Birch Lake

Vadnais Lake Area Water Management Organization

Macrophyte, Biovolume, and Eurasian Watermilfoil Survey 9/5/19

This document contains data collected on Birch Lake in White Bear Lake, MN. The report details the methods and findings of a point intercept survey of macrophyte vegetation, a vegetation bio-volume survey, and a survey for Eurasian watermilfoil in Birch Lake.

Data collected and prepared by **Ramsey County Parks and Recreation - Soil & Water Conservation Division** for

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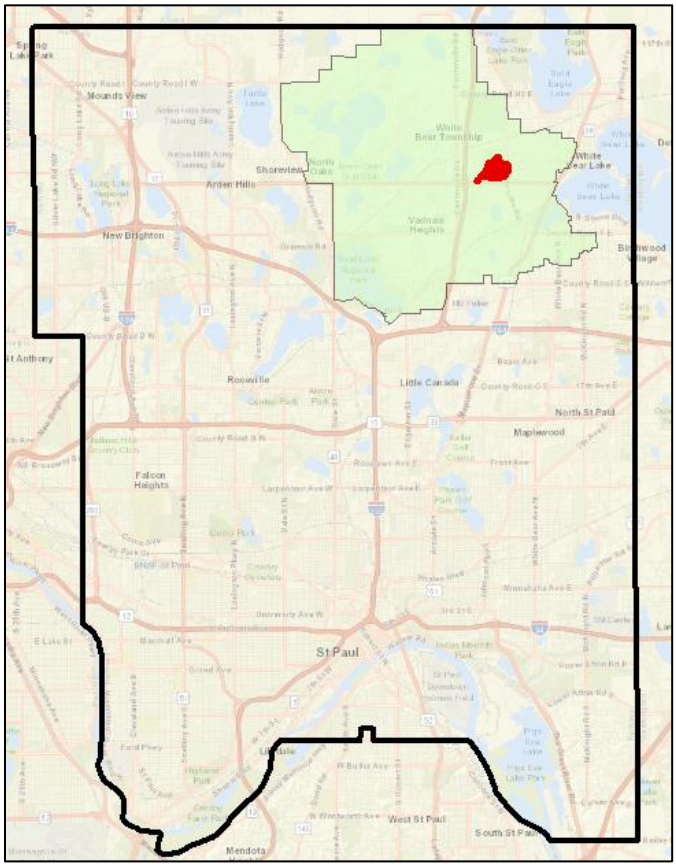


Figure 1. Location of Birch Lake (red) in Ramsey County within VLAWMO borders

Birch Lake

September 5, 2019

1. Macrophyte Survey Methods:

The point intercept method incorporating a Lowrance HDS-5™ Global Positioning System (GPS) was used to assess the aquatic macrophyte community on Birch Lake on September 5, 2019. Sampling occurred at 45 geo-referenced points 100 meters apart to be consistent with previous surveys. Data on plant species and abundance rank was recorded and displayed in Table 2 of this report. A secchi disk measurement was also taken in the lake.

A double-tined metal rake attached to an 11-meter rope was used to collect specimens. At each point, the device was thrown out approximately 1 meter and then dragged across the substrate for approximately one meter. Species were identified and given a ranking based on cover of rake tines (Table 1). Plant species and algae that were floating in the water at the collection points were also counted.

Table 1

Abundance rankings for percent cover of rake tines

Percent Cover of Tines	Abundance Ranking
41-100	3
21-40	2
1-20	1

Results:

Aquatic macrophytes were found at all 45 points surveyed. 25 total macrophytes 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 and do not appear on the numbered list in Table 2. 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.

