Kearney Watershed Environmental Foundation

2017

Water Quality Monitoring Report

Testing and instrument evaluation

performed by

Stan Walker with assistance from our volunteer Lake Stewards

Report prepared by

Stan Walker

Contents

1.0 Introduction

1.1 Background information

General

In 2014 the University of Waterloo Summit Centre for the Environment (WSCE) partnered with the Kearney Environmental Watershed Foundation (KWEF) to create a lake monitoring program. This lake monitoring program was meant to be a follow up on water testing done by the Town of Kearney several years ago with the Ministry of the Environment and Climate Change. The lakes sampled and tested were Groom/Lynx Lake, Emsdale Lake, Big Clam Lake, Little Clam Lake, Peters Lake, Beaver Lake, Hassard Lake, Perry Lake, Perbcth/Fisher Lake, Mason Lake, Island Lake, Sand Lake, Himbury Lake, Magnetawan Lake, Grass Lake and Loon Lake and two spots on the south branch of the Magnetawan River in the vicinity of the Graphite Mine. Each of these water bodies was sampled in the field and tested at the WSCE lab. The data collected is intended to be part of a long-term monitoring project in order to detect any changes in the quality of the water over time. The long-term goals for this project were to annually sample the lakes in order to identify trends over time. The benefits of long-term water monitoring include detection of positive or negative changes in the data from large annual data sets.

KWEF was created to help preserve the quality of air, water, and terrestrial ecosystems of the Almaguin area ("KWEF," n.d.). Most of the lakes within the Kearney region are part of the Ontario Lake Partner Program. This program monitors total phosphorus concentrations and secchi depth for Ontario's inland lakes collected by volunteer efforts. For the WSCE/KWEF monitoring program, water composition (pH, DO, and conductivity) was tested in the lab as well as water nutrient levels (total phosphorus, phosphate, nitrate, and nitrite) using specific lab detection methods.

Throughout this report references to the “Town of Kearney” usually are referring to the original town site and if just the word “Kearney” is used we are referring to the original town site and the townships (Bethune, ,Proudfoot, and those parts of Butt and McCraney outside the Algonquin Park boundaries) that were amalgamated in 1979. This municipality of Kearney encompasses 532 square kilometers and has a year round population of approximately 850

Background information – 2014 & 2015 Monitoring Program

All of the 17 water bodies sampled were within the municipality of Kearney with the exception of Magnetawan, Lake which is inside the Park Boundaries. The terrain in the Kearney region which adjoins the western edge of Algonquin Park varies from extensive deposits of sand and gravel or wetland areas along the Magnetawan River to the uplands of Canadian Shield granites (Gartner Lee Water Quality Study, 2002). There is a graphite mine just north of the town which has the potential to impact the water quality of the nearby Magnetawan River. The mine which has been closed for several years was planning to reopen in 2015 and aims to produce one million tonnes of ore and 20,000 tonnes of graphite per year ("The Kearney Mine", n.d.). The dense forest cover has attracted and sustained a large lumbering industry in the past, however water based recreation and tourism have emerged more recently as a source of greater economic growth (Gartner Lee Water Quality Study, 2002). While the town itself is small, tourism and development could impact the watershed .

In 2014 the report was issued in 2 parts. Students from the university sampled and reported results on 16 lakes and the Magnetawan River. In 2015 students again sampled and issued one combined report on all 16 lakes and the river.

Background information – 2016 Monitoring Program

Unfortunately in the spring of 2016 we learned that the University of Waterloo would not be able to participate in any way with the monitoring program. Our long term goal for this program was to continue to sample the lakes on an annual basis in order to identify trends over time. With this in mind KWEF looked at trying to continue the program itself by just duplicating the methodology employed the previous two years. With the departure of the WSCE from Huntsville the local lab for processing the water samples was also no longer available. This meant that the water samples would have to be shipped to a southern Ontario commercial lab for analysis and we realized the costs would be prohibitive.

While looking for a solution, we learned that a portable field instrument and sensor package was on the market that would allow us to measure many of the same parameters that the lab tests provide. This instrument would measure Dissolved Oxygen (DO) conductivity, pH, and water temperature. The sensor package was connected to the instrument by a long cable which allowed the operator to lower the sensor package into the lake or river and take these measurements at various depths. Atmospheric pressure, file/site name and a time/date stamp can also be recorded with each set of readings in the instruments internal memory. The instrument did not have the ability to measure Phosphates or Nitrates and Nitrites at the low levels found in our lakes. Since the levels were low when measured in 2014 and 2015 we had decided that there was no urgent need to sample them again this year. In addition we would be able to obtain the TP (Total Phosphorous) readings for most of the lakes from the annual Lake Partners samples sent to MOE in Dorset. The other major benefit with this instrument was that we could take the readings from the sensors at various depths from the surface to the bottom of the lake to get a different perspective on conditions in the lake. We decided to use this instrument to gather data for 2016 Lake Monitoring Program and evaluate its suitability at the same time. For evaluation purposes we arranged two test dates in August approximately 2 weeks apart with a volunteer on each lake.

We used the previously selected sampling sites on each lake as much as possible. The smaller lakes had 3 sites the larger lakes had 6. Some sites were in shallow water and were obviously selected because they had the potential for higher nitrate and phosphate levels. Since we weren't measuring those parameters and there was the potential to lower the sensor into the muddy bottom we skipped those sites. During the second round of testing on Mason, Beaver, Hassard and Sand Lake when we were mainly evaluating the second instrument we just did a single deep spot profile. On Sand Lake we picked a new site that was more sheltered from the wind because we were having problems with the anchor dragging and the resultant problems with drift. We also did add a third site on the Magnetawan River well below the mine site to see how much the pH and conductivity levels had changed compared to readings closer to the mine site. Due to scheduling or logistical problems we visited Peters, Emsdale and Magnetawan Lakes only once. We didn't feel that two complete sets of readings were necessary so we used the second set of test sessions to evaluate the second instrument. In the process we did obtain a lot more additional test data.

Background information – 2017 Monitoring Program

Because of a heavy workload last fall our planning for the 2017 Water Quality Monitoring Program was delayed until April. The Kearney Council supported the program again this year so we were able to rent a YSI PRO DSS multi-parameter instrument from Hoskins Scientific in Burlington and arrange with Near North Labs in North Bay to analyze water samples from the first five lakes for nitrate and ortho-phosphate levels. Because we were late approaching Hoskins Scientific to rent the equipment all their ProDSS instruments were spoken for. Fortunately they were able to borrow a unit from their Vancouver office. We also rented a 2.2L Beta Plus Bottle Sampler that allowed us to take water samples at a particular depth. This was the method originally used by WSCE. The reason we wanted to re-test for nitrate and phosphate levels was that the instruments used by WSCE to analyze the samples appeared to have a MDL (Minimum Detection Level) of .01 mg/L for nitrates and .05 mg/L for phosphates. The Near North Labs instrument had an MDL of .003 mg/L for nitrates and .001mg/L for phosphates.

The YSI ProDSS would measure and record temperature, DO, conductivity, pH, turbidity and depth plus a time / date stamp. The unit we rented also had a GPS capability and recorded Lat and Long values as well. Based on our experiences with the 2016 program it was decided that we should use the YSI instrument on all the designated sites on each lake to obtain results down to and just below the thermocline. We would continue to do one profile of the water column at one of the deep spots on each lake. This and the fact that the instrument recorded the depth with each set of readings meant that the need to anchor over each site was less important.

In the spring prior to starting the testing program, a standard Fish Finder/depth finder was purchased and modified so that it had its own built in battery power supply and a portable mount for the transducer so that we could use it on all the volunteer's boats. It meant that we could verify depths at the various sites without dropping a weighted marked line over the side. This meant we didn't stir up the mud on the bottom which was especially important when taking water samples and minimized the chance of the instrument sensor package or the Beta Bottle Sampler contacting the muddy bottom.

For this 2017 report we used the same Section 2 from last year's report which contains a brief lake profile plus the lake outline and site map. The information provided was taken from the Ministry of Natural Resources and Forestry (MNRF) lake Fact sheet, Google Earth, and MBendi information services. We also included Section 4 "Measured Parameters and Water Quality Standards" .

Our rental period for the instrument ran from July10 – Aug 4th. Near North Labs had a courier pickup samples and drop off sample bottles each Tuesday at the Emsdale Information Center. Our samples needed to be analyzed within 4 days and needed to be refrigerated until the sample reached the lab.

We were very fortunate to have all our volunteer Lake Stewards agree to help us again this summer. It is always challenging to mesh the testing schedule with the individual volunteer's schedules because many are just seasonal visitors. This year the stormy and rainy weather created additional scheduling problems.

2.0 Lake Profiles,Maps and Sampling Sites

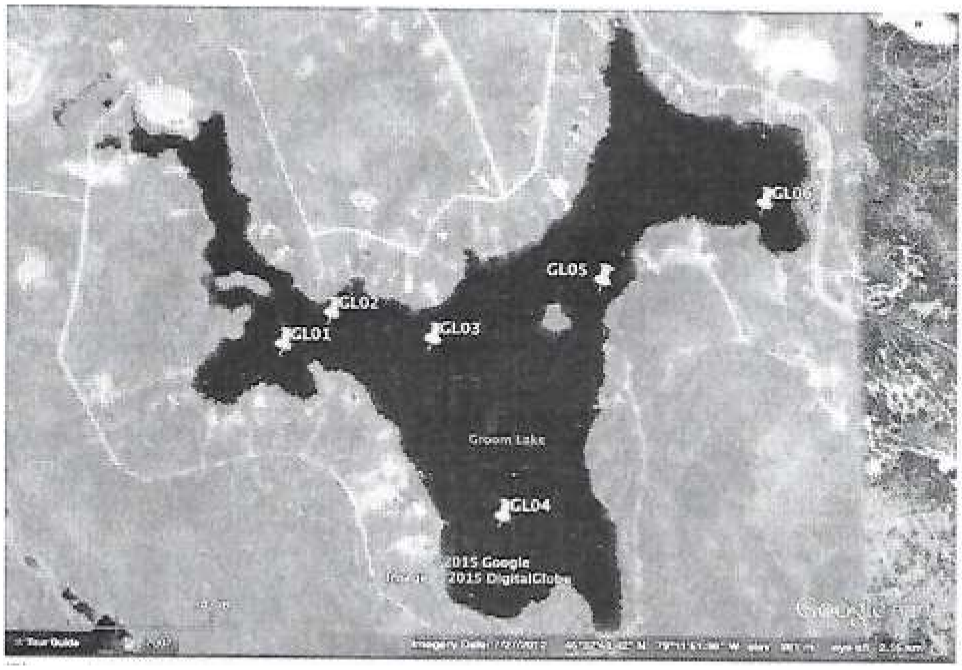
The lake profile information where provided was taken from the Ministry of Natural Resources and Forestry (MNRF) lake Fact sheets, Google Earth, and MBendi information services.

2.1 Grooml/Lynx Lake

Groom Lake, also known as Lynx Lake, is located 7 km southeast from the town of Kearney. There were several cottages visible from each sampling point. The lake does not have any surrounding crown land. The largest island is Squirrel Island. The map of the lake showing the sample points and the GPS coordinates for each sample site can be found below.

Groom/Lynx Lake Characteristics

Surface Area	Mean Depth	Max Depth	Perimeter
59.4 Ha	4.9m	12.5 m	6.7 km (plus 0.5 km island shoreline)



Map of Groom/Lynx Lake with sample sites, Retrieved from Google Earth

GPS Coordinates for sample sites at Groom Lake

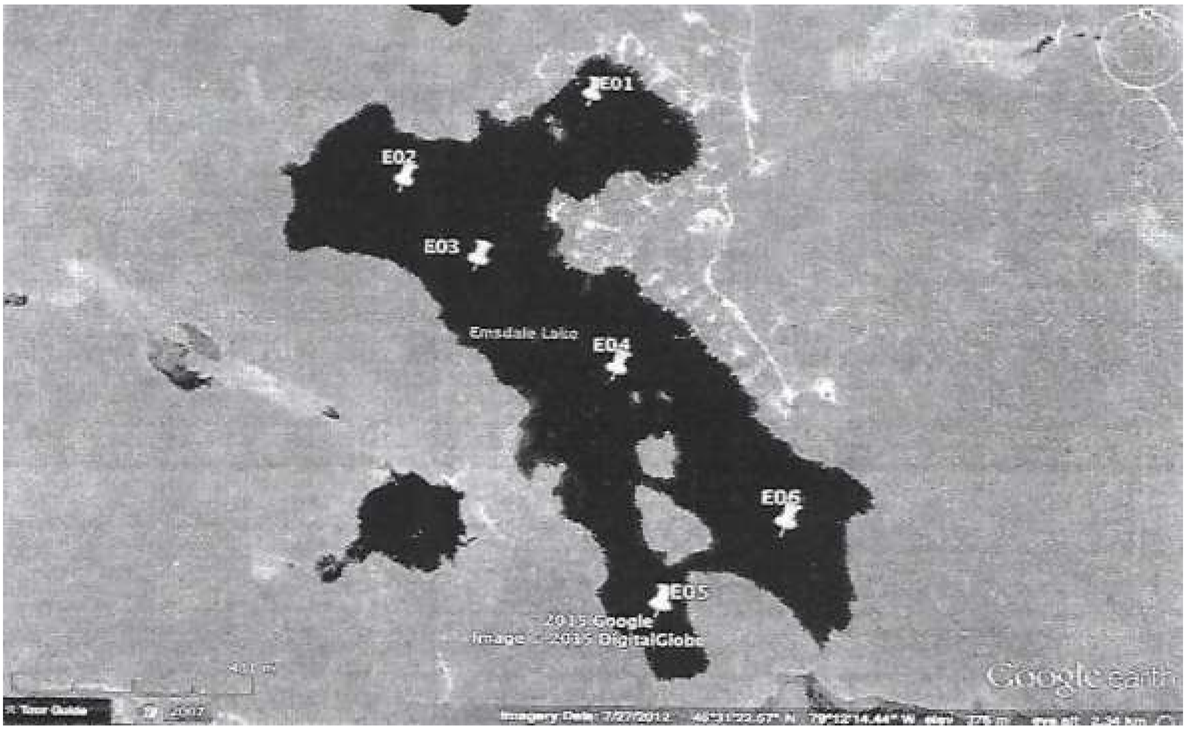
GLOI	N 45° 32' 19.1" W 79° II' 24.5"	GL04	N 45° 32' 7.0" W 79° 1 I' 2.5"
GL02	N 45° 32' 21.4" W 79° 11' 19.7"	GL05	N 45° 32' 23.9" W 79° 10' 52.7"
GL03	N45''32' 19.6" W 79° 11' 9.6"	GL06	N 45'' 32' 29.5" W 79° 10' 36.5"

2.2 Emsdale Lake

Emsdale Lake is located 6 km south of Kearney, Ontario. There are a couple of cottages visible from the sampling points. Fifteen percent of the surrounding land is Crown Land. Compared to the other lakes, this lake's water is very clear due to less cottage input and being spring fed. The map of the lake showing the sample sites and the GPS coordinates for each sample site can be found below

Ernsdale Lake characteristics (MNRF, 2010).

Surface Area	Mean Depth	Max Depth	Perimeter
61 ha	9m	22 111	5.5 krn (plus 1 km island shoreline)



GPS Coordinates for sample sites at Emsdale Lake.

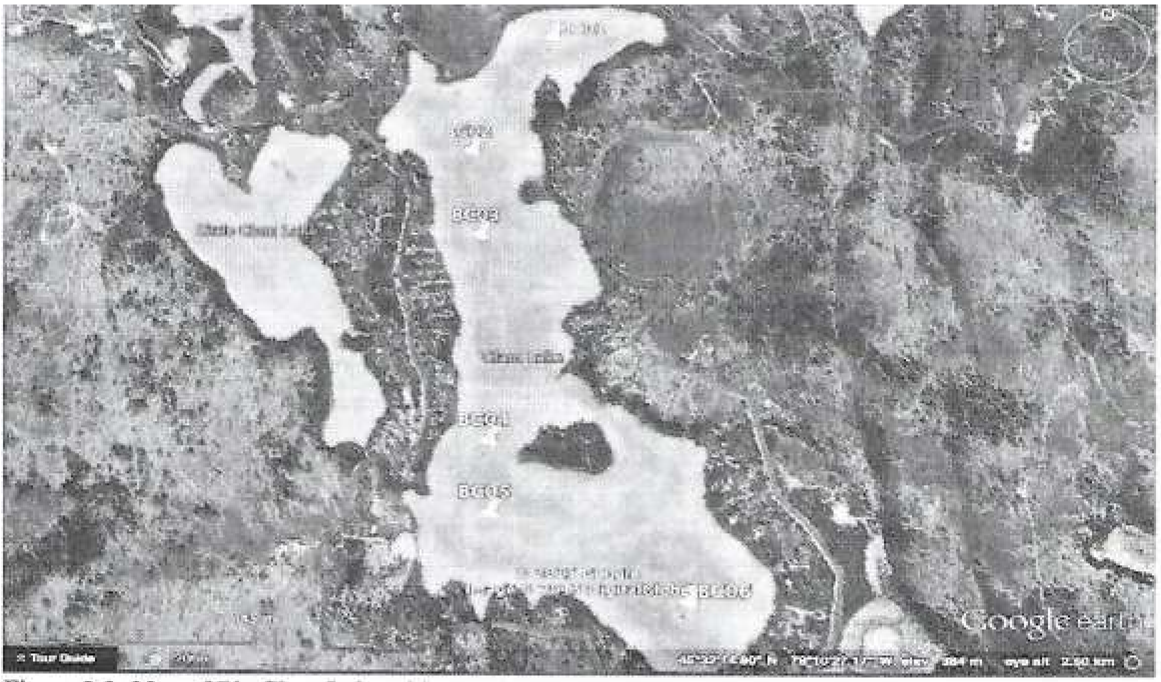
EOI	N 45° 31' 17.3" W 79° 11' 50.7"	E04	N 45° 30' 54.9" W 79°· 11' 45.8"
E02	N 45° 31' 08.7" W79°·12'08.0"	E05	N 45°· 30' 38.5" W 79° 11' 40.4"
E03	N 45° 31' 02.7" W 79° 11' 59.8"	E06	N 45°· 30' 44.7" W 79°' 11' 30.0"

2.3 Big Clam Lake

Big Clam Lake, also known as Clam Lake, is located 11.5 km southeast of Kearney, Ontario. There are a few visible cottages from the lake sample points, the shoreline is moderately developed, and 10% of the surrounding land is Crown Land. Big Clam Lake has one privately owned island known as Prince Edward Island. The map of the sample sites and the GPS coordinates for each sample site can be found below.

