Sustainable Lake Management Plan
Birch Lake

Prepared by Blue Water Science & the
Vadnais Lake Area Water Management Organization
In Partnership with the Birch Lake Improvement District

2007 – 2008

(Revised May 2009)

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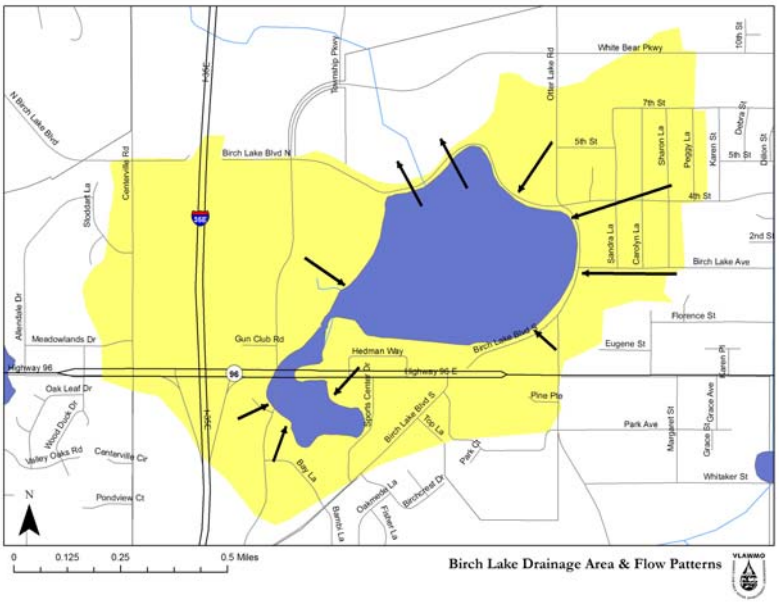
BIRCH LAKE
RAMSEY COUNTY
State of the Lake – Summary of the Sustainable Lake Management Report

Watershed is Small and Appears to be the Original Size

Birch Lake is located in Ramsey County. It is a shallow lake at only 6 feet depth maximum and has clear water. The water basin south of Highway 96 is about 14 acres and has a culvert connection to the lake under the highway.



However, VLAWMO staff has been unable to find the culvert and it may be filled in with sediment and vegetation. Initial water quality samples from the south basin show significantly different nutrient levels; which may mean that the lakes are not hydrologically connected. The drainage area to Birch Lake is approximately 486 acres which is about 4 times larger than the surface area of the lake. This is a relatively small drainage area, which can be considered positive in that it does not receive the runoff (and therefore pollutants) from a large amount of area. The small watershed indicates this may be the original watershed that has drained to the lake since the retreat of the glaciers, over 9,000 years ago.

Runoff is Typical for Urban Settings

Runoff water quality data is limited, but available data shows typical phosphorus nutrient concentrations for urban runoff. Average phosphorus concentrations in runoff are averaging from 91 ug/L to 282 ug/L. Typical phosphorus concentrations in this ecoregion is 150 ug/L. Ongoing watershed nutrient reduction programs should help to get to the phosphorus goal.

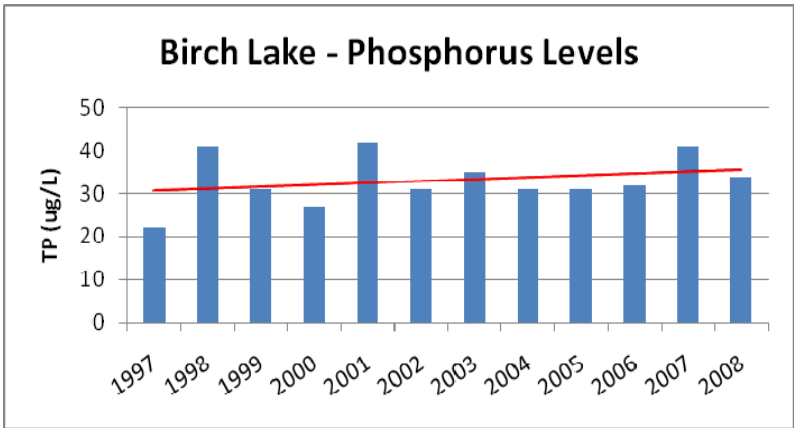
Runoff water quality

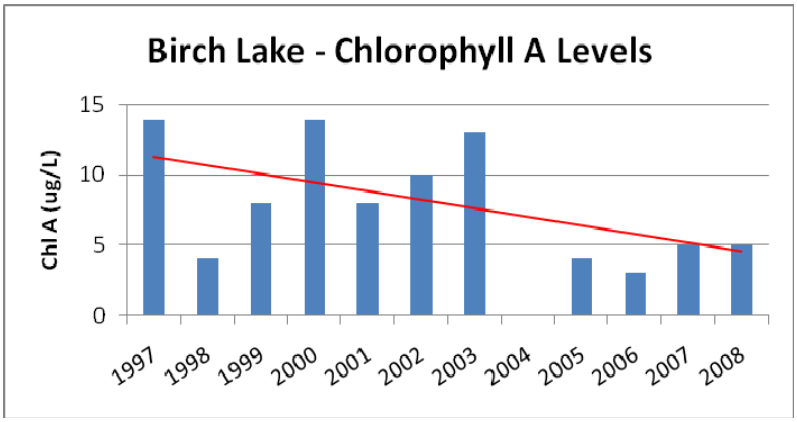
Site	Total Phosphorus (ug/L)
Birch Lake - 4th Street	282
Birch Lake - Birch Lk Blvd	91
Birch Lake - Bremer Bank	265
Runoff Goal	150 or less

Birch Lake Statistics

Lake size (acres)……...…..123
Mean depth (feet)……...……...4
Maximum depth (feet)……...…….5.5
Watershed area……...486
Water clarity (feet)…….5
Lake phosphorus (ug/L) (2008)…...…34

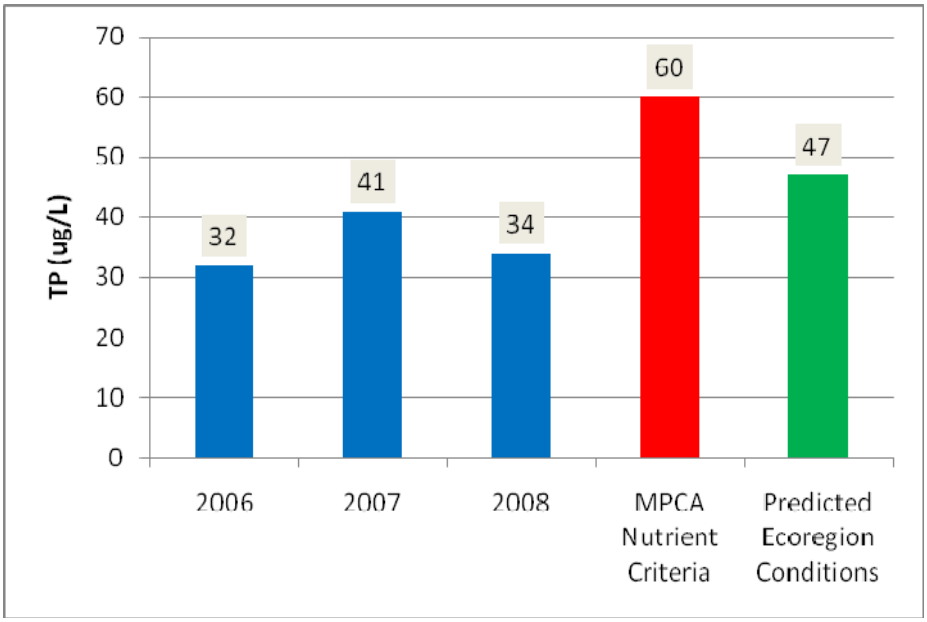
Birch Lake is Healthy Based on Nutrient Concentrations





Birch Lake is a healthy lake and several factors support the finding. Lake monitoring results show low nutrient concentrations in the lake resulting in low algae and clear water. The phosphorus is showing a slight increase over the past decade however the chlorophyll A levels have dropped. Both levels of phosphorus and chlorophyll A are below the state standards for nutrient levels. This is a healthy condition. Low algae numbers indicate the low potential for toxic algae. Also the presence of fish and wildlife show the lake supports abundant life. The lake has not been monitored for E. coli, an indicator bacteria for solid waste pollution, but there is little evidence that would indicate there is a source of pathogenic bacteria (broken sewer lines or large flocks of resident geese and ducks) that enter the lake.

