University of Waterloo Water Quality Analysis: July 2015

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University of Waterloo
ERS 341
August 7, 2015

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1 Introduction

1.1 Contract Summary

The University of Waterloo Summit Centre for the Environment (WSCE) has partnered with the Muskoka Lake associations to create a lake monitoring program. This lake monitoring program is meant to be a follow up on water testing done by the Ministry of Environment and Climate Change. Each of these lakes were sampled and tested twice, two weeks apart from each other, between July 1st and July 31st 2015. Bi-weekly reports were also sent out to the partners as well as the supervisor. Previous sampling data for some lakes was provided to gain an understanding of what might be seen as well as where sampling locations were in the past. For some lakes, new sampling points needed to be established. Parameters that were investigated included: secchi, water temperature, sampling depth, dissolved oxygen (DO), conductivity, pH, nitrates (NO_3), nitrite (NO_2), phosphates (PO_4) and total phosphorus (TP). All samples were collected in a clean 500 mL bottle and were analyzed within 24 hours of collection. This report contains both the field and lab methods in addition to all the field and lab data for all locations. The data 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.

This report outlines the methods, data collected and statistical analysis as stated in the Contract Obligations. The objective of this report was to assess and analyze the current state of the lakes that were sampled and tested. The long-term goals for this project are 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 (Halliday et al., 2012). This report will hopefully be used in the future for long-term monitoring effects on these lakes.

1.2 Background Information

There are a variety of factors which effect fresh water systems including human activity, creating a threat on biodiversity as well as ecosystem functions (Hawryshyn, Rühland, Quinlan, Smol, & Vinebrooke, 2012). It is therefore, important to test and gain years of data on watersheds and lakes to have an understanding of changes over time. Water testing can also give a baseline of where a lake is and over the years if this varies significantly (Loftis & Ward, 1980). In addition, data that is collected in similar areas over a time span can be used for management decision making for a given area (Loftis & Ward, 1980). This project, for the most part is a continuation of data collection on the water quality of lakes in the surrounding Muskoka area. Some of the lakes in this report are new to the project and some have changed sampling locations. Using the water samples collected, the physical and chemical components were found and recorded. The aim of this project was to collect data to have on an annual basis for these lakes, to help gain a better understanding of their health.

2 Lake Profile

2.1 Lake Waseosa

Lake Waseosa is highly developed lake just north of Huntsville. The lake is elongated in the north to south direction, is fed by Jessop Lake, and feeds into both Palette and Ripple Lakes to the north. Three deep basins with depths well over 15m exist and were the focus of the sampling efforts included within this report. This is the first time that Waseosa has been included in the Lake Monitoring Program headed by the University of Waterloo and, as such, little data exists prior to this assessment.

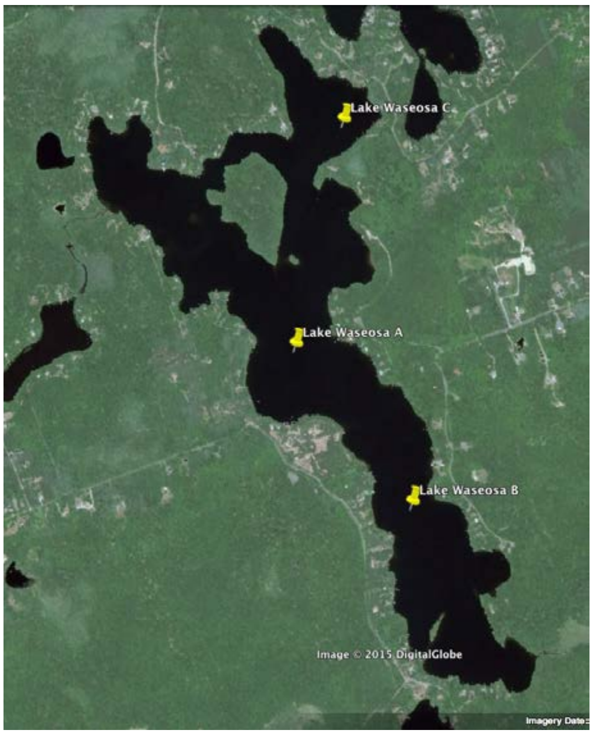

Figure 2-1Map of Lake Waseosa (Google Maps, 2015).

