Goose Lake

VLAWMO
Vadnais Lake Area
Water Management Organization

Macrophyte, Biovolume, and Curly-leaf Pondweed Survey 6/13/19

This document contains data collected on East and West Goose Lake in White Bear Lake and White Bear Township, 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 Curly-leaf Pondweed in East Goose Lake.

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

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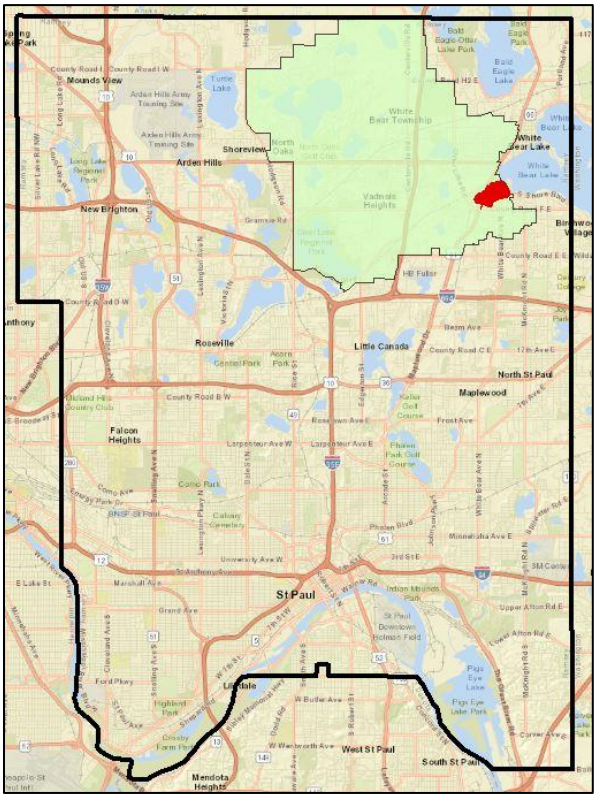


Figure 1. Location of Goose Lake (red) in Ramsey County within VLAWMO borders

Goose Lake

June 13, 2019

1. Macrophyte Survey Methods:

The point intercept method incorporating aerial photography and a Lowrance HDS-5™ Global Positioning System (GPS) was used to assess the aquatic macrophyte community on Goose Lake on June 13, 2019. Sampling occurred at 116 geo-referenced points 70 meters apart. Data on plant species and abundance rank was recorded and displayed in Table 2 of this report. A secchi disk measurement was also taken on both sides of 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 10 of 116 points surveyed (Figure 3), all of which were located in West Goose Lake. The most prevalent species was Curly-leaf Pondweed (*Potamogeton crispus),* which had 100% occurrence, meaning that it was found at all 10 points where macrophytes were detected on West Goose Lake. Leafy Pondweed (*Potamogeton foliosus),* Sago Pondweed (*Stuckenia pectinata*), and Canada Waterweed (*Elodea canadensis*) were also present in 1 to 3 points each. Algae present included Filamentous Algae (*Spirogyra sp./Cladophora*), Blue-green Algae (*Cyanobacteria*), and Muskgrass (*Chara*). The secchi disk reading was 1.0 ft (0.30m) in East Goose Lake and 1.5 ft (0.46 m) in West Goose Lake. Water temperature was 70 degrees in East Goose Lake and 75 degrees in West Goose Lake. According to the sonar record, the deepest point in East Goose Lake was 6.3 ft and in West Goose Lake was 5.5 ft, although the actual depths could be up to a foot deeper due to the depth of the transducer in the water.

Table 2

Percent occurrence and average abundance of aquatic plant taxa present during Goose Lake point-intercept surveys

Species	Common Name	Scientific Name	Average Abundance 6/13/2019	Percent Occurrence 6/13/2019	*Average Abundance 6/06/2014	*Percent Occurrence 6/06/2014
1	Curly Leaf Pondweed	*Potamogeton crispus*	1.7	100	1.9	39
2	Bluegreen Algae	*Cyanobacteria*	1.4	50	-	-
3	Leafy Pondweed	*Potamogeton foliosus*	1.3	30	1.3	8
4	Sago Pondweed	*Stuckenia pectinata*	1	20	-	-
5	Filamentous Algae	*Spirogyra/Cladophora sp*	1	10	1	3
6	Canada Waterweed	*Eleodea canadensis*	1	10	1.9	81
7	Muskgrass	*Chara spp .*	1	10	-	-

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 June 6 2014 survey results were merged to produce the numbers in these columns. They were in two separate reports in 2014, with West Goose Lake detecting macrophytes at 12 points and East Goose Lake detecting macrophytes at 24 points. Abundance ranking in 2014 was ranked on a 1-5 scale, which has since moved to 1-3.

