

HIGGINS LAKE WATER ANALYSIS

Report #5 Sixth year



SEPTEMBER 23, 2023

RAVEN ANALYTICAL
104 First Street

Higgins Lake Report

The Higgins Lake Property Owners Association (HLPOA) approached Raven Analytical Laboratory in Roscommon, Michigan in 2018 to provide water testing on Higgins Lake. This was to be a multi year evaluation of the chemistry of the Lake and any changes over time.

This testing began as a project in concert with the Roscommon high school chemistry students (teacher). Raven personnel trained students with all the procedures and testing protocols necessary to complete this study. The actual testing took place in our EPA certified laboratory under the direct supervision of our staff. In this way we help reinforce the chemistry the students are learning and make the community aware of the concern for the total ecology of Higgins Lake.

Because of the Covid pandemic restrictions, water testing on Higgins Lake was performed by Raven Analytical personnel for 2022. As the previous effort on this project was in concert with the Roscommon High School, a meeting was held with the school Superintendent. She whole heartily supported this project and working with the students and chemistry teacher to continue this “very valuable real life education”.

A first introduction meeting was held with the chemistry students at the high school. They were very excited and were looking forward to begin training and start testing the lake. This group of students performed their first round of training and testing on May 25th. A picture and list of students and grades is provided in Appendix A.

This report covers the testing of water and the results on Higgins Lake on May 25, June 23, July 21, August 23, and September 2023.

Based on the data provided for testing from USGS suggestions and the concern(s) about the water quality on Higgins Lake, the following testing protocols are suggested.

Water Tests:

1. Phosphorus
 - a. Total phosphorus is reported in milligrams/liter (mg/L)
2. Nitrate
 - a. Nitrate is reported in milligrams/liter (mg/L)
3. Nitrite
 - a. Nitrite is reported in milligrams/liter (mg/L)
4. pH
 - a. pH is measured on a 1 to 14 scale with pure water being a pH of 7.0
5. Dissolved Oxygen
 - a. Dissolved oxygen is reported in milligrams/liter (mg/L)
6. Total dissolved solids (TDS)
 - a. measured in parts per million
7. Conductivity
 - a. Conductivity is reported in microsiemens per centimeter (uS/cm)
8. Water Temperature
 - a. Measured in degrees Centigrade
9. Air Temperature
 - a. Measured in degrees Centigrade
10. Beach Plate Count; MPN
 - a. Most probable number (MPN) is measured in colonies per 100 milliliters of cultured water
11. Beach Plate count: E-coli
 - a. E-coli is measured in colonies per 100 milliliters of cultured water

All water analysis was performed at Raven Analytical Laboratory in Roscommon using EPA approved test methods. This lab is an EPA certified water analysis laboratory (#9954) and has two certified water sanitarians on staff at Roscommon.

The listing of testing areas, such as high human concentration, lagoons, both state parks and boat launches along with the marinas and suggestions from the Team resulted in the following test sites:

1. Water quality tests were performed at:

	Site #		
Gerrish Township Marina	1	44.428433	-84.701303
South State Park	2	44.425523	-84.684881
Cut river	3	44.433023	-84.669963
Sam-O-Set	4	44.465303	-84.739635
DNR boat launch	5	44.477728	-84.778012
Gold Coast	6	44.466471	-84.767884
North State Park	7	44.511663	-84.758545
B&B Marina	8	44.511237	-84.742792
Camp Cornelia	9	44.496694	-84.699217
Treasure Island – 1	10	44.477461	-84.727788
Treasure Island – 2	11	44.482555	-84.722664
Kennedy Beach	12	44.457288	-84.670740
Flag Point	13	44.471165	-84.696090

Data collected:

Although there are no maximum limits on Phosphorus and nitrogen for pond and lake waters, as a reference, the EPA regulations for drinking water standards for these are 1 mg/L for Phosphorus and 10 ppm for nitrogen.

Swimming beaches should be tested for water quality before the swimming season begins to get a baseline of contamination resulting from natural wildlife or run-off and tested thereafter until the season ends. Beaches may be regulated by local ordinances or local health standards. The standards developed for the Great Lakes in Michigan and may be used for inland beaches are:

- If the E. coli count is greater than 1000 MPN/100 mL, the beach is closed.
- If the E. coli count is greater than 235 MPN/100 mL but less than 1000 MPN/100 mL, an advisory is issued.
- If the E. coli count is under 235 MPN/100 mL, the beach has no advisories or warnings issued.

The data collected from the thirteen sites in the fifth round of testing on September 21, 2023 is shown in the Tables below. Additional data analysis tables and graph

include a monthly average of all 13 sites and a graph of the significant increase in Coliforms in the lake for July, August and September.

