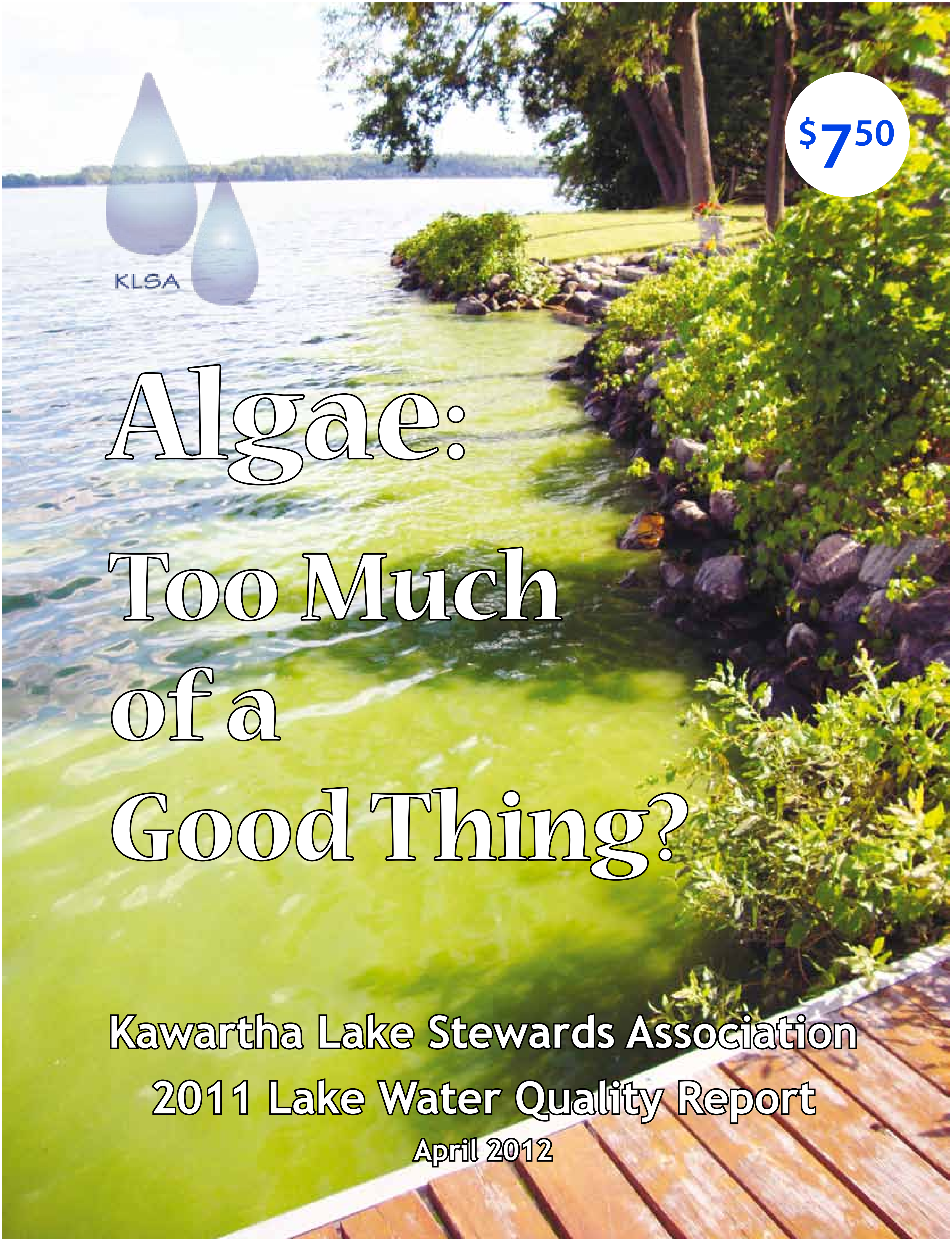

KLSA

$7.50

Algae: Too Much of a Good Thing?

Kawartha Lake Stewards Association
2011 Lake Water Quality Report

April 2012

KLSA

Kawartha Lake Stewards Association

Lake Water Quality Report - 2011

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Please Note: To obtain copies of our report or to find out more about KLSA please contact:

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You can view Adobe pdf versions of KLSA reports on the web at the KLSA website:

klsa.wordpress.com

KLSA is grateful for the funding from the Ontario Trillium Foundation for a two-year study of algae in the Kawartha Lakes.

Cover photo by Bob Peters, taken on Sturgeon Lake, summer, 2011.

THE ONTARIO TRILLIUM FOUNDATION

LA FONDATION TRILLIUM DE L'ONTARIO

Table of Contents

Peter Hopperton

The Editorial Committee at work (l-r): Sheila Gordon-Dillane, Kevin Walters, Pat Moffat, Ruth Kuchinad, Simon Conolly. Missing from photo: Kathleen Mackenzie, Janet Duval, Anita Locke.

Chair's Message

Mike Stedman, Chair, Kawartha Lake Stewards Association (KLSA)

KLSA's thirteenth year of operation started on the upbeat. At the Kawartha Region Conservation Authority's (KRCA) January Annual General Meeting, KLSA was awarded their Community Conservationist Award recognizing volunteer-based, community or organized groups that have successfully undertaken projects that contribute to a healthier watershed.

Congratulations to our KLSA Board, members, financial partners and especially our over sixty volunteer lake stewards.

Why did KLSA win this award?

In the past I have used this space to remind you of KLSA's mandate but instead the same purpose can be served by reading a quote from KRCA's CAO Rob Messervey's presentation describing why KLSA was chosen for this award.

> "We are very pleased to recognize your outstanding contribution to the understanding of local lakes through water quality sampling and research, and the production and distribution of high quality annual reports. The KLSA's involvement with ongoing Trent University studies of various lake issues, such as algae and the milfoil weevil, break new ground with respect to lake association activities. We also recognize the valuable contribution of the KLSA to lake management planning in the City of Kawartha Lakes through participation on the Community Advisory Panel."

Blue-green algae blooms

Not surprisingly, the highlight topic at our 2011 Fall Annual General Meeting at the wonderful new Lakehurst Community Hall was blue-green algae (cyanobacteria) blooms. The emphasis of our discussion was on the public health issues ably outlined by Richard Ovcharovich, Manager, Environmental Health for the Haliburton, Kawartha, Pine Ridge District Health Unit. We were left to wrestle with the question of whether this blue-green experience is something we have to learn to live with, much as we do with poison ivy. Or does it demonstrate that our lakes' 'delicate balance' is in danger and that phosphorus levels need to be reduced and more resources should be applied toward corrective action?

For a bit of historical trivia, the Canadian Journal of Comparative Medicine published an article in 1950 describing 'blue-green' conditions occurring in Sturgeon Lake. In the article they referenced toxic blooms affecting cattle as far back as the 1880s. Although more than 130 years ago, global warming was not in the lexicon but the conditions they quoted sound familiar - "hot weather, gentle southwest wind and high organic content".

For examples of stewardship actions, we have only to look at the "Lake Simcoe Phosphorus Reduction Strategy". Just search for this title and you'll find 51 pages of excellent science-based analysis supporting phosphorus reduction. A section starting on page 13 entitled Stewardship and Community Action details several actions that would be worth discussing at summer lake association meetings.

Sturgeon/Cameron/Balsam Lake Management Plans

KLSA is committed to the support of lake management planning and judging by the KRCA award, our effort is appreciated. Doug Erlandson, Chris Appleton and I all serve on the Sturgeon Lake Management Plan (SLMP) Community Advisory Panel. Indeed Chris is the Chair so our interests are well served. KLSA's water testing and monitoring program, facilitated in these lakes by Rod Martin, is essential to their water quality research. This is a three or more year project and we can expect increasing demands for KLSA's involvement in broad-based community stewardship activities associated with plan implementation.

I believe that lake management planning should also be undertaken for our other lakes. Issues that complicate the planning process include lakes in multiple township jurisdictions and conservation authority boundaries. KLSA members with influence in these areas should approach their township representatives. KRCA's SLMP can serve as a template to help initiate the effort to organize. Having said that, there is the alternative of undertaking a less sophisticated Lake Plan much as exists with the Clear/Stony/White Lake Plan but the rewards of having the infrastructure, skill sets and financial backing of a conservation authority make the lake management approach preferable if possible.

The 2012 KLSA Algae Guide - watch for your copy

To promote better public awareness concerning algae in our lakes, KLSA has been working on an Ontario Trillium Foundation sponsored research project with Trent University. Dr. Emily Porter-Goff, a post-doctoral fellow at Trent University, is preparing an Algae Guide that will be published by KLSA in the summer of 2012 in time for summer distribution and discussion at our Fall Annual General Meeting on October 6, 2012. This Algae Guide will be a companion piece to our well-received 2009 Aquatic Plants Guide.

Increased experience with biological control of Eurasian Milfoil

The KLSA Milfoil Weevil Guide published on our website in July 2011 was used by the Scugog Lake Stewards Inc. (SLS) in their continuing efforts to better employ biological control of milfoil. President Jamie Ross thanked us for what he described as an "excellent educational booklet". In conjunction with the Baagwating Community Association, SLS are experiencing encouraging results at the end of their second year with their pilot project that involved the introduction of over 20,000 watermilfoil weevils to Lake Scugog. This summer, we hope that our Big Cedar Lake stewards will report favourably on success with their 2011 application of weevils conducted with EnviroScience Inc. An article on these research studies by Kyle Borrowman, a graduate student at Trent University, is included in this Report.

Partnerships help to grow the KLSA

Over the past few years KLSA has pursued constructive growth and influence through partnerships. This ranges from formal contracts that we have with the Ontario Trillium Foundation, Trent University and the Trent-Severn Waterway to informal agreements with other organizations listed below. The value of the partnership is proportional to the effort we put into it. In most cases what we bring to the partnership is volunteer and for some issues skilled resources, dedicated lake stewards, an organizational infrastructure, an annual water quality report, two public general meetings each year and an enviable reputation. As a minimum we try to attend partner meetings and provide analysis for Kawartha Lake water quality issues. Examples include:

- Trent-Severn Waterway
- KRCA Lake Management Plans for Sturgeon Lake and Balsam and Cameron Lakes
- Lakeland Alliance
- Voices for the Trent-Severn Waterway
- Federation of Ontario Cottagers' Associations (FOCA)
- Fleming College
- Trent University
- Kawartha Protect Our Water (KPOW)
- Sustainable Peterborough
- City of Kawartha Lakes
- Kawartha Natural Heritage Strategy

Voices for the Trent-Severn Waterway (TSW)

Voices for the TSW is a volunteer organization that promotes the Panel on the Future of the Trent-Severn Waterway's 2008 Report *It's all About the Water*. This past year has been spent enlisting public support throughout the entire TSW area. KLSA is a participant at the advisory committee level. Anticipating the federal budget, the focus has shifted recently to advocacy to obtain the support of our elected representatives for funding of increased capital and operational expenditures on the TSW. The need is for $200 million in capital expenditure over the next ten-year period. The East Kawartha Chamber of Commerce has taken a lead role in this thrust. In addition, Voices for the TSW is urging restoration of the former level of operating funds for the waterway and initiating a committee to explore revenue-generating opportunities for the TSW watershed.

Water quality considerations for the Trent-Severn Waterway

In October of 2011, KLSA representatives attended a meeting at which Roger Stanley of the TSW spoke about canal operations. Historic water level considerations have been flood control, navigation, power generation and property values. The strict quantitative model the TSW uses for decision-making does not consider water quality so this was an opportunity to make the following observations:

- Kawartha Lakes water quality is greatly influenced by nutrient content.
- A large majority of the flow-through comes from the north where phosphorus levels remain at about 8 parts per billion (ppb) year round. The levels in the Kawartha Lakes increase to 20-25 ppb in mid-summer.
- Any reduction in water flow from the north would reduce the flushing rate in the Kawartha Lakes, thus increasing the concentration of nutrients.
- Any reduction in the ratio of northern (low nutrient content) to southern (higher nutrient content) water in our lakes would increase the concentration of nutrients.

Your opportunity to influence County Official Plans

As public concern for environmental issues increases, five-year revisions of our Provincial Policy Statement (PPS) and County Official Plans are beginning to include policies addressing environmental sustainability. Implementation of these policies often rests with our local township zoning bylaws. Groups like KLSA are asked for their input in framing Official Plans partly to assure legislation is consistent with the public interest. The first significant environmental policy addition to the Official Plans about 10 years ago was the adoption of the watershed concept in place of traditional geographic boundaries. This made a lot of sense when addressing water quality issues. In more recent years, a second significant change has been the controversial 30 metre shoreline setback requirement. The new PPS is due to be released in the near future to be followed by County Official Plans that will be subject to a consultative process. In my opinion, it is in this process that KLSA can have a role. I suggest that the emphasis be placed on the shoreline "ribbon of life" with suggested best practices of 25% developed, 75% natural. To help us develop appropriate policies, a Trent/Queen's Master's student has been commissioned to search out all progressive environmental policies adopted by other Ontario municipalities. We expect to have access to this report this summer at which time KLSA will be eligible to identify best policies and practices and make recommendations for the City and County of Peterborough and City of Kawartha Lakes Official Plan amendments.

What is encouraging is the fact that planners from both Peterborough County and the City of Kawartha Lakes regularly attend the same environmental meetings in which KLSA participates throughout the winter months. We share common interests and I know from experience they will welcome any well-considered input.

Letters of support

Judging by the requests for KLSA letters of support, I would say our reputation as a reputable reference continues to grow. Organizations including the Kawartha Region Conservation Authority for Blue Canoe, City of Kawartha Lakes for Showcasing Water Innovations (MOE), Trent University for the Natural Sciences and Engineering Research Council of Canada (NSERC), Sustainable Peterborough and Voices for the TSW have all been given enthusiastic letters of KLSA support.

Kawarthas Naturally Connected is a sophisticated, well resourced multi-partner initiative funded by Natural Resources Canada to develop a Natural Heritage System (NHS) for the 40 watersheds that overlap the City of Kawartha Lakes and the City and County of Peterborough. The vision statement reads "A landscape that supports the needs of people and nature in a way that preserves the unique character of the Kawarthas." Their message is "...providing an opportunity for communities to sustain the wealth and health of our natural areas, in a way that considers our health and our cultural, social, environmental and economic values."

The NHS overall project goal is to identify and map a connected system of natural areas that can inform and support:

- Sustainable land use planning and resource management decision-making
- Strategic priorities for stewardship and restoration projects
- Priorities for conservation land acquisitions, and
- Priorities for inventory programs and research projects.

A considerable effort is to be devoted to developing an objective decision support tool based on the Marxan (an ecosystem management tool) model. The intent is to provide a strategic tool to support decision-making by many different organizations.

By invitation we attended an early session of the 20-member Scenario Planning Team but found the expectations for time and commitment beyond what was available in our volunteer group. Most of the team members are professionals participating on behalf of their employers. KLSA has committed to support this NHS initiative to the extent that is beneficial to both parties and probably more with the later phase of information dissemination and public education. I mention it here because we will be hearing much more about this initiative.

We hope you find this edition of our water quality annual report informative and we welcome your feedback. Just a closing reminder: "Stewardship programming has the largest impact when good practices are adopted by many."

For generous donations of their time and talents,
special thanks to:

Helen Batten, Basterfield & Associates

Kyle Borrowman, Trent University

Simon Conolly, The Lakefield Herald

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

George Gillespie, McColl Turner LLP

Colleen Middleton, Algae Researcher, Trent University

Richard Ovcharovich, Environmental Health Dept., Haliburton, Kawartha, Pine Ridge District Health Unit

Dr. Emily Porter-Goff, Algae Research Project Leader, Trent University

Dr. Eric Sager, Coordinator, Ecological Restoration Program, Fleming College and Adjunct Professor, Trent University

Ann Ambler

Loons and chicks on Lovesick Lake

Executive Summary - 2011 Report

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. Established to provide a coordinated approach to lake water monitoring, the Association tests lake water for phosphorus, water clarity and *E.coli* bacteria during the spring, summer and early fall. In recent years, KLSA has expanded its activities significantly, primarily into the areas of research and public education. Over the past decade, KLSA has forged valuable partnerships with Trent University, Fleming College and the Kawartha Conservation Authority, resulting in research studies of aquatic plant and algae management, sources of phosphorus and stormwater pollution. In more recent years, additional partnerships have been developed for public education and advocacy purposes through involvement in such initiatives as the Sturgeon Lake Management Plan and the deliberations of the Voices for the Trent-Severn Waterway. In 2011, KLSA research initiatives have continued to investigate algae in the Kawartha Lakes, the effectiveness of weevils for biological control of milfoil and the performance of sewage treatment plants.

Algae in the Kawartha Lakes

An article by Dr. Emily Porter-Goff describes an important initiative of the KLSA and Trent University. The KLSA received Ontario Trillium Foundation funding for a two-year collaborative project with a Trent University research team led by Dr. Paul Frost, to answer basic but important questions about algae in the Kawartha Lakes. The study aims to identify the primary algal species in the Kawartha Lakes, the nutrients that affect algal growth and potential methods of preventing excessive algal growth. Field work began in 2010 and continued in 2011 under the leadership of Dr. Emily Porter-Goff. More than 200 different kinds of algae were identified in the Kawartha Lakes. Studies were undertaken in 2011 to determine the impact of five different types of nutrients, salts and minerals on the growth of algae. The analysis showed that the addition of nutrients to the lakes did stimulate algal growth and emphasized the importance of limiting the amount of human-sourced nutrients going into the lakes. It is, however, natural and healthy to have algae in lakes and streams. Most species are harmless but there are types of blue-green algae, also known as cyanobacteria that release toxins into the water. These blooms occur when growing conditions are optimal for one particular species such as when the time of year, amount of sunlight, nutrients and water temperature all become optimal at the same time.

Six workshops were held by the Trent University researchers in 2011 to introduce shoreline residents to the different types of algae occurring in the lakes. An educational booklet on algae, similar to the Aquatic Plants Guide, will be published and distributed in the summer of 2012.

Blue-Green Algae Risks

In the late summer of 2011, blue-green algae blooms occurred in Sturgeon and Pigeon Lakes. Tom Cathcart, the Manager of Inspection Programs at the Peterborough City and County Health Unit, responds to questions about the toxicity and health risks of blue-green algae, which are considered a type of bacteria called cyanobacteria. They grow rapidly and give the water a "pea soup" appearance. Some release toxins into the water and pose a health risk for animals and humans. Waterfront residents who obtain their drinking water from the lake should be aware of the fact that domestic treatment systems do not remove the toxins and boiling the water will not decrease the risk. People should not swim or use the water for cooking or drinking until the bloom has gone. Blue-green algae blooms should be reported to the Ministry of the Environment at 1-800-565-4923.

My Brush with Blue-Green Algae or the Cyanobacteria Blues

In a companion article, Rod Martin, a former KLSA Director and cottager on Sturgeon Lake, provides a personal perspective on a large blue-green algae bloom that occurred in the vicinity of his cottage. The frustrations of being unable to enjoy the lake for several weeks in the middle of the summer emphasize the importance of prevention by limiting the amount of nutrients that enter the lakes.

E.coli Bacteria Testing

In 2011, KLSA volunteers tested 96 sites in 15 lakes for *E.coli* bacteria. Each site was tested up to six times during the summer. Samples were analyzed by SGS Lakefield Research and the Centre for Alternative Wastewater Treatment (CAWT) laboratory at Fleming College in Lindsay. Public beaches are posted as unsafe for swimming when levels reach 100 *E.coli*/100 mL of water. The KLSA believes that counts in the Kawartha Lakes should not exceed 50

E.coli/100 mL, given their high recreational use. In general, *E.coli* levels were low throughout the summer, consistent with other years. Of the 96 sites tested, 42 were "very clean" (no readings above 20), 39 were "clean" (one or two readings above 20), four were "somewhat elevated" (three readings between 20-100) and eight were designated as "needing observation" because they had more than two counts over 100 or more than three counts over 20. The high results are generally located in areas of low water circulation, near wetlands or are due to pollution from waterfowl. Detailed lake and site results can be found in Appendix E. Thank you to all our volunteer water samplers for their efforts to collect the samples and deliver them to the laboratories.

Phosphorus Testing

In 2011, as part of the Ministry of the Environment's Lake Partner Program, volunteers collected water samples six times per year (May to October) at 41 sites on 16 lakes for phosphorus testing. Samples were analyzed by the Ministry laboratory. Volunteers also measured water clarity, using a Secchi disk. The Ministry's Provincial Water Quality Objectives consider average phosphorus levels exceeding 20 parts per billion (ppb) to be of concern since at that point algae growth accelerates, adversely affecting enjoyment of the lakes. Overall in the summer of 2011, average phosphorus levels were slightly higher than those of previous years, particularly in the late summer, although they were within normal variability. The usual patterns of rising and falling phosphorus levels occurred from month to month (low in May, rising from June to August and declining in September). An unusually high level of phosphorus was found at two sites in Pigeon Lake on the same test date at the end of July for no immediately apparent reason. Detailed results of the 2011 Lake Partner Program are provided in Appendix F. The KLSA is grateful to the many volunteers who participate in our phosphorus monitoring program.

The Wonderful World of Weevils...A World Full of Milfoil!

