Balsam Lake Long Range Plan

Balsam Lake Protection and Rehabilitation District

July 2006

Commissioners (2006)

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Plan Prepared by Harmony Environmental

Watershed Maps Prepared by Polk County Land and Water Resources Department

A Message From the BLPRD Commissioners

We want our 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 the size of our boats and motors and the way we use them, the lake will 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 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 action items 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 to address lake management issues. 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. 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) was 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 – Historical Perspective

Balsam Lake Early Development

Chippewa Indians lived along the shores of Balsam Lake when Caucasian settlers arrived in the area. A trading post was located on the lake from 1844 to 1854. Initial development of the Balsam Lake area centered around construction of a dam, mill, and boarding house. The mill was used to construct 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. In 1875 the Town of Balsam Lake had a population of 555. The first log schoolhouse in the area was built in 1876.[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 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. 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 $5,000 each year to a management fund that Northwestern Electric also made contributions to. 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 49 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[3]

1985 Sanitary sewer feasibility study (SEH, Inc.)

1986 Sanitary sewer study completed. Board decided not to proceed with sewer system

1988 Portable toilets for boat landings

Boat and boat lift purchased for water safety patrol

1994 Purchased 80 acre Glenna Farm and named property Balsam Acres
Removed animals from farm and ended farming operations
(reduced nutrient and sediment loading to Rice Creek and Balsam Lake)

1995 Seeded Balsam Acres uplands to prairie

Dockside newsletter began

1998 Sewer feasibility study completed (Cedar Corporation)

1999 Flyover study completed (A.W. Research)
Formed sanitary district within boundaries of the lake district
Constructed sediment basin on Balsam Acres

2000 Initiated water quality testing of some streams
Ground-truthing for flyover study
Web site established
Adopted macrophyte management plan (Barr Engineering)
Began application of herbicide to lake navigational channels; ended harvesting
Began cost-share plan with Village of Balsam Lake for dam operation

2002 Presented sewer feasibility study results (Cedar Corporation)
Sanitary sewer system proposal rejected at annual meeting
Installed four survey monuments to monitor lake levels and better manage dam
Acquired five contiguous Deaver Trust parcels on south shore of Balsam Lake
Water quality testing around lake
Phosphorus-free fertilizer $2 coupons distributed

2003 Began lake level monitoring
Pursued acquisition of Stumps properties
Received grant for acquisition of lot next to Deaver property
Installed auto sampler on Harder Creek
Shared cost to install conservation practices:

1) stabilized two gullies on Little Balsam
2) cleaned-up gravel pit on Otter Creek
3) fenced cattle from pond adjacent to East Balsam

[3] The property was eventually purchased by the BLPRD, and conservation practices were installed here. See page 20 for more information about property location and water quality improvements made.

Balsam Lake Management Goals

The following goals will guide BLPRD management efforts around Balsam Lake. An aquatic plant management plan was prepared for the BLPRD in 2005. The plan is summarized on page 26. Aquatic plant management plan goals are shown below.

Goal: Improve and maintain nutrient levels and water clarity in each basin of Balsam Lake.

Goal: Protect, maintain, and improve fish and wildlife habitat in Balsam Lake and its watersheds.

Goal: Promote the preservation and restoration of natural vegetation along the Balsam Lake shoreline.

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

Aquatic Plant Management Goals

1. Preserve native species, preserve and/or improve fish and wildlife habitat, protect the lake's ecosystem, and protect and/or improve the quality of Balsam Lake for all to enjoy (i.e., people, fish, wildlife).
2. Remove vegetation from public beach areas and public swimming areas to insure safe swimming conditions.
3. Remove vegetation from public boat landings to insure public access to the lake.
4. Improve navigation within the lake through areas containing dense plant beds.
5. Reduce curlyleaf pondweed density and coverage as warranted to preserve native species, preserve fish and wildlife habitat, protect the lake's ecosystem, and protect the quality of the lake for all to enjoy.
6. Prevent the introduction of additional non-native species to the greatest extent practicable, including education, postings, etc.
7. Protect and, when feasible, improve the water quality of Balsam Lake to protect plant habitat conditions, particularly light conditions to insure the lake's plants have adequate light for growth.

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, a special advisory meeting, and public survey. Results of these efforts are included in Appendix A. The input received guided the formation of goals and activities for this long range plan.

Input to Commissioners

District members (lake residents) have the opportunity to express concerns at annual meetings. They may also contact commissioners who pass on these concerns at regular board meetings or members may appear at board meetings themselves. Concerns expressed by residents to commissioners were captured in a worksheet completed by BLPRD commissioners.

Special Advisory Meeting

Background information gathered for the plan was presented at a special advisory meeting for the long range plan development. This meeting was held January 23, 2006 at the Balsam Lake Village Library. Participants and results of the meeting are included in Appendix A. Participants were asked to review the background information, prioritize a list of concerns, and propose action items.

Combined Results: Advisory Group and Commissioners

Top Resource Concerns

- ✓ Level of water clarity
- ✓ Aquatic invasive species

Priority Balsam Lake Causes of Impacts

- ✓ Waterfront development and runoff
- ✓ Invasion of exotic species
- ✓ Residential fertilizer and pesticide use

Priority Recommended Activities

- ✓ Environmental education programs for adults
- ✓ Herbicide use for treating invasive aquatic plants
- ✓ Property acquisition for watershed and lake habitat protection
- ✓ Invasive species information and technical assistance

Plan Survey

A summary of the draft plan was distributed in early summer 2006 with resident input requested in the form of a one-page survey. The survey results closely mirrored priorities identified by the commissioners and the advisory group.

Population Dynamics

Balsam Lake and its watersheds are located in central Polk County, Wisconsin in the Towns of Milltown, Georgetown, Balsam Lake, and Apple River. The watershed also includes the Village of Milltown and the Village of Balsam Lake. The area has experienced steady population growth since 1970 as illustrated in Figure 1.

Municipalities around Balsam Lake experienced a slight increase in growth rate from the year 2000 to 2005 when compared to previous decades. These rates average 6.3 percent, below the overall Polk County growth rate of 8 percent. Population growth rates are highest in the southwest portions of Polk County; these towns are closest to the Twin Cities Metropolitan Area in Minnesota.

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. The percentage of residences occupied seasonally is quite high throughout the watershed with seasonally occupied housing at 33% of total housing units in the Town of Apple River, 45% in the Town of Balsam Lake, 69% in the Town of Georgetown, 43% in the Town of Milltown, and 32% in the Village of Balsam Lake. Countywide, about 20 percent of the housing units are occupied seasonally for recreational use.[4]

Records of new septic permits capture the amount of residential development occurring in the watershed. Figure 2 illustrates this growth from 2000 through 2005 in towns included in the watershed. In this time period, there was an average of 65 homes constructed with a new septic system each year in the Towns of Apple River, Balsam Lake, Georgetown, and Milltown. Some of the construction was outside of the Balsam Lake watershed area.

[4] U.S. Census. 2000.

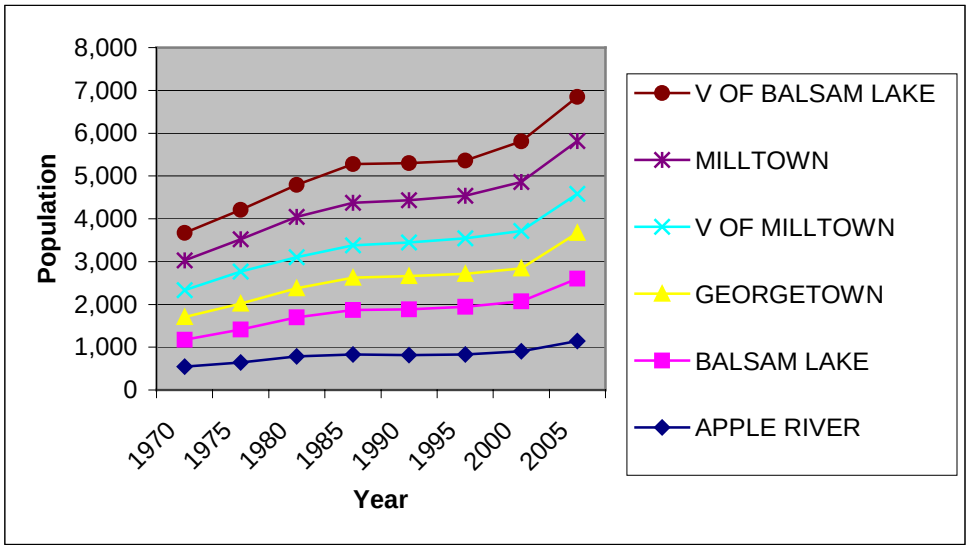

Figure 1. Balsam Lake Area Population Change[5]

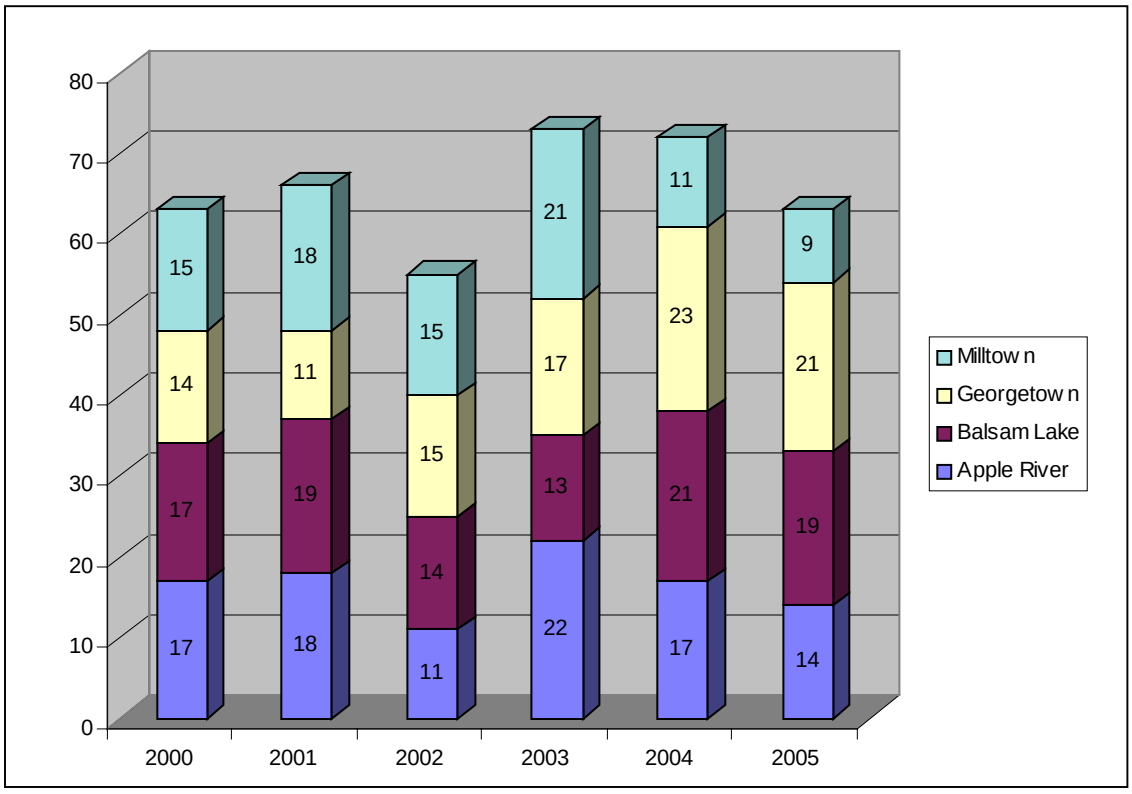

Figure 2. New Septic Permits: Towns Within the Balsam Lake Watershed

[5] Note that the population values in this figure are cumulative: lines above include the populations of each municipality reported beneath. Population figures include land outside of the Balsam Lake watershed as well as land within the watershed.

Balsam Lake Inventory

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. 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.[6]

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 the north side of Balsam Lake's main basin to the Stumps area.

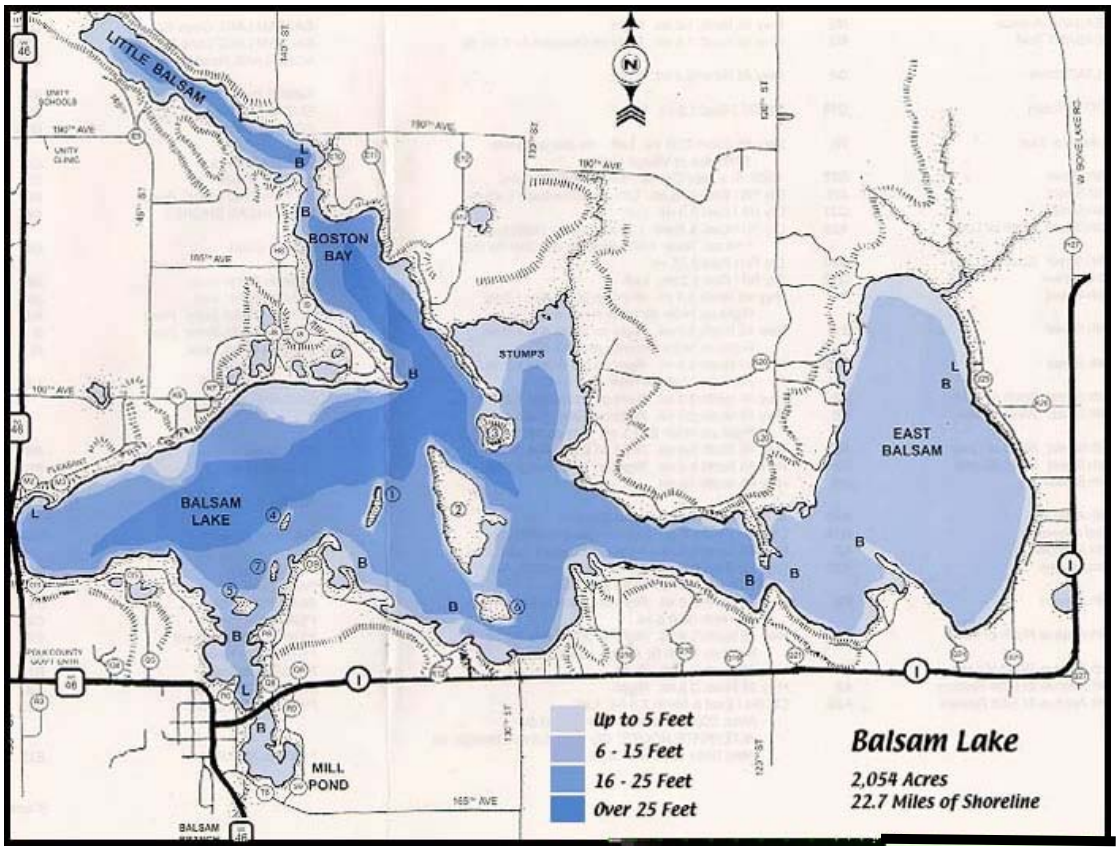

Figure 3. Map of Balsam Lake

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

Water Cycle

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 most recently assessed for Balsam Lake using data from December 1987 through November 1989.[7] Precipitation, groundwater levels, and streamflow were below normal during the study period and the year preceding the study. Precipitation, the dominant water-budget inflow component, was followed in decreasing order by inflows from Rice Creek, groundwater, Harder Creek, and near-lake drainage. This plan recommends completing an update of the water and total-phosphorus budget in 2007.

