Kawartha Lake Stewards Association

2019 Annual Lake Water Quality Report

Climate Change and Citizen Science in the Kawarthas

MAY 2020

This report was prepared exclusively for the members of the KLSA, its funders, interested academics and researchers, and other non-profit associations and individuals engaged in similar water quality testing in Ontario. The accuracy of the information and the conclusions in this report are subject to risks and uncertainties including but not limited to errors in sampling methodology, testing, reporting and statistics. KLSA does not guarantee the reliability or completeness of the data published in this report. Nothing in this report should be taken as an assurance that any part of any particular body of water has any particular water quality characteristics, or is (or is not) safe for swimming or drinking. There can be no assurance that conditions that prevailed at the time and place that any given testing result was obtained will continue into the future, or that trends suggested in this report will continue.

Please Note:
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You can view Adobe pdf versions of KLSA reports on the KLSA website: **klsa.wordpress.com**

KLSA Privacy Policy

The complete KLSA Privacy Policy is on the KLSA website: klsa.wordpress.com. KLSA collects information about our members and volunteers such as name, address, telephone number, email address and preferred method of communication. Information may be kept in written form or electronically. It is used to provide information about KLSA activities and related lake water issues of interest to residents of the Kawartha Lakes. Information will not be disclosed to anyone else unless required to do so by law and will be deleted when it is no longer required. Mailing lists will not be sold, transferred or traded. Information will be kept in a secure place. Further details can be obtained by contacting the KLSA Privacy Officer, Lynn Woodcroft, by email at kawarthalakestewards@yahoo.ca or by regular mail at 264 Bass Lake Road, Trent Lakes ON K0M 1A0.

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Snowy sunset on Pigeon Lake by Jessie Gordon

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The Kawartha Lake Stewards Association (KLSA) is a volunteer-driven, non-profit organization of cottagers, year-round residents and local business owners in the Kawartha Lakes region. The Association's programs include the testing of lake water for phosphorus, clarity, calcium and *E. coli* bacteria and research and public education about water quality issues. KLSA has partnered with universities, colleges and governmental agencies to conduct research studies and produce publications. KLSA is led by a twelve member Board of Directors, chaired by William A. Napier. A list of the members of the Board is provided in Appendix A. A summary of articles contained in the *2019 KLSA Annual Lake Water Quality Report: Climate Change and Citizen Science in the Kawarthas* follows.

Have You Ever Wondered What Climate Change Means in the Kawarthas?

What does a changing climate mean for the Kawartha region? Based on international models, Ontario scientists have predicted the effects of climate change on the Great Lakes Basin. This can be extended to the Kawartha Lakes. Air temperatures will rise by 2°C to 7°C by the end of the century. This has implications for fisheries, lake temperatures, forests and habitat for birds and animals. The Muskoka Watershed Council has prepared an excellent study on this and Kawartha Conservation has also developed a climate change strategy. A reduction in greenhouse gases by individuals and organizations is essential. KLSA has applied for funds to study lake water temperatures and dissolved oxygen concentrations in several of the Kawartha Lakes.

Why Community Science is Essential for Managing Lake Health in the Kawartha Lakes

The Kawartha Lakes are experiencing significant changes with more people living year-round in cottage country in larger houses. The increased use of the lakes puts pressure on them, resulting in more aquatic plant growth and an influx of invasive species and potentially toxic blue-green algae. Community science (also called citizen science) is the use of local and seasonal residents to monitor their lake, collecting water samples to develop databases to track changes. One example is the Lake Partner Program, which has collected data on phosphorus and calcium and monitored lake clarity for two decades. Lake Simcoe provides an example of a successful monitoring program. Community science programs require support from conservation authorities, universities and government agencies. Community volunteers benefit from the experience of undertaking scientific studies and become more committed to protecting the environment.

It's Our Time to Make an IMPACT on the Kawartha Lakes

During the past ten years, Kawartha Conservation has led the development of Lake Management Plans in 12 lakes within its jurisdiction. This effort engaged 8,800 people and resulted in the identification of issues and values of residents towards their lakes and rivers. Specific issues of concern were identified for each lake and action plans to address them were developed. Funding and technical assistance are provided to residents and community organizations for projects to improve their shorelines through the City of Kawartha Lakes WATER fund. Kawartha Conservation's Citizen Science Lake and River Nearshore Water Quality Monitoring and Kawartha Water Watch programs will engage citizen science volunteers in collecting water samples monthly during the summer for water quality analysis.

Citizen Science in Action

Several articles in this year's report provide examples of citizen science in action and provide opportunities to participate in monitoring programs. (Some 2020 programs may be suspended due to COVID-19).

- **Losing the Lost Channel on Stony Lake** – In an effort to stop the spread of starry stonewort, cottagers and a volunteer Environment Council on Stony Lake closed off access to a popular canoe route, the Lost Channel, and conducted public education initiatives through signs, information sheets and website bulletins about the rapid spread of the algae and the need to clean boats when travelling between lakes.
- **Temperature and Dissolved Oxygen in Clear and Stony Lakes** – The Environment Council for Clear, Stony and White Lakes conducted a study of water temperatures and dissolved oxygen at sites in Upper Stoney, Stony and Clear Lakes over a period of several months. A lack of oxygen caused by the decomposition of organic matter on the lake bottom causes nutrient enrichment resulting in the growth of algae and aquatic plants, reducing water quality.
- **Surface Water Characterization of Nogies Creek** – For seven years, the residents of Nogies Creek have hired a company to analyze surface water samples at three locations on the Creek. Testing began when a quarry was proposed near the Creek and the residents wanted to gather baseline water quality data. It has continued annually and *E. coli* testing was added three years ago.
- **Kawartha Land Trust – 2019 Highlights** – The Kawartha Land Trust (KLT) relies extensively on volunteers to undertake stewardship projects such as building trails to preserve donated lands and protect wetlands and forests. In 2019, KLT also partnered with two children's camps to teach campers the importance of conservation and threats to the environment such as invasive species. They participated in guided walks and native prairie grass plug planting.

Executive Summary

- **Monitoring the Status of Loons in the Kawartha Lakes** – Birds Canada welcomes volunteers to participate in the Canadian Lakes Loon Survey, recording loon sightings once a month in June, July and August.
- **Freshwater Mussels – Did You Know?** – The Clam Counter program provides an opportunity for the public to record sightings of freshwater mussels on their shorelines.

Action on Climate Change in Selwyn Township

Selwyn Township has valued environmental sustainability for more than 30 years. In 2016, in partnership with government agencies, First Nations and non-profit organizations, Selwyn developed a Climate Change Action Plan (CCAP) to reduce greenhouse gas emissions by 39% by 2031. A Coordinator was hired and a wide range of programs in such areas as energy conservation, community transportation, waste reduction and diversion, water and aquatic health and upgrades to municipal facilities have been implemented. Additional projects are planned for 2020 and beyond.

Trent University's Aquatic Research Program

Trent University has a long history of studying aquatic ecosystems. The Trent Aquatic Research Program (TARP) is an integrated research program focused on the long-term study of freshwater ecosystems in the Kawarthas. The program includes the collection of environmental data and monitoring of changes in lakes, rivers, habitat, etc. Partnerships will be developed with governments, lake stewards and environmental organizations to create plans to improve water quality, stop the spread of invasive species and restore the fisheries. Public education and citizen science opportunities will be offered.

Historical Assessment of the North Pigeon Lake Watershed

One of the study sites of the paleoecological environmental assessment study undertaken in 2016 was in the north part of Pigeon Lake. Historical changes that occurred from the 1830s to the 1900s, including the building of dams and locks, the development of the logging, milling and farming industries and later cottaging affected water quality and settlement patterns on the lakes and rivers of the region.

2018 Kawartha Lakes Sewage Treatment Plants Report

Each year, KLSA monitors output from local sewage treatment plants (STPs) that discharge effluent either directly into the Kawartha Lakes or to water bodies that flow into these lakes. Data for 2018, the latest year available, was analyzed. Phosphorus output is a key to and a primary cause of increased plant and algae growth in our lakes. KLSA would like all STPs that discharge directly into the lakes to achieve a 99% phosphorus removal rate. The report includes results for Minden, Coboconk, Fenelon Falls, Lindsay, Bobcaygeon, Omemee, King's Bay and Port Perry. The total amount of phosphorus discharged from all these plants in 2018 was 572 kg, an increase from 566 kg in 2017 and well below the 99% removal goal, which would have been about 198 kg. Continued monitoring of all STPs is vital.

***E. coli* Bacteria Testing**

In 2019, KLSA volunteers tested 66 sites in 11 lakes for *E. coli* bacteria. Samples were analyzed by SGS Canada Inc. in Lakefield. *E. coli* levels were low throughout the summer of 2019, consistent with other years. Of the total 378 tests conducted, 356 were in the 0-20 range, 16 were in the 21-50 range, four were in the 51-100 range and two exceeded 100 *E. coli* cfu/100 mL. The sites with elevated counts were usually in places where wildfowl congregated. Lakes west of Pigeon Lake, which used the laboratory at Fleming College in Lindsay, did not participate in 2019 since there was no one to coordinate sample drop-off. KLSA hopes to resume the program in 2020. Lake-by-lake 2019 results can be found in Appendix E.

Phosphorus Testing

In 2019, as part of the Ministry of the Environment, Conservation and Parks' Lake Partner Program (LPP), KLSA volunteers collected water samples four to six times (monthly from May to October) at 50 sites on 17 lakes for phosphorus testing. Five new sites were added. Samples were analyzed by the Ministry laboratory. Volunteers also measured water clarity, using a Secchi disk. In 2019 phosphorus levels in most lakes were low in the spring, rose in June and July and tapered off in August and September, a typical Kawartha pattern. However, in many lakes phosphorus levels were higher than usual in August and September while in a few lakes, levels stayed low throughout the entire season. Calcium levels are also provided. Detailed results are provided in Appendix F.

KLSA Support and Public Meetings

KLSA relies on donations from individuals, businesses, municipalities and other government agencies. Please consider making a donation to support our work. KLSA holds two general meetings per year in the spring and fall. The fall meeting includes the Association's Annual General Meeting.

Thank you! KLSA appreciates the extraordinary support of the many volunteers who participate in our monitoring programs and the individuals and organizations that provide financial support. Thank you to our scientific advisors and staff at the Lake Partner Program and SGS Canada Inc. who assist with the water testing programs. We are grateful to Danielle Shaw (Gull's Graphic Design) who prepared the layout and the Lakefield Herald for arranging for the publication of this report. For further details, visit our website: http://klsa.wordpress.com.

KLSA Editorial Committee: Sheila Gordon-Dillane (Chair), Janet Duval, Tom McAllister, Kathleen Mackenzie, Alyssa Stewart and Kimberly Ong.

Chair's Message

William A. Napier, Chair
Kawartha Lake Stewards Association

The first KLSA report, see: KLSA. 2002. Water Quality 2001 report, *Don't Feed the Geese* - states:

"Like most 'grass roots' organizations, the KLSA started with a group of people having a shared vision. We wanted to know more about the water quality on our TSW-connected lakes, particularly E. coli (remembering Walkerton) and phosphorus levels."

In an ever-changing world, the Kawartha Lake Stewards Association has remained true to its initial mission. We have remained an all-volunteer group of concerned cottagers, year-round residents, local businesses and interested parties. Our programs still include testing lake water for phosphorus and *E. coli* bacteria, monitoring the performance of sewage treatment plants and providing environmental education through publications and public meetings. Our projects have spanned the environmental horizon of aquatic plant investigations, modelling water flows, invasive species assessment, looking into historical water quality concentrations and illustrating the beauty of the Kawartha region.

We have seen progress. Lake management plans are now being implemented on the lakes managed by Kawartha Conservation, and lake associations to the east have undertaken the initiative to create their own plans.

Now with the looming prospect of climate change and other environmental effects, we will continue to pursue scientifically based information to assist shoreline residents, businesses and lake managers in developing measures to ensure excellent water quality and viable ecosystems.

In 2019 KLSA coordinated water quality testing at 66 sites for bacteria and 50 sites for phosphorus in the 17 lakes referenced in this report.

KLSA continued its work by participating with Watershed Canada and The Land Between's Blue Flag program in the development of a new eco label called the Blue Lakes program. Lake associations that agree to adopt stewardship principles and actions will receive the eco label. For more information see: www.bluelakes.ca.

At our May 11th spring meeting we were excited to have Dr. Jim Buttle, School of Environment, Trent University whose topic was "*Lake Ice Dynamics and the Kawarthas: Climate Change at your Dock*". His excellent presentation described how ice is made, its forms and what is in store for us in a changing climate.

At the October 5th meeting Dr. Andrea Kirkwood, Associate Professor and supervisor of the Kirkwood Laboratory at Ontario Tech University spoke about a topic close to the hearts of KLSA members: "*How Citizen Science will improve nearshore water quality*". In addition, Dr. Kirkwood provided a summary of her work on the invasive species *Starry Stonewort and its prevalence in the Kawartha Lake Continuum*.

After almost 15 years on the Board of Directors, including several years as Chair, Mike Stedman did not stand for re-election to the Board in 2019. Mike was the first KLSA Board member I met. Throughout his time with KLSA, Mike has developed strong relationships with many of our partners and provided wise counsel and leadership. The KLSA welcomes new director Ms. C. Lee. Her interest in aquatic species will benefit all KLSA members and she has already begun to develop new public education initiatives.

KLSA is fortunate to have an active and committed Board of Directors. Their contributions are greatly appreciated. We also appreciate the work of the Editorial Committee in producing this annual report.

KLSA relies on your support and interest. We are indebted to the folks at Grant Thornton LLP, the Peterborough Chapter of the Workforce Development Board and the Lakefield Herald for their ongoing help.

Our Scientific Advisors at Queen's University, Trent University and Fleming College provide us with technical support and keep us on the right track. Without the support of the business community, municipalities, government agencies and private donors like you, KLSA would not exist.

Check the KLSA website for dates, locations and speaker information for KLSA public meetings. All are welcome.

Have You Ever Wondered What Climate Change Means in the Kawarthas?

William A. Napier, Chair
Kawartha Lake Stewards Association

As annual air temperatures continue to rise, what are the projections for environmental change in the Kawartha region? Fortunately, Ontario scientists have not been idle[1]. In the course of the past decade, they have taken the international models and applied climate change data to identify potential effects in Ontario including the Great Lakes Basin. Based on this information we can paint a picture of what the Kawarthas may look like during the balance of this century. The Muskoka Watershed Council has prepared an excellent document and a Kawartha Conservation Authority report has outlined its climate change strategy. It is difficult to consolidate and summarize all the available information into an article for the annual Lake Water Quality Report. Therefore, KLSA has published and uploaded on our website a publication summarizing the available information on what is in store for us here in the Kawarthas. The information found in this article and references can be found in the website article.

So, what does a changing climate mean for the Kawartha region? In the future there will still be warm and cold, wet and dry years. By mid-century the annual air temperatures will be 2°C to 3°C warmer and by the end of the century 3°C to 7°C warmer and about ten percent wetter. Figure 1 shows where air temperatures will be for us relative to today's annual average temperature based on the best- and worst-case climate projection scenarios. Under the best-case scenario, the annual average temperature for Peterborough will be similar to what is found in Albany, New York. Under the worst-case scenario, the annual average temperature will be similar to Richmond, Virginia.

Figure 1: Scenario Based Air Temperature

The cryosphere will change (those portions of earth's surface where water is in solid form, including lake and river ice, snow cover and frozen ground). Ice conditions will become variable as slushing conditions prevail. Ice will be off the lakes sooner and arrive later. Likely our lakes will become more productive. Fishing for walleye will become more difficult but bass may become more plentiful. That's because each fish species has a range of temperatures considered to be optimal. In shallow lakes like the Kawarthas, cold and cooler water habitat will be severely restricted, stressing cool water fish such as walleye. Warm water fish such as bass are projected to benefit.

Some economists see an economic advantage, on a macro scale, for an area that will have an annual increase in average air temperatures. There will be an increase in tourism because of an earlier spring, and warmer summer and autumn conditions. In response to projected climate change, the weather-visitation models suggest that for each additional degree of warming experienced, despite the negative effects of increasing precipitation and more frequent heat extremes, annual visitation at provincial parks and along the Trent-Severn Waterway could increase by 3.1% annually. The projected increase in park visitation as a result of rising temperatures would be mainly associated with shoulder season visitation, with only minor increases in peak season visitation.

There will still be forests, but there will be a variety of different species found in all levels and successional stages. Figure 2 shows the current range of red oak. By the end of the century, the range is shifted northwards, becoming less prevalent in the southern part of the United States and increasing up to the north shore of Lake Superior (Figure 3). The boreal trees that are located along the northern border of the Kawartha region are at their current southern range and will become stressed under warmer climate conditions. The change in black

[1]See: http://climateontario.ca/scripts/MNR_Pub/mnr_publication.php

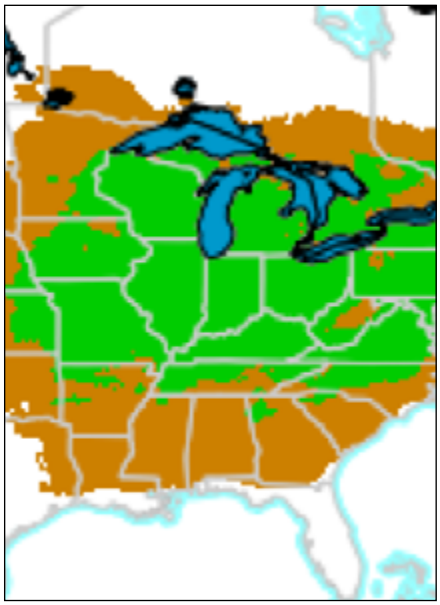


Figure 2: Current Range of Red Oak

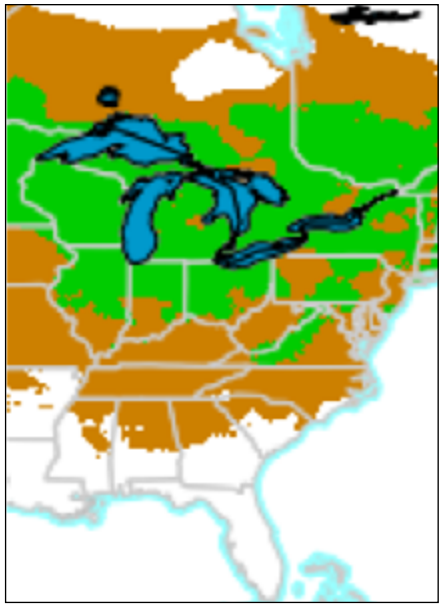


Figure 3: Red Oak Range by end of Century

spruce range is more startling as shown in Figures 4 and 5. At present, black spruce is found along the north shore of the Great Lakes. By the end of the century, black spruce almost disappears in the Kawartha region.

The generally dryer conditions during the growing season could increase the risk of fire. During the early stage of ecosystem succession, pioneer species will change as will the forest floor understorey as species from the Carolinian forests find their way into our neighbourhood. A National Audubon Society study attributes a 30% loss in bird numbers since 1970 to a number of factors unrelated to climate change, but that climate change will compound declining bird populations. The Society has projected amount of habitat loss and habitat gained (usually less) for hundreds of bird species as a result of climate change (see: https://www.3billionbirds.org/).

In our sister watershed to the east, Lake Simcoe, a wildlife vulnerability study assessing climate change was undertaken. This study observed an increase in bird and mammal species richness and accelerated reproduction in spring-breeding frogs and toads. There will be a shift in bird and mammal composition as some species expand

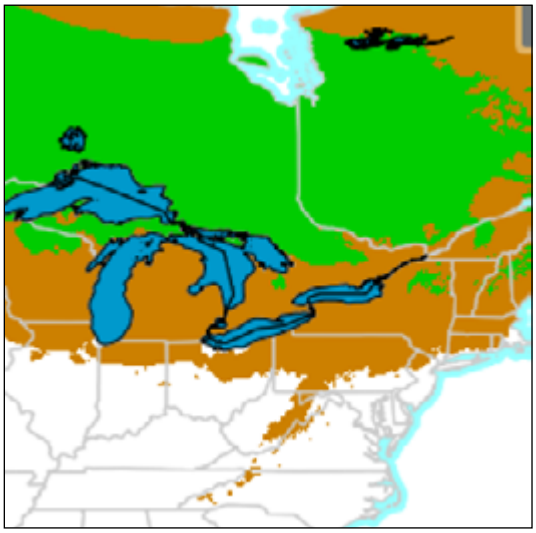


Figure 4: Current Range of Black Spruce

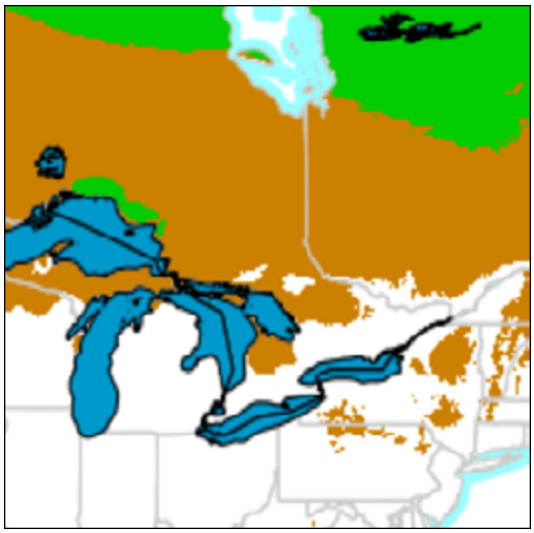


Figure 5: Black Spruce Range by end of Century

into the area while others recede out of the Kawartha region. Some new bird species will become present and some of our current friends will find the Temiskaming lakes more to their liking. The warmer climate and increased atmospheric carbon dioxide levels should facilitate plant growth and farmland should become more productive.

While the opossum has been around Southern Ontario since 1970, Figure 6 shows its projected range expansion as a result of climate change. In the Lake Ontario watershed, another study found the redside dace to be extremely vulnerable because of warmer water coupled with habitat loss within the Greater Toronto Area. Eighteen other species were assigned a highly vulnerable score. Taxa found to be highly vulnerable included two amphibians, two birds, five fishes, two bryophytes (a classification which includes mosses), one reptile, and six vascular plants.

As stated in the Muskoka Climate Change Report, which can equally apply to the Kawartha region: *"Climatic changes likely to come to Muskoka by mid-century are manageable if we plan ahead and take adaptive action. Our experience will be better, and the expense we will incur in adapting to the new climate will be less, if we begin that planning and those actions now."* KLSA proposes a two-pronged approach. The actions are tangible, realistic and within the capability of each of us to deliver.

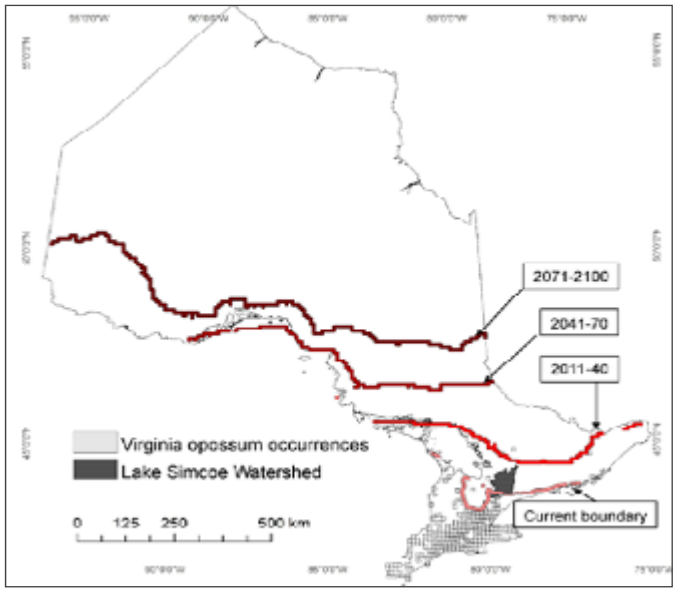


Figure 6: Welcome the Virginia Opossum

1. In addition to a number of government initiatives taken to reduce greenhouse gas (GHG) emissions, there are a number of websites that show you how to calculate household emissions. Once a household emission is determined there are a number of websites to guide one on how to reduce household GHG emissions.

2. Upon consultation with our scientific advisors, it was suggested that one of the most direct effects of climate change will be on lake temperatures. KLSA and its partners propose undertaking a three year project that includes collecting information on lake water temperatures. Monitoring of lake temperatures can be an especially meaningful method of detecting this change. By the continuous monitoring of lake temperatures, we will create the opportunity to forecast/model changes in water temperatures based on various climate change scenarios.

3. KLSA is also proposing to measure seasonal dissolved oxygen (DO) levels. The proliferation of aquatic plants due to increasing water temperatures will cause the consumption of large quantities of dissolved oxygen during their decaying process which could lead to anoxic conditions. Extremely low levels of DO have been observed in some of the Kawartha Lakes. The Environmental Council for Clear, Ston(e)y and White Lakes recognized the importance of dissolved oxygen measurements and has initiated an annual summer sampling program. This KLSA proposed program builds on that sampling campaign by taking measurements in a series of lakes all year long.

The next revision to the model scenarios used by scientists and summarized, in part, in this report is expected in 2021 when the Intergovernmental Panel on Climate Change (IPCC) will release the Sixth Assessment Report (AR6). Based on their projections, we will be able to reconsider our recommendations for action. Throughout history, nature has continued to change and adapt. Now within the era of anthropogenic climate change (resulting from the influence of human beings on nature), we have an opportunity to take on the challenge of ameliorating potential impacts.

Why Community Science is Essential for Managing Lake Health in the Kawartha Lakes

Andrea Kirkwood, PhD, Associate Professor/ Undergraduate Program Director – Biological Science, Faculty of Science,
Ontario Tech University

Most of us who enjoy spending time at the lake love it for a variety of reasons, be it communing with nature or for recreation. For those of us that have spent decades visiting the cottage, or are now making a home there, it is hard to deny that noticeable changes have occurred. Whether it is the knocking down of small cottages to make way for bigger abodes, or the encroachment of city living to cottage country, the Kawartha Lakes are feeling the pressure. To add to these physical changes on the landscape, are the changes happening in our lakes. The numbers of non-native invasive species have steadily increased over the last 50 years in the Kawartha Lakes, facilitated by boat traffic and hydrological connection to the Trent-Severn Waterway (TSW). Sure, many cottagers and residents have been battling weeds along their lakefront for decades, but when new invasive species take hold, the rules for control can be a moving target. Then there are the algae blooms. Some Kawartha Lakes have been dealing with intermittent algae blooms for a while now, but in the last decade, their occurrence has been increasing, particularly in lakes with no history of blooms. Across North America, we know that algal blooms are, in part, being driven by climate change. One species of algae causing periodic blooms in some Kawartha Lakes (not the filamentous "Elephant Snot" algae that can build up along the lakeshore) is called *Microcystis*. A type of blue-green algae (scientifically referred to as "cyanobacteria"), *Microcystis* can produce toxins, which is of concern for drinking water supplies and possible ingestion by swimmers or pets.