Table

May 24,2023

Site	1	2	3	4	5	6	7
Phosphorus	0.79	0.25	0.12	0.17	0.36	0.51	0.37
Nitrogen (Nitrate)	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Nitrogen (Nitrite)	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Beach Plate Count; MPN	378	361	344	328	238	298	228
Beach Plate Count; e-coli	17	24	35	26	22	23	41
pH	7.37	7.16	7.04	7.24	7.37	7	6.7
Dissolved Oxygen	6	5	5	7	5	5	4
Total Dissolved Solids	149	144	142	141	140	146	142
Water Temperature; C	16.7	16.7	16.7	16.7	16.7	16.7	16.7
Air Temperature; C	11.1	11.1	11.1	11.1	11.1	11.1	11.1
Conductivity; uS	296	287	283	278	274	277	280

Site	8	9	10	11	12	13
Phosphorus	0.66	0.61	0.34	0.42	0.63	0.18
Nitrogen (Nitrate)	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Nitrogen (Nitrite)	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Beach Plate Count; MPN	201	298	238	260	328	238
Beach Plate Count; e-coli	14	30	45	38	49	34
pH	6.81	6.85	6.8	6.65	7.75	6.95
Dissolved Oxygen	5	6.6	4	6.6	3.25	6
Total Dissolved Solids	142	138	140	140	176	144
Water Temperature; C	16.7	16.7	16.7	16.7	16.7	16.7
Air Temperature; C	11.1	11.1	11.1	11.1	11.1	11.1
Conductivity; uS	281	277	282	284	360	275

June 22,2023

<u>Site</u>	1	2	3	4	5	6	7
Phosphorus	0.11	1.52	0.05	0.02	0.01	0.01	0.01
Nitrogen (Nitrate)	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Nitrogen (Nitrite)	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Beach Plate Count; MPN	39	25.8	54.1	42.3	33.8	48.3	46
Beach Plate Count; e-coli	0	0	0	0	1	1	1
pH	7.42	7.36	7.29	7.24	7.12	7.12	6.89
Dissolved Oxygen	6.3	7.1	7.2	7.3	7.9	6.6	7.5
Total Dissolved Solids	161	143	142	142	142	142	145
Water Temperature; C	19.4	23	24.4	24.3	23.8	23.9	23.2
Air Temperature; C	15.5	15.5	15.5	15.5	15.5	15.5	15.5
Conductivity; uS	321	285	285	284	284	284	285

<u>Site</u>	8	9	10	11	12	13
Phosphorus	0.01	0.02	0.01	0.07	0.18	0.02
Nitrogen (Nitrate)	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Nitrogen (Nitrite)	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Beach Plate Count; MPN	50	41.6	40.1	47.2	44.4	56.5
Beach Plate Count; e-coli	0	0	2	0	0	0
pH	6.67	6.87	7.16	7.16	7.18	7.19
Dissolved Oxygen	6.6	7.4	6.9	7.3	7.6	7.3
Total Dissolved Solids	143	142	142	142	142	142
Water Temperature; C	22.8	22.8	23.6	23.3	23.1	23.9
Air Temperature; C	15.5	15.5	17.7	17.7	17.7	17.7
Conductivity; uS	284	284	281	283	283	275

July 20,2023

<u>Site</u>	1	2	3	4	5	6	7
Phosphorus	0.87	0.81	1.48	0.93	1.29	0.27	0
Nitrogen (Nitrate)	N.D.	N.D.	N.D.	0.1	0.7	0.08	N.D.
Nitrogen (Nitrite)	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Beach Plate Count; MPN	1011	1011	1011	960	1011	1011	1011
Beach Plate Count; e-coli	1	1	0	0	1	3	0
pH	7.75	7.12	8.04	7.96	7.5	7.53	7.65
Dissolved Oxygen	6.6	6.5	6.9	6.8	6.5	5.7	6.3
Total Dissolved Solids	184	144	140	154	229	218	143
Water Temperature; C	19.6	20.4	20.5	20.3	20.4	20.1	20.7
Air Temperature; C	11.7	11.7	11.7	11.7	13	13	13
Conductivity; uS	351	319	277	307	446	435	290

<u>Site</u>	8	9	10	11	12	13
Phosphorus	0.03	0.02	0	0	0	0.01
Nitrogen (Nitrate)	N.D.	1.15	N.D.	N.D.	N.D.	N.D.
Nitrogen (Nitrite)	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Beach Plate Count; MPN	1011	914	1011	1011	961	1011
Beach Plate Count; e-coli	3	2	1	4	1	0
pH	7.71	7.63	7.52	7.53	7.49	7.56
Dissolved Oxygen	6.9	6.9	6.1	6.2	6.4	5
Total Dissolved Solids	143	141	144	140	140	141
Water Temperature; C	20.5	20.8	20.4	20.4	20.6	19.3
Air Temperature; C	13	13	16	16	16	16
Conductivity; uS	286	283	286	276	272	281