Figure 2. Left: Green color of lake water on East Goose Lake – secchi disk visibility was 1 ft. No macrophytes were present at the 94 surveyed points.

Right: Blue-green algae and curly-leaf pondweed along the southern border of West Goose Lake. Secchi disk visibility was 1.5 ft, and macrophytes were found at 10 out of 22 surveyed points.

The following map (Figure 3) show the locations where vegetation was found, with Table 3 providing details on the types and abundance of macrophyte species present per point, as corresponding to the numbered points on the map.

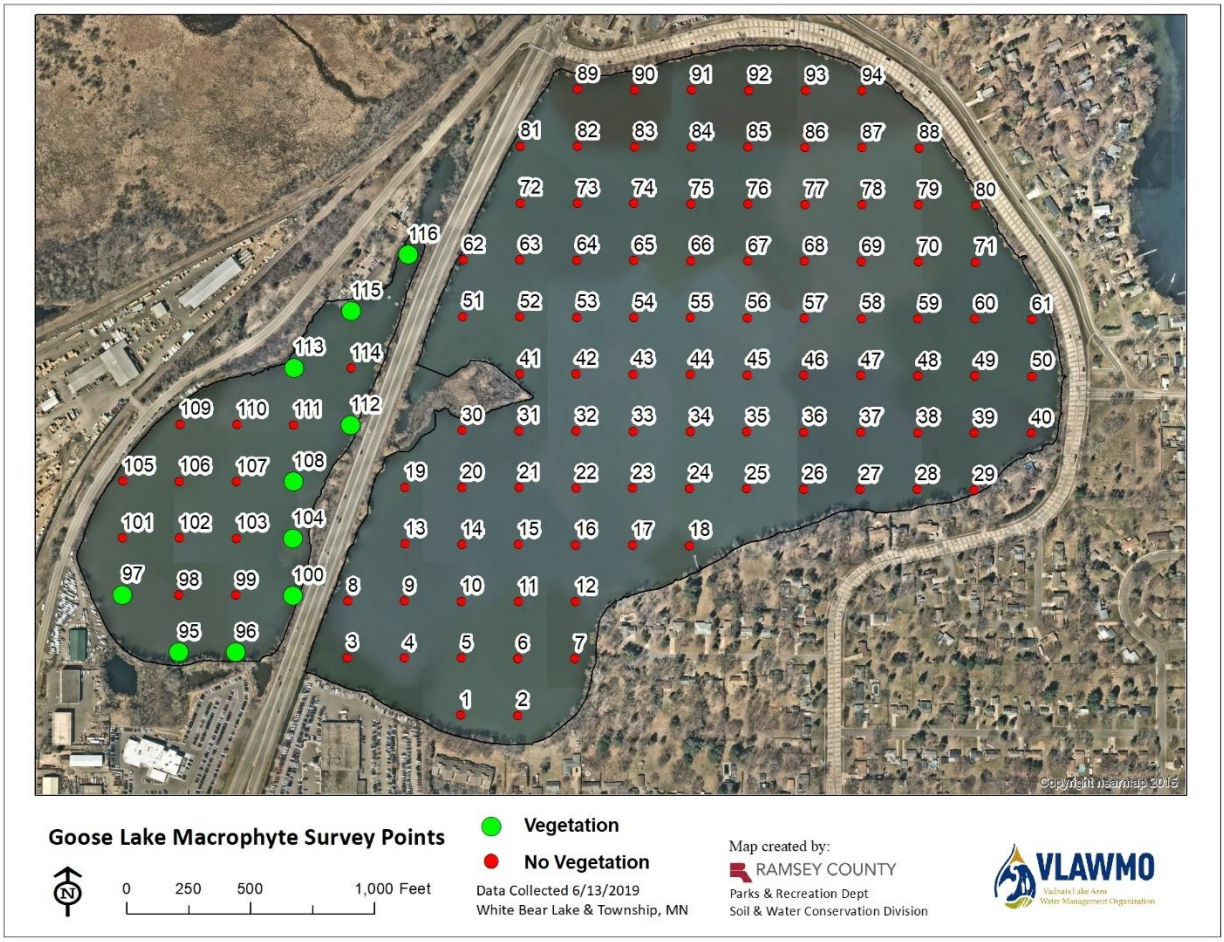


Figure 3. Goose Lake vegetation point intercept survey locations. N=116.

