VLAWMO

VADNAIS LAKE AREA WATER MANAGEMENT ORGANIZATION

Sustainable Lake Management Plan
Birch Lake, Ramsey County, MN

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March 2020

VADNAIS LAKE AREA WATER MANAGEMENT ORGANIZATION SUSTAINABLE LAKE MANAGEMENT PLAN – BIRCH LAKE MARCH 2020

SLMP Update: The Birch Lake SLMP was originally prepared in 2009 by VLAWMO and Blue Water Science. Numerous surveys have been completed since that time. This SLMP includes prior data and incorporates new data collected since the last SLMP was completed. With data through time, we are able to look at trends in water quality and vegetation in this lake. We are also able to make new plans going forward to build on work that has been completed.

Our mission at VLAWMO is to protect and enhance water resources in the watershed through water quality monitoring, wetland protection, and water quality improvement projects. The cornerstone of our success is our partnerships. We appreciate all of our partners' work and assistance to help us fulfill our mission.

Figure 1: Original Birch Lake SLMP Image (2009).

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VLAWMO
Vadnais Lake Area
Water Management Organization

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1 INTRODUCTION

1.1 INTRODUCTION

Birch Lake is located in the City of White Bear Lake, Ramsey County, and is in the Vadnais Lake Area Watershed. Birch Lake is a shallow lake with a maximum depth of 7.4 feet. The 125-acre lake has clear water and abundant aquatic vegetation. The lake receives input from the surrounding 575-acre subcatchment (subwatershed). Birch Lake has excellent water quality. It is the highest quality lake in the Vadnais Lake Area Watershed. It is classified as mesotrophic according to the TSI (Trophic State Index, MPCA). Birch Lake receives chloride from nearby roads and neighborhoods and nutrients from developed areas. The lake receives inflow from its surrounding subcatchment, and outflows in the north of the lake through the Rotary Park stream. The stream connects with North Oaks Chain of Lakes and eventually flows into East Vadnais Lake.

Birch Lake has been targeted for a number of habitat and structural improvements to protect water quality. Shoreline restoration areas are abundant, neighbors have used VLAWMO cost-share funds to add raingardens and other native vegetation to their yards, and an iron-enhanced sand filter will be constructed during summer 2020 with Watershed-based Funding from the Board of Water and Soil Resources. Service-learning students worked with VLAWMO during 2019 to remove buckthorn on a parcel adjacent to the future site of the filter. As a result of that invasive species control effort, VLAWMO and the City of White Bear Lake were able to work together on a Conservation Partners Legacy grant through MN DNR. That was funded and completed in 2020. Maintenance and continued restoration of the site will be ongoing to prevent recolonization of buckthorn and optimize filter function.

The Birch Lake Improvement District (BLID) is active in protecting this lake. The BLID partners with VLAWMO to fund additional water quality monitoring (e.g., chlorides). They also conduct vegetation harvest in the lake, permitted through MN DNR. One of the major actions of the BLID was to purchase a lake harvester, which they use to keep open areas for recreation. Recent vegetation surveys show that invasive Eurasian watermilfoil has expanded. VLAWMO would like to increase involvement with the BLID to strategically harvest vegetation and limit invasive species spread. The BLID has also worked with VLAWMO to do fish stocking, although no efforts are currently underway. Many studies, including in-lake and shoreline vegetation, fish, sediment, and bathymetry have been conducted on this lake. All of those studies are available on the VLAWMO website -> Birch Lake.

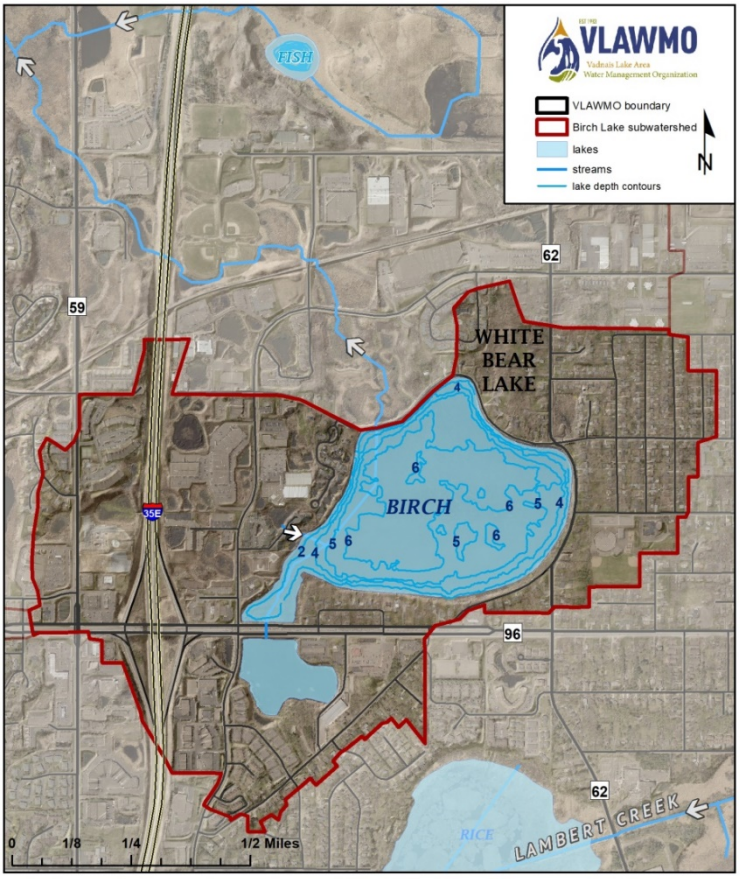


Figure 2: Birch Lake and Subcatchment Area.

2 WATERSHED FEATURES

2.1 AERIAL PHOTO HISTORY

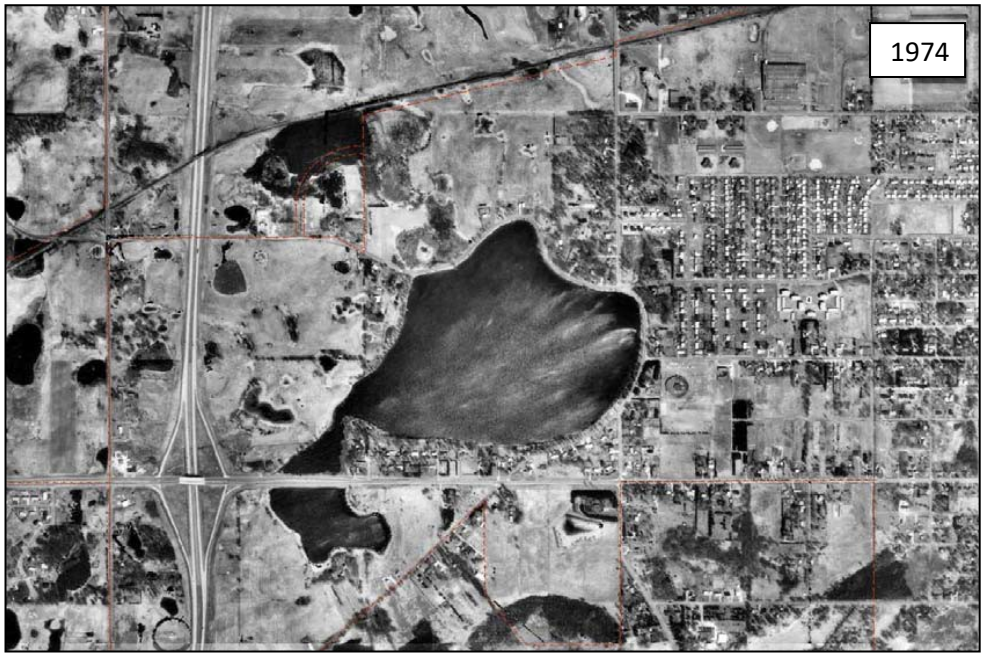
Figure 3: 1940 aerial photo of Birch Lake

In 1940, aerial photos from Ramsey County show that the land surrounding Birch Lake was largely agricultural, and the road that is now Highway 96 was in place to the south of Birch Lake.

Figure 4: 1953 aerial photo of Birch Lake

By 1953, residential development is present around the lake. Vegetation is less dense on the surface water area on either side of Highway 96.

Figure 5: 1974 aerial photo of Birch Lake



By 1974, Interstate 35E is in place, and development east of Birch Lake has increased.

Figure 6: 1985 aerial photo of Birch Lake

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

Figure 7: 2006 aerial photo of Birch Lake

The 2006 aerial photo shows that commercial development has been built west and south of the lake along with townhome developments on the sides to the west and north. White Bear Parkway has been extended to cross Highway 96. It cuts through a portion of the southern basin of Birch Lake (colloquially known as Little Birch).

2 WATERSHED FEATURES

Figure 1: 2011 aerial photo of Birch Lake

In 2011, little has changed since 2006 at this scale.

2 WATERSHED FEATURES

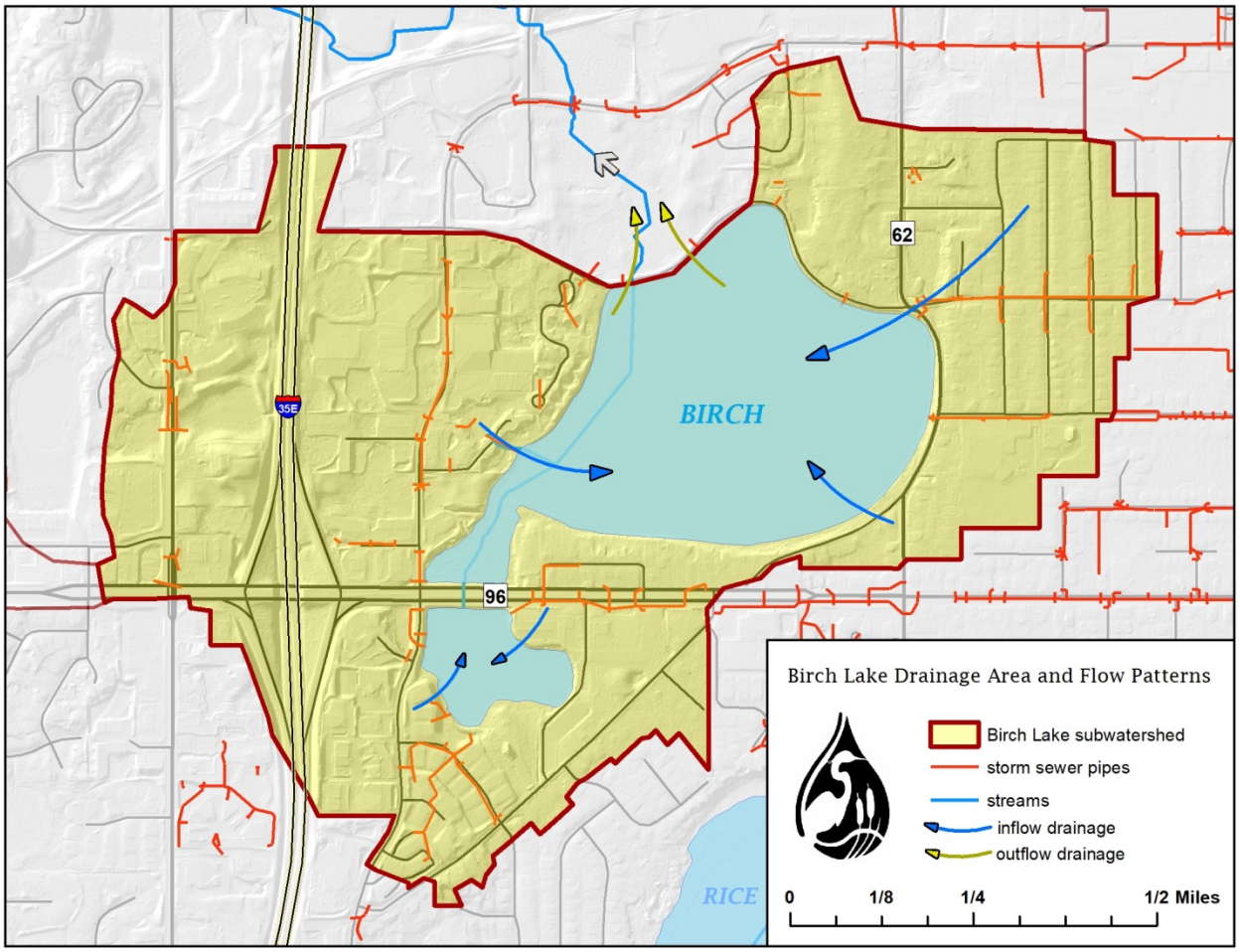
Figure 2: 2018 aerial photo of Birch Lake

In 2018, little has changed since 2011, though several small residential lots have been developed near the Lake in recent years. An iron-enhanced sand filter will be constructed on the northeast corner of the Lake in 2020 to treat roughly 50 acres of stormwater input into Birch Lake. Note that additional years of aerials are available on the VLAWMO GIS Map, linked on the website under Resources.

2.2 BIRCH LAKE DRAINAGE AREA

The drainage area (shaded area in Figure 2) into Birch Lake is approximately 575 acres and is about 5 times larger than the surface area of Birch Lake, which is 125 acres. This is a relatively small drainage area to Birch Lake. Lakes with a small drainage area (less than 10:1 ratio) tend to have better water quality.

Figure 10: Birch Lake Drainage Area and Flow Patterns



In 2007 and 2008, VLAWMO collected water samples from 3 areas around the lake where stormwater drains enters the lake to track the levels of nutrients and sediment. Results are shown in Table 1.

