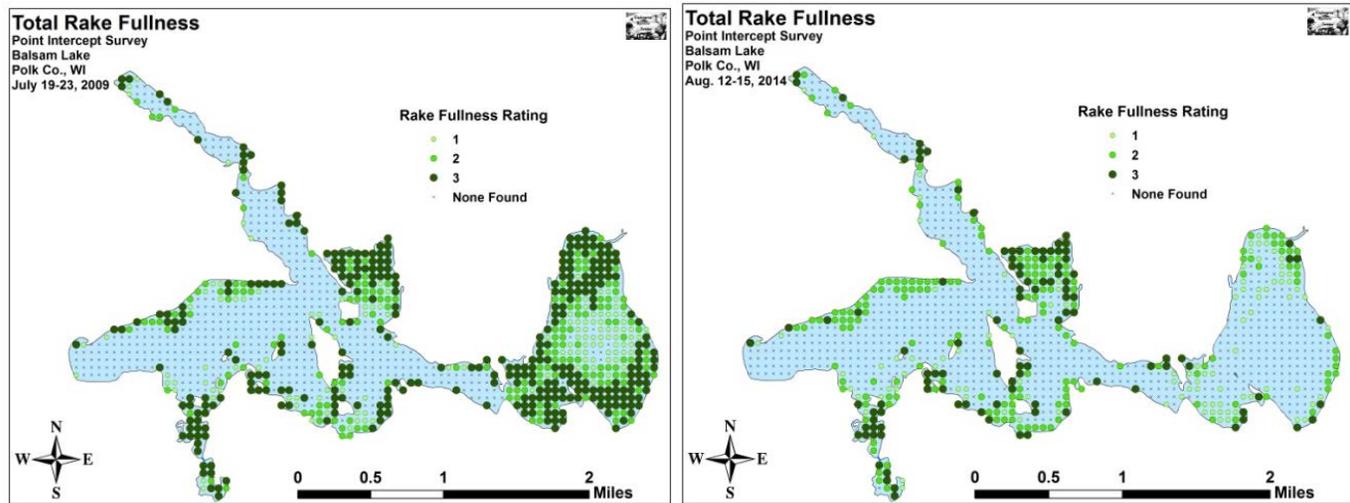


Figure 24. Total Rake Fullness 2009 and 2014

Table 6. Aquatic Macrophyte Survey Summary Statistics 2009 and 2014

Summary Statistics:	2009	2014
Total number of points sampled	1,095	1,095
Total number of sites with vegetation	600	377
Total number of sites shallower than the maximum depth of plants	676	538
Frequency of occurrence at sites shallower than maximum depth of plants	88.76	70.07
Simpson Diversity Index	0.90	0.92
Maximum depth of plants (ft)	19.0	15.5
Mean depth of plants (ft)	10.0	7.3
Median depth of plants (ft)	10.0	7.0
Number of sites sampled using rake on Rope (R)	116	148
Number of sites sampled using rake on Pole (P)	537	509
Average number of all species per site (shallower than max depth)	3.13	2.44
Average number of all species per site (veg. sites only)	3.53	3.49
Average number of native species per site (shallower than max depth)	2.97	2.38
Average number of native species per site (sites with native veg. only)	3.35	3.41
Species richness	38	38
Species richness (including visuals)	39	38
Species richness (including visuals and boat survey)	47	46
Mean rake fullness (veg. sites only)	2.32	2.03

The Balsam Lake ecosystem is home to a diverse plant community that is typical of high nutrient lakes with good water quality. This community can be subdivided into four distinct zones (emergent, shallow submergent, floating-leaf, and deep submergent) with each zone having its own characteristic functions in the aquatic ecosystem. Depending on the local bottom type (sand, rock, sandy muck, or nutrient rich organic muck), these zones often had somewhat different species present. More complete descriptions of the areas along with photos of the plants are found in the plant inventory report.

In shallow areas, beds of emergent plants prevent erosion by stabilizing the lakeshore, break up wave action, provide a nursery for baitfish and juvenile gamefish, offer shelter for amphibians, and give waterfowl and predatory wading birds like herons a place to hunt. These areas also provide important habitat for invertebrates like dragonflies and mayflies.

Emergent vegetation was found along sandy and rocky shorelines and at the edge of wetlands adjacent to the Rice and Harder Creek Inlets where the soil was a more nutrient rich organic muck. These areas also supported patches of Reed canary grass (*Phalaris arundinacea*) and sizable beds of Northern wild rice.

Just beyond the emergents, in muck-bottomed areas in up to five feet of water, the floating-leaf species were present. The canopy cover this community provides is often utilized by panfish and bass for protection. Submergent species grew among these floating leaf species.

Sand and sandy muck bottomed habitats supported few floating-leaf species. In pure sand areas, in water up to 5 feet deep, the plant community was dominated by generally finer leaved submergent plants which tend to form a carpet that stabilizes the bottom.

Shallow sandy muck areas tended to support slightly broader-leaved species. The roots, shoots, and seeds of these species are heavily utilized by both resident and migratory waterfowl for food. They also provide important habitat for fish throughout their lifecycles, as well as invertebrates like scuds, dragonfly and mayfly nymphs, and snails.

Floating-leaf and many shallow submergent species disappeared on Balsam Lake in water over 5 feet. These deeper areas were dominated by Coontail, Common waterweed, Curly leaf pondweed, Large-leaf pondweed, Small pondweed, White-stem pondweed (*Potamogeton praelongus*), and Flat-stem pondweed (*Potamogeton zosteriformis*). Predatory fish like the northern pike are often found along the edges of these beds.



Figure 25. Balsam Lake Areas

Table 7. Balsam Lake Species Frequency and Mean Rake Fullness 2014

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sight.
<i>Ceratophyllum demersum</i>	Coontail	245	18.63	64.99	45.54	1.64	1
<i>Lemna trisulca</i>	Forked duckweed	154	11.71	40.85	28.62	1.21	1
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	153	11.63	40.58	28.44	1.61	18
	Filamentous algae	145	*	38.46	26.95	1.61	0
<i>Vallisneria americana</i>	Wild celery	105	7.98	27.85	19.52	1.58	4
<i>Elodea canadensis</i>	Common waterweed	69	5.25	18.30	12.83	1.41	8
<i>Myriophyllum sibiricum</i>	Northern water-milfoil	66	5.02	17.51	12.27	1.36	27
<i>Potamogeton richardsonii</i>	Clasping-leaf pondweed	60	4.56	15.92	11.15	1.43	25
<i>Potamogeton pusillus</i>	Small pondweed	57	4.33	15.12	10.59	1.33	8
<i>Nymphaea odorata</i>	White water lily	47	3.57	12.47	8.74	1.57	11
<i>Potamogeton robbinsii</i>	Fern pondweed	33	2.51	8.75	6.13	1.39	6
<i>Potamogeton crispus</i>	Curly-leaf pondweed	32	2.43	8.49	5.95	1.09	1
<i>Heteranthera dubia</i>	Water star-grass	30	2.28	7.96	5.58	1.20	9
<i>Spirodela polyrhiza</i>	Large duckweed	30	2.28	7.96	5.58	1.43	1
<i>Lemna minor</i>	Small duckweed	29	2.21	7.69	5.39	1.34	1
<i>Najas flexilis</i>	Slender naiad	29	2.21	7.69	5.39	1.28	4
<i>Nuphar variegata</i>	Spatterdock	24	1.83	6.37	4.46	2.25	9
<i>Potamogeton illinoensis</i>	Illinois pondweed	21	1.60	5.57	3.90	1.71	7
<i>Wolffia columbiana</i>	Common watermeal	18	1.37	4.77	3.35	1.67	1
<i>Potamogeton amplifolius</i>	Large-leaf pondweed	14	1.06	3.71	2.60	1.57	8
<i>Nitella</i> sp.	Nitella	11	0.84	2.92	2.04	1.36	0
<i>Potamogeton friesii</i>	Fries' pondweed	11	0.84	2.92	2.04	1.27	1
<i>Ranunculus aquatilis</i>	White water crowfoot	11	0.84	2.92	2.04	1.36	1
<i>Stuckenia pectinata</i>	Sago pondweed	10	0.76	2.65	1.86	1.80	2

\* Excluded from the Relative Frequency Calculation

Table 7. continued

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sight.
<i>Potamogeton praelongus</i>	White-stem pondweed	9	0.68	2.39	1.67	1.56	7
<i>Chara</i> sp.	Muskgrass	6	0.46	1.59	1.12	1.17	1
<i>Sagittaria rigida</i>	Sessile-fruited arrowhead	6	0.46	1.59	1.12	1.33	2
<i>Utricularia gibba</i>	Creeping bladderwort	6	0.46	1.59	1.12	1.33	0
<i>Bidens beckii</i>	Water marigold	5	0.38	1.33	0.93	1.20	1
<i>Pontederia cordata</i>	Pickerelweed	5	0.38	1.33	0.93	1.80	3
<i>Brasenia schreberi</i>	Watershield	3	0.23	0.80	0.56	1.67	1
<i>Myriophyllum verticillatum</i>	Whorled water-milfoil	3	0.23	0.80	0.56	1.67	0
<i>Sparganium eurycarpum</i>	Common bur-reed	3	0.23	0.80	0.56	2.33	6
<i>Utricularia vulgaris</i>	Common bladderwort	3	0.23	0.80	0.56	1.00	1
<i>Zizania palustris</i>	Northern wild rice	3	0.23	0.80	0.56	1.33	1
	Aquatic moss	2	*	0.53	0.37	1.00	0
<i>Calla palustris</i>	Wild calla	1	0.08	0.27	0.19	1.00	0
<i>Potamogeton epihydrus</i>	Ribbon-leaf pondweed	1	0.08	0.27	0.19	2.00	0
<i>Potamogeton natans</i>	Floating-leaf pondweed	1	0.08	0.27	0.19	1.00	0
<i>Typha latifolia</i>	Broad-leaved cattail	1	0.08	0.27	0.19	3.00	0
<i>Eleocharis acicularis</i>	Needle spikerush	***	***	***	***	***	***
<i>Eleocharis intermedia</i>	Matted spikerush	***	***	***	***	***	***
<i>Eleocharis palustris</i>	Creeping spikerush	***	***	***	***	***	***
<i>Lythrum salicaria</i>	Purple loosestrife	***	***	***	***	***	***
<i>Phalaris arundinacea</i>	Reed canary grass	***	***	***	***	***	***
<i>Sagittaria latifolia</i>	Common arrowhead	***	***	***	***	***	***
<i>Schoenoplectus acutus</i>	Hardstem bulrush	***	***	***	***	***	***
<i>Schoenoplectus tabernaemontani</i>	Softstem bulrush	***	***	***	***	***	***

\*\* Visual Only \*\*\* Boat Survey Only

Coontail, the most common species in both 2009 and 2014, continues to be abundant throughout the main lake, but disappeared from most areas that it had formerly inhabited in East Balsam. This was especially true in the north bay (Figure 26). Found at 344 sites in 2009, it demonstrated a nearly significant decline in distribution to 245 sites in 2014.

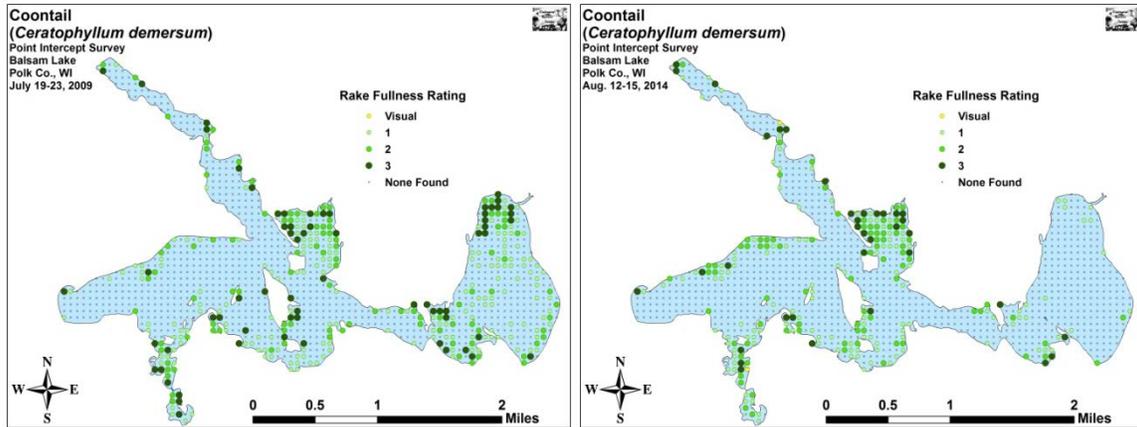


Figure 26. Coontail Density and Distribution 2009 and 2014

Forked duckweed's highly significant decline in distribution (331 sites in 2009 to 154 sites in 2014) and density appears to have been lakewide (Figure 27). The second most common species in each year, it was historically found growing in areas that had significant Curly leaf pondweed stands in June. Herbicide treatment to control CLP in East Balsam coupled with generally low levels of CLP in the main basin may explain Forked duckweed's relative scarcity.

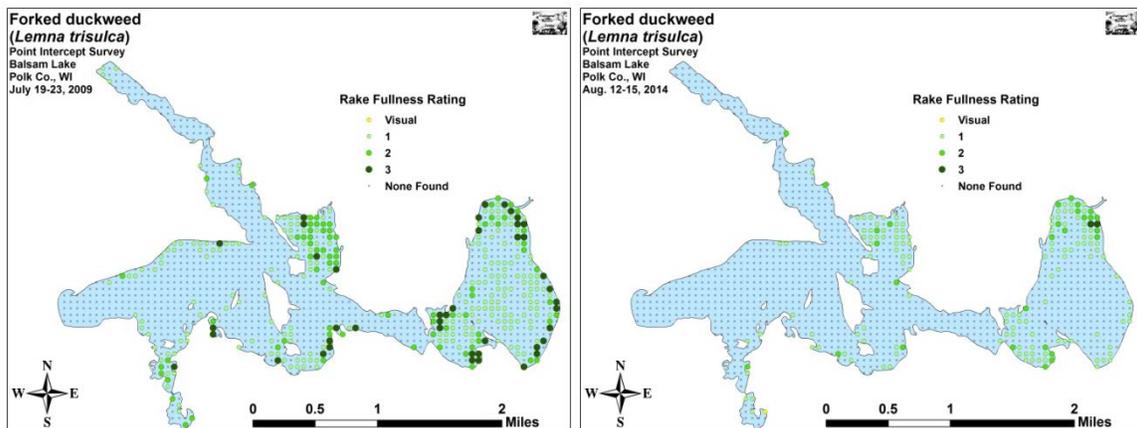


Figure 27. Forked Duckweed Density and Distribution 2009 and 2014

Small pondweed was the third most common macrophyte species in 2009, but only the eighth most common in 2014. Its highly significant decline in numbers (288 sites in 2009 to 57 in 2014) was accompanied by a significant decline in density. In 2009, this species formed a dense, nearly monotypic carpet that covered the majority of the deep flat in East Balsam. At this time, plants dominated the 10-18 foot bathymetric ring and grew from 8-10 feet in height producing a dense "forest" of habitat throughout much of the area. The maps for this species show that, while it was all but eliminated from East Balsam, it remained relatively unchanged in the main lake (Figure 28). This was also the case for Flat-stem pondweed which was the fourth most common species in 2009

(212 sites and a mean rake fullness of 1.55) and the third most common in 2014 (153 sites and a mean rake fullness of 1.61) (Figure 29).

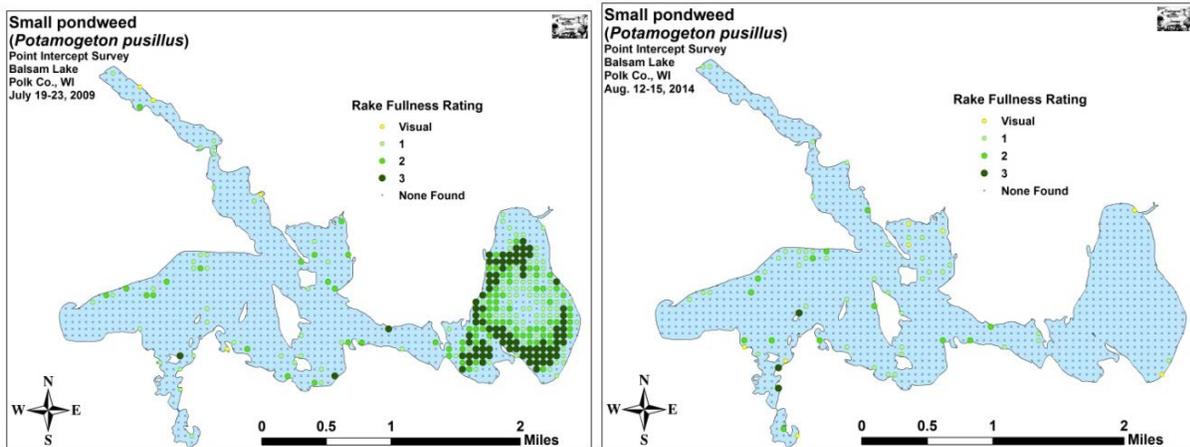


Figure 28. Small Pondweed Density and Distribution 2009 and 2014

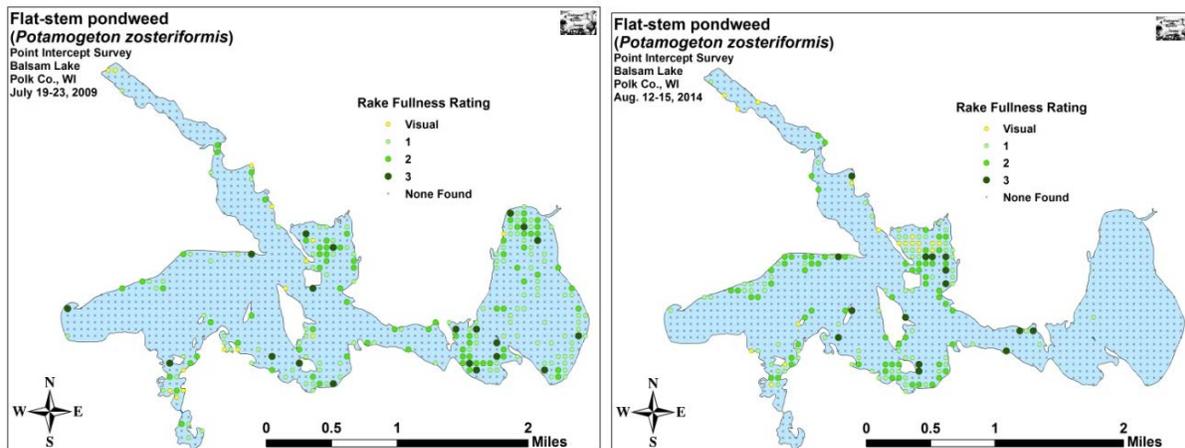


Figure 29. Flat-stem Pondweed Density and Distribution 2009 and 2014

**The Floristic Quality Index (FQI)** is an index developed by Dr. Stanley Nichols of the University of Wisconsin-Extension. This index is a measure of the plant community response to development and human influence on the lake. It takes into account the species of aquatic plants present and their tolerance for changing water quality and habitat characteristics. A plant's tolerance is expressed as a coefficient of conservatism (C). Native plants in Wisconsin are assigned a conservatism value between 0 and 10. A plant with a high conservatism value has more specialized habitat requirements and is less tolerant of disturbance and/or water quality changes. Those with lower values are more able to adapt to disturbance or changing conditions, and can therefore be found in a wider range of habitats. The FQI is calculated using the number of species present and these plants' species conservatism values. A higher FQI generally indicates a healthier aquatic plant community.

The 37 plants identified to species during the point intercept survey in 2009 produced a mean Coefficient of Conservatism of 6.1 and a Floristic Quality Index of 37.2. Similarly in 2014, 37

native index plants produced a mean Coefficient of Conservatism of 6.3 and a Floristic Quality Index of 38.1. Nichols (1999) reported an average mean C for the Northern Central Hardwood Forests Region of 5.6 putting Balsam Lake well above average for this part of the state. The FQI was also nearly double the mean FQI of 20.9 for the Northern Central Hardwood Forests Region (Nichols 1999).

### **Northern Wild Rice**

Wild rice is an aquatic plant with special significance to Native American Tribes. Wild rice is both ecologically and culturally important on the landscape. Rice beds provide diverse habitat for wildlife and fish acting as brood rearing and nursery areas. Waterfowl also use rice beds as a food source for both the abundant seeds and the diverse invertebrate community found attached to stalks. An annual grass dependent on flowing water, rice can exhibit a fair amount of variation in abundance from year to year in the same bed. Densities can fluctuate from bumper crops to poor production years. Being a plant of shallow water means that beds will not expand out further than 4 feet deep, preferring water depths from 6 inches to 3 feet. Culturally rice has played a prized role in the lives of the Ojibwe and others who have realized the nutritional value of this important resource.

Native American Tribal representatives have special interest and rights related to aquatic plant management in Balsam Lake because of the wild rice present. Balsam Lake is located within Tribal ceded territories. Draft and final copies will be distributed to the St. Croix Tribal Environmental Services Department and the Great Lakes Indian Fish and Wildlife Commission.

When Ojibwe tribes living in the western Great Lakes region ceded lands by treaty to the United States, they retained the right to fish, hunt, trap, and gather resources from the lands they ceded. These treaties and the agreements in them have been upheld by modern courts, and remain in effect today. In Wisconsin, roughly the northern third of the state (including all of Polk County but the southwest corner) consists of ceded territory where tribal rights were retained. On these lands, the state has the legal obligation to provide consultation with the tribes whenever a permit, decision, or management action may affect the wild rice resources upon which their harvest rights depend.

Northern wild rice (*Zizania palustris*) was present at three points in the 2014 plant survey – up from one in 2009. Dense rice beds with human harvest potential occurred at the Rice Creek inlet while rice at the Harder Creek inlet was patchy and of poorer quality.

All significant rice stands were established in the far ends of Little Balsam and Stump Bay at the Rice and Harder Creek inlets, and, outside these two areas, rice was not found anywhere in the system. These bays have filled in with plants over time to the point that there is now just a few inches to a foot of water over many feet of muck and detritus. In addition to the single rice plant at the survey point on the far downstream edge of the bed in Little Balsam, there was an estimated overall mean rake fullness of 3 along the creek inlet as far upstream as visible. This high density bed would have been profitable for human harvest; although shallow water in the bed would have made navigation difficult. At the Harder Creek inlet, the water was even shallower, and the many stumps and floating muck bogs coupled with a low overall rice density that varied from <1-2 with an estimated mean rake fullness of 1 likely meant that human harvest

in these beds would not have been profitable. Despite this, there were large numbers of waterfowl and other wildlife utilizing this important habitat area.



*Figure 30. Wild Rice Beds at the Rice Creek Harder Creek Inlets August 2014*

## Invasive Species

Three invasive species were located in the aquatic plant surveys. They include purple loosestrife, curly leaf pondweed, and reed canary grass. Giant and Japanese knotweed was located by the Polk County Land and Water Resources Department. More information about these species is included in Appendix B. Inventory results from the point intercept survey and other sources are included below.

### Purple Loosestrife

Purple loosestrife has been present in Balsam Lake for many years. Plant surveyor, Matt Berg, first documented purple loosestrife near the village beach in 2009. The BLPRD referred this location to the Polk County Land and Water Resources Department who removed the plants and treated the stems with herbicide.<sup>21</sup> Since that time, it has been repeatedly found and removed (dug up) from this area. In 2013 Matt documented many plants further north in the same bay (below the bank and gas station on Highway 46). The Polk County Land and Water Resources Department released beetles used to control purple loosestrife in 2014 and 2015.

### Giant and Japanese Knotweed<sup>22</sup>

Polk County Land and Water Resources staff located a few populations of the two invasive species around Balsam Lake as part of a rapid response project. Giant knotweed is a prohibited species listed in NR40.04(2)). Plants were found on the Millpond and at a private residence.

---

<sup>21</sup> Williamson, Jeremy, Polk County LWRD Personal communication. October 2009.

<sup>22</sup> Wojchik, Eric. Polk County Land and Water Resources Department. January 2015.

## Curly Leaf Pondweed

Endangered Resource Services conducted a curly leaf pondweed distribution survey June 16 through 18 and a bed mapping survey June 17 and 20, 2014.<sup>23</sup> The distribution survey involved taking rake samples and recording plant abundance. Results of this survey are illustrated in Figure 31 below.

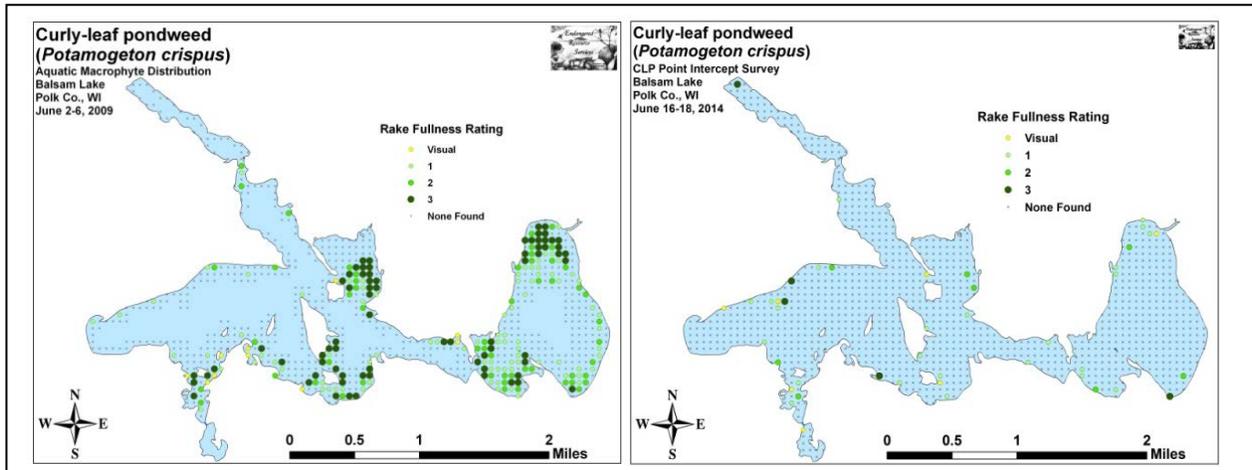


Figure 31. Balsam Lake CLP Density 2009 and 2014.

### Curly Leaf Pondweed Density Survey

In 2014 CLP was present in the rake at 37 points which approximated to 3.4% of the entire lake. The 2009 spring Curly-leaf pondweed survey found CLP at 212 sites which approximated to 19.4% of the entire lake. Collectively, there was a greater than 82.5% reduction in total CLP coverage also well as an 89.7% reduction in areas where the infestation was significant enough to potentially be considered a nuisance. The reduction in East Balsam was especially dramatic as CLP was abundant and frequently canopied here in 2009, but almost completely absent following the 63 acre herbicide treatment in May 2014.

### CLP Bed Mapping Survey

For the purpose of this study, a CLP bed was defined by the following criteria: 1) CLP plants made up greater than 50% of all aquatic plants in the bed, and 2) the CLP had canopied at the surface or was close enough to the surface that the growth would likely interfere with normal boat traffic.

Endangered Resource Services located and mapped a total of 14 beds in 2014 which covered a total of 4.45 acres or 0.2% of the lake's 2,054 total acres (Table 8). CLP beds were also mapped in 2009 and in 2011 through 2013 each year following herbicide treatment which had varying degrees of success. CLP 2014 mapped beds represented a 76.13 acre (-94.5%) reduction from the 80.58 acres mapped in 2013, and a 36.76 acre (-89.2%) reduction from the original 2009 survey. Changes in CLP acreage result not only from CLP herbicide treatment, but also natural fluctuations in growth.

<sup>23</sup> Berg, Matthew S. *Curly-leaf Pondweed (Potamogeton crispus) Point-Intercept and Bed Mapping Surveys, and Warm Water Macrophyte Point/ Intercept Survey, Balsam Lake – WBIC 2620600 Polk County, Wisconsin*. February 2015.

Table 8. CLP Bed Summary - Balsam Lake, Polk County (2009 – 2014)

Bed #	Location	2014 Area (Acres)	2013 Area	2012 Area	2011 Area	2009 Area	2013-14 Change in Area	Est. Range and Mean Rake-full	Years Treated	Acreege Treated
1	HWY 46 Landing	0.07	0.00	0.58	0.00	1.81	0.07	<1-2; 1	2011	1.81
1A	Balsam Branch Inlet	0.04	0.00	0.00	0.00	0.00	0.04	<<<1-2; <1	-	-
2	Boston Bay	0.15	0.64	1.23	0.08	1.71	-0.49	<1-2; 1	-	-
3-6	Stump Bay	0.00	0.00	0.67	0.00	1.33	0.00	<<<<1	-	-
7+8	East Shore Stump Bay/Outlet	0.08	3.08	4.91	0.00	10.64	-3.00	<1-3; 2	-	-
9	NW of Big Narrows	0.00	0.00	0.19	0.00	0.10	0.00	<<<<1	2011	0.11
10	NW of Big Narrows	0.00	0.18	0.00	0.00	0.16	-0.18	<<<<1	2011	0.22
11	Bay NW of Big Narrows	0.00	2.70	4.72	1.04	2.83	-2.7	<<<1-1; <<1	2013, 11, '10	4.71, 2.80, 2.85
12	Bay NE of Big Narrows	0.00	10.34	0.00	5.91	0.73	-10.34	0	2014, 2012	10.37, 5.91
13	N. Bay of East Balsam	0.00	40.83	0.00	43.14	5.29	-40.83	0	2014, 2012	38.66, 43.14
14	SE Bay of East Balsam	0.00	4.37	0.00	6.95	1.29	-4.37	0	2014, 2012	4.37, 6.95
14B, 14C	Bay SE of Big Narrows	0.00	9.92	0.00	0.00	0.00	-9.92	0	2014, '11, '09	9.92, 3.07, 11.38
15, A, B	SE of Big Island	1.59	8.22	8.78	3.80	3.55	-6.63	<<<1-3; 2	2013	8.70
16	Bay S. of Paradise Island	0.00	0.00	0.65	0.00	1.21	0.00	<<<<1	2011	1.26
16A	N. of Paradise Landing	0.42	0.00	0.00	0.00	0.00	0.42	1-3; 3	-	-
16B	NE of Paradise Landing	0.11	0.00	0.00	0.00	0.00	0.11	1-3; 2	-	-
17	Bay SW of Paradise Island	0.08	0.00	0.00	0.00	0.66	0.08	1-2; 2	-	-
17A	West of Paradise Island	0.13	<0.01	1.86	0.00	0.00	0.12	<1-2; 2	-	-
17B	Raskin Bay	0.00	0.00	0.00	0.26	0.00	0.00	<<<<1	-	-
17C	Raskin Bay Outlet	0.00	<0.01	1.04	0.00	0.00	-<0.01	<1-1; <1	-	-
18	Channel E. of Pine Island	0.00	0.00	0.00	0.00	0.55	0.00	<<<<1	2011, '10	0.59, 0.57
19A , B	Channel E. of First Island	0.00	0.00	0.98	0.00	4.83	0.00	<<<<1	2011, '10	4.87, 4.55
20, 20A	East of Idlewild Bay	1.58	0.30	0.10	0.00	4.19	1.28	<1-3; 3	2011	4.26
21	N. of Village Beach	0.00	0.00	0.00	0.00	0.29	0.00	<<<<1	-	-
22	Northwest Mill Pond	0.00	0.00	0.40	0.00	0.00	0.00	<<<<1	-	-
23	Northeast Mill Pond	0.05	0.00	0.43	0.00	0.00	0.05	1-2; 1	-	-
24	Mill Pond Point	0.15	0.00	1.37	0.00	0.00	0.15	1-2; 1	-	-
25	Southeast Mill Pond	0.00	0.00	0.30	0.00	0.00	0.00	<<<<1	-	-
<b>Total</b>		<b>4.45</b>	<b>80.58</b>	<b>28.21</b>	<b>61.18</b>	<b>41.21</b>	<b>-76.13</b>			

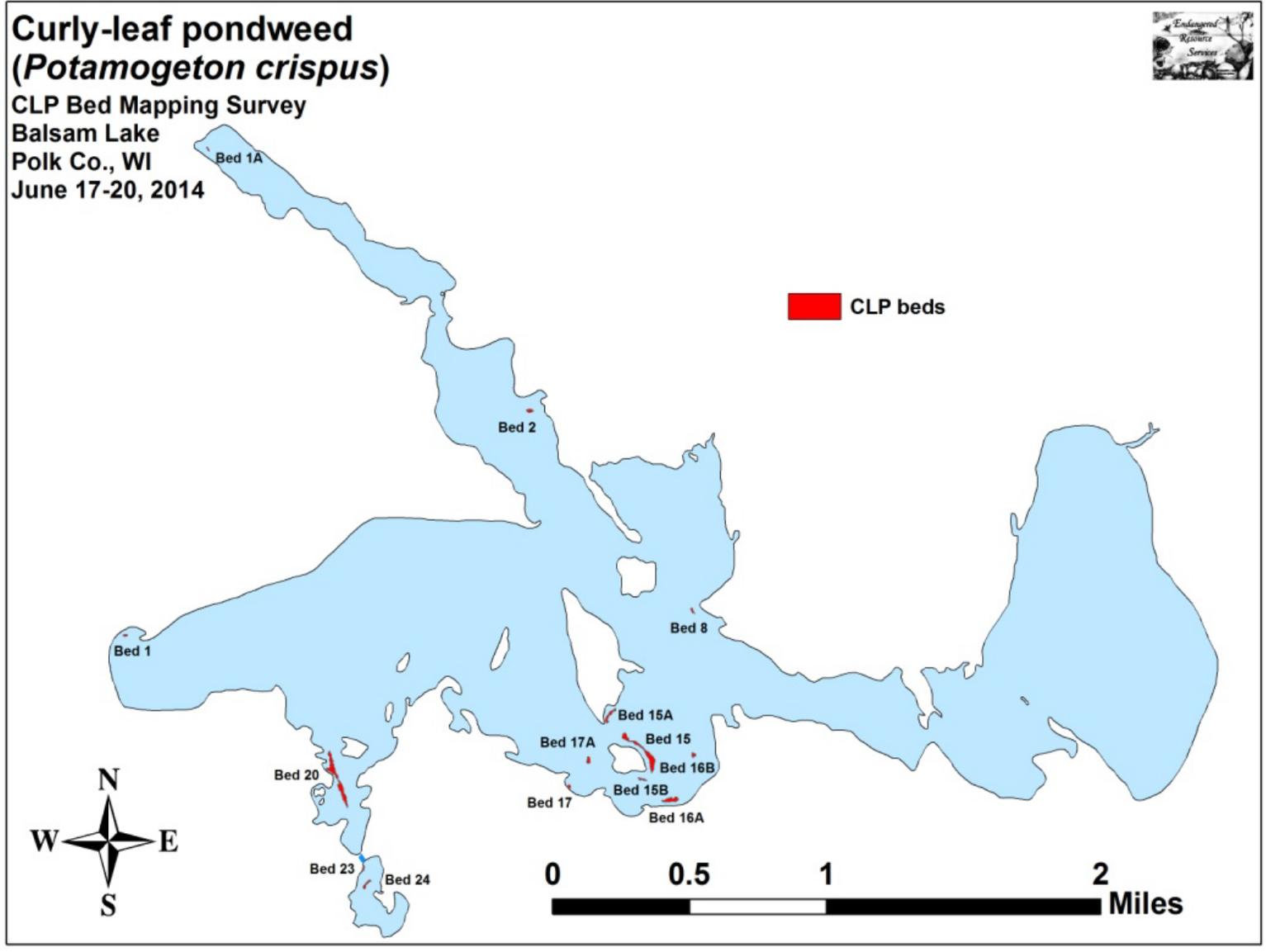


Figure 32. Balsam Lake CLP Beds 2014 (Following East Balsam Lake Herbicide Treatment)

## CLP Bed Descriptions – Current and Past

Bed 1 – This bed near the western boat landing was characterized by low density but continuously canopied Curly leaf pondweed (CLP) and Coontail.