Table 2-1 Sites and GPS coordinates for Lake Waseosa.

Site	GPS
A	N 45 24 18.1 W 079 16 36.3
B	N 45 23 55.0 W 079 16 12.0
C	N 45 24 51.0 W 079 16 26.3

2.2 Jessop Lake

Jessop Lake is a small, semi-developed lake immediately south of Lake Waseosa and is located just north of Huntsville. The western half of the lake has, up until this point, remained fairly untouched save for three cottages. The eastern half of the lake is fairly well developed and has been for some time. The lake is very shallow with a maximum depth of around 4m. The lake flows out into Lake Waseosa from the north. Site A has historically been used for the Lake Partner Program run by the MOE. Site B was chosen due to its proximity to the outflow of Jessop Lake. Site C was chosen to represent the western portion of the lake, as it is noticeably less developed than the eastern portion. It should also be noted that the western portion of the lake has just been given the go ahead for development. Monitoring all of the sites, especially site C, could give great insight into how the change in activity will affect this lake's health.

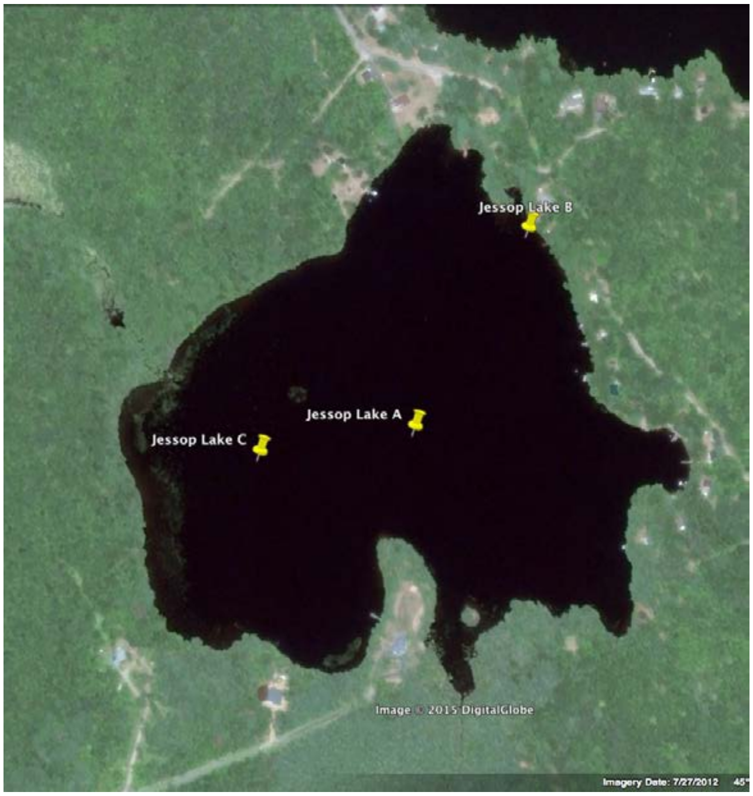

Figure 2-2 Map of Jessop Lake (Google Maps, 2015).

Table 2-2 Sites and GPS coordinates for Jessop Lake.

Site	GPS
A	N 45 23 15.0 W 079 16 10.0
B	N 45 23 23.9 W 079 16 03.6
C	N 45 23 14.0 W 079 16 18.8

2.3 Ripple Lake

Ripple Lake is located just north of Huntsville and is part of the series of lakes that are fed by Lake Waseosa. The lake has two inflows: one from Lake Waseosa from the south and the other from Palette Lake from the east. The outflow of the lake occurs in the northwestern corner. The southeastern corner of the lake is well developed while the remainder of the lake has sparse to some development. The lake is very deep and both sites were found to have a thermocline. Site A is historically used for the Lake Partner Program run by the MOE. Site B was chosen in order to determine the effect of the more densely populated southern portion of the lake as well as any impacts coming from the inflow of the two connected lake.