Water Quality

Trophic status describes the degree of nutrient enrichment of a lake. 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).

The main basin of Balsam Lake is a mesotrophic lake with moderate fertility.[8] The northwest basin of the lake or "Little Balsam" and the East Basin are upper mesotrophic to lower eutrophic. Algal growth in Balsam Lake is dependent upon the amount of available phosphorus rather than nitrogen[9] (which is the case for most lakes).

The northwest bay of Balsam Lake, Little Balsam Lake, is heavily used for boating, water skiing, and other recreational activities. During windy conditions, its sheltered waters provide safe recreational opportunities when unsafe conditions prevail on the larger lake. However, there is concern that sediments carried to Little Balsam via Rice Creek will reduce lake depth, increase plant growth, and increase the lake's fertility. Little Balsam Lake is currently a target for monitoring and management efforts because of concerns regarding sediment and nutrient inputs from Rice Creek.[10]

Lake Self-Help Monitoring Results

Volunteers have collected secchi depth measurements in three locations in Balsam Lake since 1987. These measurements provide an important historical record of lake water clarity. The following graphs, prepared by Barr Engineering, illustrate changes in lake water clarity scaled against the trophic status of each area of the lake. Water clarity is highest in the main basin.

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[7] *Water and Phosphorus Budgets and Trophic State, Balsam Lake, Northwestern Wisconsin.* 1987 – 1989. U. S. Geological Survey. Water Resources Investigations Report 91-4125.
[8] *Balsam Lake Polk County. Feasibility Study Results: Management Alternatives.* Wisconsin Department of Natural Resources. Office of Inland Lake Renewal. 1979.
[9] Letter to Gerald Kafka, BLPRD from Stephen Field, USGS. June 3, 1994.
[10] *Planning Grant Applications.* Barr Engineering for the Balsam Lake Protection and Rehabilitation District. February 2005.

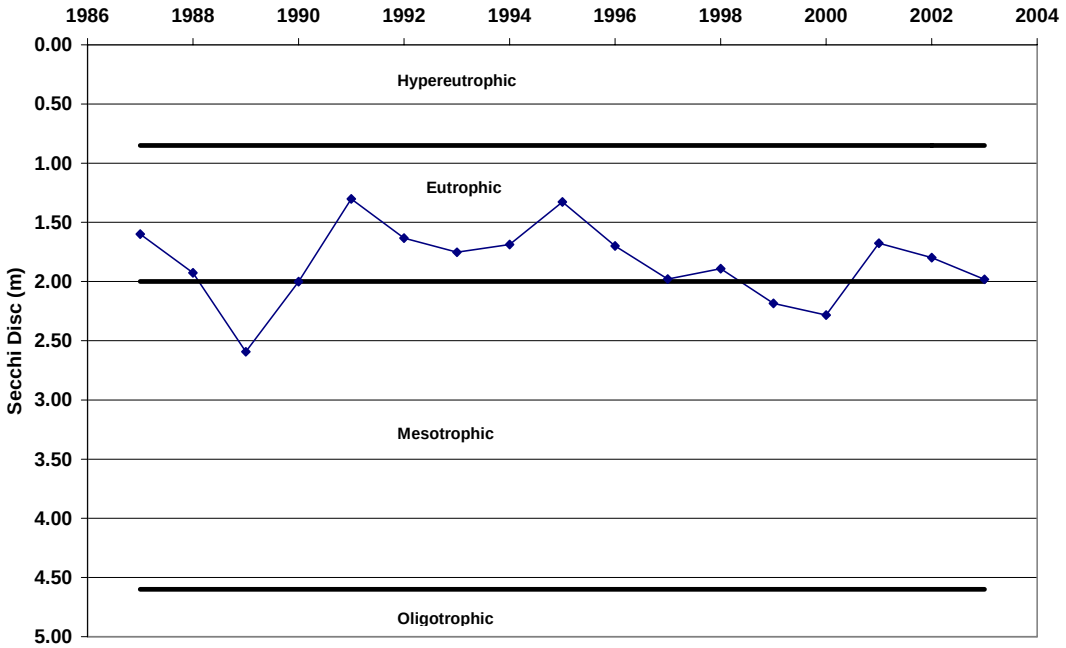

Figure 4. 1987-2003 Little Balsam Lake Secchi Disc Water Transparency

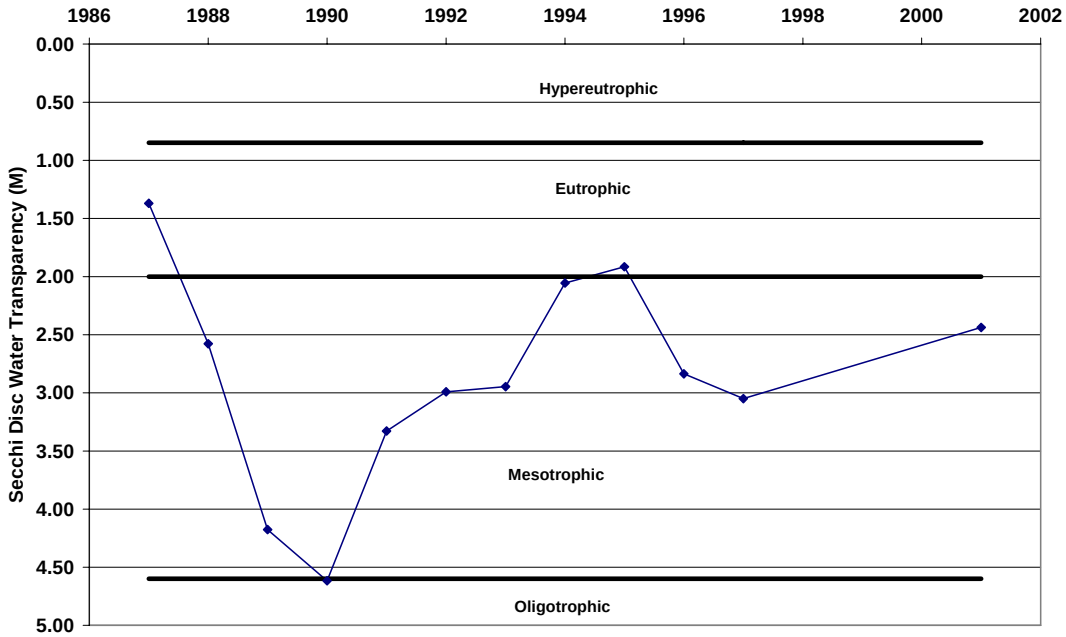

Figure 5. 1987-2001 Balsam Lake Main Basin Secchi Disc Water Transparency

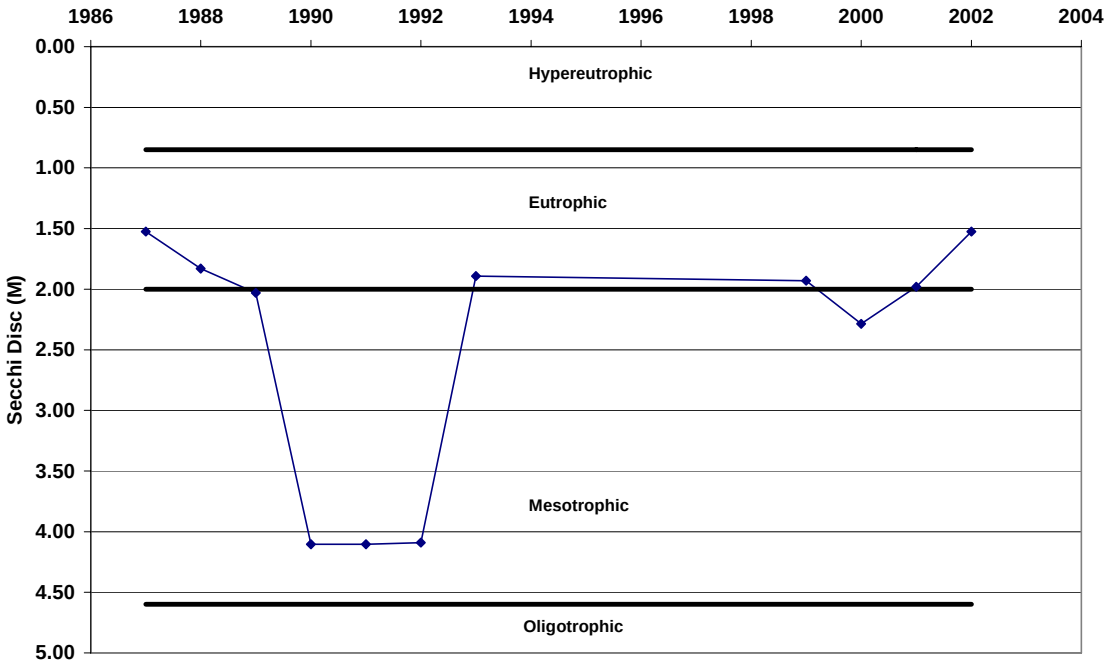

Figure 6. 1987-2002 East Balsam Lake Secchi Disc Water Transparency

Watershed Description

The Balsam Lake watershed is a portion of the Balsam Branch watershed in the St. Croix Basin. The Balsam Lake watershed is roughly 17,000 acres with 10,219 acres draining directly to Balsam Lake with little or no retention in wetlands or low areas. Of the direct drainage area, 30.5 percent is forested, 20 percent is open water, 19 percent is in grassland, 13 percent is in row crops, 12 percent is wetland, 4.5 percent is forage (hay crop) and 1 percent is barren. Forested lands may, in fact, be in residential development because of tree cover over houses and yards.[11] 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.[12] These areas of closed depressions result in only about 60 percent of the watershed draining directly to the lake.

[11] Data from Polk County Land and Water Resources Department.
[12] *Water and Phosphorus Budgets and Trophic State, Balsam Lake, Northwestern Wisconsin.* 1987 – 1989. U. S. Geological Survey. Water Resources Investigations Report 91-4125.

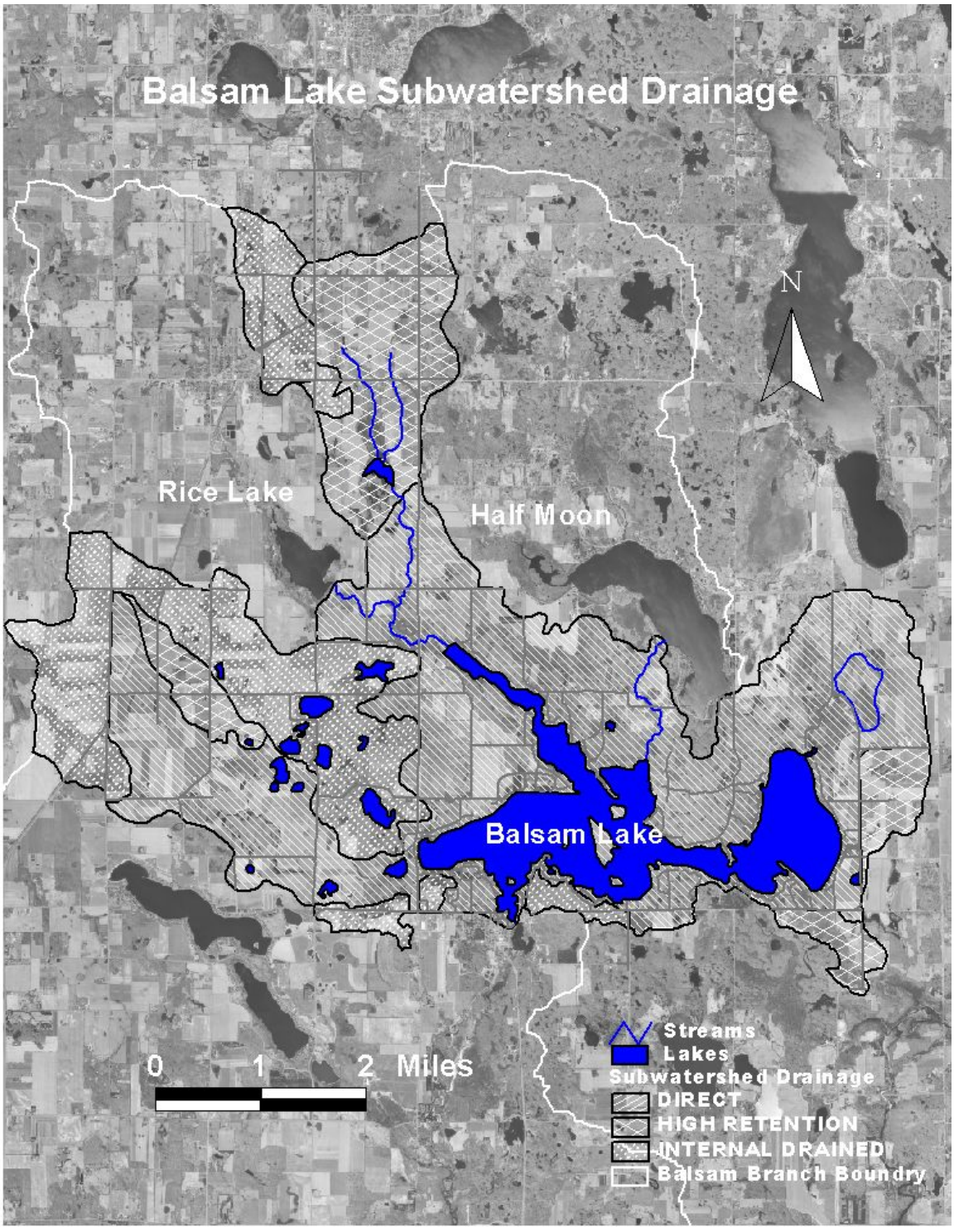

Figure 7. Balsam Lake Watershed and Drainage Areas

Fisheries

The Balsam Lake fishery is comprised of northern pike, walleye, largemouth bass, and pan fish. The DNR reported the Balsam Lake fishery as strong and well balanced in 1979.[13] However, recent declines in the walleye population could alter that assessment.