Table 1: Birch Lake Runoff Water Quality

	Avg TP		Avg NO_3N		Avg TSS		Avg VSS	
Birch Lake - 4th St	0.282	44.2%	0.165	24.4%	12.7	27.9%	5.7	28.1%
Birch Lake - Birch Lk Blvd	0.091	14.2%	0.298	44.1%	17.0	37.3%	7.8	38.4%
Birch Lake - Bremer Bank	0.265	41.5%	0.213	31.5%	15.9	34.9%	6.8	33.5%

Figure 11: Impervious Surfaces in the Birch Lake Drainage

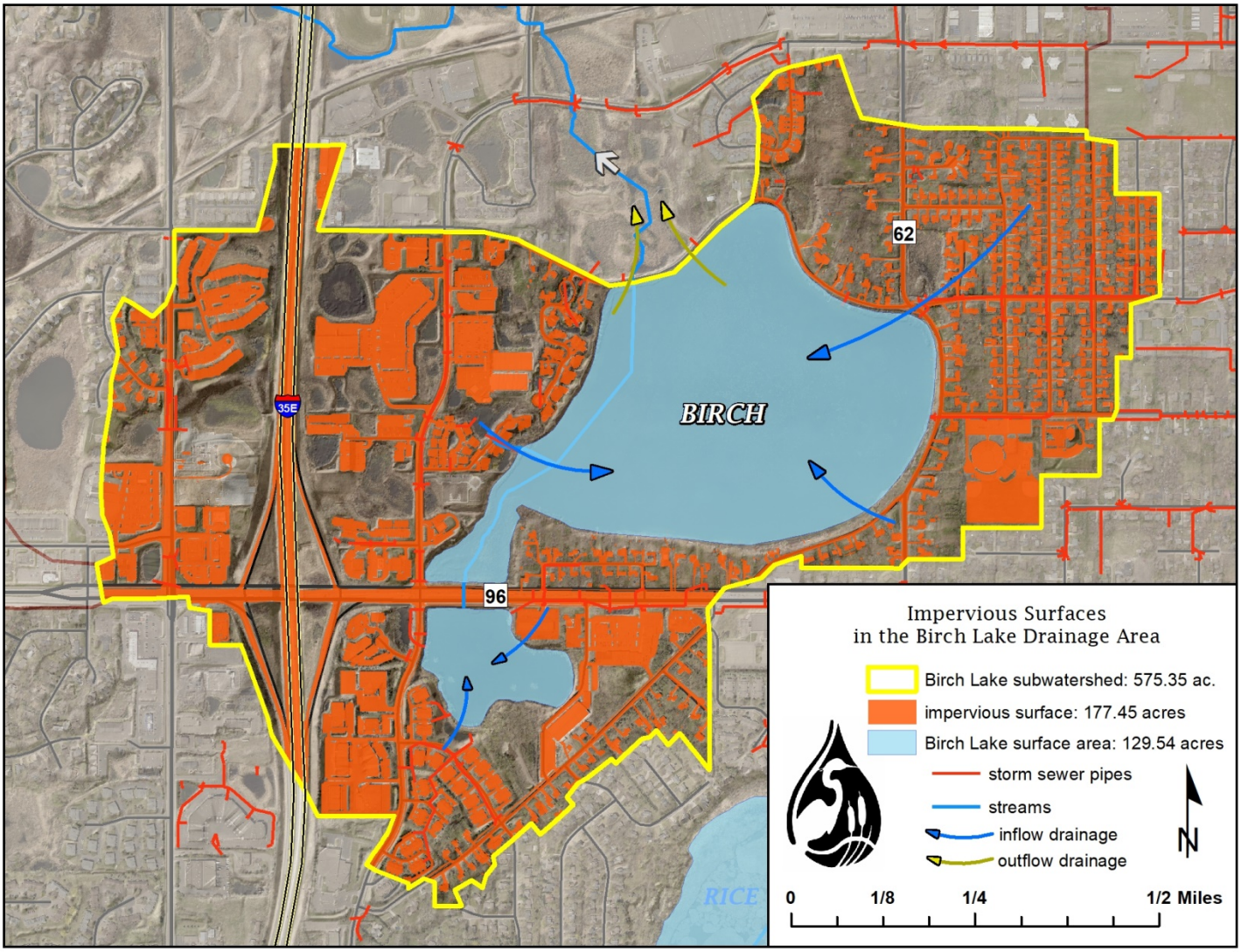
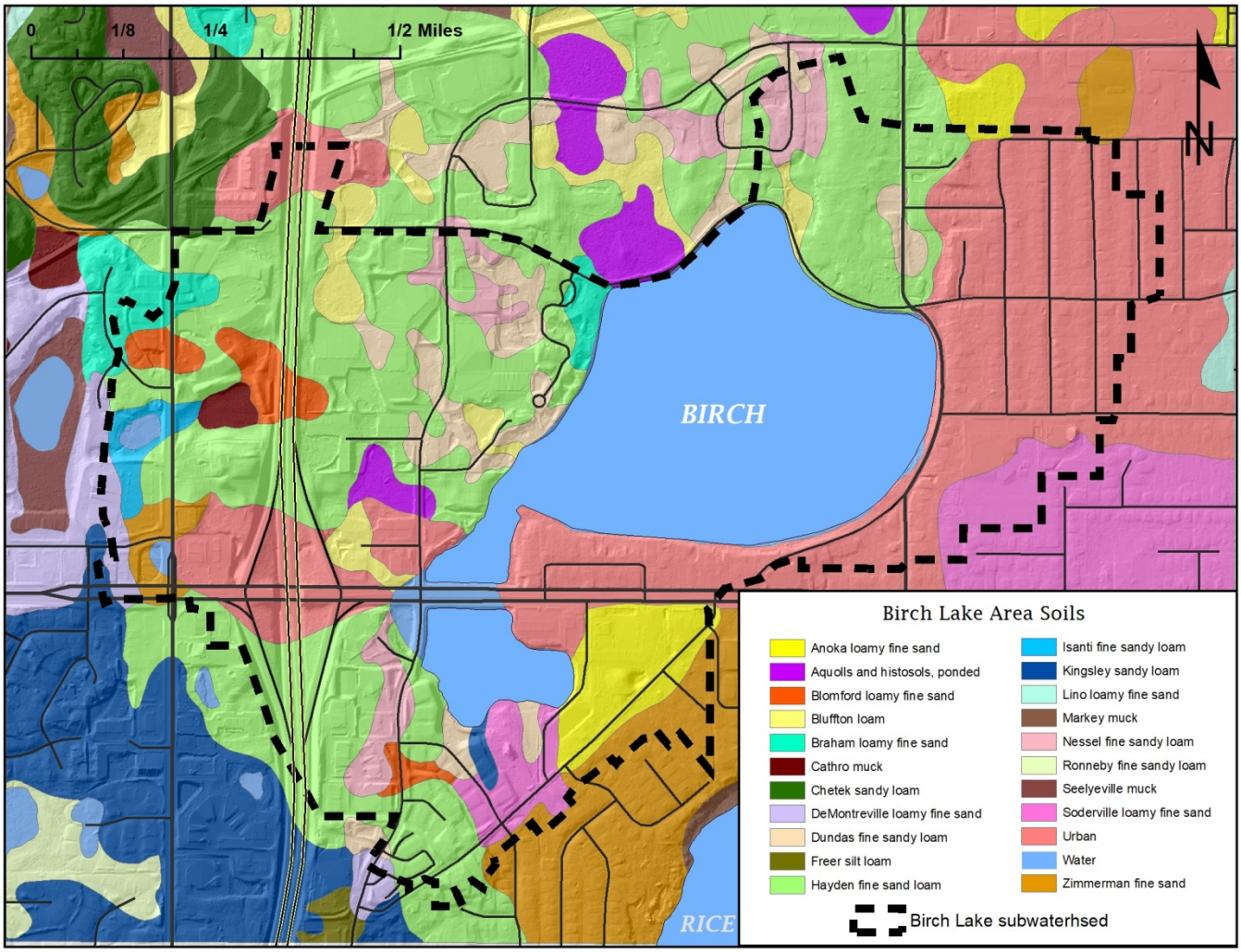


Figure 11 shows that a large amount of land cover in the Birch Lake Subwatershed is developed, and consists primarily of impervious surface (30.8% of total land cover, including water surface area and undeveloped surface area; not including Birch Lake's surface water area, impervious surface is 39.8% of the total land cover.). The majority of precipitation that falls on those surfaces moves rapidly into downstream lakes, wetlands, and streams.

2.3 BIRCH LAKE SOILS

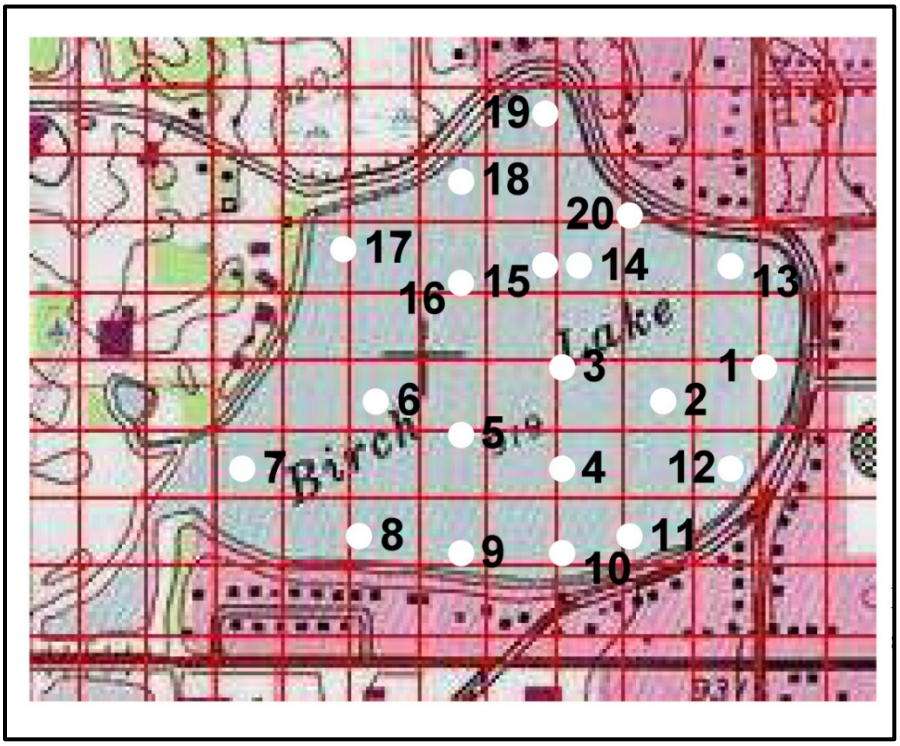
Soils in the Birch Lake Subwatershed are dominated by Hayden fine sandy loam and Urban Land-Zimmerman Complex. Both soils are good for building and residential development. These soils tend to be well drained, allowing water to infiltrate. With development, much of the soil has been compacted, moved, and paved over. Retrofits such as raingardens are especially effective in these soil types and have been added over time.

Figure 12: Birch Lake Area Soils



Soils in Birch Lake sediments have also been analyzed. A sediment study in the lake was conducted in 2008 to inform the Aquatic Invasive Species Action Plan that was completed in 2015. The lake sediment study was conducted with uniform sampling of the lake area. A total of 20 samples were collected and analyzed.

Figure 13: Birch Lake Sediment Sampling



A total of 15 parameters were analyzed for each sediment sample (see full list in the report included on the VLAWMO website -> Birch Lake). Lake sediments overall are soft and mucky. Typically high organic matter content is associated with the soft mucky sediments sample sites. Lake sediment phosphorus concentrations at all sites were low.

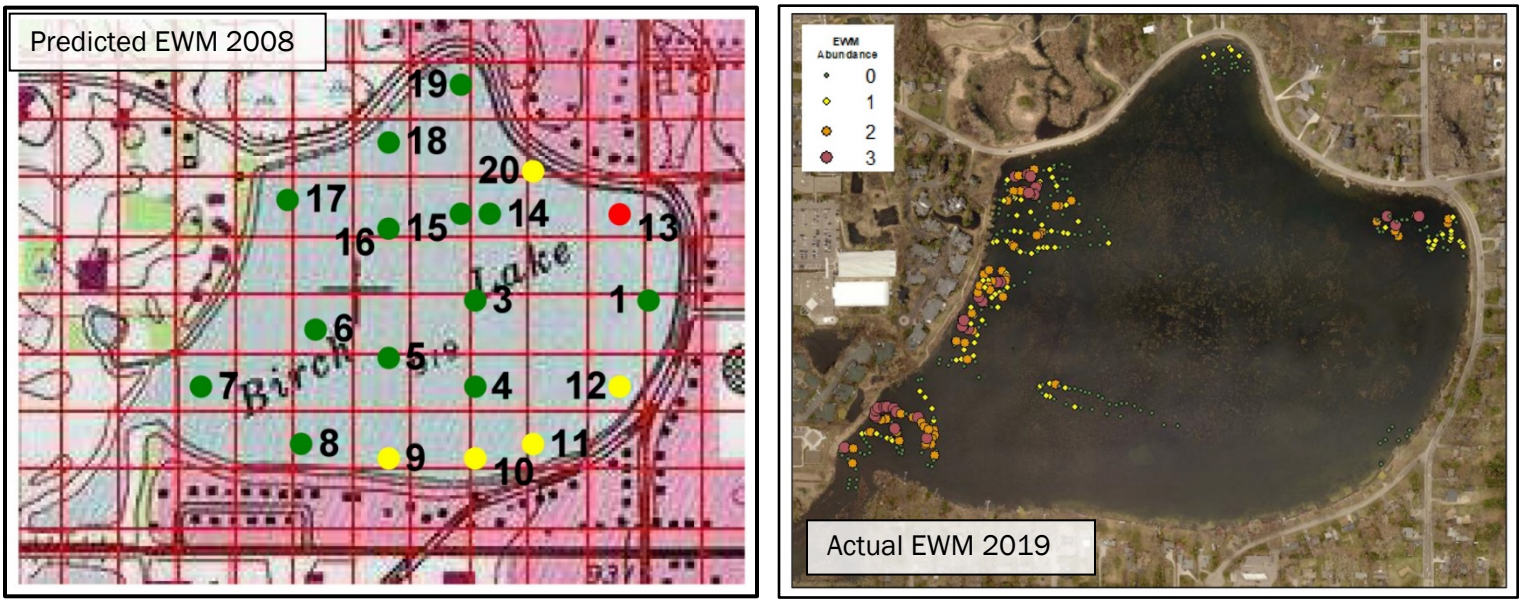
Lake Sediments and Invasive Aquatic Plants

Lake sediment sampling results from 2008 were used to predict lake bottom areas with the potential to support nuisance (invasive) Curlyleaf pondweed growth. Based on sediment parameters of pH, sediment bulk density, organic matter, and the Fe:Mn ratio (McComas, unpublished), the predicted growth characteristics of Curlyleaf pondweed was investigated. Curlyleaf pondweed growth was not predicted to produce nuisance growth (where plants top out in a solid canopy) in Birch Lake, based on the low sediment pH and high Fe:Mn ratio.