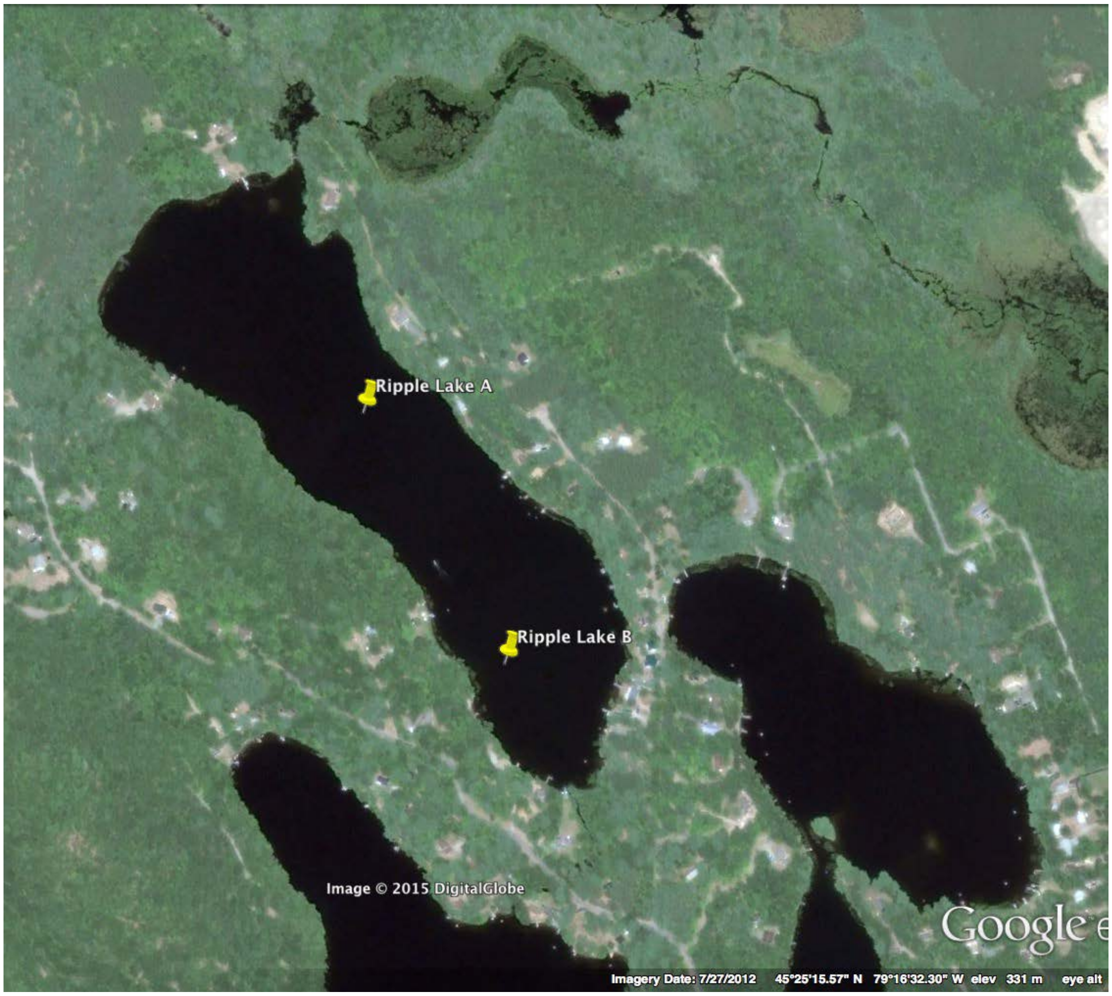

Figure 2-3 Map of Ripple Lake (Google Maps, 2015).

