Life is about

Testing the waters

Roscommon High School

With

Raven Analytical Laboratory

By

John Blizzard

And

Joan McMahon

Introduction

The Higgins Lake Property Owners Association (HLPOA) approached Raven Analytical Laboratory in Roscommon, Michigan in 2018 to provide water testing on Higgins Lake. There are thirteen test sites around 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 joint project with the Roscommon High School chemistry students and teacher. This effort was to document the chemistry of Higgins Lake over time. This would also provide a data base for any other studies in the future. Raven personnel trained students with all the procedures and testing protocols necessary to complete this study. Students would collect water samples from selected sites and bring them to Raven Analytical Lab for testing. 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. After four years of testing and data collection we have put together a complete report to document all of the testing and results of the testing.

This report also includes the sponsored activities of the High School students and their participation in this project. A significant part of this program was to provide Roscommon High School chemistry students the oppprtunity to participate and use the chemistry they are obtaining in school. Unfortunately, with the advent of the Covid pandemic, student participation was very limited in 2020 and 2021. However, it is anticipated that the full student involvment will resume again in 2022.

Water testing protocols

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 were 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

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.

Water testing sites

The thirteen sites chosen for testing are shown in the table below. These sites were chosen to provide analysis covering the entire perimeter of Higgins Lake as well as Treasure Island.

	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

Water testing data

1. Attached are sheets containing all the data collected over four years of testing. These include complete test results for all thirteen test sites for each year of the study including: (Appendix A)
    a. 2018
    b. 2019
    c. 2020
    d. 2021

2. The Year averages by month (Appendix B)
3. The Monthly average by each year(Appendix C)
4. Testing comparisons of previous water testing on Higgins Lake(Appendix D)
5. Big Creek and Little Creek testing(Appendix E)

Also included in this report are some of the activities the Roscommon High School students were involved with as a result of this program. These include:

6. Roscommon High School Poster/activities
    a. Poster at ACS Fall Scientific Meeting 2018
    b. Poster at ACS regional meeting in 2019
    c. Tee shirts
    d. Pizza party
    e. ACS national recognition

YEAR 2018

5/17/2018

Lab Number 180518- 180518- 180518- 180517- 180517- 180517- 180518- 180518- 180518- 180516- 180516-9

Site	Result 1	2	3	4	5	6	7	8	9	10	11	12
Phosphorus	0	0.1	0.25	0.2	0	0.3	2.25	0.25	0.6	0	0	
Nitrogen (Nitrate)	0.096	0.124	0.056	0.267	0.126	0.124	0.05	0.085	0.069	0	0	
Nitrogen (Nitrite)	0.006	0.006	0.007	0.011	0.007	0.006	0.003	0.006	0.003	0.006	0.007	
Beach Plate Count; MPN	12.1	13.4	5.2	356	121	914	148	56	201	<1	25.4	
Beach Plate Count; e-coli	<1	<1	<1	31	20	<1	<1	13	2	<1	<1	
pH	7.46	7.68	7.03	7.5	7.91	6.94	7.12	7.26	7.65	8	7.8	
Dissolved Oxygen	5.1	4.7	4.8	5.7	4.9	7.3	5.3	5.3	6	8.1	7.74	
Total Dissolved Solids	0.0169	0.0149	0.0166	0.0047	0.37	0.005	0.0167	0.02	0.013	0.0005	0.015	
Water Temperature; C	12.9	18.5	11.4	17.7	19.5	17.3	17.3	17.3	16.6	11.3	11.3	
Air Temperature; C	21.1	21.1	21.1	26.2	21.2	24.7	17.6	27.5	25	17.8	17.8	
Conductivity; uS	278	288	273	309	297	290	297	292	277	280	278	

6/14/2018

Lab Number 180615- 180615- 180615- 180614- 180614- 180614- 180613- 180613- 180613- 180614- 180614- 180614

Site	Result 1	2	3	4	5	6	7	8	9	10	11	12
Phosphorus	0.05	0.11	0.11	0.1	2.4	0.35	0.25	0.05	0.55	0.024	0.041	0.005
Nitrogen (Nitrate)	0.048	0.032	0.01	0.064	0.068	0.029	0.61	0.14	0.05	0.03	0.024	0.118
Nitrogen (Nitrite)	0.003	0.005	0.008	0.005	0.006	0.006	0.008	0.008	0.006	0.006	0.003	0.007
Beach Plate Count; MPN	206	284	315	68.3	436	53.8	457	143	416	194	186	689
Beach Plate Count; e-coli	11.8	<1	3	1	3	<1	2	37	4	1	2	43
pH	7.97	7.72	7.35	7.12	6.89	6.98	6.43	6.35	6.24	7.29	7.53	7.77
Dissolved Oxygen	5.2	5.1	5.4	4.3	5.1	5.2	4.2	4.5	5	4.4	4.5	4.5
Total Dissolved Solids	0.001	0.003	0.012	0.011	0.005	0.002	0.006	0.004	0.002	0.008	0.016	0.011
Water Temperature; C	17.5	18.5	11.4	18	17.7	18.2	18.3	17.8	17.2	16.7	16.7	15.4
Air Temperature; C	12.2	12.2	13.3	13.3	15	12.7	13.5	14	14.8	14.4	14.4	14.6
Conductivity; uS	315	282	282	280	206	277	308	308	281	282	284	156

7/18/2018

Lab Number	180720-	180720-	180720-	180719-	180719-	180719-	180718-	180718-	180718-	180718-	180718-	180718-	180717
	Result												
Site	**1**	2	3	4	5	6	7	8	9	10	11	12	13
Phosphorus	0	n.d.	n.d.	0.07	0.1	0.06	0.02	0.01	0.01	n.d.	n.d.	0.01	0.01
Nitrogen (Nitrate)	0.081	0.051	0.068	0.061	0.105	0.081	0.105	0.101	0.118	0.109	0.092	0.104	0.105
Nitrogen (Nitrite)	0.001	n.d.	0.005	0.003	0.005	0.007	0.009	0.004	0.005	0.004	0.004	0.005	0.005
Beach Plate Count; MPN	579	436	307	228	870	260	285	474	478	378	260	285	397
Beach Plate Count; e-coli	<1	8.6	<1	1	1	<1	1	2	2	<1	<1	<1	1
pH	7.64	7.94	7.9	7.74	8	7.7	7.93	7.46	7.38	7.33	7.24	7.17	8
Dissolved Oxygen	4	3.7	3.7	4.1	3.8	4	6.6	7.5	7.5	7	7.1	6.8	3.8
Total Dissolved Solids	0.034	0.0028	0.0011	0.0013	0.0026	0.0029	0.001	0.0013	0.0017	0.0025	0.0018	0.002	0.002
Water Temperature; C	22.3	22.1	23.2	22.6	22	22.6	19.8	21.7	19.9	19.6	19.7	21	20.5
Air Temperature; C	18.9	19.4	19.4	13.9	13.9	13.9	10	10.6	10	13.9	13.9	14.4	13.9
Conductivity; uS	275	292	273	2832.8	283	283	311	311	270	275	272	272	283

