Pleasant Lake

VLAWMO
Vadnais Lake Area
Water Management Organization

Curly-leaf Pondweed Delineation, Macrophyte, Contour, Biovolume and Bottom Composition Survey

This document contains three reports of data collected on Pleasant Lake. The first report details the methods and findings of a Curly-leaf pondweed (*Potamogeton crispus*) delineation survey completed May 25, 2023. The second report details the methods and findings of a point intercept survey of macrophyte vegetation completed August 18, 2023. The third report details the methods and results of a contour, vegetation bio-volume and bottom hardness (composition) survey also completed on August 18, 2023.

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

Vadnais Lakes Watershed Management Organization
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Curly-leaf Pondweed (*Potamogeton crispus*) Delineation Survey

5/25/2023

A delineation survey method incorporating aerial photography and a Lowrance Elite-7 TI2 Global Positioning System (GPS) were used to assess the Curly-leaf pondweed community in Pleasant Lake on May 25, 2023. Samples were taken at 641 randomly spaced geo-referenced points within the littoral zone (Figure 2). Data on abundance rank were recorded as displayed in figures 2-5 of this report.

A double-tined metal rake attached to a 11-meter rope was used to collect specimens. At each point the device was thrown out approximately one 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). Visual confirmation was used in some locations utilizing the same rake scale in table 1.

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

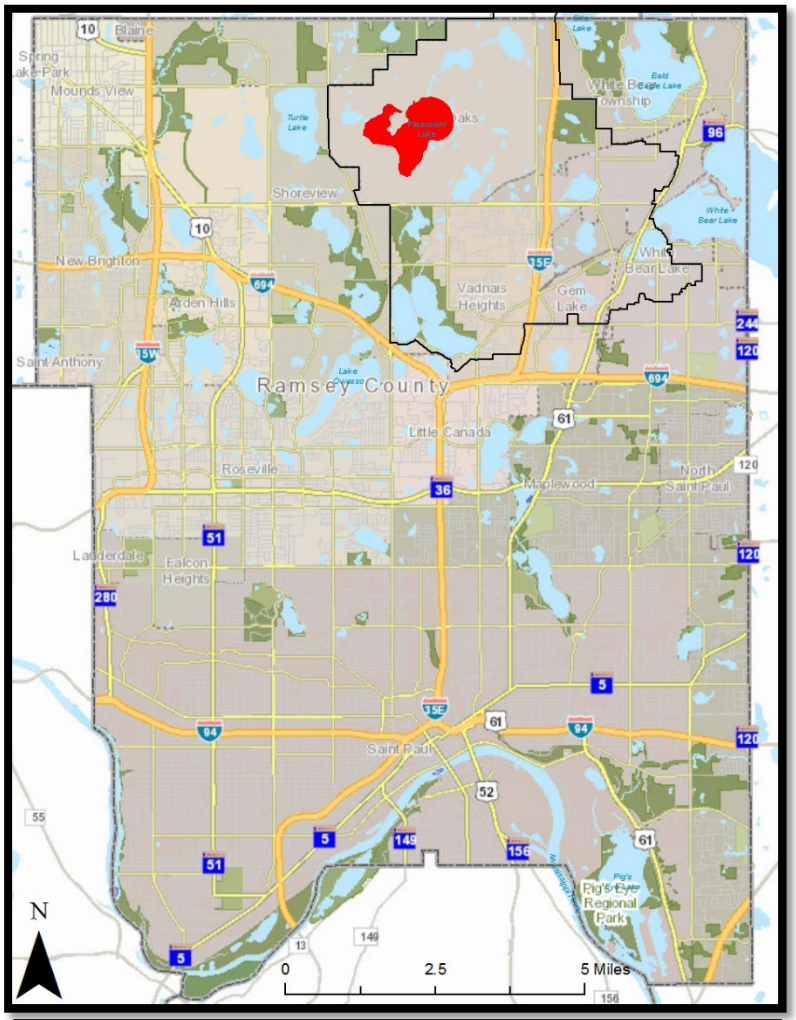


Figure 1. Location of Pleasant Lake shown in red within Vadnais Lakes Watershed Management Organization and Ramsey County Boundaries.

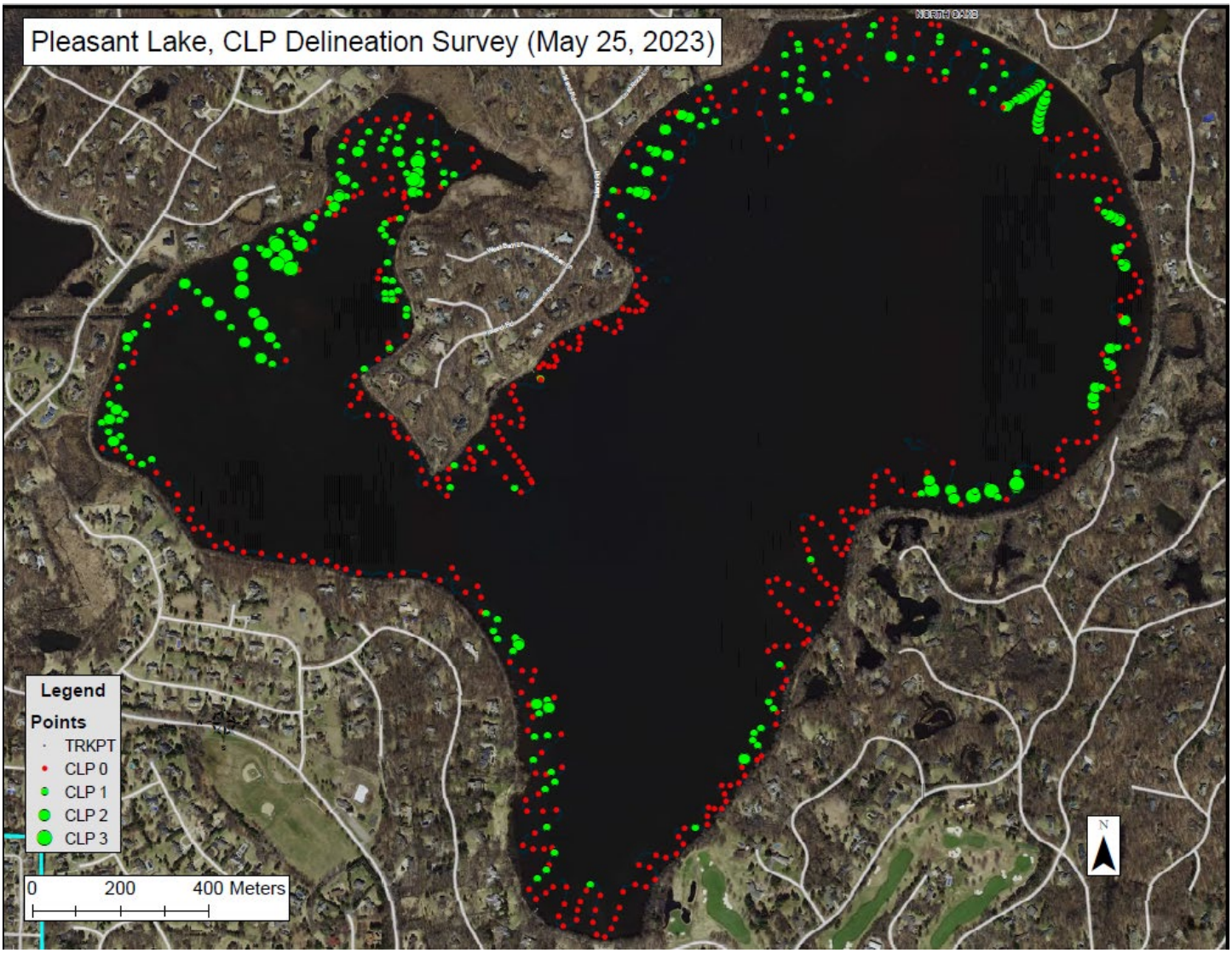


Fig. 2 entire Pleasant Lake delineation. Approximately 115 total acres of Curly-leaf pondweed infested area.

