

Long Lake



Macrophyte, Contour, Biovolume and Bottom Hardness Survey 6/15/16

This document contains two reports of data collected on Long Lake. The first report details the methods and findings of a point intercept survey of macrophyte vegetation. The second report details the methods and results of a contour, vegetation bio-volume and bottom hardness (composition) survey.

Data collected and prepared by **Ramsey Conservation District** for:
Ramsey County Public Works Environmental Resources

Long Lake Macrophyte Survey

Ramsey County Public Works Environmental Resources & Ramsey Conservation District

June 15, 2016

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 Long Lake on June 15, 2016. Samples were taken at 110 of the shallower 155 geo-referenced points, spaced 70 meters apart (Figure 2). Data on depth, plant species, and abundance rank were 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 south lobe of the lake on the shady side of the boat, as displayed in Table 3.

A double-tined metal rake attached to a 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. Of the 155 points, the rake was thrown at 110 locations. 45 of the deepest points in the southern half of Long Lake were omitted from the survey, as they had been in the previous survey, due to the dearth of vegetation growth over 5 meters of depth.

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 70 survey points (Figure 2). Curly-leaf Pondweed (*Potamogeton crispus*) and Eurasian Watermilfoil (*Myriophyllum spicatum*) were the most common species detected. Other species present included Canada Waterweed (*Elodea canadensis*), Coontail (*Ceratophyllum demersum*), Small Pondweed (*Potamogeton pusillus*), Lesser Duckweed (*Lemna minor*), Watermeal (*Wolffia*), Filamentous Algae (*Spirogyra/Cladophora sp.*), Leafy Pondweed (*Potamogeton foliosus*), Slender Leaf Naiad

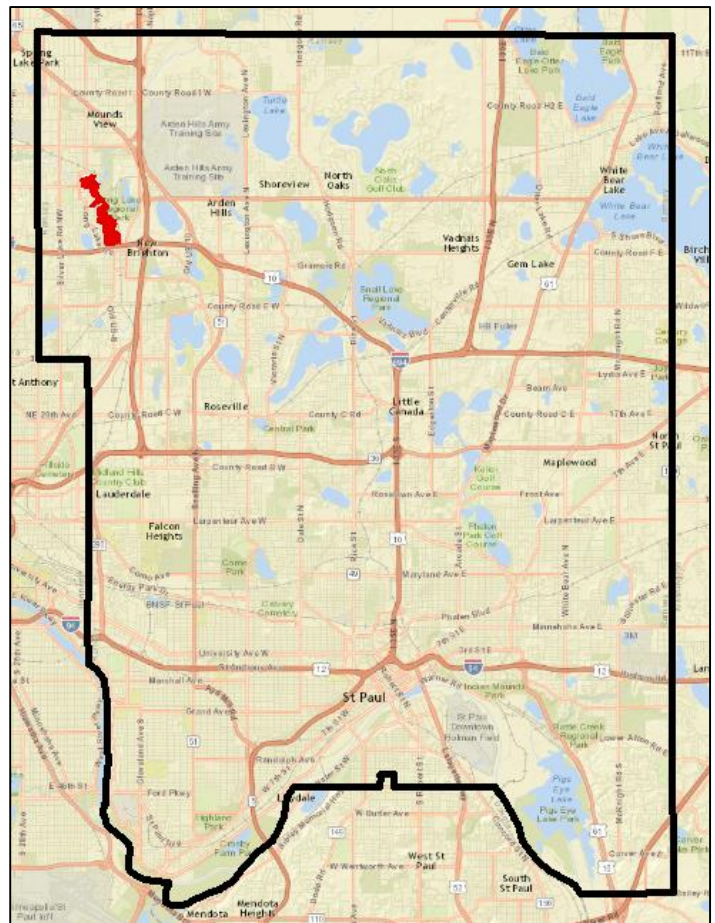


Figure 1. Location of Long Lake shown in red within Ramsey County Boundaries.

(*Najas flexilis*), and Sago Pondweed (*Stuckenia pectinata*). The secchi disk reading was 1.7m (5.5ft), taken from the south basin.

A previous macrophyte survey of Long Lake was conducted on June 4, 2012 using the same methodology. Species observed on June 15, 2016 not present on June 4, 2012 included Eurasian Watermilfoil (*Myriophyllum spicatum*), Leafy Pondweed (*Potamogeton foliosus*), Slender Naiad (*Najas flexilis*), and Sago Pondweed (*Stuckenia pectinata*). Species present on June 4, 2012 not observed on June 15, 2016 included Flat-stem pondweed (*Potamogeton zosteriformis*) and Yellow Water Lily (*Nuphar lutea*) (Table 2).

