



**Eagle Lake Baseline and Two Year Post-LFA
Data Report
2016-2018
Kalamazoo County, Michigan**



**Prepared by: Restorative Lake Sciences
Jennifer L. Jermalowicz-Jones, PhD
Water Resources Director
18406 West Spring Lake Road
Spring Lake, Michigan 49456
www.restorativelakesciences.com**

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Eagle Lake Baseline and Two Year Post-LFA Data Report 2016-2018 Kalamazoo County, Michigan

1.0 PROJECT INTRODUCTION & SUMMARY

Eagle Lake is located in Section 8,9,16 and 17 of Texas Township (T.3S, R.12W) in Kalamazoo County, Michigan. The lake has a surface area of approximately 230 acres (Michigan Department of Natural Resources, 2004) and is classified as a eutrophic (nutrient-enriched) aquatic ecosystem with three distinct deep basins. The entire lake serves as a littoral (shallow) zone. Eagle Lake contains a volume of approximately 1,120 acre-feet of water and has a mean depth of 4.9 feet and a maximum depth of 12 feet. The maximum depth was confirmed by RLS scientists in 2014 with the use of a bottom-scanning GPS system that created a modernized depth contour bathymetric map. In addition to the depth contour map, a map of soft versus hard bottom was also created. The bottom hardness map shows that the majority of the lake bottom contains soft deposits of organic content and small areas of hard sand and gravel bottom. Eagle Lake receives water from a groundwater well that pumps at a rate of 1,000-1,200 gallons per minute (USGS, 1970) and the lake does not contain an inlet or outlet but contains some springs. Eagle Lake has a lake perimeter of approximately 4.5 miles (Michigan Department of Natural Resources, 1999). The longest point across the lake (fetch) is 0.7 miles and thus the lake may produce sizeable waves during high winds. A laminar flow aeration (LFA) system was installed in the lake during the late summer of 2017 to improve previously studied impairments of the lake which are discussed below. Thus all of 2016 and part of 2017 serve as baseline data for this report. The remainder of 2017 and all of 2018 serve as year 1 and year 2 data, respectively.

1.1 Summary of Eagle Lake Aeration Operations:

Laminar Flow Aeration (LFA) was installed in Eagle Lake in 2017, with approval and permitting from the MDEQ under Permit Number: WRP006143. Bacteria (MuckAway®) was added to the lake on July 11, 2017, August 3, 2017 and August 28, 2017 by PLM. The July 11, 2017 bacteria treatment consisted of approximately 135 acres whereas the last two 2017 dates consisted of approximately 180 acres. In 2018, PLM added an equivalent of 375 acres of MuckAway® microbe treatments to Eagle Lake by PLM.

NOTE: Unexpected and unprecedented flood conditions occurred throughout 2018 and this may have affected results of the LFA. RLS is aware of this possibility and does explain any changes in water quality parameters that may have been attributed to the resultant increased runoff, nutrients, or other impairments.

1.2 Summary of Aeration Operation Purpose/Goals:

Eagle Lake is a well-recreated lake and is utilized by many for fishing, swimming, boating, and waterfront living. In recent years, the lake has become dominated by aggressive watermilfoil and pondweed growth and has a very mucky bottom throughout most of the lake. The local residents have desired a more holistic approach to addressing both the aquatic plant issues as well as the muck reduction with the ability to use aquatic herbicides for aquatic plant control as needed. The residents desired a lake restoration strategy that would make the lake healthier and accomplish the following objectives:

The primary objectives of the implemented LFA system for Eagle Lake include:

- 1) Reduction of nuisance rooted submersed aquatic vegetation such as milfoil and pondweed
- 2) Reduction of muck in problem areas
- 3) Added in 2017: Reduction of nutrients in the lake that contribute to aquatic vegetation and algae growth.

2.0 EAGLE LAKE SAMPLING METHODS & PARAMETERS

2.1 Summary of Equipment/Sampling Devices/Replicates/Parameters Measured:

Restorative Lake Sciences sampled 5 locations in Eagle Lake to satisfy the MDEQ permitting requirements for a lake this size. This baseline water quality data was collected on May 13, 2016, June 21, 2016, and September 15, 2016. The first-year water quality data was collected on May 10, 2017, July 25, 2017 and on September 11, 2017. The second-year water quality data was collected on May 2, 2018, July 7, 2018 and September 4, 2018.

All chemical water samples were collected at the specified depths (one each at the top, middle, and bottom depths of each of the sampling sites) using a 4-liter VanDorn horizontal water sampler with weighted messenger (Wildco® brand). Water quality physical parameters (such as water temperature, dissolved oxygen, conductivity, and pH) were measured with a calibrated Hanna® multi-probe meter at top, middle, and bottom depths of the 4 sampling sites in 2016 and a calibrated Eureka Manta 2® probe in 2017-2018 for the five sampling sites. Total phosphorus was titrated and analyzed in the laboratory according to method SM 4500-P E. Ortho-phosphorus was titrated and analyzed in the laboratory according to method SM 4500-P E. Total suspended solids were analyzed for each sample using SM 2540 D-97. Chlorophyll-*a* was analyzed with the SM 10200H method. All of the aforementioned chemical parameters were analyzed at Trace Analytical Laboratories in Muskegon, Michigan.

Prior to analysis of the samples as described above, water samples were placed in clean, unpreserved polyethylene bottles for ortho-phosphorus and total suspended solids and placed in H₂SO₄-preserved, clean, polyethylene bottles for total phosphorus analysis. Chlorophyll-*a* samples were placed in glass brown amber 1-liter bottles. All water samples were maintained on ice in a large cooler prior to being taken to the laboratory.

Samples used for microscopic analysis of algal community composition were preserved with glutaraldehyde and counted with a Sedgewick Rafter® Counting Cell under high power objective on a bright-field Accuscope® compound microscope in 2016-2017 and a Zeiss® compound scope in 2018. Multiple 1 micro-liter (μL) aliquots were used to determine the relative abundance of algal genera in the samples.

2.2 Sampling Dates and Locations:

Since the LFA system has not yet been installed, the baseline data collection occurred on May 13, 2016, June 21, 2016, and September 15, 2016. In addition to the aforementioned parameters, 60 sediment muck depths were measured with a calibrated “muck meter” on September 22, 2016. The first-year water quality data was collected on May 10, 2017, July 25, 2017 and on September 11, 2017. The second-year water quality data was collected on May 2, 2018, July 7, 2018 and September 4, 2018. Actual installation of the LFA system occurred in early June of 2017 due to electrical installation delays and took approximately two weeks to complete. The LFA system was officially turned on June 21, 2017. NOTE: Since the May 10, 2017 data was collected prior to LFA operation, it should also be considered baseline and will be presented as such below.

Aquatic vegetation survey was conducted on May 13, 2016 and again on September 15, 2016 and on May 10, 2017, and on May 30, 2018. All water quality samples in 2016-2018 were collected from the sampling locations according to Figure 1. Sediment muck depths in 2016-2017 were collected from the sampling locations according to Figure 2.

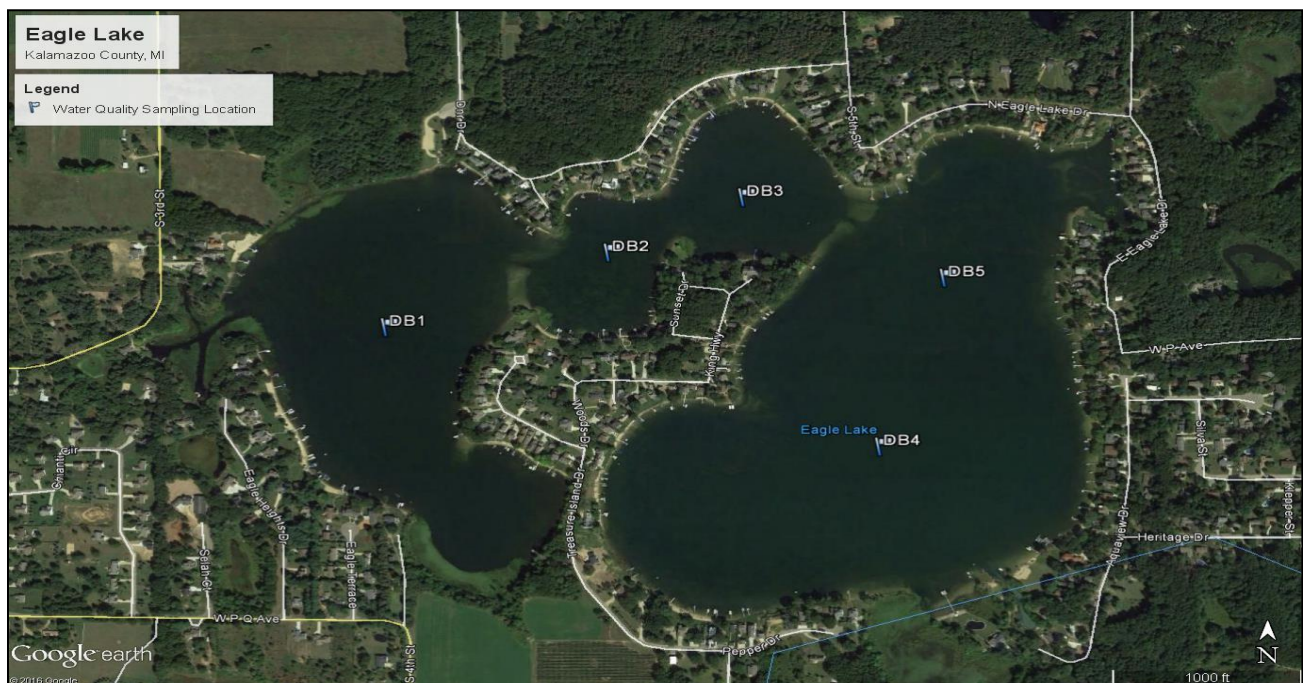


Figure 1. 2016-2018 water quality sampling locations on Eagle Lake, Kalamazoo County, MI.

3.0 EAGLE LAKE 2016 BASELINE WATER QUALITY SAMPLING RESULTS

All baseline physical water quality data is shown in tables 1-15 below. Baseline chemical water quality data is shown in tables 16-30 below. Sediment muck depth data can be found in Table 31 below.

3.1 Eagle Lake Baseline Physical Water Quality Data Tables:

Pre-Aeration Data Table (May 13, 2016): Site 1

<i>Depth</i> <i>ft.</i>	<i>Water</i> <i>Temp °C</i>	<i>DO</i> <i>mg L⁻¹</i>	<i>pH</i> <i>S.U.</i>	<i>Cond.</i> <i>µS cm⁻¹</i>	<i>Secchi Depth</i> <i>(ft.)</i>
0	17.1	10.1	8.4	151	6.5+
3.3	17.4	9.9	8.4	157	--
6.5	17.3	9.9	8.4	160	--

Table 1. Eagle Lake baseline physical water quality parameter data collected from Site 1 on May 13, 2016.

Pre-Aeration Data Table (May 13, 2016): Site 2

<i>Depth</i> <i>ft.</i>	<i>Water</i> <i>Temp °C</i>	<i>DO</i> <i>mg L⁻¹</i>	<i>pH</i> <i>S.U.</i>	<i>Cond.</i> <i>µS cm⁻¹</i>	<i>Secchi Depth</i> <i>(ft.)</i>
0	17.6	9.9	8.3	152	7.2+
3.6	17.5	9.9	8.3	150	
7.2	17.3	10.4	8.3	139	

Table 2. Eagle Lake baseline physical water quality parameter data collected from Site 2 May 13, 2016.

Pre-Aeration Data Table (May 13, 2016): Site 3

<i>Depth</i> <i>ft.</i>	<i>Water</i> <i>Temp °C</i>	<i>DO</i> <i>mg L⁻¹</i>	<i>pH</i> <i>S.U.</i>	<i>Cond.</i> <i>µS cm⁻¹</i>	<i>Secchi Depth</i> <i>(ft.)</i>
0	16.6	10.3	8.3	150	8.5+
4.3	17.0	10.3	8.3	147	
8.5	16.6	10.5	8.4	154	

Table 3. Eagle Lake baseline physical water quality parameter data collected from Site 3 May 13, 2016.

Pre-Aeration Data Table (May 13, 2016): Site 4

<i>Depth</i> <i>ft.</i>	<i>Water</i> <i>Temp °C</i>	<i>DO</i> <i>mg L⁻¹</i>	<i>pH</i> <i>S.U.</i>	<i>Cond.</i> <i>µS cm⁻¹</i>	<i>Secchi Depth</i> <i>(ft.)</i>
0	17.3	10.3	8.3	241	12.0+
6.0	16.7	11.1	8.3	230	
12.0	16.3	10.9	8.3	190	

Table 4. Eagle Lake baseline physical water quality parameter data collected from Site 4 May 13, 2016.

Pre-Aeration Data Table (May 13, 2016): Site 5

<i>Depth</i> <i>ft.</i>	<i>Water</i> <i>Temp °C</i>	<i>DO</i> <i>mg L⁻¹</i>	<i>pH</i> <i>S.U.</i>	<i>Cond.</i> <i>µS cm⁻¹</i>	<i>Secchi Depth</i> <i>(ft.)</i>
0	17.1	10.2	8.3	154	9.4+
4.7	17.0	10.4	8.3	152	
9.4	16.6	10.7	8.3	156	

Table 5. Eagle Lake baseline physical water quality parameter data collected from Site 5 May 13, 2016.

Pre-Aeration Data Table (June 21, 2016): Site 1

<i>Depth</i> <i>ft.</i>	<i>Water</i> <i>Temp °C</i>	<i>DO</i> <i>mg L⁻¹</i>	<i>pH</i> <i>S.U.</i>	<i>Cond.</i> <i>µS cm⁻¹</i>	<i>Secchi Depth</i> <i>(ft.)</i>
0	25.2	8.0	8.0	148	6.0+
3.0	25.5	7.9	8.0	140	--
6.0	25.4	6.1	8.0	158	--

Table 6. Eagle Lake baseline physical water quality parameter data collected from Site 1 on June 21, 2016.

Pre-Aeration Data Table (June 21, 2016): Site 2

<i>Depth</i> <i>ft.</i>	<i>Water</i> <i>Temp °C</i>	<i>DO</i> <i>mg L⁻¹</i>	<i>pH</i> <i>S.U.</i>	<i>Cond.</i> <i>µS cm⁻¹</i>	<i>Secchi Depth</i> <i>(ft.)</i>
0	25.0	8.0	8.0	158	6.0+
3.0	25.1	7.9	8.0	158	
6.0	25.0	7.0	8.0	142	

Table 7. Eagle Lake baseline physical water quality parameter data collected from Site 2 June 21, 2016.

Pre-Aeration Data Table (June 21, 2016): Site 3

<i>Depth</i> <i>ft.</i>	<i>Water</i> <i>Temp °C</i>	<i>DO</i> <i>mg L⁻¹</i>	<i>pH</i> <i>S.U.</i>	<i>Cond.</i> <i>µS cm⁻¹</i>	<i>Secchi Depth</i> <i>(ft.)</i>
0	24.9	8.0	8.0	161	8.0+
4.0	24.8	8.0	8.0	156	
8.0	24.7	7.4	8.0	135	

Table 8. Eagle Lake baseline physical water quality parameter data collected from Site 3 June 21, 2016.

Pre-Aeration Data Table (June 21, 2016): Site 4

<i>Depth</i> <i>ft.</i>	<i>Water</i> <i>Temp °C</i>	<i>DO</i> <i>mg L⁻¹</i>	<i>pH</i> <i>S.U.</i>	<i>Cond.</i> <i>µS cm⁻¹</i>	<i>Secchi Depth</i> <i>(ft.)</i>
0	25.2	7.9	8.0	140	11.0
6.0	25.1	8.2	8.0	144	
12.0	24.5	7.0	8.0	138	

Table 9. Eagle Lake baseline physical water quality parameter data collected from Site 4 June 21, 2016.

Pre-Aeration Data Table (June 21, 2016): Site 5

<i>Depth</i> <i>ft.</i>	<i>Water</i> <i>Temp °C</i>	<i>DO</i> <i>mg L⁻¹</i>	<i>pH</i> <i>S.U.</i>	<i>Cond.</i> <i>µS cm⁻¹</i>	<i>Secchi Depth</i> <i>(ft.)</i>
0	25.1	8.0	8.0	138	11.0
6.0	24.9	8.0	8.0	140	
12.0	24.8	7.0	8.0	142	

Table 10. Eagle Lake baseline physical water quality parameter data collected from Site 5 June 21, 2016.

Pre-Aeration Data Table (September 15, 2016): Site 1

<i>Depth</i> <i>ft.</i>	<i>Water</i> <i>Temp °C</i>	<i>DO</i> <i>mg L⁻¹</i>	<i>pH</i> <i>S.U.</i>	<i>Cond.</i> <i>µS cm⁻¹</i>	<i>Secchi Depth</i> <i>(ft.)</i>
0	24.0	8.0	8.3	174	6.0+
3.0	23.9	8.0	8.1	173	--
6.0	23.7	7.5	8.1	172	--

Table 11. Eagle Lake baseline physical water quality parameter data collected from Site 1 on September 15, 2016.

Pre-Aeration Data Table (September 15, 2016): Site 2

<i>Depth</i> <i>ft.</i>	<i>Water</i> <i>Temp °C</i>	<i>DO</i> <i>mg L⁻¹</i>	<i>pH</i> <i>S.U.</i>	<i>Cond.</i> <i>µS cm⁻¹</i>	<i>Secchi Depth</i> <i>(ft.)</i>
0	24.1	8.0	8.3	178	6.0+
3.0	23.9	8.0	8.3	174	
6.0	23.9	7.5	8.2	173	

Table 12. Eagle Lake baseline physical water quality parameter data collected from Site 2 September 15, 2016.

Pre-Aeration Data Table (September 15, 2016): Site 3

<i>Depth</i> <i>ft.</i>	<i>Water</i> <i>Temp °C</i>	<i>DO</i> <i>mg L⁻¹</i>	<i>pH</i> <i>S.U.</i>	<i>Cond.</i> <i>µS cm⁻¹</i>	<i>Secchi Depth</i> <i>(ft.)</i>
0	24.2	8.1	8.3	174	8.0+
4.0	24.0	8.0	8.3	175	
8.0	23.9	7.0	8.3	176	

Table 13. Eagle Lake baseline physical water quality parameter data collected from Site 3 September 15, 2016.

Pre-Aeration Data Table (September 15, 2016): Site 4

<i>Depth</i> <i>ft.</i>	<i>Water</i> <i>Temp °C</i>	<i>DO</i> <i>mg L⁻¹</i>	<i>pH</i> <i>S.U.</i>	<i>Cond.</i> <i>µS cm⁻¹</i>	<i>Secchi Depth</i> <i>(ft.)</i>
0	24.4	8.0	8.3	179	11.0+
5.5	24.2	7.6	8.3	185	
11.0	23.8	6.1	8.3	181	

Table 14. Eagle Lake baseline physical water quality parameter data collected from Site 4 September 15, 2016.