Bed 1A – Located at the Balsam Branch inlet adjacent to the lake's largest Northern wild rice (*Zizania palustris*) bed, this area was more a collection of clusters than a true bed. This is the first time CLP was observed in Little Balsam.

Bed 2 – Scattered canopied CLP was present throughout the area. Plants were dense at the core before becoming fragmented along the edges.

Beds 3-6 – CLP was only very widely scattered in Stump Bay.

Beds 7 and 8 – Located along the east shoreline of Stump Bay, this area was dominated by native vegetation in 2014. Although very low levels of CLP was scattered throughout the former large bed, it was never dominant and only canopied in the small mapped area on the south side at the drop off.

Beds 9, 10 and 11 – Located just northwest of the Big Narrows/East Balsam, these beds have been treated several times in the past with minimal success. Despite not being directly treated in 2014, there was almost no CLP growing in the area.

Beds 12, 13, 14, 14B, and 14C – None of East Balsam's CLP beds survived the 2014 treatment.

Bed 15 and 15A – Although these beds were not treated in 2014, they acted as though they were with limited numbers of CLP plants reaching canopy. Plant surveyors speculated that these beds may have been impacted by residual herbicide from East Balsam.

Bed 16 – There were only a handful of CLP plants in this area in 2014, and none of them were canopied or bed forming.

Beds 16A, 16B, and 16C – Each of these beds was new in 2014, and, although dense and canopied at their cores, they were all <0.5 acre making them relatively easy to avoid. They were also surrounded by important native plant beds. This was especially true of 16B as this area has some of the best stands of Northern water milfoil (*Myriophyllum sibiricum*) in the lake.

Beds 17 and 17A – Neither of these beds were particularly dense, and, although canopied or near canopy, they did not appear likely to interfere with boat traffic. As in the past, 17A is situated next to a Hardstem bulrush (*Schoenoplectus acutus*) bed that provides important spawning habitat for the lake panfish (surveyor observation).

Beds 17B, and 17C – There were almost no CLP plants in Raskin Bay in 2014, and the bed at the bay entrance had only a handful of plants. Raskin Bay was again dominated by Coontail and water lilies while 17C had large numbers of Claspingleaf pondweed (*Potamogeton richardsonii*).

Beds 18 and 19 – The areas around Pine Island and east of First Island continued to be almost completely CLP free.

Bed 20 – This bed stretched farther north (past Idlewild Bay and beyond the no wake zone) along the western shoreline than observed in past years. Many plants were prop clipped or had been ripped out of the sediment by boat traffic.

Bed 21 – In 2014, CLP was rare and not bed forming north of the village beach.

Beds 23-24 – CLP was dense and canopied in the Mill Pond in 2012, nearly absent in 2013, and only moderately dense in 2014. Most areas around the beds were dominated by Coontail and Northern water milfoil.

Beds 22 and 25 – These Mill Pond beds had almost no CLP in them in 2014.

# Aquatic Plant Management

This section reviews the potential management methods available and reports recent management activities on the lakes.

## Discussion of Management Methods

### Permitting Requirements

The Department of Natural Resources regulates the removal of aquatic plants when chemicals are used, when plants are removed mechanically, and when plants are removed manually from an area greater than thirty feet in width along the shore. The requirements for chemical plant removal are described in Administrative Rule NR 107 – Aquatic Plant Management. A permit is required for any aquatic chemical application in Wisconsin. Additional requirements exist when a lake is considered an ASNRI (Area of Special Natural Resource Interest) due, in the case of Balsam Lake, to the designation of sensitive areas.

The requirements for manual and mechanical plant removal are described in *NR 109 – Aquatic Plants: Introduction, Manual Removal & Mechanical Control Regulations*. A permit is required for manual and mechanical removal except for when a riparian (waterfront) landowner manually removes or gives permission to someone to manually remove plants, (with the exception of wild rice) from his/her shoreline up to a 30-foot corridor. A riparian landowner may also manually remove the invasive plants Eurasian water milfoil, curly leaf pondweed, and purple loosestrife along his or her shoreline without a permit. Manual removal refers to the control of aquatic plants by hand or hand-held devices without the use or aid of external or auxiliary power.<sup>24</sup>

The *Department of Natural Resources Northern Region Aquatic Plant Management Strategy* (May 2007) requires documentation of impaired navigation or nuisance conditions before native plants may be managed with herbicides. Severe impairment or nuisance will generally mean that vegetation grows thickly and forms mats on the water surface.

Techniques to control the growth and distribution of aquatic plants are discussed in the following text. The application, location, timing, and combination of techniques must be considered carefully. A summary table of Management Options for Aquatic Plants from the WDNR is found in Appendix F.

### Manual Removal<sup>25</sup>

Manual removal—hand pulling, cutting, or raking—will effectively remove plants from small areas. It is likely that plant removal will need to be repeated more than once during the growing season. The best timing for hand removal of herbaceous plant species is after flowering but before seed head production. For plants with rhizomatous (underground stem) growth, pulling

---

<sup>24</sup> More information regarding DNR permit requirements and aquatic plant management contacts is found on the DNR web site: [www.dnr.state.wi.us](http://www.dnr.state.wi.us).

<sup>25</sup> Information from APIS (Aquatic Plant Information System). U.S. Army Corps of Engineers. 2005. and the *Wisconsin Aquatic Plant Management Guidelines*.

roots is not generally recommended since it may stimulate new shoot production. Hand pulling is a strategy recommended for rapid response to a Eurasian water milfoil establishment and for private landowners who wish to remove small areas of curly leaf pondweed growth. Raking is recommended to clear nuisance growth in riparian area corridors up to thirty feet wide.

SCUBA divers may engage in manual removal for invasive species like Eurasian water milfoil. Care must be taken to ensure that all plant fragments are removed from the lake. Manual removal with divers is recommended for shallow areas where sporadic EWM growth occurs.

### Mechanical Control

Larger-scale control efforts require more mechanization. Mechanical cutting, mechanical harvesting, diver-operated suction harvesting, and rotovating (tilling) are the most common forms of mechanical control available. WDNR permits under Chapter NR 109 are required for mechanical plant removal.

**Aquatic plant harvesters** are floating machines that cut and remove vegetation from the water. The cutter head uses sickles similar to those found on farm equipment, and generally cut to depths from one to six feet. A conveyor belt on the cutter head brings the clippings onboard the machine for storage. Once full, the harvester travels to shore to discharge the load of weeds off of the vessel.

The size, and consequently the harvesting capabilities, of these machines vary greatly. As they move, harvesters cut a swath of aquatic plants that is between 4 and 20 feet wide, and can be up to 10 feet deep. The on-board storage capacity of a harvester ranges from 100 to 1,000 cubic feet (by volume) or 1 to 8 tons (by weight).

In some cases, the plants are transported to shore by the harvester itself for disposal, while in other cases, a barge is used to store and transport the plants in order to increase the efficiency of the cutting process. The plants are deposited on shore, where they can be transported to a local farm to be used as compost (the nutrient content of composted aquatic plants is comparable to that of cow manure) or to an upland landfill for proper disposal. Most harvesters can cut between 2 and 8 acres of aquatic vegetation per day, and the average lifetime of a mechanical harvester is 10 years.

Mechanical harvesting of aquatic plants presents both positive and negative consequences to any lake. Its results—open water and accessible boat lanes—are immediate, and can be enjoyed without the restrictions on lake use which follow herbicide treatments. In addition to the human use benefits, the clearing of thick aquatic plant beds may also increase the growth and survival of some fish. By eliminating the upper canopy, harvesting reduces the shading caused by aquatic plants. The nutrients stored in the plants are also removed from the lake, and the sedimentation that would normally occur as a result of the decaying of this plant matter is prevented. Additionally, repeated treatments may result in thinner, more scattered growth.

Aside from the obvious effort and expense of harvesting aquatic plants, there are many environmentally-detrimental consequences to consider. The removal of aquatic species during harvesting is non-selective. Native and invasive species alike are removed from the target area.

This loss of plants results in a subsequent loss of the functions they perform, including sediment stabilization and wave absorption. Shoreline erosion may therefore increase. Other organisms such as fish, reptiles, and insects are often displaced or removed from the lake in the harvesting process. This may have adverse effects on these organisms' populations as well as the lake ecosystem as a whole.

While the results of harvesting aquatic plants may be short term, the negative consequences are not so short lived. Much like mowing a lawn, harvesting must be conducted numerous times throughout the growing season. Although the harvester collects most of the plants that it cuts, some plant fragments inevitably persist in the water. This may allow the invasive plant species to propagate and colonize in new, previously unaffected areas of the lake. Harvesting may also result in re-suspension of contaminated sediments and the excess nutrients they contain.

Disposal sites are a key component when considering the mechanical harvesting of aquatic plants. The sites must be on shore and upland to make sure the plants and their reproductive structures don't make their way back into the lake or to other lakes. The number of available disposal sites and their distance from the targeted harvesting areas will determine the efficiency of the operation, in terms of time as well as cost.

Timing is also important. The ideal time to harvest, in order to maximize the efficiency of the harvester, is just before the aquatic plants break the surface of the lake. For curly leaf pondweed, it should also be before the plants form turions (reproductive structures) to avoid spreading the turions within the lake. If the harvesting is conducted too early, the plants will not be close enough to the surface, and the cutting will not do much damage to them. If too late, turions may have formed and may be spread, and there may be too much plant matter on the surface of the lake for the harvester to cut effectively.

If the harvesting work is contracted, the equipment should be inspected before and after it enters the lake. Since these machines travel from lake to lake, they may carry plant fragments with them, and facilitate the spread of aquatic invasive species from one body of water to another. One must also consider prevailing winds, since cut vegetation can be blown into open areas of the lake or along shorelines.

Harvesting will be used for maintaining navigation and controlling curly leaf pondweed on Balsam Lake as part of this management plan.

**Diver dredging** operations use pump systems to collect plant and root biomass. The pumps are mounted on a barge or pontoon boat. The dredge hoses are from 3 to 5 inches in diameter and are handled by one diver. The hoses normally extend about 50 feet in front of the vessel. Diver dredging is especially effective against the pioneering establishment of submersed invasive plant species. When a weed is discovered in a pioneering state, this methodology can be considered. To be effective, the entire plant, including the subsurface portions, should be removed.

Plant fragments can result from diver dredging, but fragmentation is not as great a problem when infestations are small. Diver dredging operations may need to be repeated more than once to be effective. When applied to a pioneering infestation, control can be complete. However, periodic

inspections of the lake should be performed to ensure that all the plants have been found and collected.

Lake substrates play an important part in the effectiveness of a diver dredging operation. Soft substrates are very easy to work in. Divers can remove the plant and root crowns with little difficulty. Hard substrates, however, pose more of a problem. Divers may need hand tools to help dig the root crowns out of hardened sediment. Diver dredging will be considered as a rapid response control measure for Eurasian water milfoil if discovered in the lake.

**Rotovation** involves using large underwater rototillers to remove plant roots and other plant tissue. Rotovators can reach bottom sediments to depths of 20 feet. Rotovating may significantly affect non-target organisms and water quality as bottom sediments are disturbed. However, the suspended sediments and resulting turbidity produced by rotovation settles fairly rapidly once the tiller has passed. Tilling contaminated sediments could possibly release toxins into the water column. If there is any potential of contaminated sediments in the area, further investigation should be performed to determine the potential impacts from this type of treatment. Tillers do not operate effectively in areas with many underwater obstructions such as trees and stumps. If operations are releasing large amounts of plant material, harvesting equipment should be on hand to collect this material and transport it to shore for disposal.

### Biological Control<sup>26</sup>

Biological control is the purposeful introduction of parasites, predators, and/or pathogenic microorganisms to reduce or suppress populations of plant or animal pests. Biological control counteracts the problems that occur when a species is introduced into a new region of the world without a complex or assemblage of organisms that feed directly upon it, attack its seeds or progeny through predation or parasitism, or cause severe or debilitating diseases. With the introduction of pests to the target invasive organism, the exotic invasive species may be maintained at lower densities.

The effectiveness of biocontrol efforts varies widely (Madsen, 2000). Beetles are commonly and successfully used to control purple loosestrife populations in Wisconsin. Weevils are used as an experimental control for Eurasian water milfoil once the plant is established. Tilapia and carp are used to control the growth of filamentous algae in ponds. Grass carp, an herbivorous fish, is sometimes used to feed on pest plant populations, but grass carp introduction is not allowed in Wisconsin.

**Weevils<sup>27</sup>** have potential for use as a biological control agent against Eurasian water milfoil. There are several documented “natural” declines of EWM infestations with weevil use. In these cases, EWM was not eliminated but its abundance was reduced enough so that it did not achieve dominance. These declines are attributed to an ample population of native milfoil weevils (*Euhrychiopsis lecontei*). Weevils feed on native milfoils but will shift preference over to EWM when it is present. Lakes where weevils can become an effective control have an abundance of

---

<sup>26</sup> Information from APIS (Aquatic Plant Information System). U.S. Army Corps of Engineers. 2005.

<sup>27</sup> *Control of Eurasian Water Milfoil & Large-scale Aquatic Herbicide Use*. Wisconsin Department of Natural Resources. July 2006.

native northern water milfoil and fairly extensive natural shoreline where the weevils can over winter. Any control strategy for EWM that would also harm native milfoil may hinder the ability of this natural bio-control agent. Lakes with large bluegill populations are not good candidates for weevils because bluegills feed on the weevils. The presence and efficacy of stocking weevils in EWM lakes is being evaluated in Wisconsin lakes. So far, stocking does not appear to be effective.

There are advantages and disadvantages to the use of biological control as part of an overall aquatic plant management program. Advantages include longer-term control relative to other technologies, lower overall costs, and plant-specific control. On the other hand, there are several disadvantages to consider, including very long control times (years instead of weeks), a lack of available agents for particular target species, and relatively specific environmental conditions necessary for success. Biological control is not without risks; new non-native species introduced to control a pest population may cause problems of its own.

### Re-vegetation with Native Plants

Another aspect to biological control is native aquatic plant restoration. The rationale for re-vegetation is that restoring a native plant community should be the end goal of most aquatic plant management programs (Nichols 1991; Smart and Doyle 1995). However, in communities that have only recently been invaded by nonnative species, a propagule (seed) bank probably exists that will restore the community after nonnative plants are controlled (Madsen, Getsinger, and Turner, 1994). Re-vegetation following plant removal might be considered in East Balsam if native plant populations do not reestablish within a few years.

### Physical Control<sup>28</sup>

In physical management, the environment of the plants is manipulated, which in turn acts upon the plants. Several physical techniques are commonly used: dredging, drawdown, benthic (lake bottom) barriers, and shading or light attenuation. Because they involve placing a structure on the bed of a lake and/or affect lake water level, a Chapter 30 or 31 WDNR permit would be required.

**Dredging** removes accumulated bottom sediments that support plant growth. Dredging is usually not performed solely for aquatic plant management but to restore lakes that have been filled in with sediments, have excess nutrients, need deepening, or require removal of toxic substances (Peterson 1982). Lakes that are very shallow due to sedimentation tend to have excess plant growth. Dredging can form an area of the lake too deep for plants to grow, thus creating an area for open water use (Nichols 1984). By opening more diverse habitats and creating depth gradients, dredging may also create more diversity in the plant community (Nichols 1984). Results of dredging can be very long term. However, due to the cost, environmental impacts, and the problem of disposal, dredging should not be performed for aquatic plant management alone. It is best used as a lake remediation technique. Dredging is being investigated for Balsam Lake for navigation improvement in shallow bays.

---

<sup>28</sup> Information from APIS (Aquatic Plant Information System) U.S. Army Corps of Engineers. 2005.

**Drawdown**, or significantly decreasing lake water levels can be used to control nuisance plant populations. With drawdown, the water body has water removed to a given depth. It is best if this depth includes the entire depth range of the target species. Drawdowns need to be at least one month long to ensure thorough drying and effective removal of target plants (Cooke 1980a). In northern areas, a drawdown in the winter that will ensure freezing of sediments is also effective. Although drawdown may be effective for control of hydrilla for one to two years (Ludlow 1995), it is most commonly applied to Eurasian water milfoil (Geiger 1983; Siver et al. 1986) and other milfoils or submersed evergreen perennials (Tarver 1980). Drawdown requires a mechanism to lower water levels.

Although drawdown can be inexpensive and have long-term effects (2 or more years), it also has significant environmental effects and may interfere with use and intended function (e.g., power generation or drinking water supply) of the water body during the drawdown period. Lastly, species respond in very different manners to drawdown and individual species responses can be inconsistent (Cooke 1980a). Drawdowns may provide an opportunity for the spread of highly weedy species, particularly annuals.

Drawdown may at first glance appear to be an option for management of curly leaf pondweed in Balsam Lake due to the dam. However, there are several reasons that drawdown for aquatic plant control is not a viable option for the lake. Curly leaf pondweed is found in much of the littoral zone area. A drawdown intended to decrease curly leaf pondweed growth would have an unknown impact on native aquatic plants and other aquatic organisms. Drawdown would dramatically change the use and appearance of the lake and it would take an undetermined amount of time to refill the lake following drawdown.

**Benthic barriers** or other bottom-covering approaches are another physical management technique. The basic idea is to cover the plants with a layer of a growth-inhibiting substance. Many materials have been used, including sheets or screens of organic, inorganic, and synthetic materials; sediments such as dredge sediment, sand, silt or clay; fly ash; and various combinations of the above materials (Cooke 1980b; Nichols 1974; Perkins 1984; Truelson 1984). The problem with synthetic sheeting is that the gases evolved from plant and sediment decomposition collect underneath and lift the barrier (Gunnison and Barko 1992). The problem with using sediments is that new plants establish on top of the added layer (Engel and Nichols 1984).

Benthic barriers will typically kill the plants under them within 1 to 2 months, after which time they may be removed (Engel 1984). Sheet color is relatively unimportant; opaque (particularly black) barriers work best, but even clear plastic barriers will work effectively (Carter et al. 1994). Sites from which barriers are removed will be rapidly re-colonized (Eichler et al. 1995). Synthetic barriers, if left in place for multi-year control, will eventually become sediment-covered and will allow colonization by plants. Benthic barriers may be best suited to small, high-intensity use areas such as docks, boat launch areas, and swimming areas. However, they are too expensive to use over widespread areas, and heavily affect benthic communities by removing fish and invertebrate habitat. A WDNR permit would be required for a benthic barrier, and these barriers are not recommended.

**Shading or light attenuation** reduces the amount of light plants have available for growth. Shading has been achieved by fertilization to produce algal growth, application of natural or synthetic dyes, shading fabric, or covers, and establishing shade trees (Dawson 1981, 1986; Dawson and Hallows 1983; Dawson and Kern-Hansen 1978; Jorga et al. 1982; Martin and Martin 1992; Nichols 1974). During natural or cultural eutrophication, algae growth alone can shade aquatic plants (Jones et al. 1983). Although light manipulation techniques may be useful for narrow streams or small ponds, in general these techniques are only of limited applicability. Physical control is not currently proposed for management of aquatic plants in Balsam Lake.

### Herbicide and Algaecide Treatments

Herbicides are chemicals used to kill plant tissue. Currently, no product can be labeled for aquatic use if it poses more than a one in a million chance of causing significant damage to human health, the environment, or wildlife resources. In addition, it may not show evidence of biomagnification, bioavailability, or persistence in the environment (Joyce, 1991). Thus, there are a limited number of active ingredients that are assured to be safe for aquatic use (Madsen, 2000).

An important caveat is that these products are considered safe when used according to the label. The U.S. Environmental Protection Agency (EPA)-approved label gives guidelines protecting the health of the environment, the humans using that environment, and the applicators of the herbicide. WDNR permits under Chapter NR 107 are required for herbicide application.

General descriptions of herbicide classes are included below.<sup>29</sup>

#### Contact herbicides

Contact herbicides act quickly and are generally lethal to all plant cells they contact. Because of this rapid action, or other physiological reasons, they do not move extensively within the plant and are effective only where they contact plants directly. They are generally more effective on annuals (plants that complete their life cycle in a single year). Perennial plants (plants that persist from year to year) can be defoliated by contact herbicides, but they quickly resprout from unaffected plant parts. Submersed aquatic plants that are in contact with sufficient concentrations of the herbicide in the water for long enough periods of time are affected, but regrowth occurs from unaffected plant parts, especially plant parts that are protected beneath the sediment. Because the entire plant is not killed by contact herbicides, retreatment is necessary, sometimes two or three times per year. **Endothall, diquat, and copper** are contact aquatic herbicides.

#### Systemic herbicides

Systemic herbicides are absorbed into the living portion of the plant and move within the plant. Different systemic herbicides are absorbed to varying degrees by different plant parts. Systemic herbicides that are absorbed by plant roots are referred to as soil active herbicides and those that are absorbed by leaves are referred to as foliar active herbicides. **2,4-D, dichlobenil, fluridone, and glyphosate** are systemic aquatic herbicides. When applied correctly, systemic herbicides act slowly in comparison to contact herbicides. They must move to the part of the plant where their site of action is. Systemic herbicides are generally more effective for controlling perennial and

---

<sup>29</sup> This discussion is taken from: *Managing Lakes and Reservoirs*. North American Lake Management Society.

woody plants than contact herbicides. Systemic herbicides also generally have more selectivity than contact herbicides.

### **Broad spectrum herbicides**

Broad spectrum (sometimes referred to as nonselective) herbicides are those that are used to control all or most species of vegetation. This type of herbicide is often used for total vegetation control in areas such as equipment yards and substations where bare ground is preferred.

**Glyphosate** is an example of a broad spectrum aquatic herbicide. **Diquat, endothall, and fluridone** are used as broad spectrum aquatic herbicides, but can also be used selectively under certain circumstances.

### **Selective herbicides**

Selective herbicides are those that are used to control certain plants but not others. Herbicide selectivity is based upon the relative susceptibility or response of a plant to an herbicide. Many related physical and biological factors can contribute to a plant's susceptibility to an herbicide. Physical factors that contribute to selectivity include herbicide placement, formulation, timing, and rate of application. Biological factors that affect herbicide selectivity include physiological factors, morphological factors, and stage of plant growth.

### **Environmental considerations**

Aquatic communities consist of aquatic plants including macrophytes (large plants) and phytoplankton (free floating algae), invertebrate animals (such as insects and clams), fish, birds, and mammals (such as muskrats and otters). All of these organisms are interrelated in the community. Organisms in the community require a certain set of physical and chemical conditions to exist such as nutrient requirements, oxygen, light, and space. Aquatic weed control operations can affect one or more of the organisms in the community, and in turn affect other organisms or weed control operations. These operations can also impact water chemistry which may result in further implications for aquatic organisms.

Table 9. Herbicides Used to Manage Aquatic Plants in Balsam Lake (2006 - 2009)

Brand Name(s)	Chemical	Target Plants
Citrine Plus, CuSO <sub>4</sub> , Captain, Navigate	Copper compounds	Filamentous algae, coontail, wild celery, elodea, and pondweeds
Reward	Diquat	Coontail, duckweed, elodea, water milfoil, and pondweeds
Aquathol, Aquathol K, Aquathol Super K, Hydrothol 191	Endothall	Coontail, water milfoil, pondweeds, and wild celery as well as other submersed weeds and algae
Rodeo	Glyphosate	Cattails, grasses, bulrushes, purple loosestrife, and water lilies
Navigate, Aqua-Kleen, DMA 4 IVM	2, 4-D	Water milfoils, water lilies, and bladderwort

General descriptions of the breakdown of commonly used aquatic herbicides are included below.<sup>30</sup>

### Copper

Copper is a naturally occurring element that is essential at low concentrations for plant growth. It does not break down in the environment, but it forms insoluble compounds with other elements and is bound to charged particles in the water. It rapidly disappears from water after application as an herbicide. Because it is not broken down, it can accumulate in bottom sediments after repeated or high rates of application. Accumulation rarely reaches levels that are toxic to organisms or significantly above background concentrations in the sediment.

### 2,4-D

2,4-D photodegrades on leaf surfaces after being applied to leaves, and is broken down by microbial degradation in water and in sediments. Complete decomposition usually takes about 3 weeks in water but can be as short as 1 week. 2,4-D breaks down into naturally occurring compounds.

### Diquat

When applied to enclosed ponds for submersed weed control, diquat is rarely found longer than 10 days after application and is often below detection levels 3 days after application. The most important reason for the rapid disappearance of diquat from water is that it is rapidly taken up by aquatic vegetation and bound tightly to particles in the water and bottom sediments. When bound to certain types of clay particles, diquat is not biologically available. When diquat is bound to organic matter, it can be slowly degraded by microorganisms. When diquat is applied foliarly, it is degraded to some extent on the leaf surfaces by photodegradation. Because it is bound in the plant tissue, a proportion is probably degraded by microorganisms as the plant tissue decays.

<sup>30</sup> These descriptions are taken from Hoyer/Canfield: *Aquatic Plant Management*. North American Lake Management Society. 1997.

### **Endothall**

Like 2,4-D, endothall is rapidly and completely broken down into naturally occurring compounds by microorganisms. The by-products of endothall dissipation are carbon dioxide and water. Complete breakdown usually occurs in about 2 weeks in water and 1 week in bottom sediments.

### **Fluridone**

Dissipation of fluridone from water occurs mainly by photodegradation. Metabolism by tolerant organisms and microbial breakdown also occurs, and microbial breakdown is probably the most important method of breakdown in bottom sediments. The rate of breakdown of fluridone is variable and may be related to time of application. Applications made in the fall or winter, when the sun's rays are less direct and days are shorter, result in longer half-lives. Fluridone usually disappears from pondwater after about 3 months but can remain up to 9 months. It may remain in bottom sediment between 4 months and 1 year.

### **Glyphosate**

Glyphosate is not applied directly to water for weed control, but when it does enter the water it is bound tightly to dissolved and suspended particles and to bottom sediments and becomes inactive. Glyphosate is broken down into carbon dioxide, water, nitrogen, and phosphorus over a period of several months.

### **Copper Compounds**

Copper-based compounds are generally used to treat filamentous algae. Common chemicals used are copper sulfate and Cutrine Plus, a chelated copper algaecide.

## Herbicide Used to Manage Invasive Species

### **Eurasian Water Milfoil**

The Army Corps of Engineers Aquatic Plant Information System (APIS) identifies the following herbicides for control of Eurasian water milfoil: 2,4-D, diquat, endothall, fluridone, and triclopyr.<sup>31</sup> All of these herbicides with the exception of diquat are available in both granular and liquid formulations. It is possible to target invasive species by using the appropriate herbicide and timing. Diquat is used infrequently in Wisconsin because it is nonspecific.<sup>32</sup> The herbicide 2,4-D is most commonly used to treat EWM in Wisconsin. This herbicide kills dicots including native aquatic species such as northern water milfoil, coontail, water lilies, spatterdock, and watershield. Early season (April to May) treatment of Eurasian water milfoil is recommended to limit the impact on native aquatic plant populations because EWM tends to grow before native aquatic plants.

---

<sup>31</sup> Additional information provided by John Skogerboe, Army Corps of Engineers, personal communication. February 14, 2008.

<sup>32</sup> Frank Koshere. Wisconsin DNR. email communication. 3/03/10.

Granular herbicide formulations are more expensive than liquid formulations (per active ingredient). However, granular formulations are generally thought to release the active ingredient over a longer period of time. Granular formulations, therefore, may be more suited to situations where herbicide exposure time will likely be limited, as is the case of treatment areas in small bands or blocks. In large, shallow lakes with widespread EWM, a whole lake treatment with a low rate of liquid herbicide may be most cost effective because exposure time is greater. Factors that affect exposure time are size and configuration of treatment area, water flow, and wind. Application rates for liquid and granular formulations are not interchangeable. A rate of 1 to 1.5 mg/L 2,4-D applied as a liquid is a moderate rate that will require a contact time of 36 to 48 hours. Application rates recommended for Navigate (granular 2,4-D) are 100 pounds per acre for depths of 0 to 5 feet, 150 pounds per acre for 5 to 10 feet, and 200 pounds per acre for depths greater than 10 feet. Allowed and recommended application rates are found on herbicide labels.

### **Curly Leaf Pondweed**

The Army Corps of Engineers Aquatic Plant Information System (APIS) identifies three herbicides for control of curly leaf pondweed: diquat, endothall, and fluridone. Fluridone requires exposure of 30 to 60 days making it infeasible to target a discrete area in a lake system. The other herbicides act more rapidly. Herbicide labels provide water use restriction following treatment. Diquat (Reward) has the following use restrictions: drinking water 1-3 days, swimming and fish consumption 0 days. Endothall (Aquathol K) has the following use restrictions: drinking water 7 – 25 days, swimming 0 days, fish consumption 3 days.

