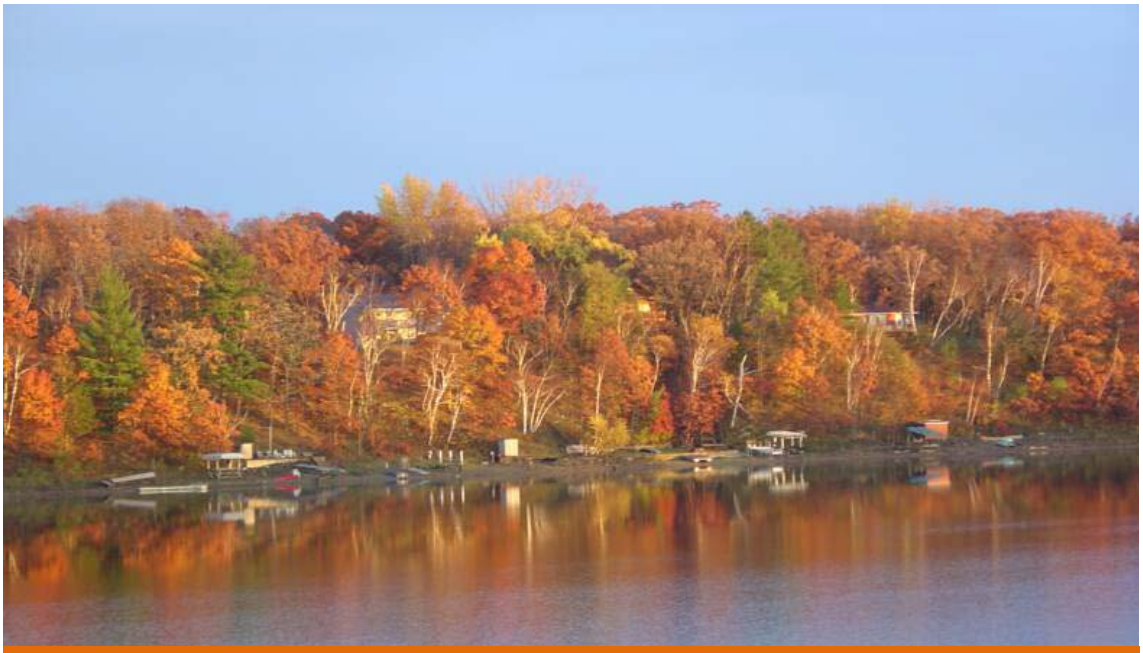

Bass Lake
Lake Management Plan

December 2016

Project Sponsors	St. Croix County, WI
	Bass Lake Rehabilitation District
	Town of St. Joseph
Grant Support	Wisconsin Department of Natural Resources
Plan Writing and Facilitation	Harmony Environmental
Social Science Assessment	University of Wisconsin Stevens Point
Lake Water Quality Modeling	University of Wisconsin Stevens Point

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Introduction

This comprehensive lake management plan establishes strategic direction for the management of Bass Lake. The St. Croix County Community Development Department initiated the project. Staff from the Wisconsin Department of Natural Resources (DNR) and St. Croix County provided guidance for plan development. The advisory committee used results of a water quality model, social science assessment, and additional background information to update goals, objectives, and actions from the 2009 Bass Lake Management Plan. A Lake Planning Grant from the DNR funded the lake management plan with grant match contributed by St. Croix County, the Bass Lake Rehabilitation District, the Town of St. Joseph, and the St. Croix County Sportsmen's Alliance.

Bass Lake is highly valued public water resource with exceptional water quality. It is a state Outstanding Resource Water enjoyed by lake residents and visitors to the lake. Of Wisconsin's 15,000 lakes and impoundments, 103 are designated as ORW—fewer than 1%. Waters currently designated as ORWs are listed in Wisconsin's Administrative Code in chapters NR 102.10 (ORWs).

Plan Scope

The plan presents information about Bass Lake water quality, fisheries, and aquatic plants. A social science assessment and a lake water quality model were completed as part of the planning process. The plan is written to meet WDNR requirements for lake management planning to establish eligibility for Wisconsin Lake Protection Grants (NR 191.45). The plan implementation period is from 2017 through 2026. Results of ongoing evaluation and monitoring and availability of new management information will likely lead to adaptations in plan actions during implementation.

Bass Lake Rehabilitation District (BLRD)

The Bass Lake Rehabilitation District was created in 1986 as a result of concerns related to rising water levels from 1962.[1] The lake district operates under Chapter 33 Wisconsin Statutes where general management powers and requirements are outlined.

Lake District General Management Powers (Chapter 33)

Lake districts can perform a wide variety of lake management activities such as:

- evaluate lake management issues
- carry out lake management activities such as lake aeration, dredging, and aquatic plant management
- develop long range lake management plans
- undertake projects to enhance recreation
- monitor water quality
- cooperate with non-profit organizations on projects
- operate water safety patrols
- form a sanitary sewer district

The lake district board which consists of 5 elected commissioners and 2 appointed members from the Town of St. Joseph and St. Croix County meets about every other month on Monday evenings. An annual meeting to approve budget and elect commissioners is held in early June each year. Meeting minutes are found on the district web site BLRD.org.

Highlights of district activities and initiatives include:

- Lake level stabilization pump (installed in 1996)
- Boating ordinances
- Aquatic plant management
- Shoreline restoration support
- Building plan review
- Water patrol
- Boat landing parking limitations

To implement the 2009 Bass Lake Management Plan the District completed the following:

- Contracted with a farmer to maintain a fence to keep cows away from the lake.
- Developed a detailed, updated lake contour map.
- Created a web site and mailed out information about shoreland restoration and controlling runoff.
- Installed fish sticks (93 oak trees) and fish cribs (60) in the lake.
- Operating a Clean Boats, Clean Water program

[1] History of the Bass Lake Rehabilitation District, not dated.

- Enforcing No-Wake Ordinance with Water Patrol Officer. Buoy placement. (Watershed status report)[2]

Bass Lake Rehabilitation District Vision Statement

The Bass Lake Rehabilitation District is a proactive entity to improve and protect the quality of Bass Lake and its watershed and assure its use for recreational purposes for this and future generations.

District focus:

- maintain designation as an Outstanding Resource Water
- monitor environmental conditions
- diagnose threats and deficiencies
- conduct programs to eliminate threats
- correct deficiencies and make desired lake quality improvements.

The BLRD engages residents to become stewards of this precious resource, and we work together with valued partner agencies and organizations to accomplish our goals.

Bass Lake Vision

Bass Lake owners and partners work together to ensure clean water, high quality habitat for fish and wildlife, and enhanced recreation.

- Bass Lake's clean, clear water maintains its designation as an Outstanding Resource Water.
- People enjoy varied recreational opportunities on the lake including time for quiet enjoyment.
- Natural vegetation along the shore provides water quality protection, natural scenic views, and habitat for fish and wildlife.
- Invasive species do not limit native habitats and recreation.
- There is a thriving sport fishery.

[2] Spaniol, Tom. *Progress Report for Bass Lake Management Plan 2009.* July 2015. 4 pages.

Lake Management Goals

The following goals will guide Bass Lake management actions:

GOAL I. Protect and enhance Bass Lake water quality to maintain its designation as an Outstanding Resource Water.

GOAL II. Protect and improve the diverse aquatic life of Bass Lake including a self- sustaining fishery and diverse aquatic plant community.

GOAL III. Protect and restore healthy shoreland habitats.

GOAL IV. Prevent the introduction of and control and contain existing (aquatic and shoreland) invasive species.

GOAL V. Ensure safe and multifaceted recreational opportunities.

Needs Assessment

Concerns of Lake and Watershed Residents and Lake Users

Concerns of lake and watershed residents and lake users were gathered in a variety of ways. These included a public meeting in the summer of 2015, a social science survey, six advisory committee meetings, and public draft plan review.

Social Science Assessment

The assessment began with a survey of lake and watershed residents. Survey questions were developed in part with input from a public meeting held in July 2015. An advance letter announcing the survey arrival was mailed in March 2016 and survey questionnaires were accepted through May 2016. The survey was distributed to 110 households, and a total of 66 surveys were returned (a response rate of 60 percent). A final report was provided in June 2016. This report is included as Appendix A.

Lake Management Plan Advisory Committee

The advisory committee met six times from March through November 2016 to consider how best to use what was learned from the social science assessment, learn more about lake issues, and update lake management goals, objectives, and actions. The advisory committee conclusions are reflected in the goals, objectives, and actions in this plan.

Public Review

The draft plan was available for public comment on the Bass Lake Management District(http://www.blrd.org/) and Town of St. Joseph (http://www.townofstjoseph.com/) websites beginning December 5, 2016 with comments accepted through December 16, 2016. The plan also was available for review at the St. Joseph Town Hall during regular business hours. A single clarifying comment was received, and the plan was updated accordingly.

Lake Overview

Bass Lake (WBIC: 2450500) is located in in the towns of St. Joseph (S23 and 26, R19W, T30N) and Somerset (S14, R19W, T30N) in St. Croix County, Wisconsin. The lake and its watershed are in the St. Croix River Basin. Bass Lake covers 381 acres with a maximum depth of 38 feet. Depths vary with water levels which can fluctuate greatly in this seepage lake (with no inlet or outlet). A map of the lake location is included as Figure 1, and a lake contour map is included as Figure 2.[3]

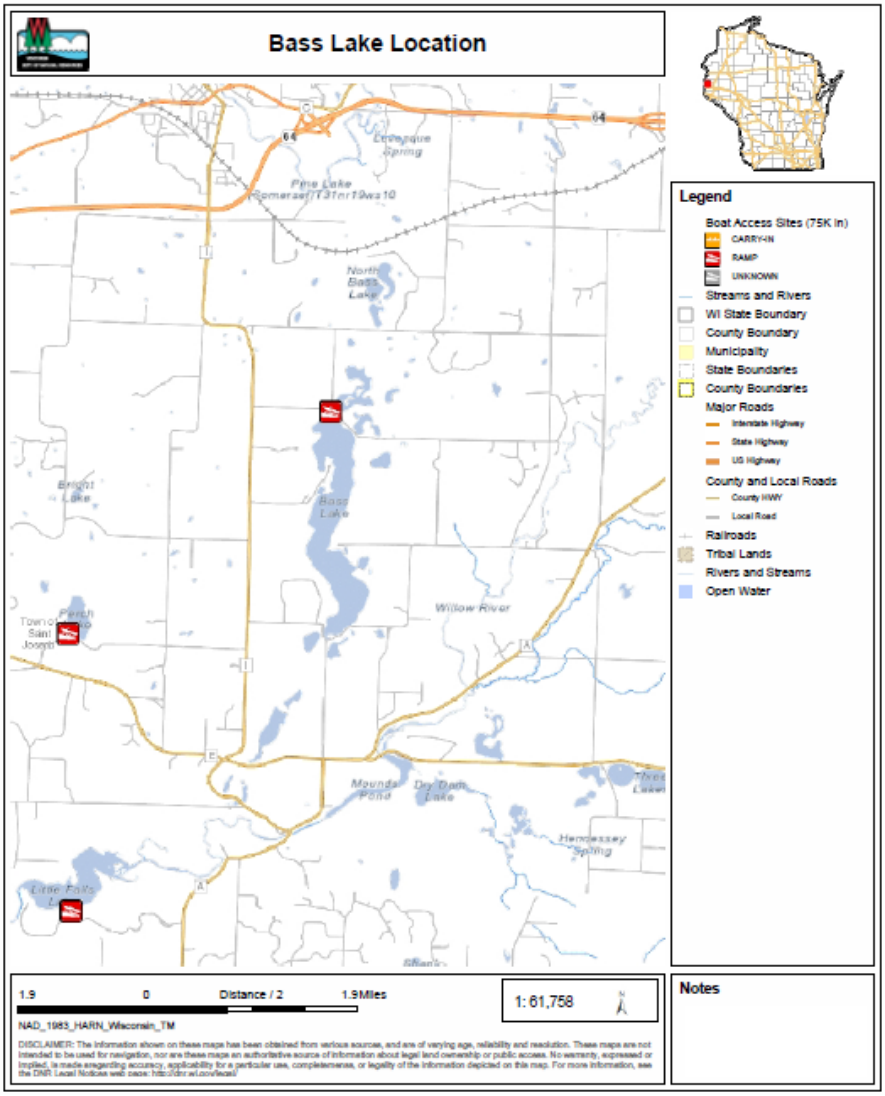

Figure 1. Bass Lake Location

[3] The map was created by Shawn Hartnett, UW Eau Claire. It is available on line on the Bass Lake Rehabilitation District website http://www.blrd.org/

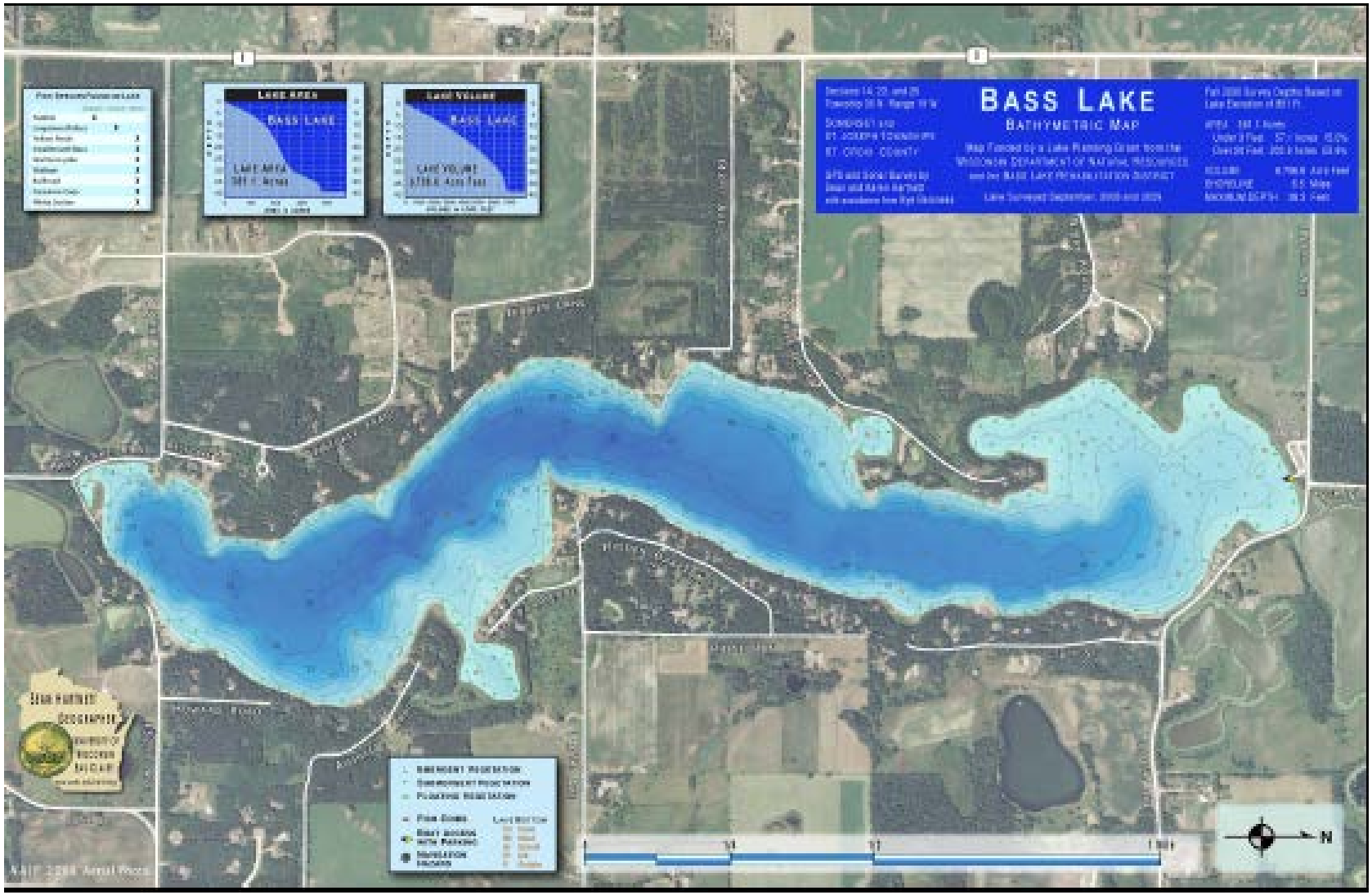

Figure 2. Bass Lake Contour Map

Lake Level

Lake level was historically a concern on Bass Lake, and it remains so today. Bass Lake water levels have fluctuated more than 10 feet. In the late 1970's and mid 1980's, homes and roads were flooded. In 1995, lake elevation exceeded all previous recorded levels. Adverse impacts included damaged and unusable roads, impaired use of the boat landing, property loss and damage, and shoreline erosion.