Largemouth bass are the dominant game fish in Balsam Lake. Approximately 25,000 largemouth bass larger than 8 inches roam Balsam Lake. 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 in total. The regulation is designed to reduce the number of smaller bass in the lake and allow the larger bass that remain to grow faster and fatter because of less competition for the available forage base in the lake.

The walleye population continues to decline on Balsam Lake. In 2005, only 1,650 adult walleye were present. This is almost ½ the number of fish present from a 2002 estimate of 3,100 adult walleye. The reason the walleye population is still declining is not clear. The WDNR has been aggressively stocking walleye in the lake over the past decade with limited success. It appears predation from other fish may be a key limiting factor in walleye recruitment. In 2004 and in 2006 larger size walleye fingerling (averaging around 7 inches in length) will be stocked in an effort to increase recruitment of stocked walleye. More restrictive walleye regulations may also be pursued in the future to protect the declining walleye population.[14]

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 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.

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

[14] 2006 Fishing Preview Barron and Polk Counties**.** Heath Benike, DNR Fisheries Biologist.

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.

Wildlife

The wildlife around Balsam Lake is 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, various song birds, snakes, frogs, and turtles to name a few.

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 agriculture areas; all are key habitats to the wildlife in the area.[15]

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

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 is identified as a mesotrophic lake with moderate fertility. The gamefish 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 are herbicide applications and harvesting.[16]

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.[17]

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

[17] *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[18]

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 phytoplankton. 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.[19]

[18] Analysis of Balsam Lake (Polk County, Wisconsin) with Recommendations for Improved Lake Management. September 1986. Lim Tech Consultants. Report No. LT-R46902.
[19] *Restoring Rice Lake at Milltown, Wisconsin.* Department of Natural Resources. Madison, Wisconsin. 1991.

Balsam Branch Priority Watershed Project

The Balsam Branch Priority Watershed Project is 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. 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. A total phosphorus reduction of 26.7 percent was needed to reach the in-lake phosphorus goal.[20]

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%).[21] 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%);
- An intensive urban nutrient reduction program;
- Consider in-lake remediation (alum treatment) for Little Balsam; and
- Reduce nutrients from Rice Creek tributary

Watershed Project Results

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 amounted to $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

[20] Nonpoint Source Control Plan for the Balsam Branch Priority Watershed Project. Wisconsin Department of Natural Resources, et. al. April. 1995.

[21] *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.

share) for projects within the Balsam Lake subwatershed. State and county cost sharing and the landowners paid the remaining costs. Some of the projects in the Balsam Lake subwatershed were completed before the BLPRD made the offer to pay a portion of the landowner share.

Table 1. Balsam Branch Priority Watershed Cost Share 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.

Because computer tracking methods for sediment and phosphorus delivery to water were not year 2000 compliant, it was not possible to assess progress toward meeting the watershed phosphorus reduction goal from installation of conservation practices.

Changing agricultural practices 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 inventoried for a total contribution of 1,121 pounds of P. Retirement and economic attrition has claimed 15 of these originally inventoried farms. Based on the modeling at the time of inventory, these reductions amount to approximately 629.9 pounds of annual P loading. Of the 14 active farms, 7 have developed and implemented nutrient management plans.

However, these phosphorus loading reductions from fewer barnyards may be negated because of increases in soil erosion. Fields that grew hay for dairy cattle consumption ten years ago 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.

Transect surveys, used by the Polk County Land and Water Resources Department to monitor soil erosion, found that erosion increased in the Balsam Lake watershed from 1999 to 2005. There are more sample sites above T, the tolerable soil loss rate, as more

fields are planted to vegetable row crops. Forage and idle ground is decreasing, and there seems to be a trend toward less residue left on crop fields. Crop residues help to decrease soil erosion from fields. 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.

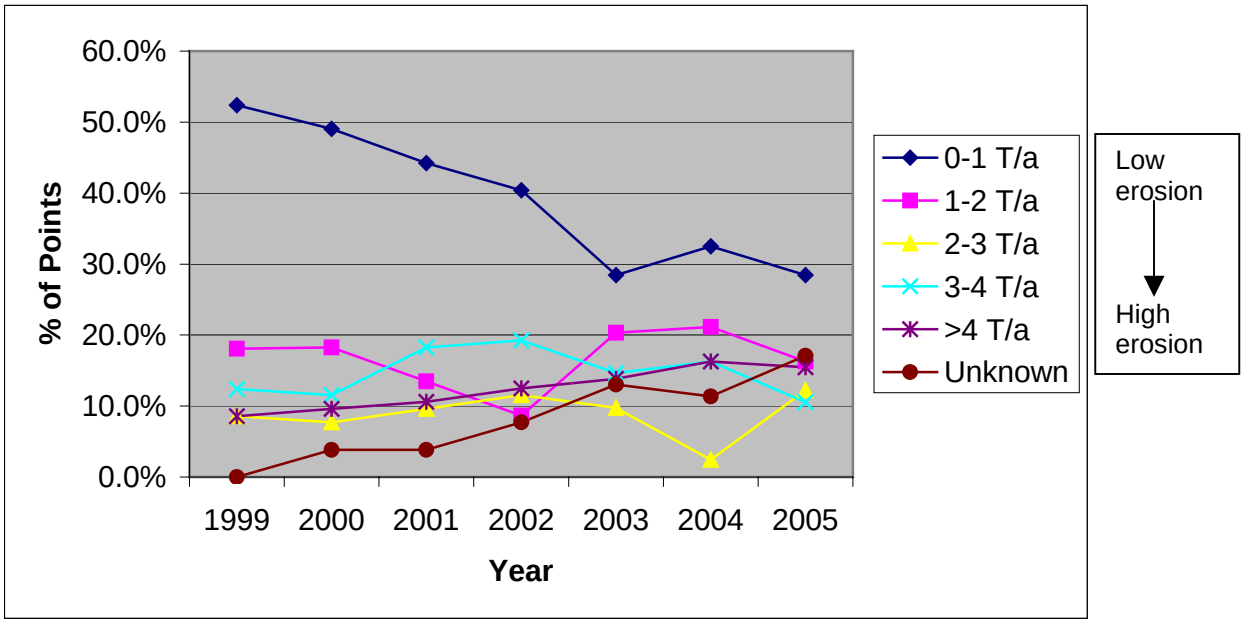


Figure 8. Soil Loss in the Balsam Lake Watershed

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 will be checked periodically to determine how much sediment the basin has captured. 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 have been recent targets for in-flow monitoring. 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 below.

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 and after sedimentation basin construction at Balsam Acres, average total phosphorus

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

values actually increased between the two time periods. These differences may be a reflection of varying storm and snow melt events more 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 down stream of where Otter Creek joins Rice Creek.

Table 2. 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

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 is due primarily to upstream sources. Emergent vegetation results 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

[23] Letter to Allen Dornfeld, BLPRD from Thomas MacDonald, Barr Engineering. August 9, 2002.

minor erosion was found, there was a minimum of 100 feet of buffer. This indicates that stream bank erosion is not likely the cause of sediment loading in Rice Creek.[24]

Rice Creek and Otter Creek Monitoring 2006

A project to be completed in 2006 will evaluate contributions of sediment to Little Balsam from Otter Creek and Rice Creek.[25] The project is divided into four phases for funding purposes. Phase 1 evaluates flow, sediment, and nutrients from Otter Creek. Phases 2 and 3 evaluate Rice Creek upstream and downstream of where Otter Creek flows into Rice Creek, and Phase 4 combines the data into a report. Phase 1 and Phase 2 studies have qualified to receive DNR Lakes Management Planning grant funding. Phase 3 and 4 will proceed without grant assistance.

Harder Creek and Other Inflow Monitoring 2003

With funding from the BLPRD, the Polk County Land and Water Resources Department monitored flow quantities 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 allow preservation of critical habitat and watershed areas. They also provide the control needed to allow installation of conservation practices. The BLPRD currently owns four 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. They may place additional restrictions on how the property is used. The BLPRD might work with

[24] Unpublished report. Jeremy Williamson. Water Quality Specialist. Polk County Land and Water Resources Department.
[25] *Planning Grant Applications.* Barr Engineering for the Balsam Lake Protection and Rehabilitation District. February 2005.

the DNR or a land trust organization to establish a conservation easement for a conservancy property.

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 3. 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. Care should be taken to prevent erosion into this area.”[26] The

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

properties themselves contain one of the few areas around the lake of native forested habitat.

Peterson Property

The Peterson Property is located adjacent to the Stumps area of Balsam Lake. 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 Stumps area of Balsam Lake is an important wildlife habitat area. The undeveloped Peterson parcel totals 18.50 acres. It is located in Section 36 in the Town of Milltown, Polk County, on each side of Harder Creek where it enters Balsam Lake. Wetlands total at least 8 acres.

The parcel has approximately 1200 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.

The acquisition of this parcel carries 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.*

The BLPRD continues to pursue acquisition of the adjacent 34-acre parcel to the west to further enhance the benefits associated with the Peterson Property acquisition.

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.[27] 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 12 lakeshore lots and one back lots and is marketed as Hidden Forest.

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

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). [28]

Recent Plant Survey and Plan

Barr Engineering completed a macrophyte survey that evaluated plant coverage, density, and species composition in the summer of 1999[29] and repeated the survey in June 2005.[30] The 2005 study reports a healthy, diverse, high quality native plant community in Balsam Lake that has changed little since 1999. Aquatic plants cover about 41 percent of the lake area. Plant diversity in Balsam Lake is relatively high when compared with fifty Wisconsin lakes. A total of 21 species were found in 2005, and 25 species were found in 1999. Coontail *(Ceratophyllum demersum)* was the most frequently occurring species. Curly-leaf pondweed *(Potamogeton crispus),* a non-native invasive plant, occurred at 56 percent of the sample points in 1999 and only 41 percent of the sample points in 2005. This change is noted as positive for the lake.

Despite the favorable aquatic plant community, the plan identifies specific locations that require annual management. The plan recommends herbicide treatment once or twice each summer for swimming beaches, boat landings, and navigation channels. This amounts to 14 acres. An additional 33 acres with very high plant density are recommended for herbicide treatment. The total recommended treatment area is less than two percent of the lake's surface area.

The 2000 plan proposed using herbicide treatments to treat public swimming areas, boat landings, and boat passageways. 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 cost of chemical application has been 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 Lake District has also applied chemicals at the public landings for several years hoping to prevent the introduction of Eurasian water milfoil to the lake. This technique is

[28] Analysis of Balsam Lake (Polk County, Wisconsin) with Recommendations for Improved Lake Management. September 1986. Lim Tech Consultants. Report No. LT-R46902.
[29] *Balsam Lake Macrophyte Surveys and Management Plan.* Prepared for Balsam Lake Protection and Rehabilitation District. Barr Engineering. February 2000.
[30] *Balsam Lake Aquatic Plant Survey and Management Plan.* Prepared for Balsam Lake Protection and Rehabilitation District. December 2005. Barr Engineering.

not described in the 2005 plan. The boat landings are checked monthly in the summer months for the presence of Eurasian water milfoil.[31]

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 is not recommended in the 2005 plan.

A long term treatment program recommends use of lime slurry to reduce plant density, including curly leaf pondweed density, to attain favorable long-term changes in problematic areas.

Because aquatic plant management is discussed in detail in the aquatic plant management plan, only the main activities are included in this long term management plan. Goals in the aquatic plant management plan are included on page 4 of this plan.

Aquatic plants provide important functions that benefit lakes. However, aquatic plants may create nuisance conditions as well.

Benefits:

- Habitat for fish, insects and other aquatic invertebrates
- Food for waterfowl, fish, and wildlife
- Produce oxygen
- Stabilize marshy lake borders
- Protect shorelines against wave erosion
- Provide nesting sites for waterfowl and marsh birds
- Aesthetics

Nuisances:

- Interfere with swimming
- Impede navigation
- Limit recreation such as water skiing and use of personal watercraft

[31] BLPRD Annual Meeting 2002.

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.[32]

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.[33]

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.

[32] BLPRD Annual Meeting Minutes. 1998.
[33] 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.