August 21,2023

<u>Site</u>	1	2	3	4	5	6	7
Phosphorus	0.02	0.05	0.22	0.07	0.43	0.3	0.47
Nitrogen (Nitrate)	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Nitrogen (Nitrite)	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Beach Plate Count; MPN	961	961	1011	524	960	721	961
Beach Plate Count; e-coli	0	2	0	1	0	1	0
pH	8.08	7.76	7.77	7.68	7.61	6.98	7.59
Dissolved Oxygen	5.8	5.9	5.8	6.1	5.4	5	5.3
Total Dissolved Solids	155	145	142	141	194	141	141
Water Temperature; C	21.5	21.4	21.4	21.4	21.4	21.4	21.4
Air Temperature; C	23	23	23	23	23	23	23
Conductivity; uS	283	281	278	275	293	285	280

<u>Site</u>	8	9	10	11	12	13
Phosphorus	0.22	0.27	0.21	0.27	0.3	0.4
Nitrogen (Nitrate)	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Nitrogen (Nitrite)	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Beach Plate Count; MPN	830	1011	721	1011	914	756
Beach Plate Count; e-coli	1	0	1	1	0	1
pH	7.67	7.65	7.66	7.67	7.68	7.66
Dissolved Oxygen	5.5	5.6	4.9	4.7	4.8	4,8
Total Dissolved Solids	140	141	140	141	140	141
Water Temperature; C	21.4	21.4	21.4	21.4	21.4	21.4
Air Temperature; C	23	23	23	23	23	23
Conductivity; uS	279	282	280	287	280	281