10/18/2018

Lab Number	181022-	181022-	181022-	181023-	181023-	181023-	181024-	181024-	181024-	181019-	181019-	181019-	181019
	Result												
Site	**1**	2	3	4	5	6	7	8	9	10	11	12	13
Phosphorus	0.4	0.31	0.23	0.2	0.24	0.17	0.83	0.26	0.22	0.25	0.47	0.19	0.21
Nitrogen (Nitrate)	0	0.01	N.D.	0.029	0.048	0.16	0.044	0.187	0.206	N.D.	N.D.	N.D.	N.D.
Nitrogen (Nitrite)	N.D.	n.d.	N.D.	0.001	N.D.	0.002	0.001	0.001	N.D.	N.D.	0.013	0.19	0.027
Beach Plate Count; MPN	1011	64	68	31.9	36.8	47.3	43	70	1011	1011	1011	91	22
Beach Plate Count; e-coli	0	1	1	1	2	3	2	3	1	1	1	1	1
pH	8.1	8.08	7.94	7.4	7.39	7.31	7.15	7.56	7.3	8.45	8.39	8.23	8.16
Dissolved Oxygen	11.8	13	10	12.4	12	12.4	11.4	11.2	12.8	11.5	9.9	9.8	9.5
Total Dissolved Solids	0.0041	0.0069	0.0019	0.0054	0.003	0.007	0.002	0.001	0.004	0.0003	0.006	0.004	0.012
Water Temperature; C	4.7	8.7	8.7	8.2	8.8	8.2	6.7	6.7	7.6	5.2	7.4	7.4	7.2
Air Temperature; C	-0.1	-0.1	-0.1	1	1	1	1.2	1.2	1.3	7.2	7.2	7.2	7.2
Conductivity; uS	281	278	279	316	310	332	304	362	323	305	279	284	285

YEAR 2019 Appendix A

5/6/2019

Lab Number	190502-	190502-	190502-	190430-	190430-	190430-	190429-	190429-	190429-	190501-	190502-	190430-	190501
	Result												
Site	**1**	**2**	**3**	**4**	**5**	**6**	**7**	8	9	10	11	12	13
Phosphorus	0	0.05	N.D.	0,12	0.04	0.07	0.05	0.03	0.7	0.06	0.04	0.03	0.1
Nitrogen (Nitrate)	N.D.	n.d.	N.D.	0.24	0.4	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	1.74	N.D.
Nitrogen (Nitrite)	N.D.	n.d.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.02	N.D.
Beach Plate Count; MPN	4	22	17	3	31	7	243	124	9.7	8.1	1	62	3
Beach Plate Count; e-coli	<1	<1	<1	34	195	32	56	4.1	N.D.	<1	<1	1	1
pH	8.85	8.6	8.85	8.87	8.62	8.9	8.94	8.87	8.45	8.77	7.69	8.93	8.1
Dissolved Oxygen	9.3	8.5	9.3	8.8	8.2	9.9	8.8	9.3	9.3	5.1	9.7	8.5	8.7
Total Dissolved Solids	244	222	288	2.1	1.05	0.98	8.9	21	7	14.3	34	23	2
Water Temperature; C	2.8	3.4	3.2	3.1	3.4	3.7	4.7	5.1	6.7	5.8	4.2	1.6	4
Air Temperature; C	1	3	3	42			5.5	5.5		4		5.4	
Conductivity; uS	281	287	281	335	269	328	323	334	299	285	286	425	298

6/17/2019

Lab Number	190619-	190619-	190619-	190618-	190618-	190618-	190617-	190617-	190617-	190617-	190617-	190618-	190618
	Result												
Site	**1**	**2**	**3**	**4**	**5**	**6**	**7**	8	9	10	11	12	13
Phosphorus	0.03	0.01	0.02	0.04	0.18	0.01	0.14	0.15	0.02	0.2	0.22	0.02	0.01
Nitrogen (Nitrate)	N.D.	n.d.	N.D.	N.D.	N.D.	N.D.	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.	N.D.	N.D.	N.D.	N.D.	n.d.	N.D.
Beach Plate Count; MPN	15.8	49	40	139	1	107	76	35	21	1011	115	40	80
Beach Plate Count; e-coli	1	<1	8.6	12	1	10	20	1	<1	130	3	8	19
pH	8.93	8.95	9.01	8.86	8.44	7.9	8.75	8.88	9.32	8.19	7.92	7.71	7.6
Dissolved Oxygen	4.1	4	3.9	5.9	6.2	4.3	4.3	4.4	4.3	4.29	4.9	6	3.9
Total Dissolved Solids	141	142	142	158	146	177	154	143	138	146	128	141	141
Water Temperature; C	14.2	15.5	14.2	12.4	11.6	13.2	12.8	16.1	16.1	18.6	18.4	11.8	12.5
Air Temperature; C	11	11	12	13	12	12	13	13	13	14	13	11	13
Conductivity; uS	279	279	279	331	293	354	289	288	293	281	282	282	279

7/23/2019

Lab number	190722-	190724-	190724-	190723-	190724-	190722-	190722-	190723-	190723-	190722-	190723-	190724-	190724
	Result												
Site	**1**	**2**	**3**	**4**	**5**	**6**	**7**	8	9	10	11	12	13
Phosphorus	0.22	0.11	0.06	0.02	0.14	0.38	0.2	0.2	0.1	0.32	0.11	0.02	0.01
Nitrogen (Nitrate)	0.279	N.D.	N.D.	N.D.	N.D.	N.D.	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.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Beach Plate Count; MPN	829	501	478	914	285	689	272	829	166	870	792	444	629
Beach Plate Count; e-coli	<1	8.6	5.2	21.6	10.9	8.6	2	16.9	4.1	7.7	9.7	7.2	3
pH	8.54	9.05	8.94	8.75	9.27	8.88	8.74	8.51	9.32	9.22	9.31	8.71	8.1
Dissolved Oxygen	3.1	3.3	3.5	6.9	3.2	3.3	3.2	6.3	4.3	3.5	6.6	6	4.4
Total Dissolved Solids	166	112	102	155	122	171	122	1304	138	122	118	147	134
Water Temperature; C	20.3	19.7	19.4	19.7	19.7	20.3	20.3	19.7	19.1	20.3	17.9	19.8	19.5
Air Temperature; C	17.2	13.2	17.2	17.2	17.2	21.1	21.1	17.2	17.2	21.1	13.2	17.2	17.2
Conductivity; uS	274	288	294	294	283	311	276	281	293	284	312	272	268