Big Clam Lake characteristics (MNRF, 2010).

Surface Area	Mean Depth	Max Depth	Perimeter
71 ha	6111	19 m	6 km (plus 0.5 km island shoreline)



Map of Big Clam Lake with sample sites, Retrieved from Googlc Earth

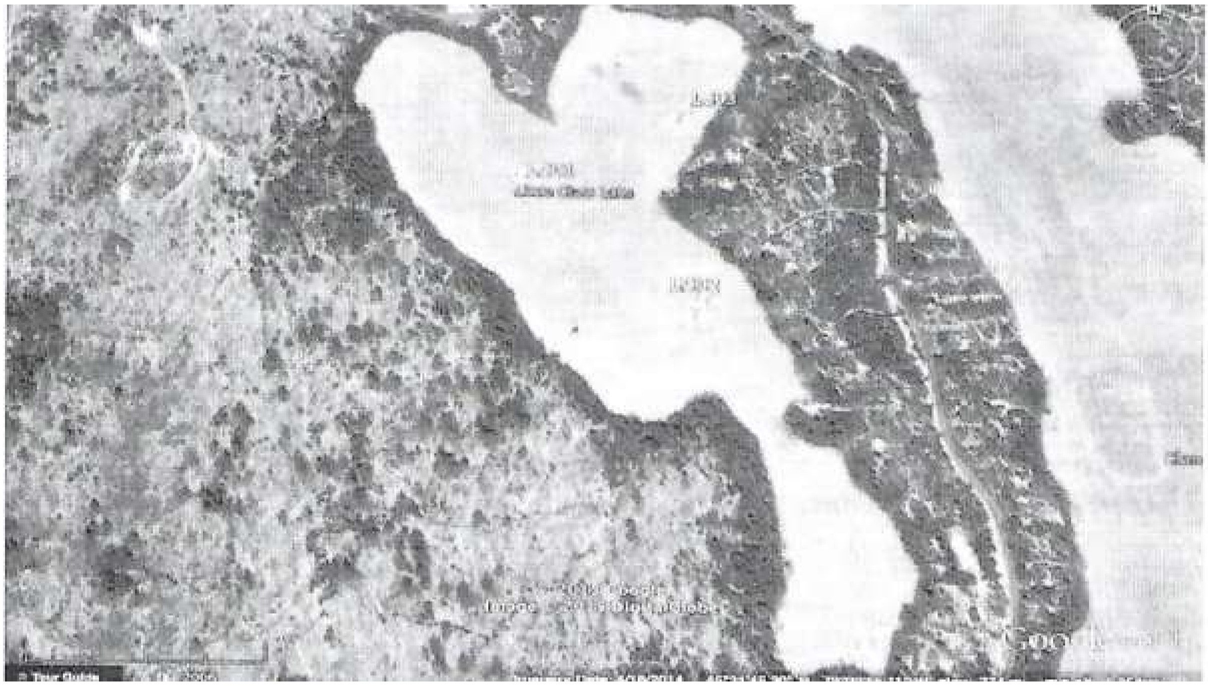
GPS Coordinates for sample sites at Big Clam Lake.

BCOI	N 45° 32' 10.3" W 79° 09' 26.3"	BC04	N 45° 31' 32.5" W 79°09' 32.1"
BC02	N 45° 31' 58.6" W 79° 09' 34.8"	BC05	N 45° 31' 26.7" W 79°' 09' 31.8"
BCO]	N 45° 31' 50.5" W 79° 09' 33.6"	BC06	N 45° 31' 19.9" W 79° 09' 13.0"

2.4 Little Clam Lake

Little Clam Lake is located 7.3 km southeast of Keamey, Ontario. There are a few visible cottages from the sampling points and Bennett's Beehive Cottages are located near sampling point LC03. The surrounding land is not Crown Land, but the lake is near the Upper Raft Lake Conservation Reserve. The lake is relatively shallow as seen below, with the deepest spot near the center of the lake. The map of the sample sites and the GPS coordinates for sample sites can be found below..

Little Clam Lake characteristics (MNRF, 2015). Surface Area 22 ha Mean Depth 6m Max Depth 16m Perimeter 3km



Map of Little Clam Lake with sample sites, Retrieved from Google Earth

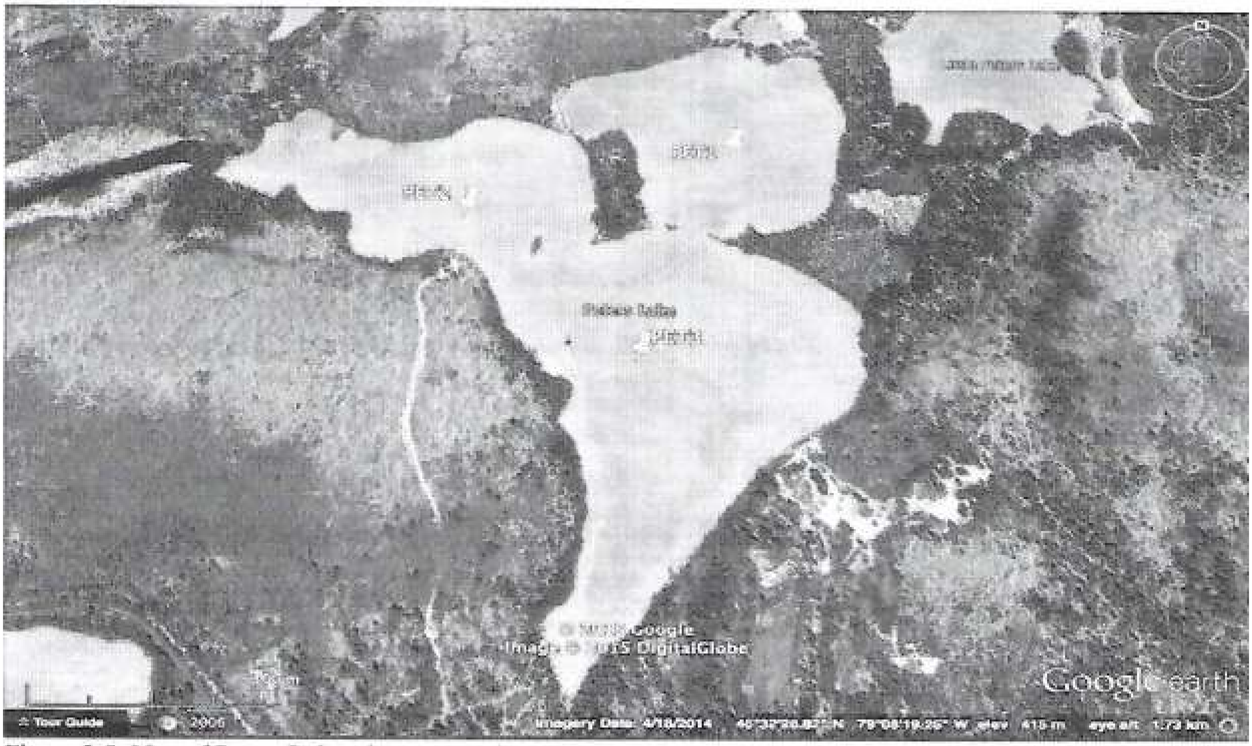
GPS Coordinates for sample sites at Little Clam Lake.

LCOI	N 45° 31' 52.0" W 79° 09' 59.6"
LC02	N 45° 31' 46.3" W 79° 09' 50.8"
LC03	N 45° 31' 55.7" W 79° 09' 51.2"

2.5 Peters Lake

Peters Lake is located 10.1 km east of Kearney, Ontario. Peters Lake is a small shallow lake and does not have any visible cottages around the sampling points but was accessed through the Toronto District School Board (TDSB) outdoor children's camp called "Camp Kearney." Most of the surrounding land is owned by TDSB and 5% is Crown Land. The map of the sample sites and the GPS coordinates for sample sites can be found below.

Peters Lake characteristics (MNRF, 2010). Surface Area 48 ha Mean Depth 4m Max Depth 13m Perimeter 5km



Map of Peters Lake with sample sites, Retrieved from Google Earth

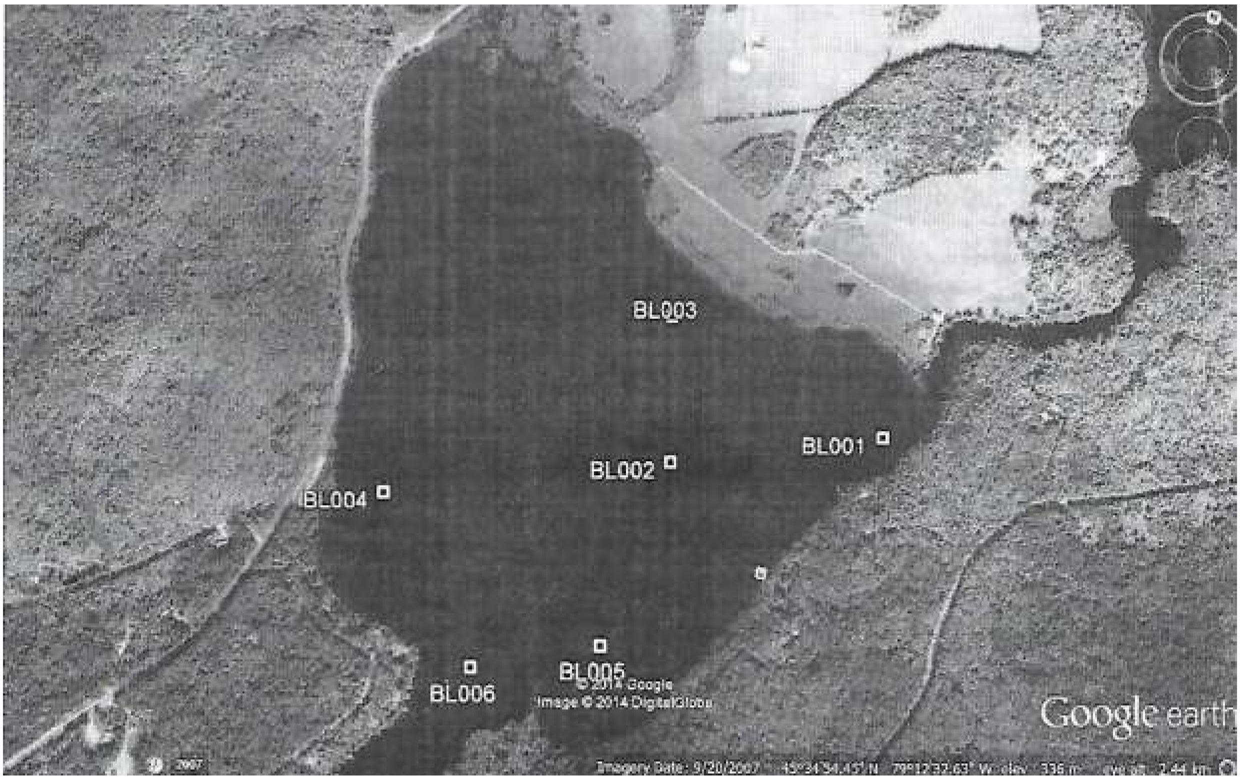
GPS Coordinates for sample sites at Peters Lake.

PETI	N 45° 32' 43.6" W 79° 08' 39.5"
PET2	N 45" 32' 39.0" W 79° 08' 58.6"
PET3	N 45° 32' 29.3" W 79° 08' 46.3"

2.6 Beaver Lake

Beaver Lake is located 3.2 km north of Keamey. Highway 518 is located close to the lake and there are many visible cottages from each of the sampling sites. The map of the lake showing sample sites and the GPS coordinates for the sample sites can be found below

Beaver Lake characteristics (MNRF, 2015). Surface Area 13.6 Ha Max Depth 8.0m Perimeter 2.3 km



Map of Beaver Lake with sample sites, Retrieved from Google Earth

GPS Coordinates for sample sites at Beaver Lake

BOl	N 45°34' 1.7" W 79° 12' 9.0"	804	N 45° 34' 44.6" W 79° 12' 51.3"
802	N 45° 34' 50.8" W 79° 12' 27"	805	N 45° 34' 39.4" W 79° 12' 29.3"
803	N 45° 34' 59.4" W 79° 12' 30.3"	806	N 45° 34' 36.2" W 79° 12' 39.9"

2.7 Hassard Lake

Hassard Lake connects to both Beaver and Perry Lake. The lake is beside downtown Kearney, Ontario. Water flows from Beaver Lake into the northern end of Hassard Lake and exits at its southern end into Perry Lake. The surrounding land is developed. There are more lawns and less of a riparian zone visible from the sampling points. The map of the sample sites and the GPS coordinates for the sample sites can be found below.°

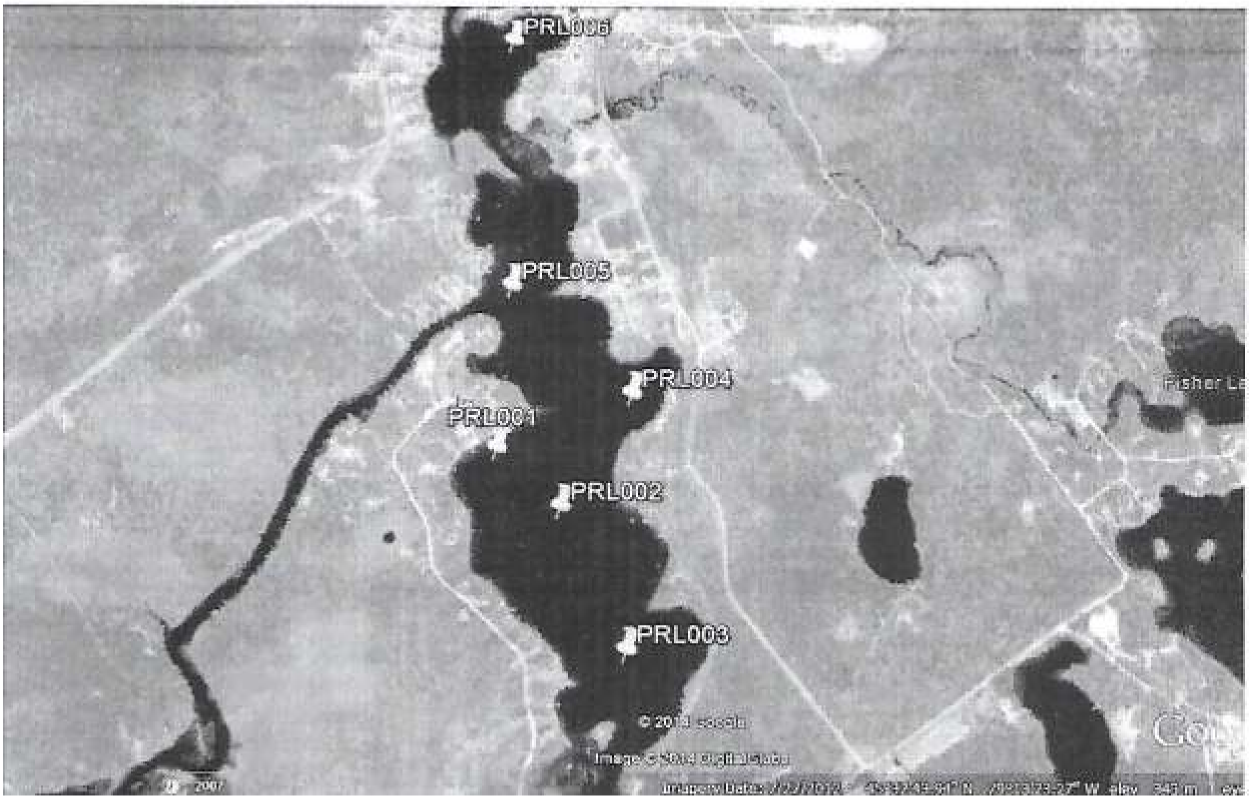
Map of Hassard Lake with sample sites, Retrieved from Google Earth

GPS Coordinates for sample sites at Hassard Lake.

HOI	N45°34' 1.7" W 79° 13' 4.1"	H04	N 45° 33' 28.7" W 79° 13' 29.7"
H02	N 45° 33' 47.0" W 79° 13' 27.7"	H05	N 45° 33' 33.1" W79° 13'32.6"
H03	N 45° 33' 34.6" W 79° 13' 22.4"	H06	N 45° 33' 37.8" W 79° 13' 26.7"

2.8 Perry Lake

Perry Lake is located in downtown Kearney. There is a public dock on Main St. and there are several cottages and homes visible from the sampling points. There is a heavy riparian zone south of the lake. The map of the lake showing the sample sites and the GPS coordinates for the sample sites can be found below.



GPS Coordinates for sample sites at Perry Lake.

