

Part Two

Pine Lake Water Quality Assessment
Pine Lake
Waushara County, Wisconsin

Companion to
Water Quality Assessment of Pine Lake,
Waushara County, Wisconsin
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DESCRIPTION OF PINE LAKE

Pine Lake was formed at the end of the last ice age by the retreating glaciers. It is a seepage lake, meaning it has no inlet or outlet. Its supply of water comes from groundwater (springs), rainwater and runoff.

Before the second half of the nineteenth century, various Indian tribes who fished and hunted in and around the lake frequented the Pine Lake area. Although there is some evidence that Indians set up camp around the lake, there apparently were no Indian villages in the immediate area, so the land immediately around Pine Lake was in a natural state.

After Waushara County was formed in 1851, settlers began to make their way into the area, and the landscape began to change. During the last half of the nineteenth century and the first two decades of the twentieth century, the principal occupation around Pine Lake was farming. In fact, an article in "The Wisconsin Archeologist" (Vol. 15 No. 3, October 1916) states that, except for the eastern shore where the road went through, the entire shoreline was cultivated farm fields up to the steep bluffs above the lake. Plat maps from this time show only a few farmhouses around the entire shoreline of Pine Lake.

Land use began to change again in the early 1920's and continues to the present day. The availability of the automobile allowed Americans more mobility, and it was at this time that people began to buy lakefront property for summer homes.

The first cottages on Pine Lake were built in the early 1920's and slowly continued through the mid-1940's. After World War II, there was a building boom that lasted about fifteen years. In the latter decades of the twentieth century, more cottages have been built, and numerous cottages have been converted or rebuilt into permanent homes.

Today, almost the entire shoreline of Pine Lake is ringed with homes and cottages, with the exception of a large swath along the north shore of the west lobe that is owned by the Crossroads Lutheran Camp. Along the roughly two and one-half miles of shoreline, there are about 100 homes and cottages. There are also several dozen cottages in the back lots just west of Pine Lake.

There is one farm in the immediate vicinity of Pine Lake and several other farms in the general vicinity, but the overall percentage of agricultural use in the immediate watershed is rather small.

Steep slopes surround most of the lake. Gentler slopes exist on the west, southwest, and a portion of the northern shore of the west lobe and on the southeast corner of the east lobe. A mixed forest, with a higher percentage of deciduous trees and a lower percentage of coniferous trees, generally covers the steep slopes. The dominant deciduous tree is oak.

DESCRIPTION OF MAP SYMBOLOGY

The purpose of this map is to show the natural and man-made features and land uses of the shoreline and near-shoreline areas of Pine Lake. It was done to fulfill a requirement of the two-year lake study that was partially funded by the Pine Lake Property Owners Association.

The scale of the features depicted in the shoreline and near-shoreline areas of the map have been slightly distorted to improve the visibility and readability of these features.

Any areal feature shown in the shoreline and near-shoreline zones indicates the predominant land-use in that particular zone. For example, if an area on the map is shown as predominantly sand beach, that does not mean that the entire area is 100% sand beach, only that a high percentage of that area is sand beach.

The term "natural vegetation" in this context can refer to natural grasses, wildflowers, emergent aquatic plants, trees, and any other vegetation that is left in its natural condition.

Sensitive Area designations are based on a report from Mary Gansberg at the Wisconsin DNR in conjunction with the two-year lake study of Pine Lake. They are defined as areas within the lake that have unique or critical characteristics based on the aquatic plant community, fish and wildlife use.

Elevation (contour) lines are shown at a 10-foot interval. Enclosed lines with interior hatches indicate a depression.

A retaining wall can be brick, block, stone, wood, concrete, riprap, or any other material used to stabilize or terrace a slope. No distinction is made regarding wall size.

Structures identified as boathouses are permanent (usually block or concrete) buildings that can easily store a boat and often have room(s) above, while structures identified as sheds/outbuildings are generally smaller and more easily moveable.

The pinpointing of retaining walls, boathouses and sheds is not meant to show an exact location relative to the shoreline. It is only meant to show an approximate location and how it relates to surrounding structures.

SHORELAND USE AND VEGETATION

SHORELINE

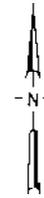
- PREDOMINANTLY SAND BEACH
- PREDOMINANTLY NATURAL VEGETATION

WITHIN 35 FEET OF SHORELINE

- PREDOMINANTLY MOWED GRASS
- PREDOMINANTLY MIXED FOREST / NATURAL VEGETATION

OTHER PERTINENT FEATURES

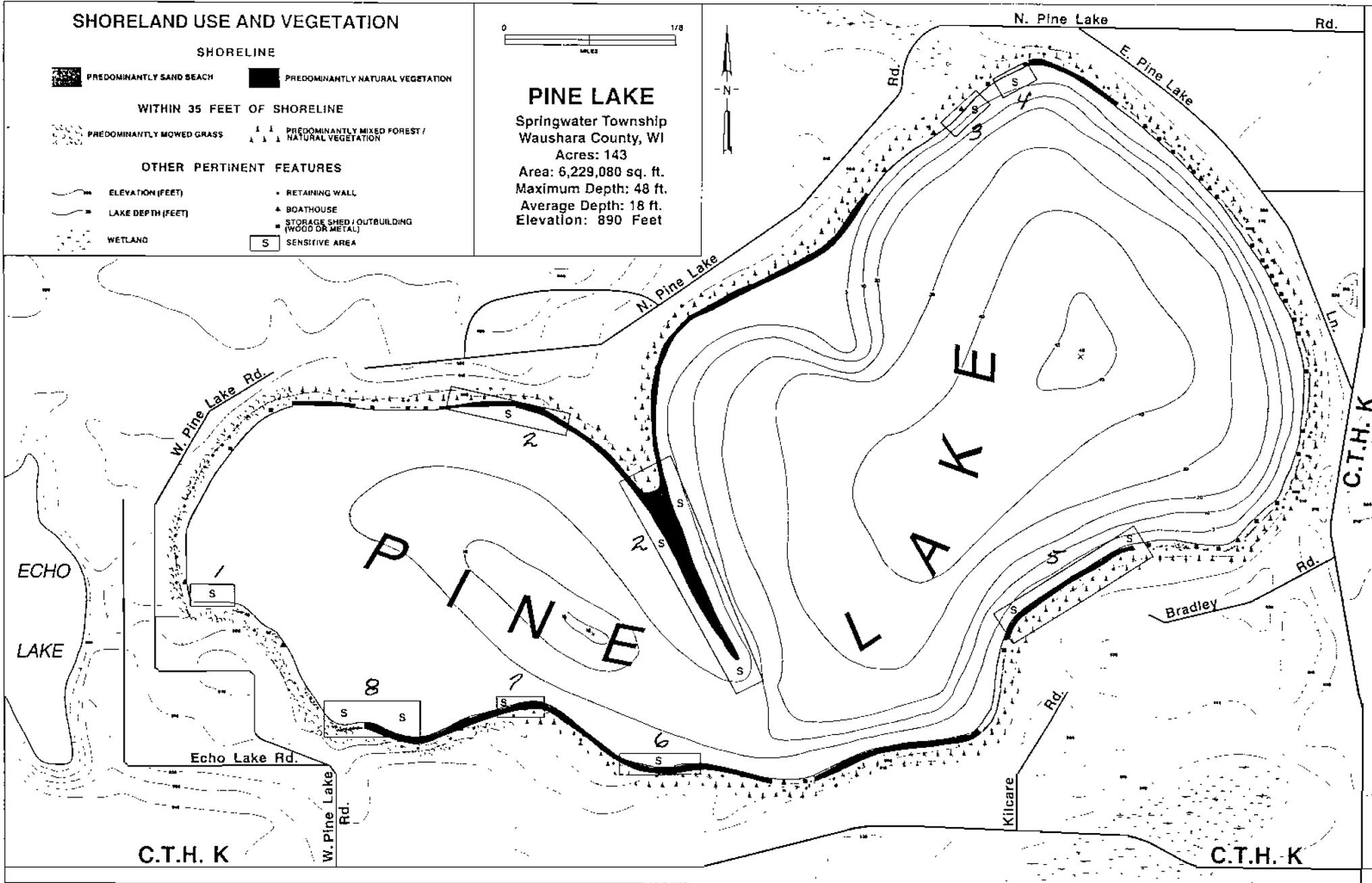
- ELEVATION (FEET)
- LAKE DEPTH (FEET)
- WETLAND
- SENSITIVE AREA
- RETAINING WALL
- BOATHOUSE
- STORAGE SHED / OUTBUILDING (WOOD OR METAL)



PINE LAKE

Springwater Township
Waushara County, WI
Acres: 143

Area: 6,229,080 sq. ft.
Maximum Depth: 48 ft.
Average Depth: 18 ft.
Elevation: 890 Feet



C.T.H. K

C.T.H. K

PINE LAKE SHORE STUDY 2001

In July of 2001 a lakeshore survey was conducted of Pine Lake. It was conducted through visual observations by walking the shoreline and by boat. The following is a summary of the findings of that survey.

