Deep Lake

VLAWMO
Vadnais Lake Area
Water Management Organization

Macrophyte and Biovolume Survey 8/27/18

This document contains two types of vegetation data collected on Deep Lake. The first section details the methods and findings of a point intercept survey of macrophyte vegetation. The second section details the methods and results of a vegetation bio-volume survey.
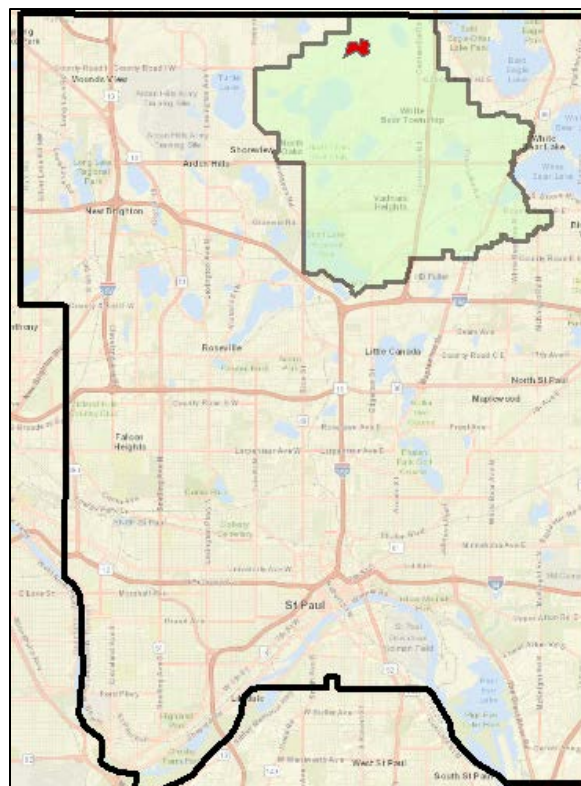
Data collected and prepared by **Ramsey County Soil & Water Conservation Division** for

Vadnais Lake Area Water Management Organization
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Figure 1. Location of Deep Lake (red) in Ramsey County within VLAWMO borders

Deep Lake Macrophyte Survey

August 27, 2018

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 Deep Lake on August 27, 2018. Samples were taken at forty-eight evenly spaced (80 m) geo-referenced points (Figure 2). Data on depth, plant species, and abundance rank was recorded as displayed in Tables 2 and 3 and in the maps of this report. A secchi disk measurement was also taken in the center of the lake on the shady side of the boat, with results in Table 3.

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 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
81-100	5
61-80	4
41-60	3
21-40	2
1-20	1

Results:

Aquatic macrophytes were found at 46 of 48 points surveyed (Figure 2). Coontail *(Ceratophyllum demersum)* was the most prevalent species, found at 45 out of 48 points with both the highest percent occurrence (98%) and the highest average abundance (3.6). The next most common species were Greater and Lesser Duckweed (*Spirodela polyrhiza* and *Lemna minor*, respectively*)* and Watermeal (*Wolffia)*, at 67% occurrence each. Species found between 28% and 50% occurrence included White Water Lily *(Nymphaea odorata*), Filamentous Algae *(Spirogyra/Cladophora sp.),* Canada Waterweed (*Elodea canadensis),* and Star Duckweed *(Lemna trisulca).* Taxa found at less than 20% occurrence included Curly Leaf Pondweed (*Potamogeton crispus*), Flat-stem Pondweed (*Potamogeton zosteriformis*), Leafy Pondweed (*Potamogeton foliosus*), Slender Naiad (*Najas flexilis*), and Southern Naiad (*Najas guadalupensis*). The secchi disk reading was 1.8m (6.0 ft) (Table 3).

Table 2

% Occurrence and Avg Abundance of aquatic plant taxa present on Deep Lake - 8/27/2018

Species	Common Name	Scientific Name	Average Abundance 8/27/2018	Percent Occurrence 8/27/2018
1	Coontail	*Ceratophyllum demersum*	3.6	98%
2	Watermeal	*Wolffia spp.*	2	67%
3	Greater Duckweed	*Spirodela polyrhiza*	1.4	67%
4	Lesser Duckweed	*Lemna minor*	1.3	67%
5	Star Duckweed	*Lemna trisulca*	1.4	50%
6	White Water Lily	*Nymphaea odorata*	1.2	50%
7	Canada Waterweed	*Elodea canadensis*	1.3	37%
8	Filamentous Algae	*Spirogyra sp./Cladophora*	1.3	28%
9	Slender Naiad	*Najas flexilis*	1.6	17%
10	Flat-stem Pondweed	*Potamogeton zosteriformis*	1.4	15%
11	Curly-leaf Pondweed	*Potamogeton crispus*	1.3	15%
12	Leafy Pondweed	*Potamogeton foliosus*	1	9%
13	Southern Naiad	*Najas guadalupensis*	1	9%

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.