Table 2-3 Sites and GPS coordinates for Ripple Lake.

Site	GPS
A	N 45 25 19.0 W 079 16 36.0
B	N 45 25 08.8 W 079 16 27.8

2.4 Palette Lake

Palette Lake is located just north of Huntsville and is fed by Lake Waseosa to the south. The lake's outflow occurs in the northwestern portion of the lake and flows into Ripple Lake to the west. The lake is broken up into two large bays that are connected by a shallow narrows. The northern bay is well developed on all sides and is fairly deep as it has a thermocline. The southern bay has no immediate development on the western bank but is in very close proximity to developed areas. The southern bay has a very deep portion that was used for sampling purposes.

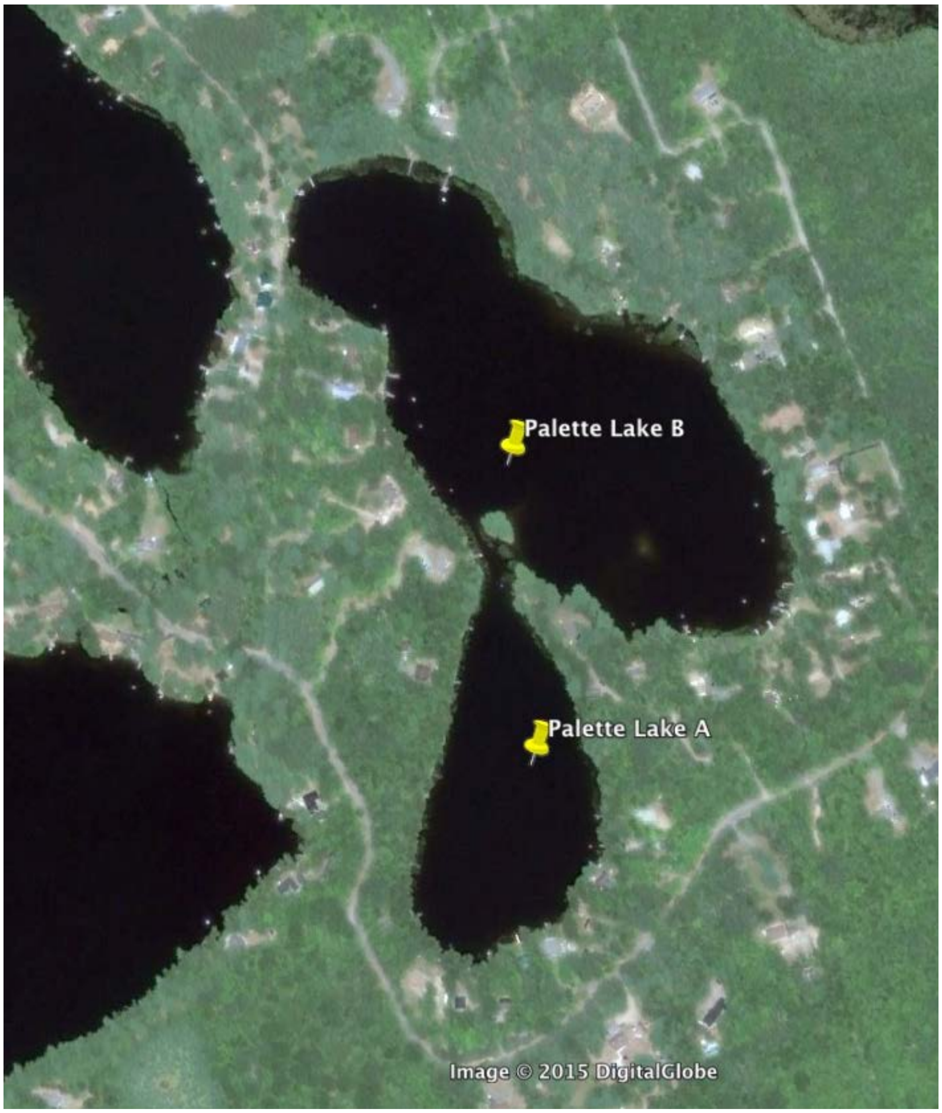

Figure 2-4 Map of Palette Lake (Google Maps, 2015).