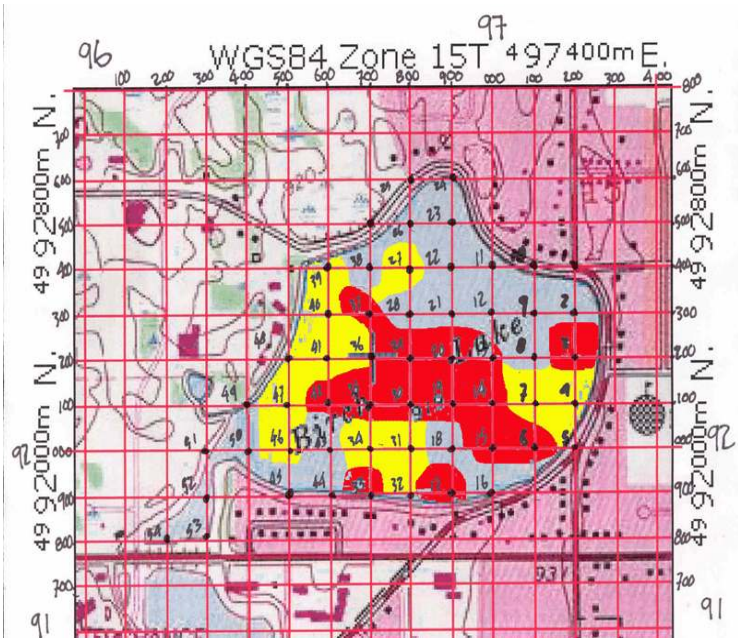
Birch Lake Water Quality is Better than Predicted



Birch Lake has good water quality and is in a "protection" status. This means that lake restoration is not necessary; rather a lake protection program is the emphasis. The blue bars are real Birch Lake data from 2006 – 2008. The red bar is the nutrient criteria threshold for shallow lakes which is set by the MN Pollution Control Agency. Birch Lake water quality is less than the nutrient criteria for shallow lakes (60 ug/L), meaning that it is unimpaired, which is good. Using a modeling program (MNLeap), the predicted phosphorus concentration is 47 ug/L (shown by the green bar). Birch Lake phosphorus levels have consistently been less than 47 ug/L and the lake water quality is better than predicted. The ongoing challenge will be to maintain the good water quality.

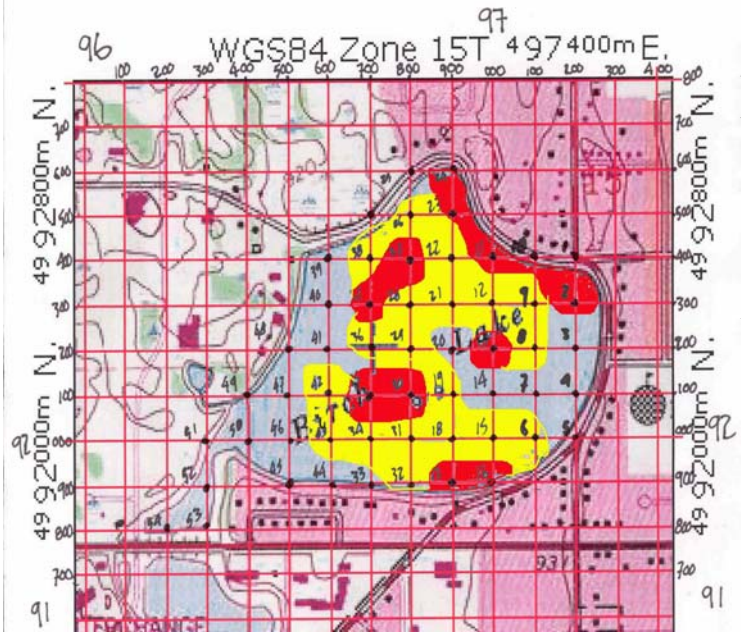
Aquatic Plants are Key to Good Water Quality in Birch Lake

Shallow lakes, such as Birch Lake, often have abundant aquatic plant communities. They are key to maintaining water quality because they bind with the pollutants and nutrients that enter the lake and filter them rather than allowing them to decay and cause algae blooms and decrease overall water quality. Birch Lake's aquatic plants have been a concern to residents because they reduce the level of recreation that can be done on the lake. A plant survey was conducted by Blue Water Science in 2007. Surveys were conducted in the early and late summer to determine the abundance and types of plants within Birch Lake. Fern pondweed is the dominant plant in Birch Lake. It is a native plant and is the plant that grows to the lake surface. Two non-native plants are also present; Curlyleaf pondweed and Eurasian watermilfoil, but they do not produce heavy growth communities.



June 1 – Early Summer Survey

In early summer, there was 100% coverage of the lake with aquatic plants. The most abundant plant in Birch Lake was fern pondweed and was found at 96% of the 54 stations. Overall, aquatic plants grew to a depth of 5 feet. Eurasian watermilfoil was found at 10 sites and a possible hybrid milfoil was found at several additional sites. Red on the map indicates plants matting at the surface. Areas with abundant growth but not reaching the surface are shown in yellow.



September 5, 2007 – Lake Summer Survey

The dominant plant in Birch Lake in September 2007 was fern pondweed. Eurasian watermilfoil was found at 16 sites but at low densities in this late summer survey. Overall, aquatic plants grew out to a depth of 5 feet and were found throughout the entire lake. Red on the map indicates plants matting at the surface. Areas with abundant growth but not reaching the surface are shown in yellow.

Projects That Will Help Keep Lake in Good Health

A variety of projects which can help protect the water quality of Birch Lake are listed below. A detailed list is located in the larger report.

1. Lake Monitoring

Continuation of current monitoring program with the possible addition of monitoring on Little Birch and/or dissolved oxygen readings in the winter.

2. Shoreline Naturalization Projects

Work to increase natural shoreline around the lake and stabilization of shoreline on northwestern portion of the lake.

3. Aquatic Plant Projects

Continuation of harvesting program is preferred over chemical treatments. Evaluation of purple loosestrife control.

4. Fish and Wildlife Surveys

Conduct a fish survey and/or coordinate residents to track wildlife seen around the lake.

5. Education Programs

Continue BLID newsletter and blog. Work with VLAWMO to conduct shoreline restoration and raingarden workshops.

What About Dredging Birch Lake to Make it Deeper?

Birch Lake is a naturally shallow lake. If Birch Lake were dredged to make it deeper, it would be costly and there are no guarantees water quality would remain good. If 40% of the lake area (roughly 49 acres) were dredged 10 feet deeper, aquatic plants would not reach the surface and winter aeration would not be necessary. Estimated cost of dredging (at $8/cubic yard) is $5.7 million.

Aquatic Plant Harvesting Program is on Track

A variety of options are available for managing dense aquatic plant growth. Manual methods, such as weed rakes, can be used to create a channel and remove plants at the same time. Mechanical harvesting is a better option for large projects.

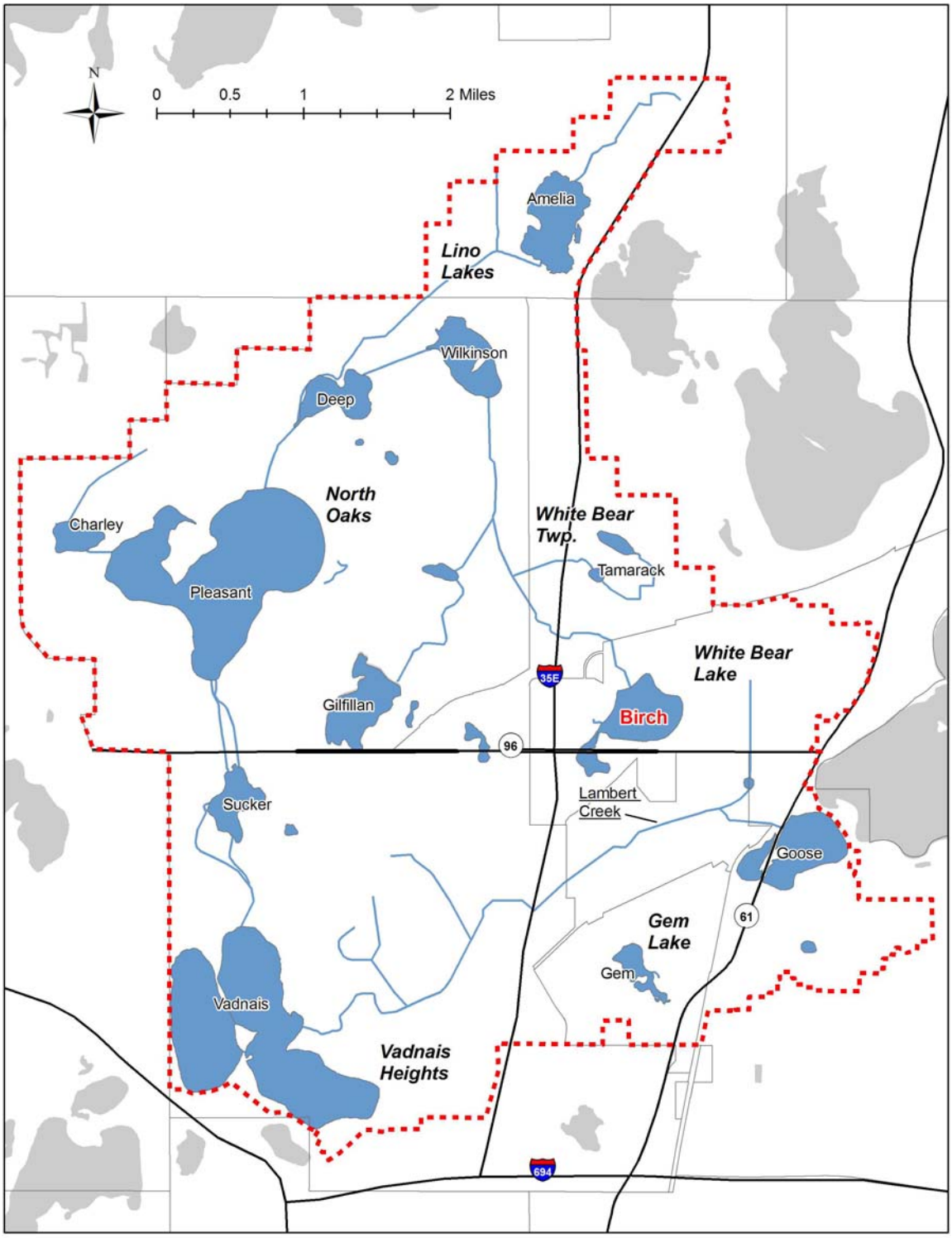
The harvesting option should continue to open channels about 20-30 feet wide through the surface matted growth which allows unrestricted navigation and should not harm the lake. Mechanical harvesters pick up most of the plants that are cut.

