Whitefish Lake

Aquatic Plant Management Plan

Sawyer County, WI
WIBC: 2392000

Spon

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Environmental Engineer

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Introduction

This Aquatic Plant Management Plan for Whitefish Lake presents a strategy for managing aquatic plants by protecting native plant populations, controlling the growth of Eurasian water milfoil (EWM) and preventing establishment of additional invasive species. The plan includes data about the plant community, watershed, and water quality of the lake. Based on this data and public input, goals and strategies for the sound management of the aquatic plants in the lake are presented. This plan will guide the Whitefish Lake Property Owners Association, the Lac Courte Oreilles Band of Lake Superior Chippewa, Sawyer County, and the Wisconsin Department of Natural Resources in aquatic plant management for the lake over the next five years (2010 through 2013).

Public Input for Development

The Whitefish Lake Property Owners Association Aquatic Plant Management (APM) Committee provided input for the development of this aquatic plant management plan. The Aquatic Plant Management Committee was comprised of members from the Whitefish Lake Property Owners Association with representation from the Lac Courte Oreilles Conservation Department, the Wisconsin Department of Natural Resources and the Sawyer County Aquatic Invasive Species Coordinator. The Whitefish Lake Property Owners Association Aquatic Plant Management Committee members included the following:

- Carl Landgrebe – Whitefish Lake Property Owners Association
- Don Semler – Whitefish Lake Property Owners Association
- Bob Vogler – Whitefish Lake Property Owners Association
- Roger Misgren – Whitefish Lake Property Owners Association
- David Weik – Whitefish Lake Property Owners Association
- Greg Johnson – Whitefish Lake Property Owners Association

The Aquatic Plant Management Committee met twice during September. At the first meeting the committee reviewed aquatic plant management planning requirements, plant survey results, plant concerns, EWM management efforts to date and a timeline for the completion of the plan. During the second meeting, the committee reviewed draft goals, objectives and action steps. The APM Committee expressed a variety of concerns that are reflected in the goals and objectives for aquatic plant management in this plan.

The Whitefish Lake Property Owners' Association board announced availability of the draft Aquatic Plant Management plan for review with a special email to all lake residents and a public notice in the Sawyer County Record early in November 2009. A copy of the plan was also made available to the public through the Sawyer County Lakes Forum website. Comments were accepted through November 23, 2009. The WLPOA board approved the plan with an email vote following the public comment period *(pending).*

Lake Management Concerns

The aquatic plant management committee had several major concerns which this plan addresses. These concerns include:

- Minimizing EWM growth and spread within the lake
- Preventing the introduction of other non-native aquatic invasive species
- Preserving the lakes diverse native plant communities
- Education of lake users about the importance of native plants

Lake Information

Whitefish Lake located in Sawyer County, Wisconsin, is considered a unique and significant water resource by the Whitefish Lake Property Owners Association (WLPOA), the Lac Courte Oreilles Band of Lake Superior Chippewa Indians (LCO), Sawyer County and the Wisconsin Department of Natural Resources (WDNR). Maps of Whitefish Lake are shown in Figures 1 and 2. Figure 1 is the west half of the lake and Figure 2 is the east half of the lake. The lake is a soft-water drainage lake located in the Couderay River watershed. It has an inlet stream from Sand Lake and an outlet flowing into Lac Courte Oreilles Lake. It has a surface area of approximately 786 acres and a volume of approximately 35,502 acre-feet. The maximum depth is 105 feet, which is one of the deepest lakes in Sawyer County. Approximately 70% of the lake is over 20 feet deep and only 8% is less than 3 feet deep. The total shoreline of the lake spans 8.07 miles. The lake has a varied fishery which includes walleye, muskellunge, northern pike, panfish, crappie, and small and largemouth bass. Cisco and whitefish are also common. The lakeshore property owners, LCO tribal members and the general public, via the public accesses, utilize the lake for a wide variety of activities, including fishing, boating, skiing, swimming, snorkeling, SCUBA diving and viewing wildlife.

Figure 1: Whitefish Lake: West Half

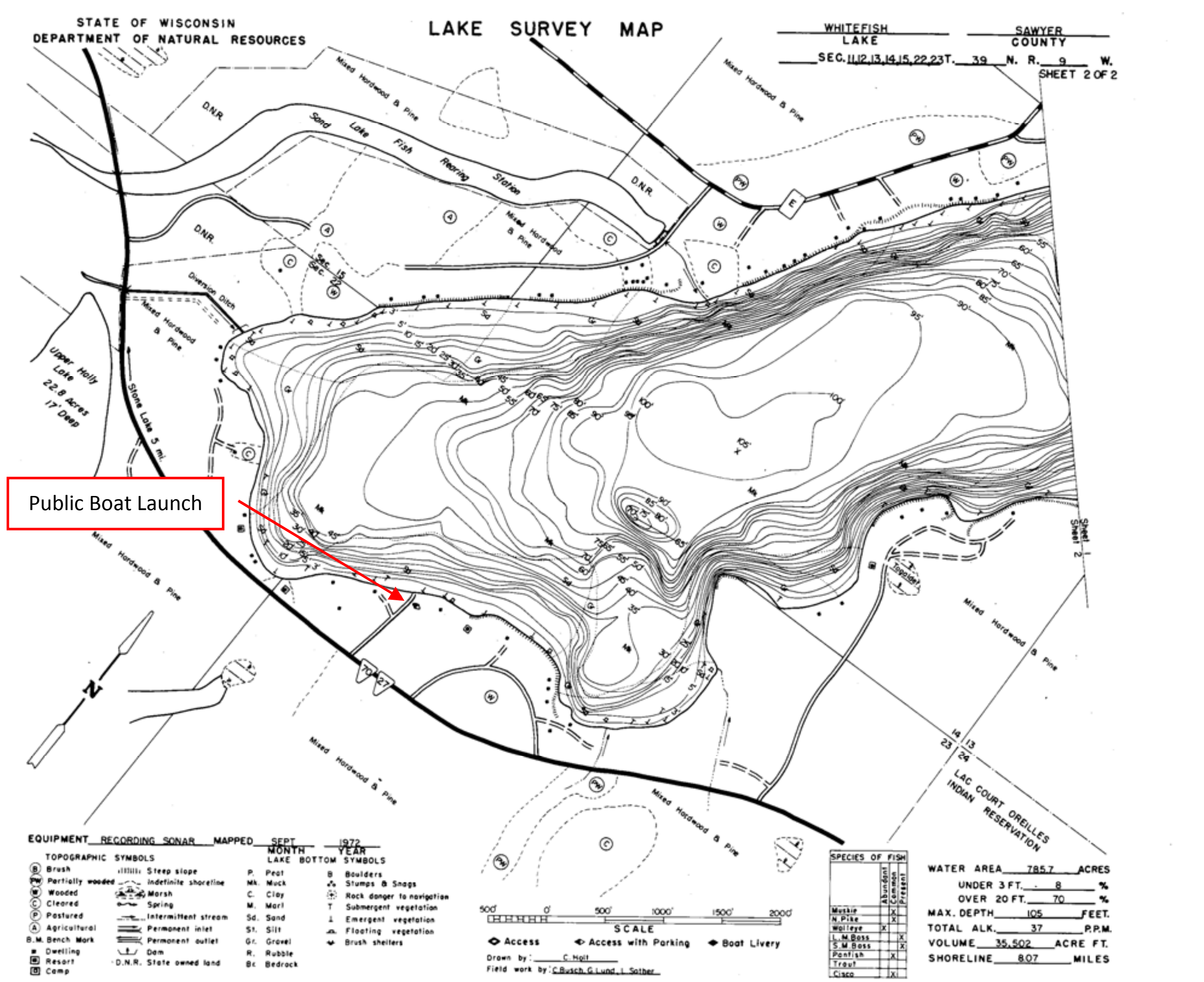
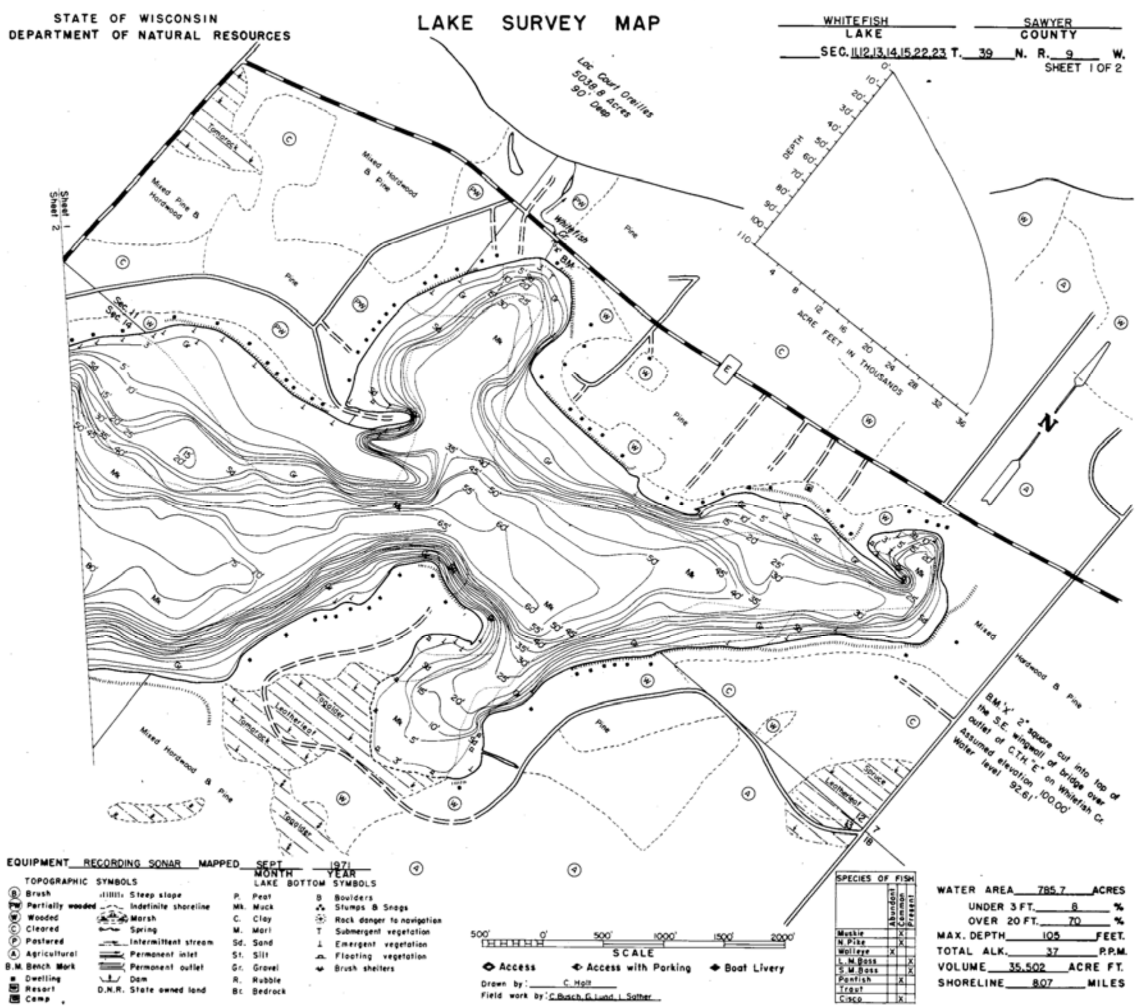


Figure 2: Whitefish Lake: East Half



Water Quality

The LCO Conservation Department has been collecting lake data on a regular basis since 2000 up to the present. This data includes total phosphorus, chlorophyll-a and Secchi disk readings. The Conservation Department has been collecting this data to determine if long-term trends may be occurring in Whitefish Lake. The LCO Conservation Department also completed a comprehensive water quality study of Whitefish Lake in 2002 to assess the existing water quality of the lake and provide information for the development of a lake management plan. The study involved collection of data from Whitefish Lake and its watershed during 2002 and annualized hydrologic and phosphorus budgets were then modeled for existing watershed land use conditions.

General Concepts in Lake Water Quality

There are many concepts and terminology that are necessary to describe and evaluate the water quality of a lake. A brief discussion follows to help better understand the following concepts and terminology:

- Eutrophication
- Trophic states
- Limiting nutrients
- Nutrient recycling and internal loading
- Stratification
- Riparian Zone
- Watershed

Eutrophication

Eutrophication, or lake degradation, is the accumulation of sediments and nutrients in a lake. As a lake naturally ages and becomes more fertile, algae and weed growth increases. The increasing biological production and sediment inflow from the lake's watershed eventually fills in the lake's basin. The process of eutrophication is natural and results from the normal environmental forces that influence a lake. Cultural eutrophication, however, is an acceleration of the natural process caused by human activities. Nutrient and sediment inputs from agriculture, new construction, houses, septic tanks, lawn fertilizers, and storm water runoff can far exceed the natural inputs to the lake. The accelerated rate of water quality degradation caused by these pollutants results in unpleasant consequences such as profuse and unsightly growths of algae (algal blooms), decreased water clarity and/or the proliferation of rooted aquatic weeds.

The main cause of cultural eutrophication is uncontrolled development within a lake's watershed and/or development without the use of Best Management Practices (BMP's). Creating and implementing a lake management plan prior to the development of the lake's watershed is the best way to try to prevent and minimize the impacts from cultural eutrophication.

Trophic States

Not all lakes are in the same stage of eutrophication because of varying nutrient status. Criteria have been established to evaluate the existing nutrient status of a lake. Trophic state indices (TSI's) are calculated for lakes on the basis of total phosphorus, chlorophyll-a concentrations, and Secchi disk transparencies. A TSI value can be obtained from any one of those parameters. TSI values range upward from zero, designating the condition of the lake in terms of its degree of fertility. The trophic status indicates the severity of a lake's algal growth problems and the degree of change needed to meet its recreational goals. Determining the trophic status of a lake is therefore an important step in diagnosing water quality problems. For a general guideline of TSI, Table 1 can be referred to.

Table 1: Trophic Status and TSI Ranges

Trophic Status	**TSI Range**	
Oligotrophic	TSI 37	Clear, low productivity lakes with total phosphorus concentrations less than or equal 10 ug/L
Mesotrophic	38 TSI 50	Intermediate productivity lakes with total phosphorus concentrations greater than 10 ug/L, but less than 25 ug/L
Eutrophic	51 TSI 63	High productivity lakes generally having 25 to 57 ug/L of total phosphorus
Hypereutrophic	64 TSI	Extremely productive lakes that are highly eutrophic, disturbed and unstable (i.e., fluctuating in their water quality on a daily and seasonal scale, producing gases, off-flavor, and toxic substances, experiencing periodic anoxia and fish kills, etc.) With total phosphorus concentrations above 57 ug/L

Limiting Nutrients

The quantity of algae in a lake is usually limited by the water's concentration of an essential element or nutrient. This is the limiting nutrient. The limiting nutrient concept is a widely applied principle in ecology and in the study of eutrophication. It is based on the idea that plants require many nutrients to grow, but the nutrient with the lowest availability, relative to the amount needed by the plant or algae, will limit its growth.