Studies have demonstrated that curly leaf pondweed can be controlled with Aquathol K (a formulation of endothall) in 50 to 60 degree F water, and that treatments of CLP this early in its life cycle can prevent turion formation.<sup>33</sup> Since curly leaf pondweed is actively growing at these low water temperatures and many native aquatic plants are still dormant, early season treatment selectively targets curly leaf pondweed. Staff from the Minnesota Department of Natural Resources and the U.S Army Engineer Research and Development Center have conducted trials of this method. Early season Endothall treatment is accepted as standard operating procedure being approved in Wisconsin for aquatic invasive species control projects.<sup>34</sup>

Because the dosage is at lower rates than the dosage recommended on the label, a greater herbicide residence time is necessary. To prevent drift of herbicide and allow greater contact time, application in shallow bays is likely to be most effective. Herbicide applied to a narrow band of vegetation along the shoreline is likely to drift, rapidly decrease in concentration, and be rendered ineffective.<sup>35</sup> Steep drop-off, high winds, and other factors that increase herbicide dilution and contact time can decrease treatment effectiveness. Early season treatment similar to that described above can be used to treat corridors for navigation purposes. Because of potential for drift, a higher concentration of endothall is generally used.

---

<sup>33</sup> *Research in Minnesota on Control of Curly Leaf Pondweed*. Wendy Crowell, Minnesota Department of Natural Resources. Spring 2002.

<sup>34</sup> Plan comments, Frank Koshere, September 16, 2010.

<sup>35</sup> Personal communication, Frank Koshere. March 2005.

## Previous Aquatic Plant Management Plans

The current Balsam Lake Aquatic Plant Management Plan is an update of an October 2010 plan approved by the Department of Natural Resources in January 2011. An aquatic plant management plan was also developed in 2005. That plan was not approved by the DNR, in part because a point intercept plant survey was not completed as background for the plan.

Barr Engineering completed a transect macrophyte survey that evaluated plant coverage, density, and species composition in the summer of 1999<sup>36</sup> and repeated the survey in June 2005.<sup>37</sup> The 2005 study reported a healthy, diverse, high quality native plant community in Balsam Lake that has changed little since 1999. Aquatic plants were reported to cover about 41 percent of the lake area. Plant diversity in Balsam Lake was relatively high when compared with 50 Wisconsin lakes. A total of 21 species were found in 2005, and 25 species were found in 1999. (As described previously, the 2014 aquatic plant survey located 46 species and the 2009 survey located 47 species.) Coontail (*Ceratophyllum demersum*) was the most frequently occurring species. Curly leaf pondweed (*Potamogeton crispus*), a non-native invasive plant, occurred at 56 percent of the sample points in 1999 and only 41 percent of the sample points in 2005. This was noted as a positive change for the lake. (In 2009, curly leaf pondweed was present in about 31 percent of the littoral zone at depths where plants were present. In 2014, that number had decreased to about 7 percent of the littoral zone.)

The 2000 plan proposed using herbicide treatments to control aquatic plants in public swimming areas, boat landings, and boat passageways or navigational channels. These 25-foot wide navigational channels were identified in maps in the plan. Prior to 2000 the District used a mechanical harvester to remove plants from the lake. The cost of chemical application was shown to be less than previous mechanical harvester costs. An evaluation in 2004 concluded that herbicide applications were an effective way to maintain navigational channels in the lake. These designated channels were inspected regularly for potential treatment in past years. Fewer navigation inspection areas were established in the 2010 aquatic plant management plan. When no significant navigation impairment was found in repeated years, the inspections were discontinued beginning in 2013.

The 2000 plan also called for treating areas identified as priorities for curly leaf pondweed management. Limited curly leaf pondweed management through the use of early season herbicide treatment was completed on 11.5 acres along the south shore of East Balsam and 1.5 acres in the North Bay near the narrows to East Balsam in 2004. A total of 11 acres were treated in 2005 in the same areas. This treatment strategy was not recommended in the 2005 plan. Instead, a “long term treatment program” - the use of lime slurry to reduce plant density (including curly leaf pondweed density) to attain favorable long-term changes in problematic areas was recommended.

---

<sup>36</sup> *Balsam Lake Macrophyte Surveys and Management Plan*. Prepared for Balsam Lake Protection and Rehabilitation District. Barr Engineering. February 2000.

<sup>37</sup> *Balsam Lake Aquatic Plant Survey and Management Plan*. Prepared for Balsam Lake Protection and Rehabilitation District. Barr Engineering. December 2005.

## Current and Past Aquatic Plant Management

Early Balsam Lake management efforts included the use of chemicals to control aquatic plants and algae. From 1960 through 1985, the most commonly used chemicals were copper sulfate and Endothall compounds. Copper sulfate use is a concern since copper is a heavy metal that can build up in lake sediments. Between 1960 and 1985, over 7.7 tons of copper sulfate were applied to Balsam Lake (not including chemical applications made directly by homeowners).<sup>38</sup>

Native aquatic plants were managed by the BLPRD primarily by harvesting through 1999. When the contract harvester operator passed away, new management methods were considered. There were many complaints about floating, drifting plant fragments when harvesting was used. Since that time through 2006, herbicides have been used to manage nuisance native aquatic plants.

According to WDNR staff, herbicide use on Balsam Lake was common at least since the 1950s. In the early 1980s through 2007 many property owners hired contractors to use herbicides to create openings in front of their parcels, generally treating twice each year. Copper compounds were also commonly used to treat planktonic (floating) algae. In the late 1990s DNR permitted only filamentous algae treatments, and copper treatments for algae control were discontinued. At that same time, individual treatment widths were limited to 50 feet.<sup>39</sup> However, according to treatment records, copper compounds had still been used (in the form of Cutrine Plus and as part of an applicator designated “efficacy mix”) at the boat landings and for individual homeowner corridors.

The DNR Northern Region released an Aquatic Plant Management Strategy (Appendix C) in the summer of 2007 to protect the important functions of aquatic plants in lakes. As part of this strategy, the DNR prohibited management of native aquatic plants in front of individual lake properties after 2008 unless management is designated in an approved aquatic plant management plan.<sup>40</sup> Because of the importance of the native plant population for habitat, protection against erosion, and as a guard against invasive species infestation, plant removal with herbicides as an option for individual property owners must be carefully reviewed before permits are issued. The DNR did not allow removal after January 1, 2009 unless the “impairment of navigation” and/or “nuisance” conditions are clearly documented.

### Individual Corridors

As stated above, some homeowners contracted with herbicide applicators to remove aquatic plants in front of their properties until 2008. A summary of past treatment is included in Table 10. Emergent, floating, and submerged water plants and algae were targeted. The stated purpose of these treatments was as follows: to maintain shoreline access for boating, swimming, and fishing, and to reduce nuisance algae accumulation. Since the 2010 plan was approved, the only area where native plant control has been permitted was at the Village Beach in 2011.

---

<sup>38</sup> Analysis of Balsam Lake (Polk County, Wisconsin) with Recommendations for Improved Lake Management. September 1986. Lim Tech Consultants. Report No. LT-R46902.

<sup>39</sup> Email communication. Mark Sundeen. 2/14/2010.

<sup>40</sup> Aquatic Plant Management Strategy. DNR Northern Region. Summer 2007.

*Table 10. Past Waterfront Herbicide Treatments on Balsam Lake*

<b>Year</b>	<b>Individual Properties (#)</b>	<b>Acres Treated w/ Herbicide</b>
2005	73	13.46
2006	66	11.61
2007	64	11.30

### Navigation Channels

DNR records document herbicide treatment of designated “navigation channels” in Balsam Lake. These navigation channels were mapped as part of previous aquatic plant management planning efforts. Relatively recent records for navigation channel permits exist in 2006 and 2009. In 2006 11.5 acres were treated.

The 2009 herbicide treatments for navigation are reported in permit records as follows:

Raskin Bay: 1.78 acres for lilies, 0.31 acres for submerged vegetation

Mill Pond: 0.21 acres for lilies, 0.5 acres for submerged vegetation.

Chemicals used included Aquathol K, Cutrine Plus, Reward, and Navigate.

### Curly Leaf Pondweed Early Season Herbicide Treatment

Early season CLP treatment began as a pilot project in 2004 and 2005 with treatment of 13 acres in East Balsam. An eight acre bed along the south shore of East Balsam was treated again on May 14, 2009.<sup>41</sup> Pre and post monitoring using standardized DNR methods began in 2009.

The 2009 pretreatment survey found CLP in 62 rake samples, with a mean fullness of 1.85 which was deemed an appropriate level of growth for treatment. The post treatment survey documented a highly significant decline in both CLP distribution and density with CLP found at 20 sites with a mean rake fullness of 1.15. There were also significant declines in Coontail in the treatment area and a slightly significant increase in the presence of Forked duckweed. Other species that increased between surveys such as Wild celery, Stiff water crowfoot, White water lily and Spatterdock are likely due to normal increases in spring plant growth patterns.

---

<sup>41</sup> Endangered Resource Services. June 2009.

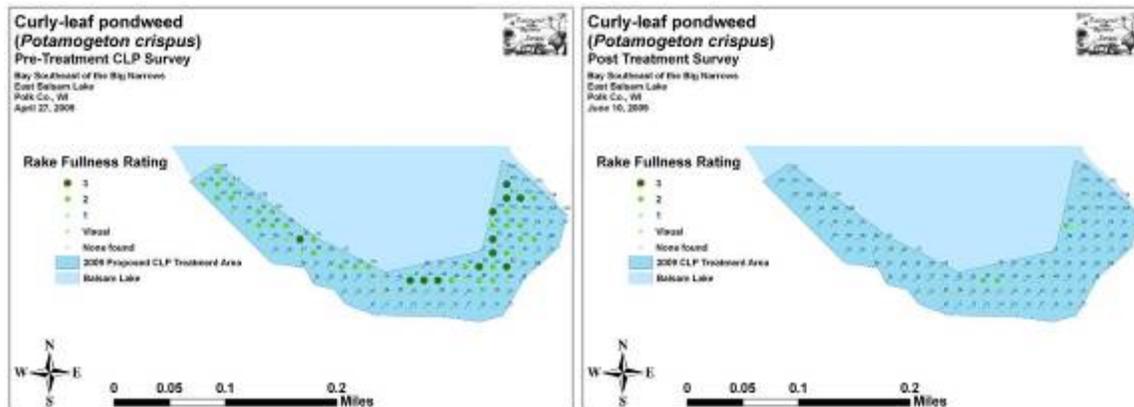


Figure 33. Bay Southeast of the Big Narrows Pre/Post CLP Distribution 2009

Pre and post monitoring reports<sup>42</sup> were used to create a recent history of CLP early season herbicide treatments in Table 11 below. In general, CLP treatment was less effective in small and narrow beds – especially with lower target herbicide concentration, next to steep drop offs, with higher wind speed, and in areas where water flows.

Table 11. CLP Treatment Summary (2009 – 2014)

Year	Acres	Target ppm	Temp. in F reported at treatment	Reported wind speed	Decline in CLP Frequency	Significant Declines in Native Plants	Notes
2009	8	?	58	NA	Yes (66% decline)	Coontail	East Balsam SE of Big Narrows
2010	8	0.75	62	5-10 mph	Yes (33% decline)	Coontail Robbin's pondweed Flat stem pondweed	Turions formed prior to treatment. Poor control.
2011	20	1.0	58-62	5-10 mph	Yes (73% decline)	Fern pondweed Large leaf pondweed White water crowfoot	Poor control in bed 11
2012	56	1.5	52-56	0-6 mph	Yes (100%)	Coontail Duckweed Robbin's pondweed Northern WM Small pondweed	Many native plants completely eliminated pre to post survey
2013	14	1.5	65	3-5 mph	No	No	Poor control in beds 11 and 15
2014	64	1.5	71	1-2.5 mph	Yes (100%)	Coontail	Still low growth of native plants in East Balsam

<sup>42</sup> Berg, Matthew. Curly-leaf Pondweed Pre/Post Herbicide Surveys First and Pine Island and Big Narrows Areas Balsam Lake, WBIC:2620600 Polk County, Wisconsin 2010.

Berg, Matthew. Pre/Post CLP Surveys 2009-2014.

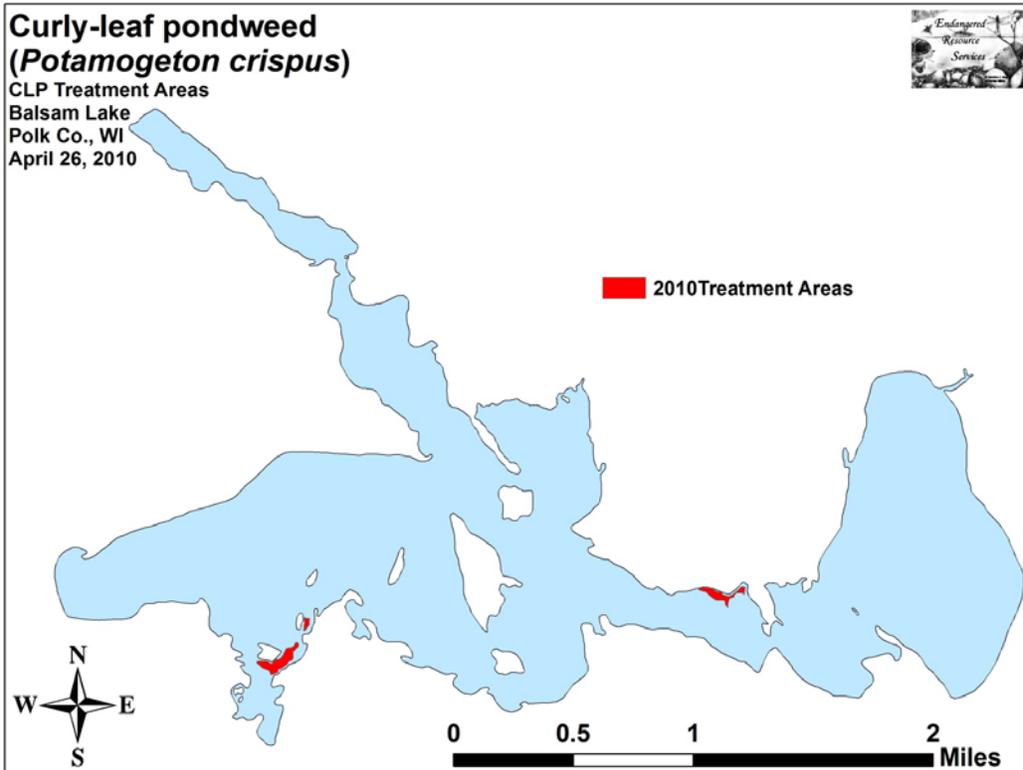


Figure 34. Balsam Lake CLP Treatment Beds 2010

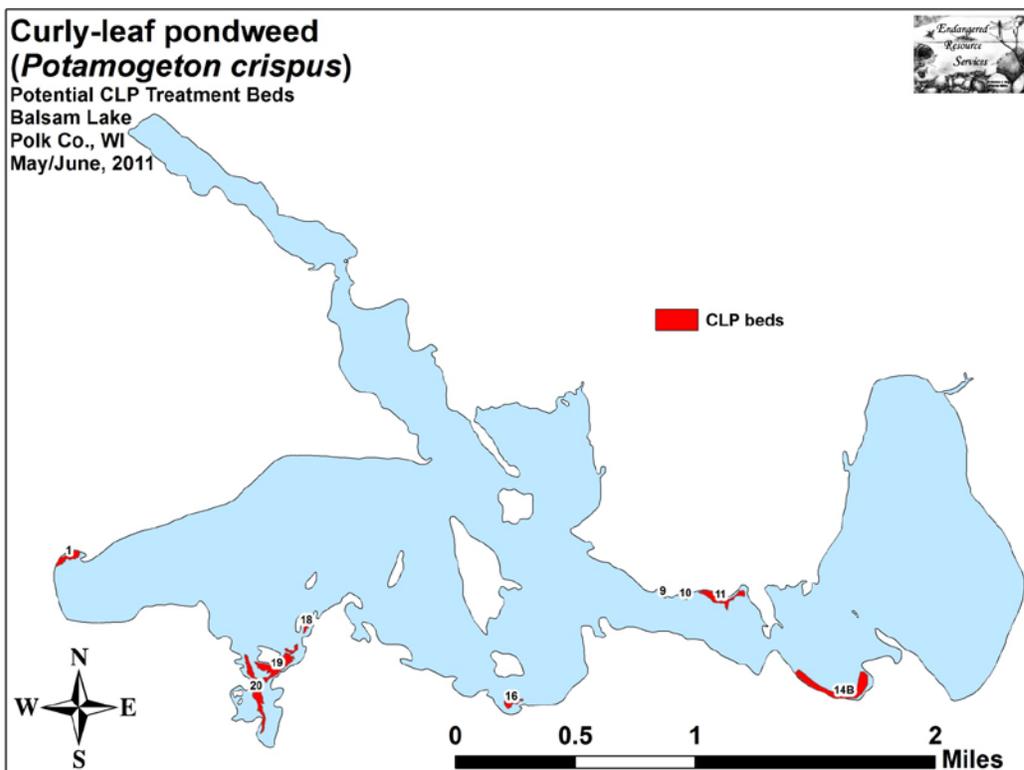
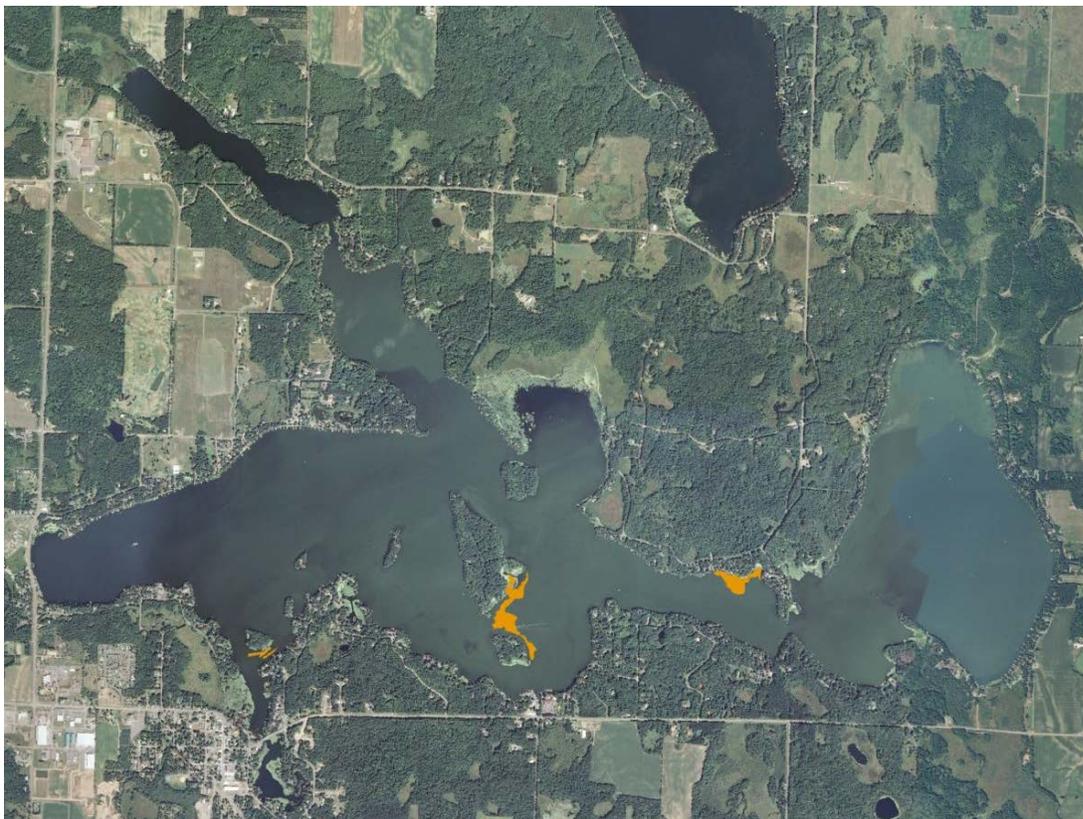


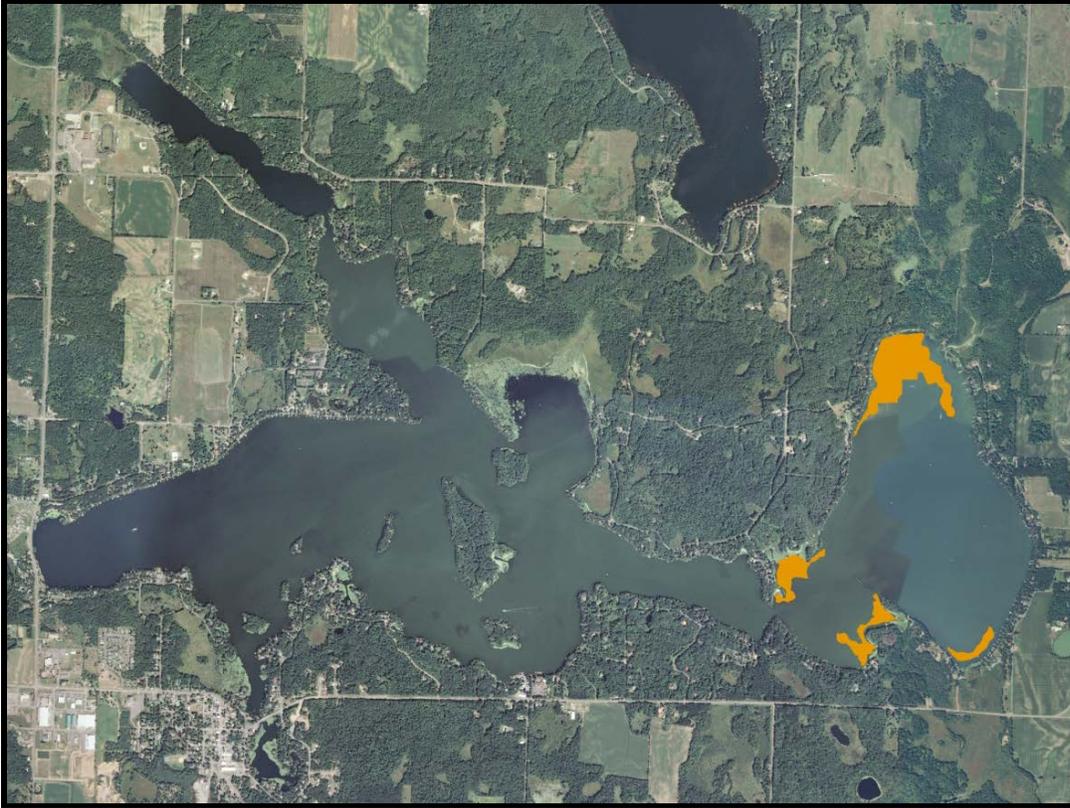
Figure 35. Balsam Lake CLP Treatment Beds 2011



*Figure 36. Balsam Lake CLP Treatment Beds 2012*



*Figure 37. Balsam Lake CLP Treatment Beds 2013*



*Figure 38. Balsam Lake CLP Treatment Beds 2014*

## Herbicide Concentration Results

The BLPRD collected water samples to assist the Wisconsin Department of Natural Resources in monitoring herbicide concentration following CLP treatment on Balsam Lake in 2012, 2013, and 2014. Data from 2012 appears to have been lost as no report was provided.

### 2013 Results<sup>43</sup>

CLP herbicide treatment occurred on 3 beds totaling 14 acres in 2013. Pre and post treatment comparison show that the treatment was not effective in reducing CLP frequency in these beds. The target concentration of the herbicide Endothall was 1.5 ppm or 1060 ug/L acid equivalent (ae in sample results).

Monitoring sites and treatment beds are shown in Figure 39 below. Water samples were collected near treatment beds and in Little Balsam to assess herbicide drift and potential impacts to wild rice beds. Results for each treatment area were similar for the monitoring sites near treatment beds. Initial concentrations ranged from approximately 500 to 1000 ae 1-2 hours after treatment. After 24 hours concentrations had dipped to baseline levels. Sites near and in Little Balsam slightly exceeded baseline 1 to 3 hours after treatment, but dipped to below detection by 5 hours after treatment.



Figure 39. 2013 CLP Herbicide Concentration Monitoring Sites and Treatment Beds

---

<sup>43</sup> Skogerboe, John. Draft Balsam Lake, Polk County Endothall Concentration Monitoring Summary 2013. November 2013.

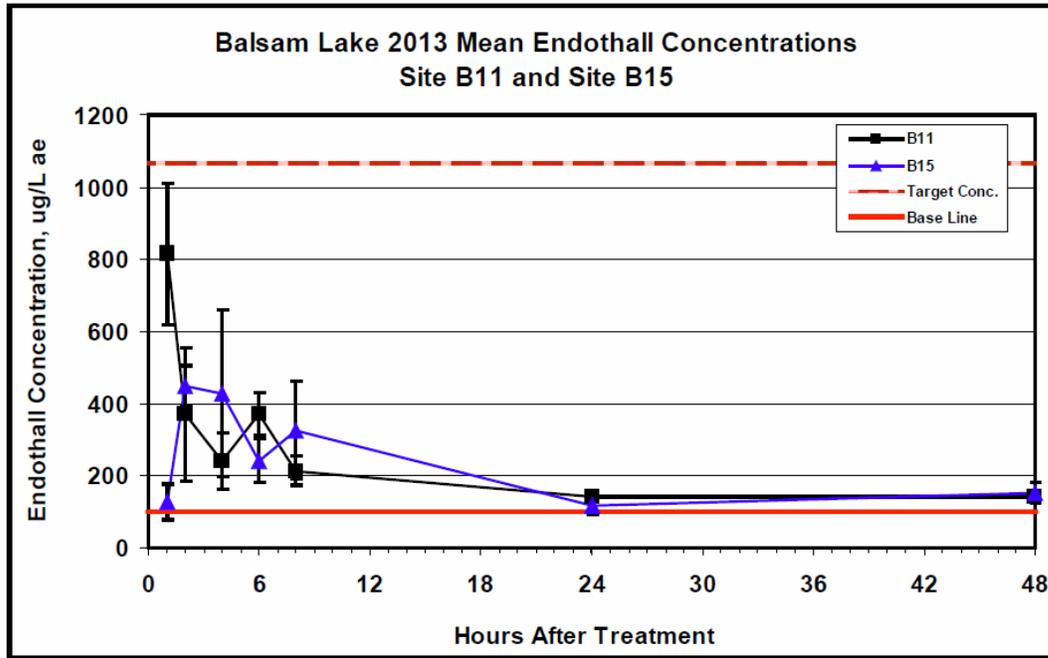
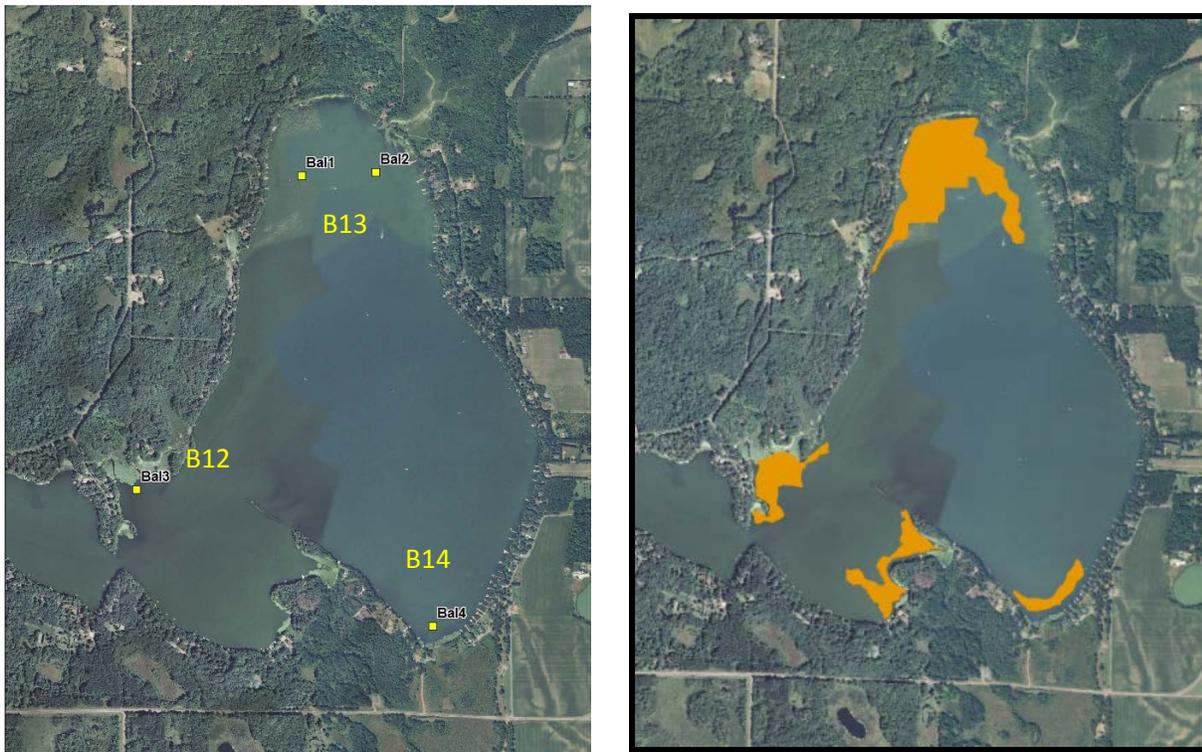


Figure 40. Endothall Concentrations Following CLP Treatment 2013

## 2014 Results<sup>44</sup>

CLP herbicide treatment occurred on 5 beds totaling 64 acres in 2014. Pre and post treatment comparison show that the treatment was very effective in reducing CLP frequency in these beds. However, significant reductions in native plants were also observed. The target concentration of the herbicide Endothall was 1.5 ppm or 1060 ug/L acid equivalent (ae in sample results). Herbicide was applied using the Littoral Zone Treatment Technology (LittLine) which injects herbicide at low pressure to a single selected depth.

Monitoring sites and treatment beds are shown in Figure 41 below. Herbicide concentration results were considerably higher near treatment beds in 2014 than in 2013. They peaked well above target application rates near bed 13 and fell to baseline levels there 48 hours after treatment. Concentration near bed 12 was lower initially, but increased well above target concentration 36 hours after treatment as herbicide dispersed throughout East Balsam. Herbicide concentration measured near bed 14 was lower throughout the sampling period. However, CLP was eliminated and native plants still greatly reduced throughout East Balsam. Coontail pre and post treatment results are provided as an example of native plant reduction in Figure 45.



*Figure 41. 2014 CLP Herbicide Concentration Monitoring Sites and Treatment Beds*

<sup>44</sup> Skogerboe, John. Draft: Balsam Lake, Polk County (WBIC 322800) Dipotassium Salt of Endothall Herbicide Concentration Monitoring Summary 2014.