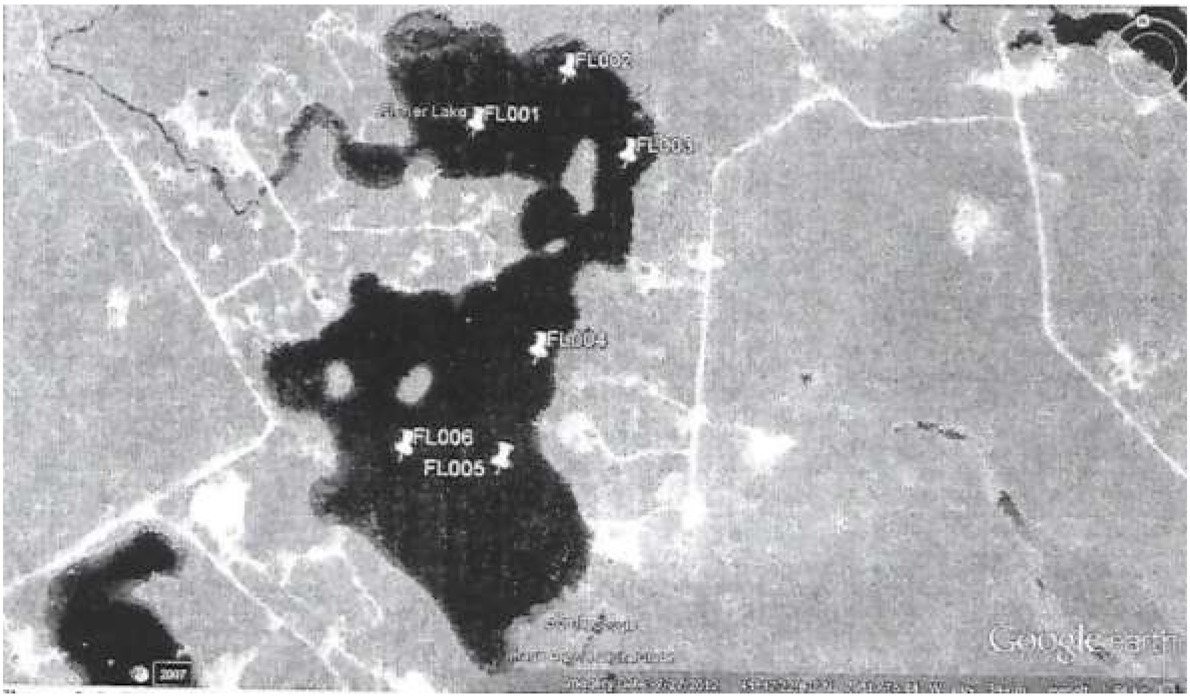
POI	N 45° 32' 42.9" W 79° 13' 47.7"	P04	N 45° 32' 44.9" W 79° 13' 30.9"
P02	N 4Y 32' 36.9" W79° 13' 41.9"	P05	N 45° 32' 56.2" W 79° 13' 42.0"
P03	N 45° 32' 24.2" W 79° 13' 38.i"	P06	N45°33' 17.9" W 79° 13' 35.3"

2.9 Perbeth/Fisher Lake

Perbeth Lake, also known as Fisher Lake, is located 2.8 km south of Kearney. It is a very shallow lake and has both springs and marshes in the lake. There is no Crown Land around the lake and the riparian zone is currently under construction with new cottages being built. The map of the lake with the sample sites and their GPS coordinates are shown below

Perbeth/Fisher Lake characteristics (MNRF, 2015).

Surface Area	Mean Depth	Max Depth	Perimeter
31 Ha	2m	4.5 m	4 km (plus 0.6 km island shoreline)



Map of Perbeth/Fisher Lake with sample sites, Retrieved from Coogle Earth

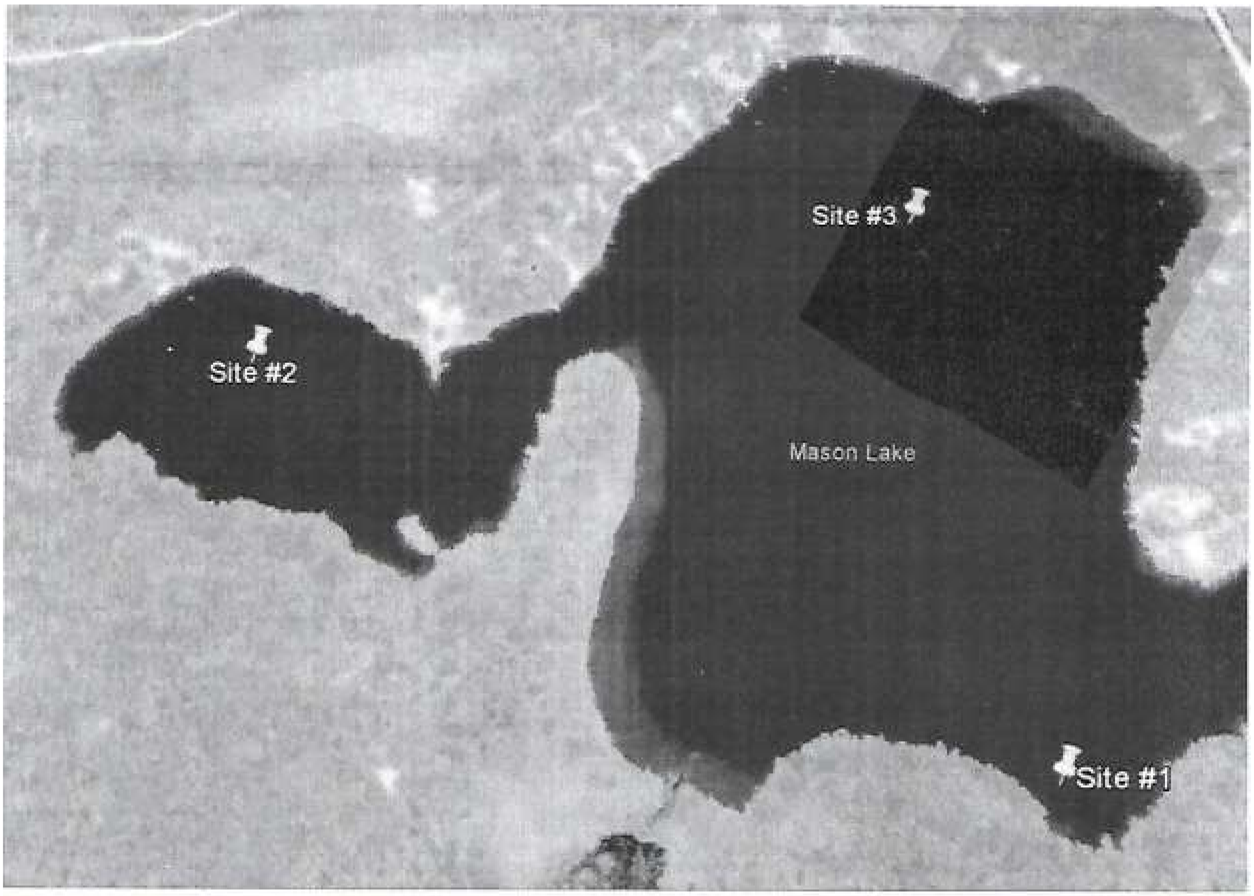
GPS Coordinates for sample sites at Perbeth/Fisher Lake.

PFOI	N 45° 32' 34.7" W 79° 12' 22.5"	PF04	N 45° 32' 22.4" W 79° 12' 12.2"
PF02	N 45° 32' 36.7" W 79° 12' 15.2"	Pf05	N 45° 32' 17.6" W 79° 12' 25.1"
PF03	N 45° 32' 31.5" VI 79° 12' 12.3"	PF06	N 45° 32' 19.1" W 79° 12' 31.3"

Above PF04 coordinates are incorrect we used N 45° 32' 22.7" W 79° 12' 20.8" based on the above map and our lake stewards memory of the location. PF04 would have put us several hundred feet into the bush.

2.10 Mason Lake

Mason Lake has a surface area of only 40 hectares and is the smallest lake sampled in this report. Maximum depth is 14m, mean depth is 6m and perimeter is 4km. This lake is spring-fed on the northwestern side. Mason Lake is moderately developed with private residences without any public access points. A map of the lake and the location of sampling sites including their GPS coordinates are located below.



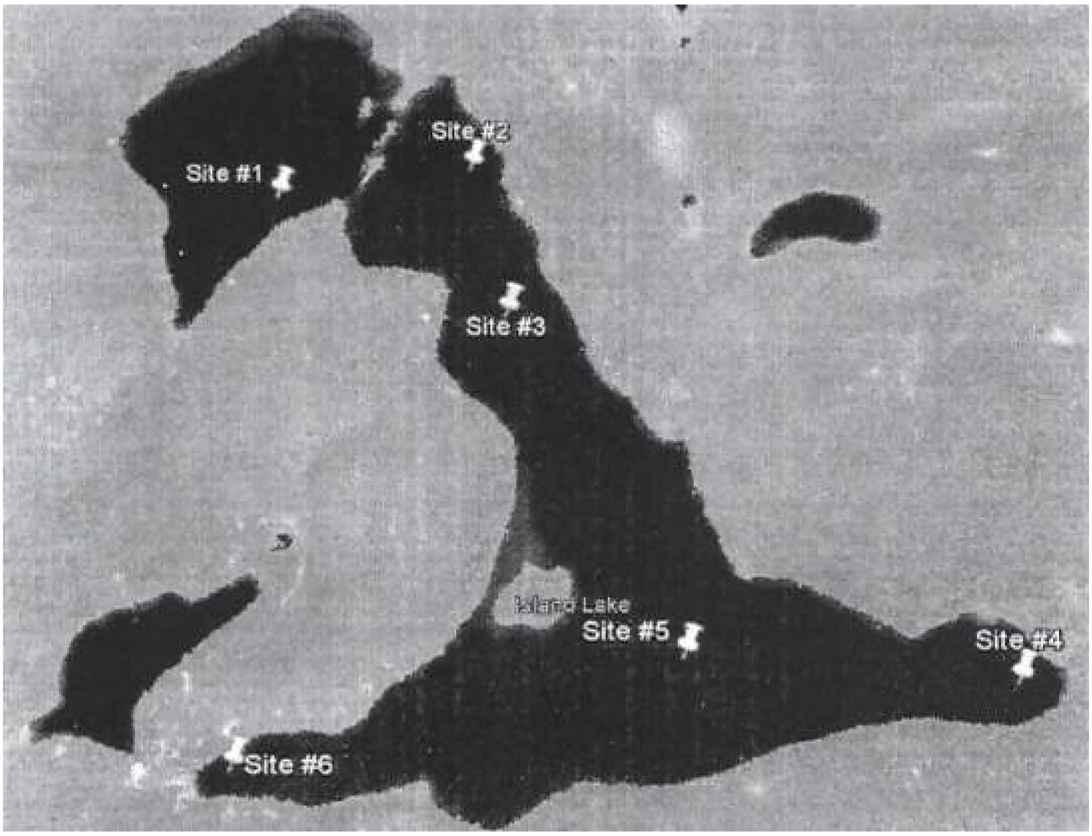
Map of Mason Lake with sample sites, Retrieved from Googlc Earth

Mason Lake sites and GPS coordinates.

Site	GPS Co-ordinate
Ml	N45°38' l5.9" W079°13'55.4"
M2	N45°38'27.S" W079°14'26.7"
M3	N45°38'32.7" W079°14'OO.8"

2.11 Island Lake

Island Lake, previously called Proudfoot Lake, is a medium-sized lake which supports a large diversity of fish species (US EPA, 2012b). There is a public access point at the southwestern tip of Island Lake with a small parking lot and dock for cottagers. There is a moderate amount of development surrounding the lake. Surface area is 130 ha, perimeter is 8.7 km Maximum depth is 29 m and mean depth is 10 m. A map of the lake showing the location of the sampling sites plus a list of their GPS coordinates are located below.



Map of Island Lake with sample sites, Retrieved from Coogle Earth

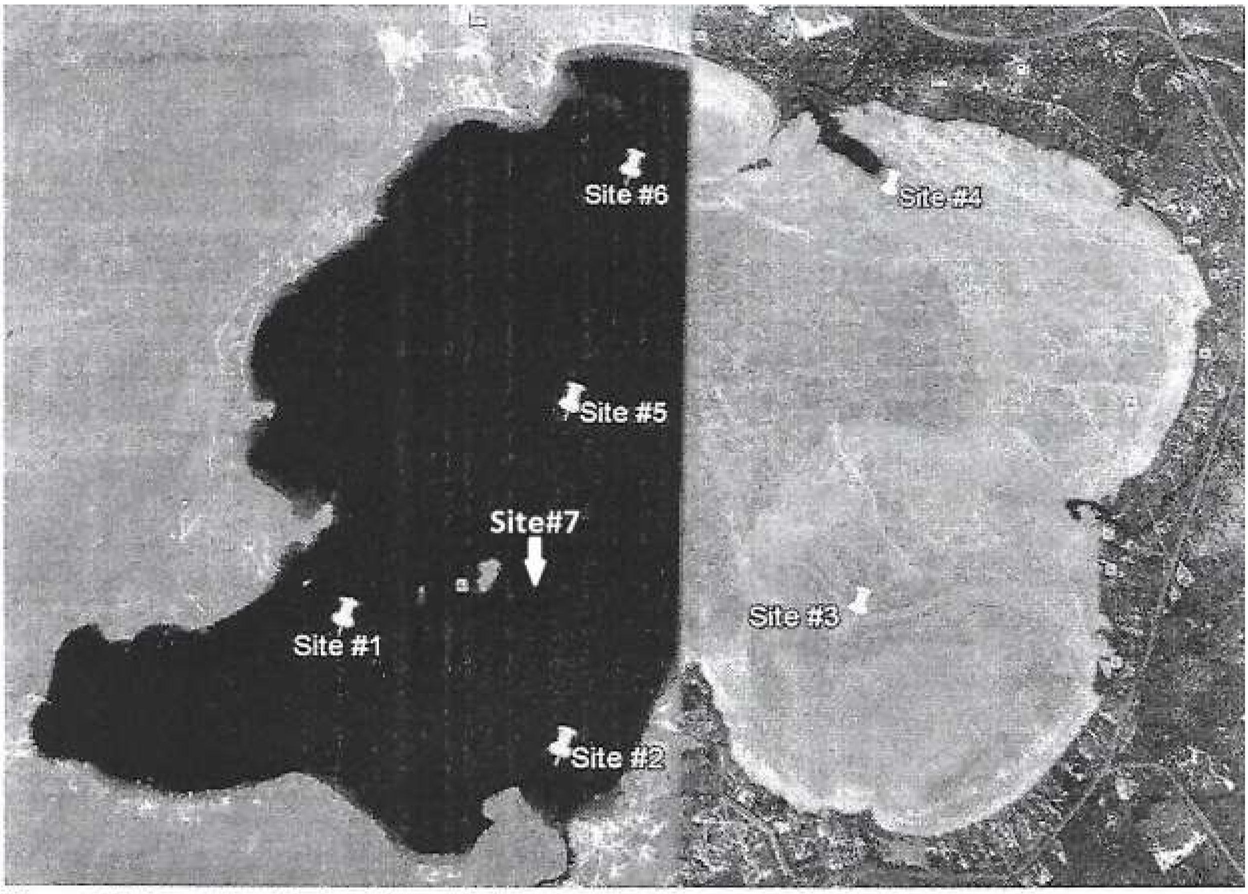
Island Lake sites and coordinates.

Site	GPS Coordinate	Site	GPS Coordinate
11	N45°41’30.6” W079°14’ 52.7”	14	N45° 40’ 52.6” W079°14'35.5”
12	N45°41’33.2” W079°14’ 31.9”	15	N45° 40’ 54.9” W079°14'07.6"
13	N45°41’22.5” W079°14’ 25.0”	16	N45° 40’ 47.5” W079°14' 51.0”

Site I1, I2 & I3 were all listed as being the same. Using the map above as a reference, our lake steward/volunteer took us to the sites as he remembered them and we recorded new coordinates which are reported above.

2.12 Sand Lake

Sand Lake has a surface area of 580 hectares and is highly developed with approximately 300 cottages and 4 public resorts around its 12.2 km perimeter. It has a maximum depth of 59m and a mean depth of 22m. This lake can be accessed through a public access point. There are sandy beaches along several shores, which appear to be eroding and creating a shallow shoreline. The Magnetawan River flows in through the north side of the lake and exits at the south side. A map of the lake showing the location of sampling sites plus their GPS coordinates are located below.



Map of Sand Lake with sample sites, Retrieved from Google Earth Sand Lake sites and GPS coordinates

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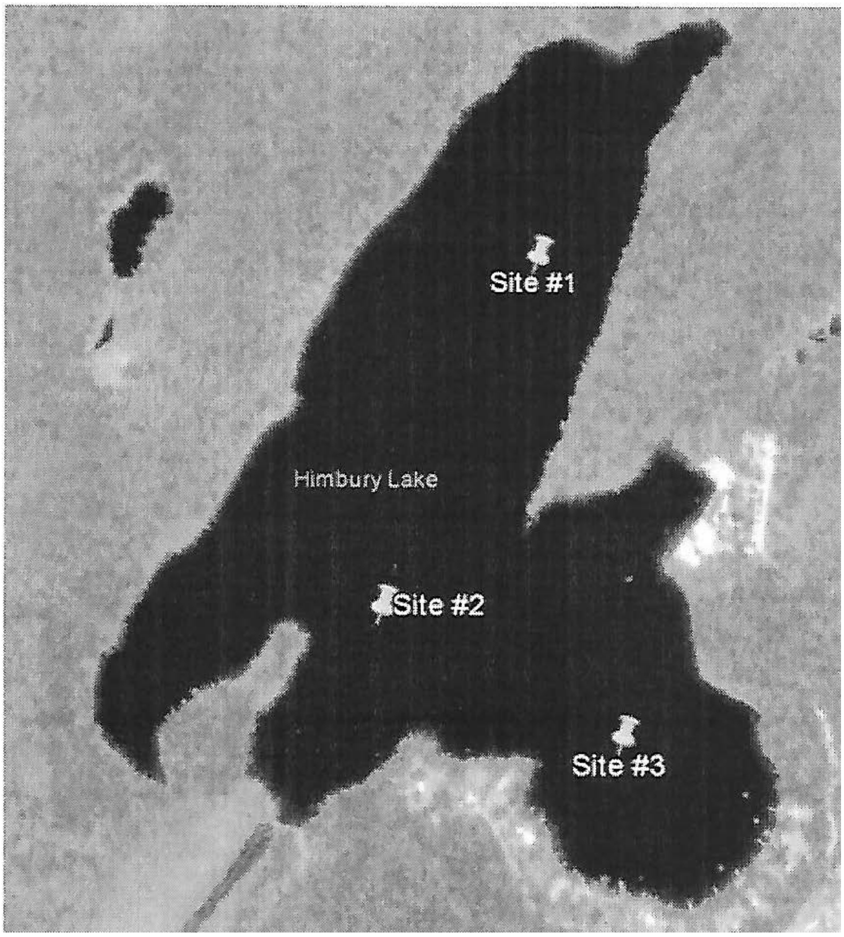
Site	GPS Co-ordinate	Site	GPS Co-ordinate
S1	N45°37'12.7" W079°11'09.6"	S4	N45°37'57.0" W079°09'55.7"
S2	N45°37'09.7" W079°37'09.7"	S5	N45°37'34.0" W079°10'40.4"
S3	N45°37'13.9" W079°10'01.2"	S6	N45°38'12.1" W079°10'32.9"

We found S2 coordinates very inaccurate and replaced them with N 45° 37’ 04.6” W79° 10’41.4” We had problems with high wind and a dragging anchor while evaluating the second instrument in 2016 and picked Site #7 (N45°37’ 17.3” W79° 10’ 44.3”) because it was deep but more sheltered. We don’t anticipate including it as a regular sampling site.