Nitrogen (N) and phosphorus (P) are generally the two growth-limiting nutrients for algae in most natural waters. Analysis of the nutrient content in lake water provides ratios of N:P. By comparing the ratio, one can estimate whether a particular nutrient may be limiting. Algal growth is generally phosphorus-limited in waters with a N:P ratio greater than 15. It has been amply demonstrated that phosphorus is usually the nutrient in limited supply in fresh waters. Therefore, reducing phosphorus in the lake is required to reduce algal abundance and improve water transparency. The failure to reduce the phosphorus concentrations entering the lake will allow the process of accelerated eutrophication to continue.

Nutrient Recycling and Internal Loading

Watershed runoff, which includes overland flow and groundwater infiltration, or direct atmospheric deposition are the two ways in which phosphorus can enter a lake. It would therefore seem reasonable that phosphorus in a lake can be decreased by reducing these external loads of phosphorus to the lake. However, all lakes accumulate phosphorus, along with other nutrients, in the sediments from the settling of particles and dead organisms. In some lakes this stored phosphorous can be reintroduced into the lake water and become available again for plant uptake. This reintroduction typically occurs during spring and fall turnover and in many cases is the cause for spring and fall algal blooms. This release of the nutrients from the sediments to the lake water is known as "internal loading". The amount of phosphorus coming from internal and external loads vary with each lake. Internal loading can be estimated from depth profiles of dissolved oxygen and phosphorus concentrations.

Stratification

The process of internal loading is dependent on the amount of organic material in the sediments and the depth-temperature pattern, or "thermal stratification", of a lake. Thermal stratification has a profound influence on a lake's chemistry and biology. As the ice melts and the air temperature warms in the spring, lakes generally progress from being completely mixed to stratified with only an upper warm well-mixed layer of water (epilimnion), and cold temperatures in a bottom layer (hypolimnion). Because of the density differences between the lighter warm water and the heavier cold water, stratification in a lake can become very resistant to mixing. When this occurs, generally in mid to late summer, oxygen from the air cannot reach the bottom lake water and, if the lake sediments have sufficient organic matter, biological activity can deplete the remaining oxygen in the hypolimnion. The epilimnion can remain well-oxygenated, while the water above the sediments in the hypolimnion becomes completely devoid of dissolved oxygen (anoxic). Complete loss of oxygen changes the chemical conditions in the water and allows phosphorus that had remained bound to sediments to reenter the lake water. Phosphorus concentrations in the hypolimnion can continue to rise as the summer progresses until oxygen is once again reintroduced. The dissolved oxygen concentration will increase if the lake sufficiently mixes to disrupt the thermal stratification. Phosphorus in the hypolimnion is generally not available for plant uptake because there is not sufficient light penetration into the hypolimnion to allow for plant growth or the growth of algae. The phosphorus, therefore, remains trapped and unavailable to the plants until the lake is completely mixed again. In shallow lakes mixing can occur frequently throughout the summer with sufficient wind energy. In deeper lakes only extremely high wind energy is sufficient to destratify a lake during the summer and complete mixing only occurs in the spring and fall. The cooling air temperature in the fall reduces the epilimnion water temperature and consequently increases the density of water in the epilimnion. As the epilimnion water density approaches the density of the hypolimnion water, very little energy is needed to cause complete mixing of the lake. When this fall mixing occurs, phosphorus that has built up in the hypolimnion is mixed with the epilimnetic water and some of it becomes available for algal growth. This is typically the cause behind fall algal blooms. The remainder of the phosphorus combines with iron in the water to form an amorphous ferric-hydroxy-phosphate complex that re-precipitates to the lake's bottom sediments.

Riparian Zone

The riparian zone is extremely important to the lake and to the plants living there. Riparian vegetation is that which is growing close to the lake and may be different from the terrestrial or upland vegetation. The width of the riparian zone varies depending on many factors, including soils, vegetation, slopes, soil moisture, depth of the water table, and even by location on the lake. For instance, the north shore vegetation may provide little or no shade, while vegetation on the southern shore may offer shade and cover well into the lake.

The riparian zone is important for the following reasons:

- Acts as a filter from outside impacts
- Stabilizes the bank with an extensive root system
- Helps control or filter erosion
- Provides screening to protect visual quality and hides man's activities and buildings
- Provides the natural visual backdrop as seen from the lake
- Provides organic material to the lake's food web.
- Offers cover and shade for fish and other aquatic life
- Provides valuable wildlife habitat

The riparian zone is the area most often impacted and riparian vegetation is lost when man enters the scene. Cabins, homes, lawns, driveways, or other structures may replace native riparian vegetation. Additional riparian vegetation may be eliminated to provide a larger view from the house or it may be mowed and its value to the lake is lost.

The loss of riparian vegetation results in the deterioration of many lake values besides water quality. Wildlife habitat is lost, the scenic quality suffers, fish habitat is impacted, bank stability may be weakened and the potential for erosion increases. The vegetation in the riparian zone filters phosphorus and sediments from runoff water, which in turn protects the water quality of the lake.

Watershed

The area of land that drains to the lake is called the lake's watershed. This area may be small, as is the case of small seepage lakes. Seepage lakes have no stream inlet or outlet and their watersheds include only the land draining directly to the lake. On the other hand, a lake's watershed may be large, as in drainage lakes such as Whitefish Lake. Drainage lakes have both a stream inlet and an outlet and therefore their watersheds include the land draining to the streams in addition to the land draining directly to the lake. The water draining to a lake may carry pollutants that affect the lake's water quality. Therefore, water quality conditions of the lake are a direct result of the land use practices within the entire watershed. Poor water quality may reflect poor land use practices or pollution problems within the watershed. Good water quality conditions suggest that proper land uses are occurring in the watershed or there is minimal development within the watershed.

All land use practices within a lake's watershed impact the lake and determine its water quality. Impacts result from the export of sediment and nutrients, primarily phosphorus, to a lake from its watershed. Each land use contributes a different quantity of phosphorus to the lake, thereby, affecting the lake's water quality differently. An understanding of a lake's watershed, phosphorus exported from the watershed, and the relationship between the lake's water quality and it's watershed must be understood.

Whitefish Lake 2002 Water Quality Study

The water quality data show that Whitefish Lake has good water quality that would be consistent with a north temperate mesotrophic lake. Total phosphorus, chlorophyll-a and Secchi disk data were within the mesotrophic category (moderate productivity, accumulated organic matter, occasional algal bloom, minimal recreational use impairments). Summer Secchi disk readings averaged 13.0 feet, summer total phosphorus readings averaged 13.9 ug/L, and summer chlorophyll-a readings averaged 2.96 ug/L during 2002. Water clarity is better than what would be expected based upon the total phosphorus and chlorophyll-a values. This may indicate that zooplankton grazing could be limiting the algal biomass. However, the seasonal pattern of chlorophyll-a, total phosphorus and Secchi disk readings were similar thru most of the monitoring period further indicating that the lake's algal growth is directly related to the phosphorus levels in the lake.

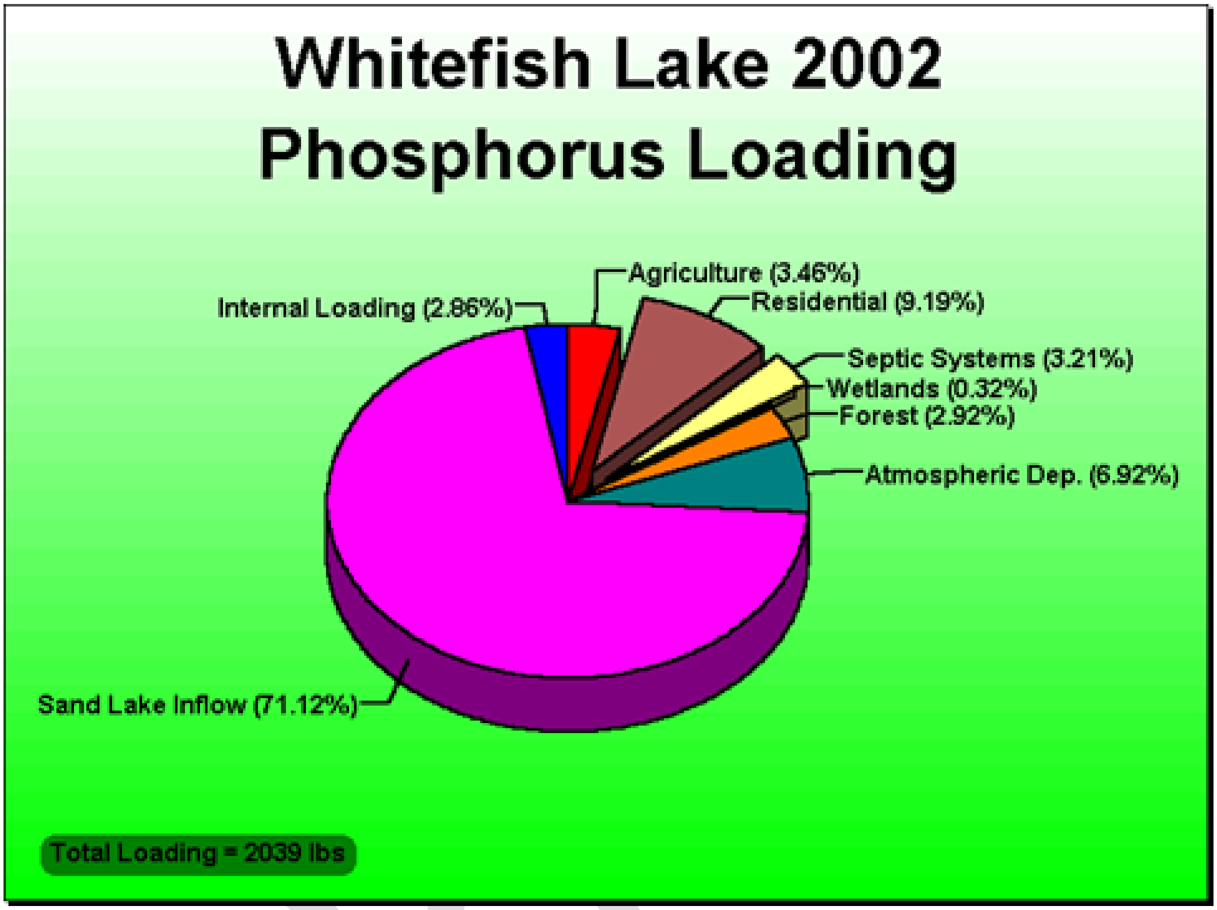
The phosphorus budget modeling indicated that the total annual phosphorus loading to Whitefish Lake was 2,039 pounds, based on 2002 data. The results of the phosphorus loading budget are presented in Figure 3. The inflow water from Sand Lake contributed the largest amount of phosphorus at 1,450 pounds (71%). Residential use and septic systems contributed 187 lbs (9%) and 65 lbs (3%) of the annual load respectively. By applying a wet and dry atmospheric deposition rate of 0.18 lbs/acre/yr to the surface of Whitefish Lake, the atmospheric component of the phosphorus loading is computed to be 141 lbs or 7%. Agriculture contributed 71 pounds (3.5%). The forested portion of the watershed contributed 60 lbs of phosphorus which is just under 3% of the loading and the wetlands were estimated to contribute only 7 lbs (0.3%). The computations reveal that Internal loading contributes 58 lbs (3%) of the total phosphorus load.

The impacts of cultural eutrophication on Whitefish Lake were estimated by modeling pre-development in-lake phosphorus concentrations and comparing the estimated pre-development concentrations with current phosphorus concentrations (i.e., post-development conditions). Cultural eutrophication describes the acceleration of the natural eutrophication process caused by human activities. An assessment of the land uses within the Whitefish Lake watershed indicate that there are two types of land uses that contribute to cultural eutrophication. These land uses are:

1. Agriculture- the phosphorus loading from agricultural land use includes the row crop land use type. The total loading from agriculture is estimated to be 3.5% of the total phosphorus loading to Whitefish Lake.

2. Residential - residential land use is comprised of the households within the watershed and the septic systems located around the lake shore. The total phosphorus loading to the direct watershed from residential land use is estimated to be just over 12% of the total phosphorus loading.

Figure 3: Whitefish Lake 2002 Phosphorus Budget



Three modeling scenarios were completed to assess the impacts of cultural eutrophication on Whitefish Lake. The three scenarios consisted of the following:

1. Estimating the in-lake phosphorus concentration assuming forested land use (i.e. pre-development condition) in place of agricultural land use (i.e. current or post-development condition).

2. Estimating the in-lake phosphorus concentration assuming forested land use (i.e. pre-development condition) in place of residential land use (i.e. current or post-development condition).

3. Estimating the in-lake phosphorus concentration assuming forested land use (i.e. pre-development conditions) in place of agricultural and residential land uses (i.e. current or post-development conditions).

The model indicates that the assumed conversion of forested land use to agricultural land use results in a 0.4 ug/L (3%) increase in the total in-lake phosphorus concentration. This increase in phosphorus does not result in a noticeable water quality change. The estimated 0.4 ug/L increase in total phosphorus concentration does not result in a decrease in the average annual Secchi disc transparency. This is based upon the regression relationship between total phosphorus and Secchi disk depth as determined in the trophic response module in the WILMS model.

The model indicates that the assumed conversion of forested land use to residential land use results in a 1.5 ug/L (11%) increase in the total in-lake phosphorus concentration. The estimated 1.5 ug/L increase in total phosphorus concentrations results in an estimated decrease in the average annual Secchi disc transparency of 0.7 feet. This is based upon the regression relationship between total phosphorus and Secchi disk depth as determined in the trophic response module in the WILMS model. The 0.7 foot decrease in Secchi disk depth correlates to 5% decrease in the water clarity based upon the 2002 average summer Secchi disk depth of 13.0 feet.

The model indicates that the assumed conversion of forested land use to agricultural and residential uses results in a 2.0 ug/L (14%) increase in the total in-lake phosphorus concentration. The estimated 2.0 ug/L increase in total phosphorus concentration results in an estimated decrease in the average annual Secchi disc transparency of 1.0 foot. This is based upon the regression relationship between total phosphorus and Secchi disk depth as determined in the trophic response module in the WILMS model. This predicted decrease in Secchi disk depth would be an overall reduction in water clarity of 8% from pre-development levels based upon the 2002 average summer Secchi disk depth of 13.0 feet.

The water quality of Whitefish Lake is heavily influenced by the water quality of Sand Lake. The study identified that over 70% of the phosphorus loading to Whitefish Lake came from Sand Lake. To gain a better understanding of how the water quality of Sand Lake affects Whitefish Lake, two additional scenarios were evaluated. The two scenarios consisted of the following:

1. Estimating the in-lake phosphorus concentration assuming forested land use (i.e. pre-development condition) in place of the agricultural land use (i.e. current or post-development condition) in both the Sand Lake and Whitefish Lake direct watersheds.