Table 2-4 Sites and GPS coordinates for Palette Lake.

Site	GPS
A	N 45 25 04.1 W 079 16 09.0
B	N 45 25 04.0 W 079 16 09.0

3 Methodology

Both field and lab work were required for this assessment. Each lake was sampled twice and six (6) samples were taken per lake per sampling day. For small lakes like Waseosa, Palette, Ripple and Jessop, two or three (3) samples were taken per sampling day. Sample locations were chosen based on prior sampling records collected by the Ministry of the Environment and Climate Change (MOECC). This aided to limit variation between past water sampling and provided more consistent comparisons between past sampling results. For those lakes without prior sampling data available sample sites were selected to ensure appropriate representation of lake water quality samples and according to community partner input. Sites were evenly spaced apart and below the thermocline (Quay, Broecker, & Hesslein, 1980).

3.1 Field Methodology

The number of lakes that were sampled on the specific day was chosen according to the lake community partner's availability. The number of samples that were taken per sampling day ranged from 2-12 samples. Sampling days for each lake were separated by more than seven days. GPS coordinates were used to mark a sample location and aided in locating the site for the second sampling. Weather conditions were recorded at start and end of each lake sampling with a Kestrel unit. General characteristics were noted of the area, such as riparian zone, cottage/human presence, boat traffic or other features noted by the lake community partners.

Sampling procedures were followed according to the MOECC's Lake Partner Program guidelines. Water clarity, thermocline depth and water temperature were measured in the field for each sampling site. The dissolved oxygen, pH, conductivity, nitrite, nitrate, phosphate, and total phosphorous were measured in the laboratory according to current procedures provided by the HACH Company. Water samples were taken from just below the thermocline when available. The thermocline was found by lowering a Thermo-depth sampler and measuring for water temperature changes exceeding more than 4˚C over a distance of one metre. Once the thermocline was located, the temperature and depth were recorded before lowering a Van Dorn sampler to just beyond that depth (MOECC, 2014; CCME, 2011). Pre-labeled sample containers were conditioned with three (3) 50 ml aliquots of sample water before filling to minimize contamination from possible residuals (EPA, 2012; CCME, 2011). Bottles were filled to avoid air pockets and ensure higher accuracy in the lab for dissolved oxygen measurement (CCME, 2011). A secchi disc was used to measure water clarity by examining the attenuation of light through the water (CCME, 2011). The disc was lowered from the shaded side of the boat until the disc disappeared (MOECC, 2014). The depth of the secchi disc was recorded. All other parameters were measured as soon as possible upon the return to the WSCE lab. The parameters measured and other techniques used in the field followed MOECC guidelines for quality assurance.

3.2 Lab Methodology

Dissolved oxygen, conductivity and pH were measured immediately upon the return to WSCE from the field with a HACH Multimeter. Nitrite, nitrate, phosphate and total phosphorous were measured using the D2700 HACH spectrophotometer following procedures described in the HACH spectrophotometer manual (HACH Company, 2013). The method used for nitrate was the Cadmium Reduction Method #8192 Low Range (0.01 to 0.50 mg/L). The nitrite method was the USEPA Diazotization #8507 Low Range (0.002 to 0.300 mg/L). The reactive phosphate method was the USEPA PhosVer3 Ascorbic Acid #8048 (0.02 to 2.50 mg/L). The method used for total phosphorus was DR2700 #10210 Ultra Low Range (HACH Company, 2011). All testing was completed within 24 hours of sampling to avoid decomposition. Samples were retained for 24 hours after testing was completed, in case retesting was necessary, and disposed of after results confirmed. There were some modifications to the HACH methods. For the nitrate and nitrite experiments, all the reactions happened in a 50 mL conical tube with 15-20 mL of sample and then 10 mL of the reacted sample was transferred into a sample cell.