Trent University graduate student Kyle Borrowman has been conducting studies of the use of weevils to control Eurasian watermilfoil in the Kawarthas. Eurasian watermilfoil is a rapidly growing aquatic plant that proliferates through fragmentation, making removal methods such as cutting and harvesting counter-productive. In 2011, laboratory studies were conducted in a Trent University growth chamber to determine the weevil's reaction to several different types of milfoil, northern watermilfoil, two types of Eurasian watermilfoil (EWM1 and EWM2) and a hybrid between northern and Eurasian watermilfoil. Shoots of each type of milfoil were grown under the same conditions and weevil larvae were introduced to each shoot (one weevil per shoot). The study results showed that the weevil larvae feeding on EWM1 and hybrid plants grew faster and larger than the larvae raised on northern watermilfoil and EWM2. One of the main differences between milfoil types was the overall nutritional quality of the plants. Hybrid watermilfoil had significantly higher nitrogen and phosphorus content compared to other plants, possibly related to hybrid vigor. Additional information is available in a booklet on the KLSA website.

Sewage Treatment Plants: 2010 Review

Each year, KLSA Vice-Chair Kevin Walters monitors and reports on output from local sewage treatment plants. Phosphorus output is a key indicator, and a primary cause of increased plant and algae growth in our lakes. In 2010, sewage treatment plants (STPs) at Lindsay, Fenelon Falls and Coboconk had good performance with phosphorus removal of 97.5%, 98.6% and 98.6% respectively. The performance of the two Bobcaygeon STPs improved from previous years to an average overall removal rate of 96.6%. Further improvement is needed. A small plant at Kings Bay had mechanical problems in 2010 and did not meet its targets but the problem appears to have been fixed. The plant at Omemee discharges effluent as spray irrigation to fields with some discharge into the Pigeon River. A new facility is planned. The phosphorus removal rate of 82% is unsatisfactory. Continued monitoring of all STPs is vital.

Lake Management Planning in the City of Kawartha Lakes

A coordinated approach to lake management planning for the Sturgeon Lake watershed is now in its third year, led by Kawartha Conservation and the City of Kawartha Lakes. Water quality monitoring of phosphorus levels and sources is a significant part of this process. Sediment sampling in collaboration with the Ministry of the Environment began in 2011 to measure levels of nutrients, metals and various contaminants. Chemicals, metals and pesticides were found in some locations and additional testing will be undertaken in 2012. Following on the success of lake management planning for Lake Scugog and Sturgeon Lake, a monitoring network was established in the Balsam and Cameron Lake watersheds and water quality and quantity, precipitation and bacteria levels at public beaches are being monitored as part of the initiation of lake management planning for those two lakes. A Natural Heritage Strategy is also being developed with the involvement of many organizations and individuals. The "Blue Canoe" program, a community-based social marketing program to encourage lake stewardship and conservation is being introduced on Sturgeon, Balsam and Cameron Lakes.

Kawartha Lake Water Quality and Summertime Flow Rates

KLSA Vice-Chair Kevin Walters describes the interaction of flow rates from the northern reservoir lakes to the southern lakes and water quality. He recommends increasing the summer flow rates and modernization of the system to benefit people both in the reservoir lakes and downstream. Better funding of the TSW for its operational activities and infrastructure is needed to balance the interests of all users.

The Shoreline Buffer Zone: Water Quality Improvement through Landscape Planning

Helen Batten, a landscape architect, describes the process of landscape design in shoreline planning. A 'wish list' of activities and facilities desired by the owner is the starting point but protection of water quality is an important element in the design process. Maintaining a shoreline buffer zone, avoiding the use of fertilizers, herbicides and pesticides and adding native plants are a few of many ways to incorporate good stewardship practices and protection of water quality into the shoreline planning process.

TSW Canoe Slide Restoration between Two Kawartha Lakes – Lower Buckhorn and Lovesick Lakes

In 2010, John Ambler and Mark Potter undertook a project to rebuild a canoe slide to make the portage between Lower Buckhorn and Lovesick Lakes easier. In 2011, they received permission from the Trent-Severn Waterway to proceed with the project, replacing a structure originally built in the 1930s and rebuilt in 1953. The canoe slide disappeared in the 1970s. With donations from cottagers, lake associations and a local business, the materials were purchased and volunteers worked in June of 2011 to rebuild the structure and a ribbon-cutting ceremony took place on July 10. The slide portage was used extensively during the rest of the summer.

Sustainable Peterborough

From September 2011 to March 2012, the Greater Peterborough Area community, including the City, County, eight townships, Curve Lake and Hiawatha First Nations, collaboratively developed a Sustainability Plan called Sustainable Peterborough. More than 2,200 people contributed to the development of the plan with a vision of *"Caring communities balancing prosperity, well-being and nature.* KLSA was a participant in this process.

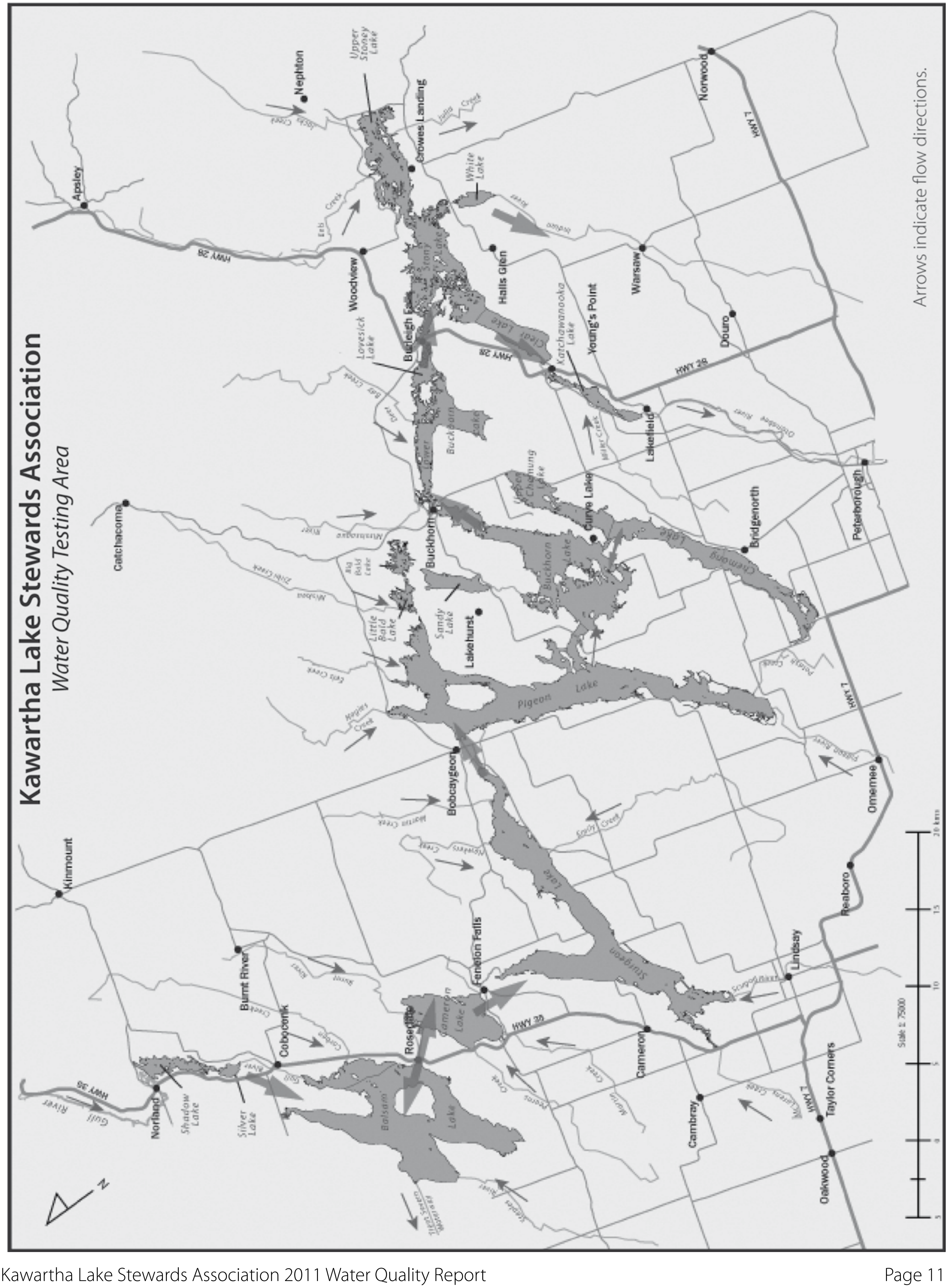
Recognition of KLSA

KLSA's efforts have been recognized by many organizations and requests for KLSA's involvement in partnerships have expanded significantly in recent years. KLSA has received a number of awards in recognition of its stewardship efforts, most recently the Kawartha Region Conservation Authority's Community Conservationist Award recognizing volunteer-based, community or organized groups that have successfully undertaken projects that contribute to a healthier watershed.

Thank you

The Kawartha Lake Stewards Association could not achieve its goals without the extraordinary support of the many volunteers who participate in our monitoring programs, our member cottage associations, ratepayer associations, municipalities and businesses that provide financial support. We are also very grateful to the Trent-Severn Waterway for its annual grant and to the Ontario Trillium Foundation for funding our algae project. Thank you also to Dr. Eric Sager, Dr. Paul Frost, Dr. Emily Porter-Goff, Professor Sara Kelly and their colleagues at Trent University and Fleming College for their scientific advice and ongoing support of our work, staff at the Ministry of the Environment Lake Partner Program and staff at SGS Lakefield Research and the Centre for Alternative Wastewater Treatment for assisting with the testing program. We are also very grateful to Simon Conolly, publisher of the Lakefield Herald for his assistance with the publication of this report and our brochures.

For further details of the work of the Kawartha Lake Stewards Association, please visit our website:
http://klsa.wordpress.com.



Kawartha Lake Stewards Association
Water Quality Testing Area
Arrows indicate flow directions.
Kinmount
Catchacoma
Apsley
Nephton
Upper Stoney Lake
Crowes Landing
Woodview
Burleigh Falls
Lovesick Lake
Stony Lake
Halls Glen
White Lake
Clear Lake
Katchawanooka Lake
Young's Point
Warsaw
Norwood
Douro
Lakefield
Lower Buckhorn Lake
Upper Chemung Lake
Curve Lake
Buckhorn
Buckhorn Lake
Chemung Lake
Bridgenorth
Peterborough
Big Bald Lake
Little Bald Lake
Sandy Lake
Lakehurst
Pigeon Lake
Bobcaygeon
Omemee
Sturgeon Lake
Fenelon Falls
Cameron Lake
Rosedale
Burnt River
Coboconk
Balsam Lake
Norland
Shadow Lake
Silver Lake
Gull River
Cameron
Cambray
Lindsay
Reaboro
Taylor Corners
Oakwood
HWY 28
HWY 7
HWY 35
Otonabee River
Indian River
Mississauga River
Pigeon River
Scugog River
Eels Creek
Jacks Creek
Squaw River
Burnt River
Nogies Creek
Emily Creek
Miller Creek
Scale 1:75000

Algae in the Kawartha Lakes: Project in Review

Dr. Emily Porter-Goff, Postdoctoral Fellow, Trent University, Peterborough

What are algae?

Algae form that slimy green stuff you wish wasn't in your lake. But why is it there? Where does it come from? Can I make it go away? Will it hurt me?

These are some reasons that researchers from Trent University joined forces with the Kawartha Lake Stewards Association (KLSA) to launch an in-depth study on the algae in the Kawartha Lakes. The two-year study was funded by the Ontario Trillium Foundation (OTF).

Algae are a diverse group of microscopic organisms that depend on energy from the sun and nutrients from the water they live in to grow and proliferate. There have been around 200 different kinds of algae documented in the Kawartha Lakes; however, there are likely many more varieties that are less common or only present at particular times of the year.

Algae are critically important to the well-being of our lake ecosystem as they are the basis of the food chain. Algae are that essential link that take the sun's energy and turn it into a form that can be used by all animals (bugs, mussels, crayfish, fish). Without algae, there would be no life in our lakes.

Algae study

In the summer of 2010, field work began on the study "Algae in the Kawartha Lakes". The study aimed to address three questions:

1) What are the primary algal species in the Kawartha Lakes?
2) Which nutrients have the greatest effect on the algal communities?
3) What can be done to prevent excessive algal growth?

To answer these questions, algae communities were exposed to five different types of additional nutrients, salts and minerals and left to grow for three weeks. Samples were collected from each of the treatment types and brought back to the lab for analysis.

As we began to wrap up the lab work portion of this study, answers began to present themselves. Overall, it seems that the study lakes (Stoney, Balsam, Sturgeon and Pigeon) generally supply nutrients in the required proportions for the current benthic (bottom dwelling) and planktonic (free floating) communities. Many different chemical and biological aspects of both the benthic and planktonic communities were measured, including the amounts of chlorophyll *a*, carbon, nitrogen and phosphorus contained within the organisms of the community, as well as the biovolume of those community members. Generally, the addition of one particular nutrient did not cause significant response in the algal community. However, when additional nutrients of each type were supplied, the community expanded. This response implies that algae are naturally supplied with essential nutrients in approximately the right proportions and only when all of these nutrients are proportionally increased will the algae increase in productivity in the Kawartha Lakes. To decrease the abundance of algae, we must limit all types of nutrients, as simply restricting nitrogen or phosphorus alone would have a small effect on the community.

To illustrate this effect, algal biovolume was estimated from each of the treatment types (Figure 1). Stoney and Sturgeon Lakes are perfect examples of strong response to the "All" treatment type, whereas Pigeon responded slightly to the "All" treatment type and Balsam actually displayed a slight inhibitory effect of the nutrients. Comparing the biovolume to the chlorophyll *a* results (Figure 2), we see strong agreement to the nutrients being supplied in correct proportions for the natural community. With chlorophyll *a* we see a strong response in all lakes.

So, if chlorophyll *a* is produced by the algae, shouldn't we see the exact same response in algal biovolume? Not necessarily. Algal cells vary dramatically in size. Some are barely perceptible on the standard microscope and others are large enough to hold in your hand. Additionally, the amount of chlorophyll that each algal cell produces not only varies by the kind of algae, but can also be affected by the health of the cells, lake conditions (like temperature or mixing of the lake and amount of sunlight) and time of year.

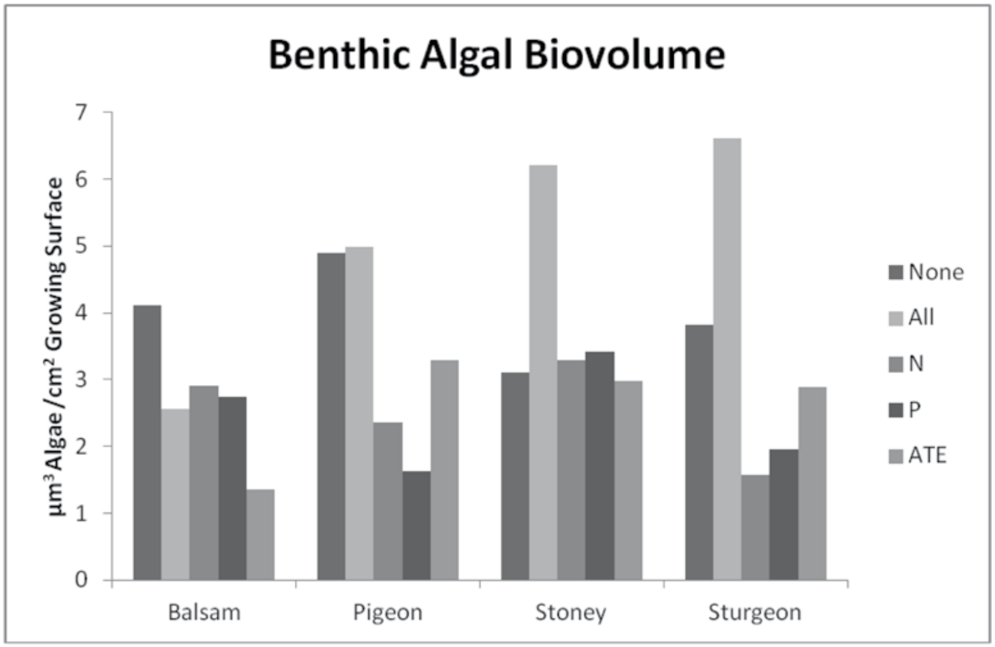


Figure 1. The average volume of algae per square centimetre of clay pot from each of the treatment types (None- control, All- treatment types combined, N- nitrogen, P- phosphorus, ATE- Algal Trace Elements).

The results of this study underline the importance of limiting *all* human impacts to the lakes. Simply cutting back on fertilizers in your garden is not enough because phosphorus and nitrogen are not the only nutrients contributing to algae in the lakes. We affect water quality with the addition of countless compounds, nutrients, salts and minerals, to concentrations above natural lake levels and the increase in concentration of these contaminants can give rise to increased algal blooms. We must minimize our footprint as a whole and reduce every impact on lake water quality.

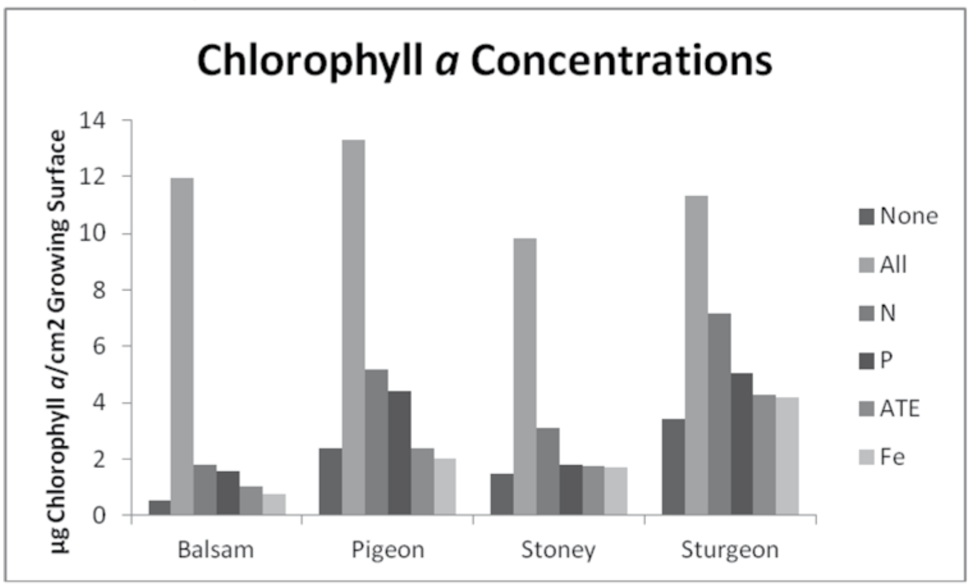


Figure 2. The average chlorophyll a per square centimeter of clay pot from each of the treatment types (None- control, All- treatment types combined, N- nitrogen, P- phosphorus, ATE- Algal Trace Elements, Fe- iron).

Summer workshops

Over the course of the summer, we hosted a series of six workshops on "Algae in the Kawartha Lakes". Workshops were hosted by various lake associations and held at Lovesick, Big Bald, Stony, Sturgeon and Pigeon Lakes and the Gamiing Nature Centre. Attendees brought along algae samples and were fascinated to get a microscopic look at the green goo from their beaches. There were many great questions and an overwhelming interest in the topic as well as concern for maintaining water quality in their lakes. Many misconceptions and concerns were addressed and attendees left with a heightened interest and understanding of the microscopic workings of their lake.

Following the completion of the algae study, we will be producing an algae booklet. This booklet will address common concerns and misconceptions, provide an introduction to identifying algae without a microscope as well as giving people a look into the microscopic world of algae. Best practices for good water quality and potential triggers for algal blooms will be a strong theme throughout. Look forward to the release of this exciting and informative booklet in the middle of the summer of 2012.

Toxic blooms

Toxic algal blooms have been in the local news a lot recently and although water quality warnings should be taken seriously, they have, unfortunately, given algae a bad rap.

There are thousands of different species of algae in the world; only a handful are toxic. And only some of those that are toxic are harmful to humans. It is natural and healthy to have algae in lakes and streams. It is even natural and healthy to have small amounts of toxic species mixed in.

A healthy lake ecosystem supports a wide range of algae species. It is only when excessive blooms of these toxin-producing algae occur that problems can arise.

Blooms occur when growing conditions are optimal for one particular species more so than other species. This occurs when the time of year, amount of sunlight, nutrients, water temperature and numerous other factors – which affect the habitat of the algae – all become optimal at the same time. These optimal conditions can occur in completely natural conditions, but occur much more frequently in areas with human disturbances.

The types of toxic algal blooms documented in the Kawartha Lakes have been caused by *Microcystis* and *Anabaena*. Both *Microcystis* and *Anabaena* are varieties of blue-green algae; however, keep in mind that there are hundreds of kinds of blue-green algae and only a few produce toxins.

Blue-green algae is also known as cyanobacteria. This is because of a slightly different sub-cellular make-up that is the same as bacteria and different than other kinds of algae. However, as an organism they function exactly the same as other kinds of algae. Blue-green algae do not make you sick because they are bacteria; they can make you sick because of the toxins they produce.

There are other types of algae that produce toxins that are not blue-green algae, but blooms of these types are unlikely in our area. *Microcystis* and *Anabaena* are typically present in our lakes, but in such low abundance that the concentration of harmful chemicals is far too low to be toxic. However, when the lake turns very cloudy with green tinted haze, the concentration of potentially harmful chemicals may be at a toxic level. Pay attention to warnings about drinking water and refrain from swimming and bathing until the lake has been deemed safe.

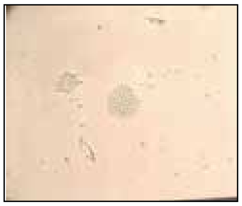
Many people have wanted to know why we are getting toxic blooms now. We can't know if toxic algal blooms occurred in this area before European settlers came and impacted local water quality as there are no records. We do however know that toxic blooms have been documented in the Kawartha Lakes as far back as the late 1800s.