With a 29% increase in occurrence since 2012, Curly-leaf Pondweed is now the dominant species of Long Lake, with 2/3 of points with vegetation containing a sample of this species. Though not present in the 2012 study, Eurasian Watermilfoil is the next prevalent species, appearing in 1/2 of points with vegetation. Coontail and Small Pondweed have slightly less prevalence and abundance than in 2012, while Watermeal is far more widespread (from 3% to 20% occurrence) than in 2012. Algal presence remains minimal.

Table 2

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

Species	Common Name	Scientific Name	Average Abundance 6/15/2016	Percent Occurrence 6/15/2016	Average Abundance 6/4/2012	Percent Occurrence 6/4/2012
1	Curly-leaf Pondweed	<i>Potamogeton crispus</i>	1.1	67	1.7	38
2	Eurasian Watermilfoil	<i>Myriophyllum spicatum</i>	1.4	50		
3	Canada Waterweed	<i>Eleodea canadensis</i>	1.1	29	1.8	46
4	Coontail	<i>Ceratophyllum demersum</i>	1	23	1.4	37
5	Watermeal	<i>Wolffia</i>	1	20	1	3
6	Lesser Duckweed	<i>Lemna minor</i>	1	19	1.3	7
7	Small Pondweed	<i>Potamogeton pusillus</i>	1	14	1.5	24
8	Leafy Pondweed	<i>Potamogeton foliosus</i>	1	11		
9	Filamentous Algae	<i>Spirogyra/Cladophora sp</i>	1.2	7	1.2	10
10	Sago Pondweed	<i>Stuckenia pectinata</i>	1	3		
11	Slender Leaf Naiad	<i>Najas flexilis</i>	1	4		

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
 Long Lake
 Depth, secchi disk and vegetation abundance point survey results, June 15, 2016

Point	Leafy Pond weed	Eurasian Watermilfoil	Curly-leaf Pondweed	Coon tail	Water meal	Lesser Duckweed	Filamentous Algae	Canada Waterweed	Slender-leaf Naiad	Sago Pondweed	Small Pond weed
1			1		1	1		1			
2			1		1	1					
3					1						
4					1	1					
5						1					
7		1	1	1							
10					1						
11			1	1							
15				1							
16											
17		1	1			1		1			
18			1								
19			1			1		1			
25		1	1	1		1					
26			2	1	1	1		1			
27			1								
30						1					
32											1
33											
34			1	1						1	
35			1								
36			1						1		
37		1	1	1	1	1		1			
38			1	1							
39		1	1	1							
40			1								
41					1	1					
44			1								
45			1		1						
46					1						
47			1	1		1		1			
48	1	2	2			1		1			
49		1	1								
50		1	1								
51		3	1								
52		2									
53		1			1						
54			1								
55	1										
56		1						1			
57	1	1	1								1
58			1						1		1
59		1	1					1			1
60			1	1	1						
61	1	1	2	1				2			
66											1
67			1								
68		1	1	1				1			
69					1						1
70	1	1	1								
71		1					1	1			
79		1	1								
80					1						
81		1					1				1
82		1	1	1			2	1			
83		1	1								
85		1									
86		1									
92			1								1
93	1		1					1	1		
96	1										
100		1	1				1	1			
110		3	1	1				1			
111	1	1	1					1			
135		1						1		1	1
136		4	1								
142		1	1					1			1
143		1	1								
146		1									
151		1	1				1				
152		2	1	1				1			
155		4	1								
Total Abundance Count	8	48	50	16	14	13	6	21	3	2	10
Avg. Abundance	1.00	1.37	1.06	1.00	1.00	1.00	1.20	1.05	1.00	1.00	1.00
% Occurrence	11%	50%	67%	23%	20%	19%	7%	29%	4%	3%	14%