Boating Regulations

The Department of Natural Resources regulates boating in the state of Wisconsin.[34] Wisconsin conservation wardens enforce boating regulations. A few highlights of boating regulations are found below.

- ✓ Personal watercrafts (PWCs) may not operate from sunset to sunrise.
- ✓ PWC operators must be at least 12 years old.
- ✓ 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 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.[35]

[34] Boating regulations may be found on line at www.dnr.wi.us/org/es/enforcement/docs/boating regs.pdf.
[35] Chapter 33. Wisconsin State Statutes.

Related Plans and Ordinances[36]

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.

Polk County Land and Water Management Plan

The land and water management plan guides the activities of the Polk County Land and Water Resources Department from 2005 – 2009. The department will partner with local, state, and federal agencies and organizations to conserve soil and water resources, reduce soil erosion, prevent nonpoint source pollution and enhance water quality. Activities include technical assistance with enforcement, technical and financial assistance, and education. Local plans and ordinances are described in the document. The land and water management plan includes an implementation strategy for state agricultural performance standards. Farmers are required to meet these standards when the county offers cost sharing.

WI Agricultural Performance Standards (NR 151)

For farmers who grow agricultural crops

- Meet "T" on cropped fields
- Starting in 2005 for high priority areas such as impaired or exceptional waters, and 2008 for all other areas, follow a nutrient management plan designed to limit entry of nutrients into waters of the state

For farmers who raise, feed, or house livestock

- No direct runoff from feedlots or stored manure into state waters
- No unlimited livestock access to waters of the state where high concentrations of animals prevent the maintenance of adequate or self sustaining sod cover
- Starting in 2005 for high priority areas, and 2008 for all other areas, follow a nutrient management plan when applying or contracting to apply manure to limit entry of nutrients into waters of the state

For farmers who have or plan to build a manure storage structure

- Maintain a structure to prevent overflow, leakage, and structural failure
- Repair or upgrade a failing or leaking structure that poses an imminent health threat or violates groundwater standards
- Close a structure according to accepted standards
- Meet technical standards for a newly constructed or substantially-altered structure

For farmers with land in a water quality management area (defined as 300 feet from a stream, or 1,000 feet from a lake or areas susceptible to groundwater contamination)

- Do not stack manure in unconfined piles
- Divert clean water away from feedlots, manure storage areas, and barnyards located within this area

[36] Plan and ordinance summaries are taken from the Polk County Land and Water Management Plan. 2004.

Polk County Comprehensive Land Use Plan

The Polk County Comprehensive Land Use Plan was adopted in 2002. The plan includes an analysis of population, economy, housing, transportation, recreation, and land use trends. It also reports the physical features of Polk County. The purpose of the land use plan is to provide general guidance to achieve the desired future development of the county and direction for development decisions. The lakes classification outlines restriction on development according to lake features. Planning areas are recommended in the plan. The plan is available online at http://co.polk.wi.us/landinfo/comprehensive_plan.htm.

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. The Town of St. Croix Falls plan is pending approval in January 2006. Polk County submitted a multi-jurisdiction Smart Growth project for grant funding pending approval as of January 2006. 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.[37]

Shoreland Protection Zoning Ordinance

Polk County passed an update of the Shoreland Ordinance in 2002. The updates put in place standards for impervious surfaces, a phosphorus fertilizer ban for shoreland property, and lakes classification and setback standards. The ordinance is available online at http://www.polkshore.com.

Subdivision Ordinance

The subdivision ordinance, adopted in 1996, requires a recorded certified survey map for any parcel less than 19 acres. The ordinance requires most new plats to incorporate storm water management practices with no net increase in runoff from development. The ordinance is available online at http://co.polk.wi.us/landinfo/PDFs/subdivisionordinance.pdf.

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 Land and Water Resource Department's objective is to have compliance with the ordinance countywide by 2006. The ordinance is available online at http://www.co.polk.wi.us/landwater/MANUR21A.htm.

[37] Personal communication Robert Kazmierski, Community Resource Development, Polk County UW Extension. January 30, 2006.

Storm Water and Erosion Control

The ordinance, passed in December 2005, establishes planning and permitting requirements for erosion control on disturbed sites greater than 3000 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.

WI Non-Agricultural Performance Standards (NR 151)

Construction Sites >1 acre – must control 80% of sediment load from sites

Storm water management plans (>1 acre after 10/1/04)
- Total Suspended Solids
- Peak Discharge Rate
- Infiltration
- Buffers around water

Developed urban areas (>1000 persons/square mile)
- Public education
- Yard waste management
- Nutrient management
- Reduction of suspended solids

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[38]. 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

[38] *Potential Environmental Effects Upon Little Balsam Lake.* Proposed Balsam Hills Development. Short Elliott Hendrickson Inc. July 1994.

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 Short, Elliot, and Hendrickson 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.[39]

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.

Web Site

The BLPRD web site, created in 2000, includes information about lake district meetings and other management activities. Summaries of conservancy properties, aquatic plant management, and the Rice Creek sedimentation basin are included. Educational topics include lawn care, shoreline maintenance, purple loosestrife and Eurasian water milfoil. A coupon for $2 off phosphorus-free fertilizer is offered on the web site. 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.

[39] Milt Stanze. Personal communication. February 3, 2006.

Recommended Management Activities

The management activities listed below are drawn from the background information reviewed and from public input gathered as part of the planning process. A work plan for 2007 – 2008 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. The work plan progress should be reviewed and revised for the coming year by the BLPRD board prior to each annual meeting. The plan itself should be reviewed and updated every five years.

Goal: Improve and maintain nutrient levels and water clarity in each basin of Balsam Lake.

Maintain installed watershed practices

Dredge sediment as needed to maintain Balsam Acres sediment basin effectiveness.

In cooperation with the Polk County Land and Water Resources Department, reassess conservation best management practice needs and priorities in the direct drainage area of the Balsam Lake watershed.

Cost share additional conservation practices

Offer incentives to farmers farming the approximately 2000 acres of crop fields in the direct drainage area to implement nutrient management planning, minimum tillage, and to maximize crop residues.

Evaluate/install practices to remove sediment from Rice Creek and Otter Creek inflows to Balsam Lake:

Otter Creek in-stream sedimentation basin
Wetland creation/restoration along Otter Creek
Control feedlot runoff to Otter Creek

Determine feasibility of dredging inflow area of Little Balsam

Consider in-lake sediment treatment methods such as alum application.

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, roads construction and maintenance, and other government functions.

Consider offering septic system inspections to residents.

Evaluating Progress of Management Efforts / Monitoring

Continue volunteer Secchi-depth measurements (be sure that volunteer monitors are in place).

Participate in expanded self-help monitoring to include long-term phosphorus and chlorophyll a levels (seek DNR funds for 2007).

Evaluate contributions of sediment to Little Balsam by measuring flow, sediments, and nutrients in Otter Creek and Rice Creek (BARR 2006).

Update of water and total-phosphorus budget (2007).

Assess release of phosphorus from sediments and analyze in-lake phosphorus contributions.

Analyze groundwater contributions of phosphorus.

Update recommendations for BLPRD priority management efforts.

Evaluate the effectiveness of Balsam Acres sedimentation basin by sampling suspended solids, dissolved phosphorus and total phosphorus above and below the basin.

Monitor sediment in Balsam Acres basin (last completed July 1999).

Continue to track installation and effectiveness of watershed practices (Polk County LWRD).

Goal: Protect, maintain, and improve fish and wildlife habitat in Balsam Lake and its watersheds.

Protect critical watershed and habitat areas on Balsam Lake shorelines and watersheds.

Pursue acquisition of additional property or conservation easements in the Stumps area of Balsam Lake.

Pursue conservation easements along the lakeshore of Balsam Lake.

Consider fish stocking in cooperation with the DNR.

Goal: Promote the preservation and restoration of natural vegetation along the Balsam Lake shoreline.

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

Identify and implement incentives to encourage restoration of buffer zones around Balsam Lake.

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

Provide invasive species information.

Contract for inspection and herbicide application (annual maintenance).

Implement “long-term improvement” program (lime slurry application).

Update the plant survey and management plan every five years.

Goal: Expand education efforts emphasizing the following topics:

Eurasian water milfoil prevention/clean boats
Impacts of runoff from waterfront property and waterfront development
Infiltration practices / alternatives to lawn
Local land use plans and ordinances
Benefits of native aquatic plants
Activities of the BLPRD
Local land use planning and zoning
Importance of shoreland habitat/buffer zones
Water use rules and regulations
Zero phosphorus fertilizer
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.
Install a buffer of native vegetation.
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).
Shoreland ordinances are understood and followed.
Do not fertilize or use zero phosphorus fertilizer.
Have your septic system pumped regularly
If you have an old system (installed before 1987), volunteer for a septic system inspection.

Use the following methods to communicate information on educational topics:

Dockside Newsletter[40]

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

BLPRD Web site

Update with information from articles above
Update maps on web site

[40] The May 2006 resident survey identified newsletters as the preferred way for residents to receive information from the BLPRD.

BLPRD Annual Meetings

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

Signage at Boat Landings

Expand signage to private landings, waterfront restaurants, and resorts

Placemats at area restaurants

Emphasize invasive species information

Coordinate volunteer boat landing inspectors for invasive species

Target fishing tournaments for inspections

Work with the Polk County Association of Lakes and Rivers on cooperative education projects for priority topics.

Participate in the development of a brochure summarizing the storm water and erosion control ordinance passed in 2005 and best management practices to manage storm water runoff (Polk LWRD).

Evaluation

Assess effectiveness of various educational techniques and incentives residents will respond best to through surveys and focus group sessions.

Appendix A. Public Input Used in Long Range Plan Development

Concerns of district members were gathered in a variety of ways. Methods included public input to commissioners, a special advisory meeting, and a public survey for the draft plan. Results of these efforts are summarized below.

Input to Commissioners

District members (lake residents) have the opportunity to express concerns at annual meetings. They may also contact commissioners who pass on these concerns at regular board meetings, or members may appear at board meetings themselves. Concerns expressed by residents to commissioners were captured in a worksheet completed by BLPRD commissioners on January 6, 2006.

BLPRD Board Results: Balsam Lake Resource Concerns

A summary of top results from the commissioner survey follows.

Top three resource concerns:

1. Level of water clarity
1. Aquatic invasive species
2. Excess plant growth in recreational areas

Top potential causes of resource concerns:

1. Invasion of exotic species
2. Waterfront development and runoff

Top recommended activities

1. Herbicide use for treating aquatic invasive plants
2. Environmental education programs for adults
3. Property acquisition for watershed and lake habitat protection
4. Input for changes to zoning and other land use ordinances
5. Invasive species information and technical assistance

Instructions provided:

- Review the list of Balsam Lake Water Resource Concerns below
- If one of your top three concerns is not listed, please add it to the list.
- Please rank your top three concerns by numbering 1, 2 and 3 in order from greatest to lesser concern in the chart below.
- Rank only three concerns, and leave remaining lines blank.

Highest-ranking results from Commissioners are shown in bold.

Resource Concern	Score[1]	Rank
1. Excessive aquatic plant growth in recreational areas	**7**	**2**
2. Level of water clarity (algae)	**10**	**1**
3. Aquatic invasive species	**10**	**1**
4. Loss of natural scenery around the lake	1	4
5. Balsam Lake fisheries		
6. Loss of fish & wildlife habitat	4	3
7. Lake water levels		
8. Lake user conflicts	4	3
Other.		
Other.		
Other.		

[1] The highest score implies the rank of most importance. Each rank of 1 was assigned 2 points, a rank of 2 was assigned 2 points, and a rank of 3 was assigned 1 point. The points were then added to derive a total score.

1) **What potential causes of your Balsam Lake water resource concerns should receive the most attention?**
(Please check your top five concerns)

_____ Agricultural fields - soil erosion
2_____ Rural residential development (eg. loss of open space or loss of habitat)
2_____Back lot development and increase in impervious (hard) surfaces
4_____Waterfront development
3_____ Agricultural fertilizer and pesticide use
3_____ Residential/lawn fertilizer and pesticide use
3_____ Septic systems
_____ Construction site or road construction (eg. soil erosion and runoff)
_____ Forest management - poor road construction and forestry practices
_____ Loss of wetlands
1_____ Agricultural livestock operations (eg. manure handling and storage)
6_____ Invasion of exotic species
2_____ Excessive harvest of fish and wildlife (incl. fishing tournaments)
_____ Non-metallic mining/gravel pits
1_____Domestic/municipal solid waste (dumps/landfills)
_____ Off-road (ATV) vehicle use – damage to habitat and runoff to waters
3_____Removal of aquatic plants

1_____ Other _____Runoff from shoreline property_____

1_____ Other _____Sedimentation_____

2) Please check five activities that you believe the BLPRD should emphasize to address the potential threats to Balsam Lake.

_____ Environmental education programs for kids
3 _____ Matching funds to landowners for approved conservation practices
1 _____ Sewer system expansion
1 _____ Land use planning input (county, town, village)
4 _____ Input for changes to zoning and other land use ordinances
1 _____ Input for zoning enforcement
4 _____ Invasive species information and technical assistance
5 _____ Environmental education programs for adults
4 _____ Property acquisition for watershed and lake habitat protection
3 _____ Herbicide use for clearing aquatic plants in navigational channels
2 _____ Herbicide use for clearing aquatic plants in beaches and other recreational areas
6 _____ Herbicide use for treating invasive aquatic plants like curly leaf pondweed
1 _____ Promote buffer zones and infiltration practices (added by board member)
_____ Other _____
_____ Other _____

3) What educational topics should the BLPRD emphasize?