Note: Although no vegetation was found at any of the 94 points in East Goose Lake, Canada Waterweed was found near the southwest shoreline of East Goose Lake during the more exhaustive survey for curly-leaf pondweed. See further information in Section 3 below.

Table 3. Goose Lake point intercept survey results. June 13, 2019.

Note: The rake was thrown at all 94 points in East Goose Lake, but came up empty at each point. Results are shown for West Goose Lake below.

Point	Curly-leaf Pondweed	Canada Waterweed	Filamentous Algae	Muskgrass (Chara)	Leafy Pondweed	Blue-green Algae	Sago Pondweed
95	3					1	
96	2				2	3	
97	1					1	
98							
99							
100	1				1	1	
101							
102							
103							
104	1						1
105							
106							
107							
108	1						
109							
110							
111							
112	3					1	
113	2			1			
114							
115	1						
116	2	1	1		1		1
Total Abundance	17	1	1	1	4	7	2
Count	10	1	1	1	3	5	2
% Occurrence	100%	10%	10%	10%	30%	50%	20%
Avg. Abundance	1.7	1.0	1.0	1.0	1.3	1.4	1.0
Secchi Depth	1.0 ft (East Goose)	1.5ft (West Goose)					

2. Biovolume Survey Methods:

A Lowrance HDS-5TM Global Positioning System (GPS)-enabled transducer was used to collect submerged aquatic vegetation biovolume data on Goose Lake on June 13, 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

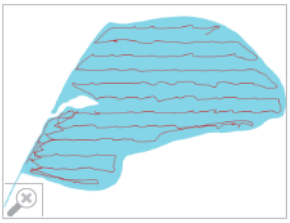
VEGETATION ANALYSIS REPORT

Goose Lake, Ramsey Minnesota

Generated: 6/27/2019 7:29:21 PM (UTC)

Waterbody Size: 117.19 acres

report link



Data Collector
Andrea Prichard

Data Collection Date
6/26/2019 6:14:03 PM (UTC)

Average Water Temperature
69.85° F

Location
Start: 45.07260077, -93.01544028
End: 45.06682076, -93.02345317

Survey Size
Area: 89.32 acres
Percent: 76.21% of waterbody
Volume: 412.23 acre ft

Est.Waterbody Volume
667179.18 cu. m
(540.89 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: Loftsgaarden, Sam
Comments: Sonar sensitivity was reduced to lessen the impact of false vegetation reads stemming from noise in the water column interacting with the ground.

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	4.7%	31.6%	±39.4%	1.5%	±10.8%	1.00 - 6.41 ft	4.28 ft	5.70 miles	3837
	Grid	4.0%	50.6%	±33.4%	2.0%	±12.0%	0.10 - 6.27 ft	4.62 ft	-	1162

Biovolume Analysis by Quantity

AOI	0-5%	5-20%	20-40%	40-60%	60-80%	>80%
1	95.26%	3.28%	0.29%	0.00%	0.00%	1.17%

Biovolume Analysis by Depth

Full Survey	Depth	Type	Count	PAC	Avg BVp	SD BVp	Avg BVw	SD BVw
	0-1m	Point	240	30.0%	68.0%	±41.2%	34.5%	±0.0%
	1-2m		3597	3.1%	7.8%	±4.8%	1.6%	±0.0%

BIOBASE

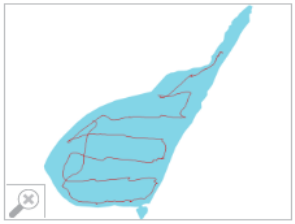
VEGETATION ANALYSIS REPORT

Little Goose Lake, Ramsey Minnesota

Generated: 6/13/2019 9:59:59 PM (UTC)

Waterbody Size: 27.59 acres

report link



Data Collector
Andrea Prichard

Data Collection Date
6/14/2019 2:58:40 AM (UTC)