There are 104 lakefront properties on Pine Lake with frontage's ranging from 50 to 300 feet in width. One property belonging to a church camp is approximately 1200 feet in length. Most original lots around the lake were plotted in 50' increments with the lots in the corners being pie shaped. Of the 104 properties only 3 have not been developed with some sort of living structure on them.

Within the 35' buffer zone (high water mark plus 35') properties were judged to be natural if no grass cutting was taking place, mowed grass if native grass was being cut and mowed lawns if areas appeared to have been sodded or seeded. Using this criteria we have 54 natural properties, 37 mowed grass and 13 mowed lawns. There are 66 properties with either stone or wood retaining wall positioned at the high water mark. There are 63 boathouses located on 59 different properties.

The lake and lakefront (shore up to the high water mark) was also surveyed for usage. Of the 104 properties there are 104 docks. Three had no docks and three had 2. There are 43 rafts in the water or on the beach. There are a total of 274 watercraft on the lake.

Fishing Boats	79	Out Board Horsepower	
Outboard Ski	48	1-10 hp	14
Inboard	18	11-25 hp	9
Jet Ski	3	26-50 hp	18
Pontoon	22	51-100 hp	23
Canoe	47	100-150 hp	18
Paddle	42	150 --up hp	3
Sailboat	12		
Kayak	2		
Zodiac	1		

Horsepower ratings for inboards are not available but the engines in the various boats had from 4 to 8 cylinders, which could produce from 120 to 350hp.

The lake has one public landing and improved boat launch with parking for 8-12 cars located in the southwest corner of the lake. There are 3 narrow public right-of-ways scattered around the lake.

Pine Lake (Waushara County, Wisconsin)

Sensitive Area Survey Report

Date of Surveys: July 30 & August 13, 2001

Number of Sensitive Areas: 8

Site Evaluators:

Mary Gansberg, Water Resources Biologist (Green Bay)

Alan Niebur, Fisheries Biologist (Wautoma)

Shawn Eisch, Water Management Specialist (Wautoma)

Nancy Cervantes (Christel), Wildlife Biologist (Wautoma)

Jack and Judy Kusch, Pine Lake Property Owners Association

Author: Mary Gansberg

General Lake Information:

Pine Lake sits in northern Waushara County approximately 10 miles south of Waupaca in the Township of Springwater (T20N, R11E, Sections 2 & 3). Pine Lake is a 143-acre hard water seepage lake with no inlet or outlet. A sand spit divides the lake; the west lobe of the lake has a maximum depth of 16 feet and the east lobe has a maximum depth of 48 feet.

There are 108 land parcels around the lake. Approximately 135 property owners are in the immediate direct drainage area to the lake. The lake's development includes a large tract of land on the north shore of the lake that includes the sand spit, which is owned by the Pine Lake Lutheran Camp. There is one public boat landing but no public beaches on the lake.

Numerous species of wildlife inhabit the shoreland areas. Standing dead and dying trees (snags) on the uplands provide habitat for various species of birds and insects. Several species of mammals and birds use cavities in trees for den sites. Salamanders, small mammals and invertebrates use downed and rotting logs for protection, feeding and breeding sites. Down trees

in or at the water's edge (woody cover) are especially valuable for resting and feeding areas. Aquatic and wetland vegetation present at or near the waters' edge provides critical habitat for small mammals, amphibians, reptiles, birds and fish at all life stages.

The best wildlife habitat around Pine Lake is where the shoreline is least impacted or the shoreline buffer is intact. Much of the woody cover has been removed along developed shorelines, both in the water and on the upland. The understory or brush layer is also absent on developed shorelines. This layer provides habitat for small mammals and numerous species of birds. Management recommendations include maintaining the undeveloped shorelines and effectively restoring the developed and disturbed shorelines and shoreland buffers.

The aquatic plant community of Pine Lake is near average quality with approximately 13 species present. The results of the aquatic plant survey conducted in the summer of 2001 is reported under separate cover (Gansberg, 2001). Aquatic plant management permits are required for chemical, mechanical and manual harvesting of aquatic plants. Please contact your Aquatic Plant Management Coordinator, Scott Provost (920) 787-4686 x-3017 before conducting any aquatic plant control activities in Pine Lake.

Introduction:

Surveys were conducted on July 30 and August 13, 2001 using the Wisconsin Department of Natural Resources protocol guidelines for conducting and implementing sensitive area surveys. The purpose of the survey is to identify areas within the lake that have unique or critical characteristics based on the aquatic plant community, fish and wildlife use. Sensitive area designations provide lake organizations, shoreline property owners, county zoning officials, Department of Natural Resources personnel and other interested individuals with specific management recommendations to protect and improve the health of the lake.

The companion document "**Guidelines for protecting, maintaining, and understanding lake sensitive area**" is attached as **Appendix A**. This document is a generic document designed to be used in conjunction with specific lake sensitive area designation reports.

Overview of Sensitive Area Designations:

Sensitive areas are defined in Wisconsin Administrative Code NR 107.05(3)(i)(1)-*Sensitive areas are areas of aquatic vegetation identified by the department as offering critical or unique fish and wildlife habitat, including seasonal or life-stage requirements, or offering water quality or erosion control benefits to the body of water.* These areas may consist of valuable aquatic/wetland vegetation, terrestrial vegetation, gravel/rubble substrate, downed woody cover and water quality buffer areas.

Following is a list of potential ways sensitive area designations could be used:

- By managers to guide permitting processes of aquatic plant management, water regulations, fisheries management, wildlife management and local zoning activities
- By local lake organizations to help guide lake use and management activities
- As a compliment to local land-use planning activities
- To provide information to potential shoreland buyers and existing shoreland owners
- As baseline data for various resource management decisions
- To provide education to the public about the benefits of protecting and restoring aquatic life habitat

Exotic Species

The only invasive exotic species documented in Pine Lake to date is Eurasian water milfoil. Eurasian water milfoil is present in numerous bodies of water in the area. Exotic species are spread mainly by human activities including boating, fishing, etc. Exotic plants can easily become established in areas that are disturbed and where native plants have been removed; therefore, protection of native plant communities is vital to slow the spread of exotics once they are introduced into the system. Management efforts should continue to try to control this exotic species as much as possible to preserve the overall integrity of the aquatic plant community of Pine Lake.

Shoreland Management

Wisconsin's Shoreland Management Program, a partnership between state and local government, works to protect clean water, habitat for fish and wildlife, and natural scenic beauty. The program establishes minimum standards for lot sizes, structural setbacks, shoreland buffers, vegetation removal and other activities within the shoreland zone. The shoreland zone includes land within 1,000 feet of lakes and 300 feet of rivers and floodplains.

A critical part of protecting our water resources is the establishment and protection of an adequate buffer. A shoreland buffer should extend from the water onto the land at least 35 to 50 feet. Recent studies have shown that many species of wildlife may require up to 500 feet of buffer for habitat. Buffers of 50 feet and more help filter pollutants from runoff associated with impervious surfaces such as driveways, rooftops, roads and fertilized lawns.