Table 3

Depth, secchi disk reading, and vegetation survey results for Deep Lake, August 27th 2018

Point	White Water Lily	Watermeal	Coontail	Greater Duckweed	Lesser Duckweed	Filamentous Algae	Canada Waterweed	Star Duckweed	CurlyLeaf Pondweed	Flat Stem Pondweed	Leafy Pondweed	Slender Naiad	Southern Naiad
1	2	3	4	2	1		1	2		1			
2	1	1	3	1				1		1			
3	1	5	1	2	2		1						
4	3	1	2	1	1			1		1			
5	1	2	5	3	1			3					
6	1	1	5	1	1		1	1					
7		1	5	1	1								
8	2	3	2	1	1			2					
9	2	3	5	3	2			3					
10	1		5	1			1	1					
11	1	1	5	2	1	1		1					
12		1	5	1	1								
13	1	1	2	1	1			4					
14			5			1							
15			3					1					
16	1		2										
17	1	2	5	1	1			1					
18	1		5	1	1	2							
19													
20	1	4	5	1	2								
21		1	1			3	1		1		1		
22		1	5	2	2			1				1	
23	1	1	5		1	1	1	1				3	
24		4	1	2	1	1	1	1				1	
25	1			1	1			1	1		1		
26			1			1					1		
27		3	5	3	3	1		1	2				1
28			4						1			3	1
29			5				3	1					
30		2	5	1	1		2						
31	1	2	1	1	2		1		1	1			
32	1		2		1		1						
33													
34		1	5	1	1	1		1					
35			1										
36	1	2	5	1	1	1	1						
37		1	5	2	2								
38		1	1	1		1	1						
39		3	5	2	1		2						
40			4	1	1								
41			5					1					1
42	1	1	5			1					2	1	
43		2	5	1				1			3	1	
44	1	3	2	1	1		1		2		1	2	1
45		3	5		1	2	2						
46			1								1		
47	1		1		1		1	1	1			1	
48		1	4	1	1			1					

|	White Water Lily	Watermeal	Coontail	Greater Duckweed	Lesser Duckweed	Filamentous Algae	Canada Waterweed	Star duckweed	CurlyLeaf Pondweed	Flat Stem pondweed	Leafy Pondweed	Slender Naiad	Southern Naiad
Total Abundance	28	61	163	44	39	17	22	32	9	10	4	13	4
Count	23	31	45	31	31	13	17	23	7	7	4	8	4
Avg Abundance	1.2	2.0	3.6	1.4	1.3	1.3	1.3	1.4	1.3	1.4	1.0	1.6	1.0
Percent Occurrence	50%	67%	98%	67%	67%	28%	37%	50%	15%	15%	9%	17%	9%