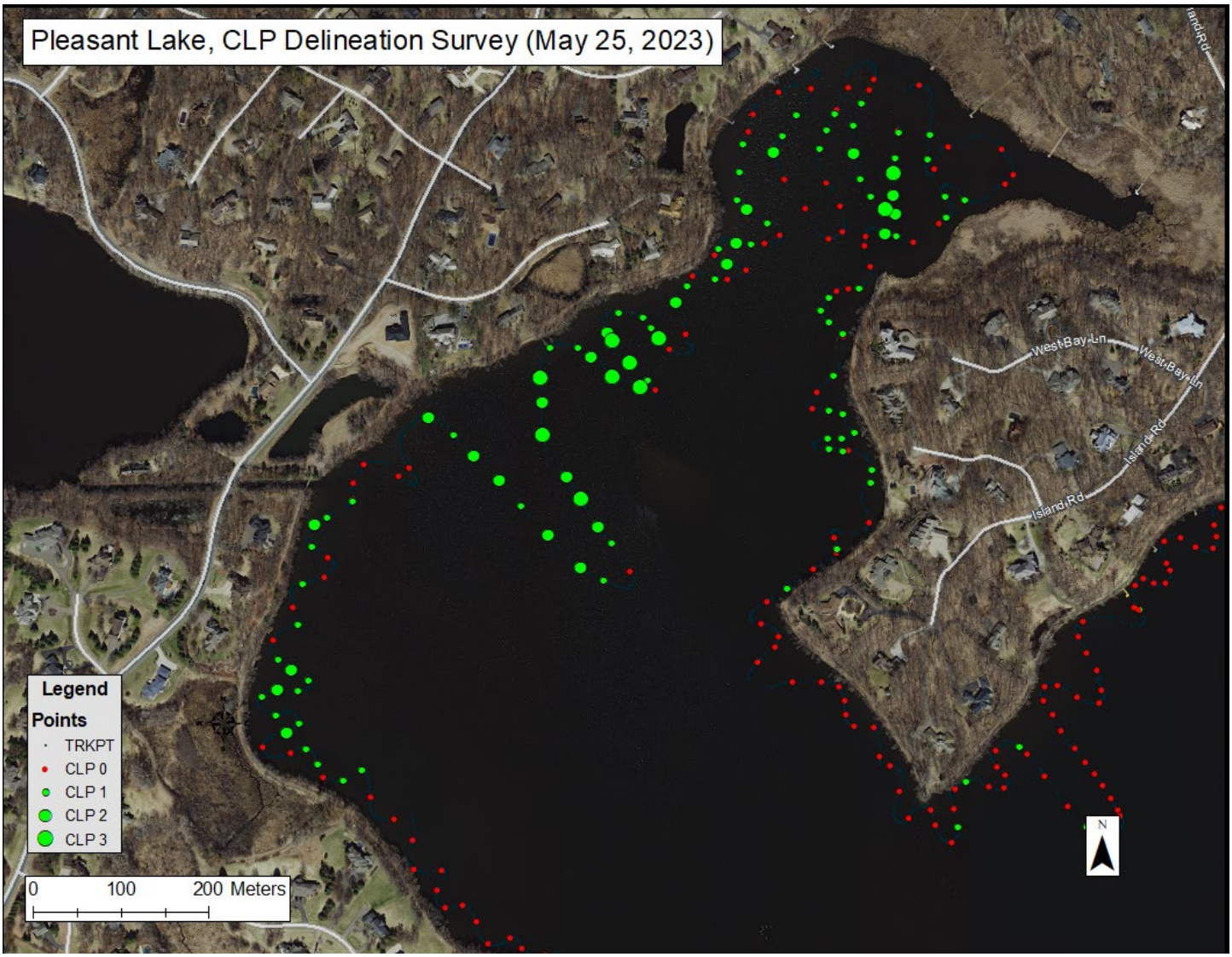


Fig. 3 West section of the Pleasant Lake delineation

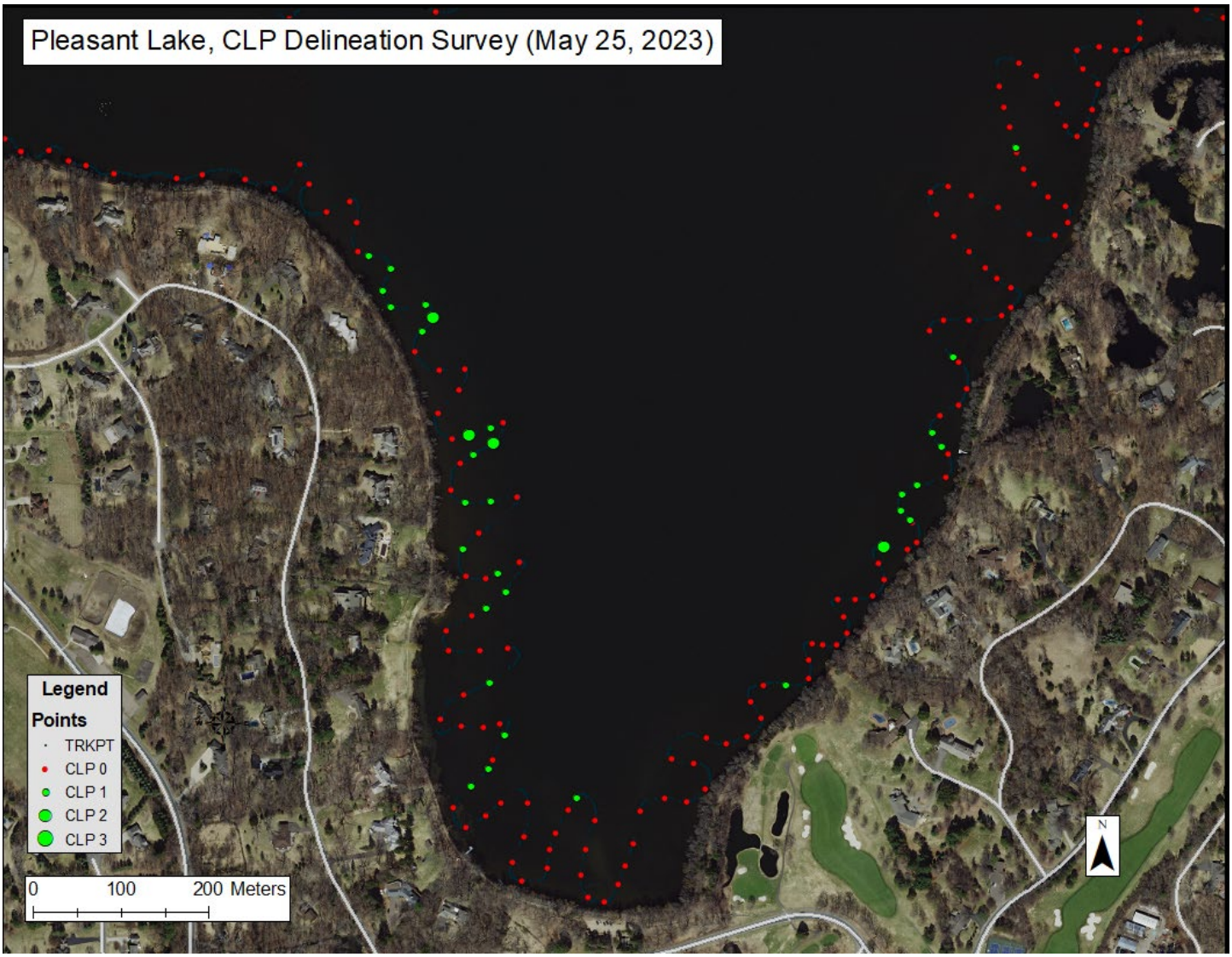


Fig. 4 South section of the Pleasant Lake delineation

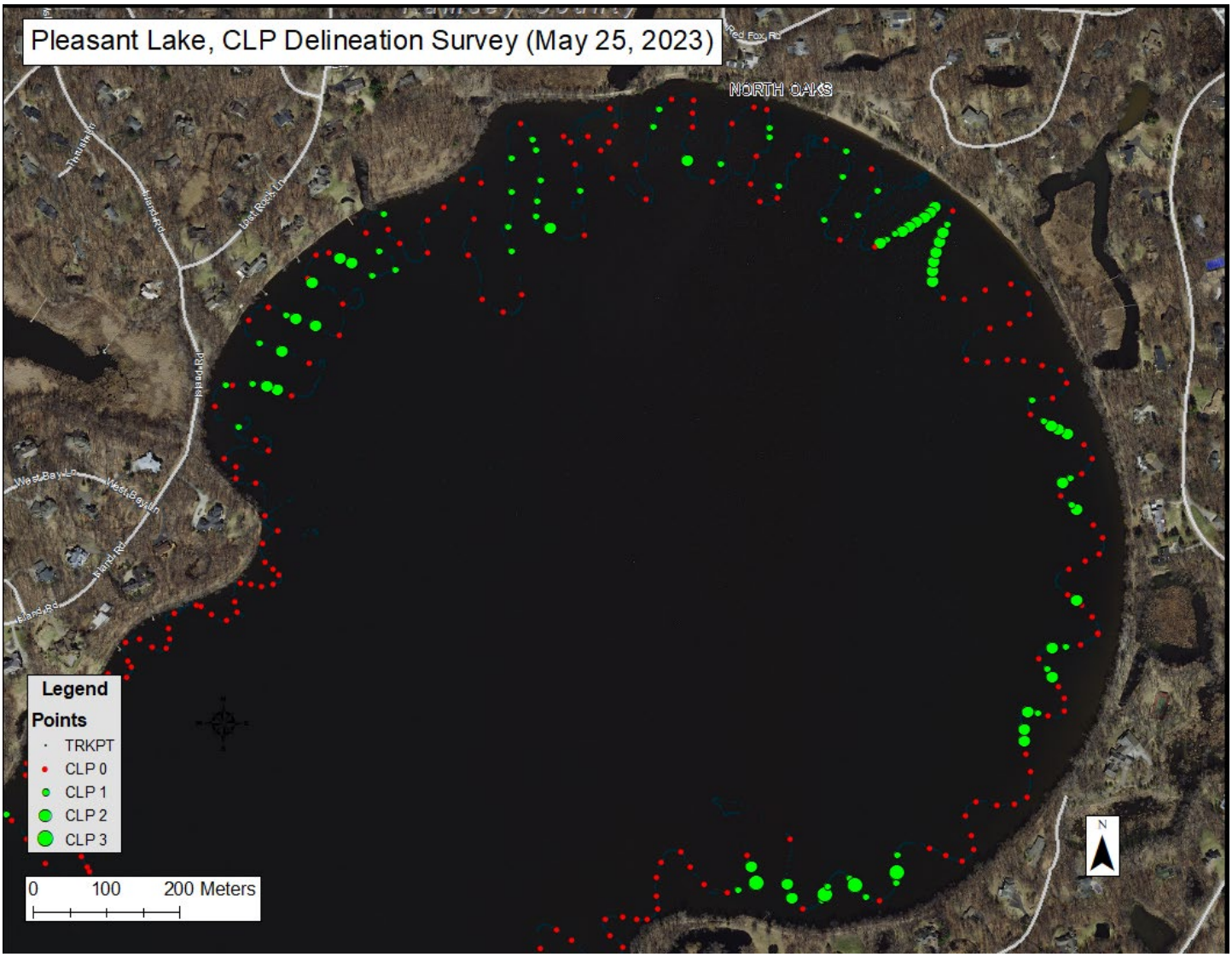


Fig. 5 North section of the Pleasant Lake delineation

Aquatic Macrophyte Point-Intercept Survey

8/18/2023

Methods:

The point-intercept method incorporating aerial photography and a Lowrance Elite-7 TI2 Global Positioning System (GPS) were used to assess the aquatic macrophyte community on Pleasant Lake on August 18, 2023. Samples were taken at 146 evenly spaced (130m) geo-referenced points (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 lake on the shady side of the boat, as displayed in Table 3.

A double-tined metal rake attached to a 11-meter rope was used to collect specimens. At each point the device was thrown out approximately one 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 within one square meter of each collection point 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

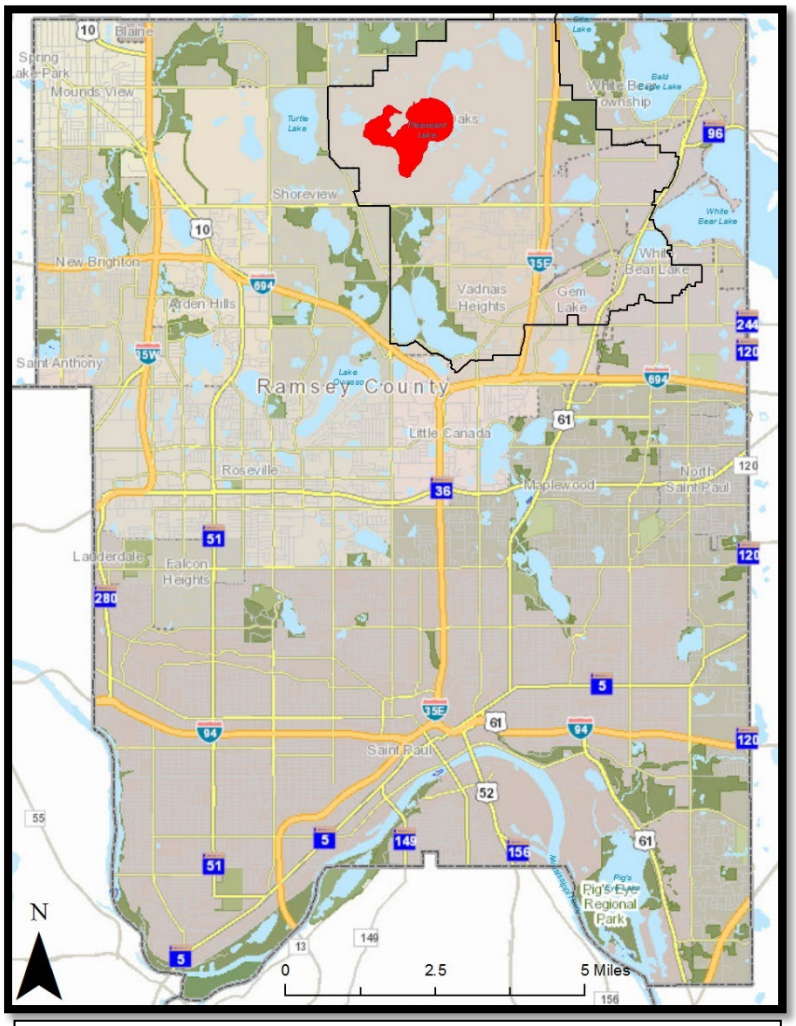


Figure 1. Location of Pleasant Lake shown in red within Vadnais Lakes Watershed Management Organization and Ramsey County Boundaries.