Shoreland restorations should focus on native plant communities and should include aquatic vegetation as well as the canopy, herbaceous, shrub and tree layers. Please contact your local DNR Lake Management Coordinator, Mark Sesing (920) 485-3023 to learn more about shoreland restoration.

Whole Lake Management Recommendations:

Resource managers made several recommendations on a whole lake basis.

1. Eliminate chemical and fertilizer use on lawns and reduce lawn size.
2. Restore shoreland buffers on developed sites.
3. Educate landowners about the importance of a healthy lakeshore buffer.
4. Protect existing native aquatic vegetation, especially floating-leaf and emergent plants.
Because of the low relative abundance of water lily, rushes, and sedges, the harvest or elimination of these types of plants through shoreline manipulation, mechanical harvesting, boating impacts, hand pulling or other means should not occur.
5. Do not remove coarse woody cover both in the water and in the shoreland zone.
6. Reduce entire tree removal to see the lake from the picture window by trimming a few choice limbs.

7. Prevent the spread and establishment of exotic species such as Eurasian water milfoil, curly-leaf pondweed, and zebra mussels.
8. Properly maintain septic systems to protect water quality.
9. Obey all slow no-wake areas.

Eight sites on Pine Lake were designated as sensitive areas because they contain critical or unique habitat (**Figure 1**). These areas are highly recommended for additional protection. Below is a description of each site with specific management recommendations for that site.

Resource Value of Site 1

This site starts at the north side of the boat landing and goes northwest approximately 150 feet along the shoreline and is about 25 feet wide (start- 44°13.870N, 89°10.246W; end- 44°13.878N, 89°10.278W). The site consists of sedges and rushes along the shoreline that stand in the water when water levels are higher, but are completely on shore when water levels are lower.

Primary reasons for site selection were fishery values, wildlife values, and water quality protection. During high water times, these plants provide important spawning, nursery, and cover area for fish and substrate for invertebrates. Aquatic vegetation provides excellent habitat for the production of macroinvertebrates (aquatic insects). The invertebrates are an essential part of the food chain. They provide food for several fish species, amphibians, reptiles, birds and larger insects. This site also is an important wildlife area. Emergent aquatic vegetation provides various species of furbearers, birds, amphibians, and reptiles with valuable habitat that is essential for one or more of their functional needs. Frogs and toads rely on this area for nesting, cover, and feeding. The site also offers a physical buffer that protects water quality by anchoring and stabilizing sediments and protecting shorelines from wave erosion.

Management Recommendation:

1. Protect the sedges and rushes in this area regardless of the water level to prevent erosion and to provide habitat for fish and wildlife. Do not remove these plants by physical, mechanical, or chemical means.

Resource Value of Site 2

This site makes up the entire shoreline of the Pine Lake Lutheran Camp excluding the outdoor chapel/beach area. The site starts on the north shore of the west basin follows the shoreline out to the sand spit then continues along the west shore of the east basin until it reaches private property (start- 44°14.005N, 89°10.074W; end- 44°13.989N, 89°09.879W). The site consists of sedges and rushes along the shoreline. Lake water levels determine if the plants stand in water or are on shore.

Primary reasons for site selection include fishery values, wildlife values, water quality protection, and natural scenic beauty. The sedges and rushes provide important spawning areas for northern pike and a nursery, feeding, and cover area for large-mouth bass and panfish. Forage species also utilize this area. The aquatic vegetation provides excellent habitat for the production of macroinvertebrates. This site also is an important wildlife area. Emergent aquatic and near-shore terrestrial areas provide various species of furbearers, birds, amphibians, and reptiles with valuable habitat that is essential for one or more of their functional needs. The site also offers a physical buffer that protects water quality by anchoring and stabilizing sediments and protecting shorelines from wave erosion.

The natural scenic beauty rating of this site was very good compared to other areas of the lake. Since the Lutheran Camp is only utilized for a few short weeks out of the year, the shoreline and upland areas are fortunately relatively undisturbed. This large contiguous minimally disturbed shoreline not only provides an aesthetic value, but also water quality, fisheries, and wildlife values.

Management Recommendations:

1. Protect the sedges and rushes in this area regardless of water levels to prevent erosion and to provide habitat for fish and wildlife. Do not remove these plants by physical, mechanical, or chemical means.
2. Protect the near-shore terrestrial vegetation for shoreland and upland wildlife.

Resource Value of Site 3

This site is on the north shore of the east basin. The site consists of sparse sedges and rushes both in the water and along approximately 150 feet of shore and approximately 20 feet out into the water (start- 44°14.190N, 89°09.627W; end- 44°14.203N, 89°09.592W).

Primary reasons for site selection include fishery values, wildlife values, water quality protection, and natural scenic beauty. The sedges and rushes provide important spawning areas for northern pike and a nursery, feeding, and cover area for large-mouth bass and panfish. Forage species also utilize this area. The aquatic vegetation provides excellent habitat for the production of macroinvertebrates. This site is also an important wildlife area. Emergent aquatic and near-shore terrestrial areas provide various species of furbearers, birds, amphibians, and reptiles with valuable habitat that is essential for one or more of their functional needs. The site also offers a physical buffer that protects water quality by anchoring and stabilizing sediments and protecting shorelines from wave erosion.

The natural scenic beauty rating was above average compared to other areas of the lake. Although this area is quite small, the more natural looking minimally disturbed shoreline provides an aesthetic value as well as water quality, fisheries, and wildlife values. Because so much of the shore is sand beach, these small pockets are important to the overall health of the lake.

Management Recommendation:

1. Protect the sedges and rushes in this area regardless of water levels to prevent erosion and to provide habitat for fish and wildlife. Do not remove these plants by physical, mechanical, or chemical means.

Resource Value of Site 4

This site is also on the north shore of the east basin and just northwest of Site #3. The site consists of sparse sedges and rushes approximately 40 feet along the shore by 20 feet wide (middle of site- 44°14.20N, 89°09.39W).

Primary reasons for site selection include fishery values, wildlife values, and water quality protection. The sedges and rushes provide important spawning areas for northern pike and a nursery, feeding, and cover area for large-mouth bass and panfish when water levels are high. Forage species also utilize this area. The aquatic vegetation provides excellent habitat for the production of macroinvertebrates. This site is also an important wildlife area. Emergent aquatic and near-shore terrestrial areas provide various species of furbearers, birds, amphibians, and reptiles with valuable habitat that is essential for one or more of their functional needs. The site also offers a physical buffer that protects water quality by anchoring and stabilizing sediments and protecting shorelines from wave erosion. Even small pockets of emergent and near-shore vegetation are preferred over no available habitat.

Management Recommendation:

1. Protect the sedges and rushes in this area regardless of water levels to prevent erosion and to provide habitat for fish and wildlife. Do not remove these plants by physical, mechanical, or chemical means.

Resource Value of Site 5

This site is on the south shore of the east basin. It contains approximately 400 feet of shoreline and extends approximately 20 feet into the lake (start- 44°13.855N, 89°09.565W; end- 44°13.917N, 89°09.425W). The site consists of rubble and gravel along the shoreline and out into the water.

The primary reason for site selection was fishery values. This site provides an important walleye and sucker spawning area. It provides even better habitat when water levels are higher because more coarse substrate is available in deeper water for fish to utilize. The substrate also provides excellent habitat for the production of macroinvertebrates. The invertebrates are an essential part of the food chain. They provide food for several fish species, amphibians, reptiles, birds and larger insects. Coarse substrate like this is very limited in Pine Lake.

Management Recommendation:

1. Protect this unique and valuable rubble/gravel substrate for fish spawning and macroinvertebrate production.

Resource Value of Site 6

This site is on the south shore of the west basin. It contains approximately 300 feet of shoreline and extends approximately 20 feet into the lake (start- 44°13.775N, 89°09.830W; end- 44°13.777N, 89°09.903W). The site consists of diverse near-shore terrestrial vegetation.