So, changes are happening across the Kawartha Lakes region – what does it mean for lake health? To answer that question, we need only look to Lake Simcoe to see what invasive species and increased development and agricultural activities in the watershed have done to lake health. Eutrophication caused by agricultural and urban nutrient inputs to the lake, and invasive species such as zebra mussels, altered the natural state of the lake by the late 1990s. The lake's food web and cold-water fishery was also threatened, not just by eutrophication and invasive species, but also by climate change. Apparently, there was enough concern about Lake Simcoe's health, that the provincial parliament passed the Lake Simcoe Protection Act (2008) - Canada's first lake-specific legislation. In 2009, the Lake Simcoe Protection Plan was developed as a requirement of the Act, to establish a management plan for the lake itself, and the large watershed draining into Lake Simcoe. As part of this management plan, monetary resources have been allocated for water quality monitoring by the province and the Lake Simcoe Region Conservation Authority (LSRCA). The Lake Simcoe Protection Plan, by all accounts, has been a success. A 5-year report published in 2015 presented several lines of evidence, based on monitoring data, that lake health was improving.

The Kawartha Lakes have a lot in common with Lake Simcoe. They are situated in a comparable geologic and climatic zone, have similar kinds of land-use and shoreline development, and are part of the TSW. The big difference at the moment is that the Kawartha Lakes have not experienced the same level of agricultural and urban land-use intensity as Lake Simcoe - yet. Demographic trends predict that the Kawartha Lakes region will experience increased watershed development as the City of Kawartha Lakes grows, and more cottagers as well as migrants from the Greater Toronto Area, move to the region permanently. What does this mean for the future of the Kawartha Lakes? Again, we need only look to Lake Simcoe to see how land-use pressures can negatively affect water quality and lake health.

Using Lake Simcoe as a model system for lake management is extremely valuable. However, Lake Simcoe has a provincial Act designed to protect it, whereas the Kawartha Lakes do not. Even without an Act, the same strategies used in Lake Simcoe could be applied to the Kawartha Lakes, right? Yes, they certainly could, but without dedicated funds to support lake and watershed monitoring, in addition to strong regulations controlling nutrient inputs, adopting similar strategies to the Kawartha Lakes would be quite challenging. Fortunately, conservation authorities and municipalities in the region are working together to protect the Kawartha Lakes through various strategies, including monitoring programs. Kawartha Conservation, for example, conducts tributary monitoring throughout the Kawartha Lakes watershed as part of the Provincial Water Quality Monitoring

Why Community Science is Essential for Managing Lake Health in the Kawartha Lakes

Network (PWQMN) program. Kawartha Conservation is also instrumental in the development of lake management plans for the Kawartha Lakes, and as part of this process, collects lake monitoring data. However, there is no consistency, year over year, from the lake monitoring programs in the Kawartha Lakes as there is in Lake Simcoe.

This is where community members have stepped up to fill the notable gap in long-term lake monitoring in the Kawartha Lakes. Community stakeholders have been organizing themselves for decades, mostly via lake associations and stewardship groups like the Kawartha Lake Stewards Association (KLSA), to participate in the provincially sponsored Lake Partner Program (LPP). The LPP depends on local volunteers to collect lake water samples, typically in deeper parts of a lake. These samples are then sent to a provincial lab to measure phosphorus, and sometimes other elements like calcium. When collecting water samples, LPP volunteers also measure Secchi depth, a low-tech way to measure water transparency. The LPP is a form of 'community science' (also known as 'citizen science'), whereby local residents or visitors engage in the systematic collection of data – in this case water quality data. Although the LPP offers important long-term information on all of the Kawartha Lakes, and many lakes in the region, there are two major limitations: 1) missing parameters (e.g., dissolved oxygen, nitrogen, salt, algae); and 2) large sampling gaps over space and time. Unlike the government-run monitoring program in Lake Simcoe, the LPP alone cannot provide the vital information needed to assess the Kawartha Lakes' health over time.

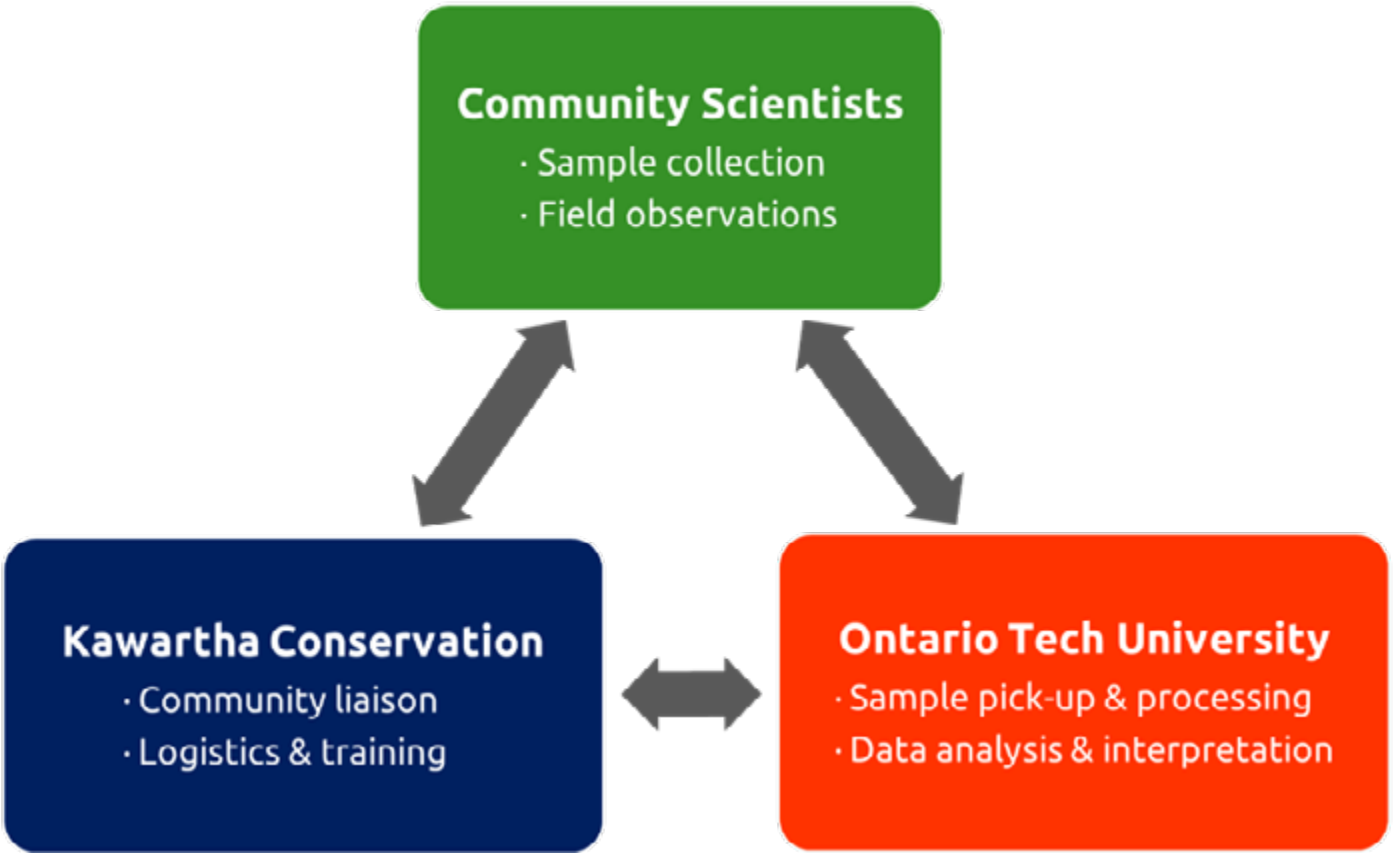
The LPP remains an important tool in the lake monitoring toolbox, but it is not enough. If we are to understand the current status of lake health in the Kawartha Lakes, as well as prepare for the future, an expanded monitoring program must be implemented. In lieu of a government sponsored program such as what is in place for Lake Simcoe, the community science model for the Kawartha Lakes is a viable option. Through the leadership of Kawartha Conservation, there has been an expansion of community science programs in the Kawartha Lakes focusing on the nearshore area. Why the nearshore and not the middle of a lake like other monitoring programs? The nearshore is the first point of contact with the land, and activities on the land can greatly influence water quality. Also, much of the productivity and fish nursery habitat in a lake is located in the nearshore zone, therefore to monitor water quality here allows us to assess the quality of habitat for aquatic plants and animals.

Although community science monitoring programs can appear to be cost effective because of volunteer labour, they still require financial support for coordination, administration, and water-sample analyses. The water sample analyses in particular can be quite costly, especially when there is a suite of parameters to be measured, and many samples to be analyzed. This is where partner institutions such as universities can offer a cost-effective and value-added component to community science initiatives. Most universities have a mandate for teaching, research, and training of students. Since the collection of water samples provides an opportunity for student research and training, universities have a vested interest in participating in community science programs. University labs not only can do the water sample analyses, but they can also provide expert data analysis and interpretation.

Kawartha Conservation and Ontario Tech University have cultivated a successful partnership through their implementation of community science initiatives. Their first community science nearshore water quality project was in Lake Scugog, a 3-year study (2017-2019) spanning 12 sites. Currently, they have expanded their community science nearshore water quality studies to four Kawartha Lakes – Balsam, Cameron, Sturgeon, and Pigeon. Starting in 2019, community science volunteers, including shoreline property owners and local residents, recorded field observations and collected water samples from June to September. Graduate student Erin Smith and several undergraduate students working in the Ontario Tech lab processed and analyzed the water samples for a suite of parameters, including nutrients, algae, and bacteria. As the results become available, they will be reported through Kawartha Conservation as well as at this website: https://kawarthanearshore.weebly.com/. For anyone interested in becoming a community scientist volunteer, please visit this website for contact details.

This lake-wide monitoring project in the Kawartha Lakes could not exist without community scientist volunteers, particularly those situated

Why Community Science is Essential for Managing Lake Health in the Kawartha Lakes



on private shorelines. When property owners are actively involved in studying their waterfront ecosystems, they become part of the solution in protecting their lake. Not only do their activities provide vital data, but during the entire process, from training to field observations, they are also learning why this information is so important. The education piece to community science is just as significant as the sampling effort of community scientists. In effect, this is why they are referred to as 'scientists', because they gain scientific knowledge while participating in data collection. With this knowledge, they are more likely to engage in practices that protect shorelines (e.g., planting native vegetation) and reduce nutrient pollution (e.g., refraining from maintaining a lawn with fertilizers), because they understand why it is necessary. Moving forward, community science should be regarded as a viable and economically feasible approach for the co-production of essential lake monitoring data. Effective lake management should be our collective objective, and working together will ensure that we achieve this important goal for the sake of our beloved lakes and future generations.

Dr. Andrea Kirkwood presenting at the KLSA Fall 2019 meeting **Photo W. A. Napier**

It's Our Time to Make an IMPACT on the Kawartha Lakes

Together over the last 10 or so years, Kawartha Conservation has accomplished great things with your help: we've managed to advance the state of lake science, share our opportunities and issues, recommend over 200 actions that will keep our lakes healthy, and complete several rehabilitation projects and demonstration sites.

It was an honour for Kawartha Conservation to lead the development of eight lake management plans for lakes within the western Kawartha Lakes region. We are grateful for the support of local municipalities and the various organizations and community members who continue to participate in the process.

The hard work is not over. It's now time to make an IMPACT.

The capital letters of IMPACT are not just for emphasis. It means IMPlementing ACTion and that is precisely what we are turning our focus to: implementing the recommendations in the lake management plans.

Kawartha Conservation - IMPACT

You and your community can make an IMPACT and Kawartha Conservation is here to help by making available programs to help empower communities and deepen their connection to their lake. Two examples include:

- **City of Kawartha Lakes Water and Terrain Environmental Restoration (WATER) Fund:** to help you undertake projects; and,
- **Citizen Science Lake and River Quality Monitoring**: to help you track lake health.

City of Kawartha Lakes WATER Fund

The WATER Fund provides funds and technical assistance to:

- landowners for environmental projects on their land; and
- organizations for community-focused environmental projects.

To be eligible, projects must implement a recommendation from one of the Lake Management Plans and have a positive impact on water quality of the Kawartha Lakes and their watersheds.

Examples of landowner projects could include private septic system upgrades, shoreline woodlot management, tree planting, shoreline restoration, naturalization and erosion control.

Examples of community projects may include shoreline restoration on public access land, reforestation, lake health monitoring, and education initiatives.

For more information about the WATER Fund, and to obtain an application please visit:
www.kawarthaconservation.com/LandownerServices/LandownerGrant

Citizen Science Lake and River Quality Monitoring

Citizen science is the practice of involving members of the public to collect data which can be used to increase scientific knowledge.

Interested in becoming a citizen scientist? No experience required, our technical staff will offer all the training you need. Here are two exciting volunteer-based programs for you to consider joining:

- Nearshore Water Quality Monitoring
- Kawartha Water Watch

The Nearshore Water Quality Monitoring program focuses on collecting water quality sampling along the shorelines of our large lakes off the end of your dock during the summer season on a monthly basis. Samples are dropped off at central pick-up locations and are picked up by Kawartha Conservation and sent to a laboratory for testing. We are looking for volunteers for Cameron Lake (northeast) and Pigeon Lake, (western and north-eastern shorelines). For more information please visit: https://kawarthanearshore.weebly.com.

The Kawartha Water Watch program focuses on water quality sampling on any stream, river, or lake near your property or at a nearby road-crossing. Using kits provided by Kawartha Conservation, volunteers test for key parameters during the open water seasons on a monthly basis. Once testing is complete, volunteers send the samples to Kawartha Conservation where we analyze and report on areas of good, satisfactory and poor water quality. For more information please visit: https://kawarthaconservation.com/watershed/citizen-science.

Kawartha Conservation - IMPACT

The City of Kawartha Lakes WATER Fund can provide you with the technical and financial assistance needed to make improvements to your shoreline. **Photo Kawartha Conservation**

You too can make the Citizen Science Lake and River Quality Monitoring program a family endeavour.
Photo Kawartha Conservation

At the time of publication, due to the COVID-19 pandemic, the programs described on page 14 are temporarily suspended but may resume. Check the KRCA website for current information.

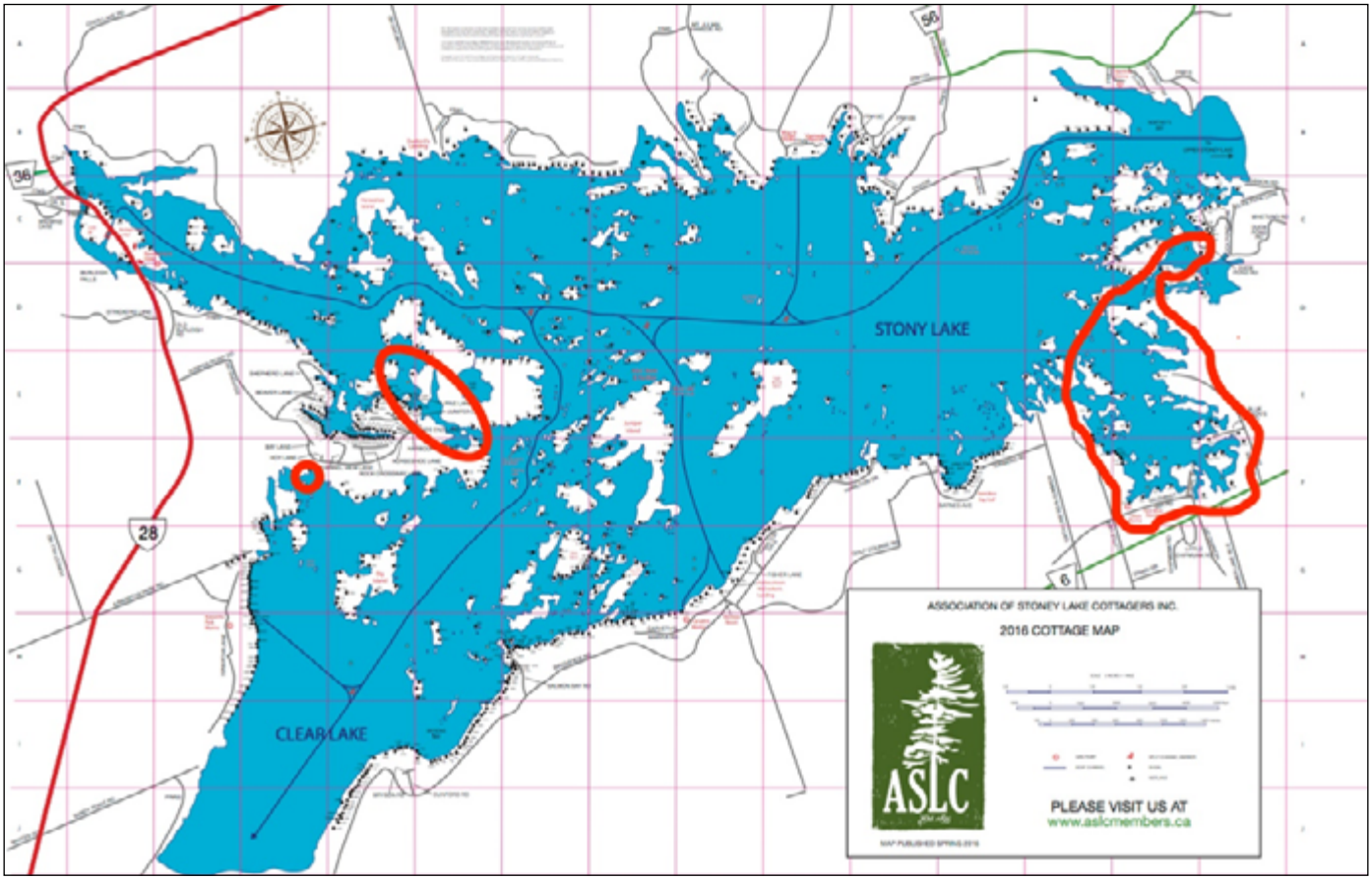
Losing the Lost Channel on Stony Lake

Carol Cole and Patty MacDonald,
Stony Lake cottagers

The Lost Channel is an iconic paddling destination for Stony Lake cottagers. It's a lovely narrow wetland channel between Fairy Lake Island and the mainland. You enter the channel through a narrow passage and find two, unexpectedly large bays separated by a narrow inlet. There are no cottages in the channel so you feel closer to nature paddling there. If you know where to look, you can find the 'Lost Channel Journal' tucked into a crevice of the rocky shoreline. Each summer, a new journal and a pen mysteriously appear, and disappear after Thanksgiving. Rumours and speculation abound as to the identity of the journal's keeper. Generations of cottagers and visitors from all over the world have left small notes about the joy they found in this beautiful and peaceful place. Sadly, that tradition ended this past summer thanks to the invasion of starry stonewort. In order to try and limit its spread, The Lost Channel became a No Go zone.

In 2018, starry stonewort was identified in two areas of Stony Lake. Large patches were found in the Lost Channel and the bays at both ends. It was also found in a marina and along the shoreline of a resort and golf club in Gilchrist Bay. By the end of summer 2019 the Lost Channel was nearly impassable in many areas due to the density of the starry stonewort and it had spread to three more bays in the area. In Gilchrist Bay it spread to much of the shoreline and progressed out to the islands at the mouth of the bay. It was also found in an additional bay not far away. At a rough guess, the area covered by meadows of starry stonewort more than doubled from 2018 to 2019.

Last summer, we began taking action. The Environment Council for Clear, Ston(e)y and White Lakes met with representatives from the Association of Stony Lake Cottagers, Upper Stoney Lake Association, Juniper Point Association, Birchview Road Association, and Kawartha Park Cottagers Association. The primary focus was to contain and minimize the



The Lost Channel is within the oval at left. Mackenzie Bay, circled below it, is also infested. Gilchrist Bay is outlined on the right.

Losing the Lost Channel on Stony Lake

Signage warns paddlers about starry stonewort infestation
Photo Carol Cole

spread of starry stonewort to new areas. In addition to signs that were posted at both ends of the Lost Channel, signs were also posted at public access points warning visiting boaters that starry stonewort is present in the lake. Information sheets were distributed to clients of the infested marina and to participants of the Stoney Lake Combo fishing derby held in September. The Environment Council also began posting updates and information on their website. In November members of the Environment Council led by Ed Paleczny, a retired Ministry of Natural Resources and Forestry (MNRF) biologist, made presentations about this issue to all four Township Councils with jurisdiction around the lake. The Environment Council's message was that there needs to be joint action by the Province, the Trent-Severn Waterway (TSW), Parks Canada and the townships in order to deal with this problem. The message was well received and as a first step the Councils agreed to write letters to their respective MPs and MPPs. Over the winter the Environment Council hopes to determine best management practices for the 2020 season and has planned further educational events for the lake.

The day starry stonewort was identified on our beautiful Stony Lake changed everything for us. We can no longer enjoy the Lost Channel which is located beside our properties. We don't even canoe the same way. Instead of looking out at the beautiful scenery around us, our heads are bent towards the water watching for new patches of starry stonewort. We spend a lot of time researching and talking to everyone we meet about the risks associated with letting this spread from lake to lake in Ontario. We've been shocked and frustrated to learn there is no system currently in place for dealing with something like this and that the few resources that were available were seen as nothing more than numbers that could be cut from a budget.

Starry stonewort, freshly harvested
Photo Patty MacDonald

In 2019 the Ford government cut the funding of nine organizations that dealt with invasive species in Ontario. Included in this group were organizations that may have been able to help us. The Ontario Invasive Plant Council (OIPC) offered to assist us in creating information sheets and educational programming regarding starry stonewort. Unfortunately, 100 percent of the already limited funding provided to OIPC was cancelled. The Federation of Ontario Cottagers' Association's (FOCA's) invasive species program had supported the Lake Scugog Stewards' efforts to reduce the spread of invasive species including starry stonewort but FOCA also lost 100 percent of the funding for their invasive species prevention and education program.

Starry stonewort, with its potential to cause serious environmental and economic impacts, is not even being tracked in Ontario. We were advised by the TSW to report the infestations of starry stonewort using EDDMapS (Early Detection and Distribution Mapping System) in order to help create an accurate representation of occurrences in the Kawarthas. This information would help Parks Canada as they work towards an invasive species priority plan which will identify which species are candidates for future control efforts.

Losing the Lost Channel on Stony Lake

Unfortunately, starry stonewort isn't on the EDDMapS list because it is a macro algae and not a plant. When we contacted the Ontario Federation of Anglers and Hunters (OFAH), the people who answer the phone if you call the EDDMapS hotline, we were told that to have starry stonewort added to the list would take years. The OFAH staff we spoke to were concerned about starry stonewort and were going to work to have it added to EDDMapS. They were willing to help create awareness of the issue and help us promote the 'Clean, Drain and Dry' watercraft stewardship program. Unfortunately, OFAH also had their funding cut in the 2019 Ontario budget and are now struggling to find a way to continue their invasive species work.

Fortunately there have been some bright spots. We became acquainted with the Scugog Lake Stewards who provided us with ideas, information and research contacts in 2018 when starry stonewort was first identified. In 2019 we attended two meetings of the Healthy Lake Scugog Steering Committee. The committee is comprised of representatives from all government levels, local business owners, private residents, the Kawartha Region Conservation Authority, Scugog Lake Stewards, Parks Canada, the MNRF and the Mississaugas of Scugog Island First Nation. Together they collaborate to find solutions to lake issues. This is a model for creating a more unified voice for dealing with issues that threaten the health of our lakes and our enjoyment of them.

We've also learned that there are simple, inexpensive ways we can help protect our own lakes that don't require any government assistance. Simple programs like 'Clean, Drain and Dry' reduce the transmission of invasives from lake to lake. As well, taking the time to learn about aquatic invasives in Ontario and monitoring lake access points would help with early detection of new invasives. This is something that could be done by citizen scientists and would give us a better chance of minimizing the infestations of new invasives. As people who love our lakes and have the privilege of enjoying them, we need to come together and start protecting them. No one else is going to do it for us.

Pileated woodpecker **Photo Pat Moffat**

Temperature and Dissolved Oxygen in Clear and Stony Lakes

Excerpt from a report to the Environment Council for Clear, Stony and White Lakes

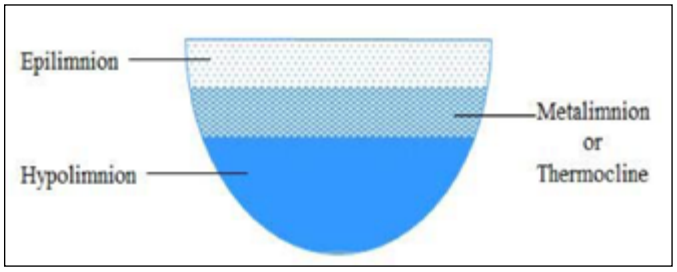
Sarah Baxter and Victor Castro, *Ministry of the Environment, Conservation and Parks (MECP)*

The primary linkage between water quality and shoreline development is nutrient input to the lake. Development can increase the supply and availability of 'fertilizing' plant nutrients such as phosphorus and nitrogen. These nutrients promote the growth of algae and other aquatic plants. As the proliferating algae die off, they settle to the lake bottom and decompose. The decomposition process consumes oxygen, which reduces the amount of dissolved oxygen (DO) in the bottom waters of the lake. This bottom layer is often referred to as the hypolimnion.

The DO and temperature data utilized in this report was kindly provided by the Environment Council for Clear, Stony and White Lakes.

While a certain amount of nutrient enrichment is beneficial, run-away eutrophication can bring about a loss in the recreational value of a body of water and degrade the structure of the biological community. Excessive growth of rooted aquatic plants can blanket the shallow regions and interfere with swimming and boating, while increased concentrations of algae in the water can result in decreased water clarity. Algae and other organic matter eventually settle to the bottom of the lake where they decompose through bacterial action. This decomposition process utilizes oxygen.