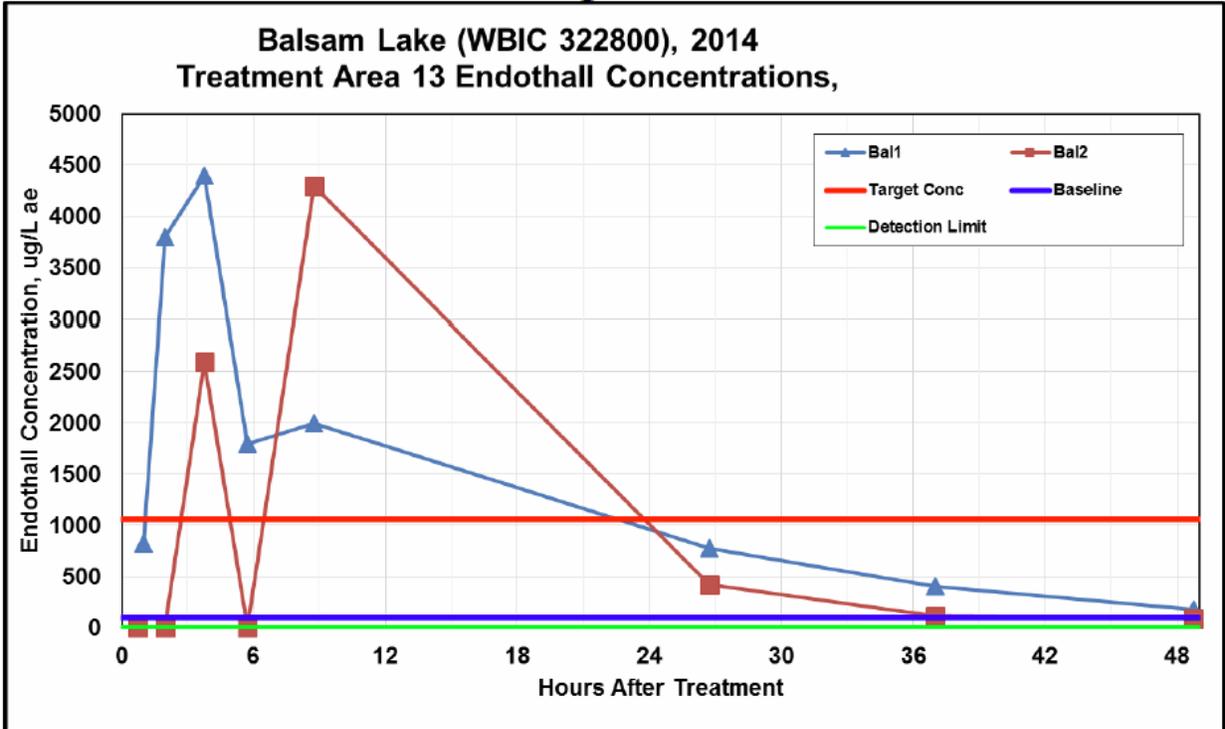


Figure 42. Endothall Concentrations Following CLP Treatment Bed 13 2014

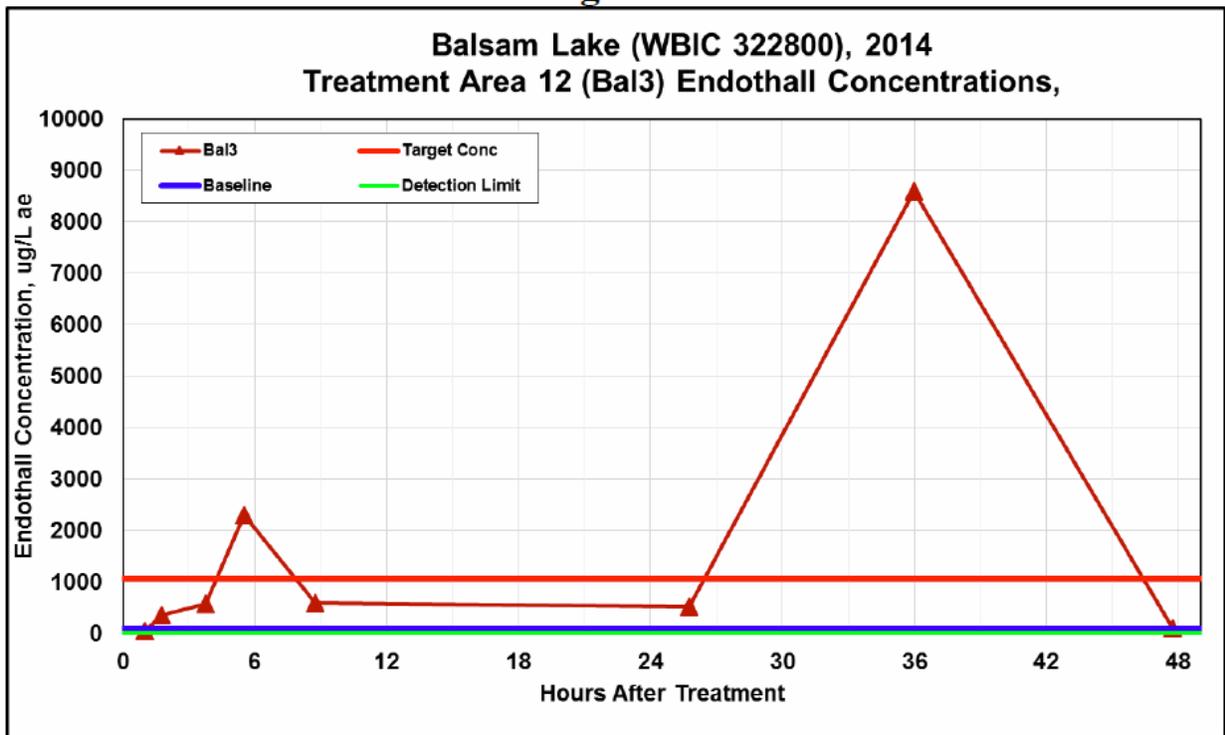


Figure 43. Endothall Concentrations Following CLP Treatment Bed 12 2014

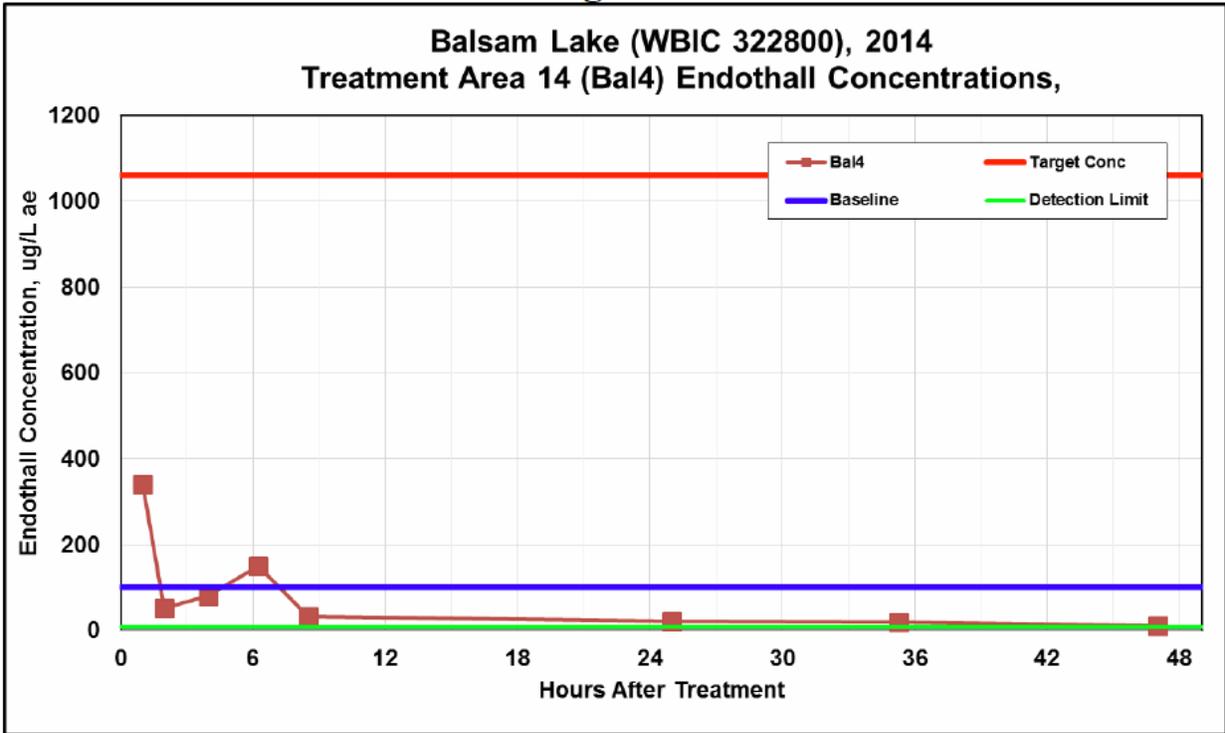


Figure 44. Endothall Concentrations Following CLP Treatment Bed 14 2014

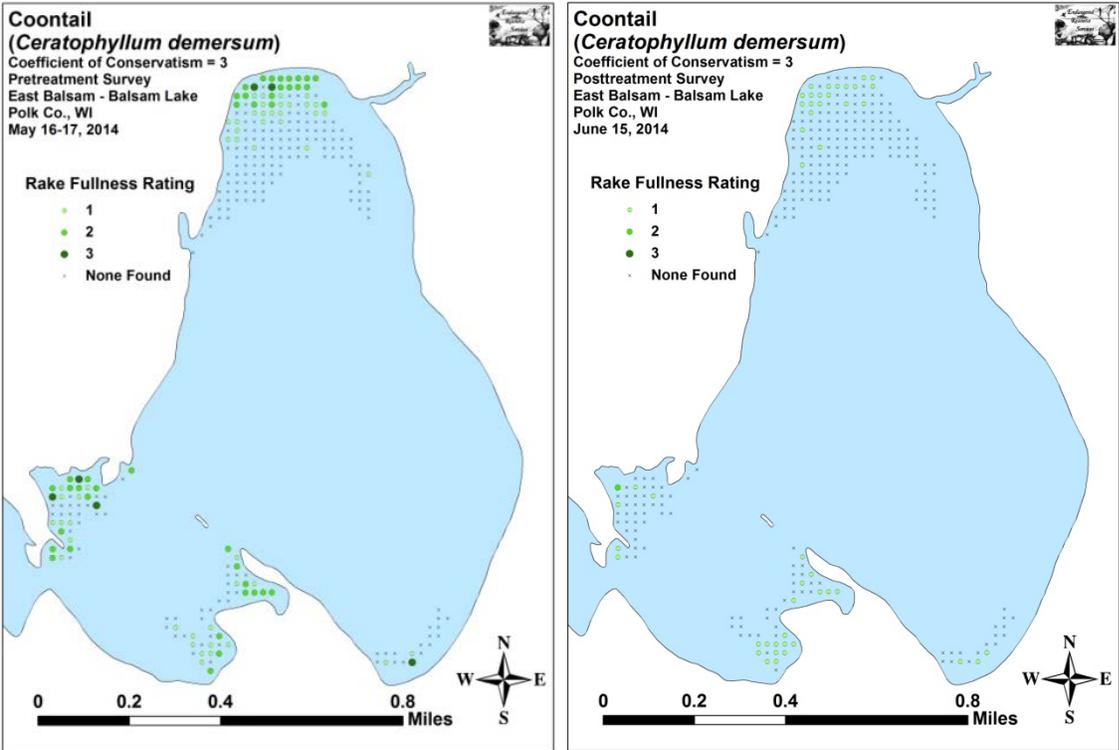


Figure 45. Coontail Rake Fullness Pre and Posttreatment Survey Results 2014

### CLP Turion Survey Results<sup>45</sup>

Curly leaf pondweed turions were monitored for the first time in November 2014 by Endangered Resource Services. Most CLP reproduction occurs from turions which are pinecone-like structures produced by plants prior to when they die back in early summer. CLP turions sprout through late fall or early winter in lake sediments, and the plants grow under the ice. The plants grow rapidly early in the spring following ice-out.



Figure 46. Germinating CLP Turion

Research suggests approximately 50% of turions germinate in a growing season while the rest remain dormant until the following growing season when another 50% will germinate (Johnson 2012). Depending on the level of turions at a given location, and knowing that latent turions may be able to survive for over 5 years in the sediment, it may take several years of control to exhaust the “turion bank” (R. Newman – U of M unpublished data).

Turion survey results are illustrated in Figure 47 and Table 12. These results can be used to predict potential growth and level of navigation impairment for the coming season.

---

<sup>45</sup> Berg, Matthew. Curly-leaf pondweed (*Potamogeton crispus*) Post Herbicide Turion Survey Balsam Lake – WBIC: 2620600 Polk County, Wisconsin. November 2014.

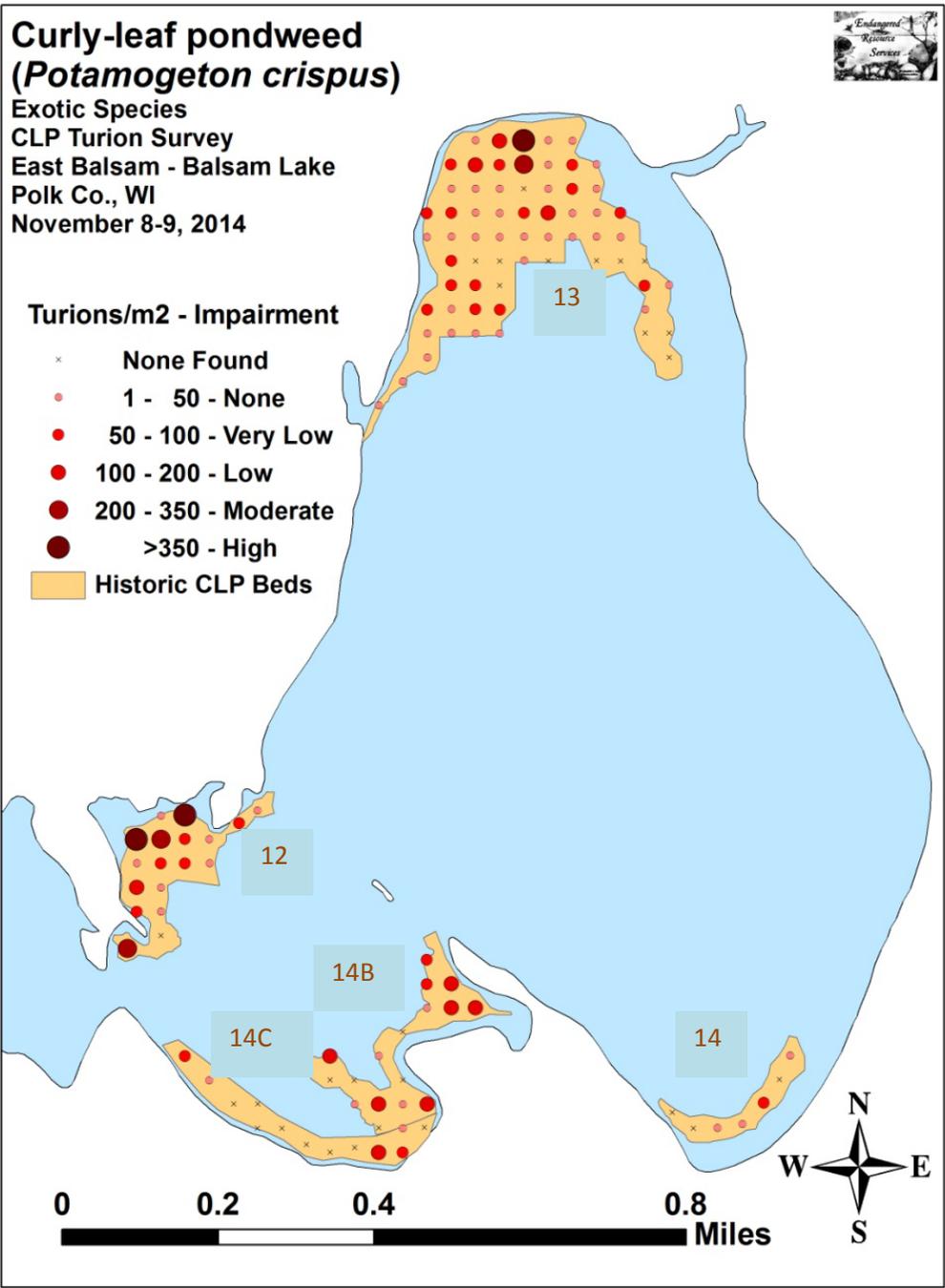


Figure 47. CLP Turion Survey Results November 2014

Table 12. CLP Turion Survey Summary Results November 2014

	Overall	Bed 12	Bed 13	Bed 14	Bed 14 B/C
Maximum turions/m <sup>2</sup>	1,012	1,012	388	65	194
Mean turions/m <sup>2</sup>	62	152	47	21	48

## AIS Prevention Efforts

### Boat Landings

In past years, the lake district applied chemicals at the public landings in an attempt to prevent the introduction of Eurasian water milfoil to the lake. This technique for EWM prevention is not described in the 2005 or 2010 aquatic plant management plans.

DNR records document herbicide treatment of 100 foot wide swaths at the Balsam Lake boat landings. There were a total of 0.55 acres treated at all 5 landings in 2005. In 2006 and 2007, reports indicated that 4 landings (not including Sunnyside) were treated with the herbicide Reward.

### Eurasian Water Milfoil Monitoring

Endangered Resource Services currently checks the boat landings for the presence of Eurasian water milfoil and other invasive plants monthly during the summer. These surveys have resulted in reporting and removing purple loosestrife, but there has been no new discovery of AIS on Balsam Lake.<sup>46</sup>

Volunteer or intern boat landing monitors check boats, clean boats if necessary, and provide information to lake users at the public boat landings. Volunteers and interns also regularly provide surveillance monitoring at boat landings to check for Eurasian water milfoil using citizen monitoring protocols and report to the project coordinator if a suspicious plant is found. If identification is confirmed, the project coordinator will report any positive EWM identification to the Department of Natural Resources.

### Clean Boats Clean Waters

The CBCW program inspects boats and trailers for invasive species, educates boaters on invasive species and the local and state Aquatic Invasive Species (AIS) rules, and gathers data.

The BLPRD completed its eighth year with the Balsam Lake Clean Boats and Clean Waters (CBCW) program in 2014. Staff for Clean Boats, Clean Waters includes high school, college students, and adults who work both compensated and volunteer hours. A landing leader is designated to coordinate hours for each landing. The program is funded with the help of DNR Aquatic Invasive Species (AIS) grants in each year of the program.

The 2014 CBCW season began with opening of fishing on May 3<sup>rd</sup> at all four public landings on the lake. Included were Balsam Lake Village Beach, 46 Store, East Balsam, and Little Balsam. The season ended on August 31<sup>st</sup>.

---

<sup>46</sup> Berg, Matthew. *Landing Invasive Species Inspection Balsam Lake WBIC: 2620600 Polk County, WI*. 2011-2014.

Table 13. CBCW Summary Statistics

	2007	2008	2009	2010	2011	2012	2013	2014
Number of Volunteers Involved	17	26	43	44	34	44	21	17
Total Inspection Hours	506	939	1,050	920	908	1,058	873	505
People Contacted	1,164	2,412	4,375	3,367	4,225	4,047	3,194	1,823
Number of Boats Inspected	587	995	1,838	1,669	1,810	1,825	1,407	834

All data collected is entered into the State DNR SWIMS database and can be accessed at [www.dnr.wi.gov/lakes/cbcw/about/](http://www.dnr.wi.gov/lakes/cbcw/about/).

**Polk County Land and Water Resources Department (LWRD)**

The BLPRD will coordinate training and educational activities with the Polk County Land and Water Resources Department and the Polk County Lakes and Rivers Association. Volunteers and staff will be trained through Clean Boats, Clean Waters workshops in cooperation with the Polk County LWRD. County staff is also willing to provide plant identification assistance.

**Polk County** has a Do Not Transport Ordinance and has placed signs at public landings to remind lake users about its requirements. It is illegal to transport aquatic vegetation on boats and equipment in Polk County.

Table 14. WDNR Aquatic Invasive Species Grants to BLPRD

Start Date	End Date	Grant Number	Amount	Tasks
April 2007	Dec 2009	AEPP-073-07	\$13,645	Clean Boats, Clean Waters Program
Oct 2009	Dec 2011	AEPP-205-10	\$49,999	Clean Boats, Clean Waters Program Aquatic Plant Survey APM Plan Update
Oct 2011	Dec 2014	ACEI-102-12	\$31,280	Curly Leaf Pondweed Control CLP Pre and Post Monitoring AIS Monitoring
Oct 2011	Dec 2014	AEPP-321-12	\$49,670	Clean Boats, Clean Waters AIS Monitoring
April 2014	Dec 2015	AEPP-430-14	\$15,919	Aquatic Plant Survey APM Plan Update CLP Pre and Post Monitoring
Feb 2015	Dec 2015	CBCW-148-15	\$16,000	Clean Boats, Clean Waters Program
Feb 2015	Dec 2017	ACEI-170-15	\$74,898.50	Curly Leaf Pondweed Control and Monitoring Purple Loosestrife and Knotweed Control

## Plan Goals and Strategies

This section of the plan lists goals and objectives for aquatic plant management for Balsam Lake. It also presents a strategy of actions that will be used to reach aquatic plant management plan goals.

**Goals** are broad statements of direction.

**Objectives** are measurable steps toward the goal.

**Actions** are actions to take to accomplish objectives.

The **Implementation Plan** outlines timeline, resources needed, partners, and funding sources for each action item. The Implementation Plan chart will be updated each year prior to the annual meeting. The Implementation Plan for 2015 and 2016 is found in Appendix H.

### Plan Goals

1. Manage established invasive species and eradicate newly introduced invasive species to reduce their impacts to the lake.
2. Prevent and detect the introduction of aquatic invasive species.
3. Maintain navigation for fishing and boating, access to lake residences, and comfortable swimming at the village beach.
4. Engage lake residents and visitors in reaching aquatic plant management goals.
5. Preserve the diverse native aquatic plant community in Balsam Lake.

## Responsible Parties for APM Implementation and Monitoring

**Balsam Lake Protection and Rehabilitation District Board (BLPRD)** – elected/appointed officials responsible for oversight of lake management district. Some actions such as hiring a contractor or consultant require a vote of the board.

**APM Lead** – makes day-to-day APM decisions, manages harvesting operations, and directs contractors in herbicide treatments for navigation. The commissioner will have volunteers and consultants to assist in these activities.

**AIS Lead** – leads and coordinates Aquatic Invasive Species prevention activities including Clean Boats, Clean Waters monitoring and education at the boat landings and lake monitoring. The AIS Lead also coordinates AIS control measures and related monitoring.

**Herbicide Contractor** – the herbicide applicator hired by the District Board to complete herbicide treatment as permitted by the Wisconsin Department of Natural Resources.

**APM Monitor**– a consultant hired to complete monitoring under the direction of the AIS Lead and the BLPRD Board.

**DNR** – APM staff will review aquatic plant management permit applications and enforce permit conditions.

**Polk County LWRD** – Staff from the Polk County Land and Water Resources Department will assist with education and plant identification.

Goal 1. Manage established invasive species and eradicate newly introduced invasive species to reduce their impacts to the lake.

*Objectives*

- A. Substantially reduce CLP growth
  - a. Priority Area: East Balsam
  - b. Targets: Reduce CLP in beds to <10 acres and sediment turions to <10/m<sup>2</sup>.
- B. Protect and restore native plants during and following AIS management efforts.
- C. Understand and prevent the release of phosphorus from CLP.
- D. Maintain navigation to homes, businesses, and public boat landings.
- E. Locate and remove purple loosestrife (PL) and giant and Japanese knotweed.
- F. Eliminate any new AIS introduction.

*Actions*

- 1. Control CLP growing in dense beds using low-dose, early season Endothall treatment or other accepted method. (OBJ A, B, C, D)

Initial identification of CLP Beds

- Beds consist of at least 50% CLP (or other invasive plant).
- Beds top out at the surface (at least 1 meter stem height).
- Average rake fullness rating equal to or greater than 2.

Note: Areas that do not meet these criteria in subsequent years may be treated with Endothall in order to achieve substantial plant and turion reduction targets in East Balsam.

Criteria for prioritizing CLP bed treatment:

- 1. East Balsam location
  - 2. Navigation into homes, businesses, or a public boat landing is limited.
  - 3. Bed is in a location where treatment is likely to be successful: avoid areas of steep drop off, currents, and/or high exposure to wind.
    - a. Select tentative beds for treatment in December of previous year (AIS Lead or committee)
    - b. Review APM contract or select new contractor (Herbicide Contractor, APM Monitor) in December (Board) – (note: existing contract is through 2019)
    - c. Apply for APM permits in January (AIS Lead with assistance from Herbicide Contractor)
    - d. Verify treatment areas with pre monitoring in April or May
- 2. Conduct DNR specified and required third-party pre and post herbicide monitoring for CLP herbicide treatment. (OBJ A, B, C, D)

3. Monitor herbicide concentration, and use these results to fine-tune treatment strategy in subsequent treatment years. (OBJ A, B, C, D)
4. Use harvesting as a CLP control method as outlined in Appendix G. Track areas and quantities of CLP harvested. (OBJ A, B, C, D)
5. Monitor sediment CLP turions in areas being managed with herbicide and selected harvesting areas to assess effectiveness of control efforts. (OBJ A)
6. Restore native plants in areas impacted by AIS herbicide treatment. (OBJ B)
7. Provide info to Balsam Lake residents so they can identify purple loosestrife (PL) and giant knotweed and Japanese knotweed and know who to contact if they have a suspected plant. (AIS Lead and/or Polk County LWRD) (OBJ E)
8. Monitor the lake for new PL and knotweed growth each year and mark locations with GPS points. (APM Monitor, AIS Lead, Polk County LWRD) (OBJ E)
9. Use best control methods for PL and giant and Japanese Knotweed. Purple loosestrife control may include hand pulling, herbicide, and biocontrol. Knotweed will be controlled with herbicides. New methods may be used as they become available. (AIS Lead, Polk County LWRD) (OBJ E)
10. Map control areas for PL and giant knotweed and Japanese knotweed and monitor in subsequent years. (AIS Lead, Polk County LWRD) (OBJ E)
11. Review the need for updates to the rapid response plan for aquatic invasive species. The current AIS Rapid Response Plan is included as Appendix E. (OBJ F)

Goal 2. Prevent and detect the introduction of aquatic invasive species.

**Objectives**

- A. 100% of boaters inspect, clean, and drain boats, trailers, and equipment.
- B. New aquatic invasive species are identified as soon as possible after being introduced to the lake. Include Eurasian water milfoil, purple loosestrife, zebra mussels and rusty crayfish at a minimum.
- C. 100% enforcement of Polk County's Do Not Transport Ordinance.

**Actions**

- 1. Continue a successful Clean Boats, Clean Waters monitoring and education program at each boat landing using paid staff and volunteers. (OBJ A)
- 2. Train volunteer monitors to identify and monitor for aquatic invasive species. (OBJ A and B)
- 3. Monitor boat landings and other areas with high potential for introduction of AIS. (Volunteers and APM Monitor) (OBJ B)
- 4. Work with the Polk County Sheriff's Department to encourage enforcement of the Do Not Transport Ordinance. (OBJ C)

Goal 3. Maintain navigation for fishing and boating, access to lake residences, and comfortable swimming at the village beach.

***Objectives***

- A. Maintain navigation for fishing and boating.
- B. Allow waterfront property owners the option of maintaining individual access corridors by manual, chemical, or mechanical means.
- C. Address aquatic plant nuisances to swimming at the village of Balsam Lake public beach (in partnership with the Village of Balsam Lake)
- D. Conduct all herbicide treatments legally and according to permit conditions. Permits are required for all aquatic application of herbicides in Wisconsin.

***Actions***

- 1. Identify areas of potential navigation concern caused by native plant growth. *Note currently identified common navigation areas of concern are identified in Appendix G and the process is outlined in more detail on the following page.* (OBJ A)
- 2. Seek permit and address confirmed navigation impairment using appropriate method. The process for potential harvesting on Balsam Lake is outlined in Appendix G. (OBJ A and D)
- 3. Allow individual landowners to apply for WDNR permits and contract with a licensed contractor to treat individual access corridors. These treatments may focus on invasive or native plants. Landowners would bear the cost of these treatments. Hand removal methods will be recommended as a first choice for navigation impairment created by native plants. Hand removal does generally not require a permit when limited to a 30-foot opening. Native plants provide an important shield against invasion by Eurasian water milfoil and other invasive aquatic plant species. (OBJ B and D)
- 4. The aquatic plant control method for the public beach will be selected by the Village of Balsam Lake. The plan allows for herbicide use, harvesting, hand control, or a combination of these methods. The Village would apply for necessary permits and pay for any treatment. (OBJ C and D)

## Addressing Impaired Navigation Conditions – Common Navigation Areas or Nuisance Conditions

### **1. Common Navigation Areas of Concern**

- Current navigation areas of concern are identified in Appendix G.
- New areas may be identified in the following manner:
  - Residents notify APM Lead or designee of potential concern.
  - Area is inspected by APM Lead. If navigation impairment is confirmed, document impairment as described below.

### **2. Documenting Navigation Impairment**

- Locate navigation routes with GPS coordinates.
- Provide dimensions (length, width, and depth).
- Indicate when plants cause problems and how long problems persist.
- List adaptations or alternatives considered to lessen problem.
- List the species of plants causing the nuisance.

### **3. Documenting Nuisance Conditions**

- Indicate when plants cause problems and how long problems persist.
- Include photos of nuisance conditions.
- Provide examples of specific activities that are limited because of presence of nuisance aquatic plants.
- An example nuisance condition is drift of uprooted wild celery.

### **4. Addressing Common Navigation in DNR Sensitive/Critical Habitat Areas**

- The appropriate control method will consider sensitive area functions.
- The most likely modification is to limit any navigation routes in sensitive areas to no more than 30 feet in width.

### **5. Selecting Appropriate Control Method**

- Harvesting will be the preferred method for maintaining common navigation areas.
- The process for harvesting is outlined in Appendix G.
- If herbicides are used to control the growth of nuisance native aquatic plants, the herbicide proposed for use will be based on the plant species, stage of growth, and other environmental factors.

## Individual Corridor Access

The only time a permit is not required to control aquatic plants is when a waterfront property owner manually removes (i.e., hand-pulls or hand rakes), or gives permission to someone to manually remove, plants (except wild rice) from his/her shoreline in an area that is 30 feet or less in width along the shore and is not within a designated Sensitive Area. This removal can create a corridor to areas where navigation is not impeded by aquatic plants. **The non-native invasive plants (Eurasian watermilfoil, curly leaf pondweed, and purple loosestrife) may be manually removed beyond 30 feet without a permit, as long as native plants are not harmed.** Wild rice removal always requires a permit.

Individual Access Corridors are the openings from a waterfront property owner's shoreline out into the lake. These corridors may be a maximum of thirty feet wide and must remain in the same location from year to year. Herbicide treatment or harvesting may be permitted for individual corridors in front of waterfront property to control invasive or native plants.

### **Invasive Plant Control**

Currently the only invasive aquatic plant prevalent in Balsam Lake is curly leaf pondweed. Curly leaf pondweed grows early in the summer, then dies back by early July. Nuisance conditions must be verified for herbicide treatment. The 2014 curly leaf pondweed bed map will verify nuisance conditions for 2016 treatment. The map is included as Figure 48. Once treatments are initiated, they may continue for three years if needed.

#### Areas on curly leaf pondweed bed map

- Early season endothall treatment may be permitted for 3 years
- Nuisance conditions must be verified beyond this treatment period

#### Areas outside of curly leaf pondweed bed map

- Nuisance conditions created by curly leaf pondweed must be verified the year before treatment
- Early season endothall treatment may be permitted for a 3 year period following this verification

The BLPRD will inform waterfront property owners of the process and limits of individual corridor access management options.