The primary reason for site selection was wildlife and natural scenic beauty. This site is an important wildlife area. The shoreline and upland area are relatively un-impacted. A diverse minimally disturbed near-shore terrestrial plant community provides habitat for a variety of wildlife species. The natural scenic beauty rating was above average compared to others areas of the lake. This site not only provides an aesthetic value but also wildlife values. Because so much of the shore is sand beach and developed, these relatively small areas are important to the overall health and aesthetics of the lake.

Management Recommendation:

1. Protect the near-shore terrestrial vegetation that currently exists at this site. Maintain shrubs, herbaceous cover, snags, cavity trees, and perch trees for wildlife and aesthetic benefits.

Resource Value of Site 7

This site is on the south shore of the west basin. It contains approximately 150 feet of shoreline and extends approximately 25 feet into the lake (start- 44°13.818N, 89°10.011W; end- 44°13.802N, 89°10.029W). The site consists of diverse aquatic vegetation in the littoral area.

The primary reason for site selection was aquatic vegetation. This site has a diverse desirable aquatic plant community in the littoral area from shore out approximately 25 feet. Aquatic plants observed here include chara (*Chara* spp), bushy pondweed (*Najas flexilis*), water celery (*Valisneria americana*), flatstem pondweed (*Potamogeton zosteriformis*), sago pondweed

(Potamogeton pectinatus), whitestem pondweed (Potamogeton praelongus), elodea (Elodea canadensis), northern water milfoil (Myriophyllum sibiricum), variable pondweed (Potamogeton gramineus), and Illinois pondweed (Potamogeton illinoensis). This diverse plant community just off shore is unique on Pine Lake and provides critical habitat for fish, macroinvertebrates, and other aquatic organisms. Because so much of the littoral zone is sand beach on Pine Lake, small areas like this site are important to the overall health of the lake ecosystem.

Management Recommendations:

1. Protect the diversity of the existing aquatic plant community in this area for aquatic life habitat.

Resource Value of Site 8

This site is on the south shore of the west basin. It contains approximately 150 feet long by 40 foot wide patch of white water lily (Nymphaea odorata) and floating leaf pondweed (Potamogeton natans) that is unique on Pine Lake (start- 44°13.793N, 89°10.133W; end- 44°13.821N, 89°10.161W).

The primary reasons for site selection were aquatic vegetation and natural scenic beauty. This site offers a desirable aquatic plant community in the littoral area that is not present anywhere else on the lake. The floating-leaf vegetation provides a feeding area for northern pike, large-mouth bass, and panfish and protective cover for large-mouth bass, panfish, and minnows. The aquatic vegetation also provides excellent habitat for the production of macroinvertebrates. The natural scenic beauty rating was above average compared to others areas of the lake because of the abundance of the beautiful fragrant white water lilies.

Management Recommendation:

1. Protect the existing floating-leaf aquatic plant community in this area for aquatic life habitat and for the aesthetic quality it provides.

Conclusions

Pine Lake is a beautiful little lake that deserves special attention. Eight sensitive areas were designated on the lake because they are unique or critical areas for the lake as a whole. Special care should be taken to protect these areas and other areas on the lake from further disturbance. The small patches of sedge/rushes, water lily, aquatic vegetation, and rubble/gravel are critical areas; however, even larger more contiguous patches would greatly benefit the lake ecosystem as a whole. Restoring disturbed shorelines and shoreland buffers to a more natural state would provide even more desirable aquatic life and wildlife habitat. Sand beaches are great for swimming, but are basically unutilized by aquatic inhabitants. The more diverse and abundant emergent, submergent, and floating-leaf aquatic plant community in the west basin provides habitat for all life stages for fish and other aquatic life which benefits the whole lake. Lakes are one of the state's most valuable resources and without proper protection, the water quality will quickly deteriorate resulting in degradation of fish and wildlife habitat. All lake ecosystems are sensitive to change and human impacts. It is critical that we protect and restore these valuable resources.

**Pine Lake
Waushara County, Wisconsin**

Aquatic Plant Survey Results

2001

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Wisconsin Department of Natural Resources

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1.0 Introduction

A study of the aquatic macrophytes (plants) in Pine Lake was conducted during June 2001 by Water Resources Management staff at the Wisconsin Department of Natural Resources. Laura Felda from University of Wisconsin-Extension Lakes Partnership and Jack and Judy Kusch from the Pine Lake Property Owners Association assisted in the field survey work. This is the first vegetation survey of Pine Lake conducted by the Department of Natural Resources. A sensitive area designation was also conducted but is reported under separate cover (Gansberg, 2003).

Pine Lake is located in the Township of Springwater, Waushara County (T20N, R11E, Sec 2 and 3). Pine Lake is a 143-acre hard water seepage lake with no inlet or outlet. The lake is divided by a sand spit; the west lobe of the lake has a maximum depth of 16 feet and the east lobe has a maximum depth of 48 feet.

This report presents the methods, results and discussion, and conclusions of the aquatic plant survey.

2.0 Methods

2.1 Sampling methods

An aquatic vegetation survey was conducted during June 25-26, 2001. Sampling methods were based on a modified rake-sampling method developed by Jessen and Lound (1962). Twenty-one transects were equally spaced around Pine Lake's shoreline labeled A through U (**Figure 1**). Species occurrence were collected at each of the four different depth ranges of 0-1.5 feet, 1.5-5 feet, 5-10 feet, and 10-20 feet going from shore out toward the deep spot in each lake basin. Four rake samples were taken at each depth range using a tethered long-handled garden rake for a total of 336 rake samples. Transect tracking was facilitated with a hand-held GPS unit (GPS coordinates are given in

Appendix 1). Data are recorded separately for each transect. All samples collected were identified to genus and to species whenever possible

2.2 Data analysis methods

The collected transect data was used to estimate percent frequency, percent relative frequency, and average density for each species observed. The percent frequency is defined as the frequency of this species at all sampling points. The percent relative frequency is the frequency of this species relative to all other plants present. It gives an indication of the importance of that species in the plant community. In other words, if plants are found, which are the most important. The average density is the average density of this species in the area sampled.

A floristic quality assessment (FQA) was also applied to the aquatic vegetation species list using the methodology of Nichols (1999). FQA is a rapid assessment metric used to assist in evaluating the floristic and natural significance of a given area. Examination of the floristic quality index within the context of statewide and regional trends was used to provide an overall evaluation of the floristic quality of Pine Lake. A coefficient of conservatism (C) value was assigned to each species present. Conservatism is the estimated probability that a plant is likely to occur in a landscape that is believed to be relatively unaltered from presettlement conditions. As disturbance occurs less conservative species become more predominant. The C value ranges from 0-10 with 10 being assigned to species most sensitive to disturbance.

And lastly, an overview of the ecological value of the plant species found in Pine Lake was also compiled.

3.0 Results and Discussion

3.1 Survey Results

A total of thirteen species of aquatic plants were observed in Pine Lake including eleven submergent, one emergent, and one floating-leaf species (**Table 1**). Chara sp was the most frequently occurring species in Pine Lake (63.1 percent of sample points).

Whitestem pondweed (*Potamogeton praelongus*) was the next most frequently occurring species at 22.9 percent of sample points. The exotic invasive Eurasian watermilfoil species was found at 2.7 percent of the sampling points. No plants were found at 24.1 percent of the sample points.

Excluding the exotic species, the number of aquatic species (12) found in Pine Lake is below the state and regional median of 13 and 14 respectively (Nichols, 1999) (**Table 2**). The FQA completed for the Pine Lake aquatic vegetation indicates a mean native species coefficient of Conservatism (C) of 6.1 (**Tables 1 & 2**). Nichols (1999) found that the median C for lakes in the North Central Hardwoods and Southeastern Till Plains lakes and flowages (NCSE) region, in which Pine Lake is located, was 5.6. Pine Lake therefore, appears to have relatively high mean coefficient of conservatism. The FQA of the plant community in Pine Lake was 21.1, which is above the 20.8 average for lakes in the NCSE region. This suggests that the plant community has been subject to less disturbance than the average lake in the region; however, more disturbed than the average lake in all of Wisconsin.

Overall, these findings indicate that Pine Lake's floristic quality is similar or slightly above that of other lakes found in the region, but slightly less than on a statewide basis.