With changes in human lifestyles, water quality has cycled through varying degrees of severity and particular acute problems. There were likely decades of few toxic blooms and those with frequent blooms over the last 100 years. We are currently seeing more frequent blooms than in the past few decades and should reevaluate our contributions to water quality.

Conclusion

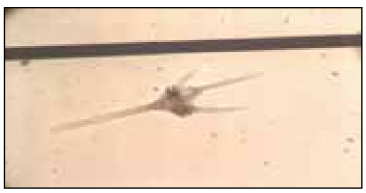
The Kawartha Lakes currently support a dynamic and flourishing algae community. The occurrence of unwanted blooms will become more frequent as human impact within the watersheds continues to increase. Reducing the human footprint in the watershed is the best way to limit the occurrence of blooms. However, under normal circumstances our lakes are providing a fairly balanced foundation of primary productivity from which energy is supplied to every other organism in the lake ecosystem. For a more in-depth look at this topic, refer to the Kawartha Lakes algae guide which will be released later this summer.

Free-floating algae of the Kawartha Lakes - Common algae found in most lakes within the eco-region

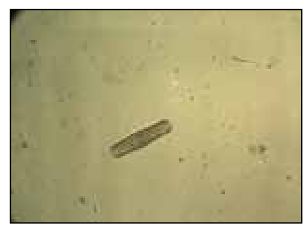


Pediastrum

Mougeotia



Ceratium



Rhopalodia

Chroococcus

Anabaena

400X microscope photos by Andrew Scott and Emily Porter-Goff

Blue-Green Algae Risks

Tom Cathcart, Manager, Inspection Programs, Peterborough City and County Health Unit and KLSA Board Member

What are blue-green algae?

Blue-green algae are not true algae, and they aren't even always blue-green. They are actually a type of bacteria, called "cyanobacteria" that get their energy through photosynthesis, like plants do. Cyanobacteria are known for rapidly reproducing and collecting to form large, highly visible blooms throughout the water column, that give water the appearance of blue-green paint, or pea soup. The blooms can also appear on the surface of water as a scum, or on the lake bottom as a mat. These blooms are not only unsightly and smelly – some species of cyanobacteria can also release poisons, called cyanobacterial toxins, into the water when the cells that make up the bloom rupture or die.

What are the health risks?

Cyanobacterial toxins can be harmful to both animals and humans, and fall into various categories: some types of toxins attack the liver; some attack the nervous system. The risk to humans is primarily from drinking water that has been contaminated with toxins. Fortunately, there have been no human deaths attributed to drinking water containing cyanobacterial toxins, but the toxins may cause headaches, fever, nausea, vomiting, abdominal pain or diarrhea. Long-term consumption of water containing high levels of cyanobacterial toxins may cause neurological or liver problems.

Farm animals and pets are not as discerning about the water they drink, and if allowed, may consume large quantities of heavily contaminated water, resulting in sickness or death.

Are all blue-green algae blooms poisonous?

No. Not all species of cyanobacteria produce toxins, but a bloom can contain a mixture of different species. It is estimated that up to half of cyanobacterial blooms may be non-toxic. However, some individuals are sensitive to contact with blue-green algae, and may develop a skin rash or eye irritation even if there is no toxin produced by the bloom.

How can I treat my lake water for drinking?

At this time, there are no systems that are recommended for homeowners to use to treat toxin-contaminated water. Municipal drinking water systems are quite effective at removing cyanobacterial toxins from water. The effective components of municipal water treatment are filtration, chlorination and activated carbon removal. There may be the potential to incorporate some of these processes into a domestic treatment system, but at this time there are no domestic devices that have been proven to consistently remove cyanobacterial toxins.

Municipal drinking water systems must meet the limits set out in the Ontario Drinking Water Quality Standards for the most common type of cyanobacterial toxin called microcystin-LR. The maximum limit is 1.5 parts per billion. This standard is based on daily, year-round consumption. The limit that could safely be consumed on a short-term basis, or the amount of toxin that could be ingested at any one time without a harmful effect, is not known.

Many rural or waterfront residents periodically rely on boiling to make bacterially contaminated water safe to drink, but water contaminated with toxin-producing cyanobacteria will still be unsafe. Boiling the water will kill the bacteria, causing their cell walls to rupture and release toxin into the water. This means that you should not even use the water for cooking.

If you use lake or river water in your home or cottage, make sure your intake is in deep water, far from shore. If you see a dense algal bloom in the vicinity of your water intake, find another source of water for drinking and cooking, such as municipal water, bottled water or potable water from a deep drilled well.

Can I use contaminated water for bathing and washing?

Not everyone will have a skin reaction to blue-green algae in water. If you know that you are not allergic or sensitive to it, bathing and washing may not present a risk. At this time, there is very little known about skin reactions to blue-green algae. We don't know what percentage of the population is sensitive to the algae, how long it takes to create a skin reaction, or how dense and large the algal bloom has to be. The smell of a thick algal bloom will probably be enough to discourage most people.

Why here, why now?

Cyanobacteria blooms have been recorded for 800 years, but reports of blooms have increased significantly in the past decade. Warm temperatures, high nutrient levels and shallow, slow moving water all increase the likelihood of a bloom occurring. The subtle effects of global warming are also being seen, as Ontario's lakes have longer ice-free periods, with blooms now being reported as late as November.

What should I do if I think I have spotted a blue-green algae bloom?

If you suspect a blue-green algae bloom, report it to the Ministry of the Environment (MOE) by calling 1-800-565-4923. If it is the first blue-green algae bloom on that lake or in that area, the Ministry will take a sample of the algae and identify whether it is cyanobacteria. They will also test the toxin levels from a dense area of the bloom, but will not return to confirm that the bloom or the toxin levels have dissipated.

Subsequent blooms will not be individually identified, so waterfront residents will need to learn about algae, and learn to identify what might be a cyanobacteria bloom. Even experts cannot tell which blooms are harmful just by looking at them, so cottagers will have to be cautious anytime that they have <u>any</u> dense algae bloom:

- Do not use the water for drinking, cooking or other consumption.
- Do not let pets or livestock consume the water.
- Do not swim in an algal bloom. Even if it is not blue-green algae, it is unsafe to swim or to allow children to play in any dense algal bloom, since you cannot see into the water. Wait until the bloom has subsided and the water is clear.
- Do not consume the liver, kidneys or other internal organs of fish caught in affected waters.
- Be observant of when the water has cleared. If you treat surface water for cooking or consumption, wait at least a week after the bloom has subsided before resuming normal use of the treated water. The toxin is naturally reduced by dilution, degradation by other bacteria in the water, and sunlight.
- Assess your water supply if you are in an area where there are frequent algae blooms. Since there is no confirmed domestic water treatment available yet, consider a drilled well or a dug well far from shore.

Bob Peters

Algae bloom on Sturgeon Lake, summer, 2011

My Brush with Blue-Green Algae or the Cyanobacteria Blues

Rod Martin, KLSA Volunteer

You can imagine my surprise when my wife called me to the window to witness my special lake that had suddenly turned a deep shade of green. It reminded me of a well-manicured fairway on a sunny day. It was mid-summer, hot, humid and uncomfortable by any standard. It was the kind of day when the lake simply beckoned you to enjoy your favorite water activity. Yet here I was rushing to the shore for a totally different reason.

The vision was real. My corner of Sturgeon Lake had turned overnight into an enormous bowl of pea soup. The water was indeed so opaque that one could not see objects two or three centimetres below the surface. I was to learn later that conditions that week had been ideal for a sudden bloom of blue-green algae. The recent rains had washed nutrients from the surrounding towns and countryside; the water temperature at my neighbour's dock measured 31°C and the water had been calm for the preceding few days. The 'normal' algae blooms had occurred some weeks earlier but this one was definitely not 'normal'.

Blue-green algae is really a misnomer since it is part of a bacteria family called cyanobacteria. It can be dangerous because some strains produce a toxin that is a threat to both animals and people, and unlike bacterial contamination in drinking water, this toxin cannot be destroyed by boiling. (See "Blue-Green Algae Risks", p. 16, for more details.)

At the water's edge I realized the potential danger of the situation and hurried to the phone. The Health Unit employee answered my call professionally, asked questions and requested photos if possible. My next call was to the Ministry of the Environment 's Spills Line. Again, an official received my report politely and asked questions about the bloom. I'm sure these folks receive a multitude of calls with each change in lake appearance. My hope for a quick response was rewarded when the following day a Ministry representative stopped by to take samples. Upon viewing the water she too suspected cyanobacteria and took samples for several kilometres along the shoreline. By this time the local media had been alerted and began reporting a potential blue-green algae bloom. Locally, we had already organized friends and neighbours and tried to alert as many shoreline residents as possible.

A frustrating reality of cyanobacteria is that while the bacteria itself may be identified quickly, the level of toxicity takes many days to determine at a laboratory. This means that the confirmation is delayed. Immediate communication of potential danger can be awkward and incomplete since area visitors are often unaware of local media reports. The result is that while some people are not informed, others are unconvinced of the danger.

During the following days and weeks, swimmers and anglers alike suffered impatiently. The cyanobacteria danger was confirmed. There were periodic sampling visits by Ministry and Health Unit officials. The bloom varied in appearance from day to day, leaving people asking if the danger was passing. Could they eat the fish they caught? Could they drink the water after normal treatment? Was it safe for animals or even for watering plants? The 'inconvenient truth' was that the danger remained for several more weeks. During this time there were rumours that a number of local children were reported ill after swimming – but then children can get sick for many reasons. One rather humorous story went around about some men who were working on a dock or raft platform. Disregarding the warnings from neighbours, they were working in the water when a gull walked up the beach beside them and proceeded to drop dead on the spot. There was an immediate rush to the showers. The details of this story remain unconfirmed, although someone suggested that the unfortunate gull may have flown in from Georgian Bay, which was then experiencing a botulism outbreak. In my personal observations, it seemed that life went on as usual for the ducks, geese, fish and mink that frequent my shoreline. I was not aware of any unusual mortality among these creatures. When the danger had finally passed, for many, the summer had been seriously compromised. It was a new experience for many residents, and one that they hope will not be repeated.

Cyanobacteria is a naturally occurring organism that has always been found in the Kawarthas, and likely most of Ontario's lakes. What made this bloom so prolific were the ideal conditions that encouraged its growth. Some people feel that the apparent increase in algae is a result of climate change. They wonder if warmer winters and summers will result in more troublesome blooms. The phosphorus and nitrogen levels in the lake are also a major concern. There are many sources of these nutrients that enter our lake system. Our lake water is currently monitored by a number of agencies and volunteers. Our local Conservation Authority, Ministries of Natural Resources and the Environment, local Health Units and our own Kawartha Lake Stewards Association all participate in adding to the knowledge base. All are involved, too, in educating the public on issues of water quality and conservation.

If we are to continue to enjoy this very special place by the lake, we must become its caretakers in thought, word and deed. We need to act with care and moderation, recognizing the symptoms of stress that our lakes are showing. We all need to think about our actions and do what we can to limit the amounts of nutrients that end up in our lakes.

Bob Peters

Algae bloom on Sturgeon Lake, summer, 2011

E.coli Bacteria Testing

Kathleen Mackenzie, KLSA Vice-Chair

During the summer of 2011, KLSA volunteers tested 96 sites in 15 lakes for *E.coli*. Each site was tested up to six times over the summer. Samples from 69 sites were analyzed by SGS Lakefield Research, and samples from 27 sites in the westernmost lakes were analyzed by the Centre for Alternative Wastewater Treatment laboratory at Fleming College in Lindsay.

We were pleased to see our first *E.coli* tests this year from Shadow and Silver Lakes. We are hoping to expand our *E.coli* testing on Sturgeon Lake, south Pigeon Lake and Buckhorn Lake, and would very much like to have some *E.coli* tests done on Cameron Lake. If anyone is interested, please let us know!

Many thanks are due to our faithful volunteers, who year after year cruise their lakes collecting samples and shuttling them to the laboratory. Thanks for donating your precious summer time, and your more-and-more-precious-by-the-year gas! Most of all, thanks for your interest and concern regarding Kawartha Lakes water quality.

KLSA extends a special thank you to Rod Martin, who has developed and coordinated *E.coli* testing in the western lakes for several years. He will be handing over the job to Doug Erlandson this year.

To see the complete results and the description of our protocol, please refer to Appendix E.

A normal year

It's difficult to compare years because sites change somewhat from year to year. However, generally it seems that 2011 results were similar to other years. A huge proportion of the tests yielded low results of less than 20 *E.coli*/100 mL. Our Kawartha Lakes continue to be generally clean.

Of the 93 sites that were tested five or six times, results can be summarized as follows:

Site Rating	Number of Sites	Comments
'Very clean': all readings less than 20 *E.coli*/100 mL	42	These low counts indicate excellent recreational quality, and reflect careful shoreline management by cottagers.
'Clean': one or two readings over 20 *E.coli*/100 mL	39	
'Somewhat elevated': three readings over 20 *E.coli*/100 mL	4	These sites are still considered to have excellent recreational quality. Reasons for slightly elevated counts include low circulation, presence of large populations of waterfowl and inflow from wetlands.
'Needing observation': More than two counts over 100, or more than three counts over 20 *E.coli*/100 mL	8	Reasons for high counts on these sites include: being at the mouth of a creek; being in an open shallow area with thick sediments which may be churned up in a storm; being in an area of high waterfowl population; and being a dead-end bay with high runoff and low circulation.

The August long weekend was the best long weekend we can remember! – three heavenly days of unbroken hot, sunny weather. The lakes were as busy as they've ever been with people enjoying themselves. So we expected that there would be some high counts on the August 2 tests. However this didn't happen; the unusually high level of human activity did not seem to increase the *E.coli* counts.

Phosphorus Testing

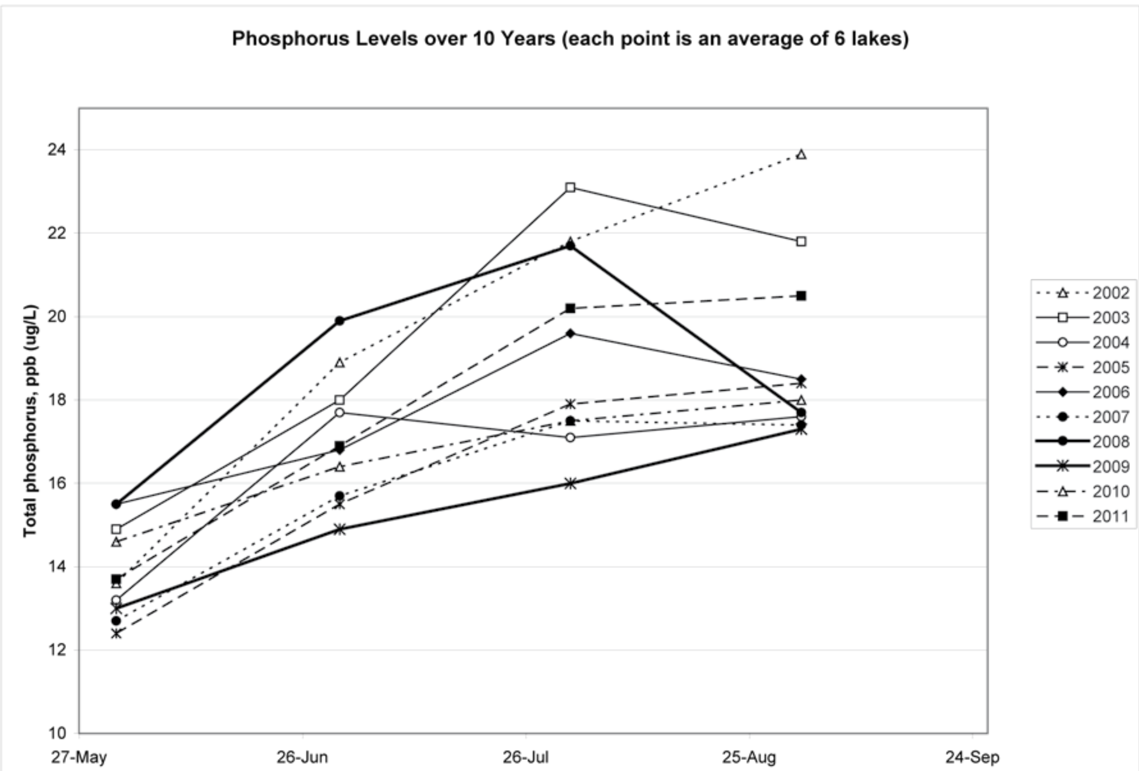
Kathleen Mackenzie, KLSA Vice-Chair

In 2011, KLSA's fleet of dedicated volunteers collected water samples from 41 locations in 16 Kawartha lakes, from Balsam Lake downstream to Katchewanooka Lake. Sites were tested on six dates from May to October. Samples were analyzed through the Ministry of the Environment's Lake Partner Program, which is available free to all lakes in Ontario. Please see Appendix F for lake-by-lake analysis, and the complete phosphorus and clarity (Secchi disk) data.

Thank you to all our volunteers who criss-crossed our lakes picking up water samples. Admittedly, it is a fun activity, but time at the cottage is precious, and so is gas, so we are grateful for your commitment. We are building a long-term database, which becomes more useful as time goes by. Let's keep it going!

The Kawartha Lakes as a whole: A slightly high phosphorus year

As seen in the graph below, 2011 started out with the same levels of phosphorus as in previous years. However, levels were somewhat higher than most years by August 1, and remained relatively high until early September. However, differences are small, and 2011's phosphorus levels certainly were within normal variability.

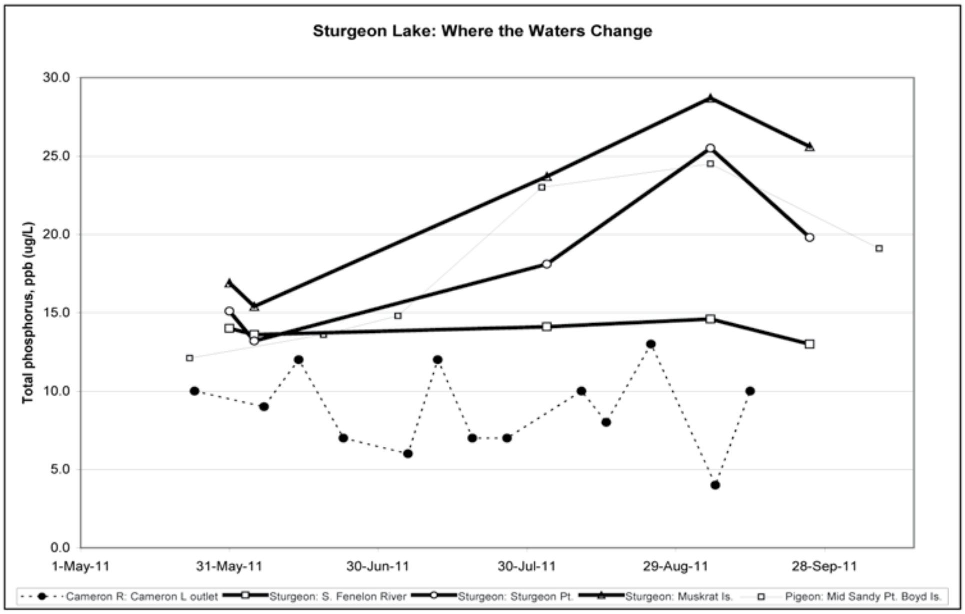


Sturgeon Lake: Where phosphorus levels change

This year, Kawartha Conservation measured phosphorus levels on the Fenelon River as it exits Cameron Lake. This river flows for about three km, then enters Sturgeon Lake. As seen on the graph below, the phosphorus levels in the Fenelon River are low, staying at about 9 ppb all summer. (The more wobbly line reflects a river location, which is more influenced by local runoff than a large lake.) However, the average at the 'S. of Fenelon R.' site is about 14 ppb, a large increase in phosphorus in a short distance! As we go downstream through Sturgeon Lake to Sturgeon Point and then Muskrat Island, phosphorus keeps increasing. It then stabilizes in Pigeon and remains around this level all the way to Katchewanooka (with a slight drop in Stony due to dilution from Upper Stoney's waters).

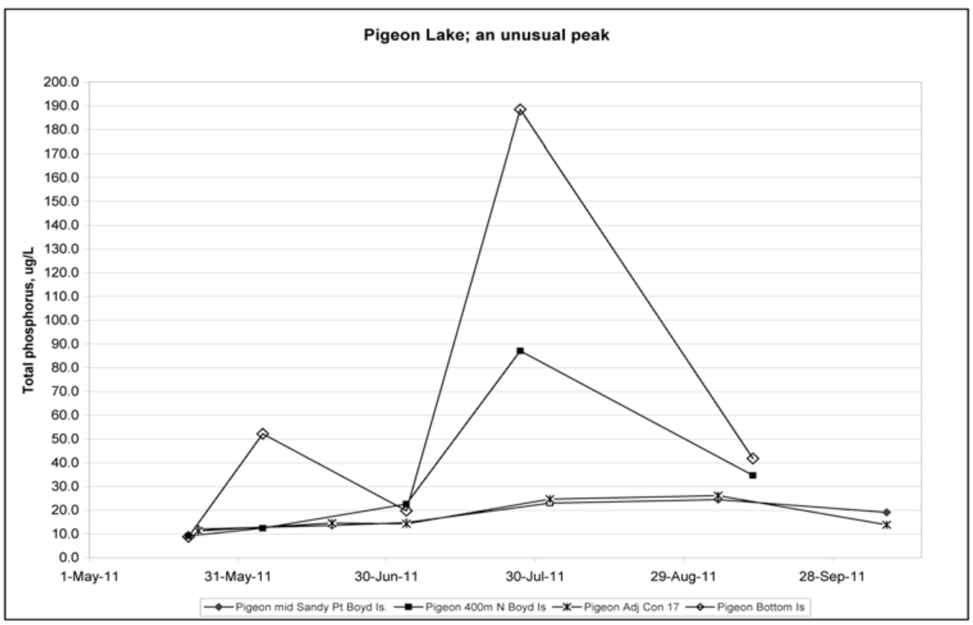
We wonder why there is such a large change in Sturgeon Lake, and if this 'sets the tone' for the rest of our lakes. If the rise in Sturgeon could be prevented, would the rest of our lakes be lower in phosphorus? The Sturgeon Lake Management Plan should help to answer these questions.