The ongoing harvesting operation appears to manage the heavy growth of fern pondweed in Birch Lake. This is preferably the best plant management option. Large scale herbicide applications could increase phosphorus levels and promote algae blooms and is not recommended. Spot herbicide treatments would be acceptable.

1. Introduction

Birch Lake is located in the City of White Bear Lake, Ramsey County and lies within the Vadnais Lake Area Water Management Organization (VLAWMO). It has active involvement from its residents through the Birch Lake Improvement District (BLID). Birch Lake is a shallow lake with a maximum depth of about 6 feet. The 125 acre lake has clear water and abundant aquatic vegetation.

Figure 1: Location Map



Birch Lake has beautiful wildlife in and around the lake. Bald Eagles, Pileated Woodpeckers, Trumpeter Swans, and Loons are just some of the observed fauna. The studies for this report were conducted by VLAWMO, Blue Water Science, and the Ramsey Conservation District (RCD). All figures and tables were created by Blue Water Science or VLAWMO, unless otherwise noted. The studies and surveys are attached as Appendices. The Birch Lake Improvement District (BLID) sponsored the aquatic plant survey and provided boat transportation for the shoreline inventory. In addition, the BLID has assisted VLAWMO with monitoring activities and has been an active participant in the formulation of this SLMP. The BLID, and it predecessor, the Birch Lake Association, have been active stewards of the lake for nearly 50 years. Partnership is the keystone of success for VLAWMO and this report is an excellent example of that cooperation.

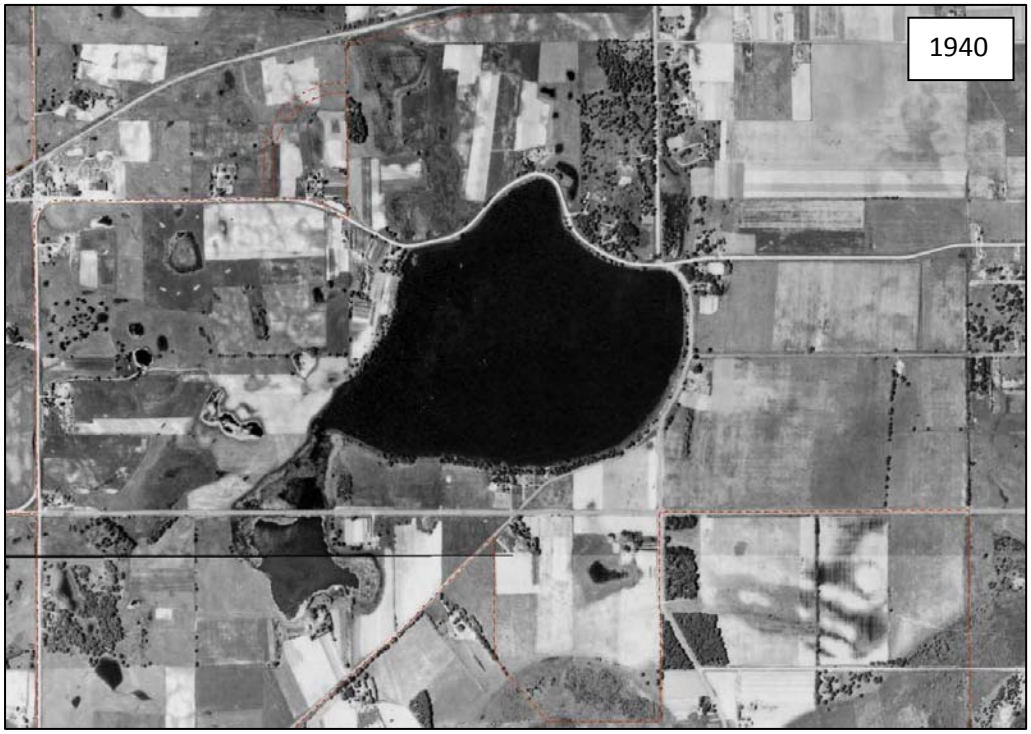
Bald Eagle at Birch Lake. Photo provided by Jim Grism.

Pileated Woodpecker at Birch Lake. Photo provided by Jim Grism.

2. Watershed Features

A. History

Aerial photos from Ramsey County show that the land surrounding Birch Lake was largely agricultural in 1940. The road that is now Highway 96 was already in place and it appears that the water in the bay on the northern side of the highway had quite a bit of vegetation in it.



By 1953, residential development is showing up around the lake and the water on both sides of Highway 96 is more cleared of vegetation.

By 1974, Interstate 35E has been built and development east of Birch Lake has increased.

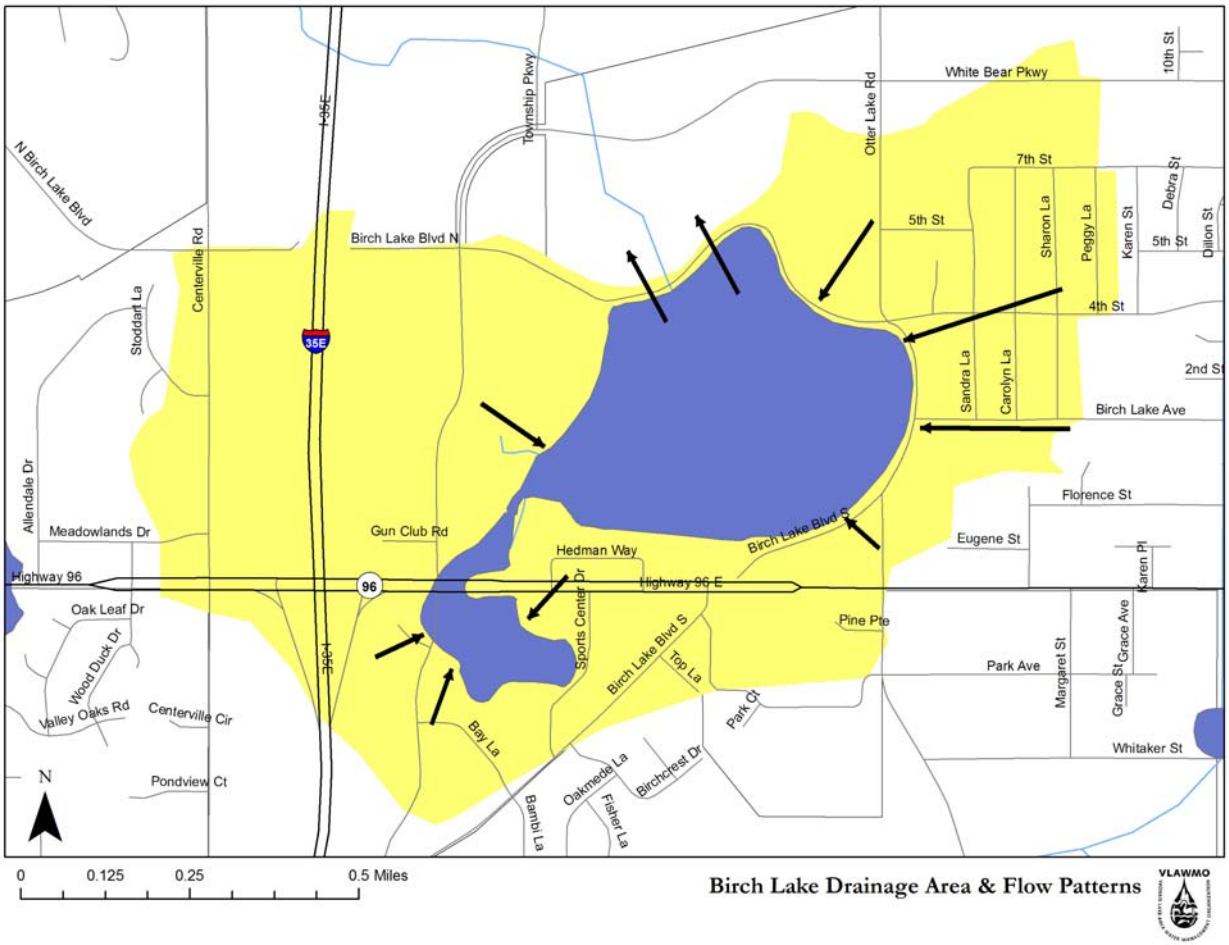
By 1985, White Bear Parkway has been constructed and residential development has continued to grow east of Birch Lake as well as commercial development on the southern side.

The 2006 aerial photo above shows the area as it currently exists. Commercial development has been built west and south of the lake along with townhome developments on the western and northern sides. The area is basically fully developed. White Bear Parkway has been extended to cross Highway 96 and it cuts through a portion of the southern basin of Birch Lake (hereinafter referred to as Little Birch).