4 Parameters and Water Quality Standards

Parameters measured were chosen by the community partner because of their ability to indicate the health of a lake (WHO, 2011; EPA, 2012). Guidelines describing appropriate or safe levels of measured parameters were found in the MOECC’s Provincial Water Quality Objectives (PWQO) and the World Health Organization`s 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).

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 water in a shaded location; the best time of day to sample secchi depth is midday (CCME, 2011). The deeper the secchi disc reading is, the clearer the lake. The CCME (2011) 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. 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 DO 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).

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). If 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 than the water it would be less conductive (EPA, 2012). The conductivity for lake water should be below 500 microSiemens/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 of 7 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 an increase 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 wastewater treatment (WHO, 2011). When exposed to oxygen, nitrite quickly converts to nitrate, which is part of the reason why it 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 phosphate has not been found to be a threat to human health. Therefore, there are no “acceptable” levels for phosphate in drinking water. However, excessive plant growth due to high phosphate levels can occur at concentrations above 0.03 mg/L (Fleming & Fraser, 1999).

4.9 Total Phosphorous

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, 2007). Canadian guidelines provide ‘trigger ranges’ indicating the health of the system according to the total phosphorous level

(CCME, 2004). Table 4-1 displays these ranges for different systems. The lakes in this study are typically oligotrophic, not exceeding a level of 10 µg/L.

Table 4-1: Canadian total phosphorous trigger ranges (CCME, 2004).

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

5 Results

Results were recorded from field and laboratory measurements, and are listed below. Results were separated according to lake. Statistical analyses were conducted to find summary characteristics and significant differences between the sampling days. The summary characteristics included the maximum and minimum values, as well as, the mean and standard deviation for each parameter. The summary characteristics can be compared with recommended levels discussed in section 4. The significant differences were evaluated with a paired sample-test between sample days, and are indicated by the p-value. When the p-value is less than 0.05, the null hypothesis is rejected and the difference between the sampled day values is significant with 95% confidence. These p-values are noted in the results. Significant differences are attributed to consistent changes in the parameter between sampling days and across all sampling sites. When the p-value is greater than 0.05 the null hypothesis cannot be rejected and the changes between the sampling days could be due to chance or experimental error.

5.1 Lake Waseosa

Day 1: July 9. 2015	**Day 2:** July 22, 2015
Weather Conditions	**Weather Conditions**
Beginning – Temperature: 21.1ºC, Wind: 0.0 m/s, Humidity: 56.0%	Beginning – Temperature: 20.2ºC, Wind 0.5 m/s, Humidity: 62.1%
Lake Conditions	**Lake Conditions**
Calm water, partly sunny, great sampling conditions	Some choppy waves making it harder to drop thermocline or Van Dorn straight down, sunny

Table 4-1 Field Lake Characteristics

Sample Site	Sample Depth (m)	Thermocline (Y/N)	Secchi Depth (m)	Sample Temp (ºC)
A1	5.5	Y	3.50	8.5
A2	4.5	Y	3.00	8.7

B1	5.5	Y	3.00	8.5
B2	6.0	Y	3.00	9.1
C1	5.5	Y	3.25	7.7
C2	5.5	Y	3.00	8.7

Table 4-2 Statistical Analysis for Field Data

	Minimum	Maximum	Mean	SD	p-value
Sample Temp(°C)	7.7	9.1	8.5	0.46	0.12

Table 4-3 Site Description

Sampling Site	Site Description
A	Middle point, well-developed area, near a camp
B	Well-developed shoreline, south location, middle of area
C	Top right 'bay' area, less developed, empty right shore, close to large island, calmer waters, close to outflow of lake