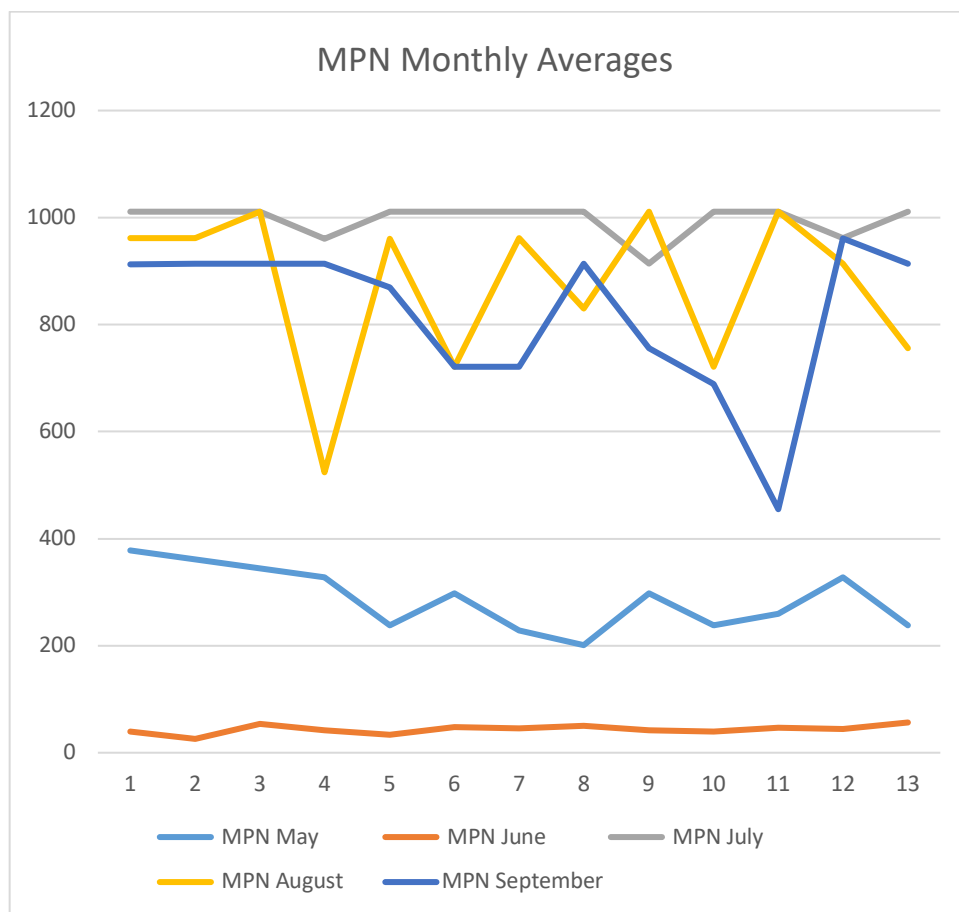
September 21,2023

<u>Site</u>	1	2	3	4	5	6	7
Phosphorus	0.21	0.05	0.12	0.64	0.08	0	0
Nitrogen (Nitrate)	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Nitrogen (Nitrite)	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Beach Plate Count; MPN	913	914	914	914	870	721	721
Beach Plate Count; e-coli	6.3	5.2	2	3	4.1	5.2	2
pH	7.58	8.17	7.46	5.44	7.56	7.61	7.62
Dissolved Oxygen	6.2	6.4	5.8	5.2	6.4	5.5	6.9
Total Dissolved Solids	137	148	141	520	138	89	169
Water Temperature; C	19.3	19.8	20.5	18.6	18.5	20.3	20.2
Air Temperature; C	18.9	18.9	18.9	18.9	18.9	18.9	18.9
Conductivity; uS	275	284	280	453	270	178	176

<u>Site</u>	8	9	10	11	12	13
Phosphorus	0.12	0	0	0.03	0	0.04
Nitrogen (Nitrate)	12.7	N.D.	N.D.	N.D.	N.D.	N.D.
Nitrogen (Nitrite)	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Beach Plate Count; MPN	914	756	689	455	961	914
Beach Plate Count; e-coli	0	6.3	4.1	1	3.1	4.1
pH	8.16	8.05	7.38	7.67	7.68	7.54
Dissolved Oxygen	6	5.7	6	5.4	6.2	6.7
Total Dissolved Solids	194	148	195	89	195	89
Water Temperature; C	19.5	19.5	19.5	19.7	20.3	20.3
Air Temperature; C	18.9	18.9	18.9	18.9	18.9	18.9
Conductivity; uS	375	302	186	183	177	187

Sample Site	1	2	3	4	5	6	7
MPN May	378	361	344	328	238	298	228
MPN June	39	25.8	54.1	42.3	33.8	48.3	46
MPN July	1011	1011	1011	960	1011	1011	1011
MPN August	961	961	1011	524	960	721	961
MPN September	913	914	914	914	870	721	721

Sample Site	8	9	10	11	12	13
MPN May	201	298	238	260	328	238
MPN June	50	41.6	40.1	47.2	44.4	56.5
MPN July	1011	914	1011	1011	961	1011
MPN August	830	1011	721	1011	914	756
MPN September	914	756	689	455	961	914



<u>2023 Averages</u>	May	June	July	August	September
Phosphorus	0.41	0.01	0.43	0.24	0.1
Nitrogen (Nitrate)	N.D.	0	0.01	N.D.	0
Nitrogen (Nitrite)	N.D.	0	0	N.D.	0
Beach Plate Count; MPN	287	43.7	1010	872	820
Beach Plate Count; e-coli	31	0	1.3	0.5	3.6
pH	7.05	7.07	7.61	7.65	6.9
Dissolved Oxygen	5.26	7.08	6.4	5	6
Total Dissolved Solids	145	143.8	159	146	173
Water Temperature; C	16.7	23.1	20.3	21.4	19.7
Air Temperature; C	11.1	16.1	13.5	23	18.9
Conductivity; uS	287	286	316	281	256

A couple of comment points concerning this project that are important for everyone involved.

The key to this project is the students. The students were very quick and eager to learn. They would take over responsibility for the testing, helping each other to complete all the tasks. This demonstrates the team building and win/win attitude to critical thinking problem solving.

One of the main goals of this project was not so much “teaching” them chemistry but demonstrating how to incorporate their education into a life experience.

One student, Corbin, commented that he wished they had more “chemistry” classes as he would be taking all of them.

It is a privilege to work with these students and I trust this life experience will continue to motivate and encourage them further in whatever and where ever they go in life.

Another significant key to this project is that none of this could be accomplished without the support of our sponsors. Additionally, this project was not possible without the support of the Roscommon High School superintendent, Ms. Cathy Erickson, and the dedicated educators at the High School. A few of our sponsors are cited below under Acknowledgments.

Like their motto says,

“Life is all about testing the waters”.

Acknowledgments:

This project would not be possible and a success without being generously supported by:

The Higgins Lake Foundation

The Higgins Lake Property Owners Association

Roscommon Rotary Club

John Ogren, Roscommon High School Graduate and HLPOA member,

Fred Swinehart, HLPOA Environmental Chair and

Kevin Kessler, HLPOA member.

Anthony Blizzard, Raven Analytical

Submitted by:

John Blizzard

CEO

QuadSil/Raven Analytical

Appendix A



2023		Grade
Jason	Beckwith	10
Rielly	Chever	10
Matt	Coffey	10
Bo	Collins	10
Gabby	Gray	11
Logan	Hasting	11
Andre	Janisse	11
Josh	Mayes	10

Isabell	McCourt	10
Jazmine	Rees	11
Corbin	Tyler	11
Jacob	Ziebell	10