6 _____ Eurasian Water Milfoil prevention/clean boats
5 _____ Benefits of native aquatic plants
4 _____ Activities of the BLPRD
4 _____ Local land use planning and zoning
4 _____ Impacts of waterfront development
5 _____ Importance of shoreland habitat/buffer zones
2 _____ Water use rules and regulations
4 _____ Zero phosphorus fertilizer
1 _____ Infiltration practices (added by individual board member)
_____ Other _____
_____ Other _____

What comments and complaints do you hear from residents most frequently?

Water – algae in the latter part of the summer
Algae
Hair algae
Water clarity

Water – excessive plant growth
"Weeds increasing"

Farmland located close to the lake and regulations they have for their operation to prevent runoff.

Noise – early start of fishing tournaments –
Fishing tournaments
Bass tournaments
Fishing tournaments. Is there a set number and who determines when, who, etc. and parking associated.

PWC noise and activities
Jet skis

Fish kills

Taxes – high RE taxes especially for local government

Where would you like to see the BLPRD place more emphasis?

Education as to buffers, shoreland restoration, impervious surfaces.

Education

Shoreline development
Run-off
Phosphorus input

I believe our emphasis is on education, water clarity, and overall health of the lake. Balsam Lake is the largest lake in Polk County and should be considered a signature lake for all to enjoy.

Doing a good job.

Advisory Group Results: Balsam Lake Resource Concerns

Advisory Group

Lake Residents

Allen Dornfeld

Clem Nelson

Dwain Kasel

Ray Biller

Polk County Land and Water Resources Department

Amy Kelsey

Dave Peterson

Polk County Health Department

Brian Hobbs

Special Advisory Meeting

Background information gathered for the plan was presented at a special advisory meeting for the long range plan development. This meeting was held January 23, 2006 at the Balsam Lake Village Library. Participants were asked to review the background information, prioritize a list of concerns, and propose action items. A summary of top results follows.

Top resource concerns:

1. Loss of fish and wildlife habitat
2. Level of water clarity
3. Aquatic invasive species
3. Loss of natural scenery

Top potential causes of resource concerns:

1. Waterfront development and runoff
2. Invasion of exotic species

Top recommended activities:

1. Environmental education programs for adults
2. Land use planning input
3. Property acquisition for watershed and lake protection
4. Invasive species information and technical assistance
5. Information about infiltration practices / alternatives to lawn

Highest-ranking results from the advisory group are in bold.

Instructions provided:

- Review the list of Balsam Lake Water Resource Concerns below
- If one of your top three concerns is not listed, please add it to the list.
- Please rank your top three concerns by numbering 1, 2 and 3 in order from greatest to lesser concern in the chart below.
- Rank only three concerns, and leave remaining lines blank.

Resource Concern	Score[2]	Rank
1. Excessive aquatic plant growth in recreational areas	6	4
2. Level of water clarity (algae)	**9**	**2**
3. Aquatic invasive species	**7**	**3**
4. Loss of natural scenery around the lake	**7**	**3**
5. Balsam Lake fisheries	3	5
6. Loss of fish & wildlife habitat	**10**	**1**
7. Lake water levels		
8. Lake user conflicts		
Other.		
Other.		
Other.		

[2] The highest score implies the rank of most importance. Each rank of 1 was assigned 2 points, a rank of 2 was assigned 2 points, and a rank of 3 was assigned 1 point. The points were then added to derive a total score.

3) What potential causes of your Balsam Lake water resource concerns should receive the most attention?
(Please check your top five concerns)

1____ Agricultural fields - soil erosion
3____ Rural residential development (eg. loss of open space or loss of habitat)
3____ Back lot development and increase in impervious (hard) surfaces
2____ Runoff from waterfront property
7____ Waterfront development (new construction and expansion and runoff)
2____ Agricultural fertilizer and pesticide use
3____ Residential/lawn fertilizer and pesticide use
2____ Septic systems
1____ Construction site or road construction (eg. soil erosion and runoff)
____ Forest management - poor road construction and forestry practices
2____ Loss of wetlands
1____ Agricultural livestock operations (eg. manure handling and storage)
4____ Invasion of exotic species
____ Excessive harvest of fish and wildlife (incl. fishing tournaments)
____ Non-metallic mining/gravel pits
____ Domestic/municipal solid waste (dumps/landfills)
____ Off-road (ATV) vehicle use – damage to habitat and runoff to waters
2____ Removal of aquatic plants

2____ Hobby farms/small numbers of animals

____ Other _____

4) Please check five activities that you believe the BLPRD should emphasize to address the potential threats to Balsam Lake.

1 Environmental education programs for kids
1 Matching funds to landowners for approved conservation practices
1 Sewer system expansion
4 Land use planning input (county, town, village)
1 Input for changes to zoning and other land use ordinances
1 Input for zoning enforcement
3 Invasive species information and technical assistance
5 Environmental education programs for adults
3 Property acquisition for watershed and lake habitat protection
1 Herbicide use for clearing aquatic plants in navigational channels
1 Herbicide use for clearing aquatic plants in beaches and other recreational areas
2 Herbicide use for treating invasive aquatic plants like curly leaf pondweed
1 Technical assistance / cost sharing for shoreline buffers
3 Infiltration practices / alternatives to lawn
2 Stocking fish
Contact officials about property taxes
3 Inspect private septic systems
1 Monitor pollution sources
Stop shoreline erosion
Sponsor beautification projects
Dredge in-lake sediments
Maintain Balsam Acres basin
Stabilize water levels

What educational topics should the BLPRD emphasize?
6 Eurasian Water Milfoil prevention / clean boats
4 Benefits of native aquatic plants
2 Activities of the BLPRD
1 Local land use planning and zoning
2 Impacts of waterfront development
4 Importance of shoreland habitat
1 Water use rules and regulations
2 Zero phosphorus fertilizer
3 Infiltration practices / berms / alternatives to lawn
Loon watch and other species indicators

BLPRD Long Range Plan Questionnaire Responses (May 2006)

The BLPRD mailed a long range plan summary and questionnaire to 835 residences around the lake. As of July 12, 2006, 127 surveys or 15 percent of the questionnaires were returned. A summary of the results follow. Responses are listed in order of occurrence.

Please check the one resource concern that should receive the most attention from the BLPRD.

62.5 Aquatic plant management
53 Water clarity / algae
46.5 Fish & wildlife habitat
7 Natural character of shorelines

Other

Sanitary sewer to south end East Balsam
The silting in of Little Balsam
Have owners clean up dead trees along shorelines and ones in water right away – looks so bad a lot have been that way for years – pine etc. can't be good for water
Property taxes
Enforce existing sanitation rules immediately. Don't expand sewer systems!
All are so important but if "invasion" types of plants aren't dealt with it really affects all of the other topics
Dredge Little Balsam entrance
Little Balsam needs priority! (re water clarity/algae)
Don't these go hand in hand? (Items 1 & 2)
Boat landings – Improve docks, Beautify/Fence portable toilets

Please choose up to three activities the BLPRD should emphasize

116 Herbicide use for nuisance aquatic plants
69 Property acquisition for watershed and lake protection
52 Watershed practices
47 Land use planning and regulations
47 Environmental education/information
33 Lake and watershed studies

Other

Sewer line to East Balsam
Fish stocking
Water safety
Speed limits & safety; stock more walleye
Clean up of existing problem areas
Algae & plants, fish
Weed control
Speed boats that cause wake that erode the shoreline

Enforce lake access lot regulations
Lakewide sewer
Spring of 2005 – They sprayed weed killer during spawning?? In the narrows area
Shoreline management (Buffers of 10' on all property)
Sewer lines around entire lake
Stop purchasing property. It is a waste
Sanitary sewers where possible
Environmental protection
Control run-off & dredge the north end of Little to remove all the sediment!
(The move from cutting weeds to treating them was a wise move!)
Mechanical weed harvest
Dredging muck areas
Public boat landings need better maintenance. Bass boats create large drop offs
Jet skis

How do you prefer to get information from the BLPRD?

88.5 Newsletter
14.5 Web
7.5 Newspaper
4.8 Annual meeting
-0- Signs

Other

Thanks
Your newsletter needs HELP!! Why not combine wi/BLHA. They have a 1st class newsletter. By combining, both organizations could save some money and publish a comprehensive newsletter.
BL paper never gives much about the lake on a weekly printing
Shorelines paper
Thank you to all the BLPRD commissioners for all your time & thoughtful mgt of our lake

I believe the board should have shown leadership and approved a sanitary sewer system in the past. With people building and spending $ on holding tanks, a vote will never be in favor now. I think there was board bias against a system

If town put in slips for day use only we could boat to restaurants & stores!

Appendix B. Bibliography and Brief Summary of Related Planning and Study Documents.

Watershed Studies and Plans

An Appraisal of the Surface WaterResources of the Balsam Branch Priority Watershed. The Wisconsin Nonpoint Source Priority Watershed Program. Wisconsin Department of Natural Resources. August 1989.

The primary phosphorus sources to Balsam Lake are agricultural runoff (37%) and Rice Lake (via Rice Creek) (18%). 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%).
- An intensive urban nutrient reduction program
- Consider in-lake remediation (alum treatment) for Little Balsam.
- Reduce nutrients from Rice Creek tributary

Potential Environmental Effects Upon Little Balsam Lake. Proposed Balsam Hills Development. Short Elliott Hendrickson Inc. July 1994.

A comprehensive review of the proposed Balsam Hills 35 lot residential development on 90 acres of the Simonson property of Little Balsam Lake was conducted. Some of the environmental issues identified:

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

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

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 best management practices from 1996 – 2006.

The entire watershed drains approximately 110 square miles. The Balsam Lake subwatershed is roughly 15,000 acres with about 60 percent of the land in agricultural use and nine percent in residential development. The watershed plan established an in-lake summer phosphorus concentration of 16 ug/l. Nutrient loading reduction of 25 percent would result in a 13.7 percent reduction of phosphorus entering Balsam Lake.

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

The study was completed to reassess the significance of phosphorus loading from Rice Lake via Rice Creek and Otter Creek. Earlier studies identified Rice Lake water flowing through Rice Creek to Balsam Lake as the most significant phosphorus source. Study results showed that the total phosphorus load from Otter Creek slightly exceeded that from Rice Creek. Phosphorus load increased 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 picked up additional sediment load between the confluence of Rice and Otter Creeks and where Rice Creek enters Balsam Lake.

Rice Lake water clarity improved significantly from the late 1980s and early 1990s when summer secchi depths averaged 0.9 feet. Summer secchi depths from 1995 – 1998 were 3 – 5 feet. Total phosphorus and chlorophyll a concentrations decreased along with increased secchi depths.

Letter to Allen Dornfeld, BLPRD from Thomas MacDonald, Barr Engineering. August 9, 2002.

The letter summarizes the results of a sediment study conducted at Little Balsam. Water depth and sediment characteristics were analyzed in the channel of Rice Creek where it flows into Balsam Lake and in three locations in Little Balsam. Water depth in the channel of Rice Creek just before it enters Balsam Lake is 1.2 feet and the sediment depth is 4.0 feet. Lake water depth and sediment depth increased with each sample point further from the mouth of the creek from a water depth of 1 foot and a sediment depth of 7.5 feet to a water depth of 15 feet and a sediment depth of 22 feet. The third lake sample point is about 675 feet from the channel sample point.

The letter concluded that sediment buildup in Little Balsam Lake is due primarily to upstream sources. Emergent vegetation results from sediment build-up. Reducing sediment build up could be accomplished by convincing landowners to install conservation practices such as buffer strips. A second sedimentation basin

might be constructed on Otter Creek. Dredging would be necessary to reclaim the lake area and remove emergent vegetation.

Planning Grant Applications. Barr Engineering for the Balsam Lake Protection and Rehabilitation District. February 2005.

This project evaluates contributions of sediment to Little Balsam from Otter Creek and Rice Creek. The project is divided into four phases for funding purposes. Phase 1 evaluates flow, sediment, and nutrients from Otter Creek. Phases 2 and 3 evaluates Rice Creek upstream and downstream of where Otter Creek flows into Rice Creek, and Phase 4 combines the data into a report.

Aquatic Plant Management

Aquatic Plant Management Sensitive Area Assessment Summary. Wisconsin Department of Natural Resources. August 1989.

Identified 26 areas on the lake with aquatic plant values and management requirements for each area.

Balsam Lake Macrophyte Surveys and Management Plan. Prepared for Balsam Lake Protection and Rehabilitation District. Barr Engineering. February 2000.

A macrophyte survey that evaluated plant coverage, density, and species composition was completed in the summer of 1999. About 41 percent of the lake area is covered by aquatic plants. Plant diversity in Balsam Lake was relatively high when compared with fifty Wisconsin lakes. A total of 26 species were found. Coontail was the most frequently occurring species found in Balsam Lake. Curly-leaf pondweed, a non-native invasive plant, occurred at 56 percent of the sample points.

The management plan includes ten goals:

- Remove vegetation from public swimming areas
- Remove vegetation from public boat landings
- Improve navigation through areas containing dense plant beds
- Minimize the spread of coontail
- Improve recreation
- Limit curly-leaf pondweed growth
- Preserve native species and limit the introduction of non-native species
- Preserve and/or improve fish and wildlife habitat
- Protect and/or improve the quality of resources for all to enjoy
- Minimize disturbance to sensitive areas

The plan proposes three main steps using herbicide treatments:

Primary Plan to treat public swimming areas, boat landings, and boat passageways.

Secondary Plan to treat priority areas of curly leaf pondweed.

Tertiary Plan to treat additional curly leaf pondweed areas as funds allow.

Balsam Lake Protection and Rehabilitation District Aquatic Plant Management Report. Prepared for Balsam Lake Protection and Rehabilitation District. Aquatic Engineering, Inc. March 2003.

This is a report of aquatic plant management efforts for the summer of 2002. The project evaluated the public boat landing areas for the presence of Eurasian Water Milfoil and found none present. The second goal of the project was to reduce the density of plants in twenty-five foot wide navigation channels. Successful clearing of navigation channels was reported.