Results:

Aquatic macrophytes were found at 49 of 146 points surveyed (Figure 2). The 12 species found on Pleasant Lake were coontail (*Ceratophyllum demersum*), Chara (*Chara spp.*), Canada waterweed (*Elodea canadensis*), Water stargrass (*Heteranthera dubia*), Northern watermilfoil (*Myriophyllum sibiricum*), Eurasian watermilfoil (*Myriophyllum spicatum*), Naiad (*Najas spp.*), Curly leaf pondweed (*Potamogeton crispus*) Richardson's or clasping leaf pondweed (*Potamogeton richardsonii*), Flat-stem Pondweed (*Potamogeton zosterformis*), sago pondweed (*Stuckenia pectinata*), and Water celery (*Vallisneria americana*). Additional floating species found were duckweed (*Lemna major and minor*), Star duckweed (*Lemna trisulca*), White water-lily (*Nymphaea odorata*),

Filamentous algae (*Spirogyra spp*.), and Watermeal (*Wolffia spp*.). Frequency of occurrence and average abundance of each species can be found in table 2. The Secchi disk reading was 2.25m (7.5ft).

A previous macrophyte survey of Pleasant Lake was conducted on June 27, 2018. The survey utilized a different survey type so direct comparison of the occurrence or abundance would not be possible. However, comparing macrophytes noted in 2018 and 2023 is possible. Macrophytes found in the 2018 survey which were also in the 2023 survey include coontail (*Ceratophyllum demersum*), Water stargrass (*Heteranthera dubia*), Northern watermilfoil (*Myriophyllum sibiricum*), Eurasian watermilfoil (*Myriophyllum spicatum*), Curly leaf pondweed (*Potamogeton crispus*) Richardson's or clasping leaf pondweed (*Potamogeton richardsonii*), Flat-stem Pondweed (*Potamogeton zosterformis*), and Water celery (*Vallisneria americana*). Additionally, floating plants seen in both 2018 and 2023 include duckweed (*Lemna major and minor*) and White water-lily (*Nymphaea odorata*). Macrophytes seen in 2018 but not 2023 include Buttercup (*Ranunculus spp.*) and Whitestem pondweed (*Potamogeton Praelongus*). Macrophytes seen in 2023 but not in 2018 are Naiad (*Najas spp*.) and sago pondweed (*Stuckenia pectinata*))[although 'stringy pondweed' was noted in 2018 which is likely sago] plus the macroalgae Chara (*Chara spp.*). There were no floating plants noted in 2018 not seen in 2023. However, Star duckweed (*Lemna trisulca*) and Filamentous algae (*Spirogyra spp*.) were found in 2023 but not 2018.

Table 2. Frequency of occurrence & avg. abundance of aquatic plant taxa present during Pleasant Lake point-intercept survey.

Species	Common Name	Scientific Name	Average Abundance 8/18/2023	Frequency of Occurrence 8/18/2023
1	Coontail	Ceratophyllum demersum	1	64
2	Chara	*Chara spp. & Nitella spp.*	1	7
3	Canada Waterweed	*Elodea canadensis*	1	1
4	Water stargrass	*Heteranthera dubia*	1	25
5	Northern Watermilfoil	*Myriophyllum sibiricum*	1	1
6	Eurasian Watermilfoil	*Myriophyllum spicatum*	1	19
7	Naiad	*Najas spp.*	1	1
8	Curly leaf pondweed	*Potamogeton crispus*	1	9
9	Richardson's pondweed	*Potamogeton richardsonii*	1	6
10	Flat-stem Pondweed	*Potamogeton zosteriformis*	1	9
11	Sago pondweed	*Stuckenia pectinata*	1	4
12	Water celery	*Vallisneria americana*	1	20
13	Duckweed	*Lemna Major/Minor*	1	7
14	Star Duckweed	*Lemna trisulca*	1	13
15	White Water-lily	*Nymphaea odorata*	1	16
16	Filamentous Algae	*Spyrogyra spp.*	1	38
17	Watermeal	*Wolffia spp.*	1	10

Sample ID	Depth (meters)	*Ceratophyllum demersum*	*Chara spp. & Nitella spp.*	*Elodea canadensis*	*Heteranthera dubia*	*Myriophyllum sibiricum*	*Myriophyllum spicatum*	*Najas spp.*	*Potamogeton crispus*	*Potamogeton richardsonii*	*Potamogeton zosteriformis*	*Stuckenia pectinata*	*Vallisneria americana*	*Lemna Major/Minor*	*Lemna trisulca*	*Nymphaea odorata*	*Spyrogyra spp.*	*Wolffia spp.*
1	0.8	3																
2	1.0	1			1			1									1	
3	3.0																	
4	0.9	2					1						1		1	1	1	
5	1.5	2															1	
6	0.7		1		2			v				1	1			1		1
7	0.8	1								2	1		1			1	1	
8	5.8																	
9	7.1																	
10	11.1																	
11	9.7																	
12	1.4	1			1					1							1	
13	0.8	2											1				1	
14	3.3																	
15	1.1																	
16	1.4	1			1	1											1	
17	1.6	1		1	2		1		1				1					
18	2.3																	
19	10.3																	
20	13.2																	
21	14.9																	
22	6.0																	
23	0.7		1									1	2			1	1	
24	1.0	2																
25	6.0																	
26	5.4																	
27	1.0	1									1		1				1	
28	1.3	1		v		v			1					1	1	1	1	1
29	1.2	2												1	1	1	3	1
30	2.5	2																
31	12.9																	
32	8.0																	
33	12.3																	
34	11.5																	
35	3.3																	
36	4.1																1	
37	6.4																	
38	7.0																	
39	6.7																	
40	6.0																	
41	0.6	2			1												1	
42	1.5	1			1				1		1				1		1	
43	1.2	1			1		1										1	1
44	3.6	1					1											
45	7.4																	
46	2.5																	
47	9.9																	
48	8.5																	
49	8.2																	
50	7.2																	
51	5.0																	
52	3.8	1																
53	4.0																1	
54	0.9	1					1				1		v		1	1	1	
55	4.8																	
56	9.4																	
57	8.5																	
58	4.5																	
59	8.3																	
60	6.8																	
61	3.5						*											
62	0.5	1					1							1	2	2	2	1
63	3.6																	
64	9.4																	
65	9"7																	
66	7.7																	
67	5.3																	
68	5.2																	
69	1.7	1																
70	0.4	2		v	1		1				1			1	1	1	2	1
71	1.3	1					1		1		1				1	2	1	
72	8.6																	
73	8.6																	