2.13 Himbury Lake

Himbury Lake is a small lake with a surface area of 49 hectares. This lake is located southwest of Sand Lake reached through a short portage between the two lakes. Much of the development on this lake is on the western side and the northern bay of the lake is surrounded by undeveloped Crown Land
This lake is spring fed on the northern side.



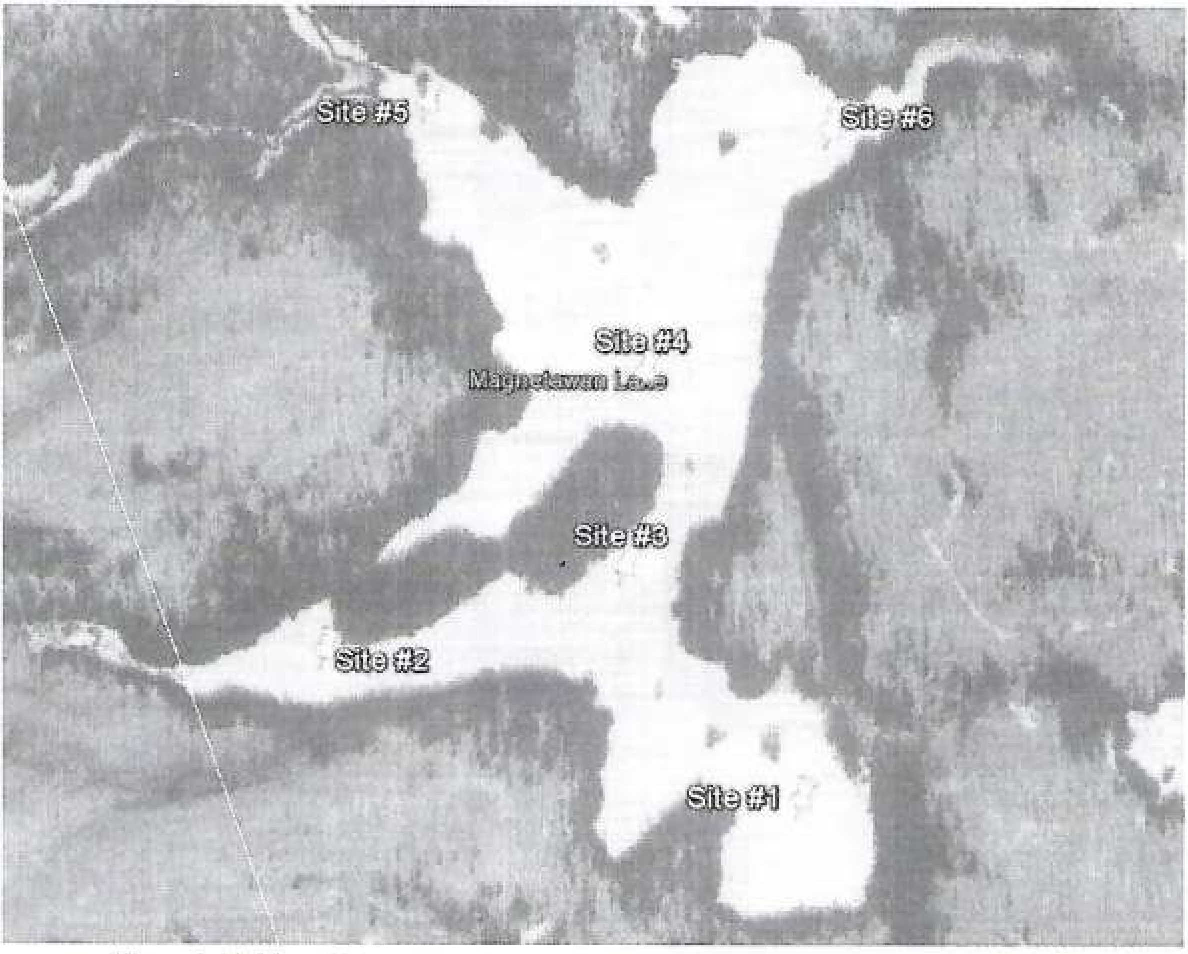
Map of Himbury lake showing sampling sites – retrieved from Google Earth.

GPS Co-ordinates for sample sites listed below.

Site	GPS Co-ordinate
H1	N45°36'31.7" W079°12'12.7"
H2	N45°36'15.4" W079°12'18.5"
H3	N45°36'11.4" W079°12'03.4"

2.14 Magnetawan Lake

Magnetawan Lake is located outside of Kearney and is situated inside the western boundary of Algonquin Provincial Park. This lake is the headwaters for the Magnetawan River and is surrounded by protected land. There are four campsites located around Magnetawan lake. A map of the lake showing the location of the sampling sites plus a list of their GPS coordinates are located below.



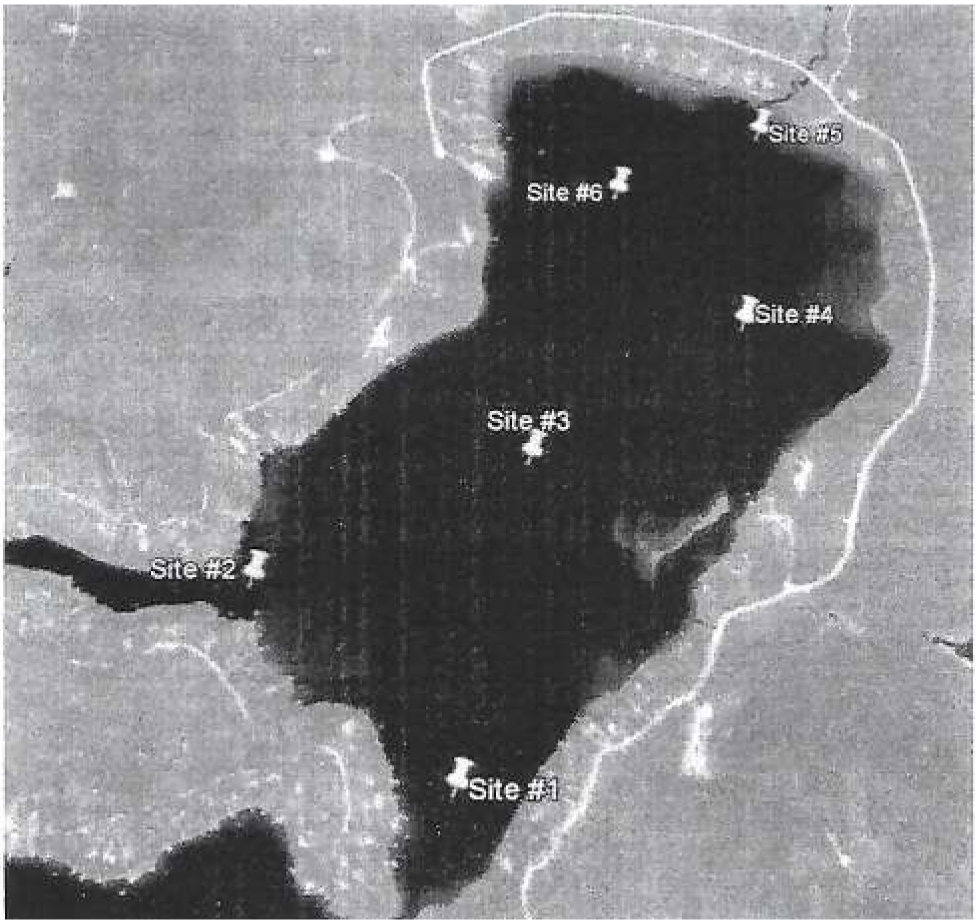
Map of Magnetawan Lake with sample sites, Retrieved from Coogle Earth

Magenetewan Lake sites and GPS Coordinates

Site	GPS Co-ordinate	Site	GPS Co-ordinate
MWl	N45° 39' 23.4" W078°59'04.2"	MW4	N45° 39' 47.7 W078° 59' l5.4"
MW2	N45° 39' 32.9" W078° 59'39.3"	MWS	N45° 40' 02.1" W078° 59' 32.0"
MW3	N45°39' 37.4" W078°59' 16.9"	MW6	N45°40' 0.07" W078° 59' l.5"

2.15 Grass Lake

Grass Lake is a medium-sized lake with a surface area of 138 hectares, maximum depth of 37m, mean depth of 11 and a perimeter of 6.4km. This lake is developed with cottages located around the entire perimeter. Grass Lake is connected by a channel to Loon Lake where there is a dam that controls water levels. A map of the lake and the location of sampling sites plus a list of their GPS coordinates are located below.



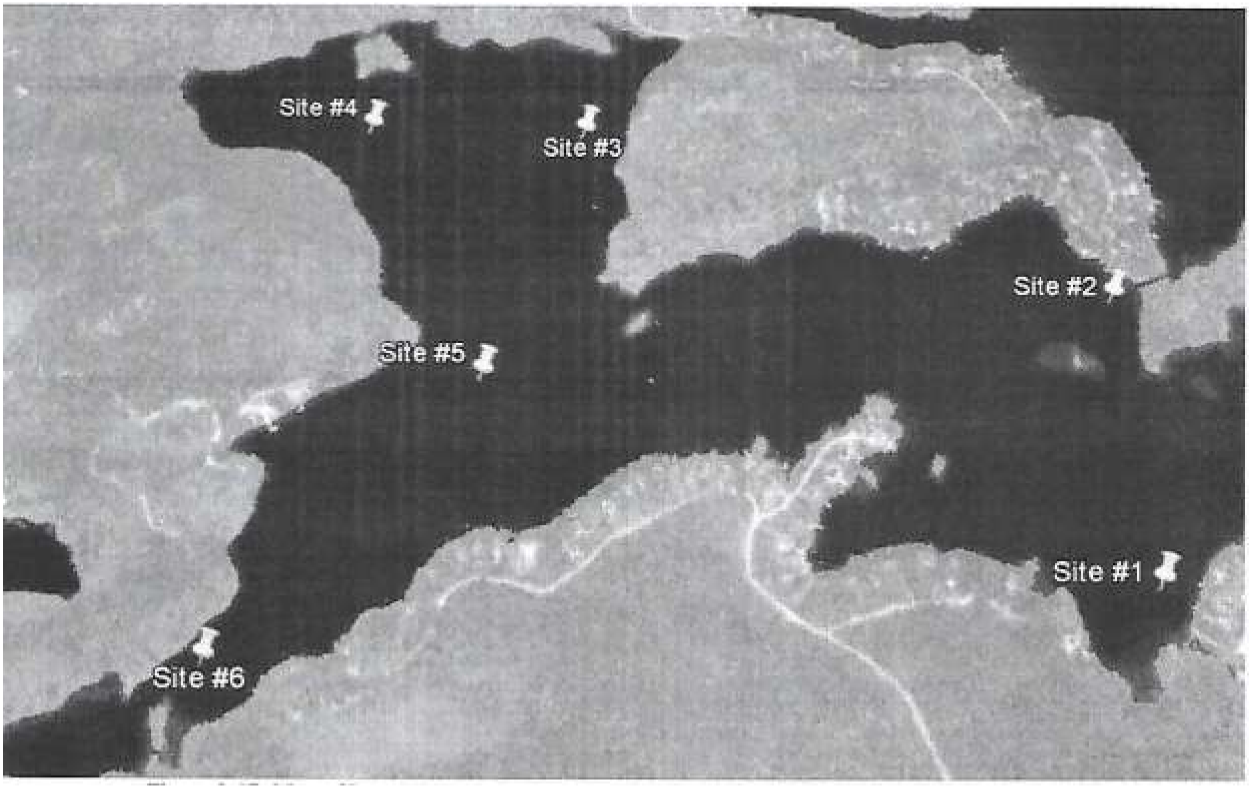
Map of Grass Lake with sample sites, Retrieved from Google Earth

Grass Lake Sites and Coordinates

Site	GPS Co-ordinate	Site	GPS Co-ordinate
GI	N45° 40' 20.9" W79° 12' 20.6"	G4	N45° 40' 52.7" W79° 11' 56.0"
G2	N45° 40' 33.S" W79° 12' 38.9"	GS	N45° 41' 08.7" W79° 11' 53.7"
G3	N45° 40' 42.6" W79° 12' I5.4"	G6	N45° 41' 03.2" W79° 12' 07.8"

2.16 Loon Lake

Loon Lake has a surface area of 156 hectares, maximum depth of 26.2m, mean depth of 7.1 m and a perimeter of 8.0 km. There is high development along the entire shoreline of this lake. There is a dam operated by the Ministry of Natural Resources that controls water levels in this lake. A map of the lake with the location of sampling sites plus their GPS coordinates are located below



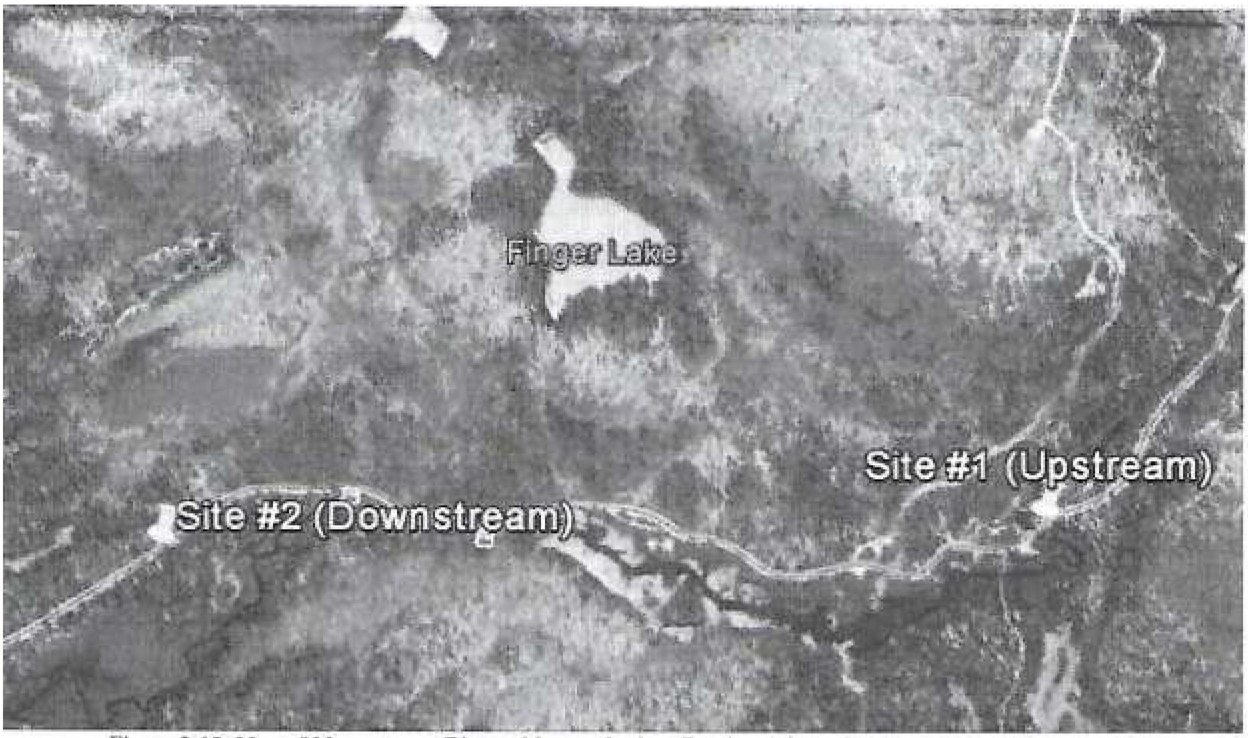
Map of Loon Lake with sample sites, Retrieved from Google Earth

Loon Lake sites and coordinates

Site	GPS Coordinate	Site	GPS Coordinate
Ll	N45° 39' 53.1" W79° 12' 27 .5"	L4	N45° 40' 23.4" W79° 13' 38.0"
L2	N 45° 40' 12.0" W79° 12' 29.6"	LS	N45° 40' O5.3" W79° 12' 29.6"
L3	N45° 40 '23.4" W79° 13' 17.9"	L6	N45° 39' 47.1" W79° 13' 44.2"

2.17(a) Magnetawan River

The Magnetawan River is 175 km long and one tributary originates in Algonquin Provincial Park at Magnetawan Lake. The river runs westward and exits into Georgian Bay linking many of the lakes sampled in this report. The sample site MRI is on a tributary that also rises in Algonquin Park passes close to the Kearney Graphite Mine and joins the Magnetawan River just below our sample site MR3. The MR1 sample site is upstream of the mine site and provides us with normal background reading levels. The second site, MR2, was selected about 1.6 km downstream from MRl and the decommissioned graphite mine. There were water quality concerns about mining effluent and tailings leakage. The MR2 sampling site is used to monitor this concern. A map of the river with the location of these two sampling sites plus their GPS coordinates are located below. Map and coordinates for MR3 are on the next page.