Table 2. Floristic Quality Assessment

	Number of species	Average conservatism	Floristic quality
Wisconsin Lakes	13	6	22.2
NCSE region	14	5.6	20.8
Pine Lake	12	6.1	21.1

3.2 Ecological values

In general, aquatic plants in Pine Lake are about average in diversity and are not abundant. Many of the species found provide important spawning, nursery and foraging habitat for fish. Likewise, many of the species found provide critical food and shelter for a variety of wildlife. The aquatic plants help maintain the lake water quality. Aquatic plants capture sediments and nutrients that enter the system. The ability of rooted plants to utilize available phosphorus greatly limits the potential for algae blooms. Aquatic plants also stabilize bottom sediments preventing resuspension from wave action. Plants species vary in their ability to provide these characteristics; thus, maintaining a high aquatic plant diversity is critical to protecting the lake's water quality. The description and ecological value of aquatic plants found in Pine Lake is given in **Table 3**.

As indicated in **Table 1**, Chara was the most prevalent species in Pine Lake. This species forms dense green blankets along the lakebed that stabilize sediment and contribute to good water quality. These plant beds provide important cover and feeding areas for juvenile fish. Chara is a favorite waterfowl food. A report in the DNR files dated December 27, 1983, says a heavy growth of Chara was observed in 1983 and this is fairly normal in hard water lakes such as Pine Lake (Reif, 1983).

The second most abundant plant found was whitestem pondweed (*Potamogeton praelongus*). This species is considered a northern pondweed that is sensitive to water quality changes. Some researchers have given it a "turbidity tolerance rating" of zero (Davis and Brinson, 1980). Because it will disappear from disturbed systems, it can be

considered an indicator species. It serves as a “canary in a cage” for degrading water quality.

Of significance is the fact that no plants were found at 24.1 percent of all sampling points. In general, a more abundant and diverse aquatic plant community in the 0-5 foot depth zone would greatly benefit fish and other aquatic life for the lake as a whole and also help protect these near shore areas from wave action and sediment resuspension. These near shore areas provide critical food and cover for young fish and other critters.

There is a definite lack of floating-leaf type plants in Pine Lake. Only one patch of white water lily (*Nymphaea odorata*) was found in the east bay of the lake. This small patch did not happen to fall within our random sampling sites, but is worth mentioning. Special care should be taken to preserve these unique and beautiful plants. White water lily provide seeds for waterfowl. Rhizomes are eaten by deer, muskrats, beaver, and porcupine. The leaves offer shade and shelter for fish.

There is also a definite lack of emergent plants in Pine Lake which is unfortunate because this type of macrophyte community provides excellent aquatic habitat and is the preferred spawning substrate for northern pike (*Esox Lucius*) (Becker, 1983). The lack of this community type is likely related to shoreline development and use. These plants need relatively undisturbed sites to do well.

3.3 Exotic species

One exotic species was found during this survey. Although Eurasian water milfoil only represented 2 percent of the plant species found in the lake, control of this exotic species should be a primary lake management concern. Eurasian water milfoil has the ability to out-compete native plants and reduce species diversity. This invasive plant can form dense stands that are a nuisance to humans and provide low-value habitat for fish and wildlife.

4.0 Conclusions

The aquatic plant community of Pine Lake is near average quality; furthermore, it has been subject to less disturbance than the average lake in the region. Chara sp was by far the dominant species within the Pine Lake plant community followed by Whitestem pondweed. Of significance is the general lack of near-shore submergent and emergent aquatic plants. Lakeshore property owners should be aware that near-shore aquatic plants are often critical habitat for fish and wildlife and play an important role in stabilizing banks and preventing erosion. Therefore human disturbances of these habitats should be minimized as much as possible. Eurasian water milfoil is present in the lake; nonetheless, management efforts should continue to try to control this exotic species as much as possible to preserve the overall integrity of the aquatic plant community of Pine Lake.

5.0 References

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Table 1. Results of aquatic plant survey conducted on Pine Lake during June 2001.

Species common name	scientific name	Percent Frequency ¹	Percent Relative Frequency ²	Average Density ³	Coefficient of Conservatism ⁴
Bushy Pondweed	<i>Najas flexilis</i>	9.2	6.7	0.37	6
Variable Pondweed	<i>Potamogeton gramineus</i>	3.3	2.4	0.13	7
Elodea	<i>Elodea canadensis</i>	6.8	5.0	0.27	3
White Stem Pondweed	<i>Potamogeton praelongus</i>	22.9	16.7	0.92	8
Musk Grass	<i>Chara spp.</i>	63.1	46.1	2.52	7
Water Celery	<i>Valisneria americana</i>	6.3	4.6	0.25	6
Eurasian Water milfoil	<i>Myriophyllum spicatum</i>	2.7	2.0	0.12	Exotic
Flatstem Pondweed	<i>Potamogeton zosteriformis</i>	4.2	3.0	0.17	6
Northern Water milfoil	<i>Myriophyllum sibiricum</i>	8.9	6.5	0.36	7
Illinois Pondweed	<i>Potamogeton illinoensis</i>	6.5	4.8	0.26	6
Floating Leaf Pondweed	<i>Potamogeton natans</i>	0.3	0.2	0.01	5
Sago Pondweed	<i>Potamogeton pectinatus</i>	1.2	0.9	0.05	3
Three-way Sedge	<i>Dulichium arundinaceum</i>	1.5	1.1	0.06	9
No Plants Found		24.1			
Average value					6.1

1 = frequency of this species at all sampling points

2 = frequency of this species relative to all other plants present

3 = average density of this species in the area sampled

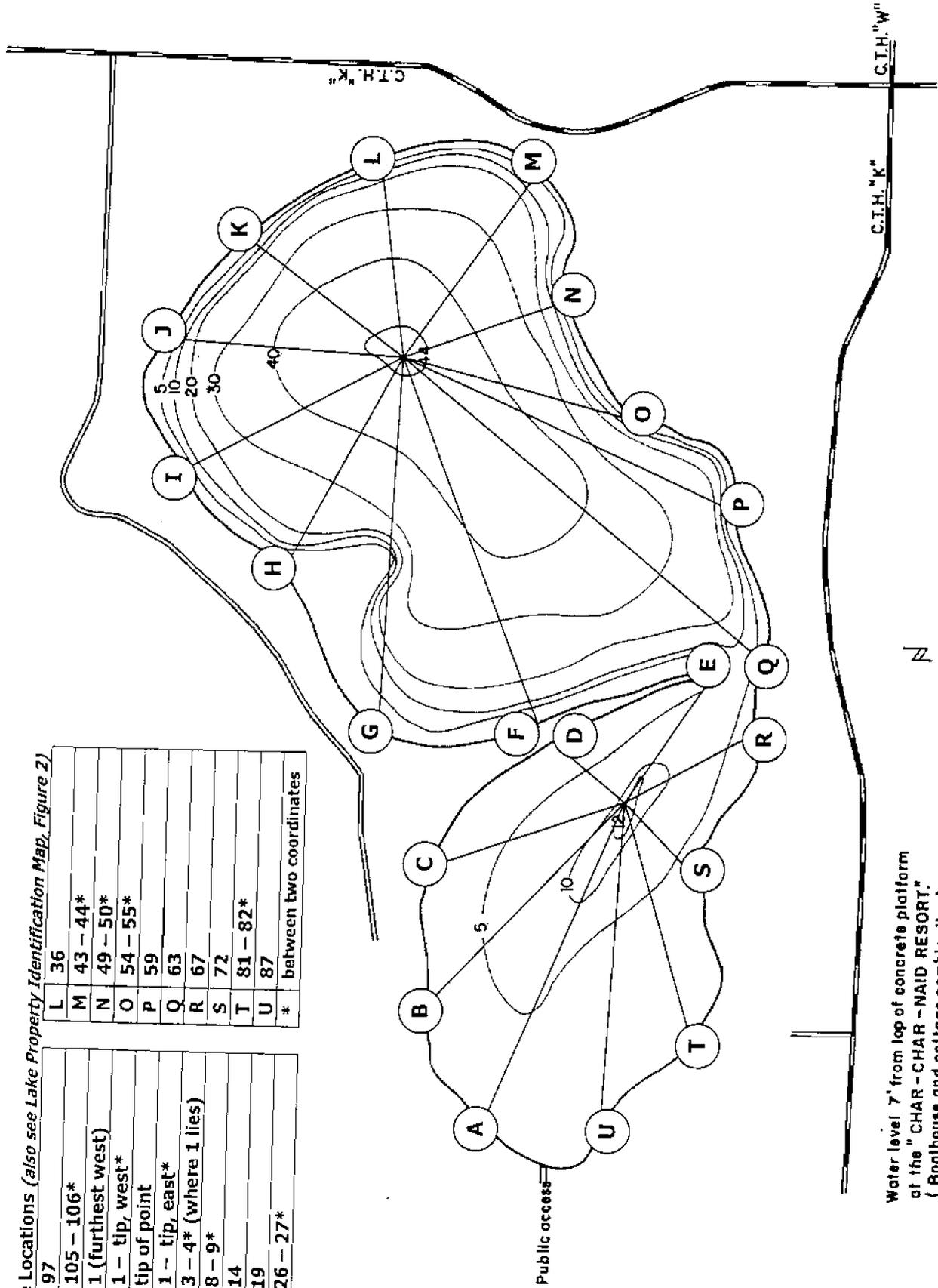
4= coefficient of conservatism (C). The probability that a plant is likely to occur in a landscape that is relatively unaltered from presettlement conditions. The C values range from 0-10 with 10 being species most sensitive to disturbance