2 WATERSHED FEATURES

Lake sediment sampling results were also used to predict lake bottom areas with the potential to support nuisance Eurasian watermilfoil (EWM) growth. EWM was first documented in Birch Lake in 2005. Based on the key sediment parameters of NH_4 and organic matter (McComas, unpublished), the predicted growth characteristics of EWM were investigated and predicted. Sediment nitrogen conditions in Birch Lake are relatively high. However, because organic matter content is very high, nuisance milfoil growth was predicted to be rare. EWM may grow widely through Birch Lake, but it was not expected to produce extensive perennial nuisance matting conditions. Ramsey County Soil and Water Conservation Division conducted an aquatic vegetation survey and EWM delineation in 2019, so we are able to compare predicted versus actual growth of this invasive species. EWM has spread since 2008. Predicted areas for colonization of EWM do not closely match with actual colonization that has occurred over time.

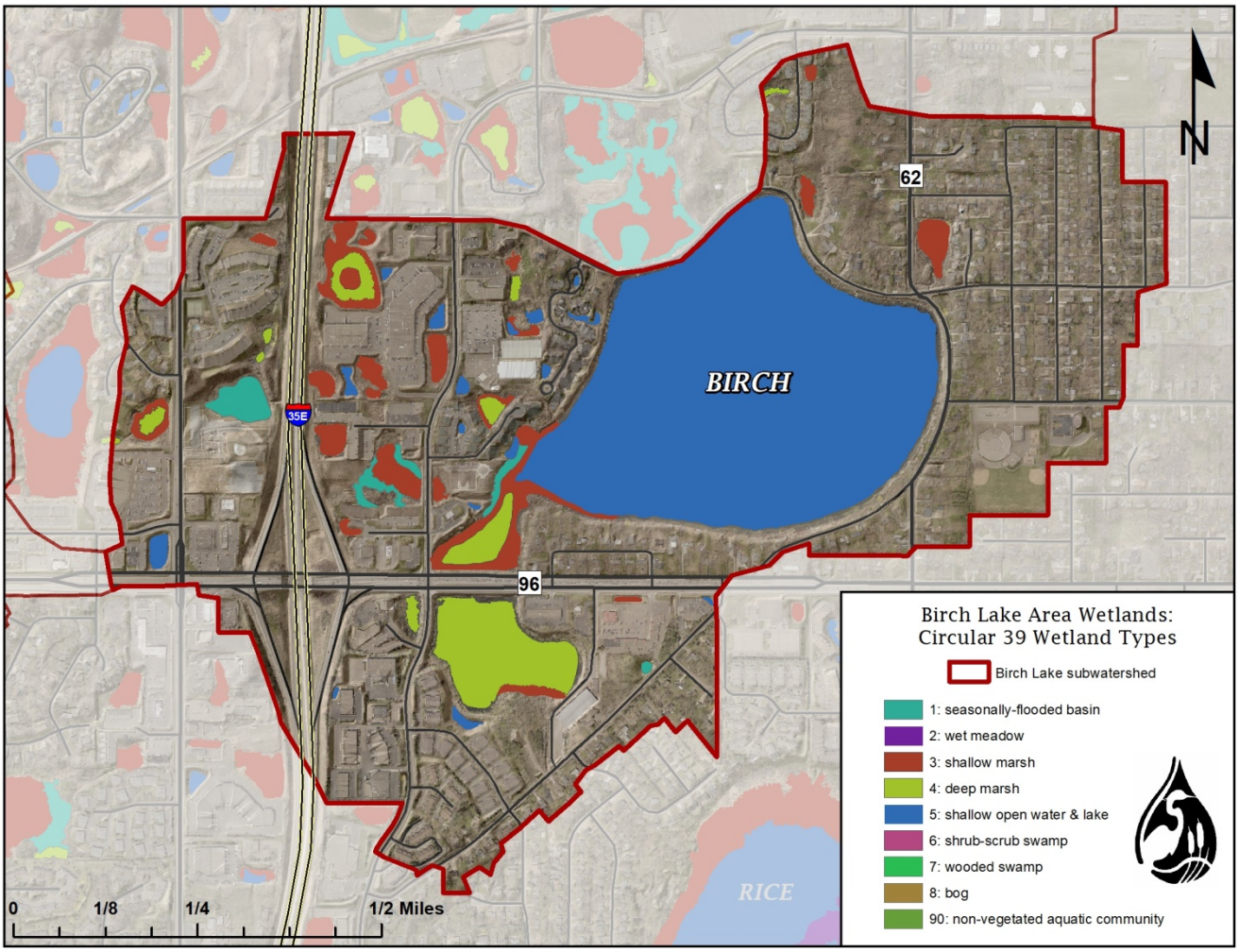
Figure 14: Birch Lake Predicted EWM Growth (2008). Green = low, Yellow = medium, and Red = high predicted coverage by EWM versus Actual Colonization (2019)



2.4 BIRCH LAKE WETLANDS

There are 40 delineated wetlands in the Birch Lake subwatershed totaling 46.6 acres or 8% of the watershed area, also considered "ponded" area. Ideally, a watershed should have at least 5% of the area ponded, so the subwatershed area of Birch Lake meets this criterion. The western third of the subwatershed contains the majority of the wetland area, and was also the last area to be developed. For new development or redevelopment, the creation of storm water mitigation or wetland area is advised, and in some cases is mandatory, according to Wetland Conservation Act (WCA) rules and/or the VLAWMO Water Management Policy.

Figure 15: Birch Lake Circular 39 Wetland Types

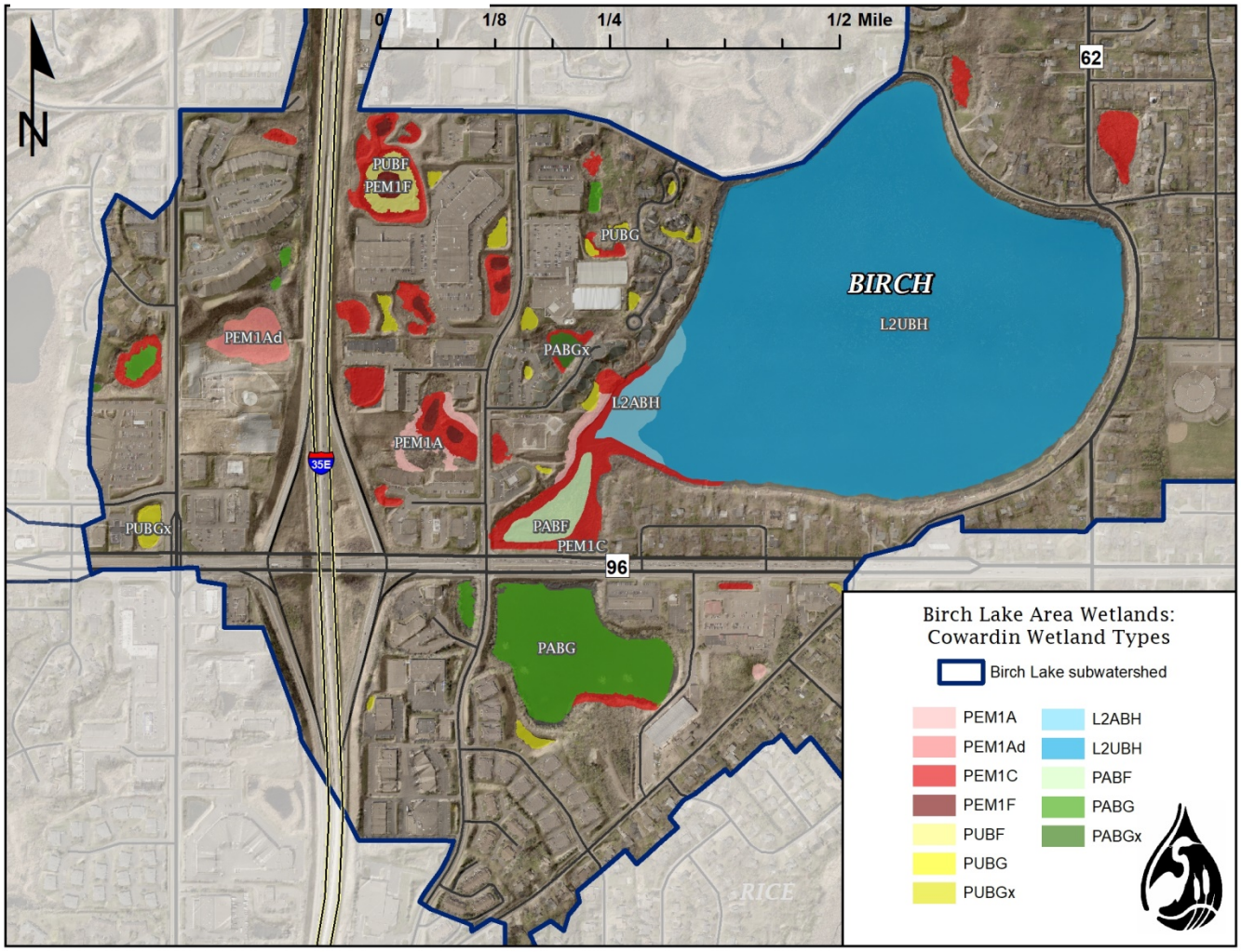


As Classified by the Circular 39 wetland classification system, the southwest bay of the Birch Lake and the lobe south of Highway 96 (South Birch) have mixed classification of deep and shallow marsh, while the greater area of Birch Lake is classified as shallow open water or lake, as the majority of the lake's perimeter is surrounded by residential development. The southwest corner of the Lake exhibits the most shallow wetland characteristics with predominantly emergent vegetation, and the western shore has the most lightly-developed or altered shoreline habitat.

2 WATERSHED FEATURES

Within the US Fish & Wildlife Service's National Wetland Inventory (Cowardin Classification System), there are three predominant classifications around Birch Lake that are non-Lacustrine (lake): PEM1C, PABF, and PABG, which correspond to Shallow and Deep Marsh wetlands (Figure 16). PEM1C refers to palustrine, emergent, persistent marshes that are seasonally flooded (1C), whereas PABF is identified as a palustrine, aquatic bed, semi-permanently flooded. PEM1C surrounds the southwestern shoreline and PABF encompasses the middle of the southwest bay. PABG is identified as being palustrine, aquatic bed, and intermittently- exposed, and is identified as nearly the entire South Birch basin. These areas within the Birch Lake basin and along the shoreline add up to 19.8 acres.

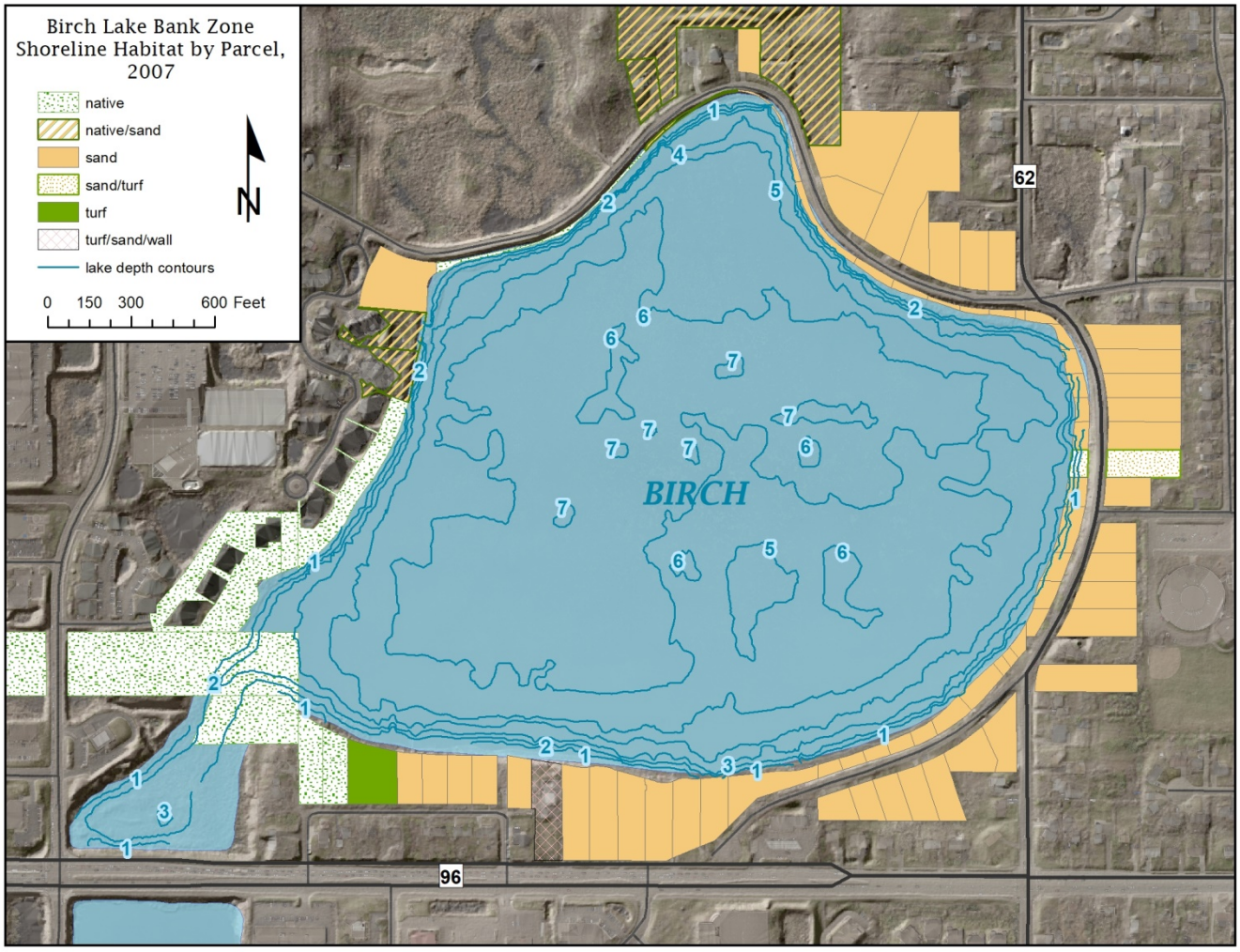
Figure 16: Birch Lake Cowardin Wetland Types



2.5 BIRCH LAKE SHORELINE VEGETATION

A shoreline survey was conducted by VLAWMO and Ramsey Conservation District (RCD) staff in 2007 (The report was published in 2008). Sixty parcels were evaluated for this effort. Based on our subjective criteria, approximately half of the sites were mostly natural or naturalized, while the other half of parcels were cleared to the shore. There were no signs of major erosion problems. Thirty parcels were deemed to have high potential for shoreline restoration. 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 project. Grants and design assistance are available through VLAWMO and the Ramsey Soil & Water Conservation Division to help homeowners with these projects.