A graph of lake level from 1953 to 2016 is shown in Figure 3. A 1979 study concluded that water level in Bass Lake varied with the amount of precipitation the lake received and that Mounds Pond (at the south end of the lake) did not affect lake level. Bass Lake was influenced by both a regional flow-through groundwater system in the northern part of the lake and a local recharge system in the southern part of the lake.[4]

The lake district was originally formed in 1986 to allow residents to respond to concerns regarding increasing lake level. A pump to maintain lake level was installed in 1996 at a cost of about $600,000. The lake district operated the pump from October 21, 1997 continuously until about May 1998 when the lake level reached 886 feet. This was the level established by the WDNR permit. Pumping then occurred sporadically through the fall of 1998.[5]

The pump has a capacity of about 1,000,000 gallons per day which was also the maximum rate established by WDNR. Actual pumping rates averaged 800,000 gallons per day to take advantage of off-peak electrical rates. Engineers hired by the lake district estimated this rate would reduce lake levels by about ¼ inch per week.[6]

The pump discharges to the Willow River which is now listed an impaired water for total phosphorus.[7] While water is not near the 886 foot pumping threshold in 2016, water levels have increased in recent years. It is not known if the Willow River impairment along with the presence of invasive species zebra mussels and Eurasian water milfoil will influence the ability of the lake district to obtain a WDNR permit to pump when needed.

Shoreline erosion was estimated to be a very high contributor to the lake phosphorus budget (34%) during the inventory for the priority watershed plan in 1996. Phosphorus inputs from shoreline erosion were predicted to decline with declining water levels.[8] In response to high water and eroding shorelines, coconut fiber rolls were installed on several properties in 1996. St. Croix County administered these projects with funding from the State of Wisconsin.[9]

In the spring of 1995, the BLRD enacted an emergency slow, no-wake ordinance for the entire lake (Voss. 1997). It was made permanent (unless rescinded in 1997). In 1999 the Towns of St. Joseph and Somerset amended their boating ordinances to create slow no-wake restrictions

[4] Rinaldo-Lee, et al. 1979.
[5] Lawton, William. Email communication from lake district records. 10/14/16.
[6] Lawson, William. Email communication. 10/14/16.
[7] http://dnr.wi.gov/topic/impairedwaters/2012IR_IWLIST.html
[8] WDNR 1997.
[9] BLRD Board Meeting Minutes 05/15/96.

throughout the lake during periods of high water (when lake level exceeds 886.1 feet above sea level).

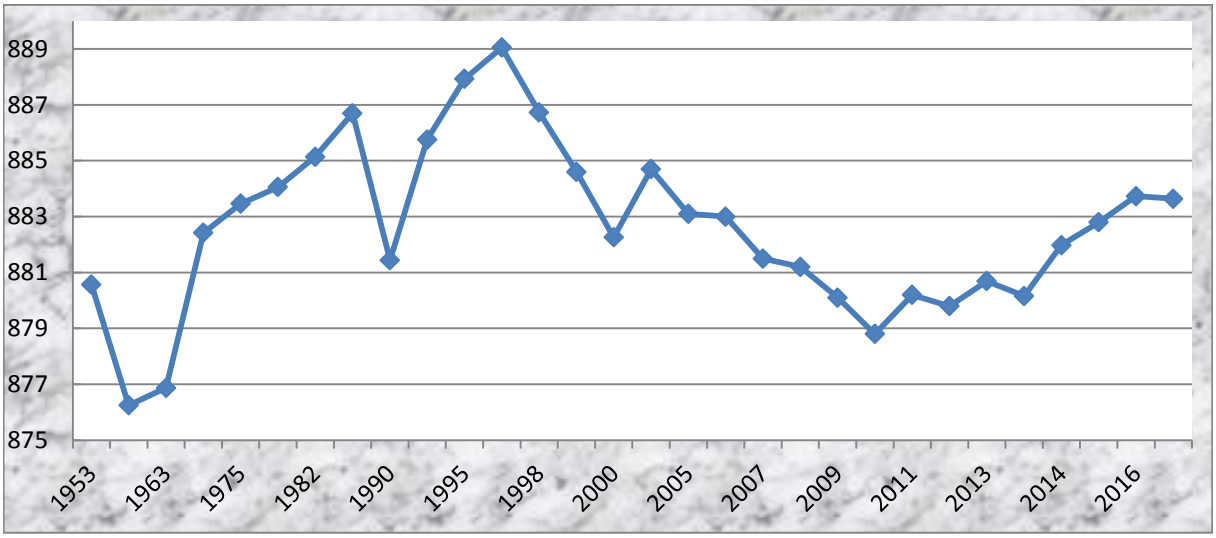

Figure 3. Bass Lake Historical Water Levels

Lake Use

There are about 106 shoreline residences around the lake. Anglers use the lake in both winter and summer, and it is a very popular site for recreational boating of all types. Its location approximately 50 miles east of Minneapolis-St. Paul, MN makes it a popular destination.

Boat Landing

The Wisconsin Department of Natural Resources owns the boat landing at the north end of the lake (Figure 1). It is leased (no fee) to St. Croix County for the purposes of development and/or maintenance including constructing, operating, maintaining, repairing, removing, and replacing a public access. The lease is a 20 year agreement signed November 18, 1998.

History

The WDNR purchased the land for the boat landing in 1980. The WDNR constructed a gravel parking lot in 1981 in cooperation with the St. Croix County Alliance of Sportsmen's Clubs in 1981. Launching occurred at the intersection of 153rd Ave and 75th Street.

The boat landing was re-designed in 1996 because of high water after initial plans for improvements in the early 1990s. Construction was completed in 1997-1998.

Goals of the Bass Lake Boat Landing upgrade:

- Upgrade gravel parking area and sand ramp to a hard surface.
- Remove ramp from town road to the east to improve safety.
- Allow safe, efficient launching without damage to personal property.
- Address handicapped accessibility.
- Protect water quality in lake by infiltration of the 1st one inch of rainfall on parking facilities.

Construction included:

- Paved parking for 16 car trailer units
- Two concrete ramps
- Curb and gutter, two retention basins, and grass swale along town road
- Access docks
- Signage

Water Quality Information

Historical Information

Lake sediment cores provide historical information about land use and impacts to the lake from these uses over many decades. Results of a sediment core taken from Bass Lake were reported in 2012. Analysis of the core suggests that phosphorus concentrations at the present time are similar to historical levels, and perhaps just slightly higher. Phosphorus is the limiting nutrient that governs algae growth in most Wisconsin lakes.

Summaries of past water quality studies are included in Appendix B.

Lake Monitoring Results

The WDNR monitored water quality annually in Bass Lake since 1986 as part of the WDNR Long Term Trends Monitoring Program. Volunteers have also monitored water quality off and on through the WDNR Citizen Lake Monitoring Program. Since this monitoring began, water quality in Bass Lake has declined slightly. The trend is most obvious in concentrations of phosphorus measured over the years. Figures below illustrate each parameter monitored in Bass Lake.

Trophic State

Trophic state describes the productivity of a lake. The least productive or nutrient-rich lakes are oligotrophic lakes. The most productive lakes are referred to as eutrophic. Those in the middle are called mesotrophic. More productive lakes have more nutrients available for algae growth. If a watershed with little runoff and phosphorus sources surrounds a lake, the water will tend to have low phosphorus levels. This will result in limited plant and algae growth and an oligotrophic lake classification. Trophic state results are available for Bass Lake based on secchi depth, phosphorus, and/or chlorophyll from 1986 through 2015 (although results are not recorded each year) as shown in Figure 4. Bass Lake trophic state hovers at the threshold between oligotrophic and mesotrophic.

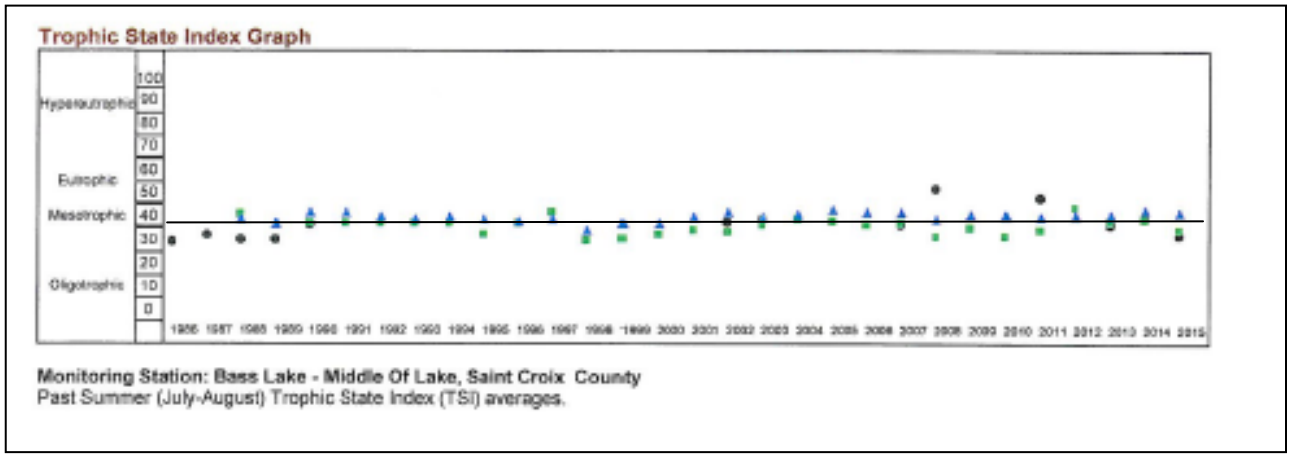

Figure 4. Bass Lake Trophic Status 1986-2015

Secchi Depth

Secchi depth is a measure of water clarity. 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. Bass Lake secchi depth fluctuates, but is generally in the mesotrophic range. Lowest clarity appears to have occurred when lake levels were relatively low (see Figures 3 and 5).

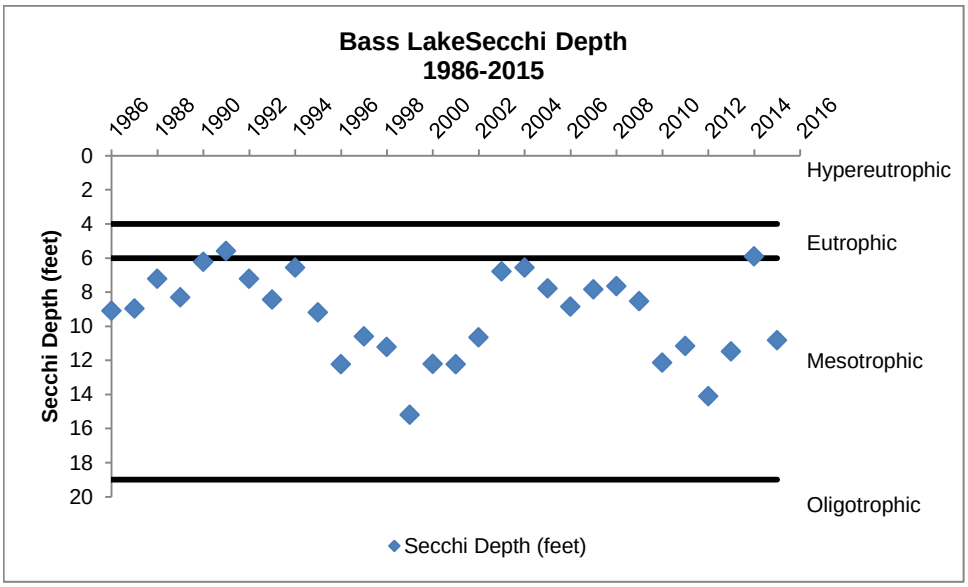

Figure 5. Bass Lake Secchi Depth 1986-2015

Chlorophyll A

Chlorophyll A is a measure of algae abundance in the water. Low levels of chlorophyll A indicate low algae levels.

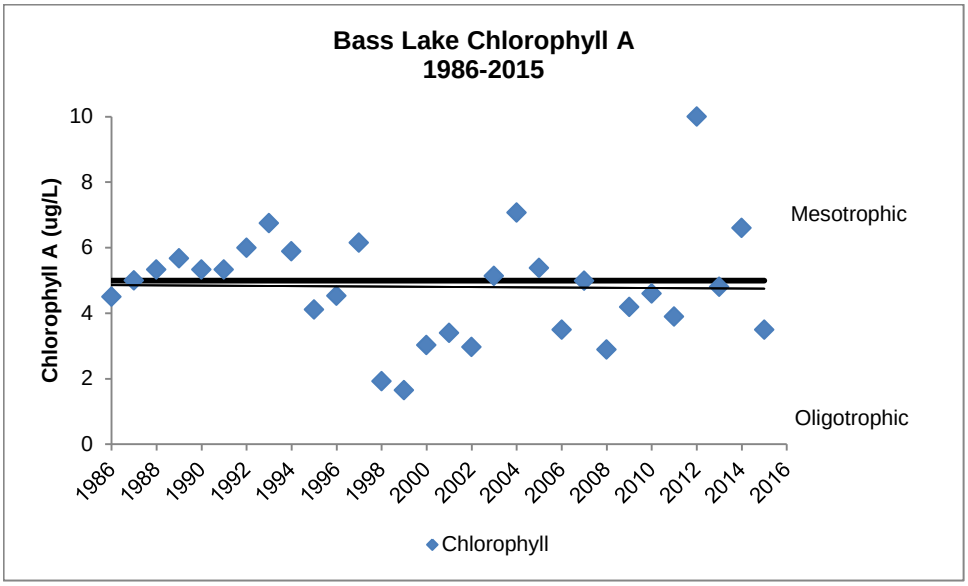

Figure 6. Bass Lake Chlorophyll A 1986-2015

Phosphorus

Phosphorus is the nutrient plants need to grow. It is the limiting ingredient for algae blooms in most Wisconsin lakes. High total phosphorus leads to low water clarity and greater algae blooms. The rising line in Figure 7 below represents increases in phosphorus over the past 30 years.