# Curly-leaf pondweed (*Potamogeton crispus*)

CLP Bed Mapping Survey

Balsam Lake

Polk Co., WI

June 17-20, 2014

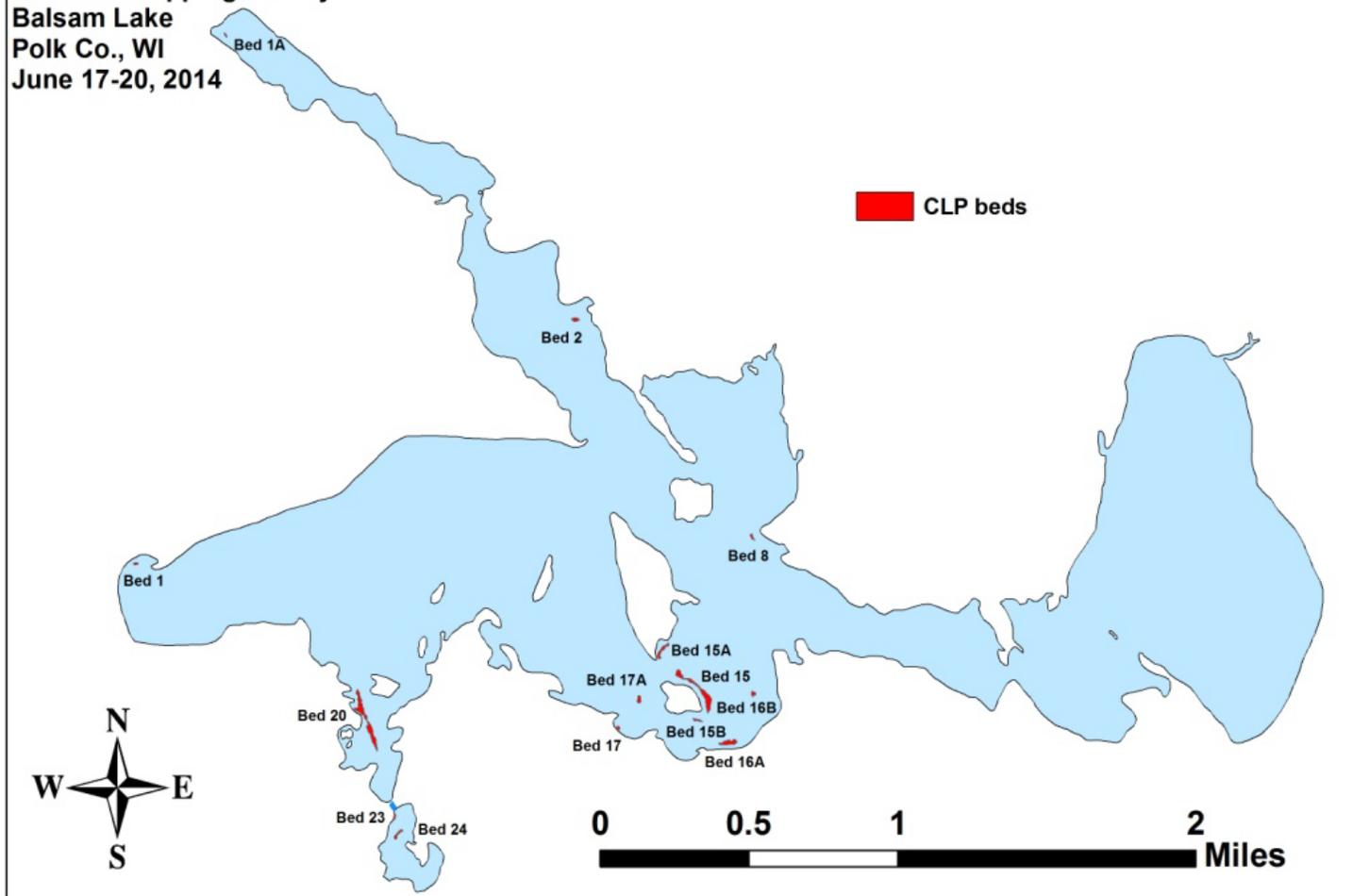


Figure 48. Balsam Lake Curly Leaf Pondweed Beds 2014

## Procedure for Individual Corridor Permitting and Monitoring

### Document nuisance conditions (landowner/ herbicide contractor provide in permit application in February/March)

- Indicate when plants cause problems and how long problems persist.
- Include dated photos of nuisance conditions.
- List depth at end of dock.
- Provide examples of specific activities that are limited because of presence of nuisance aquatic plants.
- Describe practical alternatives to herbicide use or harvesting that were considered. These might include:
  - Hand removal/hand raking of aquatic plants
  - Extending dock to greater depth
  - Altering the route to and from the dock
  - Use of another type of watercraft or motor, i.e., is the type of watercraft used common to other sites with similar conditions on this lake?
- Herbicide use for curly leaf pondweed may occur along the entire length of a waterfront property owner's shoreline with a WDNR permit. Herbicide use in areas with wild rice will not be permitted.
- Aquatic Herbicide/Harvesting Contractor to provide this information in permit application based on information from the landowner.

### Verify/refute nuisance conditions and/or navigation impairment

- Landowners will document conditions with photographs and submit request for review by the BLPRD APM Lead or designee. BLPRD charges a fee to the landowner for this service. Fee will be waived for invasive species control, or if hand removal or harvesting methods are selected.
- Landowner requests BLPRD APM Lead review of their property prior to submitting a permit application to DNR.
- The APM Lead or designee visits site, reviews documentation and provides a written opinion of navigation impairment (i.e., is herbicide treatment or harvesting warranted?) to attach to the permit application.
- Landowner applies for permit to WDNR including photographic documentation, identification of plants causing navigation problems, and BLPRD evaluation.
- The landowner is responsible for permit and treatment costs related to individual corridor aquatic plant control.
- A licensed applicator must complete the herbicide application.
- For curly leaf pondweed treatment, verification must occur the year before treatment in May or June. Once CLP nuisance is verified and a permit is approved, additional verification is not needed for three subsequent years (although permit applications must be completed each year). Treatment for CLP must occur with water temperatures from 50 - 58 degrees F.
- WDNR will contact landowner with a notice to proceed with treatment or denial of permit application and copy BLPRD.

Goal 4. Engage lake residents and visitors in reaching aquatic plant management goals.

### *Desired Behaviors*

#### Lake Residents

- Are able to identify AIS present in Balsam Lake including curly leaf pondweed, purple loosestrife, giant knotweed, and Japanese knotweed.
- Are able to identify priority AIS that could potentially be introduced into Balsam Lake including Eurasian water milfoil, zebra mussels, and rusty crayfish.
- Know what to do if they find an AIS.
- Speak up – if you notice something, say something – encourage others to do the right thing!
- Use hand removal methods if you wish to open up individual navigation access – contractors are available.
- Follow approved process if you wish to seek manual or chemical assistance to open up individual navigation access.
- Employ only licensed contractors to use chemicals in the water – and allow them to do so only with a permit.

#### Lake Residents and Visitors

- Clean boats, trailers and other equipment and drain live wells to prevent AIS introduction.
- Observe no-wake zones.

### *Messages*

1. Provide executive summary of APM plan, notice of public meeting, and how to get full APM plan.
2. List of APM dos and don'ts
3. Contact list for APM: include web resources
4. Emphasize importance of native aquatic plants.
5. Aquatic plants are not weeds – describe their benefits such as fish habitat.
6. Limit impacts on native aquatic plants by traveling with no wake in shallow areas, using hand removal methods near docks and swimming areas, etc.
7. The DNR is not against aquatic plant management to allow navigation. But, management must be balanced with an understanding and concern for native plant benefits.
8. Explain procedure for individual corridor herbicide applications and conditions where herbicide treatment may be allowed. Nuisance conditions must be documented.
9. Explain location and procedures for curly leaf pondweed herbicide treatment
10. The aquatic plant management efforts included in the plan
11. Identification of CLP and methods for removal (include illustrations)

12. Identification of PL and methods for removal (include illustrations)
13. Identification of EWM and contact if suspected (include illustrations)
14. Locations of nearby lakes with EWM
15. New potential invasive species and why they are a threat
16. Native plant identification
17. Inspect, clean, and drain boats and equipment
18. Polk County has an ordinance that makes it illegal to transport aquatic plants on public roads.

### ***Methods***

Newsletter articles (Dockside and Lake Association newsletter)

Web site – frequently asked questions, high quality plant ID pictures

Annual meeting presentation

Talk to your neighbor campaign

Articles for Laker and/or Ledger

Campground activities

Library summer programs

Bill inserts

ID cards

Placemats at local restaurants

Elementary school education (parents learn from kids)

Info at bait shops, restaurants, bars, other businesses

Aquarium display of native plants

Plant ID expert – bring plants in

Plant ID competition

Internet tools like Twitter and Facebook

Training classes/workshops with quizzes

DNR “wild cards”

Playing cards with aquatic plants on back

Handouts for plant identification – include high quality photos

Goal 5. Preserve the diverse native aquatic plant community in Balsam Lake.

***Objectives***

- A. Implement strict adherence with treatment standards (early CLP treatment prior to native plant growth) and monitoring methods prior to and following herbicide treatment.
- B. Restore native plant growth in East Balsam if recovery is not evident in post-monitoring and point intercept plant surveys.
- C. Limit removal of native plants to areas with severe navigation problems or nuisance conditions.
- D. Allow only limited plant control in designated sensitive areas – most often by limiting width of navigation channels through native plants.
- E. Increase Balsam Lake residents’ understanding of the role and importance of aquatic plants and their impacts on them.

**Discussion**

The plant community in Balsam Lake is very diverse. It is important to understand that these plants play a critical role in the lake ecosystem. Aquatic plants in the lake provide habitat for fish. They also provide protection from shoreline erosion. Removing native plants could lead to adverse effects on the lake. Healthy native plant populations prevent colonization by invasive plants such as Eurasian water milfoil. Erosion and runoff from waterfront property may alter sediment characteristics encouraging spread of invasive plants. Boating disturbance near the shoreline can remove aquatic plants and the valuable functions they provide.

***Actions***

- 1. Follow DNR requirements and BLPRD and APM plan guidelines to allow native plant removal only in areas with severe navigation impairment or nuisance conditions for common and individual navigation corridors. (OBJ C)
- 2. Complete pilot and full scale native plant restoration in East Balsam if native plants do not recover naturally following the end of intensive CLP herbicide treatment. (OBJ B)
- 3. Limit navigation channels in sensitive areas to not more than 30 feet in width, or take other measures to protect these areas when removing native plants. (OBJ C)
- 4. Conduct a point intercept survey of the lakes every five years. (OBJ B)
- 5. Update the aquatic plant management plan beginning in 2019. (OBJ A, B and C)

Educational activities are detailed in the discussion for Goal 4.

## Monitoring and Assessment

### Aquatic Plant Surveys

Aquatic plant (macrophyte) surveys are the primary means for tracking achievement toward plan goals.

**Action.** Conduct whole lake aquatic plant surveys approximately once every five years to track plant species composition and distribution. The next survey is scheduled for 2019.

The whole lake surveys will be conducted in accordance with the guidelines established by the Wisconsin DNR. Any new species sampled will be saved, pressed, and mounted for voucher specimens.

### Aquatic Invasive Species Grants

Department of Natural Resources Aquatic Invasive Species (AIS) grants are available to assist in funding some of the action items in the implementation plan. Maintaining navigation channels to alleviate nuisance conditions are an exception. Grants provide up to 75 percent funding.

Applications are accepted each year with a postmark deadline of February 1.

*Table 15. BLPRD Aquatic Invasive Species Grants*

Grant Number	Grant Period	Amount	DNR Grant	Tasks
AEPP-430-14	04/01/14 - 12/31/15	\$15,918.75	75%	<ul style="list-style-type: none"> <li>• APM Plan Update</li> <li>• CLP Monitoring</li> </ul>
ACEI-170-15	2/1/15 – 12/31/17	\$74,898.50	50%	<ul style="list-style-type: none"> <li>• CLP Control</li> <li>• CLP Monitoring</li> <li>• Knotweed and PL Control</li> <li>• AIS Prevention Monitoring</li> </ul>
CBCW-148-15	2/1/15 – 12/31/15	\$16,000.00	75%	<ul style="list-style-type: none"> <li>• Clean Boats, Clean Waters Staffing</li> </ul>

# Appendix A. Balsam Lake Property Owner Survey Results

**Please complete and return in the enclosed self-addressed stamped envelope to:**

BLPRD  
 PO Box 202  
 Balsam Lake, WI 54810

**301 of 800 surveys returned: 38%**

1. Which of the following best describes when you use your Balsam Lake home/property?  
 (Please consider the property you use most if you own more than one.)

**(Check one)**

- 61 of 301 20% Full-time residency
- 64 of 301 21% Seasonal – continued occupancy for months at a time
- 171 of 301 57% During weekends, vacations, and/or holidays
- 2 of 310 0.6% Rental to others
- 1 of 301 0.3% Land Only
- 3 of 301 1% No Response

2. How long have you owned property on Balsam Lake? **(Check one)**

- 13 of 301 4.3% 0 to 2 years
- 26 of 301 8.6% 2+ to 5 years
- 45 of 301 15% 5+ to 10 years
- 75 of 301 24.9% 10+ to 20 years
- 137 of 301 45.4% More than 20 years
- 5 of 301 1.6% No Response

3. Please indicate your degree of participation in the following activities at Balsam Lake?

**(Circle appropriate response for each item)**

	None	A little	Some	Quite a bit	A great deal	Average
<u>Appreciating peace and tranquility</u>	0	1	2	3	4	3.48
<u>Enjoying the view</u>	0	1	2	3	4	3.69
<u>Fishing</u>	0	1	2	3	4	2.13
<u>Jet skiing</u>	0	1	2	3	4	0.07
<u>Motor boating</u>	0	1	2	3	4	2.82
<u>Non-motorized boating</u>	0	1	2	3	4	1.19
<u>Observing wildlife</u>	0	1	2	3	4	3.13
<u>Wind surfing</u>	0	1	2	3	4	0.14
<u>Scuba diving or snorkeling</u>	0	1	2	3	4	0.12
<u>Swimming</u>	0	1	2	3	4	2.33
<u>Water skiing</u>	0	1	2	3	4	1.49
<u>Other (list)</u>	0	1	2	3	4	
<u>Snow shoe</u>	1 response at 4			<u>Sailing</u>	5 ave 3	
<u>Running</u>	1 response at 4			<u>Tubing</u>	5 ave 3.2	

Entertain. & Family time	2 at 4	Sun bathing	1 at 3
Snowmobile on lake	3 ave. 2.67	Ice Walking	1 at 1
Walks in Winter	1 at 3	Water Therapy Handi.	1 at 3
Socializing	1 at 4	Wake Boarding	2 ave 3.5
Enjoy Restaurants	1 at 3	Star gazing	1 at 4
Kayaking	1 at 3	Walking	1 at 3
Biking	1 at 3	Paddle boats	1 at 1
Out of Cities	1 at 4	Ice Fishing	1 at 4
Gardening	1 at 4	No Response	1

4. Please indicate how much each of the following **negatively** impacts your use of the lake. If you believe the concern is not present on the lake, circle "0".

(Circle appropriate level of negative impact for each item)

	Level of Negative Impact							Average Score
	Not present	No impact	A little	Some	Quite a bit	A great deal	Unsure	
Algae growth	0	1	2	3	4	5	6	3.71
Small fish size	0	1	2	3	4	5	6	2.65
Not enough fish	0	1	2	3	4	5	6	2.76
Lake level too high	0	1	2	3	4	5	6	1.21
Lake level too low	0	1	2	3	4	5	6	2.61
Native aquatic plant* growth	0	1	2	3	4	5	6	3.4
Invasive aquatic plant** growth	0	1	2	3	4	5	6	3.68
Loss of wildlife habitat	0	1	2	3	4	5	6	2.87
Boat congestion	0	1	2	3	4	5	6	2.81
Noise	0	1	2	3	4	5	6	2.82
Loss of natural scenery	0	1	2	3	4	5	6	2.57
Other (list)	0	1	2	3	4	5	6	
Culvert Size	1 at 5							
Too many bass tourn.	1 at 4							
Fewer Loons	1 at 4							
Muck	1 at 5							
Water Clarity	2 at 4							
Loose Dogs	1 at 5							
ATVs	1 at 5							
Garbage in Lake	2 at 4							
DNR is a poison	1 at 1							
Light Pollution	2 at 4.5							
Street Light Glare	1 at 5							
Moss on Lake Bottom	1 at 5							
Rock wall McMansions	1 at 5							
Renting out Docks	1 at 5							
Increase Boat Houses	1 at 1							
Neighbors Renting	1 at 1							
Silt	1 at 5							
Operation of PWC	1 at 5							
Float Planes	1 at 1							
Too weedy to canoe	1 at 4							
Too weedy to boat	1 at 4							
Large houses right on lake	1 at 1							
Noise from large boats	1 at 5							
Jet Skiing too close to shore	1 at 5							

<u>Jet skiing noise</u>	<u>1 at 5</u>
<u>Jet skiing speed</u>	<u>1 at 5</u>
<u>No response</u>	<u>4</u>

\***Native aquatic plants** – plants which grow submerged in water, floating on the water, or in shallow water. Native aquatic plants are naturally present in the lake. They provide food and cover for fish and wildlife and stabilize lake sediments and shorelines.

\*\* **Invasive aquatic plants** - Invasive plants are "out of place." They are usually introduced by human action to a location where they did not previously occur naturally and then dominate their new location. Eurasian water milfoil and curly-leaf pondweed are examples of aquatic invasive species.

**QUESTIONS RELATED TO AQUATIC PLANT MANAGEMENT FOLLOW**

Note that aquatic plants are rooted in the lake bottom or floating on the lake surface. Particles of algae floating in the lake are not considered aquatic plants.

5. How would you describe the overall amount of aquatic plants in the lake? **(Check one)**

- 48 of 301 16 % Not sure
- 5 of 301 1.6% Too few
- 66 of 301 21.9% Right amount
- 177 of 301 58.8% Too many
- 5 of 301 1.6% No Response

6. Which best describes the amount of rooted aquatic plants near the shore (in the water)? **(Check one)**

- 33 of 301 10.9% Not sure
- 9 of 301 3 % Too few
- 70 of 301 23.3% Right amount
- 181 of 301 60.1% Too many
- 7 of 301 2.3% No Response

7. At what time period during the year do you consider the aquatic plant growth in Balsam Lake to be excessive? **(Check all that apply)**

- 25 of 301 8.3 % May - June
- 224 of 301 74.4% July - August
- 3 of 301 1 % August - September
- 53 of 301 17.6% September - October
- 23 of 301 7.6% I don't know
- 43 of 301 14.3% Aquatic plant growth is always excessive
- 9 of 301 3 % Aquatic plant growth is never excessive
- 3 of 301 1 % No Response

8. During the past few years how much, if at all, have aquatic plants limited participation for you or your family in the following activities? **(Circle the appropriate response for each item)**

	Do not participate	Not at all	A little	Somewhat	Quite a bit	A great deal	Average:
Swimming	0	1	2	3	4	5	2.85
Fishing	0	1	2	3	4	5	1.99
Motorized boating	0	1	2	3	4	5	2.35
Non-motorized boating	0	1	2	3	4	5	1.17
Enjoying the view	0	1	2	3	4	5	1.73
Water skiing or tubing	0	1	2	3	4	5	1.79
Jet skiing	0	1	2	3	4	5	0.98

1 No Response

9. Curly leaf pondweed is an aquatic invasive plant that is found in many lakes in Wisconsin.

Do you believe that you can identify this plant? **(Check one)**

68 of 301 22.6% Definitely no

64 of 301 21.3% Probably no

67 of 301 22.3% Not sure

64 of 301 21.3% Probably yes

35 of 301 11.6% Definitely yes

3 of 301 1 % No Response

10. How much of a problem, if at all, do you consider curly leaf pondweed growth in Balsam Lake?

**(Check one)**

40 of 301 13.3% Large problem

57 of 301 18.9% Moderate problem

176 of 301 58.5% Unsure

16 of 301 5.3% Small problem

6 of 301 2 % No problem

6 of 301 2 % No Response

11. Curly leaf pondweed has been found in Balsam Lake. The potential impacts of this invasive plant include overtaking native plants, impeding navigation in early summer, and increasing phosphorus levels in the water when the plant dies in June or July. The Lake District has previously used the herbicide Endothall to control the growth of curly leaf pondweed early in the season to avoid impacts to native plants. Should the Lake District continue control efforts for curly leaf pondweed? **(Check one)**

4 of 301 1.3 % Definitely no

3 of 301 1 % Probably no

34 of 301 11.3 % Not sure

88 of 301 29.2 % Probably yes

167 of 301 55.5 % Definitely yes

5 of 301 1.6 % No Response

12. In 2009, the Lake District spent about \$5,000 to treat an 8 acre area of curly leaf pondweed with herbicide and to monitor the results. Should curly leaf pondweed management efforts be expanded to additional acreage? **(Check one)**

8 of 301 2.6 % Definitely no

4 of 301 1.3 % Probably no

68 of 301 22.6 % Not sure

102 of 301 33.9 % Probably yes

114 of 301 37.9 % Definitely yes

5 of 301 1.7 % No Response

13. Below is a list of management activities that could be used to manage aquatic plants on Balsam Lake. Please tell us if you think each activity should be pursued by the Lake District.

**(Circle a response for each item.)**

	Definitely no	Probably no	Unsure	Probably yes	Definitely yes	Average
Spray native aquatic plants	0	1	2	3	4	2.34
Harvest native aquatic plants	0	1	2	3	4	2.13
Spray invasive aquatic plants	0	1	2	3	4	3.14
Harvest invasive aquatic plants	0	1	2	3	4	2.61
Educate residents about lake issues	0	1	2	3	4	3.46
Prevent invasive species introduction	0	1	2	3	4	3.66
Protect sensitive habitat areas	0	1	2	3	4	3.33
Expand "slow no-wake" area	0	1	2	3	4	2.21
Encourage individuals to hand pull/rake invasive plants	0	1	2	3	4	2.98
Allow individuals to hire contractors to spray up to 30 ft. around docks	0	1	2	3	4	2.84
No management	0	1	2	3	4	0.46
Other (list)	0	1	2	3	4	
if sprays effect fish 1 response						Allow indiv. Spray entire shore line 1 at 4
DNR won't let us do anything 1 at 4						Use any herbicide/chem. 1 response
Silt 1 at 4						Concerned about toxic subs. used 1 at 4
Harvest!! 1 at 4						No response 4

14. Which of the following methods(s) have been used to control aquatic plants in the lake in front of your lakeshore property within the past 5 years? Please consider the property you use most if you own more than one. **(Check all that apply)**

196 of 301 65.1 % Removal by hand-pulling or raking myself

9 of 301 3 % Hired someone to hand pull or rake

54 of 301 17.9 % Hired an herbicide applicator to apply chemical

26 of 301 8.6% Applied chemical myself

30 of 301 10 % Physical removal aided by a boat, ATV, lawn-mower, or similar machine

29 of 301 9.6 % I don't know

32 of 301 10.6 % None

13 of 301 4.3 % No Response

Other (list)

2 of 301 .7 % Some machine harvesting by BLPRD

2 of 301 .7 % BLPRD spraying

1 of 301 0.3 % Increase native aquatic plant growth

1 of 301 0.3 % Don't remove plant

2 of 301 .7 % Use outboard motor to move dead/cut off weeds

1 of 301 0.3 % Don't own lake shore, only access to it

1 of 301 0.3 % Waiting for harvest machine

1 of 301 0.3 % Have let the lily pads expand

1 of 301 0.3 % Permission from DNR to maintain navig. channel

**QUESTIONS RELATED TO THE WATERFRONT RUNOFF PROGRAM FOLLOW**

15. Below is a list of landscaping practices designed to protect and improve lake water quality. Please tell us which practices, if any, you use at your Balsam Lake property or whether or not you are familiar with the practice. **(Check one for each line)**

	Already use	Familiar but not used	Not familiar
Rain gardens	12.6%	55.5%	18.9%
Rain barrels	7 %	70.4%	10.3%
Shoreline buffer zones	59.1%	24.9%	9.3%
Native plants anywhere on lake property	55.5%	19.3%	15.3%
Infiltration pits or trenches	7 %	41.2%	38.5%
Water diversions	20.9%	37.5%	28.6%
Not fertilizing or using zero phosphorus fertilizer	80.4%	12 %	4.3%
Other, please list			

Natural rocks SBZ AU 0.7%    RG Plan to 0.7%    RB plan to 0.3%    SBZ Plan to 0.3%  
 NP Plan to 0.3%    Run off Away from lake AU 0.3%    Less Grass/More shrub AU 0.3%  
 No Grass Cutting AU 0.3%    Don't burn leaves AU 0.3%    Installed "shore sox" 0.3%  
 No response 0.7%

16. In the following list, please indicate which water quality landscaping practice, if any, you would consider putting in place on your Balsam Lake property. Please see the definitions below. If you already use the practice, please check the box. **(Check all that are of interest)**

- 124 of 301    41.2%      Rain gardens
- 102 of 301    33.9%      Rain barrels
- 172 of 301    57.1%      Shoreline buffer zones
- 158 of 301    52.5%      Native plants anywhere on lake property
- 63 of 301    20.9%      Infiltration pits or trenches
- 98 of 301    32.6%      Water diversions
- 203 of 301    67.4%      Not fertilizing or using zero phosphorus fertilizer
- 33 of 301    10.9%      No Response
- Other, please list \_\_\_\_\_
- 1 of 301    0.3%      Postage stamp size lot
- 1 of 301    0.3%      Don't have mow able shoreline
- 1 of 301    0.3%      Roof water into an abandoned septic system (functional)
- 1 of 301    0.3%      Have 2nd WD that could use a "pit"
- 1 of 301    0.3%      Let people handle own property, w/o gov't control

**Rain gardens** – Rain gardens are depressions in the landscape planted with flowers and grasses. A rain garden is positioned to capture runoff from rain events and absorb the water over several hours to a few days.  
**Rain barrels** – Rain barrels capture water from a rain gutter downspout for watering gardens and potted plants.  
**Shoreline buffer zone** – Areas of planted or naturally-growing native vegetation beginning at the water’s edge and extending upland. Shoreline buffer zone minimum depths generally extend 35 feet back from the high water mark.  
**Infiltration pit or trench** – A depression lined with filter fabric and filled with rock. Runoff is directed to the pit or trench for temporary storage until it soaks into the ground.  
**Water diversion** – A practice that directs water flow to a place where it can soak into the ground rather than flow to the lake. Arranging gutters and downspouts to direct water so that it doesn’t flow to the lake is an example. Berms (low ridges), drain tile, and channels are other means to divert water.

17. Are you aware of the free visits the Lake District offered in 2008 and 2009 to lake residents to address waterfront property runoff? **(Check one)**

141 of 301 46.8% Yes

153 of 301 50.8% No

7 of 301 0.3% No Response

18. Have you taken advantage of these services? **(Check one)**

23 of 301 7.6% Yes (If you choose this answer, go to Question 20)

72 of 301 23.9% No, but I plan to (If you choose this answer, go to Question 20)

185 of 301 61.5% No (If you choose this answer, go to Question 19)

20 of 301 6.6% No Response

19. If you don't plan to request a free visit, please describe the reason. **(Check one)**

92 of 301 30.6% It is not needed on my property.

12 of 301 3.9% I don't have time.

12 of 301 3.9% I am concerned about inviting someone representing the Lake District onto my property.

24 of 301 7.9% I don't have the money to install a landscaping practice to address waterfront runoff.

44 of 301 14.6% I don't know enough about the visit.

14 of 301 4.6% No Response

Other \_\_\_\_\_

1 of 301 0.3% Charities my property

1 of 301 0.3% Not sure of benefits/practice landscaping tech.

2 of 301 0.6% Small lot

1 of 301 0.3% Not there on weekdays

2 of 301 0.6% Handle property w/o gov't body

1 of 301 0.3% Limited use on home

1 of 301 0.3% Property 4 sale

1 of 301 0.3% I have a plan!!

1 of 301 0.3% Don't drive

1 of 301 0.3% Condo assn.

1 of 301 0.3% Don't live right on lake

20. The Balsam Lake District sends out information regarding its management activities and living on the lake. How do you prefer to receive information from the Balsam Lake District?

**(Check all that apply)**

4 of 301 1.3% I do not wish to receive information from the Lake District

257 of 301 85.3% Docksider Newsletter

82 of 301 27.2% Annual meeting

131 of 301 43.5% Special mailings

76 of 301 25.3% Web site

86 of 301 28.6% E-mail notices

14 of 301 4.7% No Response

Other, please specify \_\_\_\_\_

1 of 301 0.3% Same been doing

**In the space below, please include any other comments you may have regarding the lake, or the activities of the Lake District.**

**Survey 1)** In the big scheme of things weed growth is the natural process & by product of an aging lake. I don't believe we should use too much radical intervention to control this issue. I am not a fan of poisons/Herbicides so limiting the use of such treatments would be important to ME. We don't, and won't, know the affects of these on human for years to come. But we all know it won't be good. I am glad that we have an active group of volunteers working on behalf the "the Lake" and its temporary visitors. Thanks for putting your time and efforts into such an important thing to all of us who share the blessing. Help the users become better stewards of this resource.

**Survey 14)** Question 4: and prohibit swimming

Question 13: Enforce the present ones (Expand "slow no wake" area)

**Survey 17)** Question 7: Really only August

Question 13: Use machine to pull invasive plants-not cut them which makes it worse

Question 14: Harvesting makes a mess of floating weeds that float into our property & Make another mess.

Harvesting is like "pruning a shrub", it makes it fuller, (what's left behind), and makes it spread.

**Survey 19)** Comment: We attended the workshops and had our property evaluated and hope to put into effect what was recommended starting this summer. It was terrific, we got a great plan. It was sad more people didn't attend.

The time Breanne spent with us was invaluable and the plans very complete.

**Survey 22)** Comment: Restricting the number of watercraft (and fisherman) who are not lake residents which trailer in to use the lake. Restricting (somehow) the number of watercraft that each lake resident can own on their property.

**Survey 23)** Question 8: In our Bay

Comment: Should consider dredging problem bays for home owners!

**Survey 25)** Comment: What's up with the Levy increase!!

It is Excessive!!! Why is the BLPRD banking up so much money? The primary mission is weed control, for which the DNR is not allowing.

**Survey 26)** Question 14) New Home Buyer

**Survey 28)** Haven't been there in about 5 years. Just don't get there....

**Survey 31)** Question 4: People renting out docks on their property to unrelated parties for money....

**Survey 32)** Comment: I appreciate the committee taking the time and interest in continuing to protect the lake!!

Thank you for helping to educate the Balsam Lake Property owners!

Those who participate in the above protection suggestions should receive a break on their property a "green" tax break on their property taxes. ☺ Thank you for you for your time! Tiffany

**Survey 33)** Question 6: Too Many in some areas.

**Survey 34)** Question 4: NOISE-Bass Boats

**Survey 36)** Question 14: Take better care to get rid of the weed's in our Lake!!

**Survey 39)** Comment: Love the lake, the area, and atmosphere of Balsam Lake. Please do something about the weeds!!

**Survey 40)** Comment: Thanks for attention to this issue.

**Survey 42)** Question 4: Added these to the list but not circle a number: Continual construction by neighbor, and Noise of Balsam Lake Factories.

**Survey 43)** Question 19: I live in California.

**Survey 45)** Comment: 1) Low walleye populations is a concern.

2) Concerned about fish population & use of chemicals for weeds that would affect fish population & health risk in consumption of fish.

3) Concerned about all the lawns that look so well & probably treated with pesticides & weed killers & phosphorous that drain in to the lake.

**Survey 46)** Question 11: How does it affect, fish & wildlife?

Question 12: sort of pricey!

Question 14: 10 of us pitch in to rake or pull by hand

Comment: Things are getting a bit out of control up at Balsam Lake. With the increase of building on the lake the new occupants destroy so much natural shoreline & Beauty. Too much focus on being “on top” of the water, boathouses, manicured lawns. Too much leniency on zoning laws!! Loons inhabit a clean, peaceful lake. Let’s hope they never leave our lake due to loss of clean water, habitat & peace. We are so lucky to have them!!

**Survey 51)** Question 12: Can we afford \$153,125 to do this? What was the success rate? (245 acres)

Question 13: Prevent inv. “cost effective!!” Encourage hand pull/rake, “cost effective!!”

Question 20: Special Mailings-High importance items!!

**Survey 56)** Question 12: What was the result? Cannot answer without results.

Comment: Please consider investigating Goose control. They are becoming pests.

**Survey 59)** Question 16: Don’t know I would use any; I’m there on weekends & like to use the shores and be in the water. Comment: The reason this is late, we just got back from Florida yesterday (Feb. 26) I’ve been on the lake for over 30 years and I love Balsam Lake. It’s a beautiful lake, the only problems is weeds and lake clarity. Thank you Larry (couldn’t read the last name)

**Survey 61)** Comment: We need more attention to fish. The bass are way too small & walleyes hardly exist. Spearing is killing the lake. We need a continual stocking program for walleyes.

**Survey 62)** Comment: I indicate that noise is an issue. This is primarily due to loud bands playing outdoors at bars in town. Even though we are over a mile away, this noise carries across the lake and ruins our peace and quiet very frequently.

**Survey 64)** Question 11: What the negatives to its use? How does Endothall effect lake species? Animals? Humans?

Question 12: What is the out come-of the test area?

**Survey 67)** Comment: I receive information from several plant removal companies. Do you advocate one? Which one?

**Survey 69)** Comment: Allowing float planes to land in the middle of the lake with blind spots at the ends of the islands is an accident waiting to happen.

**Survey 71)** Question 4: East Balsam being very shallow promotes algae. Need major effort to prevent algae on north end of East Balsam.

Question 14: Some application of herbicide on East Balsam but not sure how much.

Comment: We are not alone in supporting algae & aquatic plant control on East Balsam. Need some promising plans. Thanks Paul. [pheysse@gmail.com](mailto:pheysse@gmail.com)

**Survey 75)** Comment: I am a lake property owner on Balsam Lake in Stump Bay. In July, August, and September that entire bay is taken over by tall weeds. From our dock it is all most impossible to use a motor boat. No swimming either.

