Balsam Lake Long Range Plan

Balsam Lake Protection and Rehabilitation District

August 2012

Prepared by Harmony Environmental

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Prepared by Harmony Environmental

A Message from the BLPRD Commissioners

We want our Balsam Lake to be healthy so we can enjoy its natural beauty and use it for recreational activities. But more than that, we feel a sense of stewardship – a responsibility to protect and restore the integrity of the lake's ecosystem. To meet our lake management goals, we must develop a set of ethics for our interactions with the lake. Unless we are willing to limit the type and location of shoreline buildings we construct, the amount of shoreline we clear, and carefully consider the ways we use the lake, it may no longer provide the benefits we enjoy.

Plan Purpose:

Provide for recreational uses while minimizing impacts to the Balsam Lake ecosystem.

This long range plan updates a plan originally developed in 2006. The plan draws upon the history of activities and studies the BLPRD and other groups have undertaken to protect and manage Balsam Lake. It includes physical information about the lake and its watersheds and describes management efforts that have been undertaken to date. The goals, objectives, and activities described in the plan set a course of action for the future. We need your participation and welcome your input as we move forward with plan implementation.

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Introduction

The Lake District Charter: Inland Lake Protection and Rehabilitation Districts

A public inland lake protection and rehabilitation district is a special unit of government formed under Chapter 33 Wisconsin State Statutes. Property owners living within the district boundaries may be assessed fees as part of the property tax levy. The lake district is not a general purpose unit of government like a town or county that must deal with a broad range of issues ranging from fire protection to road repairs. Instead, it addresses lake management issues. A lake district is empowered to operate on its own initiative, independent of its creating entity and the state, but subject to local ordinances and state law. Lake districts can act together with other municipalities and agencies to undertake lake protection and rehabilitation projects.

The Balsam Lake Protection and Rehabilitation District (BLPRD) formed in 1976. A lake feasibility study was one of the first activities of the newly formed lake district. The BLPRD became a sanitary sewer district in July of 1999 to provide the powers needed to pursue a municipal sewer system and to inspect private septic systems within the district.

Lake District General Management Powers

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

Balsam Lake History

Balsam Lake Early Development

Chippewa Indians lived along the shores of Balsam Lake when Caucasian settlers arrived in the area. Initial development of the Balsam Lake area centered around construction of a dam, mill, and boarding house. The mill was used to make shingles in early years, and logs were floated down the Balsam Branch to Sucker Lake (now Lake Wapogasset) as early as 1846. A lumber mill was constructed at the dam in 1856.[1]

Balsam Lake Dams

The first Balsam Lake dam was constructed where County Highway I now passes between Balsam Lake and the Mill Pond. This dam was reconstructed in 1941. A lower Balsam Lake dam was built at the outflow of the Mill Pond in the 1860's and rebuilt in approximately 1893. The dam was deeded from Northwestern Wisconsin Electric Company to the Village of Balsam Lake in 2000. Electricity is no longer produced at the dam. The Village of Balsam Lake now operates the dam and maintains the area around the dam. The BLPRD contributes $10,000 each year to a management fund that Northwestern Electric also contributed to.

The lower or Mill Pond dam is the only dam presently in use. The lower dam holds the lake about 10 feet higher than natural water levels before dam construction. Lake water levels are maintained between 92.60 and 94.30 as established by DNR and based on a benchmark at the dam.[2] The BLPRD installed four lake level gauges to assist in maintaining the proper lake level in 2004. The Village of Balsam Lake owns 39 acres near the dam.

[1] Information written by Chester W. Haskins, 1882 in a compilation of *Polk County History* edited by Timothy L. Ericson. Published by the Polk County Historical Society. November 1980.
[2] Email from Dan Harrington, DNR Water Regulations Specialist. December 19, 2005.

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

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 Balsam Acres
Animals removed from farm and ended farming operations

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 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

2006 Long Range Plan completed

2005 Peterson property acquired in the Stumps area

2007 Clean Boats, Clean Waters Program began

2008 Waterfront Runoff Program began

2010 Aquatic Plant Management Plan updated

2011 Soltau Property acquired in Stumps area

Balsam Lake Management Goals

The following goals will guide BLPRD management efforts around Balsam Lake.

Top Priority

Goal 1. Enhance Balsam Lake property owners' and visitors' understanding of lake issues and increase their involvement in protecting and improving the lake.

Top Priority

Goal 2. Manage native and invasive aquatic plants according to the goals, objectives, and activities outlined in the Aquatic Plant Management Plan.

Top Priority

Goal 3. Improve and maintain water clarity and quality in Balsam Lake.

Goal 4. Protect, maintain, and improve fisheries and fish and wildlife habitat in and around Balsam Lake.

Goal 5. Promote the preservation and restoration of natural vegetation and scenery along the shoreline.

Goal 6. Maintain and enhance recreation and navigation.

An aquatic plant management plan was prepared for the BLPRD in 2010. The plan is summarized on page 37. Aquatic plant management plan goals are shown below.

Aquatic Plant Management Goals (2010)

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

2. Prevent the introduction of aquatic invasive species.

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

4. Increase lake residents' and visitors' understanding of aquatic plants and management.

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

Assessing Needs and Identifying Problems

Concerns of District Members

Concerns of district members were gathered in a variety of ways. Methods included public input to commissioners, advisory committee meetings, and a property owner survey. Results of these efforts are included in Appendix A. The input received guided the formation of goals, objectives, and activities for this long range plan.

Property Owner Survey

A survey of lake residents was completed in February 2010. The results of the survey are discussed below and are found in Appendix A.

Popular lake activities are rated in Figure 1 by degree of participation from 0 (none) to 4 (a great deal). Enjoying the view, appreciating peace and tranquility, and observing wildlife are the highest ranked activities (3.69, 3.48, and 3.13 respectively). Motor boating and swimming follow with rankings of 2.82 and 2.33 respectively.

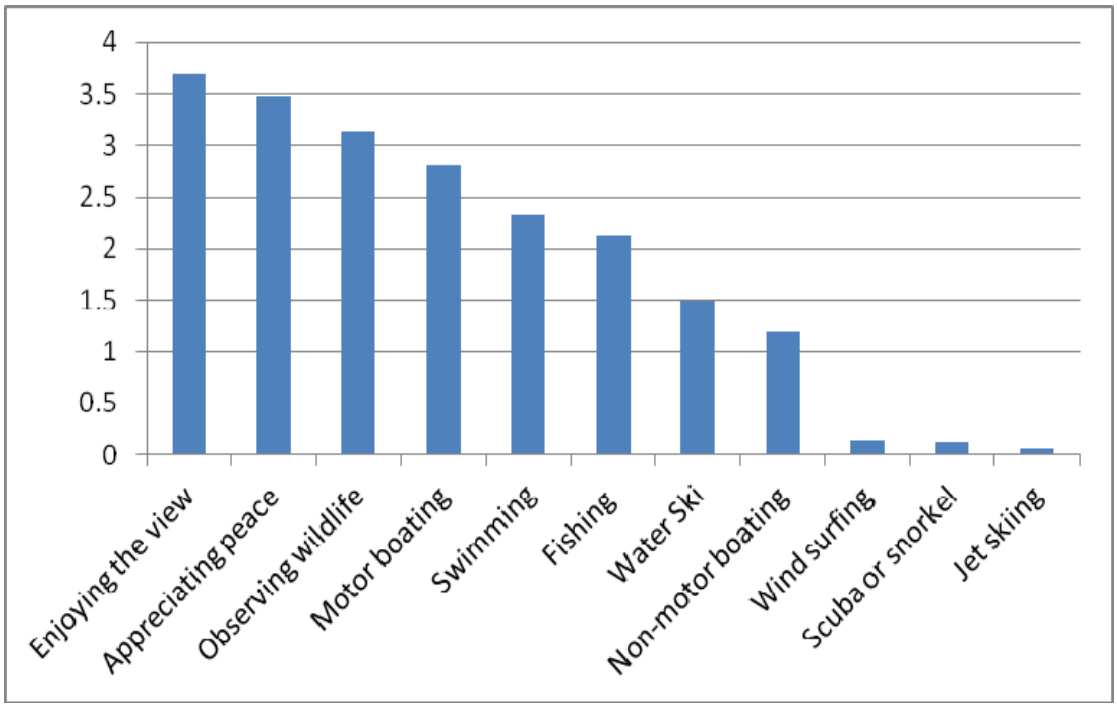

Figure 1. Degree of Participation in Lake Activities

Additional survey results indicate 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 rank above native plant growth (these are the top three negative impacts on the lake).

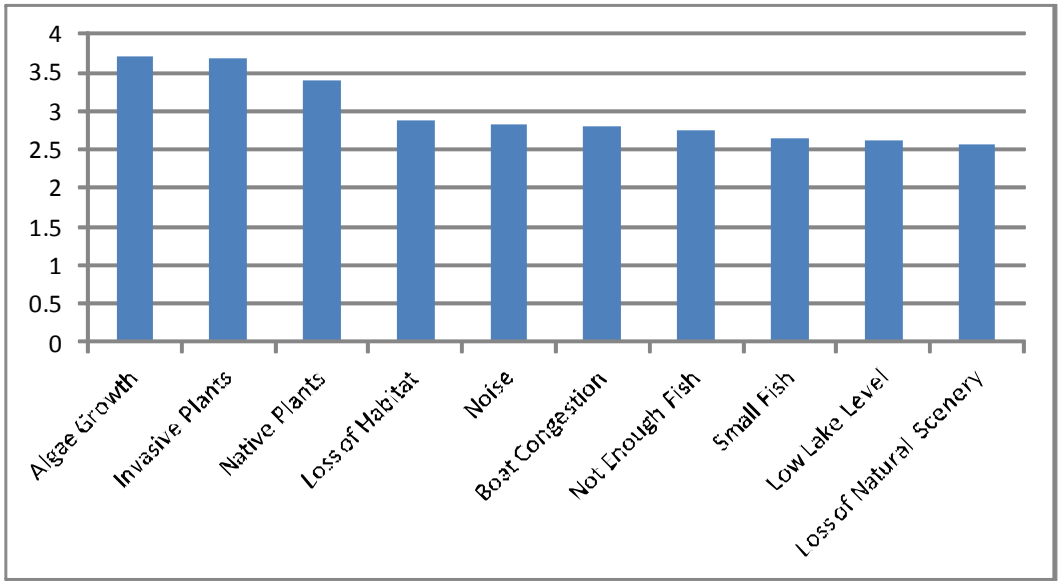

Figure 2. Lake Resident Reported Negative Impacts to Use of the Lake

Advisory Meetings and Questionnaire

An advisory committee consisting of BLPRD commissioners, citizen volunteers, and Polk County and DNR advisors provided input for plan development. Background information gathered for the plan was sent to this committee along with a questionnaire to solicit their input. A series of committee meetings followed. The committee met on January 25 to review questionnaire results, discuss previous plan goals and activities, and select priorities for further discussion. At a second meeting on February 15 the committee further reviewed goals and selected activities and were presented information about the results of the recent water quality study. At a third meeting on April 15th, which followed an opportunity to comment on goals and activities drafted to date, the group reviewed questions raised in comments and prioritized activities. All meetings were held at the Balsam Lake Business Center. Meeting notes are included in Appendix A.

Plan Survey

A summary of the draft plan was distributed in early summer 2012 with resident input requested in the form of a one-page survey. Feedback received from this survey is included in Appendix A.

Combined Results: Advisory Group and Commissioners - 2012

Top Resource Concerns

- ✓ Protecting water clarity
- ✓ Lack of clarity in East Balsam
- ✓ Aquatic invasive species

Priority Balsam Lake Causes of Impacts

- ✓ Aquatic invasive species
- ✓ Residential fertilizer and pesticide use
- ✓ Waterfront development and runoff
- ✓ Agricultural fields: soil erosion and fertilizer and pesticide use

Priority Recommended Activities

- ✓ Prevent aquatic invasive species introduction
- ✓ Monitor water quality
- ✓ Monitor for invasive species
- ✓ Environmental education programs for children and adults
- ✓ Prevent and provide information to reduce residential runoff (don't pay)
- ✓ Be involved in planning and zoning
- ✓ Use herbicides to control invasive aquatic plants
- ✓ Protect sensitive aquatic habitat areas
- ✓ Study release of phosphorus from lake sediments

Balsam Lake Today

The Lake

Balsam Lake has a surface area of 2,054 acres and a maximum depth of 37 feet. The average depth is 16.8 feet. A map of the lake is included as Figure 3. Little Narrows in the northwestern part of the lake and Big Narrows in the eastern part separate the lake into three basins. The areas of the northwestern basin (Little Balsam Lake), the main basin, and the eastern basin are about 86 acres, 1,270, and 550 acres respectively.[3] 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 Lake. Harder Creek flows from Half Moon Lake into Stump Bay.