2. Estimating the in-lake phosphorus concentration assuming forested land use (i.e. pre-development conditions) in place of agricultural and residential land uses (i.e.

current or post-development conditions) in both the Sand Lake and Whitefish Lake direct watersheds.

The model indicates that the assumed conversion of forested land use to agricultural land use in the Sand Lake and Whitefish Lake watersheds results in a 4.4 ug/L (32%) increase in the total in-lake phosphorus concentration. This increase in phosphorus results in a noticeable water quality change. The estimated 4.4 ug/L increase in total phosphorus concentration results in an estimated decrease in the average annual Secchi disc transparency of 2.3 feet. This predicted decrease in Secchi disk depth would be an overall reduction in water clarity of 18% from pre-development levels based upon the 2002 average summer Secchi disk depth of 13.0 feet.

The model indicates that the assumed conversion of forested land use to agricultural and residential uses in the Sand Lake and Whitefish Lake direct watersheds results in a 6.8 ug/L (49%) increase in the total in-lake phosphorus concentration. The estimated 6.8 ug/L increase in total phosphorus concentration results in an estimated decrease in the average annual Secchi disc transparency of 4.3 feet. This predicted decrease in Secchi disk depth would be an overall reduction in water clarity of 33% from pre-development levels based upon the 2002 average summer Secchi disk depth of 13.0 feet.

Evaluation of Historical Water Quality Data

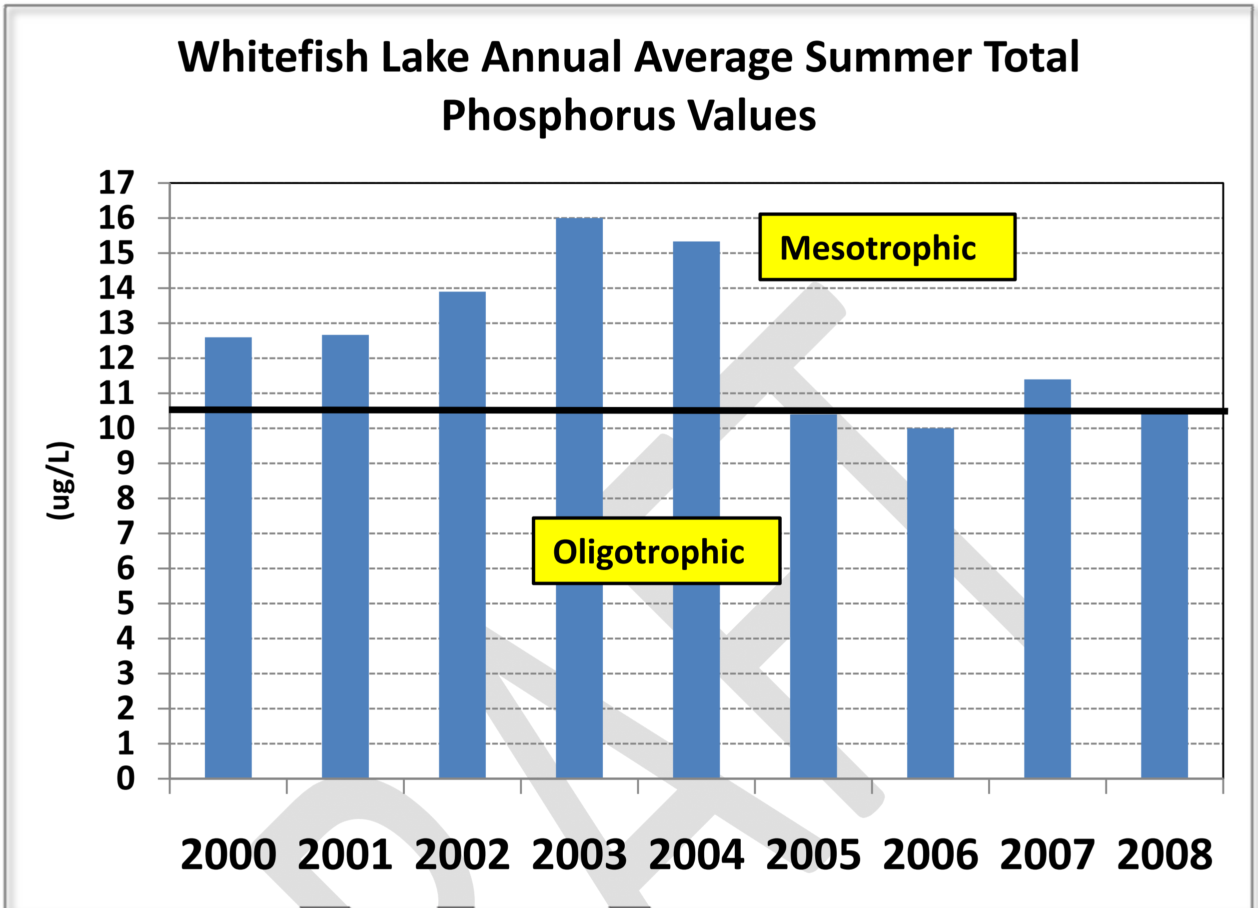
Phosphorus

Phosphorus is the plant nutrient that most often limits the growth of algae. Phosphorus-rich lake water indicates a lake has the potential for abundant algal growth, which can lead to lower water transparency and a decline in hypolimnetic oxygen levels in a lake.

While nitrogen can limit algal growth, it can be obtained from the atmosphere by certain algal species. This is termed nitrogen fixation. Thus, phosphorus is the only essential nutrient that can be effectively managed to limit algal growth.

An evaluation of total phosphorus data from 2000 – 2008 indicates that there is no statistically significant trend. The summer average total phosphorus results are shown in Figure 4.

Figure 4: Whitefish Lake Annual Average Summer Total Phosphorus Values

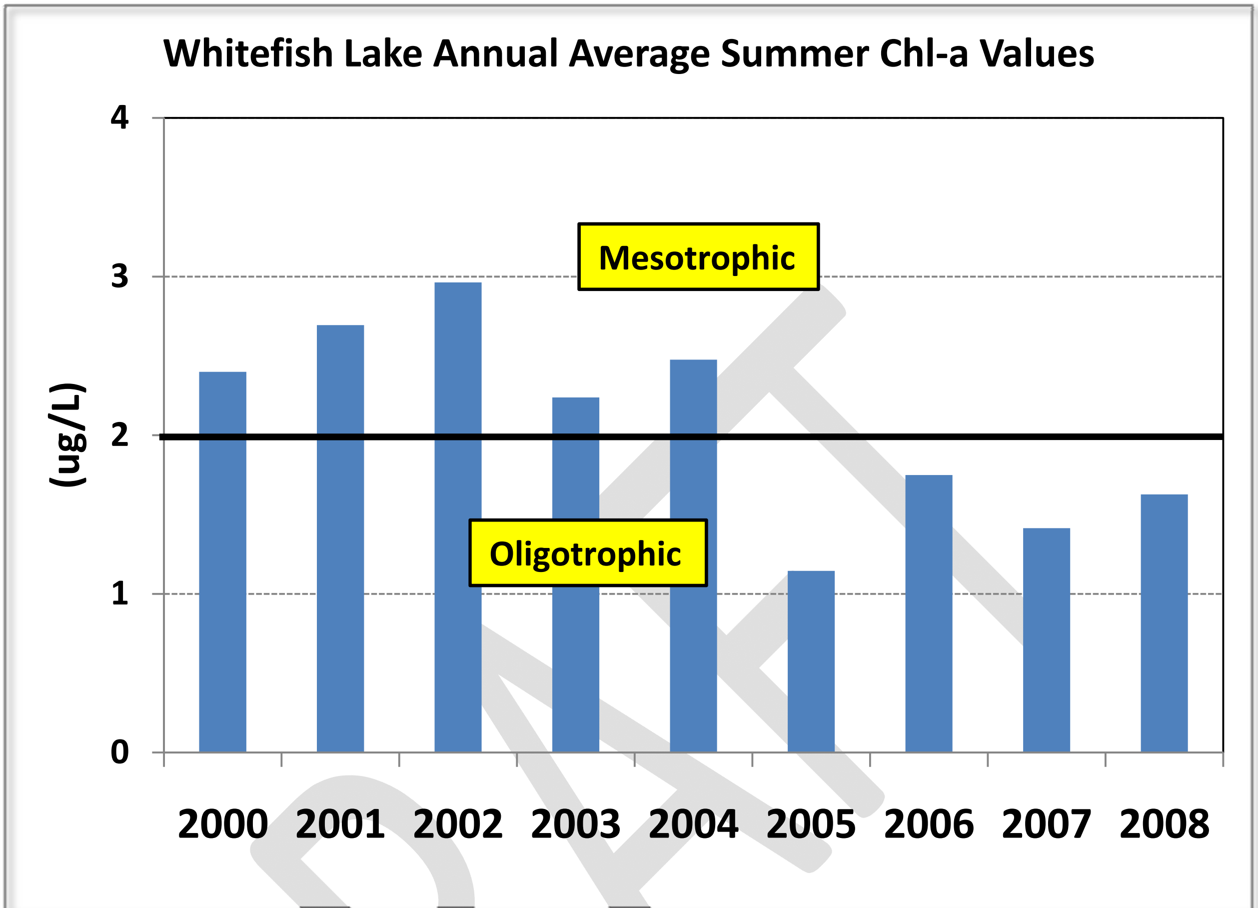


Chlorophyll-a

Chlorophyll-a is a measure of algal abundance within a lake. High chlorophyll-a concentrations indicate excessive algal abundance (i.e. algal blooms), which can lead to recreational use impairment.

An evaluation of the chlorophyll-a data from 2000 – 2008 indicates that there is no statistically significant trend. The summer average Chl-a results are shown in Figure 5.

Figure 5: Whitefish Lake Annual Average Summer Chlorophyll-a Values



Secchi Disk Transparency

Secchi disk transparency is a measure of water clarity. Perceptions and expectations of people using a lake are generally correlated with water clarity. The results of a survey completed by the Metropolitan Council (Osgood, 1989) indicated that the following relationships can generally be perceived between a lake's recreational use impairment and Secchi disk transparencies:

- *No impairment occurs at Secchi disk transparencies greater than 4 meters (13 feet).*[1]
- *Minimal impairment occurs at Secchi disk transparencies of 2 to 4 meters (6.5 - 13 feet).*

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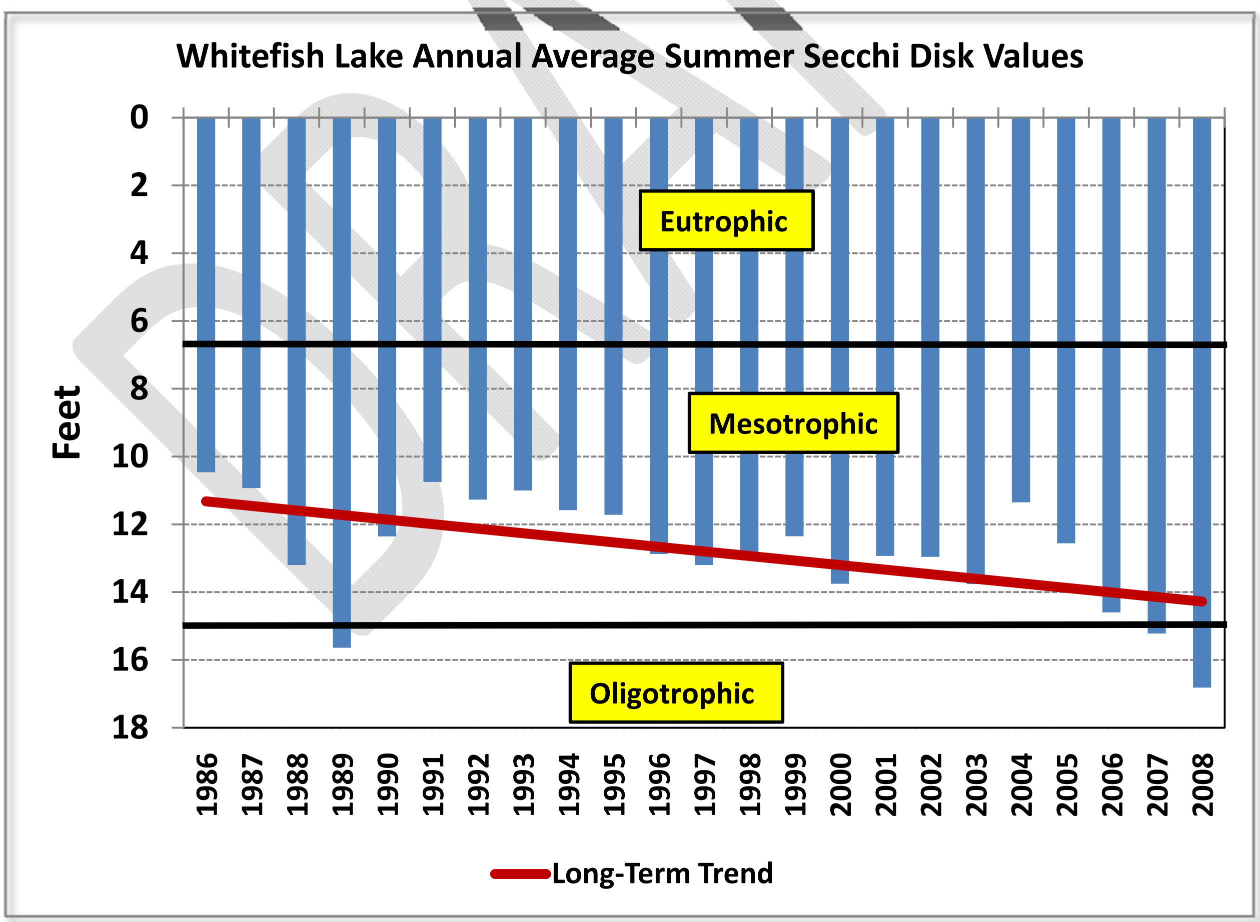
[1] Osgood, R.A.;1989. Assessment of Lake Use - Impairment in the Twin Cities metropolitan Area. Prepared for the Minnesota Pollution Control Agency. Metropolitan Council Publication 590-89-130. 12 pp.

- *Moderate impairment occurs at Secchi disk transparencies of 1 to 2 meters (3.3 - 6.5 feet).*
- *Moderate to severe use-impairment occurs at Secchi disk transparencies less than 1 meter (3.3 feet).*

Good, long-term data going back to 1986 was available for Secchi Disk readings. The historical data from 1986 – 2000 that was used was collected at the deep hole by a Whitefish Lake Property Association Volunteer for the Wisconsin Department of Natural Resource's volunteer monitoring program.

An evaluation of the annual summer Secchi disk data (Figure 6) reveals a statistically significant trend of improving visibility over of the monitoring period from 1986 to 2008. The seasonal pattern of the Secchi disk values suggest that the lake's water transparency was, for the most part, determined by the algal abundance.