Figure 17: Birch Lake Bank Zone Shoreline Habitat by Parcel



A 25-50 foot buffer of natural vegetation that extends both onto land and into water and covers at least 75% of a property's frontage is ideal for the a lake ecosystem. Twenty-five percent of the lake frontage can be mowed and/or used as a beach area. For some people, this requires a change in their idea of what a nice shoreline looks like. Reestablishing natural conditions improves water quality by limiting the amount of

stormwater runoff, reducing the amount of lawn fertilizer that would wash into the lake. Native prairie grasses, shrubs, or other perennials are deep-rooted and hold a shoreline in place. Naturalized plantings also discourage nuisance wildlife and waterfowl such as Canada geese and muskrats while attracting desirable ones such as loons, otters, frogs, hummingbirds, and ducks.

These issues were identified in 2007. Although shoreline restoration has been conducted and maintained with the City of White Bear Lake, there are still large areas that are mowed to the shoreline. Additional restoration and minimizing clearing remains a recommendation for Birch Lake.

Table 2: Birch Lake Shoreline Inventory Summary

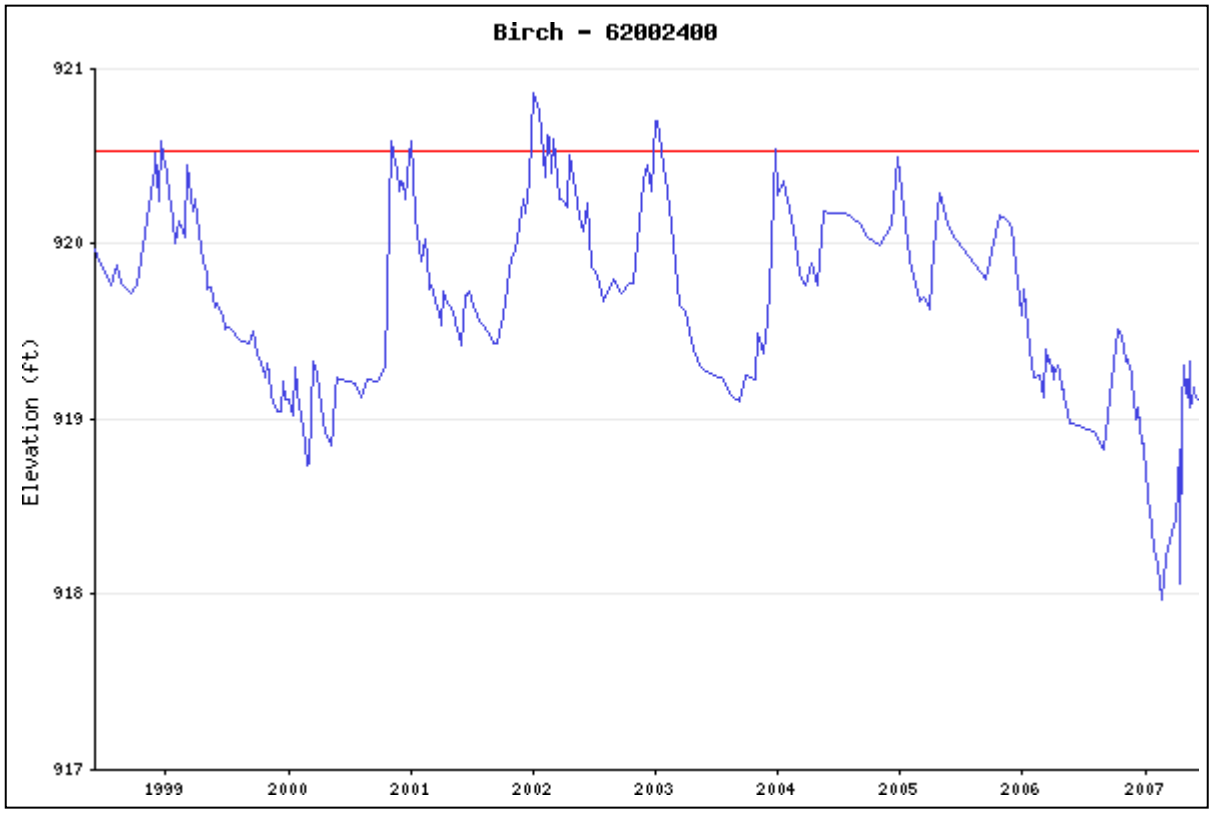
Shoreline Material %		
Grass	42.50%	Approximately half of the parcels are grass all the way to the shore; the other half is mainly woody and natural vegetation.
Rip Rap	1%	
Woody Vegetation	53.50%	
Retaining Wall	1%	
Sand	2%	
Shoreline Conditions		
0-25% Natural	28 (45.16%)	Approximately half of the 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 18: Example of a Birch Lake shoreline parcel. This parcel was rated as having good natural conditions.

2.6 BIRCH 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. Water levels from 1998 through 2007 are shown in Figure 19. Birch Lake was approximately 2 feet below its historical average when the original SLMP was developed in 2007. After an especially wet period in 2018-2019, the maximum lake depth exceeded 1952 levels and was 7.4 feet deep. This shows that lakes are dynamic systems that vary over time.

Figure 19: 10-year Hydrograph of Birch Lake



When looking at the lake level data from 1930 to present, there have been other times when the lake level was lower than it was in 2007. The lake was lower in the late 1930s, 1948–1949, 1959, and 1989–1990. In 2007, it was predicted that Birch Lake levels would once again rise to its historical average. That has indeed occurred. As of, 2019, the lake was 7.4 feet deep.

3.1 BIRCH LAKE DEPTH

A bathymetry survey was completed by Ramsey County Soil and Water Conservation Division on April 16, 2019, to develop a map of the bottom of Birch Lake and determine depths. The survey was conducted early (about 1-week post ice out) to capture depths before aquatic vegetation became too thick. Thick vegetation could register as lake bottom and give erroneously shallow readings. Birch Lake has a maximum depth of 7.4 feet. It follows a typical lake bottom shape, with shallower areas along the outer areas and deeper sections towards the middle. Birch Lake has small pockets that are 7-feet deep in the middle of the lake.

Figure 20: Birch Lake Depth with 1-foot Contours

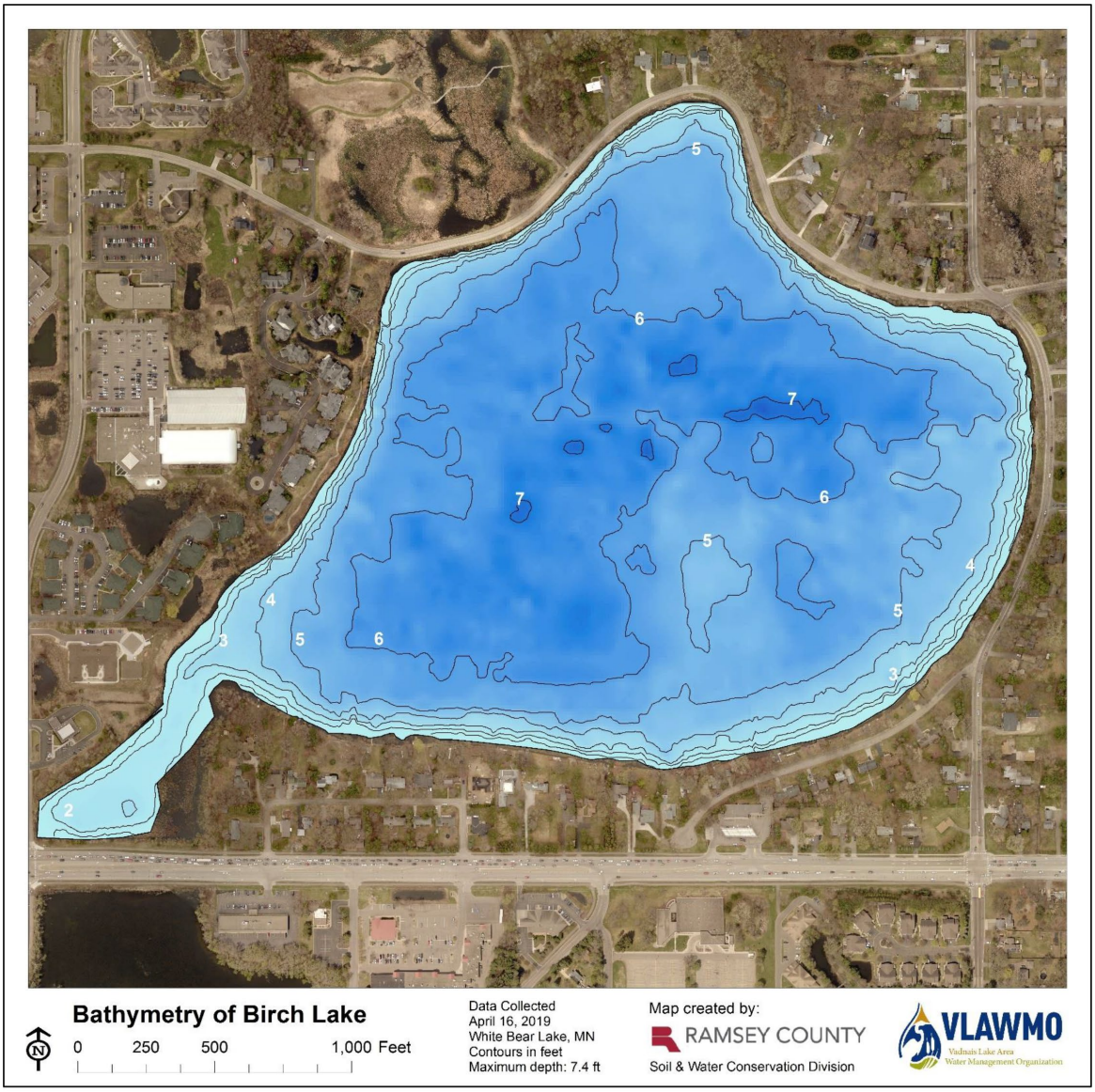


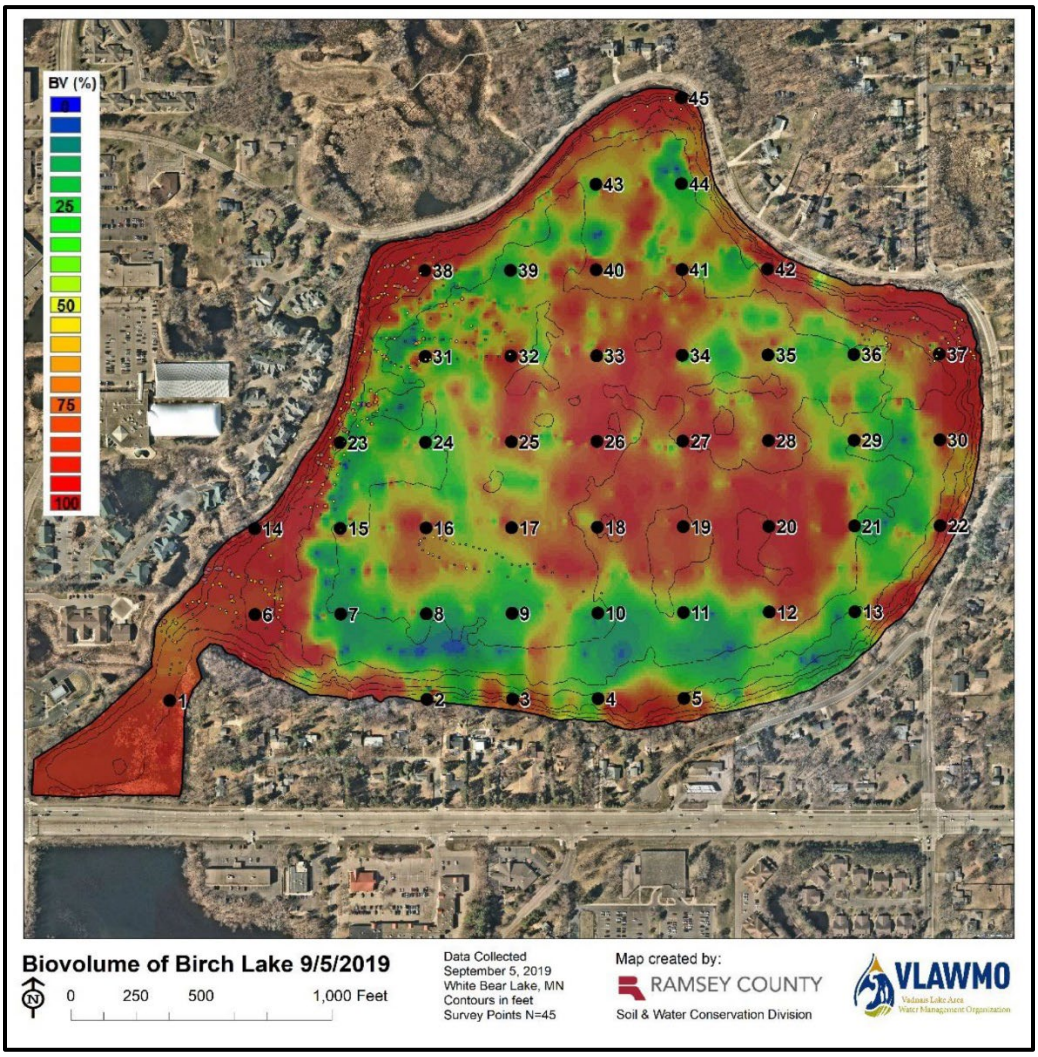
Figure 3. Depth of Birch Lake with 1-ft contours

3.2 BIRCH LAKE BIOVOLUME AND AQUATIC VEGETATION

Biovolume

Ramsey Soil and Water Conservation Division conducted a biovolume and aquatic vegetation survey on September 5, 2019. Biovolume measures the density of plant life within the lake. Blue signifies 0% plant life, and red signifies 100% plant life. At depths greater than 4-6 feet, there is commonly no plant life in Minnesota lakes. Plant growth is limited because the sun does not penetrate the water column below those depths enough to allow photosynthesis to occur. Birch Lake has abundant plant life throughout the lake, even in its deepest pockets (Figure 21).