Secchi Depth: 1.7m

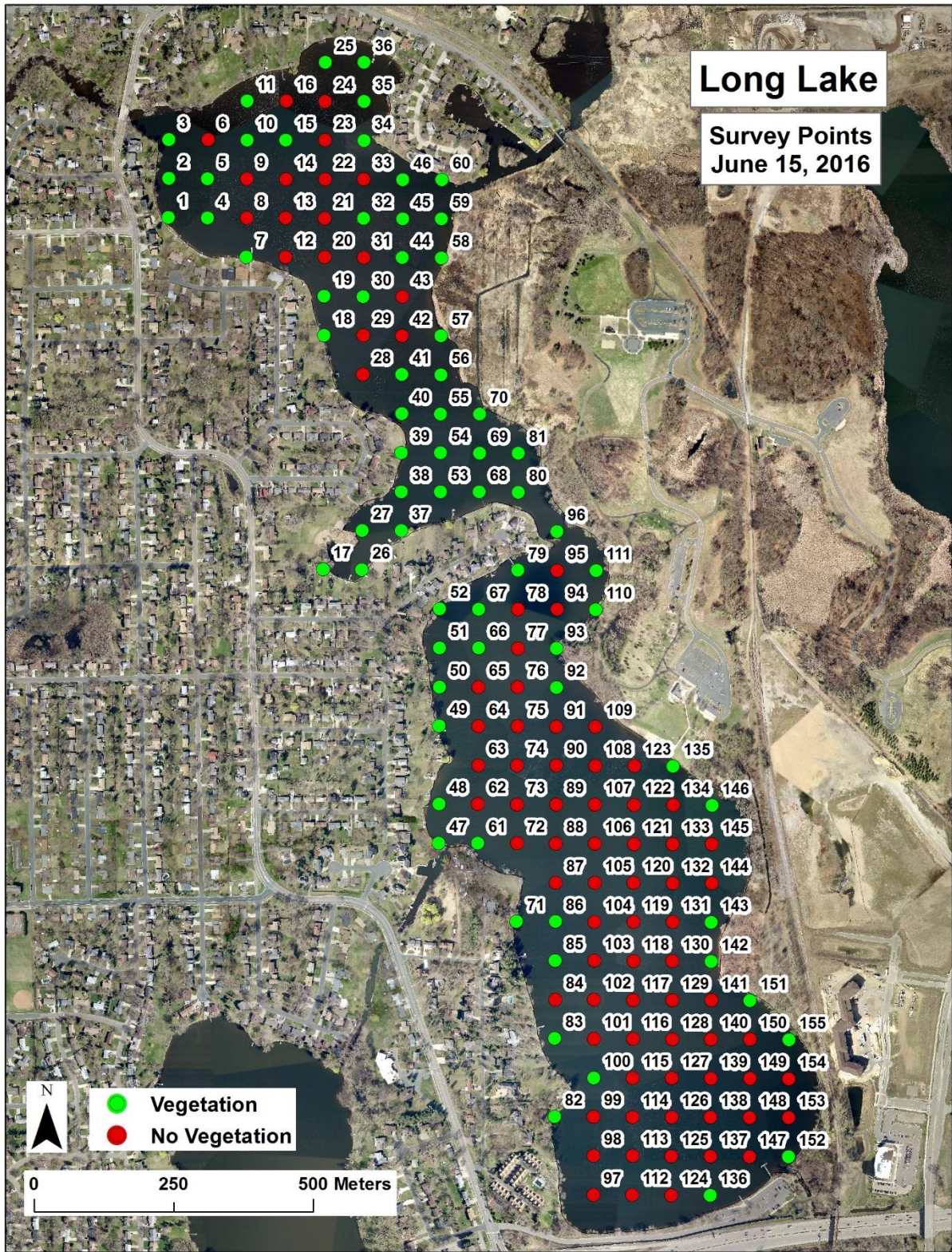


Figure 2. Long Lake vegetation point intercept survey locations. N=155.

Long Lake Biovolume, Contour and Bottom Hardness Survey

June 15, 2016

Methods:

A Lowrance HDS-5™ Global Positioning System (GPS)-enabled depth finder was used to collect submerged aquatic vegetation biovolume, lake depth (bathymetry), and bottom hardness (composition) data on Long Lake on June 15, 2016. The lake was transected at a maximum distance of 40 meters between transects at a speed of no more than 5 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. Additional results include contour depth maps at one-meter intervals as well as bottom hardness (composition) maps. Bottom hardness is represented as soft, medium, or hard; with soft bottoms characterized as muck, loose silt or sand and medium to harder bottoms characterized as compacted sand, gravel, or rock. 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

Long Lake, Ramsey County Minnesota Generated: 6/16/2016 7:52:13 AM (UTC)

Waterbody Size: 79.40 ha (196.20 acres) [report link](#)



Data Collector	Andrea Prichard
Data Collection Date	6/15/2016 2:18:08 PM (UTC)
Average Water Temperature	23.03° C (73.45° F)
Location	Start: 45.08503723, -93.20585632 End: 45.06742096, -93.19766235

Survey Size	Area: 75.88 ha (187.50 acres)
	Percent: 95.56% of waterbody
	Volume: 2,919,101.00 cu. m (2,366.55 acre ft)
Est. Waterbody Volume ?	3,054,557.10 cu. m (2,476.37 acre ft)

Settings	Track Buffer: 25 m
	Grid Cell Size: 5 m
	Min. BV Detect: 5%
	Min. Veg Depth Detect: 0.73152 m