Balsam Lake Aquatic Plant Survey and Management Plan. Prepared for Balsam Lake Protection and Rehabilitation District. December 2005. Barr Engineering.

The study reports a healthy, diverse, high quality native plant community in Balsam Lake that has changed little since 1999. One positive change noted is the reduced occurrence of curlyleaf pondweed. Despite the favorable aquatic plant community, the plan identifies specific locations that require annual management. Swimming beaches, boat landings, and navigation channels require herbicide treatment once or twice each summer amounting to 14 acres. An additional 33 acres with very high plant density are recommended for herbicide treatment. The total recommended treatment area is less than two percent of the lake's surface area. A long term treatment program recommends use of lime slurry to reduce plant density, including curlyleaf pondweed density, to attain favorable long-term changes in problematic areas.

Lake Studies

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

The recently formed Balsam Lake Inland Lake Protection Districted requested technical assistance from the Department of Natural Resources. The 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 is identified as a mesotrophic lake with moderate fertility. The gamefish population is 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 are 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 are herbicide applications and harvesting.

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

This study analyzed water chemistry in various areas of Balsam Lake and its tributaries in 1986. The study's conclusions are as follows:

1. Water quality of Balsam Lake is good in spring and becomes poor due to algal blooms in July.

2. Nutrient and suspended solids loading are the primary contributing factors to decreased water quality.

3. Rice Creek is an important source of nutrients and solids to Balsam Lake.

4. Standard control methods for reducing suspended solid load of Rice Creek will be ineffective in reducing nutrient load (because much of the phosphorus is in the form of dissolved phosphorus).

5. Influent groundwater, contaminated due to defective septic systems, is an important source of nutrients to Balsam Lake.

6. Human wastes enter Balsam Lake, and pose a potential human health risk.

7. Chemicals have been extensively used in Balsam Lake to control nuisance macrophytes and algae and have largely proven to be ineffective, and could potentially be contributing to worsening water quality.

Resulting recommendations:

1. The BLPRD should assess the specific sources of nutrients and erosion on Rice Creek and develop appropriate management strategies. This process should be followed by appropriate monitoring to assure effective and continued control.

2. The BLPRD should determine if human waste and presumed nutrient contamination of Balsam Lake is due to isolated defective septic systems or comprises a more widespread problem.

3. The BLPRD should 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 and continuation of mechanical weed harvesting, dissemination of information to area residents concerning fertilization of lawns, use of chemicals, and proper shoreline management to reduce runoff and erosion.

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

Water and total-phosphorus budgets were determined for Balsam Lake in northwestern Wisconsin. 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.

Restoring Rice Lake at Milltown, Wisconsin. Department of Natural Resources. Madison, Wisconsin. 1991.

Wind and high water, after decades of erosion and runoff from farms and municipal wastewater treatment plant, converted a clear lake bordered by wild rice into a turbid one dominated phytoplankton. Water turbidity 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 eat most of the shoots that sprouted. Establishing wild rice would be desirable to blunt the force of the wind that stirs up sediments and creates turbid water.

Letter to Gerald Kafka, BLPRD from Stephen J. Field, United States Geological Survey. June 3, 1994.

The letter reports progress on evaluating Balsam Lake water quality according to data collected from October 1992 to September 1993. The letter stresses that results are unpublished and therefore preliminary. A final report from the study was not located.

Some key results:

- Algal growth appears to dependent upon the amount of available phosphorus rather than nitrogen.
- Water quality varies throughout Balsam Lake.
- Balsam Lake is a mesotrophic to eutrophic lake.
- Poorer water quality in 1993 compared with 1991 and 1992 may have been due to excessive runoff in June and July 1993.

Feasibility Studies

Feasibility Study Glenna Property – Balsam Lake. Prepared for the Balsam Lake Protection & Rehabilitation District. Balsam Lake, WI. Mead & Hunt, Inc. January 1996.

The primary study goal was to analyze phosphorus removal structural practices along Rice Creek as it flows through the Glenna site that would remove at least 50 percent of the phosphorus loading into Balsam Lake from Rice Creek. The report recommended a combination of a sediment basin with chemical precipitation that drains into a wetland. The following activities were recommended:

- Participate in the Balsam Lake Priority Watershed Program
- Undertake a detailed design project
- Apply for construction permits.
- Construct the practice.
- Maintain the structure.

Balsam Acres – Rice Creek Phosphorous Sedimentation Basin. Balsam Lake Protection and Rehabilitation District. Cedar Corporation. April 1998.

The objectives of this project were to determine a cost effective phosphorus removal rate for Rice Creek; locate and size an appropriate sedimentation basin on Rice Creek within the Balsam Acres property (formerly known as the Glenna property); and prepare plans, specifications, and estimates for the proposed project.

Planning Documents

Polk County Land and Water Management Plan. Polk County Land Conservation Committee. September 2004.

> The land and water plan guides the activities of the Polk County Land and Water Resources Department from 2005 – 2009. The department will partner with local, state, and federal agencies and organizations to conserve soil and water resources, reduce soil erosion, prevent nonpoint source pollution and enhance water quality. Activities include assistance with enforcement, technical and financial assistance, and education. Local plans and ordinances are described in the document.

Appendix C. Glossary

Aeration — To add air (oxygen) to the water supply. Generally used in lake management to reduce the release of phosphorus from lake sediments or to prevent fish kills.

Algae — Small aquatic plants without roots that contain chlorophyll and occur as single cells or multi-celled colonies. Algae form the base of the food chain in aquatic environments.

Algal bloom — Heavy growth of algae in and on a body of water resulting from high nutrient concentrations.

Alluvium — Clay, silt, sand, gravel, or similar detrital material deposited by running water.

Alkalinity — The acid combining capacity of a (carbonate) solution, also describes its buffering capacity.

Animal waste management — A group of practices including barnyard runoff management, nutrient management, and manure storage facilities designed to minimize the effects of animal manure on surface and groundwater resources.

Aquatic plant survey — A systematic mapping of types and location of aquatic plants in a water body, usually conducted in a boat. Survey information is presented on an aquatic plant map.

Aquifer — A water-bearing stratum of permeable rock, sand, or gravel.

BMP's (Best Management Practices) — Practices or methods used to prevent or reduce amounts of nutrients, sediments, chemicals or other pollutants from entering water bodies from human activities. BMP's have been developed for agricultural, silvicultural, construction, and urban activities.

Bathymetric map — A map showing depth contours in a water body. Bottom contours are usually presented as lines of equal depth, in meters or feet.

Benchmark — A mark of reference indicating elevation or water level.

Benthal — Bottom area of the lake (Gr. *benthos* depth).

Biocontrol — Management using biological organisms, such as fish, insects or micro-organisms like fungus.

Biomass — The total organic matter present (Gr. *bios* life).

Bottom barriers — Synthetic or natural fiber sheets of material used to cover and kill plants growing on the bottom of a water body; also called sediment covers.

Buffer strips - Strips of grass, shrubs, trees, and other vegetation between disturbed areas and a stream, lake, or wetland.

Cluster development - Grouping homes on part of a property while maintaining a large amount of open space on the remaining land.

Chlorophyll — The green pigments of plants (Gr. *chloros* green, *phyllon* leaf).

Conservation easement — A legal document that restricts the use of land to farming, open space, or wildlife habitat. A landowner may sell or donate an easement to a government agency or a private land trust.

Consumers — Organisms that nourish themselves on particulate organic matter (Lat. *consumere* to take wholly).

Contact herbicide — An herbicide that causes localized injury or death to plant tissues it contacts. Contact herbicides do not kill the entire plant.

Cost effective — A level of treatment or management with the greatest incremental benefit for the money spent.

Decomposers — Organisms, mostly bacteria or fungi, that break down complex organic material into its inorganic constituents.

Detritus — Settleable material suspended in the water. Organic detritus comes from the decomposition of the broken down remains of organisms. Inorganic detritus comes from settleable mineral materials.

Dissolved oxygen — A measure of the amount of oxygen gas dissolved in water and available for use by microorganisms and fish.

Drainage basin — The area drained by, or contributing to, a stream, lake, or other water body (see watershed).

Drawdown — Decreasing the level of standing water in a water body to expose bottom sediments and rooted plants. Water level drawdown can be accomplished by physically releasing a volume of water through a controlled outlet structure or by preventing recharge of a system from a primary external source.

Dredging — Physical methods of digging into the bottom of a water body to remove sediment, plants, or other material. Dredging can be performed using mechanical or hydraulic equipment.

Ecology — Scientific study of relationships between organisms and their surroundings (environment).

Ecosystems — The interacting system of a biological community and its nonliving surroundings.

Emergent plants — Aquatic plants that are rooted or anchored in the sediment around shorelines, but have stems and leaves extending well above the water surface. Cattails and bulrushes are examples of emergent plants.

Endothall — The active chemical ingredient of the aquatic contact herbicide Aquathol®.

Environmental Protection Agency — The federal agency responsible for enforcing federal environmental regulations. The Environmental Protection Agency delegates some of its responsibilities for water, air, and solid waste pollution control to state agencies.

Epilimnion — The uppermost, warm, well-mixed layer of a lake (Gr. *epi* on, *limne* lake).

Eradication — Complete removal of a specific organism from a specified location, usually refers to a noxious, invasive species. Under most circumstances, eradication of a population is very difficult to achieve.

Erosion — The wearing away of the land surface by wind or water.

Eutrophic — Refers to a nutrient-rich lake. Large amounts of algae and weeds characterize a eutrophic lake (see also "Oligotrophic" and "Mesotrophic").

Eutrophication — The process of nutrient enrichment of a lake leading to increased production of aquatic organisms. Eutrophication can be accelerated by human activity such as agriculture and improper waste disposal.

Exotic — Refers to species of plants or animals that are not native to a particular region into which they have moved or invaded. Eurasian watermilfoil is an exotic plant invader.

Fecal coliform — A group of bacteria used to indicate the presence of other bacteria that cause disease. The number of coliform is particularly important when water is used for drinking and swimming.

Floating-leafed plant — Plants with oval or circular leaves floating on the water surface, but are rooted or attached to sediments by long, flexible stems. Waterlilies are examples of rooted floating-leafed plants.

Fluridone — The active chemical ingredient of the systemic aquatic herbicide SONAR®.

Flushing rate — Term describing rate of water volume replacement of a water body, usually expressed as basin volume per unit time needed to replace the water body volume with inflowing water. The inverse of the flushing rate is the (hydraulic) detention time. A lake with a flushing rate of 1 lake volume per year has a detention time of 1 year.

Food chain — A sequence of organisms where each uses the next as a food source.

Freely-floating plants — Plants that float on or under the water surface, unattached by roots to the bottom. Some have small root systems that simply hang beneath the plant. Water hyacinth and tiny duckweed are examples of freely-floating plants.

Glyphosate — The active chemical ingredient of the systemic herbicide RODEO®.

Ground-truthing —Close or on-the-ground observation used to test the validity of observations made at a distance as in aerial or satellite photography

Groundwater — Underground water-bearing areas generally within the boundaries of a watershed, which fill internal passageways of porous geologic formations (aquifers) with water that flows in response to gravity and pressure. Often used as the source of water for communities and industries.

Habitat — The place or type of site where a plant or animal naturally lives and grows.

Herbicide — A chemical used to suppress the growth of or kill plants.

Habitat — The physical place where an organism lives.

Hydraulic detention time — The period of detention of water in a basin. The inverse of detention time is flushing rate. A lake with a detention time of one year has a flushing rate of 1 lake volume per year.

Hypolimnion — The cold, deepest layer of a lake that is removed from surface influences (Gr. *hypo* under, *limne* lake).

Integrated aquatic plant management — Management using a combination of plant control methods that maximizes beneficial uses, minimizes environmental impacts and optimizes overall costs.

Limiting nutrient — Essential nutrient needed for growth of plant organism which is the most scarce in the environment. Oftentimes, in freshwater systems, either phosphorus or nitrogen may be the limiting nutrient for plant growth.

Limnology — The study of inland waters (Gr. *limne* lake).

Littoral — The region of a body of water extending from shoreline outward to the greatest depth occupied by rooted aquatic plants.

Loam — A soil consisting of varying proportions of sand, clay, and silt. Generally well-suited for agriculture.

Loess — A loamy soil deposited by wind.

Macrophyte — Large, rooted or floating aquatic plants that may bear flowers and seeds. Some plants, like duckweed and coontail, are free-floating and are not attached to the bottom. Occasionally, filamentous algae like *Nitella* sp. can form large, extensive populations and be an important member of the aquatic macrophyte community.

Mesotrophic — Refers to a moderately fertile nutrient level of a lake between the oligotrophic and eutrophic levels. (See also "Eutrophic" and "Oligotrohpic.")

Milligrams per liter (mg/l) — A measure of the concentration of substance in water. For most pollution measurements this is the equivalent of "parts per million" (ppm).

Mitigation — The effort to lessen the damages from a particular project through modifying a project, providing alternatives, compensating for losses, or replacing lost values.

Morphology — Study of shape, configuration, or form.

Navigable waters — A water body with a bed and a bank that can float a watercraft at any point in the year.

Niche — The position or role of an organism within its community and ecosystem.

Nitrogen — A chemical constituent (nutrient) essential for life. Nitrogen is a primary nutrient necessary for plant growth.

Nonpoint source pollution (NSP) — Pollution whose sources cannot be traced to a single point such as a municipal or industrial wastewater treatment plant discharge pipe. Nonpoint sources include eroding farmland and construction sites, urban streets, and barnyards. Pollutants from these sources reach water bodies in runoff. They can best be controlled by proper land management.

Non-target species — A species not intentionally targeted for control by a pesticide or herbicide.

Nutrient — Any chemical element, ion, or compound required by an organism for the continuation of growth, reproduction, and other life processes.