Some species of fish require well-oxygenated water found at the bottom of deep lakes and are sensitive to oxygen depletion. Reduced levels of oxygen in deeper waters force these species to migrate into shallower, warmer, well-oxygenated water. These conditions increase the fish stress levels and expose them to predation.



Thermal Stratification of Lakes

During the spring mixing period, oxygen from the atmosphere and photosynthetic activity of algae and macrophytes is uniformly distributed throughout all lake depths. If mixing is complete and of sufficient duration, the oxygen concentration will approach saturation at all depths of the lake. Although most lakes mix completely, some lakes that are very deep and have a small surface area or are sheltered from the wind may undergo only partial mixing in the hypolimnion. These lakes enter the summer stratification period with a DO deficit in the hypolimnion.

Once stratification is established, the surface waters continue to be supplied with oxygen through exchange with the atmosphere and by photosynthesis. Both algae and rooted plants produce oxygen in the presence of inorganic nutrients and light. Although there is a demand for oxygen in the epilimnion by respiration and decomposition, the supply of oxygen usually greatly exceeds the demand. Wind-induced mixing near the surface ensures the distribution of oxygen throughout the epilimnion.

Aquatic life in the hypolimnion depends upon the amount of oxygen acquired during spring overturn.

Dissolved Oxygen

The oxygen and temperature profiles are presented in **Figure 1** (Upper Stoney Lake), **Figure 2** (Stony Lake), and **Figure 3** (Clear Lake).

Upper Stoney Lake

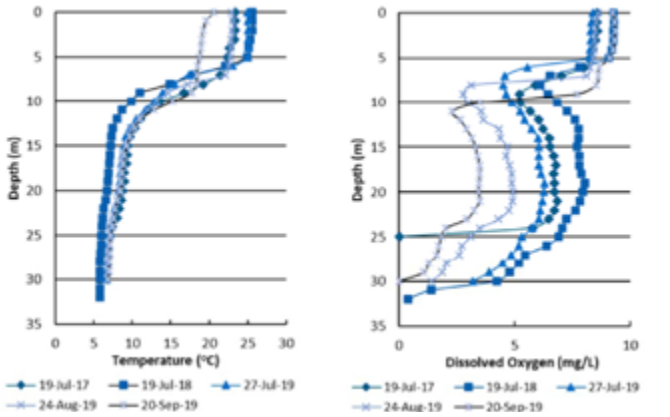


Figure 1: Temperature and dissolved oxygen profiles from Upper Stoney Lake

Temperature and Dissolved Oxygen in Clear and Stony Lakes

The temperature and dissolved oxygen profiles for Upper Stoney Lake follow similar patterns across months and years. Upper Stoney Lake thermally stratifies. Most of the DO profiles depict a decrease of oxygen in the metalimnion; this type of profile is referred to as a negative heterograde curve which develops from the decomposition of settling organic material accumulating in the metalimnion as a result of a thermally induced water density gradient.

The DO profiles suggest that Upper Stoney Lake is anoxic (i.e., no or low oxygen) near the bottom, and the top of the hypolimnion generally occurs between 11 and 13 meters in depth.

Stony Lake

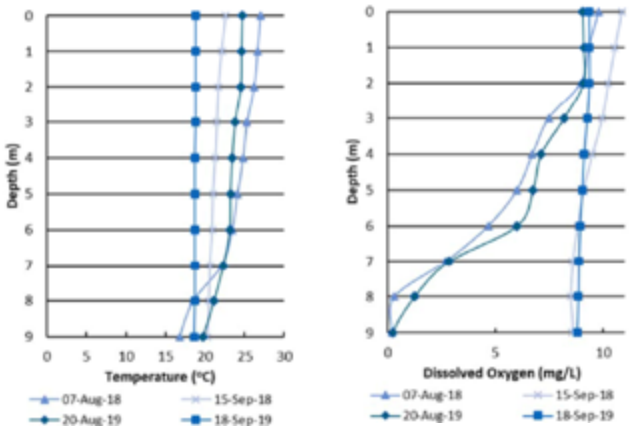


Figure 2: Temperature and dissolved oxygen profiles from Stony Lake

Recent profiles indicate that this particular location in Stony Lake weakly thermally stratifies or does not thermally stratify at all; this means that the lake does not develop distinct thermal layers (i.e., epilimnion, metalimnion, hypolimnion) and temperature does not vary significantly with depth. This is not surprising due to the shallow depth of this sampling location and significant flow-through in this narrow channel.

The August DO profile depicts a weak clinograde pattern, meaning that oxygen concentrations constantly decline towards the bottom. Due to lack of thermal stratification and water mixing in September, oxygen concentrations remain constant with depth.

To ensure appropriate representation of the oxygen conditions in Stony Lake, all future profiles should be collected from the deepest hole in the main portion of the basin. Nautical charts suggest this would be north of Hamilton Bay and Austin Island, at a maximum depth of approximately 11 meters.

Clear Lake

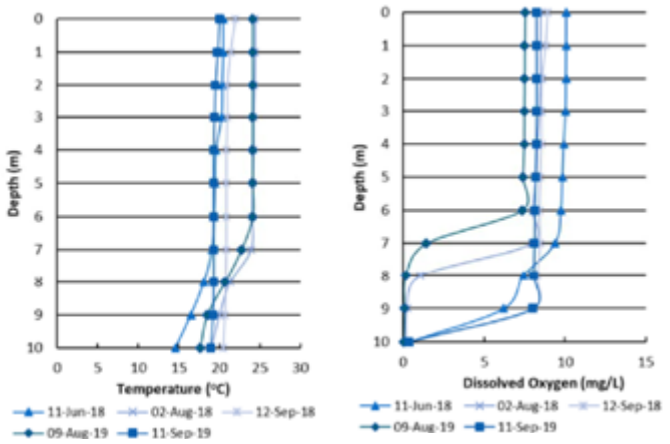


Figure 3: Temperature and dissolved oxygen profiles from Clear Lake

Recent profiles indicate that this particular location in Clear Lake weakly thermally stratifies or does not thermally stratify at all; the lake does not develop distinct thermal layers (i.e., epilimnion, metalimnion, hypolimnion) and temperature does not vary significantly with depth. This is not surprising due to the shallow depth of this sampling location.

The DO profiles depict a clinograde pattern; oxygen concentrations remain constant with depth in the metalimnion, then constantly decline towards the bottom. The oxygen concentrations at the lake bottom are low, but the lack of lake stratification suggests that the lake bottom may not be anoxic due to water mixing.

To ensure appropriate representation of the oxygen conditions in Clear Lake, all future profiles should be collected from the deepest hole in the basin. Nautical charts suggest this would be at the southern extent of the lake, at a maximum depth of approximately 12 meters.

Surface Water Characterization of Nogies Creek

Janet Klein,
Resident on Nogies Creek

In 2012, Cambium Environmental Inc. was retained by a small group of residents of Nogies Creek to conduct surface water tests in the Creek. Seven years later residents still come together each fall to hire this firm to continue the analysis. The cost is around $1500 but we feel it is important for our precious creek. Nogies Creek flows into Pigeon Lake in the Trent-Severn Waterway (TSW) so we thought it would be of interest to KLSA to know about this initiative. Much of the information in this document has been taken from Cambium reports. Even though we own the documents, Cambium was informed that they would be used for this report.

The objective of the residential surface water characterization (assessment) program was to obtain baseline surface water quality data prior to the potential construction of a quarry. The quarry was proposed to be only metres from Nogies Creek and this was a worry to the local residents, many of whom still use the creek for their drinking water. Even though the quarry proposal did not come to fruition, it was felt that it was wise to continue this yearly testing for continuity, given that this is an area rich in limestone and a prime area for possible aggregate development.

Three years ago we decided to also test for *E. coli* and this test is being graciously paid for by the North Pigeon Lake Association. Their area of membership now includes the entire catchment of the northern part of the lake, including members on Nogies Creek.

The primary concern related to development of a quarry was the discharge of sediment to the environment; therefore, the water quality was analyzed for total suspended solids (TSS). In addition, as explosives would have been used at the proposed site, there was the potential for ammonia to enter the environment and surface waters downstream of the site. Ammonia is readily converted to nitrates in the environment. As such, ammonia, nitrate and nitrite are analyzed every year. Lastly, due to a concern with arsenic concentrations, an inorganic (metal) scan was included in the analysis.

Three surface water sampling stations were established. One sampling station was located at Watson's Bridge, upstream from the then proposed quarry site. The second site was established in a clear run of the creek, downstream of the proposed quarry property. The third site was established approximately 3.5 km south of the proposed quarry site. To properly characterize the water supplying the residences, it was important to obtain a raw water sample that had not passed through a treatment system. Because the residents reportedly obtain their drinking water from the creek, Cambium personnel obtained the water samples directly from the creek to avoid any treatment systems that may be present at the three locations.

Watson's Bridge: Surface water location SW 103-12, 2260 Bass Lake Road, Bobcaygeon ON
Photo Cambium Environmental Inc.

All collected samples are tested at the SGS Environmental Analytical Lab in Lakefield and compared with the Ontario Drinking Water Quality Standards (ODWQS). The 2019 sample was taken after five days of precipitation.

The most recent test results were similar to those reported during the previous eight years of testing. Most parameters including TSS, ammonia and nitrate, were observed to be less than the ODWQS criteria limits at all monitoring stations and in many cases the concentrations were too low to be detected.

Hardness is historically observed to consistently exceed the ODWQS criteria limits. As Nogies Creek flows through sedimentary limestone bedrock described as the Bobcaygeon Formation (Chapman & Putnam, 1984), elevated parameters of alkalinity, calcium, hardness, magnesium and pH would be anticipated.

Organic nitrogen concentrations in surface water from all surface water stations have historically exceeded the ODWQS limit of 0.15 mg/L. In 2019 the lab reported that the concentration of organic nitrogen was below the detection limit of 0.5 mg/L; as such the sample may have exceeded the ODWQS limit. It should be noted that the source water is surface water derived so exceedances of organic nitrogen are anticipated. These exceedances have been interpreted to be the result of the presence of organic wetland soils (peatlands) upstream of the surface water locations. When organic nitrogen exceeds the operational guideline criterion it may affect chlorine disinfectant systems.

The *E. coli* results ranged from 29 – 71 Colony Forming Units (cfu) per 100 millilitres at the monitoring stations. Elevated concentrations of this parameter in surface water systems are typically linked to events of high precipitation, which would carry this type of bacteria from agricultural areas, overloaded sewage systems, or animal and bird point sources to downstream receptors. To ensure that there are no risks to human health a treatment system that ensures adequate disinfection of any drinking water should be considered.

Generally, although some variation was observed, most parameters report concentrations that were similar to, or less than, those reported in 2018 and ultimately reflect baseline water quality conditions in Nogies Creek.

FOCA: Your Provincial Partner in Water Quality Monitoring

The KLSA is a long-standing Supporting Group of the Federation of Ontario Cottagers' Associations (FOCA).

For more than 55 years, FOCA has been the voice of waterfront Ontario. In 1963, a small group of cottage owners united as a provincial organization that has grown to represent more than 500 lake associations with 50,000 families across the province. Our united voice carries weight on the issues that matter. **The issues have evolved over time, but the motivation remains the same: to protect the sustainability of Ontario waterfronts and freshwater resources for our kids, and their kids after them.**

Over the years, FOCA has played an important advocacy role on environmental and policy concerns. In the 1980s, FOCA fought hard for government action on the issue of acid rain, and lobbied to stop the use of toxic Dombind as a road-dust suppressant. FOCA secured your right to vote at the cottage in Ontario municipal elections as second-home owners. FOCA's Lake Stewards are at the core of the Lake Partner Program of volunteer water quality monitoring, to inform scientific and policy decision-making in the face of a changing climate.

Got a cottage-country question? Start your search by keyword here: https://foca.on.ca/resources/ as FOCA has posted more than 400 pages of online content.

FOCA also publishes print and digital resources for lake associations and waterfront property owners. Find brochures, videos and newsletters from FOCA on a variety of topics including:

- preventing the spread of invasive species
- climate change impacts
- septic systems
- citizen science
- the important role of lake associations in rural communities
- healthy shorelines

and so much more! For free downloads and links to on-line videos, visit: https://foca.on.ca/publications/. FOCA provides regular updates in the monthly Elert (e-newsletter); be sure you have provided your consent to receive these messages, for all the latest cottage-country news. Look for the red "sign up" button on the FOCA website, or visit this link: http://bit.ly/FOCAElertSubscribe

Monitoring the Status of Loons in the Kawartha Lakes

Brett Tregunno, Aquatic Biologist,
Kawartha Conservation; KLSA Director

The common loon is arguably one of the most iconic birds of cottage country. Its various calls, drifting long distances across the open water remind us of 'life at the lake' – some of our best memories. There simply is no substitute for spending recreational time with friends and family while enjoying the company of nature.

Given that loons are such an integral part of our natural and cultural heritage, it may come as a surprise that there is not a clear understanding of the health of their populations in the Kawartha Lakes. We can't answer basic questions regarding their status. For example, are populations improving, declining or stable? How does my lake compare to your lake? Is their reproductive success sufficient to ensure my grandkids' kids will get the pleasure playing 'hide-and-seek' with a diving loon? We can guess, but without crunching the data, we simply don't know.

Why don't we know? In brief, it's because we have information gaps and haven't analyzed the data that have already been collected in the Kawartha Lakes region.

Participating in the Canadian Lakes Loon Survey

Want to monitor loons? Joining the program is easy: first contact Birds Canada at www.birdscanada.org to register. Then, pick a section of your lake that typically has loons. Seek out and record loon sightings once a month in June, July and August, and submit your data when you're finished to Birds Canada.

Who is responsible for collecting data on loon populations? We know that Parks Canada tracks water levels, the Ministry of Natural Resources and Forestry tracks fish populations and the Kawartha Lake Stewards Association tracks *E. coli* and phosphorus. So, who is tracking loons?

The answer is . . . you could be!

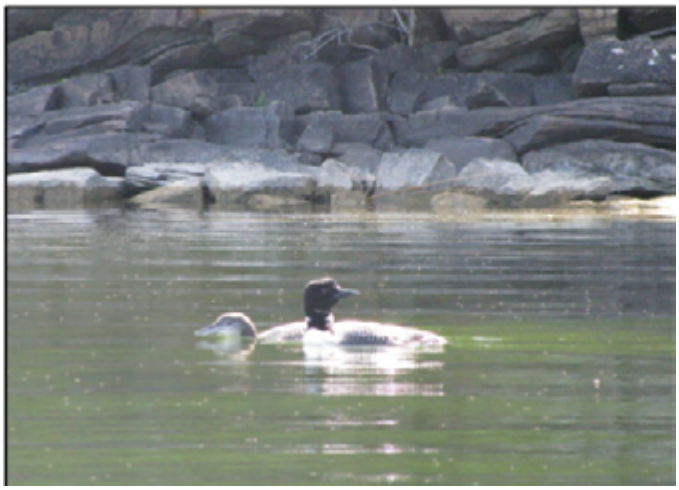


Photo: Brett Tregunno

Due to COVID-19, Birds Canada has come to the difficult but necessary decision to suspend all volunteer surveys and field work until further notice. For further details, see Birds Canada's policy on outdoor work during COVID-19 at www.birdscanada.org. Policy on Outdoor Work under COVID-19.

With guidance from Birds Canada, volunteers have been collecting information on loons in the Kawartha Lakes (and across Ontario) since the early 1980s as part of the Canadian Lakes Loon Survey (www.birdscanada.org/loons). Birds Canada does an amazing job of administering this program, providing technical guidance, managing the database, and producing nationwide status reports. The latest report can be accessed online at: www.birdscanada.org/loons.

However, given that Birds Canada operates at a national level, they simply do not have the capacity to analyse and report on Kawartha Lakes loon data on a regular basis. With your help, that's where the Kawartha Lake Stewards Association can assist: by promoting the Canadian Lakes Loon Survey program and by reporting the findings on a regular basis.

For example, after a quick look through the database, I noticed that certain lakes have lots of available data (e.g., Balsam, Cameron, Chemong, Pigeon and Stony), while others have limited or no data at all (Scugog, Katchewanooka, Lower Buckhorn, Sandy, among others), and others fall somewhere in between. This means at least two things are apparent:

Monitoring the Status of Loons in the Kawartha Lakes

1. There are likely enough long-term data on enough 'representative' lakes to be able to report on the overall status of loons across the Kawartha lakes, and;
2. More loon monitoring volunteers are likely needed on certain lakes to fill in data gaps.

Over the next few years, the Kawartha Lake Stewards Association will endeavour to work with Birds Canada staff to report on the status of loons in the Kawartha lakes and will be presenting these findings through various means including through articles in the annual report, presentations at the General Meetings and technical reports.

Loons as indicators of lake health

Given that loons are at the top of the food chain and have specific life-history traits (e.g., they are long-lived, typically return to the same breeding territory year after year, and feed their young almost exclusively with fish from the nesting lake), they are good indicators of lake health, especially in relation to mercury pollution and acid precipitation.

FUN FACTS: LOON ECOLOGY

Loon nests are typically shallow mounds of vegetation, within one or two metres of the lake. Island sites are preferred. If the first nest of the season is lost, re-nesting at a different location within the territory is attempted.

If you are interested in collecting data on loons for your lake, please contact Birds Canada and consider joining the Canadian Lakes Loon Survey.

Visit www.birdscanada.org/birdmon/clls or phone 1-888-448-2473 ext. 124. If you are interested in analyzing data on loons, please contact Brett Tregunno. Email Brett.Tregunno@gmail.com or phone 705-931-5303.

BIRDS CANADA OISEAUX CANADA

Loon family on Lovesick Lake Photo Pat Moffat

Action on Climate Change in Selwyn Township

Anna Currier, *Climate Change Coordinator for Selwyn Township*

Selwyn Township has valued environmental sustainability for over 30 years, dating back to when the Lakefield Environmental Action Forum (LEAF) was formed in 1989. Composed of six to ten core community members, LEAF was instrumental in establishing a recycling program in the Village of Lakefield. Beyond this, LEAF organized public forums on recycling and composting, hazardous household products, organic gardening, wetland conservation and many other issues. LEAF was focused on mobilizing local action on climate change through a grass-roots approach and connecting with people directly by providing education and opportunities to collaborate on solutions to environmental problems. The legacy of LEAF is reflected today in Selwyn Township's Climate Change Action Plan (CCAP), a long range plan comprised of a range of strategies to reduce greenhouse gas emissions across corporate and community sectors. The CCAP for Selwyn was developed in 2016 in partnership with Sustainable Peterborough, fellow Peterborough County townships and First Nations, with

Selwyn Mayor Andy Mitchell speaks at a Climate Action March September 2019. **Photo Anna Currier**

support from ICLEI Canada consultants. This collaborative is part of the Partners for Climate Protection Program (PCP) through the Federation of Canadian Municipalities (FCM). Selwyn targeted a 39% reduction in greenhouse gas emissions by the year 2031.

CCAP achievements

The Township has made significant progress reaching its corporate goal having reduced emissions by 35% since 2011. This has been achieved through switching to LED street lighting, using solar energy, investing in energy-efficient upgrades to municipal facilities and operating systems, waste reduction and diversion programs, reducing transportation-related fossil fuel dependency and more. In April 2019, Selwyn acquired funding from FCM to hire a Climate Change Coordinator, me, to formally implement the CCAP with a stronger focus on engaging the community. After updating the Township's corporate and community greenhouse gas emissions inventories, I was supported by colleagues across departments to establish a work plan based on priorities in the CCAP and local projects underway.

The work plan consists of playing a lead role in the following activities:

- The Link community transportation project: The Province of Ontario through their Community Transportation Grant awarded $1.48 million dollars for a three year pilot transportation service. This service will provide access to Curve Lake First Nation, Lakefield, Bridgenorth, and Ennismore, with connections to the City of Peterborough at Trent University. Project partners include Selwyn Township, Curve Lake First Nation, the City of Peterborough, and Community Care Peterborough. Along with expanding access to employment, education and recreation, this service will reduce emissions from the use of passenger vehicles.
- Waste reduction and diversion: Selwyn Township is leading several special efforts related to waste reduction and diversion to prolong the life of the landfill and reduce methane-based emissions. Firstly, in September the Township secured funding from TD Friends of the Environment to undertake a food and organic waste reduction and diversion program at Lakefield District Public School in partnership with Nourish Lakefield and the Peterborough Master Gardeners. Secondly, to reduce the amount of recyclable items ending up in the landfill, the Township is implementing a Township-wide clear garbage bag policy in March 2020, with enforcement commencing September 2021. Thirdly, the Township was awarded funding from the Frank Cowan Company to provide subsidized digesters for residents to sustainably divert food waste.
- Fleet carbon footprint: Selwyn Township consistently ensures corporate vehicles meet the latest emissions standards and has been switching machinery from gasoline to battery powered wherever possible. Beyond these efforts, the

Action on Climate Change in Selwyn Township

Elementary students tour the Smith landfill. **Photo Meaghan Larocque, Selwyn Marketing and Communications Coordinator**

150 maple trees were planted on residential properties since 2017. In 2020 ReLeaf plans to give out food waste digesters and more trees. **Photo Meaghan Larocque**

Township is pursuing an application to FCM's Green Municipal Fund for a pilot project involving the lease of a plug-in hybrid electric vehicle for the Building and Planning department's 2020 vehicle replacement and the installation of a charging station at the Township office that will be available free to the public for one year.

- Climate change and the Official Plan: Township staff are part of the Technical Advisory Committee for the County of Peterborough's Official Plan update and are advocating for the inclusion of climate-related polices related to all future development.
- Green events: A Township-wide Green Event Policy is being developed to help ensure all events that happen on Township property are sustainable in regards to the venue, transportation, waste, food, equipment and materials, water, dishware, and power generation. The Township is working with the Lakefield Jazz, Art and Craft Festival committee to pilot the Green Event Policy through the festival on July 4th.
- ReLeaf Program: A portion of funding from the Frank Cowan company is reserved to undertake a ReLeaf tree planting program with residents in the Township. There is potential to collaborate with a range of community partners.
- Water and aquatic health: Selwyn Township recognizes that warming temperatures and increased stormwater runoff to local waterways pose a threat to aquatic health and promotes the growth and spread of invasive species. The Township supports local lake and cottager associations in their efforts to raise awareness of the connections between climate change and aquatic health, including the prevalence of starry stonewort in parts of the Trent-Severn Waterway.
- Community engagement & collaboration: The Township has had a presence at farmers' markets and community events through the summer raising awareness of the municipality's action on climate change and inviting community involvement. Staff are also involved in local environmental committees such as Peterborough Public Health's Health and Climate Change Adaptation Committee, and share information on funding opportunities and incentive programs with an environmental focus on the non-profit and commercial sector.

Future Actions

Beyond continuing with current projects, the Township is aimed at helping residents with flood preparedness and stormwater management in the face of increased frequency and intensity of stormwater events. This involves sharing resources and opportunities for residents to reduce flood risk, manage stormwater and improve biodiversity on their properties. The Township is also pursuing funding for a Seabin (a floating trash bin) at the Lakefield Marina which will help to cleanse source water, protect aquatic health, and reduce strain on the water treatment plant intake systems.

In 2020 the Township can look forward to several capital projects with environmental benefits. Some of these include an LED retrofit of the Lakefield Marina boardwalk lighting, improved roof insulation at the Ennismore Seniors Club, stormwater management upgrades, improving active transportation infrastructure and corridors, and energy-efficient upgrades to arena equipment. It is unique for a small, rural municipality like Selwyn Township to have a staff person dedicated

Action on Climate Change in Selwyn Township

Elementary students toured the Lakefield water treatment plant to learn where we get our drinking water and how to protect it.
Photo Meaghan Larocque

to sustainable initiatives. More and more, municipalities small and large are investing in these staff positions and initiatives that protect and preserve natural assets, stimulate the green economy, build adaptive capacity to mitigate the impacts of climate change and reduce greenhouse gas emissions. These investments may cost more up front, but will save municipalities money in the long run as well as mitigate the impacts of climate change for future generations. However, political and cross-departmental buy-in is critical. And, on a day to day basis, I deal with many community members who feel a strong sense of urgency that we need to move faster and make bigger strides. I share this sense of urgency, but am also aware of the limitations municipal governments are faced with.