Map of Magnetawan River with sample sites, Retrieved from Coogle Earth

Magnetawan River sites and coordinates

Site	GPS Co-ordinate
MRI	N45° 42' 40.3" W79° 04' 07.S"
MR2	N45° 42' 36.7" W79° 05' 20.6"

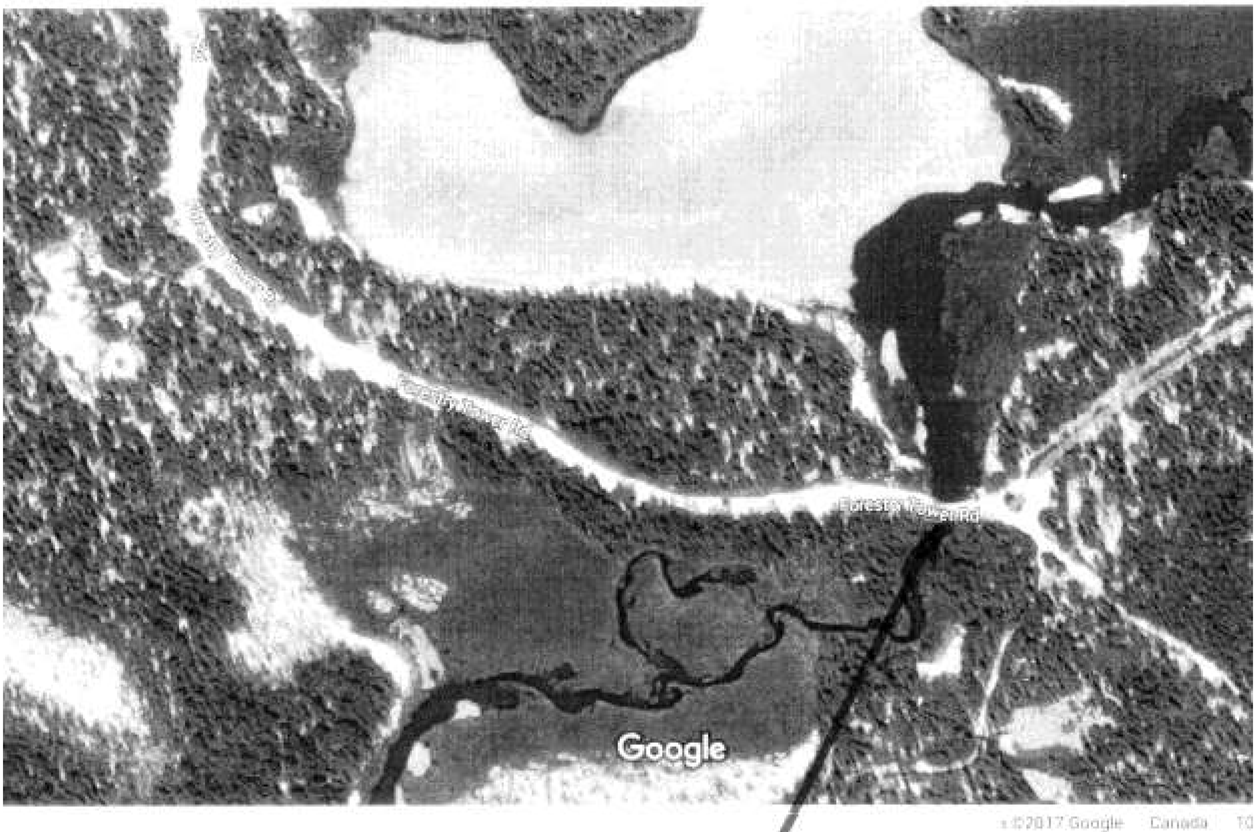
2.17(b) Magnetawan River

We added a third site in 2016 on the Magnetawan River several kilometers below MR2. This additional monitoring point was picked to see how much the pH and conductivity readings were reduced. The site on the river is easily accessed from a bridge over the river. The map of the river with the location of sampling site plus the GPS coordinates are located below.

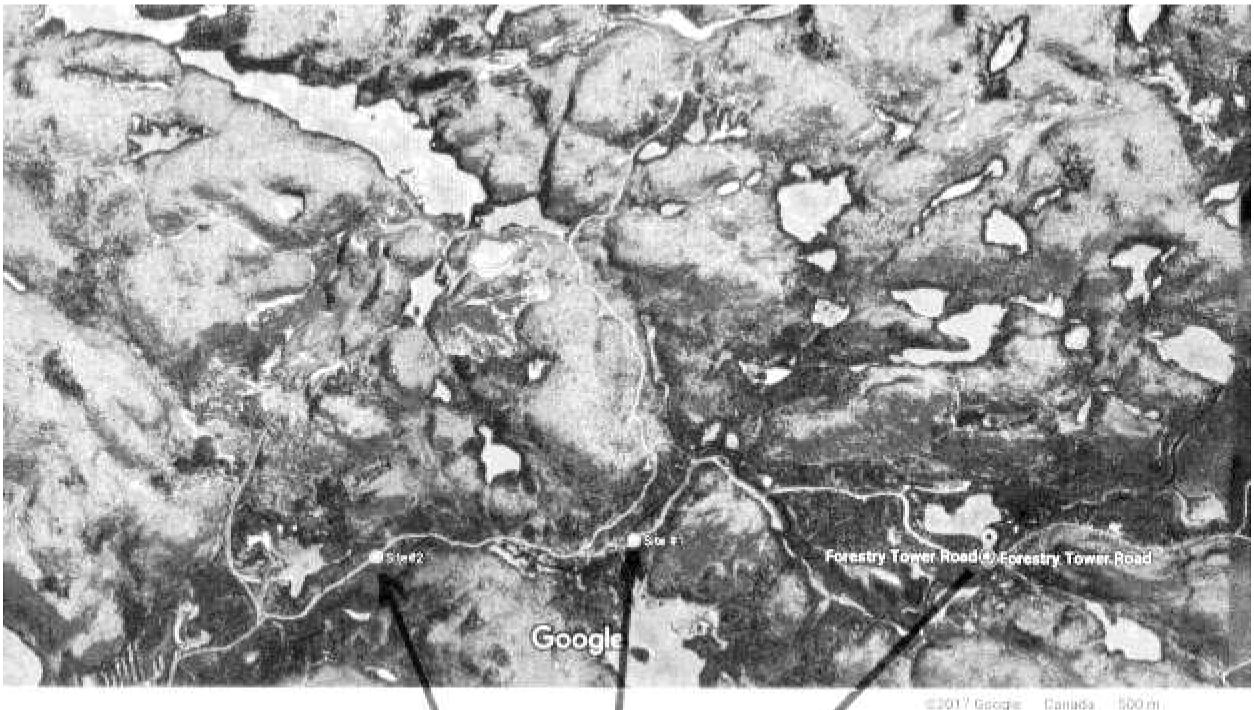
Map of Magnetawan River with third sample site MR3

Site #3 GPS coordinates N 45° 40’ 12.0” W 79° 07’ 46.3

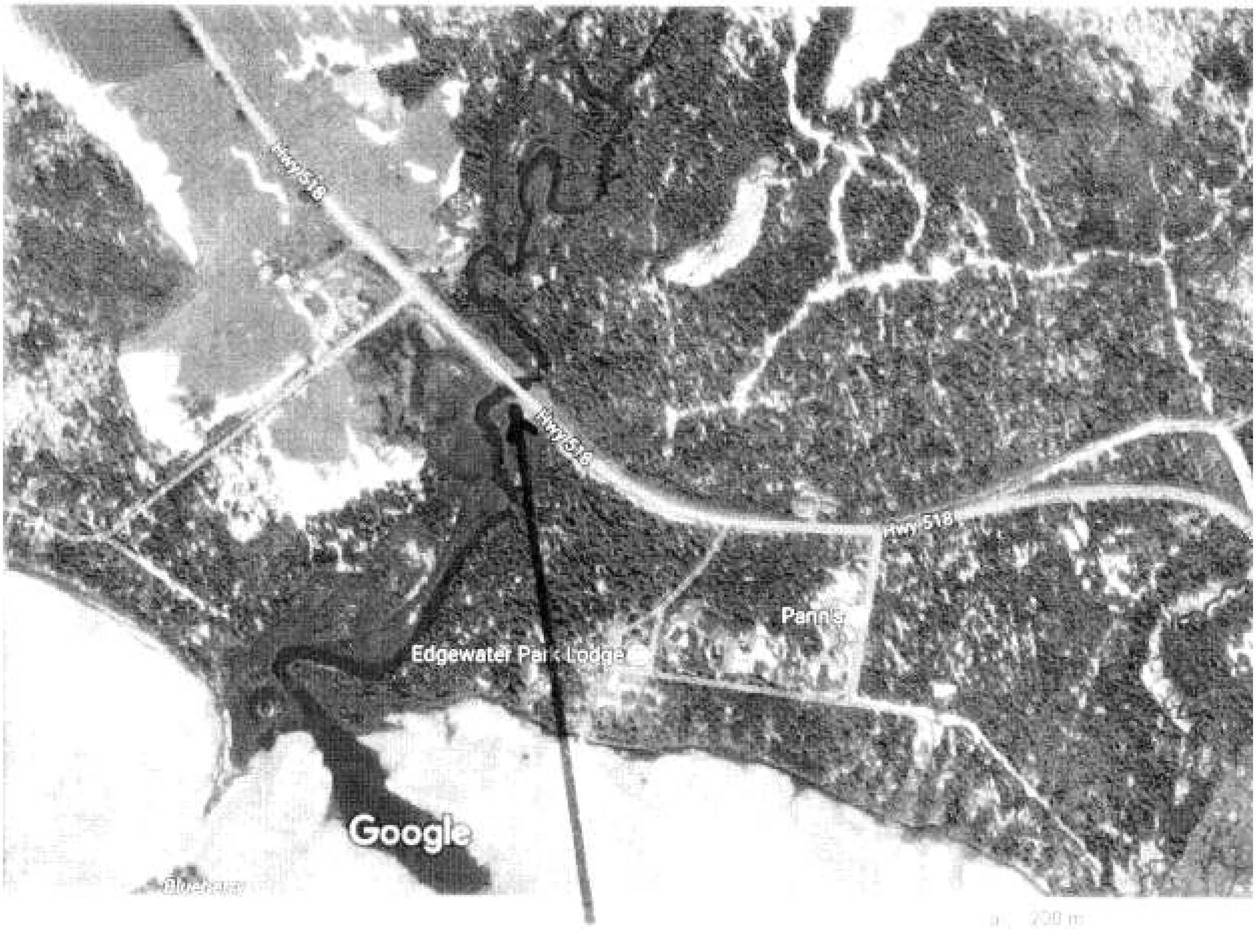
We added two additional sites on the Magnetawan River in 2017. To be sure we were well away from any ground water influences from the mine site we added MR4 which was above MR1 at a culvert on the Forestry Tower Rd that goes to the Magnetawan Lake. This was well above the mine site where water from Charlie’s Lake and the headwaters of the Magnetawan River cross the road. Flow is from left-right when you are inbound to Magnetawan Lake. MR5 is at the down river side of the bridge on Hwy #518 where the Magnetawan River crosses just before it enters Sand Lake and was added out of interest to see if the pH and conductivity levels had dropped to background levels this far from the minesite.



Site #4
Magnetawan River



Site #2 Site #1 Site #4
Magnetawan River



Site #5 Magnetawan River

Map of location of Site#5 – Hwy 518 crosses Magnetawan just before the river enters Sand Lake.

3.0 Measurement Methodology

The DO, pH, Conductivity, Turbidity and temperature readings were taken by the YSI PRODSS multi-parameter field instrument on site. The cable connecting the sensor package to the readout unit was marked off in meter intervals. We located the sample sites on the lake using a Magellan eXplorist 310 GPS handheld receiver and the co-ordinates provided in the 2016 reports. The co-ordinates were entered prior to arriving at the lake..

When we arrived at each sample site we verified the depth of water with a depth finder, and if the volunteer was able to hold the boat on station we didn't use an anchor to avoid stirring up the mud on the bottom. We lowered the sensor package into the water at the surface, waited for the readings to stabilize then took the initial set of readings by pressing the "take sample" button on the instrument. The data is recorded in the memory of the hand held display unit. After that the sensor package was lowered a meter at a time using the markings on the cable as a depth reference. At each depth we would wait for the readings to stabilize before recording the readings. If this was the designated deep spot we would continue down for at least 20 meters or until we approached the bottom. If this was a non- deep spot this year we took readings until we had crossed through and were at least a couple of meters below the Thermocline or were within a meter of the bottom. All the readings for that particular site on the lake were kept in the same file in the memory of the display unit.

This year we also took a water sample at two different sites on each of the first 5 designated lakes. Once we had established the depth of the thermocline using the PRO DSS instrument, we rinsed the Beta Bottle Sampler with surface water several times then lowered it down to the thermocline area and triggered the sampler to capture water at that depth. The sampler was then returned to the surface where the lab sample bottle was rinsed 3 times with water from the Beta Bottle Sampler before filling it with more water from the sampler. Part of the sampling technique is to drag the sampler sideways at depth to make sure that the water captured in the sampler tube is from that depth. Because the doors on both ends of the tube are open before the sampler is triggered the technique works quite well.

This year, because we only did a profile on one deep spot per lake, our time on the lake was reduced to less than 90 minutes if there were six sample sites. On the other sites we still did a profile but generally just down to 5-6 meters. Each evening the data collected that day was uploaded from the instrument into a spreadsheet on a personal computer.

The YSI ProDSS instrument performed as well as hoped with a couple of exceptions. The unit we rented had been used for off shore work in BC and came with a 90 meter cable that was a bit unwieldy to use on our lakes. After some preliminary testing during the first couple of days it was determined that the pH was high by about 0.22 units. The pH sensor was re-calibrated and everything seemed fine after that. Two days later during a routine calibration check the unit again was about .15 units high. After talking to Hoskins they suggested that we do a two point cal (7 and 4) instead of just the single point (7) performed a couple days before. After that the pH checked out ok. On the 23rd we experienced an intermittent problem while doing Groom/Lynx lake where the unit stopped taking readings. On contacting Hoskins they suggested that we bring the unit in to be checked out, which was done the following day. They discovered an intermittent break in the cable and replaced the cable. Unfortunately all they had on hand was a 10 meter cable but since we had completed most of our testing on deep lakes so it wasn't a serious problem.

The instruments were calibrated both times at Hoskins Scientific before we picked them up and we were provided with standard solutions so that we could check the calibration. We checked both instruments at the start, during the test program and before the instrument was returned to be sure the unit was still calibrated.

We also took at least one Secchi disc reading on each lake. We are aware that there can be quite a variation in Secchi disc readings caused by amount of sunlight, wave action and what the individual observer considers a "visible" disc. Secchi readings are also taken by the Lake Partners volunteers throughout the summer and should be similar to our readings. This year probably because of all the rain, it appeared that water clarity was not as good as last year.

Because of the quantity of rainfall and cooler weather we experienced this year, we realized that we should probably be including weather data and perhaps lake flow and water level data and will be looking into how we can obtain that data for next year. We have copied some information from the Environment Canada website regarding rainfall and pH.

4.0 Measured Parameters and Water Quality Standards

The parameters measured were chosen by the community partners because of their ability to indicate the health of a lake (WHO, 20 II; EPA, 2012). Guidelines describing appropriate or safe levels for measured parameters were found in the MOECC's Provincial Water Quality Objectives (PWQO) and the World Health Organization's (WHO) Guidelines for Drinking-Water Quality (MOECC, 1994; WHO 2011). PWQO measure the aquatic toxicity, bioaccumulation, and mutagenicity of a water source in order to identify the quality of water for human recreation purposes and overall health of the lake (MOECC, 1994). In order to maintain the PWQO, the water quality of lakes in Ontario should be monitored regularly and compared to appropriate standards.

4.1 Temperature

The temperature of a water source can directly affect many of the physical, biological, and chemical factors of aquatic organisms (Environment Canada, 2013). If the temperature rises above the tolerance for a specific organism it can lead to detrimental effects (Environment Canada, 2013). Temperature can also affect other parameters within the water, such as, dissolved oxygen. High water temperatures can decrease oxygen levels and increase algal growth, while low water temperatures can increase oxygen levels (CCME, 2011).

Preferred Temperature Range for Adult Freshwater Fish (Deg. Celsius)

Name	Range	Limit	Name	Range	Limit
Atlantic Salmon	12-16	23	Lake Trout	9-13	23
Chinook Salmon	12-16	25	Lake Whitefish	11-15	26
Coho Salmon	12-16	25	Pink Salmon	13-17	24
Rainbow Trout	12-20	26	Brook Trout	13-17	24
Northern Pike	17-21	32	Brown Trout	15-18	24
Walleye	19-23	31	Yellow Perch	20-24	31
Black Crappie	21-25	32	White Sucker	22-26	31
Small Mouth Bass	20-26	35	Muskellunge	22-26	33
Freshwater Drum	24-28	32	White Bass	28-32	36

Pumpkinseed	22-30	35	Rock Bass	25-29	36
Bluegill	24-30	35	Brown Bullhead	26-30	36
Bowfin	28-32	35	White Perch	26-30	36
Common Carp	28-32	35	Largemouth Bass	26-30	36

The material above was taken from a poster published by Fisheries & Oceans Canada, Consevation Ontario and Ontario Ministry of Natural Resources.

The “Limit” in the table above is actually Upper Lethal Limit – all temperatures are in degrees Celsius

4.2 Secchi Disc

Secchi discs are used to provide a visual measure of water clarity and optical depth (CCME, 2011). A secchi disc is lowered into the body of watcr in a shaded location; the best time of day to sample sec chi depth is midday (CClYlE, 2011). The deeper the secchi disc reading is, the clearer the lake. The CCME recommends that secchi measurements should be made every two weeks between June and October, if possible. Secchi depth provides an idea of how turbid the water is. High turbidity can be caused by soil erosion, waste discharge, urban runoff and excessive algal growth (EPA, 2012). The Provincial Water Quality Guidelines states that if the water body is for recreational use, and the bottom is not visible, the water should have a secchi reading of at least 1.2 m (MOECC, 1994).