B. Birch Lake Drainage Area

It is important to understand where water flows into and out of a waterbody in order to ascertain the potential inputs of pollutants. The drainage area (shaded area in Figure 2) into Birch Lake is approximately 486 acres and is about 4 times larger than the surface area of Birch Lake which is 125 acres. This is a relatively small drainage area to Birch Lake which is a positive aspect for the lake. Lakes with a small drainage area (less than 10:1 ratio) tend to have better water quality. Water enters the lake primarily through storm sewers. Land use within the drainage area is largely developed. Roughly 50% of the land use in the drainage area is residential while 25% is commercial or industrial use. Drainage from Birch Lake flows to a wetland on the north side of Birch Lake Blvd. Two major thoroughfares run through the Birch Lake drainage area: Interstate 35E and Highway 96. The water on the southern side of Highway 96 is connected via culverts under the highway.

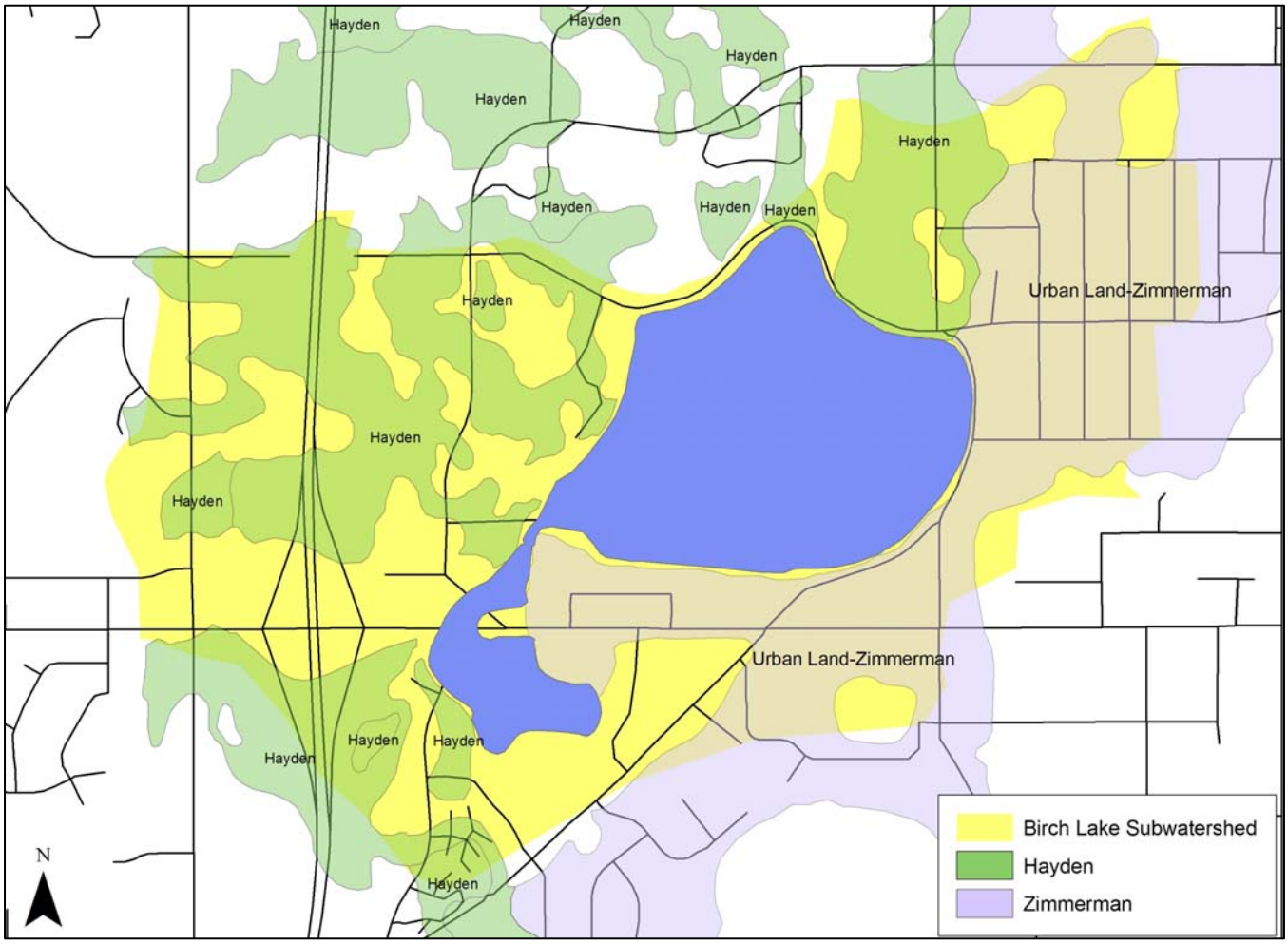
Figure 2: Birch Lake Drainage Area and Flow Patterns



C. Soils

Soils within the Birch Lake subwatershed are dominated by two types of soils: Hayden fine sandy loam and Urban Land-Zimmerman Complex. Both soils are good for building and residential development. These soils tend to be well drained, allowing water to filter into the ground. However, with urban development, much of the soil has been compacted, moved, and covered over, thus pushing rain water into storm sewer systems which outlet to the lake. **However, it is good to know what the main soil types are in the watershed because it can help property owners with the successful installation of rain gardens or other infiltration practices.** Additionally, a survey was conducted to examine the sediment of the lake bottom and the results are addressed on page 25 of this SLMP and in Appendix A.

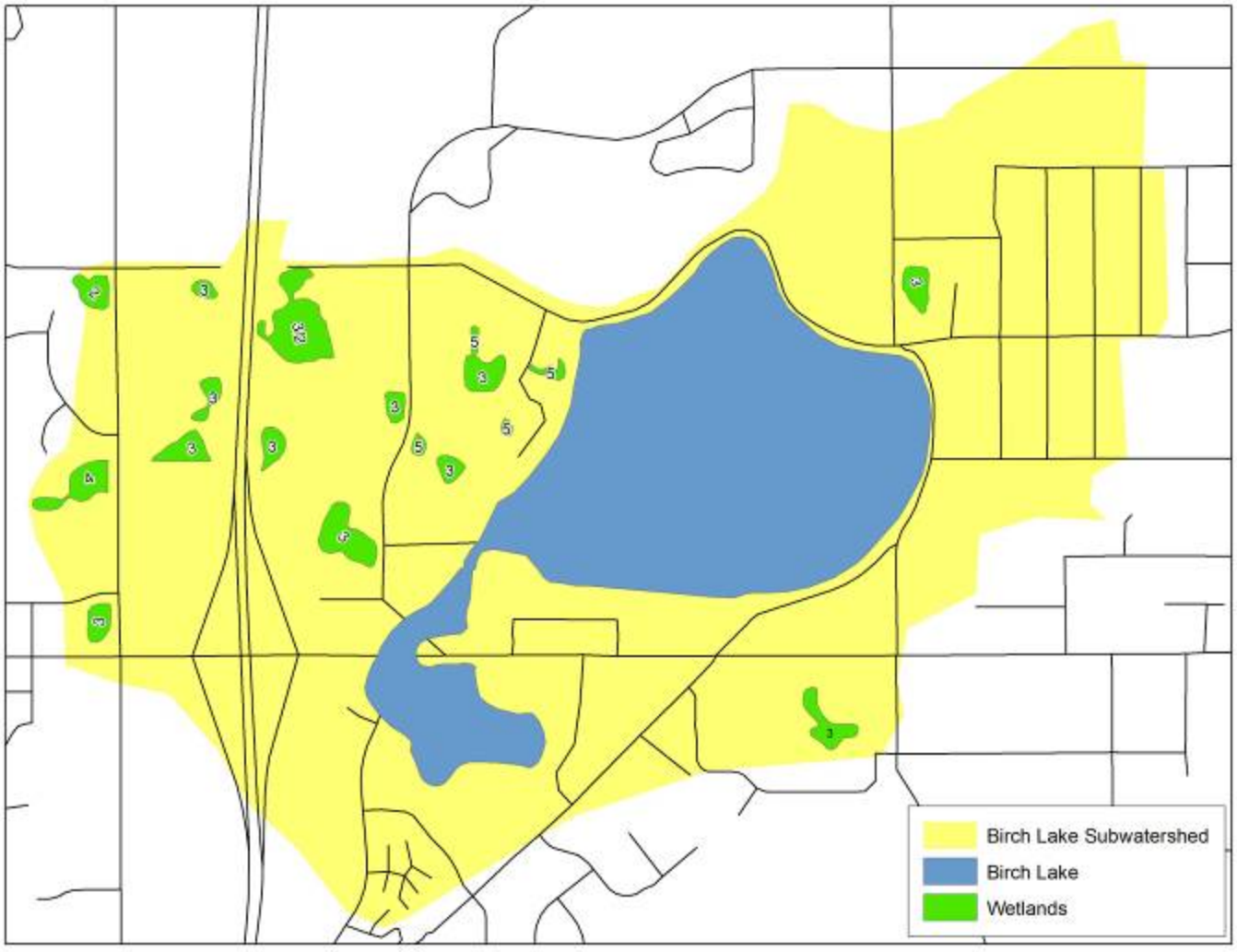
Figure 3: Birch Lake Soils Map



D. Wetlands

There are 17 delineated wetlands within the Birch Lake subwatershed totaling 16.8 acres or 3% of the watershed area. Ideally, a watershed should have at least 5% of the area ponded therefore the area is lacking in this regard. The western side of the subwatershed has all but two of the wetlands. For any new development or redevelopment, the creation of ponds would be advised, especially on the southern and eastern sides of the subwatershed. The wetland to the northeast of the lake could provide a buffer for pollutant and nutrient runoff into the lake. **VLAWMO will discuss potential opportunities with the City of White Bear Lake regarding this particular wetland.**

Figure 4: Birch Lake Wetlands



E. Homeowner Survey

VLAWMO conducted a survey of homeowners on Birch Lake in 2007. Half of the residents responded which is a high number of returns for a paper survey. Results are shown below. **Aquatic plant topics are important to many of the residents who responded. There was division among the respondents regarding how to manage the abundant aquatic plants.** Further discussion regarding aquatic plant management is found on page 25 and Appendix B.