8/22/2019

Lab number	190822-	190822-	190822-	190822-	190822-	190822-	190822-	190822-	190822-	190822-	190822-	190822-	190822
	Result												
Site	**1**	**2**	**3**	**4**	**5**	**6**	**7**	8	9	10	11	12	13
Phosphorus	0.02	0.02	0.01	0.11	0.02	0.1	0.2	0.04	0.1	0.1	0.02	0.01	0.02
Nitrogen (Nitrate)	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	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.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Beach Plate Count; MPN	601	328	208	120	82	1011	89	71	361	4	25	272	66
Beach Plate Count; e-coli	<1	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	3.1	<1
pH	9.06	9.32	9.5	9.09	9.08	8.95	8.83	8.6	8.6	8.47	8.48	8.48	8.31
Dissolved Oxygen	5.8	5.2	6.8	5.6	6.4	6.2	6.4	5.6	5.6	6.5	6.6	6.6	6.4
Total Dissolved Solids	145	139	137	137	138	138	138	139	139	138	139	138	138
Water Temperature; C	22.3	22.3	22.3	22.3	22.3	22.3	22.3	22.3	22.3	22.3	22.3	22.3	22.3
Air Temperature; C	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5
Conductivity; uS	290	276	273	273	275	276	276	278	276	276	277	277	275

9/22/2019

Lab number	190917-	190917-	190917-	190918-	190918-	190918-	190916-	190916-	190918-	190917-	190917-	190918-	190916
	Result												
Site	**1**	**2**	**3**	**4**	**5**	**6**	**7**	8	9	10	11	12	13
Phosphorus	0.03	N.D.	0.56	0.12	0.35	N.D.	0.16	0.31	0.05	0.03	0.28	0.17	0.16
Nitrogen (Nitrate)	N.D.	N.D.	N.D.	N.D.	0.26	N.D.	0.035	0.097	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.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Beach Plate Count; MPN	344	172	691	574	178	26	299	209	524	69	89	140	313
Beach Plate Count; e-coli	8.6	5.2	2	4	9.6	4.1	6.2	9.6	<1	2	3.1	10.8	5.2
pH	9.3	9.22	9.13	9.45	9.28	8.77	9.5	9.48	9.17	9.1	8.93	9.66	9.39
Dissolved Oxygen	4.3	4.4	2.74	4.3	6.7	4	6.8	6	4.2	4.8	4.8	4.4	4.4
Total Dissolved Solids	133	139	130	153	128	135	139	122	137	133	133	137	144
Water Temperature; C	17.5	18	17.1	16.4	16.5	16.1	17.4	16.3	16.3	16.8	16.5	16.8	16.6
Air Temperature; C	12.1	12.1	12.2	12.2	16	16	14.9	14.9	16	12.1	12.1	16	16
Conductivity; uS	279	276	275	290	354	274	286	286	281	300	277	275	304

YEAR 2020 Appendix A

Lab Number 051920-1051920-2051920-3051920-4051920-5051920-6051920-7

5/20/2020

Site	1	2	3	4	5	6	7	8	9	10	11	12	13
Phosphorus	0.03	N.D.	0.07	0.03	N.D.	N.D.	0.01	0.04	N.D.	0.02	0.07	N.D.	N.D.
Nitrogen (Nitrate)	N.D.	0.29	N.D.	N.D.	N.D.	N.D.	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.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Beach Plate Count; MPN	127	272	178	108	478	285	146	259	122	378	360	829	432
Beach Plate Count; e-coli	5	32	32	56	19	14	8	19	9	19	16	36	7
pH	8.65	9.21	9.23	9.2	9.14	9.11	8.13	8.98	9.22	9.23	9.21	9.24	9.19
Dissolved Oxygen	2.7	2.8	2.7	2.6	2.6	2.6	2.9	2.8	2.9	2.9	2.8	2.9	2.8
Total Dissolved Solids	149	144	144	144	142	143	143	133	145	144	146	144	145
Water Temperature; C	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2
Air Temperature; C	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3
Conductivity; uS	298	288	287	297	256	288	284	286	284	287	287	286	287

6/24/2020

Lab Number 061920-1061920-2061920-3061920-4061920-5061920-6061920-7

Site	1	2	3	4	5	6	7	8	9	10	11	12	13
Phosphorus	N.D.	0.06	N.D.	N.D.	0.02	0.07	0.04	0.03	0.02	N.D.	N.D.	0.05	0.02
Nitrogen (Nitrate)	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	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.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Beach Plate Count; MPN	457	344	479	436	416	524	344	524	914	1011	574	524	477
Beach Plate Count; e-coli	17	11	15	13	10	19	16	13	10	16	12	15	12
pH	8.54	9.12	9.02	9.06	9.02	8.97	8.92	8.91	8.87	8.77	8.74	8.71	8.67
Dissolved Oxygen	6.2	6.1	6.4	6.4	5	5.5	4.5	4.9	5.1	5.1	5.1	5	4.9
Total Dissolved Solids	146	144	142	142	142	143	142	143	142	150	143	143	142
Water Temperature; C	17.2	16.2	15.8	16.8	16.8	16.2	16.3	16.3	16.3	16.3	16.3	16.3	16.2
Air Temperature; C	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	21.1	21.1	21.1	21.1	21.1
Conductivity; uS	292	289	284	283	284	285	283	286	285	303	291	284	284

7/29/2020

Lab Number	072920-	072920-	072920-	072920-	072920-	072920-	072920-	072920-	072920-	072920-	072920-	072920-	72920
	Result												
Site	**1**	**2**	**3**	**4**	**5**	**6**	**7**	8	9	10	11	12	13
Phosphorus	0.09	0.02	0.12	0.09	0	0.09	0	0.08	0.01	0.02	0	0.05	0.02
Nitrogen (Nitrate)	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	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.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Beach Plate Count; MPN	201	260	201	218	791	913	960	870	755	721	272	201	396
Beach Plate Count; e-coli	0	0	0	0	0	5	0	5	6	7	1	0	0
pH	8.41	9.07	9.07	8.98	8.9	8.88	8.88	8.75	8.56	8.54	8.44	8.52	8.47
Dissolved Oxygen	2.2	2.2	2.2	2.3	2.3	2.3	2.4	2.4	2.4	2.4	2.3	2.3	2.3
Total Dissolved Solids	151	140	141	138	137	136	137	136	136	140	138	139	138
Water Temperature; C	25.1	25.1	25.1	25.1	25.1	25.1	25.8	20.1	20.1	20.1	21.5	21.5	21.5
Air Temperature; C	25.5	25.5	25.5	25.5	25.5	25.5	25.5	19.4	19.4	19.4	19.4	19.4	19.4
Conductivity; uS	303	281	277	276	273	272	273	272	272	280	276	278	276