4.3 Dissolved Oxygen

Dissolved oxygen (DO) is present in water due to photosynthetic activity and diffusion (CCME, 1993). The DO concentration is dependent on the temperature and atmospheric pressure within the water (CCME, 2011). Fast moving water will have higher dissolved oxygen due to the mixing of water with air (CCME, 1993). Oxygen is required for basic life processes. Higher levels can better support some sensitive lake species and is used as an indicator of water quality. The presence of agriculture, industry and deforestation can lower dissolved oxygen levels, because runoff from these sources can react with oxygen through decomposition reactions (CCME, 1993). Recommended levels for cold-water systems are no lower than 9.5 *mg/L* (CCME, 1993).

Dissolved Oxygen requirements for various fish Species

The following information was taken from the following website : http://www.fondriest.com/environmental-measurements/parameters/water-quality/dissolved-oxygen

Coldwater fish like trout and salmon are most affected by low dissolved oxygen levels. The mean DO level for adult salmonids is 6.5 mg/L, and the minimum is 4 mg/L . These fish generally attempt to avoid areas where dissolved oxygen is less than 5 mg/L and will begin to die if exposed to DO levels less than 3 mg/L for more than a couple days . For salmon and trout eggs, dissolved oxygen levels below 11 mg/L will delay their hatching, and below 8 mg/L will impair their growth and lower their survival rates. When dissolved oxygen falls below 6 mg/L (considered normal for most other fish), the vast majority of trout and salmon eggs will die.

Bluegill, Largemouth Bass, White Perch, and Yellow Perch are considered warm water fish and depend on dissolved oxygen levels above 5 mg/L. They will avoid areas where DO levels are below 3 mg/L, but generally do not begin to suffer fatalities due to oxygen depletion until levels fall below 2 mg/L. The mean DO levels should remain near 5.5 mg/L for optimum growth and survival .

Walleye also prefer levels over 5 mg/L, though they can survive at 2 mg/L DO levels for a short time. Muskie need levels over 3 mg/L for both adults and eggs . Carp are hardier, and while they can enjoy dissolved oxygen levels above 5 mg/L, they easily tolerate levels below 2 mg/L and can survive at levels below 1 mg/L .

The freshwater fish most tolerant to DO levels include fathead minnows and northern pike. Northern pike can survive at dissolved oxygen concentrations as low as 0.1 mg/L for several days, and at 1.5 mg/L for an infinite amount of time. Fathead minnows can survive at 1 mg/L for an extended period with only minimal effects on reproduction and growth.

As for bottom-dwelling microbes, DO changes don't bother them much. If all the oxygen at their water level gets used up, bacteria will start using nitrate to decompose organic matter, a process known as denitrification. If all of the nitrogen is spent, they will begin reducing sulfate [17]. If organic matter accumulates faster than it decomposes, sediment at the bottom of a lake simply becomes enriched by the organic material.

4.4 Conductivity

Conductivity is a measure of the ability of water to conduct electricity. This parameter is affected by the number ions that are dissolved in the water (EPA, 2012).lf a lake were to have a high amount of inorganic solids, the water would be more conductive whereas if the lake were to have more amounts of organic solids it would be less conductive (EPA, 2012). The conductivity for lake water should be below 500 micro Siemens/centimeter. If a lake were to have a higher conductivity than the suggested limit, the water may not be suitable for living organisms (EPA, 2012).

4.5 pH

The pH of a solution is a measure of the concentration of H+ ions. The pH has a scale from 0-14, where a pH below 7 is acidic and a pH above 7 is basic. A pH of7 is considered to be neutral (Environment Canada, 2013). Water that has a pH from 6.5-9 is suitable for aquatic organisms (Environment Canada, 2013). The organisms that are most sensitive to extreme changes in pH are young fish and benthic invertebrates. The pH of a water body can be altered by acid rain, wastewater discharges and drainage from coniferous forests (Environment Canada, 2013).

4.6 Nitrate

Nitrate is an essential nutrient for plants, however in excess can be considered a contaminate (EPA, 2012). When nitrate is in excess it can accelerate eutrophication by causing increases in plant growth and changing the types of organisms found in the water. High nitrate levels can also lower the dissolved oxygen level and increase temperature (EPA, 2012). Sources of nitrate contamination are wastewater treatment plants, failing septic systems, runoff from fertilized lawns and manure storage sites. The natural level of nitrate in freshwater is commonly less than 1 mg/L, however, in effluent of some wastewater treatment plants nitrate levels can be 30 mg/L (EPA, 2012). Health Canada states that the maximum nitrate level allowable in drinking water is 45 mg/L (Health Canada, 2012).

4.7 Nitrite

Nitrite is usually found in minimal concentrations, but it can be damaging. The concentration increases with chloro-aminated waters, which is a result of waste water treatment (WHO, 2011). Nitrite quickly converts to nitrate when exposed to oxygen, which is part of the reason why nitrite is found in such low levels (Health Canada, 2011). It is naturally present due to the nitrogen cycle, but it can be present in higher levels due to agriculture, fertilizers, waste, and industry input (Health Canada, 2012). Infants are more susceptible to health risks from increased nitrite levels, but the common health concern related to nitrite is methemoglobinemia, which impairs the ability of blood cells to bind with oxygen (Health Canada, 2012). The maximum acceptable nitrite concentration in drinking water is 3 mg/L (Health Canada, 2012)

4.8 Phosphate

Phosphate (orthophosphate) is an inorganic form of phosphorus and an essential nutrient. Aquatic plants use orthophosphate and convert it to organic phosphate for their tissue (EPA, 2012). Phosphate tests measure only the orthophosphate form of phosphorus. Phosphate stimulates the growth of plankton and aquatic plants to provide food for fish. However, human or animal waste, industrial effluents and fertilizer runoff (Oram, n.d.) can provide excess phosphate conditions causing large growth bursts of undesirable organisms and accelerated eutrophication disrupting aquatic ecosystems. (Oram, n.d.). Human consumption of phosphorous has not been found to be a threat to human health, therefore there is no "acceptable" levels for phosphate in drinking water. However, excessive plant growth due to high phosphorous levels can occur at concentrations above 0.03 mg/L (Fleming & Fraser, 1999).

4.9 Total Phosphorus

Total phosphorous is the measure of all forms of phosphorous, including organic, inorganic and poly (EPA, 2012). Phosphorus occurs naturally in rocks and mineral deposits as poly-phosphorous but higher levels can occur as a result of agricultural runoff (CCME, 2011). Phosphorus is a limiting nutrient in freshwater and too much can be harmful resulting in algal blooms and eutrophication (CCME, 2012). Canadian guidelines provide 'trigger ranges' indicating the health of the system according to the total phosphorous level (CCME, 2004). The table below displays these ranges for different trophic systems. The lakes in this study are typically oligotrophic, not exceeding a level of 10 ug/L.

Canadian total phosphorous trigger ranges (CCME, 2004).

Trophic Status	Total Phosphorous (ug/L)
Ultra-oligotrophic	< 4
Oligotrophic	4 - 10
Mesotrophic	10 -- 20
Meso-eutrophic	20 - 35
Eutrophic	35 - 100
Hyper-eutrophic	> 100

5.0 Results

The following tables show the data for temperature, dissolved oxygen (DO), conductivity, pH, turbidity obtained at that specific depth at that site on that specific lake. The depth was chosen as the point where the temperature was approx. 4 degrees lower than the surface temperature which is the area where WSCE had previously taken their water samples.

There are some unusual pH levels in these results. My assumption is that they were caused in large part by the enormous quantities of rain often in a short time period that we experienced over the past summer. Rainfall in our area can be quite acidic (4 - 4.5) as well.

Further on in the results section we have included an example for each lake of the readings obtained at one meter intervals at one of the deep spots on that lake.

TP (Total Phosporous) levels were obtained from the Lake Partners Program operated by the MOECC in Dorset.

Beaver Lake

Beaver Sampling site	Date Time D/M/Y HH:MM	Temp C	SpCond uS	DO mg/L	Depth meters	pH	Secchi meters	TP (Lpdata) Ug\L
Site-1	7/17/17 12:45	19.5	37.6	5.45	5.1	6.01		
Site-2	12:24	17.5	39.9	4.71	6.0	6.16	4.0	7.6 & 8.0
Site-3	12:52	21.4	36.7	8.49	1.1	6.69		
Site-4	13:00	20.9	36.5	8.33	4.0	6.66		
Site-5	12:17	21.1	36.4	8.43	3.0	6.68		
Site-6	12:11	21.3	36.4	8.58	1.9	6.67		

Big Clam Lake

Big Clam-1 Sampling site	Date Time D/M/Y HH:MM	Temp C	SpCond uS	DO mg/L	Depth meters	pH	Secchi meters	TP (Lpdata) ug\L
Site-1	7/15/17 14:46	16.7	23.1	9.46	4.0	6.51		
Site-2	13:27	17.9	23.1	8.02	3.9	6.63		
Site-3	14:17	16.8	22.8	9.27	4.0	6.83		10.0 & 11.8
Site-4	13.28	16.5	23.0	8.71	4.0	6.66	4.5	
Site-5	11:53	16.3	23.2	8.37	3.8	6.39		
Site-6	11:22	16.7	23.0	8.29	4.0	6.49		

Emsdale Lake

Emsdale-1 Sampling site	Date Time D/M/Y HH:MM	Temp C	SpCond uS	DO mg/L	Depth meters	pH	Secchi meters	TP (Lpdata) ug\L
Site-1	7/25/17 15:39	17.8	22.8	11.92	4.9	6.81		
Site-2	15:57	18.6	22.9	10.91	5.0	7.00		
Site-3	16:06	17.8	22.8	11.29	4.9	6.85	4.5	N/A
Site-4	16:18	18.4	22.5	11.25	4.9	6.84		
Site-5	16:32	19.2	22.6	9.78	4.9	6.73		
Site-6	16:41	18.5	22.4	11.25	4.9	6.85		

Fisher / Perbeth Lake

Fisher/Perbeth-1 Sampling site	Date Time D/M/Y HH:MM	Temp C	SpCond uS	DO mg/L	Depth meters	pH	Secchi meters	TP (Lpdata) ug\L
Site-1	7/23/17 16:00	22.8	31.4	8.22	0.9	6.52		
Site-2	16.05	23.1	28.5	8.18	0.9	6.60		
Site-3	16:10	23.1	28.2	8.25	1.0	6.63	2.5	N/A
Site-4	16.15	20.2	25.6	6.16	2.8	6.15		
Site-5	16.23	15.6	20.3	1.42	3.9	5.98		
Site-6	16.32	20.2	25.6	2.29	3.0	6.07		

Grass Lake

Grass-1 Sampling site	Date Time D/M/Y HH:MM	Temp C	SpCond uS	DO mg/L	Depth meters	pH	Secchi meters	TP (Lpdata) ug\L
Site-1	8/01/17 8:15	21.1	17.9	8.94	4.0	6.68		
Site-2	8:23	15.5	18.7	10.17	6.0	6.56		
Site-3	8:32	17.1	18.3	10.24	5.8	6.58	4.3	3.4 & 4.2
Site-4	8:52	17.7	18.3	10.01	5.9	6.56		
Site-5	9:01	18.6	18.3	9.2	5.9	6.64		
Site-6	9:15	18.1	18.2	9.86	5.9	6.59		

Groom/Lynx Lake

Groom-1 Sampling site	Date Time D/M/Y HH:MM	Temp C	SpCond uS	DO mg/L	Depth meters	pH	Secchi meters	TP (Lpdata) ug\L
Site-1	7/28/17 9:10	20.0	24.4	7.35	2.0	6.29		
Site-2	9:15	18.6	26.2	4.89	3.8	6.11		
Site-3	9:20	17.9	26.8	4.08	3.8	6.00		5.4 & 5.5
Site-4	9:27	18.2	25.1	4.69	3.8	6.00	3,5	
Site-5	9:44	18.5	25.0	5.42	3.8	6.03		
Site-6	9:15	18.3	25.2	6.24	3.2	6.08		

Hassard Lake

Hassard -1 Sampling site	Date Time D/M/Y HH:MM	Temp C	SpCond uS	DO mg/L	Depth meters	pH	Secchi meters	TP (Lpdata) ug\L
Site-1	7/17/17 11:53	21.1	36.9	8.54	1.1	6.26		
Site-2	11:39	21.4	39.9	8.43	1.0	6.29		
Site-3	11:04	14.9	40.5	5.68	4.8	5.81	3.8	9.2 & 9.6
Site-4	10:52	14.2	43.7	5.65	4.9	5.8		
Site-5	11:21	14.5	39.2	5.32	5.0	5.81		
Site-6	11:30	14.9	41,4	6.00	5.0	5.83		

Himbury Lake

Himbury-1 Sampling site	Date Time D/M/Y HH:MM	Temp C	SpCond uS	DO mg/L	Depth meters	pH	Secchi meters	TP (Lpdata) ug\L
Site-1	7/13/17 13:37	17.1	21.0	10.45	5.0	6.86		
Site-2	14:03	16.7	21.3	9.97	4.9	6.86	4.0	5.2 & 5.4
Site-3	14:15	16.8	21.0	10.54	4.9	6.91		
					..			

Island Lake

Island-1 Sampling site	Date Time D/M/Y HH:MM	Temp C	SpCond uS	DO mg/L	Depth meters	pH	Secchi meters	TP (Lpdata) ug\L
Site-1	7/20/17 10:04	16.3	20.8	11.89	5	6.75		
Site-2	10:22	16.9	22.8	11.07	5.5	6.74	7.0	
Site-3	10.36	17.1	22.4	11.00	5.8	6.78		3.6 & 4.0
Site-4	10:45	17.5	21.6	10.88	5.5	6.79		
Site-5	10:52	17.5	21.3	10.86	5.5	6.74		
Site-6	11:06	17.5	21.9	11.13	6	6.61		

Little Clam Lake

Little Clam Sampling site	Date Time D/M/Y HH:MM	Temp C	SpCond uS	DO mg/L	Depth meters	pH	Secchi meters	TP (Lpdata) ug\L
Site-1	7/16/17 8:17	15.7	22.3	11.79	4.9	6.92	4.8	3.6 & 3.6
Site-2	8:45	15.3	25.0	11.69	4.9	6.83		
Site-3	8:55	21.6	23.2	9.03	1.0	6.87		

Loon Lake

Loon-1

Sampling site	Date Time	Temp	SpCond	DO	Depth	pH	Secchi	TP (Lpdata)
	D/M/Y HH:MM	C	uS	mg/L	meters		meters	ug\L
Site-1	7/14/17 9:46	15.7	18.6	10.82	5.8	6.91		
Site-2	10:03	16.1	18.7	10.64	5.8	6.78		
Site-3	10:16	16.2	18.6	10.58	6.0	6.97		4.2 & 5.0
Site-4	10:41	15.2	18.5	11.17	6.1	6.83		
Site-5	10:56	16.5	18.9	10.32	5.8	6.94		
Site-6	11:12	20.9	18.2	8.91	3.8	6.89	4.5	

Magnetawan Lake

Magnetawan Lake-1

Sampling site	Date Time	Temp	SpCond	DO	Depth	pH	Secchi	TP (Lpdata)
	D/M/Y HH:MM	C	uS	mg/L	meters		meters	ug\L
Site-1	7/21/17 10:03	18.9	13.5	10.44	3.7	5.71	3.5	
Site-2	10:21	18.3	14.1	10.55	4.0	5.77	3.5	
Site-3	10:33	18.7	14.3	10.22	4.0	5.90	4.0	N/A
Site-4	10.44	19.9	14.4	8.94	4.0	5.75	4.0	
Site-5	10:55	19.6	14.4	8.88	4.0	5.87	3.7	
Site-6	11:06	18.2	13.1	9.78	4.2	5.80	3.7	

Magnetawan River

Magnetawan River-1

Sampling site	Date Time	Temp	SpCond	DO	Depth	pH	Secchi	TP (Lpdata)
	D/M/Y HH:MM	C	uS	mg/L	meters		meters	ug\L
Site-1	8/01/17 10.29	21.6	25.7	7.26	0.2	6.31		
Site-2	10:19	19.9	793	7.36	0.5	6.43	N/A	N/A
Site-3	9:59	20.3	162.8	8.50	1.0	6.49		
Site-4	7/21/17 12:03	24.5	26.8	8.14	0.2	6.20		
Site-5	11:00	18.5	67	8.44	0.5	6.44		

Mason Lake

Mason-1

Sampling site	Date Time	Temp	SpCond	DO	Depth	pH	Secchi	TP (Lpdata)
	D/M/Y HH:MM	C	uS	mg/L	meters		meters	ug\L
Site-1	7/20/17 13.22	21.5	19.7	8.26	2.0	6.34		
Site-2	13:37	16.6	22.3	5.9	3.3	5.78	2.5	5.2 & 5.6
Site-3	13:11	18.7	20.3	7.24	3.1	5.78		

Perry Lake

Perry-1

Sampling site	Date Time	Temp	SpCond	DO	Depth	pH	Secchi	TP (Lpdata)
	D/M/Y HH:MM	C	uS	mg/L	meters		meters	ug\L
Site-1	7/17/17 9:12	16.6	37.5	5.75	4.6	5.90		
Site-2	9:29	17.4	37.6	6.41	4.1	5.99	2.5	16.8 & 14.4
Site-3	9:41	17.2	38.8	5.73	4.4	5.88		
Site-4	10:03	19.2	40.4	6.60	4.0	5.99		
Site-5	10:19	16.6	42.2	5.69	4.2	5.89		
Site-6	10:36	21.1	48.6	8.02	4.8	6.22		

Peters Lake

Peter-1

Sampling site	Date Time	Temp	SpCond	DO	Depth	pH	Secchi	TP (Lpdata)
	D/M/Y HH:MM	C	uS	mg/L	meters		meters	ug\L
Site-1	7/19/17 9:10	23.6	18.9	8.04	0.9	6.25		
Site-2	9:28	21.6	22.6	8.97	2.0	6.43		
Site-3	9:40	16.3	22.9	10.46	3.8	6.40	3.75	NA

Sand Lake

Sand-1 Sampling site	Date Time D/M/Y HH:MM	Temp C	SpCond uS	DO mg/L	Depth meters	pH	Secchi meters	TP (Lpdata) ug\L
Site-1	7/13/17 9:41	16.1	35.1	8.33	6.3	6.38		
Site-2	9:52	16.6	35.3	8.43	5.8	6.55	2.5	6.0 & 6.0
Site-3	10:02	16.2	35.7	8.47	5.8	6.54		
Site-4	10:13	17.4	34.8	8.47	5.9	6.57		
Site-5	9:26	16.7	36.8	8.35	5.8	6.48		
Site-6	9:17	20.8	35.4	8.80	2.9	6.95		

Water column profiles for each lake

We have included an example for each lake of the readings obtained at one meter intervals at one of the deep spots on each lake. We also found some interesting information on the DO and temperature requirements for various fresh water fish species which has been included in section 4.3

We will attempt to publish the data collected on the water column profiles for all the lakes from 2016 now that we have something to compare it to. Some anomalies in data this year may be due to the large quantity of rain we experienced this year. According to the Environment Canada website normal rainwater has a pH of about 5.6 .. However the rain in the Muskoka – Haliburton area is about 4.5 which is about 40 times more acidic than normal. Next year we will actually try to measure the pH from a local rainfall. Of course the runoff from rain that falls on the ground up here on the Canadian Shield becomes even more acidic. Lakes because of their volume have a certain capacity to buffer the pH of rainfall.