Figure 21: Birch Lake Biovolume



Aquatic Vegetation

Blue Water Science conducted previous vegetation surveys (2007, 2013, and 2015). Ramsey County Soil and Water Conservation Division (RCSWCD) conducted the most recent vegetation survey (September 2019). Because of previous efforts, we can look at vegetation trends through time and see that the extent of Eurasian watermilfoil (EWM) has expanded. Because of suspected expansion of this invasive species, RCSWCD included a delineation for EWM in 2019.

In 2007, early summer and fall surveys were completed. In early summer, there was 100% coverage of the lake with aquatic plants. The most abundant plant in Birch Lake was Fern pondweed. It was found at 96% of the 54 stations. Overall aquatic plants grew to a depth of 5 feet in 2007. Eurasian watermilfoil (EWM) was found at 2 sites and a possible hybrid milfoil was found at 16 additional sites. In fall, the dominant plant species was also Fern pondweed. EWM was documented in this late summer survey. Overall, aquatic plants grew out to a depth of 5 feet, and were found throughout the entire lake. Species documented through these surveys are shown in the table below.

Table 3: Aquatic Plant Survey Results from 2007

Common Name	Scientific Name	Percent Occurrence		Native to MN?
		Summer	Fall	
Olney's Three-square Bulrush	*Scirpus americanus*	2%	2%	Yes
Arrowhead	*Saggitaria spp.*	4%	0%	Yes
Watershield	*Brasenia scheberi*	4%	4%	Yes
Spatterdock	*Nuphar variegatum*	15%	2%	Yes
White Water Lily	*Nymphaea odorata*	2%	2%	Yes
Chara	*Chara spp.*	13%	0%	Yes
Needle Spikerush	*Eleocharis acicularis*	2%	0%	Yes
Canada Waterweed	*Elodea canadensis*	26%	6%	Yes
Filamentous Algae	*Spirogyra/Cladophora sp*	6%	0%	Yes
Northern Watermilfoil	*Myriophyllum sibiricum*	2%	0%	Yes
Hybrid and Eurasian Watermilfoil	*Myriophyllum spicatum (EU)*	34%	34%	No
Large-leaf Pondweed	*Potamogeton amplifolius*	31%	43%	Yes
Illinois Pondweed	*Potamogeton illinoensis*	2%	0%	Yes
Fern Pondweed	*Potamogeton robinsii*	96%	100%	Yes
Coontail	*Ceratophyllum demersum*	0%	2%	Yes
Naiad	*Naias spp.*	0%	2%	Yes
Water Celery	*Vallisneria Americana*	0%	26%	Yes

In 2013, 1 aquatic plant point-intercept survey was conducted. The September 5, 2013 survey was done to characterize the aquatic plants community of Birch Lake. Fern pondweed was again the dominant plant and was found at 26 out of 45 sample sites (58% of the sites). Plants grew out to about 6 feet of water, which was also about the deepest depth in the lake.

The aquatic plant community in 2013 had 10 species of submerged plants in late summer (See full report on VLAWMO's website -> Birch Lake). This is a good plant diversity condition. Eurasian watermilfoil was the only non-native plant present. EWM covers about 8 acres in late summer but was found to have mostly light growth. EWM control was not deemed necessary at this time by Blue Water Science.

Figure 22: Birch Lake Vegetation Sampling Locations 2013

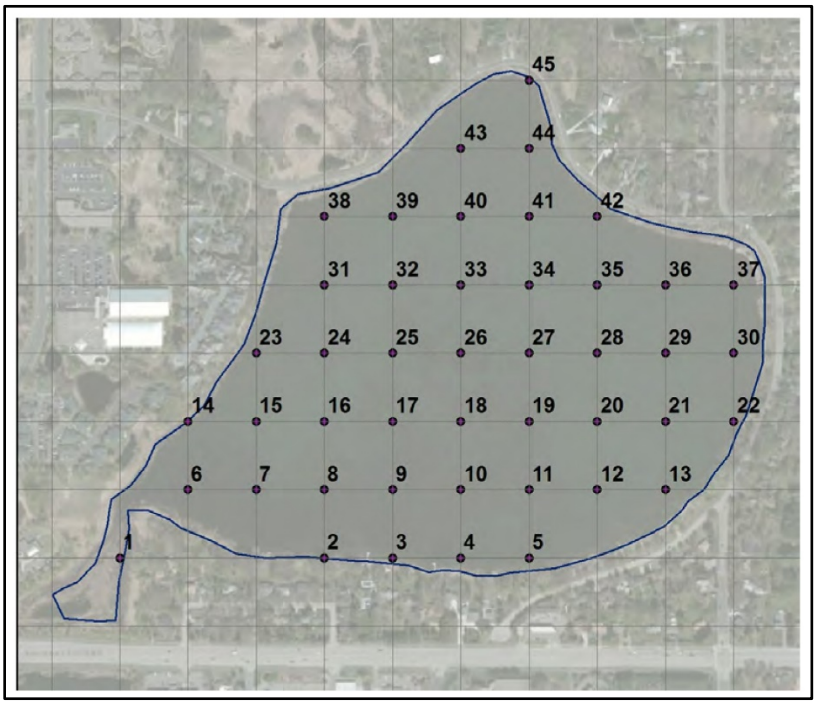


Figure 23 : Birch Lake Native Plant and EWM Locations 2013

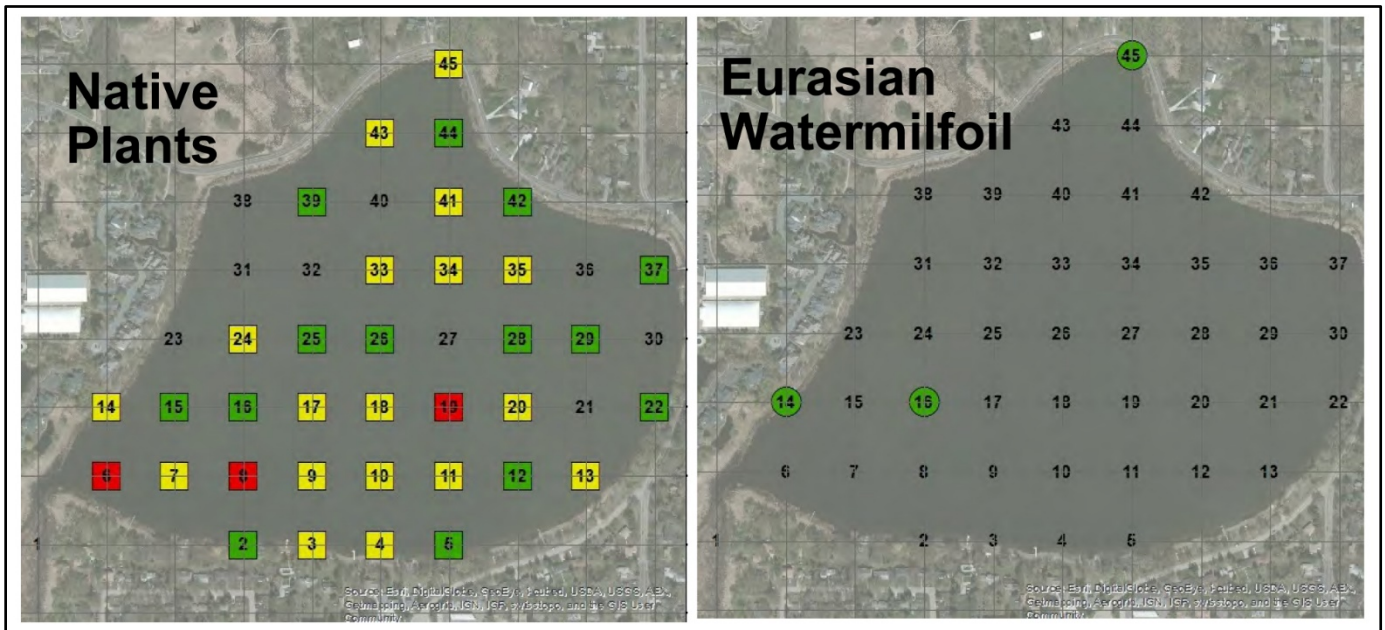
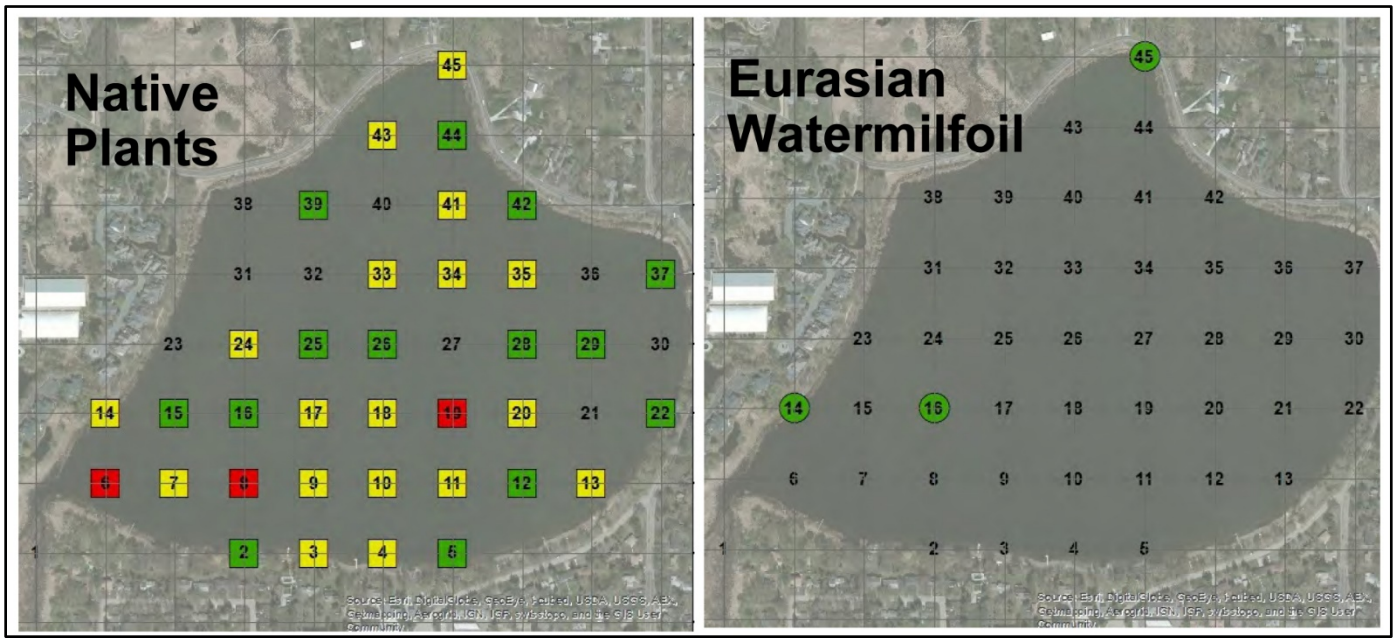


Figure 4. Aquatic plant coverage maps for September 5, 2013.
[top] Native plant coverage was about 95 acres.
[bottom] Eurasian watermilfoil, a non-native species, coverage was about 8 acres.

In 2015, aquatic plants in Birch Lake were checked at 13 points on September 8, 2015 using the same sites that were sampled in 2013. Results of the 2015 plant check indicated that aquatic plants were similar in abundance compared to the 2013 survey. In 2015, Fern pondweed and Water celery were the dominant plants, which was also the case in 2013. The plant community in Birch Lake in 2015 was similar to conditions in 2013. In 2013, the lake was about 1 foot lower in depth, and plants may have been closer to the surface. Plant distribution and coverage indicated that the lake remained in a healthy condition.

Figure 24: Birch Lake Native Plant and EWM Locations 2015



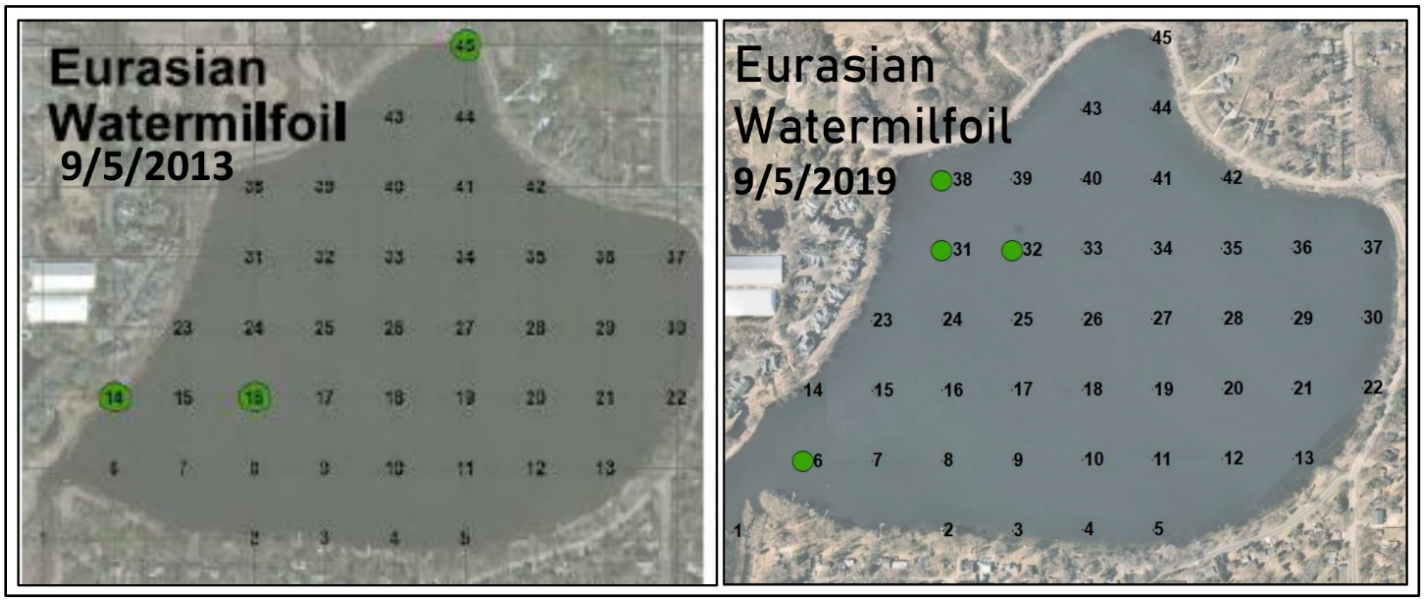
In 2019, 45 points were surveyed, replicating the study design of previous vegetation efforts. Aquatic macrophytes were found at all 45 points. 25 total macrophyte species were identified, 11 of which occurred at more than one point and 3 of which (Flat-stem Pondweed, Watermeal, and Northern Watermilfoil) were observed between designated points. The previous survey of 45 points in 2013 identified 12 species, all of which were detected in the 2019 survey, although Flat-stem pondweed, which had been found in four points in 2013, was only observed between points in 2019. The most prevalent species were Fern Pondweed (Potamogeton robbinsii) and Large-leaf Pondweed (Potamogeton amplifolius), both above 50% occurrence. Water Celery (Vallisneria americana) and Canada Waterweed (Elodea canadensis) were also prevalent at 29% and 27% occurrence, respectively. Present between 7% and 18% occurrence in the lake were Coontail (Ceratophyllum demersum), Slender Naiad (Najas flexilis), Eurasian Watermilfoil (Myriophyllum spicatum), Small Pondweed (Potamogeton pusillus), White Water Lily (Nymphaea odorata), Filamentous Algae (Spirogyra sp./Cladophora), and Muskgrass (Chara). Remaining species were found at one point only in the survey. The secchi disk reading was limited due to the shallowness of the lake. The disk was visible resting at the bottom at 6 ft, and so the official reading was not taken – the measurement was thus greater than 6 feet (or greater than 1.8 meters). Water temperature was 69.5 degrees. For full distribution information, refer the the report posted on the VLAWMO website -> Birch Lake.