8/27/2020

	082720-	082720-	082720-	082720-	082720-	082720-	082720-	082720-	082720-	082720-	082720-	082720-	82720
	Result												
Site	**1**	**2**	**3**	**4**	**5**	**6**	**7**	8	9	10	11	12	13
Phosphorus	0.6	0.1	0.4	0.1	0.6	N.D.	0.6	N.D.	0.4	0.71	0.05	0.07	0.07
Nitrogen (Nitrate)	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	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.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Beach Plate Count; MPN	829	1011	1011	549	1011	1011	1011	601	456	1011	529	829	1011
Beach Plate Count; e-coli	7	19	12	13	6	12	13	5	10	24	11	11	9
pH	8.95	8.36	8.25	8.09	8.12	8.07	8.6	8.61	8.58	8.55	8.56	8.55	8.56
Dissolved Oxygen	2.2	2.2	2.2	2.2	2.2	2.1	2.1	2.1	2.1	2.1	2.1	1.8	1.9
Total Dissolved Solids	141	139	138	137	138	138	138	137	137	139	138	137	138
Water Temperature; C	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.8	20.8	20.8
Air Temperature; C	30	30	30	30	30	30	30	30	30	30	30	30	30
Conductivity; uS	282	274	274	274	277	277	275	274	275	271	273	274	275

9/29/2020

200929-1200929-2200929-3200929-4200929-5200929-6200929-7200929-8

Result

200929-9200929-1200929-1200929-1 200929

Site	1	2	3	4	5	6	7	8	9	10	11	12	13
Phosphorus	0.04	0.043	0.044	0.038	0.042	0.036	0.048	0.043	0.047	0.037	0.035	0.036	0.035
Nitrogen (Nitrate)	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	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.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Beach Plate Count; MPN	399	238	298	1011	549	524	791	1011	416	260	791	210	830
Beach Plate Count; e-coli	7	12	1	4	109	127	298	218	32	1	73	2	66
pH	8.68	9.3	9.3	8.28	8.26	8.2	8.18	8.16	8.21	8.88	8.36	8.4	8.38
Dissolved Oxygen	3	2.7	2.6	2.9	2.8	2.7	3.1	2.7	1.8	1.9	1.9	1.7	1.7
Total Dissolved Solids	147	138	139	137	140	141	141	141	168	149	159	142	158
Water Temperature; C	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6
Air Temperature; C	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Conductivity; uS	291	276	277	275	280	281	281	282	313	305	318	284	313

YEAR 2021 Appendix A

5/27/2021

Lab Number 051221-1051221-2051221-3051221-4051221-5051221-6051221-7

Site	Result 1	2	3	4	5	6	7	8	9	10	11	12	13
Phosphorus	0.02	0.06	0.03	0.2	0.1	0.01	0.01	0.02	0.02	0.01	0.03	0.01	0
Nitrogen (Nitrate)	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	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.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Beach Plate Count; MPN	1	0	6.3	2	1	2	4.1	1	0	0	0	2	1
Beach Plate Count; e-coli	0	1	0	0	0	0	0	0	0	0	0	0	0
pH	7.73	7.99	7.91	7.81	7.9	7.82	7.85	8.02	7.9	8.32	8.38	8.33	8.29
Dissolved Oxygen	10	10.2	10.6	10.5	8.9	9.3	9.8	8.8	8.9	9.3	9.6	9.2	9
Total Dissolved Solids	145	144	145	144	144	149	145	143	145	153	149	145	145
Water Temperature; C	7.8	7.8	7.8	7.8	7.8	7.8	7	6.9	6.9	6.9	6.9	7.8	6.9
Air Temperature; C	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Conductivity; uS	289	289	289	287	287	298	290	286	290	305	290	289	290

6/17/2021

Site	Result 1	2	3	4	5	6	7	8	9	10	11	13	13
Phosphorus	0.02	0.02	0.02	0.02	0.02	0.03	0.06	0.01	0.02	0.01	0.01	0.02	0.02
Nitrogen (Nitrate)	N.D.	N.D.	0.778	0.586	0.326	N.D.	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.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Beach Plate Count; MPN	525	285	397	397	914	870	313	478	396	124	791	388	388
Beach Plate Count; e-coli	4	6	2	4	7	1	1	2	2	0	4	3	3
pH	8.11	7.94	8,04	7.94	7.9	8.06	8.17	8.27	8.13	8.12	8.2	8.15	8.15
Dissolved Oxygen	7.9	7.16	7.4	6.75	7.06	7	7.02	6.79	7.44	7.12	6.95	7.19	7.19
Total Dissolved Solids	130	129	128	136	135	138	140	135	137	137	136	138	138
Water Temperature; C	18.1	18.1	18.1	18.1	18.1	18.1	18.5	18.1	18.1	18.1	18.5	18.5	18.5
Air Temperature; C	17.2	17.2	17.2	17.2	17.2	17.2	19	17.2	17.2	17.2	19	19	19
Conductivity; uS	261	258	260	265	261	275	281	269	273	274	271	276	276

7/27/2021

Site	Result 1	2	3	4	5	6	7	8	9	10	11	13	13
Phosphorus	0.31	0.19	0.14	0.06	0.1	0.16	0.09	0.14	0.13	0.23	0.03	0.01	0.01
Nitrogen (Nitrate)	0.021	N.D.	0.026	0.076	0.031	0.018	N.D.	N.D.	0.018	N.D.	N.D.	N.D.	N.D.
Nitrogen (Nitrite)	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Beach Plate Count; MPN	1011	755	1011	913	870	870	1011	1011	913	1011	960	1011	1011
Beach Plate Count; e-coli	0	1	2	0	0	0	4	0	0	2	1	5	5
pH	7.38	7.46	7.41	7.48	7.46	7.42	7.39	7.44	7.45	7.46	7.44	7.45	7.45
Dissolved Oxygen	7.49	7.91	7.17	7.72	7.88	7.32	7.26	7.47	6.9	7.62	7.45	7.55	7.55
Total Dissolved Solids	137	135	135	137	135	134	141	137	137	135	137	135	135
Water Temperature; C	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3
Air Temperature; C	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5
Conductivity; uS	277	269	272	269	269	268	282	269	273	268	273	270	270

8/27/2021

Site	Result 1	2	3	4	5	6	7	8	9	10	11	13	13
Phosphorus	0.04	0.02	0.02	0.04	0.03	0.06	0.01	N.D.	0.04	0.03	N.D.	N.D.	N.D.
Nitrogen (Nitrate)	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.04	0.03	N.D.	N.D.	N.D.
Nitrogen (Nitrite)	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Beach Plate Count; MPN	1011	755	1011	913	870	870	1011	1011	913	1011	960	1011	1011
Beach Plate Count; e-coli	0	1	2	0	0	0	4	0	0	2	1	5	5
pH	7.56	7.49	7.63	7.6	7.47	7.36	7.49	7.42	7.61	7.62	7.6	7.68	7.68
Dissolved Oxygen	6.7	6.75	7	7.31	7.32	7.41	7.41	7.11	6.98	7.18	6.99	7.34	7.34
Total Dissolved Solids	119	119	118	120	119	119	117	118	117	119	119	122	122
Water Temperature; C	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3
Air Temperature; C	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3
Conductivity; uS	237	236	236	239	238	238	234	236	234	238	238	243	243