Pre-Aeration Data Table (September 15, 2016): Site 5

<i>Depth</i> <i>ft.</i>	<i>Water</i> <i>Temp °C</i>	<i>DO</i> <i>mg L⁻¹</i>	<i>pH</i> <i>S.U.</i>	<i>Cond.</i> <i>µS cm⁻¹</i>	<i>Secchi Depth</i> <i>(ft.)</i>
0	24.5	8.1	8.3	138	8.0+
4.0	23.8	7.5	8.3	140	
8.0	23.6	5.3	8.2	142	

Table 15. Eagle Lake baseline physical water quality parameter data collected from Site 5 September 15, 2016.

3.2 Eagle Lake Baseline Chemical Water Quality Data Tables:

Pre-Aeration Data Tables (May 13, 2016): Site 1

<i>Depth</i> <i>(ft.)</i>	<i>Total</i> <i>Phosphorus</i> <i>(mg/L)</i>	<i>Ortho-</i> <i>Phosphorus</i> <i>(mg/L)</i>	<i>Total</i> <i>Suspended</i> <i>Solids (mg/L)</i>	<i>Chlorophyll-a</i> <i>(µg/L)</i>
0	<0.010	<0.010	<10	0.668
3.3	<0.010	<0.010	<10	--
6.5	<0.010	<0.010	<10	--

Table 16. Eagle Lake baseline chemical water quality parameter data collected from Site 1 on May 13, 2016.

Pre-Aeration Data Tables (May 13, 2016): Site 2

<i>Depth (ft.)</i>	<i>Total Phosphorus (mg/L)</i>	<i>Ortho- Phosphorus (mg/L)</i>	<i>Total Suspended Solids (mg/L)</i>	<i>Chlorophyll-a (µg/L)</i>
0	<0.010	<0.010	<10	-1.20
3	<0.010	0.012	<10	--
6	0.084	0.044	200	--

Table 17. Eagle Lake baseline chemical water quality parameter data collected from site 2 on May 13, 2016.

Pre-Aeration Data Tables (May 13, 2016): Site 3

<i>Depth (ft.)</i>	<i>Total Phosphorus (mg/L)</i>	<i>Ortho- Phosphorus (mg/L)</i>	<i>Total Suspended Solids (mg/L)</i>	<i>Chlorophyll-a (µg/L)</i>
0	<0.010	<0.010	<10	-3.87
4	0.020	0.014	<10	--
8	0.024	<0.010	<10	--

Table 18. Eagle Lake baseline chemical water quality parameter data collected from site 3 on May 13, 2016.

Pre-Aeration Data Tables (May 13, 2016): Site 4

<i>Depth (ft.)</i>	<i>Total Phosphorus (mg/L)</i>	<i>Ortho- Phosphorus (mg/L)</i>	<i>Total Suspended Solids (mg/L)</i>	<i>Chlorophyll-a (µg/L)</i>
0	0.013	<0.010	<10	-4.54
6	0.011	<0.010	<10	--
12	0.014	<0.010	<10	--

Table 19. Eagle Lake baseline chemical water quality parameter data collected from site 4 on May 13, 2016.

Pre-Aeration Data Tables (May 13, 2016): Site 5

<i>Depth (ft.)</i>	<i>Total Phosphorus (mg/L)</i>	<i>Ortho- Phosphorus (mg/L)</i>	<i>Total Suspended Solids (mg/L)</i>	<i>Chlorophyll-a (µg/L)</i>
0	0.019	<0.010	<10	-6.01
6	0.010	<0.010	<10	--
12	<0.010	<0.010	<10	--

Table 20. Eagle Lake baseline chemical water quality parameter data collected from site 5 on May 13, 2016.

Pre-Aeration Data Tables (June 21, 2016): Site 1

<i>Depth (ft.)</i>	<i>Total Phosphorus (mg/L)</i>	<i>Ortho- Phosphorus (mg/L)</i>	<i>Total Suspended Solids (mg/L)</i>	<i>Chlorophyll-a (µg/L)</i>
0	0.016	<0.010	<10	-1.59
3.0	0.019	<0.010	<10	--
6.0	0.027	<0.010	<10	--

Table 21. Eagle Lake baseline chemical water quality parameter data collected from Site 1 on June 21, 2016.

Pre-Aeration Data Tables (June 21, 2016): Site 2

<i>Depth (ft.)</i>	<i>Total Phosphorus (mg/L)</i>	<i>Ortho- Phosphorus (mg/L)</i>	<i>Total Suspended Solids (mg/L)</i>	<i>Chlorophyll-a (µg/L)</i>
0	<0.010	<0.010	<10	-3.74
3	0.018	<0.010	<10	--
6	0.019	<0.010	<10	--

Table 22. Eagle Lake baseline chemical water quality parameter data collected from site 2 on June 21, 2016.

Pre-Aeration Data Tables (June 21, 2016): Site 3

<i>Depth (ft.)</i>	<i>Total Phosphorus (mg/L)</i>	<i>Ortho- Phosphorus (mg/L)</i>	<i>Total Suspended Solids (mg/L)</i>	<i>Chlorophyll-a (µg/L)</i>
0	<0.010	<0.010	<10	-10.7
4	0.013	<0.010	<10	--
8	<0.010	<0.010	<10	--

Table 23. Eagle Lake baseline chemical water quality parameter data collected from site 3 on June 21, 2016.

Pre-Aeration Data Tables (June 21, 2016): Site 4

<i>Depth (ft.)</i>	<i>Total Phosphorus (mg/L)</i>	<i>Ortho- Phosphorus (mg/L)</i>	<i>Total Suspended Solids (mg/L)</i>	<i>Chlorophyll-a (µg/L)</i>
0	0.013	<0.010	<10	-23.7
6	0.013	<0.010	<10	--
12	<0.010	<0.010	<10	--

Table 24. Eagle Lake baseline chemical water quality parameter data collected from site 4 on June 21, 2016.

Pre-Aeration Data Tables (June 21, 2016): Site 5

<i>Depth (ft.)</i>	<i>Total Phosphorus (mg/L)</i>	<i>Ortho- Phosphorus (mg/L)</i>	<i>Total Suspended Solids (mg/L)</i>	<i>Chlorophyll-a (µg/L)</i>
0	<0.010	<0.010	<10	1.78
6	0.017	<0.010	<10	--
12	0.011	<0.010	10	--

Table 25. Eagle Lake baseline chemical water quality parameter data collected from site 5 on June 21, 2016.

Pre-Aeration Data Tables (September 15, 2016): Site 1

<i>Depth (ft.)</i>	<i>Total Phosphorus (mg/L)</i>	<i>Ortho- Phosphorus (mg/L)</i>	<i>Total Suspended Solids (mg/L)</i>	<i>Chlorophyll-a (µg/L)</i>
0	<0.010	<0.010	<10	-3.20
3.0	<0.010	<0.010	<10	--
6.0	<0.010	<0.010	<10	--

Table 26. Eagle Lake baseline chemical water quality parameter data collected from Site 1 on September 15, 2016.

Pre-Aeration Data Tables (September 15, 2016): Site 2

<i>Depth (ft.)</i>	<i>Total Phosphorus (mg/L)</i>	<i>Ortho- Phosphorus (mg/L)</i>	<i>Total Suspended Solids (mg/L)</i>	<i>Chlorophyll-a (µg/L)</i>
0	<0.010	<0.010	<10	2.49
3	<0.010	<0.010	<10	--
6	<0.010	<0.010	<10	--

Table 27. Eagle Lake baseline chemical water quality parameter data collected from site 2 on September 15, 2016.

Pre-Aeration Data Tables (September 15, 2016): Site 3

<i>Depth (ft.)</i>	<i>Total Phosphorus (mg/L)</i>	<i>Ortho- Phosphorus (mg/L)</i>	<i>Total Suspended Solids (mg/L)</i>	<i>Chlorophyll-a (µg/L)</i>
0	<0.010	<0.010	<10	-2.67
4	<0.010	<0.010	<10	--
8	<0.010	<0.010	<10	--

Table 28. Eagle Lake baseline chemical water quality parameter data collected from site 3 on September 15, 2016.

Pre-Aeration Data Tables (September 15, 2016): Site 4

<i>Depth (ft.)</i>	<i>Total Phosphorus (mg/L)</i>	<i>Ortho- Phosphorus (mg/L)</i>	<i>Total Suspended Solids (mg/L)</i>	<i>Chlorophyll-a (µg/L)</i>
0	<0.010	<0.010	<10	-5.16
5.5	<0.010	<0.010	<10	--
11	<0.010	<0.010	<10	--

Table 29. Eagle Lake baseline chemical water quality parameter data collected from site 4 on September 15, 2016.

Pre-Aeration Data Tables (September 15, 2016): Site 5

<i>Depth (ft.)</i>	<i>Total Phosphorus (mg/L)</i>	<i>Ortho- Phosphorus (mg/L)</i>	<i>Total Suspended Solids (mg/L)</i>	<i>Chlorophyll-a (µg/L)</i>
0	<0.010	<0.010	<10	1.96
6	<0.010	<0.010	<10	--
12	<0.010	<0.010	<10	--

Table 30. Eagle Lake baseline chemical water quality parameter data collected from site 5 on September 15, 2016.

3.3 Eagle Lake Baseline Sediment Thickness Data Table and Bottom Scan:

Figure 2 below shows the sampling locations (n=63) for baseline (2016) sediment thickness which was measured with a calibrated muck meter device. Each location was marked by GPS. RLS also scanned the lake bottom for sediment bottom hardness which is shown below in Figure 3.

Sediment Sample ID (GPS)	Sediment Thickness (feet)	Sediment Sample ID (GPS)	Sediment Thickness (feet)
1	1.45	34	0.12
2	4.28	35	6.7
3	4.73	36	5.89
4	2.59	37	5.18
5	3.2	38	5.98
6	3.13	39	6.0
7	3.8	40	5.5
8	5.33	41	2.73
9	2.97	42	3.02
10	2.0	43	3.45
11	2.78	44	4.73
12	2.85	45	4.5
13	3.47	46	7.35
14	3.57	47	4.08
15	4.18	48	7.32
16	5.15	49	2.97
17	5.52	50	5.0
18	5.37	51	4.55
19	5.98	52	0.57
20	4.58	53	3.47
21	3.07	54	1.27
22	4.42	55	3.78
23	4.53	56	5.65
24	2.68	57	3.78
25	5.1	58	4.28
26	4.97	59	3.72
27	5.05	60	6.8
28	3.18	61	2.62
29	3.27	62	1.6
30	3.0	63	0.98
31	1.9		
32	5.5		
33	5.7		

Table 31. Baseline sediment thickness measurements (September 22, 2016).

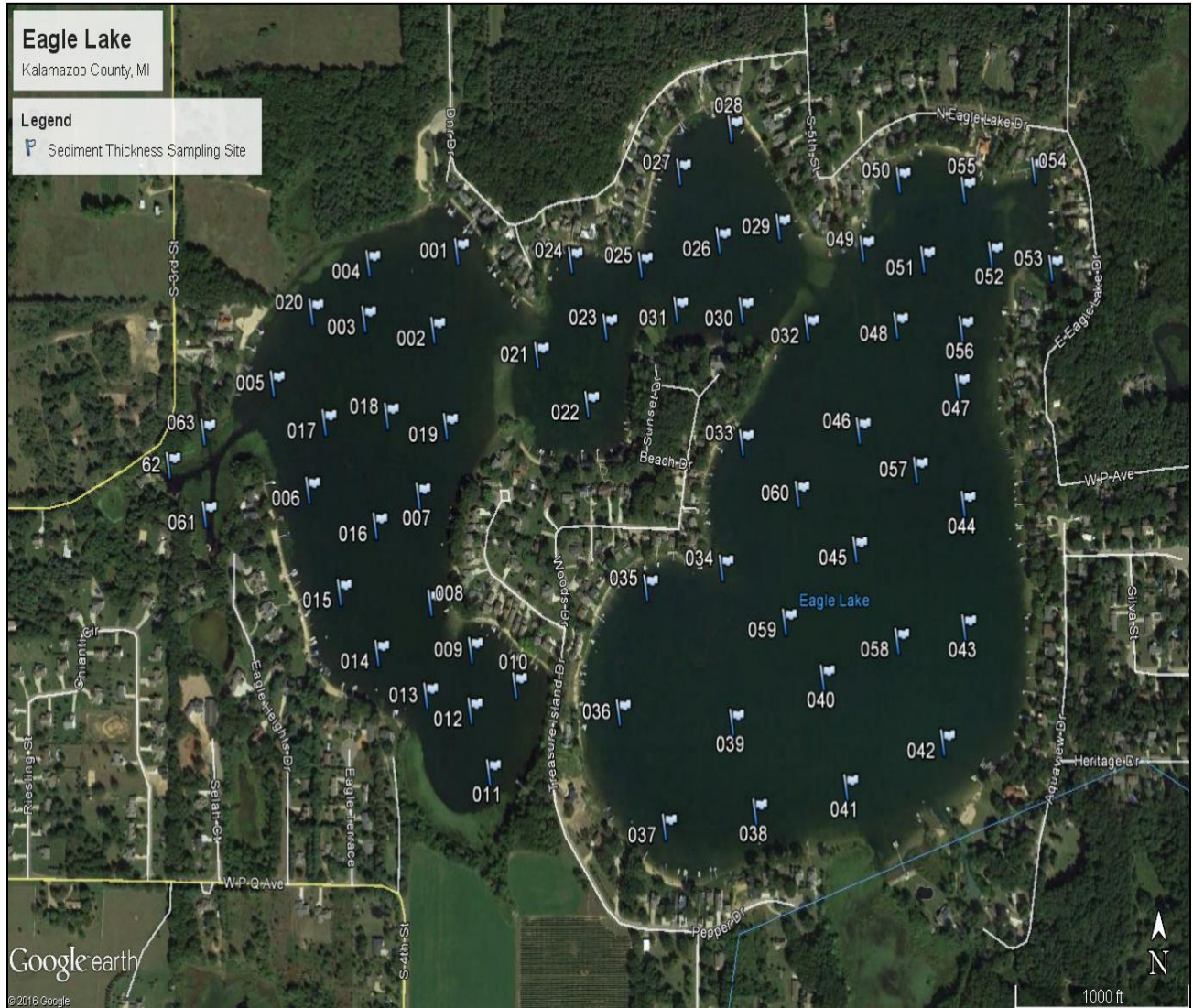


Figure 2. Eagle Lake sediment thickness sampling locations (RLS, September 22, 2016 and October 25, 2017).

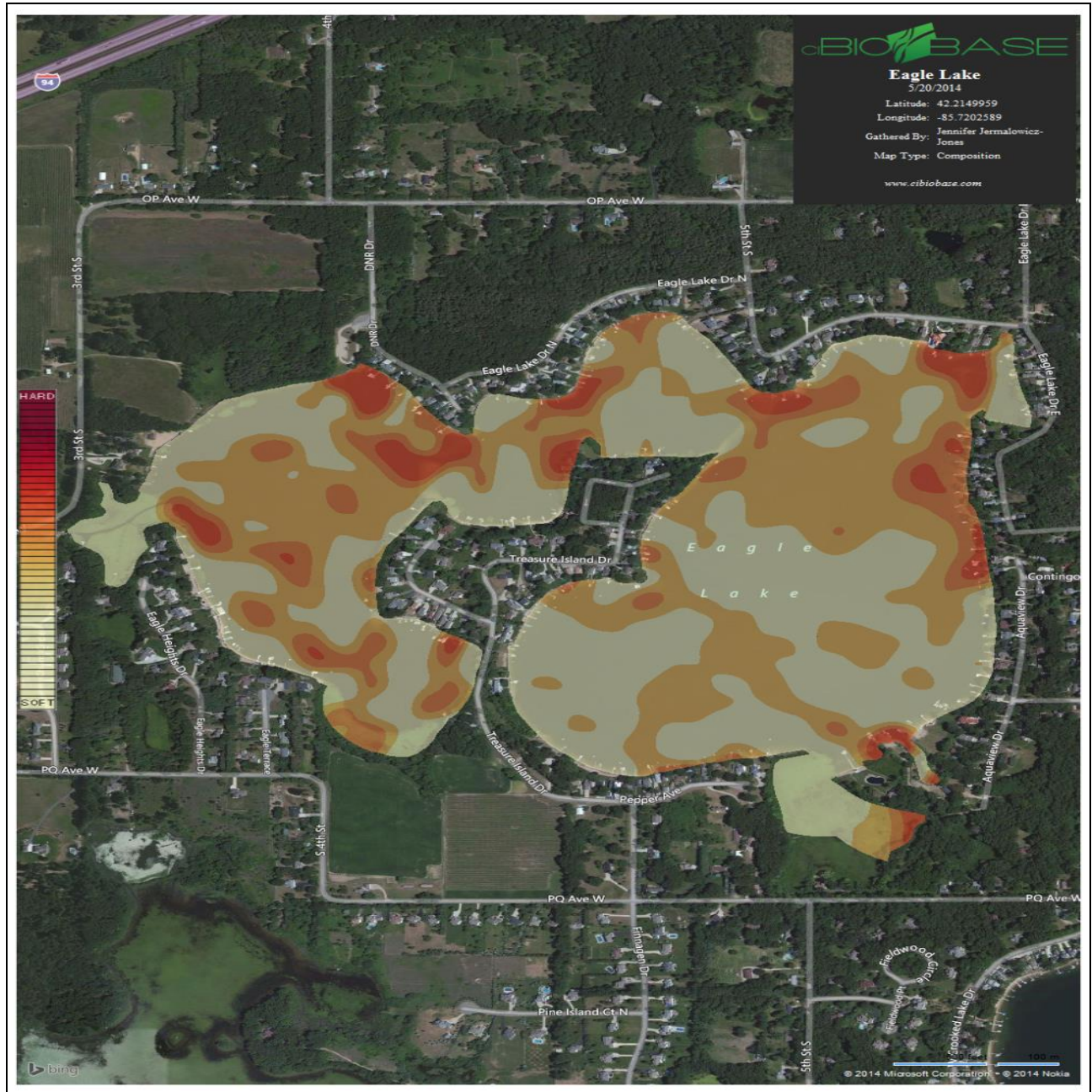


Figure 3. Bottom hardness map of Eagle Lake (RLS, May, 2014).

3.4 Eagle Lake Baseline Phytoplankton Community:

Algal Community Composition Data Graph (Figure 4):

Algal community composition data were collected during the 3 sampling periods at each of the 5 basins in 2016. Means of the taxa were placed in the graph (Figure 4) below. Genera are listed here in the order of most abundant to least abundant. The genera present included the Chlorophyta (green algae): *Scenedesmus* sp., *Chlorella* sp., *Haematococcus* sp., *Rhizoclonium* sp., *Mougeotia* sp., *Ulothrix* sp., *Pandorina* sp., *Pediastrum* sp., *Spirogyra* sp., *Euglena* sp., and *Chloromonas* sp. the Cyanophyta (blue-green algae): *Oscillatoria* sp.; the Bascillariophyta (diatoms): *Navicula* sp., *Fragilaria* sp., *Synedra* sp., *Tabellaria* sp., and *Rhoicosphenia* sp.