KLSA would like to investigate this further.



A mysterious phosphorus peak in Pigeon Lake near Bobcaygeon

As seen in the graph below, there were two large phosphorus peaks in the 'Pigeon Lake: Bottom Is.' site, just downstream from Bobcaygeon. The Kawartha Lakes rarely have readings above 25 ppb, but we see here readings of 52 ppb and 188 ppb! Often, unusual readings such as these are considered errors, but this seems unlikely on July 27 because there were two peaks in neighbouring points: the 'Bottom Is.' site is only about 1.5 km across open water from the 'N. Boyd Is.' site.



Editorial Note:

We wondered what happened to cause this unusual peak and, whatever it was, did it account for the peaks seen at both the Boyd Island and Bottom Islands test sites? We did some investigation, suspecting at first that we might have been seeing the effects of problems at the Bobcaygeon Sewage Treatment Plant again. We contacted the Ontario Clean Water Agency, who advised us that there were no phosphorus removal issues at that time. So, we thought that this was either caused by a large stormwater runoff event or a sudden release from the sediments. While there was such a storm event, the peaks seemed too high to be explained by that alone. Further research into the possibility of sediment releases suggests that this is the likely source. The recent report of the bi-national Lake Ontario Lakewide Management Plan has determined that years of high phosphorus discharges from municipal treatment plants in more protected areas of Lake Ontario have resulted in heavy build-up of phosphorus in the sediments, which is being re-released and is contributing to cyanobacterial and other algal blooms.

The Wonderful World of Weevils… A World Full of Milfoil!

Kyle Borrowman, Masters Student, Environmental and Life Sciences Graduate Program, Trent University, Peterborough

Eurasian watermilfoil (*Myriophyllum spicatum*) has recently been a hot topic across lake associations in Ontario, including the Kawartha Lake Stewards Association (KLSA). As many are aware, we teamed up with students from the Ecosystem Management Program at Fleming College in the winter of 2011 to create the "KLSA's Guide to the Milfoil Weevil". We introduced the milfoil weevil (*Eurychiopsis lecontei*) to its readers and discussed concerns surrounding the presence of Eurasian watermilfoil. We wanted to reiterate some of the key points discussed in last year's weevil guide and annual report:

Eurasian milfoil is present throughout the Kawarthas and in some lakes (Lower Buckhorn, Pigeon, Scugog and Stony) milfoil hybrids were identified. These hybrids consist of Eurasian watermilfoil and the native milfoil, northern watermilfoil (*Myriophyllum sibiricum*).

In last year's report, we proposed questions surrounding the invasiveness of these hybrids and their relationship to the milfoil weevil. The results of our 2010 survey gave us a strong base of questions and directions to explore in the 2011 season. Unlike the summer of 2010 when we found ourselves snorkeling like weevils through thick patches of milfoil, we moved our research indoors. Throughout the summer of 2011, we were fortunate to have access to an environmental growth chamber at Trent University. We were able to control the temperature, light duration and light intensity of the artificial environment. Although it was a tradeoff to work indoors, it was a constant 23ºC and sunny!

One of the main questions we were curious about is how the weevil responds to different types of milfoil present in Ontario. In addition to identifying hybrids during the 2010 survey, two genetic distinct 'biotypes' were also identified (aptly named EWM1 and EWM2). These biotypes are suggestive of different lineages or points of origin in their native range. Our objective for the study was to determine how well the weevil develops on these different hybrids and biotypes of Eurasian milfoil present in Ontario.

Our experimental design was built on previous research into weevil growth. These studies consisted of growing the milfoil weevil on northern milfoil (NWM), its native host, Eurasian milfoil (EWM1), and northern x Eurasian hybrids (HYB). These experiments determined that there is a higher survival rate of weevils grown from egg to adult on EWM in comparison to NWM and intermediate survival on HYB.

We decided to replicate and build on the previous research for several reasons. First, at the time these experiments were run, it was not known that multiple biotypes of Eurasian existed. Second, in our 2010 survey there was no significant difference in weevil density based on milfoil type (EWM1, EWM2 or HYB). If the weevil is to be used as a form of biological control, it is important to determine how effective it will be on the invasive milfoil we have in Ontario.

Our weevil growth experiment consisted of collecting different populations of milfoil from across the Kawarthas and Sudbury and growing them under controlled conditions in the environmental chamber. HYB, NWM and EWM1 were collected from the Kawarthas and EWM1 and EWM2 were collected from the Sudbury Region. Since HYB was not present in Sudbury, and EWM2 was not present in the Kawarthas, EWM1 was collected from both regions to control for any local differences between the regions (Kawartha was named EWM1*a* and Sudbury was EWM1*b*). See Figure 1 for the map of where we collected milfoil.

The plants were acclimatized to the chamber and after two weeks we introduced weevil larvae to determine how many would survive to adulthood on the various types of milfoil. Weevil eggs were provided by Enviroscience Inc. and each egg was carefully plucked and placed into an ice cube tray for incubation. Once hatched, weevils were then carefully moved onto the bushy growing tip of the plant to begin feeding. In total, 120 weevils were placed on 120 shoots of milfoil.

Over a process of 8-11 days, the weevil larvae grew from little, almost invisible, 'squiggly' lines into full-grown (centimetre long, 0.3 centimetre wide) weevil larvae. These larvae spent most of their time burrowing through the stems of the plants, although they would periodically come out of the plant to move down the stem to start a new borehole. At the end of this period, the larvae would move down the stem to burrow a pupation chamber. Pupation would take 8-11 days, at which point adults would emerge.

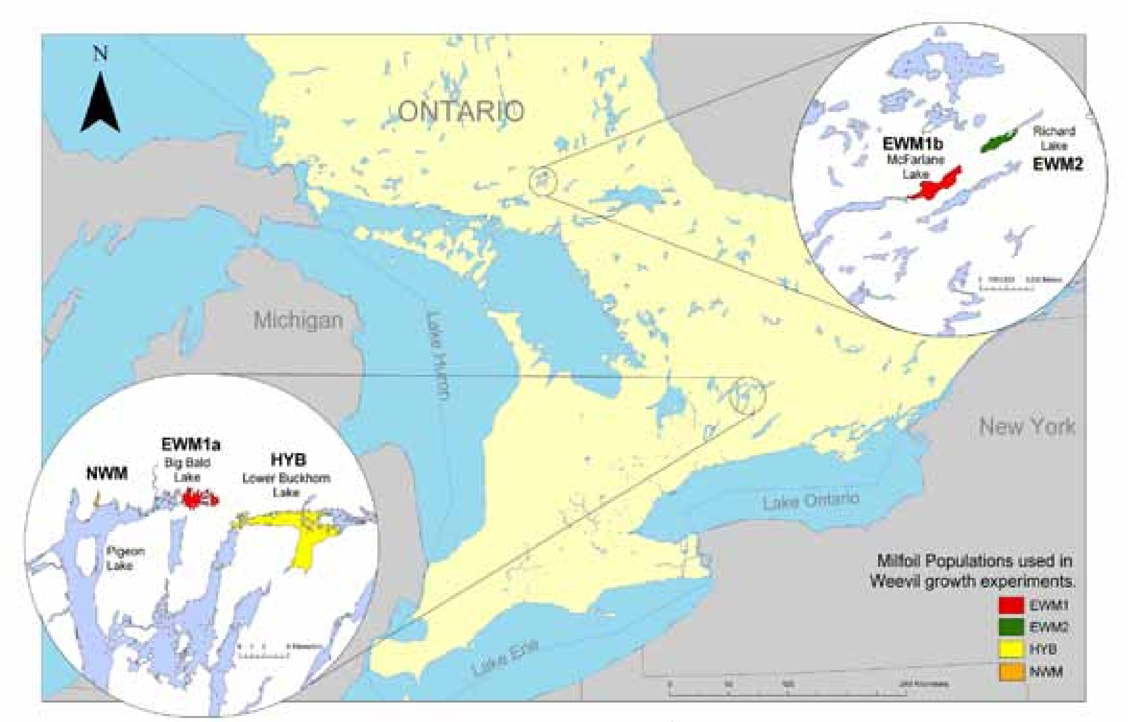


Figure 1: Distribution of milfoil populations used in the milfoil weevil (*E. lecontei*) growth experiment. EWM2 and HYB have not been identified to co-occur in the province. EWM1 populations from both regions were used to control for any local/geographic adaptation.

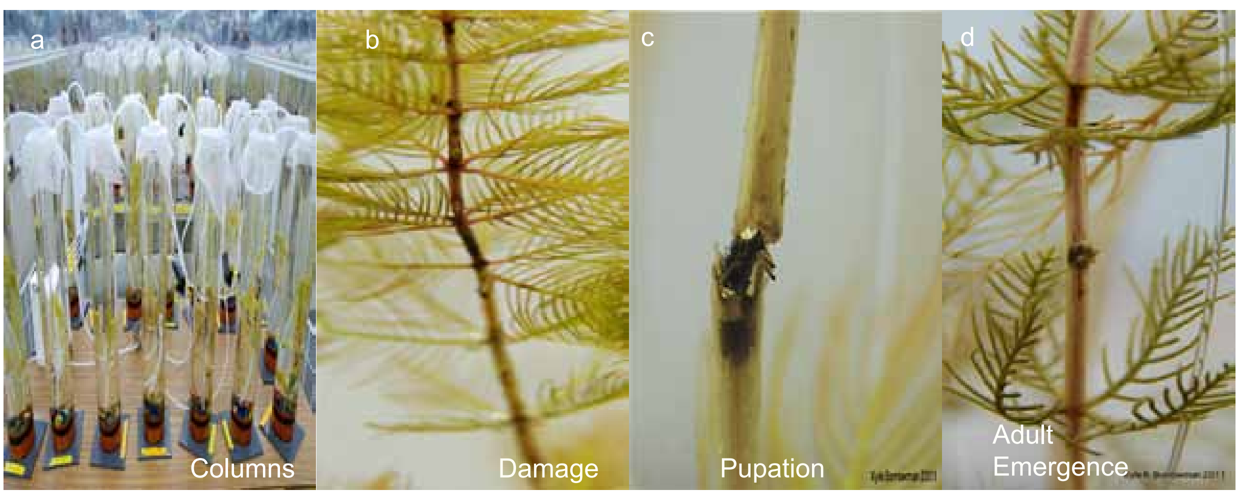


Figure 2: *E. lecontei* were reared on various milfoil types in columns in an environmental chamber (a). Daily observations of larval burrowing damage (b), pupation (c) and emergence from pupation (d) were documented.

Throughout the duration of the experiment, we were able to document the amount of damage each weevil had caused to its plant as well as how long it took to finish each life stage (larval and pupal).

See Figure 2 for the experimental setup and various weevil life stages observed.

At the end of the experiment we compared the percentage of weevils that were able to fully develop from egg to adult. In addition we were able to compare the length of days to complete each life cycle and their weight (in milligrams) at emergence as adults.

We found that significantly more weevils raised on HYB reached adulthood (88%) in comparison to NWM (38%) and EWM2 (46%). EWM1 survivorship was intermediate (EWM1*a*: 58%, EWM1*b*: 75%). In addition, weevils took a significantly longer amount of time to finish their larval development when raised on NWM (11 days) and EWM2 (10 days) in comparison to EWM1*a,b* (8 days) and HYB (8 days). Weevils raised on HYB (1.150mg) and EWM 1*a,b* (1.221mg, 1.244mg) were significantly larger that weevils raised on NWM (0.951mg). See Table 1 for the results of the experiment.

Our results were somewhat similar to previous studies, where weevils raised on EWM1 and HYB had a higher developmental performance in comparison to weevils raised on NWM. Unlike previous studies, weevils raised on HYB had the highest overall developmental success. Weevils raised on HYB may have been successful due to the dietary quality of the plant. Before weevils were introduced, all of the plants were grown in similar conditions for two weeks. During this time, hybrid plants flourished in the growth chamber allowing them to grow an extra 10cm higher than most other plants in the chamber.

This added 'fitness' was also noticed in plant chemistry. Plants were collected before weevils were introduced to determine the carbon, nitrogen and phosphorus content of the plants. Hybrid plants had a significantly higher percentage of nitrogen and phosphorus. High dietary nitrogen, in particular, has been widely accepted to increase the developmental performance (identified above) of herbivorous insects.

In addition, we were the first to study the development of the weevil on the second biotype (EWM2). The poor development of weevils on EWM2 was surprising to us since the EWM2 population used for this experiment had the highest weevil density in the 2010 survey. In the spring of 2011 it was difficult to locate healthy EWM2 plants, many of the plants were severely damaged and did not reach the surface. In the experiment, the plants appeared to be very unhealthy following the larval stage. The low survivorship may actually be due to the lack of "quality" pupation sites available to the weevils after larval feeding. We need to further explore the relationship between this biotype and the weevil.

The plants also responded to weevil damage in different ways. Throughout the experiment, it was often noted that EWM1, EWM2 and HYB would grow a new shoot from the leaf node just above the sediment. This response to damage caused by the weevil allows the plant the opportunity to grow new shoots to assist in its survival. NWM did not typically share the same response, although the plants appeared to be much more rigid and unpalatable to the feeding larva. It was common to see several attempts at burrowing without success.

Our results build on previous research into the effectiveness of the weevil as a form of biological control. We were able to provide new information surrounding growth of the weevil on various types of milfoil and the importance of plant nutrition. The presence of different Eurasian watermilfoil hybrids and biotypes has created new challenges for lake managers. But what was really interesting in this study is that weevils can successfully grow on Eurasian watermilfoil hybrids and biotypes that are present in the Kawartha Lakes. As is the case with the interaction of different species, there is always more than meets the eye and there are always new questions that need to be asked.

Table 1: Shows the mean number of days to complete larval and pupal life stages and mean adult mass (mgfw) for each milfoil type.

Successful Lifestage Completion				
Milfoil Type	n	Larvae (days)	Pupae (days)	Adult Mass (mg^{fw})
NWM *% survival*	24	11.1±0.9 2SE* *75%*	8.8±0.7 2SE *50%*	0.951±0.88 SD** *38%*
HYB *% survival*	24	8.2±0.5 2SE *92%*	8.0±0.5 2SE *95%*	1.150±0.139 SD *88%****
EWM1*a* *% survival*	24	8.2±0.6 2SE *75%*	8.0±0.3 2SE *78%*	1.221±0.171 SD *58%*
EWM1*b* *% survival*	24	8.3±0.7 2SE *88%*	8.1±0.3 2SE *86%*	1.244±0.167 SD *75%*
EWM2 *% survival*	24	10.0±0.7 2SE* *92%*	8.6±0.6 *50%*	1.137±0.179 SD *46%*

*NWM and EWM2 had a significantly longer larval stage duration than HYB, EWM1a and EWM1b ($H_{4,101}$=36.3 ,P<0.001)
**Adult weevils reared on NWM had a significantly smaller mass at emergence than HYB, EWM1a and EWM1b ($F_{4,67}$=6.08, p<0
***HYB has a significantly higher proportion of weevils reach adulthood than NWM and EWM2 ($F_{1,4}$=4.26, p<0.01)

2010 Sewage Treatment Plant Update

Kevin Walters, KLSA Vice-Chair

(Note that the previous year's sewage plant reports are not available to us prior to press.)

Lindsay: As usual, this plant is showing good performance at about 97.5% phosphorus removal, not far off our preferred target of 99%. Total tonnage of phosphorus (P) to the lakes was **255 kg**, one-sixth of what the Ministry of Environment (MOE) allows them to discharge. And there were no reported spills.

Fenelon Falls: We are seeing excellent performance, which leaves us wondering why we see such a large phosphorus jump in the Fenelon arm of Sturgeon Lake. Removal was 98.6%, with total loading of **36.9 kg**. Again, this is nearly one-sixth of what the MOE sets as the objective. There was one massive spill of 'partly treated' sewage in early July amounting to 73,500 gallons into Cameron Lake, owing to heavy rains. We need to have the MOE/City of Kawartha Lakes (CKL) investigate why rain gets into their system. Heavy rain is not a particularly unusual event.

Coboconk: Here there were good results, with 98.6% removal. Flows were down 33%, as surface water was previously entering the system. (There are so many opportunities for major problems with communal sewage facilities.) Problems have occurred with odour and neighbours have complained of the smell from the lagoons, which are situated just north of town west of the Gull River. Total phosphorus loading was **21.6 kg**.

Bobcaygeon: It appears the earlier problems have been rectified. This town has two side-by-side plants. Located at the confluence of the Bobcaygeon River and Pigeon Lake, one plant was performing very badly. Both now function similarly. Unfortunately, while both plants have had separated reports for years, in October, the MOE requested that a single combined report be issued, which was done for November and December. This makes the 2010 data difficult to summarize and will obscure any problems with either plant in the future. I spoke with the report author at the Ontario Clean Water Agency and she has agreed to provide the separate data in the report as well as the combined MOE summary. Plant 1 had a ten-month removal rate of 96.8% and Plant 2 had a rate of 96.9%. The combined rate for November-December was only 95.8%. Average overall removal rate then was 96.6%, still the poorest of our three main (Sturgeon Lake) plants. The total ten-month loading for Plant 1 was 42.0 kg, and Plant 2 was 38.7 kg. Inexplicably, the combined loading for the last two months is not provided, but based on the removal efficiencies, it should be around 21.5 kg. Total loading then would be about **102.2 kg**. This is almost 50 per cent of Lindsay's load, and Lindsay is four times larger than Bobcaygeon. I note that all plants have achieved 99+% removal in certain months. If they could achieve this as a norm, Bobcaygeon would be discharging around 30 kg. Accordingly, they're currently getting about three times what we'd like to see.

Kings Bay: This little plant had mechanical problems in 2010 so it could not meet its phosphorus effluent target, exceeding it by about 30% for the year. Total loading was 18.6 kg, approaching that of Coboconk. These problems at Kings Bay plant were fixed late in the year and the plant was functioning properly into early 2011, we're told. Fortunately, this plant discharges into a tile bed, rather than directly to the lake, so further phosphorus removal can be expected to occur within the ground.

Omemee: Most of the effluent here is discharged as spray irrigation to fields. When spray irrigation is impractical, some discharges are to the Pigeon River, usually in the winter when the lagoon storage capacity is exceeded. There are major problems here and an Environmental Assessment (EA) has recently been completed for a new facility. This is to consist of expanded lagoons to store the plant's sewage effluent, with increased spray irrigation during the warmer months for disposal. We hope the emergency discharges into the Pigeon River will no longer occur, as is intended. There has not been volume data available for the effluent discharged to the Pigeon River. However, the phosphorus removal rate this year was a mere 82%.

Mike Stedman and I met with the MOE to discuss the low standard decreed for effluent that some of our plants are permitted under their Certificates of Approval and to understand the wide variability. Essentially, this is due to the date at which the plants were given their approvals. As the MOE came to recognize the negative effects these plants were having on the lakes in the past, the standards were tightened up with each subsequent certificate as technology allowed. Plants with apparently 'lax' effluent standards were ones that were approved many years ago. If there is no application from a plant to expand or otherwise change their facilities, the old certificates stand as-is, because they do not expire. However, when a new approval is required, this is the MOE's opportunity to impose a higher standard. The MOE has taken note of our concerns and expects that increasingly high standards will prevail in future certificates. Fortunately, notwithstanding low standards at many plants, the operators are clearly going over and above the standards voluntarily.

If we keep up the pressure for higher standards for our municipal treatment plants, we can expect the quality of the water in our lakes to continue to improve.

Osprey

Lake Management Planning in the City of Kawartha Lakes

Rob Messervey, CAO, Kawartha Conservation

Kawartha Lake Stewards Association receives 2012 Community Conservationist Award

We were pleased to recognize the KLSA with a 2012 *Community Conservationist Award* during our Annual General Meeting for their long-term research and work contributing to the health of lakes in the Kawarthas. This work, and KLSA's participation on a Community Advisory Panel, is making an important contribution to Lake Management Planning in the City of Kawartha Lakes.

Kawartha Conservation Director Chuck Mercier presents the 2012 Community Conservationist Award to the Kawartha Lake Stewards Association, accepted by Kawartha Lake Stewards Vice-Chair Kathleen Mackenzie

Why lake management planning?

The need for a coordinated approach to lake management planning became increasingly apparent in 2011, with a large outbreak of blue-green algae in the northeastern arm of Sturgeon Lake, and smaller outbreaks in other areas. We also experienced beach closures due to high *E.coli* levels, excessive aquatic plant growth in many areas, erosion along some of our shorelines and other issues that tell us our lake ecosystems are under stress.

We are beginning to understand the stresses and what we need to do to enhance lake health, as we enter our third year of the Sturgeon Lake Management Plan and second year of the Balsam and Cameron Lake Management Plan. These plans are both funded by the City of Kawartha Lakes, with tremendous in-kind and other contributions from all participants. The initiation of these plans has come after our successful completion of the Lake Scugog Environmental Management Plan, which is now in the implementation phase and producing results.