In 2019 Selwyn Township had information booths at farmers' markets and other events to raise awareness of climate action.
Photo Angela Chittick, Selwyn Manager of Corporate and Community Services/Clerk

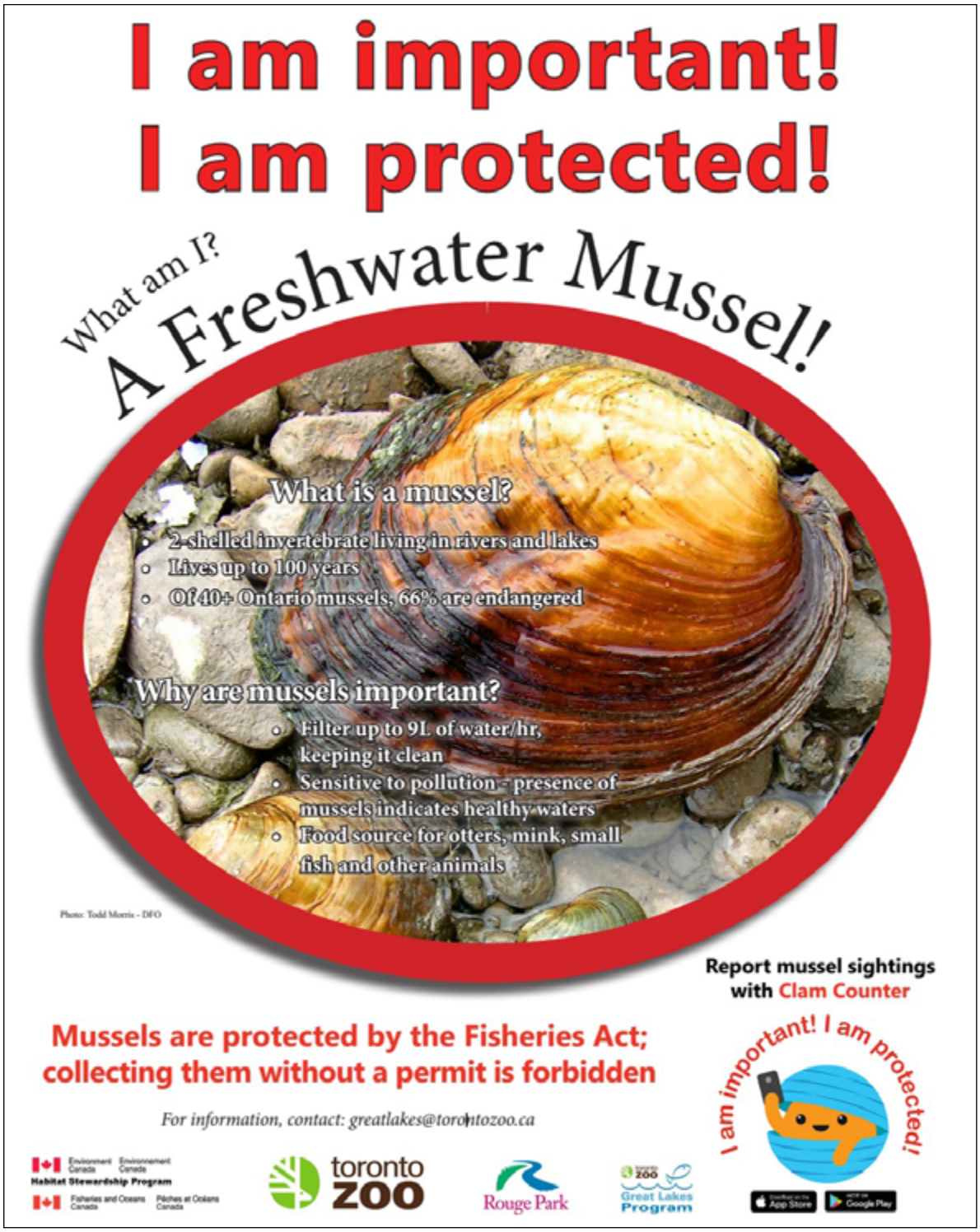
We need stronger support from upper levels of government to make green investments more accessible. We also need more consistent scientific rigour around greenhouse gas (GHG) emission inventories across all levels of government so we can adequately assess current realities and make realistic reduction targets. Furthermore, the data and large-scale actions are important, but building grassroots adaptive capacity through empowering people with the tools and knowledge to make a difference in their community is a critical piece of this work. Shaping the narrative around climate change to accurately represent the urgency of taking action while remaining hopeful is a challenge all people in this field can identify with.

Credit is due to *Sustainable Peterborough* and James Byrne for his support updating corporate and community GHG inventories for the City of Peterborough and Greater Peterborough Area (GPA) and reporting on actions taken to-date. The willingness of the Townships and First Nations across the GPA to advance their CCAP priorities is inspiring, and so much important work is being done.

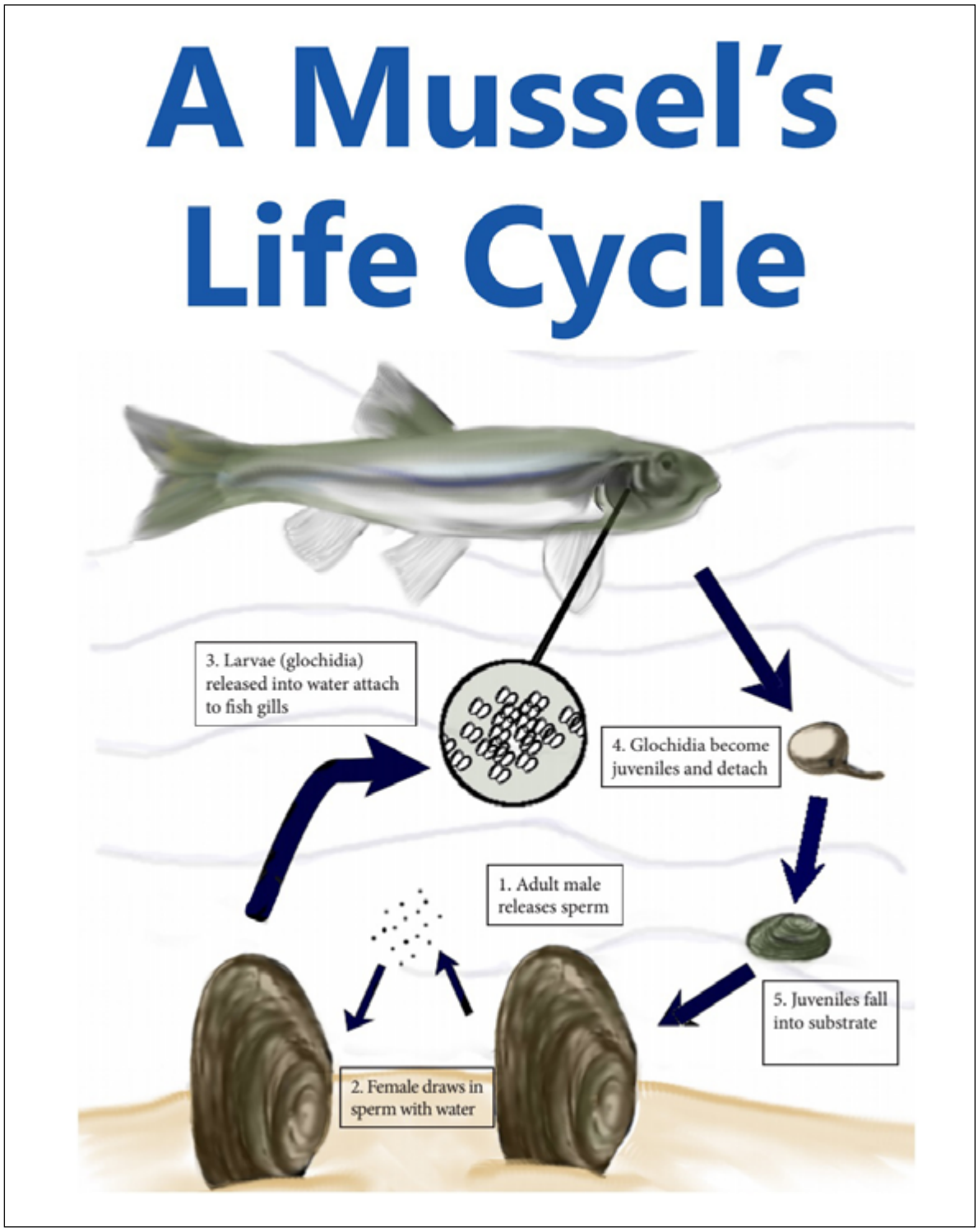
Freshwater Mussels: Did You Know?

C. Lee, *KLSA Director*

Freshwater mussels are the largest and longest lived invertebrates in North America. As bottom dwellers they play a key role in aquatic ecosystems by filter-feeding suspended algae, bacteria and zooplankton from the water and in turn provide food for fishes and wildlife. Highly sensitive to habitat changes, pollution and invasive species like zebra mussels, over 50% of the 40+ species of Ontario mussels are considered threatened. Learn more from the two posters on these pages.



Freshwater Mussels: Did You Know?



Ontario biologists need our help in the search for native mussels. Start by downloading the bilingual ***"Clam Counter"*** app through Apple or Google Store. Designed for non-biologists, it takes you step-by-step to collect vital information for these important creatures. Report your observations of local mussels. It is EASY and with family and friends a great summer activity. Help out, learn and contribute to keeping our lakes healthy.

Trent University's Aquatic Research Program

Dr. Paul Frost, The David Schindler Professor of Aquatic Science,
Trent University, Peterborough

Trent University has a long and storied history of studying aquatic ecosystems, especially those in the Kawartha region. Almost as soon as the university was established, scientists from Trent were sampling rivers and lakes to learn about their aquatic residents and to work out basic ecological processes. That research, on a wide range of topics, has continued largely without interruption over the past four decades by multiple generations of Trent faculty and students. Research by Trent on our freshwater ecosystems in the Kawarthas is an important legacy and one that we will build on through the creation of the Trent Aquatic Research Program (TARP).

TARP is an integrated research program focused on the long-term study of freshwater ecosystems in the Kawarthas. Long-term means 'slow science' where we will collect environmental data on lakes, rivers, and their catchments over many years. The work will include tracking when the ice comes and goes each year, patterns of temperature stratification, oxygen dynamics, and other important physical/chemical conditions. At the same time, we will be looking to see which plants and animals live where and how much this changes through time and differs among our lakes and rivers. Collecting all of these observations to reveal patterns and changes that occur over space and time is just a starting point. Descriptive findings from long-term monitoring are not very useful without explanation. We will use a variety of modern, innovative scientific approaches to explain and understand patterns and processes in our aquatic ecosystems. These approaches include laboratory and in-field experiments, comparative field-based studies, data syntheses, and mathematical models, all of which can be used to reveal mechanisms that explain the patterns we find within and among Kawartha region lakes and rivers. In short, TARP will be conducting long-term and meaningful aquatic science on our local water bodies.

You are probably wondering why TARP and why now? It might seem that we have already studied and sampled our lakes enough already that we ought to know what we need to know. Are more graduate students with their bottles, nets, and laptops really going to make a difference? That is a good question. We see how our academic pursuits may appear to have little practical value, especially when we package our work in highly-focused and jargon-filled academic papers. But aquatic science has much to offer beyond published studies, technical presentations, and undecipherable discussions of statistics and complex processes. Our aim is to use what we discover for the betterment of our aquatic ecosystems. One part of this will involve working closely with government agencies, lake stewards, and stakeholders in a complementary way to create and implement scientifically-sound management plans that will improve water quality, stop the spread of invasive species, and protect and restore our fisheries. To be meaningful, we need information, data, and knowledge about how our ecosystems function and how we do or do not affect them. One of the goals of TARP is to serve as a clearinghouse for all information related to our surface waters in the Kawartha Region.

Student collecting samples **Photo Paul Frost**

TARP will also be a local resource for those wanting to know more about their lake, river, or wetland. Our first objective is to work with stewards and other groups to share our knowledge with shoreline owners, lake users, and anyone who is interested in aquatic ecology. This sharing will include presentations delivered in plain language, easily digestible reports and booklets, and archived data that will

Trent University's Aquatic Research Program

be permanently available on-line. We also hope to interact with local educators to teach people of all ages about what goes on under the surface of their favourite water body. We envision this to include short courses, seminars, scientist-for-a-day and other activities that engage the public and bring aquatic research to life. We will also develop and lead citizen science projects that give everyone a chance to help collect data and in doing so connect more deeply to their local lake or river.

It might seem that some of this research is or has already been taking place. There are a steady stream of researchers, government agencies, and stewards arriving in the Kawarthas to study different aspects of lakes, streams, and wetlands in the Kawartha region. The Trent Aquatic Research Program aims to better organize and coordinate this work, bring more focus to our most pressing environmental problems, and better use the results of these efforts. Our overall goal is to implement a systematic approach and to create a more meaningful and lasting base of knowledge. We aim to better leverage our own expertise, Trent's equipment, infrastructure, and location, and the deep well of community support to sustainably fund and manage this research program. One step towards this goal is the addition of a new fish ecologist, Dr. Graham Raby, to the Biology faculty at Trent. Dr. Raby studies the ecology of fish physiology and movement and will be a key member of our TARP team. A second step is the establishment of an endowment at Trent University that will provide stability to TARP's funding, which will be very important in developing and sustaining this program over the long-term. We are deeply indebted to Ralph and Carol Ingleton for their leadership in creating this funding initiative.

If you would like to learn more about TARP and how you can help support us in completing this important mission, please contact Dr. Paul Frost (paulfrost@trentu.ca).

Visit klsa.wordpress.com

Learn more about KLSA on the website:

- ***Climate Change and the Kawarthas: Context, Issues and Response***
  W. A. Napier, Kawartha Lake Stewards Association, 2020
  A detailed assessment of the potential impact of climate change on the Kawartha Region, projecting the impact of climate change on air and water temperatures, the physical environment, precipitation, forests, wetlands and fisheries. Individuals and organizations can take action now to protect the ecosystem of the Kawarthas.
- KLSA Annual Lake Water Quality Reports from 2001 to 2019
- KLSA Aquatic Plants Guide (2009) and Algae Guide (2012)
- Research Studies by University and College Faculty and Students
- Lake Water *E. coli* sampling video and instructions for volunteer water testers
- Announcements of upcoming meetings and events

@KawarthaLakeStewardsAssociation
Watch for posts about water quality in the Kawarthas and upcoming KLSA events.

Become a KLSA volunteer
Contact: kawarthalakestewards@yahoo.ca

Protecting the Land You Love
Kawartha Land Trust – 2019 Highlights

Rachel Rutherford,
Community Engagement & Marketing Assistant
Kawartha Land Trust

The year 2019 was another busy year for Kawartha Land Trust (KLT), the only non-governmental land conservation organization dedicated to protecting the beautiful and diverse Kawartha landscape.

As a result of support from the community, KLT has continued its essential mission of caring for the lands entrusted to us, helping others protect the land they love through our Partners in Conservation initiative in the Fleetwood Creek Watershed, protecting the Fell Wetland, and engaging the community to advance our conservation efforts.

The Fell Wetland

The newly protected Fell Wetland is relatively untouched by human activity and is home to a forested wetland and cattail marsh. This property, donated by Allan Fell and family, has been in the Fell family since 1908.

The 50-acre property lies inside the Kawarthas Naturally Connected (KNC) Preferred Scenario within a wetland complex and contains a large portion of a Provincially Significant Wetland (PSW). This important land parcel provides an excellent habitat to a biodiversity of flora and fauna.

Mitchell Creek runs through the property and leads to Cameron Lake, part of the Trent-Severn Waterway (TSW). This wetland system contributes significantly to the connectivity throughout the agricultural landscape, and is a major biodiversity hot spot in an otherwise highly disturbed area. The forests on the property are mostly lowland mixed consisting of trembling aspen, black and green ash, and balsam poplar species.

The wetland and forests on this property are important corridors for wildlife movement in the area. By linking together the fragmented natural areas near it, the Fell property contributes to the conservation and connectivity of habitats in and around its boundaries. The property shows excellent natural value with outstanding provincially significant features.

Vernal pond at the Fell Wetland **Photo: KLT**

Partners in Conservation: Fleetwood Creek Watershed

The lands and waters of the Fleetwood Creek Watershed are some of the most important in our region. KLT's Fleetwood Creek Watershed project guides private landowners on how to maintain their properties in ways that will preserve the special environment found there. This is done through stewardship projects and other voluntary permanent protection options. KLT works with landowners and uses landscape analysis to deepen their understanding of the natural features on their property. This helps them plan and understand land stewardship, advance enhancement and connects them with other available resources.

Ten landowners have participated in this project since it began in 2018. This project expands KLT's conservation and restoration efforts to an additional 1,000 acres of ecologically significant land. This initiative is improving aquatic connectivity and habitat

Cold streams and ponds at Fleetwood Creek **Photo: KLT**

Protecting the Land You Love
Kawartha Land Trust – 2019 Highlights

diversity beyond the over 4,000 acres of formally protected land which is either owned by KLT or protected through a Conservation Easement Agreement.

Connecting Youth to Nature – Inspiring the next generation of stewards

Another exciting opportunity that took place last summer was the partnership between KLT and two youth based camps - the ME to WE camp and the Trent Aboriginal Cultural Knowledge and Science (TRACKS) Camp.

During July, KLT provided campers with unique hands-on learning experiences that ranged from native tall grass prairie plug planting to property clean-ups and trail maintenance. The campers were educated on the importance of conservation and land stewardship and learned about the threats affecting our environment including climate change, urban development, invasive species and political challenges. Camp participants went on guided walks of three protected properties - John Earle Chase Memorial Park, Ballyduff Trails and the Jeffrey-Cowan Forest Preserve. They took part in educational and fun days and helped with important property stewardship work.

The campers learned about the globally rare tall grass prairie ecosystem and the stewardship work that is needed for this ecosystem to thrive. They helped plant pollinator plants and tall grass prairie plugs on the properties.

None of the work done by KLT would be possible without our supporters who have helped us develop these new partnerships and projects that are advancing conservation in the Kawarthas.

KAWARTHA LAND TRUST
Protecting the land you love.

For more information about KLT such as upcoming events, property profiles, trail maps, donation options or volunteer opportunities, visit: www.kawarthalandtrust.org

Youth campers at John Earle Chase Memorial Park **Photo: KLT**

Historical Assessment of the North Pigeon Lake Watershed

Mike Dolbey, Ph.D., P. Eng.,
KLSA Director

In 2016, Queen's University's Paleoecological Environmental Assessment and Research Laboratory (PEARL) collected sediment cores from three Kawartha lake sites for paleoecological assessment. Funding for this project was arranged by the Kawartha Lake Stewards Association (KLSA) through the Stony Lake Heritage Foundation, the City of Kawartha Lakes, Kawartha Conservation and private donors. One of the core sites was in the north portion of Pigeon Lake. To assist with the interpretation of the paleoecological results, a knowledge of the historical changes that may have impacted the water quality in the area of the core site is presented below.

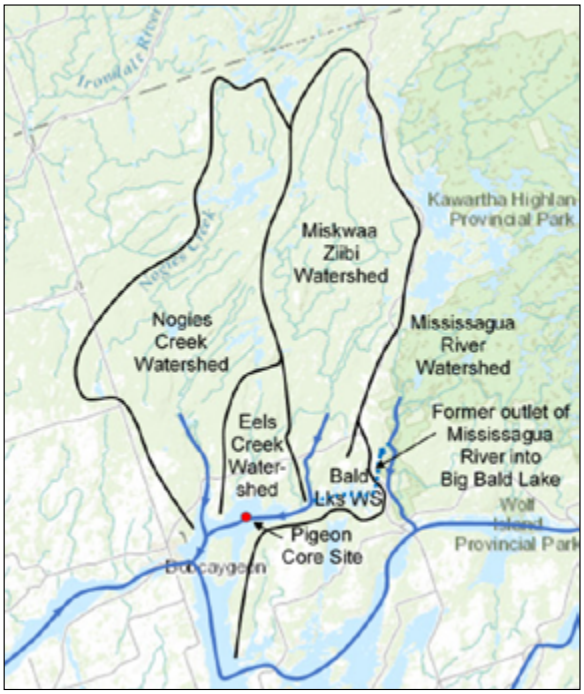


Figure 1. **Map showing watersheds surrounding KLSA's north Pigeon Lake Core Site.**

Figure 1 shows the location of the core site in the north portion of Pigeon Lake, and outlines the watersheds that provide water that flows over the core site. The core site location in north Pigeon Lake receives water primarily from the Bald Lakes to the east and from a number of small watersheds to the north, the largest of which are the Miskwaa Ziibi River and Eels Creek. These combined northern watersheds are approximately 10 kilometers wide near the lake by 35 kilometers high and have a total area of about 240 square kilometers. A gentle escarpment along the south shore of the north portion of Pigeon Lake limits the runoff area to about 1 kilometer from land to the south of the lake. The Bald Lakes watershed is very small being bounded on the east by the Mississagua River which now flows south into Lower Buckhorn Lake. In the past the Mississagua River had a second outlet into Big Bald Lake that might have provided seasonal flow to the Pigeon Lake core site as described by Walters.[1]

Nogies Creek flows from the north into the north portion of Pigeon Lake but it enters further to the west and downstream of the core site. It is assumed that the water quality of Nogies Creek would have little effect on the water quality at the core site. However, pollen from nearby cleared land in the Nogies Creek and southern watersheds might be distributed to the core site by wind.

Based on Ontario's Ministry of Natural Resources and Forestry's *Ontario Flow Assessment Tool* (OFAT)[2], today the combined northern and Bald Lakes watershed areas consist of ~5% open water (lakes), 24% marshes, swamps, fens and bogs, 64% trees, 1% community infrastructure and 6% agricultural or rural land use. The southern part of these watersheds is in the former Harvey Township between Lots 16 and 32 and the northern part is in Galway Township Concessions 1 to 10 and Cavendish Township between Concessions 1 and 18, see Figure 2.

The earliest European settlement in the vicinity of interest was at Buckhorn where John Hall purchased land on both sides of the rapids between Buckhorn and Lower Buckhorn Lakes in 1828. In 1830 he built a dam and by 1832 he had saw and grist mills operating. There was little arable land nearby and the community served only the mill until the late 1860s when the Government opened the Buckhorn colonization road (later known as the Gooderham Road)[3]. The building of the dam at Buckhorn probably resulted in more stable water levels. Prior to dams being built there was an annual cycle of spring floods followed by a steady decline in water level during

[1] Walters, Kevin, *The Central Lakes of the Kawarthas*, Kawartha Lake Stewards Association Lake Water Quality Report – 2008, page 17.
[2] https://www.gisapplication.lrc.gov.on.ca/OFAT/Index.html?site=OFAT&viewer=OFAT&locale=en-US
[3] Buckhorn: http://www.kinmount.ca/friends_vol_3_iss_7.php

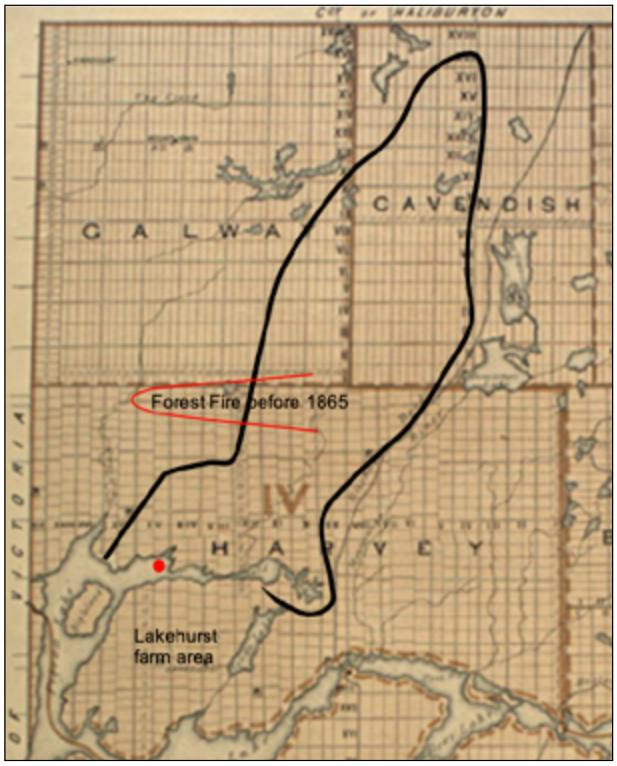


Figure 2. **Location of Pigeon Lake northern watersheds in Harvey, Galway and Cavendish Townships**

the summer as inflowing stream flows gradually slowed followed by higher autumn rainfall before freeze-up. This change from variable water levels to a more constant water level might have resulted in species changes in lake planktonic diatoms.

The Lakehurst area south of the core site was the largest arable area in the vicinity. It was initially settled in the 1830s by military pensioners but few remained on their grants. Most of the marketable timber had been cleared from the area by 1850 when farming developed in earnest. In 1869 a post office was opened and within a few years the hamlet of Lakehurst had a general store, cheese factory, church, school and community centre/township hall. After the development of the Buckhorn Road the community declined[4]. The Lakehurst area is the only large agricultural region close to the Pigeon Lake core site. Drainage from the area is to the south and should have little effect on the water quality in north Pigeon Lake but windblown pollen from invasive species such as *Ambrosia* might settle on the lake and make its way to the core site.

The best early description of the land north of Pigeon Lake was made by Public Land Surveyors (P.L.S.). Many of their notes are quoted in Charles Pelham *Mulvany's History of the County of Peterborough, Ontario: etc.* that was published in 1884.[5] The township of Harvey was re-surveyed by Theodore Clementi, P.L.S. in 1864-65. He states:

> "I will speak first of the western portion of the township, or of that part lying to the west of Mississagua Creek. Along the shores of Buckhorn and Pigeon Lakes the land does not present an inviting appearance, and indeed is generally very rough and broken; but after you proceed inward a lot or two the hardwood timber appears, and the tall, clean trees of maple and beech which are seen, are a sure indication of the richness of the soil which supports them. The upturned roots of fallen trees, also show it to be usually a fine sandy loam, with a subsoil of clay. Going a little farther north the hardwood is thickly interspersed with hemlocks, which run to a very large size. Here the soil is rather lighter and the land generally more undulating, but at the same time more free from stone; and I would not have you to believe that even the lots which are the best timbered with maple and beech are by any means without a fair share of stone, but as in the adjoining Township of Smith this will no doubt, with labour and perseverance, prove to be the very best land for wheat.
>
> Along the northern boundary of the township the character of the land changes, as the granite ridges appear; and of this I can only say that I have scarcely ever seen a rougher country. There has been at one time a large quantity of pine timber there, but the fires of late years have destroyed all that the lumbermen had left, and a dense second growth of hemlock and birch has sprung up, so thick that in places it is almost impenetrable. This commences at the 15th and 16th concession line, running into the township about the breadth of three lots, and gradually increasing in width as you proceed eastward. ….
>
> I regret much that I cannot speak in the same terms of that portion of the township which lies

[4] Lakehurst: http://www.kinmount.ca/friends_vol_3_iss_8.php

[5] Mulvaney, C. P. *History of the County of Peterborough, Ontario, etc;* C. Blackett Robinson,1884. Harvey Twp history - page 447-454; Galway & Cavendish Twp history – pages 454-460.

to the east of Mississagua Creek, it being almost entirely useless for agricultural purposes; but although year after year the lumbermen have been despoiling it of its splendid pine timber, even this year there are no less than four shanties erected.

There is a block of land on the 3rd, 4th and 5th concessions, and about the 10th, 11th and 12th lots, comprising some six hundred acres, which, although stony, is worthy of notice, as being fit for farming purposes. Than the beech and maple which are standing on it, I have never seen finer; and this is the only portion of what can be termed hardwood land in the eastern section of the township. As soon as you leave this on either side the granite crops out, and the pine ridges are merely diversified with tamarac marshes and beaver ponds.

On the north ends of the 1st, 2nd and 3rd concessions to the breadth of about three lots, there is a good deal of pine still standing, and that too of a first-class quality; and I imagine that now (through the energy of Mr. W. A. Scott) the Mississagua Creek having been improved to such an extent that even masts may be taken down with safety, all this timber, which it has hitherto been considered impracticable to take out, will find its way to Quebec."