Figure 6: Whitefish Lake Annual Average Summer Secchi Disk Values



Alkalinity Data

Alkalinity is associated with the carbon system in the lake. Another term used to indicate a lake's alkalinity is hardness. Hard water lakes (greater than 60 mg/L calcium carbonate) tend to be better producers of aquatic life, including both plants and animals. Soft water lakes (less than 60 mg/L calcium carbonate) are not as productive. Extremely low alkalinities (less than 5 mg/L calcium carbonate) are more likely to be impacted by acidification resulting from acid rain. Alkalinities above 5 mg/L calcium carbonate have enough buffering to counteract the effects of acid rain.

The average alkalinity for Whitefish Lake during the 2002 study was determined to be 40 mg/L calcium carbonate. Whitefish Lake would therefore be classified as a soft water lake.

Current Trophic State Indices

Table 2 indicates the trophic state index (TSI) for Whitefish Lake for 2008 based on the given parameter. The TSI values used for Whitefish Lake correspond to the parameter readings taken between Memorial Day and Labor Day, or the dates closest to these when samples were taken. The span of these dates corresponds with typical summer conditions and peak recreational use of the lake and therefore should most closely correlate with user perceptions of the lake. The TSI values indicate that Whitefish Lake was oligotrophic (Table 1) during 2008.

Table 2: Whitefish Lake 2008 Trophic State Indices

Parameter	Value	Trophic State Index
Total Phosphorus	10.5 ug/L	38
Chlorophyll-a-	1.63 ug/L	37
Secchi disk depth	16.8 feet	37

Hydrologic Budget Calculations

The 2002 water year (October 1, 2001 through September 30, 2002) estimated hydrologic budget for Whitefish Lake which was completed for the 2002 water quality study is presented in Figures 7 and 8. Figure 7 presents the estimated inflow budget and Figure 8 presents the estimated outflow budget. The inflow budget indicates that the diversion ditch from Sand Lake is the major contributor of water to Whitefish Lake. It accounts for over 80% of the inflow. This large contribution of water from Sand Lake indicates that the water quality of Whitefish Lake is heavily dependent upon the water quality of Sand Lake. As the water quality of Sand Lake changes, a corresponding change would also be noted in Whitefish Lake. Direct precipitation on the lake surface, which is comprised of both rain and snowfall, accounted for the next largest contribution with a combined total of just over 10%. Runoff from the watershed was the next largest with almost 7% and groundwater flow comprised almost 3% of the total inflow. The watershed runoff volume, including overland flow and groundwater, represents an annual water yield of approximately 16.05 inches from the Whitefish Lake watershed.

Water leaving the lake via the outlet was over 85% of the outflow budget for the lake. Evaporation from the lake's surface was the next largest output at 8.5% and groundwater seepage comprised the remainder at 6%.

Figure 7: 2002 Inflow Water Budget

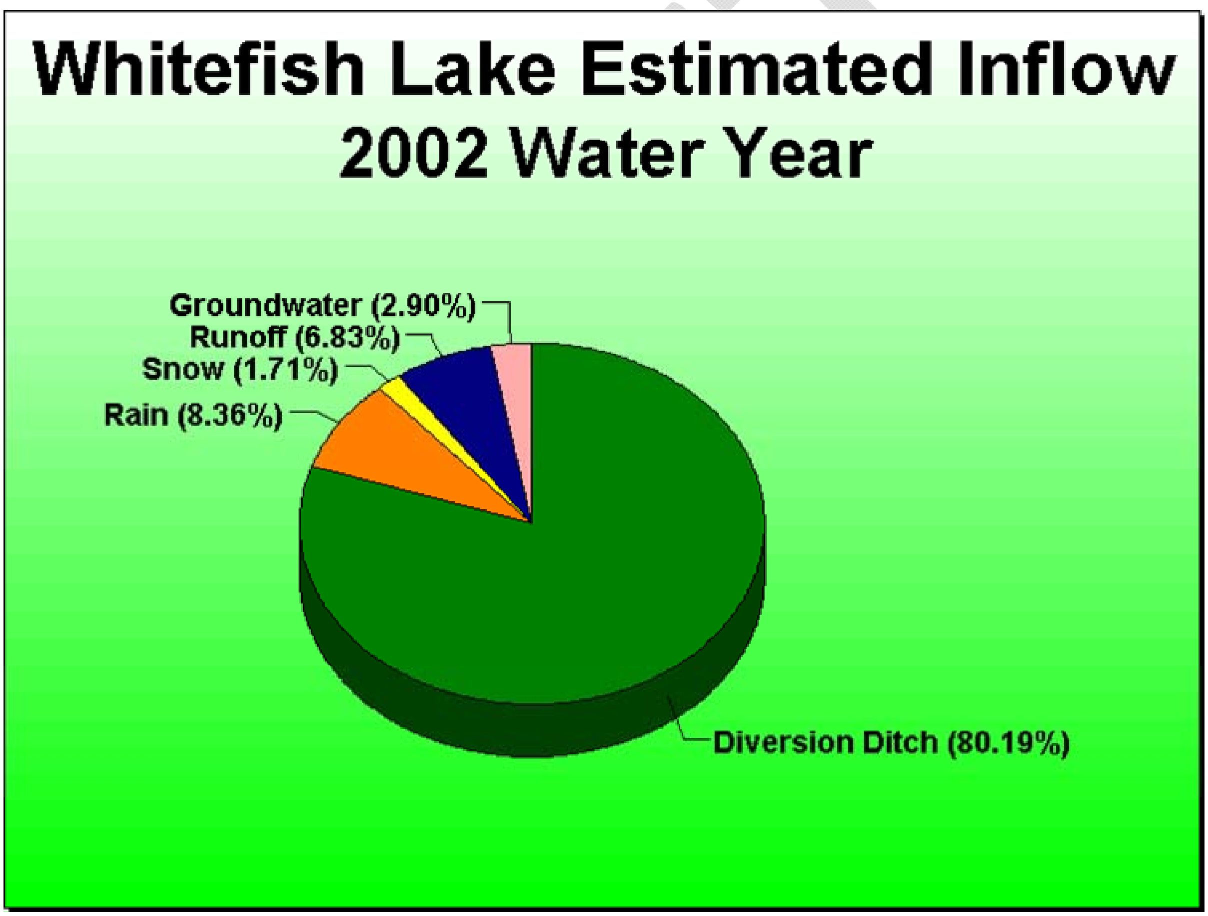
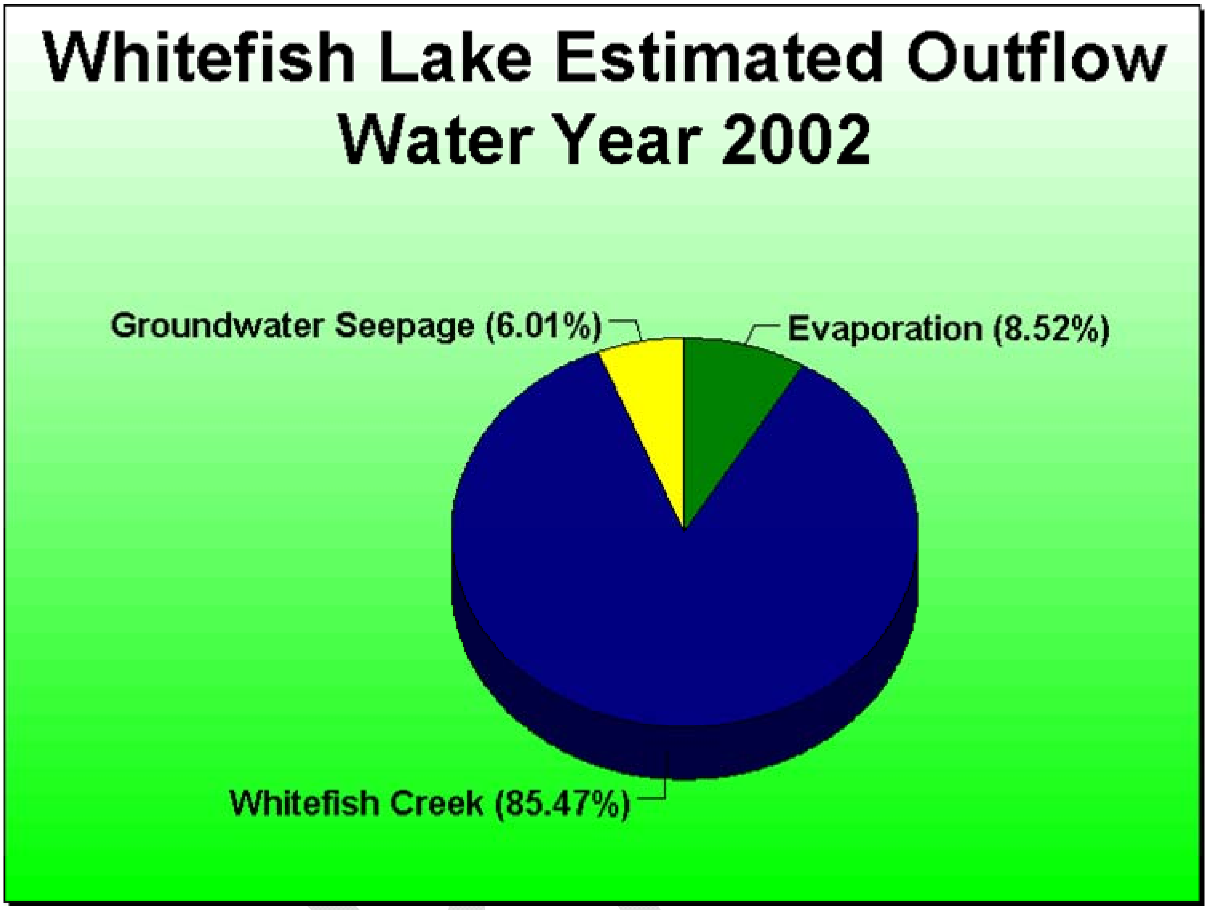


Figure 8: 2002 Outflow Budget



Watershed

The watershed for Whitefish Lake is part of the Couderay River watershed (Watershed Identification Key UC20) located in the Upper Chippewa River Basin. The watershed is primarily forest with development occurring along the lakeshore. The forested land is a good land cover to have around the lake since it contributes much smaller nutrient and sediment amounts into the lake compared to developed land covers such as residential and agriculture. Figure 9 delineates the watershed for Whitefish Lake. The total watershed of Whitefish Lake encompasses 20,504 acres or 32.0 miles^2. This gives a watershed basin to lake area ratio of 26:1. Of the 20,504 acres, only 1,333 acres drain directly into Whitefish Lake. This is referred to as the direct watershed. The remaining 19,171 acres drain into Big Sissabagama Lake which then drain into Sand Lake which then finally drain into Whitefish Lake. The various land uses and their corresponding acreage within the direct watershed are indicated in Table 3. Figure 10 is graphical representation of different land use acreage within the direct watershed.

Table 3: Whitefish Lake Direct Watershed Land Uses and Acreage (2002)

Land Use	Acres
Row Crop	94.2
Medium Density Residential	276
Rural Residential	140
Wetlands	82.5
Forest	740.3
Lake Surface Area	786

Aquatic Habitats

Primary Human Use Areas

The lakeshore property owners, LCO tribal members and the general public, via the public accesses, utilize the lake for a wide variety of activities, including fishing, boating, skiing, swimming, snorkeling, SCUBA diving and viewing wildlife. Public access to the lake is via the public boat launch which is indicated in Figure 1. A township ordinance is in place on the lake to limit waterskiing and jet skis between the hours of 10 am and 6pm.

In 2002 there were determined to be 276 residences along the lakeshore. Of these residences, 48% were year round and 52% were determined to be seasonal. All of these residences utilize septic systems. The septic systems are all assumed to be functioning properly since the Sawyer County Zoning and Sanitation Department conducted a septic system survey around Whitefish lake in 2001. Any deficient systems were required to be brought into compliance.