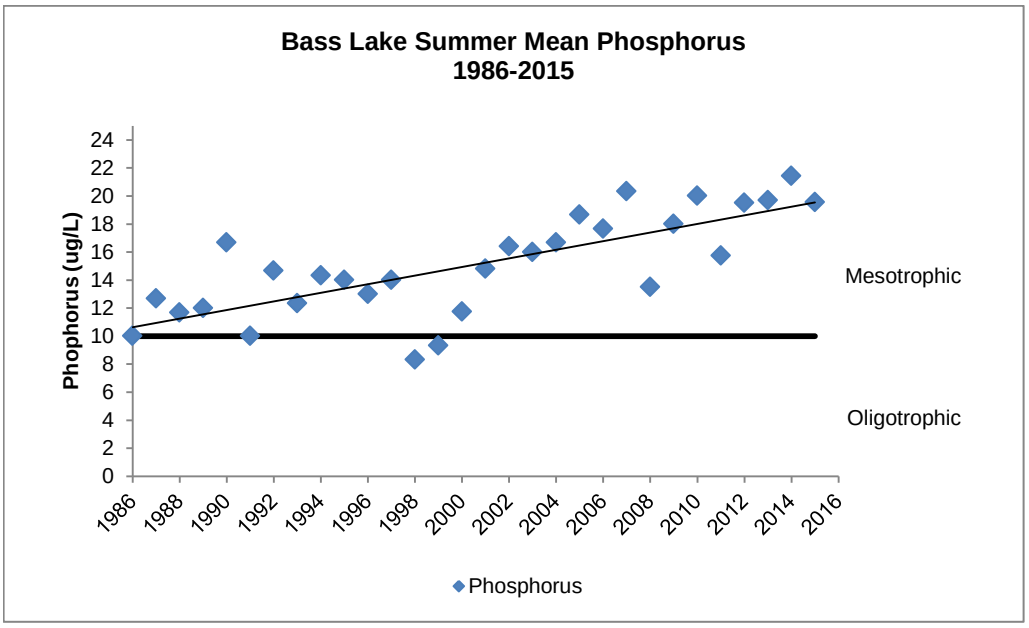

Figure 7. Bass Lake Total In-Lake Phosphorus 1986-2015

Lake Stratification

Each year as the waters of Bass Lake warm in late spring and early summer the lake stratifies, or layers, into 3 distinct layers by water density. The colder bottom layer (hypolimnion) of the lake is separated by a mid-layer (thermocline) from the warmer surface layer (epilimnion). These layers remain stratified into three distinct layers until late fall when the lake mixes top to bottom and again with spring turnover. During these mixing periods, oxygen is returned to the lowest layer of the lake.

The temperature profile indicates the lake is stratified in the deep hole. Due to stratification, oxygen levels decline and phosphorus released from the sediments is generally contained in the lower lake layer (the hypolimnion) until fall turnover. By mid-July there is no oxygen on average below a depth of 21 feet (about 7 meters) in Bass Lake (see Figure 8). With low oxygen levels, lake sediments tend to release phosphorus, a phenomenon known as internal loading. The loss of oxygen is caused by bacteria decomposing algae. This rapid loss of oxygen from the bottom layer is an indication of declining water quality.

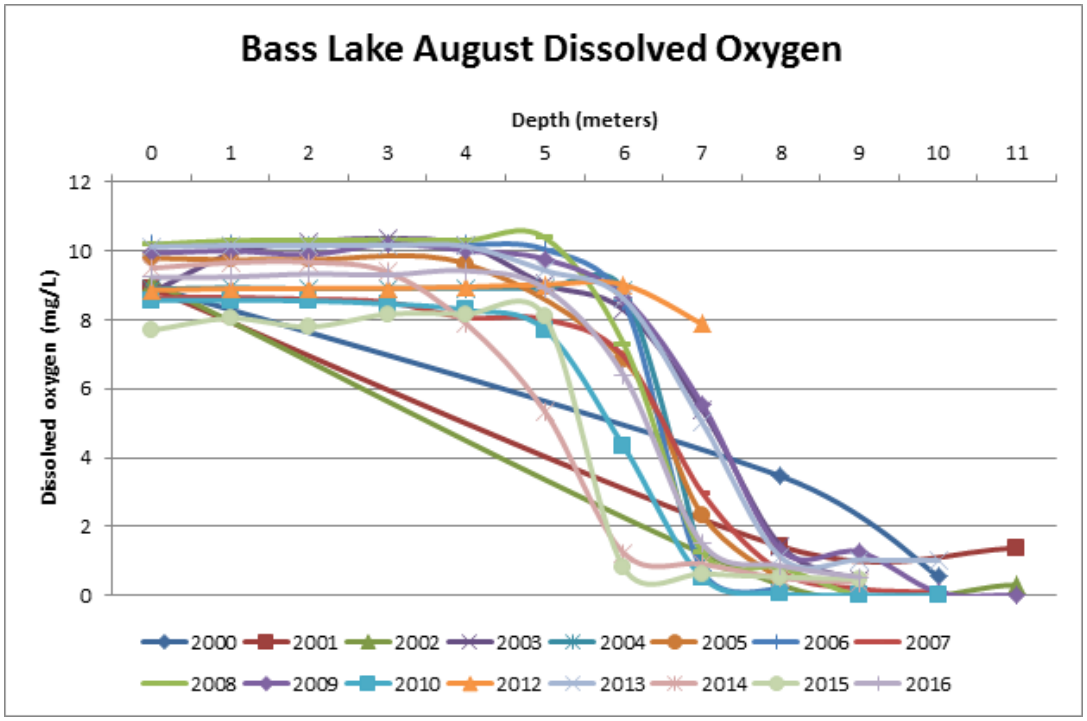

Figure 8. Bass Lake August Dissolved Oxygen

For those unfamiliar with lake management related to water quality, Appendix C. *Understanding Lake Information* is recommended reading.

Watershed

Paul McGinley from the University of Wisconsin – Stevens Point Center for Watershed Science and Education modeled phosphorus in Bass Lake as part of this lake management plan. In order to better understand existing lake nutrient levels and potential influences on future water quality, McGinley and others developed water and phosphorus budgets and modeled lake conditions.

The Bass Lake watershed - the surface area that drains to the lake - is 341 acres not including the lake. It is illustrated in Figure 9. Land cover in the watershed is described in Table 3. Land cover determines how much runoff flows to the lake and the levels of nutrients that are carried. Coefficients were assigned to various land cover types to estimate phosphorus loading rates from the watershed. Phosphorus loading estimates from the Bass Lake watershed are relatively low.

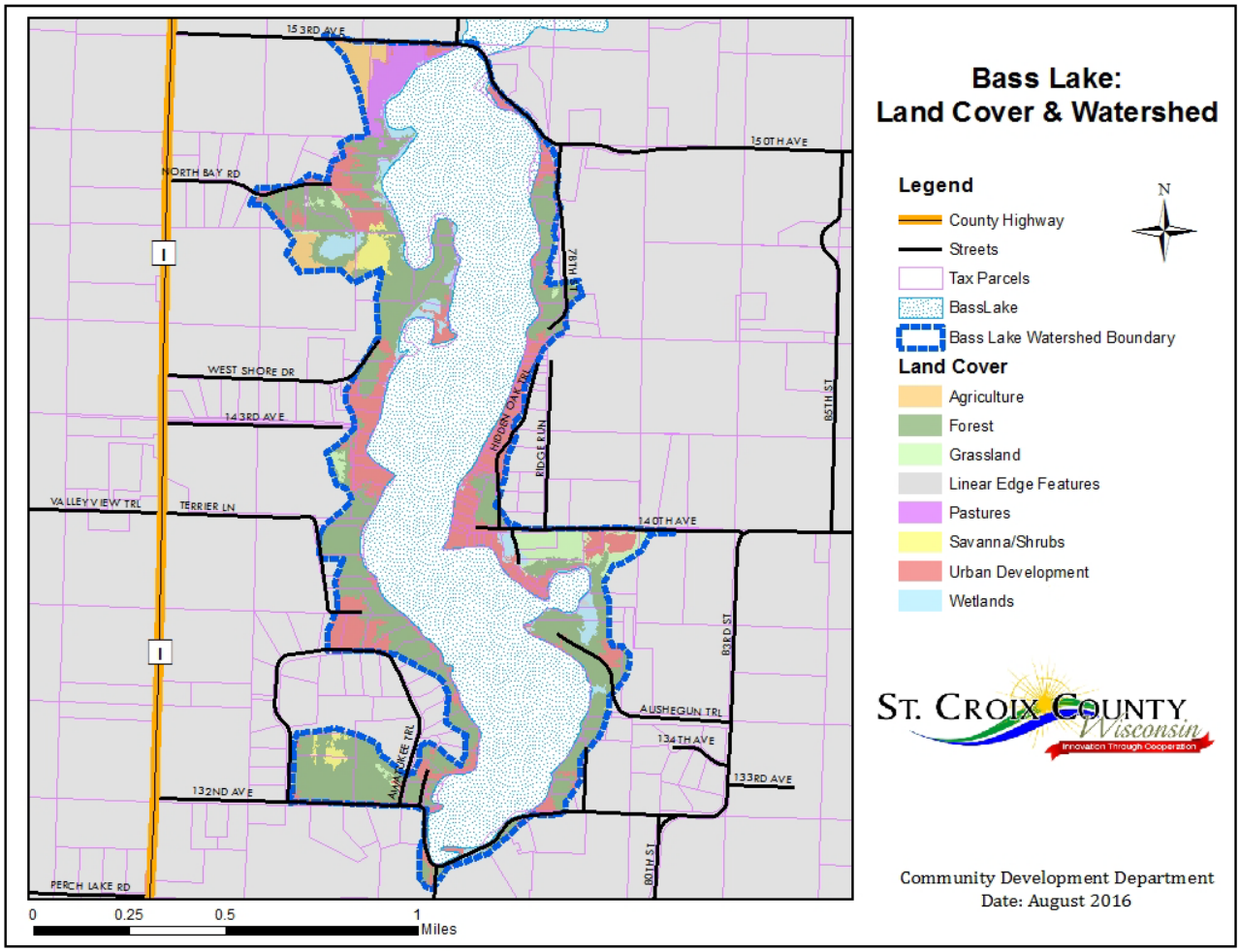

Figure 9. Bass Lake Land Cover and Watershed

Table 1. Bass Lake Watershed Land Cover and Phosphorus Loading

Land Cover	Acres	% of Land	P lb/acre-yr	P lb/year
Agriculture	12.01	1.64%	0.28	**3.4**
Developed Forest	179.31	24.53%	0.15	**26.9**
Grassland	17.66	2.42%	0.28	**4.9**
Linear Edge Features	0.16	0.02%	0.52	**0.1**
Pastures	11.7	1.60%	0.28	**3.3**
Savanna/Shrubs	7.18	0.98%	0.02	**0.1**
Res. Development	116.03	15.87%	0.52	**60.3**
	344.05	100.00%		**99.0**

Phosphorus delivery to the lake from the watershed varies by land cover type. Natural land uses such as forest, grasslands and wetlands tend to deliver low amounts of stormwater runoff and nutrients to lakes. The development of land for residential, commercial or agricultural purposes significantly increases the amount of stormwater runoff and nutrients delivered to lakes. These increases occur by adding impervious surfaces (rooftops, sidewalks, and roadways), decreasing the soil's ability to infiltrate water due to compaction during construction, and changing natural drainage patterns. Nutrients are present in stormwater runoff even without yard fertilizers, animal manure, and agricultural fertilizer although these factors increase nutrients in stormwater. Increased soil erosion causes increased nutrient loading because nutrients like phosphorus attach to soil particles.

Table 2 summarizes phosphorus contributions to Bass Lake. The water quality model estimates that more nutrients come from groundwater than surface water. This is a function of the large volume of groundwater flowing to the lake. The groundwater phosphorus concentration was estimated at 0.02 mg/l. This was the median concentration in 240 samples from private wells participating in UW-Extension drinking water education programs in the Town of St. Joseph (Center for Watershed Science and Education).

Additional phosphorus contribution from septic systems was not added to measured concentrations that were used for groundwater phosphorus estimates. Phosphorus treatment in septic systems requires adsorption of the phosphorus within the soil beneath the drainfield. High retention of phosphorus (e.g., 90% retention) is often assumed because of the reactivity of iron and aluminum in the soil profile. If weaker retention occurs because of soil conditions or long periods of use, higher phosphorus loading to the lake could result.

The area of contributing groundwater is larger than the surface water watershed as shown in Figure 10. Groundwater enters Bass Lake from the east and northeast and leaves in groundwater flowing south and west.

The atmospheric phosphorus load comes from particles such as dust and pollen and rain falling directly on the lake.

Table 2. Phosphorus Loading to Bass Lake

Watershed	**99**	lb/year
Groundwater	**75**	lb/year
Atmospheric	**157**	lb/year

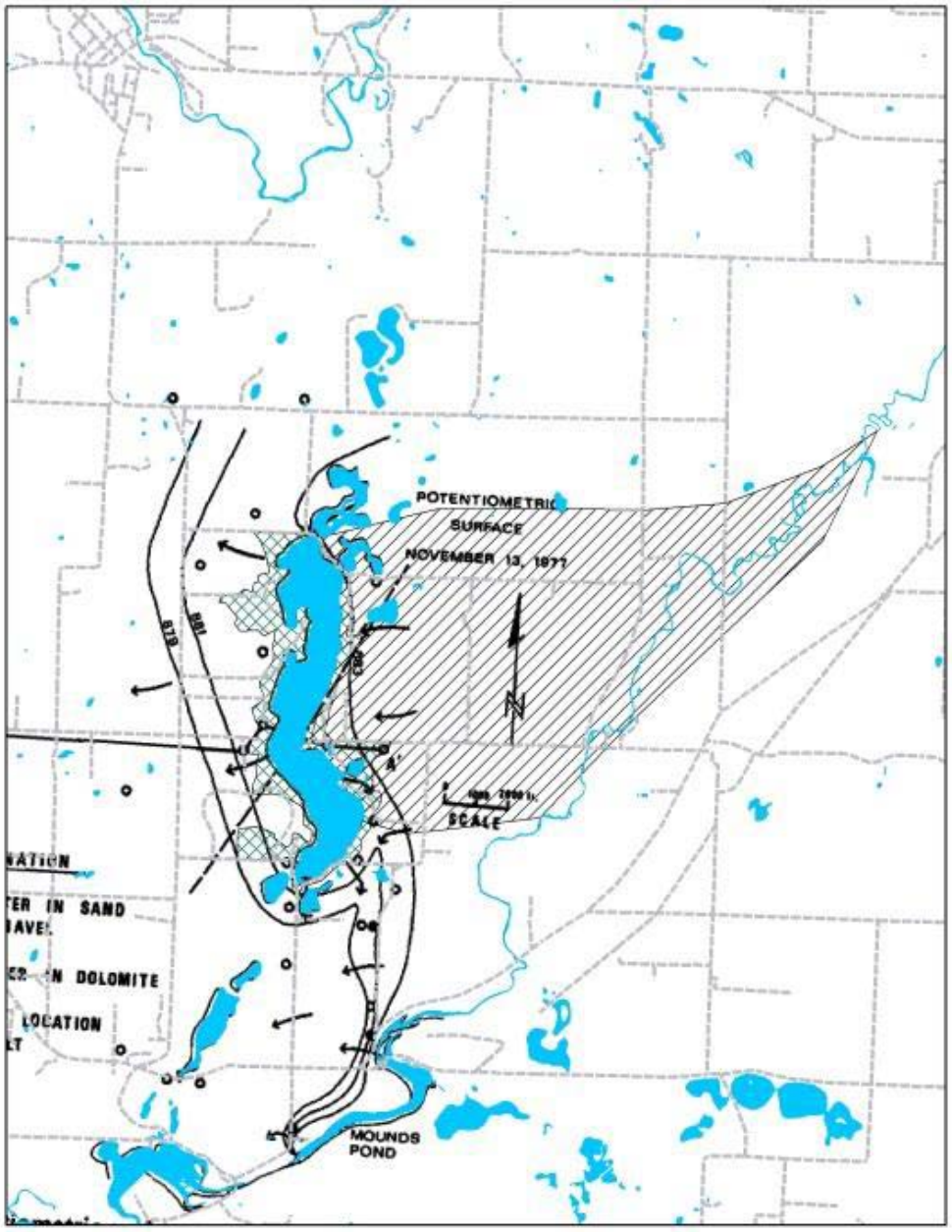

Figure 10. Bass Lake Groundwater Watershed

Water Quality Modeling

Bass Lake nutrient levels are currently in the mesotrophic or moderate range. From 2011 through 2015 the average growing season total P (TP) mean was 19.0 ug/L. The objective from the 2009 plan was to reach 15.0 ug/L TP. In 2009 the in-lake TP concentration was 18.25 ug/L, so the trend is toward increasing rather than decreasing in-lake TP levels.