Area of Interest Summary

AOI ?	Type ?	PAC ?	Avg BVp ?	SD BVp ?	Avg BVw ?	SD BVw ?	Depth Range	Avg Depth	Distance	No. Points
1	Point	50.5%	60%	±36.4%	30.3%	±39.6%	0.32-8.23 m	3.06 m	26.45 km	4,617
	Grid	44.7%	57.9%	±33.6%	25.9%	±36.5%	0-8.2 m	3.75 m	-	57,826

▲ Biovolume Analysis by Quantity

AOI ?	0-5%	5-20%	20-40%	40-60%	60-80%	>80%
1	49.47%	12.13%	6.19%	5.13%	5.57%	21.51%

▲ Biovolume Analysis by Depth

AOI ?	Depth	Type ?	Count	PAC ?	Avg BVp ?	SD BVp ?	Avg BVw ?	SD BVw ?
1	0-1m	Point	328	95.7%	88%	±20.9%	84.3%	±27.1%
	1-2m		1605	86%	68.2%	±32.4%	58.7%	±38.2%
	2-3m		756	44.3%	42.7%	±32.9%	18.9%	±30.5%
	3-4m		601	37.6%	14.2%	±10.3%	5.3%	±9.3%
	4-5m		365	21.1%	9.5%	±3.6%	2%	±4.2%
	5-6m		312	0%	-	-	0%	±0%
	6-7m		245	0%	-	-	0%	±0%
	7-8m		382	0%	-	-	0%	±0%
	8-9m		23	0%	-	-	0%	±0%
	>9m		0	-	-	-	-	-
	0-1m	Grid	9258	98.7%	82%	±24%	80.9%	±25.6%
	1-2m		11671	92.5%	55%	±30.1%	50.8%	±32.3%
	2-3m		6229	44.1%	37.1%	±24.8%	16.4%	±24.7%
	3-4m		5230	35.6%	20.1%	±14.5%	7.1%	±12.9%
	4-5m		4604	21%	13.4%	±8.8%	2.8%	±6.8%
	5-6m		5597	5.1%	11.7%	±6.2%	0.6%	±2.9%
	6-7m		5602	1.5%	8.9%	±3.1%	0.1%	±1.1%
	7-8m		9040	0%	5.4%	±0%	0%	±0.1%
8-9m	595		0%	-	-	0%	±0%	
>9m	0	-	-	-	-	-		

▲ Glossary

AOI
Area of Interest: Defines the individual transects or contiguous data samples as depicted by the color coding of each trip line. Separate 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. Long Lake BioBase survey summary statistics.