Balsam Lake is a high-use lake for fishing, and is the location for professional and amateur fishing tournaments. 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 (N), and the Town of Milltown landing on Little Balsam.

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.

[3] *Water and Phosphorus Budgets and Trophic State, Balsam Lake, Northwestern Wisconsin.* 1987 – 1989. U. S. Geological Survey. Water Resources Investigations Report 91-4125.

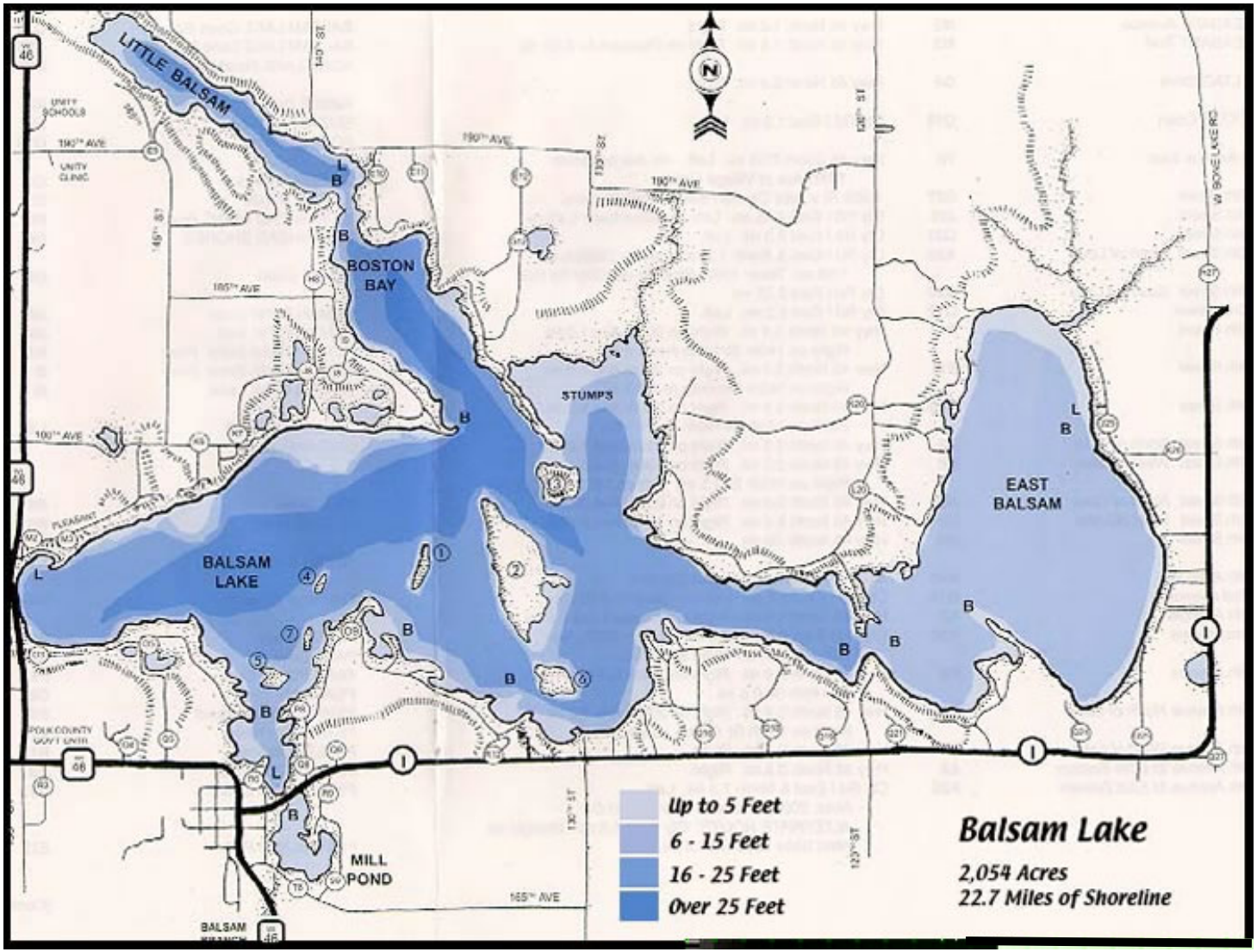

Figure 3. Map of Balsam Lake

Population Dynamics

Balsam Lake and its watersheds are located in central Polk County, Wisconsin mostly in the towns of Milltown and Balsam Lake, and the villages of Milltown and Balsam Lake. The area experienced steady population growth from 1970 to 2005, although growth has slowed in recent years as illustrated in Figure 4.

Population records include only permanent residents and do not reflect increases in residential development for seasonal housing. Most seasonal housing is concentrated around waterfront. Balsam Lake has about 825 residences. Of these residences, over 80 percent are occupied only seasonally.

Records of new septic permits capture the amount of residential development occurring in the watershed. Figure 5 illustrates this growth from 2000 through 2010 both in the watershed and in the lake district. In this time period, there was an average of 21 homes constructed with a new septic system each year in the watershed and an average of 4 homes constructed with a new septic system each year in the lake district. Construction slowed beginning in 2006.[4]

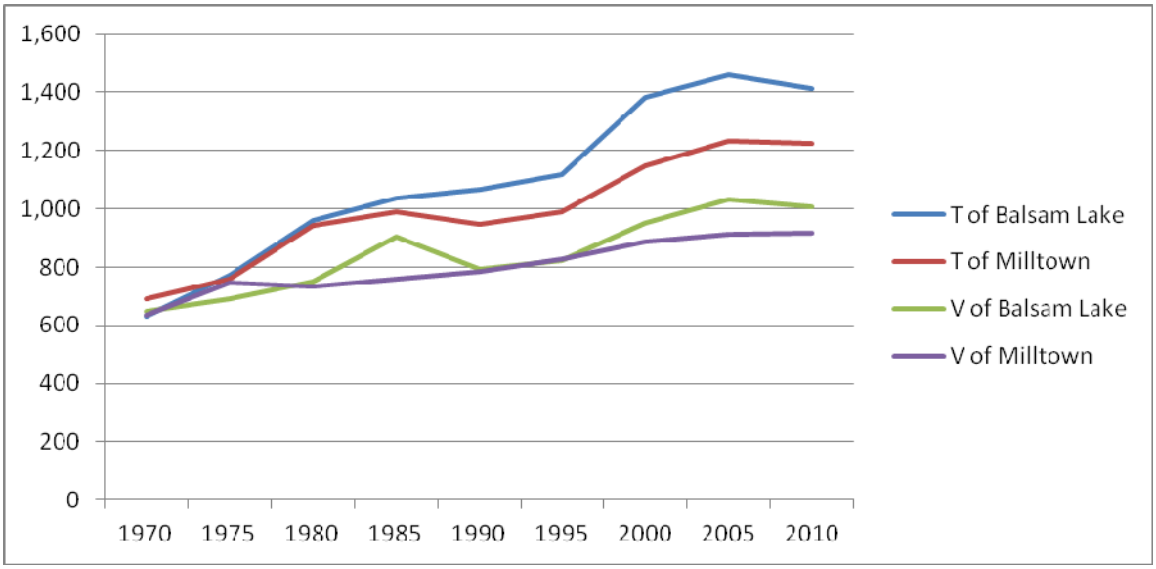

Figure 4. Balsam Lake Area Population Change

[4] Information provided by Polk County Zoning. November 15, 2011.

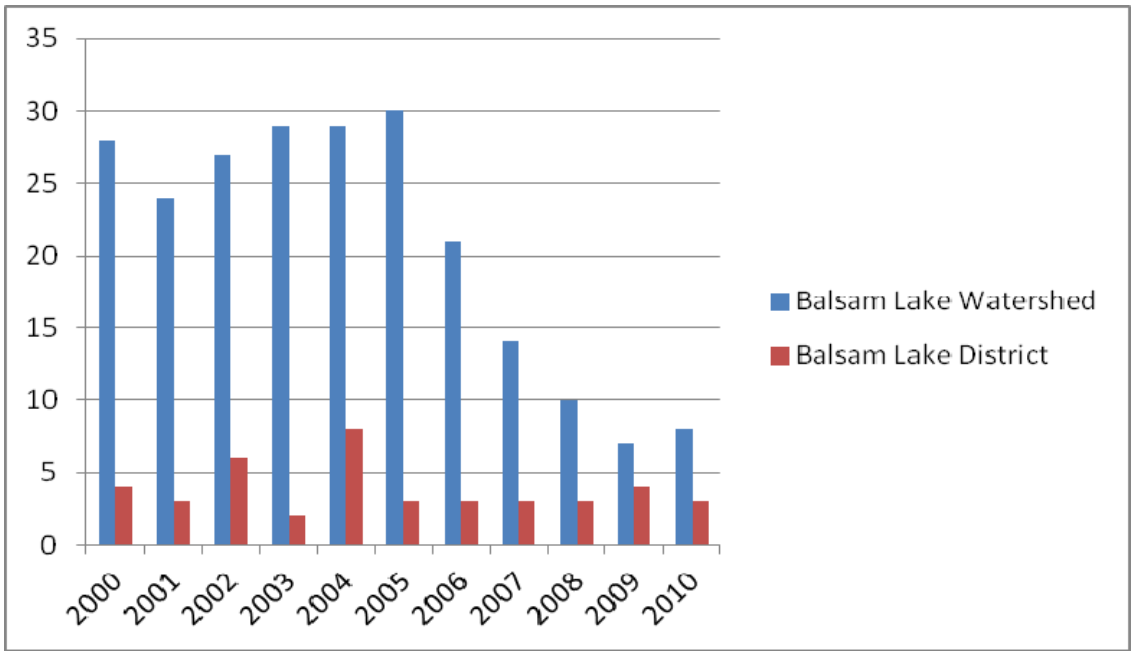

Figure 5. New Septic Permits: Balsam Lake Watershed and Lake District

Water Quality

Water and total-phosphorus budgets assist in understanding nutrient and water dynamics that influence algae and aquatic plant growth. Water and total-phosphorus budgets were assessed for Balsam Lake in 2010.[5] The lake was divided into six areas for the purposes of this study. They are identified by commonly used names in the table below.

Trophic state describes the degree of nutrient enrichment of a lake. Trophic states can be calculated using total phosphorus concentration, chlorophyll a levels, and secchi disc depth measurements. Oligotrohpic lakes are nutrient-poor with little growth of plants and algae. Mesotrophic lakes have intermediate nutrient levels and only occasional algae blooms. Lakes with high nutrient levels are considered eutrophic lakes. Eutrophic lakes have low light transparency, high phosphorus concentrations, and high levels of algae growth (as measured by chlorophyll a levels). Hypereutrophic lakes have severe algae blooms and very low water clarity.

Table 1. 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

In general, Balsam Lake has clear water in the spring with increasing growth of algae and declining water clarity in the summer months and into the fall.

Figure 6 illustrates the progression of total phosphorus concentrations in each basin in the summer of 2010.

7 illustrates the progression of chlorophyll a concentrations – a measure of algae production.

The 2011 study concludes that because the lake does not meet the phosphorus threshold

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

for an impaired lake in Wisconsin, water quality problems are not experienced. The 2010 overall average summer lake phosphorus concentrations indicate that Balsam Lake is mildly eutrophic, while the basins other than East Balsam are mesotrophic. However, when chlorophyll a is used to measure trophic state, basins are all mildly eutrophic.[6] East Balsam has the highest nutrient levels and lowest water clarity of any of the lake basins. Little Balsam has shown significant improvement in water clarity in recent decades. Detailed results for each basin are found in the Barr study.