This vegetation survey was conducted in anticipation of updating the SLMP and to observe if Eurasian watermilfoil was expanding in extent in the lake.

The aquatic invasive species Eurasian watermilfoil (*Myriophyllum spicatum*) was detected in previous surveys of Birch Lake. To inform future management efforts of this species, a delineation of the species's current extent was conducted. Native Northern Watermilfoil (Myriophyllum sibiricum) was also detected in the lake, and it is suspected that hybrid watermilfoil (M. spicatum x M. sibiricum) is also present due to the collection of samples with traits of both species. For the purposes of delineation, hybrid watermilfoil was included, as it is also considered invasive.

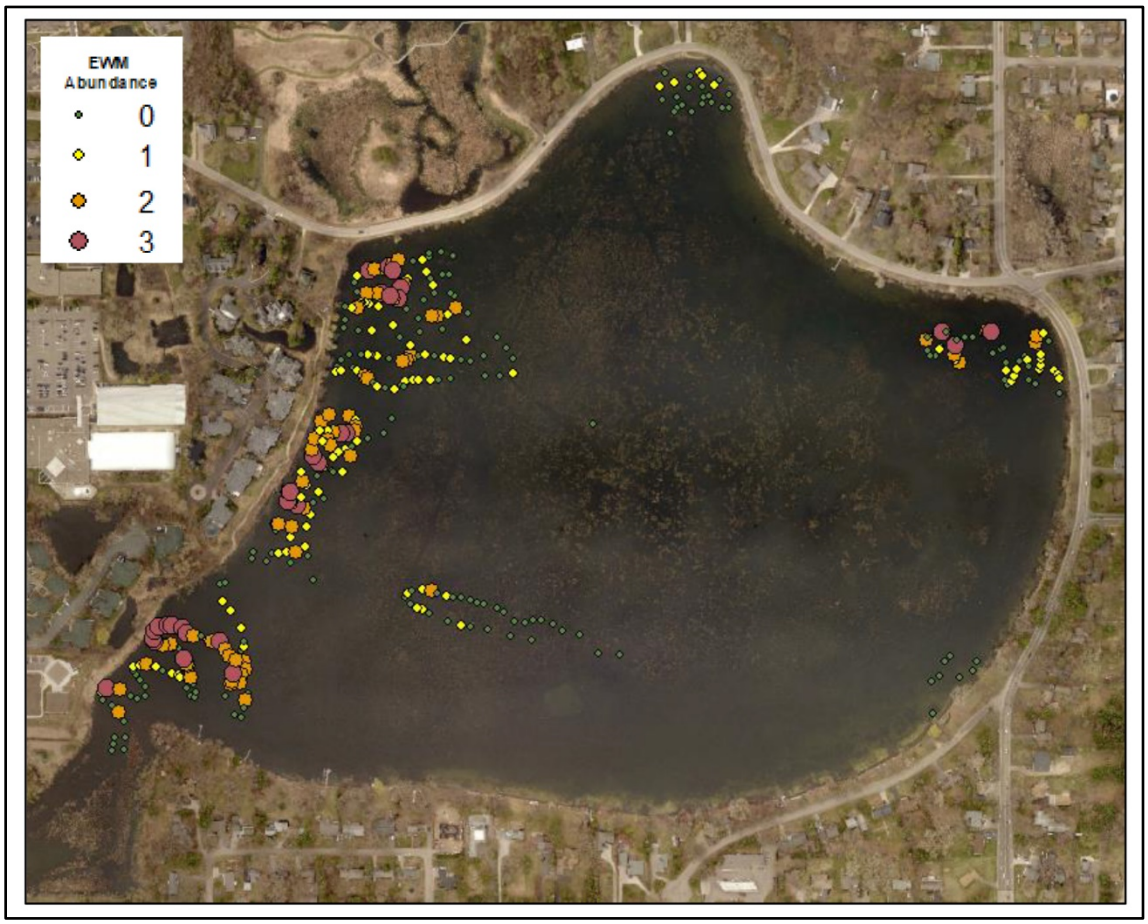
The first step of the delineation was the 2019 point intercept survey, in which field staff noted the locations of all points throughout the lake where Eurasian watermilfoil was found, as well as areas between points where it was detected. Next, staff returned to each location where it had been found to conduct a more in-depth vegetation survey in the interest of quantifying the present extent of Eurasian watermilfoil.
Figures show the sections of Birch Lake where Eurasian watermilfoil had been detected in the 2013 survey (points 14, 16, and 45) as well as where it had been observed in the 2019 survey (points 6, 31, 32, 38). The northeast was also re-visited due to an EWM sighting between points 36 and 37 on 9/5/2019.

Figure 25: Birch Lake Native Plant and EWM Locations 2015 compared to 2019



Consistent with the MNDNR's manual *Guidance for Delineating Invasive Aquatic Plants for Management*, the target areas were transected in a zig-zag pattern while staff took GPS points to note observation locations and results. Observation points are indicated in the figure below for each target area identified.

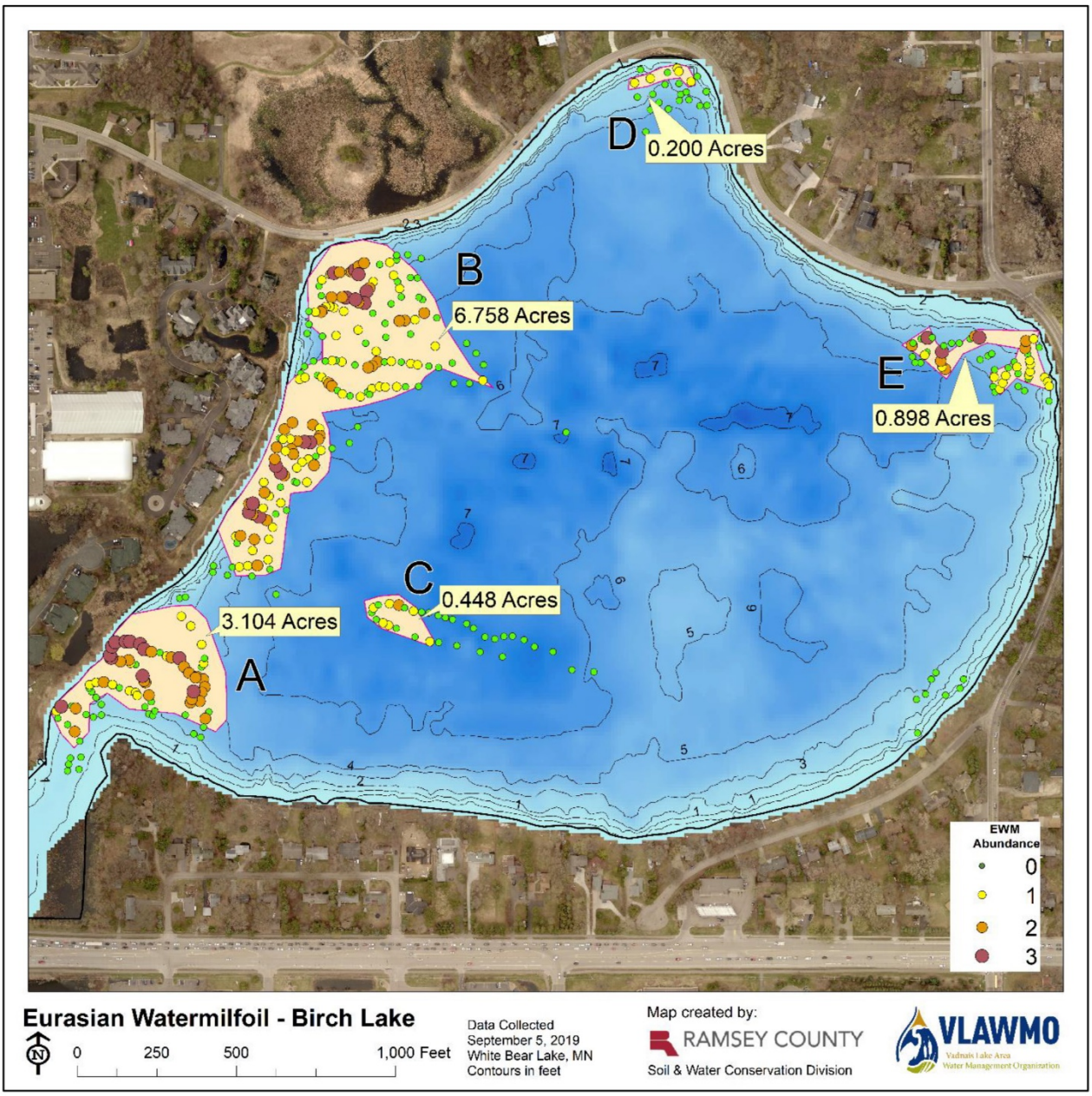
Figure 26: Birch Lake EWM Delineation 2019



Eurasian watermilfoil is widespread in Birch Lake, primarily along the western shoreline and the northeast corner of the lake. Due to the shallow littoral nature of Birch Lake, EWM is not restricted to the shore areas, although it is currently most prevalent in the 3-5 foot depth range. **Total acreage for Eurasian watermilfoil is about 11.4 acres, a rise from the 8 acres found in the 2013 survey.**

This is a 42.5% increase in EWM on Birch Lake.

Figure 27: Birch Lake EWM Extent in 2019. Total coverage is 11.4 acres.



3.3 FISH SURVEYS AND WILDLIFE MONITORING

Fish Surveys

Fish surveys were conducted partly to investigate the effectiveness of previous stocking efforts. Fish have been stocked in Birch Lake, in coordination with MN DNR.

Table 4: Birch Lake Fish Stocking Compared to 2011 Trapnet Captures.

	Largemouth Bass	Walleye	Yellow Perch	Crappie	Bluegill
April 2007	700 (4-7")	300 (3")			
April 2010	500 (4-7")	500 (4-7")	75 (2-3")		
July 2011	1,000 (3-5")		800 (3-4")	300 (4-7")	800 (3-5")
Fish Survey Results (Fish/trapnet) (August 2011)	1.0	0	0	0.6	15

Fish surveys were conducted on Birch Lake in August 2011 and September 2014. Full results of those surveys can be found on the VLAWMO website under Birch Lake.

In 2011, 6 standard trapnets were used to sample fish diversity for 2 days, for a total of 12 lifts. The trapnet was a MN DNR-style with a 4 x 6 feet square frame with two funnel mouth openings and 50-feet lead. Net mesh size was either 3/8 inch or ½ inch. Trapnets were set on August 22, 2011. Six nets were fished for the following 2 days (August 23, 24). Trapnet locations are shown in the full report.

A total of six fish species were sampled in Birch Lake on August 23 and 24, 2011. Bluegill sunfish were the most abundant species followed by pumpkinseed sunfish. The average number of Bluegills caught per net was moderate with the average haul of 15 fish per net. Pumpkinseed sunfish were found at moderate numbers and within a typical range for a lake like Birch, as defined by the MN DNR. Black crappie and Black bullhead abundance was low based on standard ranges compiled by the MN DNR. Northern pike had a moderate population with an average of 1.3 fish per net.

In 2014, 6 standard trapnets were sampled for 2 days for a total of 12 lifts. Net dimensions were unchanged from 2011. Six nets were fished for the following 2 days (September 5 and 6).

A total of 8 fish species were sampled in Birch Lake on September 5 and 6, 2014. Bluegill sunfish were the most abundant species followed by Pumpkinseed sunfish. The average number of bluegills caught per net was moderate with the average haul of 19 fish per net. Pumpkinseed sunfish were found at moderate numbers and within a typical range. Black crappie and Black bullhead abundance was low. Northern pike had a moderate population with an average of 1.2 fish per net.

Figure 28: Birch Lake Fish Survey: Adult summaries for fish species detected

2011			2014	
Common Name	Fish per net	MN DNR ave per net	Fish per net	MN DNR ave per net (if new)
Black Bullhead	0.6	2-61	1.4	
Bluegill Sunfish	15	6-60	19	
Pumpkinseed Sunfish	3.4	1-8	4.6	
Black Crappie	0.6	2-18	4.3	
Largemouth Bass	1.0	0.3-1	0	
Northern Pike	1.3	NA	1.2	
Green Sunfish			0.3	0.3-2.8
Hybrid Sunfish			0.3	NA
Yellow Perch			0.1	0.3-1.5

Summary

The fish community in Birch Lake changed from 2011 to 2014. A winterkill over the 2013-14 winter was suspected based on finding dead bullheads after ice-out in the spring of 2014. The winterkill may have impacted the fish community. Black bullheads increased slightly from 2011 to 2014. Black crappies also increased. Fish lengths have a wide distribution and indicate several year classes are present. In addition, Bluegill sunfish were at regional abundances with a good length distribution, indicating a balanced condition. The winterkill did not appear to impact Bullheads and Bluegills. However, it appears Largemouth bass may have been impacted. No largemouth bass were netted in 2014, while they were present in 2011. Northern pike numbers were similar for both surveys, but the lengths in 2014 were dominated by young fish up to 9 inches. It appears stocking Largemouth bass would reestablish the bass community. Other fish species in Birch Lake should continue to do well.