Average Water Temperature
75.43° F

Location
Start: 45.06907427, -93.02585974
End: 45.07105398, -93.02202005

Survey Size
Area: 20.57 acres
Percent: 74.56% of waterbody
Volume: 69.73 acre ft

Est.Waterbody Volume ?
115353.07 cu. m
(93.52 acre ft)

Settings

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

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	23.1%	59.4%	±35.0%	13.7%	±27.6%	1.00 - 5.59 ft	3.07 ft	1.38 miles	1184
	Grid	37.3%	51.2%	±29.3%	19.1%	±30.6%	0.10 - 5.52 ft	3.39 ft	-	2474

Biovolume Analysis by Quantity

AOI ?	0-5%	5-20%	20-40%	40-60%	60-80%	>80%
1	76.86%	5.24%	2.36%	3.63%	3.13%	8.78%

Biovolume Analysis by Depth

Full Survey	Depth	Type ?	Count	PAC ?	Avg BVp ?	SD BVp ?	Avg BVw ?	SD BVw ?
	0-1m	Point	312	77.2%	66.2%	±31.7%	30.8%	±0.0%
	1-2m		872	3.8%	9.6%	±3.6%	1.9%	±0.0%
	2-3m		0	0.0%	0.0%	±0.0%	0.0%	±0.0%

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: Goose Lake BioBase survey summary statistics for East Goose Lake (top) and West Goose Lake (bottom)

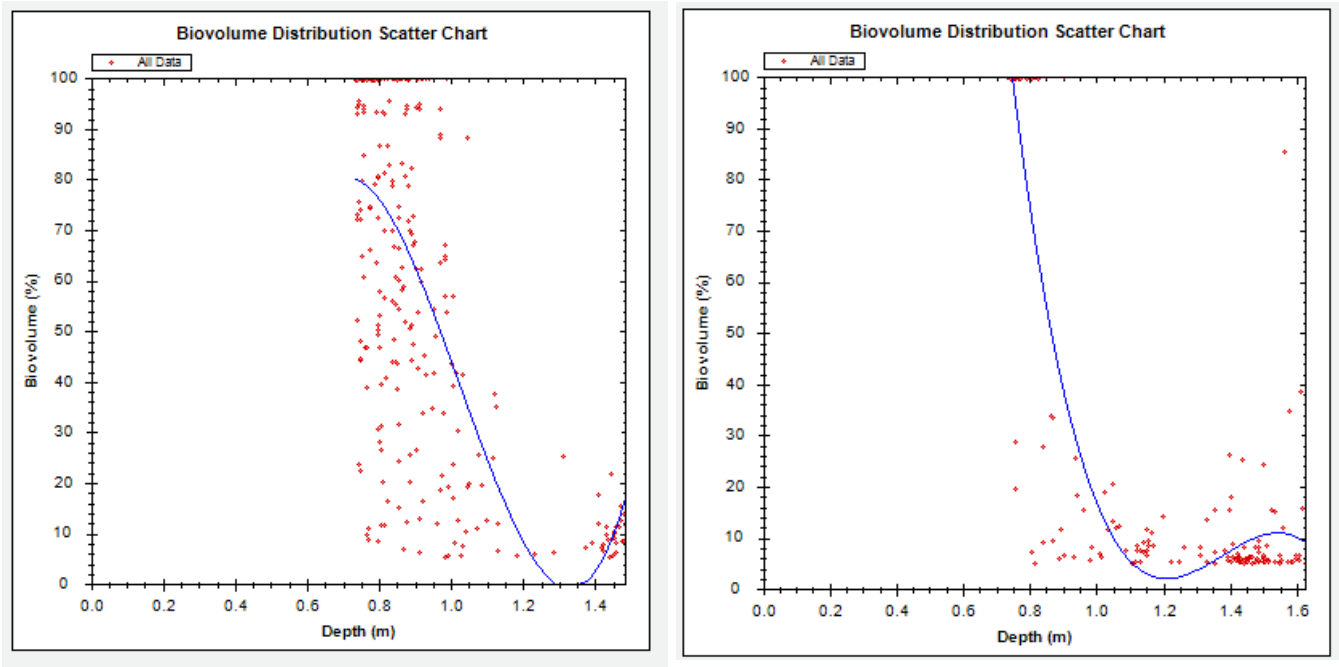


Figure 5. Goose Lake BioBase biovolume distribution scatter chart for West Goose (left) and East Goose (right) Lakes