Nutrient management plan — A guidance document that provides fertilizer and manure spreading recommendations for crop fields based upon soil test results and crop needs. Plans are sometimes referred to as NRCS 590 plans for the Natural Resources Conservation Service Standard that guides their preparation.

Oligotrophic — Refers to an unproductive and nutrient-poor lake. Such lakes typically have very clear water. (See also "Eutrophic" and "Mesotrophic.")

Ordinary high water mark — The point on the bank or shore up to which the water leaves a distinct mark on the shore or bank from its presence, wave action, or flow. The mark may be indicated by erosion, destruction of or change in vegetation, or another easily recognizable characteristic.

Oxidation — A chemical process that can occur in the uptake of oxygen.

pH — The negative logarithm of the hydrogen ion activity. pH values range from 1-10 (low pH values are acidic and high pH levels are alkaline).

Peat — Soil material formed by partial decomposition of plant material.

Pesticide — Any chemical agent used to control specific organisms, such as insecticides, herbicides, fungicides, etc.

Phosphorus — A chemical constituent (nutrient) essential for life. Phosphorus is a primary nutrient necessary for plant growth. When phosphorus reaches lakes in excess amounts, it can lead to over-fertile conditions and algae blooms.

Photosynthesis — Production of organic matter (carbohydrate) from inorganic carbon and water in the presence of light (Gr. *phos, photos* light, *synthesis* placing together).

Phytoplankton — Free floating microscopic plants (algae).

Point (pollutant) source — A source of pollutants or contaminants that discharges through a pipe or culvert. Point sources, such as an industrial or sewage outfall, are usually readily identified.

Pollution — The presence of materials or energy whose nature, location, or quantity produces undesired environmental effects. Pollutants can be chemicals, disease-producing organisms, silt, toxic metals, oxygen-demanding materials, to name a few.

Primary production — The rate of formation of organic matter or sugars in plant cells from light, water, and carbon dioxide (Lat. *primus* first, *producere* to bring forward). Algae are primary producers.

Priority watershed — A drainage area selected to receive state money to help pay the cost of controlling nonpoint source pollution.

Problem statement — A written description of important uses of a water body that are being affected by the presence of problem aquatic plants.

Producers — Organisms able to build up their body substance from inorganic materials.

Productivity — A measure of the amount of living matter which is supported by an environment over a specific period of time. Often described in terms of algae production for a lake.

Public Awareness/Outreach — Programs designed to share technical information and data on a particular topic, usually associated with activities on or around a water body.

Recruitment — The process of adding new individuals to a population.

Residence time — The average length of time that water or a chemical constituent remains in a lake.

Riparian — Belonging or relating to the bank of a lake, river, or stream.

Riprap — Broken rock, cobbles, or boulders placed on the bank of a stream to protect it against erosion.

Rotovation — A mechanical control method of tilling lake or river sediments to physically dislodge rooted plants. Also known as bottom tillage or derooting.

Runoff — Water from rain, snowmelt, or irrigation that flows over the ground surface and returns to streams and lakes. Runoff can collect pollutants from air or land and carry them to receiving waters.

Secchi depth — A measure of transparency of water (the ability of light to penetrate water) obtained by lowering a secchi disc into the water until it is no longer visible. Measured in units of meters or feet.

Secchi disc — A 20-cm (8-inch) diameter disc painted white and black in alternating quadrants. It is used to measure light transparency in lakes.

Sediment — Soil particles suspended in and carried by water as a result of erosion.

Sensitive areas — Plant communities and other elements that provide important fish and wildlife habitat as designated by the Wisconsin Department of Natural Resources.

Septic system — Sewage treatment and disposal for homes not connected to sewer lines usually with a tank and drain field. Solids settle to the bottom of the tank. Liquid percolates through the drain field.

Standing crop — The biomass present in a body of water at a particular time.

Storm sewers — A system of sewers that collect and transport rain and snow runoff. In areas that have separated sewers, such stormwater is not mixed with sanitary sewage.

Stratification — Horizontal layering of water in a lake caused by temperature-related differences in density. A thermally stratified lake is generally divided into the epilimnion (uppermost, warm, mixed layer), metalimnion (middle layer of rapid change in temperature and density) and hypolimnion (lowest, cool, least mixed layer).

Submersed plants — An aquatic plant that grows with all or most of its stems and leaves below the water surface. Submersed plants usually grow rooted in the bottom and have thin, flexible stems supported by the water. Common submersed plants are milfoil and pondweeds.

Susceptibility — The sensitivity or level of injury demonstrated by a plant to effects of an herbicide.

Suspended solids (SS) — Small particles of solid pollutants suspended in water.

Systemic herbicide — An herbicide in which the active chemicals are absorbed and translocated within the entire plant system, including roots. Depending on the active ingredient, systemic herbicides affect certain biochemical reactions in the plant and can cause plant death. SONAR® and RODEO® are systemic herbicides.

Thermal stratification — Horizontal layering of water in a lake caused by temperature-related differences in density. A thermally stratified lake is generally divided into the epilimnion (uppermost, warm, mixed layer), metalimnion (middle layer of rapid change in temperature and density), and hypolimnion (lowest, cool, least mixed layer).

Thermocline — (Gr. *therme* heat, *klinein* to slope.) Zone (horizontal layer) in water body in which there is a rapid rate of temperature decrease with depth. Also called metalimnion, it lies below the epilimnion.

Tolerable soil loss — The tolerable soil loss rate, commonly referred to as "T," is the maximum average annual rate of soil erosion for each soil type that will permit a high level of crop productivity to be sustained economically and indefinitely (ATCP 50.01(16)).

Topographic map — A map showing elevation of the landscape in contours of equal height (elevation) above sea level. This can be used to identify boundaries of a watershed.

Total maximum daily loads — The maximum amount of a pollutant that can be discharged into a stream without causing a violation of water quality standards.

Transect lines — Straight lines extending across an area to be surveyed.

Tributaries — Rivers, streams, or other channels that flow into a water body.

Trophic state — The level of growth or productivity of a lake as measured by phosphorus content, algae abundance, and depth of light penetration. Lakes are classified as oligotrophic (low productivity, "good" water quality), mesotrophic (moderate productivity), or eutrophic (high productivity; "poor" water quality).

Turbid — Lack of water clarity. Turbidity is closely related to the amount of suspended materials in water.

Uniform dwelling code — A statewide building code specifying requirements for electrical, heating, ventilation, fire, structural, plumbing, construction site erosion, and other construction related practices.

University of Wisconsin Extension (UWEX) — A special outreach and education branch of the state university system.

Vascular plant— A vascular plant possesses specialized cells that conduct fluids and nutrients throughout the plant. The xylem conducts water and the phloem transports food.

Variance — Government permission for a delay or exception in the application of a given law, ordinance, or regulation. Also, see water quality standard variance.

Waste — Unwanted materials left over from manufacturing processes; refuse from places of human or animal habitation.

Water body usage map — A map of a water body showing important human use areas or zones (such as swimming, boating, fishing) and habitat areas for fish, wildlife and waterfowl.

Water quality criteria — A measure of the physical, chemical, or biological characteristics of a water body necessary to protect and maintain different water uses (fish and aquatic life, swimming, etc.).

Water quality standards — The legal basis and determination of the use of a water body and the water quality criteria; physical, chemical, or biological characteristics of a water body, that must be met to make it suitable for the specified use.

Water quality management area (WQMA) — The area within 1,000 feet from the ordinary high water mark of navigable waters that consists of a lake, pond or flowage; the area within 300 feet from the ordinary high water mark of navigable waters that consist of a river or stream; and a site that is susceptible to groundwater contamination, or that has the potential to be a direct conduit for contamination to reach groundwater. (NR 151.015(24))

Water quality standard variance — When natural conditions of a water body preclude meeting all conditions necessary to maintain full fish and aquatic life and swimming, a variance may be granted.

Watershed — The entire surface landscape that contributes water to a lake or river.

Watershed management — The management of the natural resources of a drainage basin for the production and protection of water supplies and water-based resources.

Wetland — Areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support a variety of vegetative or aquatic life. Wetland vegetation requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs, and similar areas.

Wisconsin administrative code — The set of rules written and used by state agencies to implement state statutes. Administrative codes are subject to public hearing and have the force of law.

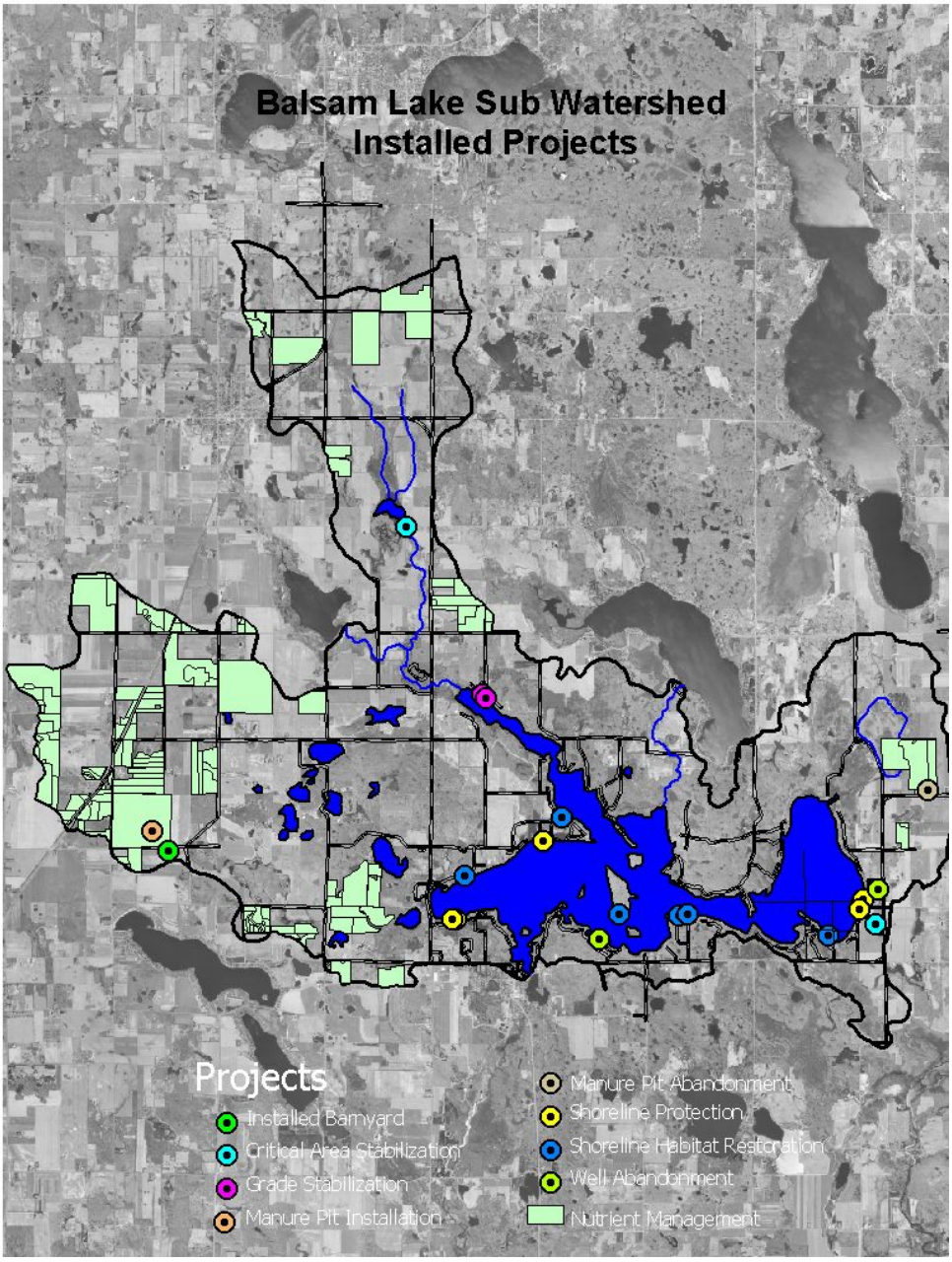
Wisconsin priority watershed program — A cost-share program established by the state legislature in 1978 to help pay the costs of controlling nonpoint source pollution.

Zooplankton — Microscopic animal plankton in water (Gr. *zoion* animal). *Daphnia* sp. or water fleas are freshwater zooplankton.

Glossary sources: Washington State Department of Ecology; Maribeth Gibbons Jr.; Wisconsin priority watershed planning guidance.

APPENDIX D. Balsam Branch Priority Watershed Accomplishments

Practices installed through the Balsam Branch Priority Watershed from 1995 – 2005 are illustrated in the map below.[1]



[1] Watershed and data and maps provided by Dave Peterson, Polk County Land and Water Resources Department. January 2006.

The cost share budget for these practices is included in the table below.