Secchi Depth: 1.8m
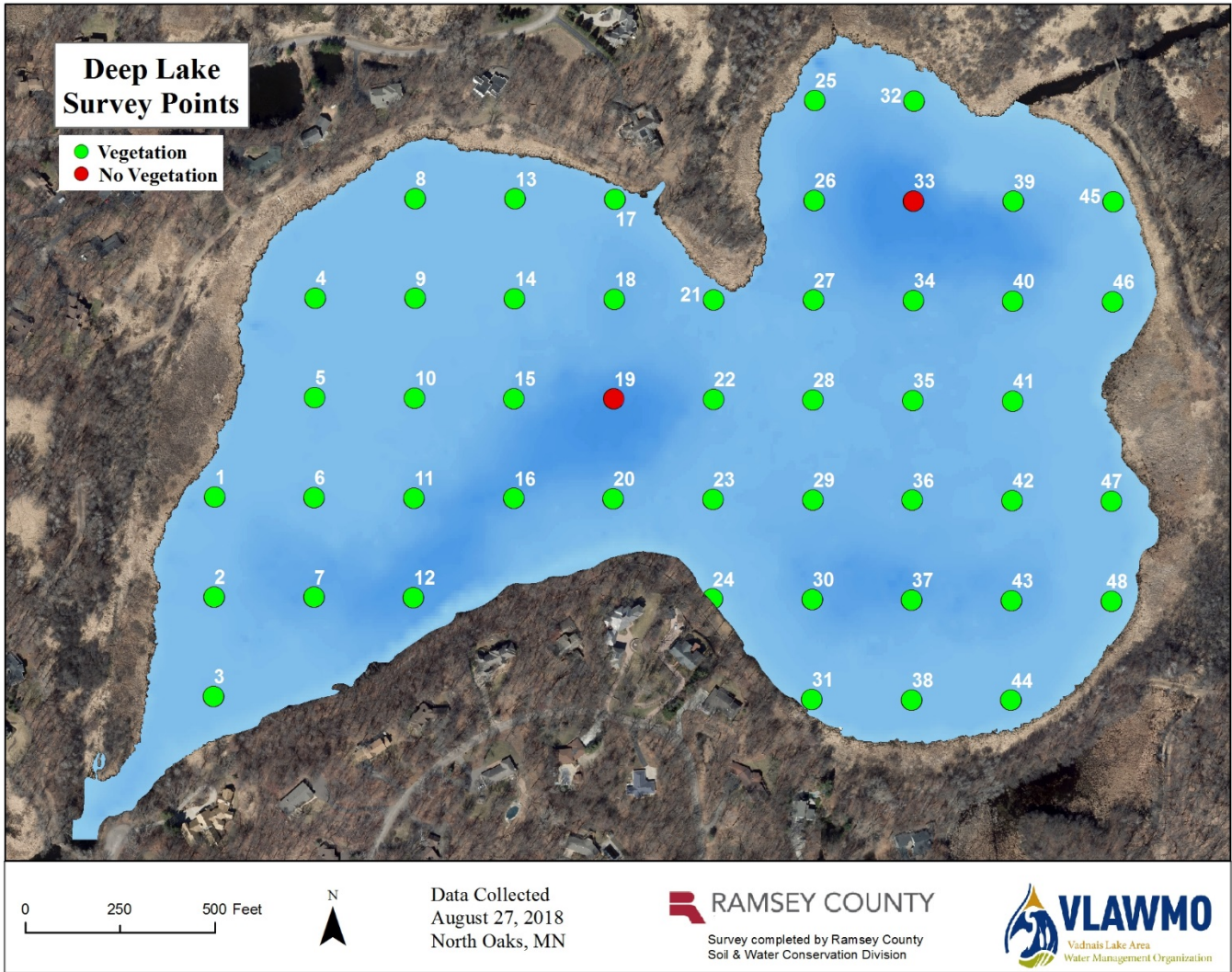
Figure 2. Deep Lake vegetation point intercept survey locations. N=48.

Deep Lake Biovolume Survey

August 27, 2018

Methods:

A Lowrance HDS-5™ Global Positioning System (GPS)-enabled depth finder was used to collect submerged aquatic vegetation biovolume data on Deep Lake on August 27, 2018. The lake was transected at a distance of 80 meters between transects at a speed of no more than 6 miles per hour. Sonar log data was recorded using the Lowrance HDS-5™ Global Positioning System (GPS)-enabled depth finder to assess this data. Transducer data was processed using Contour Innovations, LLC, BioBase software.
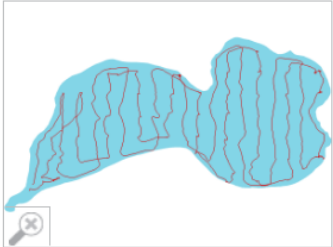
Results:

The results below were produced by exporting the processed data from the BioBase system and interpolating spatial data using ArcGIS software. Results include maps as well as statistics of biovolume distribution represented as total percent of water column occupied by plant matter ranging from zero to one hundred. Interactive map data, including sonar log trip replays, can be viewed on the BioBase website:www.cibiobase.com.

BIOBASE — VEGETATION ANALYSIS REPORT

Deep Lake, Ramsey Minnesota

Generated: 8/31/2018 5:50:56 PM (UTC)

Waterbody Size: 78.10 acres

report link

Data Collector	**Survey Size**
Andrea Prichard	Area: 77.74 acres
	Percent: 99.54% of waterbody
Data Collection Date	Volume: 185.72 acre ft
8/27/2018 5:10:31 PM (UTC)	
	Est.Waterbody Volume ?
Average Water Temperature	230136.79 cu. m
77.35° F	(186.57 acre ft)
Location	**Settings**
Start: 45.11189957, -93.08832242	Track Buffer: 25 m
End: 45.11210948, -93.08821426	Grid Cell Size: 5.0 m
	Min.BV Detect: 5%
	Min.Veg Depth Detect: 0.73 m

Manual Offset

0 ft

Quality Control

Reviewer: Ian McCormack

Comments: False bathymetry due to dense vegetation.