Research begins to uncover impacts on Sturgeon Lake health

Monitoring activities continued across the Sturgeon Lake watershed in 2011 and a monitoring report for the 2010-2011 hydrological year was published. The results indicated that there is good water quality in many areas of Sturgeon Lake. However, a significant amount of phosphorus is entering the lake from the Scugog River, mainly due to stormwater and seasonal runoff from the Town of Lindsay.

Phosphorus is a nutrient that, along with other factors, can increase the potential for excessive aquatic plant growth, blue-green algae (cyanobacteria) blooms and lower water quality. Phosphorus is present in the following:

- Lawn and agricultural fertilizers
- Waterfowl and animal waste

- Soil particles that run into water bodies from erosion
- Rain and snow, and
- Effluent from septic systems.

We also detected high maximum levels of phosphorus in the smaller creeks and rivers that drain to the lake, with Jennings and McLaren creeks having the highest. Although these tributaries have a smaller influence on the lake than the Scugog River, they can influence their immediate outflow areas.

A positive finding was that the large amount of water entering Sturgeon Lake at Fenelon Falls had lower phosphorus levels. This water combines with water from the Scugog River and the smaller tributaries as it flows toward Bobcaygeon. The average phosphorus concentration at the Bobcaygeon outflow from Sturgeon Lake was either at, or just below, the upper limit of what the province considers healthy.

For many people on Sturgeon Lake, 2011 was not a great year due to the blue-green algae. While water quality may be good most of the time, the lake is still vulnerable to significant nutrient spikes that can contribute to this and other issues. It is possible that, just before the outbreak, a long, dry period resulted in a large amount of nutrients accumulating on lawns, hard surfaces and in urban areas. During the heavy rain that followed, these nutrients would have been washed into the lake all at once.

During the study stage of the plan, we are in the process of identifying ways of reducing both the average nutrient levels in the lake and the severity of nutrient spikes, to decrease the potential for future blue-green algae outbreaks.

Sediment sampling on Sturgeon Lake

We began sediment sampling with the Ministry of the Environment (MOE), collecting five samples from the southwestern portion of the lake in the summer of 2011. The samples were sent to the Laboratory Branch of the MOE to be analyzed for nutrients, metals and other widespread contaminants found in natural waters and sediments. This list includes Polychlorinated Biphenols (PCBs), Polycyclic Aromatic Hydrocarbons (PAHs), Organochlorinated (OC) pesticides and metals, as well as total phosphorus, organic nitrogen, organic carbon, and particle size.

PCBs and OC pesticides (Heptachlor-Epoxide) were detected above guidelines at two stations near Snug Harbour (SD3 and SD4). At the same stations, the metals Cadmium, Chromium, Copper, Lead and Zinc, and also PAHs, exceeded corresponding guidelines. A more detailed analysis of the data is currently underway, as we plan for the collection of sediment samples from the eastern portion of the lake in 2012.

Balsam & Cameron Lake Management Plan initiated

Launch of the Balsam and Cameron Lake Management Plan at the municipal dock in Coboconk on June 18, 2011, during the Fresh Water Summit Festival. From left to right: Councillor Patrick O'Reilly; Councillor Doug Elmslie; Lou Probst, City of Kawartha Lakes Environmental Advisory Committee; Councillor Brian Junkin; Dave Pridham, Kawartha Conservation; Councillor Emmett Yeo; Trent-Severn Waterway Superintendent Dawn Bronson; Mayor Ric McGee; MP Barry Devolin; and Councillor Stephen Strangway.

In 2011, we established a monitoring network in the Balsam and Cameron lake watersheds, and held an official launch for the plan at "Canada's Fresh Water Summit" event in Coboconk.

The monitoring network includes water quality, shared by Kawartha Conservation (17 sites), the Kawartha Lake Stewards Association/Lake Partner Program (five sites), and the Ministry of Environment (three sites). Water quantity is monitored by Kawartha Conservation (one site) and Trent-

Severn Waterway (two sites). Precipitation is monitored by Kawartha Conservation (two sites). Bacteria levels at public beaches are monitored by the Haliburton, Kawartha, Pine Ridge District Health Unit (six sites).

We will begin reporting on our findings in 2012.

The benefits of a scientific approach

Science is an important foundation for lake management plans. It provides the following:

- Information needed for making informed decisions involving the lake
- Credibility for recommended updates to Official Plan policies and other strategic plan documents
- Precise knowledge of specific issues, including the local ecological and socio-economic contexts in which they occur, that enables targeted stewardship actions and a greater return on investments of money, time and other resources.

City of Kawartha Lakes Mayor Ric McGee provides opening remarks at a Lake Management Planning open house on October 25, 2011 at Ops Community Centre, Lindsay.

Monitoring is also important for detecting changes in the environment, which may include both improvements and environmental deterioration. It enables us to respond quickly to issues before they become too difficult and expensive to manage, and funders and other contributors can be confident that their investments are achieving measurable results.

We are ensuring the credibility of our research by working under the guidance of a Science and Technical Committee that includes our own Water Quality Specialist, Dr. Alex Shulyarenko, and representatives from Trent University, Fleming College, the local Health Unit, and the Ministry of Agriculture, Food and Rural Affairs. This committee reviews and approves sampling protocols and networks. Guest experts also attend on an ad hoc basis to discuss various concerns and issues.

The Killarney Bay-Cedar Point Cottage Association along with Kawartha Conservation staff naturalize the shoreline at Killarney Bay Parkette, Balsam Lake, on May 18, 2011.

A Natural Heritage Strategy will contribute to the plans

The Kawartha Heritage Conservancy and Victoria Stewardship Council are leading a group of partners in the development of a Natural Heritage Strategy for the Kawartha Lakes region. Natural heritage includes all living organisms, natural areas and ecological communities that we inherit and leave to future generations. The development of this strategy involves many organizations represented on the lake management planning Community Advisory Panel. The final product will provide recommendations and considerable support for aspects of the lake management plans.

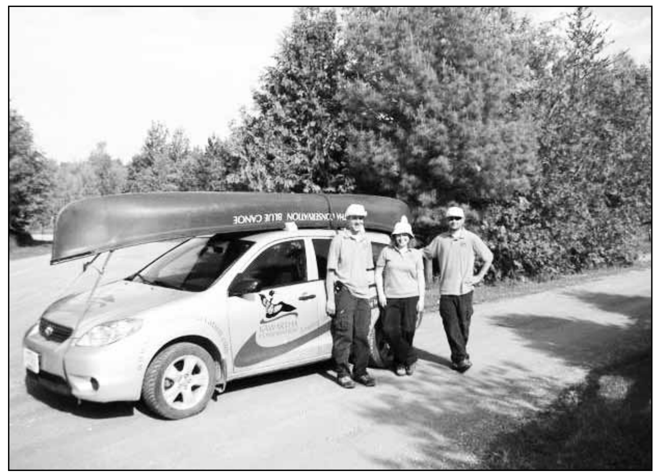
Working toward a healthier environment

While developing the plans, we have been undertaking stewardship actions to get a head start on improving the health of our lakes and environment.

There are specific types of actions that are proven to contribute to lake health, including naturalizing your shoreline (the more area, the better), avoiding the use of fertilizers and other lawn chemicals, picking up pet waste, keeping leaves and other organic debris from entering storm sewers and the lake, and undertaking septic system maintenance and upgrades where needed.

In 2011 we encouraged these actions across our watershed area by:

- Working directly with 1,130 landowners and business owners
- Engaging 255 participants in three workshops
- Engaging over 200 community members at seven ratepayer/cottage association meetings
- Responding to over 150 requests for stewardship support, including blue-green algae
- Conducting over 93 site visits under our Shoreline Naturalization Advisory Program
- Distributing over 2,000 copies of *Living In Town* to urban residents around Lake Scugog
- Supporting 17 projects with grant dollars, resulting in 757m^2 of shoreline being vegetated, and
- Visiting 310 properties under the Ontario Drinking Water Stewardship Program and allocating $81,555 in grants that help protect municipal drinking water sources.



In 2008, the Blue Canoe team visited over 1,600 property owners around Lake Scugog to help them protect their lake. In 2012, they will be out on Balsam, Cameron and Sturgeon Lakes.

The Blue Canoe is coming to Balsam, Cameron and Sturgeon

We are expanding our stewardship activities in 2012 by bringing back the Blue Canoe – a popular program on Lake Scugog during the completion of the Lake Scugog Environmental Management Plan.

This community-based, social marketing program will involve working with partners such as the KLSA and Victoria Stewardship Council. Over a three-year period, we intend to initiate direct contact with 1,500 property owners on Sturgeon Lake, 450 on Cameron Lake and 1,200 on Balsam Lake. Qualified technicians will provide information and personalized consultations while gaining commitments from the property owners to undertake beneficial management practices and projects on their properties.

Some of the other activities in 2012 will include continued monitoring with partners in the Balsam, Cameron and Sturgeon lake watersheds, and more open houses, among other activities. We also intend to extend planning to a portion of Pigeon Lake.

Thank you!

Lake management planning in the City of Kawartha Lakes is a collaborative effort. More than just public consultation, stakeholders and partners are making decisions and guiding activities through the various committees. We had four Community Advisory Panel meetings, two Science and Technical Committee meetings and one Executive Liaison Group meeting in 2011.

Many thanks to everyone who has participated in this program; it is going to be another exciting and busy year in 2012.

Kawartha Lake Water Quality and Summertime Flow Rates

Kevin Walters, KLSA Vice-Chair

Recently there has been controversy over many issues affecting the Kawartha Lakes:

- Blue-green algae/cyanobacteria blooms
- Increased weeds and filamentous algae
- Increased phosphorus levels in late summer
- Trent-Severn Waterway (TSW) reservoir lake property owners' demand for retention of water
- Proposals for more hydro generation along the waterway
- Deteriorating infrastructure
- Lack of funding for the Trent-Severn Waterway

All of these issues are linked:

We know that phosphorus (P) levels increase during the summer when flow rates are typically reduced, usually close to the minimum mandated by the TSW. It appears that the source of this phosphorus is from local southern streamflows (which are higher in phosphorus than that from the north) and sewage treatment plant discharges/urban stormwater runoff, along with re-solution from the lake sediments, which are high in phosphorus.

Accordingly, the concentration of phosphorus in our lakes is affected by the amount of low-phosphorus water entering our lakes from the north. It follows then, that reducing the flows from the north will result in increased phosphorus levels in the Kawartha Lakes and increasing the flows will have the opposite effect.

Blue-green algae blooms, like any algae blooms, are associated with higher phosphorus levels. This relationship is not one of direct cause and effect, but there is a clear link, i.e., lakes with high P levels have frequent blooms, lakes with low levels have infrequent or no known blooms.

For this reason, Kawartha Lake Stewards Association (KLSA) has been working diligently to seek out unnatural sources of nutrients and undertake whatever practical means are available to reduce these inputs. In our lakes, these sources currently appear to be primarily municipal sewage treatment plants, urban stormwater runoff and agriculture. These taps can neither be turned off completely nor reduced overnight.

So clearly we need to maintain, at the very least, current reservoir lake flows in the summer months to keep P levels down and, in turn, the opportunities for blue-green algae blooms. Any reduction in flows would be likely to aggravate the blooms.

Aquatic plants, i.e., nuisance weeds, are another matter. Weed growth has been prolific of late, partly due, we suspect, to increased water clarity due to a combination of nutrient reductions and zebra mussels. However, we have a long legacy of high nutrient levels in our waters and this has, no doubt, led to unusually high levels in the sediments. This nutrient, we believe, partially returns to the water at certain times of the year, by dissolving directly or through re-suspension. It is partly taken up by those aquatic plants and then returned to the water when the plants die and decay. The rest returns to the sediment to go back into the water another day. That which returns to the water may in turn be taken up by weeds later or by algae. Throughout this process some of this nutrient is flushed downstream and out of the lake. This cycle repeats itself every year with some of the phosphorus from the sediments being returned to the water stream and flushed out of the system. We know that the deeper water of the lakes becomes anoxic (low oxygen) at times during late summer, and this condition facilitates the movement of phosphorus from the sediments to the water. It appears that, in time, excess sedimentary phosphorus will be flushed out of the lakes and the levels in the sediments gradually depleted until reaching a stable level.

How can we speed up this process? The cycle of weed life and death is something we really can't change nor can we change the total flushing rate, given a defined watershed and rainfall. However, we can enhance the flushing rate in summer when it matters the most. That's when the water is warmest, and weed and algae growth is at its peak. This is also the time when anoxia occurs and when it would be most opportune to increase the flushing rate through the system, moving this dissolved phosphorus downstream and out of the lakes.

The key to enhancing the summer flow rate is stored reservoir water in the reservoir lakes. Currently, the TSW holds back as much reservoir water as possible in the summer, with a minimum flow rate being maintained through the Kawartha Lakes.

Come autumn, excess retained water is released to drop the reservoir lake water levels to their prescribed water levels, usually set to assist lake trout spawning. This results in a huge 'wastage' of water that might have been passed through the system during the summer months, keeping phosphorus levels lower and minimizing the potential for algal blooms. This water might have been utilized for other purposes as well.

Hydro electricity is also generated along the waterway, in the reservoir lake part of the system (Haliburton, Minden and Norland), in the Kawartha Lakes (Fenelon Falls, Lakefield) and, in particular, further downstream. Regular reliable and substantial flows are important to hydro-electric companies. The TSW has the potential to supply greater regularity than it currently does. There are several undeveloped sites currently licensed, and which can be expected to come into production. There are other sites that have potential for redevelopment, e.g., Bobcaygeon, or new development.

The reservoirs on the upper lakes in the watershed have the potential to supply more water during the dry summer periods than they currently do. There are a number of reasons that they don't. One is the state of the infrastructure itself, i.e., aging infrastructure, and an archaic manual operation methodology. Another major reason is that the shoreline along the reservoir lakes has now become substantially developed. In spite of the fluctuating water levels, these are often very scenic shores with few constraints to residential use, and excellent water quality. Falling water levels during the summer create problems for dock owners who have to move their docks out to deeper waters or otherwise have to lower them. Navigational hazards present themselves, and difficulty can be had in navigating through shallow connecting channels. Accordingly, many property owners along the reservoir shorelines want to see less fluctuation during the prime summer months, and lobby for retention of higher, more stable levels.

Of course this pits one water user group against another, and everyone's needs cannot be fully satisfied. While we might like to see increased release rates from the reservoir lakes, especially during late summer, we know that that would be most unpopular to the north, and a major challenge to implement, at least without appropriate mitigating measures.

Most of us have heard how the system is deteriorating from lack of funding, and money is urgently needed to enable repairs. We need to go beyond this. The system is rather outdated, operated mostly using 19th century technology, with little automation or modern infrastructure. With modernization, the flows could be better controlled, conserving water for when it is needed, say for the Kawartha Lakes in late summer, and maintaining the highest practical water levels in the reservoir lakes. Further to this, if the reservoir lake connection channels could be deepened to permit boat passage during low water, and/or buoyed to facilitate safe navigation, more water could be drawn with less impact to the reservoir lake users. Other potential flow augmentation, such as the restoration of the west outlet of the Mississagua River to the Bald Lakes could increase the flushing rate of the huge 'Lake Kawartha' or 'Great Buckhorn' lake group without increased discharges from the reservoir lakes. All this requires funds.

What we *all* need to do is get together to lobby for better funding for the TSW, for its operational activities and infrastructure, to optimize the performance of the extensive system we have, in order to obtain the best possible water management scenario for all interests.

The TSW offers a recreational waterway available to everyone, including reservoir lake property owners. I recommend that all such cottagers take a boat tour of at least a part the waterway that their lakes support. This will lead to a much better appreciation and understanding of this complex and unique system, and perhaps greater demand for adequate funding.

The Shoreline Buffer Zone: Water Quality Improvement through Landscape Planning

Helen Batten, Principal Landscape Architect, Basterfield & Associates Inc., Peterborough, Ontario

Waterfront property owners have never been more willing to help in the increasing and most necessary effort to contribute to better water quality in the Kawartha Lakes. Through the process of thoughtful site and landscape design, we can prioritize our interactions with land and water to make informed decisions about how our impact on waterfront properties can contribute to better water quality both in the lakes and in the ground. "It's All About the Water"…. more urgently than ever before. It is heartening to experience the increase in understanding that is taking place among professionals and the public. With respect to landscape design and construction, every decision matters and every person can make a difference.

Landscape design begins with establishing a 'wish list' of all the activities and facilities that need to be supported on the site. As waterfront 'wish list' discussions begin, we anticipate clients' needs that typically include waterfront access, swimming, docking, sitting, boating, fishing, etc. The 'water' also has a voice that is arguably the more urgent voice. In taking water quality protection and enhancement seriously, the voice of the lake trumps the landowner's needs. 'Tighter' waterfront development regulations reflect this situation and exist to encourage better environmental protection and improvement.

Protecting water quality in the lakes also means protecting the source water that enters the lakes. Surface runoff control and groundwater protection include strategies to allow surface water to percolate into the ground, to trap sediment from overland flows, to slow down and de-channelize storm water, finding options to spread surface flows and create natural filtration through vegetation and grading. Making changes to land adjacent to open water (cutting and filling, vegetation removal, soil compaction, etc.) directly affects the ability of the riparian zone to protect shoreline ecology and water quality. Naturally occurring vegetation, with established roots near the shore, is integral to a healthy waterfront. Also imperative throughout a generous buffer zone are diversity and high quantity of plants, rough textures, permeable materials, shade, slopes rather than walls, and absence of fertilizers, herbicides and pesticides.

It is encouraging to note a definite trend toward the landowner's desire and ability to articulate the lake's needs – to understand that disturbing the naturally occurring ecology and biodiversity can lead to degradation of aquatic environs, local water quality, and indeed the sustainability of the greater reach of the aquifer beyond one property's borders.

If I own waterfront property, what can I do? How can I help?

Highly effective and relatively simple beneficial actions can occur in the shoreline buffer zone. Disturbance of the buffer zone should be held to an absolute minimum. Where disturbance is unavoidable, landscape reconstruction and ecological enhancements should follow. Landscape planning decisions moving further inland are equally important, but the shore zone is the least tolerant of change brought on by development. Consider these suggestions to guide protection and enhancement of the buffer zone:

- Identify the shoreline buffer zone: measure inland from the water's edge at least 10 metres (30 feet). This zone should remain as natural as possible, including all existing rock, vegetation, tree roots, tree stumps, grades, organic debris, drainage (or lack of it) patterns and soils.

- Avoid mowing existing vegetation or using turf-grass sod in the buffer zone. Denser, more robust vegetation slows potentially erosive surface runoff from running quickly into the lake. Also, vegetation at least 60 centimetres (two feet) high will deter waterfowl from walking onto the land. Taller vegetation blocks sight lines of swimming geese. If geese can't see comfortable ground to walk on, they are less likely to try to get out of the water. If the ground is rough, because of rock rubble or vegetation, geese will move on.

- Do not feed waterfowl. They will not easily forget the gesture, which most landowners come to regret.

- Use no fertilizer, herbicide or pesticide. Phosphorus contained in fertilizer is a major cause of high nutrient levels in the water, leading to excess growth of aquatic vegetation and algae blooms. Instead take nothing away. Mulch fallen leaves or clippings to recycle the nutrients in-situ.

- Maintaining existing conditions in the shoreline buffer zone also encourages protection of habitat for all species, especially species at risk. Land-based habitat meets water-based habitat in the shoreline zone, and it follows that biodiversity increases where habitat is highly variable. This interface of habitat type and transition space is highly sensitive to disruption by virtue of its inherent complexity.

- Add native plants to the buffer zone to improve habitat for native species of all types. Avoid invasive plants, as they inhibit establishment and natural succession of native plants. Also, plant fragments and seeds are easily conveyed by open water, increasing invasiveness.

- Encourage over-wintering of milfoil weevil. The milfoil weevil is an indigenous biological control for invasive aquatic water milfoil. Weevils walk out of the water in the fall and seek protection in organic material in the top 10 centimetres (four inches) of soil and organic debris, a distance of up to six metres (20 feet) from the shore. Maintain organic material and leaf-fall in that zone, and avoid raking in the fall. Hold off 'cleaning up' until late May, when the weevils are expected to be back in the water.

- Hold off 'cleaning up' leaves altogether if possible, as a strategy to encourage decomposition and healthy soil microbial activity, which contributes to topsoil generation. This is especially necessary in parts of the Kawarthas where native soils are characteristically thin. A healthy topsoil layer is imperative for ongoing seed germination and sustainability of plant communities at the shore.

- If vegetation alone is not adequate for shoreline stabilization, add rock rubble to areas that are eroding (applying for permits where necessary). Create a gentle slope rising away from the water to dissipate onshore waves, allow natural flotsam deposition, deter geese and reduce potentially damaging ice-push. Rock rubble and rough vegetation also assist in trapping sediment in surface runoff from washing into the lake, slowing and cleaning and cooling the runoff in the process.

- Maintain existing roots and mature trees and shrubs. Besides the habitat provided by the upper structure of plants, existing roots stabilize soils well beyond the visible canopy of the tree above. Tree canopies near shores create important shade for fish and contribute to evenness of water temperature. But existing trees often conflict with landowners' desire to see the water. Selective pruning for views is often possible without wholesale removal of trees. Vegetation within one metre (three feet) of the ground should be left alone. Selective removal of (not more than 20%) of secondary branches, maintaining a balance in the canopy as a whole, can contribute to view, light access to the ground level (which encourages development of essential ground level vegetation), and ongoing health of the tree and root structures.