The above description suggests that in the watersheds north of Pigeon Lake, white pine may have been logged from an area along the north part of Harvey Township (a distance of about 10 km from the lake) and the area had been burned a few years previously, see Figure 2. The easterly extent of the burning is not given but it seems likely that it extended into the Miskwaa Ziibi watershed so it is possible that ash and silt may have been washed downstream that could have impacted water quality in the north portion of Pigeon Lake. It is surprising that this report does not mention logging having taken place in the Miskwaa Ziibi watershed south of this area by 1865. It is said that Mossom Boyd built a sawmill on the Miskwaa Ziibi River (formerly called the Squaw River) where it enters Bald Lake in 1861. The lumber was transported by barge to Omemee and other locations by the steamboat "Novelty", the first to be acquired by the Boyd family.[6] Dr. T. W. Poole stated that in 1866, Boyd's Squaw River mill produced 1,500,000 feet of sawn lumber.[7] To facilitate log drives down the river there were six substantial crib and rock-filled dams located as follows: "Goodenough's Dam at the outlet of Goodenough's Marsh (near Otter Lake), Tumbling Dam, southwest of Parker's Mountain, Forks Dam, at the marshy junction of the east and west branches of the Squaw River, Burnt Dam, at the outlet of the Burnt Marsh (so named after a forest fire), Big and Little Dams, both of which were located toward the mouth of the river, and Boyd's own mill".[8]

A search of the land records for three lots north of Pigeon Lake in Concessions 9 through 16 (from the Bald Lakes to Nogies Creek) indicates that Bobcaygeon lumber baron Mossom Boyd purchased much of this land between 1853 and 1867. Some he sold to lumberman Allan Gilmore in 1857. The rest was held by Boyd till sold to the John Carew Lumber company in 1901.

Scott's Mill on the Mississagua River was built by William Henry in 1863 and subsequently improved and operated by W. A. Scott. Dr. T. W. Poole stated that in 1866, Scott's Mill produced 4,000,000 feet of sawn lumber.[9] Mulvaney says that "This was an excellent mill site, since, being close to Bald Lake [<1 km], the sawn lumber could be easily shipped by that and Pigeon Lake to a market." Apparently there was a railway line from the mill to Pluard's Landing on Big Bald Lake. Train cars moved to the Lake under gravity, and returned to the Mill by horsepower. Scows towed by steamboat then took the lumber to market via Bobcaygeon.[10] It is probable that the damming of the west branch of the Mississagua River described by Walters took place about 1863 when the mill was built. It is not known how much water flowed down the west branch. As Walters speculates, it may have only been active during spring floods or may have varied from time to time depending on changes in natural damming

[6] Barker, Grace, *Timber Empire: the exploits of the Entrepreneurial Boyds – 2nd ed.*, Fox Meadow Creations, Huntsville ON. 2003 Pages 128 & 135.

[7] Poole, Dr. T. W., *The Early Settlement of Peterborough County*, 1867. Reprint by The Peterborough Printing Co. Ltd, 1967. Page 94-5

[8] Brunger, Alan G., Editor, *Harvey Township: An illustrated History*. The Greater Harvey Historical Society. 1992. Page 210

[9] Poole, Dr. T. W., *The Early Settlement of Peterborough County,* 1867. Reprint by The Peterborough Printing Co. Ltd, 1967. Page 94-5

[10] Big Bald Lake Cottage Association, *Big Bald Lake Plan*, February 22, 2010. https://www.bblca.ca/PDFs/LakePlan.pdf

factors on the two branches below their division. The permanent blocking of the west branch after 1863 may have had a significant impact on the water quality in the north portion of Pigeon Lake.

Scott's Mill is the only one mentioned by surveyor Clementi in 1865 which suggests that he was not aware of any others in Harvey at that time. In 1884 Mulvaney states that besides Scott's Mill and Hall's Mill, "there are in Harvey four saw and shingle mills which do good business; they are mostly situated on Pigeon Lake". One was at the mouth of the Miskwaa Ziibi River.

The top of the northern watersheds is in the townships of Galway and Cavendish. Once again, Mulvaney quotes the report of William Drennan, P.L.S. who surveyed these townships in 1859-60. In part he states:

> "The timber is almost wholly hardwood; the line of junction of the limestone and granite corresponds very closely with that of the hardwood and pine in the south-west portion of the township. There is some very fine pine timber, both white and red, much of it being from three to four feet in diameter. It is the only timber of much commercial importance, except, perhaps, tamarac, there being very little elm and no oak. The most frequent kinds of hardwood timber are maple, basswood, ironwood and beech.
>
> The greater number of the watercourses run in a southwesterly direction. Two of these - Nogie's Creek and Squaw River - are of considerable size, and there are good mill sites on both, on the former, on lot 10, in the 2nd concession, and on the latter, on lots 31 and 32, in the 1st concession."

The above description suggests that logging in this area had not yet begun by 1860 and while good mill sites were available, no mills were operating there.

Mulvaney tells us that by 1884 from where the Buckhorn Road enters the 8th concession, another road, the Bobcaygeon Road, extends westward past the north of Pigeon Lake to the Village of Bobcaygeon, in the County of Victoria, the present day Highway 36. Despite the roads that were intended to encourage settlement, settlers were slow to come. In 1865 there were only 65 ratepayers in Harvey. By the time of the 1881 census there were 1,114 men, women and children, and the number of acres under cultivation was 967, just 1½ square miles, virtually all of it in the Lakehurst area.

In conclusion, based on the above, a chronology of factors that might have had an effect on water quality at the core site in north Pigeon Lake is as follows:

1830: A dam built at Buckhorn would have changed the pattern of water level variation from considerable seasonal change to a relatively constant level. Permanent flooding of low shoreline areas probably occurred.

1832 to 1850: Limited settlement of farms in Lakehurst area. Area probably logged.

1850: Increased development of farms in Lakehurst area culminating in 1880s.

1861: Boyd's Mill is built at the mouth of the Miskwaa Ziibi (Squaw) River and logging takes place north of Pigeon Lake.

1863: Scott's Mill is built and the west branch of the Mississagua River that might have provided low phosphorus water to north Pigeon Lake was permanently blocked.

1870: Additional mills are operating at various locations north of Pigeon Lake. A few farms developed on the north shore of Pigeon Lake. Many subsistence farmers moved west between 1890-1900 as the prairies opened up.

1920: Logging ends and mills close.

1950: Cottage development begins in earnest.

Construction of dams and locks that may have affected water levels at the Pigeon Lake site are as follows:

1833-38: Lock #1&2 constructed Bobcaygeon

1837-38: Buckhorn lock (Hall, Madge and Dixon)

1842-44: Bobcaygeon bridge (Board of Works Contractor)

1842-45: Buckhorn slide and bridge constructed

1883-87: Buckhorn, Lovesick and Burleigh Falls locks constructed or upgraded (George Goodwin contractor)

1887-89: Buckhorn, Burleigh Falls bridges upgraded (Robert Waddell contractor)

1887: New Lockgates installed at Buckhorn, and Burleigh Falls (George Goodwin contractor)

2018 Kawartha Lakes Sewage Treatment Plants Report

Mike Dolbey, Ph.D., P. Eng.,
KLSA Director

Each year, KLSA monitors the performance of Sewage Treatment Plants (STPs) that discharge effluent either directly to the Kawartha Lakes or their watershed, or to waterbodies that flow into the Kawartha Lakes. The purpose of STPs is to protect public health by minimizing the discharge of pathogens and to protect the environment by minimizing the discharge of phosphorus (P) to our lakes. Of primary interest to KLSA is the quantity of phosphorus that is discharged by these plants to our lakes because phosphorus is known to be the most likely nutrient to cause increases in the growth of aquatic plants and algae.

Lake management studies have shown that the amount of phosphorus now discharged from STPs is only a small percentage of the phosphorus entering our lakes from all sources. This was not always the case. Prior to the 1970s, STPs discharged between 50 and 100 times more phosphorus than modern STPs. However, unlike most other phosphorus sources that are widely distributed, STPs are localized sources that can be controlled and considerable dollars are spent to build and operate these plants to protect our health and the environment. Municipalities fund STPs by charging the users of the systems an annual levy but they also receive grants from the federal and provincial governments, i.e., all taxpayers, that partly offset the cost of capital projects to repair, upgrade and increase the capacity of STPs.

KLSA monitors the performance of STPs to determine if they are being operated to their fullest potential. Ideally KLSA would like all STPs that discharge directly to our lakes to achieve a 99% phosphorus removal rate. This means that only one part in 100 of the phosphorus entering the plant leaves in the effluent. A drop of removal efficiency to 95% means five parts in 100 leave the plant, which is five times more phosphorus released compared to 99% removal efficiency. What might seem like a small change in removal efficiency can have a very large consequence!

As we have indicated in past years, our STP data is always one year behind, because the reports for the previous year are not available to us before going to press. This year all of the reports were available online on the websites of their respective municipalities. Due to changes in the City of Kawartha Lakes' website, key tables in their online reports were not included but they were provided upon request.

Again this year we have included three STPs, Minden, Port Perry and King's Bay, which do not discharge directly into the Kawartha Lakes. These plants are upstream of our Kawartha Lakes and have at least one body of water in between to attenuate the effects of their effluent discharge.

Minden

Minden's STP discharges to the Gull River just above Gull Lake, which is two lakes away from our most upstream Kawartha lake, Shadow Lake. In 2018 this plant again incorrectly reported an overall removal efficiency of 98%. This was the best removal efficiency achieved in the month of December. The average annual removal efficiency was actually 96.3% without accounting for bypasses. Three bypasses of the tertiary filters occurred during the year. An estimated 2,587 m^3 of partially treated sewage entered the river. Based on samples taken during these events it is estimated that the P load to the river was 0.4 kg. This increased the total annual P load to 16.6 kg, considerably less than last year's 32.9 kg. The Minden STP's effective removal efficiency was 96.2% compared to 92.3% last year. No other spills, bypasses or overflows were reported and no complaints were received during the year.

Average *E. coli* discharges were generally low during the year but were somewhat elevated during the bypass event in October when readings were 82 cfu/100mL, but well below the plant's Certificate of Approval level of 200 cfu/100mL.

Coboconk

This lagoon system continued to function well in 2018, with planned discharges to the Gull River just above town occurring in April, May and November. The average phosphorus content of effluent discharges was 0.11 mg/L in the spring and 0.03 mg/L in the fall. With lagoon systems such as Coboconk's, the volume of effluent released from the lagoons each year may be considerably more or less than the volume of raw input to the plant during the year. This may be due to operational considerations and variable amounts of precipitation and evaporation. Hence, determining the phospho-

rus removal rate is problematic. Considering all inputs and outputs over the past eight years, the overall phosphorus removal rate was greater than 97.0% during that period and the 2018 total annual discharge of phosphorus was estimated to be 4.0 kg.

Average *E. coli* in the discharges in spring and fall were a low 1.4 and 1.6 cfu/100mL respectively. No spills or bypasses occurred during 2018 but one overflow of about 50 m^3 of partially treated wastewater was reported. The wastewater flowed into a ditch where it was absorbed by the surrounding soil with none reaching the Gull River. One odour complaint was received during the year.

Fenelon Falls

In 2018 the Fenelon Falls Waste Water Treatment Plant (WWTP) performed adequately with no spills or overflows at the plant. The annual average removal rate was 96.0%, up from last year's 94.8% but still below our target of 99%. This resulted in a P discharge from the WWTP to Sturgeon Lake of 32.4 kg for the year. However, snow melt and high flows in February and heavy rain in November caused some bypassing of the tertiary filters at the plant. It is estimated that these two events resulted in an additional 1.5 kg of phosphorus entering Sturgeon Lake. Consequently, the Fenelon Falls system as a whole discharged a total of up to 34.0 kg of phosphorus to Sturgeon Lake and had an annual effective P removal rate of 95.8%.

The wet weather flow detention tank at the Ellice Street pumping station that was completed in April 2017 probably reduced the severity of the above-mentioned bypasses. It was also probably responsible for the excellent news that there were no reports of raw sewage discharges from the Colborne Street pumping station that had occurred many times in previous years.

Again this year *E. coli* levels in the effluent from the Fenelon Falls WWTP were generally low with an annual average of 2.2 and a maximum of 4 cfu/100mL. No complaints about plant operations were received in 2018.

Lindsay

The Lindsay WWTP is the largest on the lakes. The City of Kawartha Lakes owns the Lindsay WWTP but its operation is contracted to the Ontario Clean Water Agency (OCWA) which operates all the other sewage treatment plants owned by CKL. In 2018 the Lindsay WWTP operated very well with no reported spills, bypasses or abnormal discharges from the plant. Two overflows of raw sewage occurred in December at a temporary pumping system between the old Colborne sewage pumping station (SPS) and a new SPS on the other side of the Scugog River. The estimated discharge of phosphorus due to this event was less than 0.1 kg. It is estimated that the 2018 annual average phosphorus removal rate was 97.4%, similar to last year's 97.5%. This resulted in a P discharge to Sturgeon Lake of 301.1 kg, down from 311.7 kg last year.

The annual average *E. coli* in the discharge was 14 cfu/100mL with a maximum of 58 cfu/100mL in February. One complaint about odour was reported in 2018 but it could not be confirmed.

Bobcaygeon

In 2018 the average phosphorus removal rate for the Bobcaygeon WWTP was calculated to be 93.0%, down from last year's 94.2%. This is well below the performance of earlier years and our desired target of 99%. The reported annual phosphorus load to the lake was 171.3 kg, significantly more than last year's 114.7 kg. There were no operational problems reported that explain the apparent poor performance but an exceptionally high effluent phosphorus measurement on January 12 with a somewhat high reading on the following day suggest that an unexplained process excursion occurred. This one event added approximately 30 kg of phosphorus to the annual total and resulted in a 1.25% drop in removal efficiency. Also, in November, based on only one sample result, the reported phosphorus content of the raw influent was only 20% of the average annual value while effluent values remained normal. This resulted in an apparent drop in removal efficiency of approximately 0.43%.

The Bobcaygeon WWTP has been experiencing increasing influent flows in recent years that studies suggest is caused by inflow and infiltration (I&I) into the Bobcaygeon's sewage collection system due to "joints, cracks, manhole covers, etc., sump pumps, storm drain tie-ins, etc." A study by OCWA in 2017 showed that influent volumes are highly correlated to rainfall events which supports the earlier study's conclusion. A significant source of inflow

was identified at a joint in the sanitary sewers along Anne St. This was repaired on February 15, 2019 and an immediate drop of 400 m3/day (about 12% of average daily flow) was observed. The City of Kawartha Lakes needs to continue to address other serious problems in the collection system in order to optimize the current plant process and defer future plant expansion/major capital upgrades.

E. coli discharges were quite high during the first eight months of the year with the highest being in April when a geometric mean of 11 samples resulted in a reading of 618 cfu/100mL. The average for the remainder of the year was 4.3 cfu/100mL. The average for the whole year was 98.8 cfu/100mL. No spills, bypasses or abnormal discharges occurred during the year. One complaint about odour at a pumping station was received during the year. Deodorizing pucks were added at the pumping station.

Omemee

This facility consists of two large settling lagoons. Until 2014 all of the effluent was spray-irrigated onto nearby fields during the summer months. A subsurface effluent disposal system was commissioned at the site in March, 2014. Both the spray irrigation and subsurface disposal systems were used in 2018 with about 59% of the effluent being sprayed between late May and early November. Earlier problems with the subsurface disposal system appear to have been overcome. Approximately 41% of the 2018 effluent was disposed of by this system during the colder months.

We are pleased to see that more detailed information about the quantity and quality of raw influent and treated effluent continued to be provided for this facility in 2018. The average effluent phosphorus concentration in 2018 was 0.26 mg/L, lower than last year's 0.44 mg/L and well below the allowable 1.0 mg/L. Lagoon systems can have considerable volume buffering capacity with the volume of raw influent and treated effluent varying considerably from year to year. In 2018 the effluent discharged was about 118% of the influent volume. Based on the numbers provided, phosphorus removal was estimated to be ~91% with ~52.6 kg being distributed to the irrigation fields and subsurface system. However, because the effluent is applied to land far from Pigeon Lake, removal is probably almost 100% with respect to our lakes. Annual average *E. coli* level in the effluent was 172 cfu/100mL this year. This lagoon facility did not require any emergency discharges to the Pigeon River in 2018 and there were no spills or bypasses reported. One complaint was received about odour at the Sturgeon St. SPS and deodorizing pucks were added at the pumping station.

King's Bay

The King's Bay STP serves a golf course community situated on a peninsula between Lake Scugog and the Nonquon River. Houses down the centre of the peninsula are surrounded by the golf course. Treated effluent from the STP at the apex of the peninsula is discharged into two large disposal beds under the golf course on each side of the peninsula. One up-gradient and three down-gradient wells are located around each disposal bed to monitor groundwater for phosphorus migration.

The King's Bay STP treats sewage using two Rotating Biological Contactor (RBC) units. In June 2017 RBC#1 broke down and was out of service awaiting a complete unit replacement during all of 2018. All waste was treated using RBC#2. Despite these difficulties the system performed well. Effluent TP concentration of discharge to the underground disposal beds averaged 0.42 mg/L, up slightly from 0.31 mg/L in 2017, out of an allowable 1.0 mg/L. The annual daily loading for 2018 was 0.019 kg per day, about 10% of the allowable discharge of 0.17 kg per day. Phosphorus annual average removal efficiency within the plant was a very good 99.0% this year. No bypasses, spills or abnormal discharges occurred in 2018 and there were no complaints about the plant.

Monitoring wells located both up and down gradient from the disposal sites have had sporadic high TP readings in past years. In 2016 the TP measurement procedure was changed to collecting a field filtered grab sample from each well twice a year. TP levels in all wells were generally low in 2018. The purpose of the monitoring wells is to detect phosphorus migration towards the lake or the Nonquon River. Since these wells average 100 m from the lake or the Nonquon River, it is probable that, at least for the time being, we still have effectively 100% removal.

2018 Kawartha Lakes Sewage Treatment Plants Report

Port Perry

Port Perry is served by the Nonquon Waste Pollution Control Plant (WPCP) which discharges treated effluent into the Nonquon River northwest of Port Perry, which, in turn, empties into Lake Scugog at Seagrave, where the King's Bay facility is located. Prior to March 1, 2017 this system was an MOECC Class Two wastewater treatment plant designed for an average flow rate of 3,870 cubic metres per day (m^3/d) utilizing two aerated lagoon cells and six seasonal facultative retention ponds. A new modern plant has been built and as of March 1, 2017 the MOECC reclassified Nonquon WPCP as a Class Three wastewater treatment plant, designed to treat wastewater at an average daily flow rate of 5900 m^3/d utilizing an extended aeration process with tertiary treatment. Thus, 2018 is the first full year of operation of the new plant. The new system performed well except for continuing difficulties with the scum removal system that allowed excessive scum and grease to flow through the secondary clarifiers and accumulate in the sand filters. This resulted in some exceedances of effluent objectives for total suspended solids and total phosphorus in 2018. Modifications to the system to address this problem should be fully implemented in 2019.

In 2018, phosphorus was reduced to a monthly average of 0.04 mg/L for a total loading of 44.5 kg, down from last year's 52.3 kg and significantly less than in earlier years. This reflects an excellent removal rate of 99.0%. *E. coli* levels this year were between 0 and 2 cfu/100mL. There were no reported bypasses, spills or abnormal discharges and no complaints were received during 2018.

Summary

The total weight of phosphorus discharged to the mainstream Kawartha Lakes from the Lindsay, Fenelon Falls and Bobcaygeon WWTPs in 2018 was 506 kg, slightly higher than last year's 476 kg. If we include all the plants that we now monitor, we had total phosphorus loading to the lakes of 572 kg in 2018 compared to 566 kg in 2017. If all plants had achieved the 99% removal rate that we would like, the total phosphorus discharge for the year would have been about 198 kg or about 35% of the 2018 total.

KLSA Annual Review of Area Sewage Treatment Plant Performance

Plant Location - Discharges to & Type	Year	Phosphorus Removal Rate % (1)	Total Annual TP Load Out kg (2)	Annual TP Load if 99% kg (3)	E. coli (cfu/100mL)	Bypasses, Spills, Comments
Minden - Gull River Extended aeration activated sludge process with tertiary treatment	2012	98.0%	12.8	6.4	2.7	None reported
	2013	90.1%	53.9	5.4	7.2	Bypass resulted in ~40 kg extra P load
	2014	96.7%	19.4	5.8	9.0	None reported
	2015	96.4%	17.9	4.9	68.0	None reported
	2016	89.7%	44.9	4.4	81.0	Bypass resulted in ~22 kg extra P load
	2017	92.3%	32.9	5.4	297.0	Bypass resulted in ~8.7 kg extra P load
	2018	96.2%	16.6	4.4	82	Bypass resulted in ~0.4 kg extra P load
Coboconk - Gull River Mill Pond Dual lagoons semiannual discharge to river	2012	99.4%	1.2	1.2	5.5	None reported
	2013	97.4%	3.2	1.0	12.4	None reported
	2014	>97.8%	< 3.1	1.7	3.7	None reported
	2015	>98.0%	< 2.2	1.1	2.5	None reported
	2016	>97.6%	4.2	1.2	3.4	None reported
	2017	>97.3%	5.1	1.1	2.7	None reported
	2018	>97.0%	4.0	1.2	1.6	Overflow of 50m^3 - no P load to Gull R
Fenelon Falls - Sturgeon Lake Extended aeration activated sludge process with tertiary treatment	2012	97.3%	27.5	8.7	2.0	Bypass resulted in ~ 8.1 kg extra P load
	2013	95.2%	45.6	9.1	2.0	Bypass resulted in ~ 19.1 kg extra P load
	2014	94.5%	51.8	9.1	2.0	Bypass resulted in ~ 21 kg extra P load
	2015	96.3%	26.3	7.2	2.0	None reported
	2016	94.6%	38.8	7.2	3.3	Bypass resulted in ~ 10.4 kg extra P load
	2017	94.6%	49.1	9.1	2.3	Bypass resulted in ~ 1.6 kg extra P load
	2018	95.8%	34.0	8.0	2.2	Bypass resulted in ~ 1.5 kg extra P load
Lindsay - Sturgeon Lake Flow equalization lagoons; extended aeration activated sludge process with Actiflo tertiary treatment	2012	98.1%	193	101.6	2.4	None reported
	2013	98.0%	220	112.2	4.0	None reported
	2014	96.0%	622	149.7	2.6	Bypass resulted in ~ 402 kg extra P load
	2015	>98.2%	<239.4	131.7	2.5	None reported
	2016	>98.6%	<176.8	134.3	3.5	None reported
	2017	97.5%	311.7	125.9	11	Overflow resulted in ~0.5 kg extra P load
	2018	97.4%	301.1	115.4	14	Overflow resulted in ~0.1 kg extra P load
Bobcaygeon - Pigeon Lake Extended aeration activated sludge process with tertiary treatment	2012	97.8%	43.2	19.6	2.5	None reported
	2013	96.9%	85.4	27.5	3.4	None reported
	2014	97.9%	61.7	29.4	7.4	None reported
	2015	98.0%	51.8	26.9	21.0	None reported
	2016	95.8%	125.6	30.0	31.0	Spill of 1 Litre reported
	2017	94.7%	114.7	19.7	53.7	None reported
	2018	93.0%	171.3	24.4	98.8	None reported
Omemee - Fields/Underground Dual lagoons with spray irrigation; pumped into underground disposal beds beginning 2015	2012	100.0%	0	0.0	309.0	None reported
	2013	100.0%	0	0.0	-	None reported
	2014	100.0%	0	0.0	-	None reported
	2015	100.0%	0	0.0	143.0	None reported
	2016	100.0%	0	0.0	496.0	None reported
	2017	100.0%	0	0.0	150	None reported
	2018	100.0%	0	0.0	172	None reported
King's Bay - Underground Pumped into underground disposal beds.	2012	100.0%	0	0.0	-	None reported
	2013	100.0%	0	0.0	-	None reported
	2014	100.0%	0	0.0	-	None reported
	2015	100.0%	0	1.1	-	Spill resulted in ~1.14 kg release to lake
	2016	100.0%	0	0.0	-	None reported
	2017	100.0%	0	0.0	-	None reported
	2018	100.0%	0	0.0	-	None reported
Port Perry - Lake Scugog Extended aeration activated sludge process with tertiary treatment; effluent discharge to Nonquon River.	2012	96.7%	148.9	45.1	-	None reported
	2013	97.0%	121.3	40.4	-	None reported
	2014	96.6%	144.2	42.4	-	None reported
	2015	98.2%	69.7	37.8	-	None reported
	2016	97.8%	75.3	33.6		None reported
	2017	96.8%	52.3	45.3	2	None reported
	2018	99.0%	44.5	44.4	2	None reported

(1) 'Phosphorus Removal Rate %' is the percentage of the phosphorus in the plant influent that is removed before effluent is discharged.
(2) 'Total Annual TP Load Out kg' is the total weight of phosphorus, in kilograms, that is discharged from the plant during the year.
(3) 'Annual TP Load if 99% kg' is the total weight of phosphorus, in kilograms, that would be discharged from the plant during the year if the plant achieved a 99% Phosphorus Removal Rate.

E. coli Bacteria Testing 2019

Kathleen Mackenzie,
KLSA Director

KLSA volunteer testers were out on 11 Kawartha lakes during the summer of 2019, collecting water samples on 66 sites, 5 or 6 times over the course of the summer. Thanks for all your good work, both sampling and then delivering samples promptly to the SGS laboratory in Lakefield. Your work is a fine example of lake stewardship!

All readings are recorded in Appendix E.

Sampling sites were almost identical to those in the past few years, and results were also very similar. Our lakes show low bacterial counts, with the large majority being less than 20 *E. coli* cfu/100 mL (see chart below). These generally low counts indicate good shoreline management.

Elevated counts occurred at sites where they have occurred in previous years. This is usually where waterfowl congregate, often along grassy shorelines. KLSA recommends keeping a 'buffer zone' of natural vegetation along your shoreline as a deterrent to geese.

For a long-term overview of the KLSA *E. coli* testing program, please see KLSA's *E. coli* Testing Program: Analysis of Results 2001 – 2017 in the 2017 KLSA Annual Report.