Sample ID	Depth (meters)	*Ceratophyllum demersum*	*Chara spp. & Nitella spp.*	*Elodea canadensis*	*Heteranthera dubia*	*Myriophyllum sibiricum*	*Myriophyllum spicatum*	*Najas spp.*	*Potamogeton crispus*	*Potamogeton richardsonii*	*Potamogeton zosteriformis*	*Stuckenia pectinata*	*Vallisneria americana*	*Lemna Major/Minor*	*Lemna trisulca*	*Nymphaea odorata*	*Spyrogyra spp.*	*Wolffia spp.*
74	8.5																	
75	6.9																	
76	2.3				1													
77	1.4	2															2	
78	0.8	1									v	v		1	1	2	1	1
79	8.5																	
80	9.0																	
81	10.1																	
82	9.3																	
83	2.0	3																
84	0.8	1	1		1		1										1	
85	1.3	2																
86	7.3																	
87	8.7																	
88	9.1																	
89	10.6																	
90	10.9																	
91	2.5																	
92	0.8	1	1		1		1						1					
93	2.6								1									
94	7.1																	
95	8.6																	
96	9.7																	
97	11.0																	
98	10.1																	
99	8.1																	
100	5.0																	
101	1.0	2															1	
102	2.3	1																
103	6.3																	
104	7.0																	
105	8.6																	
106	10.7																	
107	9.7																	
108	8.4																	
109	7.5																	
110	3.6																	
111	1.3	2																
112	1.0	1			2		1											
113	6.0																	
114	8.3																	
115	10.9																	
116	11.6																	
117	11.0																	
118	8.6																	
119	6.7																	
120	0.7	1											1					
121	2.4	2																
122	5.5																	
123	6.3																	
124	8.4																	
125	10.2																	
126	15.0																	
127	10.6																	
128	3.1																	
129	0.8	2																
130	4.5																	
131	4.4																	
132	3.7																	
133	6.4																	
134	7.9																	
135	8.0																	
136	0.8	1	1							1			1					
137	0.9	1			1							1	1					
138	3.8																	
139	3.6																	
140	3.1						1											
141	2.3	1			1		1											
142	3.0																	
143	1.2	1			2					1			1					
144	1.1	1											1				1	
145	1.2	3																
146	1.1	1			1				1				1				1	

Sample ID	Depth (meters)	Ceratophyllum demersum	Chara spp. & Nitella spp.	Elodea canadensis	Heteranthera dubia	Myriophyllum sibiricum	Myriophyllum spicatum	Najas spp.	Potamogeton crispus	Potamogeton richardsonii	Potamogeton zosteriformis	Stuckenia pectinata	Vallisneria americana	Lemna Major/Minor	Lemna trisulca	Nymphaea odorata	Spyrogyra spp.	Wolffia spp.
Total Abundance		44	5	1	17	1	13	1	6	4	6	3	14	5	9	11	26	7
Count in Littoral Zone		44	5	1	17	1	13	1	6	4	6	3	14	5	9	11	26	7
Avg. Abundance		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Frequency of Occurance		64	7	1	25	1	19	1	9	6	9	4	20	7	13	16	38	10
Secchi Depth (m)		2.25																
Water Temperature C (F)		23.2 (73.8)																

Table 3. Depth, Secchi disk, water temperature, and vegetation abundance point survey results on August 18, 2023

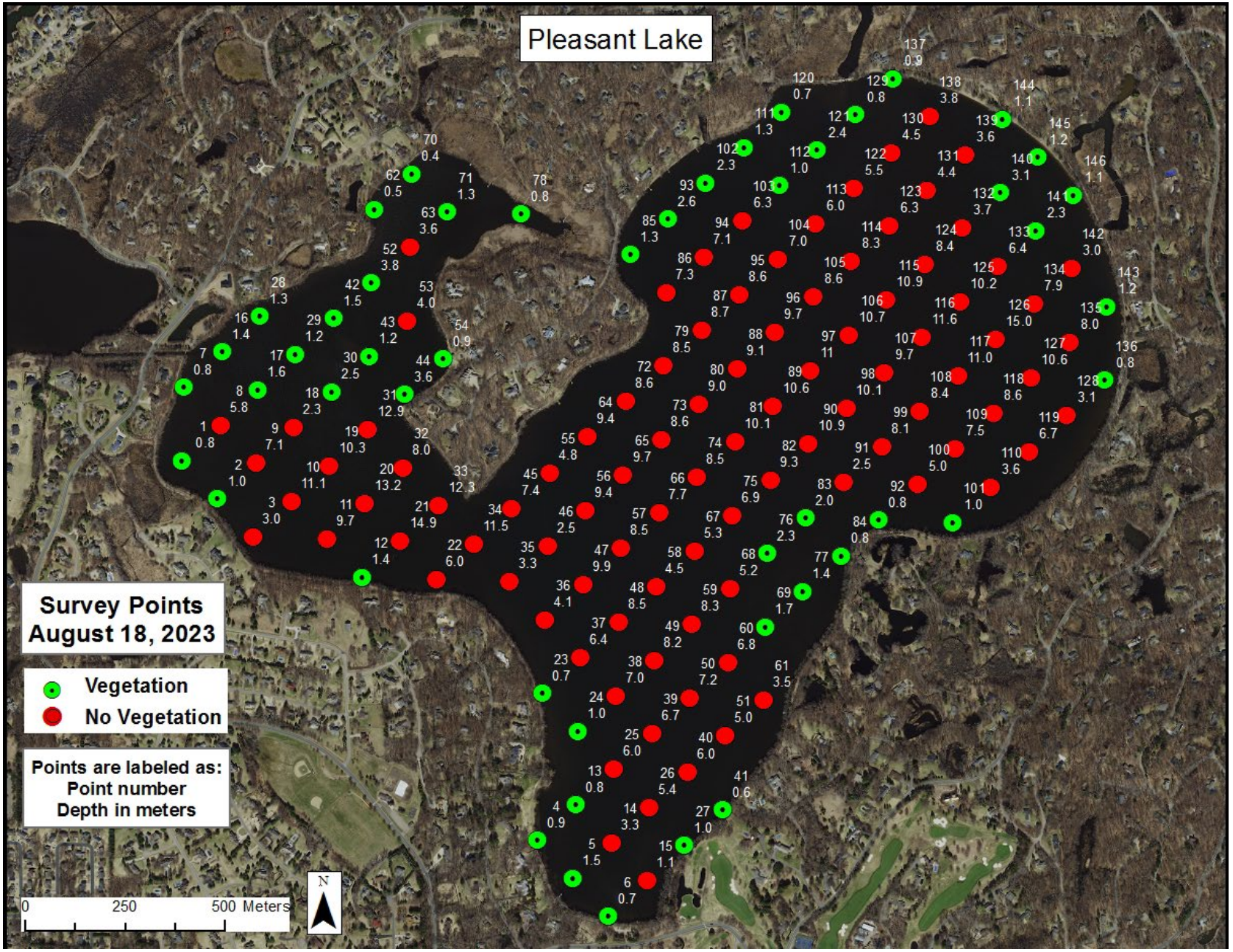


Figure 2. Pleasant Lake vegetation point intercept survey locations. N=146.

Contour, Biovolume and Bottom Composition Survey

8/18/2023

Methods:

A Lowrance Elite-7 Ti2 Global Positioning System (GPS)-enabled depth finder was used to collect submerged aquatic vegetation biovolume, lake depth (bathymetry), and bottom hardness (composition) data on Pleasant Lake on August 18, 2023. The lake was transected at a speed of no more than 5 miles per hour. Sonar log data were recorded using the Lowrance Elite-7 Ti2 Global Positioning System (GPS)-enabled depth finder. Transducer data were processed using Contour Innovations, LLC, BioBase software.

Results:

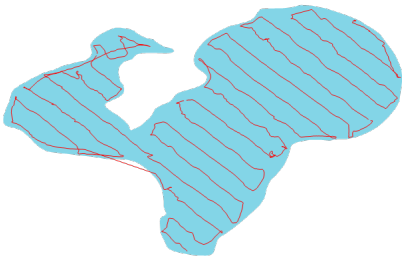
The results below were produced by exporting the processed data from the BioBase system and interpolating spatial data using ArcGIS software. Results include maps as well as statistics of biovolume distribution represented as total percent of water column occupied by plant matter ranging from zero to one hundred. Additional results include contour depth maps at 0.3-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 BioBase website: www.biobasemaps.com.