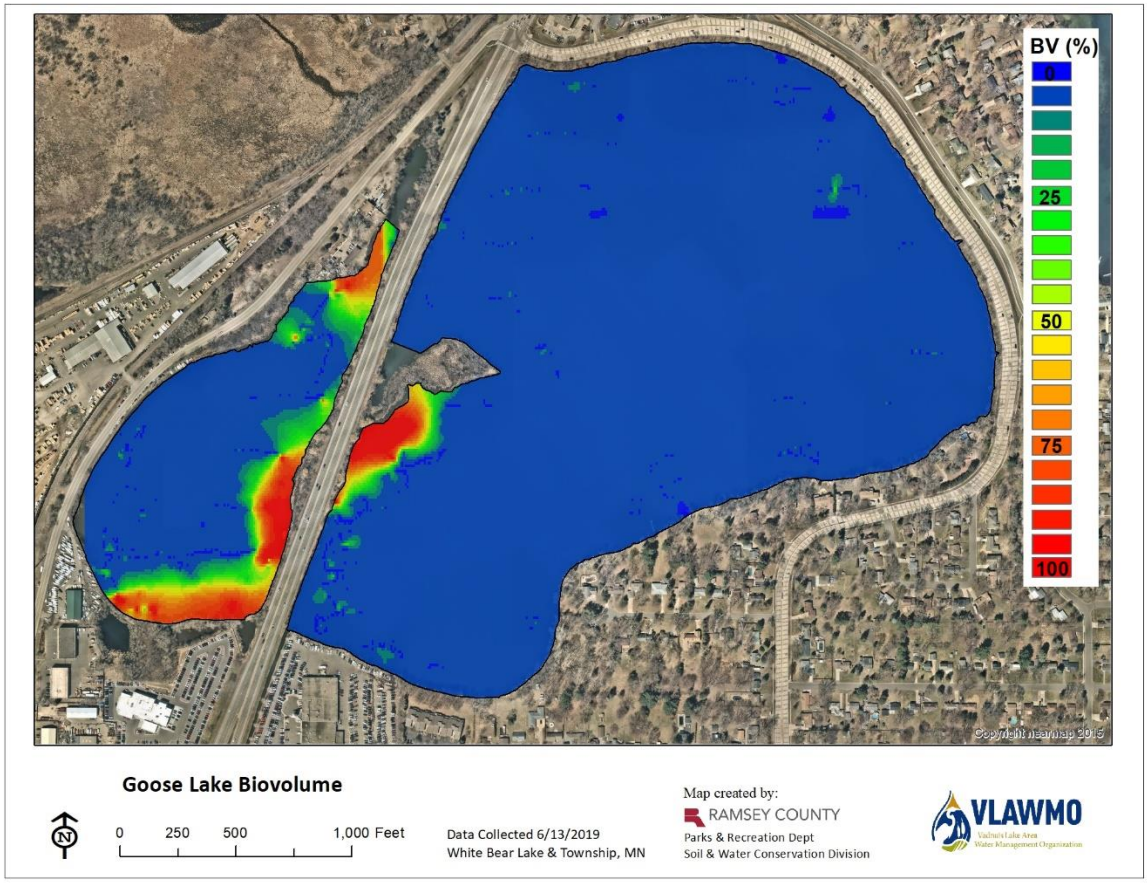


Figure 6. Goose Lake biovolume map. Biovolume represented in %.

3. Curly-leaf Pondweed Survey Methods:

In the 2014 survey of Goose Lake, curly-leaf pondweed (*Potamogeton crispus*), an invasive species, was detected in the southwest corner of East Goose Lake at points 19, 8, and 3 (Figure 7), as well as throughout West Goose Lake. In the interest of stopping the spread of this invasive species, staff conducted a more in-depth vegetation survey of the section of East Goose Lake where curly-leaf pondweed was detected in 2014 in order to delineate precise boundaries of the macrophyte's occurrence for future management.