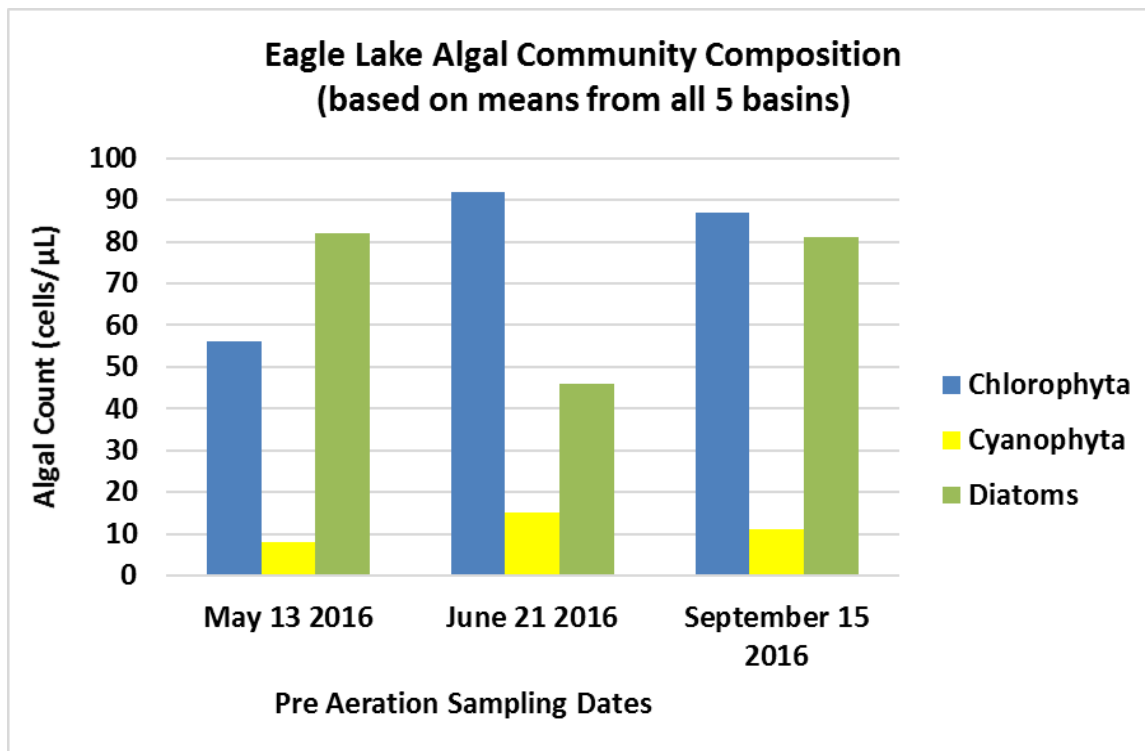


Figure 4. Baseline relative abundance of algal taxa in Eagle Lake (2016).

3.5 Eagle Lake Aquatic Vegetation Surveys and Biovolume Scan:

Aquatic Vegetation Assessment Site Surveys were conducted on Eagle Lake on May 13, 2016 and again on September 15, 2016. The relative abundance of each aquatic plant species along with the original data sheets and maps can be found in Appendix B. In general, there were 16 native submersed, 4 native floating-leaved, and 5 emergent aquatic plant species found during the survey. A whole lake scan using a Lowrance HDS 8[®] sonar unit with GPS software was used to create an aquatic vegetation biovolume map (Figure 5) of the lake on May 13, 2016 as a baseline. Three invasive species were found and included Eurasian Watermilfoil which occupied approximately 4.2 acres in May, 2016 (Figure 6) and 3.5 acres in late summer of 2016 (Figure 7). Additionally, approximately 117 acres of nuisance Illinois Pondweed (Figure 8) were noted and would make recreation on the lake nearly impossible. Both milfoil and pondweeds were effectively treated in 2016. The entire lake will again be monitored in 2017 to assess any changes in aquatic plant communities. Note that changes in aquatic plant communities may occur naturally annually on inland lakes and changes due to the LFA system require not only reference to changes in relative abundance but also to bio volume.

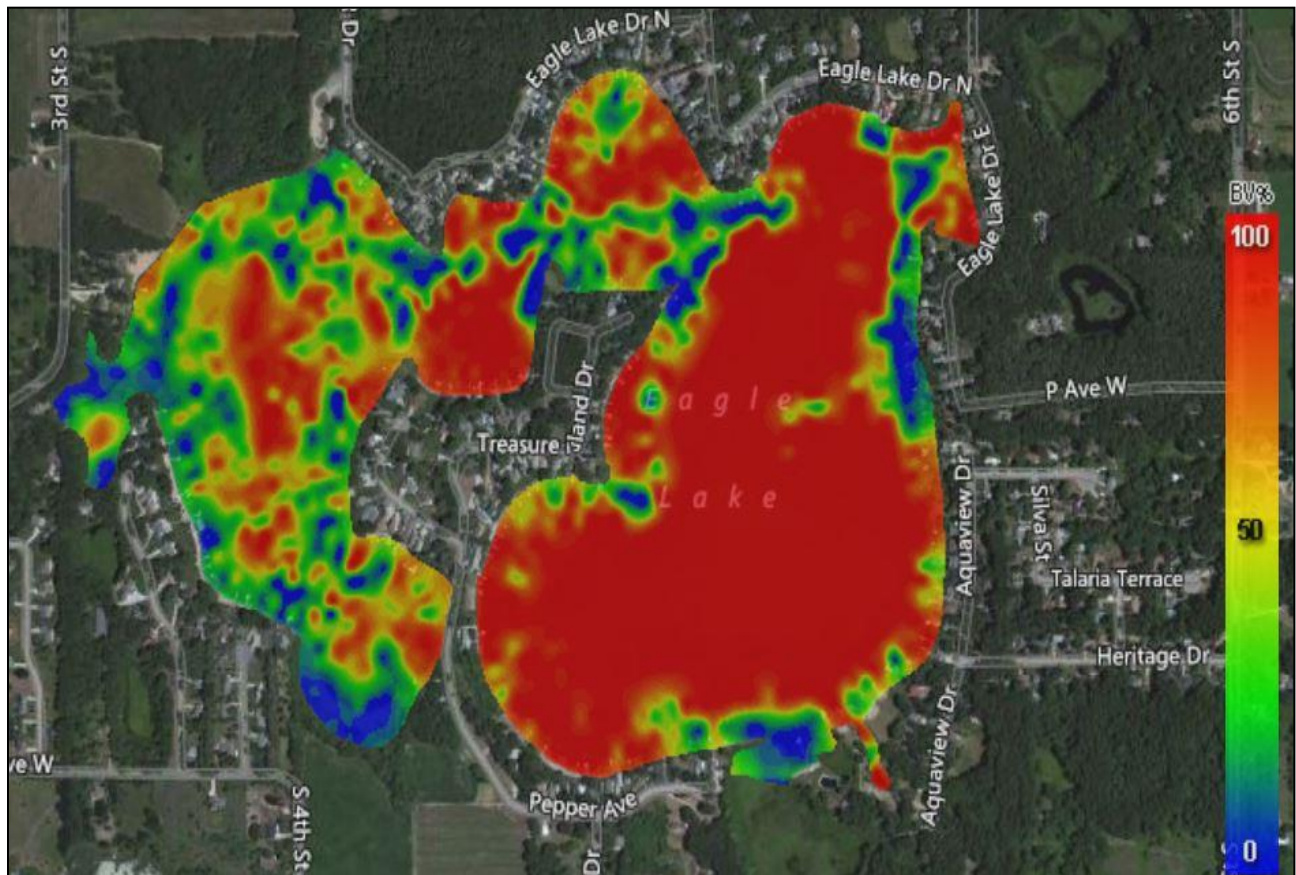


Figure 5. An aquatic vegetation biovolume scan map of Eagle Lake (May 13, 2016, RLS).

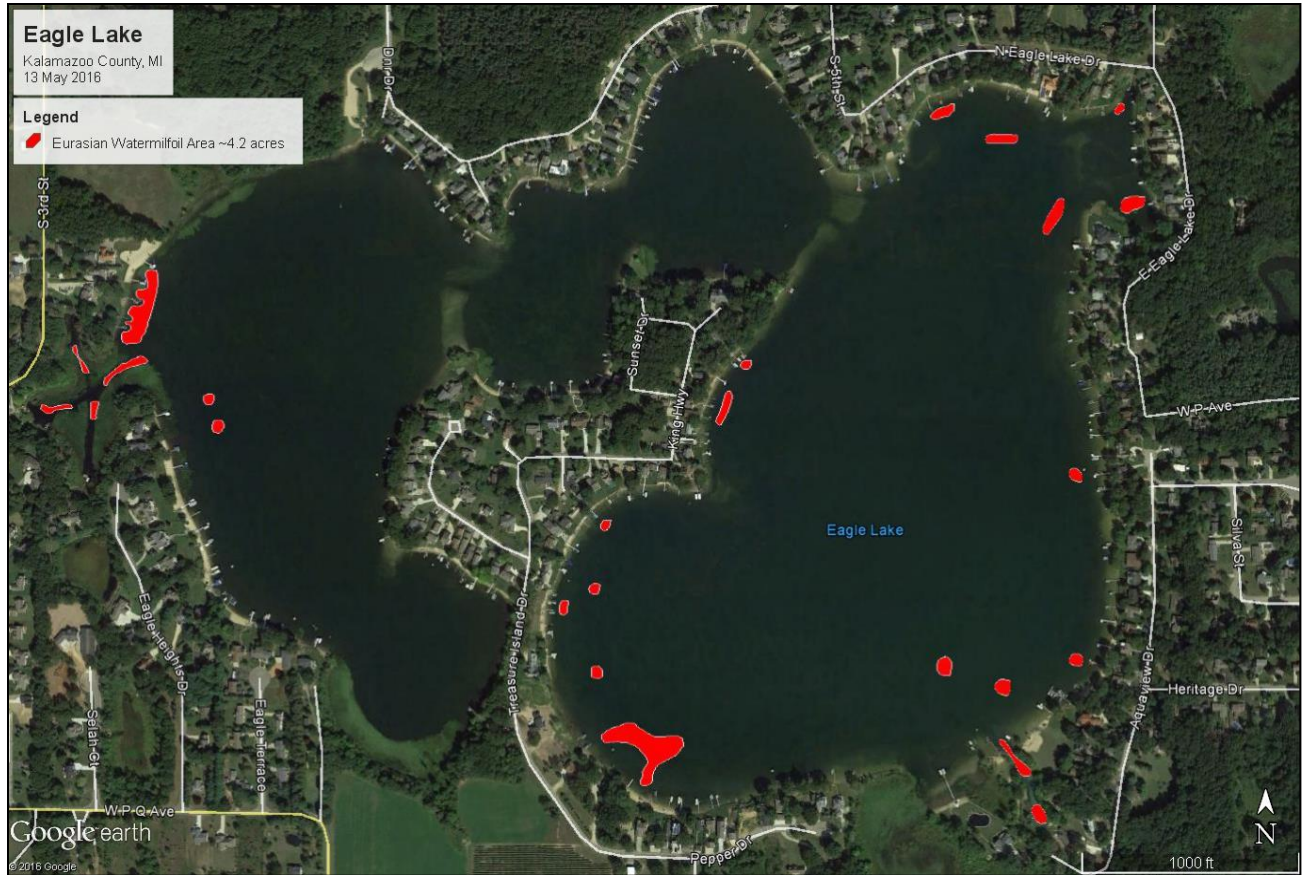


Figure 6. A map of invasive milfoil locations within Eagle Lake (May 13, 2016, RLS).

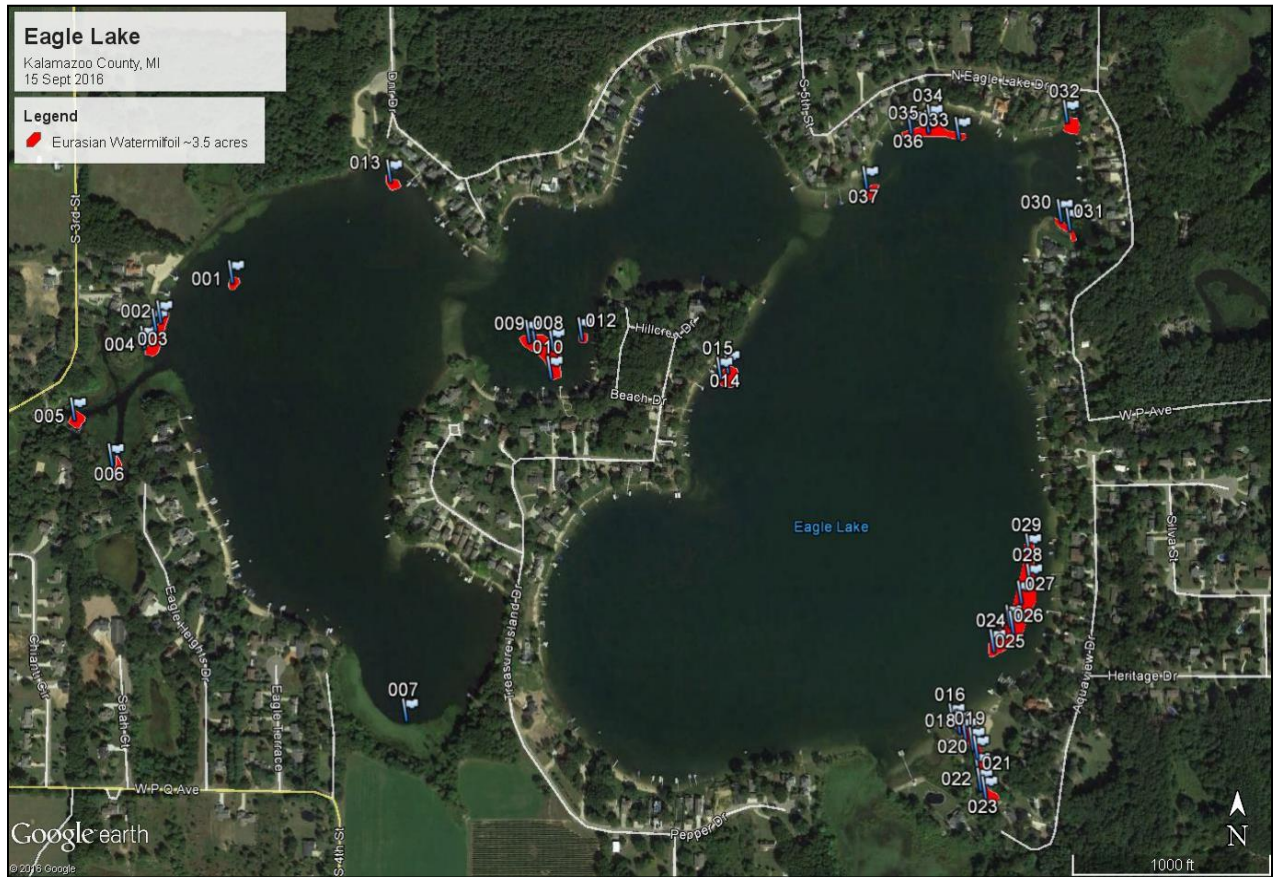


Figure 7. A map of invasive milfoil locations within Eagle Lake (September 15, 2016, RLS).

4.0 EAGLE LAKE 2017 FIRST-YEAR WATER QUALITY SAMPLING RESULTS

All first-year physical water quality data is shown in tables 32-46 below. Baseline chemical water quality data is shown in tables 47-61 below. Sediment muck depth data can be found in Table 62 below.

4.1 Eagle Lake First-Year Physical Water Quality Data Tables: NOTE: The May 10, 2017 data is still considered baseline due to the late install. For presentation purposes, this data is displayed below but for the actual analysis of baseline (2016) and first-year (2017) this data was used to calculate baseline statistics.

Pre-Aeration Data Table (May 10, 2017): Site 1

<i>Depth</i> <i>ft.</i>	<i>Water</i> <i>Temp °C</i>	<i>DO</i> <i>mg L⁻¹</i>	<i>pH</i> <i>S.U.</i>	<i>Cond.</i> <i>µS cm⁻¹</i>	<i>Secchi Depth</i> <i>(ft.)</i>
0	17.1	8.7	8.4	138	7.0
3.5	16.5	8.5	8.4	132	--
7.0	15.9	8.1	8.4	130	--

Table 32. Eagle Lake baseline physical water quality parameter data collected from Site 1 on May 10, 2017.

Pre-Aeration Data Table (May 10, 2017): Site 2

<i>Depth</i> <i>ft.</i>	<i>Water</i> <i>Temp °C</i>	<i>DO</i> <i>mg L⁻¹</i>	<i>pH</i> <i>S.U.</i>	<i>Cond.</i> <i>µS cm⁻¹</i>	<i>Secchi Depth</i> <i>(ft.)</i>
0	16.3	8.9	8.4	135	8.0
4.0	15.2	8.7	8.4	136	--
8.0	15.1	8.5	8.2	134	--

Table 33. Eagle Lake baseline physical water quality parameter data collected from Site 2 May 10, 2017.

Pre-Aeration Data Table (May 10, 2017): Site 3

<i>Depth</i> <i>ft.</i>	<i>Water</i> <i>Temp °C</i>	<i>DO</i> <i>mg L⁻¹</i>	<i>pH</i> <i>S.U.</i>	<i>Cond.</i> <i>µS cm⁻¹</i>	<i>Secchi Depth</i> <i>(ft.)</i>
0	16.8	8.5	8.4	132	9.0
4.5	16.1	8.1	8.4	138	--
9.0	15.9	8.1	8.4	137	--

Table 34. Eagle Lake baseline physical water quality parameter data collected from Site 3 May 10, 2017.

Pre-Aeration Data Table (May 10, 2017): Site 4

<i>Depth</i> <i>ft.</i>	<i>Water</i> <i>Temp °C</i>	<i>DO</i> <i>mg L⁻¹</i>	<i>pH</i> <i>S.U.</i>	<i>Cond.</i> <i>µS cm⁻¹</i>	<i>Secchi Depth</i> <i>(ft.)</i>
0	17.1	8.7	8.4	126	12.0
6.0	16.9	8.7	8.4	124	--
12.0	16.5	8.1	8.3	121	--

Table 35. Eagle Lake baseline physical water quality parameter data collected from Site 4 May 10, 2017.

Pre-Aeration Data Table (May 10, 2017): Site 5

<i>Depth</i> <i>ft.</i>	<i>Water</i> <i>Temp °C</i>	<i>DO</i> <i>mg L⁻¹</i>	<i>pH</i> <i>S.U.</i>	<i>Cond.</i> <i>µS cm⁻¹</i>	<i>Secchi Depth</i> <i>(ft.)</i>
0	18.2	8.7	8.4	127	11.8
6.5	18.0	8.7	8.4	126	
13.0	16.8	8.4	8.3	120	

Table 36. Eagle Lake baseline physical water quality parameter data collected from Site 5 May 10, 2017.