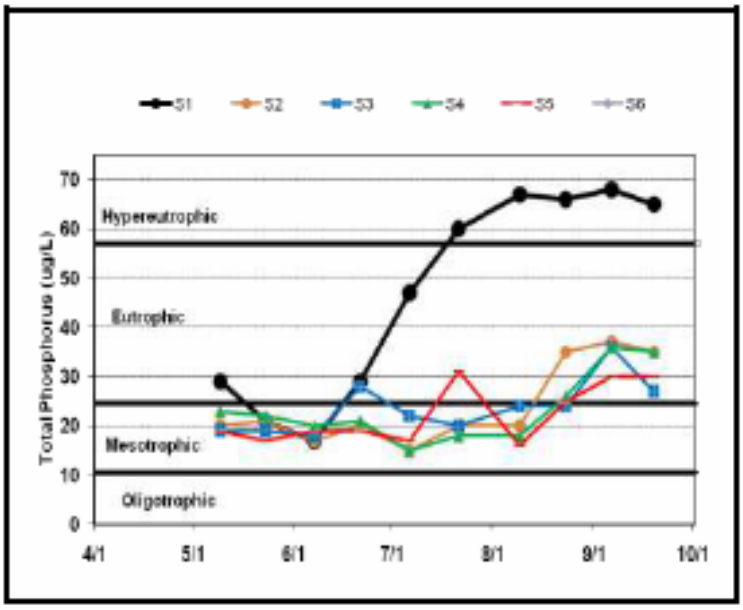

Figure 6. Balsam Lake Surface Total Phosphorus 2010 (from Barr 2011)

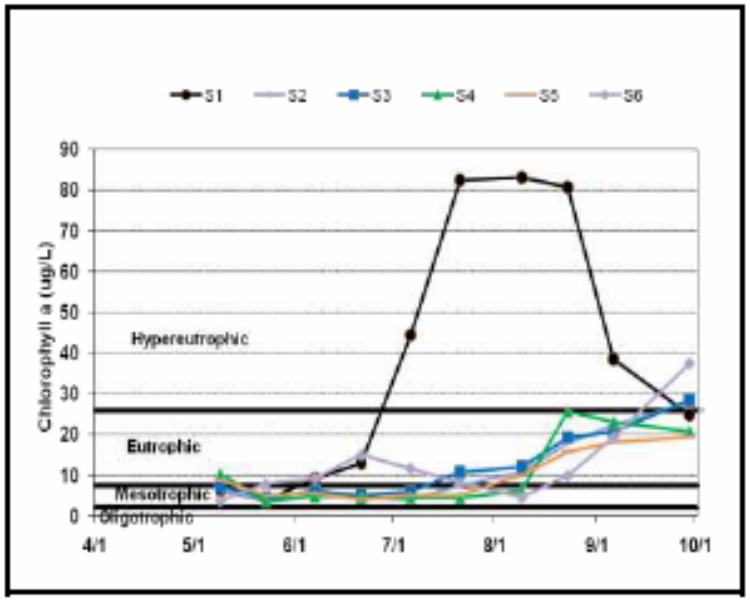

Figure 7. Balsam Lake Surface Chlorophyll a 2010 (from Barr 2011)

[6] *Balsam Lake Water Quality Study*. Prepared for BLPRD. Barr Engineering. June 2011.

Citizen Lake Monitoring Results

Volunteers have collected secchi depth measurements in three locations in Balsam Lake since 1987. These include East Balsam, the Main Basin and Little Balsam. Additional lake data including total phosphorus and chlorophyll have been supported by DNR in the Main Basin and East Balsam since 2009.[7] These measurements provide an important historical record of lake water clarity. The following graphs, from the Department of Natural Resources web site, illustrate changes in lake summer water clarity over the years. Water clarity is highest in the main basin.

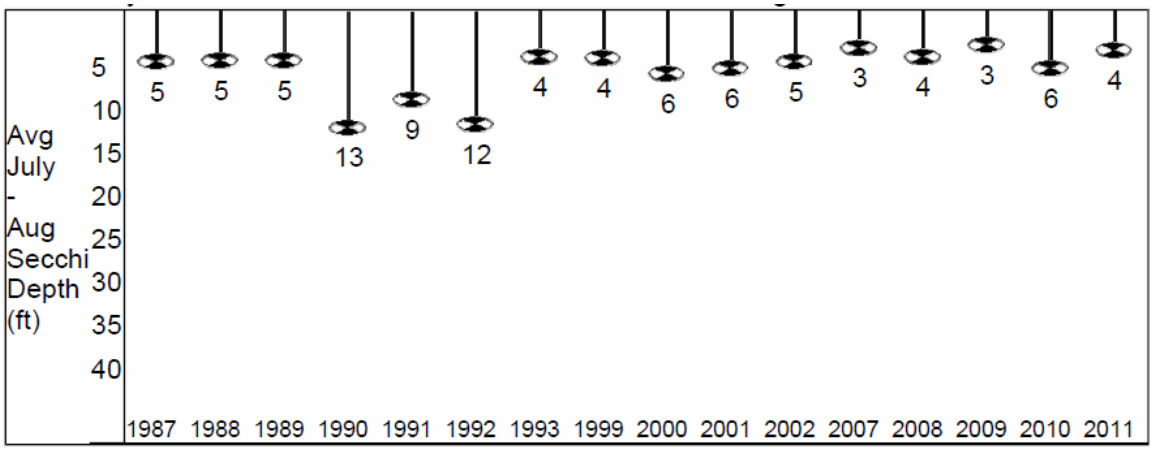

Figure 8. East Balsam (S-1) Secchi Disc Transparency

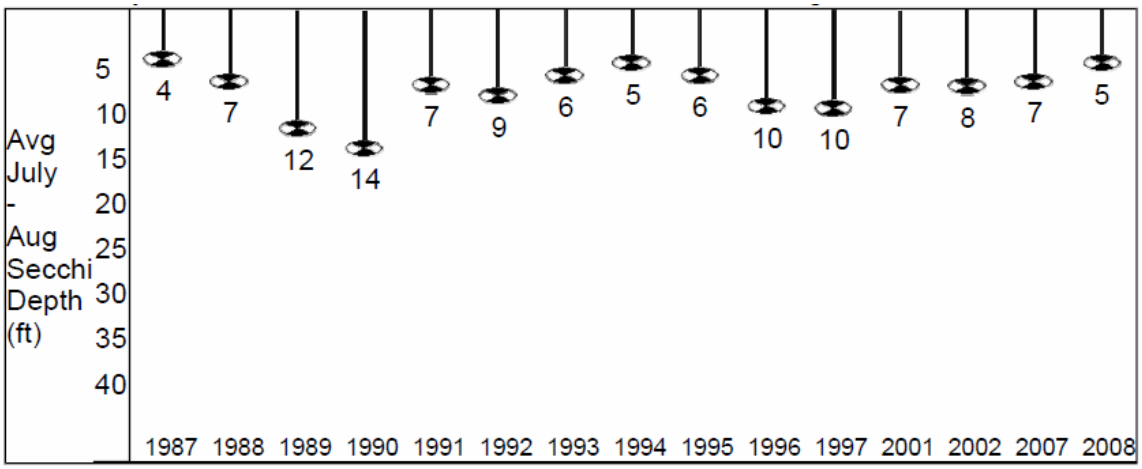

Figure 9. 1987-2008 Main Balsam (S-3) Secchi Disc Transparency

[7] According to Kris Larsen, DNR, locations could be added where secchi depth is measured upon request. Water chemistry could be requested in subsequent years.

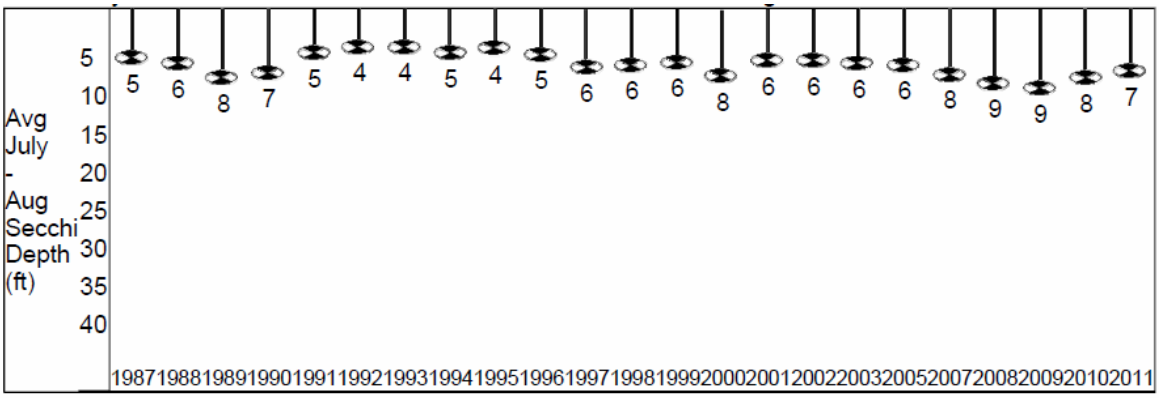

Figure 10. Little Balsam (S-6) Secchi Disk Transparency

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. 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 1. Balsam Lake Basin Water Quality Summary*. 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.

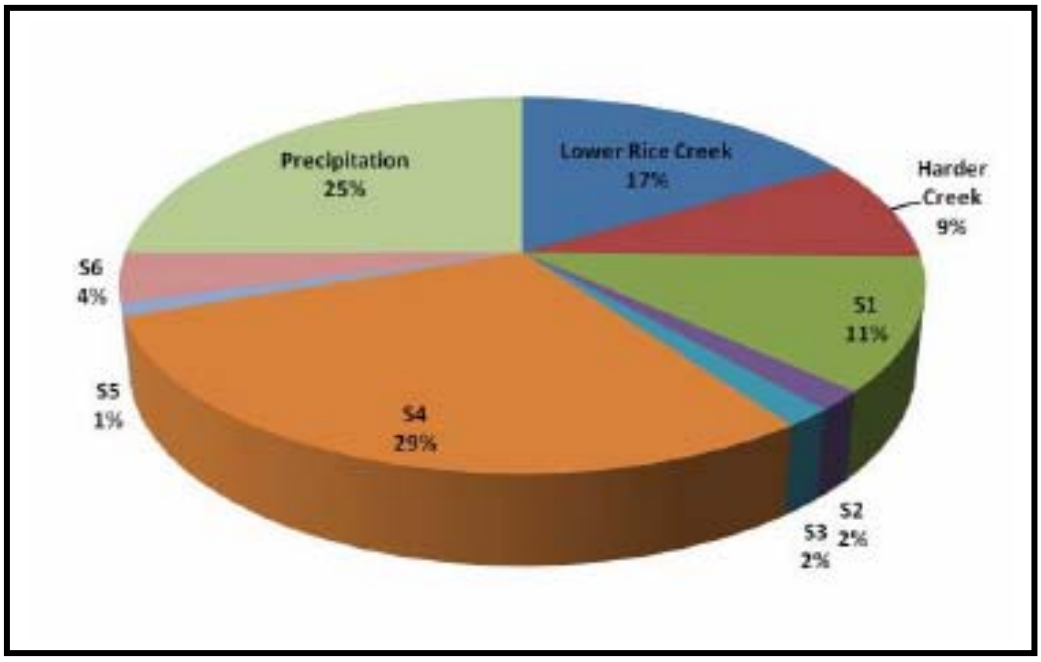

Figure 11. Sources of Water to Balsam Lake (from Barr 2011)

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.

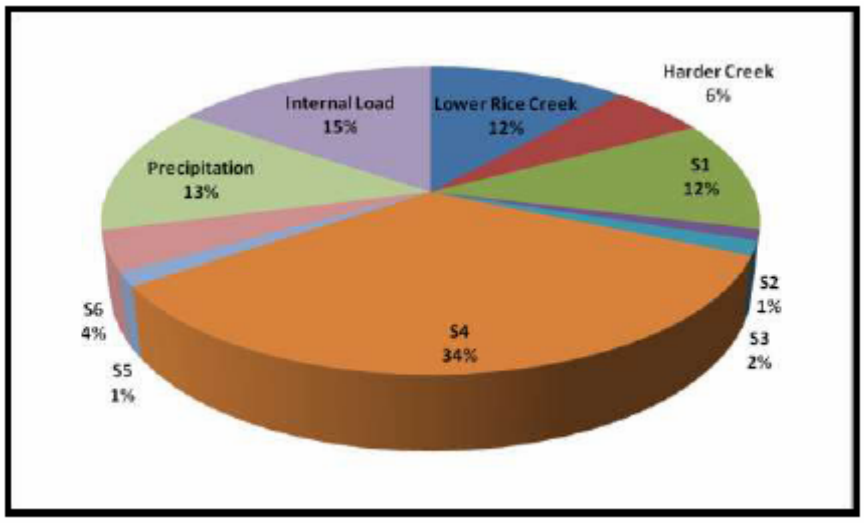

Figure 12. Balsam Lake Phosphorus Budget (from Barr 2011)

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.[8] These areas of closed depressions result in water that is temporarily captured before it drains to the lake.