**Survey 77)** 2<sup>nd</sup> generation family

Question 14: Do not interfere with any growth (put up with it) I do rake tons of weed waste from the shoreline that drift in from being cut off by boat traffic.

**Survey 78)** Question 4: Where are the walleye????

**Survey 84)** Question 14: On North side, others cut weeds on other parts of lake & they all end up on our shoreline by the boat load. If someone else cuts the weeds they should take it with them, not burden others with the mess & smell. Thanks ☺

Question 19: found info. Online and Jon Hol, also info from Balsam Lake City Hall, and we leave as much of our yard natural as possible & add lots of new trees and plants each year.

Comment: Thank you for all the work you do to keep the lake safe. It upsets me when I see people cutting down everything and then wondering why the shoreline is caving in.

**Survey 87)** Comment: Help us manage weeds in town bay. We could hardly use pontoons toward end of \_\_\_\_\_ do to weeds!!!

**Survey 89)** Comment: I believe excessive lake weeds could be managed by making them economically valuable, such as allowing them to be harvested & bagged & sold such as peat moss. Though the smell would drive buyers off, or they could be harvested & used in biomass methane generators by the local electric , utility. This would create a value for “seaweed” & change the nature of the problem to an asset. Minnesota should be asked to participate. Mini stills, such as micro breweries could be located close to problem areas & add some jobs and a change of attitude about “lake weeds” or a commercial fishing industry could be developed by introducing a fish such as “grass carp” which thrive on eating weeds. This would also create some jobs and develop a valuable industry over the upper Midwest. A lake can be more than just a reservoir to hold water for recreational purposes- fishing, boating, and swimming. It is also a rich farm land going to waste and lying fallow. Farming the lake could be restricted to week days-leaving the weekends open for recreation. If a government agency studies this problem it will waste money and die on the vine, but if private entrepreneurs are encouraged to come up with a method to control lake weeds it just might happen to the benefit us all. I think a china man would come up with a way to create a bigger benefit from all our lakes but it would probably drive the fish sauce industry into bankruptcy!! Good LUCK.

**Survey 91)** Question 5: Mill pond (too many)

**Survey 92)** Comment: I think the use of no phosphors fertilizer, enforcing septic tank inspections, and continuing to work with local farmers involving runoff is the best way to control the phosphorus levels. Harvesting Lake weeds is a good way to remove material; nature has already consolidated it into plant form.

**Survey 96)** Comment: Too many bass tournaments-it wrecks our weekend fishing!! I don't mind some, but not 2-3x per month!!

**Survey 98)** Comment: Thank you for doing what I consider to be good work!! We need to get rid of the weeds in East Balsam!! Thanks Ralph McGowley 612-337-2780

**Survey 103)** Question 11: Though we don't know much about Endothall, we always worry about any chemicals used in our water or around animals. Would prefer non-chemical option.

**Survey 107)** Comment: We are all concerned about air, lake, water quality. Maybe we have to look at ourselves. Within 4 cabins of mine; one guy had no indoor plumbing or properly operating drain field, the other guy shovels out his out house waste and dumps it next to the pond; the third guy burns plastic bags, jugs, & B.S. all weekend. Maybe we should ban burn barrels, outhouses, without containment, and actual look at ourselves and use the money we have for a sanitary inspector and bring people into compliance. Then we can look at other stuff.

P.S. Sanitary should be done by holding tanks, mound systems, and septic systems, NOT costly sewer systems!!

**Survey 111)** Question 16: I would like to see my neighbors stop burning leaves by the lake shore.

Comment: I have, as you may have guessed, a problem with the DNR. They as, most government offices, start out as a good thing but somewhere along the way they become an elite group that rules over the people that use and own Wisconsin lake property. We need common sense back in our government and the DNR.

**Survey 112)** Comment: 1. Sanitary sewer systems for all lake properties. 2. Lighting ordinance to reduce glare and unnecessary light pollution in lake district.

**Survey 114)** Question 11: If not harmful to the water/fish quality.

Comment: How do you stop shoreline erosion, and how to get rid of large beaver house attached to our shorelines?

**Survey 118)** Question 6: Depends on what part of the lake you are on!!

Comment: Landings-Launching boat sites need to be more restrictive. Bass boaters practices at landings are not good. The way they put their boats on trailers destroys the landings!!! Do Something!!!! Curt

**Survey 122)** Comment: I am considering selling my property on the lake due to the worsening quality of the water and high taxes. The Secchi Disk readings are horrible on East Balsam and lakes in Hayward, ie. LCO, Round, Whitefish are much better even Half Moon which is next to Balsam is much better. I believe this has been a lack of Board leadership and that sewer systems should have been put in 10 years ago. You will never get this approved now because the 4 seasons places have spent money updating their systems and won't approve and there are older systems that if forced to upgrade will never approve. The Lake Management was anti sewer and lost its chance and the Lake quality has worsened ever since.

**Survey 129)** Call me at 612-220-6299 (cell) to set up a meeting, or 952-758-6776 (home) after 5:00pm Greg Larson

**Survey 130)** Question 4: We have protected land already.

**Survey 132)** Question 18: Made 2 contacts and they never followed thru with visit.

**Survey 141)** Question 2: 51 years

Question 12: What were the results?

**Survey 143)** Question 4: Need better access to the Millpond-I do not live on the Millpond but can't get there.

Culvert **TOO SMALL!!**

**Survey 146)** Comment: THANK YOU!!!

**Survey 150)** Comment: Too high of property taxes!!

**Survey 153)** Question 11: As long as it doesn't screw up fishing.

Comment: Slow down jet ski's-wild riding; put a 20 mile . Limit on boats-we don't need another Lake Minnetonka; Improve fishing; watch pontoon parting-noise & covering large areas while hooked up; eliminate wave boats-wakes dangerous for small boats.

**Survey 158)** Question 4: Raskin Bay-Native aquatic plant growth, Boat congestion-July 4

Question 6: Too many rooted plants near the shore of Raskin Bay

Comment: Thank you to the board for all their work!!

**Survey 161)** Comment: Keep the motorized boats from going too far into stubs bay-let's keep that area natural.

**Survey 168)** Question 8: Swimming-can't because of Silt.

Question 13: Silt is where the plants root-Let's do something about that!!

**Survey 171)** Comment: The weeds on my property are out of control!!

**Survey 172)** Question 5: Reversal during year, Balsam Lake in summer.

Question 6: Average, see below, present late in summer.

Question 8: Late in year (1<sup>st</sup> four on list) It is getting worse each on my shore where only a few years ago we were weed free all summer.

Question 11: If it works and does not have negative impact.

Question 13: Weeds floor to shore and spread. (1<sup>st</sup> 4 on list) Do not know if it works (encourage ind. To hand pull/rake invasive plants)

Comment: Thank you for your efforts to improve the quality of the lake. We know Balsam is an \_\_\_\_\_ reserve to all of us in Polk county. I wish the speed and noise could be limited. I agree boats w/o proper noise control. That erodes shorelines, such as pulling multiple skiers or tubers creating massive waves. Jet ski's!!!!

**Survey 173)** Comment: We installed a buffer zone a few years ago when money was available to help. We really enjoy it.

**Survey 181)** Question 7: need for good fishing

Question 11: Only if the product works

Question 12: Did it work???

Question 13: Copper sulfate was put in the lake with DNR approval and look at the effect it has had on the Lake???

Question 14: applied chemical myself-against the law

Any chemical put in the lake by the BLPRD does move about

Comment: Be very careful using ANY chemical in Balsam Lake. Any mistakes you and the DNR make will affect the lake forever. Do not hire any company that uses young people to apply any chemical because they have “no idea” what they are doing. Personal experience, I asked them what they are applying and their answer was- They didn't know they just mixed so much of this & that & spray in the lake. You already put copper sulfate in the lake and that killed most all the bullheads, most frogs & turtles. The few walleye spanning beds were also upset. This is a “FACT” anyone who has lived on the lake a long time knows this.

**Survey 183)** Comment: I believe the greatest impact on the lake consists of two issues: 1.) Run off from agricultural and land owners, 2.) Not maintaining a buffer between their lake shore and the lake.

**Survey 184)** Comment: Dock and boat were totally unusable due to weeds. Been on the lake since 1983-never anywhere near this bad before. \*In July and August

**Survey 185)** Question 2: 26 years

Question 4: Boat Congestion-only on weekends, Noise-only on weekends

Comment: Thanks for doing a good job.

**Survey 189)** Comment: We have already installed a shoreline buffer zone with native plants 2 years ago.

**Survey 193)** Comment: We have frontage on Raskin Bay as well as Main Lake. In the 5+ years we have been on lake, Raskin Bay has become very congested with lily pads & other plant along shoreline that appear to be negatively impacting, choking the aquatic life out of the bay. A large portion of the bay has become almost non-negotiable. Is there a solution to this?? Tom Kelly 612-508-0879 [tkelly56@comcast.net](mailto:tkelly56@comcast.net)

**Survey 194)** Comment: It appears that more and more of the lake has visible weeds. North end of the Little Balsam is getting worse. The channel to Little Balsam is getting worse. North side of the Main lake seems to be getting worse. Also North part of the Lake, west of Narrows to East Balsam is bad. And of course most of East Balsam is bad. Algae levels \_\_\_ get bad to the point where the water looks gross. However, much of last summer wasn't bad, probably because it was cooler.

**Survey 196)** Comment: What is the status of efforts to prevent sewage run-off into the lake? Will the sewer line be extended beyond the village of Balsam Lake? Will drain fields and similar sewage management systems be inspected on a regularly recurring schedule? Could owner-paid measures to protect the lake be considered when property

taxes are amended? I appreciate your concern and effort on behalf of the quality of our lake. Thanks!!! Hans & his wife Koenig. [hkoenig@blakeschool.org](mailto:hkoenig@blakeschool.org)

**Survey 200)** Question 12: Provided the \$5,000 was effective

Comment: 1. Control Adverse runoff

2. Prevent invasive species

3. Address aquatic plant growth before the lake is lost.

4. Continually discourage lawn fertilization

5. Promote more shoreline buffer zones.

**Survey 201)** Comment: [mnelson@apimix.net](mailto:mnelson@apimix.net)

**Survey 202)** Comment: We are very unhappy about the huge increase in taxes.

**Survey 203)** Comment: More water patrol enforcement. A “no wake” of entire lake before 10 am. No more fishing tournaments!!!! Too Noisy!!!!

**Survey 205)** Question 14: Last year was our first summer

**Survey 206)** Comment: Lake weeds have become bad enough the last 2 years that they foul the motors almost every time we use the boat late in the season. This has not been an issue in the past at our place. We have been there since the 1950's. We have family photos showing how clean the lake was back then.

[djsteinke@earthlink.net](mailto:djsteinke@earthlink.net)

**Survey 210)** Question 12: Yes if needed!!

Question 13: Please, No pulling or raking of invasive plants as I don't think most people pick them up, consequently we get the “leftover's” on our shore line. The odor is terrible and the mess looks terrible.

**Survey 215)** Question 12: What were the results of the monitoring???

**Survey 216)** Comment: South end of East Balsam because of low water levels-experience a lot of weed growth.

**Survey 218)** Comment: I don't drive, so sometimes someone in the family will drive me to the meetings.

**Survey 219)** Comments: Bass tournaments have to be minimized. I have, and my son has participated in tournaments over the years and have stopped. Our lake cannot support so many tournaments, plus club tournaments during the week. I have talked to many tournaments fisherman who agree.

**Survey 220)** Question 12: Sounds like a lot to treat 8 acres.

**Survey 221)** Comment: Weeds need to be controlled. There are plenty of sprays that do not impact fish. I know DNR does not care, but why do we have a lake home when we can't access lake. No lake, no people, hurts economy even more.

**Survey 223)** Question 13: No wake means no wake-not just slow down. I see boats go through the narrows near East Balsam with their front end up in the air. When they are “planed out” the wake the make is huge. They would be better off going through at full speed.

Comment: All in all-I thought the lake was more “clear” this year 2009.

**Survey 226)** Comment: My greatest concern is the low lake level-mostly in the mid & late summer. I know that annual precipitation has a lot to do with it, but I hope we're keeping as much water in the lake as possible. I don't know what the requirements are for the dam, but don't let too much water out!! Thanks for asking my opinion.

**Survey 228)** Comment: Last June the lake was clearer than it's been in 20 years.

**Survey 230)** Comment: Stop letting the Indians spear. Stock with bigger fish, find frogs are just food for the bass.

**Survey 233)** Comment: Please keep rental property down on lake property. I consider this activity add problems to the lake residents because of the many parties, garbage pollution, security & theft- all around not caring what they do, renters.

**Survey 240)** Question 5 & 6: Especially East Balsam

Question 14: Applied chemical myself-If legal I would

Question 16: Very little runoff from our road, we are on a back lot with easement to the lake

Comment: Your efforts are very much appreciated-East Balsam is shallow & weeds & algae are an ongoing problem.

**Survey 241)** Question 12: not enough info on the results.

Question 13: Encourage ind. To hand pull-The method only helps for a week or 2

**Survey 242)** Comment: I love the plants there, it's good for fishing.

**Survey 243)** Question 4: Not enough fish-WALLEYES

**Survey 244)** Question 12: Poor Question!!!! Was the treatment effective?????

**Survey 255)** Comment: Thank you!!

**Survey 257)** Comment: Rollie Smith: [mcherrier.pcade@yahoo.com](mailto:mcherrier.pcade@yahoo.com)

**Survey 258)** Comment: I have a concern about the number of ice fishing houses on Balsam Lake. In the winter and the fact that they are often on the lake for days if not weeks at a time. I am concerned about the manner in which some fisherman treat or mistreat the lake when they are on the ice.

**Survey 259)** Comment: We would like to try 1 of 2 trench recommendations on our property, but was a bit concerned about cost. We are investigating again this year.

**Survey 264)** Comment: Important to remove hazardous fallen trees from water to avoid boat damage! Also floating logs... Thanks!

**Survey 266)** Comment: Weeds so bad in lake home, had to tow boats with rope from shore!! There so called spraying was a joke!!! No affect, and just sprayed around center of bay in the fall after the weeds have died!!!!!! Joke watching these guys try to spray!!!! Don't think they had any idea what they were doing!!! These sprays appeared to have little affect!!!! Raskins Bay

**Survey 269)** Question 8: Unsure just purchased property in late October.

**Survey 270)** Residence need to be able to have more control with their weeds by their docks and swimming area.

**Survey 273)** Comment: Own no lakeshore property!!!!

**Survey 247)** Comment: I'm selling my property because of the high rural estate taxes.

**Survey 275)** Comment: I'm not sure how to deal with it, but there does seem an increasing amount of garbage around the shores. I don't know if there is more in the Spring of the year or if it is just more noticeable before Summer vegetation begins to grow.

**Survey 276)** Question 13: Encourage indiv. To hand pull—"As long as they remove them from the water."

Question 20: Is there a website??

Comment: We enjoy the lake very much. Our property is in Little Balsam. The end of the bay is getting weedier every year. However, on the end going into Boston Bay seems to be clearing out. I find that very interesting. Why are we not harvesting anymore???

**Survey 277)** Comment: We need to protect our lakes, they are a precious gift!!!!

**Survey 281)** Question 14: Hired and herbicide applicator to apply chemical—"Thought we couldn't, are herbicides in the lake?????"

**Survey 285)** Comment: Let's research further the feasibility and desirability of opening Mill Pond to boat traffic from the rest of the lake. "JUST DO IT!!!!!"

**Survey 288)** Question 12: What were the results???

Question 16: Buffer zones with desired shoreline plants that would be environmentally friendly, even if not "native".

**Survey 291)** Comment: Limit time jet skiing is allowed on lake---- 10:00am to 4:00pm

**Survey 292)** Question 14: Grandchildren cannot even fish off my dock anymore....

Comment: 1. Why don't go back to cutting the weeds as in the past----

2. Ski Boats and boats, coming to close to shore have eroded the shore line out from behind the riprap. We have had installed, washing out the soil into the lake. In front of the rip rap is approx. 30ft of lily pads and the riprap and lily pads don't slow down the wakes which come over everything into the yard.... Why not start enforcing a no wake area out further away from the shoreline

**Survey 293)** Comment: Make sure property owners do not pollute. I have noticed the real increase in green algae growth in the past 4 years. Some people blame the year or lack of snow. I feel it is affecting the fish population. Walleyes have been planted the last few years, but it doesn't seem like they are multiplying. Where is our pollution occurring?????? Sewers, fertilizing, agriculture????? Identify and publish the source and stop it.

**Survey 295)** Comment: Keep Educating!!!

**Survey 300)** Comment: Low water issues!!! Too much water released into Balsam Branch. WE are losing lakeshore due to low water levels. NO!! Too paying more for suggested water culvert into the Millpond \$2500.00 for a structure that will last another 50 years to help a private business.

## Appendix B. Invasive Species Information

### Curly Leaf Pondweed

Curly leaf pondweed is specifically designated as an invasive aquatic plant (along with Eurasian water milfoil and purple loosestrife) to be the focus of a statewide program to control invasive species in Wisconsin. Invasive species are defined as a “non-indigenous species whose introduction causes or is likely to cause economic or environmental harm or harm to human health (23.22(c)).”

The Wisconsin Comprehensive Management Plan for Aquatic Invasive Species describes curly leaf pondweed impacts as follows:

It is widely distributed throughout Wisconsin lakes, but the actual number of waters infested is not known. Curly-leaf pondweed is native to northern Europe and Asia where it is especially well adapted to surviving in low temperature waters. It can actively grow under the ice while most plants are dormant, giving it a competitive advantage over native aquatic plant species. By June, curly-leaf pondweed can form dense surface mats that interfere with aquatic recreation. By mid-summer, when other aquatic plants are just reaching their peak growth for the year, it dies off. Curly-leaf pondweed provides habitat for fish and invertebrates in the winter and spring when most other plants are reduced to rhizomes and buds, but the mid-summer decay creates a sudden loss of habitat. The die-off of curly-leaf pondweed also releases a surge of nutrients into the water column that can trigger algal blooms and create turbid water conditions. In lakes where curly-leaf pondweed is the dominant plant, the summer die-off can lead to habitat disturbance and degraded water quality. In other waters where there is a diversity of aquatic plants, the breakdown of curly-leaf may not cause a problem.<sup>48</sup>

The state of Minnesota DNR web site explains that curly leaf pondweed often causes problems due to excessive growth. At the same time, the plant provides some cover for fish, and some waterfowl species feed on the seeds and winter buds.<sup>49</sup>

---

<sup>48</sup> *Wisconsin's Comprehensive Management Plan to Prevent Further Introductions and Control Existing Populations of Aquatic Invasive Species*. Prepared by Wisconsin DNR. September 2003.

<sup>49</sup> Information from Minnesota DNR ([www.dnr.state.mn.us/aquatic\\_plants](http://www.dnr.state.mn.us/aquatic_plants)).

The following description is taken from a Great Lakes Indian Fish and Wildlife Commission handout.

## Curly Leaf Pondweed (*Potamogeton crispus*)<sup>50</sup>

### Identification

Curly leaf pondweed is an invasive aquatic species found in a variety of aquatic habitats, including permanently flooded ditches and pools, rivers, ponds, inland lakes, and even the Great Lakes. Curly leaf pondweed prefers alkaline or high nutrient waters one to three meters deep.

Its leaves are strap-shaped with rounded tips and undulating and finely toothed edges. Leaves are not modified for floating, and are generally alternate on the stem.

Stems are somewhat flattened and grow to as long as two meters. The stems are dark reddish-green to reddish-brown, with the mid-vein typically tinged with red. Curly leaf pondweed is native to Eurasia, Africa, and Australia and is now spread throughout most of the United States and southern Canada.



### Characteristics

New plants typically establish in the fall from freed turions (branch tips). The winter form is short, with narrow, flat, relatively limp, bluish-green leaves. This winter form can grow beneath the ice and is highly shade-tolerant. Rapid growth begins with warming water temperatures in early spring – well ahead of native aquatic plants.

### Reproduction and Dispersal

Curly leaf pondweed reproduces primarily vegetatively. Numerous turions are produced in the spring. These turions consist of modified, hardened, thorny leaf bases interspersed with a few to several dormant buds. The turions are typically 1.0 to 1.7 cm long and 0.8 to 1.4 cm in diameter. Turions separate from the plant by midsummer, and may be carried in the water column supported by several leaves. Humans and waterfowl may also disperse turions. Stimulated by cooler water temperatures, turions germinate in the fall, over-wintering as a small plant. The next summer plants mature, producing reproductive tips of their own. Curly leaf pondweed rarely produces flowers.

### Ecological Impacts

Rapid early season growth may form large, dense patches at the surface. This canopy overtops most native aquatic plants, shading them and significantly slowing their growth. The canopy lowers water temperature and restricts absorption of atmospheric oxygen into the water. The dense canopy formed often interferes with recreational activities such as swimming and boating.

In late spring, curly leaf pondweed dies back, releasing nutrients that may lead to algae blooms. Resulting high oxygen demand caused by decaying vegetation can adversely affect fish

---

<sup>50</sup> Information from GLIFWC Plant Information Center (<http://www.glifwc.org/epicenter>).

populations. The foliage of curly leaf pondweed is relatively high in alkaloid compounds possibly making it unpalatable to insects and other herbivores.

### Control

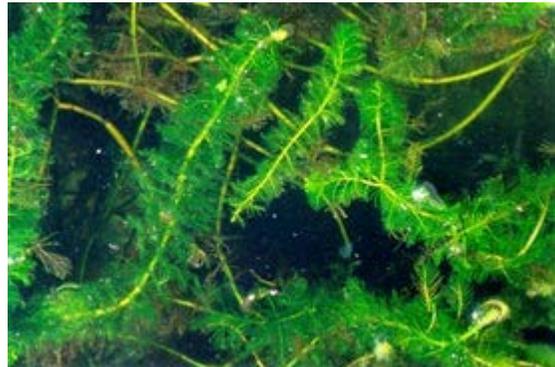
Small populations of curly leaf pondweed in otherwise un-infested water bodies should be attacked aggressively. Hand pulling, suction dredging, or spot treatments with contact herbicides are recommended. Cutting should be avoided because fragmentation of plants may encourage their re-establishment. In all cases, care should be taken to remove all roots and plant fragments, to keep them from re-establishing.

Control of large populations requires a long-term commitment that may not be successful. A prudent strategy includes a multi-year effort aimed at killing the plant before it produces turions, thereby depleting the seed bank over time. It is also important to maintain, and perhaps augment, native populations to retard the spread of curly leaf and other invasive plants. Invasive plants may aggressively infest disturbed areas of the lake, such as those where native plant nuisances have been controlled through chemical applications.

## Eurasian Water Milfoil (*Myriophyllum spicatum*)

### Introduction

Eurasian water milfoil is a submersed aquatic plant native to Europe, Asia, and northern Africa. It is the only non-native milfoil in Wisconsin. Like the native milfoils, the Eurasian variety has slender stems whorled by submersed feathery leaves and tiny flowers produced above the water surface. The flowers are located in the axils of the floral bracts, and are either four-petaled or without petals. The leaves are threadlike, typically uniform in diameter, and aggregated into a submersed terminal spike. The stem thickens below the inflorescence and doubles



its width further down, often curving to lie parallel with the water surface. The fruits are four-jointed nut-like bodies. Without flowers or fruits, Eurasian water milfoil is nearly impossible to distinguish from Northern water milfoil. Eurasian water milfoil has 9-21 pairs of leaflets per leaf, while Northern milfoil typically has 7-11 pairs of leaflets. Coontail is often mistaken for the milfoils, but does not have individual leaflets.

### Distribution and Habitat

Eurasian milfoil first arrived in Wisconsin in the 1960's. During the 1980's, it began to move from several counties in southern Wisconsin to lakes and waterways in the northern half of the state. As of 1993, Eurasian milfoil was common in 39 Wisconsin counties (54%) and at least 75 of its lakes, including shallow bays in Lakes Michigan and Superior and Mississippi River pools.

Eurasian water milfoil grows best in fertile, fine-textured, inorganic sediments. In less productive lakes, it is restricted to areas of nutrient-rich sediments. It has a history of becoming dominant in

eutrophic, nutrient-rich lakes, although this pattern is not universal. It is an opportunistic species that prefers highly disturbed lake beds, lakes receiving nitrogen and phosphorous-laden runoff, and heavily used lakes. Optimal growth occurs in alkaline systems with a high concentration of dissolved inorganic carbon. High water temperatures promote multiple periods of flowering and fragmentation.

### Life History and Effects of Invasion

Unlike many other plants, Eurasian water milfoil does not rely on seed for reproduction. Its seeds germinate poorly under natural conditions. It reproduces vegetatively by fragmentation, allowing it to disperse over long distances. The plant produces fragments after fruiting once or twice during the summer. These shoots may then be carried downstream by water currents or inadvertently picked up by boaters. Milfoil is readily dispersed by boats, motors, trailers, bilges, live wells, or bait buckets, and can stay alive for weeks if kept moist.

Once established in an aquatic community, milfoil reproduces from shoot fragments and stolons (runners that creep along the lake bed). As an opportunistic species, Eurasian water milfoil is adapted for rapid growth early in spring. Stolons, lower stems, and roots persist over winter and store the carbohydrates that help milfoil claim the water column early in spring, photosynthesize, divide, and form a dense leaf canopy that shades out native aquatic plants. Its ability to spread rapidly by fragmentation and effectively block out sunlight needed for native plant growth often results in monotypic stands. Monotypic stands of Eurasian milfoil provide only a single habitat, and threaten the integrity of aquatic communities in a number of ways; for example, dense stands disrupt predator-prey relationships by fencing out larger fish, and reducing the number of nutrient-rich native plants available for waterfowl.

Dense stands of Eurasian water milfoil also inhibit recreational uses like swimming, boating, and fishing. Some stands have been dense enough to obstruct industrial and power generation water intakes. The visual impact that greets the lake user on milfoil-dominated lakes is the flat yellow-green of matted vegetation, often prompting the perception that the lake is "infested" or "dead". Cycling of nutrients from sediments to the water column by Eurasian water milfoil may lead to deteriorating water quality and algae blooms of infested lakes.<sup>51</sup>

---

<sup>51</sup> Taken in its entirety from WDNR, 2008 (<http://www.dnr.state.wi.us/invasives/fact/milfoil.htm>)

## Reed Canary Grass (*Phalaris arundinacea*)

### Description

Reed canary grass is a large, coarse grass that reaches 2 to 9 feet in height. It has an erect, hairless stem with gradually tapering leaf blades 3 1/2 to 10 inches long and 1/4 to 3/4 inch in width. Blades are flat and have a rough texture on both surfaces. The leaf ligule is membranous and long. The compact panicles are erect or slightly spreading (depending on the plant's reproductive stage), and range from 3 to 16 inches long with branches 2 to 12 inches in length. Single flowers occur in dense clusters in May to mid-June. They are green to purple at first and change to beige over time. This grass is one of the first to sprout in spring, and forms a thick rhizome system that dominates the subsurface soil. Seeds are shiny brown in color.



Both Eurasian and native ecotypes of reed canary grass are thought to exist in the U.S. The Eurasian variety is considered more aggressive, but no reliable method exists to tell the ecotypes apart. It is believed that the vast majority of our reed canary grass is derived from the Eurasian ecotype. Agricultural cultivars of the grass are widely planted.

Reed canary grass also resembles non-native orchard grass (*Dactylis glomerata*), but can be distinguished by its wider blades, narrower, more pointed inflorescence, and the lack of hairs on glumes and lemmas (the spikelet scales). Additionally, bluejoint grass (*Calamagrostis canadensis*) may be mistaken for reed canary in areas where orchard grass is rare, especially in the spring. The highly transparent ligule on reed canary grass is helpful in distinguishing it from the others. Ensure positive identification before attempting control. The ligule is a transparent membrane found at the intersection of the leaf stem and leaf.

### Distribution and Habitat

Reed canary grass is a cool-season, sod-forming, perennial wetland grass native to temperate regions of Europe, Asia, and North America. The Eurasian ecotype has been selected for its vigor and has been planted throughout the U.S. since the 1800's for forage and erosion control. It has become naturalized in much of the northern half of the U.S., and is still being planted on steep slopes and banks of ponds and created wetlands.

Reed canary grass can grow on dry soils in upland habitats and in the partial shade of oak woodlands, but does best on fertile, moist organic soils in full sun. This species can invade most types of wetlands, including marshes, wet prairies, sedge meadows, fens, stream banks, and seasonally wet areas. It also grows in disturbed areas.

### Life History and Effects of Invasion

Reed canary grass reproduces by seed or creeping rhizomes. It spreads aggressively. The plant produces leaves and flower stalks for 5 to 7 weeks after germination in early spring, then spreads laterally. Growth peaks in mid-June and declines in mid-July. A second growth spurt occurs in

the fall. The shoots collapse in mid to late summer, forming a dense, impenetrable mat of stems and leaves. The seeds ripen in late June and shatter when ripe. Seeds may be dispersed from one wetland to another by waterways, animals, humans, or machines.

This species prefers disturbed areas, but can easily move into native wetlands. Reed canary grass can invade a disturbed wetland in less than twelve years. Invasion is associated with disturbances including ditching of wetlands, stream channelization, deforestation of swamp forests, sedimentation, and intentional planting. The difficulty of selective control makes reed canary grass invasion of particular concern. Over time, it forms large, monotypic stands that harbor few other plant species and are subsequently of little use to wildlife. Once established, reed canary grass dominates an area by building up a tremendous seed bank that can eventually erupt, germinate, and recolonize treated sites.<sup>52</sup>

## Purple Loosestrife (*Lythrum salicaria*)<sup>53</sup>

### Description

Purple loosestrife is a non-native plant common in Wisconsin. By law, purple loosestrife is a nuisance species in Wisconsin. It is illegal to sell, distribute, or cultivate the plants or seeds, including any of its cultivars.

Purple loosestrife is a perennial herb 3-7 feet tall with a dense bushy growth of 1-50 stems. The stems, which range from green to purple, die back each year. Showy flowers vary from purple to magenta, possess 5-6 petals aggregated into numerous long spikes, and bloom from July to September. Leaves are opposite, nearly linear, and attached to four-sided stems without stalks. It has a large, woody taproot with fibrous rhizomes (underground stems) that form a dense mat.



### Characteristics

Purple loosestrife is a wetland herb that was introduced as a garden perennial from Europe during the 1800's. It is still promoted by some horticulturists for its beauty as a landscape plant, and by beekeepers for its nectar-producing capability. Currently, about 24 states have laws prohibiting its importation or distribution because of its aggressively invasive characteristics. It has since extended its range to include most temperate parts of the United States and Canada. The plant's reproductive success across North America can be attributed to its wide tolerance of physical and chemical conditions characteristic of disturbed habitats, and its ability to reproduce prolifically by both seed dispersal and vegetative propagation. The absence of natural predators,

---

<sup>52</sup> Taken from WDNR, 2008. ([http://www.dnr.state.wi.us/invasives/fact/reed canary.htm](http://www.dnr.state.wi.us/invasives/fact/reed%20canary.htm)).

<sup>53</sup> Wisconsin DNR invasive species factsheets. (<http://dnr.wi.gov/invasives>).

like European species of herbivorous beetles that feed on the plant's roots and leaves, also contributes to its proliferation in North America.

Purple loosestrife was first detected in Wisconsin in the early 1930's, but remained uncommon until the 1970's. It is now widely dispersed in the state, and has been recorded in 70 of Wisconsin's 72 counties. This plant's optimal habitat includes marshes, stream margins, river flood plains, sedge meadows, and wet prairies. It is tolerant of moist soil and shallow water sites such as pastures and meadows, although established plants can tolerate drier conditions. Purple loosestrife has also been planted in lawns and gardens, which is often how it has been introduced to many of our wetlands, lakes, and rivers.

### Reproduction and Dispersal

Purple loosestrife spreads mainly by seed, but it can also spread vegetatively from root or stem segments. A single stalk can produce from 100,000 to 300,000 seeds per year. Seed survival is up to 60-70%, resulting in an extensive seed bank. Most of the seeds fall near the parent plant, but water, animals, boats, and humans can transport the seeds long distances. Vegetative spread through local disturbance is also characteristic of loosestrife; clipped, trampled, or buried stems of established plants may produce shoots and roots. It is often very difficult to locate non-flowering plants, so monitoring for new invasions should be done at the beginning of the flowering period in mid-summer.