Table 2 Percent occurrence and average abundance of aquatic plant taxa present during Birch Lake point-intercept survey

Species	Common Name	Scientific Name	Average Abundance 9/5/2019	Percent Occurrence 9/5/2019	Average Abundance 9/05/2013	*Percent Occurrence 9/05/2013
1	Fern Pondweed	*Potamogeton robbinsii*	2.7	96%	2.3	72%
2	Large-leaf Pondweed	*Potamogeton amplifolius*	1.6	53%	1.6	14%
3	Water Celery	*Vallisneria americana*	1.9	29%	1.6	47%
4	Canada Waterweed	*Elodea canadensis*	1.3	27%	-	-
5	Coontail	*Ceratophyllum demersum*	1.9	18%	0.5	3%
6	Slender Naiad	*Najas flexilis*	1.4	11%	1.5	6%
7	Filamentous Algae	*Spirogyra/Cladophora sp*	1.0	11%	-	-
8	Eurasian Watermilfoil	*Myriophyllum spicatum*	1.0	9%	1.0	8%
9	Muskgrass	*Chara spp .*	1.3	9%	1.7	17%
10	Small Pondweed	*Potamogeton pusillus*	1.3	9%	-	-
11	White Water Lily	*Nymphaea odorata*	2.7	7%	2.7	8%
12	Yellow Water Lily	*Nuphar lutea*	3.0	2%	2.0	6%
13	Illinois Pondweed	*Potamogeton illinoensis*	1.0	2%	2.0	6%
14	Greater Duckweed	*Spirodela polyrhiza*	1.0	2%	-	-
15	Lesser Duckweed	*Lemna minor*	1.0	2%	-	-
16	Star Duckweed	*Lemna trisulca*	2.0	2%	-	-
17	Watershield	*Brasenia schreberi*	1.0	2%	-	-
18	Bladderwort	*Utricularia sp.*	2.0	2%	-	-
19	Leafy Pondweed	*Potamogeton foliosus*	1.0	2%	1.0	8%
20	White-Stem Pondweed	*Potamogeton praelongus*	1.0	2%	-	-
21	Hybrid Watermilfoil	*M. spicatum x M. sibiricum*	1.0	2%	-	-
22	Slender Riccia	*Riccia fluitans*	2.0	2%	-	-

Note. Percent occurrence represents the number of times a plant species was observed divided by the number of total sample sites where vegetation was observed. Average abundance is calculated as the average of the abundance ranking for an individual species present.

*The 2013 percent occurrence was calculated by dividing occurrence by 45 in the 2013 report but re-calculated in this table dividing by 36 (the number of points where vegetation was found in 2013) for comparison purposes.

Figure 2. Left: VLAWMO staff Dawn Tanner assisting with macrophyte identification and rake toss. Right: View of Birch Lake facing northeast from near Point 6.

Table 3. Birch Lake point intercept survey results. September 5, 2019.

Depth,secchi disk and vegetation abundance point survey results in Birch Lake, September 5, 2019

Pt	Depth (ft)	Yellow Water Lily	White Water Lily	Coon tail	Musk grass	Eurasian watermil foil	Slender Naid	Large-leaf Pond weed	Illinois Pond weed	Fern Pond weed	Water Celery	Greater Duck-weed	Lesser Duck-weed	Water shield	Canada Water-weed	Fila ment ous Algae	Small Pond weed	Leafy Pond weed	Bladder wort	White Stem Pond-weed	Star Duck-weed	Hybrid Water-milfoil	Slender Riccia
1	1		**3**	**3**								**1**	**1**		**1**			**1**	**2**		**2**		**2**
2	4			**1**					**1**	**2**	**3**						**1**						
3	4									**2**	**3**												
4	5									**2**	**3**												
5	2									**2**	**2**												
6	4		**3**	**3**		**1**		**2**															
7	5			**2**						**3**					**2**								
8	5			**1**	**1**					**3**													
9	6							**1**		**3**													
10	5									**3**													
11	5									**3**													
12	6				**2**		**1**	**3**		**3**													
13	4									**1**	**1**						**1**						
14	2	**3**		**1**				**1**		**2**	**1**				**1**								
15	5							**2**		**3**					**1**								
16	5			**3**	**1**					**3**					**3**								
17	5							**1**		**3**					**1**								
18	5									**3**					**1**	**1**							
19	5							**1**		**3**					**1**								
20	5							**1**		**3**	**1**												
21	5				**1**			**1**		**3**	**1**												
22	3		**2**				**1**			**1**	**3**				**1**		**1**						
23	5			**1**				**2**		**3**													
24	5						**1**			**3**					**1**								
25	5							**1**		**1**					**1**								
26	5							**2**		**3**										**1**		**1**	
27	5							**2**		**3**													
28	5						**3**	**3**		**3**													
29	5							**1**		**3**													
30	4						**1**	**2**		**3**					**1**								
31	5					**1**		**1**		**3**						**1**							
32	5					**1**		**2**		**3**						**1**							
33	5									**3**				**1**		**1**							
34	5							**1**		**2**													
35	5							**3**		**3**													
36	5									**3**													
37	4									**3**	**1**					**1**							
38	4					**1**		**2**		**3**													
39	5									**3**													
40	5							**2**		**3**	**1**												
41	5							**1**		**3**													
42	4									**2**	**2**						**2**						
43	5							**1**		**3**													
44	5									**3**													
45	1									**3**	**3**												
Sum		3	8	15	5	4	7	39	1	116	25	1	1	1	15	5	5	1	2	1	2	1	2
Count		1	3	8	4	4	5	24	1	43	13	1	1	1	12	5	4	1	1	1	1	1	1
Avg Abundance		3.0	2.7	1.9	1.3	1.0	1.4	1.6	1.0	2.7	1.9	1.0	1.0	1.0	1.3	1.0	1.3	1.0	2.0	1.0	2.0	1.0	2.0
% Occurrence		2%	7%	18%	9%	9%	11%	53%	2%	96%	29%	2%	2%	2%	27%	11%	9%	2%	2%	2%	2%	2%	2%