Lake water quality management efforts focus on watershed areas where reduction of phosphorus is feasible. Control of atmospheric loading is limited to broad efforts that might reduce dust in the air. Groundwater phosphorus control efforts would be limited to addressing failing septic systems. However, septic systems were not estimated to be a significant source of phosphorus in the water quality model.

The water quality model allows predictions of lake water quality based on changes to watershed P loading. Results are shown in Figure 11. The water quality model predicts that a 50% reduction in watershed P loading would be needed to bring in-lake TP levels to the 2009 water quality goal of 15 ug/L. Since residential land has the greatest phosphorus loading, it makes sense to focus phosphorus reduction efforts here.

Table 3 provides an example of the reductions of P loading from residential land required to reach 50% reduction in watershed P loading. There are two classes of residential land around Bass Lake. Developed forest consists of larger residential lots with nearly complete forest cover. Urban development consists of smaller residential lots. In this example, all developed forest would need to be reduced by 50%, and all urban development lots would need to be reduced by 67%. Another way of looking at this would be to reduce P on 50% of developed forest lots by 100% and to reduce P on 67% of urban development lots by 100%. These are very ambitious goals.

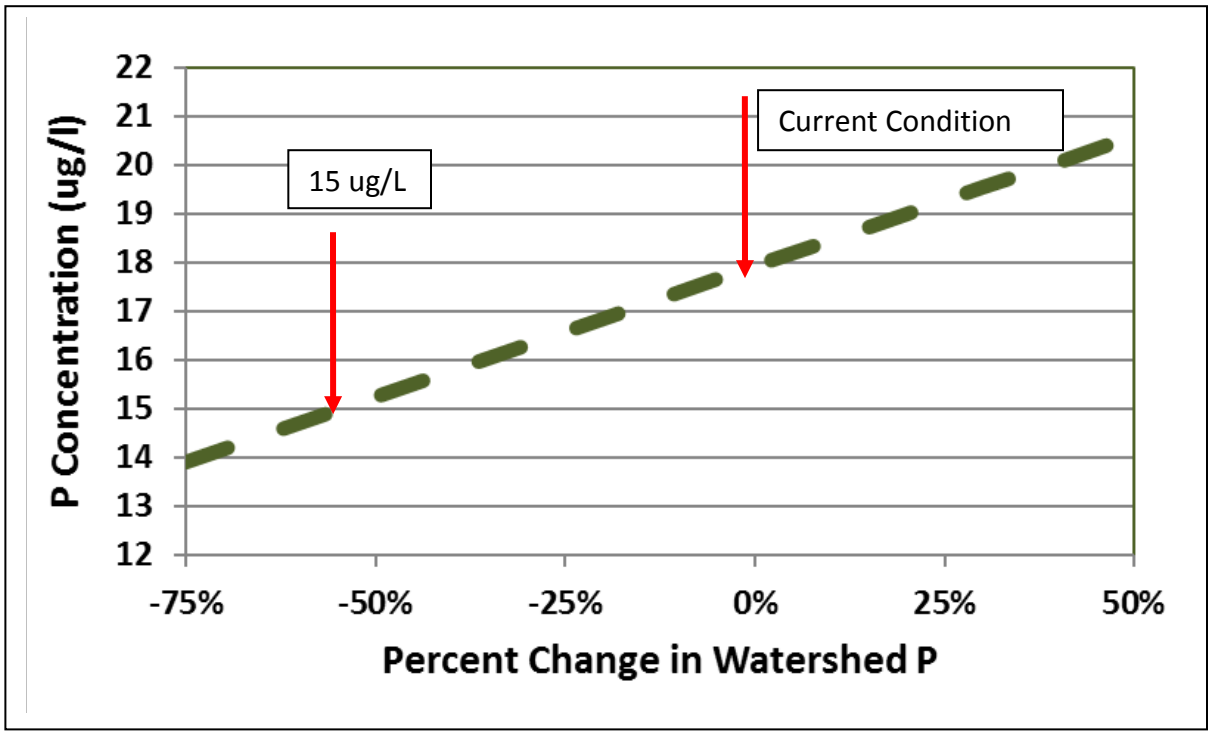

Figure 11. Predicted In-lake Phosphorus Concentrations with Changes to Watershed P Loading

Table 3. Bass Lake Watershed Loading Changes Needed to Reach 50% Reduction

Land Cover	Acres	% of Land	P lb/acre-yr	P lb/year	% Reduction
Agriculture	12.01	1.64%	0.28	**3.4**	
Developed Forest	179.31	24.53%	0.10	**17.9**	**50**
Grassland	17.66	2.42%	0.28	**4.9**	
Linear Edge Features	0.16	0.02%	0.52	**0.1**	
Pastures	11.7	1.60%	0.28	**3.3**	
Savanna/Shrubs	7.18	0.98%	0.02	**0.1**	
Res Development	116.03	15.87%	0.17	**19.7**	**67**
	344.05	100.00%		**49.4**	

Sociological Science Assessment results were examined to assess the likelihood of residential participation in efforts to reduce phosphorus loading. Dr. Aaron Thompson divided survey respondents into four stakeholder groups as illustrated in Figure 12 below. Groups were divided based upon their views of whether existing lake conditions were acceptable or if challenges existed. A second division was based on preference for a more natural or a maintained landscape.

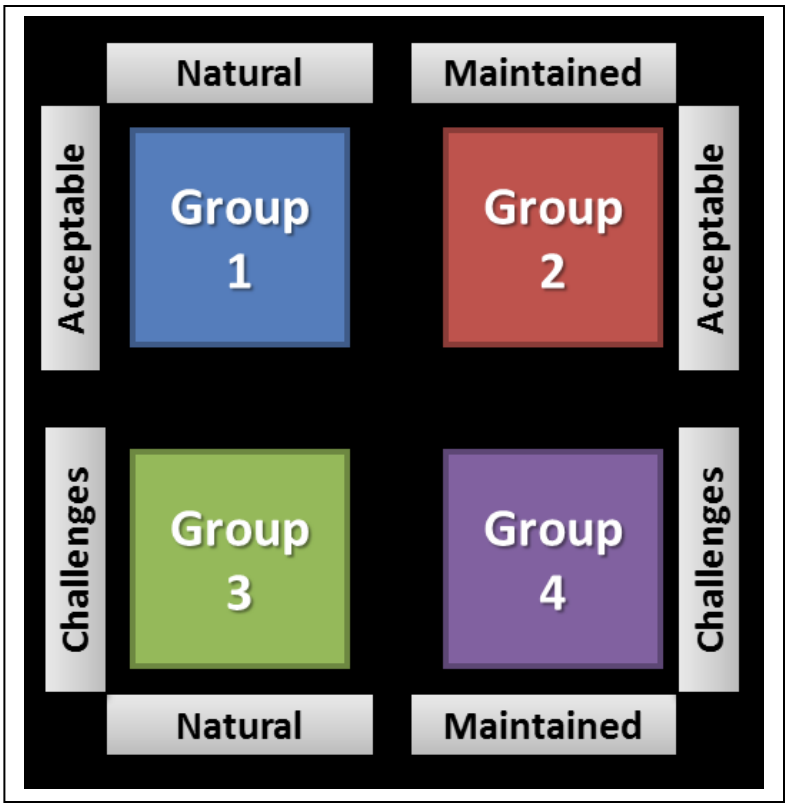

Figure 12. Bass Lake Stakeholder Groups

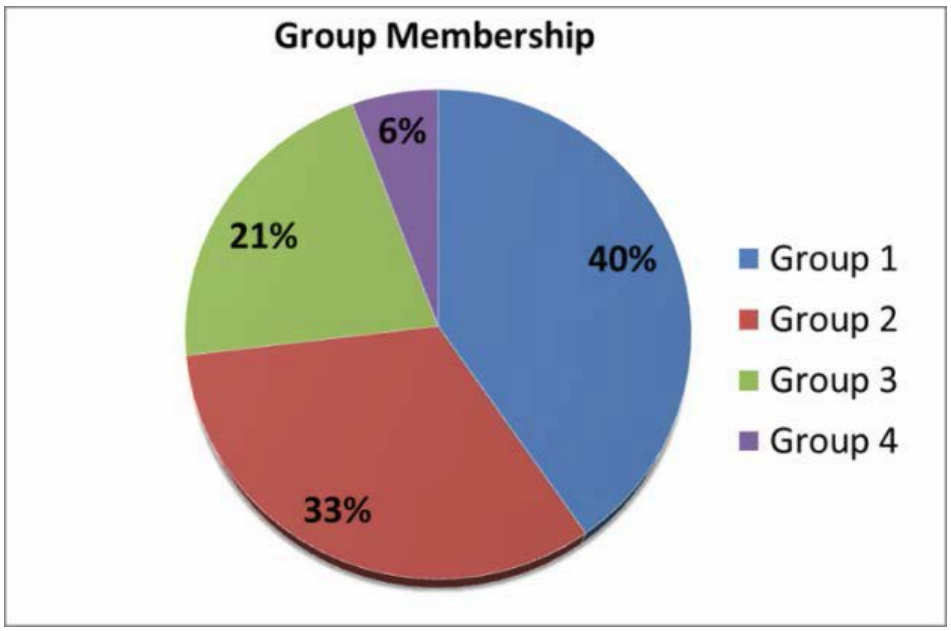

Figure 13. Social Science Assessment Group Membership

Recommendations

The analysis suggested that Group 3 members (those who believe there are lake challenges and prefer a more natural shoreline) would be the leaders in encouraging positive water quality changes on the lake. Furthermore, Group 1 members (those who believe the lake is in good shape but still prefer a more natural shoreline) are the next most likely group to participate in projects to benefit the lake. These two groups total 54% of respondents. However, survey results do not tell us if these properties are in the Developed Forest or Urban Development land use categories or if their shoreline is already natural.

The report further recommended that neighboring landowners work together to install practices and demonstrate their water quality impact. Teaching about practices is recommended over providing funding, although the potential importance of funding is not ruled out. About 94% of survey respondents maintain their own lawn and landscaping, so providing do-it-yourself information will likely be important. The report pointed out that one of the biggest challenges will be creating a call to action – individuals in some groups do not believe that water quality and habitat improvements are needed for Bass Lake. An outreach approach of neighbor to neighbor communication is suggested to identify property owners willing to make changes on their property.

Slopes

The watershed contains areas with slopes greater than 20 percent (Figure 14). Such slopes are highly limited for development. The St. Croix County General Zoning Ordinance requires the following when construction or land disturbance activities occur on:

- Slopes 12 to 19% affecting more than 10,000 square feet
  - ✓ Erosion control plan
- Slopes 20 to 24.9% or slopes 25 to 29.9% (public improvements only)
  - ✓ Erosion control plan
  - ✓ Stormwater management plan (performance standards described in Wisconsin Administrative Code NR 151 must be submitted and recorded with the St. Croix County Register of Deeds)
- Slopes 25% or greater with the slope measured over a horizontal distance of 50 feet (except public improvements to 29.9%)
  - ✓ Construction and land disturbance prohibited.

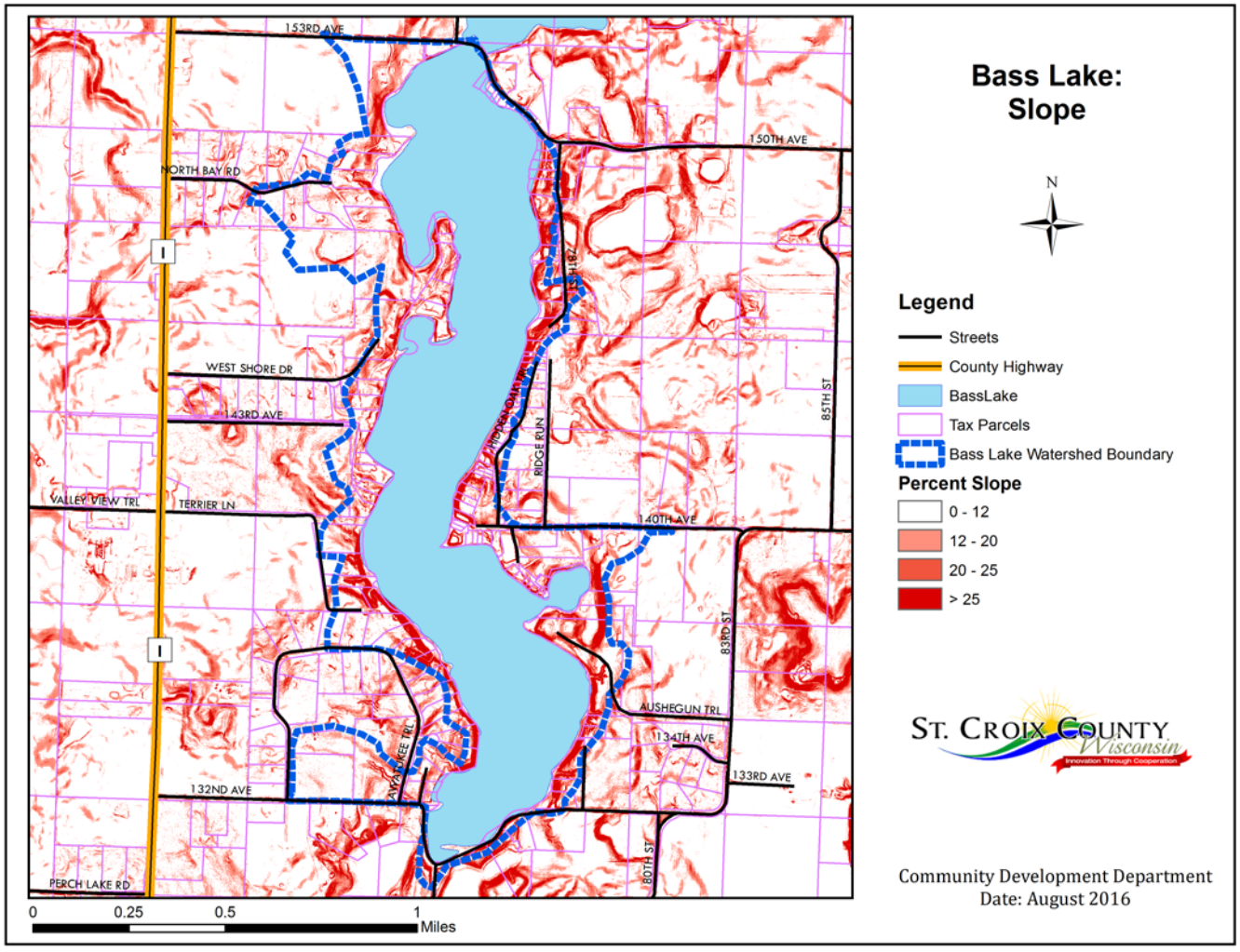

Figure 14. Bass Lake Slope Map

Water Quality Protection Tools

Best Management Practice Installation

Restoration of natural shorelands and reduction of runoff from shoreland property is included in many lake management plans to meet goals of restoring habitat next to the water and reducing runoff of nutrients and sediment from waterfront properties. A range of management actions are available to implement including the following:

- Information and Education
- Demonstration Projects
- Recognition
- Technical and Design Assistance
- Incentives such as Cost Sharing Installation

St. Croix Lake Cluster Priority Watershed Project

The St. Croix Lakes Cluster Priority Watershed Project plan was completed in 1997, and funding was available through 2009. Funding provided support for technical assistance and installation of best management practices to meet plan goals. During this time twelve shoreline owners helped protect Bass Lake's water quality by participating in the program with shoreline restorations and raingardens. (Voss. 2009) These and other installed projects are shown in Figure 15.