Table 1: Lake Resident Questionnaire Results

How important to you are the following items? (1=low; 5=high)							
Average Scores							
excessive plant growth	algae control	odor issues	access to the lake	poor fishing	mucky lake bottom	wildlife nuisance	exotic plant control
4.6	4.3	3.9	2	3	3.8	2.5	4.5
Answers were greatly varied in regards to "poor fishing" being important; there is no dominant viewpoint for this which is why the score is in the middle. "Wildlife nuisance" also had varied answers. There was a clearer consensus regarding "excessive plant growth", "algae control", and "exotic plant control" where most residents find these issues to be very important.							

What are your primary activities on the lake?					
viewing water & wildlife	fishing	boating	swimming	walking around the lake	socializing
87%	33%	46%	28%	82%	46%

How do you feel about the following aspects of your lake? (1=poor; 5=excellent)					
water quality	fishing	swimming	boating	wildlife viewing	other (please describe)
3.5	3.2	1.8	2.4	4	2 added that lake depth was poor while one added that privacy was excellent.
Strong consensus that swimming and boating were poor but that wildlife viewing was excellent.					

If you were to control plants, what method would you prefer?		
herbicide/ chemical	harvest/ mechanical	other (please describe)
46%	36%	combo of both - 13%
		do nothing - 0.5%
		other answers included to try other things such as carp, triploid asian grass, or dredging

3. Lake Features

A. Shoreline Inventory

A shoreline inventory consists of taking photographs of lakeshore parcels and evaluating natural conditions associated with that parcel. It is important to assess shoreline conditions because runoff from lawns or other land practices directly enter the lake. If a shoreline is naturalized, it allows nutrients and pollutants to filter before reaching the water. Natural shorelines also provide habitat for turtles, frogs, and waterfowl. Finally, a natural shoreline is a major deterrent to nuisance wildlife such as Canada Geese. A shoreline inventory was conducted on Birch Lake in June 2007 by VLAWMO and RCD staff. The BLID provided a boat and driver to conduct the survey. Each parcel was photographed and rated for the percentage of naturalness along the shoreline as well as in the upland area. A summary of the results are listed below in Table 2. See Appendix C for a detailed report.

Table 2: Birch Lake Shoreline Inventory Summary

Shoreline Material %		
Grass	42.50%	Approximately half of the parcels are grass all the way to the shore; the other half is mainly woody and natural vegetation.
Rip Rap	1%	
Woody Vegetation	53.50%	
Retaining Wall	1%	
Sand	2%	
Shoreline Conditions		
0-25% Natural	28 (45.16%)	Approximately half of the parcels are cleared to the shore; the other half are kept very natural.
25-50% Natural	4 (6.45%)	
50-75% Natural	1 (1.61%)	
75-100% Natural	29 (46.77%)	
Upland Conditions		
0-25% Natural	45 (72.58%)	Most of the properties have homes or businesses on site and therefore the majority of the upland area are developed and mowed.
25-50% Natural	7 (11.29%)	
50-75% Natural	6 (9.67%)	
75-100% Natural	4 (6.45%)	

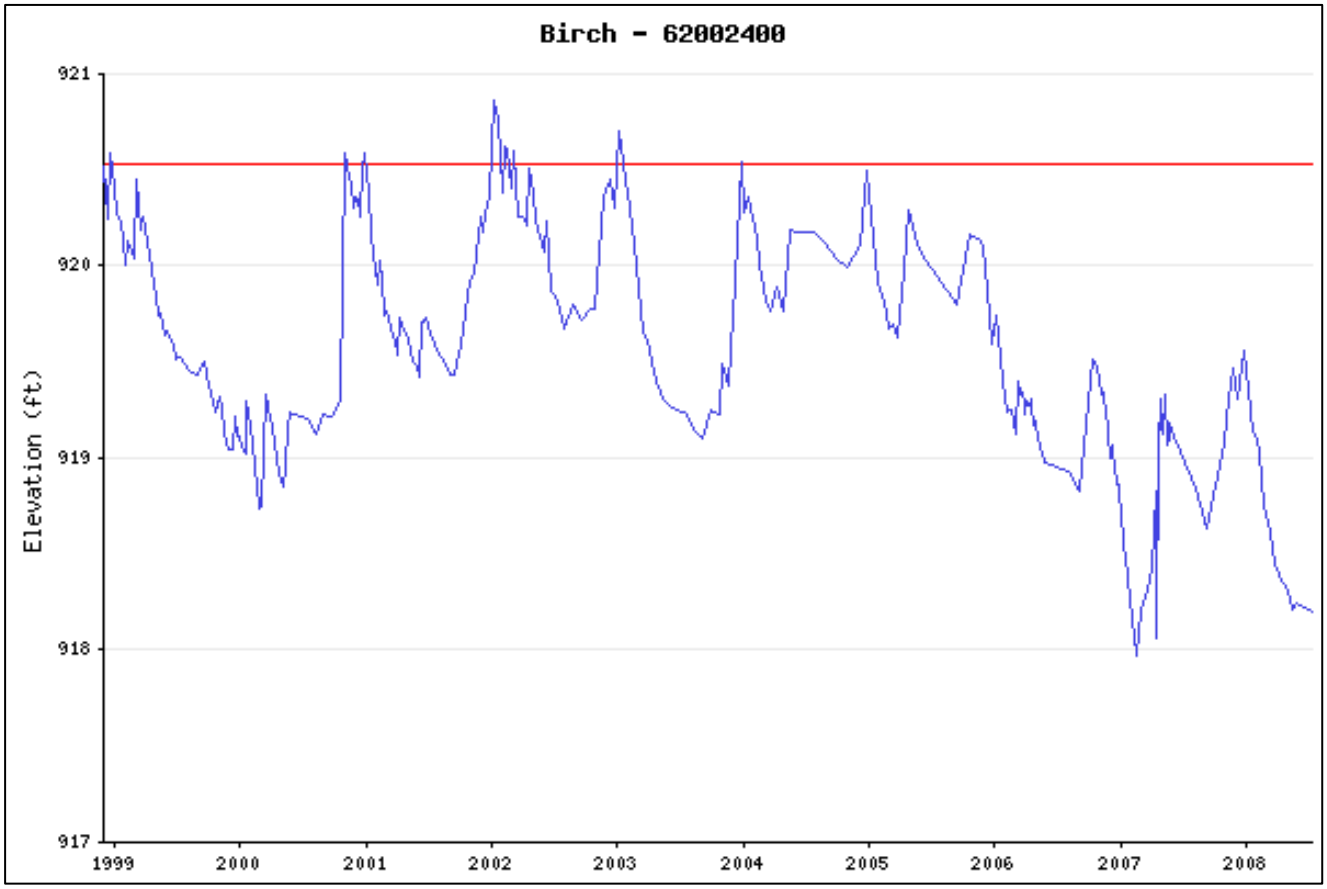
Figure 5: Example of a Birch Lake shoreline parcel. This parcel was rated as having good natural conditions.

Approximately half of the properties around Birch Lake were considered naturalized. The other properties were largely lawn all the way to the shore. There were signs of shoreline erosion on the northern and eastern sides of Birch Lake. Shoreline erosion causes soil to rush into the lake and is an indicator of the health of a lake. Nineteen of the properties that are cleared to the shore were determined to have good potential for restoration to a more natural shoreline. By creating a buffer of natural vegetation along the shoreline, there will be more filtering of chemicals from lawns and roads before it reaches the water. Homeowners on Birch Lake should be encouraged to implement these types of landscaping projects with a goal of increasing the amount of naturalized shoreline by 5% each year until 75% of the shoreline is natural. Education, grants and design assistance are available through VLAWMO and RCD to help homeowners with these projects.