Secchi Depth: Greater than 1.8m (greater than 6 ft.) - (Secchi disk obscured by plants at the bottom rather than the water column)

Figure 3 show the biovolume of Birch Lake Sept 5, 2019 as well as the locations of survey points, all of which contained macrophyte species, as shown above in Table 3, which provides details on the types and abundance of macrophyte species present per point, as corresponding to the numbered points on the map.

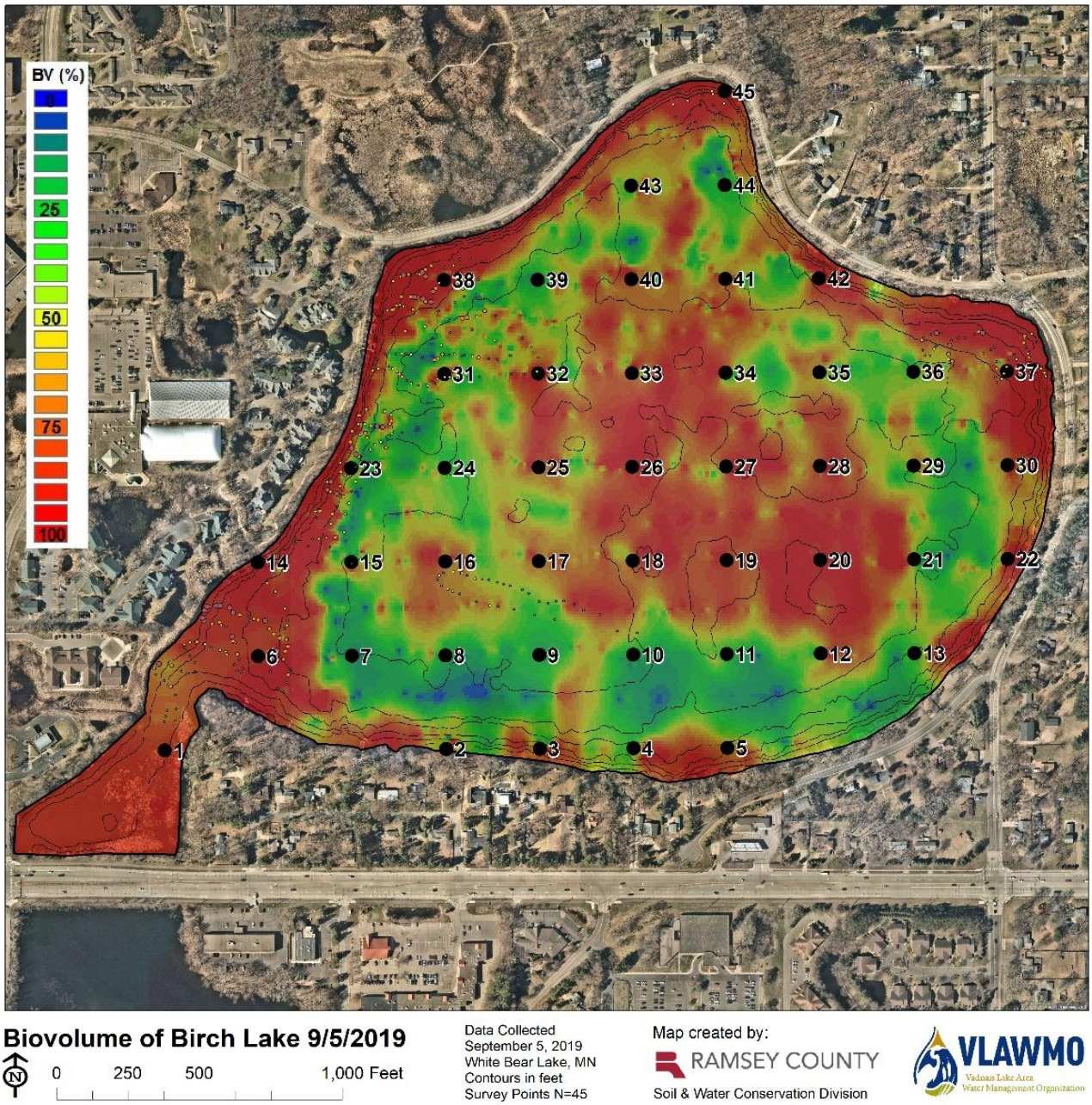


Figure 3. Birch Lake vegetation point intercept survey locations. N=45.

2. Biovolume Survey Methods:

A Lowrance HDS-5TM Global Positioning System (GPS)-enabled transducer was used to collect submerged aquatic vegetation biovolume data on Birch Lake on September 5, 2019. The lake was transected at a speed of no more than 6 miles per hour. Transducer log data was processed using Contour Innovations, LLC, BioBase software, downloaded, and interpolated in ArcMap to create a biovolume map.

Results:

Results include a map as well as statistics of biovolume distribution represented as total percent of water column occupied by plant matter ranging from zero to one hundred. More robust interactive contour and vegetation map data, including sonar log trip replays, can be viewed on the ciBioBase website:www.cibiobase.com.

BIOBASE

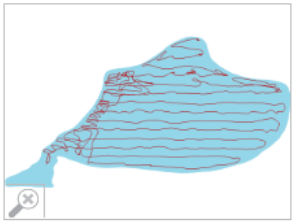
VEGETATION ANALYSIS REPORT

Birch Lake, Ramsey Minnesota

Generated: 9/6/2019 6:17:57 PM (UTC)

Waterbody Size: 117.16 acres

report link



Data Collector
Andrea Prichard

Data Collection Date
9/5/2019 9:41:27 PM (UTC)

Average Water Temperature
69.18° F

Location
Start: 45.08682553, -93.03949698
End: 45.08410178, -93.04322851

Survey Size
Area: 106.14 acres
Percent: 90.60% of waterbody
Volume: 416.91 acre ft

Est.Waterbody Volume ?
567622.30 cu. m
(460.18 acre ft)

Settings

Track Buffer:	25 m
Grid Cell Size:	5.0 m
Min.BV Detect:	5%
Min.Veg Depth Detect:	0.73 m

Quality Control
Reviewer: Valley, Ray
Comments: We have reviewed this trip. Please use the "ASK THE EXPERTS" button for this trip if you have any questions.