9/27/2021

Site	Result 1	2	3	4	5	6	7	8	9	10	11	13	13
Phosphorus	0.2	0.09	0.11	0.05	0.02	0.06	0.06	0.07	0.09	0.06	0.06	0.02	0.02
Nitrogen (Nitrate)	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	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.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Beach Plate Count; MPN	1011	1011	1011	1011	1011	1011	1011	1011	1011	1011	1011	1011	1011
Beach Plate Count; e-coli	57	45	40	81	55	35	42	42	49	65	48	38	38
pH	6.7	6.8	6.91	7.03	7.01	7.11	7.14	7.18	7.22	6.87	7.07	7.28	7.28
Dissolved Oxygen	7.2	7.6	7.74	7.55	7.48	7.51	7.86	8.08	7.74	8.32	7.39	7.98	7.98
Total Dissolved Solids	128	128	125	125	128	128	128	129	129	122	117	123	123
Water Temperature; C	16.6	15.9	16.2	15.9	15.9	16.2	15.9	16.2	16.6	16.6	16.2	16.6	16.6
Air Temperature; C	50	50	50	50	50	50	50	50	50	50	50	50	50
Conductivity; uS	257	256	249	250	254	255	255	257	257	243	233	246	246

Appendix B

Year Averages by month	2018	2019	2020	2021
May	5/18/2018	5/6/2019	5/20/2020	5/12/2021
	Avg	Avg	Avg	Avg.
Phosphorus	0.35	0.04	0.02	0.04
Nitrogen (Nitrate)	0.09	0.17	0	0
Nitrogen (Nitrite)	0.006	0	0	0
Beach Plate Count; MPN	168	41	305.7	1.3
Beach Plate Count; e-coli	6	24.8	20.9	0
pH	7.48	8.6	9	8.01
Dissolved Oxygen	6	8.7	2.78	9.5
Total Dissolved Solids	0.044	66.8	143.5	145.8
Water Temperature; C	15.5	4	14.2	7.4
Air Temperature; C	21.9	5.33	13.3	3.3
Conductivity; uS	287	310	285.8	290

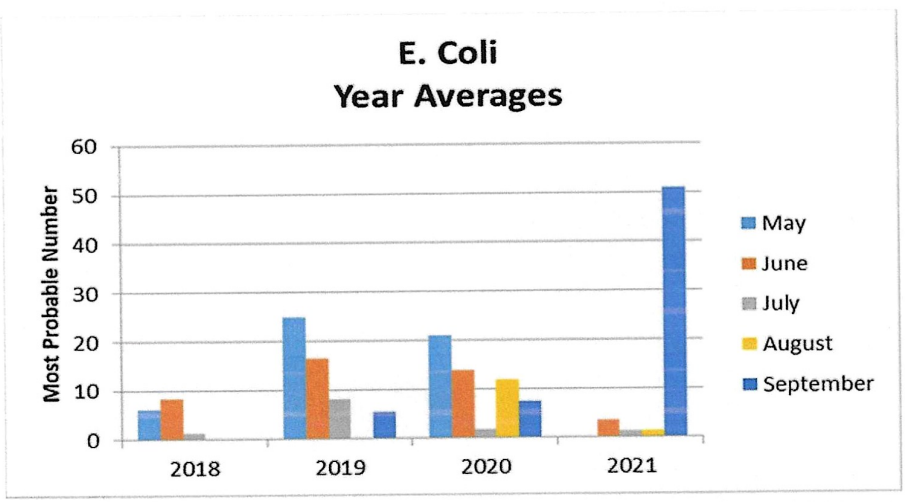
June	6/14/2018	6/17/2019	6/24/2020	6/18/2021
	Avg	Avg	Avg	Avg
Phosphorus	0.31	0.08	0.02	0.02
Nitrogen (Nitrate)	0.094	0	0	0
Nitrogen (Nitrite)	0.005	0	0	0
Beach Plate Count; MPN	265	131.8	540	489
Beach Plate Count; e-coli	8.3	16.4	13.7	3.5
pH	6.58	8.46	8.8	7.4
Dissolved Oxygen	4.41	4.6	5.4	7
Total Dissolved Solids	0.006	146	143	135
Water Temperature; C	15.5	14.4	16.4	18.1
Air Temperature; C	12.6	12.4	16.2	18
Conductivity; uS	250	293	287	269

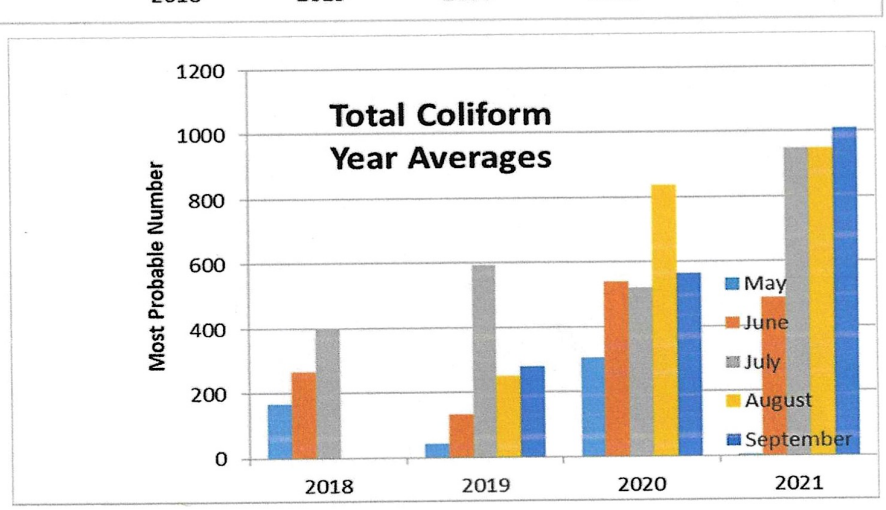
July	7/14/2018	7/17/2019	7/30/2020	7/27/2021
	Avg	Avg	Avg	Avg
Phosphorus	0.02	0.14	0.19	0.02
Nitrogen (Nitrate)	0.16	0.02	0	0
Nitrogen (Nitrite)	0.004	0	0	0
Beach Plate Count; MPN	402	592	520	950
Beach Plate Count; e-coli	1.28	8.07	1.8	1.2
pH	7.65	8.84	8.7	7.3
Dissolved Oxygen	5.35	4.36	2.3	7.4
Total Dissolved Solids	0.004	224	139	136
Water Temperature; C	21.3	19.6	23.15	23.3
Air Temperature; C	14.3	17.7	22.6	20.5
Conductivity; uS	479	287	277.6	272