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

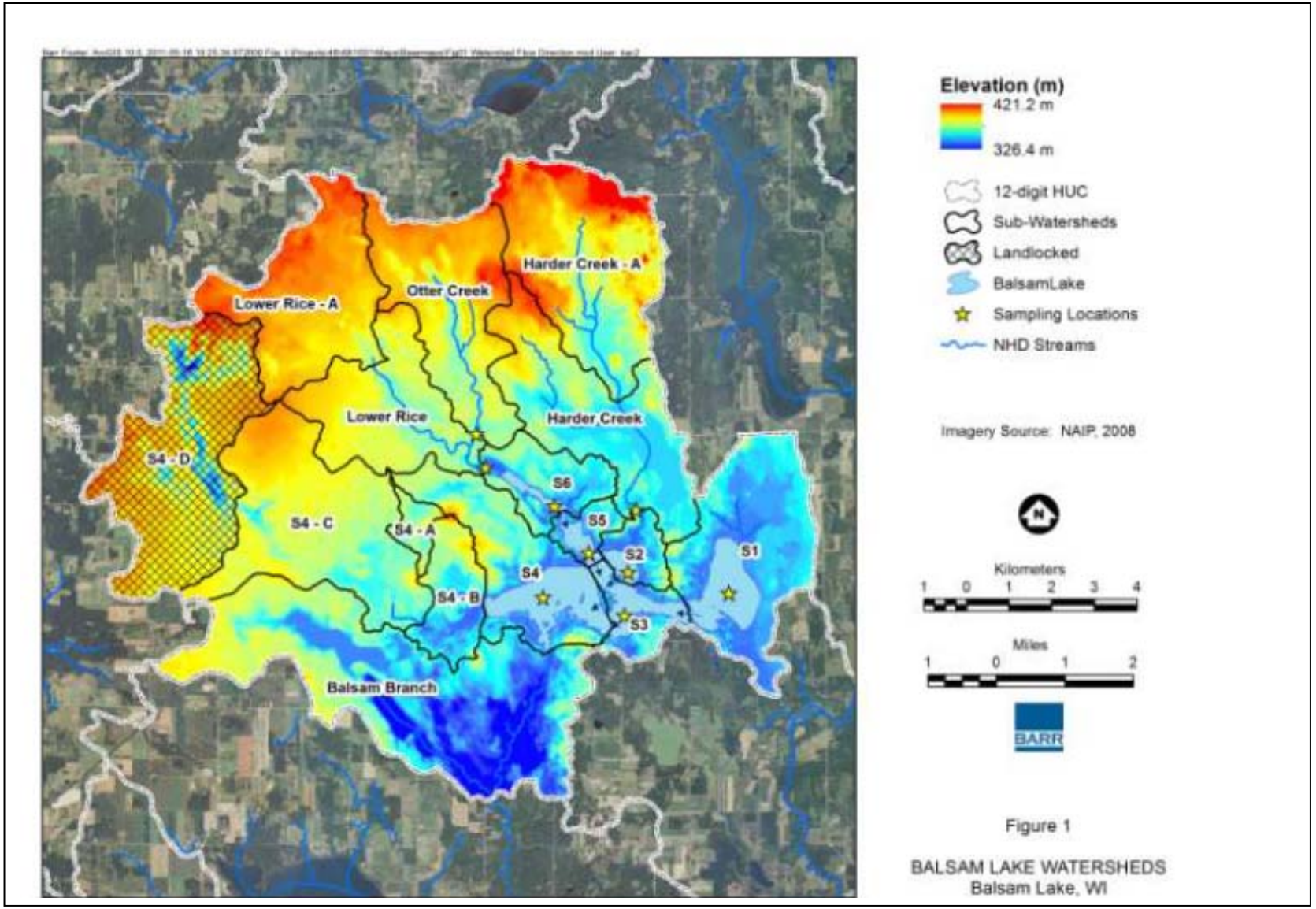

Figure 13. Balsam Lake Watershed and Drainage Area (from Barr 2011)

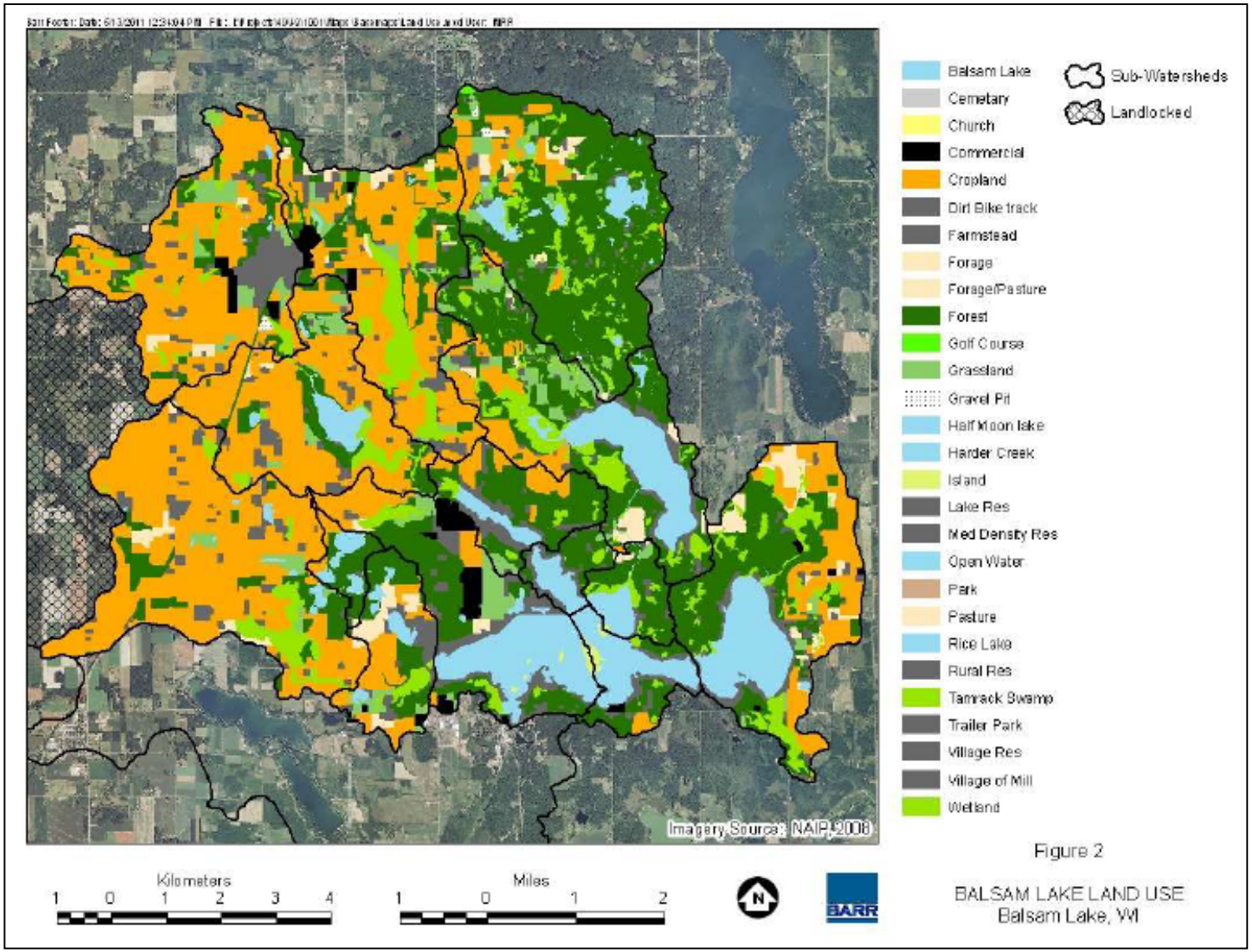

Figure 14. Balsam Lake Land Use (from Barr 2011)

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 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.[9]

*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 (*see Figure 3*).*

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

[9] Barr. 2011.
[10] Berg. 2011.

Aquatic Habitat

Aquatic Plants

Balsam Lake has a diverse native plant community with 46 native species found in a July 2009 survey. Plants grow to a depth of 19 feet in the lake. Highest plant diversity was found in shallow bays including Idlewild, Stump and Raskin. Curly leaf pondweed is found in many areas of the lake. Purple loosestrife was found in only a single location. Aquatic plants provide a diversity of habitats, help maintain water quality, sustain fish populations, and support common lakeshore wildlife such as loons and frogs. An aquatic plant management plan is in place to protect native plants, prevent introduction of invasive species, manage curly leaf pondweed, and manage nuisance native plants.

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 developed management requirements for each sensitive area. These areas are mapped in the sensitive area assessment and in the Balsam Lake Aquatic Plant Management Plan.

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 management recommendations that follow as good recommendations for the entire lake. These recommendations are especially important in designated 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.

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.

Fisheries[11]

The Balsam Lake fishery is comprised of northern pike, walleye, largemouth bass, and pan fish. At the 2009 BLPRD annual meeting, DNR fishery biologist Heath Benike reported largemouth bass were very common, but small. He also reported large and plentiful pan fish. These populations can be attributed to good aquatic plant structure. Recommendations were made for altering fish regulations to increase the allowed size of bass and to increase the number of walleye harvested. Stocking of large walleye fry was also recommended.

Largemouth bass are the dominant game fish in Balsam Lake. With greater abundance, growth rates declined between 1988 and 2008. In 2002, the WDNR liberalized bass regulations on Balsam Lake because bass growth rates declined and the overall condition of bass was poorer when compared to past fish surveys. Anglers are now allowed and encouraged to keep one bass less than 14 inches as part of their daily bag limit of five bass. The regulation is designed to reduce the number of smaller bass in the lake. With less competition for the available forage base in the lake, the larger, remaining bass will be able to grow faster and reach greater sizes. In March of 2012, the largemouth bass regulation reverted back to a 14 inch minimum length. A regulation proposal is being advanced that will liberalize bass regulations on Balsam Lake. A proposal for no minimum length and a daily bag limit of five bass will appear on the Conservation Congress spring hearing questionnaire, likely in 2013[12].

The walleye population has declined on Balsam Lake from the late 1980s. In 2008, only 1,956 adult walleye were present - a similar number to 2005. The reason for walleye population decline is still unclear. The WDNR has been aggressively stocking walleye in the lake over the past decade with limited success. It appears predation from other fish (especially largemouth bass) may be a key limiting factor in walleye recruitment. The DNR stocked larger walleye fingerling (averaging around 7 inches in length) in an effort to increase recruitment of stocked walleye. Minimum length for walleye harvest is 15 inches, and bag limits vary each year.

Fifty percent of angling effort is directed toward catching bluegill and black crappie. The 2008 average harvested length of bluegill was 8.1 inches and of black crappie was 9.6 inches. Anglers are allowed to catch 25 pan fish each day on Balsam Lake. Anglers are allowed a daily catch of 2 northern with a minimum length of 26 inches.

[11] *Balsam Lake Treaty Assessment Survey. Polk County, Wisconsin (MWBIC: 2620600) Draft.* Heath M. Benike. Senior Fisheries Biologist. Wisconsin DNR. April 2010.
[12] Personal email communication: Terry Margenau, DNR Fisheries Supervisor, January 20, 2012.

Wildlife

The wildlife around Balsam Lake are very plentiful. Animals ranging from the abundant whitetail deer (*Odocoileus virginianus)* to the majestic bald eagle (*Haliaeetus leucocephalus*) can be found around the area.

Some of the common species present in the area are: wild turkeys, ring-neck pheasants, grouse, woodcock, mallards, wood ducks, geese, coyotes, fox, black bear, raccoon, beavers, otters, fishers, mink, muskrats, song birds, snakes, frogs, and turtles.

One reason for the numerous wildlife species around Balsam Lake and its watersheds is the diversity in habitat. This geographic area contains various types of wetlands, open grasslands, upland and lowland woodlands, and agricultural areas; all are key habitats for wildlife.[13]

[13] Provided by Eric Mark, DNR Wildlife Biologist, Balsam Lake. January 5, 2006.

Balsam Lake P&R District Management Activities

Lake Studies

Supporting and initiating study of Balsam Lake's water and nutrient budgets was one of the first activities of the BLPRD. In the mid 1970's, the recently formed Balsam Lake Inland Lake Protection Districted requested technical assistance from the Department of Natural Resources.

DNR Feasibility Study

The resulting feasibility study included measurement and descriptions of 1) nutrient loading from stream and groundwater inflow, 2) in-lake water chemistry, 3) algal densities, and 4) macrophyte abundance and distribution. Balsam Lake was identified as a mesotrophic lake with moderate fertility. The game fish population was described as exceptionally strong and well balanced. The problems identified were: 1) extreme variation in water clarity, with poor conditions occurring during much of the summer and 2) excessive weed abundance in select areas that receive heavy recreational use.

Recommendations were made for protecting groundwater quality with contributions of septic systems emphasized. Watershed protection emphasized creating buffer zones along the lake and its tributaries, minimizing impervious surfaces and exposed soil, and influencing land use decisions as the watershed develops. Protecting critical watershed areas by purchasing property is mentioned. Aquatic plant management methods considered as reasonable options were herbicide applications and harvesting.[14]

USGS Water and Phosphorus Budgets

The United States Geological Survey completed a second lake water quality study in the late 1980's. This study estimated water and total-phosphorus budgets for Balsam Lake. Rice Creek and near-lake drainage accounted for 80 percent of the phosphorus entering the lake. Principal sources of phosphorus input to Balsam Lake in decreasing order were Rice Creek, near-lake drainage, precipitation, Harder Creek, and groundwater. Internal loading from sediments was not quantified. Outflow to Balsam Branch removed 30 percent of the phosphorus that entered the lake. The main basin was identified as mesotrophic. The northwest basin of the lake or "Little Balsam" was identified as upper mesotrophic to lower eutrophic.[15]

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[14] *Balsam Lake Polk County. Feasibility Study Results: Management Alternatives.* Wisconsin Department of Natural Resources. Office of Inland Lake Renewal. 1979.