Post-Aeration Data Table (July 25, 2017): Site 1

<i>Depth</i> <i>ft.</i>	<i>Water</i> <i>Temp °C</i>	<i>DO</i> <i>mg L⁻¹</i>	<i>pH</i> <i>S.U.</i>	<i>Cond.</i> <i>µS cm⁻¹</i>	<i>Secchi Depth</i> <i>(ft.)</i>
0	27.6	8.3	8.4	170	5.9
2.7	27.5	8.5	8.4	169	--
5.5	27.4	9.1	8.6	168	--

Table 37. Eagle Lake post-aeration physical water quality parameter data collected from Site 1 on July 25, 2017.

Post-Aeration Data Table (July 25, 2017): Site 2

<i>Depth</i> <i>ft.</i>	<i>Water</i> <i>Temp °C</i>	<i>DO</i> <i>mg L⁻¹</i>	<i>pH</i> <i>S.U.</i>	<i>Cond.</i> <i>µS cm⁻¹</i>	<i>Secchi Depth</i> <i>(ft.)</i>
0	27.8	8.3	8.4	166	6.4
3.5	27.7	8.3	8.4	166	--
7.0	27.4	8.5	8.4	166	--

Table 38. Eagle Lake post-aeration physical water quality parameter data collected from Site 2 July 25, 2017.

Post-Aeration Data Table (July 25, 2017): Site 3

<i>Depth</i> <i>ft.</i>	<i>Water</i> <i>Temp °C</i>	<i>DO</i> <i>mg L⁻¹</i>	<i>pH</i> <i>S.U.</i>	<i>Cond.</i> <i>µS cm⁻¹</i>	<i>Secchi Depth</i> <i>(ft.)</i>
0	27.5	8.2	8.6	163	8.0
3.7	27.5	8.4	8.5	162	--
7.5	27.0	8.9	8.7	161	--

Table 39. Eagle Lake post-aeration physical water quality parameter data collected from Site 3 July 25, 2017.

Post-Aeration Data Table (July 25, 2017): Site 4

<i>Depth</i> <i>ft.</i>	<i>Water</i> <i>Temp °C</i>	<i>DO</i> <i>mg L⁻¹</i>	<i>pH</i> <i>S.U.</i>	<i>Cond.</i> <i>µS cm⁻¹</i>	<i>Secchi Depth</i> <i>(ft.)</i>
0	25.2	7.9	8.0	161	8.5
6.0	25.1	8.2	8.0	162	--
12.0	24.5	7.0	8.0	158	--

Table 40. Eagle Lake post-aeration physical water quality parameter data collected from Site 4 July 25, 2017.

Post-Aeration Data Table (July 25, 2017): Site 5

<i>Depth</i> <i>ft.</i>	<i>Water</i> <i>Temp °C</i>	<i>DO</i> <i>mg L⁻¹</i>	<i>pH</i> <i>S.U.</i>	<i>Cond.</i> <i>µS cm⁻¹</i>	<i>Secchi Depth</i> <i>(ft.)</i>
0	27.3	8.7	8.8	138	10.0
5.0	27.2	8.7	8.8	140	--
10.0	26.4	7.0	7.5	142	--

Table 41. Eagle Lake post-aeration physical water quality parameter data collected from Site 5 July 25, 2017.

Post-Aeration Data Table (September 11, 2017): Site 1

<i>Depth</i> <i>ft.</i>	<i>Water</i> <i>Temp °C</i>	<i>DO</i> <i>mg L⁻¹</i>	<i>pH</i> <i>S.U.</i>	<i>Cond.</i> <i>µS cm⁻¹</i>	<i>Secchi Depth</i> <i>(ft.)</i>
0	19.5	10.5	9.0	163	5.0+
2.5	19.3	10.7	9.0	162	--
5.0	19.1	11.0	9.1	162	--

Table 42. Eagle Lake post-aeration physical water quality parameter data collected from Site 1 on September 11, 2017.

Post-Aeration Data Table (September 11, 2017): Site 2

<i>Depth</i> <i>ft.</i>	<i>Water</i> <i>Temp °C</i>	<i>DO</i> <i>mg L⁻¹</i>	<i>pH</i> <i>S.U.</i>	<i>Cond.</i> <i>µS cm⁻¹</i>	<i>Secchi Depth</i> <i>(ft.)</i>
0	19.1	10.5	9.0	163	6.0+
3.0	19.1	10.6	9.0	163	--
6.0	19.0	10.7	9.0	163	--

Table 43. Eagle Lake post-aeration physical water quality parameter data collected from Site 2 September 11, 2017.

Post-Aeration Data Table (September 11, 2017): Site 3

<i>Depth</i> <i>ft.</i>	<i>Water</i> <i>Temp °C</i>	<i>DO</i> <i>mg L⁻¹</i>	<i>pH</i> <i>S.U.</i>	<i>Cond.</i> <i>µS cm⁻¹</i>	<i>Secchi Depth</i> <i>(ft.)</i>
0	19.3	10.1	9.1	165	7.5+
3.5	19.1	10.2	9.0	165	--
7.5	18.9	10.1	9.0	165	--

Table 44. Eagle Lake post-aeration physical water quality parameter data collected from Site 3 September 11, 2017.

Post-Aeration Data Table (September 11, 2017): Site 4

<i>Depth</i> <i>ft.</i>	<i>Water</i> <i>Temp °C</i>	<i>DO</i> <i>mg L⁻¹</i>	<i>pH</i> <i>S.U.</i>	<i>Cond.</i> <i>µS cm⁻¹</i>	<i>Secchi Depth</i> <i>(ft.)</i>
0	19.1	10.0	9.2	176	11.2+
5.6	19.0	10.6	9.1	175	--
11.2	17.7	9.1	8.6	286	--

Table 45. Eagle Lake post-aeration physical water quality parameter data collected from Site 4 September 11, 2017.

Post-Aeration Data Table (September 11, 2017): Site 5

<i>Depth</i> <i>ft.</i>	<i>Water</i> <i>Temp °C</i>	<i>DO</i> <i>mg L⁻¹</i>	<i>pH</i> <i>S.U.</i>	<i>Cond.</i> <i>µS cm⁻¹</i>	<i>Secchi Depth</i> <i>(ft.)</i>
0	19.5	9.5	9.0	171	8.0+
4.0	19.3	9.6	9.0	170	--
8.0	19.3	9.8	9.0	168	--

Table 46. Eagle Lake post-aeration physical water quality parameter data collected from Site 5 September 11, 2017.

4.2 Eagle Lake Baseline and Post-Aeration 2017 Chemical Water Quality Data Tables:

Pre-Aeration Data Tables (May 10, 2017): Site 1

<i>Depth</i> <i>(ft.)</i>	<i>Total</i> <i>Phosphorus</i> <i>(mg/L)</i>	<i>Ortho-</i> <i>Phosphorus</i> <i>(mg/L)</i>	<i>Total</i> <i>Suspended</i> <i>Solids (mg/L)</i>	<i>Chlorophyll-a</i> <i>(µg/L)</i>
0	<0.010	<0.010	<10	-14.4
3.5	<0.010	<0.010	<10	--
7.0	0.011	<0.010	<10	--

Table 47. Eagle Lake baseline chemical water quality parameter data collected from Site 1 on May 10, 2017.

Pre-Aeration Data Tables (May 10, 2017): Site 2

<i>Depth (ft.)</i>	<i>Total Phosphorus (mg/L)</i>	<i>Ortho- Phosphorus (mg/L)</i>	<i>Total Suspended Solids (mg/L)</i>	<i>Chlorophyll-a (µg/L)</i>
0	0.013	<0.010	<10	-10.9
4	0.015	<0.010	<10	--
8	0.016	<0.010	<10	--

Table 48. Eagle Lake baseline chemical water quality parameter data collected from site 2 on May 10, 2017.

Pre-Aeration Data Tables (May 10, 2017): Site 3

<i>Depth (ft.)</i>	<i>Total Phosphorus (mg/L)</i>	<i>Ortho- Phosphorus (mg/L)</i>	<i>Total Suspended Solids (mg/L)</i>	<i>Chlorophyll-a (µg/L)</i>
0	<0.010	<0.010	<10	-10.7
4.5	0.012	<0.010	<10	--
9.0	0.023	<0.010	18	--

Table 49. Eagle Lake baseline chemical water quality parameter data collected from site 3 on May 10, 2017.

Pre-Aeration Data Tables (May 10, 2017): Site 4

<i>Depth (ft.)</i>	<i>Total Phosphorus (mg/L)</i>	<i>Ortho- Phosphorus (mg/L)</i>	<i>Total Suspended Solids (mg/L)</i>	<i>Chlorophyll-a (µg/L)</i>
0	<0.010	<0.010	<10	-2.14
6	0.013	<0.010	<10	--
12	0.018	<0.010	<10	--

Table 50. Eagle Lake baseline chemical water quality parameter data collected from site 4 on May 10, 2017.

Pre-Aeration Data Tables (May 10, 2017): Site 5

<i>Depth (ft.)</i>	<i>Total Phosphorus (mg/L)</i>	<i>Ortho- Phosphorus (mg/L)</i>	<i>Total Suspended Solids (mg/L)</i>	<i>Chlorophyll-a (µg/L)</i>
0	0.012	<0.010	<10	-11.5
6.5	0.021	<0.010	<10	--
13.0	0.020	<0.010	<10	--

Table 51. Eagle Lake baseline chemical water quality parameter data collected from site 5 on May 10, 2017.

Post-Aeration Data Tables (July 25, 2017): Site 1

<i>Depth (ft.)</i>	<i>Total Phosphorus (mg/L)</i>	<i>Ortho- Phosphorus (mg/L)</i>	<i>Total Suspended Solids (mg/L)</i>	<i>Chlorophyll-a (µg/L)</i>
0	0.014	<0.010	<10	-1.48e ¹⁴
2.7	0.024	<0.010	<10	--
5.5	0.026	<0.010	<10	--

Table 52. Eagle Lake post-aeration chemical water quality parameter data collected from Site 1 on July 25, 2017.

Post-Aeration Data Tables (July 25, 2017): Site 2

<i>Depth (ft.)</i>	<i>Total Phosphorus (mg/L)</i>	<i>Ortho- Phosphorus (mg/L)</i>	<i>Total Suspended Solids (mg/L)</i>	<i>Chlorophyll-a (µg/L)</i>
0	0.010	<0.010	<10	-1.07
3.5	0.012	<0.010	<10	--
7.0	0.015	<0.010	<10	--

Table 53. Eagle Lake post-aeration chemical water quality parameter data collected from site 2 on July 25, 2017.

Post-Aeration Data Tables (July 25, 2017): Site 3

<i>Depth (ft.)</i>	<i>Total Phosphorus (mg/L)</i>	<i>Ortho- Phosphorus (mg/L)</i>	<i>Total Suspended Solids (mg/L)</i>	<i>Chlorophyll-a (µg/L)</i>
0	0.014	<0.010	<10	-1.34
3.7	0.014	<0.010	<10	--
7.5	0.013	<0.010	260	--

Table 54. Eagle Lake post-aeration chemical water quality parameter data collected from site 3 on July 25, 2017.

Post-Aeration Data Tables (July 25, 2017): Site 4

<i>Depth (ft.)</i>	<i>Total Phosphorus (mg/L)</i>	<i>Ortho- Phosphorus (mg/L)</i>	<i>Total Suspended Solids (mg/L)</i>	<i>Chlorophyll-a (µg/L)</i>
0	<0.010	<0.010	<10	-0.267
5.5	<0.010	<0.010	<10	--
11.0	0.013	<0.010	<10	--

Table 55. Eagle Lake post-aeration chemical water quality parameter data collected from site 4 on July 25, 2017.

Post-Aeration Data Tables (July 25, 2017): Site 5

<i>Depth (ft.)</i>	<i>Total Phosphorus (mg/L)</i>	<i>Ortho- Phosphorus (mg/L)</i>	<i>Total Suspended Solids (mg/L)</i>	<i>Chlorophyll-a (µg/L)</i>
0	0.014	<0.010	<10	0.356
5	0.018	<0.010	<10	--
10	0.018	<0.010	<10	--

Table 56. Eagle Lake post-aeration chemical water quality parameter data collected from site 5 on July 25, 2017.

Post-Aeration Data Tables (September 11, 2017): Site 1

<i>Depth (ft.)</i>	<i>Total Phosphorus (mg/L)</i>	<i>Ortho- Phosphorus (mg/L)</i>	<i>Total Suspended Solids (mg/L)</i>	<i>TKN mg/L</i>	<i>Chlorophyll-a (µg/L)</i>
0	0.013	<0.010	<10	0.84	0.712
2.5	0.018	<0.010	10	0.85	--
5.0	0.017	0.010	<10	0.96	--

Table 57. Eagle Lake post-aeration chemical water quality parameter data collected from Site 1 on September 11, 2017. Note: Total Kjeldahl Nitrogen was collected during this time.

Post-Aeration Data Tables (September 11, 2017): Site 2

<i>Depth (ft.)</i>	<i>Total Phosphorus (mg/L)</i>	<i>Ortho- Phosphorus (mg/L)</i>	<i>Total Suspended Solids (mg/L)</i>	<i>TKN mg/L</i>	<i>Chlorophyll-a (µg/L)</i>
0	0.011	<0.010	<10	0.79	-0.267
3	0.012	<0.010	<10	0.72	--
6	0.015	<0.010	<10	0.91	--

Table 58. Eagle Lake post-aeration chemical water quality parameter data collected from site 2 on September 11, 2017. Note: Total Kjeldahl Nitrogen was collected during this time.

Post-Aeration Data Tables (September 11, 2017): Site 3

<i>Depth (ft.)</i>	<i>Total Phosphorus (mg/L)</i>	<i>Ortho- Phosphorus (mg/L)</i>	<i>Total Suspended Solids (mg/L)</i>	<i>TKN mg/L</i>	<i>Chlorophyll-a (µg/L)</i>
0	0.012	<0.010	<10	0.71	-0.267
3.5	0.011	<0.010	<10	0.81	--
7.5	0.013	<0.010	<10	0.76	--

Table 59. Eagle Lake post-aeration chemical water quality parameter data collected from site 3 on September 11, 2017. Note: Total Kjeldahl Nitrogen was collected during this time.

Post-Aeration Data Tables (September 11, 2017): Site 4

<i>Depth (ft.)</i>	<i>Total Phosphorus (mg/L)</i>	<i>Ortho- Phosphorus (mg/L)</i>	<i>Total Suspended Solids (mg/L)</i>	<i>TKN mg/L</i>	<i>Chlorophyll-a (µg/L)</i>
0	0.011	<0.010	<10	0.76	-0.214
5.6	0.011	<0.010	<10	0.69	--
11.2	0.012	<0.010	<10	0.67	--

Table 60. Eagle Lake post-aeration chemical water quality parameter data collected from site 4 on September 11, 2017. Note: Total Kjeldahl Nitrogen was collected during this time.

Post-Aeration Data Tables (September 11, 2017): Site 5

<i>Depth (ft.)</i>	<i>Total Phosphorus (mg/L)</i>	<i>Ortho- Phosphorus (mg/L)</i>	<i>Total Suspended Solids (mg/L)</i>	<i>TKN mg/L</i>	<i>Chlorophyll-a (µg/L)</i>
0	0.011	<0.010	<10	0.70	0.000
4	0.012	<0.010	<10	0.74	--
8	0.013	<0.010	<10	0.71	--

Table 61. Eagle Lake post-aeration chemical water quality parameter data collected from site 5 on September 11, 2017. Note: Total Kjeldahl Nitrogen was collected during this time.

4.3 Eagle Lake Additional First-Year Sediment Data Tables and Bottom Hardness Scan:

A bottom hardness scan of Eagle Lake was conducted on October 25, 2017 along with the sediment probe data which was collected as baseline data during 2016. Figure 9 below shows the bottom hardness scan map and Table 62 below shows the 2017 bottom muck depth data.

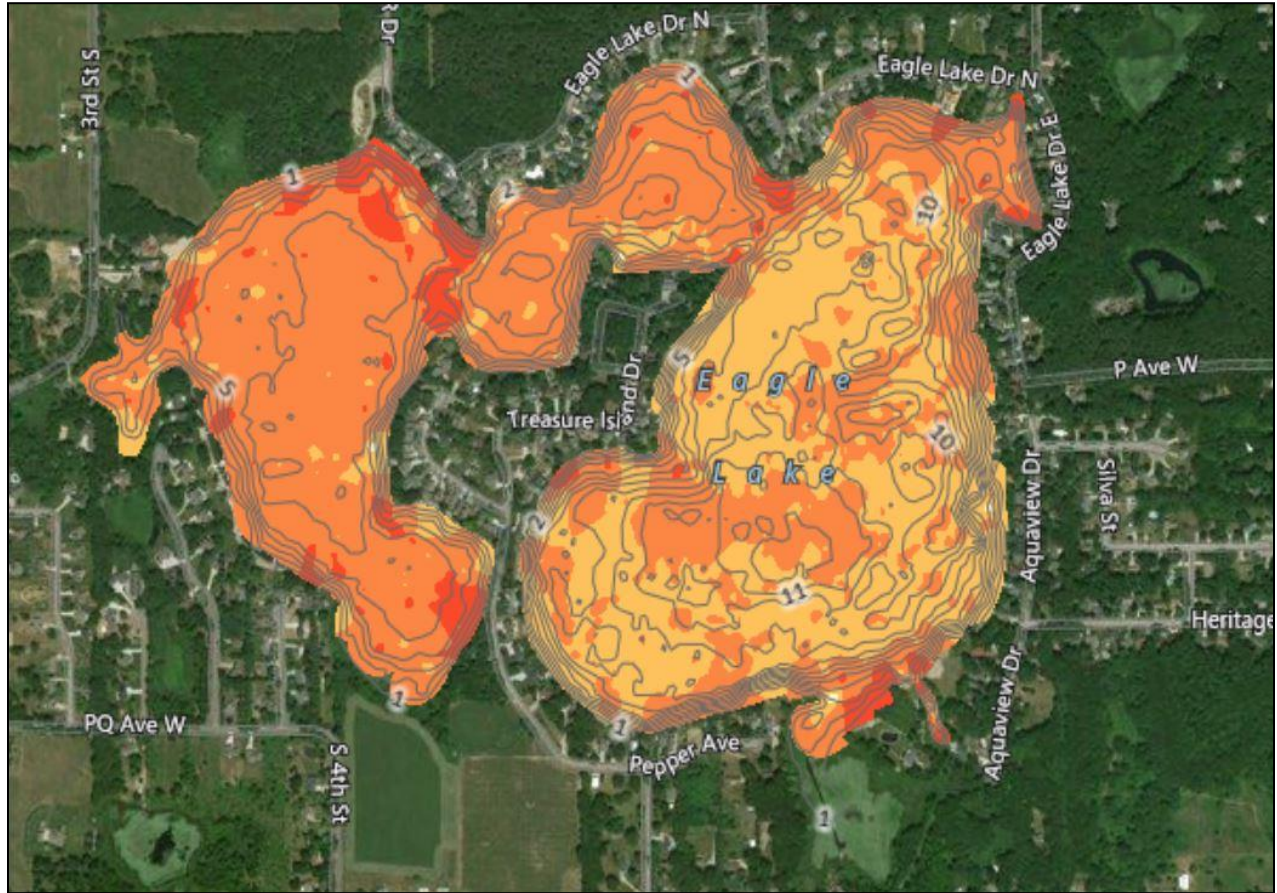


Figure 9. Bottom hardness scan of Eagle Lake (October 25, 2017).