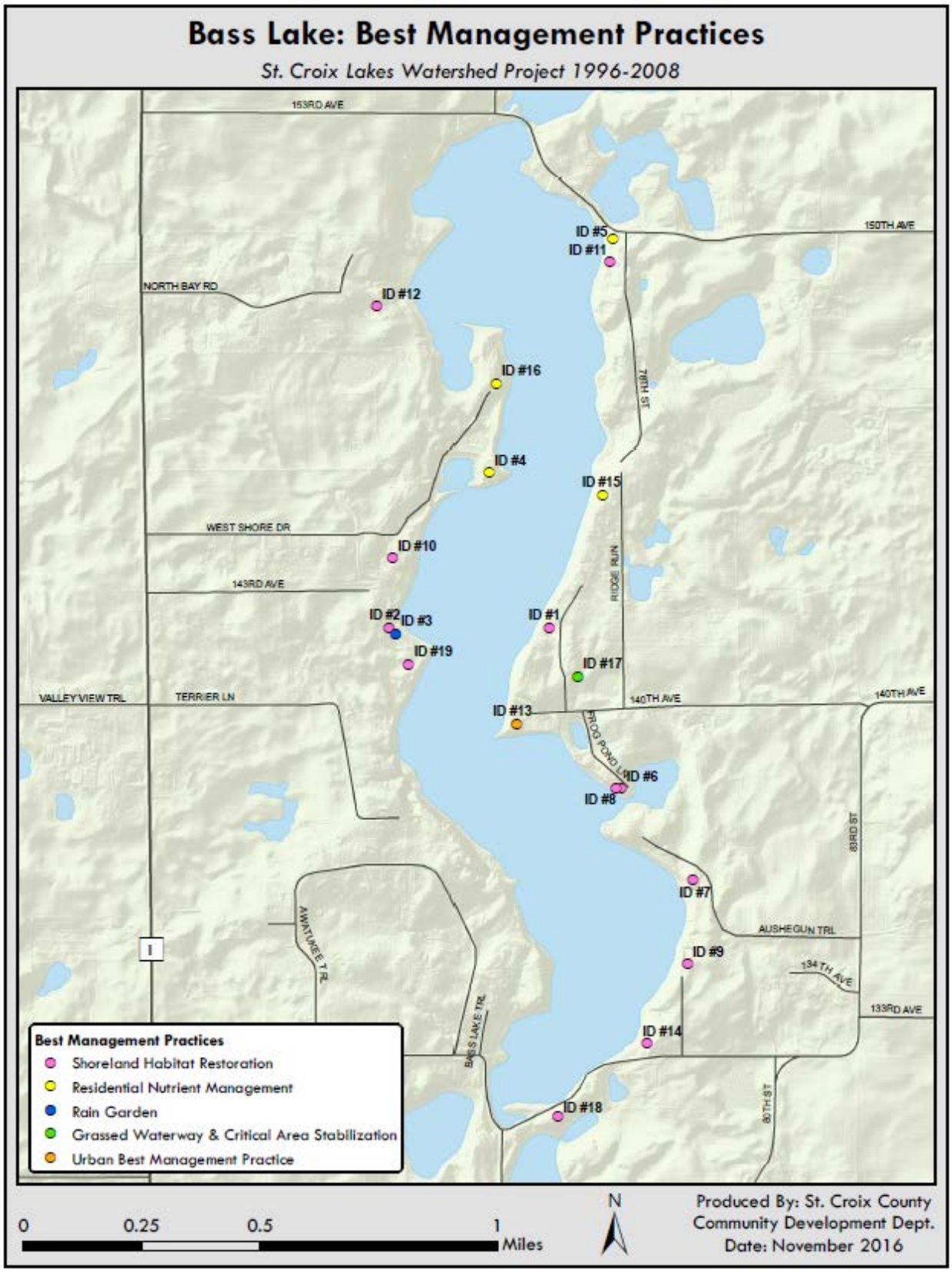

Figure 15. Priority Watershed Best Management Practices Installed

Regulations

Regulations that apply to new development and re-development provide opportunities for water quality protection and improvement.

St. Croix County Ordinances

http://www.co.saint-croix.wi.us/index.asp?Type=B_LIST&SEC={D1648D84-3ECE-4FC7-85BC-D55386B8D210}

Chapter 13. Land Division

The St. Croix County Land Division ordinance has more restrictive stormwater requirements than state NR151 requirements. There are no current plans for revisions.

Chapter 17. Zoning

Growth management funds provide the opportunity to revise the entire zoning code and incorporate MIDS (minimum impact development standards used in MN). Provisions that protect lakes might be incorporated into general zoning standards rather than shoreland standards.

Subchapter 1. General Provisions

Subchapter 2. General Zoning

The zoning ordinance includes limitations and requirements for construction on steep slopes as described previously. Stormwater standards in the ordinance are from NR 151.12. They include post-construction performance standards for new development and redevelopment

Total Suspended Solids

80% TSS for new development
40% TSS for redevelopment

Peak Discharge

Pre and post development (2-year, 24-hour storm)

Infiltration (Residential)

25% of the 2-year storm

Shoreland Zoning

Changes to state regulations require updates to shoreland zoning provisions. These changes will limit lake protection currently in the county ordinance.

- June 2016 update planned to address boathouses
- October 2016 update planned to reflect limits instituted by the State of WI in Act 55 and Act 167

Town of St. Joseph Ordinances
http://www.ecode360.com/SA1784

Chapter 168. Subdivision of Land

The ordinance establishes a 3-acre minimum lot size.

Chapter 149. Roads, driveways and trails erosion and sediment control and right of way construction

The Town of St. Joseph passed a resolution to delegate authority to adopt and enforce ordinances related to lakes to the Bass Lake Rehabilitation District by resolution dated August 9, 1990.[10]

Conservation Easements

A conservation easement is a restriction placed on a piece of property to protect its associated natural resources. Conservation easements can have provisions to restrict development and protect vegetation on the shoreline and in the uplands, among other provisions, in order to protect its associated natural resources. They can be donated or purchased. Easements can be held by land trust organization or government entities. Conservation easements are a tool that can be used for permanent water quality protection for Bass Lake. Ongoing monitoring of easements is critical to ensure their success.

The Town of St. Joseph Comprehensive Plan (Draft September 2016) identifies Natural Resource Corridors. A few of these areas are within the Bass Lake watershed. The Town Subdivision Ordinance includes use of conservation easements and set asides to protect these areas now called Preservation Residential areas. In Preservation Residential areas, primary conservation areas (168.18(a)) are required to be set aside from development and be preserved through deed restrictions, conservation easements or other permanent conservation restrictions, limiting their use and development.

[10] Town of St. Joseph Resolution. August 9, 1990.

Invasive Species[11]

When non-native plants, animals, or pathogens rapidly take over a new location and alter the ecosystem, they are considered invasive species**.** Invasive species can sometimes take over and spread rapidly and widely causing major harm to the native ecosystem or humans. One of the reasons that invasive species are able to succeed is that they lack natural predators and competitors. Without these checks and balances, they are able to reproduce rapidly and out-compete native species.

Invasive species can alter ecological relationships among native species and can affect ecosystem function, economic value of ecosystems, and human health. Humans have created conditions where plants and animals can aggressively invade and dominate natural areas and water bodies in three ways:

- introducing exotic species (from other regions or countries);
- disrupting the delicate balance of native ecosystems by changing environmental conditions -- e.g., stream sedimentation, ditching, building roads or restricting or eliminating natural processes such as fire; and
- spreading invasive species through various methods:
    - moving watercrafts between waterbodies without removing invasive plants and animals;
    - carrying seeds of invasive plants on footwear or pet fur;
    - mowing along roadsides;
    - importing firewood and leaving in campgrounds;
    - driving and biking with invasive seeds in tire treads.

The net result of invasive species spread is a loss of diversity of native plants and animals. About 42 percent of the species on the Federal Threatened or Endangered species lists are at risk, primarily because of invasive species.

The following invasive species are found in Bass Lake: common carp, Eurasian water milfoil (1997), curly leaf pondweed, zebra mussels (2010), and Chinese mystery snail.

Eurasian Water Milfoil

Eurasian water milfoil is an invasive, submersed aquatic plant native to Europe, Asia, and northern Africa. It is the only non-native milfoil in Wisconsin. Eurasian water milfoil grows best in mucky sediments. It has a history of becoming dominant in nutrient-rich lakes, although this pattern is not universal. In less productive lakes, it is restricted to areas of nutrient-rich sediments. It is an opportunistic species that prefers highly disturbed lake beds, lakes receiving nitrogen and phosphorous-laden runoff, and heavily used lakes.[12]

[11] Information from the Wisconsin Department of Natural Resources web site: http://dnr.wi.gov/topic/Invasives
[12] Taken from WDNR, 2008 http://www.dnr.state.wi.us/invasives/fact/milfoil.htm

Zebra Mussels

Zebra Mussels are an invasive species that have inhabited Wisconsin waters and are displacing native species, disrupting ecosystems, and affecting citizens' livelihoods and quality of life. They hamper boating, swimming, fishing, hunting, hiking, and other recreation, and take an economic toll on commercial, agricultural, forestry, and aquacultural resources. The zebra mussel (*Dreissena polymorpha*) is a tiny (1/8-inch to 2-inch) bottom-dwelling clam native to Europe and Asia. Zebra mussels were introduced into the Great Lakes in 1985 or 1986, and have been spreading throughout them since that time. They were most likely brought to North America as larvae in ballast water of ships that traveled from fresh-water Eurasian ports to the Great Lakes. Zebra mussels look like small clams with a yellowish or brownish D-shaped shell, usually with alternating dark- and light-colored stripes. They can be up to two inches long, but most are under an inch. Zebra mussels usually grow in clusters containing numerous individuals.[13]

Zebra mussels were first found on Bass Lake in 2010. The US Fish and Wildlife Service detected zebra mussels on plate samplers each year since that time.[14]

Shoreland Habitat

The 2007 aquatic plant survey results reported that much of the shoreline on Bass Lake was protected by native plant buffers (wooded, shrub, and herbaceous). Natural shoreline occurred at 95% of the sites and covered 85% of the shore. Cover of natural shoreline had increased slightly from 74% in 1996. Wooded shoreline was dominant in 1996, but was surpassed by herbaceous plant growth in 1999-2006. Some of the increase in natural shoreline and especially herbaceous cover was attributed in part to the shoreline restoration projects on Bass Lake through the priority watershed project. Some increase in herbaceous cover was attributed to lower water levels that had recently exposed bare soil on which herbaceous pioneer species had colonized. The WDNR has not completed a shoreland assessment since 2007; nor has St. Croix County.

[13] http://dnr.wi.gov/topic/Invasives/fact/Zebra.html
[14] Personal email communication. Byron Karns, National Park Service 11/22/16.

Bass Lake Fishery[15]

Bass Lake is primarily managed as a bass and panfish lake. Largemouth bass are the most common gamefish in Bass Lake. Prior to 1990 and the implementation of a 14 inch size limit on bass statewide, Bass Lake contained a high quality bass fishery with trophy (>20 inches) potential. Since then bass populations have increased and growth rates have plummeted resulting in an overly abundant population of small, slow growth fish. Few bass reach the 14 inch minimum size limit. Water level changes may also be partially responsible for the change in size structure. In an effort to improve the size structure of the largemouth bass population, a protective slot size regulation of 14-18 inches with a bag of three – only one of which can be over 18 inches was implemented in 2013. This regulation is designed to increase angler harvest of overly abundant small bass (< 14 inches) thus improving the growth rate of the remaining bass. The ultimate goal is to increase the number of quality bass 14 inches and greater and return trophy potential. The reduced number of smaller bass should also allow more of the stocked walleye fingerlings to reach adult sizes.

Bluegill are the most abundant panfish in the lake. Black crappie are the next most abundant panfish. Other species present include yellow bullhead, pumpkinseed, smallmouth bass, white sucker, golden shiners and spotfin shiners. The statewide regulation for panfish is a bag limit of 25. Bass Lake has a 10 fish bag limit on panfish to protect/maintain the high quality pan fishery from overharvest. It was implemented in 2008. A complete life cycle for bluegill is about 8 years, so the regulation effectiveness at maintaining quality size bluegill can be evaluated in 2019. Quality bluegill can be measured as number per mile captured elelctrofishing greater or equal to 7 and 8 inches. Due to the pelagic nature of black crappie, evaluations are difficult and therefore will not be evaluated.

Extended growth walleye (>7 inches) are stocked to provide additional sport fish recreation. Walleye fingerlings have been stocked in Bass Lake since the 1970's with fingerlings 2- 5 inches. Success in recent years has been poor. Between 2009 and 2012 extended growth fingerlings were stocked annually at varying rates (3.3 – 14.3 per acre). Since 2014, Bass Lake became part of a statewide evaluation of extended growth walleye stocking. Currently, Bass Lake is stocked every other year at a rate of 15 per acre. At this time it is too early to evaluate the success or failure of large fingerling stocking to restore adult walleye populations to an accepted minimum of one adult per acre. 2011 survey results were encouraging. An adult walleye population estimate should be conducted during the next scheduled rotation survey in 2019.

Exotic species found in Bass Lake include common carp, Eurasian water milfoil, and zebra mussels (discovered in 2010). Common carp were observed in low numbers in the most recent survey and are not considered to be a problem in Bass Lake.

Northern Pike were illegally introduced to Bass Lake prior to 1975 and densities normally are low. However, during high water levels northern pike populations expanded for a short period before returning to pre-high water conditions. No new management recommendations are proposed for northern pike at this time.

[15] Engel, 2011 and 2015 and personal communication March 2016.

Fish Crib and Fish Stick Project[16]

Heavy residential development, low water levels, and the practice of cleaning up shorelands and downed trees over time have resulted in a loss of near shore habitat especially when water levels are low. The placement of fish sticks was designed to replace lost wood and improve near-shore fish habitat. In addition, fish cribs were added along with fish sticks in areas void of deep-water habitat where the lake depth drops off quickly. Such combinations provided both deep and shallow-water woody habitat in the same area.

The WDNR worked with the Bass Lake Rehabilitation District to improve fisheries woody habitat through the installation of fish sticks and fish cribs. Beginning in 2012, a cooperative effort between WDNR, the Bass Lake Rehabilitation District, St. Croix County Alliance of Sports Clubs, Star Prairie Fish and Game, St. Croix County Land and Water Conservation and Parks Departments, and the US Fish and Wildlife Service began. The plan called for the construction and installation of 100 fish cribs and the placement of fish sticks along the shoreline of cooperating landowners.

Fish Sticks

During winter of 2011-12, 93 oak trees were cut in a nearby waterfowl production area, dragged onto the ice and placed along the shoreline in eight locations (shown as orange dots on maps). The trees were placed in clumps of 3-5 trees and temporarily tethered to the shoreline until the ice melted and the trees dropped into the water and became waterlogged. The tethers were then removed.

Fish Cribs

In addition, oak logs and other materials needed to build fish cribs were ordered and delivered to the lake. Before construction, hardwood tops were cut and hauled and the logs pre-drilled. With volunteers, a couple of skid loaders, and ATVs, 15 cribs were assembled and installed on one day each winter. The cribs were placed on the ice in 14 to 20 feet of water in small colonies and allowed to drop in as the ice went out. An additional 15 cribs each year during the winter of 2012-13, 2013-14, and 2014-15 were installed, for a total of 60 cribs.

Tree drop (orange dots) and fish crib (red dots) locations are shown in Figure 16.

Results

Today 93 fish sticks have been placed in eight sites and 60 fish cribs have been placed in seven sites on Bass Lake (see Figure 15. In this figure, fish sticks are referred to as tree drops). Additional fish sticks and fish cribs are planned for the lake. Proposed fish crib locations are shown in Figure 16. Preliminary results indicate walleye, bass, bluegill and crappie are using the cribs and angler success has improved. More results will be available following the next fishery survey on Bass Lake which is scheduled for 2019.