Direct watershed
Sub watershed

Figure 9: Whitefish Lake Watershed

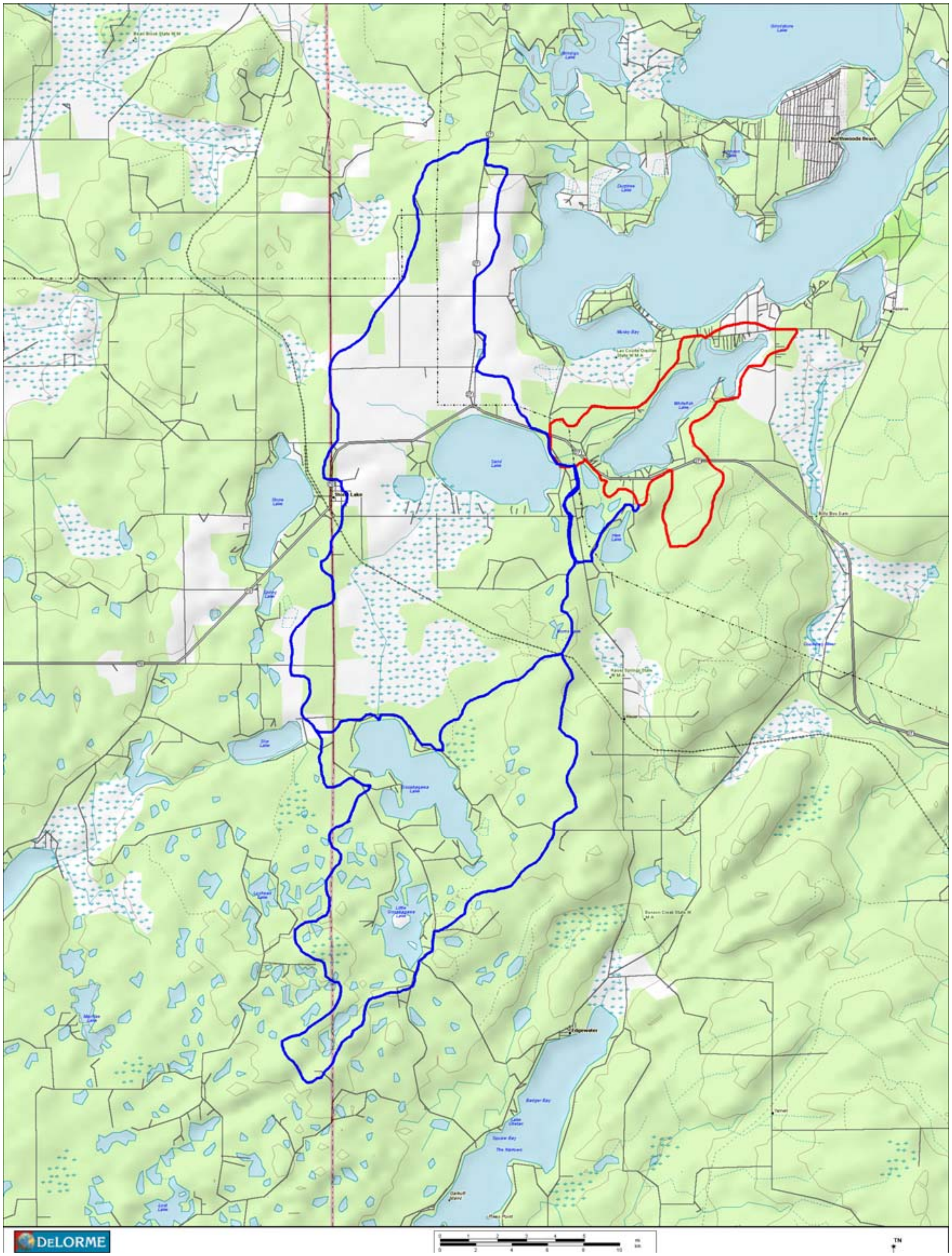
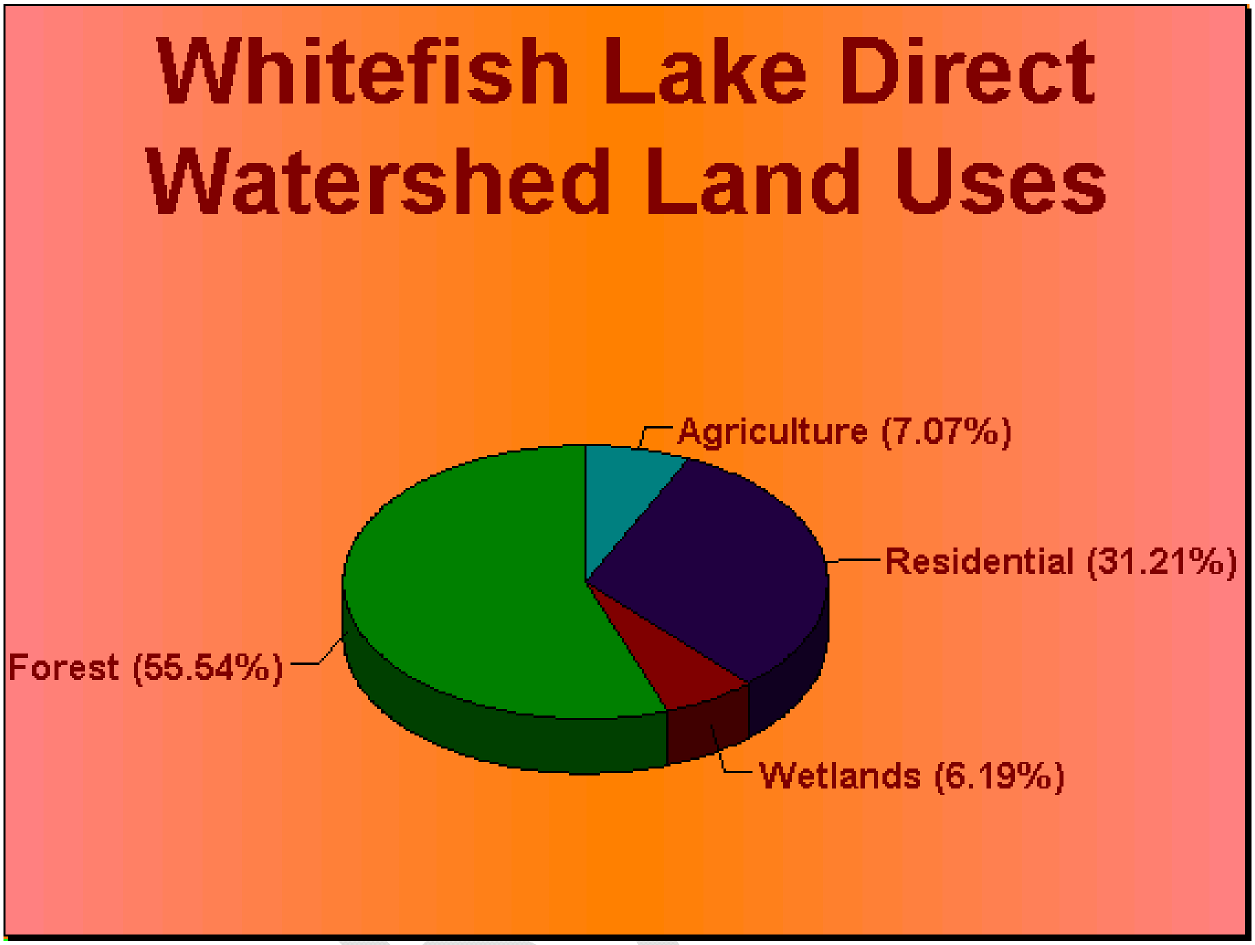


Figure 10: Whitefish Lake Direct Watershed Land Uses



Fisheries

Whitefish Lake has a varied fishery. It is one of the few lakes in the region with lake whitefish. It is a stocked walleye lake with approximately 2 adult walleye per acre. It has a quality muskellunge fishery and is a good smallmouth fishery. Cisco are also abundant in the lake and provide a quality food source for good growth rates of the gamefish. The population of Largemouth bass is increasing and may already be or become a management problem. The increasing numbers of largemouth bass may be linked to the macrophytes in the lake.[2] Other fish species present in the lake include, northern pike, bluegill, perch, black crappie, rock bass, pumpkinseed, bullheads, white suckers, redhorse, longnose gar and various minnow species.

Rare and Endangered Species Habitat

Whitefish Lake is located in T39N R9W. Table 4 lists the species that the Wisconsin Natural heritage Inventory has listed for the Town and Range that Whitefish Lake is located in. The

[2] Personal communication, Frank Pratt, WI DNR Fisheries Biologist.

listing does not provide enough detail to know if the species are actually found in Whitefish Lake. Robbins' Spikerush was found to be present in the lake.

Table 4: Rare and Endangered Species (T39N R9W)

Scientific Name	Common Name	State Status[3]
Canis lupus	Gray Wolf	SC/FL
Eleocharis robbinsii	Robbins' Spikerush	SC
Haliaeetus leucocephalus	Bald Eagle	SC/P
Lepomis megalotis	Longear Sunfish	THR
Moxostoma valenciennesi	Greater Redhorse	THR
Potamogeton pulcher	Spotted Pondweed	END
Scirpus torreyi	Torrey's Bulrush	SC
Utricularia purpurea	Purple Bladderwort	SC

Habitat Areas of Concern

Robbins' Spikerush was found to be present in Whitefish Lake. The WI DNR has classified it as a "Species Concern" warranting it's preservation. Many property owners around the lake have also expressed a concern over the decline of the bulrush stands around the lake. These stands help to protect the shoreline from erosion and the importance of preserving these areas is very high.

[3] THR = Threatened, SC = Special Concern, SC/FL = Special Concern (federally protected as endangered or threatened), SC/P = Special Concern (federally protected), END = endangered

PLANT COMMUNITY

Functions and Values of Aquatic Plants

Native aquatic plants play a key role in the ecology of a lake. They can help to maintain water quality, prevent shoreline erosion and provide habit for a wide diversity of species from fish to amphibians to mammals. Table 5 lists the species of plants that were sampled or observed in Whitefish Lake and their ecological significance.

Table 5: Whitefish Lake Plants and Their Significance

Scientific Name	Common Name	Ecological Significance[4]
filamentous algae	filamentous algae	
Brasenia schreberi	Watershield	The seeds, leaves, stems and buds are consumed by a wide variety of waterfowl. The Floating leaves offer shade and shelter for fish and invertebrates.
Ceratophyllum demersum	Coontail	The stiff whorls of leaves offer prime habitat for a host of critters, particularly during the winter when many other plants are reduced to roots and rhizomes. Both the foliage and fruit are grazed by waterfowl. Bushy stems of coontail harbor many invertebrates and provide important shelter and foraging opportunities for fish.
Chara	Muskgrasses	A favorite waterfowl food. Algae and invertebrates found on it provide additional grazing. It is also considered valuable fish habitat. Beds of muskgrass offer cover and are excellent producers of food, especially for young trout, largemouth bass and smallmouth bass. The rhizoids slow the movement and suspension of sediments. Therefore, stands of muskgrass can benefit water quality. It is a good bottom stabilizer.
Elatine minima	Waterwort	Moss-like mats of waterwort are grazed by a variety of ducks. It also offers habitat for zooplankton and fish fingerlings.
Eleocharis robbinsii	Robbins spikerush	Stems, rhizomes and nutlets are consumed by a variety of waterfowl. Muskrats also graze on stems and rhizomes. The fine submersed stems offer habitat for invertebrates and small fish. Stands of spikerush help protect the shoreline by stabilizing sediment and dampening wave action.

[4] Summarized from Through the Looking Glass. Borman etal. 1997.

Scientific Name	Common Name	Ecological Significance[4]
Elodea canadensis	Common waterweed	The branching stems offer valuable shelter and grazing opportunities for fish, although very dense stands can obstruct fish movement. It also provides food for muskrats and waterfowl.
Eriocaulon aquaticum	Pipewort	Beds of pipewort create shallow water structure for young fish, amphibians and invertebrates. The leaves are sometimes grazed by ducks.
Lemna minor	Small duckweed	It is a nutritious food source that can provide up to 90% of the dietary needs for a variety of ducks and geese. It is also consumed by muskrat, beaver and fish. Rafts of duckweed offer shade and cover for fish and invertebrates. Extensive mats of duckweed can also inhibit mosquito breeding.
Lemna trisulca	Forked duckweed	A good food source for waterfowl. Tangled masses of fronds also provide cover for fish and invertebrates.
Lobelia dortmanna	Water lobelia	Beds of water lobelia can help stabilize sandy, eroding shorelines. It also offers shallow water habitat for invertebrates and young fish.
Megalodonta beckii	Water marigold	The submersed foliage offers shade, shelter and foraging opportunities for fish. Waterfowl and shorebirds may consume the fruit when the plant produces it. It is considered an "indicator species." It is sensitive to changes in water quality, and may be one of the first submersed plants to disappear from a lake when water quality declines.
Myriophyllum sibiricum	Northern water milfoil	Leaves and fruit are consumed by a variety of waterfowl. The feathery foliage traps detritus and provides invertebrate habitat. Beds offer shade, shelter and foraging opportunities for fish.
Myriophyllum tenellum	Dwarf water milfoil	Provides good spawning habitat for panfish and shelter for small invertebrates. The network of rhizomes helps stabilize sediment.
Najas flexilis	Bushy pondweed	It is one of the most important plants for waterfowl. Stems, leaves and seeds are all consumed by a wide variety of ducks. It is also important to a variety of marsh birds as well as muskrats. It is a good producer of food and shelter for fish.
Nitella sp.	Nitella	It is sometimes grazed by waterfowl. The algae and invertebrates on its surface are attractive to ducks and geese. It also offers foraging opportunities for fish.

Scientific Name	Common Name	Ecological Significance[4]
Nuphar variegata	Spatterdock	It anchors the shallow water community and provide food for many residents. It provides seeds for waterfowl. The leaves, stems and flowers are grazed by deer. Muskrat, beaver and even porcupine have been reported to eat the rhizomes. The leaves offer shade and shelter for fish as well as habitat for invertebrates.
Nymphaea odorata	White water lily	It provides seeds for waterfowl. The leaves, stems and flowers are grazed by deer. Muskrat, beaver and even porcupine have been reported to eat the rhizomes. The leaves offer shade and shelter for fish.
Pontederia cordata	Pickerelweed	The flowering stalk is a haven for many insects - some seeking nectar and others a spot to rest. The seeds are consumed by waterfowl as well as muskrats. Networks of rhizomes and leaves also offer shade and shelter for fish. Beds can be important shoreline stabilizers and help dampen wave action.
Potamogeton amplifolius	Large-leaf pondweed	The broad leaves offer shade, shelter and foraging opportunities for fish. Abundant production of large nutlets makes this a valuable waterfowl food.
Potamogeton pusillus	Small pondweed	It can be a locally important food source for a variety of ducks and geese. It may also be grazed by muskrat, deer, beaver and moose. It provides a food source and cover for fish.
Potamogeton richardsonii	Clasping-leaf pondweed	It can be a locally important food source for a variety of ducks and geese. It may also be grazed by muskrat, deer, beaver and moose. It provides a food source and cover for fish.
Potamogeton robbinsii	Fern pondweed	It provides habitat for invertebrates that are grazed by waterfowl. It also offers good cover and foraging opportunities for fish, particularly northern pike.
Potamogeton zosteriformis	Flat-stem pondweed	It can be a locally important food source for a variety of ducks and geese. It may also be grazed by muskrat, deer, beaver and moose. It provides a food source and cover for fish.
Ranunculus aquatilis	Stiff water crowfoot	As flowers give way to fruit, the water crowfoot bed becomes a choice spot dabbling ducks. Both fruit and foliage are consumed by variety of waterfowl. When it is growing in shallow zones, it is sometimes consumed by upland game birds including ruffed grouse. Stems and leaves provide valuable invertebrate habitat and it is considered a fair producer of food for trout.

Scientific Name	Common Name	Ecological Significance[4]
Schoenoplectus acutus	Hardstem bulrush	It offers habitat for invertebrates and shelter for young fish, especially northern pike. The nutlets are consumed by a wide variety of waterfowl, marsh birds (including bitterns, herons, rails) and upland birds. Stems and rhizomes are eaten by geese and muskrats. Bulrushes also provide nesting material and cover for waterfowl, marsh birds and muskrats.
Sparganium eurycarpum	Common bur-reed	Colonies of bur-reed help anchor sediment and provide nesting sites for waterfowl and shorebirds. The fruit is eaten by a variety of waterfowl including mallards and tundra swans. The whole plant is grazed by muskrat and deer.
Typha latifolia	Broad-leaved cattail	Cattails provide nesting habitat for many marsh birds. Shoots and rhizomes are consumed by muskrats and geese. Submersed stalks provide spawning habitat and shelter for fish. Invertebrates also live on cattails.
Vallisneria americana	Wild celery	It is a premier source of food for waterfowl. All portions of the plant are consumed including foliage, rhizomes, tubers and fruit. Wild celery is a prime destination for canvasback ducks. It is also important to marsh birds and shore birds including rail, plover, sand piper and snipe. Muskrats are also known to graze on it. Beds are considered good fish habitat providing shade, shelter and feeding opportunities.

Aquatic Plant Survey Results

The Wisconsin Department of Natural Resources generated the sampling point grid for Whitefish Lake which consisted of 1591 points. Only points shallower than 20 feet were initially sampled until the maximum depth of plants could be established. This was determined to be 18 feet and is considered the littoral zone. Figure 11 shows all the points that were sampled at depths of 18 feet or less and can be considered a map of the littoral zone. A total of 488 points were at depths of 18 feet or less and out those 488 points, 409 of them contained vegetation. See Table 6 for a summary of the survey statistics. Appendix A contains a more detailed discussion of the aquatic plant survey and also depicts maps of all the species sampled or observed.