Sediment Sample ID (GPS)	Sediment Thickness (feet)	Sediment Sample ID (GPS)	Sediment Thickness (feet)
1	2.94	33	6.37
2	4.46	34	1.14
3	4.16	35	5.19
4	3.28	36	6.68
5	3.36	37	2.88
6	4.14	38	2.78
7	3.86	39	10.98
8	1.79	40	12.67
9	2.86	41	2.73
10	2.35	42	2.32
11	3.18	43	9.58
12	2.89	44	7.3
13	3.03	45	10.75
14	3.55	46	11.98
15	3.18	47	2.02
16	5.83	48	12.75
17	5.59	49	0.39
18	5.35	50	4.08
19	4.16	51	7.36
20	5.19	52	1.64
21	1.73	53	2.81
22	4.23	54	1.59
23	4.9	55	5.08
24	2.77	56	5.64
25	5.82	57	2.51
26	5.41	58	9.43
27	4.03	59	10.96
28	1.09	60	12.68
29	3.67	61	1.66

30	3.34	62	3.77
31	1.87	63	2.1
32	4.07		

Table 62. 2017 sediment probe muck depth measurements on Eagle Lake.

4.4 Eagle Lake First-Year Phytoplankton Community Data:

Algal community composition data was also collected in 2017 as in the 2016 baseline. Figure 10 below shows the relative abundance of the key taxa which include the green algae (Chlorophyta), blue-green algae (Cyanophyta), and the diatoms (Basillariophyta). The chlorophyta consisted of genera such as: *Scenedemsus* sp., *Chlorella* sp., *Spirogyra* sp., *Mougeotia* sp., *Pediastrum* sp., and *Cosmarium* sp. The blue-green genera consisted of: *Gleocystis* sp., and *Oscillatoria* sp. The diatoms consisted of: *Navicula* sp., *Synedra* sp., *Cymbella* sp., *Fragillaria* sp., and *Rhoicospenia* sp. These taxa represent a balanced algal community.

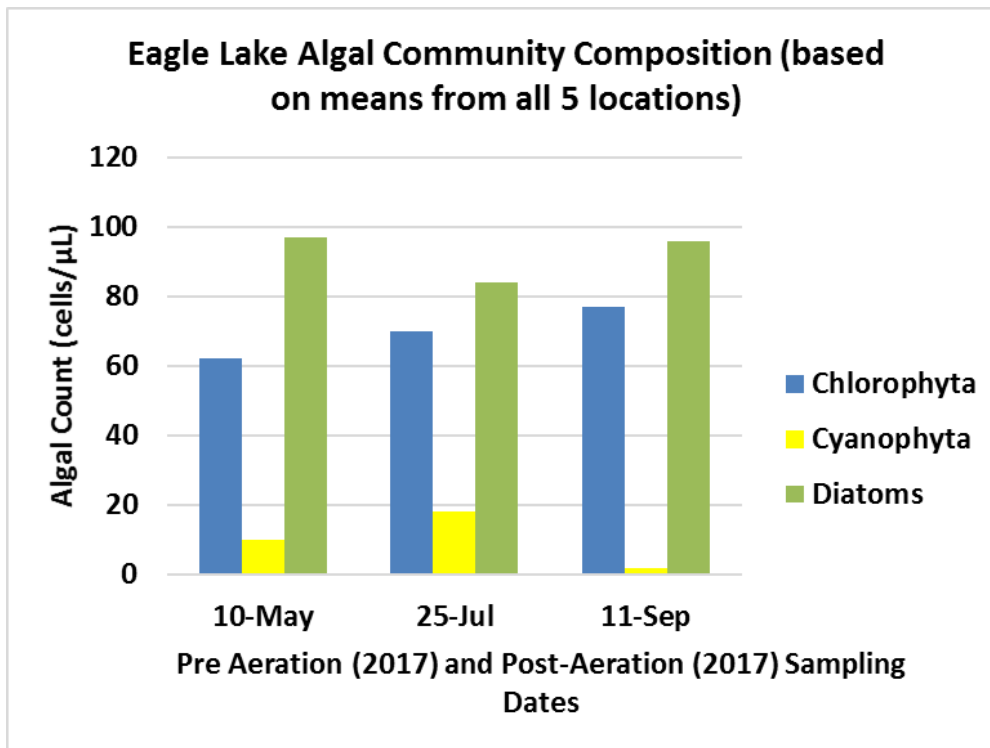


Figure 10. Algal community composition in 2017 (pre [May] and post-aeration [July and September]).

4.5 Eagle Lake 2017 Aquatic Vegetation Biovolume, Survey, and Scan:

On May 10, 2017, a whole-lake aquatic vegetation GPS point-intercept survey was conducted to determine the native and invasive species cover present. During the survey, 14 submersed, 4 floating-leaved, and 7 emergent aquatic plant species were found. Eagle Lake is thus a very diverse aquatic ecosystem with 25 native aquatic plant species. The most dominant native aquatic plant was Illinois Pondweed. A complete data sheet for the 2017 survey can be found in Appendix C. Also found, were approximately 9.5 acres of invasive milfoil, 1.1 acres of invasive Curly-leaf Pondweed (CLP), 7.35 acres of nuisance Elodea, and 124 acres of dense pondweeds. Herbicide treatments to address these areas and small additional areas throughout the 2017 season were conducted on May 22, 2017, June 8, 2017, June 14, 2017, July 11, 2017, August 3, 2017, and August 28, 2017. The aquatic herbicide Aquathol-K® was used on the CLP and nuisance pondweeds. The systemic aquatic herbicide Renovate OTF® was used on the invasive milfoil. The aquatic herbicides diquat and flumioxazin (Clipper® at 200 ppb) were used on the nuisance Elodea.

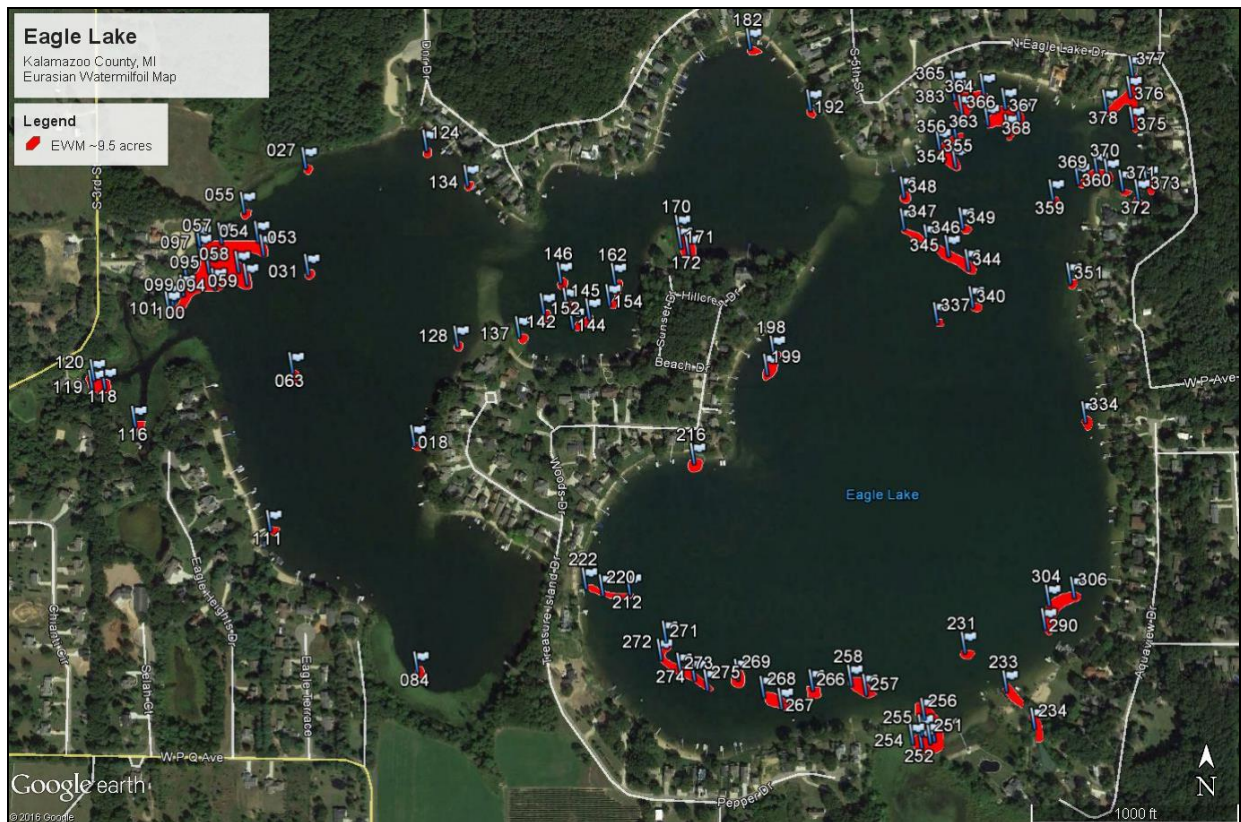


Figure 11. EWM locations in Eagle Lake (May, 2017).

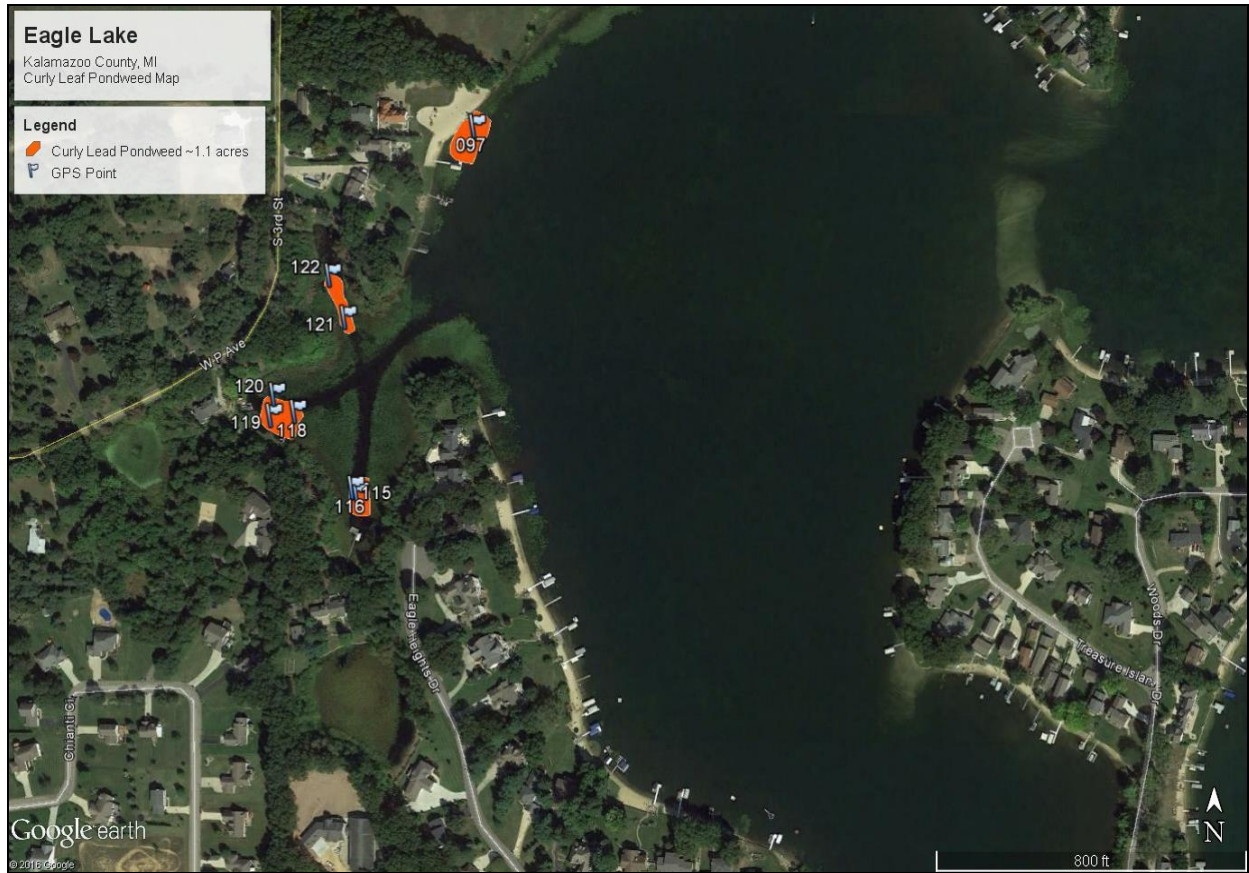


Figure 12. CLP locations in Eagle Lake (May, 2017).

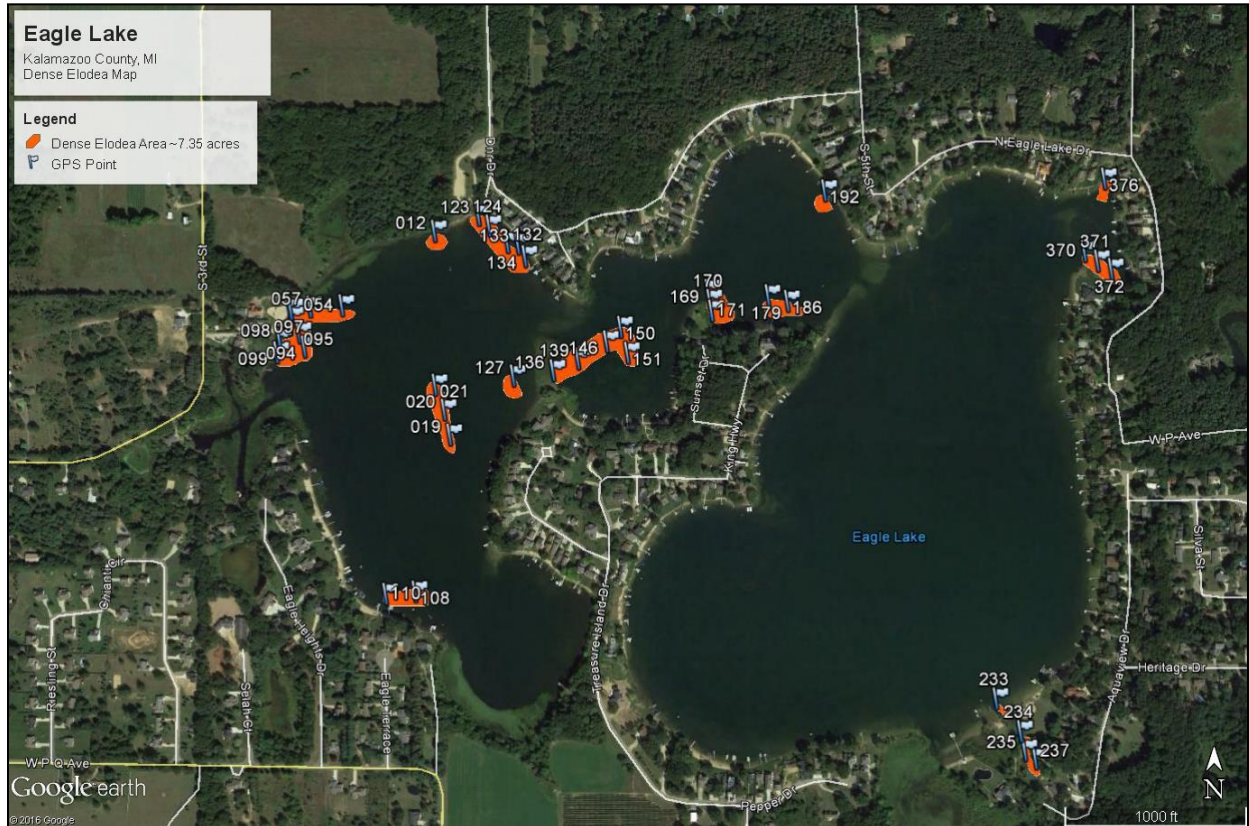


Figure 13. Nuisance Elodea locations in Eagle Lake (May, 2017).

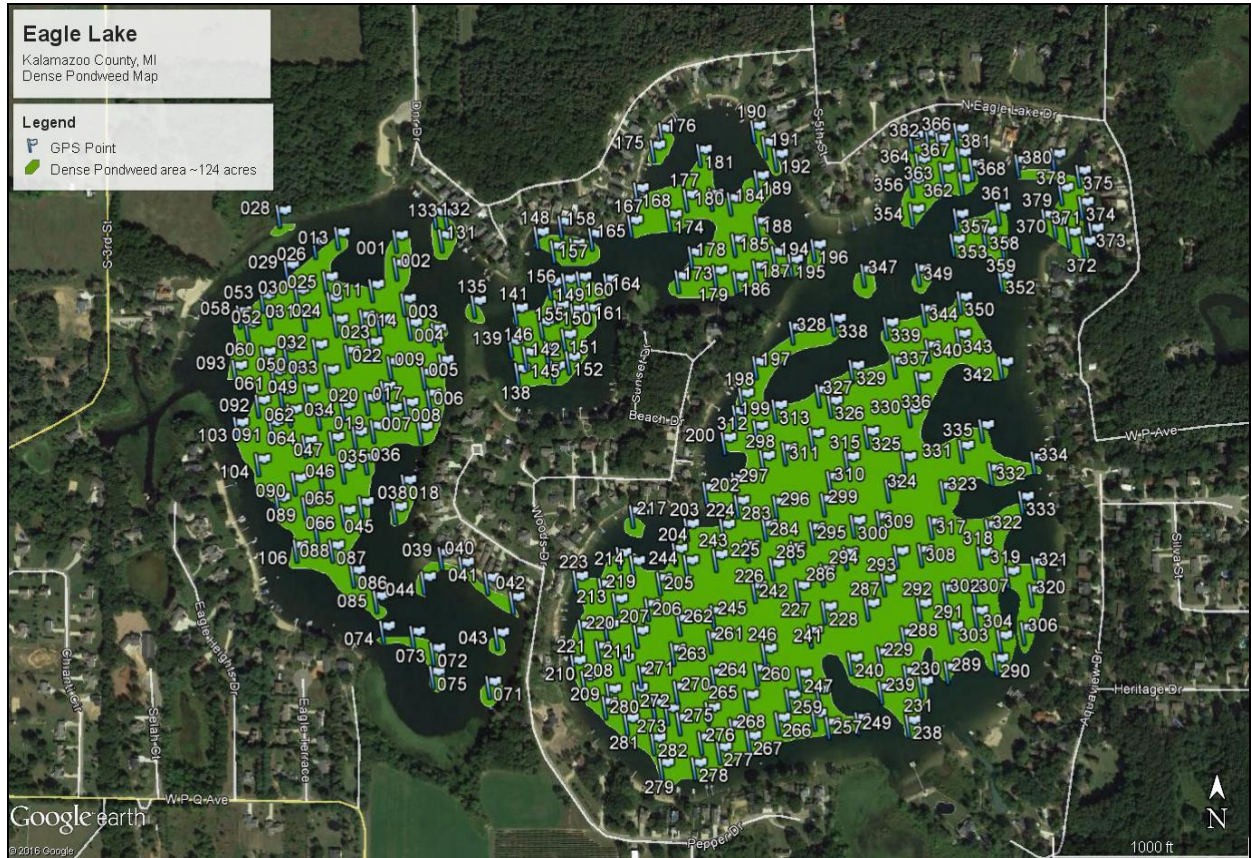


Figure 14. Nuisance pondweed locations in Eagle Lake (May, 2017).