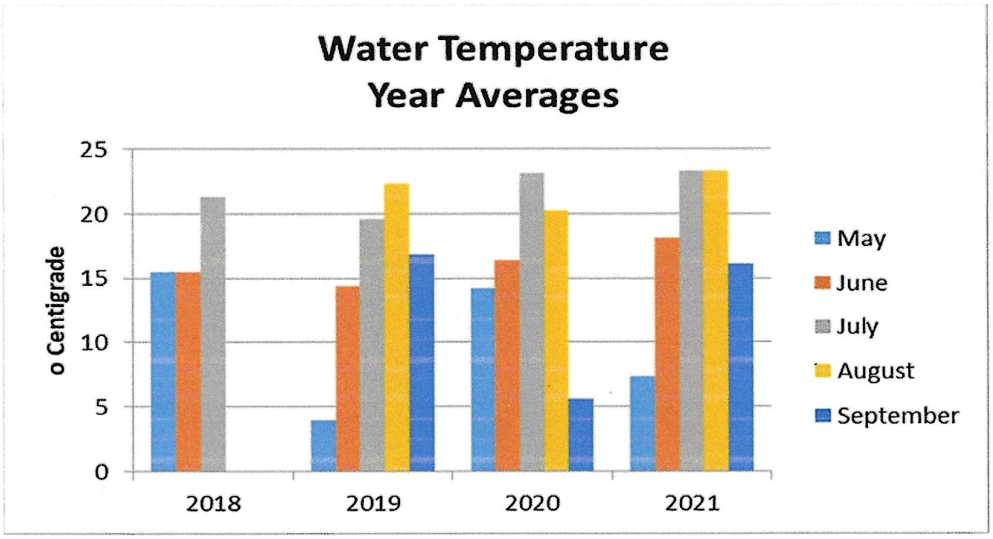
August	8/14/2019	8/26/2020	8/27/2021
	Avg	Avg	AVG
Phosphorus	0.06	0.28	0.02
Nitrogen (Nitrate)	0	0	N.D.
Nitrogen (Nitrite)	0	0	N.D.
Beach Plate Count; MPN	249	836	950
Beach Plate Count; e-coli	<1	11.7	1.2
pH	8.84	8.46	7.55
Dissolved Oxygen	6.15	2.07	7.09
Total Dissolved Solids	138.7	138	119
Water Temperature; C	22.3	20.2	23.3
Air Temperature; C	26.5	30	28.3
Conductivity; uS	276.8	275	237

September	9/17/2019	9/27/2020	9/27/2021
	Avg	Avg	Avg
Phosphorus	0.17	0.04	0.07
Nitrogen (Nitrate)	0.03	N.D.	N.D.
Nitrogen (Nitrite)	0	N.D.	N.D.
Beach Plate Count; MPN	279	566	1011
Beach Plate Count; e-coli	5.4	73	50.8
pH	9.23	8.46	7.03
Dissolved Oxygen	4.75	2.42	7.76
Total Dissolved Solids	135.6	146	125
Water Temperature; C	16.8	5.6	16.1
Air Temperature; C	14	4.5	50
Conductivity; uS	289	290	249

October	10/24/2018
	Avg
Phosphorus	0.3
Nitrogen (Nitrate)	0.05
Nitrogen (Nitrite)	0.02
Beach Plate Count; MPN	347.5
Beach Plate Count; e-coli	1.38
pH	7.77
Dissolved Oxygen	11.3
Total Dissolved Solids	0.04
Water Temperature; C	7.34
Air Temperature; C	2.71
Conductivity; uS	302.9






Water Temperature
Year Averages
o Centigrade
25
20
15
10
5
0
2018
2019
2020
2021
May
June
July
August
September

Monthly average by year
Appendix c

2021

	5/12/2021	6/18/2021	7/26/2021	8/27/2021	9/27/2021
	Avg.	Avg	Avg	AVG	Avg
Phosphorus	0.04	0.02	0.02	0.02	0.07
Nitrogen (Nitrate)	0	0	0	N.D.	N.D.
Nitrogen (Nitrite)	0	0	0	N.D.	N.D.
Beach Plate Count; MPN	1.3	489	950	950	1011
Beach Plate Count; e-coli	0	3.5	1.2	1.2	50.8
pH	8.01	7.4	7.3	7.55	7.03
Dissolved Oxygen	9.5	7	7.4	7.09	7.76
Total Dissolved Solids	145.8	135	136	119	125
Water Temperature; C	7.4	18.1	23.3	23.3	16.1
Air Temperature; C	3.3	18	20.5	28.3	50
Conductivity; uS	290	269	272	237	249

2020

	5/20/2020	6/24/2020	7/30/2020	8/26/2020	9/27/2020
	Avg	Avg	Avg	Avg	Avg
Phosphorus	0.02	0.02	0.19	0.28	0.04
Nitrogen (Nitrate)	0	0	0	0	N.D.
Nitrogen (Nitrite)	0	0	0	0	N.D.
Beach Plate Count; MPN	305.7	540	520	836	566
Beach Plate Count; e-coli	20.9	13.7	1.8	11.7	73
pH	9	8.8	8.7	8.46	8.46
Dissolved Oxygen	2.78	5.4	2.3	2.07	2.42
Total Dissolved Solids	143.5	143	139	138	146
Water Temperature; C	14.2	16.4	23.15	20.2	5.6
Air Temperature; C	13.3	16.2	22.6	30	4.5
Conductivity; uS	285.8	287	277.6	275	290

	2019				
	5/6/2019	6/17/2019	7/17/2019	8/14/2019	9/17/2019
	Avg	Avg	Avg	Avg	Avg
Phosphorus	0.04	0.08	0.14	0.06	0.17
Nitrogen (Nitrate)	0.17	0	0.02	0	0.03
Nitrogen (Nitrite)	0	0	0	0	0
Beach Plate Count; MPN	41	131.8	592	249	279
Beach Plate Count; e-coli	24.8	16.4	8.07	<1	5.4
pH	8.6	8.46	8.84	8.84	9.23
Dissolved Oxygen	8.7	4.6	4.36	6.15	4.75
Total Dissolved Solids	66.8	146	224	138.7	135.6
Water Temperature; C	4	14.4	19.6	22.3	16.8
Air Temperature; C	5.33	12.4	17.7	26.5	14
Conductivity; uS	310	293	287	276.8	289