Figure 11: Whitefish Lake Littoral Zone

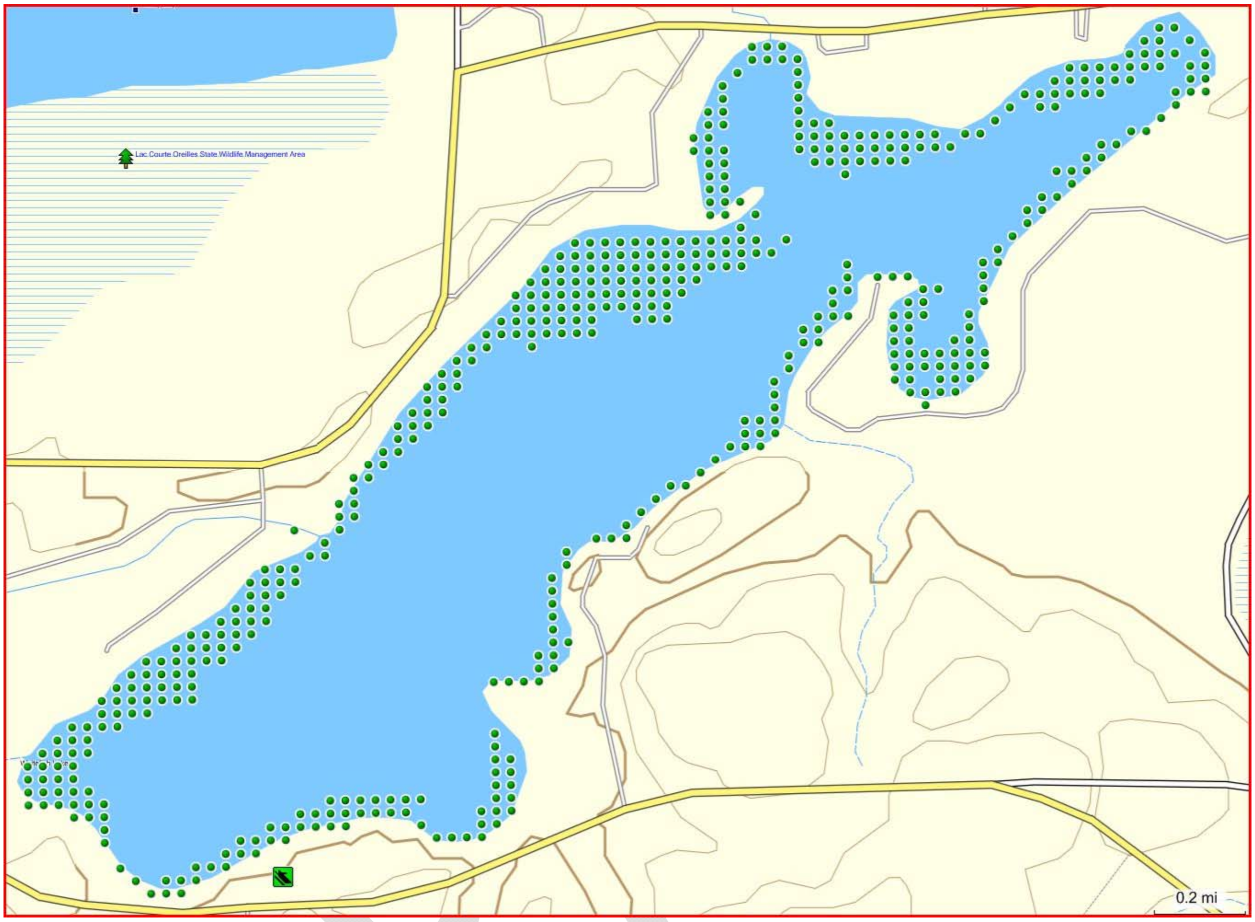


Figure 12 indicates the type of substrate that was present at each of the littoral zone sampling points. Sand was the most dominant substrate type (57.6%) followed by rock (23.0%) and then muck (19.4%).

Species Richness

Twenty-six species of aquatic macrophytes were sampled in Whitefish Lake. Four more species were viewed from the boat which brings the total species richness to 30 species. One of the species observed was *Myriophyllum spicatum (*Eurasian watermilfoil). This species was observed in the early season (June) survey and also at one location during the August survey. Table 7 lists all of the species that were sampled or observed along with their frequency and average rake density.

Table 6: Whitefish Lake Aquatic Plant Survey Statistics

SUMMARY STATS:	
Total number of points sampled	503
Total number of sites with vegetation	409
Total number of sites shallower than maximum depth of plants	488
Frequency of occurrence at sites shallower than maximum depth of plants	83.81
Percentage of all points with vegetation	25.70
Simpson Diversity Index	0.93
Maximum depth of plants (ft)	18.00
Average number of all species per site (shallower than max depth)	2.64
Average number of all species per site (veg. sites only)	3.15
Average number of native species per site (shallower than max depth)	2.59
Average number of native species per site (veg. sites only)	3.15
Species Richness	26
Species Richness (including visuals)	30

Plant Diversity

Whitefish Lake has a very diverse plant community consisting of 29 native species (Table 7). The Simpson's diversity index is also very high at 0.93 indicating a healthy ecosystem and a high degree of diversity. No single plant dominates within the lake. The plant species abundance is very balanced between many different types. The most common plants sampled included pipewort (*Eriocaulon aquaticum)*, dwarf water milfoil (*Myriophyllum tenellum)*, muskgrass (*Chara*), small pondweed (*Potamogeton pusillus)* and robbins pondweed (*Potamogeton robbinsii)*. All of these are desirable species and indicate a high degree of water quality.

Table 7: Whitefish Lake Aquatic Macrophytes

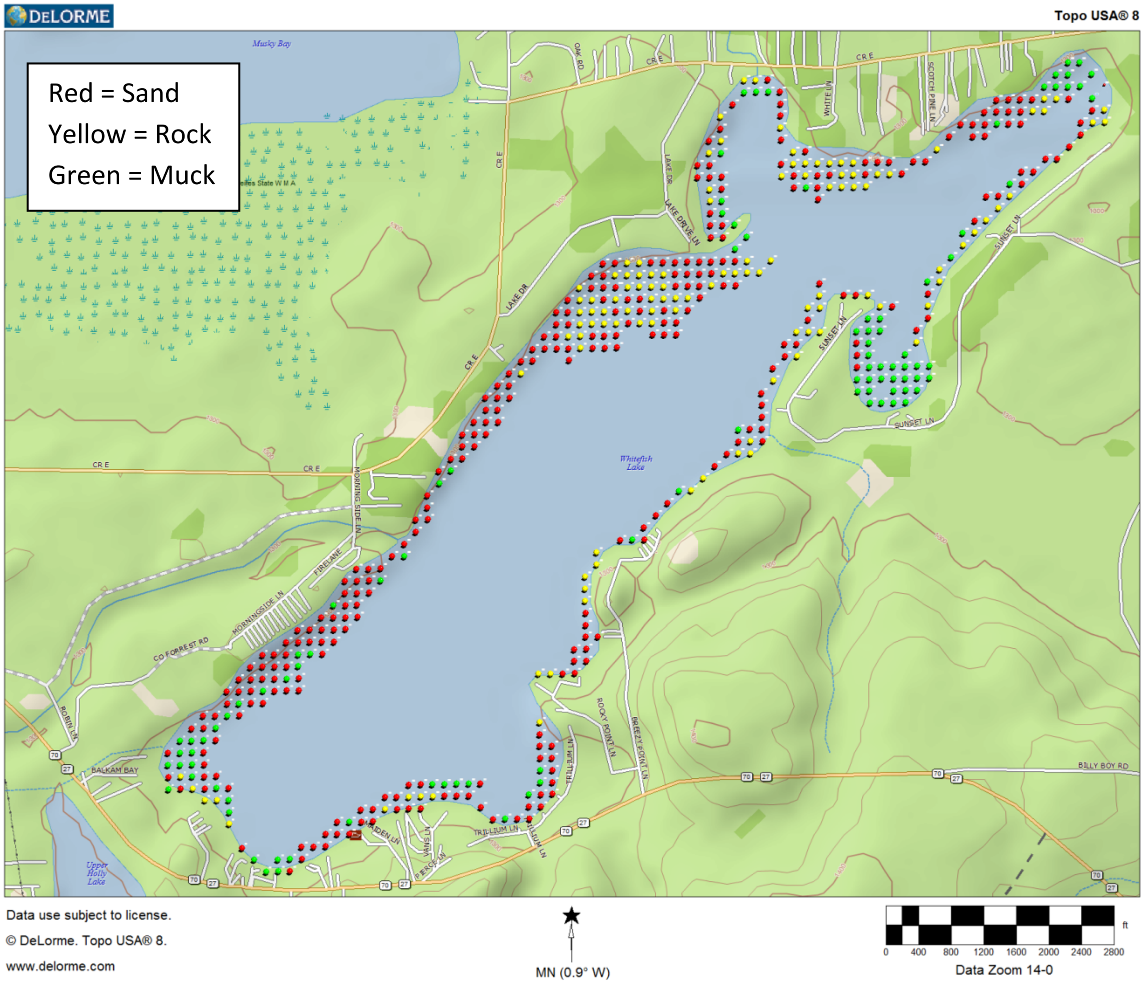
Species Name	Common Name	Freq w/in vegetated areas	Freq at sites shallower than max depth of plants	Rake Density
Eriocaulon aquaticum	Pipewort	35.45	29.71	1
Myriophyllum tenellum	Dwarf water milfoil	32.03	26.84	1
Chara	Muskgrasses	31.05	26.02	1
Potamogeton pusillus	Small pondweed	29.34	24.591	1
Potamogeton robbinsii	Robbins pondweed	27.87	23.36	2
Elodea canadensis	Common waterweed	22.25	18.65	1

Species Name	Common Name	Freq w/in vegetated areas	Freq at sites shallower than max depth of plants	Rake Density
Najas flexilis	Bushy pondweed	20.05	16.8	1
Vallisneria americana	Wild celery	18.09	15.16	1
Potamogeton zosteriformis	Flat-stem pondweed	14.43	12.09	1
Myriophyllum sibiricum	Northern water milfoil	11.98	10.04	2
Ceratophyllum demersum	Coontail	11.25	9.43	1
Potamogeton amplifolius	Large-leaf pondweed	11.25	9.43	1
Potamogeton richardsonii	Clasping-leaf pondweed	8.07	6.76	1
Elatine minima	Waterwort	6.36	5.33	1
Megalodonta beckii	Water marigold	6.36	5.33	1
filamentous algae	filamentous algae	5.62	4.71	1
Lobelia dortmanna	Water lobelia	4.65	3.89	1
Eleocharis robbinsii	Robbins spikerush	3.91	3.28	1
Brasenia schreberi	Watershield	3.67	3.07	1
Ranunculus aquatilis	Stiff water crowfoot	2.44	2.05	1
Nitella sp.	Nitella	2.2	1.84	1
Nymphaea odorata	White water lily	2.2	1.84	1
Nuphar variegata	Spatterdock	1.71	1.43	2
Pontederia cordata	Pickerelweed	1.22	1.02	2
Schoenoplectus acutus	Hardstem bulrush	0.73	0.61	1
Sparganium eurycarpum	Common bur-reed	0.49	0.41	2
Lemna minor	Small duckweed	Visual		
Typha latifolia	Broad-leaved cattail	Visual		
Spirodela polyrhiza	Large Duckweed	Visual		
Myriophyllum spicatum	Eurasian water-milfoil	Visual		

Frequency of occurrence within vegetated areas (%): *Number of times a species was seen in a vegetated area divided by the total number of vegetated sites.*

Frequency of occurrence at sites shallower than maximum depth of plants: *Number of times a species was seen divided by the total number of sites shallower than maximum depth of plants (whole lake value)*

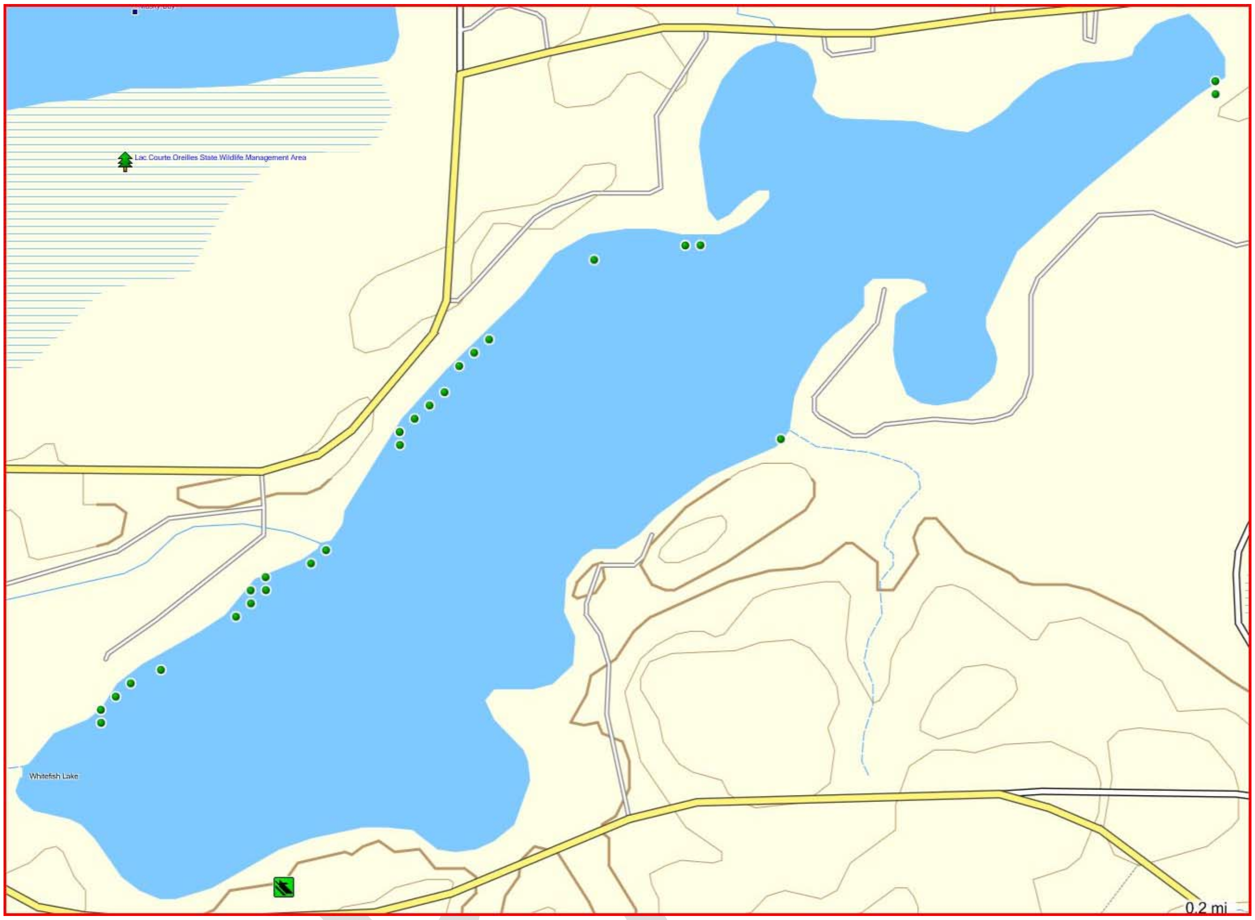
Figure 12: Whitefish Lake Littoral Zone Substrate



Species of Special Concern

One species of special concern was found in Whitefish Lake. This plant was robbins spikerush (*Eleocharis robbinsii)*. Robbins spikerush is listed to be present in the town and range that Whitefish Lake is located in. Species of special concern are not endangered or threatened but are of concern for becoming threatened. Figure 13 indicates where this species was found in the lake.