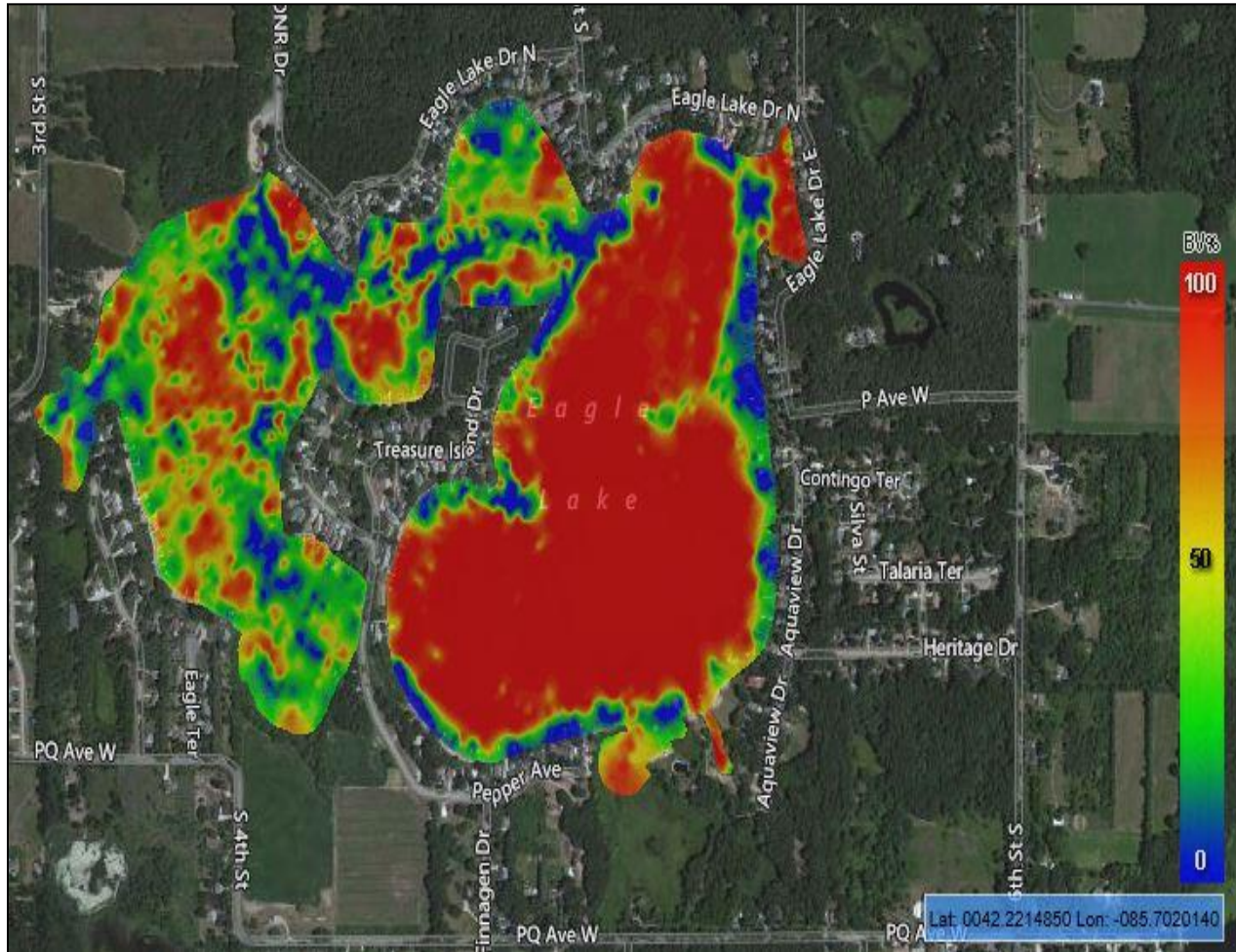


Figure 15. Aquatic vegetation biovolume scan of Eagle Lake (May, 2017). Note: The blue areas represent no vegetation; green represents low-growing vegetation; red represents high-growing vegetation such as the Illinois Pondweed, lily pads, and EWM.

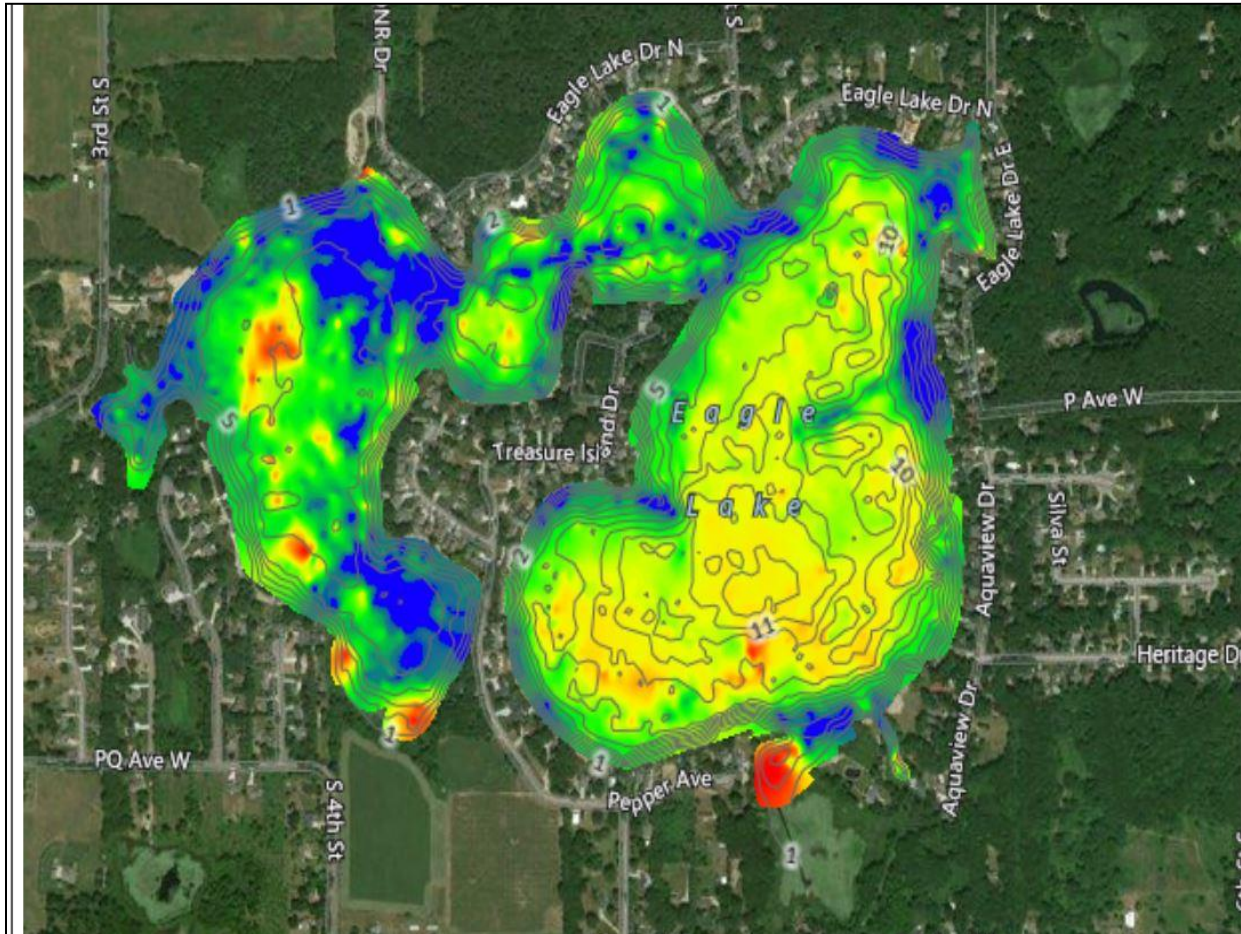


Figure 16. Aquatic vegetation biovolume scan of Eagle Lake (October, 2017). Note: The blue areas represent no vegetation; green represents low-growing vegetation; red represents high-growing vegetation such as the lily pads and pondweeds.

5.0 EAGLE LAKE 2018 SECOND-YEAR WATER QUALITY SAMPLING RESULTS

All second-year physical water quality data is shown in tables 63-77 below. Baseline chemical water quality data is shown in tables 78-92 below. Sediment muck depth data can be found in Table 93 below. The LFA system was not operating on May 2, 2018 but was operational on the July 7 and September 4, 2018 sampling dates. This was due to flooding of compressors in May of 2018 which were later elevated off ground to avoid future flooding damage.

5.1 Eagle Lake Second-Year Physical Water Quality Data Tables
Post-Aeration Data Table (May 2, 2018): Site 1

<i>Depth</i>	<i>Water</i>	<i>DO</i>	<i>pH</i>	<i>Cond.</i>	<i>Secchi Depth</i>
<i>ft.</i>	<i>Temp °C</i>	<i>mg L⁻¹</i>	<i>S.U.</i>	<i>µS cm⁻¹</i>	<i>(ft.)</i>
0	16.8	10.7	8.6	174	6.0+
2.0	16.8	10.8	8.6	174	--
6.0	16.7	10.8	8.6	174	--

Table 63. Eagle Lake post-LFA physical water quality parameter data collected from Site 1 on May 2, 2018.

Post-Aeration Data Table (May 2, 2018): Site 2

<i>Depth</i>	<i>Water</i>	<i>DO</i>	<i>pH</i>	<i>Cond.</i>	<i>Secchi Depth</i>
<i>ft.</i>	<i>Temp °C</i>	<i>mg L⁻¹</i>	<i>S.U.</i>	<i>µS cm⁻¹</i>	<i>(ft.)</i>
0	16.4	11.1	8.8	171	6.0+
2.0	16.4	11.2	8.8	171	
6.0	16.1	11.7	8.9	168	

Table 64. Eagle Lake post-LFA physical water quality parameter data collected from Site 2 on May 2, 2018.

Post-Aeration Data Table (May 2, 2018): Site 3

<i>Depth</i>	<i>Water</i>	<i>DO</i>	<i>pH</i>	<i>Cond.</i>	<i>Secchi Depth</i>
<i>ft.</i>	<i>Temp °C</i>	<i>mg L⁻¹</i>	<i>S.U.</i>	<i>µS cm⁻¹</i>	<i>(ft.)</i>
0	16.3	10.7	8.8	171	8.0+
4.0	16.2	11.1	8.8	171	
8.0	15.9	11.2	8.8	170	

Table 65. Eagle Lake post-LFA physical water quality parameter data collected from Site 3 on May 2, 2018.

Post-Aeration Data Table (May 2, 2018): Site 4

<i>Depth</i> <i>ft.</i>	<i>Water</i> <i>Temp °C</i>	<i>DO</i> <i>mg L⁻¹</i>	<i>pH</i> <i>S.U.</i>	<i>Cond.</i> <i>µS cm⁻¹</i>	<i>Secchi Depth</i> <i>(ft.)</i>
0	15.2	10.8	8.8	169	12.0+
6.0	15.2	11.7	8.8	169	
12.0	13.8	12.3	8.9	168	

Table 66. Eagle Lake post-LFA physical water quality parameter data collected from Site 4 on May 2, 2018.

Post-Aeration Data Table (May 2, 2018): Site 5

<i>Depth</i> <i>ft.</i>	<i>Water</i> <i>Temp °C</i>	<i>DO</i> <i>mg L⁻¹</i>	<i>pH</i> <i>S.U.</i>	<i>Cond.</i> <i>µS cm⁻¹</i>	<i>Secchi Depth</i> <i>(ft.)</i>
0	15.5	11.1	8.8	170	10.0+
4.0	15.5	11.2	8.8	170	
10.0	14.9	10.9	8.7	171	

Table 67. Eagle Lake post-LFA physical water quality parameter data collected from Site 5 on May 2, 2018.

Post-Aeration Data Table (July 7, 2018): Site 1

<i>Depth</i> <i>ft.</i>	<i>Water</i> <i>Temp °C</i>	<i>DO</i> <i>mg L⁻¹</i>	<i>pH</i> <i>S.U.</i>	<i>Cond.</i> <i>µS cm⁻¹</i>	<i>Secchi Depth</i> <i>(ft.)</i>
0	28.7	8.1	8.4	166	8.0+
4.0	28.4	8.3	8.4	166	--
8.0	27.9	8.6	8.5	166	--

Table 68. Eagle Lake post-LFA physical water quality parameter data collected from Site 1 on July 7, 2018.

Post-Aeration Data Table (July 7, 2018): Site 2

<i>Depth</i> <i>ft.</i>	<i>Water</i> <i>Temp °C</i>	<i>DO</i> <i>mg L⁻¹</i>	<i>pH</i> <i>S.U.</i>	<i>Cond.</i> <i>µS cm⁻¹</i>	<i>Secchi Depth</i> <i>(ft.)</i>
0	28.7	8.3	8.6	162	8.0+
4.0	28.3	8.7	8.7	162	
8.0	27.8	8.9	8.8	163	

Table 69. Eagle Lake post-LFA physical water quality parameter data collected from Site 2 on July 7, 2018.

Post-Aeration Data Table (July 7, 2018): Site 3

<i>Depth</i> <i>ft.</i>	<i>Water</i> <i>Temp °C</i>	<i>DO</i> <i>mg L⁻¹</i>	<i>pH</i> <i>S.U.</i>	<i>Cond.</i> <i>µS cm⁻¹</i>	<i>Secchi Depth</i> <i>(ft.)</i>
0	28.4	8.1	8.6	162	10.0+
5.0	28.2	8.1	8.6	163	
10.0	27.6	7.9	8.4	162	

Table 70. Eagle Lake post-LFA physical water quality parameter data collected from Site 3 on July 7, 2018.

Post-Aeration Data Table (July 7, 2018): Site 4

<i>Depth</i> <i>ft.</i>	<i>Water</i> <i>Temp °C</i>	<i>DO</i> <i>mg L⁻¹</i>	<i>pH</i> <i>S.U.</i>	<i>Cond.</i> <i>µS cm⁻¹</i>	<i>Secchi Depth</i> <i>(ft.)</i>
0	27.6	7.4	8.2	169	8.0*
5.0	27.8	7.4	8.3	168	
14.0	22.7	3.5	7.6	234	

Table 71. Eagle Lake post-LFA physical water quality parameter data collected from Site 4 on July 7, 2018.

Post-Aeration Data Table (July 7, 2018): Site 5

<i>Depth</i> <i>ft.</i>	<i>Water</i> <i>Temp °C</i>	<i>DO</i> <i>mg L⁻¹</i>	<i>pH</i> <i>S.U.</i>	<i>Cond.</i> <i>µS cm⁻¹</i>	<i>Secchi Depth</i> <i>(ft.)</i>
0	28.2	8.3	8.7	160	12.0
5.0	28.1	8.4	8.7	161	
12.0	27.0	8.5	8.8	162	

Table 72. Eagle Lake post-LFA physical water quality parameter data collected from Site 5 on July 7, 2018.

Post-Aeration Data Table (September 4, 2018): Site 1

<i>Depth</i> <i>ft.</i>	<i>Water</i> <i>Temp °C</i>	<i>DO</i> <i>mg L⁻¹</i>	<i>pH</i> <i>S.U.</i>	<i>Cond.</i> <i>µS cm⁻¹</i>	<i>Secchi Depth</i> <i>(ft.)</i>
0	25.7	7.7	8.0	174	8.0
3.0	25.6	7.3	7.9	174	--
9.0	25.5	7.1	7.6	176	--

Table 73. Eagle Lake post-LFA physical water quality parameter data collected from Site 1 on September 4, 2018.

Post-Aeration Data Table (September 4, 2018): Site 2

<i>Depth</i> <i>ft.</i>	<i>Water</i> <i>Temp °C</i>	<i>DO</i> <i>mg L⁻¹</i>	<i>pH</i> <i>S.U.</i>	<i>Cond.</i> <i>µS cm⁻¹</i>	<i>Secchi Depth</i> <i>(ft.)</i>
0	26.0	7.0	7.9	176	8.0
3.0	25.9	7.0	7.9	176	
9.0	25.6	7.0	8.0	176	

Table 74. Eagle Lake post-LFA physical water quality parameter data collected from Site 2 on September 4, 2018.

Post-Aeration Data Table (September 4, 2018): Site 3

<i>Depth</i> <i>ft.</i>	<i>Water</i> <i>Temp °C</i>	<i>DO</i> <i>mg L⁻¹</i>	<i>pH</i> <i>S.U.</i>	<i>Cond.</i> <i>µS cm⁻¹</i>	<i>Secchi Depth</i> <i>(ft.)</i>
0	26.2	7.2	8.1	177	9.0+
6.0	25.6	7.4	8.2	176	
9.0	25.7	7.6	8.7	176	

Table 75. Eagle Lake post-LFA physical water quality parameter data collected from Site 3 on September 4, 2018.

Post-Aeration Data Table (September 4, 2018): Site 4

<i>Depth</i> <i>ft.</i>	<i>Water</i> <i>Temp °C</i>	<i>DO</i> <i>mg L⁻¹</i>	<i>pH</i> <i>S.U.</i>	<i>Cond.</i> <i>µS cm⁻¹</i>	<i>Secchi Depth</i> <i>(ft.)</i>
0	25.7	7.7	8.2	178	11.0
7.0	25.3	7.5	8.1	178	
14.0	22.7	3.8	7.1	328	

Table 76. Eagle Lake post-LFA physical water quality parameter data collected from Site 4 on September 4, 2018.

Post-Aeration Data Table (September 4, 2018): Site 5

<i>Depth</i> <i>ft.</i>	<i>Water</i> <i>Temp °C</i>	<i>DO</i> <i>mg L⁻¹</i>	<i>pH</i> <i>S.U.</i>	<i>Cond.</i> <i>µS cm⁻¹</i>	<i>Secchi Depth</i> <i>(ft.)</i>
0	26.0	7.7	8.3	178	11.0
6.0	25.7	7.7	8.4	177	
12.0	24.9	5.9	7.7	225	

Table 77. Eagle Lake post-LFA physical water quality parameter data collected from Site 5 on September 4, 2018.

5.2 Eagle Lake Second-Year Chemical Water Quality Data Tables

Post-Aeration Data Tables (May 2, 2018): Site 1

<i>Depth (ft.)</i>	<i>Total Phosphorus (mg/L)</i>	<i>Ortho- Phosphorus (mg/L)</i>	<i>Total Suspended Solids (mg/L)</i>	<i>Chlorophyll-a (µg/L)</i>
0	<0.010	<0.010	<10	-0.356
3.0	<0.010	<0.010	<10	--
6.0	0.034	<0.010	230	--

Table 78. Eagle Lake post-LFA chemical water quality parameter data collected from Site 1 on May 2, 2018.