	2018			
	5/18/2018	6/14/2018	7/14/2018	10/24/2018
	Avg	Avg	Avg	Avg
Phosphorus	0.35	0.31	0.02	0.3
Nitrogen (Nitrate)	0.09	0.094	0.16	0.05
Nitrogen (Nitrite)	0.006	0.005	0.004	0.02
Beach Plate Count; MPN	168	265	402	347.5
Beach Plate Count; e-coli	6	8.3	1.28	1.38
pH	7.48	6.58	7.65	7.77
Dissolved Oxygen	6	4.41	5.35	11.3
Total Dissolved Solids	0.044	0.006	0.004	0.04
Water Temperature; C	15.5	15.5	21.3	7.34
Air Temperature; C	21.9	12.6	14.3	2.71
Conductivity; uS	287	250	479	302.9

Appendix D

		WQI	USGS	MSU	HLPOA	HLPOA	HLPOA
annual averages		1998	1999	2014	2018	2019	2020
Phosphorus MSU 2014	Phosphorus	0.005	0.014	0.017	0.25	0.098	0.08
Water Quality Investigators 1998							
USGS 1999							
Nitrates MSU 2014	**Nitrates**	0.011	0.006	0.047	0.098	0.04	0
Water Quality Investigators 1998							
USGS 1999							
Conductivity MSU2014	Conductivity	245		270	330	229	283
Water Quality Investigators 1998							
Dissolved oxygen MSU 2014		9.16		8.2	7.5	4.91	3.5
Water Quality Investigators 1998							

Acknowledgments:

This project would not be 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 Kesseler, HLPOA member.

Roscommon High School chemistry class logo

Life is about

Testing the waters

Roscommon High School

Higgins Lake Watershed Study: A Community-School Based Surface Water Monitoring Program

John Blizzard (Quadsil and Raven Analytical), Chuck Schepke (Roscommon High School Chemistry Teacher) , and Student Researchers- Dylan Aubrey, Brady Briggs, J.T. Cole, Ashley Desmith, Jessica Disney, Anna Erikson, Karlee Erickson, Ethan Ferency, Micheal Ficaj, Caleb Jacobs, Justin Janisse, Jeff Kuchar, Brandon Mitchell, Mac Schultz, Dominic Tatrai, Emily Terry, Zoe Tomes, Jennifer Tussey, and Ian Wybraniec.

Abstract

This program utilizes high school chemistry and physics students to sample, test and evaluate the Higgins Lake Watershed and tributaries in Michigan. Students would sample water from a number of sites within the land watershed and test for inorganics, bacteria and physical characteristics of the test site. Sampling has increased to 12 different sites within the watershed and has been performed each month during 2018. The first year of testing at each site is to obtain a base line of each test site for continued testing over the next five years. Each site database has been combined together to provide a complete, systematic picture of the quality of water in this important water shed over an extended period of time. Water analysis included a variety of EPA certified chemical analysis techniques.

The water testing is performed and compared with EPA certified standards to ensure accurate, reliable test results. Using EPA standards reinforces the importance of using standards to compare testing technique, procedures and analyst ensuring quality data collection. This reinforces and connects the academic realm to real world job potentials. This is also part of a job-shadowing program within the watershed program to expose the students to potential employment opportunities available to qualified trained individuals.

Introduction

The first year of testing at each site is to obtain a base line of each test site for continued testing over the next five years. Each site database has been combined together to provide a complete, systematic picture of the quality of water in this important water shed over an extended period of time. Water analysis includes:

1. air temperature
2. water temperature
3. flow
4. hardness (alkalinity)
5. dissolved oxygen
6. pH
7. nitrate
8. phosphates
9. turbidity
10. nitrite
11. Bacteria · e-coli · coliform

A grant from Higgins Lake Foundation, the Higgins Lake Property Owners Association and the Higgins Lake Rotary provided the initial start for the watershed school program with continuing support from these partners. The High School involved in the program was also provided with all of the necessary equipment, water analysis training and supplies to perform the water quality tests in concert with the EPA certified Raven Analytical Laboratory in Roscommon.

Some of the results of this longer-term project include:

- -Student awareness of the environment
- -School science clubs started
- -Student involvement in their communities
- -Business coalition strengthened with area schools
- -School participation continues to grow

Methodology

The following locations were sampled in May and July of 2018, with a follow-up this seasonal planning to be done this October so we can establish a baseline for comparative analysis in the proceeding years.

	Flag #		
Green Township Marina	1	44.215013	-84.751333
North View Park	2	44.215722	-84.748889
Cut river	3	44.217972	-84.747083
Sam O Set	4	44.221333	-84.739833
BNR Boat launch	5	44.217514	-84.739111
Gill Creek	6	44.2147	-84.73194
North View Park	7	44.215833	-84.735667
B&B Marina	8	44.215167	-84.732361
Camp Cavalier	9	44.206806	-84.730111
Devils Head - 1	10	44.177361	-84.727806
Devils Head - 2	11	44.167139	-84.727861
Kennedy Beach	12	44.167139	-84.719722
Flag Point	13	44.172361	-84.694167

Results

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 a certified water sanitarian on staff at Roscommon. Training and testing was performed by the Roscommon High School student under the guidance and direction of certified water chemists.

Water Tests

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

Analytical Results of the May 26-28th , 2018 Sampling Data

Location	GHPR	GHPR	GHPR	GHPR	GHPR	GHPR	GHPR	GHPR	GHPR	GHPR	GHPR	GHPR
Site	1	2	3	4	5	6	7	8	9	10	11	12
Phosphorus	0.06	0.06	0.05	0.06	0.07	0.07	0.07	0.07	0.06	0.06	0.06	0.06
Nitrogen Nitrate	0.175	0.14	0.175	0.17	0.175	0.175	0.175	0.175	0.175	0.175	0.175	0.175
Nitrogen Nitrite	0.007	0.01	0.01	0.01	0.007	0.007	0.007	0.007	0.006	0.007	0.007	0.007
Beach Plate Count MPN	1.1	2.2	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Beach Plate Count CFU	0	0	0	0	0	0	0	0	0	0	0	0
pH	7.6	7.6	7.5	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6
Dissolved Oxygen	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	7.9
Total Dissolved Solids	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Water Temperature C	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7
Air Temperature C	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9
Conductivity uS	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Comment												