KLSA would like to have bacteria testing on the more western Kawartha lakes. All we need is a few volunteers, plus a coordinator to work with the laboratory at Fleming College. Please let us know if you are on Balsam, Sturgeon, Cameron or west Pigeon and are interested in participating in this important program. If you would like to test a location of your choice on your lake, please let KLSA know. There is an excellent instructional video on our website in the 'Publications' section about bacteria testing if you would like to see what is involved.

Year	Number of *E. coli* Readings (cfu/100 mL)			
	0 – 20	21 – 50	51 – 100	Over 100
2019	356	16	4	2
2018	347	23	6	0
2017	324	16	6	6
2016	351	12	4	3
2015	296	17	16	5

Lovesick Lake reflection **Photo Pat Moffat**

Phosphorus Testing 2019

Mike Dolbey, PhD, P.Eng, *KLSA Director*
Kathleen Mackenzie, *KLSA Director*

Thank you, volunteers, for a job well done during KLSA's nineteenth year of water quality monitoring. We hope you feel proud that you have been part of creating a database which is increasing in value every year.

The Lake Partner Program (LPP) for 2020 has been temporarily suspended until pandemic restrictions on volunteers and the Dorset Environmental Sciences Centre (DESC) are eased. Testers will be notified when sample collection can begin. Check the KLSA website for information.

In 2019, we were pleased to add five Lake Partner Program sites! These were: Buckhorn/E. of Fox Is, Cameron/S. end, Cameron/N. end, Pigeon/S. end, and Chemong/N. of Big Is. A warm welcome goes out to our new volunteers!

In 2019, total phosphorus (TP) was measured at 50 sites on 17 lakes, four to six times over the summer. Samples were analyzed by the Ministry of the Environment, Conservation and Parks' Lake Partner Program (LPP). The TP data for hundreds of LPP sites on Ontario lakes can be found on the Federation of Ontario Cottagers' Associations (FOCA) website.

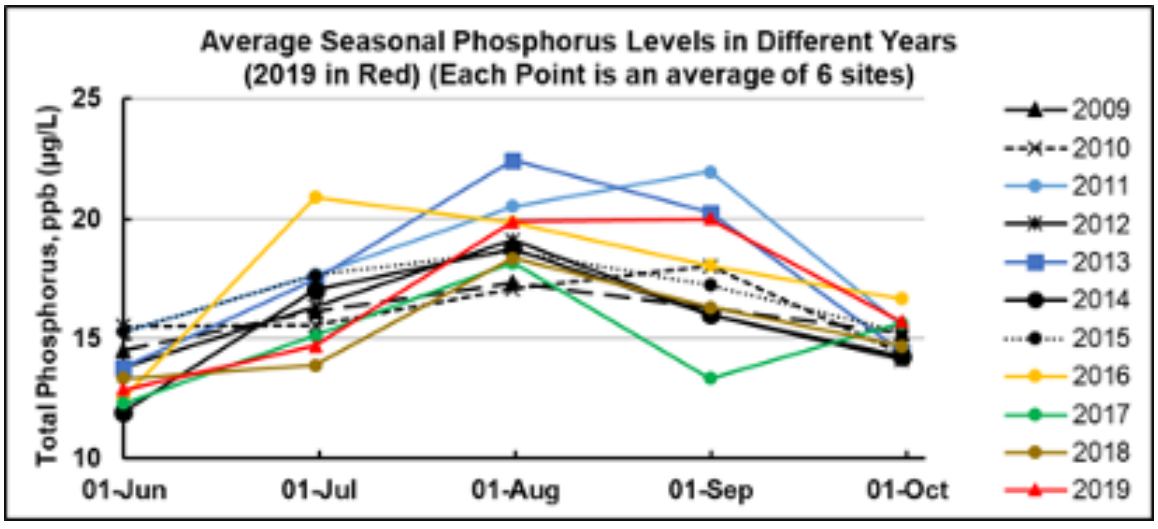
If you are unable to continue testing, please let any director in KLSA know, so we can help find a replacement for you. The program is free, and kits are mailed to you along with instructions. We have fairly complete coverage of the Kawartha Lakes, but many volunteers would welcome an assistant. Also, we are looking for a tester for south Sturgeon Lake and for the middle of Chemong Lake. Please let us know if you are interested.

This section is an analysis of the 2019 results. The complete chart of TP measurements, Secchi depths and calcium levels is found in Appendix F.

Why measure phosphorus levels in lake water?

Phosphorus is regarded as the chemical that is most responsible for increased algal growth in freshwater lakes, causing murky water. Sources of phosphorus include shoreline erosion, fertilizers, wildlife, septic systems, sewage treatment plants and pets. Limited fertilizer use and a well-vegetated shoreline are good ways to limit your phosphorus input, and keep our lakes clear.
The Ontario Ministry of the Environment, Conservation and Parks issued the following guidelines for total phosphorus in our lakes:

- To avoid nuisance concentrations of algae in lakes, average total phosphorus concentrations for the ice-free period should not exceed 20 µg/L (equal to 20 parts per billion, ppb);
- A high level of protection against aesthetic deterioration will be provided by a total phosphorus concentration for the ice-free period of 10 µg/L or less.



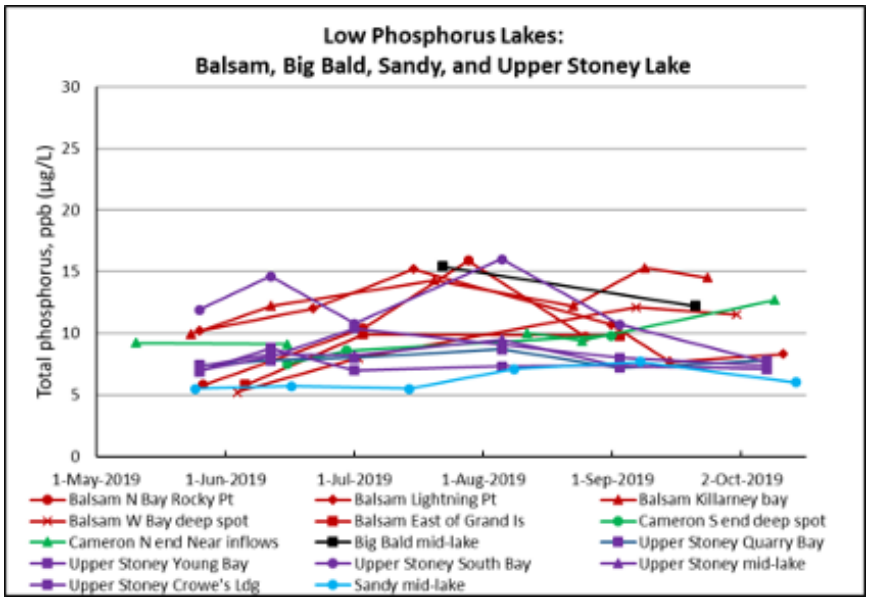
Phosphorus Testing 2019

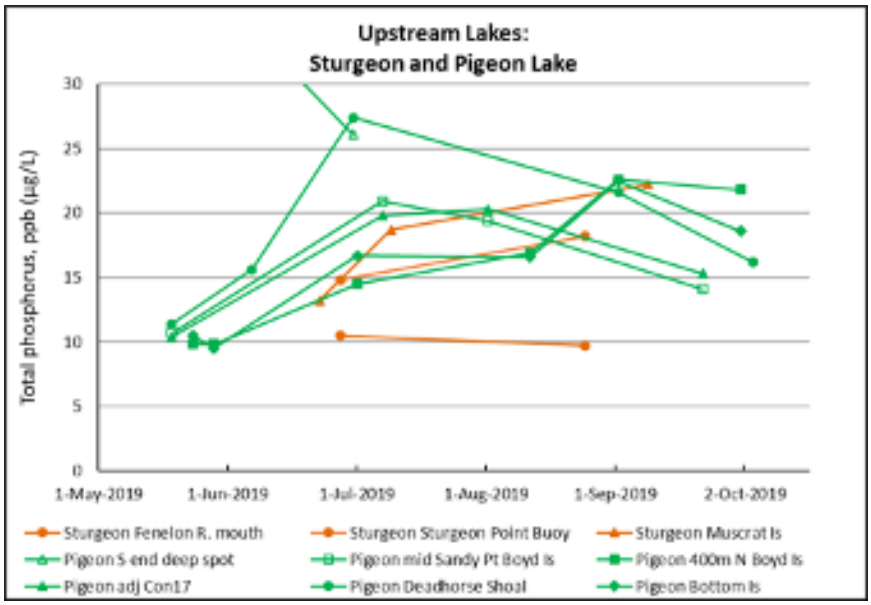
Lake-to-Lake Phosphorus Results

The lake-to-lake phosphorus pattern is very similar in the Kawarthas from year to year, as seen in the graph above. All lakes start the season with low phosphorus levels, due to a large spring flush of water from the north. Most lakes then show rising phosphorus levels during June and July, which then taper off in August and September. As seen in the graph above, 2019 was an average year, though somewhat higher than average in August and early September. There are a few lakes that are an exception to this pattern. These lakes continue to show low phosphorus levels through the entire season (see "Low Phosphorus Lakes" graph, below).

Low Phosphorus Lakes

The low phosphorus lakes have stable TP levels, rarely above 15 ppb. Balsam, Upper Stoney and Big Bald Lake are fed directly with low phosphorus water from the north. With three new sites being tested (Balsam/E. of Grand Island and the two Cameron Lake sites), it is now possible to track phosphorus levels at the upstream end of the Kawartha Lakes. Water flows into the TSW at Lightning Point, at the northeast corner of Balsam Lake.





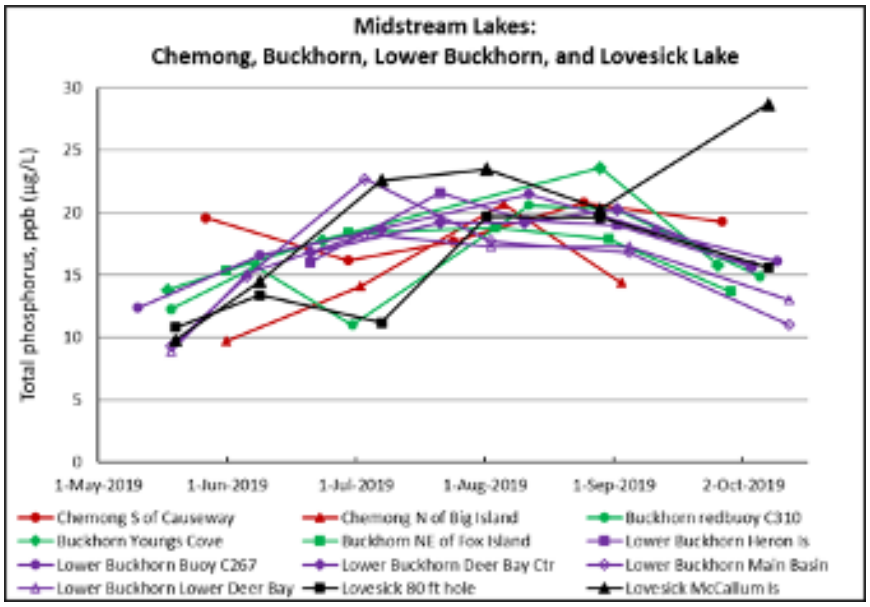
As the water moves southward into the main part of Balsam Lake, phosphorus levels drop about 4 ppb. (It would be nice to be able to explain that!) From the exit from Balsam Lake (E. of Grand Is.), through Cameron Lake and into the north end of Sturgeon Lake (see Sturgeon: Fenelon R. mouth in Upstream Lakes chart), phosphorus levels remain below 15 ppb throughout the summer. Sandy Lake has a unique marl chemistry; its lake phosphorus is precipitated into the sediments during the summer (which incidentally accounts for its attractive turquoise colour).

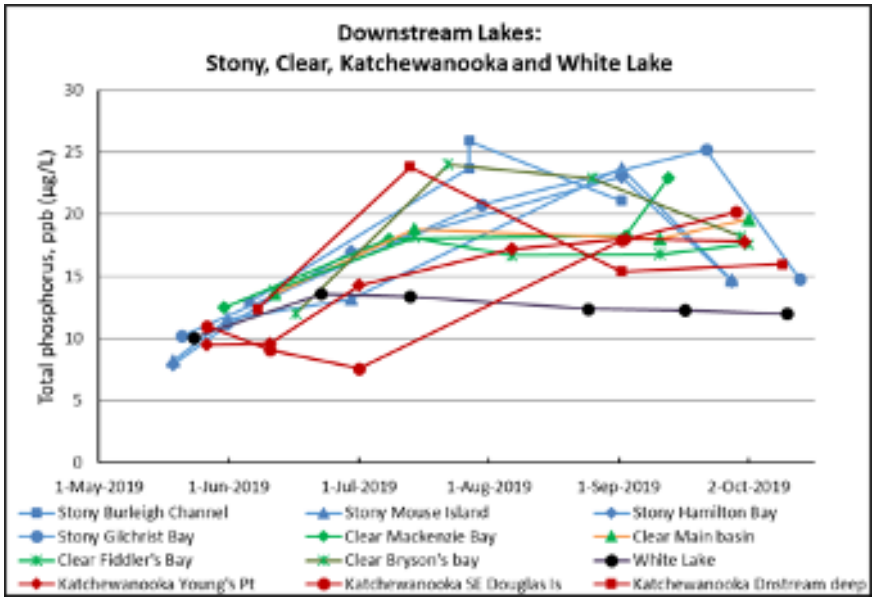
The high reading in early June on Upper Stoney's South Bay was also observed in 2017 and 2018. South Bay is a 'dead-end' bay, with relatively shallow water, so the chemistry of this 'corner' of lake can be somewhat different from the rest of Upper Stoney Lake.

Upstream Lakes

Water quality at the upstream end of Sturgeon Lake (Fenelon R. mouth) is similar to the low phosphorus lakes. However, as water moves downstream through Sturgeon Lake it mixes with southern water from Lindsay via the Scugog River, and from surrounding agricultural land. Phosphorus levels rise throughout June and then level off. The high reading at Pigeon: Dead

Phosphorus Testing 2019





Horse Shoal on July 1 had no apparent cause. In 2018, this site had a much *lower* reading than its neighbouring sites around the same date. Is there something unusual happening around July 1 near Dead Horse Shoal?

This is the first year we have had testing in the south Pigeon Lake area. The phosphorus level on May 30 was 36.9 ppb, which was off the chart. The level was reduced to 26.1 ppb on July 1, but it seems that the south end of Pigeon is adding higher phosphorus water to the Trent-Severn Waterway. It will be valuable to do more testing in south Pigeon Lake in the future to get a better sense of this area's phosphorus contribution.

Midstream Lakes

The midstream lakes have similar phosphorus levels to the upstream lakes. This is the first year we have measured in the north end of Chemong Lake, just north of Big Island. It is interesting to see how different the phosphorus levels are here than in at the 'south of the causeway' site. KLSA used to have an LPP site at Poplar Point, halfway between these two points; it would be interesting to see how this would compare to the other two sites.

Downstream Lakes

As water flows into Stony Lake (Burleigh Channel site) phosphorus levels are similar to those of its upstream neighbour, Lovesick Lake. However, as the water moves through Stony Lake it mixes with low phosphorus water flowing in from Upper Stoney Lake resulting in lower phosphorus levels (Mouse Island, Hamilton Bay and Gilchrist Bay sites). Levels then remain about the same as water continues flowing through Clear Lake and Katchewanooka Lake. White Lake, which is fed directly from Gilchrist Bay, has lower phosphorus levels, presumably due to low phosphorus springs.

Summary of 2019

The phosphorus levels were similar to other years. This year, for the first time, we could see clearly the low phosphorus levels through the top of Balsam Lake, throughout Cameron Lake, and in the upstream section of Sturgeon Lake. This emphasized the rise in phosphorus levels that occurs in the middle of Sturgeon Lake. Also for the first time, we could see that the southern end of Pigeon Lake has relatively high phosphorus levels.

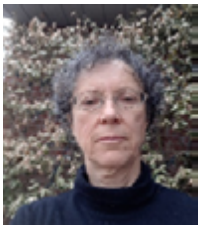
Appendix A - Mission Statement & Board of Directors

KLSA Mission Statement

The Kawartha Lake Stewards Association (KLSA) was founded to carry out a coordinated, consistent water quality testing program (including bacteria and phosphorus) in lake water in the Kawartha Lakes. KLSA ensures that water quality test results, prepared according to professionally validated protocols with summary analysis, are made available to interested parties. The Kawartha Lake Stewards Association has expanded into research activities that help to better understand lake water quality and may expand its program into other related issues in the future.

2019 – 2020 Board of Directors

William A. Napier
Chair
Lovesick Lake



Kathleen Mackenzie
Vice-Chair[2]
Stony Lake

Tom McAllister
Vice-Chair[4]
Lower Buckhorn Lake

Mike Stedman[2]
Treasurer[1]
Lakefield

Ed Leerdam
Treasurer[3]
Trent Lakes

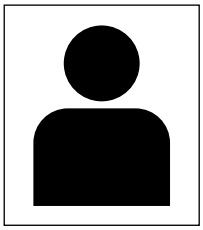
Lynn Woodcroft
Secretary
Buckhorn

Sheila Gordon-Dillane
Recording Secretary
Pigeon Lake

Jeffrey Chalmers
Director
Clear Lake

Doug Colmer
Director
Big Cedar Lake

Mike Dolbey
Director
Katchewanooka Lake



C. Lee[4]
Director
Balsam Lake

Tracy Logan
Director
Big Bald Lake

Brett Tregunno
Director
Omemee

[1] *until May 11, 2019*
[2] *until October 5, 2019*
[3] *effective May 11, 2019*
[4] *effective October 5, 2019*

Heron visit Photo Sheila Gordon-Dillane

Appendix A - Scientific Advisors & Volunteer Testers

Scientific Advisors

Dr. Brian Cumming, Professor and Head, Department of Biology; Director, School of Environmental Studies; Co-Director, Paleoecological Environmental Assessment and Research Laboratory (PEARL), Queen's University, Kingston

Dr. Paul Frost, David Schindler Professor of Aquatic Science, Trent University, Peterborough

Sara Kelly, Faculty, Ecosystem Management Program, Fleming College, Lindsay

Dr. Eric Sager, Ecological Restoration Program, Fleming College and Trent University, Peterborough

KLSA Volunteer Testers 2019

Balsam Lake - Douglas and Peggy Erlandson, Ross Bird, Rob Sproat, Leslie Joynt

Big Bald Lake - Big Bald Lake Cottagers Association: Rich Corbin, John Boyce

Big Cedar Lake - Big Cedar Lake Stewardship Association: Ralph and Diane Trauzzi

Buckhorn Lake (U) - Buckhorn Sands Property Owners Association: Jacob Bigg
Buckhorn Lake (U) - Darrell Darling, Brett Tregunno, Emma Ekin

Cameron Lake – Bruce and Ruth Long
Cameron Lake – East Cameron Lake Association: Mark Crane

Chemong Lake – Brian and Linda Neck, Drew and Sandy Beaton, Steve and Annette Thomson

Clear Lake – Birchcliff Property Owners Association: Jeff Chalmers, Colin Tener
Clear Lake – Steve Foulon
Clear Lake - Kawartha Park Cottagers Association: Judy Finch

Julian Lake – David, Carol, Andrew and Kim MacLellan

Katchewanooka Lake – Steven Wildfong, Mike Dolbey
Katchewanooka Lake – Imagine the Marsh: Guy Hanchet

Lovesick Lake – Lovesick Lake Association: Rick and Dian Bogie

Lower Buckhorn Lake – Lower Buckhorn Lake Owners Association: Mark and Diane Potter, Dave Thompson, Harry Shuman, Paul Pause, Brian Brady, Janet and Paul Duval

Pigeon Lake – Concession 17 Pigeon Lake Cottagers Association: Donald Morrison, Ruth Russell
Pigeon Lake – North Pigeon Lake Association: Line Pinard, George Brown, Kent Crawford, Janet Klein
Pigeon Lake – Victoria Place: Brenda Ounjian, Bob Johnson

Sandy Lake – Sandy Lake Cottagers Association: The Boysen family, the Streeter family

Stony Lake – Association of Stony Lake Cottagers: Bev and Don Foster, Rob Little, Ralph and Barb Reed, Kathleen Mackenzie, Bob Woosnam, Gail Szego

Sturgeon Lake – Bruce Hadfield, Dave Young, Rod Martin

Upper Stoney Lake - Upper Stoney Lake Association: Karl Macarthur

White Lake – White Lake Association: Wayne Horner

Appendix B - Financial Partners

Thank You to our 2019 Supporters*

*Please support our advertisers listed inside the back cover

FOUNDATIONS AND MUNICIPALITIES

Gold ($5,000+)

Silver ($1,000 - $4,999)
Township of Douro-Dummer

Bronze (less than $1,000)
Township of Selwyn
Municipality of Trent Lakes

ASSOCIATION/BUSINESSES/INDIVIDUALS

Gold ($200+)

Ann and John Ambler
Susan and Mike Dolbey
Sheila Gordon-Dillane and Jim Dillane
Happy Days Houseboats
Mary and Jim Keyser
Kathleen and Blair Mackenzie
Patti and Tom McAllister
Lois and Bill Napier
Pinewood Cottages and Trailer Park
Judy and Lou Probst
Sandy Lake Cottagers Association

Silver ($100 - $199)

Chris Appleton and Nancy Hunt
Helen and Doug Batten
Big Bald Lake Cottagers' Association
Birch Bend Cottage Resort
Birch Cliff Property Owners Association
Diane and Michael Boysen
Camp Kawartha
Peter Chappell
Janet and Paul Duval
Egan Marine Houseboat Rentals
Fire Route 44 Cottagers Association
Gillian Fisher and Robert Woosnam
Janet Haslett-Theall and Larry Theall
Mary and Edward Hill
Cindy and Brian Hunt
Lakefield Foodland
Penny and Rob Little
Audrey and Tom McCarron
Ted Oakes
Jackie and Murray Shaver
Cathy and Jeff Webb

Bronze (less than $100)

Big Cedar Lake Stewardship Association
Buckhorn Sands Property Owners Association
Andrea Kirkwood
Lakeside Cottages
C. Lee
Ed Leerdam
David MacLellan
Chris Norman
Peterborough Pollinators
R. Rawn
Rosemary and Claudio Rosada
Serendipity Bed & Breakfast
Heather and Hans Stelzer
Norma and Alan Walker
Heather Watson

Appendix C - Treasurer's Report

KLSA Treasurer's Report as of December 31, 2019

Ed Leerdam, *KLSA Treasurer*

This Treasurer's Report refers to the 2019 calendar year and the Grant Thornton LLP Chartered Accountants Statement of Financial Position summarizing Revenue, Expenditures and Assets for 2018 and 2019 Fiscal Years. Our thanks to Mr. John West, Partner, Grant Thornton LLP Chartered Accountants who provided this community service.

2019 Revenue of $12,564 increased by almost 3% over 2018 revenue. While business and individual donations decreased by almost 20%, and cottage association donations decreased by over 14%, grants from Municipalities increased by almost 43%. Water testing fees (and expenditures) increased due to an increase in lab testing fees.

Our continuing sources of income were:

- Water Testing Fees $4,077
- Municipal Grants $1,735
- Private business / Individual Donations $6,037
- Association Donations $ 715

2019 Expenses of $11,958 decreased by almost 27% over 2019 expenses. This is mainly attributed to having made final payment of $7,500 in 2018 to Queen's University Paleoecological Environmental Assessment and Research Laboratory (PEARL) for the collection, analysis and age-dating of sediment cores. 2019 had a smaller expense of $643 for Special Projects for joint Credit for Product (C4P) Dissolved Oxygen and Total Phosphorus Projects with Fleming College students (see articles in our May 2019 Report). 2019 Annual Lake Water Quality Report expenses now include graphic design cost of $500 and mailing cost of $500. 2019 expenditures now include expenses related to our 2 public meetings (Spring and Fall). Water testing expenditures (and fees) increased due to an increase in lab testing fees.

Recurring operating expenses included:

- *E. Coli* Lab Test Fees $3,689
- KLSA Insurance $1,761
- KLSA Annual Lake Water Quality Report $4,951
- Semi-Annual Public Meetings $ 637
- Office and Banking $ 277

In terms of Total Assets, we closed 2019 with a net cash position of $9,443 (after a Grant and an Expense deferral for 2020, paid in 2019), enough to cover working capital requirements for early 2020 Annual Report and Insurance expenditures.

Appendix C - Financial Statements

Grant Thornton

Notice to Reader

Grant Thornton LLP
362 Queen Street
Peterborough, ON
K9H 3J6

T +1 705 743 5020
F +1 705 743 5081
www.GrantThornton.ca

On the basis of information provided by the organization, we have compiled the statement of financial position of Kawartha Lake Stewards Association as at December 31, 2019 and the statement of operations and changes in net assets for the year then ended.

We have not performed an audit or a review engagement in respect of these financial statements and, accordingly, we express no assurance thereon.

Readers are cautioned that these statements may not be appropriate for their purposes.

Grant Thornton LLP

Peterborough, Canada
February 24, 2020

Chartered Professional Accountants
Licensed Public Accountants

Appendix C - Financial Statements

Kawartha Lake Stewards Association
Statement of Operations and Changes in Net Assets

(Unaudited - see Notice to Reader)
Year ended December 31

	2019	2018
Revenues		
Private contributions and donations	$ 6,037	$ 7,498
Water testing fees	4,077	2,660
Municipal grants	1,735	1,215
Associations	715	835
	12,564	12,208
Expenditures		
Meetings and annual report costs	5,588	3,845
Water testing fees	3,689	2,791
Insurance	1,761	1,743
Special projects	643	7,500
Office and administration	222	373
Bank charges	55	26
	11,958	16,278
Excess (deficiency) of revenues over expenditures	606	(4,070)
Net assets, beginning of year	8,837	12,907
Net assets, end of year	$ 9,443	$ 8,837

See accompanying note to the financial statements.

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Appendix C - Financial Statements

Kawartha Lake Stewards Association
Statement of Financial Position
(Unaudited - see Notice to Reader)
December 31

	2019	2018
Assets		
Cash	$ 10,311	$ 8,837
Prepaid expenses	132	-
	$ 10,443	$ 8,837
Liabilities		
Deferred grant revenue	$ 1,000	$ -
Net assets	9,443	8,837
	$ 10,443	$ 8,837

See accompanying note to the financial statements.