Table 4-4 Lab Analysis Results

Site	DO (mg/L)	pH	Conductivity (µS/cm)	Nitrate (mg/L)	Nitrite (mg/L)	Phosphate (mg/L)	TP (µg/L)
A1	7.79	7.02	30.7	0.03	<0.002	0.68	9
A2	7.54	6.79	31.4	0.04	<0.002	<0.05	8
B1	7.06	6.38	31.7	0.07	<0.002	0.54	14
B2	6.83	6.46	31.5	0.11	<0.002	<0.05	5
C1	8.05	6.51	30.2	0.03	<0.002	<0.05	26
C2	7.15	6.45	31.4	0.10	<0.002	<0.05	6
Minimum	6.83	6.38	30.2	0.03	UR	0.54	5
Maximum	8.05	7.02	31.7	0.11	UR	0.68	26
Mean	7.40	6.60	31.2	0.06	UR	0.61	11.3
SD	0.47	0.25	0.58	0.04	UR	0.10	7.84
p-value	0.17	0.52	0.30	0.15	UR	UR	0.21

*UR – when values are under range and statistical analysis could not be conducted. (N=6, $p<0.05$)

5.2 Jessop Lake

Day 1: July 7, 2015	**Day 2:** July 28, 2015
Weather Conditions	**Weather Conditions**
Beginning – Temperature: 22.2°C, Wind: 1.0 m/s, Humidity: 70%	Beginning – Temperature: 25.5°C, Wind: 0.1 m/s, Humidity: 68.1%
Lake Conditions	**Lake Conditions**

Calm waters, sunny	Very calm water, sunny

Table 4-5 Field Lake Characteristics

Sample Site	Sample Depth (m)	Thermocline (Y/N)	Secchi Depth (m)	Sample Temp (ºC)
A1	2	N	1.75	17.8
A2	2	N	2.00	22.3
B1	2	N	1.75	23.4
B2	1	N	2.00	25.2
C1	1	N	1.75	23.2
C2	1	N	2.00	24.9

Table 4-6 Statistical Analysis for Field Data

	Minimum	Maximum	Mean	SD	p-value
Sample Temp(ºC)	17.8	25.2	22.8	2.69	0.11

Table 4-7 Site Description

Sampling Site	Site Description
A	Near an peninsula and shoreline, wildlife
B	Near outflow, swampy by mouth of the outflow, seaweed on bottom
C	Less developed side, close to lily pads, shallowest spot

Table 4-8 Lab Analysis Results

Site	DO (mg/L)	pH	Conductivity (µS/cm)	Nitrate (mg/L)	Nitrite (mg/L)	Phosphate (mg/L)	TP (µg/L)
A1	6.98	6.30	27.16	<0.01	<0.002	0.17	5
A2	7.51	6.84	21.01	<0.01	<0.002	<0.05	7
B1	8.00	6.44	20.50	<0.01	<0.002	0.05	5
B2	7.98	6.70	21.51	<0.01	<0.002	<0.05	3
C1	8.32	6.50	19.82	<0.01	<0.002	<0.05	3
C2	7.91	6.70	19.99	<0.01	<0.002	<0.05	7
Minimum	6.98	6.30	19.82	UR	UR	0.04	3
Maximum	8.32	6.84	27.2	UR	UR	0.17	7
Mean	7.78	6.58	21.7	UR	UR	0.09	5.0
SD	0.47	0.20	2.76	UR	UR	0.07	1.79
p-value	0.91	0.09	0.54	UR	UR	UR	0.53

*UR – when values are under range and statistical analysis could not be conducted. (N=6, p<0.05)

5.3 Ripple Lake

Day 1: July 9, 2015	**Day 2:** July 21, 2015
Weather Conditions	**Weather Conditions**
Beginning – Temperature: 16.0°C, Wind: 0.6 m/s Humidity: 77.2%	Beginning – Temperature: 18.4°C, Wind: 1.5 m/s, Humidity: 67.9%
Lake Conditions	**Lake Conditions**
Calm waters, small closed lake, partly sunny	Calm to slightly choppy waters, full sun