Analytical Results of the June 19-20th , 2018 Sampling Data

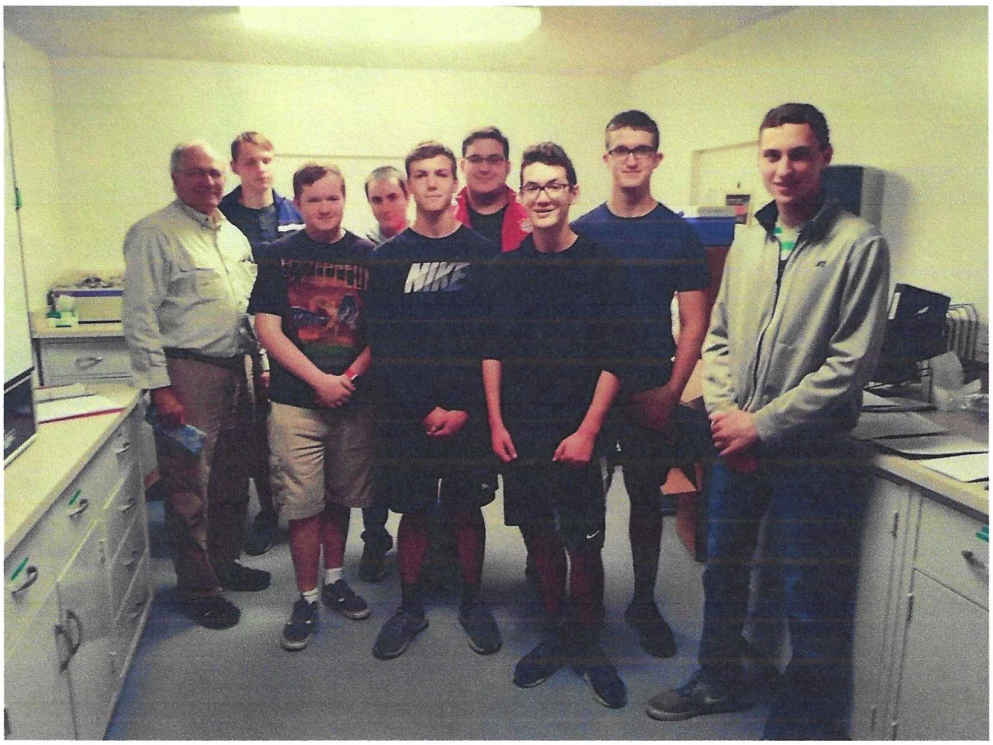
Location	GHPR	GHPR	GHPR	GHPR	GHPR	GHPR	GHPR	GHPR	GHPR	GHPR	GHPR	GHPR
Site	1	2	3	4	5	6	7	8	9	10	11	12
Phosphorus	0.06	0.06	0.05	0.06	0.07	0.07	0.07	0.07	0.06	0.06	0.06	0.06
Nitrogen Nitrate	0.175	0.175	0.175	0.175	0.175	0.175	0.175	0.175	0.175	0.175	0.175	0.175
Nitrogen Nitrite	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007
Beach Plate Count MPN	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Beach Plate Count CFU	0	0	0	0	0	0	0	0	0	0	0	0
pH	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6
Dissolved Oxygen	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1
Total Dissolved Solids	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Water Temperature C	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7
Air Temperature C	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9
Conductivity uS	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Comment												

Conclusion

This is the first year of our study and we are already seeing a significant increase in Beach Plate Count from May to June most likely due to human activity increasing on the lake and watershed with maybe some contributions from waterfowl.

Poster presentation at the American Chemical Society Fall scientific meeting at Saginaw Valley University.

Student testing at Raven Analytical lab under the supervision of Anthony Blizzard, S-5 certified water sanitarian.



Student testing at Raven Analytical lab with Fred Swinehart observing the testing.

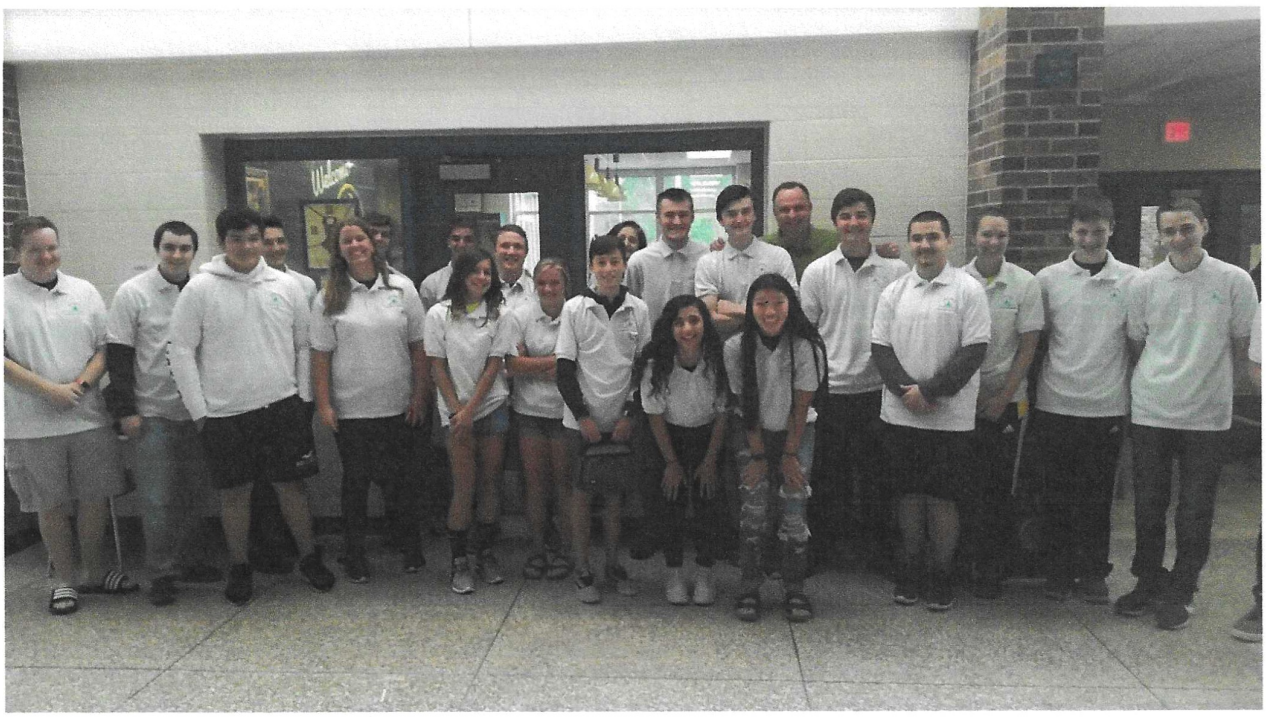
The Midland Section American Chemical Society Poster presentation at Saginaw Valley State University October 13, 2018

1st Row-left to right.

Justin Janisse, Jessica Disney, Zoe Tomes, Emily Terry, John Blizzard (Owner of Raven Analytical) , Karlee Erikson, Jon Suvada, Domonic Tatrai, and Mac Schultz.

2nd Row-left to right.

Brady Briggs and J.T. Cole.



Roscommon High School presentation of the student chemistry shirt to MJ Ewald, RHS Principal

Roscommon School Superintendent Kathy Erickson presentation of the student chemistry shirt.