Offset Information
See Below

Survey Summary

	Type ?	PAC ?	Avg BVp ?	SD BVp ?	Avg BVw ?	SD BVw ?	Depth Range	Avg Depth	Distance	No.Points
Full Survey	Point	98.2%	63.7%	±31.8%	62.6%	±31.6%	1.00 - 5.72 ft	3.26 ft	8.57 miles	3181
	Grid	99.9%	59.7%	±25.2%	59.7%	±25.2%	0.10 - 5.42 ft	3.93 ft	-	34189

Biovolume Analysis by Quantity

AOI ?	0-5%	5-20%	20-40%	40-60%	60-80%	>80%
1	1.79%	12.20%	18.11%	12.98%	13.30%	41.62%

Biovolume Analysis by Depth

Full Survey	Depth	Type ?	Count	PAC ?	Avg BVp ?	SD BVp ?	Avg BVw ?	SD BVw ?
	0-1m	Point	2578	99.7%	73.6%	±26.0%	25.9%	±0.0%
	1-2m		603	91.9%	17.9%	±6.0%	5.9%	±0.0%
	2-3m		0	0.0%	0.0%	±0.0%	0.0%	±0.0%
	3-4m		0	0.0%	0.0%	±0.0%	0.0%	±0.0%
	4-5m		0	0.0%	0.0%	±0.0%	0.0%	±0.0%
	5-6m		0	0.0%	0.0%	±0.0%	0.0%	±0.0%
	6-7m		0	0.0%	0.0%	±0.0%	0.0%	±0.0%
	7-8m		0	0.0%	0.0%	±0.0%	0.0%	±0.0%
	8-9m		0	0.0%	0.0%	±0.0%	0.0%	±0.0%
	9-10m		0	0.0%	0.0%	±0.0%	0.0%	±0.0%
	0-1m	Grid	7102	100.0%	77.3%	±22.3%	77.3%	±22.3%
	1-2m		27087	99.9%	55.1%	±23.8%	55.0%	±23.9%

Glossary

AOI

Area of Interest: Defines the individual transects or contiguous data samples as depicted by the color coding of each trip line. Seperate areas of interest can be generated through merging of multiple trips, appending data to a single sonar log or lapses in time (greater than five minutes) within a sonar log.

BVp

Biovolume (Plant):: Refers to the percentage of the water column taken up by vegetation when vegetation exists. Areas that do not have any vegetation are not taken into consideration for this calculation.

BVw

Biovolume (All water): Refers to the average percentage of the water column taken up by vegetation regardless of whether vegetation exists. In areas where no vegetation exists, a zero value is entered into the calculation, thus reducing the overall biovolume of the entire area covered by the survey.

PAC

Percent Area Covered: Refers to the overall surface area that has vegetation growing.

Grid

Geostatistical Interpolated Grid: Interpolated and evenly spaced values representing kriged (smoothed) output of aggregated data points. The gridded data is most accurate summary of individual survey areas.

Point

Individual Coordinate Point: A single point represents a summary of sonar pings and the derived bottom and canopy depths. Individual point data create an irregularly spaced dataset that may have overlaps and/or gaps in the data resulting in a increased potential for error.