Table 3. Description and ecological value of aquatic plants found in Pine Lake, June 2001.

Species	Description	Ecological Value
Bushy Pondweed (<i>Najas flexilis</i>)	Submersed plant with a finely branched stem growing up to 1 meter; leaves are narrow, pointed, and grow in pairs	Very important food for many species of waterfowl and marsh birds; provides a good source of shelter and food for fish
Elodea (<i>Elodea canadensis</i>)	Made up of slender stems with small, lance shaped leaves that attach directly to the stem; leaves are in whorls of 2 or 3 and are more crowded toward the stem tip	Provide cover for fish and is home for many insects that fish feed upon
Variable Pondweed (<i>Potamogeton gramineus</i>)	Stems emerge from spreading rhizomes and often sprawl on the sediment and branch repeatedly; leaves lack stalks and have 3-7 veins	Provides food for ducks, geese, muskrats, beaver and deer; provides habitat for invertebrates for foraging fish
Eurasian Water milfoil (<i>Myriophyllum spicatum</i>)	Produces long spaghetti-like stems; leaves are feather-like with 14-20 leaflet pairs, resemble bones on a fish spine, and are in whorls of 4-5; flower spike sticks out of the water with whorls of flowers	An invasive exotic species that grows in dense stands and has the ability to out-compete more desirable native plant species
Flat-stem Pondweed (<i>Potamogeton zosterformis</i>)	Emerges from a rhizome and has strongly flattened stems; leaves are stiff with a prominent midvein and many fine parallel veins	Provides cover for fish and is home for many insects which are fed upon by fish
Floating-Leaf Pondweed (<i>Potamogeton natans</i>)	Stems emerge from red-spotted rhizomes; floating leaves are heart shaped at base and rest flat on the water's surface	Provides food for ducks, geese, muskrats, beaver, and deer; offers shade and cover for fish
Illinois Pondweed (<i>Potamogeton illinoensis</i>)	Stout stems emerge from a thick rhizome; leaves are lance-shaped to oval and often have a sharp needle-like tip	Excellent cover for fish and invertebrates; source of food for waterfowl, muskrats, beaver, and deer
Musk Grass (<i>Chara spp.</i>)	A complex algae that resembles a higher plant; its is identified by its pungent, musk-like odor and whorls of toothed branched leaves	Is a favorite waterfowl food and provides a food source and cover for fish; helps stabilize bottom sediments and contributes to better water quality
Three-way Sedge (<i>Dulichium arundinaceum</i>)	The stiff round and hollow stems emerge from a spreading rhizome; the leaves are short and stiff and stand out from the plant	The shallow, spreading rhizomes create interlocking stands that are effective in buffering wave action and stabilizing sediments
Northern Water milfoil (<i>Myriophyllum sibiricum</i>)	Light colored stems with leaves divided like a feather with a short stalk and about 5-12 leaflet pairs; flower spike emerges above water level and is made up of whorls of red tinted flowers	Offers excellent foraging habitat for fish; food for waterfowl and provides a home for invertebrates
Sago Pondweed (<i>Potamogeton pectinatus</i>)	Stems emerge from slender rhizomes with many starchy tubers; leaves are thin and resemble a pine needle; flowers emerge in small whorls that are slightly spaced apart on the stalk	One of the most important foods for migrating waterfowl; important habitat for young fish
Water Celery (<i>Valisneria americana</i>)	Made up of long ribbon-like leaves that emerge from a cluster; leaves tend to be mostly submersed with only leave tips trailing at water surface; the white female flower bobs at the surface on a spiral-coiled stalk	A premiere source of food for waterfowl and good habitat for fish
White-Stem Pondweed (<i>Potamogeton praelongus</i>)	Long zigzag stems up to 2-3 meters; leaves clasp the stem and are oval shaped with a cupped, boat shaped tip.	Good food producer for waterfowl and furbearers; good habitat for fish

Figure 1
 PINE LAKE, Waushara County
 Aquatic Plant Survey Sites

Site Locations (also see Lake Property Identification Map, Figure 2)	
A	97
B	105 - 106*
C	1 (furthest west)
D	1 - tip, west*
E	tip of point
F	1 - tip, east*
G	3 - 4* (where 1 lies)
H	8 - 9*
I	14
J	19
K	26 - 27*
L	36
M	43 - 44*
N	49 - 50*
O	54 - 55*
P	59
Q	63
R	67
S	72
T	81 - 82*
U	87
*	between two coordinates



Water level 7' from top of concrete platform
 at the "CHAR - CHAR - NAID RESORT."
 (Boathouse and cottage combination)

Fish Management of Pine Lake

Fishing has always been a part of Pine Lake recreational use. Known in the area as a good Largemouth Bass and Bluegill lake, Pine Lake has always had moderate fishing pressure. Winter Ice fishing for Panfish and Northern has been exceptionally heavy for most of the lake's recent history. Because of the heavy fishing pressure the Wisconsin Department of Natural Resources has continually sampled the lake for fish management purposes. Records of fish specie, and size are available back to 1953. A summary of all sampling done on Pine Lake is shown below.

Sampling of Pine Lake has been done at different times of the year, with different capture methods, and for different purposes. Thus, it is difficult to compare year-to-year reports. Seines are large nets of lengths exceeding 2,000 feet and reaching down to 20-25 feet. They are spread out in a large arc and are slowly pulled to the shore capturing all the fish in the encircled area. Fyke nets are funneling nets that are set at right angles to the shoreline. Fish swim along the shoreline, encounter the net and swim deeper to attempt to avoid the net and swim into a series of funnel nets. Fish that do not inhabit the shoreline are not usually caught in the nets. Boom shocking is shallow water, nighttime method where a boat moves along the shoreline and electrically shocks fish swimming in the shallow water. When comparing the data from year to year one needs to take into account the capture method used to gather the data. Water temperature, time of year and weather do also play a role in the amount of each kind of fish captured. Fish population estimating is not a precise science.

The data reported in the DNR files does show the changes in the lake fishery over time. Most notable is the stocking of trout in the late fifties and early sixties. The lake was managed during those years as a two-story lake, warm water species like bass and northern and cold-water species like the trout. The planting of trout was discontinued in 1969 due to the competition for food sources and habitat as well as predation by the northern pike.

Pine Lake is a very good Largemouth bass and Northern lake. Populations have remained steady at high levels of fish. Growth and reproduction are generally above average for similar lakes in the area for both species. In recent years Northern sizes have reduced on the average from 27 inches long

(1969), to 19-20 inches (1979), to 22-24 inches (1984), to the current mean of 20 inches (2001).