You will notice that in some lakes the temperature in the lake really starts to drop between 4 - 6 meters and the DO increases. Above that depth the temperature and DO is fairly uniform due to mixing by wind, waves etc. Between 4 and 7 meters the DO is higher than at the surface mainly because the colder water will absorb more oxygen. Based on the secchi disc readings sunlight can penetrate down to these depths so that photosynthesis can occur and oxygen is produced as a by product. Decomposition of plant material etc. at the lower depths consumes oxygen which is not being replenished on an ongoing basis.

Our Pro DSS instrument came with a Turbidity sensor so we included the readings out of interest this year. Turbidity refers to water clarity, is a measure of how much light is reflected off of suspended materials in the water and is usually measured with a nephelometer in NTU's (nephelometric turbidity units). Natural background should be 80 NTU or less.

Beaver Lake – Site#2

Date	Time	Site	°C	DO mg/L	SPC-uS/cm	pH	Turbidity NTU	Dep m
07/17/17	12:22:37	b2	21.3	8.54	36.5	6.18	0.5	1.0
07/17/17	12:23:09	b2	21.1	8.47	38.0	6.31	0.4	2.0
07/17/17	12:23:28	b2	21.0	8.39	39.3	6.31	0.5	3.0
07/17/17	12:23:50	b2	20.6	7.93	39.3	6.27	0.5	4.0
07/17/17	12:24:03	b2	20.0	7.03	39.4	6.05	0.3	5.0
07/17/17	12:24:24	b2	17.5	4.71	39.9	5.81	0.4	5.9
07/17/17	12:24:53	b2	14.9	4.51	38.1	5.74	0.5	7.0
07/17/17	12:25:12	b2	12.4	5.00	35.5	5.72	0.5	7.9
07/17/17	12:25:32	b2	10.0	6.47	32.4	5.70	0.6	9.0
07/17/17	12:25:51	b2	8.0	7.59	31.4	5.70	0.6	10.0
07/17/17	12:26:08	b2	7.2	8.15	30.3	5.68	0.5	10.9
07/17/17	12:26:40	b2	6.6	8.84	29.9	5.67	0.5	11.9
07/17/17	12:26:57	b2	6.4	9.13	29.7	5.67	0.5	12.9
07/17/17	12:27:32	b2	6.2	9.31	29.8	5.66	0.4	13.8
07/17/17	12:27:54	b2	6.1	8.64	29.8	5.60	0.2	14.9
07/17/17	12:28:16	b2	6.1	8.18	30.0	5.56	0.1	15.8
07/17/17	12:28:39	b2	6.0	7.69	30.0	5.52	0.1	16.8
07/17/17	12:28:57	b2	6.0	7.25	30.0	5.49	0.3	17.8
07/17/17	12:29:14	b2	6.0	6.79	30.3	5.47	0.5	18.8
07/17/17	12:29:28	b2	6.0	5.92	30.6	5.45	1.1	19.8

Big Clam Lake – Site 2

Date Y-D-M	Time	Site	°C	DO mg/L	SPC-uS/cm	pH	Turbidity NTU	Dep m
2017-01-08	13:26:15	bc2	23.5	8.35	23.0	6.68	0.5	1.0
2017-01-08	13:26:57	bc2	22.4	8.6	22.8	6.66	0.1	2.0
2017-01-08	13:27:16	bc2	20.8	8.76	22.7	6.63	0.3	3.0
2017-01-08	13:29:00	bc2	19.4	8.84	22.3	6.29	0.9	3.6
2017-01-08	13:29:51	bc2	17.8	7.58	23.0	6.06	0.6	3.8
2017-01-08	13:30:03	bc2	17.5	7.44	23.1	6.04	0.6	3.9
2017-01-08	13:31:08	bc2	13.6	6.14	23.7	5.87	0.7	4.9
2017-01-08	13:31:27	bc2	10.3	6.12	23.7	5.83	0.7	5.9
2017-01-08	13:31:46	bc2	8.3	5.89	24.1	5.80	1.2	6.9
2017-01-08	13:32:39	bc2	7.8	5.48	23.9	5.74	1.1	7.8
2017-01-08	13:33:48	bc2	7.5	5.73	23.7	5.70	0.7	8.9

Emsdale Lake – Site #3

Date	Time	Site	°C	DO mg/L	SPC-uS/cm	pH	Turbidity NTU	Dep m
07/25/17	16:04:13	e3	22.5	8.74	22.4	6.64	0.2	0.9
07/25/17	16:05:20	e3	21.5	8.90	22.3	6.76	0.2	3.0
07/25/17	16:06:22	e3	21.1	9.38	22.0	6.83	0.3	3.9
07/25/17	16:06:58	e3	15.9	12.13	22.7	6.95	0.6	5.0
07/25/17	16:08:03	e3	13.8	12.88	22.5	7.19	0.6	5.9
07/25/17	16:08:50	e3	10.7	13.17	22.4	7.29	0.5	6.9
07/25/17	16:09:09	e3	9.5	12.83	22.5	7.13	0.5	7.9
07/25/17	16:09:44	e3	8.4	11.88	22.9	6.77	0.5	8.9

Fisher / Perbeth Lake – Site # 5

Date	Time	Site	°C	DO mg/L	SPC-uS/cm	pH	Turbidity NTU	Dep m
07/23/17	16:20:33	f5	23.4	8.32	58.6	6.63	0.4	1.0
07/23/17	16:21:34	f5	22.9	8.23	8.3	6.59	0.3	2.0
07/23/17	16:23:06	f5	20.0	5.51	17.6	6.03	0.0	2.9
07/23/17	16:23:50	f5	15.6	1.42	20.3	5.98	13.0	3.9

Grass Lake Site # 6

Date YDM	Time	Site	°C	DO mg/L	SPC-uS/cm	pH	Turbidity NTU	Dep m
08/01/17	9:09:43	gg6	22.2	8.78	17.7	6.59	1.2	1.0
08/01/17	9:10:32	gg6	22.2	8.84	17.9	6.68	0.3	1.8
08/01/17	9:11:09	gg6	21.7	8.89	17.9	6.71	0.4	3.0
08/01/17	9:11:45	gg6	21.3	8.95	17.9	6.71	0.4	3.9
08/01/17	9:12:29	gg6	20.0	8.99	17.9	6.67	0.5	4.9
08/01/17	9:14:46	gg6	18.1	9.45	18.4	6.59	0.5	5.9
08/01/17	9:15:25	gg6	12.7	10.38	19.5	6.43	0.6	6.9
08/01/17	9:15:55	gg6	8.7	9.75	19.1	6.09	0.4	7.9
08/01/17	9:16:25	gg6	7.6	9.06	19.2	5.95	0.5	8.8

Groom /Lynx Lake Site #4

Date	Time	Site	°C	DO mg/L	SPC-uS/cm	pH	Turbidity NTU	Dep m
07/28/17	9:26:24	g4	20.4	8.66	22.6	6.54	1.9	1.0
07/28/17	9:26:58	g4	20.4	8.82	23.2	6.63	0.6	2.0
07/28/17	9:27:23	g4	19.9	7.60	23.2	6.34	0.7	3.0
07/28/17	9:27:54	g4	18.2	4.69	25.1	6.00	1.5	3.8
07/28/17	9:28:10	g4	15.6	2.12	28.6	5.86	3.6	4.8
07/28/17	9:28:42	g4	11.0	2.11	26.8	5.82	2.9	5.7
07/28/17	9:29:10	g4	9.2	1.81	29.0	5.75	8.7	6.5

Hassard Lake Site #6

Date	Time	Site	°C	DO mg/L	SPC-uS/cm	pH	NTU	Dep m
07/17/17	11:28:47	ha6	21.4	8.44	36.9	6.18	0.3	0.6
07/17/17	11:29:01	ha6	21.3	8.41	38.1	6.20	0.3	0.8
07/17/17	11:29:23	ha6	21.1	8.34	41.7	6.23	0.1	1.9
07/17/17	11:29:47	ha6	21.1	8.31	42.0	6.24	0.2	2.0
07/17/17	11:30:09	ha6	20.9	8.17	42.1	6.22	0.1	2.8
07/17/17	11:30:43	ha6	18.9	7.12	40.1	5.99	0.3	3.9
07/17/17	11:31:00	ha6	14.9	6.00	41.4	5.83	0.1	5.0
07/17/17	11:31:59	ha6	11.3	6.35	35.3	5.63	0.4	5.8

Himbury Lake – Site #1

Date	Time	Site	°C	DO mg/L	SPC-uS/cm	pH	Turbidity NTU	Dep m
07/13/17	13:35:17	h1	22.0	8.76	20.4	7.20	0.9	1.0
07/13/17	13:35:53	h1	21.7	8.78	20.3	7.21	0.8	2.0
07/13/17	13:36:39	h1	21.6	8.77	20.3	7.20	0.8	3.0
07/13/17	13:37:20	h1	20.7	8.99	20.4	7.12	0.8	4.0
07/13/17	13:38:54	h1	17.0	11.15	20.6	6.96	0.5	5.0
07/13/17	13:40:04	h1	12.7	10.65	21.5	6.81	0.2	5.9
07/13/17	13:40:37	h1	10.5	9.24	22.5	6.62	0.2	7.0
07/13/17	13:41:02	h1	9.2	7.55	23.2	6.49	0.3	8.0
07/13/17	13:41:35	h1	8.3	6.12	23.9	6.32	0.3	9.0
07/13/17	13:42:01	h1	7.9	4.13	25.3	6.24	0.3	9.9
07/13/17	13:42:43	h1	7.5	1.98	26.8	6.19	0.6	11.0

Island Lake- Site #1

Date	Time	Site	°C	DO mg/L	SPC-uS/cm	pH	Turbidity NTU	Dep m
07/20/17	10:02:10	ii1	22.5	8.75	20.1	6.74	0.9	1.0
07/20/17	10:03:04	ii1	22.3	8.8	20.0	6.69	1.0	1.9
07/20/17	10:03:45	ii1	21.8	9.0	20.0	6.68	0.9	2.9
07/20/17	10:04:20	ii1	20.9	9.01	20.1	6.68	0.9	3.9
07/20/17	10:04:51	ii1	16.3	11.89	20.8	6.75	0.7	5.0
07/20/17	10:05:11	ii1	12.4	12.56	21.4	6.83	0.8	5.9
07/20/17	10:05:36	ii1	10.0	12.89	21.4	6.90	0.7	7.0
07/20/17	10:06:10	ii1	8.6	12.79	21.7	6.79	0.6	7.9
07/20/17	10:06:34	ii1	7.4	12.05	22.2	6.51	0.4	8.9
07/20/17	10:06:52	ii1	6.9	10.91	22.4	6.26	0.4	10.0
07/20/17	10:07:29	ii1	6.2	8.33	23.0	5.91	0.4	10.9
07/20/17	10:08:03	ii1	5.8	6.29	23.4	5.63	0.3	11.9

Little Clam Lake – Site #1

Date	Time	Site	°C	DO mg/L	SPC-uS/cm	pH	NTU	Dep m
07/16/17	8:16:07	lc1	21.6	9.11	21.5	6.97	-0.8	0.7
07/16/17	8:16:31	lc1	21.6	9.17	22.2	7.07	-0.8	2.0
07/16/17	8:16:55	lc1	21.4	9.24	21.4	7.11	-0.9	2.9
07/16/17	8:17:15	lc1	20.6	10.09	22.0	7.15	-0.9	4.0
07/16/17	8:17:59	lc1	15.7	11.79	22.3	7.07	-0.8	4.9
07/16/17	8:18:20	lc1	12.8	11.85	22.1	6.99	-0.8	5.9
07/16/17	8:19:14	lc1	10.2	9.51	23.2	6.56	-0.7	7.0
07/16/17	8:20:21	lc1	8.5	6.26	25.8	6.09	-0.6	7.9
07/16/17	8:21:22	lc1	7.5	3.39	27.6	5.89	-0.5	8.9
07/16/17	8:21:49	lc1	6.8	1.59	29.4	5.82	-0.3	10.0
07/16/17	8:22:25	lc1	6.7	0.90	29.8	5.79	-0.1	10.9
07/16/17	8:23:14	lc1	6.5	0.54	30.2	5.76	0.2	11.9

Loon Lake – Site #3

Date	Time	Site	°C	DO mg/L	SPC-uS/cm	pH	NTU	Dep m
07/14/17	10:13:59	ll3	21.0	8.95	18.3	6.87	0.8	1.0
07/14/17	10:14:34	ll3	21.0	8.97	18.3	6.94	0.7	2.0
07/14/17	10:15:14	ll3	21.0	8.97	18.3	6.96	0.8	3.0
07/14/17	10:15:36	ll3	21.0	8.97	18.3	6.96	0.8	4.0
07/14/17	10:16:03	ll3	20.9	8.97	18.3	6.95	0.8	4.9
07/14/17	10:16:28	ll3	16.2	10.58	18.6	6.97	0.6	6.0
07/14/17	10:19:01	ll3	10.0	11.43	18.9	6.58	0.3	7.9
07/14/17	10:19:25	ll3	8.8	10.73	19.0	6.45	0.4	8.9
07/14/17	10:19:47	ll3	7.8	10.36	19.2	6.31	0.5	9.9
07/14/17	10:20:24	ll3	7.1	9.77	19.3	6.15	0.5	10.9
07/14/17	10:20:45	ll3	6.9	9.52	19.4	6.09	0.5	11.9
07/14/17	10:21:33	ll3	6.6	9.06	19.5	5.99	0.5	12.9

Magnetawan Lake – Site #4

Date	Time	Site	°C	DO mg/L	SPC-uS/cm	pH	Turbidity NTU	Dep m
07/21/17	10:43:20	ml4	23.0	8.43	12.8	6.01	0.8	1.1
07/21/17	10:43:48	ml4	22.8	8.44	13.7	5.95	0.8	2.1
07/21/17	10:44:10	ml4	21.9	8.56	14.0	5.90	0.8	2.9
07/21/17	10:44:28	ml4	19.9	8.94	14.4	5.75	0.7	3.9
07/21/17	10:45:37	ml4	14.0	11.53	16.9	5.66	0.4	5.0
07/21/17	10:46:05	ml4	10.3	11.16	17.5	5.43	0.5	5.9
07/21/17	10:46:39	ml4	8.5	10.06	17.1	5.26	0.4	6.9
07/21/17	10:47:09	ml4	7.4	9.18	16.3	5.15	0.4	8.0
07/21/17	10:47:50	ml4	6.6	8.05	15.6	5.04	0.4	8.8

Mason Lake – Site #3

Date	Time	Site	°C	DO mg/L	SPC-uS/cm	pH	NTU	Dep m
07/20/17	13:10:04	mm3	23.2	8.46	20.1	6.53	0.8	1.2
07/20/17	13:10:20	mm3	23.0	8.45	20.0	6.52	0.7	1.5
07/20/17	13:10:32	mm3	22.9	8.45	20.0	6.49	0.7	1.7
07/20/17	13:10:53	mm3	20.1	7.98	19.9	6.24	0.5	2.8
07/20/17	13:11:59	mm3	15.5	7.83	20.8	5.82	0.5	3.1
07/20/17	13:12:19	mm3	13.2	7.95	20.8	5.76	0.5	3.5
07/20/17	13:12:43	mm3	10.4	8.12	20.3	5.63	0.6	4.8
07/20/17	13:13:14	mm3	8.5	8.31	20.4	5.55	0.6	5.6
07/20/17	13:13:35	mm3	7.3	8.27	20.4	5.52	0.6	6.4

Perry Lake – Site #2

Date	Time	Site	°C	DO mg/L	SPC-uS/cm	pH	Turbidity NTU	Dep m
07/17/17	9:26:03	p2	21.5	8.52	36.2	6.18	0.4	1.0
07/17/17	9:27:24	p2	21.4	8.45	36.3	6.37	0.3	1.9
07/17/17	9:28:16	p2	21.2	8.27	36.9	6.33	0.3	2.9
07/17/17	9:28:45	p2	19.6	7.05	37.4	6.09	0.4	3.9
07/17/17	9:29:27	p2	14.8	6.05	37.5	5.90	0.5	4.9
07/17/17	9:30:07	p2	10.8	5.97	35.6	5.77	0.4	5.8
07/17/17	9:30:36	p2	8.7	5.85	36.8	5.72	0.1	6.9

Peters Lake – Site #3

Date	Time	Site	°C	DO mg/L	SPC-uS/cm	pH	Turbidity NTU	DEP m
07/19/17	9:38:08	pp3	23.1	8.56	19.6	6.47	0.8	1
07/19/17	9:38:34	pp3	22.4	8.58	20.0	6.50	0.8	2
07/19/17	9:39:02	pp3	21.5	8.58	22.3	6.45	0.7	3
07/19/17	9:39:31	pp3	16.3	10.46	22.9	6.40	0.7	4
07/19/17	9:39:55	pp3	11.8	11.54	23.6	6.41	0.4	5
07/19/17	9:40:22	pp3	8.3	8.96	24.1	5.82	0.5	6
07/19/17	9:40:42	pp3	7.2	8.14	24.2	5.71	0.5	7
07/19/17	9:41:10	pp3	6.3	7.05	25.0	5.56	0.5	8
07/19/17	9:41:28	pp3	5.8	6.26	25.2	5.48	0.5	9
07/19/17	9:42:27	pp3	5.3	3.97	25.6	5.39	0.4	10