- Consider the buffer zone as a sponge. Surface runoff should be encouraged to percolate as much as possible, maximizing the potential for nutrient-laden water to be utilized by land-based root systems and intercepting water that would otherwise flush directly into the lake. This is especially important between the septic tile bed and the lake, or, if the bed is behind the building, on either side of that building. Avoid hardening the buffer zone with patios or paths constructed of impermeable materials. For example: decks are better than patios in the buffer zone, as the ground underneath can remain permeable. Paths made of granular materials or mulch, rather than paving stones or concrete, allow water percolation into the soil and reduce the concentration and speed of stormwater runoff.

- Avoid the use of asphalt or concrete driveways. These generate substantial runoff that could overwhelm the buffer zone.

• Dissipate roof-top rainwater via numerous downspouts, or, where practical, avoid the use of eaves-troughs.
A final note, and an encouraging trend, is our changing perception of what constitutes 'beauty' in the landscape.

Landscape architecture is rooted in finding a balance between human activity and environmental stewardship. And we value what we judge to be beautiful. In environmental terms there can be no beauty without health. A healthy landscape has biodiversity and sustainability. When we understand how to improve the health of an environment, we are much more likely to regard it as beautiful. Rather than man's historic high-maintenance control of landscape (Versailles, suburbia…), with dependence on artificial additives to ensure growth, our current role, in the context of improving water quality, is more one of a knowing, compassionate parent: we guide landscape development, make choices and provide opportunities for natural systems to work together and encourage trends in environmental improvement. We monitor, observe and provide positive influences when necessary.

Every waterfront property owner can and does influence the health of their shoreline buffer zone (knowingly or not), whether their lake frontage is 30 metres or 3,000 metres. If human actions are not a benefit to the waterway, they are a detraction; there is very little neutral effect. Choices that help rather than hinder are the goals of environmental stewardship. Each and every decision with respect to alterations to the shoreline buffer zone, no matter how seemingly small, has effects on the health of the shoreline and on water quality, and every landowner can make a positive difference.

Robin Blake

Young naturalists at work

TSW Canoe Slide Restoration Between Two Kawartha Lakes – Lower Buckhorn and Lovesick Lakes

John Ambler and Mark Potter

Lovesick and Lower Buckhorn Lakes share the water and shoreline of the Provincial Park at Wolfe Island and the surrounding islands. The area remains uninhabited and a true wilderness, which makes it attractive to canoeists and kayakers. Until the 1950s these lakes were known as Lovesick Lake, with Deer Bay (on Lower Buckhorn) listed as a large body of water on upper Lovesick Lake. In the 1930s, a canoe slide was built to connect the two lakes during the off-season or when the nearby lock was not in operation. In 1953 the slide was repaired and rebuilt, and then sometime in the 1970s it disappeared.

During the summer of 2010, Mark Potter of Lower Buckhorn and John Ambler of Lovesick Lake, two true conservationists, believed that there was enough interest among cottagers on both sides of the lock to rebuild the canoe slide, which would make portage around the Lovesick Lock (Lock 30) much easier.

The two wrote a letter to Parks Canada (Trent-Severn Waterway [TSW]), requesting permission to reconstruct this Heritage Canoe Slide on the original foundation, which still existed. The TSW responded positively and undertook an environmental assessment. After careful assessment of any impact of the construction and permanent slide to species-at-risk (SAR), other environmental concerns and right-of-way property rights between the Provincial Government and Parks Canada, the TSW granted a permit in the spring of 2011.

Mark and John determined that the project would cost about $1,000 for materials, which had to be raised through volunteer contributions. Through the generosity of the nearby Lake Associations, several cottagers and a resort, these funds appeared quickly. The labour was all by volunteers.

Construction and assembly took place in June. On July 10, cottagers, canoeists and kayakers, as well as government representatives and the local paper, all arrived at the new canoe slide for the ribbon-cutting. Volunteers demonstrated the ease of canoe and kayak travel between the two lakes: paddle to the slide, get out, put the craft on the slide, walk beside the craft, pulling it to the other side. The new slide portage was used extensively throughout the remainder of the summer of 2011.

Photo by Steven Potter

New canoe slide between Lovesick and Lower Buckhorn Lakes

To ensure that the slide remains in good repair for many years, a Donation Box is located at the site. So if you are paddling in the neighbourhood of Lock 30, stuff a couple of loonies in your pocket before leaving your dock.

The Trent-Severn Waterway is very willing to work with community groups and lake associations to improve or rebuild infrastructure along the Waterway. If you, too, are interested in restoring a canoe slide or other structure in your lake, present your idea, get the permits and get started.

sustainable
Peterborough

James Knott, Outreach Coordinator – Sustainable Peterborough

From September 2011 to March 2012, the Greater Peterborough Area (GPA) community (City, County and its eight townships, Curve Lake and Hiawatha First Nations) collaboratively developed its very own Sustainability Plan – known as Sustainable Peterborough. This Plan serves as a roadmap for the next 25 years; guiding the region towards achieving healthier environments, more equitable social systems and a more prosperous economy. Over 2,200 community members directly participated in its development, helping to create an overall vision, establish goals and strategic directions for each of the eleven theme areas of focus, and propose specific actions that will help us move toward our regional vision of sustainability:

Caring communities balancing prosperity, well-being and nature.

Often a top-of-mind issue in the GPA, our lakes and rivers were continuously identified by residents throughout the development of Sustainable Peterborough as something they truly value about the region and as something we should be taking measures to conserve and protect for future generations to enjoy. The work undertaken by volunteers in groups such as the Kawartha Lake Stewards Association is immeasurably valuable in this regard, and they should be commended for their outstanding work in the areas of lake monitoring, research and community education. Indeed, this work fits well with the goal established within Sustainable Peterborough's *water* theme and its four strategic directions:

Goal: *We will make wise use of our water to enhance its quality and quantity, ensuring that future generations will be able to use our water to drink, fish, and swim.*

- *Protect watersheds to ensure healthy water quality and quantity.*
- *Conserve the amount of water we use.*
- *Recognize and protect the ecological functions of the shorelines of water bodies.*
- *Maintain public access to our lakes and rivers for recreation and enjoyment.*

Although Sustainable Peterborough is supported by area municipalities, the Plan at times goes beyond their scope and mandate. Reflective of the collaborative, community-based approach taken to its development, a collaborative, partnership-based approach is required for its implementation. Work by groups such as the KLSA will further the legacy of Sustainable Peterborough. By continuing to: monitor trends in phosphorus levels in area lakes, study the algae found in local waters, or advise shoreline property owners on appropriate aquatic weed controls, the KLSA is helping to move the community as a whole toward its vision of sustainability.

To learn more about Sustainable Peterborough visit us at www.sustainablepeterborough.ca

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Sustainable Peterborough

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Appendix A:

KLSA Mission Statement, Board of Directors & Volunteer Testers

Mission Statement:

The Kawartha Lake Stewards Association was founded to carry out a coordinated, consistent, water quality testing program (including bacteria and phosphorus) in lake water in the Kawartha Lakes. The Kawartha Lake Stewards Association ensures that water quality test results, prepared according to professionally validated protocols with summary analysis, are made available to all 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.

2011-2012 Board of Directors

Mike Stedman, Chair
Lakefield

Kathleen Mackenzie, Vice-Chair
Stony Lake

Kevin Walters, Vice-Chair
Shadow, Lovesick and Sandy Lakes

Chris Appleton, Treasurer
Sturgeon Lake

Ann Ambler, Secretary
Lovesick Lake

Sheila Gordon-Dillane, Recording Secretary
Pigeon Lake

Pat Moffat, Past Chair*
Lovesick Lake

Tom Cathcart, Director**
Peterborough

Jeff Chalmers, Director
Clear Lake

Mike Dolbey, Director
Katchewanooka Lake

Janet Duval, Director
Lower Buckhorn Lake

Doug Erlandson, Director**
Balsam Lake

Mike Frings, Director**
Pigeon Lake

Rod Martin, Director*
Sturgeon Lake

Mark Potter, Director*
Lower Buckhorn Lake

*until October 1, 2011
**after October 1, 2011

Scientific Advisors

Dr. Eric Sager, Coordinator of the Ecological Restoration program at Fleming College and Adjunct Professor at Trent University

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

Volunteer Testers, 2011

Balsam Lake Association: Ross Bird, Cathrine Couchman, Douglas and Peggy Erlandson, Leslie Joynt, Barbara Peel, Diane Smith, Jeff Taylor, Bob Tuckett, Steve and Laura Watt

Big Bald Lake Association: Ron Brown, John Shufelt

Big Cedar Lake: Rudi Harner

Buckhorn Lake: Buckhorn Sands Property Owners: Jackie Shaver

Cameron Lake: Erin Macey

Chemong Lake: Ann Bulpit

Clear Lake – Birchcliff Property Owners Association: Jeff Chalmers

Clear Lake - Kawartha Park Cottagers' Association: Vivian Walsworth

Katchewanooka Lake – Lake Edge Cottages: Peter Fischer, Mike Dolbey

Lovesick Lake Association: Ron Brown, John Ambler, Ann Ambler

Lower Buckhorn Lake Owners' Association: Jeff Lang, Peter Miller, Mike Piekny, Mark and Diane Potter, Rob McRae, Peter Miller, Harry Shulman

Pigeon Lake – Concession 17 Pigeon Lake Cottagers Association: Jim Dillane, Sheila Gordon-Dillane

Pigeon Lake – North Pigeon Lake Ratepayers' Association: Tom McCarron, Francis Kerr

Pigeon Lake – Victoria Place: Ralph and Nona Erskine

Sandy Lake Cottagers Association: Mike and Diane Boysen

Sandy Lake – Harvey Lakeland Commonlands Owners' Association: Brian and Marg Norman

Shadow Lake and Silver Lake: Phil Taylor

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

Sturgeon Lake Association: Chris Appleton, Ken LeMasurier, Rod Martin, Paul Reeds

Upper Stoney Lake Association: Karl, Kathy, Ken and Kori Macarthur, and their Golden Retriever Kooper

White Lake Association: Wayne Horner

Appendix B: Financial Partners

Thank You to our 2011 Financial Partners

Federal Government Contributions
Trent-Severn Waterway (Parks Canada)

Provincial Government Contributions
Ontario Trillium Foundation

Municipal Government Contributions
City of Kawartha Lakes
Township of Douro-Dummer
Township of Galway-Cavendish & Harvey
Township of Smith-Ennismore-Lakefield

Community Association Donations

Big Cedar Lake Road Committee
Jack Lake Association
Killarney Bay ~ Cedar Point Cottage Association
Kawartha Protect Our Water
North Pigeon Lake Ratepayers' Association
Sandy Lake Cottagers Association
Stony Lake Heritage Foundation
White Lake Association

Private Business Donations

Basterfield and Associates Inc.
Beachwood Resort
Buckeye Marine
Clearview Cottage Resort
Egan Houseboat Rentals
Pinewood Cottages and Trailer Park
Red Eagle Family Campground
Rosedale Marina
Shining Waters B&B
And one anonymous business donor

Individual Donations

Mary Auld
David Bain
Robert Brown
Mike Dolbey
Patricia and Robert Green
Allan J. Heritage
Edward(Ted) and Mary Hill
Allan Hobbs
Barry and Carol Hooper
Jim Keyser
Ken King
Robert Little
Carol McCanse
Richard Morgan
Lou and Judy Probst
Kay (Kathleen)Ross
Linda Trott
Jelle and Karen Visser
Jim Watt
John Williamson

Many thanks to all of our generous donors

Appendix C: Financial Statements

Chris Appleton, KLSA Treasurer; Mike Stedman, KLSA Chair

Attached are financial statements showing Revenue, Expenditures and Net Assets for the Kawartha Lake Stewards Association for the years 2011 and 2010. The financial statements have been reviewed by McColl Turner LLP Chartered Accountants in Peterborough, Ontario. A copy of their Review Engagement Report is included. Our thanks to George Gillespie for his continuing support of KLSA.

The Statements show that KLSA had Excess Revenue of $17,172 in 2011. Included in that amount is $16,000 advanced by the Ontario Trillium Foundation for the Algae Project (see below) which amount is committed to completing the Project in 2012. Therefore the effective Net Revenue (net of the Algae Project) for 2011 is a modest $1,172. Net Revenue is down from 2010 due to slight increase in some expenses, and the granting of certain one-time honorariums to deserving individuals. In summary, KLSA essentially broke even on the year. For 2012 we forecast similar results in Net Revenue.

The Statements show that KLSA had Net Assets of $29,466 at year-end 2011. Netting out $16,000 for the Algae Project results in available Net Assets of $13,466. The Board considers that $10,000 is available for funding a new project. New projects are being considered, but no commitments have been made at this date.

The Algae Project is in the final year of a 27-month study in collaboration with Trent University and is funded by an Ontario Trillium Foundation grant. OTF monitors progress through regular reports. Work is on schedule for completion and publication this year. The OTF grant has been fully advanced, and the costs of completion of the Project are fully covered.

KLSA thanks the Stony Lake Heritage Foundation for its continuing support in accepting donations on behalf of KLSA and providing charitable receipts.

Jeff Chalmers

The KLSA Board and guests

Financial Statements of

KAWARTHA LAKES STEWARDS ASSOCIATION

December 31, 2011

Note To The Financial Statements
December 31, 2011

BASIS OF PRESENTATION

The accompanying financial statements relate to the incorporated association registered by Letters Patent as Kawartha Lakes 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.

In 2010, the Association collaborated with Trent University on an Algae Project with funding from the Ontario Trillium Foundation. The project is a 27 month study and has continued into 2011 with funding from Ontario Trillium Foundation of $36,000 (2010 – $35,000) while expenditures totalled $20,000 in the fiscal year (2010 – $35,976).

Kawartha Lakes 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 any 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.

McCOLL TURNER LLP
CHARTERED ACCOUNTANTS

McCOLL TURNER LLP
CHARTERED ACCOUNTANTS

362 Queen Street
Peterborough, ON
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P: 705.743.5020
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E: info@mccollturner.com
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REVIEW ENGAGEMENT REPORT

To Mr. Chris Appleton, Treasurer
KAWARTHA LAKES STEWARDS ASSOCIATION

We have reviewed the statement of financial position of Kawartha Lakes Stewards Association as at December 31, 2011 and the statement of operations for the year then ended. Our review was made in accordance with Canadian generally accepted standards for review engagements and accordingly consisted primarily of enquiry, analytical procedures and discussion related to information supplied to us by the Association.

A review does not constitute an audit and consequently we do not express an audit opinion on these financial statements.

Based on our review, nothing has come to our attention that causes us to believe that these financial statements are not, in all material respects, in accordance with Canadian generally accepted accounting principles.

McColl Turner LLP

Licensed Public Accountants

Peterborough, Ontario
March 16, 2012

KAWARTHA LAKES STEWARDS ASSOCIATION

Statement of Financial Position - December 31, 2011

	(Unaudited) 2011	2010
ASSETS		
Current Assets		
Cash	$ 24,466	7,294
Guaranteed Investment Certificate	5,000	5,000
	29,466	12,294
NET ASSETS	29,466	12,294
	$ 29,466	$ 12,294

Statement of Operations
Year ended December 31, 2011

	(Unaudited) 2011	2010
REVENUE		
Parks Canada, Trent-Severn Waterway	$ 3,000	$ 3,000
Ontario Trillium Foundation Grant	36,000	35,000
Municipal grants	5,755	5,750
Associations	2,110	6,700
Private contributions	2,300	1,686
Water testing fees	4,145	-
Interest	40	-
	53,350	52,136
EXPENDITURES		
Water testing fees	5,546	5,025
Algae project / Aquatic plant project	20,000	35,976
Annual report costs	6,275	3,470
Insurance	1,599	1,552
Telephone, copies and other administrative costs	2,692	2,387
Bank charges	66	49
	36,178	48,459
EXCESS OF REVENUE OVER EXPENDITURES FOR THE YEAR	17,172	3,677
NET ASSETS - beginning of year	12,294	8,617
NET ASSETS - end of year	$ 29,466	$ 12,294

McCOLL TURNER LLP
CHARTERED ACCOUNTANTS

Appendix D: Privacy Policy

Jeffrey Chalmers, KLSA Privacy Officer

As a result of recent Federal Privacy Legislation changes, all businesses and associations that collect personal information from their customers and members must develop and post a Privacy Policy. The following is the policy that your Board has developed to protect you and your personal information held by the Kawartha Lake Stewards Association (KLSA).

To our Membership: Your privacy is important to us. This policy tells you what information we gather about you, how we would use it, to whom we may disclose it, how you can opt out of the collection, use or disclosure of your personal information, and how to get access to the information we may have about you.

Collecting Information: We collect information about our members and volunteers such as name, address, relevant telephone numbers, email address and preferred method of communication. We obtain this information through the attendance form at our workshops and AGM, and by information provided by the many volunteers assisting in our lake water quality testing programs. We may keep the information in written form and/or electronically. Keeping your email address information at our email site allows us to send you information in an efficient and low cost manner. By providing this information to us, you enable us to serve you better.

Using Information: We use the information collected to provide you with information about the association activities and related lake water issues of interest to residents of the Kawartha Lakes. We will retain your personal information only for as long as required by law or as necessary for the purposes for which it is collected. Your personal information will not be used for other purposes without your consent.

Disclosing Information: We will not disclose any personal information collected about you to anybody else, unless required to do so by law. We will comply with all laws, which require us to supply the information to government agencies and others. We will not otherwise sell, transfer or trade any mailing list, which includes your information.

Keeping Information Secure: We will keep written information in a secure place.

Access to Information: If you wish to review the personal information we keep about you please contact the association c/o "Privacy Officer" at the address set out below. At your request, subject to applicable law, we will delete your personal information from our records. The Privacy Officer is not intended to be an elected position. It is an appointment to one of the elected directors of the board providing they are in good standing and have the support of the Chair and other directors.

Obtaining Your Consent: By providing personal information to us, you are consenting to us using it for the purposes set out above and disclosing it to the parties described above. If you do not want us to use any personal information about you, or wish to limit the use or disclosure of such personal information by us, please contact the Privacy Officer at the address set out below by mail.

Contacting us: We may be contacted by email at kawarthalakestewards@yahoo.ca or by regular mail to:

KLSA
24 Charles Court
RR #3 Lakefield, ON K0L 2H0

Appendix E: Rationale for *E.coli* Testing and 2011 Lake-by-Lake Results

Kathleen Mackenzie, KLSA Vice-Chair

Choosing sites

The goals of this testing were 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 swin in at all times and in all locations.*

Why did we test for *E.coli*?

E.coli was the bacteria of choice because:

- 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 ½ 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 such as in the Walkerton tragedy, or occasionally in ground beef 'scares'. 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.

Note: <3 means less than 3.

To put the results in perspective:

- 100 *E.coli*/100 mL is the level at which public beaches are posted unsafe for swimming in Ontario;
- KLSA considers counts over 50 *E.coli*/100 mL as somewhat high for the Kawartha Lakes, and cause for re-testing;
- counts 20 and below, with an occasional reading between 20 and 50, are normal for the Kawartha Lakes.

Balsam Lake

2011 *E.coli* Lake Water Testing
E.coli/100 mL

Site	4-Jul-11	18-Jul-11	25-Jul-11	27-Jul-11	2-Aug-11	8-Aug-11	6-Sep-11
00	3	22	**87**	16,11,16	3	8	3
01	3	8	39	--	3	<3	5
02	11, 8	8, 8	5	--	<3	<3	5
03	<3	<3	--	<3	<3	3	<3
04	<3	11	**59**	5, <3, 5, 5	<3	<3	3
05	8	46	--	22	<3	28	5
06	<3	<3	--	3	5	<3	11
07	3	5	5	--	3	8	<3
08	<3	43	3	--	22, 19	3	16
12A	<3	25	19	--	<3	3, <3	8
12B	5	39	<3	--	8	<3	<3
12C	5	49	49, 36	<3, <3, <3	<3	3	<3

As in previous years, counts were generally very low on Balsam Lake.

The July 18 tests were preceded by a thunderstorm and torrential rain at approximately 4:00 a.m. This may have been the reason for somewhat higher counts on Sites 3, 12A, 12B, and 12C.

The July 25 tests were preceded by a heavy rainfall that lasted for several hours during the night of 24-25 July, probably the cause of somewhat elevated counts at Sites 00, 01, 04 and 12C.

Big Bald Lake

2011 *E.coli* Lake Water Testing
E.coli/100 mL

Site	5-Jul-11	26-Jul-11	2-Aug-11	9-Aug-11
1	3	8	3	12
2	0	4	1	4
3	0	5	2	2
5	0	1	0	2
7	0	0	1	0
8	1	5	1	4

Similar to previous years, counts were consistently low on Big Bald Lake.

Big Cedar Lake

2011 *E.coli* Lake Water Testing
E.coli/100 mL

Site	5-Jul-11	19-Jul-11	3-Aug-11	9-Aug-11	30-Aug-11	7-Sep-11
640	0	1	16	0	4	3

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

To put the results in perspective:

- 100 *E.coli*/100 mL is the level at which public beaches are posted unsafe for swimming in Ontario;
- KLSA considers counts over 50 *E.coli*/100 mL as somewhat high for the Kawartha Lakes, and cause for re-testing;
- counts 20 and below, with an occasional reading between 20 and 50, are normal for the Kawartha Lakes.

Buckhorn Lake: Buckhorn Sands

2011 *E.coli* Lake Water Testing
E.coli/100 mL

Site	4-Jul-11	18-Jul-11	24-Jul-11	2-Aug-11	8-Aug-11	5-Sep-11
A	<2	10	2	2	1	5
B	<2	9	0	2	3	27
C	<2	4	6	2	2	2
D	2	13	2	0	3	4

As in previous years, counts were uniformly low in all locations tested in the Buckhorn Sands area, even though there were heavy rains before the July 18, August 8 and September 5 testing dates.