[15] *Water and Phosphorus Budgets and Trophic State, Balsam Lake, Northwestern Wisconsin.* 1987 – 1989. U. S. Geological Survey. Water Resources Investigations Report 91-4125.

Lim Tech Study[16]

This study analyzed water chemistry in various areas of Balsam Lake and its tributaries in 1986. The study's conclusions are similar to the original DNR feasibility study in identifying Rice Lake via Rice Creek as an important phosphorus and sediment source to Balsam Lake. The study's conclusions also point to the importance of septic systems as a contributor of bacteria and nutrients to Balsam Lake. [However, no groundwater samples were taken as part of the study.] The report also suggested that chemicals should not be used for controlling aquatic macrophytes and algae in the lake.

Recommendations include assessing the sources of nutrients to Balsam Lake and developing appropriate management strategies followed by monitoring of project effectiveness. The study also recommends a closer examination of septic systems as a source of nutrient and bacterial contamination.

The final recommendation is that the BLPRD adopt a nutrient reduction based approach to maintaining water quality in Balsam Lake. In addition to the recommendations above, this would involve discontinuing chemical control of macrophytes and algae with continuation of mechanical weed harvesting, and dissemination of information to area residents concerning fertilization of lawns, use of chemicals, and proper shoreline management to reduce runoff and erosion.

Rice Lake Water Quality

With Rice Lake identified as a primary source of phosphorus to Balsam Lake, attention was directed here in the late 1980's. A DNR study explained that wind and high water, after decades of erosion and runoff from farms and a municipal wastewater treatment plant, converted Rice Lake from a clear lake bordered by wild rice into a turbid one dominated by algae. Water turbidity (low water clarity) led to poor aquatic macrophyte diversity. Secchi disk transparency decreased each June to about 13 inches. Under such light-limited conditions, macrophytes had little chance to grow. Efforts to seed wild rice were largely unsuccessful because muskrats ate most of the shoots that sprouted. Establishing wild rice was desired to blunt the force of the wind that stirs up sediments and creates turbid water.[17]

Balsam Lake Water Quality Study

Phosphorus and water budgets were analyzed in 2010 and 2011 in a study completed by Barr Engineering. The lake was divided into six basins for the purposes of the study. Results are reported in water quality information summarized earlier in this report. Water quality models were used to estimate the relative contribution of various sources of phosphorus for each basin. Precipitation, flow, and water quality data were collected in three of the lake's tributaries in 2010. Watershed data was used to compare phosphorus yields in these areas, and to estimate phosphorus load from the land in others.

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[16] *Analysis of Balsam Lake (Polk County, Wisconsin) with Recommendations for Improved Lake Management.* September 1986. Lim Tech Consultants. Report No. LT-R46902.

[17] *Restoring Rice Lake at Milltown, Wisconsin.* Department of Natural Resources. Madison, Wisconsin. 1991.

The study recommends the following:

- A sediment study for East Balsam to design an alum treatment
- Periodic inspection and maintenance of the Rice Creek sedimentation basin
- Annual secchi disc monitoring and trend analysis of results
- Watershed practices emphasizing reductions from crop land
- Periodic water quality monitoring[18]

Balsam Branch Priority Watershed Project

The Balsam Branch Priority Watershed Project was a project of the Polk County Land and Water Resources Department supported by state Department of Natural Resources (DNR) and Department of Agriculture, Trade, and Consumer Protection (DATCP) funding. This project ended in 2006. 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 examines 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 (micrograms per liter). A total phosphorus reduction of 26.7 percent was needed to reach the in-lake phosphorus goal.[19]

The Department of Natural Resources conducted a water quality appraisal as background for the priority watershed project. The appraisal identified the primary phosphorus sources to Balsam Lake as agricultural runoff (37%) and Rice Lake (via Rice Creek) (18%).[20] 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);
- An intensive urban nutrient reduction program;
- Consider in-lake remediation (alum treatment) for Little Balsam; and
- Reduce nutrients from the Rice Creek tributary

[18] *Balsam Lake Water Quality Study*. Prepared for Balsam Lake Protection and Rehabilitation District. Barr Engineering. June 2011.
[19] *Nonpoint Source Control Plan for the Balsam Branch Priority Watershed Project.* Wisconsin Department of Natural Resources, et. al. April. 1995.
[20] *An Appraisal of the Surface Water Resources of the Balsam Branch Priority Watershed.* The Wisconsin Nonpoint Source Priority Water shed Program. Wisconsin Department of Natural Resources. August 1989.

Watershed Project Results

A summary of conservation best management practices installed through the Balsam Branch Priority Watershed project through the end of 2005 is included as Appendix D. The state/county share of practice installation totaled $171,663. For the whole project area (the entire Balsam Branch watershed), $811,234 was provided. 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 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 2. Balsam Branch Priority Watershed Projects with BLPRD Contributions

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

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) 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.

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.[21]

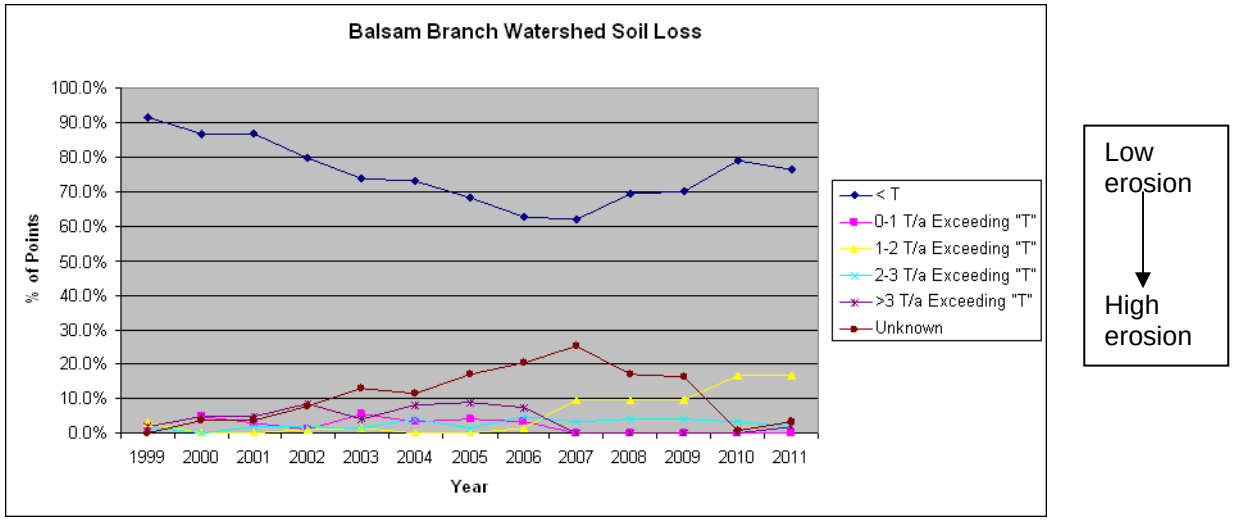

Figure 15. Soil Loss in the Balsam Lake Watershed

[21] Information provided by Eric Wojchik, Polk County Land and Water Resources Department. November 2011. 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.

Balsam Acres

The Balsam Lake Protection & Rehabilitation District purchased 80 acres of farmland along Rice Creek in 1995 with assistance from a DNR Lake Protection Grant. The property was purchased to facilitate removal of a barnyard from the shore of the creek. By removing the cattle, manure inputs to the creek and stream bank trampling were eliminated.

The property purchase also provided control of the creek running out of Rice Lake for potential future conservation best management practices. A 1996 feasibility study for the property completed by Mead & Hunt identified a sedimentation basin as the best option to assist in reducing phosphorus loading to Balsam Lake.

Sedimentation Basin Construction

The sedimentation basin was constructed in 1999. The cost of basin was approximately $132,000 with $98,935 paid by a DNR Lake Protection Grant. The basin covers 3.52 acres, including a 2.44-acre active sedimentation area that averages five feet deep and a 1.08-acre shallow wetland bench at the edge.

Emergent vegetation on the bench helps to slow water flow as it enters the basin, thereby increasing sediment removal. The bench also provides habitat for waterfowl, wading birds, amphibians, and furbearers.

Sedimentation Basin Testing

The basin was mapped and depths were recorded across 11 transects in July 1999. Depth measurements were checked by BLPRD representatives in 2006, 2009 and 2011 to determine how much sediment the basin had captured. Sediment has accumulated near the pond inlet nearly to the full six foot depth of the pond (from 1.5 to 6 feet of sediment). Further away from the inlet, sediment accumulation ranges from .25 to .75 feet.

Sediment will be dredged and removed once accumulated sediment impairs basin performance. The sediments will be analyzed for phosphorus content to determine how much phosphorus has been captured in the basin.

Stream Inflow and Lake Sediment Monitoring

Monitoring the flow and concentration of pollutants in streams flowing into the lake helps to identify pollutant sources of concern. With water clarity at its lowest in Little Balsam, and Rice Creek identified as the source of nutrient and sediment loading to this portion of the lake, Otter Creek and Rice Creek were targeted for in-flow monitoring in the late 90s and early 2000's. This information was updated in 2011. After exiting Rice Lake, Rice Creek flows an additional two miles before entering Balsam Lake. Otter Creek is a tributary joining Rice Creek about halfway between Rice Lake and Balsam Lake.

Rice Creek and Otter Creek Monitoring 1996 – 1998

The DNR completed a study to reassess the significance of phosphorus loading from Rice Lake via Rice Creek and Otter Creek from 1996-1998.[22] Stream sampling and flow monitoring from 1996-1998 showed that the total phosphorus load from Otter Creek slightly exceeded that from Rice Creek although the quantity of flow was significantly lower in Otter Creek. Phosphorus load increased again downstream from where Otter Creek and Rice Creek joined presumably from agricultural runoff and groundwater inflow.

Sediment loads were higher in Rice Creek than Otter Creek upstream of where they join. Rice Creek also picked up additional sediment load between the confluence of Rice and Otter Creeks and where Rice Creek enters Balsam Lake.

One important factor influencing the water quality of Rice Creek was the improvement in the water quality of Rice Lake during this time period. The DNR identified Rice Lake as a lake with very poor water quality and a significant source of phosphorus to Balsam Lake in the 1980's. Rice Lake water clarity had improved significantly by the mid 1990's following changes in the Milltown sewage treatment plant and in cropping practices near the lake. Summer secchi depths from 1995 – 1998 were 3 – 5 feet, a big improvement from results of 13 inches in the late 1980's. Total phosphorus and chlorophyll a concentrations decreased along with increased secchi depths.

Rice Creek and Otter Creek Monitoring 2001-2003

The Polk County Land and Water Resources Department collected grab samples from three locations to assess the relative loading of Otter Creek and Rice Creek and the changes that may have resulted from the construction of the sedimentation basin on Balsam Acres. Samples from a total of seven rainfall events were collected. Average results are shown in Table 2.

It is not possible to determine the effectiveness of the sediment basin based upon these results. While it appears that sediment concentrations decreased in samples taken before

[22] *Monitoring Results for Rice Creek, Otter Creek, and Rice Lake.* Roesler, Craig. Wisconsin Department of Natural Resources. February 1999.

and after sedimentation basin construction at Balsam Acres, average total phosphorus values actually increased between the two time periods. These differences may be a reflection of varying storm and snow melt events rather than changes that result from installation of the sedimentation basin. It would be necessary to monitor above and below the sediment basin to assess the actual basin effectiveness.

The results indicate that Otter Creek has higher average total phosphorus inputs and lower total suspended solids contributions than Rice Creek at Balsam Acres in both time periods. Rice Creek at Highway 46 is downstream of where Otter Creek joins Rice Creek.

Table 3. Rice Creek and Otter Creek Sampling Results

Site	Date	Total P (ug/l)*	Suspended Solids (mg/l)**
Rice Creek @ Balsam Acres	2001 – 2003	58	9.4
	1996 - 1998	52	11.7
Otter Creek near 200th Avenue	2001 – 2003	110	2.4
	1996 - 1998	122	6.9
Rice Creek @ Highway 46	2001 – 2003	81	16.4
	1996 - 1998	75	10.4

* micrograms per liter
** milligrams per liter

Little Balsam Sediment Monitoring

Lake residents raised concerns regarding accumulation of sediment in Little Balsam and the resulting decrease of depth and increase of aquatic macrophyte growth in 2002. The BLPRD hired Barr Engineering to conduct a study to characterize the sediment of Little Balsam. Water depth and sediment characteristics were analyzed in the channel of Rice Creek where it flows into Rice Lake and in three locations in Little Balsam.