Recommendations

Recommendations and future considerations include the following:

- In Birch Lake, northern pike are the dominant gamefish, although their average length is relatively small. Walleye and perch have been stocked in the past and have not become established. Future stocking of walleyes and perch are unnecessary at this time.
- Stocking 2,000 largemouth bass in 2014 should reestablish the bass population and add another predator to the fish community.
- Because sunfish currently spawn in the lake, the young fish should produce a forage base on an annual basis. The fish carrying capacity of Birch Lake will be established naturally, which is a good long-term management strategy.
- The winter aeration system is essential to maintain the existing fish community. It is recommended that efforts continue to insure proper operation of the winter aeration system.
- Water quality remains good in Birch Lake, and fishing has the potential to be very good for panfish and Largemouth bass. In 3-4 years, another fish survey should be conducted to evaluate conditions and re-evaluate recommendations.

Wildlife Monitoring

During 2019, VLAWMO made it a priority to better understand our wetlands in a variety of ways. One way we did that was by conducting initial phases of a remote-camera survey. The survey allows us to focus on areas near waterways and in wetlands to better understand mammal diversity in these areas. Birds are also photographed at remote-camera sites. They are not included in this monitoring report because birds are better sampled by other methods (e.g., point-count call surveys, visual detection, mist netting). Some mammal species are indicators of habitat health and water quality (e.g., River otters). These species are of particular interest to us as we work to learn more about wildlife diversity in our watershed. These data provide baseline information about species present in our watershed and help VLAWMO identify priorities for future monitoring efforts.

Full details of the survey can be found in the VLAWMO Remote-camera survey monitoring results, posted on the VLAWMO website.

Bird Rotary Nature Preserve was included in this survey effort. One location was monitored from May 7-June 12, 2019, for a total of 36 trapnights. This site is among the smaller habitat areas included in the camera study. The nature preserve is ~31 acres, and much of the area is wetland. There are high densities of frogs and toads and many interesting plant species. The camera location was located south of the boardwalk and accessible by kayak. A small, natural, muddy platform was found that was kept clear by geese grazing. The camera was aimed at this open area and mounted on a metal post sunk into the peat. Mammal diversity was low at this camera site. There were interesting avian visits including a family of Wood ducks, Great blue heron, and Sandhill cranes. **Mammals included: Mink and Raccoon.**

Figure 29: Birch Rotary Sample Photos

Mink

Raccoon

Great blue heron

Sandhill crane

Wood duck family

Wood duck family

3.4 WATER QUALITY SUMMARY

VLAWMO has collected water quality (WQ) data on Birch Lake since 1997. Regular, long-term uniform sampling was implemented in 2009 (Table 1). VLAWMO staff collects WQ data and water samples biweekly, May-September, for water clarity (secchi disk), nutrients (TP, Chl-a, SRP, nitrogens), and chemistry (temperature, conductivity, dissolved oxygen, and potential hydrogen [pH]). Total Phosphorus (TP) and Chlorophyll A (Chl-a) analyses are conducted by a contracted lab.

- TP 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 waste, soil erosion, detergents, septic systems, and stormwater runoff. Internal loading can also be present in a lake. Internal loading can result from P becoming re-suspended into the water column from the sediment. High amounts of P in sediments may occur as a result of historical land uses including, but not limited to, waste disposal into the lake.

- Chl-a is a green pigment in algae. Measuring Chl-a concentration gives an indication of algae abundance.

- The MN Pollution Control Agency (MPCA) has impairment standards for the levels of TP and Chl-a. For shallow lakes in Minnesota, the impaired water quality standard levels are: <60µg/L for TP, <20µg/L for Chl-a, and <230 mg/L for Chloride.

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Table 5: Birch Lake Monitoring Data 2010-2019

Birch Lake Historical Avg TP/Chl A/SDT/Cl				
Year	TP (µg/L)	Chl A (mg/m³)	Secchi (m)	Chloride (mg/l)
2010	31	5	1	95
2011	29	3	2	100
2012	30	3	2	89
2013	30	3	2	89
2014	26	3	1.7	80
2015	21	1	1.7	89
2016	14	7	1.8	78
2017	28	8	1.8	83
2018	25	5	1.8	95
2019	18	3	2	110

Figure 30: Historical Water Quality Averages in Birch Lake 2010-2019

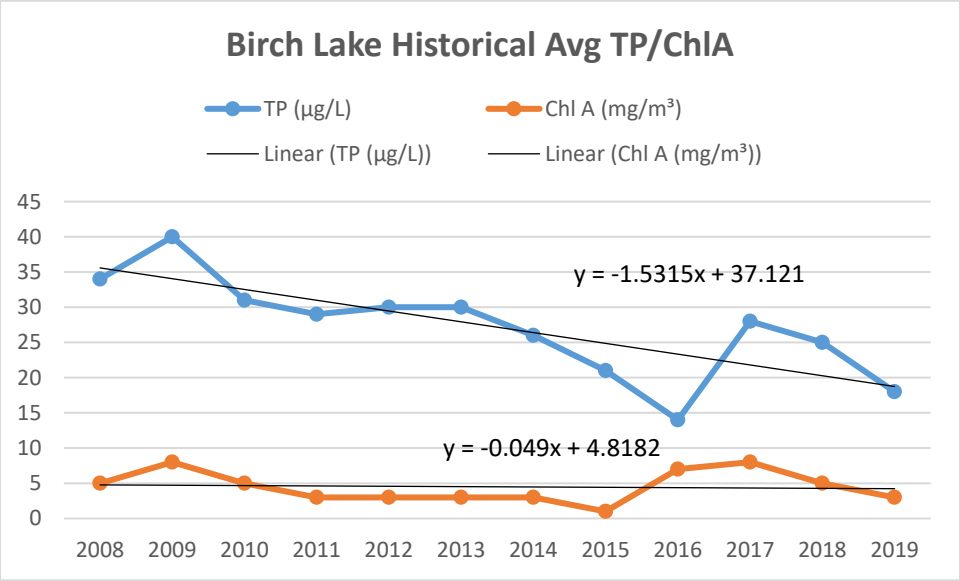


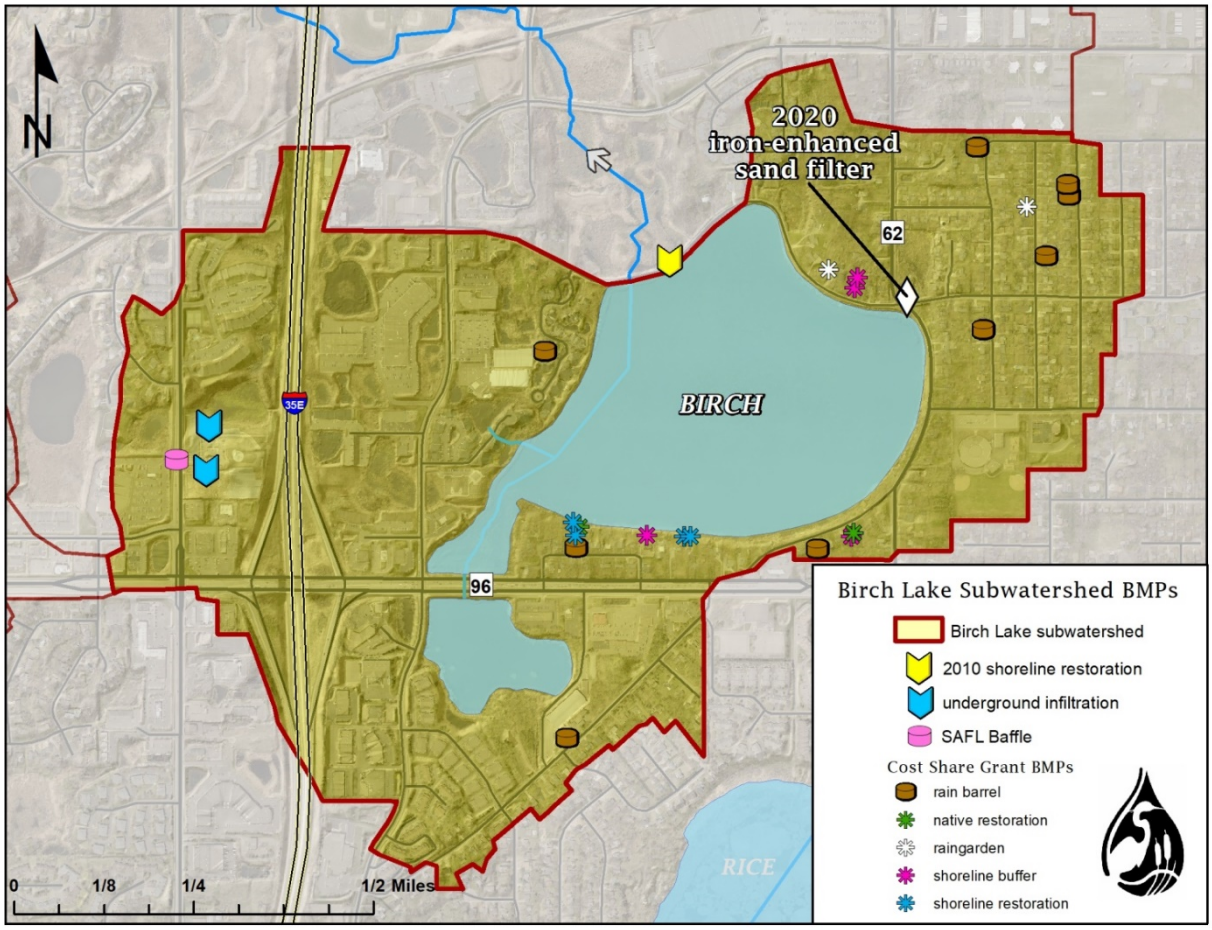
Figure 30: The graph shows results of TP/Chl-a with a linear trend through time. TP levels are below the State Standard (60 µg/L). Chl-a hovers around the value of 5 mg/m³.

4 MANAGEMENT PLAN

4.1 COMPLETED BPMS IN THE SUBWATERSHED

Best Management Practices (BMPs) are implemented to improve and protect water quality. Common small-scale examples of BMPs include raingardens, infiltration basins, shoreline restorations, rain barrels, and native plantings. Larger BMPs include stormwater retention basins, iron-enhanced sand filters, weirs and stormwater conveyance retrofits, and in-lake treatments such an alum treatment, rough fish management, or aquatic vegetation management. Many smaller-scale BMPs have been implemented in the subwatershed area. An iron-enhanced sand filter is being constructed on the northeast corner of the lake in 2020 to treat stormwater and reduce nutrient loading input into Birch Lake. This filter is being constructed at a hotspot nutrient input location identified by retrofit analysis.

Figure 31: Birch Lake Subwatershed Implemented BMPs



Summary of BMPs implemented:

- Large shoreline restoration on the north shore of Birch Lake, completed in 2010.
- Development of the Pillars senior living facility in 2017, Lunds & Byerlys grocery store in 2018, and subsequent reconstruction of Centerville Road prompted installation of underground infiltration cells and SAFL Baffle stormwater treatment.

- 21 VLAWMO Cost Share grant BMPs: 2 native restorations, 2 raingardens, 8 shoreline restorations/buffers, and 9 rain barrels.
- A 2-acre restoration is underway. It was begun during fall 2019 by removing buckthorn with assistance from volunteers and University of Minnesota service-learning students. The area was seeded with native, shady plants using funds provided from a Conservation Partners Legacy grant from MN DNR during winter 2020. Ongoing maintenance will be important to ensure successful establishment of the native plants and complete the restoration initiative.

4.2 Results of Stakeholder Survey and SLMP Update Meeting

VLAWMO conducted a lake resident survey in 2007. Half of the residents responded. A topic that was shown to be of high concern to residents is excessive aquatic plant growth.

Table 6: Lake Resident Questionnaire Results

How important to you are the following items? (1=low; 5=high); averages shown							
excessive plant growth	algae control	odor	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 that received high scores included excessive plant growth, exotic plant control, and algae growth. Residents are concerned with aquatic-plant management issues.

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; 1 stated that privacy was excellent.
Responses showed that overall residents felt that swimming and boating were poor, and 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%	Combination of both - 13%
		Do nothing - 0.5%
		Other responses included trying other things such as carp, Asian grass, or dredging

4.3 MANAGEMENT PLAN FOR BIRCH LAKE

Retrofit Report and Management Plan (2013)

In 2013, the Ramsey Conservation District completed a Retrofit Report for the Birch Lake subwatershed, This was part of a larger effort to assess the full watershed and subwatershed scales and identify optimal locations for BMPs. For these retrofit reports, 3 types of bioretention were considered. The full report is available on the VLAWMO website -> Birch Lake.

Bioretention was defined as curb-cut raingardens. These raingardens take stormwater runoff offline for treatment and utilize the current stormwater conveyance system for overflow. Depending on the soil type at the location being constructed, bioretention basins consist of a depression utilizing native soils for infiltration or replacing current soil with an engineered soil and native vegetation plantings more conducive to infiltration. At some sites, an underdrain with connection to the existing storm sewer system may be needed if infiltration capability is limited by underlying soils or if infiltration cannot be allowed due to soil compaction or other conditions. Bioretention basins fell within categories listed below:

- Simple Bioretention: Native vegetation, a curb cut and forebay, but no engineered soils or under-drains. May include a retaining wall if grade is steep.
- Moderately Complex Bioretention: Native vegetation, engineered soils, a curb cut, forebay and underdrain, and no retaining walls.
- Complex Bioretention: The same as the MCB, but with 1.5-2.5 ft partial perimeter walls.

Retrofit locations were identified for the east, west, and south subcatchment areas of Birch Lake.