Clear Lake: Birchcliff Property Owners

2011 *E.coli* Lake Water Testing
E.coli/100 mL

Site	6-Jul-11	21-Jul-11	27-Jul-11	3-Aug-11	9-Aug-11
BB	4	10	28	0	3
1	0	2	0	0	0
2	0	1	0	0	0
3	18	0	0	7	**66**
4	0	0	1	9	4
5	0	3	0	0	0
6	1	1	1	0	1
7	0	1	0	0	24
8	6	2	2	16	**136**

Sites 3 and 8 are near a shoal where birds tend to roost, and this would likely be the source of the elevated counts here on August 9. Otherwise, counts were low, consistent with other years.

Clear Lake: Kawartha Park

2011 *E.coli* Lake Water Testing
E.coli/100 mL

Site	4-Jul-11	18-Jul-11	2-Aug-11	15-Aug-11
B	0	0	0	0
C	0	0	0	1
D	0	0	0	0
P	0	3	0	0
S	4	1	0	2
W	0	12	2	0

As in previous years, the Kawartha Park area exhibited very low counts.

To put the results in perspective:

- 100 *E.coli*/100 mL is the level at which public beaches are posted unsafe for swimming in Ontario;
- KLSA considers counts over 50 *E.coli*/100 mL as somewhat high for the Kawartha Lakes, and cause for re-testing;
- counts 20 and below, with an occasional reading between 20 and 50, are normal for the Kawartha Lakes.

Katchewanooka Lake

2011 *E.coli* Lake Water Testing *E.coli*/100 mL							
Site	**4-Jul-11**	**5-Jul-11**	**18-Jul-11**	**25-Jul-11**	**2-Aug-11**	**8-Aug-11**	**6-Sep-11**
2	--	6	19	32	32	25	1
5	--	5	13	10	25	11	24
6	--	1	3	14	2	11	0
7	6	--	21	6	<2	0	2

As in previous years, Site 2 had the occasional count over 50, so was not as consistently low as Sites 1, 6 and 7. There is no obvious reason for this.

Site 5 has had good years and bad years. It showed very low counts in 2001/02/05/06/07, but had frequent counts over 50 in 2003/04/08/09/10. This is at the mouth of a creek, with farms, a golf course and a wetland area upstream. Any of these may cause a rise in *E.coli* counts. 2011 was obviously one of the 'clean' years, but we don't know precisely why.

Lovesick Lake

2011 *E.coli* Lake Water Testing *E.coli*/100 mL						
Site	**5-Jul-11**	**19-Jul-11**	**25-Jul-11**	**2-Aug-11**	**8-Aug-11**	**6-Sep-11**
15	2	15	2	0	1	1
16	6	31	18	1	0	4
17	2	25	8	0	4	3

This is the fourth year of testing on these three locations. As in 2008/09/10, counts were uniformly low.

Lower Buckhorn Lake

2011 *E.coli* Lake Water Testing *E.coli*/100 mL						
Site	**14-Jul-11**	**18-Jul-11**	**25-Jul-11**	**2-Aug-11**	**8-Aug-11**	**5-Sep-11**
1	15	4	5	3	27	10
2	4	6	4	3	5	3
3	35	21	28	24	32	46
3A	--	43	--	--	--	--
5	1	2	4	0	41	1
8	3	3	1	0	25	21
9	4	1	0	0	4	**53**
11	2	5	--	5	9	**55**
12	28	6	--	**51**	9	29
13	2	28	--	1	7	24
14	0	2	1	1	7	3

Sites 2, 11 and 12 historically have had low counts, so the three counts over 50 at these sites were unusual. There was no obvious reason for this; there were no large collections of birds and no heavy rains previous to testing.

To put the results in perspective:

- 100 *E.coli*/100 mL is the level at which public beaches are posted unsafe for swimming in Ontario;
- KLSA considers counts over 50 *E.coli*/100 mL as somewhat high for the Kawartha Lakes, and cause for re-testing;
- counts 20 and below, with an occasional reading between 20 and 50, are normal for the Kawartha Lakes.

Pigeon Lake: Concession 17 Pigeon Lake Cottagers Assn.						
2011 *E.coli* Lake Water Testing *E.coli*/100 mL						
Site	**4-Jul-11**	**18-Jul-11**	**24-Jul-11**	**2-Aug-11**	**7-Aug-11**	**5-Sep-11**
A	<2	1	0	0	**70**	2
B	<2	7	2	1	1	0
3	<2	5	1	1	**68**	2

Over the years, there have been almost no counts over 50 on these three sites so the two elevated counts on August 7 were unusual.

Pigeon Lake: North Pigeon Lake Ratepayers' Assn.					
2011 *E.coli* Lake Water Testing *E.coli*/100 mL					
Site	**4-Jul-11**	**18-Jul-11**	**2-Aug-11**	**9-Aug-11**	**5-Sep-11**
1A	2	20	21	49	45
5	24	19	26	33	16
6	48	23	23	12	32
8	<2	2	2	1	3
13	<2	4	4	7	23

In the past, Sites 5 and 6 have occasionally had counts between 50 and 100 quite regularly, probably due to the presence of a large population of Canada Geese. As in 2010, these sites had consistently low counts this year.

Pigeon Lake: Victoria Place					
2011 *E.coli* Lake Water Testing *E.coli*/100 mL					
Site	**4-Jul-11**	**18-Jul-11**	**20-Jul-11**	**25-Jul-11**	**2-Aug-11**
1	3	49	5	11	19
2	<3	**52**	8	5	5
3	<3	33	5	5	5
4	5	**119**	5, 8	8, 11, 13	8
5	<3	30, 43	28	36, **59**	11

There was no obvious reason for the high reading at Site 4/July 18. In fact, all the readings on July 18 were somewhat elevated. Although rain gauges in the area show only a 14 mm rainfall, perhaps there was more rain locally. Also, there had been almost no rain for 19 days previous to this July 18, so perhaps there was a more 'dirty' runoff than usual.

To put the results in perspective:

- 100 *E.coli*/100 mL is the level at which public beaches are posted unsafe for swimming in Ontario;
- KLSA considers counts over 50 *E.coli*/100 mL as somewhat high for the Kawartha Lakes, and cause for re-testing;
- counts 20 and below, with an occasional reading between 20 and 50, are normal for the Kawartha Lakes.

Sandy Lake: Fire Route 48

2011 *E.coli* Lake Water Testing *E.coli*/100 mL		
Site	**7-Jul-11**	**12-Aug-11**
MD1	0	0
MD2	0	2

As in 2008/09, counts were uniformly very low on these Sandy Lake sites.

Sandy Lake: Harvey Lakeland Estates

2011 *E.coli* Lake Water Testing *E.coli*/100 mL			
Site	**7-Jul-11**	**15-Jul-11**	**15-Aug-11**
38	1	2	2
1286	0	4	0
1459	1	3	**113**
1501	11	2	34

The high count was probably due to waterfowl populations congregating on rock islets in very shallow water. This site is not in a swimming location.

Shadow Lake

2011 *E.coli* Lake Water Testing *E.coli*/100 mL					
Site	**4-Jul-11**	**18-Jul-11**	**25-Jul-11**	**2-Aug-11**	**6-Sep-11**
SH01	5, 16	5	3	<3	5

Readings were very low in this first year of testing on Shadow Lake.

Silver Lake

2011 *E.coli* Lake Water Testing *E.coli*/100 mL					
Site	**4-Jul-11**	**18-Jul-11**	**25-Jul-11**	**2-Aug-11**	**6-Sep-11**
SI01	13	5	5	<3	11

Readings were very low in this first year of testing on Silver Lake.

To put the results in perspective:

- 100 *E.coli*/100 mL is the level at which public beaches are posted unsafe for swimming in Ontario;
- KLSA considers counts over 50 *E.coli*/100 mL as somewhat high for the Kawartha Lakes, and cause for re-testing;
- counts 20 and below, with an occasional reading between 20 and 50, are normal for the Kawartha Lakes.

Stony Lake: Association of Stony Lake Cottagers

2011 *E.coli* Lake Water Testing
E.coli/100 mL

Site	4-Jul-11	11-Jul-11	18-Jul-11	19-Jul-11	25-Jul-11	26-Jul-11	2-Aug-11	8-Aug-11	6-Sep-11
E	2	--	7	--	--	6	2	3	6
F	2	--	1	--	--	6	6	8	3
I	<2	--	17	--	--	22	19	27	17
J	--	0	--	21	4	--	8	7	3
K	--	0	--	4	48	--	1	1	8
L	<2	--	4	--	--	9	8	1	**55**
P	0	--	0	--	--	0	25	**518**	0
26	<2	--	49	--	--	17	26	36	**56**
27	4	--	7	--	--	27	24	14	5
28	2	--	13	--	--	5	5	15	17

Once before, in 2004, there was a very high reading (1,580 *E.coli*/100 mL) at Site P. This is an area of high human use, including many live-aboard boats. Generally though, Site P has very low counts.

There was no obvious reason for the elevated counts at Sites L and 26 on September 6. The sites aren't near each other, and there had not been any rain in the 48 hours previous to testing.

Sturgeon Lake: North Shore Combined Group

2011 *E.coli* Lake Water Testing
E.coli/100 mL

Site	4-Jul-11	18-Jul-11	25-Jul-11	2-Aug-11	8-Aug-11	9-Aug-11	6-Sep-11
NS2A	11	**114**	**83, 136, 94**	22	8	--	28
NS3	36	**146**	**136, 94, 127**	**106**	**161**	--	19
NS4	<3	3	5, 5	<3	3	--	<3
SB1	49	49	**132**	8	<3	--	11
WS1	3	8	**83**	13, 8	19, 19	--	13, 13
SH-1-1	5	39	13	<3	8	--	11
SS1	--	8	<3	<3	--	28	--
SS2	--	3	11	--	--	8	--

The results for Sturgeon were typical of previous years, with several sites showing counts over 100 on several occasions. There was a very heavy rain, about 45 mm, just before the July 25 testing date, which may have resulted in more high counts on that date. This frequency of high counts, and at several sites, is unusual for a Kawartha lake. As stated in the 2010 report, it is possible that the *E.coli* reside in the sediments, and counts are higher when these sediments are disturbed.

However, a number of sediment samples were taken by Kawartha Conservation in 2010 as part of the Sturgeon Lake Management Plan, and no *E.coli* were found. However, there were some inflowing streams that had high *E.coli* counts. Results are preliminary however, and further work is needed before the source of the elevated *E.coli* counts in Sturgeon can be firmly identified.

To put the results in perspective:

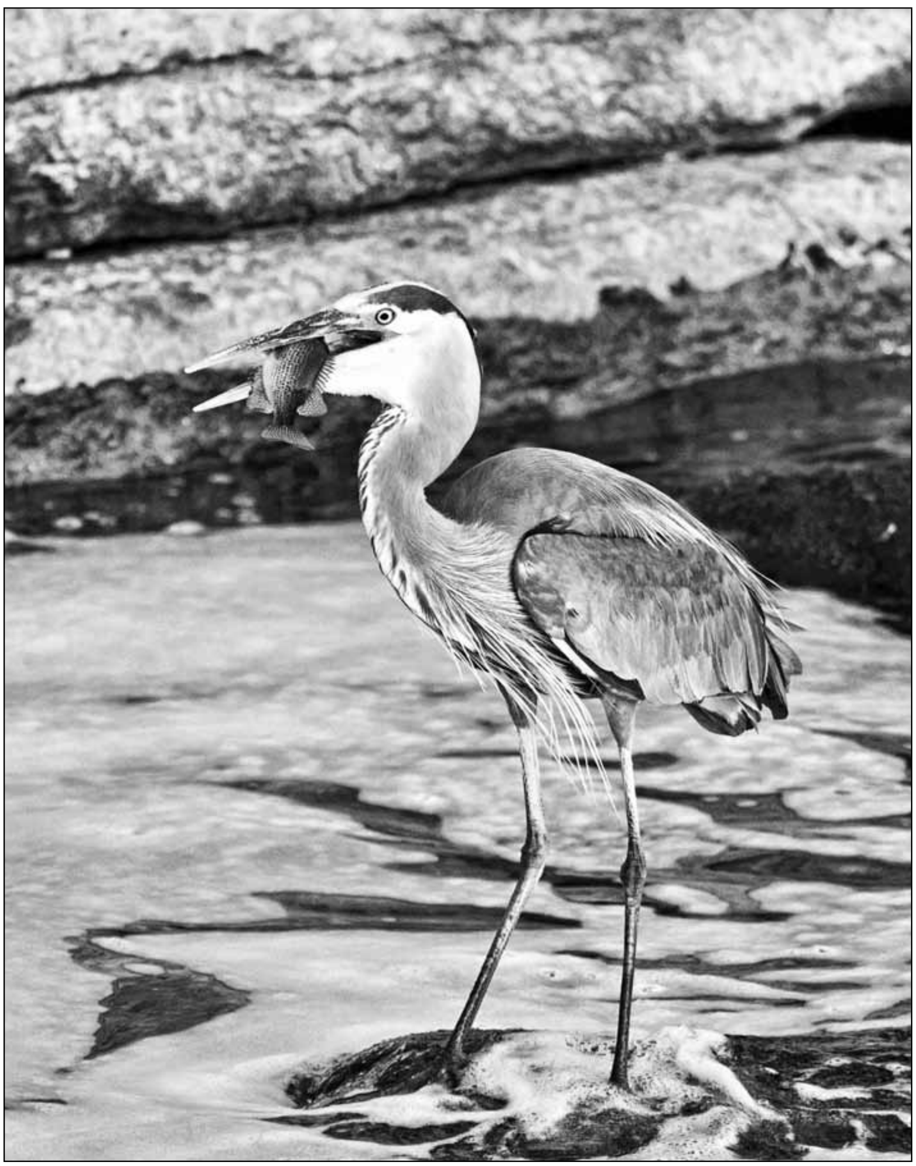
- 100 *E.coli*/100 mL is the level at which public beaches are posted unsafe for swimming in Ontario;
- KLSA considers counts over 50 *E.coli*/100 mL as somewhat high for the Kawartha Lakes, and cause for re-testing;
- counts 20 and below, with an occasional reading between 20 and 50, are normal for the Kawartha Lakes.

Upper Stoney Lake: Upper Stoney Lake Assoc.

2011 *E.coli* Lake Water Testing
E.coli/100 mL

Site	4-Jul-11	18-Jul-11	25-Jul-11	4-Aug-11	8-Aug-11	6-Sep-11
6	4	**52**	28	3	4	15
20	35	23	1	2	2	5
21	0	8	1	1	1	3
52	15	32	26	22	28	40
65	10	**52**	2	0	4	1
70	0	0	1	1	2	0
78A	2	2	9	2	0	2

Readings were generally low on Upper Stoney. The two slightly elevated counts on July 18 were a bit unusual, but it is normal on the Kawartha Lakes for a site to have an occasional count in this range.



Great Blue Heron

Appendix F: 2011 Phosphorus and Secchi Data

Kathleen Mackenzie, KLSA Vice-Chair

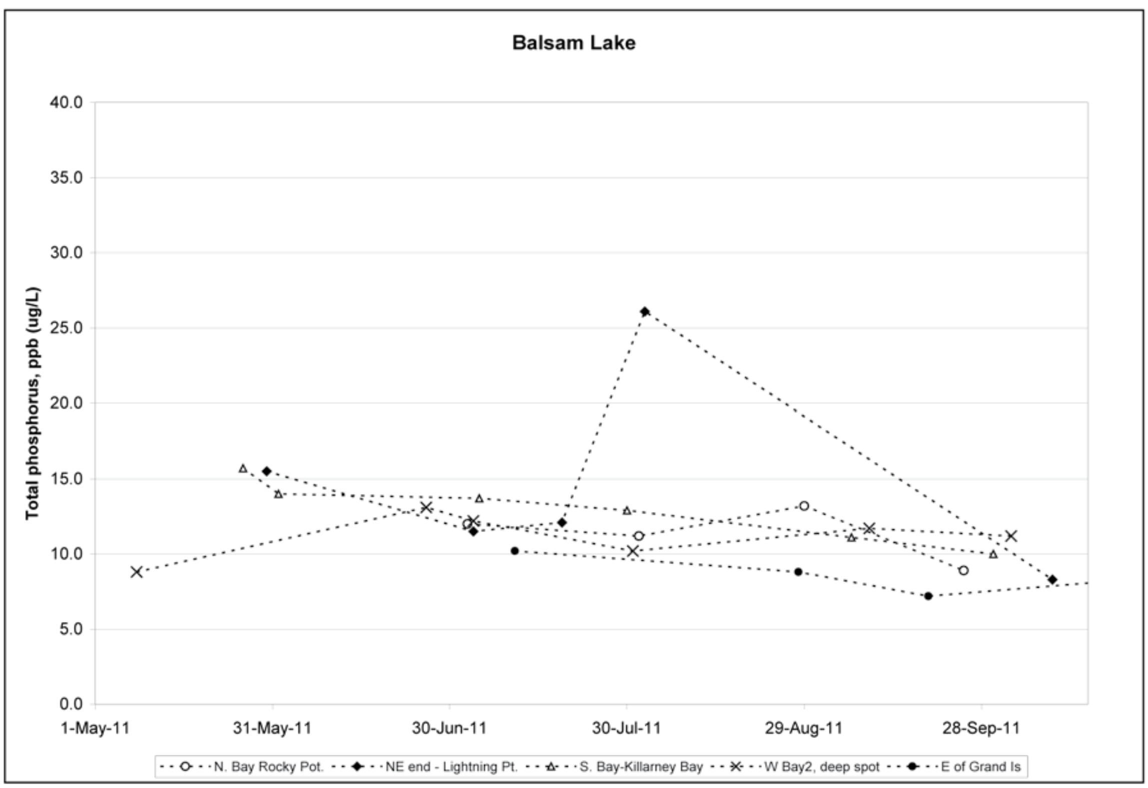
Why test for phosphorus? Arguably, phosphorus is the chemical that does the most aesthetic damage to inland lakes. Phosphorus encourages algal growth, resulting in a turbid lake and eventually thicker, enriched sediments that are more likely to grow aquatic plants. The Ontario Ministry of the Environment's Interim Provincial Water Quality Objective for Total Phosphorus is as follows:

> Current scientific evidence is insufficient to develop a firm Objective at this time. Accordingly, the following phosphorus concentrations should be considered as general guidelines which should be supplemented by site-specific studies:
>
> - To avoid nuisance concentrations of algae in lakes, average total phosphorus concentrations for the ice-free period should not exceed 20µg/L;
> - A high level of protection against aesthetic deterioration will be provided by a total phosphorus concentration for the ice-free period of 10µg/L or less. This should apply to all lakes naturally below this value;

Natural sources of lake phosphorus include rock, soil and decaying vegetation. Human sources include sewage treatment plants, septic systems, fertilizers, and urban and agricultural runoff.

Phosphorus levels are constantly changing in the Kawartha Lakes. They change in each lake from month to month, and on any one date, phosphorus levels differ from lake to lake. And they are somewhat different from year to year! Tracking these fluctuating phosphorus levels helps us to understand the chemistry of our lakes.

Balsam Lake: "Top o' the Trent"

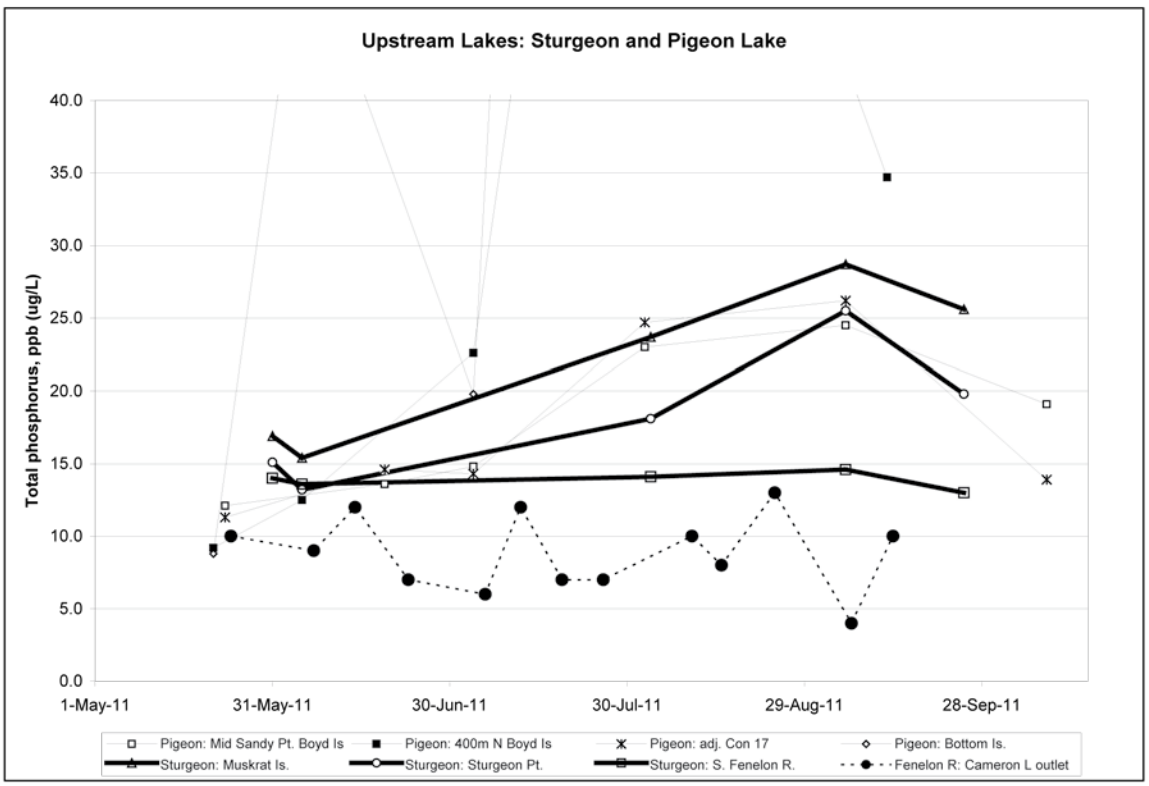


Balsam Lake is H-shaped, with a large flow through the NE corner in from Gull River and out into Cameron Lake. Balsam Lake is generally low in phosphorus (10 to 15 ppb) compared to its neighbours downstream of Fenelon Falls (15 to 25 ppb). This is probably mainly due to the large flows into Balsam from the north (Gull River), the low-phosphorus part of our watershed.