Post-Aeration Data Tables (May 2, 2018): Site 2

<i>Depth (ft.)</i>	<i>Total Phosphorus (mg/L)</i>	<i>Ortho- Phosphorus (mg/L)</i>	<i>Total Suspended Solids (mg/L)</i>	<i>Chlorophyll-a (µg/L)</i>
0	0.015	<0.010	<10	1.60
3	0.017	<0.010	<10	--
6	0.020	<0.010	<10	--

Table 79. Eagle Lake post-LFA chemical water quality parameter data collected from site 2 on May 2, 2018.

Post-Aeration Data Tables (May 2, 2018): Site 3

<i>Depth (ft.)</i>	<i>Total Phosphorus (mg/L)</i>	<i>Ortho- Phosphorus (mg/L)</i>	<i>Total Suspended Solids (mg/L)</i>	<i>Chlorophyll-a (µg/L)</i>
0	0.017	<0.010	<10	0.178
4	0.011	<0.010	<10	--
8	0.014	<0.010	<10	--

Table 80. Eagle Lake post-LFA chemical water quality parameter data collected from site 3 on May 2, 2018.

Post-Aeration Data Tables (May 2, 2018): Site 4

<i>Depth (ft.)</i>	<i>Total Phosphorus (mg/L)</i>	<i>Ortho- Phosphorus (mg/L)</i>	<i>Total Suspended Solids (mg/L)</i>	<i>Chlorophyll-a (µg/L)</i>
0	0.011	<0.010	<10	-0.178
6	0.012	<0.010	<10	--
12	0.015	<0.010	<10	--

Table 81. Eagle Lake post-LFA chemical water quality parameter data collected from site 4 on May 2, 2018.

Post-Aeration Data Tables (May 2, 2018): Site 5

<i>Depth (ft.)</i>	<i>Total Phosphorus (mg/L)</i>	<i>Ortho- Phosphorus (mg/L)</i>	<i>Total Suspended Solids (mg/L)</i>	<i>Chlorophyll-a (µg/L)</i>
0	0.013	<0.010	<10	0.712
5	0.015	<0.010	<10	--
10	0.012	<0.010	<10	--

Table 82. Eagle Lake post-LFA chemical water quality parameter data collected from site 5 on May 2, 2018.

Post-Aeration Data Tables (July 7, 2018): Site 1

<i>Depth (ft.)</i>	<i>Total Phosphorus (mg/L)</i>	<i>Ortho- Phosphorus (mg/L)</i>	<i>Total Suspended Solids (mg/L)</i>	<i>Chlorophyll-a (µg/L)</i>
0	0.018	<0.010	<10	0.178
4.0	0.015	<0.010	<10	--
8.0	0.018	<0.010	<10	--

Table 83. Eagle Lake post-LFA chemical water quality parameter data collected from Site 1 on July 7, 2018.

Post-Aeration Data Tables (July 7, 2018): Site 2

<i>Depth (ft.)</i>	<i>Total Phosphorus (mg/L)</i>	<i>Ortho- Phosphorus (mg/L)</i>	<i>Total Suspended Solids (mg/L)</i>	<i>Chlorophyll-a (µg/L)</i>
0	0.016	<0.010	<10	0.356
4	0.020	<0.010	<10	--
8	0.021	<0.010	<10	--

Table 84. Eagle Lake post-LFA chemical water quality parameter data collected from site 2 on July 7, 2018.

Post-Aeration Data Tables (July 7, 2018): Site 3

<i>Depth (ft.)</i>	<i>Total Phosphorus (mg/L)</i>	<i>Ortho- Phosphorus (mg/L)</i>	<i>Total Suspended Solids (mg/L)</i>	<i>Chlorophyll-a (µg/L)</i>
0	0.020	<0.010	<10	0
5	0.021	<0.010	<10	--
10	0.024	<0.010	<10	--

Table 85. Eagle Lake post-LFA chemical water quality parameter data collected from site 3 on July 7, 2018.

Post-Aeration Data Tables (July 7, 2018): Site 4

<i>Depth (ft.)</i>	<i>Total Phosphorus (mg/L)</i>	<i>Ortho- Phosphorus (mg/L)</i>	<i>Total Suspended Solids (mg/L)</i>	<i>Chlorophyll-a (µg/L)</i>
0	0.017	<0.010	<10	0.356
5	0.018	<0.010	<10	--
14	0.017	<0.010	<10	--

Table 86. Eagle Lake post-LFA chemical water quality parameter data collected from site 4 on July 7, 2018.

Post-Aeration Data Tables (July 7, 2018): Site 5

<i>Depth (ft.)</i>	<i>Total Phosphorus (mg/L)</i>	<i>Ortho- Phosphorus (mg/L)</i>	<i>Total Suspended Solids (mg/L)</i>	<i>Chlorophyll-a (µg/L)</i>
0	0.020	<0.010	<10	0
5	0.019	<0.010	<10	--
12	0.019	<0.010	<10	--

Table 87. Eagle Lake post-LFA chemical water quality parameter data collected from site 5 on July 7, 2018.

Post-Aeration Data Tables (September 4, 2018): Site 1

<i>Depth (ft.)</i>	<i>Total Phosphorus (mg/L)</i>	<i>Ortho- Phosphorus (mg/L)</i>	<i>Total Suspended Solids (mg/L)</i>	<i>Chlorophyll-a (µg/L)</i>
0	0.016	<0.010	<10	-0.712
6	0.016	<0.010	<10	--
9	0.016	<0.010	<10	--

Table 88. Eagle Lake post-LFA chemical water quality parameter data collected from Site 1 on September 4, 2018.

Post-Aeration Data Tables (September 4, 2018): Site 2

<i>Depth (ft.)</i>	<i>Total Phosphorus (mg/L)</i>	<i>Ortho- Phosphorus (mg/L)</i>	<i>Total Suspended Solids (mg/L)</i>	<i>Chlorophyll-a (µg/L)</i>
0	0.012	<0.010	<10	-0.356
4	0.019	<0.010	<10	--
8	<0.010	<0.010	<10	--

Table 89. Eagle Lake post-LFA chemical water quality parameter data collected from site 2 on September 4, 2018.

Post-Aeration Data Tables (September 4, 2018): Site 3

<i>Depth (ft.)</i>	<i>Total Phosphorus (mg/L)</i>	<i>Ortho- Phosphorus (mg/L)</i>	<i>Total Suspended Solids (mg/L)</i>	<i>Chlorophyll-a (µg/L)</i>
0	0.014	<0.010	<10	-0.890
5	0.018	<0.010	<10	--
10	<0.010	<0.010	<10	--

Table 90. Eagle Lake post-LFA chemical water quality parameter data collected from site 3 on September 4, 2018.

Post-Aeration Data Tables (September 4, 2018): Site 4

<i>Depth (ft.)</i>	<i>Total Phosphorus (mg/L)</i>	<i>Ortho- Phosphorus (mg/L)</i>	<i>Total Suspended Solids (mg/L)</i>	<i>Chlorophyll-a (µg/L)</i>
0	0.016	<0.010	<10	-2.14
5	0.016	<0.010	<10	--
14	0.022	<0.010	<10	--

Table 91. Eagle Lake post-LFA chemical water quality parameter data collected from site 4 on July 7, 2018.

Post-Aeration Data Tables (September 4, 2018): Site 5

<i>Depth (ft.)</i>	<i>Total Phosphorus (mg/L)</i>	<i>Ortho- Phosphorus (mg/L)</i>	<i>Total Suspended Solids (mg/L)</i>	<i>Chlorophyll-a (µg/L)</i>
0	0.022	<0.010	<10	-0.890
5	0.036	<0.010	<10	--
12	0.020	<0.010	<10	--

Table 92. Eagle Lake post-LFA chemical water quality parameter data collected from site 5 on September 4, 2018.

5.3 Eagle Lake Additional Second-Year Sediment Data Tables and Bottom Scan

Sediment probe measurements were not conducted in 2018 due to the extreme flooding that may have deposited sediment loads into the lake. Bioaugmentation was applied to reduce any incoming organic loads and sediment probe measurements will be conducted in 2019 and compared to previous measurements. A whole-lake sediment bottom hardness scan was conducted in 2018 and these values and the corresponding map are shown below.

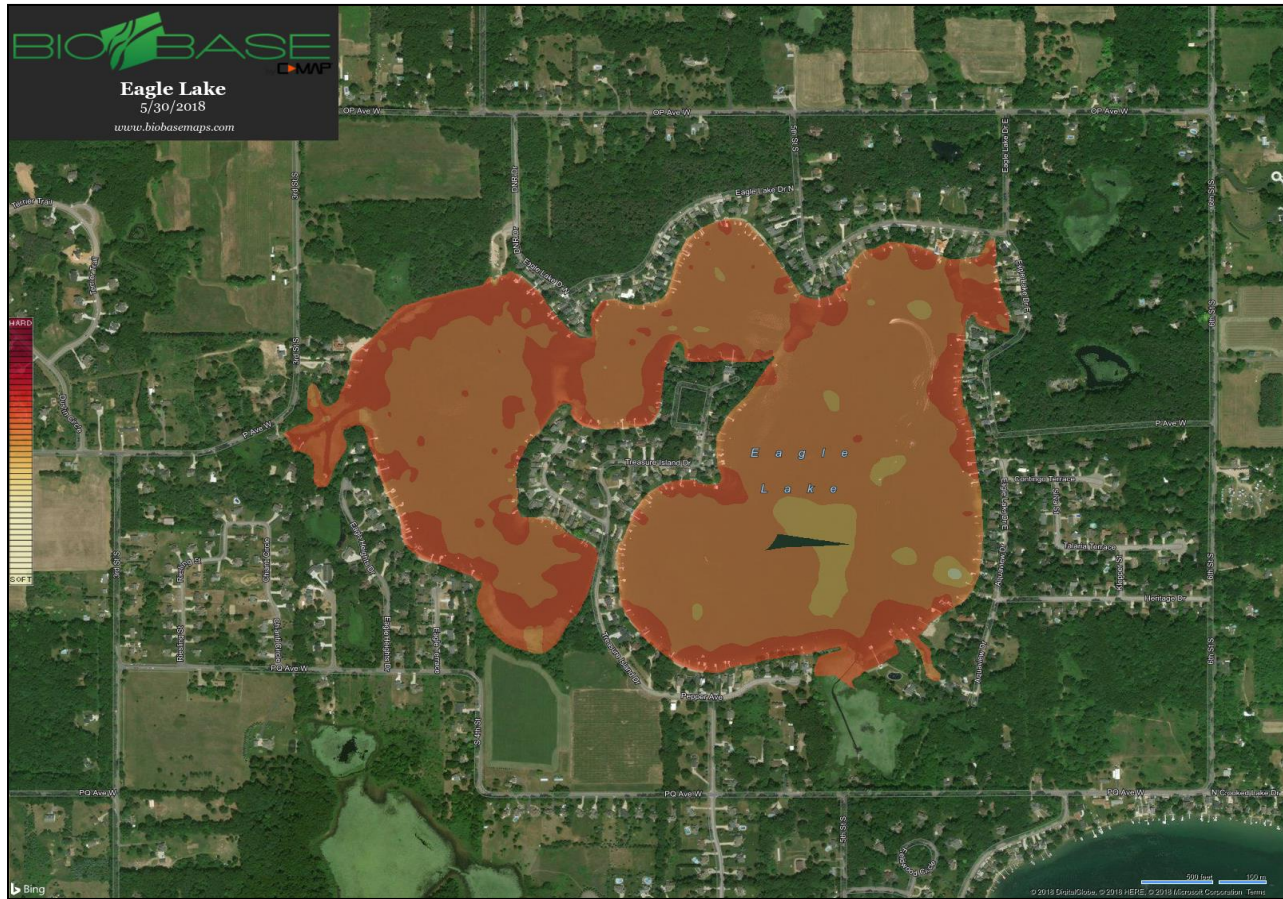


Figure 17. Eagle Lake sediment bottom hardness scan (May 30, 2018).

Table 93. Eagle Lake sediment bottom hardness comparisons (2017-2018).

Hardness Category	May 2017 %	Oct 2017 %	May 2018 %
<0.1	0.08	0.04	0.09
0.1-0.2	2.5	0.61	0.09
0.2-0.3	59.67	62.88	14.28
0.3-0.4	31.98	30.93	57.13
>0.4	5.78	5.54	28.41

5.4 Eagle Lake Second Year Phytoplankton Community

Algal community composition samples were collected during the three 2018 sampling dates. The graph showing the relative abundance of each algal group is shown below in Figure 18. Genera are listed here in the order of most abundant to least abundant. The genera present included the Chlorophyta (green algae): *Scenedesmus* sp., *Chlorella* sp., *Cladophora* sp., *Rhizoclonium* sp., *Mougeotia* sp., *Ulothrix* sp., *Haematococcus* sp., *Pediastrum* sp., and *Spirogyra* sp., the Cyanophyta (blue-green algae): *Oscillatoria* sp.; the Bascillariophyta (diatoms): *Navicula* sp., *Synedra* sp., *Fragilaria* sp., and *Rhoicosphenia* sp.

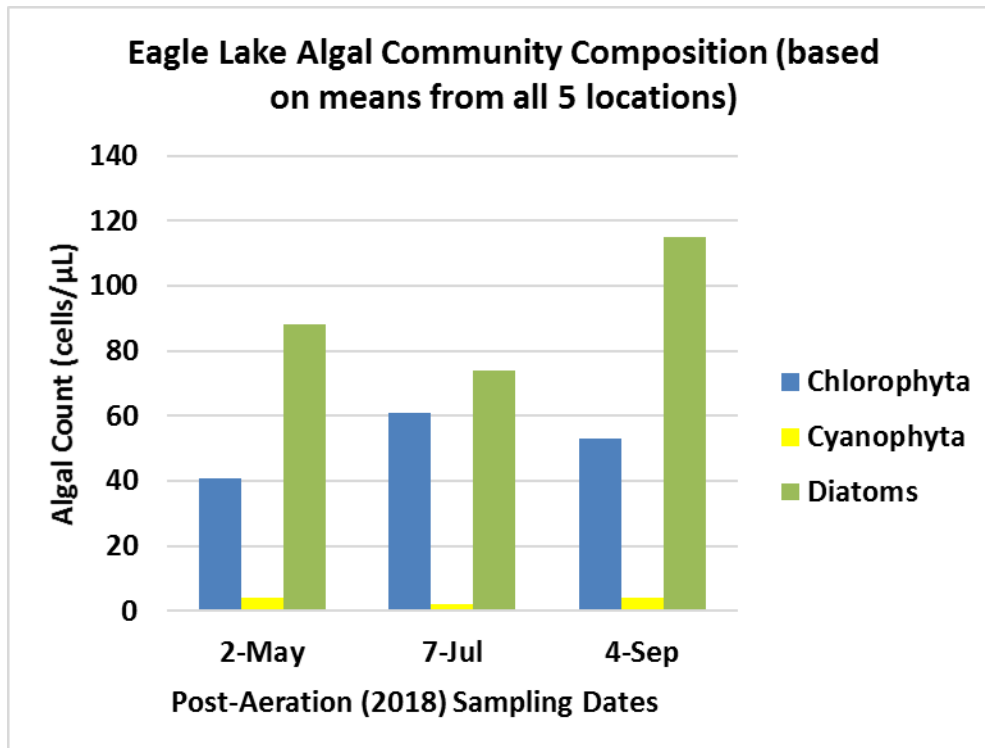


Figure 18. Algal community composition in Eagle Lake in 2018.

5.5 Eagle Lake 2018 Aquatic Vegetation Surveys and Biovolume Scan

A whole lake aquatic vegetation biovolume scan was conducted on Eagle Lake on May 30, 2018. In addition, there were survey maps prepared for weed treatments from surveys on May 30, 2018, July 7, 2018, and August 2, 2018. The data comparisons of biovolume and corresponding map are shown below.

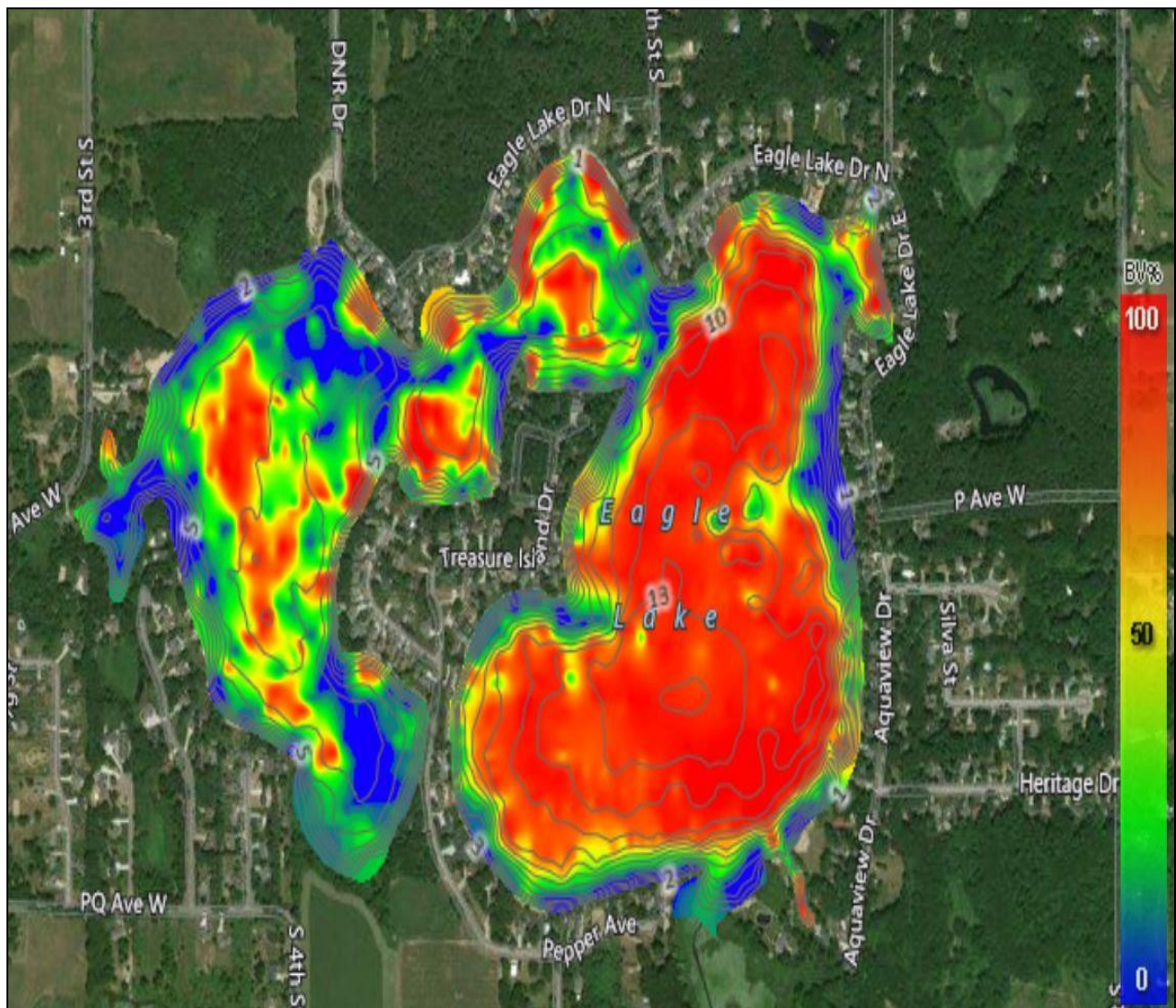


Figure 19. 2018 Eagle Lake aquatic vegetation biovolume map (May 30, 2018).