B. Lake Levels

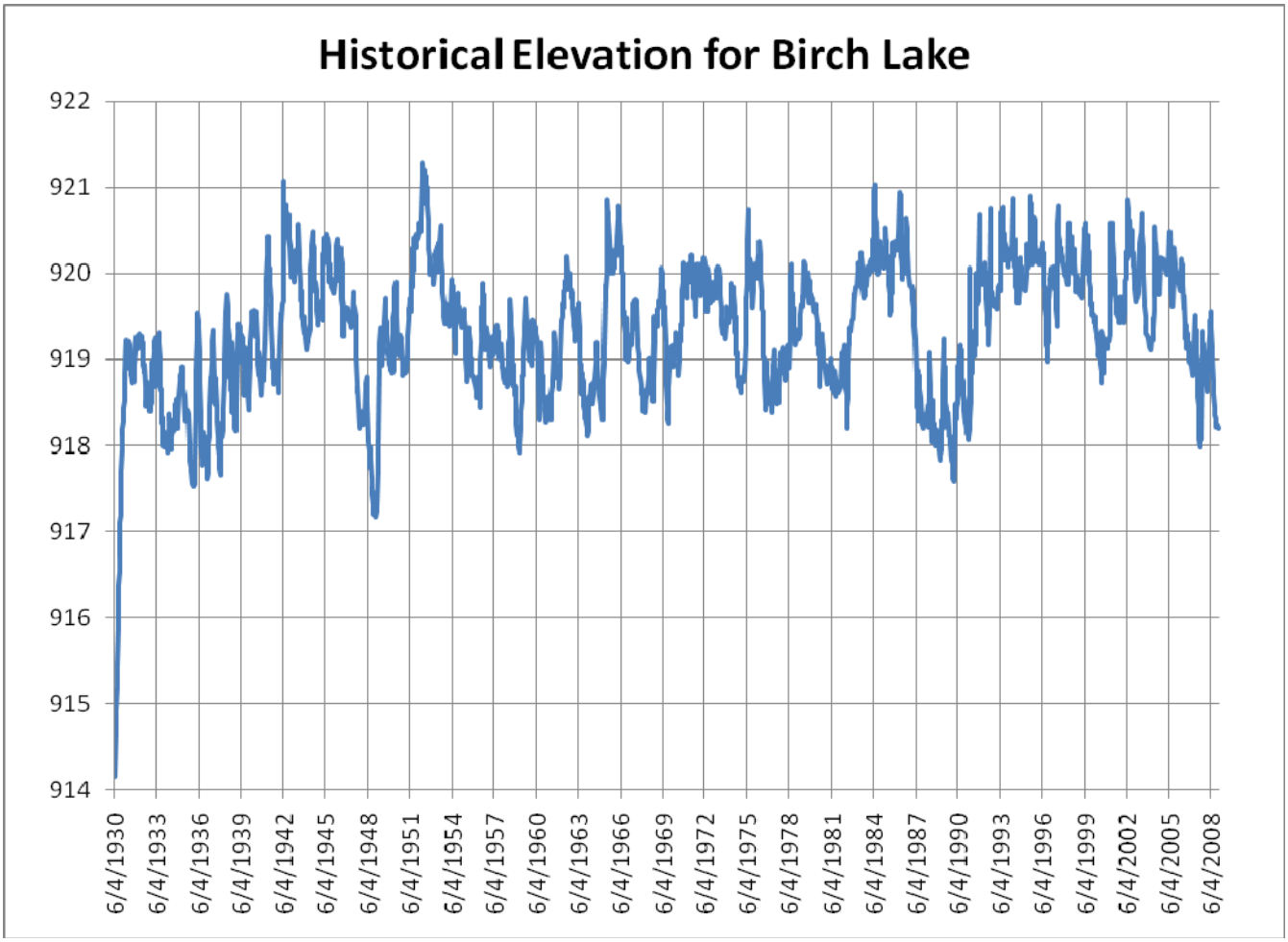
Water levels have fluctuated in Birch Lake since records were taken starting in June 1930 when the lake was dry. The highest recorded level was in 1952 when the lake was 7 feet deep. Recent water levels from 1999 through 2008 are shown in Figure 6. Birch Lake is approximately 2 feet below its historical average. There has been little rain over the last few years and a majority of lakes in the area are reporting lower than normal water levels. Having the lower water levels makes the appearance of vegetation more pronounced even though it is unlikely that the amount of vegetation in the water has increased. Higher water levels allows pondweed to lay down which would make it easier to harvest.

Figure 6: 10 year Hydrograph of Birch Lake



When looking at the lake level data from 1930 to present (Figure 7), there have been other times when the lake level was lower than it was in 2008. The lake was lower in the late 1930's, 1948-1949, 1959, and 1989 – 1990. Fluctuation in a lake is expected and if history proves correct, Birch Lake levels will once again rise to its historical average.

Figure 7: Elevation levels of Birch Lake from 1930 to present



C. Lake Water Quality Summary

The water quality of Birch Lake is surprisingly good, considering its proximity to two major roads and the urban development within its drainage area. Water quality data has been collected since 1997 and is shown in Table 3. Also included are the water quality results for samples taken every 2 weeks during the 2008 sampling season in Table 4. Overall, phosphorus and chlorophyll levels are low to moderate for a shallow lake in this ecoregion. Water transparency is very good. Secchi disc readings consistently reach the lake bottom. Birch Lake has the best water quality of all the lakes within VLAWMO.

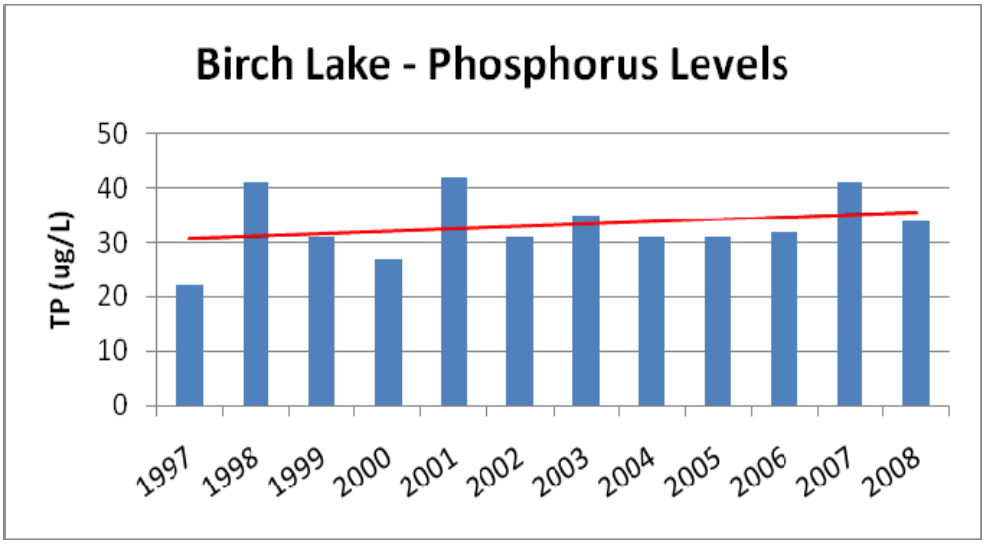
Table 3: Birch Lake Water Quality

	Total Phosphorus (ug/L)	Chlorophyll A (ug/L)
1997	22	14
1998	41	4
1999	31	8
2000	27	14
2001	42	8
2002	31	10
2003	35	13
2004	31	
2005	31	4
2006	32	3
2007	41	5
2008	34	5

Table 4: 2008 Water Quality Readings

	Total Phosphorus (ug/L)	Chlorophyll A (ug/L)
5/13/2008	23	3.5
5/27/2008	32	2.8
6/10/2008	29	1.6
6/24/2008	37	6.5
7/8/2008	23	3.5
7/22/2008	30	5.6
8/5/2008	56	9.2
8/19/2008	27	6.7
9/9/2008	29	4.3
9/23/2008	59	4.1
9/23/2008	37	2.2

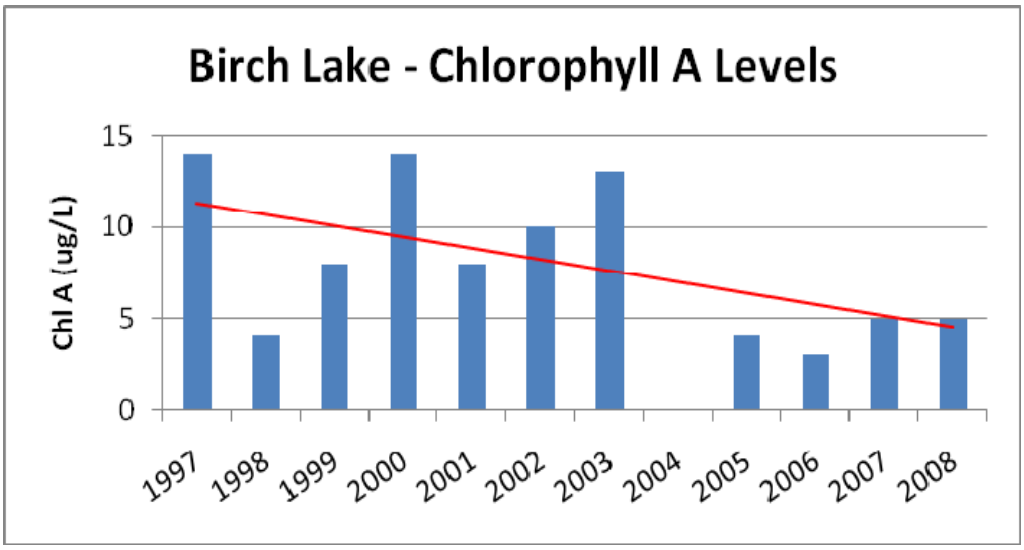
Figure 8: Graph of Historical Phosphorus Levels



Phosphorus is the primary cause of excessive plant and algae growth in lake systems. Phosphorus originates from a variety of sources, many of which are human related. Major sources include human and animal wastes, soil erosion, detergents, septic systems, and runoff from yards and streets. The standard level set by the Minnesota Pollution Control Agency (MPCA) is less than 60 ug/L. **Birch Lake currently meets the MPCA standards but it should be noted that the trend line is showing an increase in Phosphorus over time.** There should be proactive measures

taken now to slow down or stop this rise in Phosphorus. Reducing phosphorus loads into a lake requires incorporating buffers around the lake to prevent unnecessary runoff from lawns. Another method to reduce phosphorus loading is to treat stormwater before it enters the lake. As stated earlier in this report, VLAWMO will work with the City of White Bear Lake and Ramsey County to determine areas where stormwater pretreatment could occur.