Figure 4: Birch Lake BioBase survey summary statistics for Birch Lake

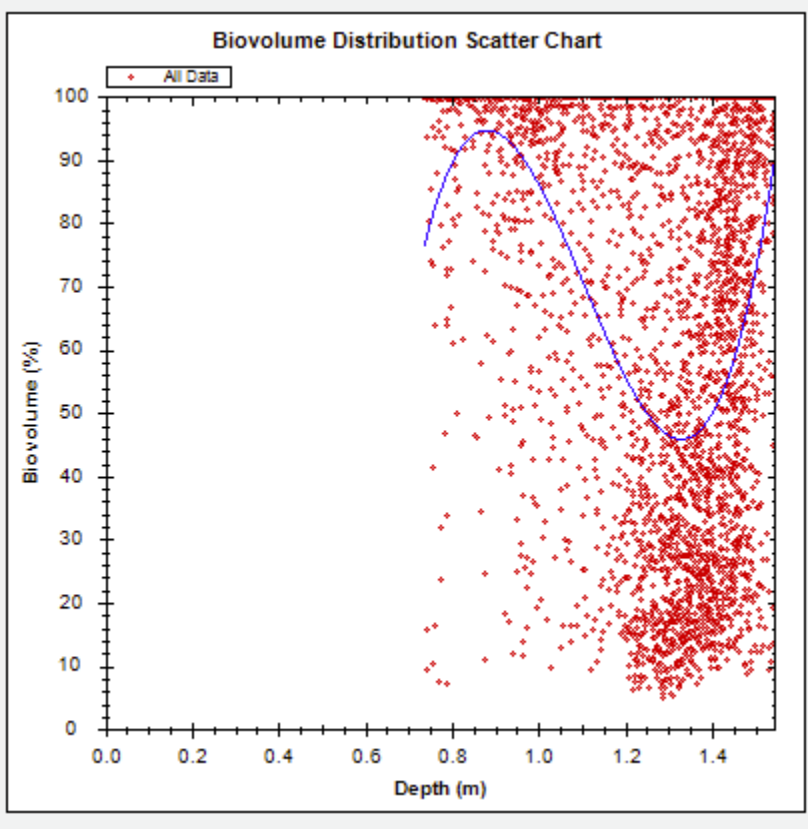


Figure 5. Birch Lake BioBase biovolume distribution scatter chart

3. Eurasian Watermilfoil Delineation Methods:

The aquatic invasive species Eurasian watermilfoil (*Myriophyllum spicatum*) was detected in previous surveys of Birch Lake. In order to inform future management efforts of this species, a delineation of the species's current extent was conducted. It should be noted that 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.

Figure 6. Eurasian Watermilfoil found in Birch Lake (hybrid watermilfoils were also counted as 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.

Figure 7 shows 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.

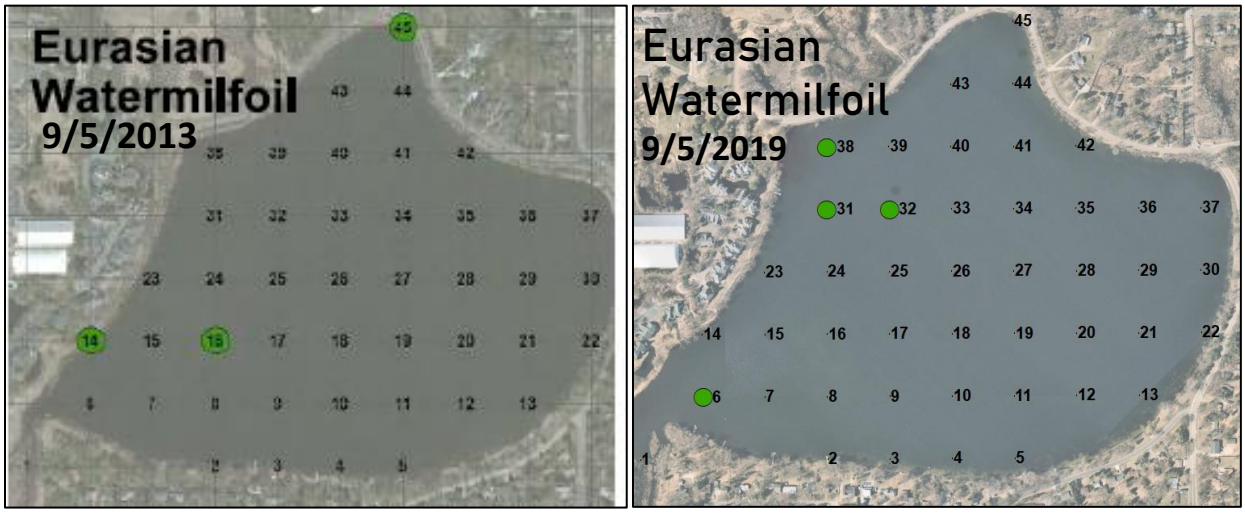


Figure 7. Locations where Eurasian watermilfoil was detected in 2013 and 2019 point intercept surveys.

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 Figure 8 for each target area identified.