Any sunny or partly shaded wetland is susceptible to purple loosestrife invasion. Vegetative disturbances such as water drawdown or exposed soil accelerate the process by providing ideal conditions for seed germination. When the right disturbance occurs, loosestrife can spread rapidly, eventually taking over the entire wetland.

### Ecological Impacts

Purple loosestrife displaces native wetland vegetation and degrades wildlife habitat. As native vegetation is displaced, rare plants are often the first species to disappear. Eventually, purple loosestrife can overrun wetlands thousands of acres in size, and almost entirely eliminate the open water habitat. The plant can also be detrimental to recreation by choking waterways.

### Mechanical Control

Purple loosestrife (PL) can be controlled by cutting, pulling, digging and drowning. Cutting is best done just before plants begin flowering. Cutting too early encourages more flower stems to grow than before. If done too late, seed may have already fallen. Since lower pods can drop seed while upper flowers are still blooming, check for seed. If none, simply bag all cuttings (to prevent them from rooting). If there is seed, cut off each top while carefully holding it upright, then bend it over into a bag to catch any dropping seeds. Dispose of plants/seeds in a capped landfill, or dry and burn them. Composting will not kill the seeds. Keep clothing and equipment seed-free to prevent its spread. Rinse all equipment used in infested areas before moving into uninfested areas, including boats, trailers, clothing, and footwear.

Pulling and digging can be effective, but can also create disturbed bare spots, which are good sites for PL seeds to germinate, or leave behind root fragments that grow into new plants. Use

these methods primarily with small plants in loose soils, since they do not usually leave behind large gaps nor root tips, while large plants with multiple stems and brittle roots often do. Dispose of plants as described above.

Mowing has not been effective with loosestrife unless the plants can be mowed to a height where the remaining stems will be covered with water for a full twelve months. Burning has also proven largely ineffective. Mowing and flooding are not encouraged because they can contribute to further dispersal of the species by disseminating seeds and stems.

Follow-up treatments are recommended for at least three years after removal.

### Chemical Control

This is usually the best way to eliminate PL quickly, especially with mature plants. The chemicals used have a short soil life. Timing is important. Treat in late July or August, but before flowering to prevent seed set. Always back away from sprayed areas as you go, to prevent getting herbicide on your clothes. The best method is to cut stems and paint the stump tops with herbicide. The herbicide can be applied with a small drip bottle or spray bottle, which can be adjusted to release only a small amount. Try to cover the entire cut portion of the stem, but not let the herbicide drip onto other plants since it is non-selective and can kill any plant it touches.

**Glyphosate herbicides:** Currently, glyphosate is the most commonly used chemical for killing loosestrife. Roundup and Glyphos are typically used, but if there is any open water in the area use Rodeo, a glyphosate formulated and listed for use over water. Glyphosate must be applied in late July or August to be most effective. Since you must treat at least some stems of each plant and they often grow together in a clump, all stems in the clump should be treated to be sure all plants are treated.

Another method is using very carefully targeted foliar applications of herbicide (NOT broadcast spraying). This may reduce costs for sites with very high densities of PL, since the work should be easier, and there will be few other plant species to hit accidentally. Use a glyphosate formulated for use over water. A weak solution of around 1% active ingredient can be used and it is generally necessary to wet only 25% of the foliage to kill the plant.

You must obtain a permit from WDNR before applying any herbicide over water. The process has been streamlined for control of purple loosestrife and there is no cost. Contact your regional Aquatic Plant Management Coordinator for permit information.

### Biological Control

Conventional control methods like hand pulling, cutting, flooding, herbicides, and plant competition have only been moderately effective in controlling purple loosestrife. Biocontrol is now considered the most viable option for more complete control for heavy infestations. The WDNR, in cooperation with the U.S. Fish and Wildlife Service, is introducing several natural insect enemies of purple loosestrife from Europe. A species of weevil (*Hylobius transversovittatus*) has been identified that lays eggs in the stem and upper root system of the plant; as larvae develop, they feed on root tissue. In addition, two species of leaf eating beetles

(*Galerucella californiensis* and *G. pusilla*) are being raised and released in the state, and another weevil that feeds on flowers (*Nanophyes marmoratus*) is being used to stress the plant in multiple ways. Research has shown that most of these insects are almost exclusively dependent upon purple loosestrife and do not threaten native plants, although one species showed some cross-over to native loosestrife. These insects will not eradicate loosestrife, but may significantly reduce the population so cohabitation with native species becomes a possibility.

## Giant knotweed (*Polygonum sachalinense*)

Giant knotweed is a perennial that can reach up to 20' tall with erect, hollow stems that resemble bamboo. Plants die back each year; the dried stalks remain standing into winter. Stems are smooth and arching with swollen nodes and twigs that zigzag from node to node.



### Ecological Threat

- Invades riparian areas where it prevents streamside tree regeneration
- Increases soils erosion along streambanks
- Often found in floodplain forests, disturbed areas, roadsides, and vacant lots
- Plants forms dense stands that crowd and shade out native vegetation
- Plants alter soil chemistry and may be allelopathic (exude chemical compounds toxic to native vegetation)
- Plant fragments as small as one inch have the potential to resprout
- Japanese and giant knotweed are known to hybridize

### **Giant Knotweed is a prohibited species in Wisconsin.**

#### Description

**Leaves:** Alternate, simple, dark green. Leaves are 6-14" long and have a heart-shaped base coming narrow to a point.

**Flowers:** Numerous small, greenish-white flowers appear in the leaf axils of the upper stems. Blooms are up to 4" long and occur during August-October. Giant knotweed blooms have both male and female parts in the same flower.

**Fruits & seeds:** Fruits are papery and broadly winged. Each fruit contains a 3-sided achene that is small, shiny and brown. Small amounts of seed are viable and have no dormancy requirement.

**Roots:** Rhizomes that extend deeply into the soil creating a dense impenetrable mat.

**Similar species:** Japanese knotweed (*P. cuspidatum*) and Bohemian (hybrid) knotweed (*P. cuspidatum* x *P. sachalinense*) look very similar but can be distinguished by the type of hair on the veins on the undersides. Each species are equally as invasive. Japanese knotweed leaves are abruptly squared at base and the flowers are dioecious. It has hollow stems with distinct raised nodes that give it the appearance of bamboo, though it is not related. Young plants are most commonly mistaken for rhubarb.

## Control

**Mechanical Control:** Hand pull, mow, or cut plants. Repeated cutting is needed to stimulate regrowth and exhaust root reserves. Digging up plants is difficult because roots can extend so deeply into the soil. Discard plant debris cautiously as this plant aggressively reproduces vegetatively.

**Chemical Control:** Treat plants in the summer when there is a large amount of leaf surface to absorb and translocate systemic herbicides. Plants are more susceptible to herbicides if they are cut when 4-5' tall and the regrowth treated is around 3' tall. Foliar spray with 0.15% a.i. aminopyralid, 0.3 % a.i. Imazapyr, or either 2% a.i. glyphosate or triclopyr. Cut-stump treatment with 25% a.i. glyphosate or triclopyr.

# Appendix C. Aquatic Plant Management Strategy WDNR

# **AQUATIC PLANT MANAGEMENT STRATEGY**

**Northern Region WDNR  
Summer, 2007**

# AQUATIC PLANT MANAGEMENT STRATEGY

## Northern Region WDNR

### ISSUES

- Protect desirable native aquatic plants.
- Reduce the risk that invasive species replace desirable native aquatic plants.
- Promote “whole lake” management plans
- Limit the number of permits to control native aquatic plants.

### BACKGROUND

As a general rule, the Northern Region has historically taken a protective approach to allow removal of native aquatic plants by harvesting or by chemical herbicide treatment. This approach has prevented lakes in the Northern Wisconsin from large-scale loss of native aquatic plants that represent naturally occurring high quality vegetation. Naturally occurring native plants provide a *diversity of habitat* that *helps maintain water quality*, helps *sustain the fishing* quality known for Northern Wisconsin, supports common lakeshore wildlife from loons to frogs, and helps to provide the *aesthetics* that collectively create the “up-north” appeal of the northwoods lake resources.

In Northern Wisconsin lakes, an inventory of aquatic plants may often find 30 different species or more, whereas a similar survey of a Southern Wisconsin lake may often discover less than half that many species. Historically, similar species diversity was present in Southern Wisconsin, but has been lost gradually over time from stresses brought on by cultural land use changes (such as increased development, and intensive agriculture). Another point to note is that while there may be a greater variety of aquatic vegetation in Northern Wisconsin lakes, the vegetation itself is often *less dense*. This is because northern lakes have not suffered as greatly from nutrients and runoff as have many waters in Southern Wisconsin.

The newest threat to native plants in Northern Wisconsin is from invasive species of aquatic plants. The most common include Eurasian Water Milfoil (EWM) and CurlyLeaf Pondweed (CLP). These species are described as *opportunistic invaders*. This means that these “invaders” benefit where an opening occurs from removal of plants, and without competition from other plants may successfully become established in a lake. Removal of native vegetation not only diminishes the natural qualities of a lake, it *may increase the risk that an invasive species can successfully invade onto the site where native plants have been removed*. There it may more easily establish itself without the native plants to compete against. This concept is easily observed on land where bared soil is quickly taken over by replacement species (often weeds) that crowd in and establish themselves as new occupants of the site. While not a providing a certain guarantee against invasive plants, protecting and allowing the native plants to remain may reduce the success of an invasive species becoming established on a lake. Once established, the invasive species cause far more inconvenience for all lake users, riparian and others included; can change many of the natural features of a lake; and often lead to *expensive annual control plans*. Native vegetation may cause localized concerns to some users, but as a natural feature of lakes, they generally do not cause harm.

To the extent we can maintain the normal growth of native vegetation, Northern Wisconsin lakes can continue to offer the water resource appeal and benefits they've historically provided. A regional position on removal of aquatic plants that carefully recognizes how native aquatic plants benefit lakes in Northern Region can help prevent a gradual decline in the overall quality and recreational benefits that make these lakes attractive to people and still provide abundant fish, wildlife, and northwoods appeal.

### **GOALS OF STRATEGY:**

1. Preserve native species diversity which, in turn, fosters natural habitat for fish and other aquatic species, from frogs to birds.
2. Prevent openings for invasive species to become established in the absence of the native species.
3. Concentrate on a "whole-lake approach" for control of aquatic plants, thereby fostering systematic documentation of conditions and specific targeting of invasive species as they exist.
4. Prohibit removal of wild rice. WDNR – Northern Region will not issue permits to remove wild rice unless a request is subjected to the full consultation process via the Voigt Tribal Task Force. We intend to discourage applications for removal of this ecologically and culturally important native plant.
5. To be consistent with our WDNR Water Division Goals (work reduction/disinvestment), established in 2005, to "not issue permits for chemical or large scale mechanical control of native aquatic plants – develop general permits as appropriate or inform applicants of exempted activities." This process is similar to work done in other WDNR Regions, although not formalized as such.

### **BASIS OF STRATEGY IN STATE STATUTE AND ADMINISTRATIVE CODE**

**State Statute 23.24 (2)(c)** states:

"The requirements promulgated under par. (a) 4. may specify any of the following:

1. The **quantity** of aquatic plants that may be managed under an aquatic plant management permit.
2. The **species** of aquatic plants that may be managed under an aquatic plant management permit.
3. The **areas** in which aquatic plants may be managed under an aquatic plant management permit.
4. The **methods** that may be used to manage aquatic plants under an aquatic plant management permit.
5. The **times** during which aquatic plants may be managed under an aquatic plant management permit.
6. The **allowable methods** for disposing or using aquatic

plants that are removed or controlled under an aquatic plant management permit.

7. The requirements for plans that the department may require under sub. (3) (b). “

**State Statute 23.24(3)(b)** states:

“The department may require that an application for an aquatic plant management permit contain a plan for the department’s approval as to how the aquatic plants will be introduced, removed, or controlled.”

**Wisconsin Administrative Code NR 109.04(3)(a)** states:

“The department may require that an application for an aquatic plant management permit contain an aquatic plant management plan that describes how the aquatic plants will be introduced, controlled, removed or disposed. Requirements for an aquatic plant management plan shall be made in writing stating the reason for the plan requirement. In deciding whether to require a plan, the department shall consider the potential for effects on protection and development of diverse and stable communities of native aquatic plants, for conflict with goals of other written ecological or lake management plans, for cumulative impacts and effect on the ecological values in the body of water, and the long-term sustainability of beneficial water use activities.”

# AQUATIC PLANT MANAGEMENT STRATEGY

## Northern Region WDNR

### APPROACH

1. After January 1, 2009\* no individual permits for control of native aquatic plants will be issued. Treatment of native species may be allowed under the auspices of an approved lake management plan, and only if the plan clearly documents “impairment of navigation” and/or “nuisance conditions”. Until January 1, 2009, individual permits will be issued to previous permit holders, only with adequate documentation of “impairment of navigation” and/or “nuisance conditions”. No new individual permits will be issued during the interim.
2. Control of aquatic plants (if allowed) in documented sensitive areas will follow the conditions specified in the report.
3. Invasive species must be controlled under an approved lake management plan, with two exceptions (these exceptions are designed to allow sufficient time for lake associations to form and subsequently submit an approved lake management plan):
  - a. Newly-discovered infestations. If found on a lake with an approved lake management plan, the invasive species can be controlled via an amendment to the approved plan. If found on a lake without an approved management plan, the invasive species can be controlled under the WDNR’s Rapid Response protocol (see definition), and the lake owners will be encouraged to form a lake association and subsequently submit a lake management plan for WNDNR review and approval.
  - b. Individuals holding past permits for control of *invasive* aquatic plants and/or “mixed stands” of native and invasive species will be allowed to treat via individual permit until January 1, 2009 if “impairment of navigation” and/or “nuisance conditions” is adequately documented, unless there is an approved lake management plan for the lake in question.
4. Control of invasive species or “mixed stands” of invasive and native plants will follow current best management practices approved by the Department and contain an explanation of the strategy to be used. Established stands of invasive plants will generally use a control strategy based on Spring treatment. (typically, a water temperature of less than 60 degrees Fahrenheit, or approximately May 31st, annually).
5. Manual removal (see attached definition) is allowed (Admin. Code NR 109.06).

---

\* *Exceptions to the Jan. 1, 2009 deadline will be considered only on a very limited basis and will be intended to address unique situations that do not fall within the intent of this approach.*

# AQUATIC PLANT MANAGEMENT STRATEGY

## Northern Region WDNR

### DOCUMENTATION OF IMPAIRED NAVIGATION AND/OR NUISANCE CONDITIONS

Navigation channels can be of two types:

- Common use navigation channel. This is a common navigation route for the general lake user. It often is off shore and connects areas that boaters commonly would navigate to or across, and should be of public benefit.
- Individual riparian access lane. This is an access lane to shore that normally is used by an individual riparian shore owner.

Severe impairment or nuisance will generally mean vegetation grows thickly and forms mats on the water surface. Before issuance of a permit to use a regulated control method, a riparian will be asked to document the problem and show what efforts or adaptations have been made to use the site. (This is currently required in NR 107 and on the application form, but the following helps provide a specific description of what impairments exist from native plants).

**Documentation of *impairment of navigation*** by native plants must include:

- a. Specific locations of navigation routes (preferably with GPS coordinates)
- b. Specific dimensions in length, width, and depth
- c. Specific times when plants cause the problem and how long the problem persists
- d. Adaptations or alternatives that have been considered by the lake shore user to avoid or lessen the problem
- e. The species of plant or plants creating the nuisance (documented with samples or a from a Site inspection)

**Documentation of the *nuisance*** must include:

- a. Specific periods of time when plants cause the problem, e.g. when does the problem start and when does it go away.
- b. Photos of the nuisance are encouraged to help show what uses are limited and to show the severity of the problem.
- c. Examples of specific activities that would normally be done where native plants occur naturally on a site but can not occur because native plants have become a nuisance.

# **AQUATIC PLANT MANAGEMENT STRATEGY**

## **Northern Region WDNR**

### **DEFINITIONS**

Manual removal:	Removal by hand or hand-held devices without the use or aid of external or auxiliary power. Manual removal cannot exceed 30 ft. in width and can only be done where the shore is being used for a dock or swim raft. The 30 ft. wide removal zone cannot be moved, relocated, or expanded with the intent to gradually increase the area of plants removed. Wild rice may not be removed under this waiver.
Native aquatic plants:	Aquatic plants that are indigenous to the waters of this state.
Invasive aquatic plants:	Non-indigenous species whose introduction causes or is likely to cause economic or environmental harm or harm to human health.
Sensitive area:	Defined under s. NR 107.05(3)(i) (sensitive areas are areas of aquatic vegetation identified by the department as offering critical or unique fish and wildlife habitat, including seasonal or lifestage requirements, or offering water quality or erosion control benefits to the body of water).
Rapid Response protocol:	This is an internal WDNR document designed to provide guidance for grants awarded under NR 198.30 (Early Detection and Rapid Response Projects). These projects are intended to control pioneer infestations of aquatic invasive species before they become established.

## Appendix D. References

Aquatic Ecosystem Restoration Foundation. *Aquatic Plant Management: Best Management Practices in Support of Fish and Wildlife Habitat*. 2005.  
[http://www.aquatics.org/aquatic\\_bmp.pdf](http://www.aquatics.org/aquatic_bmp.pdf)

Barr Engineering. *Balsam Lake Water Quality Study*. Prepared for Balsam Lake Protection and Rehabilitation District. June 2011.

Berg, M. (2015). *Warm Water Point Intercept Macrophyte Survey Balsam Lake Polk County, Wisconsin*.

Berg, Matthew S. *Warm Water Point/Intercept Macrophyte Survey Balsam Lake, Polk County, Wisconsin*. Endangered Resource Services, LLC. July 2009.

Berg, Matthew S. *Curly-leaf Pondweed P/I, Bed Mapping, and Pre/Post Herbicide Surveys Balsam Lake, Polk County, Wisconsin*. Endangered Resource Services, LLC. June 2009.

Borman, Susan, Robert Korth and Jo Tempte. *Through the Looking Glass*. University of Wisconsin-Extension. Stevens Point, Wisconsin. 1997.

Crow, Garrett E. and C. Barre Hellquist. *Aquatic and Wetland Plants of Northeastern North America*. The University of Wisconsin Press. Madison, Wisconsin. Volumes 1 and 2. 2000.

Harmony Environmental. *Aquatic Plant Management Plan. Big and Little Yellow Lake and the Yellow River, Burnett County, Wisconsin*. September 2009.

Harmony Environmental. *Balsam Lake, Polk County Aquatic Invasive Species Education, Prevention, and Planning grant application*. August 2009.

Nichols, Stanley A. *Distribution and Habitat Descriptions of Wisconsin Lake Plants*. Wisconsin Geological and Natural History Survey. Bulletin 96. Madison, Wisconsin. 1999.

Nichols, Stanley A. *Floristic Quality Assessment of Wisconsin Lake Plant Communities with Example Applications*. *Journal of Lake and Reservoir Management* 15 (2): 133-141. 1999.

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

University of Wisconsin-Extension. *Citizen Lake Monitoring Manual*. Revised 2006.

University of Wisconsin-Extension. *Aquatic Plant Management in Wisconsin*. April 2006 Draft.

University of Wisconsin – Madison. Wisconsin State Herbarium. *WISFLORA: Wisconsin Vascular Plant Species*. [www.botany.wisc.edu/wisflora/](http://www.botany.wisc.edu/wisflora/)

U.S. Army Corps of Engineers. *Aquatic Plant Information System (APIS)*. 2005.

Vilas County Land and Water Conservation Department. *Aquatic Invasive Species: A Guide for Proactive & Reactive Management*. 2006.

<http://wisconsinlakes.org/AboutLakes/PDFs/aisguidevc06.pdf>

Wisconsin Department of Natural Resources. *Balsam Lake Sensitive Area Survey Report and Management Guidelines*. 1999.

Wisconsin Department of Natural Resources. *Control of Eurasian Water Milfoil & Large-scale Aquatic Herbicide Use*. July 2006.

Wisconsin Department of Natural Resources. *Creel Survey Report. Balsam Lake, Polk County, 2008-2009*. Treaty Fisheries Publication 2009.

Wisconsin Department of Natural Resources. Eau Claire, WI. *Designation of Critical Habitat Areas. Bear Lake, Portage County*. March 2007.

Wisconsin Department of Natural Resources. *Fisheries in the Wisconsin Ceded Territory*. Last revised March 27, 2009.

Wisconsin Department of Natural Resources. *Natural Heritage Inventory County Data by Township: Polk County*. Last revised October 2009.

Wisconsin Department of Natural Resources. Northern Region. *Aquatic Plant Management Strategy*. Summer 2007.

Wisconsin Department of Natural Resources. *Reports and Data: Polk County*. December 2009. <http://www.dnr.state.wi.us/lakes/CLMN/reportsanddata/>.

Wisconsin Department of Natural Resources. *The State of the St. Croix River Basin*. 2002.

Wisconsin Department of Natural Resources. *Walleye Bag Limits Revised on 255 Northern Lakes*. May 19, 2009.

Wisconsin Department of Natural Resources. *WISCLAND Digital Land Cover*. 1998.

Wisconsin Department of Natural Resources. *Wisconsin Lakes*. PUB-FH-800. 2009.

Approved:	Appendix E. Balsam Lake Protection and Rehabilitation District Invasive Species Rapid Response	Revision A
-----------	---	------------



### Purpose

This procedure provides immediate actions to contain and eradicate an invasive biological species, plant or animal, in or at the water's edge upon discovery.

### Applicability

This procedure applies to all lakes and streams that drain into or out of Balsam Lake. This procedure also applies to the lake body and Balsam Lake's abutting land surfaces.

### Implementing Document

1. Wisconsin Statute 23.22 Invasive Species
2. Wisconsin Statute 23.235 Nuisance Weeds
3. Wisconsin Statute 23.24 Aquatic Plants

### Definitions

1. **Aquatic plant:** means a planktonic, submergent, emergent or floating-leaf plant or any part thereof.
2. **Control:** means to cut, remove, destroy, suppress or prevent the introduction or spread of.
3. **Invasive aquatic plant:** means an aquatic plant that is designated as an aquatic plant and is Eurasian water milfoil, curly leaf pondweed, purple loosestrife or other species as designated by the Wisconsin Department of Natural Resources (WDNR) if it has the ability to cause significant adverse change to aquatic habitat or to significantly displace desirable aquatic vegetation.
4. **Nuisance weeds:** means purple loosestrife or hybrids of thereof and multiflora rose when observed in uplands areas.

<b>Approved:</b>	<b>Appendix E. Balsam Lake Protection and Rehabilitation District Invasive Species Rapid Response</b>	<b>Revision A</b>
------------------	---	-------------------

## **Responsibilities**

### **BLPRD Chairman**

1. Succession of responsibility to implement this procedure if the Chairman is not available shall be:
  - a. Vice Chairman
  - b. Secretary
  - c. Treasurer
  - d. Elected BLPRD Commissioner
  - e. Appointed BLPRD Commissioner
  
2. It is the responsibility of the BLPRD Chairman to ensure that the actions in this plan are implemented in a timely and consistent manner.
  
3. The BLPRD Chairman shall appoint a Rapid Response Team Leader.

### **Rapid Response Team Leader**

1. It is the responsibility of the BLPRD Rapid Response Team Leader to implement the actions delineated in this plan.

### **Procedure Revisions**

1. This procedure may be revised:
  - a. A revision to the procedure shall begin as a proposal supported by a basis statement.
  - b. The proposed revision shall be consistent with Wisconsin state statutes or rules, or with United States federal employment laws or regulations.
  - c. The proposed revision shall be presented and discussed by the BLPRD board during a regular meeting.
  - d. The BLPRD board shall approve, amend and approve, or disapprove the revision.
  - e. Approved amendments shall be assigned an implementation date.
  - f. The BLPRD Secretary shall revise and distribute the maintenance plan prior to the implementation date.

<b>Approved:</b>	<b>Appendix E. Balsam Lake Protection and Rehabilitation District Invasive Species Rapid Response</b>	<b>Revision A</b>
------------------	---	-------------------

**Description**

**Overview**

**Preventative Maintenance Process**

Balsam Lake Protection and Rehabilitation District’s Clean Boats, Clean Waters program monitors the lake’s public boat landings from late May through September. This is the first line of defense to prevent aquatic invasive species (AIS) from entering or leaving the lake as hitch hikers on boats and boat trailers.

**Maintenance Management Process**

Balsam Lake has Curly Leaf Pondweed (CLP) which is managed through a herbicide program applied yearly in the spring of the year.

BLPRD Contracts with a biologist to monitor CLP beds, to identify and alert BLPRD of any new invasive species and provide an opinion on the lake’s aquatic plant health. This process is carried out during midsummer.

BLPRD provides information through the Dockside about certain invasive species such as Rusty Crayfish and relies on feedback from citizens for early identification. Citizens are also educated about invasive species through publications provided by Polk County Land and Water department, the WDNR and other public sources.

**Rapid Response Process**

The goal of the Rapid Response process is to eradicate an invasive species or nuisance plant before it gets established. Once an invasive species or nuisance plant is established BLPRD develops a management plan. Management plan development is outside the scope of this procedure.

1. In the event that an invasive aquatic plant or nuisance weed (NW) is reported, the BLPRD Aquatic Invasive Species (AIS) Lead shall be notified. The precise location of the sighting and any relevant details shall be documented. Use Global Position (GPS) points and/or floating marker, line and weight.
2. The AIS Lead shall notify the Polk County AIS Coordinator and the BLPRD Chairman (or in accordance with the succession outline in Responsibilities section of this procedure.)
3. The BLPRD Chairman shall appoint a Rapid Response Team Leader.
4. The Rapid Response Team Leader shall attempt to validate the sighting with the Polk County AIS Lead. If the AIS is a plant, then two entire rooted specimens of the suspected plants shall be collected and bagged. If the AIS is an animal, then collect, bag and freeze the specimen.

<b>Approved:</b>	<b>Appendix E. Balsam Lake Protection and Rehabilitation District Invasive Species Rapid Response</b>	<b>Revision A</b>
------------------	---	-------------------

Delivered to the Wisconsin Department of Natural Resources (WDNR), 810 West Maple Street, Spooner, WI 54801 for positive confirmation.

5. If the issue is an aquatic plant and it is determined to be an invasive species, take measures to avoid spreading or redistribution. Consider:
  - a. Posting a public notice at the boat landings. Identify the location.
  - b. Posting the affected waterway or location to restrict boating traffic.
  - c. Closing a boat landing if necessary.
  - d. Develop a method for eradication;
    - i. Contract a diver for small infestations that can be removed by hand.
    - ii. Contract an herbicide contractor for infestations that require broad application.
    - iii. Contract a consultant to discuss methodology and to monitor effectiveness.
    - iv. Enlist the help and cooperation of the WDNR.
  
6. If the issue is nuisance plant and it is determined to be an invasive species, take measures to avoid spreading or redistribution. Consider:
  - a. Posting a public notice at the boat landings. Identify the location.
  - b. Develop a method for eradication;
    - i. Contract for small infestations that can be removed by hand.
    - ii. Contract an herbicide contractor for infestations that require broad application.
    - iii. Contract a consultant to discuss methodology and to monitor effectiveness.
    - iv. Enlist the cooperation of the WDNR.
  
7. If the issue is an invasive animal, then coordinate an eradication plan with the WDNR.
  
8. BLPRD will fund as necessary reasonable expenses incurred during the implementation of this procedure.
  
9. The Rapid Response Lead will ensure that any rapid response grants available are applied for in a timely manner. Obtain internal or external support for this step as needed.