Survey Summary

	Type ?	PAC ?	Avg BVp ?	SD BVp ?	Avg BVw ?	SD BVw ?	Depth Range	Avg Depth	Distance	No.Points
Full Survey Point		79.3%	80.4%	±26.5%	63.8%	±27.9%	1.00 - 14.86 ft	2.33 ft	5.83 miles	1511
Grid		96.2%	72.8%	±25.5%	70.1%	±28.6%	0.10 - 6.57 ft	2.39 ft	-	22717

Biovolume Analysis by Quantity

AOI ?	0-5%	5-20%	20-40%	40-60%	60-80%	>80%
1	20.71%	3.97%	5.16%	6.68%	10.85%	52.61%

Biovolume Analysis by Depth

Full Survey	Depth	Type ?	Count	PAC ?	Avg BVp ?	SD BVp ?	Avg BVw ?	SD BVw ?
	0-1m	Point	1156	98.0%	84.0%	±22.4%	22.2%	±0.0%
	1-2m		349	18.6%	17.8%	±9.8%	7.6%	±0.0%
	2-3m		6	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	18210	100.0%	79.4%	±21.3%	79.4%	±21.3%
	1-2m		4507	83.6%	46.3%	±23.9%	38.7%	±27.8%
	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.

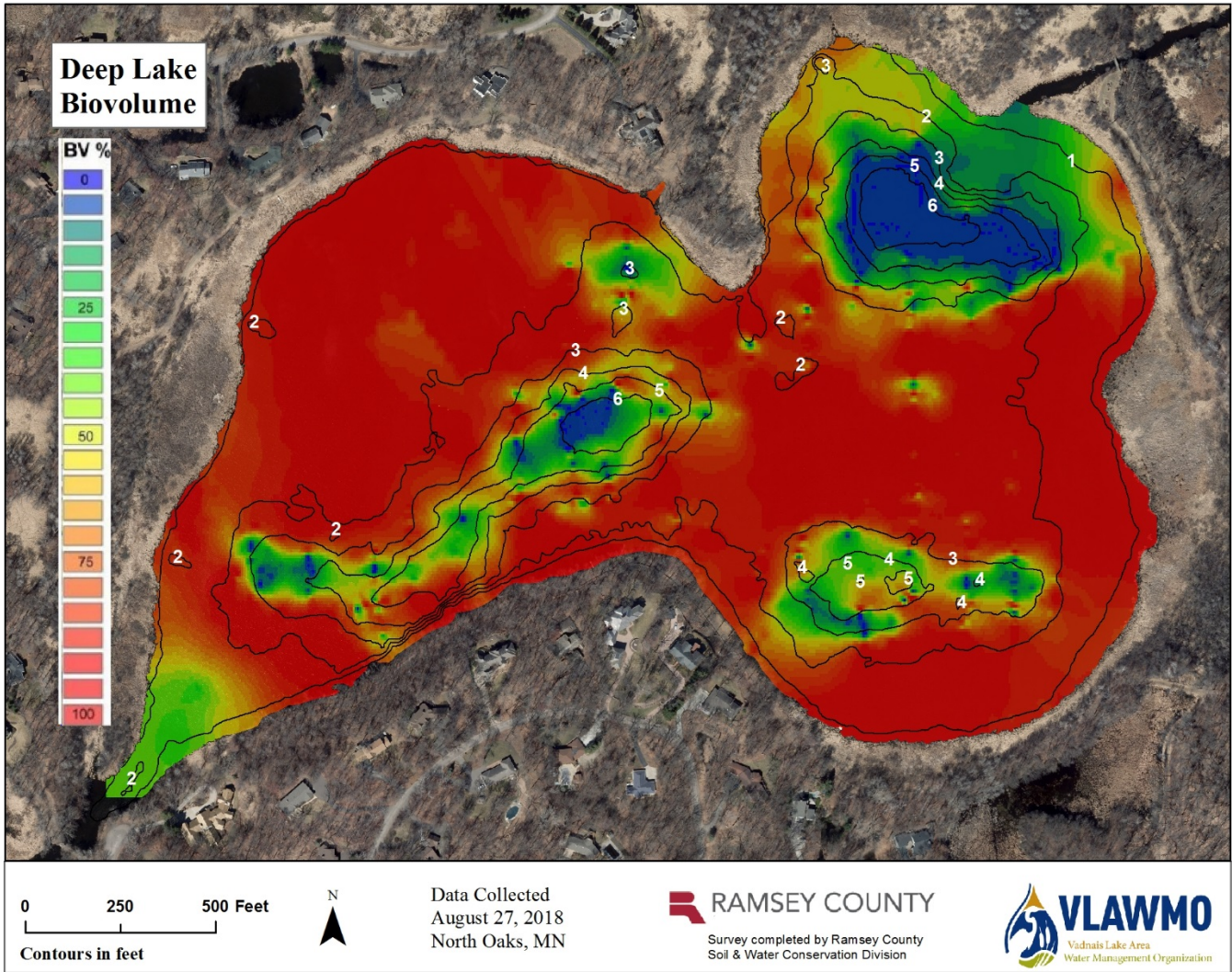Figure 3. Deep Lake BioBase survey summary statistics.

Figure 4. Deep Lake vegetation biovolume with 1ft contours. Blue = 0% and Red = 100%