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Appendix C - Financial Statements

Kawartha Lake Stewards Association
Note to the Financial Statements
(Unaudited - see Notice to Reader)
December 31, 2019

1. Basis of presentation

The accompanying financial statements relate to the incorporated association registered by Letters Patent as Kawartha Lake Stewards Association. The Association conducts co-ordinated, consistent water quality testing programs (including bacteria and phosphorus) of lake water on lakes within the Trent Canal System watershed. The Association derives its revenue from those groups and individuals who are concerned about maintaining the quality of water within the watershed.

Kawartha Lake Stewards Association qualifies as a non-profit organization under section 149(1)(l) of the Income Tax Act, and, as such, is not responsible to pay income tax. The distribution of any of its assets or profits to, or for the personal benefit, of its members, directors or affiliates is prohibited.

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Appendix D
Kawartha Lake Stewards Association Survey Results

Tracy Logan, *KLSA Director*

In 2019, the Kawartha Lake Stewards Association (KLSA) conducted a survey to assess awareness of the organization and its programs, evaluation of KLSA programs and suggestions of topics and activities to be addressed in the future. Opportunities to complete the survey were provided on-line and at the KLSA public meetings in May and October.

First, thank you to the nearly 100 individuals who participated in the survey; your feedback will help us develop events, projects and materials relevant to the needs, interests and concerns of those who utilize the Kawartha Lakes.

It is easy to see from the survey results that KLSA has a devoted and supportive following with 35% being aware of our mandate and programs for over 6-10 years and 35% over 10 years!
When asked how satisfied the individual was with the KLSA, the average answer was 8.55 out of 10.

Those participating in the survey stated that 63% attend the spring meeting, 50% attend the fall meeting and 30% do not attend them. Out of those that do not attend, 22% said that they are not in the area and 60% stated that the timing has not worked due to obligations and conflicts.

When asked what issues the KLSA should focus on the topics were ranked as follows, with 1 being the highest:

1. Invasive Species
2. Aquatic Plants/Algae
3. Phosphorus Levels
4. Shoreline Development
5. *E. coli*
6. Water Chemistry
7. Fish Populations

Other topics suggested were water temperature, loon and turtle surveys, species at risk protection and climate change.

Regarding the KLSA Annual Report, almost 60% of the responders read the report from cover to cover!
When asked how satisfied they are with the report they gave it an average score of 8.5 out of 10.

Thank you again for your assistance and we look forward to taking the feedback and suggestions into consideration as we plan our activities for the following years. If you did not complete the survey in 2019, it is available on-line at www.surveymonkey.com/r/M37LJ3D. We welcome your feedback.

Appendix E - *E. coli* Test Results

Rationale for *E. coli* Testing and 2019 Lake-by-Lake Results

Kathleen Mackenzie, *KLSA Director*

Providing context for these results

- In Ontario, a public beach is "posted" when the level of *E. coli* in the water exceeds 100 *E. coli* cfu/100mL (colony-forming units/100mL) of water. This means that the water is unsafe for recreational use, including human bathing (swimming).
- KLSA considers counts over 50 cfu/100mL as somewhat high for the Kawartha Lakes, and cause for re-testing where possible.
- Counts of 20 and below, with an occasional reading between 20 and 50, are normal for the Kawartha Lakes.

Choosing sites for the KLSA *E. coli* testing program

The goals of this testing are threefold:

- To see how safe the water was for swimming at these sites
- To provide baseline data for ongoing monitoring in future years
- To discover sources of elevated bacterial counts

Almost all sites were chosen because it was thought that they would have the highest *E. coli* counts in the lake; that is, we were 'looking for trouble'. Therefore, please realize that the readings shown here do not represent the average bacterial levels on our lakes; rather, they would represent some of the highest bacterial levels on our lakes. Test sites included:

- Areas of high use (resorts, live-aboard docking areas, etc.)
- Areas of low circulation (quiet, protected bays)
- Areas near inflows (from culverts, streams, wetlands)
- Areas of concentrated populations of wildlife (near wetlands, areas popular with waterfowl)

Please note:

- KLSA does not test drinking water. Only surface waters are tested. All untreated surface waters are considered unsafe for drinking.
- KLSA results are valid only for the times and locations tested, and are no guarantee that a lake will be safe to swim in at all times and in all locations.
- Only sites consistent with provincial sampling protocol have been reported.

How and why did we test for *E. coli*?

The protocol for *E. coli* testing is found in the Ontario Ministry of Health and Long-Term Care's Operational Approaches to Recreational Water Quality, 2018.

- The presence of *E. coli* usually indicates fecal contamination from warm-blooded animals such as birds or mammals, including humans. The presence of *E. coli* indicates the possible presence of other disease-causing organisms found in fecal material, such as those causing gastrointestinal and outer ear infections.
- *E. coli* is present in fecal material in very high numbers. Healthy humans excrete about 100 million *E. coli* per ¼ teaspoon of fecal matter! Therefore, it is easier to 'find' than most other less plentiful bacteria.
- *E. coli* itself can be dangerous. Although most strains of *E. coli* are harmless, some strains cause serious disease or illness, as occurs in occasional ground beef 'scares' which can lead to food poisoning. The basic analysis done by the laboratories cannot distinguish the difference between the harmless and the deadly, so we always treat *E. coli* as if we were dealing with a harmful strain.

Results are expressed as *E. coli* cfu/100 mL. When sample water is plated on growth medium in the laboratory, each live bacterium will grow to form a visible colony. 'Cfu' signifies 'colony forming units'. 'Cfu' generally represents numbers of live bacteria as opposed to a microscopic count which would count both live and dead bacteria.

Appendix E - *E. coli* Test Results

What do this year's results tell us?

E. coli readings were, as in other years, predominantly less than 20 cfu/100 mL, with a few readings between 20 and 100. There were two readings over the 'safe swimming limit' of 100 cfu/100 mL, but counts were low upon further testing.

Big Bald Lake - Big Bald Lake Cottagers' Association						
2019 *E. coli* Lake Water Testing – *E. coli* cfu/100mL						
Site	July 2	July 22	July 29	August 6	August 12	September 3
1	1	9	5	18	11	3
3	0	11	2	18	3	5
9	0	4	2	1	2	0
10	0	3	4	14	6	2
12	0	0	7	2	1	3

Counts were consistently low at all 5 sites on Big Bald Lake.

Big Cedar Lake - Big Cedar Lake Road Association						
2019 *E. coli* Lake Water Testing – *E. coli* cfu/100mL						
Site	July 4	July 26	July 29	August 7	August 12	September 2
640	11	0	2	2	1	1

Counts were consistently low at this location on Big Cedar Lake.

Buckhorn Lake - Buckhorn Sands Property Owners Association						
2019 *E. coli* Lake Water Testing – *E. coli* cfu/100mL						
Site	July 2	July 21	July 29	August 7	August 12	September 2
A	1	6	5	0	1	1
B	3	6	6	0	0	0
C	1	**52**	2	0	0	0
D	4	15	0	0	1	0

Counts were low at the four locations tested by Buckhorn Sands, with the exception of the somewhat elevated count of 52 on the July 21 reading at Site 9. Counts returned to a low level the next week.

Clear Lake – Kawartha Park Cottagers Association						
2019 *E. coli* Lake Water Testing – *E. coli* cfu/100mL						
Site	July 2	July 11	August 6	August 20	September 3	September 13
A	0	1	0	0	0	0
B	0	6	1	0	0	0
C	1	18	0	1	1	2
D	0	2	0	0	0	2
P	1	22	3	0	0	1
W	21	23	1	1	0	2

***E. coli* counts were consistently low at all six Kawartha Park sites.**

Appendix E - *E. coli* Test Results

Clear Lake – Birchcliff Property Owners Association						
2019 *E. coli* Lake Water Testing – *E. coli* cfu/100mL						
Site	July 8	July 26	August 1	August 7	August 12	September 5
2	0	0	2	1	0	0
3	1	**72**	0	0	2	9
4	1	38	2	7	0	1
5	21	0	0	0	2	0
6	2	0	0	0	1	0
7	1	4	1	0	1	0
8	2	1	5	1	2	11
B-B	1	0	3	0	2	1

There was only one count over 50, the Site 3/July 26 reading of 72. Counts at this site returned to a normal low level in all subsequent samples.

Katchewanooka Lake – Site 2							
2019 *E. coli* Lake Water Testing – *E. coli* cfu/100mL							
Site	July 2	July 23	July 26	July 29	August 6	August 12	September 2
2	7	**600**	0, 3, 2	3	3	3	0

There was no obvious reason for the high count of 600 on July 23. The site was immediately re-tested and counts returned to their normal low level.

Katchewanooka Lake – Site 7						
2019 *E. coli* Lake Water Testing – *E. coli* cfu/100mL						
Site	July 2	July 22	July 29	August 7	August 12	September 3
7	1	5	1	2	3	2

All counts were very low at Site 7.

Lovesick Lake – Lovesick Lake Association						
2019 *E. coli* Lake Water Testing – *E. coli* cfu/100mL						
Site	July 7	July 18	July 25	August 2	August 8	August 29
16	0	4	0	1	7	42
18	1	0	0	1	0	0
19	1	0	1	0	0	1

Counts were very low at these three locations on Lovesick Lake.

Appendix E - *E. coli* Test Results

Lower Buckhorn Lake - Lower Buckhorn Lake Owners Association					
2019 *E. coli* Lake Water Testing – *E. coli* cfu/100mL					
Site	July 5	July 22	August 6	August 12	September 2
2	0	3	1	2	0
5	5	8	1	0	0
11	0	4	1	1	2
13	0	8	-	2, 0, 2	0
20	1	0	0	-	1
12	-	-	-	0	-

Counts were consistently very low on the Lower Buckhorn Lake sites.

Pigeon Lake – Concession 17 Pigeon Lake Cottagers Association				
2019 *E. coli* Lake Water Testing – *E. coli* cfu/100mL				
Site	June 13	July 8	August 2	August 23
A	0	0	0	0
B	2	0	0	3
3	0	0	0	0

Counts were consistently low at all three sites in the Pigeon Lake Concession 17 area.

Pigeon Lake – North Pigeon Lake Association						
2019 *E. coli* Lake Water Testing – *E. coli* cfu/100mL						
Site	July 2	July 21	July 29	August 9	August 11	September 2
1A	0	0	0	0	0	0
5A	11	13	35	21	24	1
6	21	44	16	38	20	3
8	0	0	0	2	0	2
13	15	4	9	13	9	20

Counts were low at all five North Pigeon Lake Association sites.

Pigeon Lake – Victoria Place						
2019 *E. coli* Lake Water Testing – *E. coli* cfu/100mL						
Site	July 2	July 22	July 29	August 7	August 12	September 3
1	**52**	**58**	1, 1, 0	2	0	0
2	4	16	1	2	1	0
3	7	5	1	1	2	0
4	0	5	0	1	2	3
5	2	1	1	2	2	2

Counts were generally very low on these Victoria Place sites. However, Site 1 had two elevated counts of 52 and 58 on July 2 and July 22 respectively. This site is near an area of concentrated human use on the shoreline; this may have been the source of the elevated counts.

Appendix E - *E. coli* Test Results

Sandy Lake – Sandy Lake Cottagers Association						
2019 *E. coli* Lake Water Testing – *E. coli* cfu/100mL						
Site	July 2	July 22	July 29	August 6	August 12	September 3
1	1	0	0	7	0	0
2	1	1	1	0	0	1
3	0	2	3	2	0	23

Counts were extremely low at all three Sandy Lake sites.

Stony Lake – Association of Stony Lake Cottagers						
2019 *E. coli* Lake Water Testing – *E. coli* cfu/100mL						
Site	July 2	July 22	July 29	August 7	August 12	September 3
E	19	**128**	21	6	3	1
F	3	4	0	2	1	1
I	10	1	2	0	7	4
L	0	0	0	0	0	0
P	1	0	0	0	0	0
PRV28	5	12	5	**67**	14	3

Generally, counts were low on Stony Lake.
There was no obvious reason for the high count of 128 on July 22. Site E experiences high human use and occasional high counts have occurred at this site. Counts had returned to normal the following week.
The count of 67 at PRV 28 on August 7 is similar to occasional elevated counts seen at this site in past years. This is a narrow bay with low circulation and fairly heavy human use on the shoreline.

Stony Lake – Association of Stony Lake Cottagers – Site J, K						
2019 *E. coli* Lake Water Testing – *E. coli* cfu/100mL						
Site	July 13	July 22	July 29	August 6	August 12	September 3
J	4	13	26	15	39	8
K	1	1	1	1	2	0

Counts were low at these two Stony Lake sites.

Upper Stoney Lake – Upper Stoney Lake Association						
2019 *E. coli* Lake Water Testing – *E. coli* cfu/100mL						
Site	July 2	July 23	July 29	August 6	August 12	September 3
6	3	5	13	8	9	11
20	6	22	8	5	2	0
21	0	0	1	0	2	1
52	11	17	11	29	12	11
65	5	1	0	0	1	3
70	0	0	2	1	4	0
78A	1	1	0	0	1	0

Upper Stoney Lake counts were typical for a Kawartha Lake – most below 20, with occasional (in this case, two) readings between 20 and 50.

Appendix F - 2019 Phosphorus, Secchi and Calcium Data

Total Phosphorus (TP) Measurements

In 2019 volunteers tested 50 sites in 17 Kawartha lakes. Results are listed below. A number of TP measurements are in bold type. These were considered outliers, and were not used to calculate the TP average.

STN	Site ID	Lake Name	Site Description	Date	TP1 (µg/L)	TP2 (µg/L)	Avg.TP (µg/L)
6902	2	BALSAM LAKE	N Bay Rocky Pt.	27-May-2019	6.00	5.60	5.80
6902	2	BALSAM LAKE	N Bay Rocky Pt.	4-Jul-2019	11.60	9.20	10.40
6902	2	BALSAM LAKE	N Bay Rocky Pt.	29-Jul-2019	15.00	16.80	15.90
6902	2	BALSAM LAKE	N Bay Rocky Pt.	26-Aug-2019	10.20	9.20	9.70
6902	5	BALSAM LAKE	NE end-Lightning Pt	26-May-2019	9.60	10.80	10.20
6902	5	BALSAM LAKE	NE end-Lightning Pt	22-Jun-2019	11.60	12.40	12.00
6902	5	BALSAM LAKE	NE end-Lightning Pt	16-Jul-2019	15.60	14.80	15.20
6902	5	BALSAM LAKE	NE end-Lightning Pt	1-Sep-2019	11.20	10.20	10.70
6902	5	BALSAM LAKE	NE end-Lightning Pt	15-Sep-2019	7.60	7.80	7.70
6902	5	BALSAM LAKE	NE end-Lightning Pt	12-Oct-2019	8.20	8.40	8.30
6902	7	BALSAM LAKE	South B-Killarney B	24-May-2019	10.00	9.80	9.90
6902	7	BALSAM LAKE	South B-Killarney B	12-Jun-2019	12.20	**22.20**	12.20
6902	7	BALSAM LAKE	South B-Killarney B	21-Jul-2019	15.60	13.00	14.30
6902	7	BALSAM LAKE	South B-Killarney B	23-Aug-2019	12.40	12.00	12.20
6902	7	BALSAM LAKE	South B-Killarney B	9-Sep-2019	15.20	15.40	15.30
6902	7	BALSAM LAKE	South B-Killarney B	24-Sep-2019	15.60	13.40	14.50
6902	8	BALSAM LAKE	W Bay2, deep spot	4-Jun-2019	5.20	5.20	5.20
6902	8	BALSAM LAKE	W Bay2, deep spot	3-Jul-2019	8.00	8.00	8.00
6902	8	BALSAM LAKE	W Bay2, deep spot	7-Sep-2019	12.60	11.60	12.10
6902	8	BALSAM LAKE	W Bay2, deep spot	1-Oct-2019	10.80	12.20	11.50
6902	9	BALSAM LAKE	E of Grand Is	6-Jun-2019	6.00	5.60	5.80
6902	9	BALSAM LAKE	E of Grand Is	4-Jul-2019	10.40	9.40	9.90
6902	9	BALSAM LAKE	E of Grand Is	3-Sep-2019	10.00	9.60	9.80
6941	1	BIG BALD LAKE	Mid Lake, deep spot	23-Jul-2019	15.60	15.20	15.40
6941	1	BIG BALD LAKE	Mid Lake, deep spot	21-Sep-2019	12.60	11.80	12.20
363	1	BIG CEDAR LAKE	Mid Lake, deep spot	31-May-2019	5.60	6.00	5.80
7131	1	BUCKHORN LAKE (U)	Narrows-redbuoy C310	19-May-2019	11.60	13.00	12.30
7131	1	BUCKHORN LAKE (U)	Narrows-redbuoy C310	8-Jun-2019	16.80	14.60	15.70
7131	1	BUCKHORN LAKE (U)	Narrows-redbuoy C310	1-Jul-2019	21.80	25.40	11.00
7131	1	BUCKHORN LAKE (U)	Narrows-redbuoy C310	12-Aug-2019	20.80	20.40	20.60
7131	1	BUCKHORN LAKE (U)	Narrows-redbuoy C310	2-Sep-2019	21.00	19.40	20.20
7131	1	BUCKHORN LAKE (U)	Narrows-redbuoy C310	6-Oct-2019	14.80	15.00	14.90
7131	9	BUCKHORN LAKE (U)	Young's Cove, Deep Spot	18-May-2019	15.00	12.60	13.80
7131	9	BUCKHORN LAKE (U)	Young's Cove, Deep Spot	24-Jun-2019	17.40	18.20	17.80
7131	9	BUCKHORN LAKE (U)	Young's Cove, Deep Spot	29-Aug-2019	24.80	22.40	23.60
7131	9	BUCKHORN LAKE (U)	Young's Cove, Deep Spot	26-Sep-2019	15.00	16.60	15.80
7131	10	BUCKHORN LAKE (U)	NE of Fox Is	1-Jun-2019	18.80	12.00	15.40

Appendix F - 2019 Phosphorus, Secchi and Calcium Data

STN	Site ID	Lake Name	Site Description	Date	TP1 (µg/L)	TP2 (µg/L)	Avg.TP (µg/L)
7131	10	BUCKHORN LAKE (U)	NE of Fox Is	30-Jun-2019	19.80	17.00	18.40
7131	10	BUCKHORN LAKE (U)	NE of Fox Is	4-Aug-2019	20.00	17.60	18.80
7131	10	BUCKHORN LAKE (U)	NE of Fox Is	31-Aug-2019	21.40	14.40	17.90
7131	10	BUCKHORN LAKE (U)	NE of Fox Is	29-Sep-2019	14.00	13.40	13.70
6905	6	CAMERON LAKE	S end, deep spot	16-Jun-2019	7.60	7.40	7.50
6905	6	CAMERON LAKE	S end, deep spot	30-Jun-2019	8.40	8.80	8.60
6905	6	CAMERON LAKE	S end, deep spot	1-Sep-2019	10.20	9.40	9.80
6905	7	CAMERON LAKE	N end near inflows, deep	11-May-2019	9.40	9.00	9.20
6905	7	CAMERON LAKE	N end near inflows, deep	16-Jun-2019	8.60	9.60	9.10
6905	7	CAMERON LAKE	N end near inflows, deep	18-Jul-2019	**53.60**	**17.00**	
6905	7	CAMERON LAKE	N end near inflows, deep	12-Aug-2019	10.40	9.60	10.00
6905	7	CAMERON LAKE	N end near inflows, deep	25-Aug-2019	9.60	9.20	9.40
6905	7	CAMERON LAKE	N end near inflows, deep	10-Oct-2019	12.60	12.80	12.70
6951	9	CHEMONG LAKE	S. of Causeway	27-May-2019	19.60	**26.20**	19.60
6951	9	CHEMONG LAKE	S. of Causeway	30-Jun-2019	16.60	15.80	16.20
6951	9	CHEMONG LAKE	S. of Causeway	25-Jul-2019	18.00	17.40	17.70
6951	9	CHEMONG LAKE	S. of Causeway	25-Aug-2019	21.20	20.40	20.80
6951	9	CHEMONG LAKE	S. of Causeway	27-Sep-2019	20.60	18.00	19.30
6951	10	CHEMONG LAKE	Deep Spot, N. of Bridgenorth	5-May-2019	12.60	10.60	11.60
6951	11	CHEMONG LAKE	N of Big Island	1-Jun-2019	9.40	10.00	9.70
6951	11	CHEMONG LAKE	N of Big Island	3-Jul-2019	13.40	14.80	14.10
6951	11	CHEMONG LAKE	N of Big Island	6-Aug-2019	20.60	20.80	20.70
6951	11	CHEMONG LAKE	N of Big Island	3-Sep-2019	13.00	15.80	14.40
6955	1	CLEAR LAKE	MacKenzie Bay	31-May-2019	12.60	12.40	12.50
6955	1	CLEAR LAKE	MacKenzie Bay	9-Jul-2019	17.40	18.60	18.00
6955	1	CLEAR LAKE	MacKenzie Bay	3-Sep-2019	18.00	18.60	18.30
6955	1	CLEAR LAKE	MacKenzie Bay	13-Sep-2019	24.20	21.60	22.90
6955	2	CLEAR LAKE	Main Basin-deep spot	12-Jun-2019	13.60	**59.80**	13.60
6955	2	CLEAR LAKE	Main Basin-deep spot	15-Jul-2019	**51.20**	18.80	18.80
6955	2	CLEAR LAKE	Main Basin-deep spot	11-Sep-2019	17.40	18.60	18.00
6955	2	CLEAR LAKE	Main Basin-deep spot	2-Oct-2019	20.80	18.40	19.60
6955	3	CLEAR LAKE	Fiddlers Bay	12-Jun-2019	14.60	13.20	13.90
6955	3	CLEAR LAKE	Fiddlers Bay	15-Jul-2019	18.60	17.60	18.10
6955	3	CLEAR LAKE	Fiddlers Bay	7-Aug-2019	17.80	15.60	16.70
6955	3	CLEAR LAKE	Fiddlers Bay	11-Sep-2019	16.40	17.20	16.80
6955	3	CLEAR LAKE	Fiddlers Bay	2-Oct-2019	17.40	17.80	17.60
6955	4	CLEAR LAKE	Brysons Bay	17-Jun-19	11.80	12.20	12.00
6955	4	CLEAR LAKE	Brysons Bay	23-Jul-19	26.00	22.00	24.00
6955	4	CLEAR LAKE	Brysons Bay	26-Aug-19	24.80	21.00	22.90
6955	4	CLEAR LAKE	Brysons Bay	30-Sep-19	18.40	18.00	18.20
7075	2	JULIAN LAKE	Mid Lake, Deep Spot	19-May-2019	5.40	7.00	6.20
7075	2	JULIAN LAKE	Mid Lake, Deep Spot	19-Jun-2019	7.20	5.40	6.30
7075	2	JULIAN LAKE	Mid Lake, Deep Spot	15-Jul-2019	7.40	7.80	7.60

Appendix F - 2019 Phosphorus, Secchi and Calcium Data

STN	Site ID	Lake Name	Site Description	Date	TP1 (µg/L)	TP2 (µg/L)	Avg.TP (µg/L)
7075	2	JULIAN LAKE	Mid Lake, Deep Spot	16-Aug-2019	6.00	6.60	6.30
7075	2	JULIAN LAKE	Mid Lake, Deep Spot	29-Sep-2019	5.80	7.80	6.80
7076	1	KATCHEWANOOKA LAKE	S/E Douglas Island	27-May-2019	12.00	10.00	11.00
7076	1	KATCHEWANOOKA LAKE	S/E Douglas Island	11-Jun-2019	8.80	9.40	9.10
7076	1	KATCHEWANOOKA LAKE	S/E Douglas Island	2-Jul-2019	18.40	15.20	7.60
7076	1	KATCHEWANOOKA LAKE	S/E Douglas Island	2-Sep-2019	17.60	18.20	17.90
7076	1	KATCHEWANOOKA LAKE	S/E Douglas Island	29-Sep-2019	22.80	17.60	20.20
7076	2	KATCHEWANOOKA LAKE	Young Pt near locks	27-May-2019	9.40	9.60	9.50
7076	2	KATCHEWANOOKA LAKE	Young Pt near locks	11-Jun-2019	9.20	10.00	9.60
7076	2	KATCHEWANOOKA LAKE	Young Pt near locks	2-Jul-2019	14.20	14.40	14.30
7076	2	KATCHEWANOOKA LAKE	Young Pt near locks	7-Aug-2019	17.20	17.20	17.20
7076	2	KATCHEWANOOKA LAKE	Young Pt near locks	3-Sep-2019	17.60	18.40	18.00
7076	2	KATCHEWANOOKA LAKE	Young Pt near locks	1-Oct-2019	18.00	17.60	17.80
7076	3	KATCHEWANOOKA LAKE	Downstream, deep spot	8-Jun-2019	12.20	12.60	12.40
7076	3	KATCHEWANOOKA LAKE	Downstream, deep spot	14-Jul-2019	**32.00**	**23.80**	
7076	3	KATCHEWANOOKA LAKE	Downstream, deep spot	2-Sep-2019	15.40	15.40	15.40
7076	3	KATCHEWANOOKA LAKE	Downstream, deep spot	10-Oct-2019	16.20	15.80	16.00
7087	1	LOVESICK LAKE	80' hole at N. end	20-May-2019	11.60	10.00	10.80
7087	1	LOVESICK LAKE	80' hole at N. end	9-Jun-2019	13.00	13.80	13.40
7087	1	LOVESICK LAKE	80' hole at N. end	8-Jul-2019	20.00	21.40	11.20
7087	1	LOVESICK LAKE	80' hole at N. end	2-Aug-2019	19.40	20.00	19.70
7087	1	LOVESICK LAKE	80' hole at N. end	29-Aug-2019	19.40	19.80	19.60
7087	1	LOVESICK LAKE	80' hole at N. end	8-Oct-2019	16.00	15.20	15.60
7087	3	LOVESICK LAKE	McCallum Island	20-May-2019	10.20	9.40	9.80
7087	3	LOVESICK LAKE	McCallum Island	9-Jun-2019	15.00	14.00	14.50
7087	3	LOVESICK LAKE	McCallum Island	8-Jul-2019	21.80	23.40	22.60
7087	3	LOVESICK LAKE	McCallum Island	2-Aug-2019	24.20	22.80	23.50
7087	3	LOVESICK LAKE	McCallum Island	29-Aug-2019	20.20	20.40	20.30
7087	3	LOVESICK LAKE	McCallum Island	8-Oct-2019	28.80	28.60	28.70
6990	1	LOWER BUCKHORN LAKE	Heron Island	21-Jun-2019	16.00	**23.20**	16.00
6990	1	LOWER BUCKHORN LAKE	Heron Island	22-Jul-2019	21.60	**32.40**	21.60
6990	1	LOWER BUCKHORN LAKE	Heron Island	11-Aug-2019	22.80	16.00	19.40
6990	1	LOWER BUCKHORN LAKE	Heron Island	2-Sep-2019	18.80	19.20	19.00
6990	1	LOWER BUCKHORN LAKE	Heron Island	4-Oct-2019	15.80	15.60	15.70
6990	4	LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	11-May-2019	14.60	10.20	12.40
6990	4	LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	9-Jun-2019	16.80	16.40	16.60
6990	4	LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	8-Jul-2019	18.80	18.60	18.70
6990	4	LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	12-Aug-2019	20.80	22.20	21.50
6990	4	LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	11-Sep-2019	18.60	18.40	18.50
6990	4	LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	10-Oct-2019	17.40	14.80	16.10
6990	6	LOWER BUCKHORN LAKE	Deer Bay-centre	21-Jun-2019	20.40	13.20	16.80
6990	6	LOWER BUCKHORN LAKE	Deer Bay-centre	22-Jul-2019	18.80	19.60	19.20
6990	6	LOWER BUCKHORN LAKE	Deer Bay-centre	11-Aug-2019	21.40	17.00	19.20