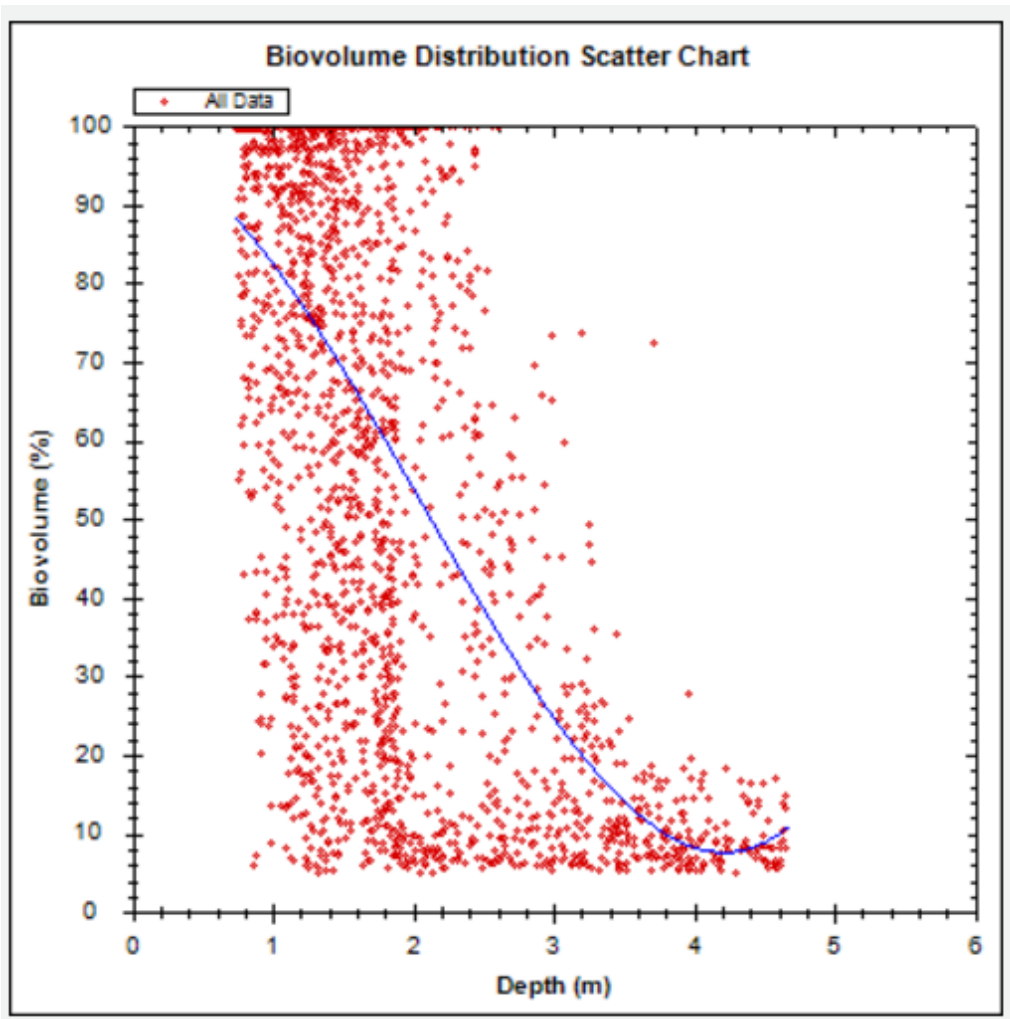


Figure 4. Long Lake biovolume distribution scatter chart.