Figure 13: Robbins Spikerush locations



Floristic Quality Index

Whitefish Lake has a high FQI (34.4). The number of species that were actually sampled during the August survey (25, not including filamentous algae) was used to calculate the FQI. The mean conservatism value was 6.88. All of these values are greater than the median values for lakes in the same eco-region (Northern Lakes and Forests). This high FQI is indicative of a plant community that is intolerant to development and other human disturbances in the watershed. It also indicates a high degree of water quality.

Invasive Species

In late June of 2009, the entire littoral zone of Whitefish lake up to approximately 12 feet in depth was visually surveyed. The primary reason for this survey was to locate any curly leaf pondweed (CLP) (Potamogeton crispus) since it is most robust during spring and early summer. No CLP was found in this early survey or the comprehensive late August survey.

Eurasian water milfoil (EWM) was viewed during the early season survey. The EWM patch that was found consisted of several vigorous plants. An isolated plant was also visually seen during the late August survey. The locations of the these EWM sightings are indicated in Figure 14. These sightings are in and adjacent to the patch of EWM which was chemically treated in 2007. Figure 14 also indicates the area for which more focused EWM monitoring should take place since EWM has been found in and around these areas. Another good strategy to use for a monitoring program is to target areas where Northern water milfoil (Myriophyllum sibiricum), which is a beneficial native plant, is found to be growing. The locations where Northern water milfoil are located are indicated in Figure 15. EWM also typically prefers high nutrient, soft, mucky sediment. These favorable sediment conditions are indicated in Figure 12 and are also key areas to monitor.

Figure 14: 2009 EWM Sightings and Focused Watch Area

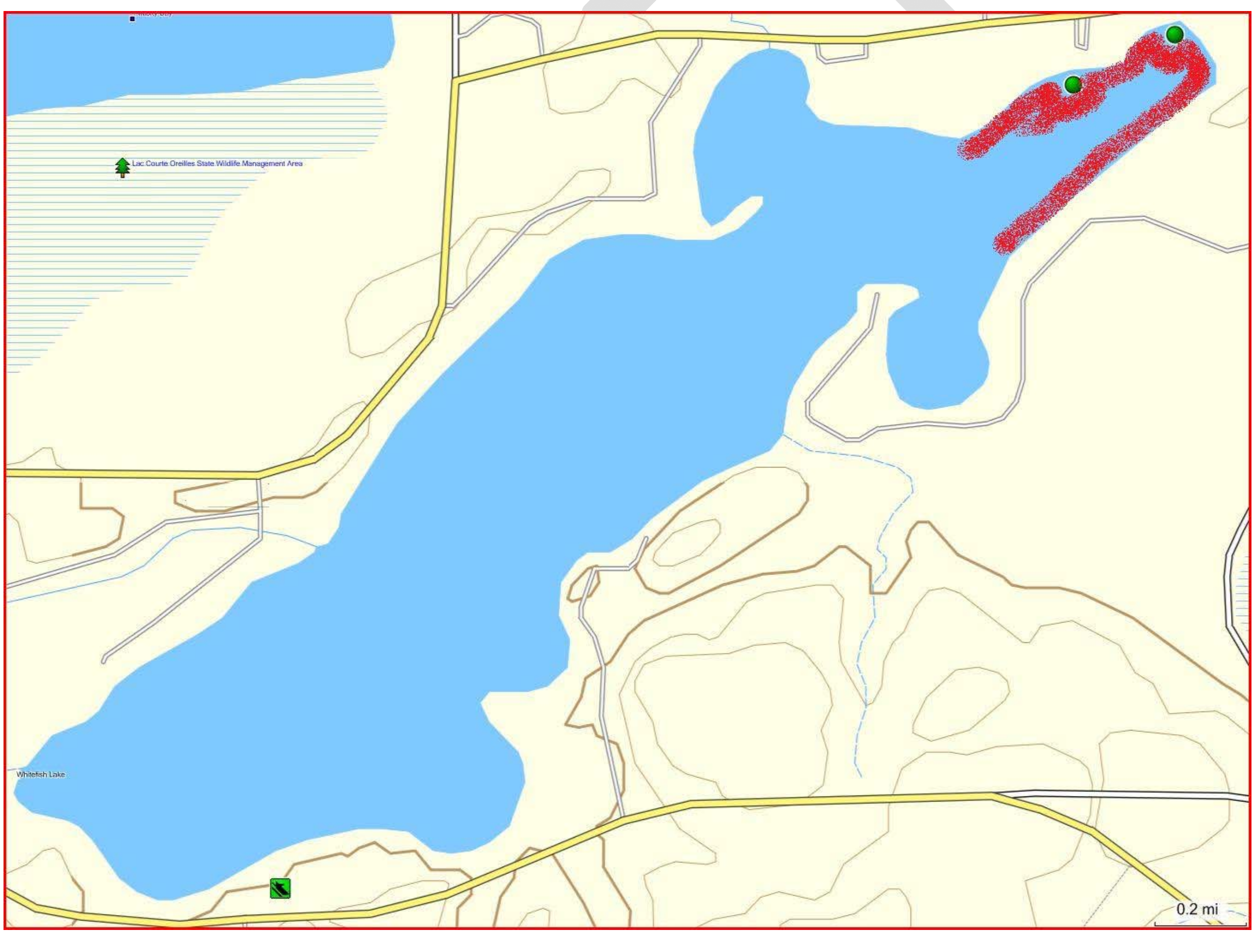
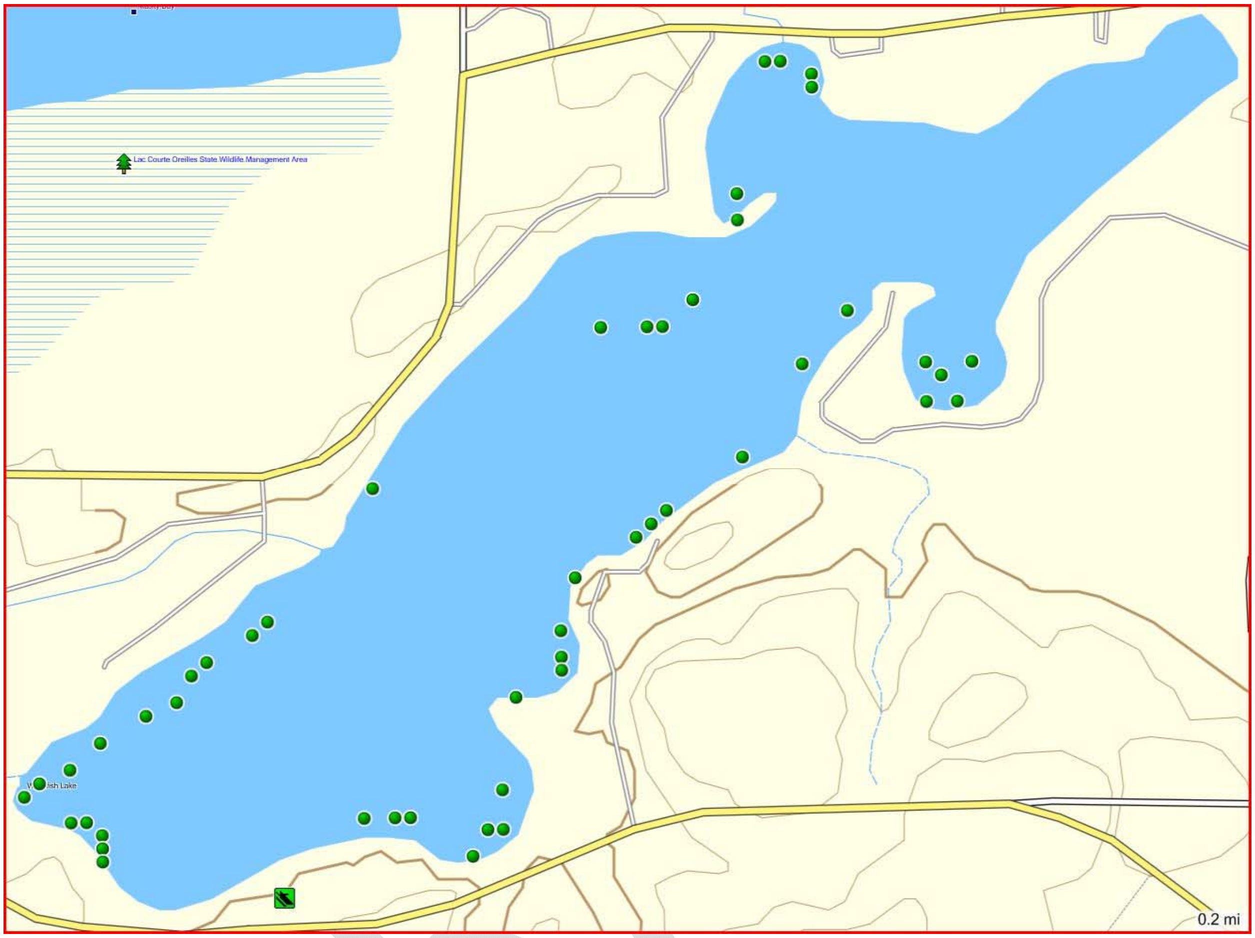


Figure 15: Northern Water Milfoil Locations



Additional information about EWM, CLP, purple loosestrife and other aquatic invasive species of concern can found in Appendix B.

Current and Past EWM Management Methods

An EWM infestation was discovered in Whitefish Lake in July 2007. The infestation was located in Schoolhouse Bay and encompassed approximately 0.25 acres. The Whitefish Lake Property Owners Association (WLPOA) coordinated with the Sawyer County Land and Water Conservation Department to chemically treat the area with the 2,4-D herbicide Navigate at a rate of 150 pounds per acre. The treatment was effective in eliminating the EWM in the treatment area. However, scattered plants have been showing up in Schoolhouse Bay since the initial treatment and scattered plants have also recently been found just outside of the bay along the shoreline. The WLPOA has been aggressively trying to control these isolated patches from spreading by hiring SCUBA divers over the past two summers (2008 – 2009) to check the priority shoreline areas and hand-pull any EWM they find. The divers have been checking these areas at least once a month during the summer (June – August).

A discussion of potential management methods to control the growth and distribution of aquatic plants, including Eurasian Water Milfoil, is discussed in Appendix C.

Plan Goals and Strategies

The Whitefish Lake aquatic plant committee came up with several goals for aquatic plant management for the lake and developed a strategy of actions to effectively and efficiently reach the Goals. The goals include the following:

Goal 1) Eradicate/Minimize Eurasian water milfoil growth.

Goal 2) Prevent the introduction and spread of other aquatic invasive species.

Goal 3) Preserve the lakes' diverse native plant communities.

Goal 4) Lake residents and users are made aware of the importance of native aquatic plants, the means to protect them, and the threat of aquatic invasive species.

Goal 5) Restore native shoreline vegetation

Goal 6) Waterfront residents will protect lake water quality and plant communities by minimizing runoff of pollutants from their lake property.

Goal 1) Eradicate/Minimize Eurasian water milfoil growth.

Objective 1: Control existing EWM infestations using established treatment thresholds

Objective 2: Identify locations of EWM plants and beds, and monitor the effectiveness of control methods

Objective 3: Obtain effective control while minimizing negative effects on native plants

Objective 4: Prevent the spread of EWM to other parts of the lake

Objective 5: Prevent any new introductions of EWM into the lake

Action Items

Improve and update signage at the boat landing to inform users of the landing regarding AIS.

Control Eurasian water milfoil growth using the following standards for treatment:

Standard	Method
Bed of EWM >250 square feet Average rake density >or =2	Herbicide treatment (2,4-D in late spring)
Bed of EWM >250 square feet Average rake density <2	Diver pulling Monitor density in this bed each Spring and Late Summer (AIS coord./ consultant)
Sporadic EWM growth (less than 250 square feet)	Hand pull (residents) Diver pulling Monitor density in identified areas each Spring and Late Summer (AIS coord./ consultant)

General procedure for EWM control

Volunteer monitoring

- Volunteers are assigned to monitor specific stretches of the shoreline by an Adopt-A-Shoreline Coordinator. Sites with mucky bottoms and where Northern Milfoil is present will be additional focal points since EWM can likely take hold in these areas. The public boat landing is also a key area that will need close monitoring since other lakes in the area have EWM and boaters and fishermen frequently visit multiple lakes.
- The stretches of shoreline will be monitored on a monthly basis from June – August. Monitoring will occur during the first week of each month and the

volunteers will report their observations (EWM present or not present) to the Adopt-A-Shoreline Coordinator. The Adopt-A-Shoreline Coordinator will send out monthly (June, July, August) post-card or email reminder notices to the volunteer monitors.

- LWCD AIS Coordinator or APM consultant confirms any areas of suspected EWM.
- APM consultant maps confirmed locations of EWM as they are found. The APM consultant records the size and density of the EWM beds.
- Annual maps will be prepared by the APM consultant to gauge success in controlling the EWM infestations. Maps will include acreage and density of EWM beds.

<u>Herbicide Treatment Procedure</u>

- The WLPOA board appoints a lead person to coordinate herbicide treatment activities in coordination with the Sawyer County LWCD AIS Coordinator.
- Herbicide Treatment Coordinator communicates with LWCD AIS Coordinator regarding availability for pre and post treatment monitoring.
- Herbicide Treatment Coordinator hires an aquatic plant management plan (APM) consultant if LWCD AIS Coordinator is not available to complete the pre and post treatment monitoring according to the DNR methods (May and July/August). (See Appendix D for the DNR pre and post monitoring protocol). Areas of special concern for the survey will be provided to the consultant by LWCD AIS Coordinator based upon past growth patterns and confirmed locations of EWM. Pre and post monitoring will result in maps of EWM locations, including size of bed and rake density, to be provided to the Herbicide Treatment Supervisor and the LWCD AIS Coordinator.
- LWCD AIS Coordinator or APM consultant provides recommended treatment areas from maps of confirmed locations of EWM along with size and measured density to the Herbicide Treatment Coordinator in late August and confirms these areas in late May.
- Herbicide Treatment Coordinator ensures that DNR permit applications are completed in a timely manner in consultation with LWCD AIS Coordinator or APM consultant (February or March).
- Herbicide Treatment Coordinator contracts for the treatment of areas that meet plan standards in consultation with LWCD AIS Coordinator/ APM consultant and the WLPOA board.

- Contractor treats Eurasian water milfoil beds early in the season (water temperature will be from 55 to 60 degrees Fahrenheit) to minimize impacts to native species. Use granular 2,4-D at a rate of 100 lbs./acre at depths < 5 feet, 150-175 lbs./acre at depths from 5-10 feet, and 200 lbs./acre at depths >10 feet – or as modified by best available information.