**References**

10. Rapid Response for Early Detection of Eurasian Water Milfoil procedure (Appendix E).

**Revision Log**

1. Revision X approved June 20, 2015.

# Appendix F. Management Options for Aquatic Plants

# Management Options for Aquatic Plants



Draft updated Oct 2006

Option	Permit Needed?	How it Works	PROS	CONS
<b>No Management</b>	N	Do not actively manage plants	<p>Minimizing disturbance can protect native species that provide habitat for aquatic fauna; protecting natives may limit spread of invasive species; aquatic plants reduce shoreline erosion and may improve water clarity</p> <p>No immediate financial cost</p> <p>No system disturbance</p> <p>No unintended effects of chemicals</p> <p>Permit not required</p>	<p>May allow small population of invasive plants to become larger, more difficult to control later</p> <p>Excessive plant growth can hamper navigation and recreational lake use</p> <p>May require modification of lake users' behavior and perception</p>
<b>Mechanical Control</b>	May be required under NR 109	Plants reduced by mechanical means	Flexible control	Must be repeated, often more than once per season
		Wide range of techniques, from manual to highly mechanized	Can balance habitat and recreational needs	Can suspend sediments and increase turbidity and nutrient release
a. Handpulling/Manual raking	Y/N	SCUBA divers or snorkelers remove plants by hand or plants are removed with a rake	Little to no damage done to lake or to native plant species	Very labor intensive
		Works best in soft sediments	Can be highly selective	Needs to be carefully monitored
			Can be done by shoreline property owners without permits within an area <30 ft wide OR where selectively removing exotics	Roots, runners, and even fragments of some species, particularly Eurasian watermilfoil (EWM) will start new plants, so all of plant must be removed
			Can be very effective at removing problem plants, particularly following early detection of an invasive exotic species	Small-scale control only

# Management Options for Aquatic Plants



Draft updated Oct 2006

Option	Permit Needed?	How it Works	PROS	CONS
b. Harvesting	Y	Plants are "mowed" at depths of 2-5 ft, collected with a conveyor and off-loaded onto shore  Harvest invasives only if invasive is already present throughout the lake	Immediate results  EWM removed before it has the opportunity to autofragment, which may create more fragments than created by harvesting  Minimal impact to lake ecology  Harvested lanes through dense weed beds can increase growth and survival of some fish  Can remove some nutrients from lake	Not selective in species removed  Fragments of vegetation can re-root  Can remove some small fish and reptiles from lake  Initial cost of harvester expensive
<b>Biological Control</b>	Y	Living organisms (e.g. insects or fungi) eat or infect plants	Self-sustaining; organism will over-winter, resume eating its host the next year  Lowers density of problem plant to allow growth of natives	Effectiveness will vary as control agent's population fluctuates  Provides moderate control - complete control unlikely  Control response may be slow  Must have enough control agent to be effective
a. Weevils on EWM	Y	Native weevil prefers EWM to other native water-milfoil	Native to Wisconsin: weevil cannot "escape" and become a problem  Selective control of target species  Longer-term control with limited management	Need to stock large numbers, even if some already present  Need good habitat for overwintering on shore (leaf litter) associated with undeveloped shorelines  Bluegill populations decrease densities through predation

# Management Options for Aquatic Plants



Draft updated Oct 2006

Option	Permit Needed?	How it Works	PROS	CONS
b. Pathogens	Y	Fungal/bacterial/viral pathogen introduced to target species to induce mortality	<p>May be species specific</p> <p>May provide long-term control</p> <p>Few dangers to humans or animals</p>	<p>Largely experimental; effectiveness and longevity unknown</p> <p>Possible side effects not understood</p>
c. Allelopathy	Y	Aquatic plants release chemical compounds that inhibit other plants from growing	<p>May provide long-term, maintenance-free control</p> <p>Spikerushes (<i>Eleocharis</i> spp.) appear to inhibit Eurasian watermilfoil growth</p>	<p>Initial transplanting slow and labor-intensive</p> <p>Spikerushes native to WI, and have not effectively limited EWM growth</p> <p>Wave action along shore makes it difficult to establish plants; plants will not grow in deep or turbid water</p>
d. Planting native plants	Y	Diverse native plant community established to repel invasive species	<p>Native plants provide food and habitat for aquatic fauna</p> <p>Diverse native community may be "resistant" to invasive species</p> <p>Supplements removal techniques</p>	<p>Initial transplanting slow and labor-intensive</p> <p>Nuisance invasive plants may outcompete plantings</p> <p>Largely experimental; few well-documented cases</p> <p>If transplants from external sources (another lake or nursery), may include additional invasive species or "hitchhikers"</p>

# Management Options for Aquatic Plants



Draft updated Oct 2006

Option	Permit Needed?	How it Works	PROS	CONS
<b>Physical Control</b>	Required under Ch. 30 / NR 107	Plants are reduced by altering variables that affect growth, such as water depth or light levels		
a. Fabrics/ Bottom Barriers	Y	Prevents light from getting to lake bottom	Reduces turbidity in soft-substrate areas  Useful for small areas	Eliminates all plants, including native plants important for a healthy lake ecosystem  May inhibit spawning by some fish  Need maintenance or will become covered in sediment and ineffective  Gas accumulation under blankets can cause them to dislodge from the bottom  Affects benthic invertebrates  Anaerobic environment forms that can release excessive nutrients from sediment
b. Drawdown	Y, May require Environmental Assessment	Lake water lowered with siphon or water level control device; plants killed when sediment dries, compacts or freezes  Season or duration of drawdown can change effects	Winter drawdown can be effective at restoration, provided drying and freezing occur. Sediment compaction is possible over winter  Summer drawdown can restore large portions of shoreline and shallow areas as well as provide sediment compaction  Emergent plant species often rebound near shore providing fish and wildlife habitat, sediment stabilization, and increased water quality  Success demonstrated for reducing EWM, variable success for curly-leaf pondweed (CLP)  Restores natural water fluctuation important for all aquatic ecosystems	Plants with large seed bank or propagules that survive drawdown may become more abundant upon refilling  May impact attached wetlands and shallow wells near shore  Species growing in deep water (e.g. EWM) that survive may increase, particularly if desirable native species are reduced  Can affect fish, particularly in shallow lakes if oxygen levels drop or if water levels are not restored before spring spawning  Winter drawdown must start in early fall or will kill hibernating reptiles and amphibians  Navigation and use of lake is limited during drawdown

# Management Options for Aquatic Plants



Draft updated Oct 2006

Option	Permit Needed?	How it Works	PROS	CONS
c. Dredging	Y	<p>Plants are removed along with sediment</p> <p>Most effective when soft sediments overlay harder substrate</p> <p>For extremely impacted systems</p> <p>Extensive planning required</p>	<p>Increases water depth</p> <p>Removes nutrient rich sediments</p> <p>Removes soft bottom sediments that may have high oxygen demand</p>	<p>Severe impact on lake ecosystem</p> <p>Increases turbidity and releases nutrients</p> <p>Exposed sediments may be recolonized by invasive species</p> <p>Sediment testing may be necessary</p> <p>Removes benthic organisms</p> <p>Dredged materials must be disposed of</p>
d. Dyes	Y	<p>Colors water, reducing light and reducing plant and algal growth</p>	<p>Impairs plant growth without increasing turbidity</p> <p>Usually non-toxic, degrades naturally over a few weeks</p>	<p>Appropriate for very small water bodies</p> <p>Should not be used in pond or lake with outflow</p> <p>Impairs aesthetics</p> <p>Effects to microscopic organisms unknown</p>
e. Non-point source nutrient control	N	<p>Runoff of nutrients from the watershed are reduced (e.g. by controlling construction erosion or reducing fertilizer use) thereby providing fewer nutrients available for plant growth</p>	<p>Attempts to correct source of problem, not treat symptoms</p> <p>Could improve water clarity and reduce occurrences of algal blooms</p> <p>Native plants may be able to better compete with invasive species in low-nutrient conditions</p>	<p>Results can take years to be evident due to internal recycling of already-present lake nutrients</p> <p>Requires landowner cooperation and regulation</p> <p>Improved water clarity may increase plant growth</p>

# Management Options for Aquatic Plants



Draft updated Oct 2006

Option	Permit Needed?	How it Works	PROS	CONS
<b>Chemical Control</b>	Y, Required under NR 107	<p>Granules or liquid chemicals kill plants or cease plant growth; some chemicals used primarily for algae</p> <p>Results usually within 10 days of treatment, but repeat treatments usually needed</p> <p>Chemicals must be used in accordance with label guidelines and restrictions</p>	<p>Some flexibility for different situations</p> <p>Some can be selective if applied correctly</p> <p>Can be used for restoration activities</p>	<p>Possible toxicity to aquatic animals or humans, especially applicators</p> <p>May kill desirable plant species, e.g. native water-milfoil or native pondweeds; maintaining healthy native plants important for lake ecology and minimizing spread of invasives</p> <p>Treatment set-back requirements from potable water sources and/or drinking water use restrictions after application, usually based on concentration</p> <p>May cause severe drop in dissolved oxygen causing fish kill, depends on plant biomass killed, temperatures and lake size and shape</p> <p>Often controversial</p>
a. 2,4-D	Y	<p>Systemic<sup>1</sup> herbicide selective to broadleaf<sup>2</sup> plants that inhibits cell division in new tissue</p> <p>Applied as liquid or granules during early growth phase</p>	<p>Moderately to highly effective, especially on EWM</p> <p>Monocots, such as pondweeds (e.g. CLP) and many other native species not affected</p> <p>Can be selective depending on concentration and seasonal timing</p> <p>Can be used in synergy with endothall for early season CLP and EWM treatments</p> <p>Widely used aquatic herbicide</p>	<p>May cause oxygen depletion after plants die and decompose</p> <p>May kill native dicots such as pond lilies and other submerged species (e.g. coontail)</p> <p>Cannot be used in combination with copper herbicides (used for algae)</p> <p>Toxic to fish</p>

# Management Options for Aquatic Plants



Draft updated Oct 2006

Option	Permit Needed?	How it Works	PROS	CONS
b. Endothall	Y	Broad-spectrum <sup>3</sup> , contact <sup>4</sup> herbicide that inhibits protein synthesis  Applied as liquid or granules	Especially effective on CLP and also effective on EWM  May be effective in reducing reestablishment of CLP if reapplied several years in a row in early spring  Can be selective depending on concentration and seasonal timing  Can be combined with 2,4-D for early season CLP and EWM treatments, or with copper compounds  Limited off-site drift	Kills many native pondweeds  Not as effective in dense plant beds; heavy vegetation requires multiple treatments  Not to be used in water supplies; post-treatment restriction on irrigation  Toxic to aquatic fauna (to varying degrees)
c. Diquat	Y	Broad-spectrum, contact herbicide that disrupts cellular functioning  Applied as liquid, can be combined with copper treatment	Mostly used for water-milfoil and duckweed  Rapid action  Limited direct toxicity on fish and other animals	May impact non-target plants, especially native pondweeds, coontail, elodea, naiads  Toxic to aquatic invertebrates  Must be reapplied several years in a row  Ineffective in muddy or cold water (<50°F)
d. Fluridone	Y; special permit and Environmental Assessment may be required	Broad-spectrum, systemic herbicide that inhibits photosynthesis  Must be applied during early growth stage  Available with a special permit only; chemical applications beyond 150 ft from shore not allowed under NR 107  Applied at very low concentration at whole lake scale	Effective on EWM for 1 to 4 years with aggressive follow-up treatments  Some reduction in non-target effects can be achieved by lowering dosage  Slow decomposition of plants may limit decreases in dissolved oxygen  Low toxicity to aquatic animals	Affects non-target plants, particularly native milfoils, coontails, elodea, and naiads, even at low concentrations  Requires long contact time at low doses: 60-90 days  Demonstrated herbicide resistance in hydrilla subjected to repeat treatments  In shallow eutrophic systems, may result in decreased water clarity  Unknown effect of repeat whole-lake treatments on lake ecology

# Management Options for Aquatic Plants



Draft updated Oct 2006

Option	Permit Needed?	How it Works	PROS	CONS
e. Glyphosate	Y	Broad-spectrum, systemic herbicide that disrupts enzyme formation and function  Usually used for purple loosestrife stems or cattails  Applied as liquid spray or painted on loosestrife stems	Effective on floating and emergent plants such as purple loosestrife  Selective if carefully applied to individual plants  Non-toxic to most aquatic animals at recommended dosages  Effective control for 1-5 years	RoundUp is often incorrectly substituted for Rodeo - Associated surfactants of RoundUp believed to be toxic to reptiles and amphibians  Cannot be used near potable water intakes  Ineffective in muddy water  No control of submerged plants
f. Triclopyr	Y	Systemic herbicide selective to broadleaf plants that disrupts enzyme function  Applied as liquid spray or liquid	Effective on many emergent and floating plants  More effective on dicots, such as purple loosestrife; may be more effective than glyphosate  Control of target plants occurs in 3-5 weeks  Low toxicity to aquatic animals  No recreational use restrictions following treatment	Impacts may occur to some native plants at higher doses (e.g. coontail)  May be toxic to sensitive invertebrates at higher concentrations  Retreatment opportunities may be limited due to maximum seasonal rate (2.5 ppm)  Sensitive to UV light; sunlight can break herbicide down prematurely  Relatively new management option for aquatic plants (since 2003)
g. Copper compounds	Y	Broad-spectrum, systemic herbicide that prevents photosynthesis  Used to control planktonic and filamentous algae  Wisconsin allows small-scale control only	Reduces algal growth and increases water clarity  No recreational or agricultural restrictions on water use following treatment  Herbicidal action on hydrilla, an invasive plant not yet present in Wisconsin	Elemental copper accumulates and persists in sediments  Short-term results  Long-term effects of repeat treatments to benthic organisms unknown  Toxic to invertebrates, trout and other fish, depending on the hardness of the water  Clear water may increase plant growth

<sup>1</sup>Systemic herbicide - Must be absorbed by the plant and moved to the site of action. Often slower-acting than contact herbicides.  
<sup>2</sup>Broadleaf herbicide - Affects only dicots, one of two groups of plants. Aquatic dicots include waterlilies, bladderworts, watermilfoils, and coontails.  
<sup>3</sup>Broad-spectrum herbicide - Affects both monocots and dicots.  
<sup>4</sup>Contact herbicide - Unable to move within the plant; kills only plant tissue it contacts directly.  
 Specific effects of herbicide treatments dependent on timing, dosage, duration of treatment, and location.  
 References to registered products are for your convenience and not intended as an endorsement or criticism of that product versus other similar products.  
**This document is intended to be a guide to available aquatic plant control techniques, and is not necessarily an exhaustive list.**  
**Please contact your local Aquatic Plant Management Specialist when considering a permit.**

# Appendix G. Harvesting Considerations

Key considerations for harvesting are

- access for a harvester (boat landings, depend on harvest location)
- distance of travel for harvesting and disposal
- availability of disposal/beneficial use sites for harvested plant materials
- timing of harvesting
- cost of harvester purchase
- operation and maintenance cost and logistics
- permitting and monitoring process

A harvester will travel about two miles per hour, so considerable time can be needed to simply get the harvester to the harvesting and disposal location.

## Access for a harvester

The four main landings will serve as access points for harvester entry and unloading collected material. Additional access sites will be identified for harvester use.

## Availability of disposal/beneficial use sites

Harvested aquatic plants can be land applied and/or composted as a soil amendment. It is possible to find sites where plant material is accepted at no charge, but there are generally costs for hauling. Farmers and nurseries will likely want harvested material. County and state “do not transport” regulations restrict moving aquatic plants on roadways, but transport is allowed for disposal as part of a harvest or control activity conducted under an aquatic plant management permit issued under ch. NR 109.

The Village of Balsam Lake is willing to take harvested material at their yard waste composting site and may do some of the hauling. A 2015 Annual Meeting Resolution included authorization of BLPRD purchase of a truck for hauling.

## Depth<sup>53</sup>

WDNR permit conditions generally allow cutting in water to a minimum depth of 3 feet. A harvesting depth to 30 inches might be considered in some circumstances. Harvester heads should be kept at least 2 feet off the bottom no matter the water depth to prevent disturbing sediment (dredging), damaging heads (stumps, logs,) and to maintain some vegetated habitat.

BLPRD owned equipment will be used to create a lake depth map of potential harvesting areas.

---

<sup>53</sup> Sundeen and Smith email communication September 2015.

Estimated capital costs of harvesting program<sup>54</sup>

Harvester with options:	\$154,120
Trailer:	\$17,500
Shore Conveyor:	\$32,000
Freight:	\$500
<b>SUBTOTAL</b>	<b>\$204,120</b>

Transport Barge:	\$129,450
Trailer:	\$17,500
Freight:	\$500
<b>SUBTOTAL</b>	<b>\$147,450</b>

**\$351,570**

Building:	\$5,880
-----------	---------

All expenses were authorized under a 2015 annual meeting resolution for aquatic harvester and related equipment purchase. A Waterways Commission grant will be sought to offset some of the capital costs. A 40% grant was anticipated in presenting the resolution.

Operation and maintenance

Contractors will be hired to operate and maintain harvesting equipment. Liability insurance would need to cover harvesting operations. Annual operation and maintenance cost are estimated to be \$6,000 to \$8,000 based on local contracted labor rates of \$12-\$13/hour and fuel and maintenance costs of \$10/hour of operation.

Timing of harvesting

Selecting the timing and depth of harvesting will be critical and will vary depending upon aquatic plant management objectives. Curly leaf pondweed harvesting must occur when plants have grown enough for harvester blades to reach (within about 5 feet of lake surface) and plants should be cut prior to turion formation.

Harvesting of CLP is planned for areas outside of East Balsam where an herbicide treatment program is contracted through 2019.

Permitting

The Department of Natural Resources regulates the removal of aquatic plants when chemicals are used, when plants are removed mechanically, and when plants are removed manually from an area greater than thirty feet in width along the shore. The requirements for manual and mechanical plant removal are described in *NR 109 – Aquatic Plants: Introduction, Manual Removal & Mechanical Control Regulations*.<sup>55</sup>

---

<sup>54</sup> 2015 Annual Meeting presentation

<sup>55</sup> More information regarding DNR permit requirements and aquatic plant management contacts is found on the DNR web site: [www.dnr.state.wi.us](http://www.dnr.state.wi.us).

A permit application will be submitted in January or February indicating all potential CLP and corridor harvesting areas (*See Figures 49-51*). The permit fee is currently capped at \$300 for the first year and \$150 for subsequent years.

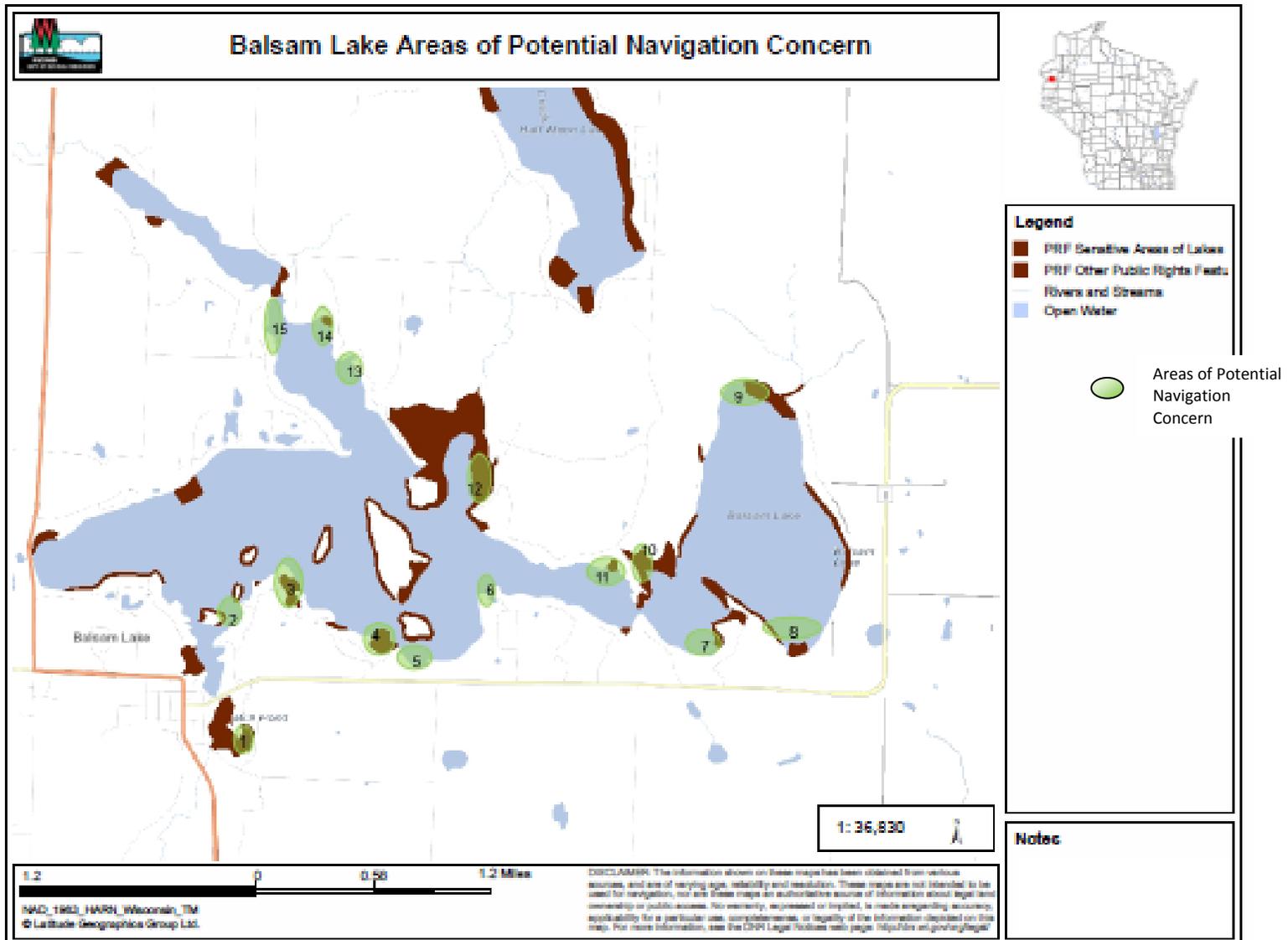
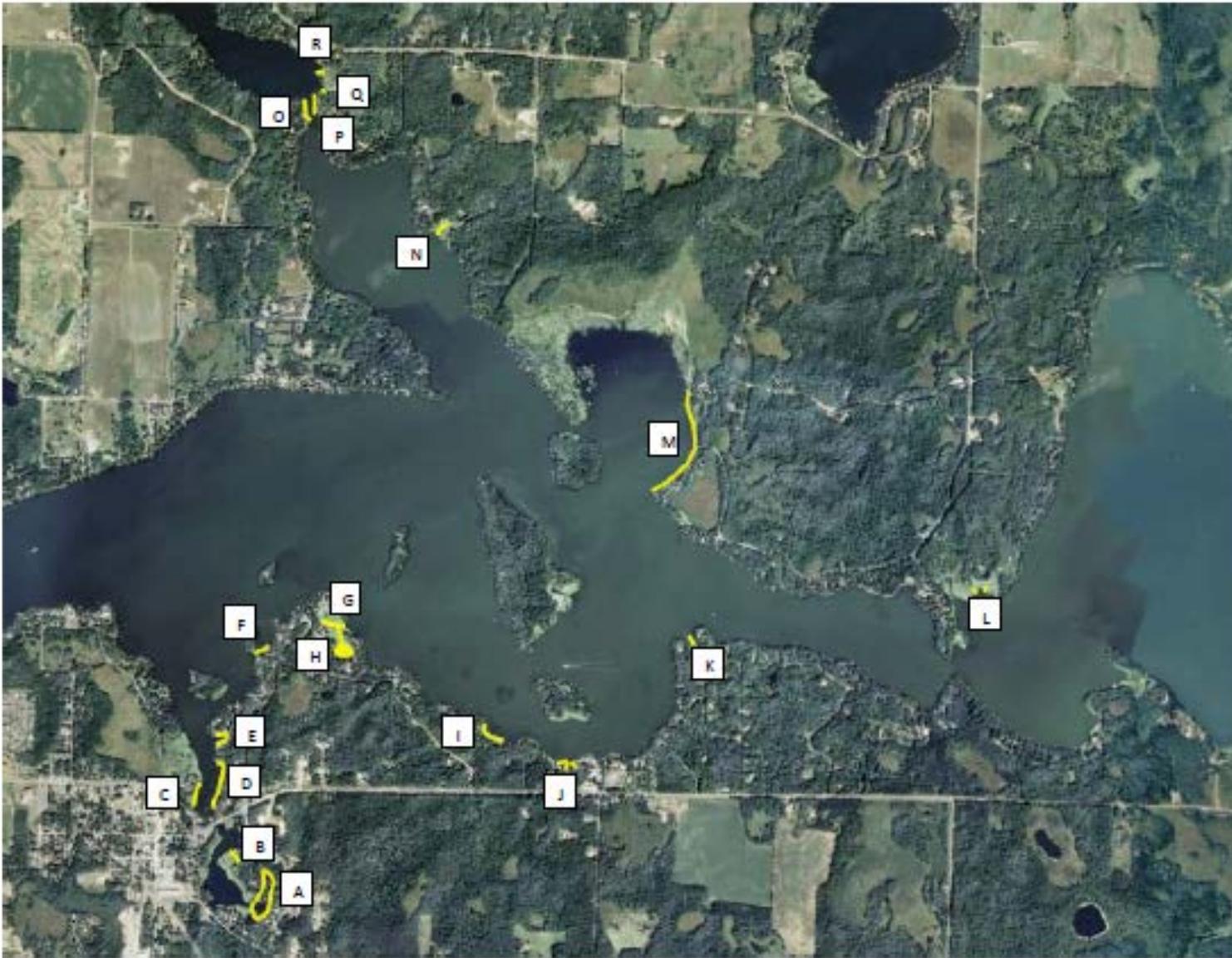


Figure 49. Areas of Potential Navigation Concern



*Figure 50. Potential Harvesting Lanes August 2015*

# Curly-leaf pondweed (*Potamogeton crispus*)

CLP Bed Mapping Survey  
Balsam Lake  
Polk Co., WI  
2009- 2015

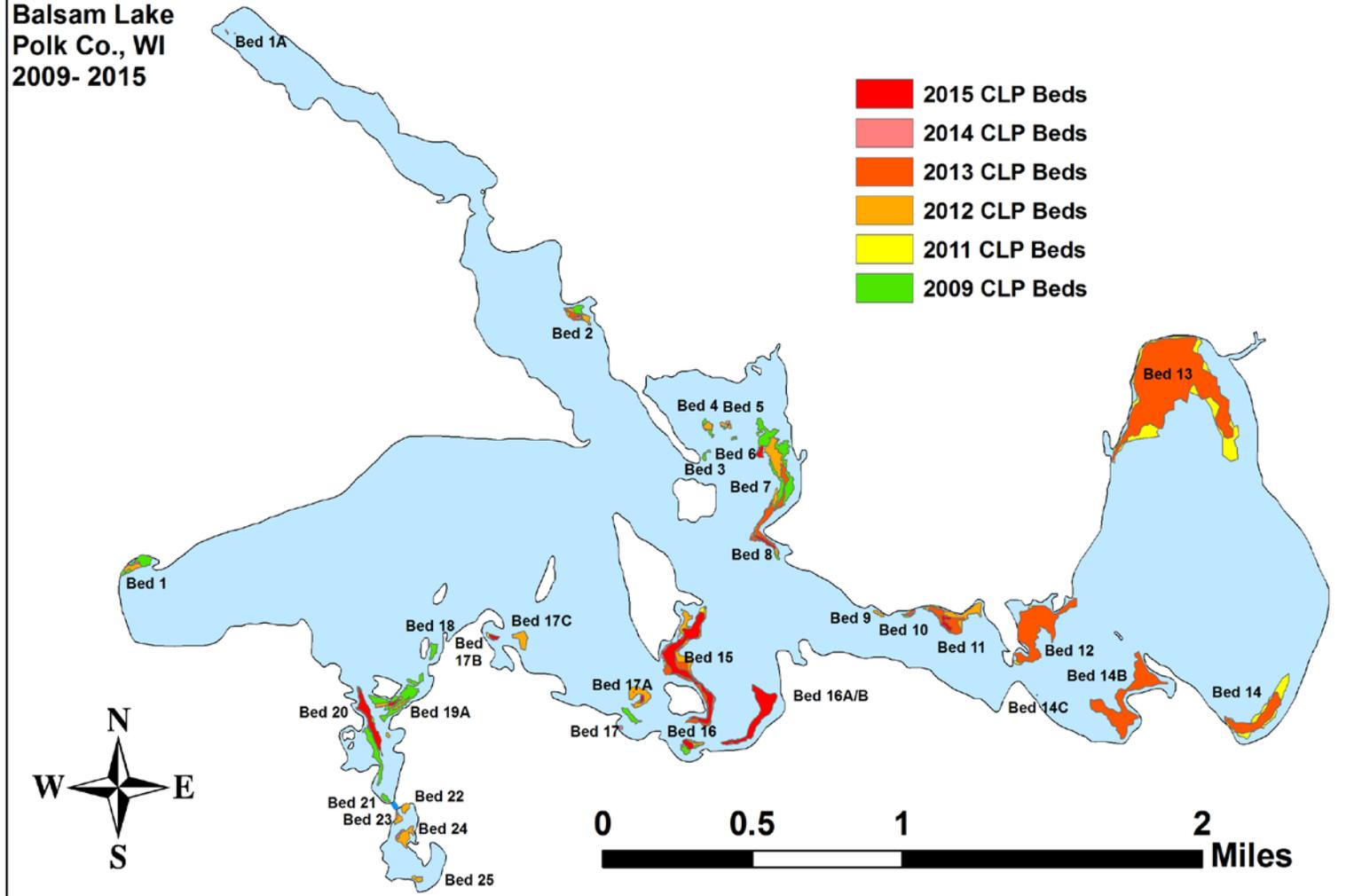


Figure 51. Potential CLP Harvesting Areas

## Appendix H. Implementation Plan for 2015-2017<sup>57</sup>

<b>Goal 1. Manage established invasive species and eradicate newly introduced invasive species to reduce their impacts to the lake.</b>					
<b>A. Substantially reduce CLP growth</b>					
<b>B. Protect and restore native plants</b>					
<b>C. Understand and prevent the release of phosphorus from CLP</b>					
<b>Actions<sup>58</sup></b>	<b>Timeline</b>	<b>Board/Committee Assignment</b>	<b>\$ Estimate</b>	<b>Funding Sources<sup>59</sup></b>	<b>Partners</b>
1. CLP Control Herbicide Treatment				Grant ACEI-170-15	
a. select beds for treatment	Dec (prev. year)	AIS Lead	\$0		
b. select APM contractors	Dec (prev. year)	AIS Lead Board	\$0		
c. apply for APM permits	January	AIS Lead	\$1,025		Herbicide Contractor
d. complete herbicide treatment	Late May	AIS Lead	\$40,000		Herbicide Contractor
2. Conduct pre and post treatment monitoring	April/May Mid June	APM Monitor	\$2,425	Grant AEPP-430-14 Grant ACEI-170-15	
3. Monitor herbicide concentrations	Late May	APM Lead	\$2,314	Grant ACEI-170-15	State Lab of Hygiene
4. Harvest and track harvesting of CLP beds	May/June	Harvester Operators	See Goal 3		

<sup>57</sup> Costs are annual costs estimated for initial implementation. These costs will be reviewed each year during the lake district budgeting process.

<sup>58</sup> See previous pages for action item detail.

<sup>59</sup> Grant ACEI-170-15 is a 50% grant funded through 12/31/17.

<b>Goal 1. Manage established invasive species and eradicate newly introduced invasive species to reduce their impacts to the lake.</b>					
<b>A. Substantially reduce CLP growth</b>					
<b>B. Protect and restore native plants</b>					
<b>C. Understand and prevent the release of phosphorus from CLP</b>					
<b>Actions<sup>58</sup></b>	<b>Timeline</b>	<b>Board/Committee Assignment</b>	<b>\$ Estimate</b>	<b>Funding Sources<sup>59</sup></b>	<b>Partners</b>
5. Monitor sediment turions	Oct/Nov	APM Monitor	\$1,750	Grant ACEI-170-15	

<b>Goal 1. Manage established invasive species and eradicate newly introduced invasive species to reduce their impacts to the lake.</b>					
<b>E. Locate and remove purple loosestrife and giant knotweed and Japanese knotweed</b>					
<b>Actions<sup>60</sup></b>	<b>Timeline</b>	<b>Board/Committee Assignment</b>	<b>\$ Estimate</b>	<b>Funding Sources<sup>61</sup></b>	<b>Partners</b>
7. Provide purple loosestrife ID and contact info to residents	July	AIS Lead	\$350	Grant ACEI-170-15	Polk County LWRD
8. Monitor for purple loosestrife and knotweed growth and mark locations	July	AIS Lead	?	Grant ACEI-170-15	APM Monitor Volunteer Monitors
9. Use best control methods for purple loosestrife and knotweed.	Summer	AIS Lead	\$0	Grant ACEI-170-15	Polk County LWRD
10. Map control areas for purple loosestrife and knotweed to target	Winter	AIS Lead	\$0		Polk County LWRD

<sup>60</sup> See previous pages for action item detail.

<sup>61</sup> Grant ACEI-170-15 is a 50% grant funded through 12/31/17.

monitoring and control in subsequent years.					
11 Implement the Rapid Response Strategy for AIS		Board	\$0		
SUBTOTAL GOAL 1			\$47,864		

<b>Goal 2. Prevent and detect the introduction of aquatic invasive species.</b>					
<b>Actions<sup>62</sup></b>	<b>Timeline</b>	<b>Board/Committee Assignment</b>	<b>\$ Estimate</b>	<b>Funding Sources</b>	<b>Partners</b>
1. CBCW Program	May – Sept.	AIS Lead	\$18,000	CBCW-148-15 <sup>63</sup>	Unity High School WDNR UWEX
2. Train volunteer monitors to ID AIS	May – June	AIS Lead	\$400		Polk LWRD
3. Monitor boat landings for AIS	Summer	AIS Lead	\$600	Grant ACEI-170-15	APM Monitor
4. Encourage sheriff enforcement of Do-Not-Transport ordinance	Summer	AIS Lead	\$0		Polk LWRD
SUBTOTAL GOAL 2			\$19,000		

<sup>62</sup> See previous pages for action item detail.

<sup>63</sup> Clean Boats, Clean Waters grants are renewable annually.

<b>Goal 3. Maintain navigation for fishing and boating, access to lake residences, and comfortable swimming at the village beach.</b>					
<b>Actions<sup>64</sup></b>	<b>Timeline</b>	<b>Board/Committee Assignment</b>	<b>\$ Estimate</b>	<b>Funding Sources</b>	<b>Partners</b>
1. Identify areas of navigation concern	Summer	APM Lead	\$0	BLPRD	WDNR
2a. Harvester, equipment, and building debt service	Ongoing	APM Lead	\$40,000	BLPRD Waterways Commissions	WDNR
2b. Apply for harvesting permit	February	APM Lead	\$300	BLPRD	WDNR
2c. Operate and maintain harvester	Summer 2016	APM Lead	\$6-8,000	BLPRD	WDNR
2d. Create lake depth map for harvesting areas	Spring 2016	APM Lead	?	BLPRD	
3. Evaluate navigation impairment for individual corridors	Summer	APM Lead	\$0	BLPRD	WDNR
<b>SUBTOTAL GOAL 3</b>			<b>\$46,300 - \$48,300</b>		

<sup>64</sup> See previous pages for action item detail.

<b>Goal 4. Engage lake residents and visitors in reaching aquatic plant management goals.</b>					
<b>Actions<sup>65</sup></b>	<b>Timeline</b>	<b>Board/Committee Assignment</b>	<b>\$ Estimate</b>	<b>Funding Sources</b>	<b>Partners</b>
1. Dockside newsletter	Three times each year	Board Chair	\$6,500	BLPRD	
2. Web site	Ongoing		\$1,000	BLPRD	
3. Annual meeting presentations	July		\$500	BLPRD	
4. Talk to your neighbor campaign	June/July		\$1,500	BLPRD	
5. Lake resident seminars			\$666	BLPRD	
<b>SUBTOTAL GOAL 4</b>			<b>\$10,166</b>		

<b>Goal 5. Preserve the diverse native aquatic plant community in Balsam Lake.</b>					
<b>Actions<sup>66</sup></b>	<b>Timeline</b>	<b>Board/Committee Assignment</b>	<b>\$ Estimate</b>	<b>Funding Sources</b>	<b>Partners</b>
Consider native plant restoration in East Balsam	2018?		\$10,000	WDNR ACEI or AEPP grant	WDNR
Conduct point intercept survey	2019		\$9,000	WDNR AEPP grant	
Update aquatic plant management plan	2019-20		\$8,000	WDNR AEPP grant	
<b>SUBTOTAL GOAL 5</b>			<b>\$27,000</b>		

<sup>65</sup> See previous pages for action item detail.

<sup>66</sup> See previous pages for action item detail.