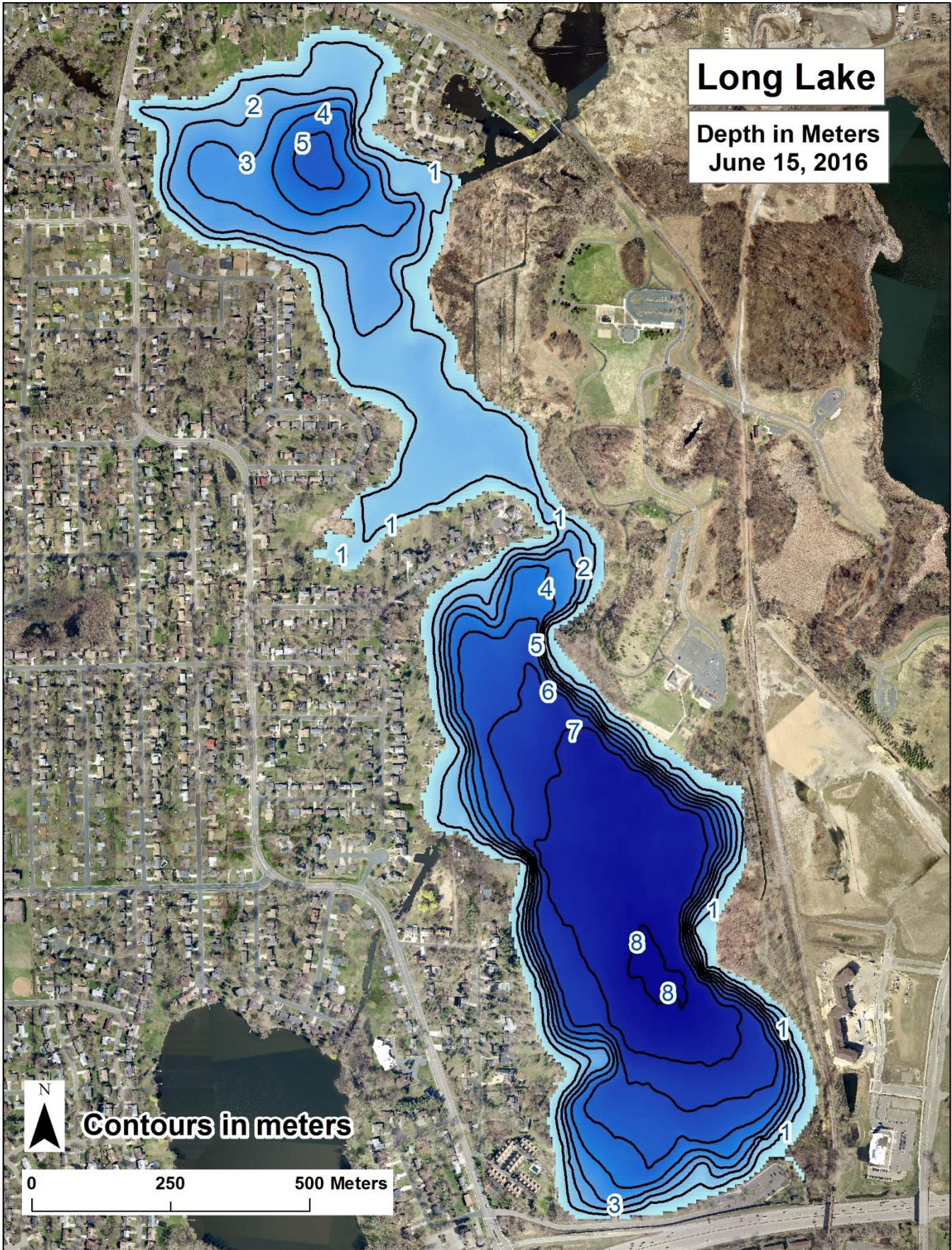


Figure 5. Long Lake depth with 1 meter contours

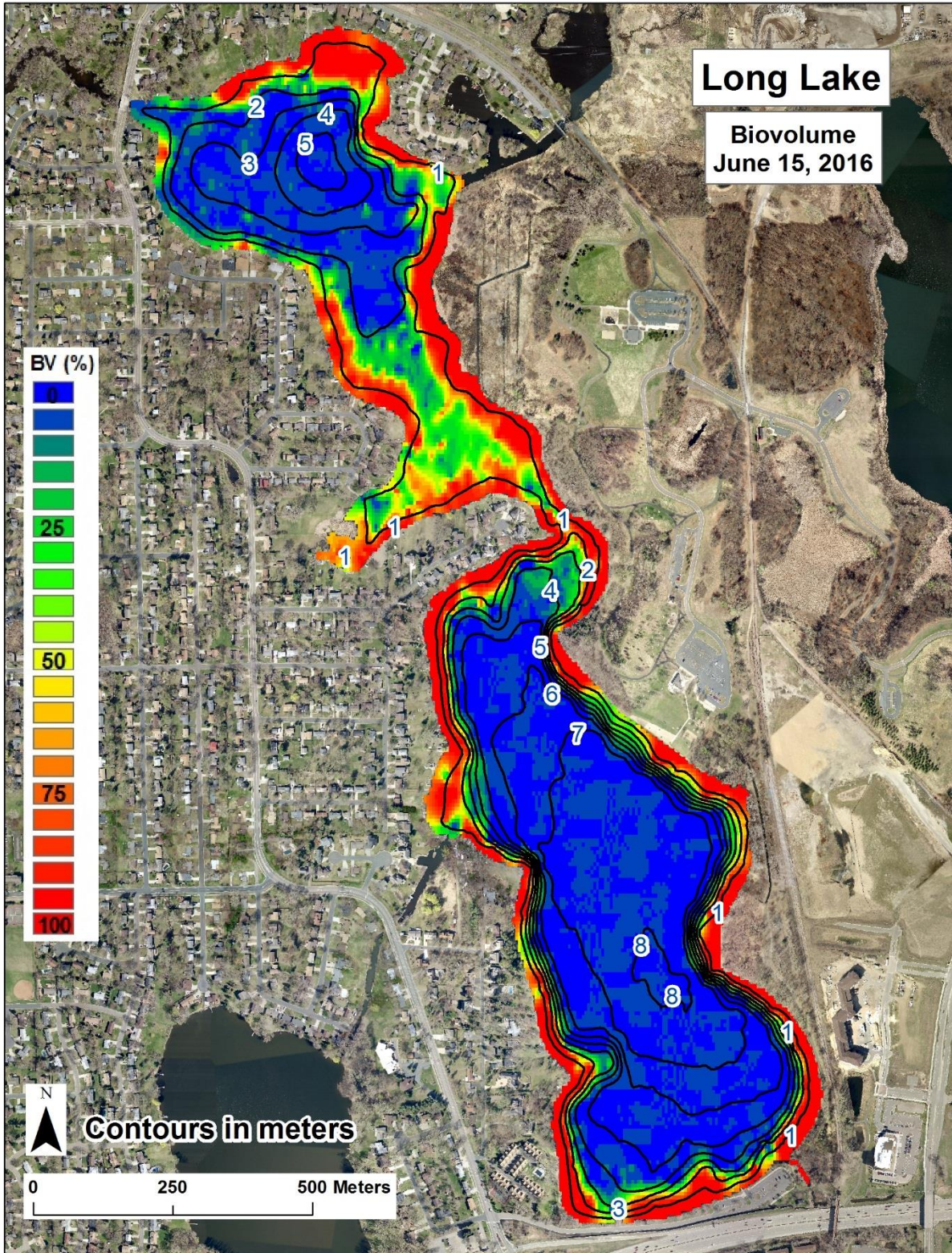


Figure 6. Long Lake vegetation biovolume with 1m contours. Percent values range from zero to one hundred; blue = 0%, Yellow = 50% and Red = 100%.