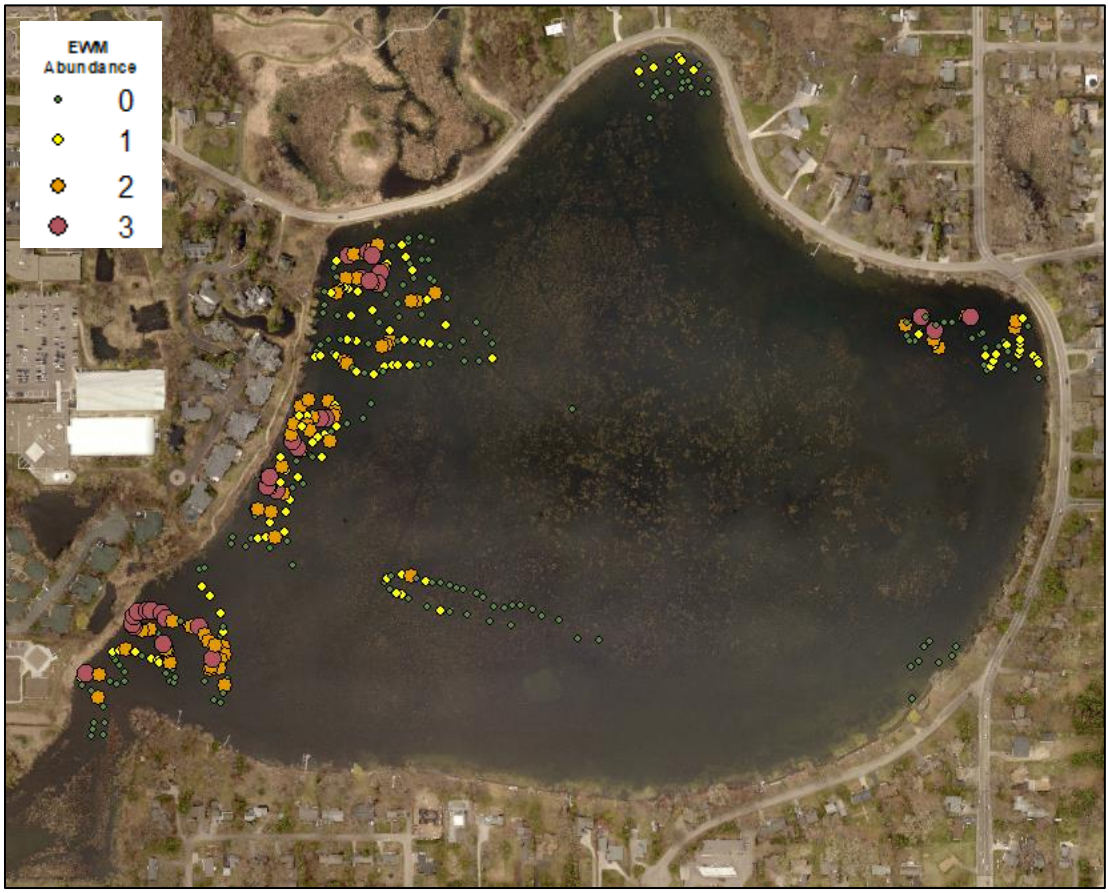


Figure 8. Observation locations for Eurasian watermilfoil survey. Abundance of EWM indicated in the legend. 1: 1-20% abundance, 2: 20-40% abundance, 3: >40% abundance

Results:

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.

Table 4: EWM Zones

Zone	Acreage	Avg Depth
A	3.104	3 ft
B	6.758	5 ft
C	0.448	6 ft
D	0.200	3.5 ft
E	0.898	4 ft
Total	**11.408**	

Figure 9 shows the five delineated zones (A-E) with confirmed instances of Eurasian watermilfoil (including hybrid watermilfoil) as of September 5, 2019. Table 4 above shows the acreage of the EWM zones as well as the estimated average depth for each delineated zone. Depths are based on values from the bathymetric survey conducted April 16, 2019.

As treatment options are considered, it will be valuable to take into consideration the results of the point intercept survey, since Eurasian watermilfoil was detected alongside a number of native species, and in some cases with very thick vegetative cover (such as Area A, pictured in Figure 2 above). With 25 identified macrophyte species, the lake has a healthy plant diversity, and Eurasian watermilfoil and Hybrid watermilfoil were the only invasive species detected.