Walleye have been present from the first census in 1953. Pine Lake is not a good lake for natural reproduction of Walleye. Populations require continuous stocking with only minor reproduction taking place.

Most DNR fish reports are not noted for their lengthy commentary. Summarized below are some comments from each report. The most recent fish census (2001) is attached in both the complete WDNR report on file and the published summary.

1953

"Bass are abundant. Walleyes are not thought to be abundant. Fishing for bass reported to being below par, however, survey indicates good supply and reproduction of bass but most range about 10" in length. Bluegills most abundant pinfish and of good sizes. Perch small. Other pan fish, crappies, rock bass, and pumpkinseeds not well represented in numbers or desirable sizes."

1963

"An ideal population of fish is present. Natural reproduction of Northern Pike the past few years has produced an excellent population. Largemouth Bass reproduction is also excellent. All pan fish taken in the seine hauls were in fine condition. The lake has provided some fairly good trout fishing in the past years. Trout fishing was spotty in 1963."

1969

"Many of the male Northern Pike (almost 50%) were fish that measured over 27 inches long. Most lakes in this part of the state do not have male Northern Pike that exceed 20-22 inches in length. This lake has been managed as a two-story lake (trout plantings) since about 1957. It provided fair to good returns to trout fisherman until 1963. Since 1964, trout fishing success has significantly dropped off although trout have been planted on a yearly basis.....trout plantings will be discontinued."

1979

"Several property owners on the lake expressed concern over the lack of fishing success in 1978. Largemouth Bass: An excellent sample of 447 (fish) indicates this species is doing very well. Northern Pike: A total of 56

(fish) measured. The pike were in exceptionally good shape being thick, deep bodied, fish in proportion to length. There is evidence that the Northern's were actively feeding on the bluegills....Bluegills: 45.6% exceeded 6.0 inches in length. A satisfactory fishable population is one where there are 25-33% exceeding 6 inches in length. Property owners observed the seining operations and were generally satisfied that the lake was supporting a good bass, Northern Pike and bluegill population”

1984

“Adult Bluegills were needed for restocking Silver Lake by Scandinavia and Long Lake by Plainfield. A total of 840 lb of Bluegills were transferred out of the lake. The fish ran on the average 8 (fish) to the pound. This lake continues to support a very satisfactory population of Northern Pike and Largemouth Bass. Of interest, is the sampling for the 1st time of Cisco in Pine Lake.” (Note: The Channel cats ranged in size between 22 and 36 inches in length.)

1994

Fyke netting began early, soon after ice out, water temperatures were 40-42 F. No significant numbers of fish were captured in the first days. When water temperatures reached 45F large numbers of fish appeared in the nightly nets. Walleyes and Northern's were first captured followed by Bluegills, Rock bass, and Largemouth bass. Pine Lake was Fyke netted for 17 days, boom shocked twice and seined twice for the most complete fish survey ever taken on Pine Lake. (No WDNR notes available, notes by Bill Powell as seen in the fish tally sheets)

2001

The complete fish survey report is unavailable at this time of printing, the WDNR summary report is attached.

Complete reports for each year surveyed may be obtained from the WDNR offices in Wautoma, WI or from the Pine Lake Property Owners Association.

Fish Management Records

	Year						
	1953	1963	1969	1979	1984	1994	2001
Date	May 21 & June 25	May 22 & June 4	Dec 12	May 5 & 6	May 21 & 22	Apr 2-18 May 18 Aug 1&2 27 Oct	See Note
Collection Method	Seine	Seine	Fyke Net	Seine	Seine	Fyke Net, Boom Shock, Seine	Fyke Net & Boom Shock
Largemouth Bass	270	345		447	526	147	
Walleye	1	1	4			63	
Bluegill	85	13,275	86	454	6,720	561	
Pumpkinseed	13					31	
Common Sunfish		20	4	9			
Rock Bass	10	35	44	4	6	77	
Black Crappie	6	69	7	8	2	1	
Perch	64	59		3	16	2	
Common Sucker	59	43		28	35	6	
Rainbow Trout		26	4				
Splake			2				
Northern Pike		141	88	56	74	68	
Brown Bullhead				1	17	2	
Black Bullhead						15	
Cisco					11		
Channel Catfish					3		

Note: Data not available at time of printing

Pine Lake Fisheries Survey Summary Report – 2001

In 2001, the Department of Natural Resources conducted a comprehensive fish survey of Pine Lake in order to provide direction for the future fisheries management of this lake. The following report is a brief summary of all activities conducted this past year, general fisheries information and future management recommendations for Pine Lake. A comprehensive report will be completed later this summer/fall. In the meantime, if you have any questions, please contact: Al Niebur, DNR Fisheries Biologist, 427 E. Tower Dr. Suite 100, Wautoma, Wisconsin. Phone: 920-787-4686 Extension 3019

Comprehensive Fish Survey – What is it?

A comprehensive fish survey is an assessment of the entire fish community in a lake. Different survey methods are used to sample all the different fish species that inhabit a lake (including the smaller forage fish). Fyke-netting and boomshocking are the primary fish capture methods, however, seines and other gear are also utilized. Once fish are captured, information can be collected as it relates to species composition, abundance, size structure, age classes, growth, survival, and reproductive success.

This past year the following surveys were conducted on Pine Lake:

Fyke Netting after ice-out: This survey is conducted to target spawning northern pike, walleye and yellow perch.

Boomshocking: This survey is conducted at night and is used to target largemouth bass. Other species are also collected. We also use this gear in the fall to check for newly hatched young of year (YOY) gamefish.

Summer Fyke-Netting: Nets are utilized to catch pre-spawn bluegills and other sunfish species as they migrate to their spawning areas.

Summer Mini Fyke-Netting: Smaller version of fyke-net used to capture newly hatched YOY gamefish and minnow species.



DNR fisheries crew removing fish from fyke-net.

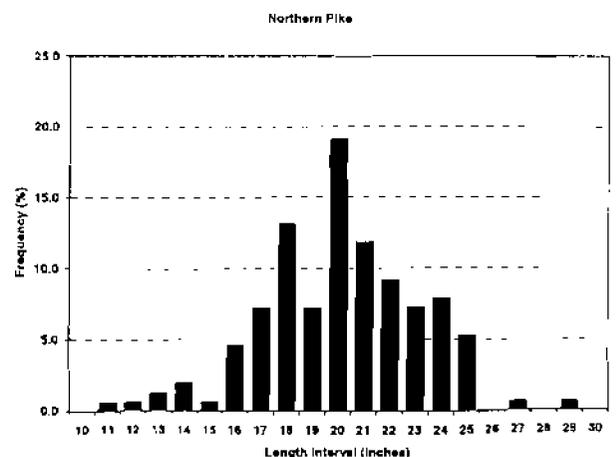
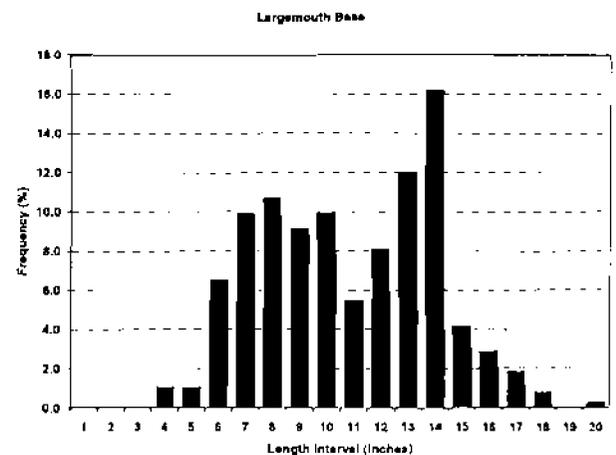
Gamefish Summary

Largemouth bass was the dominant gamefish sampled in Pine Lake.

Approximately 383 were captured during our surveys with length ranges of 4.2 – 20.0 inches and a mean length of 11.3 inches. Abundance was below average when compared to other lakes in the area. Size structure appeared to be average with 32% of catch greater than minimum length limit (14.0 inches). Growth was above average with most bass attaining legal size by the end of their fourth summer.