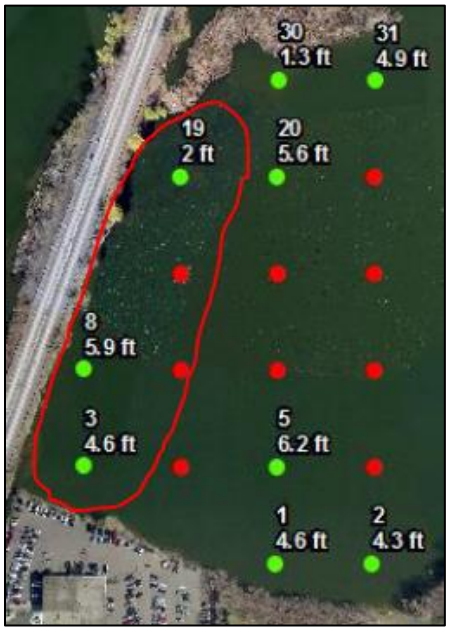


Figure 7. Excerpt of 2014 point intercept survey map of Goose Lake. Curly-leaf Pondweed was found at points 19, 8, and 3. The area in red was the focus of the in-depth survey in 2019 to delineate the occurrence of curly-leaf pondweed.

Consistent with the DNR's manual *Guidance for Delineating Invasive Aquatic Plants for Management*, the target area from figure 7 was transected in a zig-zag pattern along the shallow littoral zone to a maximum of 5 ft depth while taking GPS locations of the boat's tracks and the rake throw locations. Since the only vegetation that was detected was along the shoreline, staff followed the shoreline for additional rake throws to find any instances of curly-leaf pondweed where it had been previously located. Locations of 42 rake throws (in white) and the boat's track (in red) are indicated in Figure 8.

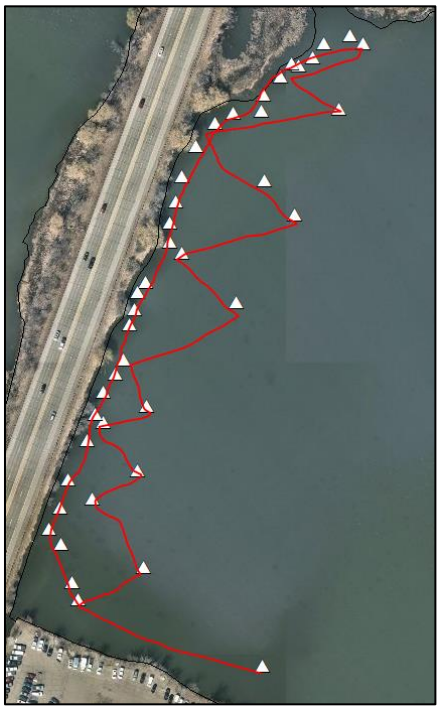


Figure 8. Boat path (red) and rake toss locations (white) for curly-leaf pondweed survey.

Results:

No instances of Curly-leaf Pondweed were found in East Goose Lake. Macrophytes were not found at any of the 94 points during the 6/13/2019 point intercept survey of East Goose Lake. However, Canada Waterweed (*Elodea canadensis*), a non-invasive species, was found at 5 of the 42 points where the rake was thrown during the curly-leaf pondweed survey. This was the lone species detected, in very low abundance, and at about 2 ft depths (Figure 9). Due to the poor amount of light penetrating the lake (secchi reading of 1 ft), macrophyte establishment much deeper than this would be unexpected.

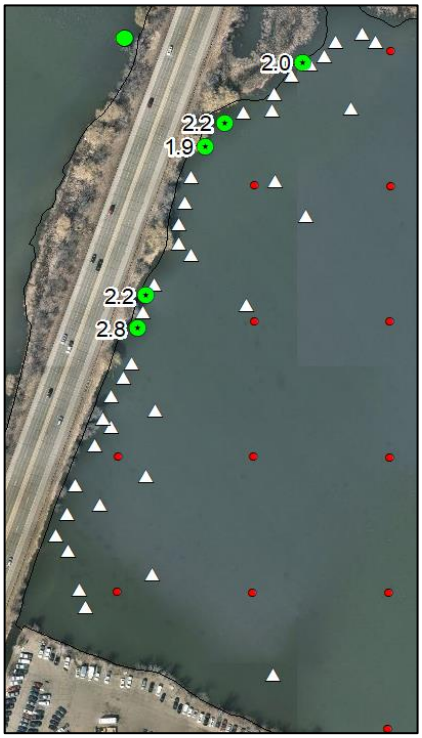


Figure 9. Left: Canada Waterweed, the only macrophyte species detected in East Goose Lake.

Right: The 5 locations (in green) where Canada Waterweed was detected in East Goose Lake, labeled by the depth (ft) in which the species was detected.