Recommendations

- Install fish cribs in high priority locations according to woody habitat plan map and spreadsheet provided by the WDNR.
- Update/revise the woody habitat plan to include more fish sticks and root wads. Install recommended practices.

[16] Engel, 2015

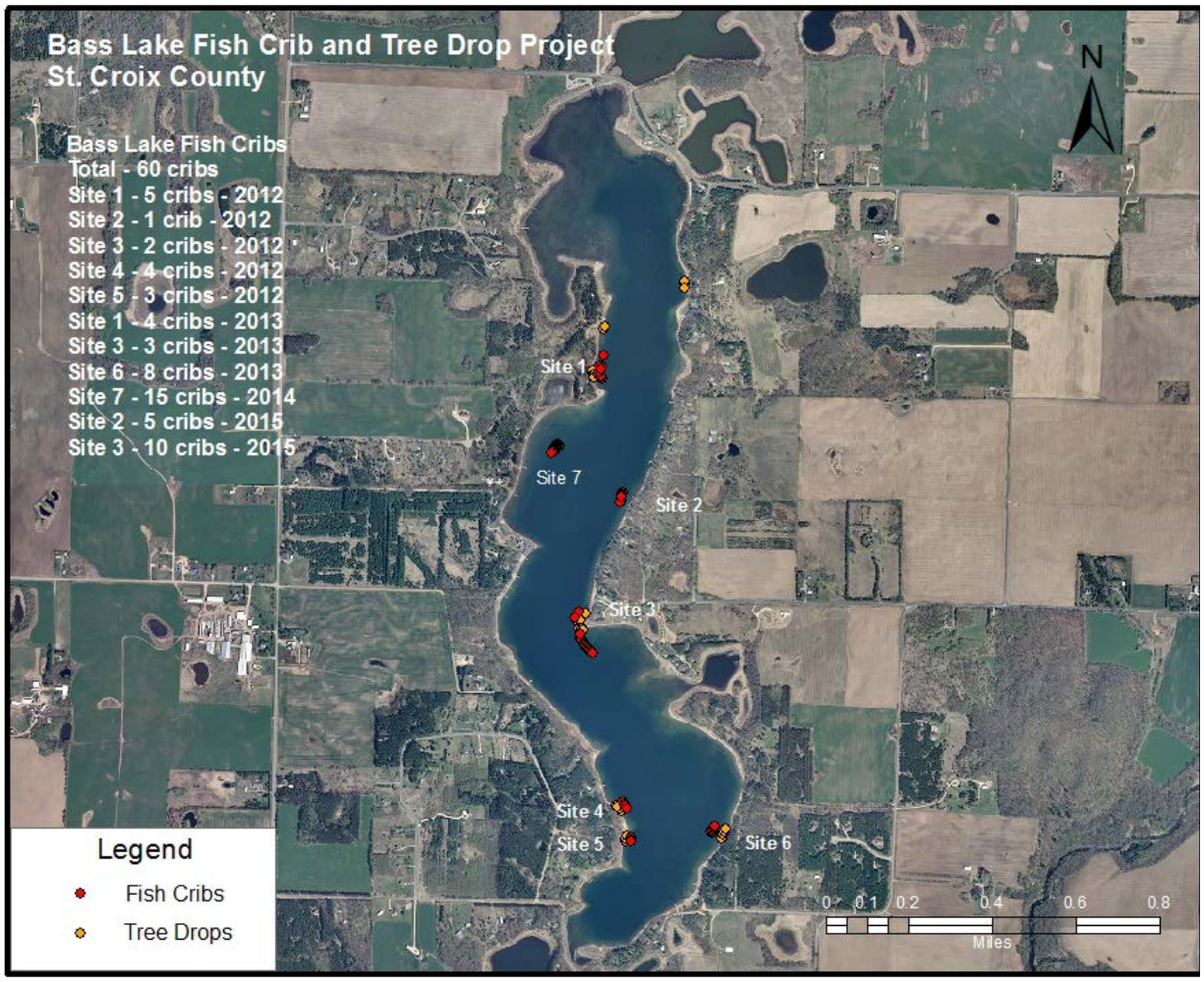

Figure 16. Fish Crib and Tree Drop Locations

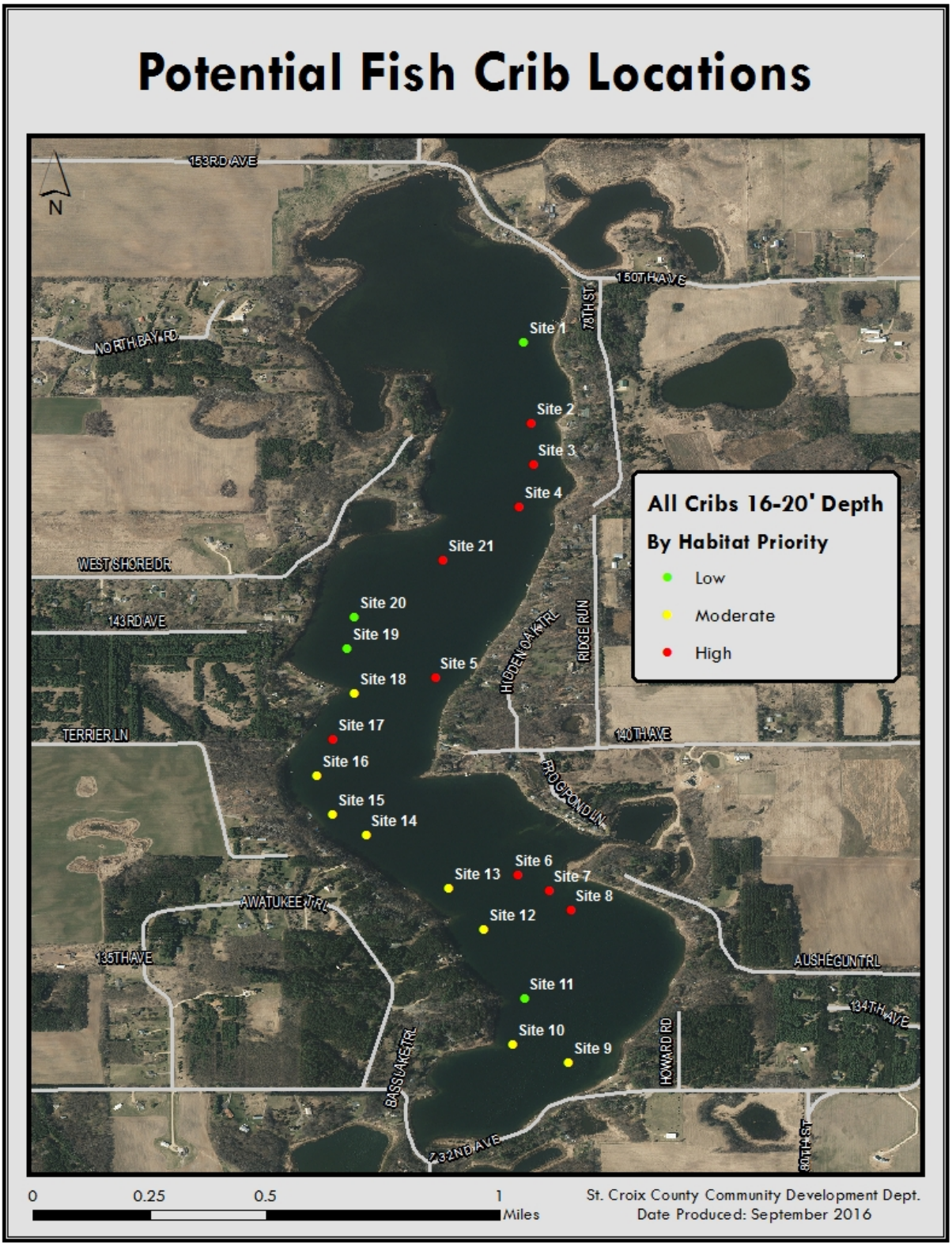

Figure 17. Recommended Fish Crib Installation Priorities

Aquatic Plants

Native aquatic plants provide important functions in lakes. They provide a diversity of habitats, help maintain water quality, stabilize shorelines, sustain fish populations, and support common lakeshore wildlife such as loons and frogs.[17]

Aquatic Plant Surveys[18]

Aquatic plant surveys were conducted according to standard point intercept methods in 2009, 2013, 2014, and 2015. Aquatic plant surveys are conducted as part of a Long Term Trend Study involving lakes throughout the state. Bass Lake has an above average aquatic plant community compared to Wisconsin lakes and lakes in the North Central Hardwood region. The maximum depth of vegetation has ranged between 17 and 21 feet. Approximately half of the lake is in the littoral zone (the area capable of supporting vegetation). Between 83 and 95 percent of the littoral zone was vegetated. Submergent vegetation was the dominant growth type. Muck sediments have increased over time to become the dominant sediment type.

Forty species were found over the four surveys. Flat-stem pondweed, slender naiad, and muskgrass were consistently the dominant species. Eight sensitive species were found in the lake: *Ceratophyllum echinatum*, *Potamogeton amplifolius, P. gramineus, P. illinoensis, P. robbinsii, P. zosteriformis, Ranunculus aquatillis* and *Utricularia vulgaris*.

Two invasive species were found in Bass Lake*: Myriophyllum spicatum* (EWM) and *P. crispus* (CLP).

History of EWM (Konkel, 2007)

Eurasian water milfoil (EWM) was first found in the lake in August 1997. It was densely colonizing a location near the boat landing that, in July 1996, had been verified to be free of Eurasian watermilfoil. A survey was conducted in September 1997 to map the extent of the Eurasian watermilfoil colonization (Konkel 2003). In June 1998, native milfoil weevils were found at naturally high numbers in Bass Lake (Jester 1998). By the summer of 1999, dense stands of Eurasian watermilfoil were beginning to limit the use of some docks. In June 2000 and May 2001, selective chemical treatments for Eurasian watermilfoil were conducted at the docks of individual landowners who requested treatment. A permit for chemical treatment of Eurasian watermilfoil was applied for in 2002, but the exotic milfoil did not appear at the docks in 2002. The quantitative survey conducted in the summer of 2002 and the 2007 study found Eurasian watermilfoil had declined lake-wide and was at very low levels in scattered locations.

EWM was last found in Bass Lake during plant surveys in 2009. In 2014, in addition to the aquatic plant survey, two separate aquatic invasive species surveys were conducted by WDNR water resources staff and Golden Sands RC&D staff. The absence of EWM after these extensive efforts indicates an absence of the species. When CLP has been found, it has been at only one site during each survey.

[17] *Through the Looking Glass*. Borman et al. 1997.
[18] Lepsch, 2015 unless otherwise noted.

A natural population of milfoil weevils exists with the northern milfoil currently present in the lake. Aquatic plant surveys will be conducted on an annual basis to learn more about the sustainable coexistence of both species and to obtain baseline levels of the weevil population in the case that EWM re-colonizes in the lake.

Aquatic plant surveys were completed using a transect method 7 times from 1987-2006, and the following changes were noted. The aquatic plant community was stable during 1987-1993. Between 1993 and 1996, the plant community started undergoing significant change that continued up to 2002. During this time of change, water levels in Bass Lake rose, Eurasian watermilfoil was introduced in 1997, water levels dropped again, Eurasian watermilfoil spread through the lake and became the dominant species and then the Eurasian watermilfoil dramatically declined. The milfoil likely declined due to the milfoil weevils in the lake. In 2002-2006, the aquatic plant community in Bass Lake stabilized and reached its highest quality. (Konkel, 2007)

Recommendations (Konkel, 2007)

1. Lake District to continue program of restoring natural vegetation buffer zones to provide critical habitat for wildlife, fish and milfoil weevils and protect water quality.
2. Lake residents protect existing natural shoreline buffers. Disturbed shoreline appears to have impacted the in-lake plant community at the disturbed sites. Disturbed shorelines in Bass Lake have a lower occurrence of sensitive species, a lower quality and less diverse aquatic plant community, a shallower maximum rooting depth, a lower percentage of vegetated sites and less cover of emergent and floating-leaf vegetation (important habitat structure).
3. Residents use native emergent vegetation to stabilize shorelines instead of rip-rap.
4. Lake District and residents cooperate with efforts in the watershed to reduce runoff and nutrient enrichment to protect the water quality in Bass Lake.
5. Lake residents protect the native plant community to help repel the spread of Eurasian watermilfoil.
6. Lake residents use best management practices on shoreline properties.
7. Lake District maintains stable water levels in Bass Lake.
8. Lake District becomes involved in Citizen Lake Monitoring Program.
9. DNR continues monitoring the aquatic plant community and Eurasian watermilfoil.

Sensitive Areas[19]

The WDNR completed a sensitive areas study and report in 2003. The report pointed out that shoreline and shallow water zone of lakes are all sensitive areas to some extent. These areas are the primary fish and waterfowl habitat on a lake and are, unfortunately, the same areas that are usually first degraded by lake use and development. It is important to preserve an adequate number of sensitive areas to insure that there is sufficient water quality protection and habitat for wildlife and fish to serve a lake of this size.

As mentioned previously, the decline of Eurasian water milfoil in Bass Lake has been attributed to the milfoil weevil population that already existed in Bass Lake. **Natural shoreline is critical for weevil survival.** Although the weevil is an aquatic insect during the growing season, it must hibernate on land in leaf litter or thick plant cover during the winter. Rip-rap, sand beaches, and mowed grass do not provide enough protection over the winter. Weevils that hibernate there will not survive the winter to repopulate the lake the next year. The sensitive area report authors conclude: "every piece of shoreline that is cleared on Bass Lake is promoting the return of uncontrolled Eurasian watermilfoil."

All of the sensitive areas that were selected are potential milfoil weevil habitat. Preserving the native plant communities in their undisturbed condition at all of the proposed sensitive areas is also important to help prevent the invasion of non-native species, such as Eurasian watermilofil, curly-leaf pondweed, and purple loosestrife. Nature loves a vacuum, so if the native plant communities are removed, something will take their place. The species that recolonize will likely be more aggressive, causing more conflicts with the current recreational use and habitat values of the sites.

Recommendations

1. Maintain aquatic vegetation in an undisturbed condition for wildlife habitat, fish cover and as a nutrient buffer for water quality protection.
2. Protect emergent vegetation as an erosion buffer.
3. Do not remove fallen trees along shoreline.
4. Maintain shoreline vegetation, shrubs and trees in a natural condition to provide wildlife habitat, weevil habitat, and to prevent erosion and protect water quality.
5. Minimize removal of any shoreline or aquatic vegetation.
6. Restore developed shorelines with a buffer strip of natural vegetation.

[19] WDNR 2003

Two slow no-wake zones were recommended in sensitive areas #1 and #7. Sensitive area #1 was protected with Town and Lake District ordinances in 2008. Sensitive area #7 is not currently navigable because of vegetative growth.[20]

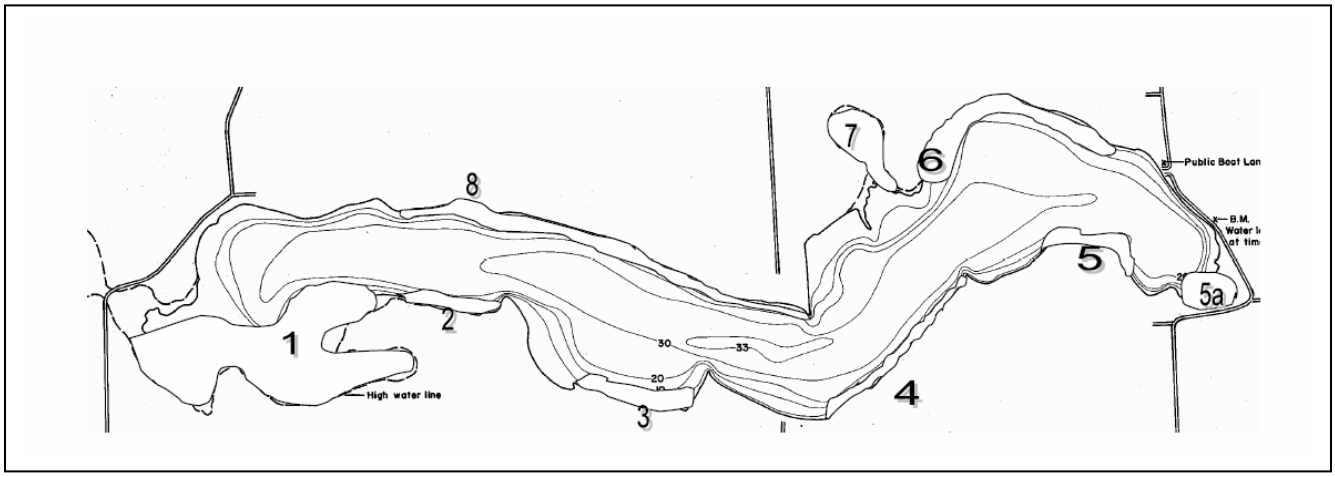

Figure 18. Designated Sensitive Areas on Bass Lake

[20] Personal communication 11/17/16. Tom Spaniol. St. Joseph Town Chair.