Northern pike were also present but comprised a small portion of the predator (gamefish) population. A population of 407 (3/acre) northern pike was estimated from mark and recapture surveys. Of concern was the poor size structure. Length ranged from 6.6 - 29.2 inches with a mean length of 20.4 inches. However, less than 2% of pike sampled were greater than 26.0 inches. In addition, pike size has decreased significantly from surveys conducted pre-1990. Growth was also very poor and is mostly likely an indicator of a depressed forage (food) supply for northern pike.

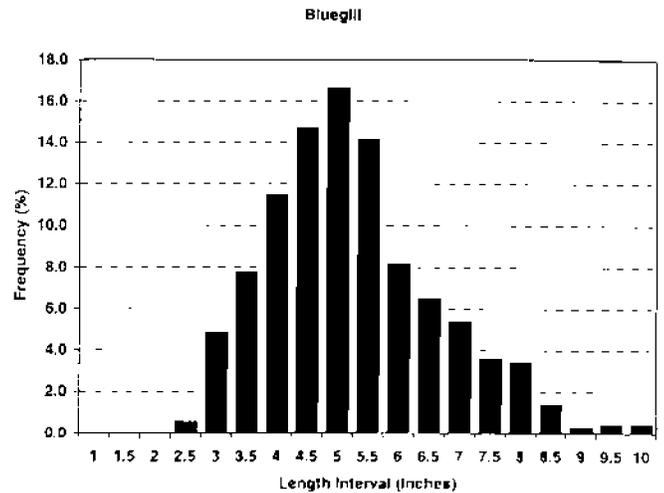
Walleye were found in very low numbers with an adult (>15.0 inches) population estimate of 52 walleye. Most walleye captured were from stockings that occurred in 1988 and 1991. Walleye length ranged from 10.7 – 28.0 inches with a mean length of 21.0 inches. Growth appeared to be above average. No young of year were captured and natural reproduction appears to be non-existent.



Panfish Summary

Bluegill was the dominant panfish sampled in Pine Lake. A total of 721 were captured during early spring fyke-netting. Of concern was the poor size structure and representation of age 7+ year old bluegills. No bluegills were sampled from spawning that should have occurred in 1992 and 1993. This may partly explain some of the poor fishing experienced over the last few years. In addition, less than 30% were found to be catchable size (>6.0 inches), however, it appears there is a strong year classes from 1996, 1997, and 1998 that should hopefully provide some decent fishing in a couple years. Growth was average with most bluegills reaching catchable size by their 5th year of life.

Black crappie and yellow perch were found in lesser numbers and exhibited average size and abundance. Other panfish species caught during the survey included: pumpkinseed, rockbass, yellow bullhead, and brown bullhead. Several hybrid bluegills (from past mistaken stocking) were captured and they showed very poor growth. In the future, no hybrids will be permitted for stocking in natural lakes because these type of fish are not suitable species for a natural fish community. These fish should be stocked only in a pond or controlled environment (e.g. hatchery tanks) where they are best suited for optimal growth.



Management Recommendations

Stocking Guidelines:

- Walleye (large fingerling): 10/acre (1400) every 2 years
- Northern Pike (large fingerling) 1/acre (140) every 2 years
- Largemouth Bass: (No Stocking)
- Forage Species: Annual plants of white sucker for improving northern pike forage. Yellow perch stocked on an annual or biannual schedule. Cisco if they ever become available from DNR hatchery.

Size and Bag Limits:

- Eliminate 26 inch minimum length limit for northern pike. The 26 inch minimum size limit has done little to improve size structure. Based on age/growth analysis, most males reach a maximum size of 24 inches which puts all the angling harvest on the faster growing females. One option is to establish a 2 fish daily bag limit with only 1 pike over 26 inches. This will spread the harvest out and minimize pressure on larger faster growing northern pike.
- Reduce daily panfish bag limit to 10 or 15 in total. Bluegill populations appear to be on a severe decline. This may be due to combination of factors including: poor reproduction (weak year classes) during 1992-1994 and angler over-harvest. A reduced bag limit will reduce angler harvest and help re-establish bluegill densities. Increased bluegill densities will also bolster gamefish growth.

Habitat Preservation/Restoration:

- Establish sensitive areas. Over the last couple decades shoreline development along with motorboat size and use has dramatically increased in Pine Lake. Research has shown that lack of aquatic plants and poor fish populations can be directly attributed to shoreline development and outboard motor impacts. The downward trend in fish abundance that was observed in Pine Lake could be linked to declining habitat from these impacts. Establishing no wake/low use zones in select areas of the lake with unique plants and habitat would be beneficial to the fish community.
- Re-introduction of woody debris into shallow (less than 5ft) littoral areas. Woody debris is an important habitat that is severely lacking in Pine Lake. The most productive area of the littoral zone for fisheries is the transition area from 0-5 ft of water. Logs, brush, and tree drops could be used to create fish habitat.
- Control of Eurasian water milfoil (EWM).
- Establishment of a boating/low impact zone in west shallow basin. This part of the lake provides critical habitat to a variety of fish species and it would be beneficial to promote using a path for waterskiing, jet ski, etc. to minimize disturbance to plant beds.
- Shoreline Restoration. Replant native wetland species along shoreline to provide habitat and stabilize banks.

Future Monitoring:

- Conduct fisheries assessments on a 5 year rotation to monitor trends in the fish community and habitat.
- Monitor and eradicate any Eurasian watermilfoil. Selective herbicide treatments that target EWM and not native beneficial plants should be considered if chemical treatment is applied. Manual removal of EWM can sometimes be more precise.

Pine Lake Local Survey Results

As part of the lake quality and awareness survey the lake association included questions relative to living habits. The reason for including this group of questions was to determine which type of local services are used by our residents and what degree of satisfaction was realized. We also wanted to see what the shopping habits of the lake community are. This type of information is very useful when dealing with local officials and community leaders as it offers a window to view our purchasing power in the community.

We received responses from about 83 residents. This is an exceptionally good response rate for surveys of this type. Table 1 is a complete record of the survey results. It is self-explanatory and needs little elaboration. It does indicate that those using the local schools are a small group but were satisfied with the education system in Wild Rose School District. About half have attended a local governmental meeting which is probably above average for a community like ours that has only a small year-around population.

A very high portion of the lake community have required local emergency services. These were mostly medical in nature. The vast majority (93%) was satisfied with the treatment received. All should be aware that 911 has come to Waushara County. The installation of 911 and the uniform property numbering system has greatly reduced the response time for emergency service vehicles. The local fire and rescue departments have continually up graded equipment and are very well trained.

We, as a community overwhelmingly shop in Waupaca. Due to the larger city size Waupaca has much to offer in retail shopping. Continuing support of the local merchants is always good for community growth. Many good restaurants, local contractors, and specialty shops exist in Wild Rose and the surrounding towns.

Local Issues Survey

Q No.	Question	Number Responding		Percent Responding			
		Yes	No	% Yes	% No		
61	Children in School	5	78	6	94		
62	Satisfied with School	5	0	100			
63	Use Local Libraries	35	47	43	57		
64	Which Libraries	Wild Rose	Waupaca	Other	Wild Rose	Waupaca	Other
		4	23	6	12	70	18
65	Attend Waushara Co Fair	27	56	33	67		
66	Attend Gov't Meeting	42	40	51	49		
67	Receive Local Mail	46	36	56	44		
68	Used Emergency Services	56	26	68	32		
69	Which Services	Doctor	Dentist	Fire	Hospital	Police	
		Number	16	4	7	35	7
		Percentage	29	7	13	62	13
70	Satisfied with Services	40	3	93	7		
72	Aware of 911	72	11	88	12		
Shopping Habits							
		% Waupaca	% Wild Rose	% Other			
73	Purchase Food	77	13	14			
74	Purchase Boat Gas	49	37	14			
75	Purchase Fishing/Bait	44	38	20			
76	Building Materials	55	16	29			
77	Local Repairs	57	23	20			
78	Eat Out	60	20	20			

Table 1. Local survey results.