Table 4-9 Field Lake Characteristics

Sample Site	Sample Depth (m)	Thermocline (Y/N)	Secchi Depth (m)	Sample Temp (°C)
A1	4.5	Y	3.25	8.2
A2	4.5	Y	4.00	9.3
B1	4.5	Y	3.25	7.5
B2	4.5	Y	4.25	9.6

Table 4-10 Site Description

Sampling Site	Site Description
A	Middle of the lake, close to non-developed land, very calm water
B	Closer to developed side of the lake, grassy marshy like spot close by, close to outflow

Table 4-11 Statistical Analysis for Field Data

	Minimum	Maximum	Mean	SD	p-value
Sample Temp(°C)	7.5	9.6	8.7	0.97	0.19

Table 4-12 Lab Analysis Results

Site	DO (mg/L)	pH	Conductivity (µS/cm)	Nitrate (mg/L)	Nitrite (mg/L)	Phosphate (mg/L)	TP (µg/L)
A1	7.07	6.36	37.3	0.07	<0.002	<0.05	11
A2	8.55	6.65	68.9	0.05	<0.002	<0.05	3
B1	7.22	6.34	37.5	0.05	<0.002	<0.05	11
B2	8.05	6.60	39.1	0.06	<0.002	<0.05	8
Minimum	7.07	6.34	37.3	0.05	UR	UR	3
Maximum	8.55	6.65	68.9	0.07	UR	UR	11
Mean	7.72	6.49	45.7	0.06	UR	UR	8.3
SD	0.70	0.16	15.47	0.01	UR	UR	3.77
p-value	0.17	0.03	0.47	0.80	UR	UR	0.27

*UR – when values are under range and statistical analysis could not be conducted. (N=4, $p<0.05$)

5.4 Palette Lake

Day 1: July 9, 2015	**Day 2:** July 22, 2015
Weather Conditions	**Weather Conditions**
Beginning – Temperature: 20.7°C, Wind: 0.0 m/s, Humidity: 66.3%	Beginning – Temperature: 17.5°C, Wind: 0.4 m/s, Humidity:59.9%
Lake Conditions	**Lake Conditions**
Calm waters, very still water in second sampling location, partly sunny	Calm waters, sunny

Table 4-13 Field Lake Characteristics

Sample Site	Sample Depth (m)	Thermocline (Y/N)	Secchi Depth (m)	Sample Temp (°C)
A1	4.5	Y	3.25	9.1
A2	4.5	Y	3.50	8.7
B1	4.5	Y	3.00	7.5
B2	4.5	Y	3.50	10.2

Table 4-14 Statistical Analysis for Field Data

	Minimum	Maximum	Mean	SD	p-value
Sample Temp(°C)	10.5	22.3	17.9	5.02	0.51

Table 4-15 Site Description

Sampling Site	Site Description
A	Small Lake, moderately developed, there is a less developed side, lawns and beaches at the water edge of some properties. Larger section of lake, close to shore, in a deep pocket
B	Moderately developed, second bay area, pretty closed off at connection point, lots of weeds and lily pads, water has less movement, deepest part of bay

Table 4-16 Lab Analysis Results

Site	DO (mg/L)	pH	Conductivity (µS/cm)	Nitrate (mg/L)	Nitrite (mg/L)	Phosphate (mg/L)	TP (µg/L)
A1	17.19	7.27	77.4	<0.01	<0.002	0.18	9
A2	12.22	6.83	60.7	<0.01	<0.002	<0.05	39
B1	12.45	7.26	61.0	<0.01	<0.002	<0.05	45
B2	16.36	7.06	76.3	<0.01	0.003	<0.05	50

Minimum	8.08	6.91	51.2	0.00	0.002	0.06	9
Maximum	10.84	7.19	55.1	0.01	0.008	0.12	50
Mean	9.40	7.06	53.3	0.01	0.004	0.08	35.5
SD	1.05	0.07	1.27	0.01	0.003	0.03	18.4
p-value	0.07	0.80	0.50	UR	UR	UR	0.39

*UR – when values are under range and statistical analysis could not be conducted. (N=4, $p<0.05$)

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