Appendix F - 2019 Phosphorus, Secchi and Calcium Data

STN	Site ID	Lake Name	Site Description	Date	TP1 (µg/L)	TP2 (µg/L)	Avg.TP (µg/L)
6990	6	LOWER BUCKHORN LAKE	Deer Bay-centre	2-Sep-2019	20.00	20.60	20.30
6990	6	LOWER BUCKHORN LAKE	Deer Bay-centre	4-Oct-2019	15.60	15.80	15.70
6990	7	LOWER BUCKHORN LAKE	Lower Deer Bay, Mid-deep	19-May-2019	10.20	8.40	9.30
6990	7	LOWER BUCKHORN LAKE	Lower Deer Bay, Mid-deep	6-Jun-2019	16.00	13.80	14.90
6990	7	LOWER BUCKHORN LAKE	Lower Deer Bay, Mid-deep	4-Jul-2019	23.40	22.00	22.70
6990	7	LOWER BUCKHORN LAKE	Lower Deer Bay, Mid-deep	3-Aug-2019	18.60	16.80	17.70
6990	7	LOWER BUCKHORN LAKE	Lower Deer Bay, Mid-deep	5-Sep-2019	18.00	15.60	16.80
6990	7	LOWER BUCKHORN LAKE	Lower Deer Bay, Mid-deep	13-Oct-2019	11.00	**18.00**	11.00
6990	8	LOWER BUCKHORN LAKE	Main basin, deep- spot	19-May-2019	8.60	9.20	8.90
6990	8	LOWER BUCKHORN LAKE	Main basin, deep- spot	6-Jun-2019	15.60	14.60	15.10
6990	8	LOWER BUCKHORN LAKE	Main basin, deep- spot	4-Jul-2019	18.40	18.20	18.30
6990	8	LOWER BUCKHORN LAKE	Main basin, deep- spot	3-Aug-2019	16.40	18.20	17.30
6990	8	LOWER BUCKHORN LAKE	Main basin, deep- spot	5-Sep-2019	17.20	17.40	17.30
6990	8	LOWER BUCKHORN LAKE	Main basin, deep- spot	13-Oct-2019	13.40	12.60	13.00
6919	1	PIGEON LAKE	S end, deep spot	30-May-2019	39.60	34.20	36.90
6919	1	PIGEON LAKE	S end, deep spot	1-Jul-2019	26.60	25.60	26.10
6919	3	PIGEON LAKE	Middle-SandyPtBoyd I	19-May-2019	9.80	11.60	10.70
6919	3	PIGEON LAKE	Middle-SandyPtBoyd I	8-Jul-2019	20.40	21.40	20.90
6919	3	PIGEON LAKE	Middle-SandyPtBoyd I	2-Aug-2019	19.60	19.20	19.40
6919	3	PIGEON LAKE	Middle-SandyPtBoyd I	22-Sep-2019	14.00	14.20	14.10
6919	12	PIGEON LAKE	N-400m N of Boyd Is.	24-May-2019	10.40	9.20	9.80
6919	12	PIGEON LAKE	N-400m N of Boyd Is.	29-May-2019	9.40	10.20	9.80
6919	12	PIGEON LAKE	N-400m N of Boyd Is.	2-Jul-2019	14.40	14.60	14.50
6919	12	PIGEON LAKE	N-400m N of Boyd Is.	12-Aug-2019	16.40	17.40	16.90
6919	12	PIGEON LAKE	N-400m N of Boyd Is.	2-Sep-2019	22.20	23.00	22.60
6919	12	PIGEON LAKE	N-400m N of Boyd Is.	1-Oct-2019	21.60	22.00	21.80
6919	13	PIGEON LAKE	N end-Adjacent Con17	19-May-2019	11.00	9.80	10.40
6919	13	PIGEON LAKE	N end-Adjacent Con17	8-Jul-2019	19.80	19.80	19.80
6919	13	PIGEON LAKE	N end-Adjacent Con17	2-Aug-2019	19.80	20.80	20.30
6919	13	PIGEON LAKE	N end-Adjacent Con17	22-Sep-2019	13.60	17.00	15.30
6919	15	PIGEON LAKE	C340-DeadHorseSho	19-May-2019	11.20	11.60	11.40
6919	15	PIGEON LAKE	C340-DeadHorseSho	7-Jun-2019	17.40	13.80	15.60
6919	15	PIGEON LAKE	C340-DeadHorseSho	1-Jul-2019	**38.60**	27.40	27.40
6919	15	PIGEON LAKE	C340-DeadHorseSho	2-Sep-2019	23.20	20.00	21.60
6919	15	PIGEON LAKE	C340-DeadHorseSho	4-Oct-2019	16.60	15.80	16.20
6919	16	PIGEON LAKE	N300yds off Bottom I	24-May-2019	11.20	9.80	10.50
6919	16	PIGEON LAKE	N300yds off Bottom I	29-May-2019	9.60	9.40	9.50
6919	16	PIGEON LAKE	N300yds off Bottom I	2-Jul-2019	16.60	16.80	16.70
6919	16	PIGEON LAKE	N300yds off Bottom I	12-Aug-2019	16.40	16.80	16.60
6919	16	PIGEON LAKE	N300yds off Bottom I	2-Sep-2019	23.20	21.80	22.50
6919	16	PIGEON LAKE	N300yds off Bottom I	1-Oct-2019	19.20	18.00	18.60
7241	2	SANDY LAKE	Mid Lake, deep spot	25-May-2019	5.00	6.00	5.50
7241	2	SANDY LAKE	Mid Lake, deep spot	17-Jun-2019	5.40	6.00	5.70

Appendix F - 2019 Phosphorus, Secchi and Calcium Data

STN	Site ID	Lake Name	Site Description	Date	TP1 (µg/L)	TP2 (µg/L)	Avg.TP (µg/L)
7241	2	SANDY LAKE	Mid Lake, deep spot	15-Jul-2019	6.00	5.00	5.50
7241	2	SANDY LAKE	Mid Lake, deep spot	9-Aug-2019	7.20	7.00	7.10
7241	2	SANDY LAKE	Mid Lake, deep spot	8-Sep-2019	7.00	8.40	7.70
7241	2	SANDY LAKE	Mid Lake, deep spot	15-Oct-2019	6.00	6.00	6.00
7133	4	STONY LAKE	Burleigh locks chan.	6-Jun-2019	12.80	13.00	12.90
7133	4	STONY LAKE	Burleigh locks chan.	28-Jul-2019	22.00	25.40	23.70
7133	4	STONY LAKE	Burleigh locks chan.	28-Jul-2019	25.00	26.80	25.90
7133	4	STONY LAKE	Burleigh locks chan.	2-Sep-2019	20.20	22.00	21.10
7133	6	STONY LAKE	Gilchrist Bay	21-May-2019	11.00	9.40	10.20
7133	6	STONY LAKE	Gilchrist Bay	31-Jul-2019	**28.00**	20.80	20.80
7133	6	STONY LAKE	Gilchrist Bay	22-Sep-2019	26.60	23.80	25.20
7133	6	STONY LAKE	Gilchrist Bay	14-Oct-2019	15.20	14.40	14.80
7133	7	STONY LAKE	Mouse Is.	19-May-2019	8.40	8.00	8.20
7133	7	STONY LAKE	Mouse Is.	1-Jun-2019	11.60	11.60	11.60
7133	7	STONY LAKE	Mouse Is.	30-Jun-2019	13.00	13.40	13.20
7133	7	STONY LAKE	Mouse Is.	2-Sep-2019	26.60	20.80	23.70
7133	7	STONY LAKE	Mouse Is.	28-Sep-2019	14.80	14.60	14.70
7133	8	STONY LAKE	Hamilton Bay	19-May-2019	8.20	7.60	7.90
7133	8	STONY LAKE	Hamilton Bay	1-Jun-2019	10.40	11.80	11.10
7133	8	STONY LAKE	Hamilton Bay	30-Jun-2019	16.40	17.60	17.00
7133	8	STONY LAKE	Hamilton Bay	2-Sep-2019	23.00	**30.40**	23.00
7133	8	STONY LAKE	Hamilton Bay	28-Sep-2019	15.60	13.60	14.60
6924	4	STURGEON LAKE	Muskrat I-Buoy C388	23-Jun-2019	13.40	13.00	13.20
6924	4	STURGEON LAKE	Muskrat I-Buoy C388	10-Jul-2019	19.60	17.80	18.70
6924	4	STURGEON LAKE	Muskrat I-Buoy C388	9-Sep-2019	23.00	21.40	22.20
6924	5	STURGEON LAKE	Sturgeon Point Buoy	28-Jun-2019	15.00	14.60	14.80
6924	5	STURGEON LAKE	Sturgeon Point Buoy	25-Aug-2019	17.20	19.20	18.20
6924	9	STURGEON LAKE	Fenelon R. mouth	28-Jun-2019	10.80	10.20	10.50
6924	9	STURGEON LAKE	Fenelon R. mouth	25-Aug-2019	9.60	9.80	9.70
5178	1	UPPER STONEY LAKE	Quarry Bay	26-May-2019	7.60	7.20	7.40
5178	1	UPPER STONEY LAKE	Quarry Bay	12-Jun-2019	7.80	7.80	7.80
5178	1	UPPER STONEY LAKE	Quarry Bay	2-Jul-2019	8.00	8.00	8.00
5178	1	UPPER STONEY LAKE	Quarry Bay	6-Aug-2019	8.40	9.00	8.70
5178	1	UPPER STONEY LAKE	Quarry Bay	3-Sep-2019	7.00	7.40	7.20
5178	1	UPPER STONEY LAKE	Quarry Bay	8-Oct-2019	7.60	8.00	7.80
5178	3	UPPER STONEY LAKE	Young Bay	26-May-2019	6.80	7.00	6.90
5178	3	UPPER STONEY LAKE	Young Bay	12-Jun-2019	9.00	8.60	8.80
5178	3	UPPER STONEY LAKE	Young Bay	2-Jul-2019	7.40	6.60	7.00
5178	3	UPPER STONEY LAKE	Young Bay	6-Aug-2019	7.40	7.20	7.30
5178	3	UPPER STONEY LAKE	Young Bay	3-Sep-2019	7.40	7.40	7.40
5178	3	UPPER STONEY LAKE	Young Bay	8-Oct-2019	7.20	7.00	7.10
5178	4	UPPER STONEY LAKE	S Bay, deep spot	26-May-2019	11.40	12.40	11.90
5178	4	UPPER STONEY LAKE	S Bay, deep spot	12-Jun-2019	16.20	13.00	14.60

Appendix F - 2019 Phosphorus, Secchi and Calcium Data

STN	Site ID	Lake Name	Site Description	Date	TP1 (µg/L)	TP2 (µg/L)	Avg.TP (µg/L)
5178	4	UPPER STONEY LAKE	S Bay, deep spot	2-Jul-2019	10.80	10.80	10.80
5178	4	UPPER STONEY LAKE	S Bay, deep spot	6-Aug-2019	16.40	15.60	16.00
5178	4	UPPER STONEY LAKE	S Bay, deep spot	3-Sep-2019	10.00	11.40	10.70
5178	4	UPPER STONEY LAKE	S Bay, deep spot	8-Oct-2019	8.00	7.40	7.70
5178	5	UPPER STONEY LAKE	Crowes Landing	26-May-2019	6.40	8.20	7.30
5178	5	UPPER STONEY LAKE	Crowes Landing	12-Jun-2019	8.00	8.60	8.30
5178	5	UPPER STONEY LAKE	Crowes Landing	2-Jul-2019	8.40	8.00	8.20
5178	5	UPPER STONEY LAKE	Crowes Landing	6-Aug-2019	9.00	10.00	9.50
5178	5	UPPER STONEY LAKE	Crowes Landing	3-Sep-2019	7.60	7.00	7.30
5178	5	UPPER STONEY LAKE	Crowes Landing	8-Oct-2019	6.80	7.40	7.10
5178	6	UPPER STONEY LAKE	Mid Lake, deep spot	26-May-2019	7.20	6.80	7.00
5178	6	UPPER STONEY LAKE	Mid Lake, deep spot	12-Jun-2019	9.00	7.20	8.10
5178	6	UPPER STONEY LAKE	Mid Lake, deep spot	2-Jul-2019	10.40	10.40	10.40
5178	6	UPPER STONEY LAKE	Mid Lake, deep spot	3-Sep-2019	8.00	8.00	8.00
5178	6	UPPER STONEY LAKE	Mid Lake, deep spot	8-Oct-2019	7.20	7.60	7.40
6963	1	WHITE LAKE (DUMMER)	S end, deep spot	24-May-2019	9.40	10.80	10.10
6963	1	WHITE LAKE (DUMMER)	S end, deep spot	23-Jun-2019	12.80	14.40	13.60
6963	1	WHITE LAKE (DUMMER)	S end, deep spot	14-Jul-2019	13.20	13.60	13.40
6963	1	WHITE LAKE (DUMMER)	S end, deep spot	25-Aug-2019	12.80	12.00	12.40
6963	1	WHITE LAKE (DUMMER)	S end, deep spot	17-Sep-2019	12.00	12.60	12.30
6963	1	WHITE LAKE (DUMMER)	S end, deep spot	11-Oct-2019	10.80	13.20	12.00

Cottage season ends on Pigeon Lake **Photo Danielle Shaw**

Appendix F - 2019 Phosphorus, Secchi and Calcium Data

2019 Secchi Depth and Calcium Measurements

Named after its inventor, Angelo Secchi, a Secchi disk is a device for measuring water clarity. It is a weighted disk 20cm in diameter with alternate black and white quadrants. When lowered into a lake, the depth at which the disk can no longer be seen (the black and white quadrants cannot be distinguished) is called the Secchi depth. The deeper the Secchi depth, the clearer the water. Basic water clarity can be affected by the amount of sediments or Dissolved Organic Matter (DOM) that the water contains. Seasonal variation of water clarity is usually related to the amount of algae it contains resulting in spring and fall Secchi depths being greater than mid-summer values. High phosphorus lakes tend to have lower Secchi depth readings. The Lake Partner Program (LPP) asks volunteers to measure the Secchi depth every two weeks between early May to early October. Since 2018, LPP have averaged the Secchi depths and only provide the seasonal average which is presented here. A – indicates no average given. Average Secchi depth is a useful number for lakes whose Secchi depth does not change much during the year, but is of limited usefulness for those lakes whose Secchi depths change over the summer.

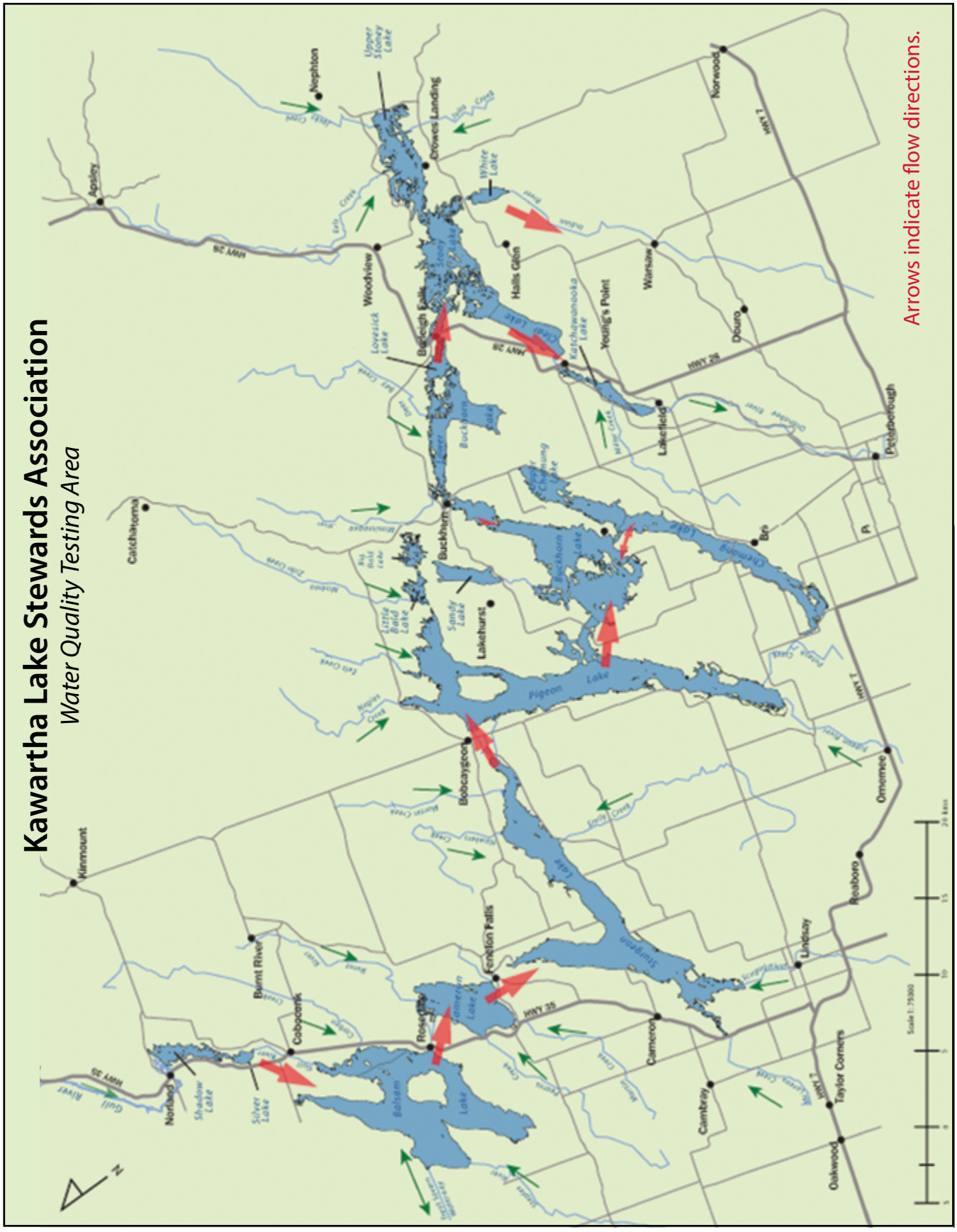
Calcium is a nutrient that is required by all living organisms. Aquatic species from zooplankton to crayfish depend on extracting calcium from lake water in order to grow. Levels of calcium below 2.5 mg/L can threaten the survival of many aquatic species. Calcium in lake water is derived from mineral weathering of rocks and atmospheric deposition of calcium-rich dust. Many Ontario lakes on the Precambrian Shield have been found to have very low calcium levels believed to be due to the low rate of weathering of hard, low calcium content rocks and the removal of calcium from the watershed by forest harvesting. As a result, since 2008 the Lake Partner Program (LPP) has been measuring the calcium concentration of some lake water samples for all lakes tested for Total Phosphorus. The average calcium measurement for each site in 2019 is provided in the table below. As shown in the table, the Kawartha Lakes do not have a calcium deficiency. The limestone bedrock and calcareous soils to the south of the lakes provide more than enough calcium to sustain the aquatic life in our lakes. Chemong Lake is higher than other Kawartha Lakes because it receives almost all its water from the local limestone-based watershed, with little contribution from the lower-phosphorus Trent-Severn Waterway main flow.

STN	Site ID	Lake	Site Description	Date	Secchi Depth (m)	Calcium (mg/L)
6902	2	BALSAM LAKE	N Bay Rocky Pt.	2019 Avg.	6.1	18.7
6902	5	BALSAM LAKE	NE end-Lightning Pt	2019 Avg.	-	10.5
6902	7	BALSAM LAKE	South B-Killarney B	2019 Avg.	-	23.8
6902	8	BALSAM LAKE	W Bay2, deep spot	2019 Avg.	4.4	19.0
6902	9	BALSAM LAKE	E of Grand Is	2019 Avg.	4.7	18.1
6941	1	BIG BALD LAKE	Mid Lake, deep spot	2019 Avg.	-	-
363	1	BIG CEDAR LAKE	Mid Lake, deep spot	2019 Avg.	4.9	28.8
7131	1	BUCKHORN LAKE (U)	Narrows-redbuoy C310	2019 Avg.	-	33.1
7131	9	BUCKHORN LAKE (U)	Young's Cove, deep spot	2019 Avg.	-	33.8
6905	6	CAMERON LAKE	S end, deep spot	2019 Avg.	3.5	20.8
6905	7	CAMERON LAKE	N end near inflows	2019 Avg.	2.9	19.6
6951	9	CHEMONG LAKE	S. of Causeway	2019 Avg.	-	46.6
6951	10	CHEMONG LAKE	Deep Spot, N. of Bridgen'th	2019 Avg.	2.7	40.6
6951	11	CHEMONG LAKE	N of Big Island	2019 Avg.	-	54.0

Appendix F - 2019 Phosphorus, Secchi and Calcium Data

STN	Site ID	Lake	Site Description	Date	Secchi Depth (m)	Calcium (mg/L)
6955	1	CLEAR LAKE	MacKenzie Bay	2019 Avg.	3.7	28.2
6955	2	CLEAR LAKE	Main Basin-deep Spot	2019 Avg.	3.7	29.5
6955	3	CLEAR LAKE	Fiddlers Bay	2019 Avg.	3.6	29.2
6955	4	CLEAR LAKE	Brysons Bay	2019 Avg.	3.1	28.2
7075	2	JULIAN LAKE	Mid Lake, deep spot	2019 Avg.	5.1	46.7
7076	1	KATCHEWANOOKA	S/E Douglas Island	2019 Avg.	4.8	28.9
7076	2	KATCHEWANOOKA	Young Pt near locks	2019 Avg.	5.4	28.3
7076	3	KATCHEWANOOKA	Downstream deep spot	2019 Avg.	3.9	30.2
7087	1	LOVESICK LAKE	80' hole at N. end	2019 Avg.	4.1	30.0
7087	3	LOVESICK LAKE	McCallum Island	2019 Avg.	4.0	31.5
6990	1	LOWER BUCKHORN	Heron Island	2019 Avg.	3.2	32.5
6990	4	LOWER BUCKHORN	Deer Bay W-Buoy C267	2019 Avg.	4.2	33.1
6990	6	LOWER BUCKHORN	Deer Bay-centre	2019 Avg.	3.5	33.3
6990	7	LOWER BUCKHORN	Lower Deer Bay, Mid-deep	2019 Avg.	1.9	25.3
6990	8	LOWER BUCKHORN	Main basin, deep-spot	2019 Avg.	2.6	21.9
6919	3	PIGEON LAKE	Middle-SandyPtBoyd Is	2019 Avg.	3.6	30.0
6919	12	PIGEON LAKE	N-400m N of Boyd Is	2019 Avg.	2.9	31.4
6919	13	PIGEON LAKE	N end-Adjacent Con17	2019 Avg.	3.5	28.7
6919	15	PIGEON LAKE	C340-Dead Horse Shoal	2019 Avg.	3.0	30.4
6919	16	PIGEON LAKE	N300yds off Bottom Is	2019 Avg.	2.9	32.6
7241	2	SANDY LAKE	Main basin, deep-spot	2019 Avg.	3.9	47.1
7133	4	STONY LAKE	Burleigh locks channel	2019 Avg.	-	29.5
7133	6	STONY LAKE	Gilchrist Bay	2019 Avg.	3.1	27.0
7133	7	STONY LAKE	Mouse Is.	2019 Avg.	3.8	29.1
7133	8	STONY LAKE	Hamilton Bay	2019 Avg.	3.9	29.2
6924	4	STURGEON LAKE	Muskrat I-Buoy C388	2019 Avg.	-	26.9
6924	5	STURGEON LAKE	Sturgeon Point Buoy	2019 Avg.	2.7	31.1
6924	9	STURGEON LAKE	Fenelon R. mouth	2019 Avg.	4.2	22.0
5178	1	UPPER STONEY LAKE	Quarry Bay	2019 Avg.	5.5	25.2
5178	3	UPPER STONEY LAKE	Young Bay	2019 Avg.	5.6	25.3
5178	4	UPPER STONEY LAKE	S Bay, deep spot	2019 Avg.	-	26.4
5178	5	UPPER STONEY LAKE	Crowes Landing	2019 Avg.	5.7	25.7
5178	6	UPPER STONEY LAKE	Mid Lake, deep spot	2019 Avg.	5.6	25.1
6963	1	WHITE LAKE	S end, deep spot	2019 Avg.	4.3	33.7

Map of Testing Area



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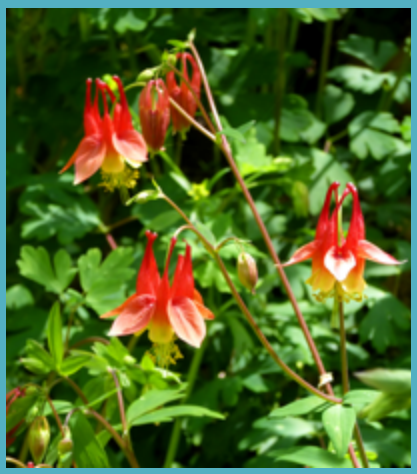

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