Diver Procedure

- The WLPOA board appoints or hires a Diver Coordinator to coordinate EWM diver activities in coordination with the Sawyer County LWCD AIS Coordinator.
- EWM Diver Coordinator obtains a list of potential divers.
- EWM Diver Coordinator contacts divers to assess interest.
- EWM Diver Coordinator arranges training for EWM Divers if there is enough interest around the lake.
- If there is not enough interest among volunteer divers, EWM Diver Coordinator investigates and pursues options for hiring divers to pull EWM.
- EWM Diver Coordinator receives low density and sporadic EWM area list from LWCD AIS Coordinator each spring in late May (following pre-treatment survey) and on a monthly basis from June - August.
- EWM Diver Coordinator informs volunteer divers of EWM locations to pull or contracts with diver service in cooperation with WLPOA board.
- Treatment locations and results are recorded by divers, reported to the EWM Diver Coordinator and provided to the Sawyer County AIS Coordinator and WLPOA board.

Hand-pulling

WLPOA board instructs residents in proper hand-pulling techniques. This would include:

- pull complete EWM plant and root;
- Either net or have a second person assisting to collect;
- Remove all plant fragments away from the water (composting is fine).

Instruction may occur at annual meetings or workshops or be distributed in newsletter or special mailings.

Adaptive Management Approach

The EWM treatment areas, standards, and methods will be reviewed each year to see if they are effective and cost efficient. Changes may be made to the treatment approach based upon project results. Significant changes will be documented as brief addendums to the aquatic plant management plan to be reviewed by the WLPOA Board and the Department of Natural Resources.

Goal 2) Prevent the introduction and spread of other aquatic invasive species.

Whitefish Lake is used heavily by anglers and other recreational users. This significantly increases the risk of invasive plant introduction. It is very important that lake residents become educated about the identification of the various invasive plant species that are or could become established in the Lake. This will provide a greater awareness about these species and if one is discovered it is more likely that it would be found before it has spread to a large area and thus be easier to manage. In order to catch a new invasive species while it is still small and therefore easier to manage, it is especially crucial that the Adopt-a-Shoreline volunteers become familiar with the various aquatic invasive species that are of concern to Whitefish Lake (refer to Appendix B for discussions of the various invasive species of concern).

It is also time for the Whitefish Lake Property Owners Association to implement a Clean Boats/Clean Waters Program. This program is provided through the University of Wisconsin Extension in cooperation with the Wisconsin DNR. The program will train volunteers on how to identify and monitor invasive species. In addition, training is provided on how to inspect boats and trailers. They also can provide many educational materials to lake users. The Association could make the public landing inspections either through volunteer or hire.

> **Objective 1**: Lake residents can identify potential invasive species and/or know who to contact for identification.
>
> **Objective 2**: Monitor for the presence of other aquatic invasive species.
>
> **Objective 3**: Control aquatic invasive species if identified on the lake.

Action Items

Gather and distribute information regarding common invasive species and who to contact if these species are suspected. Provide this information to the Adopt-A-Shoreline Volunteers so they can be on the watch for these during their scheduled

EWM surveys. Information will also be provided to the lake residents at the annual meetings or through special mailings.

Implement a clean Boats/Clean Waters program.

Ensure that adequate and updated information is available at the boat landing educating users about AIS.

Goal 3) Preserve the lakes' diverse native plant communities.

The plant community in Whitefish Lake is very diverse. Twenty-nine different native species were recorded in the 2008 plant survey and nearly 84% of the littoral zone of the lake area is covered with aquatic plants. It is important to preserve the diversity and quantity of the native plants that are present. This diverse plant community provides key habitat for a diverse fish population and it also helps to provide protection from shoreline erosion. It is important to understand that these plants play a very important role in the ecosystem of Whitefish Lake.

> **Objective 1**: Minimize removal of native plants from waterfront corridors.
>
> **Objective 2**: Control methods selectively target invasive species avoiding impacts to native plants.

Action Items

Recommend hand removal only (not herbicides) if needed to maintain access for swimming and navigation. Limit this hand clearing to a thirty foot access corridor or less. Note that invasive species may be removed along the entire shoreline by hand.

Selectively control EWM by using herbicide early in the season before native plants are actively growing.

Provide residents with educational materials and present information regarding aquatic plant values and methods at annual meetings and in newsletters to limit impacts to native aquatic plants.

Assess the need of establishing no-wake zones in areas where plants may be affected by wave action.

Goal 4) Lake residents and users are made aware of the importance of native aquatic plants, the means to protect them, and the threat of aquatic invasive species.

Objective 1: The Whitefish Lake Property Owners Association will implement an aggressive education effort.

Action Items

Develop a Whitefish Lake Property Owners website to help effectively convey educational components of this aquatic plant management plan.

Implement the education plan detailed below.

Target audience

Lake residents
Boat landing visitors

Messages

- Explain the plan activities to increase support for APM plan implementation (volunteer and monetary resources). This will include explaining the EWM treatment strategy and importance of timing.
- It is likely not possible to eradicate Eurasian water milfoil once it is established in the lake. The plan is geared to minimize the growth and spread of this invasive plant. All efforts will be employed to try and eradicate it however.
- Describe the importance of native plants to the lakes.
- Describe how lake residents and users can best preserve native plants – no wake near shore, effects of activity and parking boats on reefs, only limited clearing/raking for dock access and swimming, preventing introduction of invasive species, etc.
- Plant identification information
- How to protect natives while controlling invasive species
- Provide maps of EWM locations and areas of native plants of special concern to residents to avoid boating through these areas
- DNR permits are required for any aquatic herbicide application – including herbicides available on-line and shown in magazine advertisements. Fines may result if herbicides are applied without the appropriate permit.

- It is ok to hand pull Eurasian water milfoil along your entire shoreline. You must be confident in your identification of invasive plant species. And, you must be very careful to remove any plant fragments from the water.
- It is ok to compost Eurasian water milfoil well away from the water and use the compost in your garden.
- Describe suitable habitat for invasive species.
- Identify who to contact for suspected Eurasian water milfoil (and other aquatic invasive species) locations.
- Property owners can hand pull or rake aquatic plants (or hire someone else to do this) in an area up to 30 feet wide along the shoreline that they own. This activity should be minimized to prevent the introduction and spread of invasive (weedy) aquatic plants in the cleared areas.

<u>Methods</u>

Website
Newsletter
Annual meetings
Special mailings (including packets of info to new property owners)
Workshops and training
UWEX/DNR informational materials and staff resources will be used whenever possible
Sawyer County LWCD AIS Coordinator can provide training on plant identification.

Goal 5) Restoration and preservation of native shoreline vegetation

Shoreline vegetation is very important to the ecosystem of Whitefish Lake. It provides key habitat for amphibians, reptiles, insects, birds and aquatic mammals. Furthermore, it buffers the lake from non-point source pollution and reduces erosion into the lake. As development occurs, the native vegetation that was present around the lake shore gets replaced by lawns and/or non-native, ornamental plants. Many times the tree and shrub layers are reduced or eliminated resulting in heavier runoff containing more sediment and nutrients. It is vital that the shoreline buffer be preserved and areas that have been adversely affected are restored. Due to the importance of the shoreline buffers and vegetation, lakeshore property owners should be highly encouraged to consider shoreline restoration projects. Sawyer County does have a program in place for helping with buffer restoration project.

Objective 1: The Whitefish Lake Property Owners Association will implement an aggressive, effective education effort about the importance of native shoreline vegetation

Objective 2: Designate several successful buffer zone restoration projects so lake residents can better understand what a buffer restoration looks like and track its progression.

Action Items

Organize and provide education about the importance of native shoreline vegetation and encourage restoration.

Encourage shoreline restoration projects and facilitate shoreline restoration projects through incentives and/or cost share programs with Sawyer County or other grants.

Conduct a shoreline assessment to document the current status of the shoreline of Whitefish lake. This assessment will include photographing from the lake each individual parcel of property and determining the characteristics of the shoreline. The National Lakes Assessment protocol can be used to guide this assessment. (See Appendix E)

Goal 6) Protect lake water quality and plant communities by minimizing runoff of pollutants from waterfront property.

The Whitefish Lake Property Owners Association is encouraged to work with property owners, the Lac Courte Oreilles Tribe, the Sawyer County Land and Water Conservation Department, the Department of Natural Resources, and other partners to further assess pollutant loading concerns and options for management.

Watershed protection measures should concentrate on areas where phosphorus loading potential is the highest and runoff to the lake is most direct. Residential and agricultural areas along the lakeshore provide the highest potential for phosphorus loading to the lake.

The Property Owners Association should encourage residents to protect water quality by installing infiltration practices such as rain gardens and rain barrels. These practices capture water from roofs and paved areas allowing water to soak into the ground rather than flowing to the lake.

Buffers of natural vegetation along the shoreline also help to slow runoff water and allow infiltration and should be encouraged. Whitefish Lake still appears to have a well-preserved shoreline buffer zone for much it’s shoreline. However, runoff may still channelize to the lake from homes, driveways and other impervious surfaces through cleared areas to the lake. Therefore, limiting cutting in a pathway even more narrower than the allowed 30 foot view corridor is highly recommended in order to preserve lake water quality and habitat.

The use of any fertilizers should also be discouraged. Phosphorus free fertilizer still contains nitrogen which will accelerate plant growth in the lake if there is any runoff. This could encourage the spread and increase the density of adjacent EWM stands. Property owners should be encouraged to follow the practices mentioned below through education and incentive programs.

> **Objective 1**: Establish an effective education program to help reduce runoff from waterfront property.

Action Items

Implement the education plan detailed below.

Target audience

Lake residents

Messages

- Waterfront development impacts lake water quality and aquatic plant growth
- Provide information on lawn care practices that can help a lake and why they help the lake
- Provide information regarding waterfront practices to protect the lakes
- Natural wetlands provide critical pollutant filters
- Use zero phosphorus fertilizer, or better yet, don’t use any fertilizer (nitrogen affects growth of plants in the water)
- Encourage property owners to establish rain gardens to collect and filter runoff from impervious surfaces on their property
- How buffer installations can help the lake and how to install them

Methods

WLPOA Website
Demonstration sites

Newsletter
Annual meetings
Special mailings (including packets of info to new property owners)
Workshops and training
On-on-one technical assistance visits
Use UWEX/DNR informational materials and staff resources whenever possible

Implementation Plan[5]

Action Items[6]	Timeline	Cost 2010	Cost 2011	Cost 2012	Responsible Parties
EWM Control					
Improve and update signage at boat landing	May	$1500			WLPOA Board
Shoreline monitoring	June – Aug.	50 hours	50 hours	50 hours	Adopt-a-Shoreline volunteers
Adopt-a-Shoreline coordination	June – Aug.	10 hours	10 hours	10 hours	APM Consultant
Confirm and map EWM locations	June – Aug.	8 hours	8 hours	8 hours	APM Consultant LWCD AIS coord.
Apply for herbicide treatment permit	March Each year treatment is needed	4 hours	4 hours	4 hours	APM Consultant LWCD AIS coord.
Conduct pre and post treatment monitoring	May (pre) Late July (post)	8 hours	8 hours	8 hours	APM Consultant LWCD AIS coord.
Hire and supervise herbicide contractor	May	2 hours	2 hours	2 hours	APM Consultant Herbicide treatment coord.
Treat EWM per plan protocol	Early June	$700/acre	$700/acre	$700/acre	Herbicide Contractor
WLPOA appoints or hires Diver Coord.	May				WLPOA Board
Obtain list of Divers and coordinate diver activities	May - August	30 hours	30 hours	30 hours	Diver Coord.
AIS Prevention					
Gather and distribute AIS info	Ongoing	15 hours	15 hours	15 hours	APM Consultant LWCD AIS coord.
Clean Boats/Clean Waters	June - August	$4000	$4000	$4000	APM Consultant

[5] Costs are an estimate and may vary considerably depending on consultant
[6] Refer to action items under plan goals

Action Items[6]	Timeline	Cost 2010	Cost 2011	Cost 2012	Responsible Parties
					CBCW Staff
Preserve plant communities					
Provide educational materials and info at meetings and for newsletter	Ongoing	6 hours	6 hours	6 hours	APM Consultant
Assess establishment of no-wake zones	Summer	12 hours			WLPOA Board APM Consultant
Plant Education					
Develop Website and provide updates	May 2010 (develop) Ongoing (update)	40 hours	10 hours	10 hours	WLPOA Board APM Consultant
Newsletter articles, presentations, meetings, workshops	Ongoing	20 hours	20 hours	20 hours	WLPOA Board APM Consultant
Restoration and Preservation of Shoreline					
Organize and distribute educational material	Ongoing	8 hours	8 hours	8 hours	WLPOA Board APM Consultant
Shoreline Assessment	Summer	40 hours			APM Consultant WLPOA volunteers
Water Quality Protection					
Implement education program	Ongoing	20 hours	20 hours	20 hours	WLPOA Board APM Consultant

Monitoring and Assessment

Aquatic Plants

Aquatic plant surveys are the primary means to track achievement towards the goals stated in this plan. Every 5 years whole lake plant surveys should be done to update the knowledge of the aquatic plant ecosystem and to further determine if management strategies where effective. Additionally, this will lead to a further understanding of how aquatic plant communities change over time. The plant surveys should be conducted in accordance with the guidelines established by the WI DNR. A copy of these guidelines are included in Appendix F.

Education

To evaluate the effectiveness of the education and prevention actions identified in this plan a survey of boaters and property owners should be done by 2012. The Clean Boats, Clean Waters Volunteer Boat Landing Monitoring Program includes a questionnaire for boaters using the landing that the volunteer asks and records. This would be one simple way to evaluate the effectiveness of education and prevention actions taken. Also, additional surveys can be utilized to gauge target areas for future education.

Water Quality

The WLPOA should continue with their volunteer monitoring of water quality through the WI DNR self-help monitoring program to help with water quality trend evaluations. An updated hydrologic and phosphorus budget survey should be completed every ten years in order to examine the changing relationships between watershed land use activities and lake water quality.

Contingency Plan for Newly-found Populations of an AIS

A contingency fund should be set aside to deal specifically with a new AIS infestation. The WLPOA should expect to pay all the cost for control up-front since the AIS rapid response grant operates on a reimbursement basis. If a new non-native, invasive species introduction should occur, the following plan should be followed once a potential identification has occurred.

1. For positive identification of the invasive species contact a designated local plant identification expert, (i.e. Sawyer County AIS coordinator, LCO Conservation Department) and the WI DNR.

2. Notify WI DNR aquatic plant management specialists of positive identification. Collect plant for a voucher specimen.

3. Carry out response plan using one or more of the following methods:

    a) Hand pulling
    b) Herbicide use (permits required)
    c) Mapping spatial coverage and density

4. If warranted, apply for an invasive species rapid response grant from the WI Department of Natural Resources. (See Appendix G)

5. Notify residents of positive invasive species identification and location.

6. Carefully monitor infested area and nearby areas for effectiveness of control methods.

7. Repeat controls as needed.

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