The study concluded that sediment buildup in Little Balsam Lake was due primarily to upstream sources. Emergent vegetation resulted from sediment build-up and shallower water. Reducing sediment build-up could be accomplished by convincing landowners to install conservation practices such as buffer strips. A sedimentation basin might be constructed on Otter Creek. Dredging would be necessary to reclaim the lake area and remove emergent vegetation.[23]

The Land and Water Resources Department surveyed Rice Creek to locate any erosion concerns in July of 2002. Staff found no evidence of slumping on the banks, and where minor erosion was found, there was a minimum of 100 feet of buffer. This indicates that stream bank erosion was not likely the cause of sediment loading in Rice Creek.[24]

[23] Letter to Allen Dornfeld, BLPRD from Thomas MacDonald, Barr Engineering. August 9, 2002.
[24] Unpublished report. Jeremy Williamson. Water Quality Specialist. Polk County Land and Water Resources Department.

Rice Creek and Otter Creek Monitoring 2006

Rice Creek and Otter Creek stream flow and water quality measurements were taken from April through August 2006. The study also measured depth of the sediment delta in Little Balsam Lake using GPS. Study conclusions are as follows:

Annual phosphorus loading and sediment loading from Rice Creek and Otter Creek watersheds to Little Balsam was low in 2006. This low rate is explained by the sedimentation basin on Rice Creek and a wetland on Otter Creek. The current rate of sediment loading does not explain the accumulation of the delta at the outflow on Rice Creek in Little Balsam. Dredging of lake sediments is recommended over construction of sedimentation ponds.

Little Balsam Sediment Discussions 2009

Initial site visits with DNR and Barr Engineering in November 2009 led again to recommending against sedimentation ponds on Rice Creek. Wild rice was found in the area, and DNR representatives stated that dredging would need to occur outside of areas where rice is growing. Moving a dock on the north end of Little Balsam was recommended because it created channelized flow which more efficiently transported sediment to the lake. (Review of 2011 aerial photos indicates that the dock has been moved.)

Additional information from Barr in January 2009 explained permitting requirements including sediment sampling. Pursuing two permits that would dredge a total of 5,000 ft^3 to a depth of 6 feet outside the wild rice area was recommended. This dredging was predicted to prevent advance of shallow water. The BLPRD authorized Barr to go ahead with a preliminary permit for this suggested dredging.

The DNR and the Great Lakes Indian Fish and Wildlife Commission reviewed the concept and responded that this project would not likely be approved. Instead, minor dredging to allow navigation from docks might be considered in the future only if access to open water is impaired.

Recommendations:

- Measure sediment out from owners' docks and in other locations near the sediment delta in Little Balsam annually.
- Install watershed best management practices to reduce sediment loads
- Monitor bed loading in Rice Creek to see if high flows move sediment. Monitoring would provide information for consideration of a sedimentation basin to reduce rate of water flow.

Harder Creek and Other Inflow Monitoring 2003

With funding from the BLPRD, the Polk County Land and Water Resources Department monitored flow and nutrient and sediment concentrations at Harder Creek in 2003. Total phosphorus concentration and total suspended solids are lower in Harder Creek than in Rice Creek. Total phosphorus averaged 48 micrograms per liter in Harder Creek in 2003 when the samples from Rice Creek averaged 77 micrograms per liter. Total suspended

solids averaged 2 milligrams per liter in Harder Creek when the samples from Rice Creek averaged 10 milligrams per liter. Lower flow was reported from Harder Creek than from Rice Creek although the data is not available.

Samples were also collected from a culvert underneath Highway 46 near Balsam Lake and across from the mobile home park. Samples collected here averaged 62 micrograms per liter total phosphorus and 2.7 milligrams per liter total suspended solids. Flow measurements are not available.

Conservancy Properties

Lake district conservancy properties may be established through outright ownership or by establishing conservation easements. Ownership of property or conservation easements ensure preservation of critical habitat and watershed areas. They also provide the control needed to allow installation of conservation practices. The BLPRD currently owns five 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. They are voluntary agreements between the easement holder and the landowner that generally limit development of commercial or residential buildings and related structures. Easements may place additional restrictions on how the property is used. The BLPRD might work with the DNR or a land trust organization to establish a conservation easement for a conservancy property.

The Balsam Lake Protection and Rehabilitation District began acquiring properties for conservation purposes with the acquisition of the 80-acre Glenna Farm in 1995. Since that time, an additional 4 properties were acquired bringing the total acres of the 5 properties acquired to 134.5. The BLPRD spent approximately $522,000 for these acquisitions, about half of which was reimbursed by DNR grants.

Future property acquisitions will be paid for using the BLPRD “Balsam Lake Protection Fund.” The fund is for capital improvements and maintenance for designated, approved projects. These funds can be carried over from year to year. Current designated Balsam Lake Protection Fund projects include Conservancy project acquisitions, Rice Creek Sedimentation, and Mill Pond/Lake Access. With the recent Soltau acquisition and installation of the County I bridge, this fund will be largely depleted in 2012. However, additional conservancy acquisitions are a potential into the future. Acquisition priorities were developed as part of this long range plan.

Balsam Acres

Balsam Acres was acquired as the 80-acre Glenna Farm in 1994. The total expenses for the Glenna Farm acquisition were $99,663. A DNR Lake Protection Grant provided $29,125 toward the Glenna Farm purchase. The property is located in the town of Milltown (T35N, R17W, S28) to the south and west of the VFW club on Highway 46.

Table 4. Balsam Acres Expenses

Purchase price	$52,000
Relocation expenses	$44,750
Fees (SEH)	$521
Interest	$1,800
Closing costs	$592
Total Acquisition Expenses	$99,663

Significant watershed restoration and protection work has been completed on the property since its purchase. DNR wildlife funds were used to restore 30 acres of crop fields to native prairie grasses. The deep roots of the prairie grasses help to stabilize soil and prevent erosion of sediment and attached nutrients to Rice Creek. The silo and barn were removed. As described earlier, a sedimentation basin was constructed in 1999 to remove phosphorus directly from Rice Creek.

Deaver Property

The 1.3-acre Deaver property is located on Park Drive along the southern shore of Balsam Lake. It includes lots 78, 79, 80, and 81 of the Park Addition subdivision with 300 feet of shoreline. The property was formerly owned by the Unity School District. Because of limited use by the school district, the property was deeded back to the Deaver Foundation who then donated the property to the BLPRD in the fall of 2002.

Lot 77

The BLPRD acquired this lot adjacent to the Deaver Property in May 2004. The lot is 0.3 acres with 98 feet of shoreline. The selling price of the property was $50,000. A Department of Natural Resources grant provided 75 percent of the appraised value and expenses. The DNR contribution was $28,511.25 while the BLPRD paid $9,503.75 directly toward the grant and an additional $15,000 to make up the difference between the appraised value and the purchase price plus expenses.

The Deaver property and Lot 77 acquisitions help to preserve an important natural habitat area identified in the DNR Sensitive Area Study as Site U. The shoreline adjacent to these properties is described as "a very unique ecosystem with an extremely diverse plant and animal community."[25] The properties contain one of the few areas around the lake of native forested habitat.

Stump Bay Acquisitions

The Stumps area of Balsam Lake is an important wildlife habitat area. The acquisition of two parcels adjacent to Stump Bay carried out a recommendation specifically mentioned in the DNR *Balsam Lake Sensitive Area Study*:[26]

> *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.*

[25] Wisconsin Department of Natural Resources. Sensitive Area Study. 1989.

Peterson Property

The Peterson Property is located adjacent to where Harder Creek flows into Stump Bay. The BLPRD purchased the property in January 2005 for $75,000. DNR grants reimbursed all of the purchase and acquisition expenses of $77,590 because the property appraised for $100,000.

The undeveloped Peterson parcel totals 18.50 acres. Wetlands total at least 8 acres. The parcel has approximately 1,200 feet of frontage on Balsam Lake and 500 feet of frontage along each side of Harder Creek. The creek and associated wetlands offer excellent wildlife habitat and learning opportunities for students and adults. The property is open to the public for educational purposes with permission of the BLPRD.

Soltau Property

Purchase of the adjacent 34-acre Soltau parcel (to the west) was approved at the 2011 annual meeting. It was purchased for $295,000 with the help of a $112,500 lake protection grant from the Department of Natural Resources. The property closing occurred on November 10, 2011.

Simonson Property

The BLPRD investigated acquiring the 90-acre Simonson Property on the south shore of Little Balsam because of the identified impacts to Little Balsam from a proposed subdivision. This property had over 3,000 feet of shoreline. A proposal for purchasing the property for $900,000 was narrowly defeated by lake residents at a special BLPRD meeting in September 1994 after initial approval at the August 1994 annual BLPRD meeting.[26] The BLPRD planned to apply for DNR grants, but had not done so at the time of the annual meeting. Since then the property has been subdivided into twelve lakeshore lots and one back lot and is marketed as Hidden Forest.

[26] Robert Carlson vs. Balsam Lake Protection and Rehabilitation District. Polk County Circuit Court. Declaratory Judgment. File No. 94CV287. January 1995.

Waterfront Runoff Program

The BLPRD Waterfront Runoff Program began in 2008. The program offers technical assistance, education, and limited cost sharing for installation of waterfront water quality practices. Free site visits are provided to residents interested in correcting erosion problems and reducing runoff from their property. Workshops and tours provide information about rain gardens and native plants and highlight installed demonstration practices. The program provided on site technical assistance and detailed site designs for 53 landowners from 2008 through 2011. The original project goal was to reach 95 landowners. Water quality practices have been installed with cost sharing on 12 properties, many of which have multiple practices. Educational materials developed for this project 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.

The University of Wisconsin Extension sent evaluations to all Balsam Lake Waterfront Runoff Program participants in the winter of 2011. Individuals who have taken advantage of the program are generally pleased with the service. Evaluation highlights follow.

- Visits were promptly scheduled
- Consultant knowledge, working relationship, and communication rated excellent
- Plans were easy to understand, had needed information, and fit the landscape
- Over 90% would recommend visits to their neighbors
- Of the projects recommended, 23 are reported to be finished, 24 to be partially finished, and 30 are planned for the future. Only 4 report projects that will never be done.

A tour of practices was held July 22, 2011. The Department of Natural Resources grant which supports the program will expire December 31, 2012. More information about the Waterfront Runoff Program is available on BLPRD.com/BalsamLakeWaterfrontRunoffProgram.

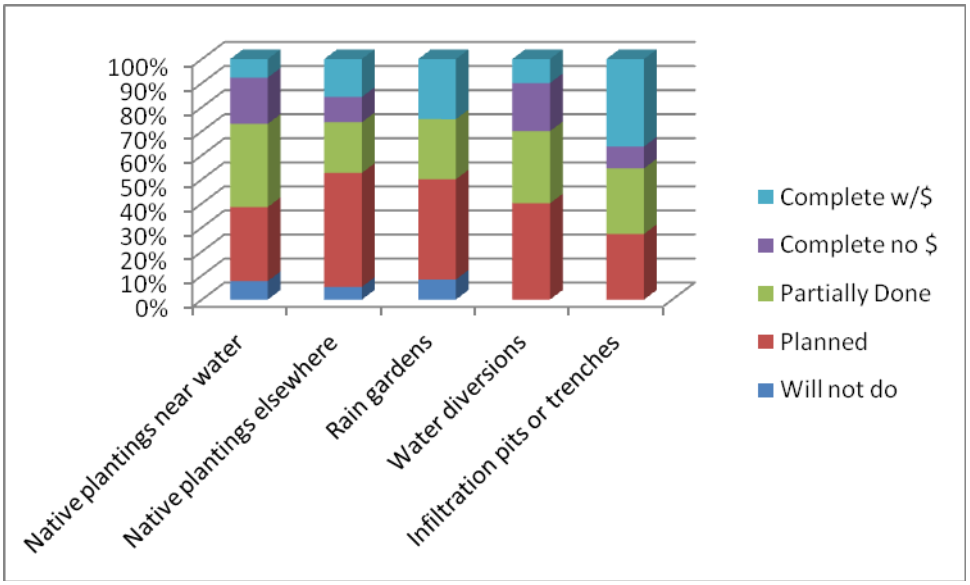

Figure 16. Project Installation Results from 2011 WRP Evaluation

Aquatic Plant Management

Historic Plant Management Activities

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 is a concern as a heavy metal that builds up in lake sediments. Between 1960 to 1985, over 7.7 tons of copper sulfate were applied to Balsam Lake (not including chemical applications made directly by homeowners). [27] Endothall is a broad spectrum herbicide.