Preventing Aquatic Invasive Species

There are five major methods to prevent invasive species: education to lake users, Clean Boats Clean Waters program, landing surveillance cameras, lake monitoring, and a rapid response strategy for any new invasive species.

Education to Lake Users

Education efforts focus on identification and prevention of new invasive species. Activities might include aquatic invasive species (AIS) information presented at annual meetings and workshops, signage at the public landings and private boat launch areas, lake maps and brochures with AIS messages, and web site and newsletter information.

Clean Boats Clean Waters (CBCW) Program

Clean Boats Clean Waters educators provide boaters with information on the threat posed by Eurasian Milfoil and other invasive species. They offer tips on how to keep boats, trailers, and equipment free of aquatic hitchhikers. They also collect information on boater behavior, concerns, and knowledge of existing local and state laws related to anti-AIS measures.

Landing Surveillance Cameras

Some lake organizations use video cameras at public landings to record landing activity. Videos are reviewed, and if watercraft are launched with vegetation attached, action is taken. Violations of a state rule which prohibits transporting and launching boats and trailers with vegetation attached can be enforced by local law enforcement officers. The camera also serves as a reminder for boaters to check their equipment.

Lake Monitoring

The objective of lake monitoring is to look for new invasive species. Monitoring for invasive species is generally focused around boat landings and other areas of high public use. Trained volunteers or consultants may complete the monitoring. Divers may be used. It is critical to complete aquatic invasive species visual surveys when algae growth is low and visibility is good.

Rapid Response for New Invasive Species

The activity is intended to control any new invasive species that are found in the lake. Rapid response protocols include the following:

- monitoring for invasive species
- education of lake residents and visitors
- contacts to confirm invasive species identification
- procedures for notification
- plans for removal and control
- funding contingencies and grants.

Invasive species information is available on the DNR website http:/dnr.wi.gov/invasives. A rapid response plan for Bass Lake is included as Appendix E.

Bass Lake Implementation Plan

Plan Timeframe

This plan covers a ten year time frame. As new knowledge is acquired and events unfold, it will be updated as appropriate.

Implementation Plan Updates

An implementation plan table is found in the following section. The implementation plan or work plan details how action steps will be carried out over the next two year period. This implementation plan will be updated annually in June to keep actions and budgets current. The Bass Lake Rehabilitation District will facilitate this effort in cooperation with a plan implementation team.

Bass Lake Management Plan Implementation Team

The Bass Lake Rehabilitation District will establish a Bass Lake Management Plan Implementation Team. The team will include board and committee members from the Bass Lake Rehabilitation District and partners in plan development and implementation including the Wisconsin Department of Natural Resources, the Town of St. Joseph, and St. Croix County. An initial task of the implementation team will be to invite additional partners to be on the team and to play an active role in implementing specific plan actions. Another task will be to coordinate formal adoption of the Bass Lake Management Plan by partner agencies. The team will meet quarterly to assess progress toward meeting plan implementation goals.

In addition to the overall implementation team, the Bass Lake Rehabilitation District will establish committees established around each of the plan goals. In some cases there may be more than one committee per goal. For example, Goal 1 already has a demonstration site committee and may have another to steer investigation into using the pump for phosphorus management.

Funding Plan Implementation

The implementation charts later in this section list potential funding sources for plan implementation.

<u>Grant Sources</u>

The DNR Lake Management Grant Program has two main types of lake management grants: planning and lake protection grants. Lake planning grants are available at two scales – large scale up to $25,000 and small scale up to $3,000. Applications are due each year on December 10th. DNR lake protection grants for plan implementation have a maximum grant amount of $200,000. These grants are due each year by February 1st. Plan activities will be eligible for lake protection grant funds following approval by the DNR.

<u>DNR Lake Planning Grants (up to 67% state share)</u>

Large scale – up to $25,000
Small scale – up to $3,000

Applications due December 10th
These grant applications could proceed without final plan approval.

DNR Lake Protection Grants (up to 75% state share)

Up to $200,000
Requires DNR approval of tasks in the comprehensive plan (allow 60 days)

Applications due February 1st

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 such as plant surveys and weevil monitoring. Grants provide up to 75 percent funding. Applications for AIS control activities are accepted each year with postmark deadline of February 1. Applications for AIS prevention, education, and planning are accepted each year with a postmark deadline of December 10.

Communicating with Watershed Residents

The social science assessment found that lake residents are responsive to receiving information from a variety of sources including the WDNR, St. Croix County Resource Management Division, UW-Extension, and the Bass Lake Rehabilitation District. The survey further revealed strong support for the continued use of meetings, newsletters, and one-on-one communication. However, respondents identified as Group 2 reported they would like to "simply be made aware of any water quality issues and left alone to handle my property" at a high level of agreement.

A mailing list of watershed residents is available from the survey, and lake district mailing lists are available from St. Croix County. There is no practical means to maintain an email list at the present time.

Goal I. Protect and enhance Bass Lake water quality to maintain its designation as an outstanding resource water.

Objective A. Reduce phosphorus loading to Bass Lake.
Evaluation. Model Total Phosphorus (TP) load reductions.

Objective B. 15 ug/L TP (in-lake Growing Season Mean-GSM). This level was found in Bass Lake from 1986-2001.
Evaluation. CLMN (Citizen Lake Monitoring Network) and LTT (Long Term Trends, WDNR) – use 5 year running GSM
2011-2015 = 19.0
2009 = 18.25

Objective C. Prevent the occurrence of algae blooms. In lake Chla: 3.5 ug/L (July 15 – Sept. 15)
Evaluation. CLMN and LTT Monitoring

Objective D. Sixty percent shoreland owners will reduce stormwater runoff to background levels.
Evaluation. Track BMP installations and estimate impacts.

Actions

1. Install stormwater runoff management practices at demonstration sites at neighboring properties.

    a. Establish a working committee of the Bass Lake Rehabilitation District to identify and guide initial demonstration sites and future projects.
    b. Identify funding source for Bass Lake demonstration sites technical assistance and installation.
    c. Establish demonstration sites: 3-5 adjacent residential properties for 1) "Urban Development" and 2) "Residential Forest" as identified in Figure 9. Consider sites where water quality work is needed (visits were completed in 2015, already restored (including those required by permit and other lakes), and natural sites.
    d. Perform site analysis to identify appropriate best management practices – introduce self-evaluation checklist to encourage owners to engage in problem solving.
    e. Use all "Healthy Lakes" practices including shoreland habitat and fish habitat. *Add soil health practice – restore infiltration capacity of the lawn by adding organic matter.*
    f. Provide technical assistance to develop designs and how-to information (DIY and/or landscapers)[21]

[21] Need to develop standards for BMP design (will 1" to 2" storm event meet WQ runoff objective? What about big rain events?)

g. Install practices (funding assistance to be determined).
h. Develop and use a standardized method to estimate and measure phosphorus reductions from BMP installation.
i. Monitor demonstration sites and report results.
j. Use standardized county best management tracking systems when available.

2. Implement stormwater runoff management practices at additional residential sites.

   a. Showcase demonstration sites and their water quality and habitat impacts – communicate call to action, share lessons learned.
   b. Offer site-analysis to encourage participation and identify appropriate BMPs. Involve demonstration site hosts and other lake leader volunteers in signing up additional owners for site analysis. Target Group 1 and 3 owners (see Figure 12) for potential projects.
   c. Involve owners by sharing self-evaluation checklist (or other tool).
   d. Provide technical assistance to develop designs and how-to information (DIY and/or landscapers).
   e. Consider providing funding for installation.

3. Engage lake residents in participating in stormwater runoff management practices.

   <u>Encourage participation with interactive, fun events</u>
   Babes on Bass Lake
   Neighborhood picnics and gatherings (fish sticks and ribs – surf and turf)
   Informal gatherings
   More emphasis at annual meetings

   <u>Use Bass Lake's Call to Action:</u>
   Phosphorus levels have increased over recent decades.
   If our lake isn't clean enough, we won't be able to turn the pump on when water levels increase!
   Climate change will result in bigger rainfall events and increased runoff and phosphorus loading to the lake.
   We can't do anything about the rain; we can do something about the runoff!

   <u>Be ready to respond to "focusing events"</u> – use appropriate timing to communicate important messages at newsworthy times.

4. Review St. Croix County and Town of St. Joseph and Somerset ordinances and make recommendations for changes to protect Bass Lake water quality. Low Impact Design standards (LIDs) are recommended for updates to Town and County ordinances. St.

Croix County is conducting a comprehensive review of ordinances beginning in 2016, and the BLRD can encourage water quality protection in these revisions.

5. Research the feasibility of using pump to remove phosphorus from Bass Lake.
The lake district will complete a cost-benefit analysis of pumping phosphorus loaded water from Bass Lake into the Willow River in cooperation with the WDNR. The Willow River is an impaired water, and there may be restrictions on pumping as a result.

6. Prepare a wastewater facilities management plan for the east side of Bass Lake.

Evaluation

Continue current water quality monitoring in Long Term Trends and Citizen Lake Monitoring Programs.

WDNR will continue annual water quality monitoring to show trends or changes. Water quality samples will be taken five times during the year: spring turnover, summer (three times) and fall turnover. CLMN data shows 3-4X/year. Expand Long Term Trends monitoring to include a bottom sample to assist with pump feasibility study in 2017.

Citizen Lake Monitoring Network volunteers will monitor temperature & dissolved oxygen profiles and water clarity (Secchi disk). (BLRD, LWCD)

Continue lake level monitoring. *Lake levels influence the water quality of Bass Lake.*

GOAL II. Protect and improve the diverse aquatic life of Bass Lake including a self-sustaining fishery and diverse aquatic plant community.

Objective A. Support a healthy bass fishery.
Evaluation. Healthy means moderate density with good growth: <75 /mile, 8" bass or greater

Objective B. Maintain a high quality pan fishery.
Evaluation. High quality means moderate abundance and good size structure – bluegills 8" and greater

Objective C. Lake residents protect and improve existing aquatic vegetation and woody habitat.

Actions.

1. Encourage lake residents to leave fallen trees and aquatic vegetation in the lake – especially important when lake levels recede from the shoreline during low water years.

2. Install 40 more fish cribs in the lake according to recommended goal of 100 cribs. Focus on high priority sites (9 locations) from priorities map and spreadsheet (2015 map or as updated).

3. Update/revise the woody habitat plan to include additional fish sticks and root wads. Develop a priority map for suitable sites.

4. Install fish sticks and root wads according to updated priority map. To solicit participation, combine demonstrations and outreach with water quality practices.
   For fish cribs and fish sticks projects:
   Drawings are needed for each landowner
   Permits are required

Evaluation.

Track number and location of cribs and fish sticks installed.

Continue Long Term Trends Monitoring for aquatic plants and fisheries on present schedule.

Fisheries. WDNR (fisheries staff) will conduct comprehensive fishery surveys on a rotational basis. Next sampling date: spring 2019. The survey will be repeated approximately every 8 years using statewide monitoring protocol to show trends and document changes. This data will be used to determine if specific fisheries objectives are being met including evaluating effectiveness of 14-18 slot size limit on bass implemented in 2013 (will need results from 2027 for full evaluation) and the 10 fish bag limit on pan fish implemented in 2008 (evaluate in 2019).

Aquatic plants. WDNR (water quality staff) will conduct aquatic plant survey each year. An annual survey is conducted because Bass Lake is part of the EWM weevil study.

GOAL III. Protect and restore healthy shoreland habitats.

Objective A. Homeowners maintain or develop buffers of natural vegetation adjacent to the shoreline.

Actions.

1. Encourage owners to restore shoreland buffers.
   a. Complete baseline WI shoreland habitat assessment methodology on Bass Lake.
   b. Combine demonstrations and outreach with water quality practices.
   c. Implement shoreland habitat demonstration projects.

2. Educate riparian land owners on the importance of shoreland vegetation.
   - Adapt education and management efforts to changing water levels.
   - Provide support for terrestrial invasive species identification and control in shoreland buffer areas.

Evaluation.

Repeat shoreland habitat assessment methodology at 5-year intervals.

GOAL IV. Prevent the introduction of and control and contain existing (aquatic and shoreland) invasive species.

Objective A. Prevent introduction of new aquatic invasive species (AIS) and contain existing AIS by informing lake users of proper prevention methods.

Actions.

1. Continue to implement the Clean Boats, Clean Waters Program.
   Notes:
   CBCW educates lake users, not just inspects boats
   Conduct with paid staff and volunteers from conservation groups
   Target peak times of landing use based on ILIDs data. Include Memorial Day and 4th of July blitzes.
   Staff landing at least 200 hours per year

2. Continue to install and operate ILIDs surveillance camera at the boat landing.

3. Work with St. Croix County Sheriff's Department to enforce Do-Not-Transport violations.

4. Develop and distribute a lake map with AIS messages.

5. Distribute additional AIS outreach materials.

6. Consider boat washing station and bait/plant disposal.

Objective B. Rapidly respond to new introductions of aquatic invasive species.

Actions.

7. Train (St. Croix County) and coordinate volunteer monitors.

8. Develop and update rapid response strategy (Board)

9. Consider professional monitoring for AIS.

10. Complete point intercept survey (WDNR – every 3 years)
    Note: WDNR may not always have funding to continue

Objective C. Prevent the re-establishment of Eurasian Water Milfoil.

Actions.

11. Protect the over-wintering habitat of the milfoil weevil by restoring and maintaining natural shorelines. (included with Goal I and III implementation)

12. Monitor effectiveness of milfoil weevils and northern water milfoil populations (WDNR).
    Note: WDNR may not always have funding to continue.

13. Consider additional EWM control measures if needed.

14. Encourage riparian landowners to leave native aquatic vegetation which serves as competition for invasive species.

Objective D. Be ready to control zebra mussels if measures become available.

Action.

15. Stay current with zebra mussel control options. Consider control methods when/if available.

GOAL V. Ensure safe and multifaceted recreational opportunities while preserving the natural lake environment.

Objective A. Provide appropriate and safe public lake access.

Actions.

1. Address excess parking on 153rd Avenue. *Revisit issue w/ with Town of Somerset, address lake car/trailer units and safety, encourage/pay for enforcement.*

2. Maintain the boat landing.

3. Renew boat landing lease. *The current WDNR lease to St. Croix County expires November 18, 2018. The lease allows the county to seek grants for and make boat landing improvements.*

4. Encourage lake residents to comply with limits for number/configuration of slips (docks) as allowed by state statute [Chapter 30, NR326]. *Place WDNR Pier Planner on web site/distribute via US mail.*

Objective B. Encourage safe boating on Bass Lake.

Actions.