Table 94. Eagle Lake aquatic vegetation biovolume comparisons (2017-2018).

Biovolume Category	2014	2015	2016	2017	2018
0-5%	11.05	33.01	13.77	16.03	38.57
5-20%	12.65	20.97	7.16	8.02	4.04
20-40%	11.04	9.02	5.75	10.92	2.46
40-60%	9.34	6.39	6.32	9.96	2.92
60-80%	11.85	4.44	8.09	8.49	8.53
>80%	41.12	26.21	58.91	46.54	43.48

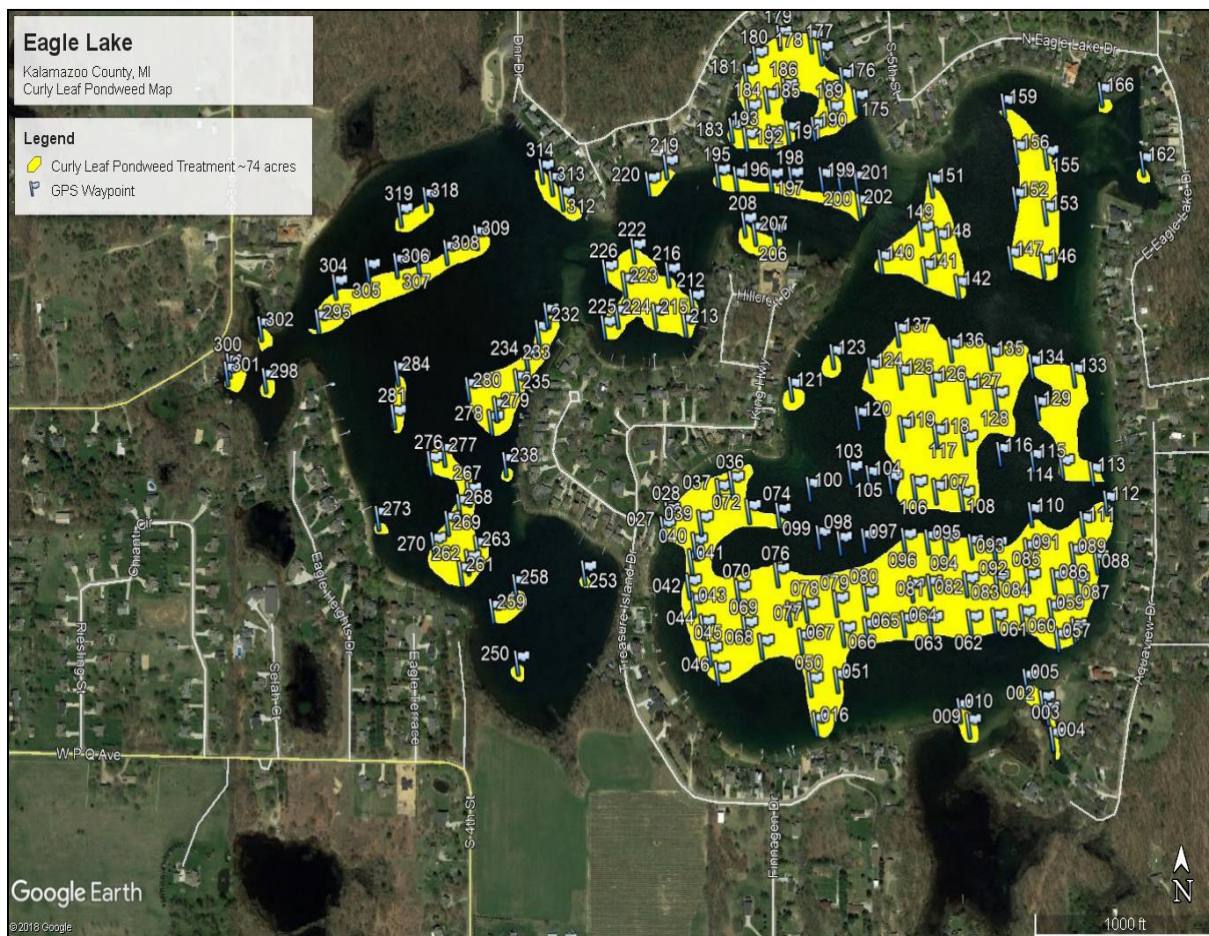


Figure 20. Distribution of CLP and nuisance pondweeds in Eagle Lake (May 30, 2018).

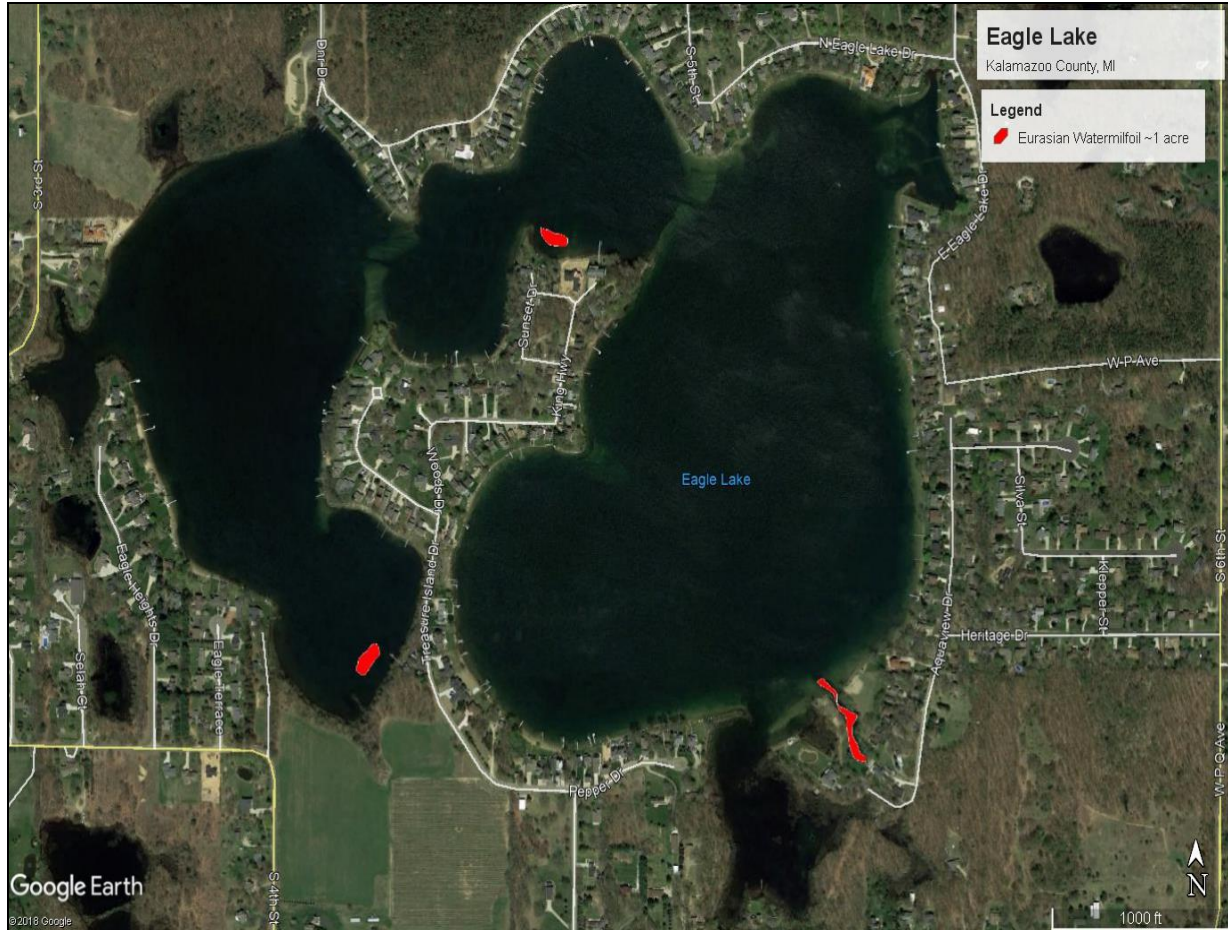


Figure 21. Distribution of EWM in Eagle Lake (May 30, 2018).

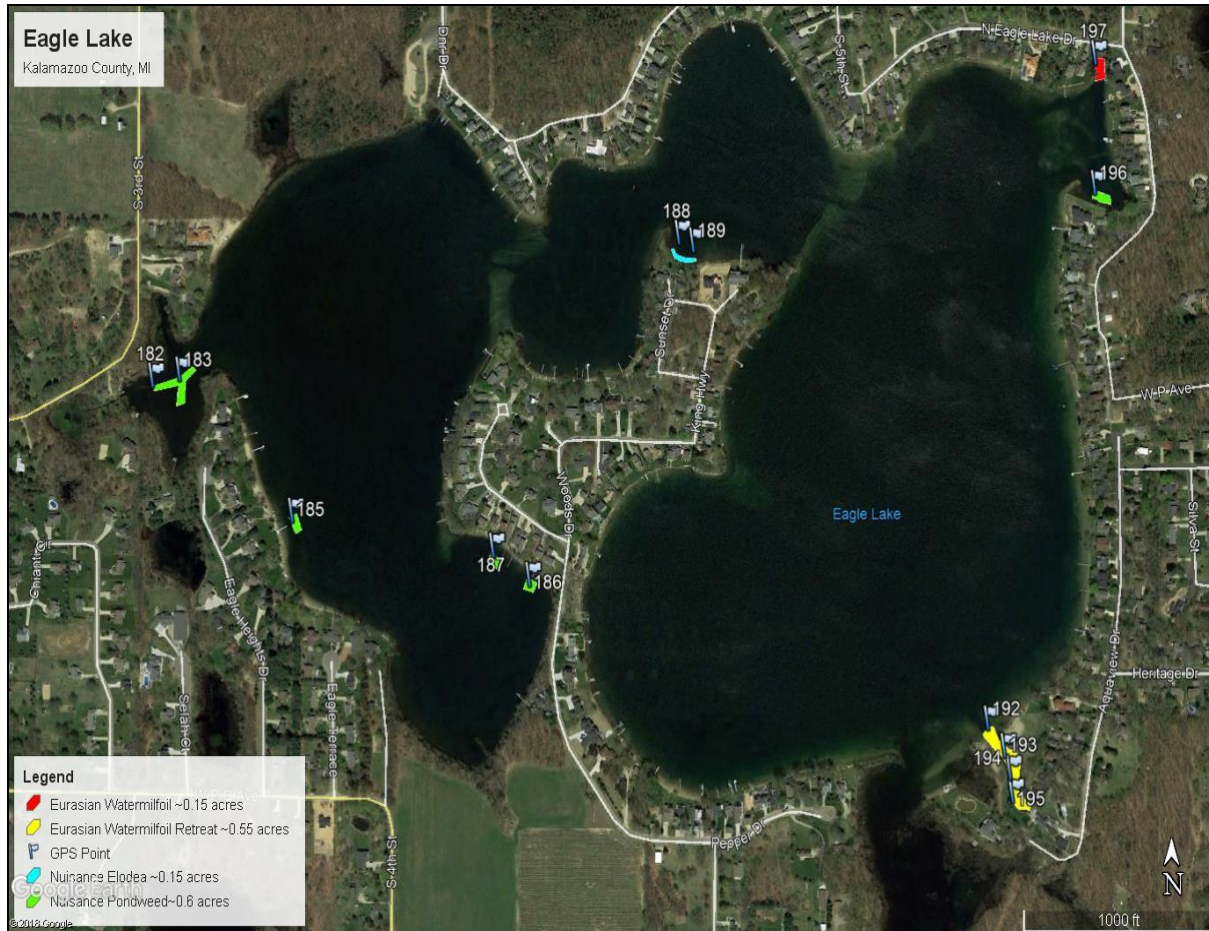


Figure 22. Late season EWM and nuisance plant growth in Eagle Lake (August 2, 2018).

6.0 EAGLE LAKE 2016 & 2017-2018 COMPARISON RESULTS

6.1 Eagle Lake Water Quality Data Comparisons

Descriptive statistics of the 2016 and 2017-2018 data were created for each water quality parameter and are shown in Tables 95 and 96 below. Based on these numbers the following could be stated:

1. Mean water temperature was slightly higher in 2017-2018 (post-aeration) but this could be due to seasonal effects and the standard deviation is high enough to show that the water temperatures are still similar.
2. The mean pH of the lake water was higher in 2017-2018 post-aeration than pre-aeration.
3. The mean dissolved oxygen (DO) was higher post-aeration than pre-aeration.
4. The mean conductivity was higher post-aeration but the standard deviation was high enough that the numbers are similar.
5. The mean Secchi transparency was lower post-aeration than pre-aeration (but all values are still reading beyond the depth measured and the disk can be seen beyond bottom depths and this could have been attributed to increases solids from rising water levels/flooding).
6. The mean chlorophyll-a concentration was lower post-aeration than pre-aeration
7. The mean total phosphorus (TP) was only marginally higher post-aeration and this could also have been attributed to increased runoff from the local flooding.
8. The mean ortho-phosphorus was slightly lower post-aeration.
9. The mean total suspended solids (TSS) was slightly higher post-aeration but still within favorable limits and may have also been attributed to increased solids from flooding runoff.

Parameter	Baseline (2016-2017) Means ± SD	Post-Aeration (2017) Means ± SD	Post-Aeration (2018) Means ± SD
Water Temp (°C)	20.6±3.9	23.0±4.0	23.0±4.8
pH (S.U.)	8.2±0.2	8.7±0.4	8.5±0.4
Dissolved Oxygen (mg/l)	8.5±1.3	9.2±1.1	8.9±1.7
Conductivity (mS/cm)	153±23	167±24	173±26
Secchi Transparency (ft.)	8.6±2.2	7.7±1.9	8.5±2.0
Chlorophyll-a (µg/l)	0.5±0.9	0.1±0.2	0.1±0.3
Total Phosphorus (mg/l)	0.014±0.01	0.014±0.0	0.015±0.0
Ortho-Phosphorus (mg/l)	0.011±0.0	0.010±0.0	0.010±0.0
Total Suspended Solids (mg/l)	14±28	16±37	18±43

Table 95. Descriptive statistics of all water quality parameters before and after aeration (2016-2018) in Eagle Lake

6.2 Eagle Lake Bottom Scan Data Comparisons

The bottom hardness scan was conducted in 2018 as in 2016-2017 and the results are shown in Table 96 below. The sediments with the hardest readings are in the .3-.4 and >.4 categories. These are relative hardness categories based on the sediment algorithm data calculations from the software. A slight loss in the two softest bottom categories resulted from 2016 to 2017; however, the hardest bottom categories declined from 2016 to 2017 but then increased significantly in 2018 which is favorable and may indicate that the bioaugmentation treatments were effective at reducing muck.

Hardness Category	2016 Hardness	2017 Hardness	2018 Hardness
<.1	0.03	0.00	0.09
.1-.2	0.52	0.21	0.09
.2-.3	18.15	70.35	14.28
.3-.4	62.93	28.18	57.13
>.4	18.36	1.26	28.41

Table 96. Sediment bottom hardness data for Eagle Lake pre (2016) and post-aeration (2017-2018).

6.3 Eagle Lake Aquatic Vegetation Data Comparisons

The whole-lake scanning also resulted in the maps shown above that show the early and late season aquatic vegetation biovolume which is the relative heights of all aquatic plants above the lake bottom. Table 97 below shows the data which results from the software algorithm. It is encouraging that the lowest biovolume category (<20%) had a substantial increase which means the aquatic plants that are low-growing are being favored. Since other management methods are being used on the lake (i.e. aquatic herbicide treatments of high-growing plants such as EWM, lily pads, and pondweeds), it is difficult to tell if the aeration is partly responsible. Additionally, in 2018 with the higher water levels, less light was reaching the plants and thus growth could have been reduced as a result of light limitation as well. RLS can monitor these changes with time and compare pre and post-treatment numbers for scans collected before aeration began and in future years to determine if in fact the aeration system is facilitating further reduction of the nuisance aquatic plants which was the primary objective from the beginning of the aeration program.

In 2018, aquatic herbicide treatments were conducted on: 1) June 14 which consisted of 76 acres of nuisance CLP and EWM and dense Elodea using Aquathol K[®] and Renovate OTF[®] and Clipper[®] at 400 ppb, respectively; on 2) June 21 which consisted of 2 acres of nuisance algae treatment in the canal area using chelated copper algacide; and on 3) for nuisance CLP using diquat and Aquathol-K[®] for approximately 2.41 acres. All treatments were conducted by PLM.

Biovolume Category	2016 Biovolume	2017 Biovolume	2018 Biovolume
0-5	13.8	16.0	38.6
5-20	7.2	8.0	4.0
20-40	5.8	10.9	2.5
40-60	6.3	10.0	2.9
60-80	8.1	8.5	8.5
>80	58.9	46.5	43.5

Table 97. Aquatic vegetation biovolume data for Eagle Lake pre (2016) and post aeration (2017-2018).

7.0 EAGLE LAKE 2016 & 2017 COMPARISON CONCLUSIONS AND PROFESSIONAL RECOMMENDATIONS

The LFA system is having some positive effects on water quality especially in relation to sediment bottom hardness (increases), aquatic vegetation biovolume (decreases), and dissolved oxygen (increases). This is especially notable in 2018 given the increased flooding and associated runoff. This indicates that the LFA system, along with bioaugmentation, is reducing nutrients and weeds within the lake.

RLS recommends continuation of the LFA system given these benefits and will continue to monitor the system as a part of the existing lake management plan prepared by RLS as well as per the MDEQ permit for the LFA system. At this time given the results on the sediment and the widely differing results in 2017 compared to 2016 relative to sediment probe data, RLS does not recommend the sediment probe test be continued. There is too much inherent variability in sediment depths even within a square meter of lake bottom. The bottom hardness scans should be analyzed each year along with changes in the depth contours to look at the increases in overall water depths and muck loss; however, this can only be conducted with consistent water levels. Methods for measuring muck loss are limited based on cost and accuracy. The microbe addition doses applied in 2018 should also be continued in 2019.

APPENDIX A

2016 FIELD DATA (WATER QUALITY, AQUATIC VEGETATION SURVEYS SEDIMENT MEASUREMENTS)

APPENDIX B1-B3
(2016 LABORATORY DATA REPORTS)

**APPENDIX C
(2017 FIELD DATA AND LAB REPORTS)**

APPENDIX D
(2018 FIELD DATA AND LAB REPORTS)