Long Lake

Biovolume and
Survey Points
June 15, 2016

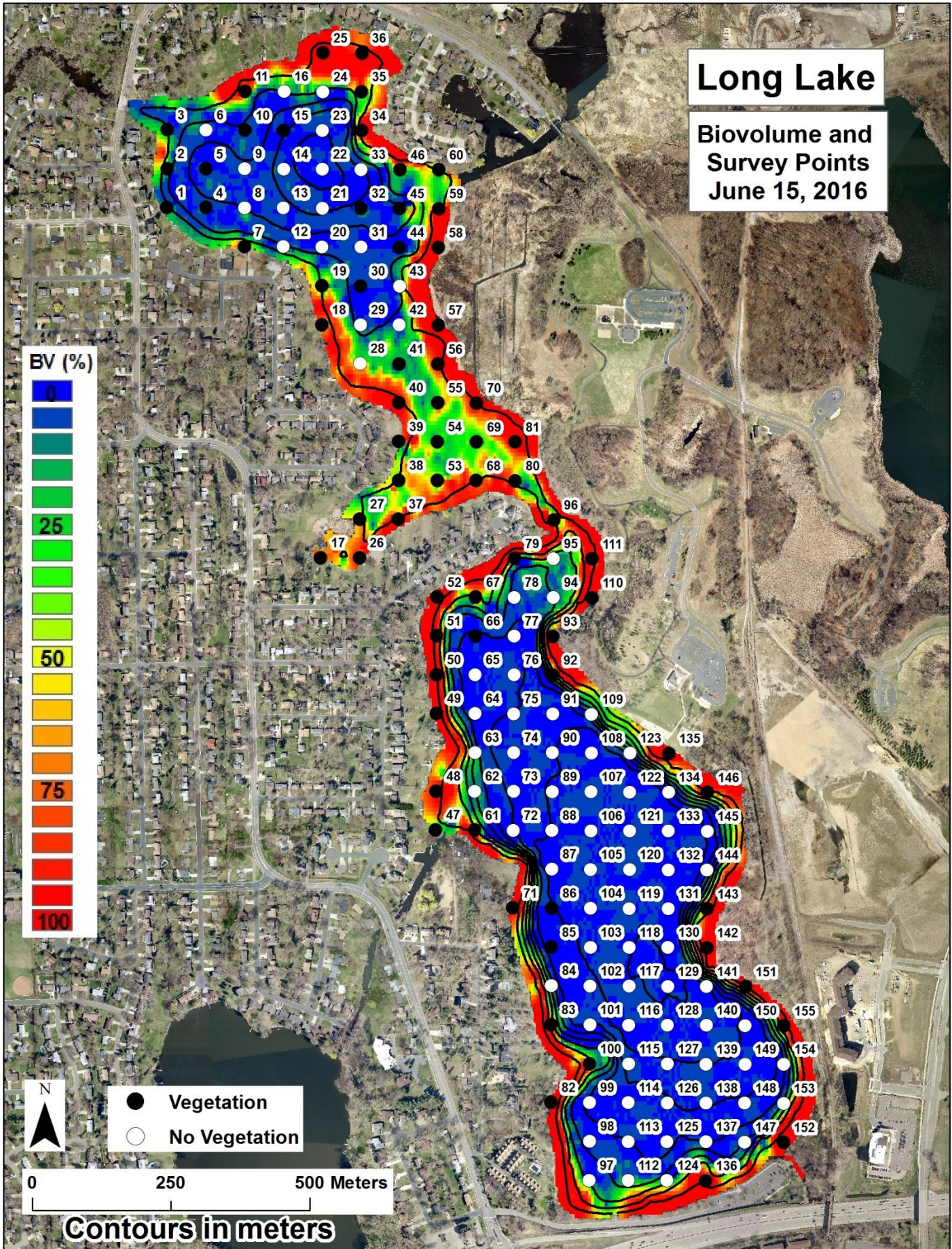
BV (%)



- Vegetation
- No Vegetation

0 250 500 Meters

Contours in meters



Point	Leafy Pond weed	Eurasian Watermilfoil	Curly-leaf Pondweed	Coon tail	Water meal	Lesser Duckweed	Filamentous Algae	Canada Waterweed	Slender-leaf Naiad	Sago Pondweed	Small Pond weed
1			1		1	1		1			
2			1		1	1					
3					1						
4					1	1					
5						1					
7		1	1	1							
10					1						
11			1	1							
15				1							
16											
17		1	1			1		1			
18			1								
19			1			1		1			
25		1	1	1		1					
26			2	1	1	1		1			
27			1								
30						1					
32											1
33											
34			1	1						1	
35			1								
36			1						1		
37		1	1	1	1	1		1			
38			1	1							
39		1	1	1							
40			1								
41					1	1					
44			1								
45			1		1						
46					1						
47			1	1		1		1			
48	1	2	2			1		1			
49		1	1								
50		1	1								
51		3	1								
52		2									
53		1			1						
54			1								
55	1										
56		1						1			
57	1	1	1								1
58			1						1		1
59		1	1					1			1
60			1	1	1						
61	1	1	2	1				2			
66											1
67			1								
68		1	1	1				1			
69					1						1
70	1	1	1								
71		1					1	1			
79		1	1								
80					1						
81		1					1				1
82		1	1	1			2	1			
83		1	1								
85		1									
86		1									
92			1								1
93	1		1					1	1		
96	1										
100		1	1				1	1			
110		3	1	1				1			
111	1	1	1					1			
135		1						1		1	1
136		4	1								
142		1	1					1			1
143		1	1								
146		1									
151		1	1				1				
152		2	1	1				1			
155		4	1								