Barr Engineering prepared aquatic plant management plans in 2000 and 2005. The 2000 plan proposed using herbicide treatments to treat public swimming areas, boat landings, and navigation channels. These 25-foot wide navigational channels are identified in maps in the plan. Prior to 2000 the District used a mechanical harvester to remove plants from the lake. The estimated cost of chemical application was 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.

The 2005 Aquatic Plant Management Plan[28] identified specific locations that require annual management. The plan recommended herbicide treatment once or twice each summer for swimming beaches, boat landings, and navigation channels. This amounted to 14 acres. An additional 33 acres with very high plant density were recommended for herbicide treatment.

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 evaluated on 13 acres of Balsam Lake in 2004. Curly leaf pondweed was treated at 11.5 acres along the south shore of East Balsam and 1.5 acres in the North Bay near the narrows to East Balsam. This treatment strategy was not recommended in the 2005 plan. Instead, a lime slurry to reduce plant density including curly leaf pondweed density, was recommended to attain favorable long-term changes in problematic areas.

[27] *Analysis of Balsam Lake (Polk County, Wisconsin) with Recommendations for Improved Lake Management.* September 1986. Lim Tech Consultants. Report No. LT-R46902.
[28] *Balsam Lake Aquatic Plant Survey and Management Plan.* Prepared for Balsam Lake Protection and Rehabilitation District. December 2005. Barr Engineering.

Current Aquatic Plant Management[29]

Because aquatic plant management is discussed in detail in the aquatic plant management plan, only an overview is included in this long range management plan. The aquatic plant management Plan presents strategies for managing aquatic plants by protecting native plant populations, managing curly leaf pondweed, and preventing establishment of invasive species through the year 2014. The plan uses the results of a comprehensive plant survey which will be repeated every five years. It also includes information about the watershed, water quality, and reviews a history of aquatic plant management on Balsam Lake.

Management strategies presented are based upon five plan goals:

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

2. Prevent the introduction of aquatic invasive species.

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

4. Increase lake residents' and visitors' understanding of aquatic plants and management.

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

An action plan outlines activities to be carried out each year. They include:

- Early season herbicide treatment of priority curly leaf pondweed beds.
- Invasive species monitoring for prevention and early identification.
- A comprehensive Clean Boats, Clean Waters program to educate lake users.
- Contingencies for monitoring and maintaining navigation through native plant beds.
- An aquatic plant management education program.

[29] *Aquatic Plant Management Plan for Balsam Lake October 2010*. Harmony Environmental and Endangered Resource Services.

Sewer Feasibility Studies

The BLPRD investigated the potential for constructing a sewage collection system around Balsam Lake and connecting to the Village of Balsam Lake wastewater treatment system. A 1998 sewer feasibility study prepared by Cedar Corporation provided preliminary cost estimates and options for the 619 parcels around Balsam Lake not served by the Village of Balsam Lake system. The study determined that a gravity collection system would be too costly and pointed to grinder pump systems with either pressure or vacuum collection. Residents at the 1998 annual meeting directed the commissioners to develop more precise cost figures and to conduct a study to determine the benefits of the sewer system.[30]

The resulting Cedar Corporation report recommended a low-pressure grinder pump system for sewage collection. Barr Engineering concluded that adequate information was not available to determine the contribution of septic systems relative to other nutrient sources to Balsam Lake. Dan Ryan, DNR Water Lake Specialist, stated that a sewer system would not necessarily benefit water quality because septic system contributions were generally in the range of 5-10 % of phosphorus contributions to lakes in the region, and a sewer system may lead to more dense development around the lake.[31]

Flyover in 1999

A. W. Research, Inc. took infrared aerial photos in a flyover of Balsam Lake waterfront parcels in the summer of 1999. The intended purpose was to identify parcels with failing septic systems and other sources of water quality problems. Slide photos were presented in early 2000, with an explanation that ground-truthing (surveys of parcels on the ground) would need to be completed to refine the results. The BLPRD hired a contractor to survey the properties on the ground in 2000. The contractor checked 190 properties. It was not possible to identify septic system problems with the ground-truthing process, which did not include soil testing. The BLPRD decided not to proceed with soil testing that would have cost $200 per parcel.

Sewer System Decision

After extensive study, the BLPRD sponsored public informational meetings June 22 and June 29, 2002 at Unity High School to explain design and costs for a sewer system around Balsam Lake and for the expansion of the Village of Balsam Lake wastewater treatment plant. The proposed system costs were described as follows:

- $1,612 for each of 700 lots for the mainline sewer system.
- $1,213,168 ($1,733 per lot) for expansion of the Village of Balsam Lake wastewater treatment plant.
- $9,270 per lot for required grinder pump and lateral connections to the mainline sewer system.

[30] BLPRD Annual Meeting Minutes. 1998.
[31] BLPRD Annual Meeting Minutes. 1999.

The sanitary sewer resolution failed at the 2002 BLPRD Annual Meeting with a vote 162 for and 194 against the sewer system.

Millpond Bridge Replacement

The BLPRD is working 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 existing box culvert under County Highway I. This culvert separates the Mill Pond from Town Bay of Balsam Lake. A replacement bridge is proposed to allow more boat access between the Mill Pond and Town Bay.

The DNR raised concerns that a wider bridge opening on the Mill Pond dam might change the dam classification with resulting need to rebuild the dam. The BLPRD entered into a $15,000 contract with Ayres for this study in June 2011. The preliminary response was received on July 7th, 2011; and Ayres' *"analysis indicates that the culvert can be increased to the 20-foot span without adversely impacting the dam's failure consequences, hazard classification, or spillway capacity requirements."*

Costs for bridge replacement and highway reconstruction which total $250,000 are currently proposed to be shared as follows:

1. Polk County Highway Department will pay all costs for County Highway I reconstruction after the new bridge is in place and will manage the bridge replacement project.
2. The Village of Balsam Lake Smart Growth Committee is taking full responsibility for structure esthetics, bike path, and lighting.
3. The Balsam Lake Area Chamber of Commerce is supportive of the project. (They also paid the cost with individual donations for the required soil borings.)
4. The BLPRD voted to pay remaining costs for bridge replacement at the 2011 annual meeting.

Related Plans and Ordinances

Knowledge of and involvement in development and implementation of local plans and ordinances can assist the BLPRD in achieving the goals of this long range plan.

Boating Regulations

The Department of Natural Resources regulates boating in the state of Wisconsin.[32] Wisconsin conservation wardens enforce boating regulations. A few highlights of boating regulations are found below.

- ✓ It is illegal to transport aquatic plants and animals.
- ✓ Personal watercrafts (PWCs) may not operate from sunset to sunrise.
- ✓ PWC operators must be at least 12 years old.
- ✓ Boating safety courses are required for operators born in 1989 or later.
- ✓ There are 100-foot restrictions between boats or PWCs and water skiers, towropes, and boats towing skiers.
- ✓ It is unlawful to operate within 100 feet of any shoreline, dock, raft, pier, or buoyed restricted area at a speed in excess of "slow-no-wake."
- ✓ Boats have specific lighting requirements after dark.
- ✓ Speed must be reasonable and prudent under existing conditions to avoid colliding with any object or person.

The Village of Balsam Lake and Towns of Balsam Lake and Milltown established no-wake zones in areas of the main basin of Balsam Lake in 1989. The Village of Balsam Lake established the Mill Pond as a no-wake zone in the late 1990's.

A town or village may delegate the authority to adopt lake use regulations to a lake district. These may include regulation of boating equipment, use, or operation; aircraft; and travel on ice-bound lakes.[33]

Polk County Land and Water Management Plan

The Polk County Land and Water Resources Management Plan describes the strategy the Land and Water Resources Department (LWRD) will employ from 2010 –2019 to addresses agriculture and non-agriculture runoff management, stormwater discharge, shoreline management, soil conservation, invasive species, and other environmental degradation that affects the natural resources of Polk County.

These goals of the plan are:

Goal 1. Protect the water quality of our groundwater, lakes, streams, rivers, creeks, and associated ecosystems.

Goal 2. Protect shorelines, undeveloped riparian land, wetlands, grasslands, forests, farmland, and agricultural resources to perpetuate the benefits they provide: habitat and associated native wildlife communities, clean water, clean air, carbon sequestration, aesthetic beauty, and recreational opportunities.

[32] Boating regulations may be found online at www.dnr.gov.
[33] Chapter 33. Wisconsin State Statutes.

Goal 3. Support and develop the human resources in Polk County that manage our natural resources – both LWRD and volunteer management groups.

This plan specifies how the LWRD will implement NR 151 (Runoff Management). It involves identifying critical sites, offering cost-share and other programs, identifying BMPs, monitoring and evaluating projects for compliance, conducting enforcement activities, tracking progress, and providing information and education. Polk County has local shoreland protection, zoning, subdivision, animal waste, and non-metallic mining ordinances. Enforcing these rules and assisting other agencies with programs are part of ongoing activities. Other activities to implement the NR 151 standards include: carry out information and education strategies, write nutrient management plans, provide technical assistance to landowners and lakeshore owners, perform lake studies, collaborate with other agencies, work on a rivers classification system, set up demonstration sites of proper best management practices, control invasive species, and revise ordinances to offer better protection of resources.

The NR151 standards were updated in 2010. Agricultural standards related to soil erosion limits, management of manure and wastewater, tillage setback from streams, and phosphorus runoff from crop fields. Non agricultural standards required control of runoff and sediment from developed sites.
http://legis.wisconsin.gov/resb/code/nr/nr151.pdf

Polk County Comprehensive Land Use Plan

The Polk County Comprehensive Land Use Plan was updated in October 2009. The plan analyzes issues and opportunities and reports information regarding housing; transportation; utilities and community facilities; agricultural, natural, and cultural resources; economic development; intergovernmental cooperation; land use; and energy and sustainability. An implementation chapter specifies how land use decisions will be guided by the comprehensive plan.
http://co.polk.wi.us/landinfo/PlanningCompPlan.asp

Smart Growth

Smart growth is a state mandated planning requirement to guide land use decisions and facilitate communication between municipalities. The City of St. Croix Falls, Village of Frederic, and the Town of Milltown had adopted Smart Growth plans as of September 2004. Polk County was awarded a multi-jurisdiction Smart Growth project for grant in July 2007. Ten towns, six villages, and the City of Amery are cooperating on this project with Polk County. The intent is for the Polk County Smart Growth plan to follow those developed by other municipalities.
http://www.co.polk.wi.us/landinfo/planning.asp

Shoreland Protection Zoning Ordinance

The shoreland ordinance was last updated in 2008 with specifications for transient lodging and height restrictions within the setback area. The ordinance includes impervious standards, a phosphorus fertilizer ban for shoreland property, a lakes classification system, and setback standards. The shoreland zoning ordinance is currently

being reviewed for updates according to new state rules (NR115). These updates focus on mitigation requirements related to impervious surfaces in the shoreland area. This ordinance does not apply within the village limits of Balsam Lake.
http://www.co.polk.wi.us/landinfo/ordinances.asp

Subdivision Ordinance

The Subdivision Ordinance, adopted in 1996 and updated in 2005, requires a recorded certified survey map for any parcel less than 19 acres. The ordinance requires most new plats to incorporate stormwater management practices with no net increase in runoff from the development. Any erosion and sediment control measures must be installed before land disturbing activities begin.
http://co.polk.wi.us/landinfo/ordinances.asp

Animal Waste

The Polk County Manure and Water Quality Management Ordinance was revised in January 2000. A policy manual established minimum standards and specifications for animal waste storage facilities, feedlots, degraded pastures, and active livestock operations greater than 300 animal units for livestock producers regulated by the ordinances. The inventory of livestock producers was updated in 1999 to identify operations within shoreland corridors. The inventory is periodically updated to identify operations for ordinance compliance.
http://www.co.polk.wi.us/landwater/Ordinances

Storm Water and Erosion Control

The ordinance, passed in December 2005, establishes planning and permitting requirements for erosion control on disturbed sites greater than 3,000 square feet, where more than 400 cubic yards of material is cut or filled, or where channels are used for 300 feet more of utility installation with some exceptions. Storm water plans and implementation of best management practices are required for subdivisions, survey plats, and roads where more than ½ acre of impervious surface will result. The Polk County Land and Water Resources Department administers the ordinance. The ordinance is a local mechanism to implement the Wisconsin Non-agricultural Runoff Performance Standards found in NR 151. This ordinance does not apply within the village limits of Balsam Lake.
http://www.co.polk.wi.us/landwater/Ordinances

District Involvement in Planning and Zoning

The BLPRD has two seats on the board of directors for representatives appointed by the Polk County Board of Supervisors and the Village of Balsam Lake Board of Trustees. These individuals help to bring concerns related to local planning and zoning to the BLPRD board. As concerns are identified, board members may attend related meetings and hearings to express concerns and gather information.