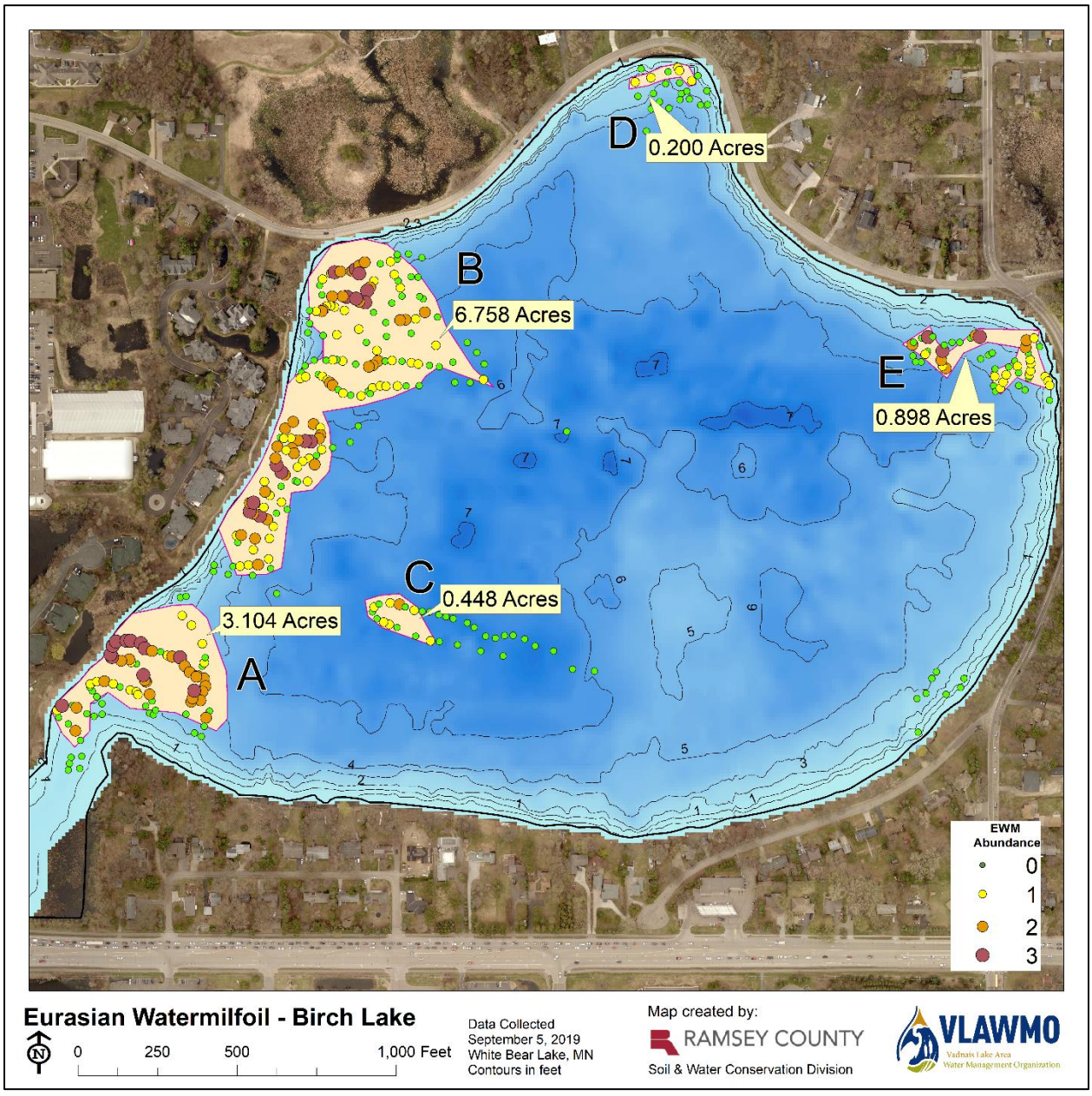


Figure 9. Locations and acreage of five delineated zones of Eurasian watermilfoil, 9/5/2019