Figure 9: Graph of Historical Chlorophyll A Levels



Chlorophyll A is a green pigment in algae. Measuring Chlorophyll A concentration gives an indication of how abundant algae are in a waterbody. The MPCA standard for Chlorophyll A is less than 20 ug/L. **Birch Lake is well below the limits set by the MPCA and is in fact showing a declining trend over time.** This can be attributed to the abundant vegetation in Birch Lake utilizing the phosphorus in the lake rather than it being available for algae growth. **This is another reason to make sure there are enough aquatic plants in Birch Lake to ensure this healthy balance.**

Little Birch Monitoring

VLAWMO began collecting samples on Little Birch in 2008 to determine if there two water bodies had significantly different water quality. Land is completely developed around Little Birch Lake and receives a lot of runoff from both Highway 96 and Gun Club Road. As stated earlier in the report, there is a culvert under Highway 96 between Birch and Little Birch, however it is unclear if the culvert is open and allowing water to flow between the two bodies. Little Birch Lake has an abundance of aquatic vegetation, just as Birch Lake. Based on the results from the 2008 samples, the two water bodies have very different water qualities.

Table 5: Monitoring results for Little Birch in 2008

Little Birch Lake 2008 TP/Chl A		
Date	TP (ug/L)	Chl A (ug/L)
7/8/2008	251	24.4
7/22/2008	125	34.4
8/5/2008	86	8.5
8/19/2008	72	15.7
9/9/2008	184	159.3
9/23/2008	82	4.3
2008 Avg	133	41.1

To visually compare the differences between Birch & Little Birch, look at the Figures 9 and 10.

Figure 10: Total Phosphorus comparison between Birch & Little Birch

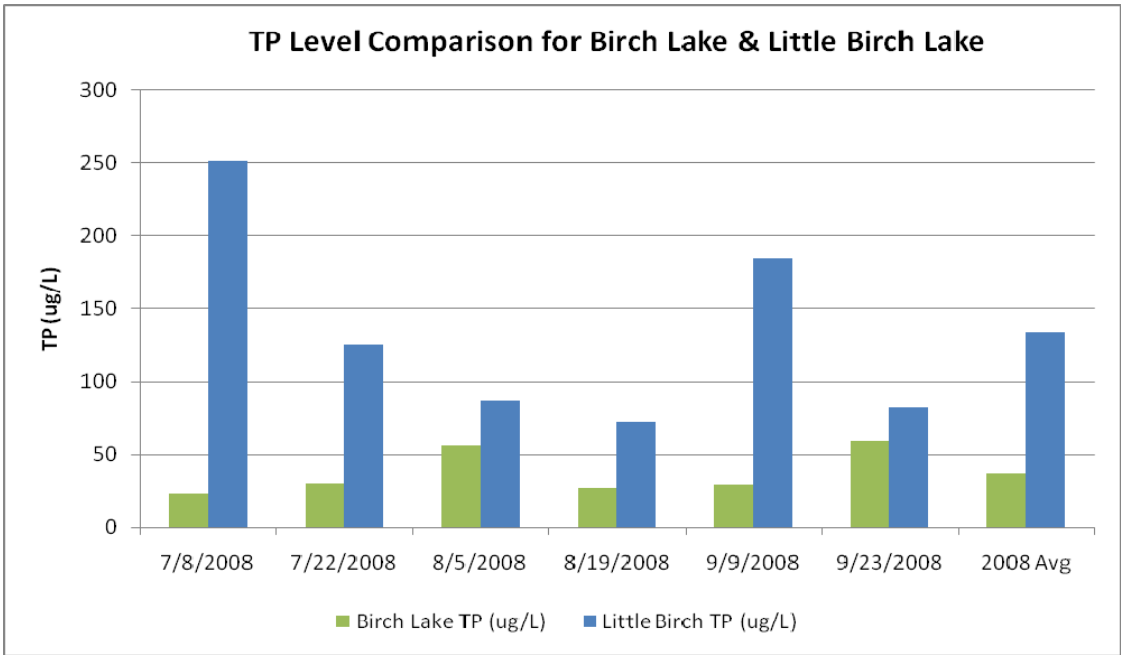
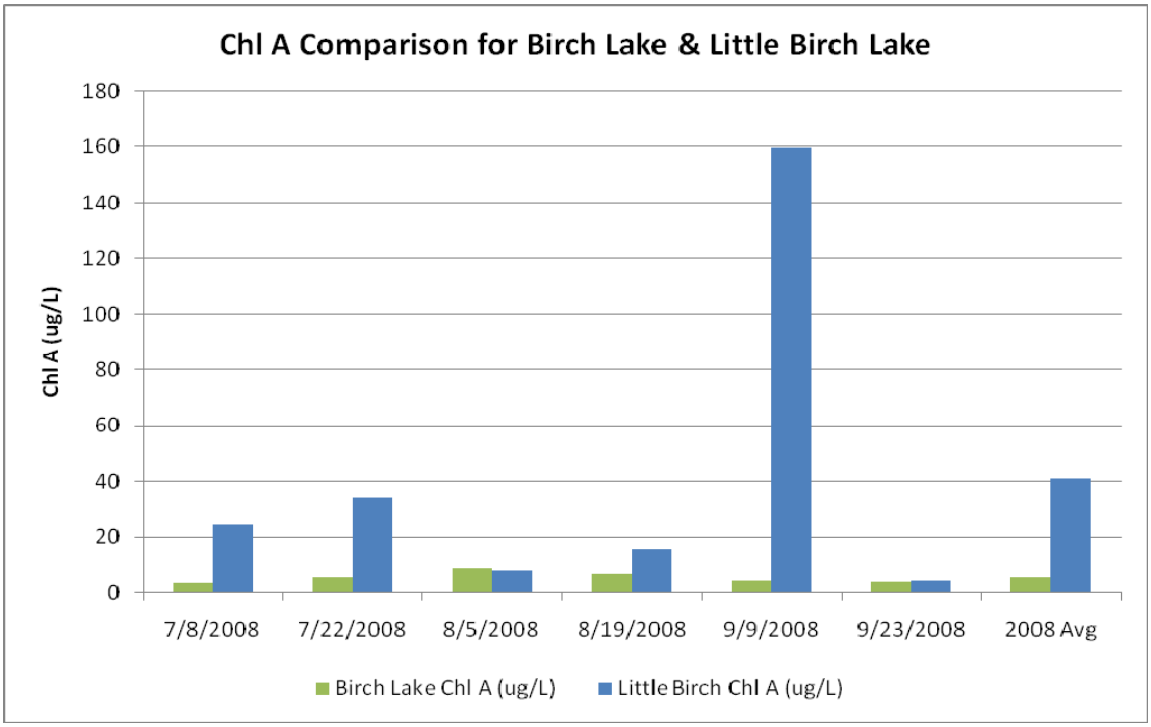


Figure 11: Chlorophyll A comparison between Birch & Little Birch



VLAWMO will continue to collect water samples in Little Birch in 2009 to see if the disparity continues.

Inlet Monitoring

Water enters Birch Lake through runoff and storm sewer inlets. There are 3 storm sewers that VLAWMO collected samples from in 2007 and 2008 in order to ascertain the levels of nutrients and sediment entering the lake. The results are shown in Table 5. Because our sample collection was dependent on storm events and due to the lack of rain in 2007 and 2008, there were only 4 samples collected and are therefore not statistically sound. VLAWMO will continue to collect samples at least through 2009 to compare with last year's data. Samples were tested for Total Phosphorus (TP), Nitrates (NO3N), and Total Suspended Solids (TSS). As stated previously, Phosphorus levels can increase from wastewater runoff. Nitrate levels measure the abundance of fertilizers used in the area. TSS measures how many particulates are in the water from dirt, sand, metals, or any other solid that may be in stormwater runoff.

Table 6: Birch Lake Runoff Water Quality

TP (ug/L)				
	3/14/2008	7/21/2008	9/24/2008	10/8/2008
Birch Lake - 4th St	539	464	199	160
Birch Lake - Birch Lk Blvd	248	90	38	33
Birch Lake - Bremer Bank	1200	288	95	85
NO3N (ug/L)				
	3/14/2008	7/21/2008	9/24/2008	10/8/2008
Birch Lake - 4th St	402	9	77	9
Birch Lake - Birch Lk Blvd	419	304	357	91
Birch Lake - Bremer Bank	338	268	77	279
TSS (mg/L)				
	3/14/2008	7/21/2008	9/24/2008	10/8/2008
Birch Lake - 4th St	38.3	21.1	8.6	4.1
Birch Lake - Birch Lk Blvd	69.3	40.7	0.4	1.6
Birch Lake - Bremer Bank	10.8	41.7	13.1	20.3

Based on the results shown in Table 7, the inlet at Birch Lake Blvd does a good job at reducing the amount of phosphorus entering the lake but is showing a high input of nitrates and suspended solids. The City of White Bear Lake installed a device at this storm sewer to intercept some of the runoff in order to lower the amount of nutrients entering the lake. VLAWMO will share these results with the City to gain their input as to how well the interceptor is working. Further data will also help determine how much nutrient input comes from these inlets.