Simonson Property

The District commissioned a comprehensive review of the proposed Balsam Hills 35 lot residential development (including back lots) on 90 acres of the Simonson property of Little Balsam Lake in 1994[34]. Some of the environmental issues identified:

- A five-fold increase in storm water runoff from the area to be developed.
- Total phosphorus loading would increase from about 6 pounds to about 18 pounds.
- Storm water and septic drain field loading will result in a 5% annual increase in total storm water loading to Balsam Lake.
- Increased phosphorus loading will not have a significant effect on lake water clarity.
- On-site wetlands will be impacted.

The BLPRD investigated acquiring the property because of the identified impacts to Little Balsam. A proposal for purchasing the property was narrowly defeated by lake residents. Input from the study helped to limit the impacts of the subdivision ultimately approved. The subdivision was limited to 12 lakefront lots with increased setbacks and one back lot.[35]

[34] *Potential Environmental Effects Upon Little Balsam Lake.* Proposed Balsam Hills Development. Short Elliott Hendrickson Inc. July 1994.
[35] Milt Stanze. Personal communication. February 3, 2006.

Educational Efforts

Dockside

The BLPRD newsletter, Dockside, was first distributed in 1995. It covers a range of topics related to district activities and property owner education. The newsletter is mailed to all property owners within the taxing district three times each year.

Web Site

The BLPRD web site, created in 2000, includes information about lake district meetings and other management activities. Plans and studies are available as pdf documents. Summaries of conservancy properties, aquatic plant management, Rice Creek sedimentation basin, and the waterfront runoff program are included. Educational topics include lawn care, shoreline maintenance, purple loosestrife and Eurasian water milfoil. The web site may be found at www.blprd.com.

BLPRD Annual Meetings

Handouts and presentations are provided at the annual meetings. Recent topics have included:

- BLPRD activities and rationale
- Eurasian water milfoil identification
- Balsam Lake fisheries
- Shoreline buffer zones
- Aquatic plant management

Signage at Boat Landings

The BLPRD posted and maintains signs at three boat landings around Balsam Lake with information about cleaning boats, Eurasian Water Milfoil, and fishing regulations.

Plan Implementation

The following goals will guide BLPRD management efforts around Balsam Lake. The plan is intended to cover at least a five year period beginning in 2013 and extending through 2017. An update of the plan would begin in 2017.

An aquatic plant management plan was prepared for the BLPRD in 2010. The plan is summarized on page 37. The aquatic plant survey will be updated in 2013 and the aquatic plant management plan will be updated based upon the results of the survey in 2014. Commissioners may wish to schedule a status report and review of plan activities prior to the update of the plan.

Aquatic Plant Management Goals (2010)

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

2. Prevent the introduction of aquatic invasive species.

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

4. Increase lake residents' and visitors' understanding of aquatic plants and management.

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

Long Range Plan Goals

Top Priority

Goal 1. Enhance Balsam Lake property owners' and visitors' understanding of lake issues and increase their involvement in protecting and improving the lake.

Top Priority

Goal 2. Manage native and invasive aquatic plants according to the goals, objectives, and activities outlined in the Aquatic Plant Management Plan.

Top Priority

Goal 3. Improve and maintain water clarity and quality in Balsam Lake.

Goal 4. Protect, maintain, and improve fisheries and fish and wildlife habitat in and around Balsam Lake.

Goal 5. Promote the preservation and restoration of natural vegetation and scenery along the shoreline.

Goal 6. Maintain and enhance recreation and navigation.

Selected Management Activities

Selected management activities are drawn from recommendations in past studies and plans and from input gathered as part of this planning process. A work plan for 2013-2014 is included as Appendix E. The work plan lists potential partners, cost estimates, and funding sources for plan activities recommended for the next two years. Work plan progress should be reviewed and revised for each coming year by the BLPRD board prior to the annual meeting. The long range plan itself should be reviewed and updated every five years.

Activity Priorities

The advisory committee evaluated activities under each goal and ranked them according to both their importance and their immediacy (how soon they should be completed). Activities are in priority order under each goal based on committee results. Those activities ranked to be of most immediate concern were included in the 2013-2014 work plan.

Ongoing Activity Evaluation

Activities are frequently suggested to the BLPRD board. The following are a series of questions to be considered before embarking on a new activity or significantly expanding an existing activity.

1. What goal and objectives will the activity most closely address?

2. Are there additional goals and objectives that would be addressed?

3. What is the priority of each of these goals?

4. What is the likely effectiveness or impact of the activity toward meeting the stated goals and objectives?

5. What is the projected annual and long-term cost of the activity?

6. Are there grant programs or additional sources of money to support the activity? If so, how much revenue is anticipated from these sources?

Evaluation of these questions will likely occur as a multi-step process with an initial evaluation of questions 1-3 and further discussion of whether or not to pursue steps 4-6 to gain additional information for a final decision on whether or not to move an activity forward.

Top Priority

Goal 1. Enhance Balsam Lake property owners' and visitors' understanding of lake issues and increase their involvement in protecting and improving the lake.

Activities[36]

The following methods are currently used and will be continued:

1. Dockside Newsletter[37]

Seek assistance from Polk County LWRD, UWEX, DNR, and other agencies to author appropriate articles on priority topics
Publish newsletter at least three times per year

2. BLPRD Annual Meetings

Distribute handouts and present information on priority topics (invite guest speakers and authors when appropriate)

3. BLPRD Web Site

Update with information from articles above
Update maps on web site

4. Signage at Boat Landings

Expand signage to private landings, waterfront restaurants, and resorts

Additional methods for implementation:

5. Sponsor and participate in events to reach lake residents

Lake fairs, Balsam Lake homeowner's activities, look for/create fun activities with food

6. Distribute information through email lists, *Shorelines* (Balsam Lake Homeowner's newsletter), Lakeland cable television, articles in local newspapers, at the Polk County Information Center, etc.

Consider for each method:

Encourage volunteer participation.

Work with the Balsam Lake Homeowner's Association, Polk County Association of Lakes and Rivers, and the Polk County Land and Water Resources Department on cooperative education projects for priority topics.

[36] Top priority activities are shown in bold.
[37] The February 2010 resident survey identified newsletters as the preferred way for residents to receive information from the BLPRD.

Evaluation

Assess effectiveness of various educational techniques and incentives through surveys and focus group sessions.

Priority Educational Messages for the BLPRD:

- Explain "What's in it for me" to lake residents
- What's new?
- What are the rules? Who do I call for information?
- What services are available?
- It is your lake – take care of it
- Focus on what individuals can do
- Boater safety
- Eurasian water milfoil prevention/clean boats
- Impacts of runoff from waterfront property and waterfront development
- Infiltration practices/alternatives to lawn
- Benefits of native aquatic plants
- Importance of shoreland habitat/buffer zones
- Activities of the BLPRD
- Local land use plans and ordinances
- Water use rules and regulations
- Septic system maintenance

Desired action by waterfront property owners:

- Clean plant fragments off of boats and trailers before placing them in Balsam Lake.
- Minimize impervious surfaces on your property and increase infiltration of runoff water.
- Allow a zone of natural vegetation between your home and the lake.
- Minimize removal of native aquatic plants near your shoreline.
- Understand the effects of boats and piers and the impacts of recreational use on near-shore habitat.
- Learn about and follow shoreland ordinances.
- If you fertilize, use zero phosphorus fertilizer.
- Have your septic system pumped regularly.

Top Priority

Goal 2. Manage native and invasive aquatic plants according to the goals, objectives, and activities outlined in the Aquatic Plant Management Plan.

Activities

Major activities from the 2010 Aquatic Plant Management Plan are summarized in the work plan in Appendix E.

Top Priority

Goal 3. Improve and maintain water clarity and quality in Balsam Lake.

- Objective A: Better understand lake processes to target actions.
- Objective B: Improve water quality in East Balsam.
- Objective C: Improve and maintain water quality in all lake basins including Little Balsam, Main Basin, Stump Bay, Boston Bay, and the Mill Pond.
- Objective D: Maintain established water quality projects.

Activities[38]

1. **Complete a sediment core study** to assess the natural or reference condition for lake water quality and the impacts of land use changes and management efforts over the past 150 years in East Balsam, Little Balsam, and the Main Basin. (OBJ A)

2. **Complete a sediment phosphorus release study** of East Balsam in order to assess if an alum treatment is appropriate for East Balsam. (OBJ A)

3. Review feasibility and potential improvements to water clarity by creating an additional outflow for East Balsam in a stepwise manner. (OBJ B)

3a. Is it legally possible to create an additional outflow for East Balsam?

Complete analysis in 3b and 3c only if permitting of an outflow is possible.

3b. Would an additional outflow improve water quality in the basin?

3c. Is it technically possible to create such an outflow?

[38] Top priority activities are shown in bold.

4. Complete additional water quality analysis for East Balsam to answer the following questions: (OBJ A)

4a. How much does curly leaf pondweed contribute to the phosphorus load of East Balsam?

4b. How significant are changes to watershed (specifically agricultural) loading to East Balsam water quality?

5. Re-evaluate water quality objectives and activities based upon the results of the sediment core study, CLP analysis, and East Balsam outflow analysis along with information from the 2010 water quality study. (OBJ A)

6. Reassess agricultural best management practice needs and priorities in the East Balsam and Main Basin watersheds. Identify actively cropped agricultural fields/farms, measure soil phosphorus on farm fields, and model phosphorus release using SNAP plus (an agricultural water quality model). (OBJ A)

7. **Encourage the Village of Balsam Lake to develop a stormwater management plan.** (OBJ C)

8. Encourage the Village of Balsam Lake to adopt an erosion control and stormwater ordinance to ensure that sediment and nutrients from construction and redevelopment are kept on site. (OBJ C)

9. Encourage the Village of Balsam Lake to consider adopting elements of the Polk County Shoreland Zoning rules, so properties within the village limits are subject to similar rules as those under county jurisdiction. (OBJ C)

10. Work cooperatively with DNR, Polk County, the Village of Balsam Lake, and Towns to address water quality concerns related to land use planning, ordinance implementation, road construction and maintenance, and other government functions. (OBJ C)

11. Consider continuing the waterfront runoff program with education, design assistance, and cost sharing for the installation of water quality practices on individual lots. (OBJ C)

12. **Maintain installed watershed practices.**
Dredge sediment as needed to maintain the Balsam Acres sediment basin effectiveness (dredge at about 50% level). (OBJ D)

Evaluating Progress of Management Efforts / Monitoring

13. **Continue volunteer Citizen Lake Monitoring** Secchi-depth measurements in East Balsam, Little Balsam and the Main Basin. Add Secchi monitoring in Stump Bay and Boston Bay.

14. Participate in expanded Citizen Lake Monitoring to include long-term phosphorus and chlorophyll a levels. Expanded Citizen Lake Monitoring is currently available in East Balsam and the Main Basin. Request additional monitoring from DNR for Little Balsam, then Stump Bay and Boston Bay.

Goal 4. Protect, maintain, and improve fisheries and fish and wildlife habitat in and around Balsam Lake.

Activity[39]

1. **Identify areas where fish habitat could be enhanced install woody habitat in appropriate locations.**

> ***Definition***
> ***Woody habitat*** consists of trees, branches, and logs in the lake. This structure provides food, cover, and protection against shoreline erosion. Habitat is improved for insects, fish, amphibians, birds and other animals. Woody habitat, fish sticks, or woody debris are all used to describe wood added back to a lake.

Goal 5. Promote the preservation and restoration of natural vegetation and scenery along the shoreline.

Activities[40]

1. Consider BLPRD incentives to plant native plants along the water's edge.

2. Promote technical assistance provided by the Polk County LWRD, UWEX, DNR and other agencies.

3. Protect critical habitat areas on Balsam Lake shorelines following the guidelines in Appendix F.

[39] Top priority activities are shown in bold.
[40] Top priority activities are shown in bold.

Goal 7: Maintain and enhance recreation and navigation.

Activities[41]

1. **Re-assess the feasibility of dredging to enhance navigation in Little Balsam**. (This activity was not pursued because permits for extensive dredging were not likely to be issued by DNR staff who stated concern about potential impacts to wild rice present.)
    a. monitor extent of sediment delta in Little Balsam annually.

2. Replace the box culvert between the Mill Pond and Town Bay with a bridge to allow more boat access.

Goal 8: Improve BLPRD operations.

Activities

1. Maintain efficient operations of the BLPRD office. For example, consider providing internet access in the office.

2. Interact with other lake districts

[41] Top priority activities are shown in bold.