BIOBASE

VEGETATION ANALYSIS REPORT

Pleasant Lake, Ramsey Minnesota

Report Time Stamp: 2023 October 06 - 16:22 (UTC) ... REPORT LINK



Survey Metadata	
Data Collector:	Justin Townsend
Survey Time Stamp (UTC):	2023 August 18 - 15:11
Starting Location:	45.104214, -93.088446
Ending Location:	45.103010, -93.107558
Distance	21.984 km

Survey Statistics	
Average Water Temperature:	23.2 °C
Survey Area:	245.535 ha
Survey Volume:	12818394.260 cu. m
Percent of Waterbody Surveyed:	99.0%
Waterbody Area:	248.058 ha
Estimated Waterbody Volume ?	12950135.874 cu. m

Survey Settings	
Includes Edited Data:	Yes
Track Buffer:	70 m
BV Grid Cell Size:	5 m
BV Minimum Detection - Percent:	5.0%
BV Minimum Detection - Depth:	0.701 m
BV Maximum Detection - Depth:	6.096 m
BV Sonar Channel:	NA

Survey Summary

Type ?	PAC ?	Avg BVp ?	SD BVp ?	Avg BVw ?	SD BVw ?	Depth Range	Depth Avg	No. Depth Records
Point	52.3%	40.5%	± 34.0%	21.2%	± 28.2%	0.30 - 16.11 m	4.895 m	10901
Grid	55.4%	37.9%	± 24.3%	21.0%	± 26.1%	0.03 - 15.89 m	5.221 m	195775

Biovolume Analysis by Depth

Type	Depth	Count	PAC	Avg BVp	SD BVp	Avg BVw	SD BVw
Point	0 - 1 m	1243	97.0%	73.2%	± 37.6%	71.0%	± 37.5%
	1 - 2 m	1754	98.0%	43.6%	± 30.5%	42.7%	± 30.5%
	2 - 3 m	684	91.8%	30.2%	± 18.8%	27.7%	± 18.7%
	3 - 4 m	864	87.8%	20.9%	± 13.8%	18.3%	± 13.5%
	4 - 5 m	607	84.0%	16.4%	± 12.6%	13.8%	± 12.3%
	5 - 6 m	288	52.1%	14.8%	± 13.9%	7.7%	± 11.9%
	6 - 7 m	0	0%	0%	± 0%	0%	± 0%
	7 - 8 m	0	0%	0%	± 0%	0%	± 0%
	8 - 9 m	0	0%	0%	± 0%	0%	± 0%
	9 m +	0	0%	0%	± 0%	0%	± 0%
Grid	0 - 1 m	27745	99.0%	61.4%	± 22.7%	60.8%	± 23.3%
	1 - 2 m	26902	98.7%	47.7%	± 17.5%	47.1%	± 18.1%
	2 - 3 m	14259	97.3%	33.4%	± 13.2%	32.5%	± 14.1%
	3 - 4 m	14608	94.7%	24.2%	± 10.0%	22.9%	± 11.2%
	4 - 5 m	13174	90.9%	17.1%	± 7.4%	15.5%	± 8.6%
	5 - 6 m	13374	74.1%	11.2%	± 5.0%	8.3%	± 6.6%
	6 - 7 m	17252	18.5%	8.6%	± 4.1%	1.6%	± 3.8%
	7 - 8 m	15451	4.8%	9.6%	± 4.8%	0.5%	± 2.3%
	8 - 9 m	19105	1.7%	10.2%	± 4.5%	0.2%	± 1.4%
	9 m +	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. Pleasant Lake BioBase survey summary statistics.

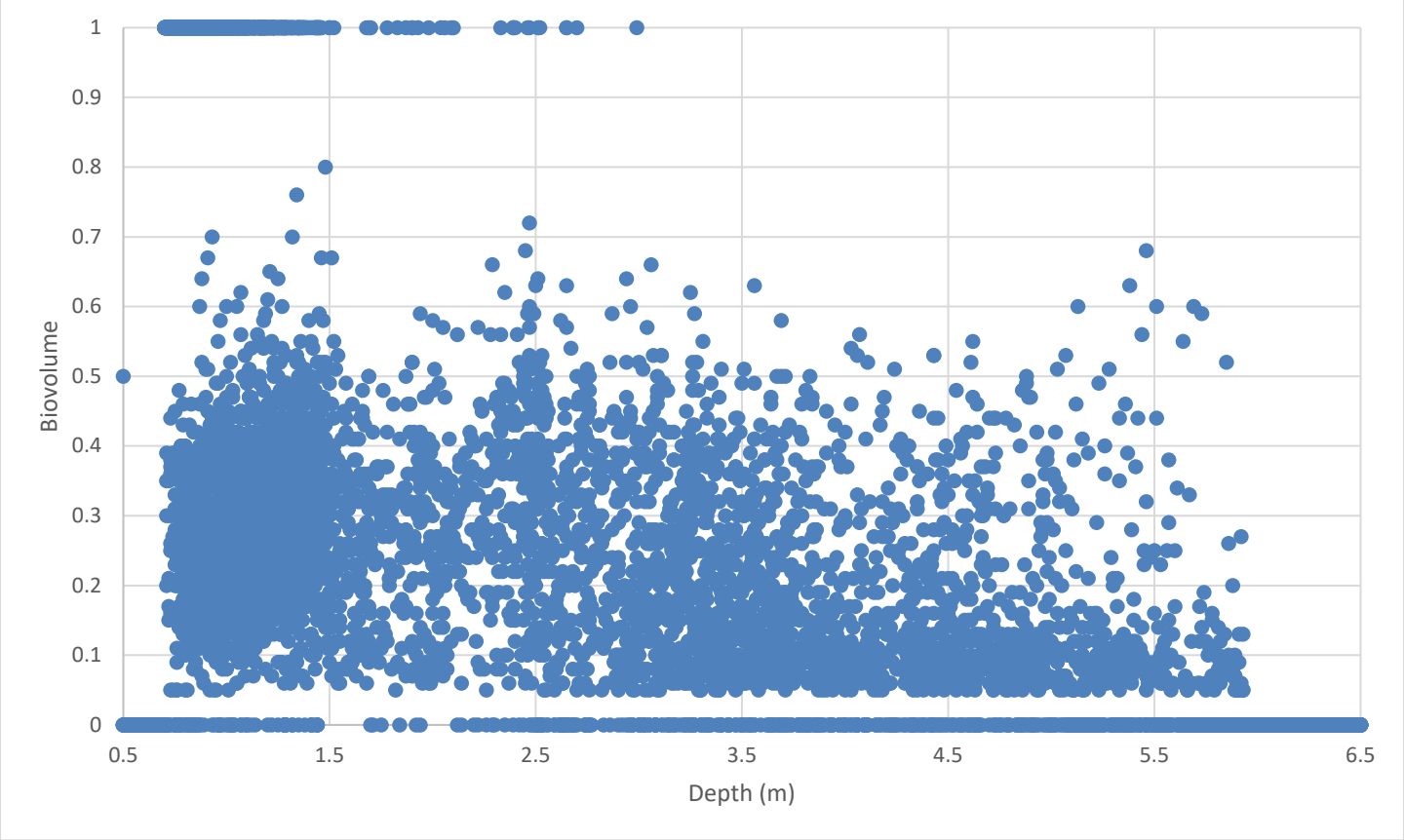


Figure 4. Pleasant Lake biovolume distribution scatter chart.