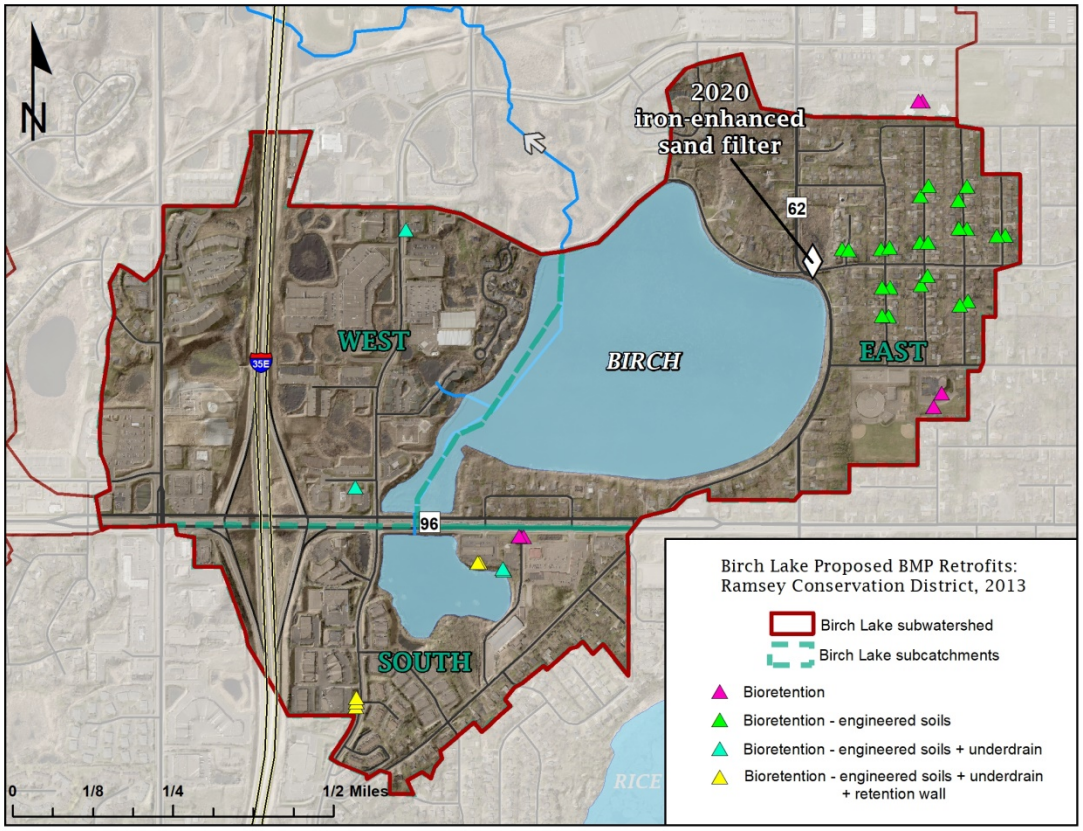


Figure 32: Retrofits identified for the Birch Lake subwatershed. The east side of the subwatershed had the most options. The iron-enhanced sand filter project (for construction in 2020) was selected for implementation for large-scale treatment of the storm sewer system, rather than individual residential raingardens.

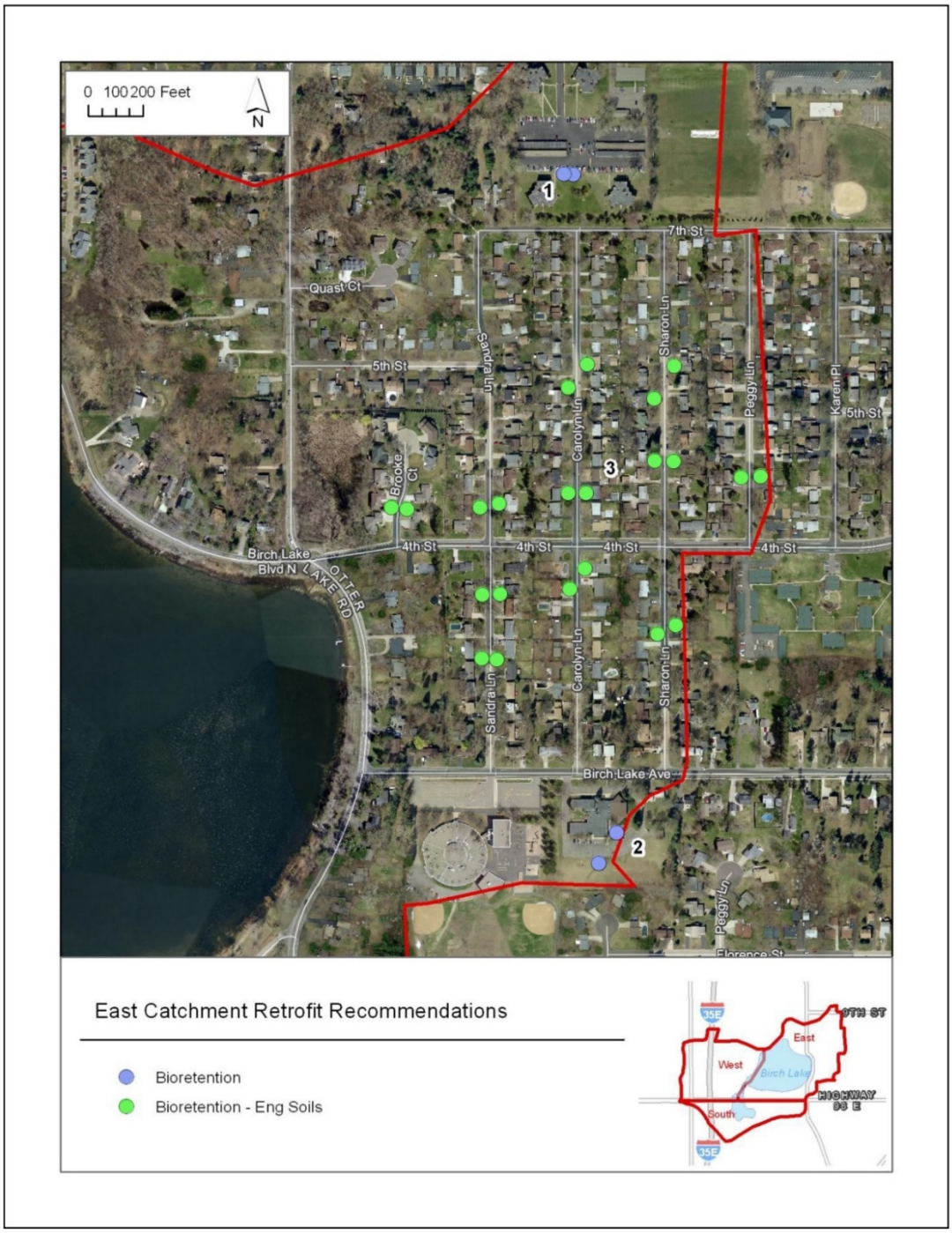


Figure 33: Retrofits identified for the east side of Birch Lake.

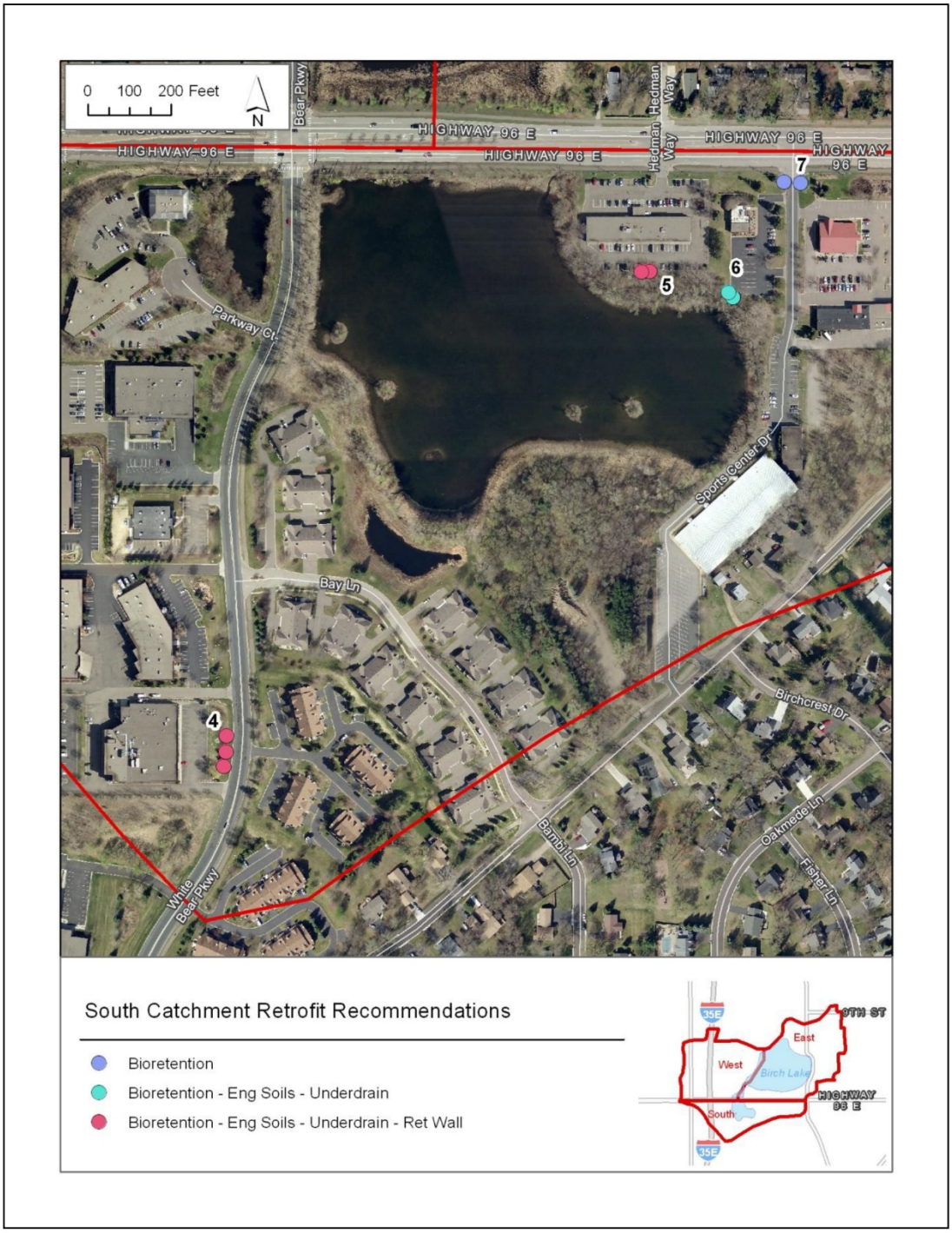


Figure 34: Retrofits identified for the south side of Birch Lake. Nine locations were identified for this side of the lake.

Figure 35: Retrofits identified for the west side of Birch Lake. Only 2 locations were identified for this side of the lake.

Total costs were included for 9 retrofit options identified in the report. The table below shows retrofit opportunities ranked from lowest to highest in terms of cost for the 3 subcatchments.

Table 7: Summary of pollutant-load reductions and costs.

Catchment	Site ID	TP (lb/yr)	TSS (lb/yr)	Volume (cubic-feet/yr)	Size (sq ft)	BMP Type	Materials/Labor/Design	Unit Promotion & Admin Costs*	Total Project Cost**	Annual O&M	Term Cost/lb/yr (30 yr)
East	3	18.66	7216.00	10.20	4750	Simple Bioretention	$57,210.00	$109.43	$62,408.01	$3,562.50	$302.45
South	4	1.68	1034.80	1.69	750	Complex Bioretention	$13,710.00	$420.27	$16,862.06	$562.50	$669.78
East	1	0.60	377.70	0.91	500	Simple Bioretention	$6,210.00	$564.81	$9,034.06	$375.00	$1,124.83
South	7	0.56	426.73	0.46	500	Simple Bioretention	$6,210.00	$564.81	$9,034.06	$375.00	$1,215.13
East	2	0.46	283.31	0.69	500	Simple Bioretention	$6,210.00	$564.81	$9,034.06	$375.00	$1,465.11
South	5	0.49	341.40	0.79	500	Complex Bioretention	$9,210.00	$564.81	$12,034.06	$375.00	$1,583.95
West	9	0.22	147.82	0.34	250	Moderately Complex Bioretention	$3,960.00	$936.17	$6,300.43	$187.50	$1,820.29
West	8	0.19	103.27	0.25	250	Moderately Complex Bioretention	$3,960.00	$936.17	$6,300.43	$187.50	$2,076.99
South	6	0.31	234.99	0.49	500	Moderately Complex Bioretention	$7,710.00	$564.81	$10,534.06	$375.00	$2,329.60

Options for Future Management Strategies

The 2017-2026 VLAWMO Comprehensive Watershed Management Plan assessed lakes and water resources within its jurisdiction and set management classifications for each of the subwatersheds. Birch Lake is part of the Birch Lake Subwatershed which was given a classification of "Protect". Updating this SLMP is a step towards determining if additional restoration activities are warranted. VLAWMO will continue to monitor water quality and consider adding BMPs to the landscape to reduce TP contributed to the system.

Table 8: Action Items for Birch Lake

Action Item	Description	Leader	Potential Costs $ = $0-$5,000 $$ = $5,000-$25,000 $$$ = >$25,000
Continued Lake Monitoring	Continue current lake monitoring program to measure nutrient levels, dissolved oxygen, and temperature.	VLAWMO	$
Promote Landscape Grant Program	Reach out to property owners to promote the VLAWMO Landscape Grant Program to help reduce stormwater runoff into Birch Lake.	VLAWMO, BLID	$
Enhanced Studies	Partner and provide support with the City of White Bear Lake on possible future studies. Consider control efforts for EWM and reduced vegetation removal in infested areas.	VLAWMO, City, BLID	$$
Water Quality Improvement Projects	Use 2013 Retrofit Analysis Report to aid in determining best opportunities. Iron-enhanced sand filter currently being implemented at the hotspot location (4th Street and Otter Lake Road) (2020)	VLAWMO, City, BLID	$ - $$$

APPENDIX

Birch Lake Contour (Bathymetry) Survey: 2019
Birch Lake Aquatic Vegetation Surveys: 2007, 2013, 2015, and 2019
Birch Lake Sediment Survey: 2008
Birch Lake Shoreland Inventory: 2007
Birch Lake Aquatic Invasive Species Action Plan: 2015
Birch Lake Fish Surveys: 2011, 2014
Birch Retrofit Analysis: 2013