5. Encourage lake residents to complete boater safety courses. *Include links to WDNR course on BLRD website. Consider ways to encourage course completion such as group classes/subsidies. Describe common violations/problems on web site and in mailings.*

6. Encourage boating regulation enforcement. Consider expanding water regulation enforcement by Lake District water patrol or County Sheriff.

Objective C. Enhance opportunities for quiet enjoyment such as non-motorized boating, wildlife watching, and swimming.

Actions.

7. Enforce the 8 p.m. - 8 a.m. slow-no-wake rules according to the Bass Lake ordinance.

8. Place slow-no-wake buoys according to the Bass Lake ordinance.

9. Maintain signage at the landing.

10. Support the development of low-impact recreation at the new county park adjacent to the boat landing.

Objective D. Preserve and enhance the opportunity to observe the beauty of the night sky.

Action.

11. Encourage behavior: If you install lights, use those that reduce glare in shoreland area.

Objective E. Provide diverse fishing opportunities through walleye stocking.

12. Support WDNR extended growth walleye stocking on an alternate year basis.

Table 1. Implementation Charts 2016-2019

IMPLEMENTATION CHART

Goal I. Protect and enhance Bass Lake water quality to maintain its designation as an outstanding resource water.

Objective A. Reduce phosphorus loading to Bass Lake.

Objective B. 15 ug/L TP (In-Lake Growing Season Mean-GSM)

Objective C. Prevent the occurrence of algae blooms.

Objective D. 60 percent shoreland owners will reduce stormwater runoff to background conditions

Actions[1]	Timeline	$ Estimate	Vol. Hours (annually)	Responsible Parties/ Partners[2]	Funding Sources	Comments
1. Install neighborhood demonstration projects.						
a. Demonstration site committee b. Identify funding sources.	2016 2017	$500 - $1,000 $3,500	20	BLRD John Reiling/Tim Jessen	WDNR Lake Small Scale Planning Grant	Costs for grant writing and consultant support to committee
c. Identify demonstration sites with willing owners.	2016/17		40	John Reiling/Tim Jessen	WDNR Lake Small Scale Planning Grant	Planning grant due 12/10/16
d. Perform site analysis to identify practices. e. Use all Healthy Lakes practices and soil health.	2017	$3,000	20	Harmony Environmental	WDNR Lake Small Scale Planning Grant	Planning grant due 12/10/16
f. Provide technical assistance to develop designs.	2017	$8,000		Consultant St. Croix County	WDNR Lake Planning Grant WDNR Lake Protection	Planning grant due 12/10/17, Protection grant due 2/01/17
g. Install demonstration projects (10 sites).	2017/18	$30,000			WDNR Lake Protection	Deadline: 2/01/17
h. Develop system to estimate and measure phosphorus reduction.	2017/18	$30,000		Town of St. Joseph St. Croix County	St. Croix River Crossing Growth Management	Could also include in Lake Protection grant

[1] See previous pages for action item detail. Estimates are for annual budgets once implementation begins.

[2] WDNR = Wisconsin Department of Natural Resources

IMPLEMENTATION CHART

Goal I. Protect and enhance Bass Lake water quality to maintain its designation as an outstanding resource water.

Objective A. Reduce phosphorus loading to Bass Lake.

Objective B. 15 ug/L TP (In-Lake Growing Season Mean-GSM)

Objective C. Prevent the occurrence of algae blooms.

Objective D. 60 percent shoreland owners will reduce stormwater runoff to background conditions

Actions[1]	Timeline	$ Estimate	Vol. Hours (annually)	Responsible Parties/ Partners[2]	Funding Sources	Comments
i. Monitor demonstration sites and report results.	2018	$1,000	20	BLRD	WDNR Lake Protection Grant	
j. Use standardized county best management tracking system when available.	2019			SCC BLRD		County BMP tracking systems are under development.
2. Install practices at additional sites.					WDNR Lake Protection Grant	
a. Showcase 10 demonstration sites.[3]	2018/19		40	Site Committee	WDNR Lake Protection Grant	A WDNR Lake Planning Grant could also be used for some of these tasks.
b. Offer site evaluation for potential new sites and projects. c. Share self-evaluation checklist.	2018/19	$3,000	20	Consultant St. Croix County	WDNR Lake Protection Grant	
d. Provide technical assistance to develop designs.	2019	$8,000		Consultant St. Croix County	WDNR Lake Protection Grant	
e. Provide funding for installation (to be considered).	2019	$30,000		BLRD Homeowners	WDNR Lake Protection Grant	

[3] Highlighted actions address education and outreach to lake residents.

IMPLEMENTATION CHART

Goal I. Protect and enhance Bass Lake water quality to maintain its designation as an outstanding resource water.

Objective A. Reduce phosphorus loading to Bass Lake.

Objective B. 15 ug/L TP (In-Lake Growing Season Mean-GSM)

Objective C. Prevent the occurrence of algae blooms.

Objective D. 60 percent shoreland owners will reduce stormwater runoff to background conditions

Actions[1]	Timeline	$ Estimate	Vol. Hours (annually)	Responsible Parties/ Partners[2]	Funding Sources	Comments
3. Engage lake residents in water quality projects.	2018/19			Site Committee and BLRD	WDNR Lake Protection Grant	
a. Host events.	2018/19	$500	40	BLRD	WDNR Lake Protection Grant	
b. Distribute messages via web and mailings.	2017-19	$1,000	40	BLRD	WDNR Lake Planning Grant	
4. Review St. Croix County and Town of St. Joe ordinances and make recommendations.						Initiated in planning process including potential development map.
a. Review St. Croix County ordinances for water quality protection: create stormwater ordinance, investigate opportunities in zoning ordinance.	RFQ: August 2016 Complete end of 2018	$500,000		SCC Community Development BLRD	St. Croix River Crossing Growth Management Funding	Encourage LID[4] standards. Identify and incorporate standards to protect water quality by reducing loading to background levels.
b. Incorporate LID standards into Town of St. Joseph ordinances.	End of 2017	$1,500	200	Town of St. Joseph Planning Commission Town Board BLRD	Town of St. Joseph	Encourage LID standards. Coordinate with County

[4] LID = Low Impact Development

IMPLEMENTATION CHART

Goal I. Protect and enhance Bass Lake water quality to maintain its designation as an outstanding resource water.

Objective A. Reduce phosphorus loading to Bass Lake.

Objective B. 15 ug/L TP (In-Lake Growing Season Mean-GSM)

Objective C. Prevent the occurrence of algae blooms.

Objective D. 60 percent shoreland owners will reduce stormwater runoff to background conditions

Actions[1]	**Timeline**	**$ Estimate**	**Vol. Hours (annually)**	**Responsible Parties/ Partners**[2]	**Funding Sources**	**Comments**
5. Research feasibility of using pump to remove phosphorus.	2017	$2,000	40	BLRD WDNR Consultant	St. Croix River Crossing Growth Management Funding	Scope to be determined
6. Prepare a wastewater facilities management plan for the east side of Bass Lake.				BLRD Town of St. Joseph Consultant	St. Croix River Crossing Growth Management Funding	
Evaluation. Continue LTT and CLM lake monitoring programs.	Ongoing	$1,500	50	WDNR BLRD	Lake Protection Grant	Purchase DO Meter.
Evaluation. Lake level monitoring.	Ongoing	$0	20	BLRD St. Croix County		Lake levels influence the quality of the water and management of Bass Lake.

IMPLEMENTATION CHART

Goal II. Protect and improve the diverse aquatic life of Bass Lake including a self-sustaining fishery and diverse aquatic plant community.

Objective A. Support a healthy bass fishery.

Objective B. Maintain a high quality pan fishery.

Objective C. Lake residents protect and improve existing aquatic vegetation and woody habitat.

Actions[5]	**Timeline**	**$ Estimate (annually)**	**Vol. Hours (annually)**	**Responsible Parties Partners**[6]	**Funding Sources**	**Comments**
1. Encourage lake residents to leave fallen trees and aquatic vegetation in the lake.	Ongoing		10	BLRD	WDNR Lake Planning Grant	
2. Install 40 more fish cribs.	2018	$3,000	80	BLRD/WDNR, SCC Alliance of Sports Clubs, Star Prairie Fish and Game, SCC Resource Management and Parks, USFWS	WDNR, BLRD, SCC Alliance of Sports Clubs, Star Prairie Fish and Game, SCC Resource Management and Parks, USFWS	Based on WDNR lead: new Fisheries Biologist
3. Update woody habitat plan.	2018			BLRD/WDNR Consultant	WDNR Lake Planning Grant	
4. Install fish sticks and root wads according to updated map.	2019			BLRD/WDNR Consultant	WDNR Healthy Lakes See list for Action 2	Need additional technical assistance for design.
Evaluation. Track number and location of cribs and fish sticks installed.	Ongoing			BLRD WDNR	WDNR Lake Planning Grant	
Evaluation. Continue LTT monitoring for aquatic plants.	2019 - Every 3 years			WDNR	WDNR	

[5] See previous pages for action item detail. Estimates are for annual budgets once implementation begins.
NA= Not applicable
Highlighted actions address education and outreach to lake residents.
[6]WDNR = Wisconsin Department of Natural Resources

IMPLEMENTATION CHART

Goal II. Protect and improve the diverse aquatic life of Bass Lake including a self-sustaining fishery and diverse aquatic plant community.

Objective A. Support a healthy bass fishery.

Objective B. Maintain a high quality pan fishery.

Objective C. Lake residents protect and improve existing aquatic vegetation and woody habitat.

Actions[5]	**Timeline**	**$ Estimate (annually)**	**Vol. Hours (annually)**	**Responsible Parties Partners**[6]	**Funding Sources**	**Comments**
Evaluation. Continue Long Term Trends Monitoring for fisheries to evaluate bass slot size limit and panfish bag limit.	2019			WDNR	Sport Fish Restoration	Subject to funding availability

IMPLEMENTATION CHART

GOAL III. Protect and restore healthy shoreland habitats.

Objective A. Homeowners maintain or develop buffers of natural vegetation adjacent to the shoreline.

Actions[7]	**Timeline**	**$ Estimate (annually)**	**Vol. Hours (annually)**	**Responsible Parties**[8]	**Funding Sources**	**Comments**
1. Encourage owners to restore shoreland buffers.						
a. Complete baseline WI shoreland habitat assessment for Bass Lake.	2017		20	WDNR BLRD SCC	WDNR Or Lake Protection Grant if not WDNR led	
b. Combine demonstrations and outreach with water quality practices. c. Implement demonstration projects.	2017-2019				WDNR Lake Protection Grant	See Goal I. Action 1 and 2
2. Educate riparian owners on the importance of shoreland vegetation.	2017-19				WDNR Lake Protection Grant	
Evaluation. Repeat shoreland habitat assessment at 5 year intervals.	2022			WDNR BLRD SCC	WDNR Lake Protection or Planning Grant	Subject to funding availability

[7] See previous pages for action item detail. Estimates are for annual budgets once implementation begins. Highlighted actions highlighted address education and outreach to lake residents.

[8] WDNR = Wisconsin Department of Natural Resources

IMPLEMENTATION CHART

GOAL IV. Prevent the introduction of and control and contain existing (aquatic and shoreland) invasive species.

Actions[22]	**Timeline**	**$ Estimate (annually)**	**Vol. Hours (annually)**	**Responsible Parties**[23]	**Funding Sources**	**Comment**
Objective A. Prevent introduction of new aquatic invasive species (AIS) and contain existing AIS by informing lake users of proper prevention methods.						
1. Clean Boats, Clean Water Program	Ongoing	$4,000	100	BLRD	WNDR Clean Boats, Clean Waters	
2. ILIDs Camera 3. Work with Sheriff's Department for enforcement.	Ongoing	$1,800	25	BLRD Environmental Sentry	BLRD	
4. Develop and distribute lake map and AIS information. 5. Distribute additional AIS materials.	2017 Ongoing	$2,000		BLRD	WDNR AIS AEPP	
6. Consider boat washing station and bait/plant disposal.	2017			WDNR BLRD SC County	WDNR AIS AEPP	Request WDNR mobile station
Objective B. Rapidly respond to new introductions of aquatic invasive species.						
7. Train, coordinate and monitor with volunteer monitors.	Annually		80	SCC BLRD WDNR		
8. Update rapid response strategy.	Annually		5	BLRD WDNR SCC		Link to more detailed WI response strategy
9. Consider professional monitoring for AIS.	As needed			BLRD		If WDNR no longer completes plant survey.
10. Complete aquatic plant point intercept survey.	2019			WDNR		Completed every 5years.

IMPLEMENTATION CHART

GOAL IV. Prevent the introduction of and control and contain existing (aquatic and shoreland) invasive species.

Actions[22]	**Timeline**	**$ Estimate (annually)**	**Vol. Hours (annually)**	**Responsible Parties**[23]	**Funding Sources**	**Comment**
Objective C. Prevent re-establishment of Eurasian Water Milfoil.						
11. Protect over-wintering habitat of milfoil weevil by restoring and maintaining natural shorelines.						Included with Goal 1, Action 1 and 2 implementation.
12. Monitor effectiveness of milfoil weevils and northern water milfoil populations.	Annually			WNDR		WNDR may not always have funding for weevil monitoring.
13. Consider addition EWM control measures.	If needed			BLRD		
14. Encourage landowners to leave native aquatic vegetation.	Ongoing			BLRD		
Objective D. Be ready to control zebra mussels if measures become available.						
15. Stay current with zebra mussel control options.	Ongoing					

IMPLEMENTATION CHART

GOAL V. Ensure safe and multifaceted recreational opportunities while preserving the natural lake environment.

Actions[9]	**Timeline**	**$ Estimate (annually)**	**Vol. Hours (annually)**	**Responsible Parties**[10]	**Funding Sources**	**Comments**
Objective A. Provide appropriate and safe public lake access.						
1. Address parking on 153rd Avenue.	2017		5	BLRD Town of Somerset Sheriff's Dept.		
2. Maintain the boat landing.	Ongoing	$5,000		SCC		
3. Renew the boat landing lease.	2018	$0		SCC WDNR		Expires 11/18/18
4. Encourage lake residents to comply with pier planner.	Ongoing		5	BLRD WDNR		Provide link on website
Objective B. Encourage safe boating on Bass Lake.						
5. Encourage completion of boater safety courses. Describe common violations and problems.	Ongoing		5	BLRD WDNR		Host group classes. Share info on web and in mailings.
6. Encourage boating regulation enforcement by Lake District water patrol or County Sheriff.	Ongoing			BLRD WDNR SCC Sheriff		

[9] See previous pages for action item detail. Estimates are for annual budgets once implementation begins.
[10] WDNR = Wisconsin Department of Natural Resources

IMPLEMENTATION CHART

GOAL V. Ensure safe and multifaceted recreational opportunities while preserving the natural lake environment.

Actions[9]	**Timeline**	**$ Estimate (annually)**	**Vol. Hours (annually)**	**Responsible Parties**[10]	**Funding Sources**	**Comments**
Objective C. Enhance opportunities for quiet enjoyment such as non-motorized boating, wildlife watching, and swimming.						
7. Enforce slow-no-wake ordinance.	Ongoing	$4,500		BLRD		BLRD Water Patrol
8. Place slow-no-wake buoys according to ordinance.	Annually	$200		BLRD		
9. Maintain signage at the boat landing.	Ongoing	$100	5	BLRD SCC Parks		
10. Support development of new county park.	2018-19		10	SCC Parks BLRD		
Objective D. Preserve and enhance the opportunity to observe the beauty of the night sky.						
11. Encourage behavior: If you install lights, use those that reduce glare in shoreland area.	Ongoing			BLRD		
Objective E. Provide diverse fishing opportunities through walleye stocking.						
12. Stock extended growth walleye.	Even years only			WDNR	Sport Fish Restoration WI Walleye Initiative	7,400 per stocking event
Evaluation. Continue LTT monitoring.	2019			WDNR	Sport Fish Restoration WI Walleye Initiative	Evaluate success or failure of stocking