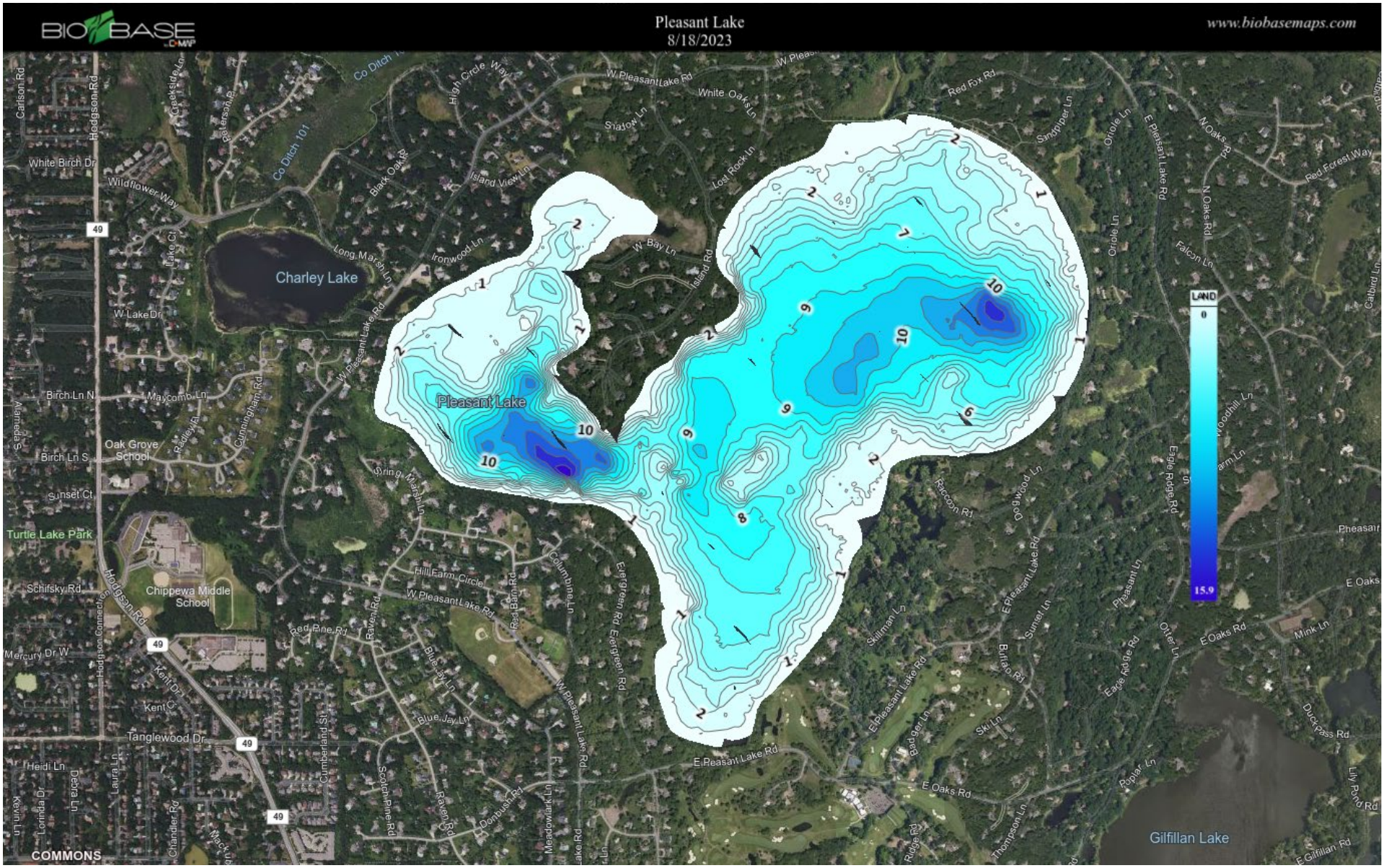


Figure 5. Pleasant Lake 0.3-m contours with depth in meters taken on August 18, 2023.

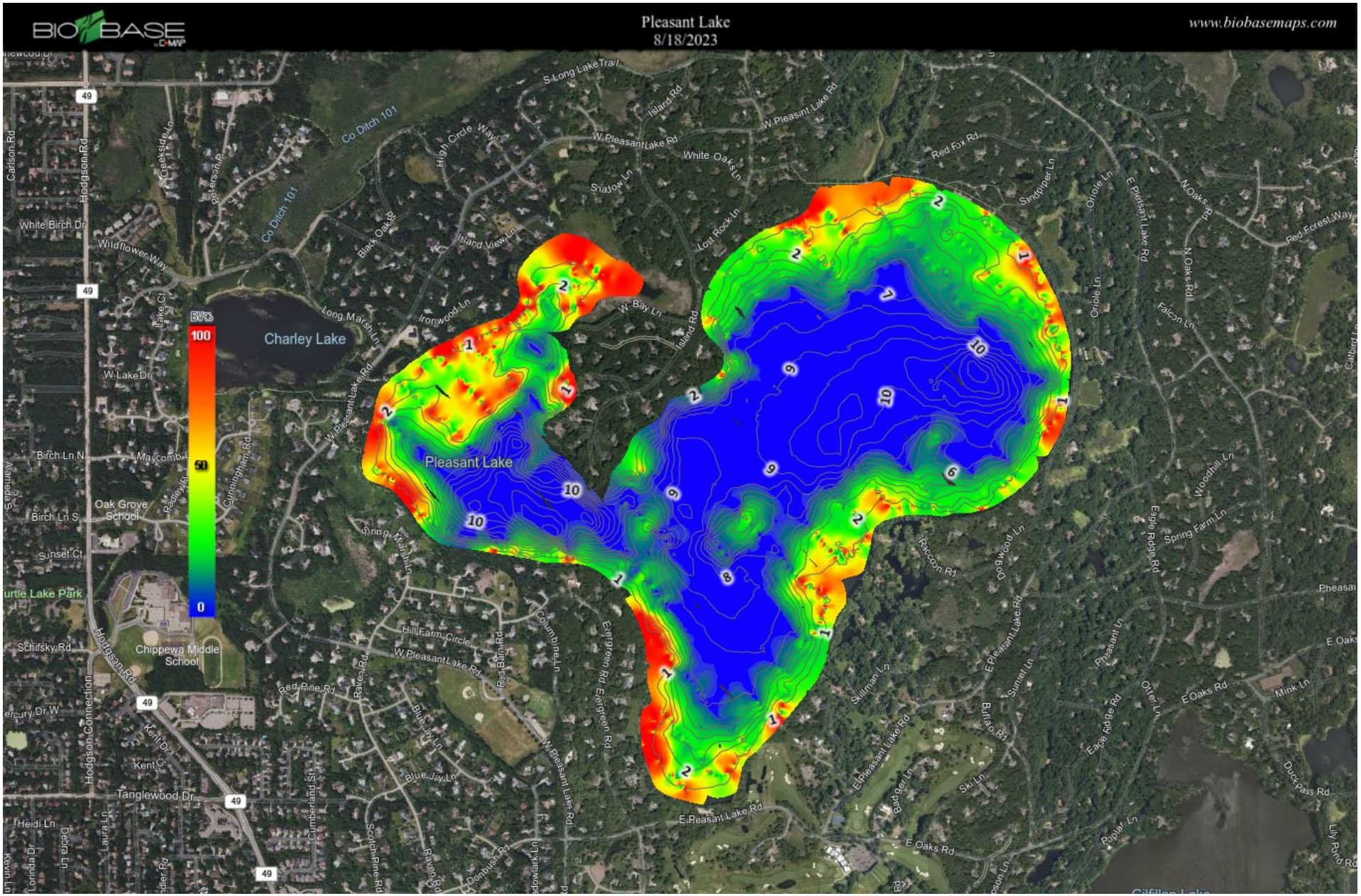


Figure 6. Pleasant Lake vegetation biovolume with 0.3-m contours taken on August 18, 2023. Percent values range from zero to one hundred; Blue = 0%, Yellow = 50% and Red = 100%.