Balsam Branch Summary

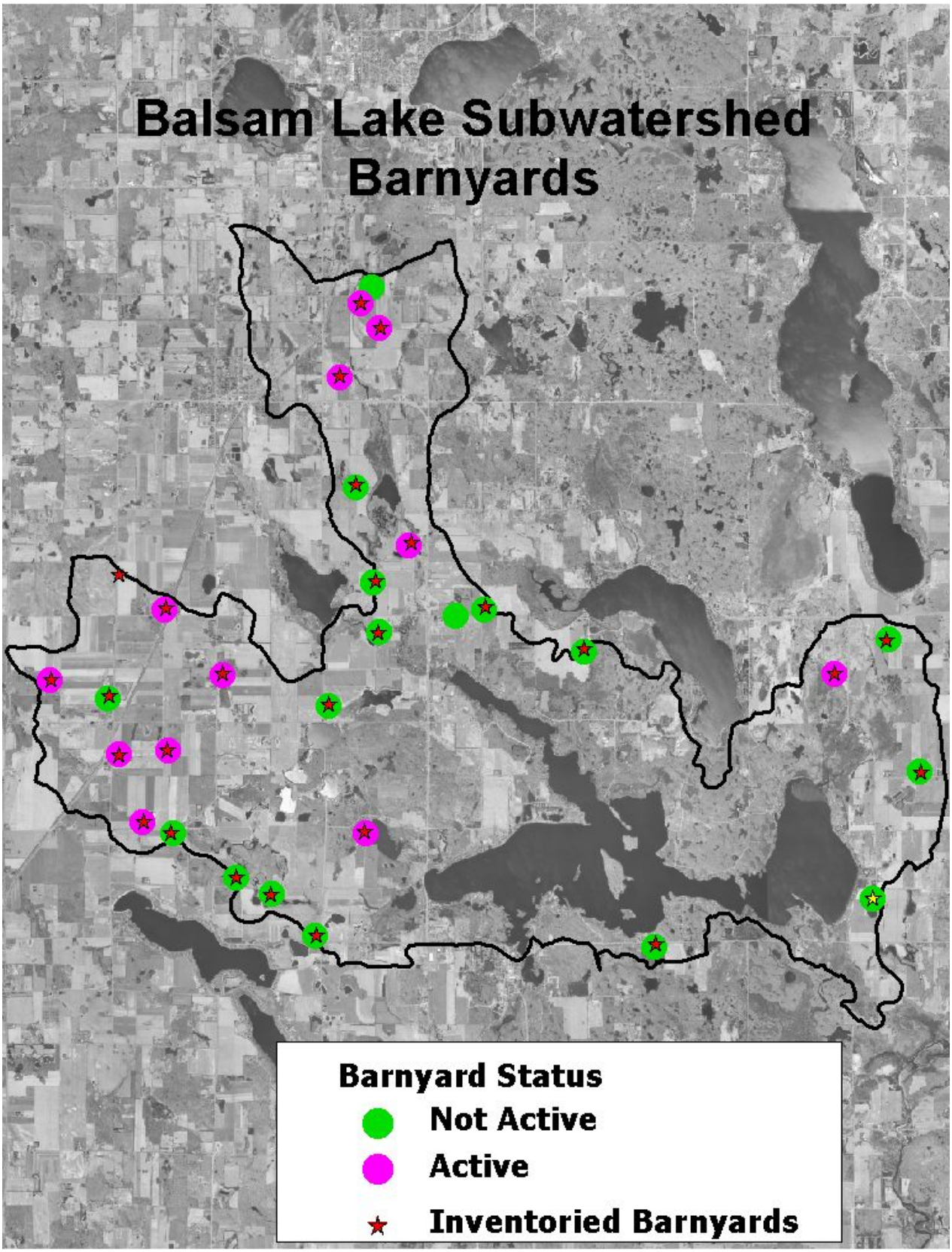
Based on state cost-sharing from Cost Share Agreements

Sub-Watershed	Practice	# Contracts	Amount	
Balsam Lake	Barnyard	1	$44,044	
	Critical Area Strabilization	2	$3,379	
	Grade Stabilization	4	$21,892	
	Livestock Fencing	1	$175	
	Livestock Watering	1	$2,100	
	Milk House Waste Control	1	$3,071	
	Manure Storage	1	$35,000	
	Manure Storage Abandonment	1	$6,751	
	Nutrient/Pest Management	5	$23,663	
	Shoreline Habitat Restoration	7	$15,087	
	Other Shoreline Protection	8	$15,856	
	Well Abandonment	2	$595	
	Wetland Restoration	1	$50	
	TOTAL			**$171,663**

Barnyard inventory in the Balsam Lake Sub-watershed

Many changes have happened since the original barnyard inventory taken in 1994. In 1994 there were 29 barnyards inventoried for a total contribution of 1,121 pounds of P. Since 1994, there has been no significant increase in the number of animal producers.[2] Retirement and economic attrition has claimed 15 of these originally inventoried farms. Based on the modeling at the time of inventory, these reductions amount to approximately 629.9 pounds of annual P loading. One farm has expanded and another has plans for an expansion, but the livestock are enclosed in a free stall, which will contain any runoff. Of the 14 active farms, 7 have developed and implemented nutrient management plans.

[2] Data from producer lists from USDA and UW-Extension.


Balsam Lake Subwatershed
Barnyards
Barnyard Status
Not Active
Active
Inventoried Barnyards

Appendix E. BLPRD Work Plan 2007 – 2008

GOAL: Improve and maintain nutrient levels and water clarity in each basin of Balsam Lake.					
Activity[1][2]	**Partners**	**Timeframe**	**Funding need estimate**	**Source of funding**	**Comments**[3]
Assess conservation BMP needs and develop potential project list	PCLWRD	Annually	None	NA	Commissioners meet with PLWRD staff. Request meeting each year prior to construction season.
Offer BMP cost sharing (Erosion projects)	PCLWRD	Annually	$1,000 budgeted for 2007	Polk County DNR Lakes Protection Grant BLPRD	Balsam Branch Priority Watershed project expires at end of 2006. Consider budget increases in the future.
Design and Install conservation practices: Otter Creek sedimentation basin Wetland restoration/creation along Otter Creek	PCLWRD DNR	2007 / 08	To be determined	DNR Lakes Protection Grant DNR wetland sources BLPRD	Need recommendations of 2006 Barr Little Balsam study. Sedimentation budget item.

[1] See plan page 35 for more information about plan activities.
[2] Balsam Acres sediment basin to be dredged every 10 – 15 years (built in 1999). Cost estimate is $21,500. Assumes 1 foot of sediment accumulated across entire 2.44 acre basin at a cost of $5.50 per cubic yard to excavate and dispose of sediment.
[3] Budget items listed correspond to the annual Balsam Lake Protection and Rehabilitation District budget categories.

DNR = Department of Natural Resources
PCLWRD = Polk County Land and Water Resources Department
Towns – Towns of Apple River, Balsam Lake, Georgetown, and Milltown
Village – Village of Balsam Lake
NRCS = Natural Resource Conservation Service
PCALR = Polk County Association of Lakes and Rivers
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GOAL: Improve and maintain nutrient levels and water clarity in each basin of Balsam Lake.					
Activity[1,2]	**Partners**	**Timeframe**	**Funding need estimate**	**Source of funding**	**Comments**[3]
Feasibility study: dredging Little Balsam inflow		2007 / 08	To be determined	DNR Lakes Planning BLPRD	Need recommendations of 2006 Little Balsam Barr study. Sedimentation budget item.
Feasibility study: alum application		2008	To be determined	DNR Lakes Planning BLPRD	Depends upon results of whole-lake nutrient study/DNR permit. Sedimentation budget item.
Be involved in land use planning, permitting, ordinance development, and implementation activities that affect Balsam Lake water quality	DNR PCLWRD Village Towns	Ongoing	$5,000 annually for occasional engineering review	BLPRD	Commissioners attend meetings and alert board to potential concerns/important activities, Lake management budget item,

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GOAL: Evaluating progress of management efforts / monitoring					
Activity[4]	**Partners**	**Timeframe**	**Funding need estimate**	**Source of funding**	**Comments**[5]
Volunteer Secchi-depth measurements	DNR	Ongoing Spring to Fall		DNR	Need to be sure that volunteers are in place,
Expanded self-help monitoring	DNR	Start in 2007	$1,000	DNR Self Help Monitoring BLPRD	Apply for program in 2006, Water testing budget item,
Update water and total-phosphorus budget	DNR	2007	$35,000	DNR Lake Management Planning Grant BLPRD	Develop scope of work, grant application, and RFP. February 1, 2007 – grant applications due. Sedimentation budget item.
Evaluate the effectiveness of Balsam Acres sedimentation basin	DNR	2007	$3,000	BLPRD	Need to sample above and below the basin. Sedimentation budget item.
Monitor sediment accumulation in Balsam Acres basin	DNR	Annually	$1,000	BLPRD	Find as-built for original basin (DNR or Cedar Corp.) . Sedimentation budget item.
Track installation and effectiveness of watershed practices	PCLWRD	Annually	$0	NA	Request meeting each year prior to construction season.

[4] See plan page 35 for more information about plan activities.
[5] Budget items listed correspond to the annual Balsam Lake Protection and Rehabilitation District budget categories.

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GOAL: Protect, maintain, and improve fish and wildlife habitat in Balsam Lake and its watersheds.

Activity[6]	Partners	Timeframe	Funding need estimate	Source of funding	Comments[7]
Pursue acquisition of additional property or conservation easements in the Stumps area of Balsam Lake.	DNR PCLWRD	Ongoing	Unknown	DNR Lake Protection Grant BLPRD	May need to budget $ to be able to make an offer. Conservancy budget item: $250,000 in 2007.
Pursue conservation easements along the lakeshore of Balsam Lake.	DNR PCLWRD	Ongoing	Unknown	DNR Lake Protection Grant BLPRD	Conservancy budget item.

GOAL: Promote the preservation and restoration of natural vegetation along the Balsam Lake shoreline.

Activity	Partners	Timeframe	Funding need estimate	Source of funding	Comments[8]
Promote technical assistance provided by other agencies.	PCLWRD UWEX DNR	Ongoing	See ed budget	BLPRD Small scale lakes planning grant	
Investigate effective incentives with focus groups and surveys	PCLWRD UWEX DNR	2007	$4,000	BLPRD Small scale lakes planning grant	Lake management budget item.

[6] See plan page 36 for more information about plan activities.
[7] Budget items listed correspond to the annual Balsam Lake Protection and Rehabilitation District budget categories.
[8] Budget items listed correspond to the annual Balsam Lake Protection and Rehabilitation District budget categories.

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GOAL: Manage native and invasive aquatic plants according to the goals, objectives, and activities outlined in the Aquatic Plant Management Plan.[9]					
Activity[10]	**Partners**	**Timeframe**	**Funding need estimate**	**Source of funding**	**Comments**
Provide invasive species information.	PCLWRD DNR UWEX Applicator	Ongoing	$3,000	DNR Aquatic Invasive Species Grants BLPRD	See education section. Weed control budget item.
Inspection and herbicide application (annual maintenance).	DNR Applicator	Annually	$46,000	BLPRD	Navigation corridor and boat landing treatments. Weed control budget item.
Implement "long-term improvement" program.	DNR Consultant	Unknown	Unknown	BLPRD Army Corps of Engineers	Method not yet approved by DNR. Weed control budget item.

[9] Note aquatic plant survey and aquatic plant management plan to be updated in 2010.
[10] See Balsam Lake Aquatic Plant Management Plan: December 2005 for more information about plan activities.

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Educational Activities

Activity	Partners	Timeframe	Funding need estimate	Source of funding	Comments[11]
Dockside newsletter	PCLWRD DNR UWEX	3 times per year	$5,500	BLPRD	Solicit articles from partners. Topic priorities in plan. Printing and board expense budget item.
BLPRD web site updates	PCLWRD DNR UWEX Contractor	Ongoing	$1,000	BLPRD	Include newsletter articles on web site. Lake management budget item.
BLPRD annual meetings	PCLWRD DNR UWEX Contractors	July each year	$500	BLPRD	Board expense budget item.
Signage at boat landings	Area resorts and restaurants	2007	$1,200	DNR Aquatic Invasive Species grants DNR Small Scale Lake Planning grants	Lake management expense budget item.
Placemats at area restaurants	Area resorts and restaurants		$500		Printing and board expense budget item.
Coordinate volunteer boat landing inspectors for invasive species	UWEX DNR	2007/08	$1,000	DNR Aquatic Invasive Species grants	Admin. Asst. schedule. Recruit volunteers for training Consider intern. Weed management budget item.
Stormwater (runoff) and erosion control ordinance brochure development and distribution	PCALR PCLWRD	2007	$500		Contact PCLWRD or PCALR. Printing budget item.

[11] Budget items listed correspond to the annual Balsam Lake Protection and Rehabilitation District budget categories.

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Other Activities Included in Annual Budget

Activity	Partners	Timeframe	Funding needed	Source of funding	Comments
Dam maintenance		Annually	$5,000	BLPRD	
Board expenses		Annually	$8,000	BLPRD	
Office expenses / administrative assistant		Annually	$5,000	BLPRD	
Administrative and financial expenses		Annually	$6,500	BLPRD	

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PCALR = Polk County Association of Lakes and Rivers
UWEX = University of Wisconsin – Extension

Appendix F. Important Contacts

Balsam Lake Protection and Rehabilitation District Board

Milt Stanze, Chairman
806 Maple Leaf Ct.
St. Croix Falls, WI 54024
(715) 483-1516 (H)
(715) 485-3047 (Lake)
(715)-483-1175 (Fax)
mstanze@lakeland.ws
Term expires July 2007

Dave Evans
805 Idlewild
Balsam Lake, WI 54810
(715) 485-3000 (H)
apexpm@amerytel.net
Term expires April 2006

John Close
3518 Glen Way
Eau Claire, WI 54701
Home (715) 835-0709
Lake: (715) 825-3331
joclose@charter.net
Term expires July 2007

Carl Holmgren Secretary
105 Indianhead Point Road
Balsam Lake, WI 54810
Home: (715) 485-9421
holmgren@lakeland.ws
Term expires April 2006

Howard Seim, Treasurer
1425 Molan Terrace
Columbia Heights, MN 55421
(763) 574-0480 (H)
(715) 825-2302 (Lake)
(763) -571-6946 (Fax)
howardseim@aol.com
Term Expires July 2006

Web Sites

Balsam Lake Protection and Rehabilitation District: www.blprd.com

Balsam Lake Home Owners Association: blha.us

Balsam Lake Village: BalsamLakeVillage.com

Balsam Lake, Wisconsin: BalsamLakeWI.com

Polk County Land and Water Resources Dept.: http://www.co.polk.wi.us/landwater

WAL / Wisconsin Association of Lakes: wisconsinlakes.org

Wisconsin DNR: dnr.state.wi.us