Figure 7. Long Lake vegetation biovolume, point intercept survey locations with table of species found

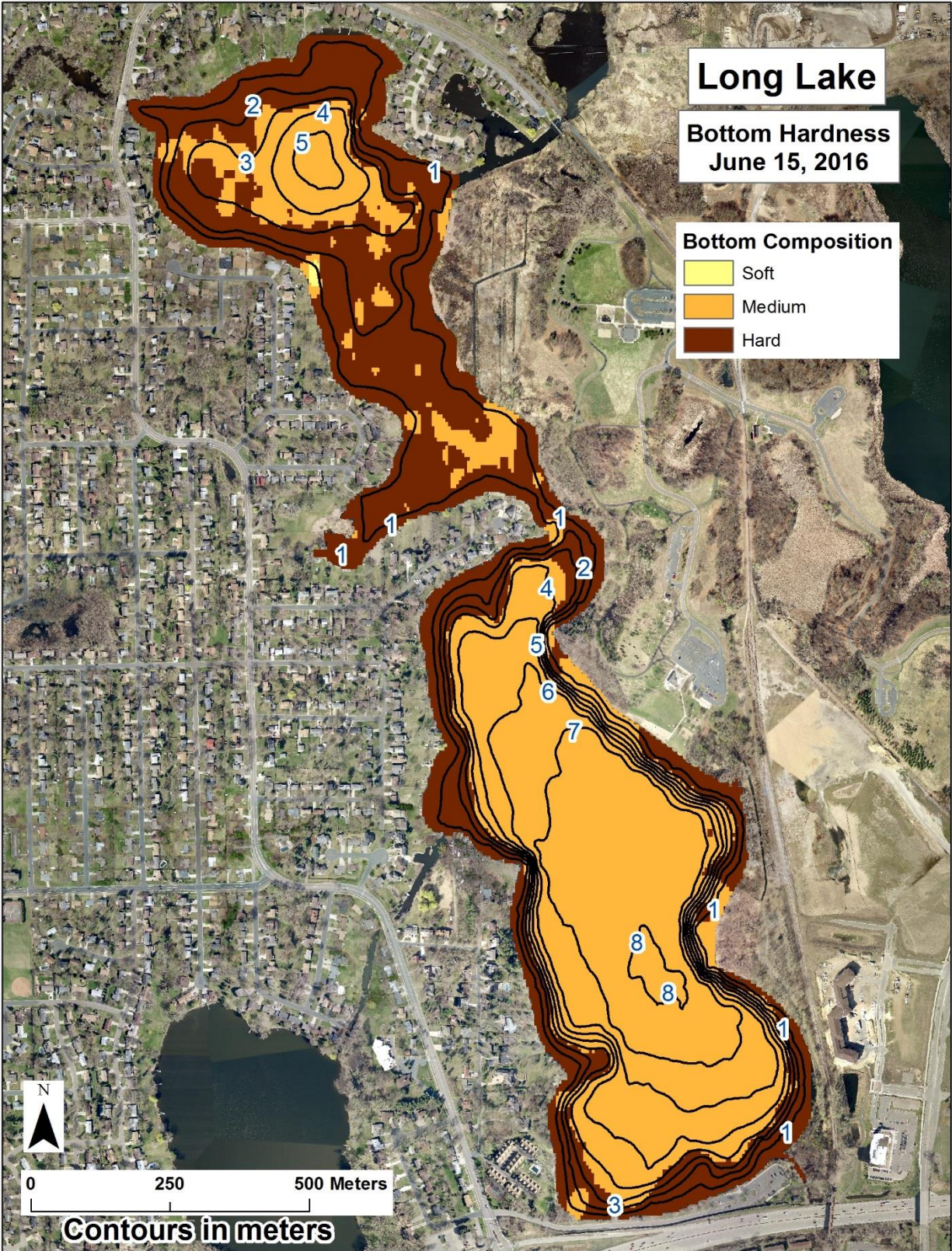


Figure 8. Long Lake bottom hardness values with 1m contours.