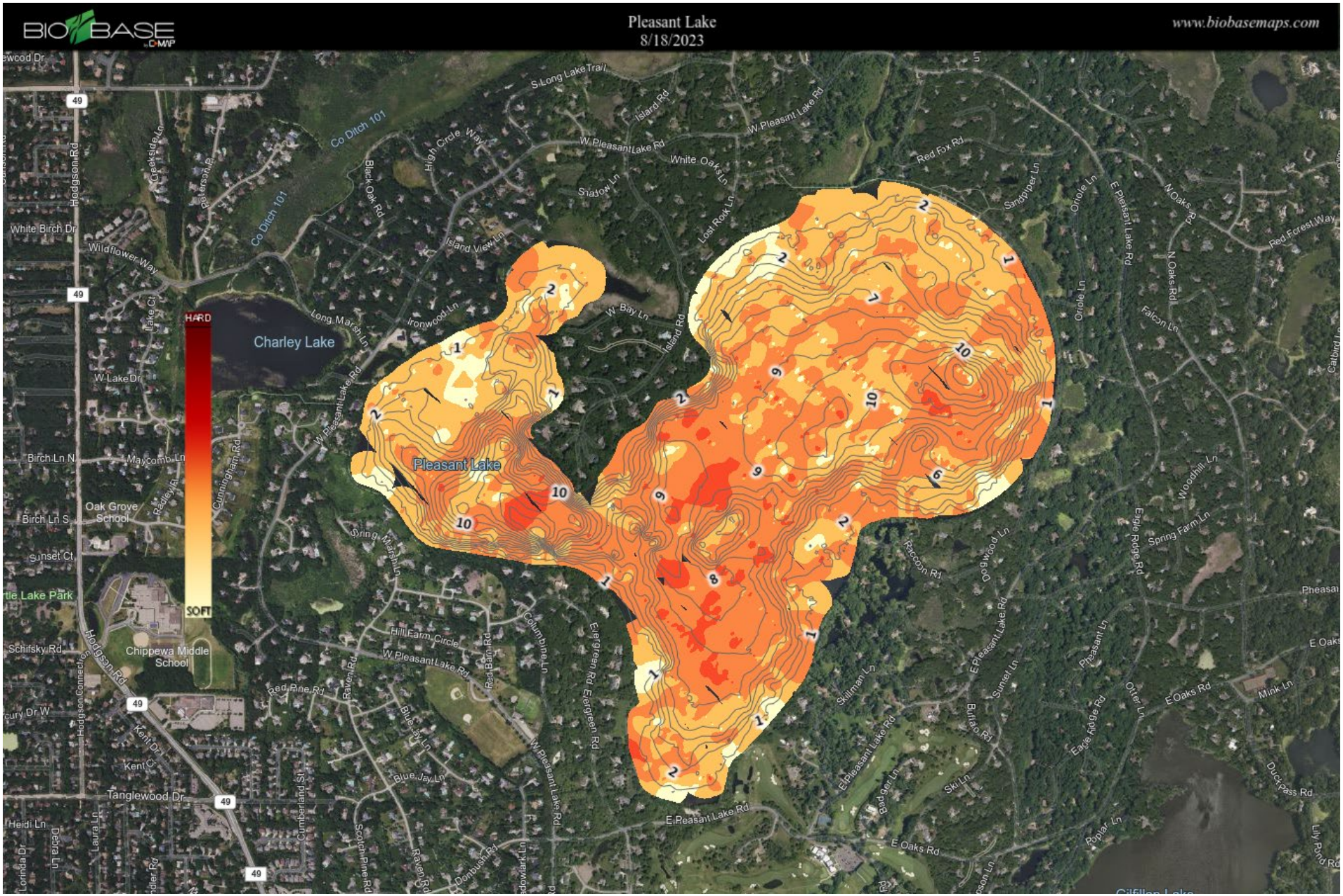


Figure 7. Pleasant Lake bottom composition values with 0.3-m contours taken on August 18, 2023.

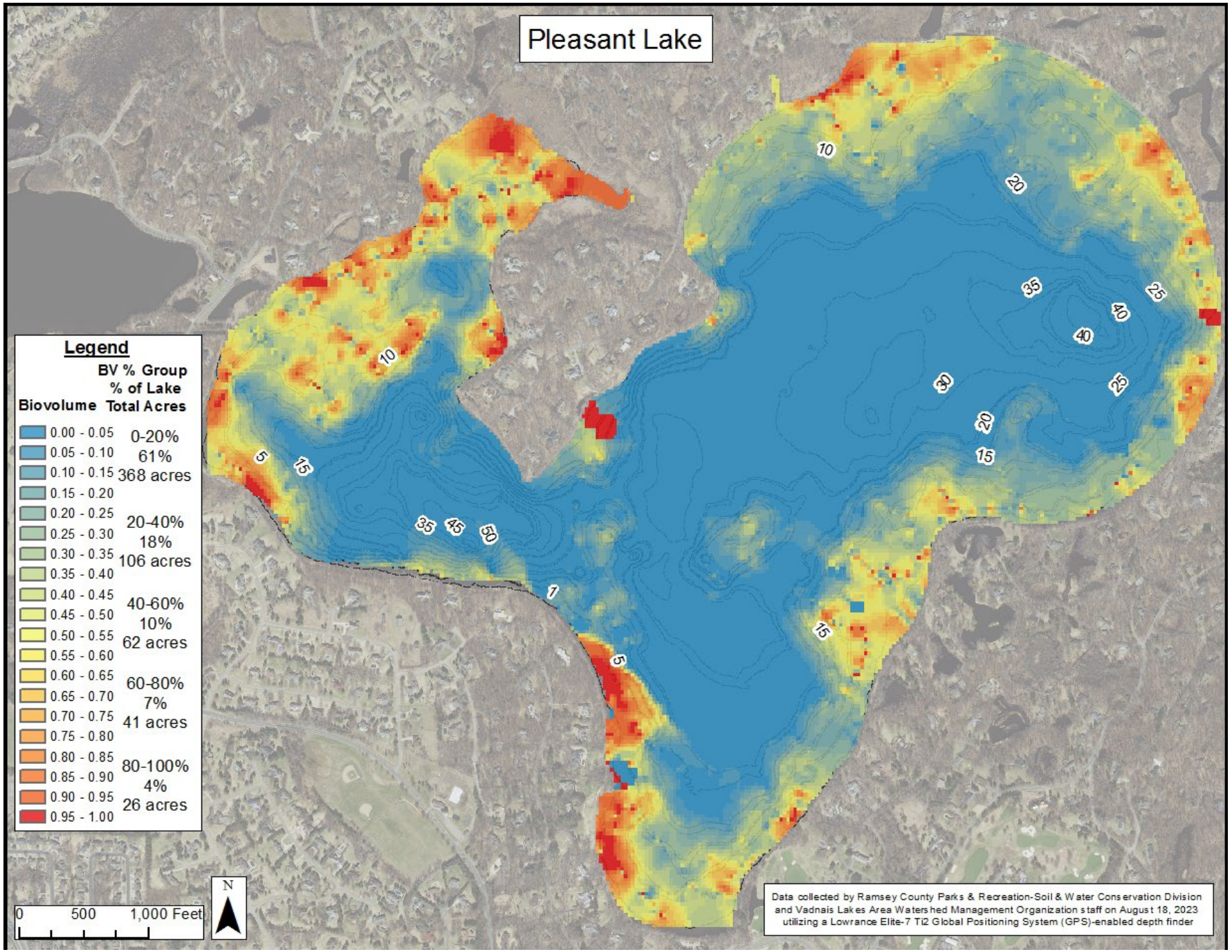


Figure 8. Pleasant Lake vegetation biovolume on August 18, 2023. Percent values range from zero to one hundred; Blue = 0%, Yellow = 50% and Red = 100%. Quintiles by percent and total acres of the lake.