Sand Lake – Site #3

Date	Time	Site	°C	DO mg/L	SPC-uS/cm	pH	Turbidity NTU	Dep m
07/13/17	9:59:59	s3	20.7	8.82	35.6	6.86	0.6	1.0
07/13/17	10:00:26	s3	20.7	8.75	35.6	6.92	0.6	2.0
07/13/17	10:00:58	s3	20.7	8.74	35.6	6.88	0.6	3.0
07/13/17	10:01:16	s3	20.7	8.73	35.6	6.88	0.6	3.9
07/13/17	10:01:46	s3	20.3	8.65	35.7	6.82	0.6	4.9
07/13/17	10:02:08	s3	16.2	8.47	35.7	6.54	0.7	5.9
07/13/17	10:02:25	s3	12.4	8.70	33.6	6.44	0.7	7.0
07/13/17	10:02:45	s3	11.0	9.04	31.2	6.33	0.7	7.8
07/13/17	10:03:01	s3	9.5	9.32	30.8	6.25	0.6	8.7
07/13/17	10:03:17	s3	8.8	9.41	30.0	6.21	0.6	9.7

Nitrate & Ortho-phosphate Results

This was KWEF'S first attempt at taking water samples and having them analyzed at a lab. We had been concerned that the results from the WSCE lab did not specify the MDL (method detect limit) and their results indicated .01 mg/L for nitrates and .05 mg/L for phosphates was their minimum resolution. Near North Labs has a stated MDL on their reports of .0031 mg/L for nitrates and .001 mg/L for ortho-phosphates. We did 5 lakes initially – Perry, Hassard, Beaver, Groom/Lynx and Fisher taking a sample from 2 sites on each lake,. We also took 2 samples from Big Clam Lake – one (a) using the Beta Bottle Sampler and one (b) using the type of sample bottle and technique used by the Lake Partners Program to sample for total phosphorous. Both samples were taken at the same spot moments apart. Sample (a) was water taken at a specific depth (in this case 4 meters) while (b) was a composite sample taken over the first 4 meters. The results were identical for both Big Clam Lake samples so we are considering using the Lake Partners sampling method in future. We will discuss this and other water quality monitoring plans with our lake stewards and other stakeholders

Results for Nitrates and Ortho-Phosphates (mg/L)

No.	Lake	Date	Site	Nitrate	Phosphate	Site	Nitrate	Phosphate
1	Perry	17/07/17	#5	.018	.002	#6	.011	.001
2	Hassard	17/07/17	#4	.036	.005	#5	.035	.002
3	Beaver	17/07/17	#1	.018	.002	#6	.009	.002
4	Groom	23/07/17	#2	<MDL	.005	#4	<MDL	<.001
5	Fisher	23/07/17	#1	<MDL	<.001	#7	<MDL	<.001
6	B.Clam	23/07/17	#5a	<MDL	<.001	#5b	<MDL	<.001

6.0 Conclusions and comments on the YSI PRO DSS instrument evaluation and the Water Quality Monitoring Program in general

1. The PRO DSS instrument worked quite well in our application. Recording the depths with each measurement allowed us to take multiple readings or skip readings at a particular depth without requiring a second person to maintain a log of the depth / time for each set of readings. That the cable & sensor might not be hanging vertical and therefore the sensor package was no longer at the depth indicated by the marks on the cable due to boat drift was no longer a major concern. Due to the optical sensor used for measuring DO we no longer needed to agitate the sensor to get accurate readings.

2. We should reserve a unit this fall for use next year. This would avoid the problems we experienced this year because of the lack of available rental equipment.

3. We will be trying for a Grant under the Great Lakes Guardian Community Fund that would allow us to purchase a YSI PRODSS instrument so that we could monitor some of the lakes more frequently throughout the year or repeat tests if the readings we were getting seemed unusual.

4. We will be reviewing the methods and procedures we are using as part of the Water Quality Monitoring Program and discussing if any changes, additions, etc are required with both our Lake Stewards and other stakeholders. We will also be looking at whether we need to be capturing data on local weather, lake levels and on both development and environmental changes on each lake on a year over year basis.

Pro DSS system accuracy for the following sensors

Dissolved Oxygen	0-20 mg/L range	+/- 1% of reading or .1 mg/L if greater
Temperature		+/- .2 deg C
Conductivity		+/- 0.5 % of reading or .001mS/cm "
pH		+/- .2 units
Barometer		+/- 1.5 mmHg
Depth		20m or greater cable +/- .04m
Turbidity		.3 FNU or +/- 2% of reading if greater

Please note that values were often reported to 2 decimal places to show variations but actual accuracy should be taken into consideration when looking at individual readings.

The specification data sheets for the two instruments we used are included in the Appendix

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8-0 Appendix

YSI Instrument Specifications

YSI
a xylem brand

SPECIFICATIONS

DOCUMENT #W83-04

Parameters:
Dissolved Oxygen (Optical)
Turbidity
pH
ORP/Redox
Conductivity
Specific Conductance
Salinity
Total Dissolved Solids (TDS)
Resistivity
Seawater Density
Total Suspended Solids (TSS)
Depth
GPS Coordinates
Ammonium
Ammonia
Chloride
Nitrate
Temperature
Barometric Pressure

YSI ProDSS Multiparameter Sampling Instrument

Portable digital sampling system for the measurement of pH, ORP, dissolved oxygen (optical-based sensor), conductivity, turbidity, temperature, depth and more.

Designed for use in applications such as surface water, groundwater, coastal waters, aquaculture, and wastewater, the rugged and reliable ProDSS allows for measurement of up to 19 parameters. The ProDSS features digital smart sensors that are automatically recognized by the instrument when connected. A backlit color display, large memory, convenient calibration procedures, rechargeable battery, and powerful PC data management program (KorDSS) make the ProDSS user friendly. The optional GPS function, wide selection of sensors, and varying cable options and lengths allow for complete customization of the ProDSS. Mil-spec (military spec) connectors and a waterproof (IP-67), rubber over-molded case ensures durability to provide years of sampling even in the harshest field conditions.

- Single cable design with lengths up to 100 meters
- User-replaceable cables provide versatility, reduce down time and reduce overall cost of ownership
- 4 port cables feature user-replaceable sensors; universal ports can accept any 4 sensors; optional depth sensor available
- ODO/CT probe and cable assemblies feature integral (built-in) optical DO and conductivity sensors; rugged ODO sensor cap with 2-year warranty is pre-installed on new assemblies
- Long-life rechargeable lithium-ion battery to power handheld and sensors
- Color display and backlit keypad allow for sampling in all lighting conditions
- Digital smart sensors are automatically recognized by the instrument and store calibration data
- Large memory (> 100,000 data sets) with extensive site list and Data ID tag capabilities
- KorDSS, a powerful PC data management program, is included with the instrument
- USB On-The-Go connector for PC connection, recharging/powering the ProDSS and connecting directly to a USB stick
- Global Positioning System (GPS) (optional)
- Rugged, waterproof case (IP-67 rated) with rubber over-mold and metal, military-spec (MS) cable connectors as well as rugged titanium sensors
- Multiple languages in handheld and KorDSS: English, Spanish, Portuguese, French, German, Italian, Japanese, Norwegian, Chinese (simplified and traditional), Korean, and Thai
- Warranty: 3-year instrument; 2-year cable assembly and sensors; 1-year pH and pH/ORP sensor modules; 6-months ammonium, nitrate and chloride sensor modules.

YSI.com/ProDSS

ProDSS General Specifications

Size	Instrument: 8.3 cm width x 21.6 cm length x 5.6 cm depth (3.27 in x 8.5 in x 2.21 in) 4 port bulkhead with sensor guard, no depth: 42.82 cm (16.86 in) length and 4.75 cm (1.87 in) outer diameter 4 port bulkhead with sensor guard, with depth: 45.36 cm (17.86 in) length and 4.75 cm (1.87 in) outer diameter ODO/CT assembly with sensor guard: 26.14 cm (10.29 in) length and 2.46 cm (0.97 in) outer diameter
Handheld weight with batteries	567 grams (1.25 lbs)
Power	Rechargeable lithium-ion battery pack provides ~48 hours with the handheld only and ~20 hours with the handheld, 4 port cable and 4 smart sensors; battery recharge time is ~9 hours with the AC power adapter The instrument can also be powered via AC or external power pack through the USB port
Instrument operating temperature	0 to 50 °C (32 to 122 °F)
Instrument storage temperature	0 to 45 °C (32 to 113 °F) with battery installed; 0 to 60 °C (32 to 140 °F) without battery installed
Display	Color, LCD graphic display; 3.9 cm width x 6.5 cm height
USB port	Built-in micro USB On-The-Go port for PC connection, recharging/powering the ProDSS and connecting directly to a USB stick
Cables	ProDSS 4 port, ProDSS ODO/CT, and ProODO field cables available in 1, 4, 10, 20, 30, 40, 50, 60, 70, 80, 90, and 100 meters; ProDSS 4 port cables feature an optional depth sensor; ProOBOD cable assemblies are also compatible
Sensor ports	4 port cables feature universal sensor ports that can accept any ProDSS sensor; other compatible cables feature integral sensors
Warranty	3-year instrument; 2-year bulkhead, cable assembly, sensors, and extended warranty ODO sensor cap (627180); 1-year pH and pH/ORP sensor modules, ODO sensor caps, and Li-ion battery pack; 6-months ammonium, nitrate, and chloride sensor modules
Memory	> 100,000 data sets
Logging modes	Single point or continuous with autostable feature
GLP compliance	Yes; 400 detailed GLP records can be stored and are available to view, download, and print.
Languages	English, Spanish, German, French, Italian, Norwegian, Portuguese, Japanese, Chinese (Simplified & Traditional), Korean, Thai
Certifications	CEC, CE; RoHS; IP-67; WEEE; FCC; UN Part III, Section 38.3, Test methods for lithium-ion batteries (Class 9)
GPS	Optional internal GPS; coordinates are stored with measurement data and site lists
Sites and data ID	100 user-defined sites and 100 user-defined data ID tags; site pictures can be sent to the handheld via KorDSS

ProDSS System Specifications (Instrument, Sensor, and Cable)

Sensor/Parameter	Range	Accuracy	Resolution	Units
Temperature	-5 to 70 °C (temperature compensation range for DO mg/L measurement: -5 to 50 °C)	±0.2 °C	0.1 °C or 0.1 °F (user selectable)	°C, °F, K
pH	0 to 14 pH units	±0.2 pH units	0.01 pH units	pH, pH mV
ORP	-1999 to 1999 mV	±20 mV	0.1 mV	mV
Dissolved Oxygen	0 to 500%, 0 to 50 mg/L	0 to 200%: ±1% of reading or 1% saturation, whichever is greater 200 to 500%: ±8% of reading 0 to 20 mg/L: ±0.1 mg/L or 1% of reading, whichever is greater 20 to 50 mg/L: ±8% of reading	0.01 mg/L and 0.1%, or 0.1 mg/L and 1% (user selectable)	% saturation, % saturation local, mg/L, ppm
Barometer	375 to 825 mmHg	±1.5 mmHg from 0 to 50 °C	0.1 mmHg	mmHg, inHg, mbar, psi, kPa, atm
Conductivity	0 to 200 mS/cm	0 - 100 mS/cm: ±0.5% of reading or .001 mS/cm, whichever is greater 100 - 200 mS/cm: ±1.0% of reading	0.001, 0.01 or 0.1 µS/cm (range dependent)	µS/cm, mS/cm
Specific Conductance*	0 to 200 mS/cm	0 - 100 mS/cm: ±0.5% of reading or .001 mS/cm, whichever is greater 100 - 200 mS/cm: ±1.0% of reading User selectable reference temperature (15 to 25 °C; default 25 °C) and compensation coefficient (0 to 4%/°C, default 1.91%)	0.001, 0.01, 0.1 mS/cm	µS/cm or mS/cm
Salinity*	0 to 70 ppt	±1.0% of reading or ±0.1 ppt, whichever is greater	0.01 ppt	ppt or PSU
Total Dissolved Solids (TDS)*	0 to 100 g/L	Calculated from specific conductance and a user-selectable TDS multiplier (0.30 to 1.00; default 0.65)	0.001, 0.01, 0.1 g/L	mg/L, g/L, kg/L
Resistivity*	0 to 2 Mohms	±0.1% Full Scale	0.001, 0.01, 0.1 ohms	ohm-cm, kohm-cm, Mohm-cm
Seawater Density*	0.0 to 50.0 sigma, sigma T	-	0.1 sigma or sigma T	Sigma, Sigma T
Turbidity	0 to 4000 FNU	0 to 999 FNU: 0.3 FNU or ±2% of reading, whichever is greater 1000 to 4000 FNU: ±5% of reading	0.1 FNU	FNU, NTU
Total Suspended Solids (TSS)*	-	User correlated from turbidity field measurements and lab TSS measurements from grab samples	0.01, 0.1 mg/L	mg/L
Ammonium**	0 to 200 mg/L NH_4-N	±10% of reading or 2 mg/L, whichever is greater	0.01 mg/L	NH_4-N mg/L, NH_4-N mV
Ammonia*	0 to 200 mg/L NH_3-N	-	0.01 mg/L	NH_3-N mg/L
Chloride**	0 to 18000 mg/L Cl	±15% of reading or 5 mg/L, whichever is greater	0.01 mg/L	Cl mg/L, Cl mV
Nitrate**	0 to 200 mg/L NO_3-N	±10% of reading or 2 mg/L, whichever is greater	0.01 mg/L	NO_3-N mg/L, NO_3-N mV
Depth	0 to 328 feet (0 to 100 m)	±0.013 ft (±0.004 m) for 1, 4, and 10 m cables ±0.13 ft (±0.04 m) for cables 20 m and longer	0.001 m or 0.01 ft	m, ft

*Derived/calculated parameter **Freshwater only, 20 m maximum depth

ProDSS System Specifications (Instrument, Sensor, and Cable)

Sensor/Parameter	Sensor Type/Measurement Method	Calibration	Maximum Depth	Warranty
Temperature	Thermistor, installed on conductivity sensor	Not available	100 m	2 years for conductivity/temperature sensor
pH	Combination glass bulb electrode, Ag/AgCl reference electrode with gelled electrolyte	1, 2, or 3 point	100 m	2 years for pH and pH/ORP sensors 1 year for pH and pH/ORP sensor modules
ORP	Platinum button with Ag/AgCl reference	1 point	100 m	2 years for pH/ORP sensor 1 year for pH/ORP sensor module
Dissolved Oxygen	Optical luminescence - lifetime method	1 or 2 point	100 m	2 years for optical DO sensor 1 year for optical DO sensor cap
Barometer	-	1 point	-	3 years, integrated into ProDSS handheld
Conductivity	Four nickel electrode cell	1 point	100 m	2 years for conductivity/temperature sensor
Specific Conductance*	Calculated from conductivity and temperature	1 point	-	-
Salinity*	Calculated from conductivity and temperature	1 point	-	-
Total Dissolved Solids (TDS)*	Calculated from specific conductance and a user-selectable TDS multiplier (0.30 to 1.00; default 0.65)	-	-	-
Resistivity*	Calculated from conductivity and temperature	-	-	-
Seawater Density*	Sigma is calculated from salinity, temperature, and pressure (depth) Sigma T is calculated from salinity and temperature	-	-	-
Turbidity	Nephelometric - Optical, 90° scatter Meets ISO 7027	1, 2, or 3 point	-	2 years for turbidity sensor
Total Suspended Solids (TSS)*	User correlated from turbidity field measurements and lab TSS measurements from grab samples	-	-	-
Ammonium**	Ion selective electrode	1, 2, or 3 point	20 m	2 years for ammonium sensor 6 months for ammonium sensor module
Ammonia*	Calculated from ammonium, temperature, salinity, and pH	-	-	-
Chloride**	Ion selective electrode	1, 2, or 3 point	20 m	2 years for chloride sensor 6 months for chloride sensor module
Nitrate**	Ion selective electrode	1, 2, or 3 point	20 m	2 years for nitrate sensor 6 months for nitrate sensor module
Depth	Pressure transducer	1 point	-	2 years, integrated into cable assembly

*Derived/calculated parameter
**ISEs for freshwater only. 20 meter maximum depth

ProDSS Order Guide

Step 1: Order Instrument

All instruments include a rechargeable lithium-ion battery (pre-installed), hand strap, USB cable for charging the ProDSS battery and for connection to a PC, universal AC charger, cable for connection to a USB memory stick, ProDSS quick start guide, and USB memory stick containing KorDSS software and digital copy of the user manual.

☐**626870-1**: Handheld without GPS

☐**626870-2**: Handheld with GPS

Step 2: Order Cable Assembly

There are two types of cables available - those with integral (built-in) sensors and those without.

Cables without Integral Sensors - ProDSS 4 Port

These cables do not include any integral sensors, although an optional built-in depth sensor is available. With the exception of depth, all sensors are user-replaceable. All cables include 4 universal sensor ports and a maintenance kit (3 port plugs, tube of o-ring lubricant, brush for conductivity probe, syringe for depth sensor, and sensor installation/removal tool). A 1 lb. weight is included with all cables 10 meters and longer while 10, 20, and 30 meter cables include a cable management kit.

☐**626909**: No depth sensor integrated in **1**, **4**, **10**, **20**, **30**, **40**, **50**, **60**, **70**, **80**, **90**, or **100** meter cable.

☐**626910**: Depth sensor integrated in **1**, **4**, or **10** meter cable.

☐**626911**: Depth sensor integrated in **20**, **30**, **40**, **50**, **60**, **70**, **80**, **90**, or **100** meter cable.