Table 7: Storm sewer nutrient loads

	% TP load	% NO3N load	% TSS load
Birch Lake - 4th Street	44.3%	24.4%	27.9%
Birch Lake - Birch Lk Blvd	14.2%	44.1%	37.3%
Birch Lake - Bremer Bank	41.5%	31.5%	34.8%

D. Lake Sediments

A study of Birch Lake sediment was conducted on March 11, 2008 by Steve McComas, Blue Water Science and Kristine Lampert, VLAWMO. Birch Lake sediments have a high organic matter which is consistent with the soft mucky bottom that exists. There were a few sites with a higher sand content in the soil which correlated to nearby shoreline properties creating a "beach". Lake sediment phosphorus concentrations are relatively low which also supports the theory that the abundant vegetation is utilizing the phosphorus that enters the lake. The results also indicate that it is unlikely that Birch Lake will have nuisance problems with Eurasian water milfoil and Curlyleaf pondweed due the sediment characteristics. See Appendix A for the full report written by Steve McComas.

E. Aquatic Plant Status

Blue Water Science conducted an aquatic plant survey on Birch Lake in 2007. An early summer (June) and late summer (September) survey tracked the amount and location of aquatic plants. The most abundant plant in Birch Lake was fern pondweed, a native plant, and it was found at nearly every station that was surveyed. Eurasian watermilfoil and/or a possible hybrid of Eurasian watermilfoil was also found but was not at a nuisance level. The ongoing harvesting operation appears to manage the heavy growth of fern pondweed in Birch Lake. This is the recommended option. Herbicide controls could increase phosphorus levels and promote algae blooms. Spot treatment would be acceptable. See Appendix B for the full report written by Steve McComas.

Figure 12: A mechanical harvester used in Birch Lake

F. Fishery Status

Quantitative data on fisheries for Birch Lake was not found. If fish surveys have been conducted, they were done prior to the winter aeration installation and would not reflect existing conditions.

Qualitative data from anglers indicate there is a mix of northern pike and panfish in Birch Lake. There apparently are also bass and bluegills, along with sunfish and walleye. Because clarity is good, along with abundant vegetation, the fish community is probably not dominated by bottom-feeding fish but rather has balanced conditions with a mix of predator fish and forage fish. A survey could be conducted by the MN Department of Natural Resources or through a company such as Blue Water Science to assess the fish within Birch Lake.

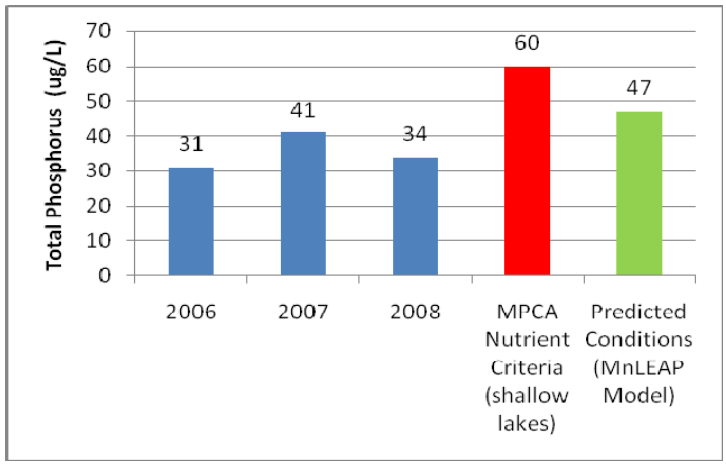
4. Setting Water Quality Goals for Birch Lake

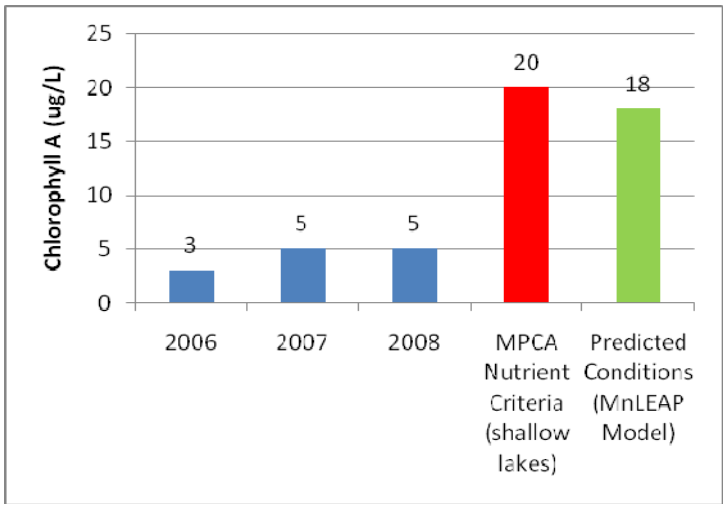
Birch Lake has good water quality and is considered to be in "protection" status. The water quality is within the MPCA nutrient criteria for shallow lakes and is better than predicted by the MN Leap modeling program for lakes within this ecoregion.

Table 8: Water Quality Overview for Birch Lake

	Total Phosphorus (ug/L)	Chlorophyll A (ug/L)	Secchi disc (m)
Existing Conditions			
2006	31	3	1.4
2007	41	5	1.3
2008	34	5	1.4
MPCA Nutrient Criteria (shallow lakes)	60	20	1.1
Predicted Conditions (MnLEAP Model)	47	18	1.4

Figure 12: Existing water quality conditions, MPCA nutrient criteria, and MnLEAP model predictions





5. Lake Management Plan for Protecting the Lake Environment

As stated previously in this report, Birch Lake's water quality is very good and is considered to be in a "protection" status. This means that actions should be taken that keep the water quality in its current state. Additionally, the homeowner's survey indicates a strong concern regarding the amount of aquatic vegetation and how it inhibits recreational use and enjoyment of the lake. Actions could be taken to improve recreation but consideration must be taken so that the water quality is not endangered.

The table below lists various action items that will expand on the current knowledge of the lake and watershed, protect the current water quality levels, and enhance the lake's recreational aspects. The table also lists who the lead for each item could be as well as a cost range for each item.

Table 9: Action List for Birch Lake

Action Item	Description	Leader	Cost Estimate $ = <$1000 $$ = $1000-$2500 $$$ = $2500-$5000 $$$$ = >$5000
Continued Lake Monitoring	Continue current monitoring program of twice monthly lake sampling to measure nutrient levels, dissolved oxygen and temperature levels, and inlet monitoring.	VLAWMO	$
Enhanced Monitoring	Check dissolved oxygen in Birch Lake every two weeks in January, February, and March depending on winter conditions.	VLAWMO	$
Increased Monitoring on Little Birch	Collect water samples at least monthly in addition to dissolved oxygen and temperature data.	VLAWMO	$
Aquatic Plant Surveys	Aquatic plant surveys (every 2 years) as recommended by Steve McComas, Blue Water Science	BLID & VLAWMO	$$$
Fish Survey	Document the type and amount of fish in Birch Lake.	BLID & VLAWMO	$$$
Wildlife Survey	Birch Lake homeowners assign 2 or more residents to do daily tracking of bird and wildlife seen in and around the lake.	BLID	$
Reduce Phosphorus (P) Levels at Lake Inlets	Work with the City of White Bear Lake to determine how to reduce P levels and implementation of those mechanisms.	VLAWMO	$$$ - $$$$
Evaluate Purple Loosestrife Control	Collect information about past methods, evaluate current purple loosestrife levels, and determine if changes need to be made.	VLAWMO	$
Continued Aquatic Plant Harvest Program	Continue to harvest aquatic plants throughout the season in order to allow for more recreation. Harvest no more than 40% of the plants in	BLID	$$$$

	order to maintain water quality (as per Steve McComas)		
Shoreline Restoration Project on North Side of Birch Lake	Partner with BLID, VLAWMO and City of White Bear Lake to stabilize the shoreline on the northwestern side of the lake.	VLAWMO	$$$$
Shoreline Restoration for Individual Homeowners	Hold a Shoreline Restoration Workshop for Birch Lake homeowners with a goal of increasing natural shoreline by 5% annually to reach a 75% natural shoreline	VLAWMO	$
Education Efforts – newsletter	Continue production of newsletter, include information about shallow lake ecology as well as specifics for Birch Lake.	BLID	$
Education Efforts - internet	Continue the BLID blog.	BLID	$

As stated in the introduction of this report, partnership is vital to achieving our goals in this watershed. VLAWMO will continue to work with the BLID, Ramsey County, and the City of White Bear Lake to move forward with the action items listed in the SLMP with the goal of protecting Birch Lake's water quality. Birch Lake is a wonderful natural resource and with continued good stewardship, it will remain that way for generations to come.

Appendix A

Predicting Curlyleaf Pondweed and Eurasian Watermilfoil Growth Based on Birch Lake Sediment Characteristics

2008

Appendix B

Aquatic Plant Survey for Birch Lake, Ramsey County, Minnesota, 2007

Prepared for:
Birch Lake Improvement District

Prepared by:
Steve McComas and
Jo Stuckert
Blue Water Science

Appendix C

Shoreland Inventory of Birch Lake
Ramsey County, Minnesota
2007

Appendix D

Shallow Lakes
Hope for Minnesota's Waters

Minnesota Department of Natural Resources