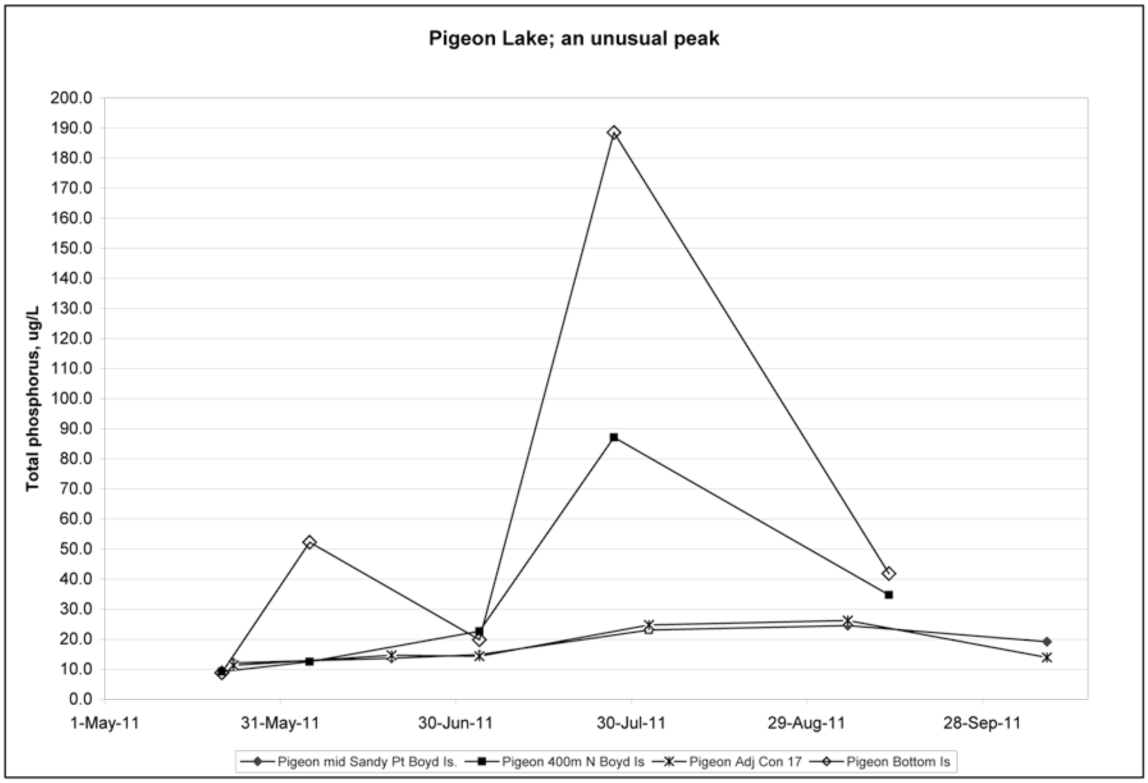
As in previous years, the lines for various locations in Balsam criss-cross over each other. This variation in water quality throughout the lake is probably due to less mixing of the water in Balsam than in most Kawartha lakes, due to its convoluted shape and the fact that the flow goes through one corner rather than from end to end as in most other Kawartha lakes.

KLSA can supply no explanation for the high reading at Lightning Point on August 2; this is 9 ppb higher than any other reading in the past five years at this location. It might possibly be contamination of the sample or an error in the laboratory. There is no Lake Partner phosphorus data for our lakes upstream, so there is no way of investigating where this phosphorus peak may have originated. There had been some heavy rains on July 25 and 29 (both over 40 mm), which would have resulted in nutrient-rich runoff. However, many times over the past 11 years we have tested many sites after heavy rains, and phosphorus hasn't shown a peak like this.

Upstream Lakes: Taking on a southern personality



While Balsam Lake has phosphorus levels much like the lakes to the north, Sturgeon takes on the personality of a more typical southern lake, and all the Kawartha lakes downstream from this are similar; Sturgeon 'sets the tone'. This year, Kawartha Conservation tested the Fenelon River at the outlet from Cameron Lake. One can see that, just upstream from Sturgeon Lake, phosphorus levels remain around 9 ppb throughout the summer. This jumps to an average of about 14 ppb at the 'South of Fenelon River' site. KLSA would like to know why is there such a jump over such a small distance, and why phosphorus increases as the water flows downstream (east) in Sturgeon Lake. Does it come from Lindsay's sewage treatment plant, or from agricultural and urban runoff from the Lindsay area, or from enriched sediments?



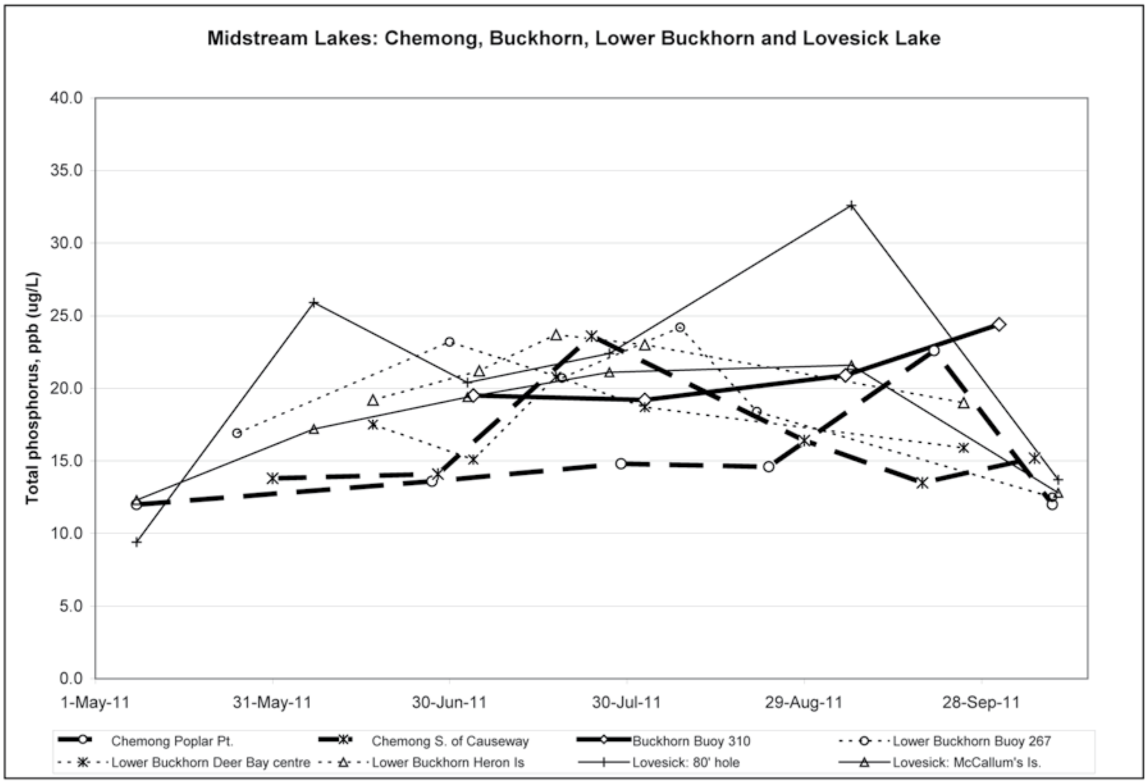
There was a most unusual spike in phosphorus levels at two locations in the northeast corner of Pigeon Lake on July 27. If there had been only one very high reading, it would probably be shrugged off as an error. However, when there are very high readings on two sites that are close to one another, it's time to take them seriously. There were no record-breaking rainfalls at that time, and this is an area where there is a lot of flow-through, so local runoff would not be a factor. If there was a spill of some sort, it must have been very large.

The peak at the Bottom Island site on June 5 may have been an error, or it may have been caused by the same mystery problem as July 27. Historically, this site has been very stable; was there something happening in the area bordered by Nogie's Creek/Bobcaygeon/Boyd Island this summer that may have contributed a large load of phosphorus?

(Please see Editor's note on page 22)

Great Blue Heron

Midstream Lakes



As water wends its way down through Buckhorn, Lower Buckhorn and Lovesick Lakes, phosphorus levels remain stable. There are two peaks at the Lovesick Lake '80 ft hole' site; peaks have not been seen in the past at this site.

One would expect Chemong Lake to have somewhat higher phosphorus levels than neighbouring Buckhorn Lake, because:

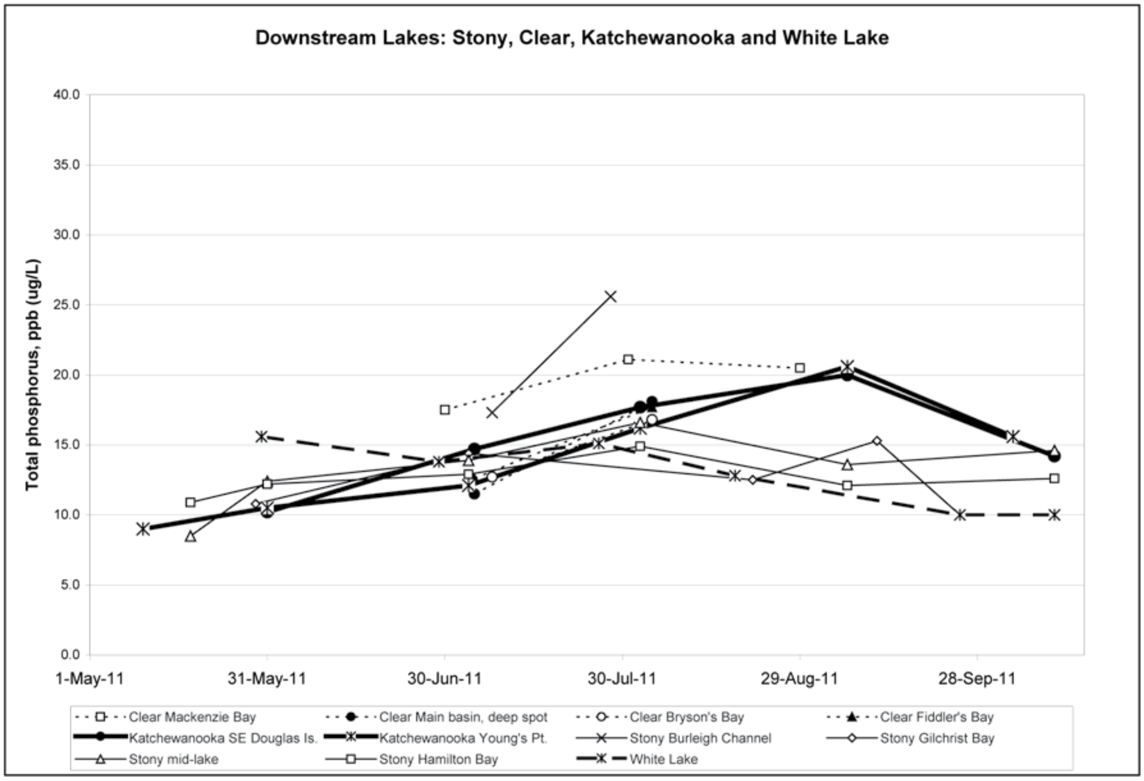
- It is a narrow lake, so has more shoreline and the shoreline tends to be agricultural and has denser residential populations than other Kawartha Lakes.
- It does not benefit from the flushing effect of the flow-through from the northern reservoir lakes.

However, the levels at the two Chemong Lake sites were, on average, slightly lower than those on Buckhorn and Lower Buckhorn.

Michael Frin

Kawartha sunset

Downstream Lakes



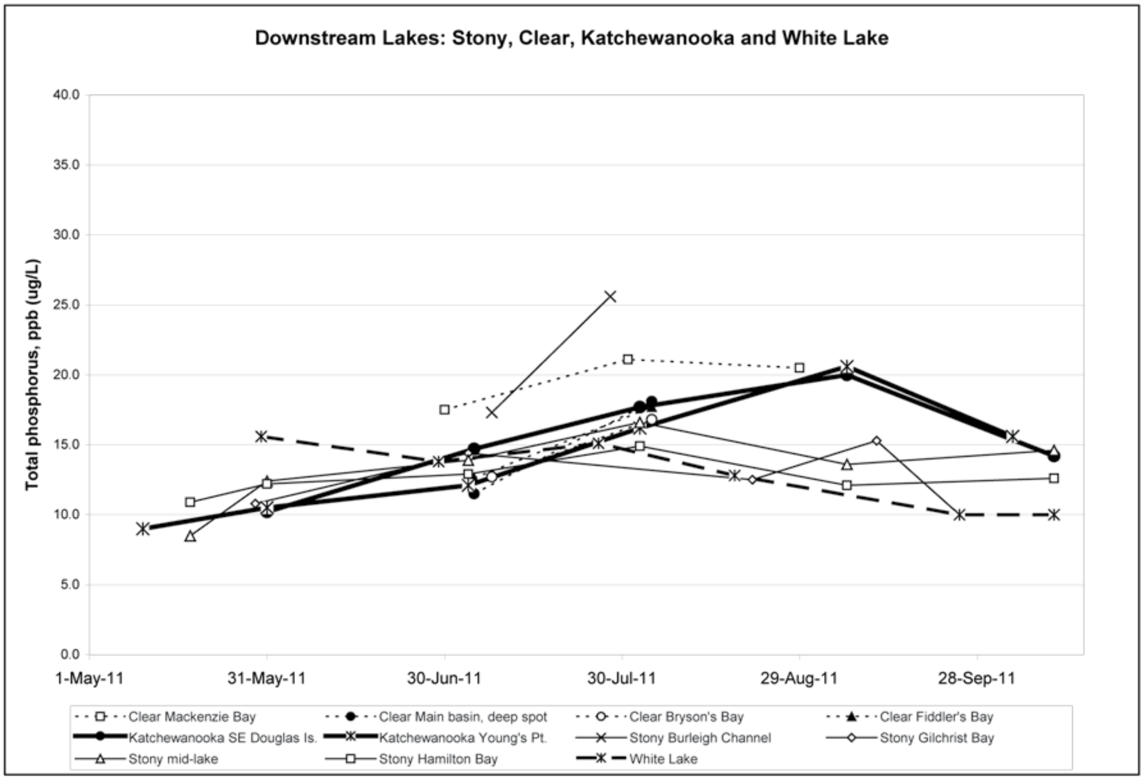
From July 1 onwards, these lakes are about 5 ppb lower in phosphorus than the upstream or midstream lakes. This is due to low-phosphorus water flowing in from Upper Stoney Lake. The 'Burleigh Channel' point on Stony Lake is the only point on the graph that is upstream from the inflow from Upper Stoney. Although there are only two points to the Burleigh Channel line, it is obvious that it is higher in phosphorus than the other locations in Stony Lake.

As in the past, the two Katchewanooka sites are somewhat higher in phosphorus than the Stony and Clear Lake sites in late summer.

Robin Bla

Lily pad bay

Low Phosphorus Lakes



As in previous years, there is a group of Kawartha lakes that have consistently low phosphorus levels. Upper Stoney Lake has low phosphorus because most of its water comes straight from the north via Jack's and Eels Creek. These ar low-phosphorus watersheds.

Sandy Lake is a special case. Its water is almost all from a very local watershed – it is almost a land-locked lake. It exist beside the Trent-Severn Waterway but is, for the most part, not linked by water to the TSW. It has little agricultural land, low development density and its chemistry is such that some phosphorus in the water is precipitated out on hot, sunny days.

Big Bald receives most of its water from local surface and groundwater and its water flows into the Trent-Severn Waterway.

An osprey feast

2011 Total Phosphorus Measurements

LAKE_NAME	Site Description	Date	TP1	TP2	Average Total Phosphorus (µg/L)
BALSAM LAKE	N Bay Rocky Pt.	3-Jul-11	11.8	12.2	12.0
BALSAM LAKE	N Bay Rocky Pt.	1-Aug-11	11.6	10.8	11.2
BALSAM LAKE	N Bay Rocky Pt.	29-Aug-11	11.8	14.6	13.2
BALSAM LAKE	N Bay Rocky Pt.	25-Sep-11	9.2	8.6	8.9
BALSAM LAKE	N/E end-Lightning Point	30-May-11	20.4	10.6	15.5
BALSAM LAKE	N/E end-Lightning Point	4-Jul-11	12.0	11.0	11.5
BALSAM LAKE	N/E end-Lightning Point	19-Jul-11	11.4	12.8	12.1
BALSAM LAKE	N/E end-Lightning Point	2-Aug-11	27.2	25.0	26.1
BALSAM LAKE	N/E end-Lightning Point	10-Oct-11	9.0	7.6	8.3
BALSAM LAKE	South Bay-Killarney Bay	26-May-11	18.4	13.0	15.7
BALSAM LAKE	South Bay-Killarney Bay	1-Jun-11	16.0	12.0	14.0
BALSAM LAKE	South Bay-Killarney Bay	5-Jul-11	13.2	14.2	13.7
BALSAM LAKE	South Bay-Killarney Bay	30-Jul-11	11.6	14.2	12.9
BALSAM LAKE	South Bay-Killarney Bay	6-Sep-11	11.0	11.2	11.1
BALSAM LAKE	South Bay-Killarney Bay	30-Sep-11	10.2	9.8	10.0
BALSAM LAKE	W Bay2, deep spot	8-May-11	8.6	9.0	8.8
BALSAM LAKE	W Bay2, deep spot	26-Jun-11	15.2	11.0	13.1
BALSAM LAKE	W Bay2, deep spot	4-Jul-11	12.4	12.0	12.2
BALSAM LAKE	W Bay2, deep spot	31-Jul-11	10.2	10.2	10.2
BALSAM LAKE	W Bay2, deep spot	9-Sep-11	11.8	11.6	11.7
BALSAM LAKE	W Bay2, deep spot	3-Oct-11	11.6	10.8	11.2
BALSAM LAKE	E of Grand Is	11-Jul-11	10.8	9.6	10.2
BALSAM LAKE	E of Grand Is	28-Aug-11	8.8	8.8	8.8
BALSAM LAKE	E of Grand Is	19-Sep-11	7.0	7.4	7.2
BALSAM LAKE	E of Grand Is	23-Oct-11	7.8	8.8	8.3
BIG BALD LAKE	Mid Lake, deep spot	24-May-11	9.8	9.6	9.7
BIG BALD LAKE	Mid Lake, deep spot	31-May-11	10.8	9.2	10.0
BIG BALD LAKE	Mid Lake, deep spot	5-Jul-11	14.6	14.8	14.7
BIG BALD LAKE	Mid Lake, deep spot	30-Jul-11	13.6	16.2	14.9
BIG CEDAR LAKE	Mid Lake, deep spot	21-May-11	6.8	9.0	7.9
BUCKHORN LAKE (U)	Narrows, red buoy C310	4-Jul-11	19.6	19.4	19.5
BUCKHORN LAKE (U)	Narrows, red buoy C310	2-Aug-11	21.8	16.6	19.2
BUCKHORN LAKE (U)	Narrows, red buoy C310	5-Sep-11	22.0	19.8	20.9
BUCKHORN LAKE (U)	Narrows, red buoy C310	1-Oct-11	20.6	28.2	24.4
CAMERON LAKE	S end, deep spot	31-May-11	9.8	12.4	11.1
CHEMONG LAKE	Poplar Pt.	8-May-11	11.8	12.2	12.0
CHEMONG LAKE	Poplar Pt.	27-Jun-11	14.4	12.8	13.6
CHEMONG LAKE	Poplar Pt.	29-Jul-11	16.0	13.6	14.8
CHEMONG LAKE	Poplar Pt.	23-Aug-11	14.6	14.6	14.6
CHEMONG LAKE	Poplar Pt.	20-Sep-11	19.0	26.2	22.6
CHEMONG LAKE	Poplar Pt.	10-Oct-11	12.2	11.8	12.0
CHEMONG LAKE	S. of Causeway	31-May-11	13.4	14.2	13.8
CHEMONG LAKE	S. of Causeway	28-Jun-11	14.2	14.0	14.1
CHEMONG LAKE	S. of Causeway	24-Jul-11	23.8	23.4	23.6
CHEMONG LAKE	S. of Causeway	29-Aug-11	16.0	16.8	16.4
CHEMONG LAKE	S. of Causeway	18-Sep-11	14.0	13.0	13.5
CHEMONG LAKE	S. of Causeway	7-Oct-11	14.4	16.0	15.2

CLEAR LAKE	MacKenzie Bay	30-Jun-11	17.8	17.2	17.5
CLEAR LAKE	MacKenzie Bay	31-Jul-11	20.0	22.2	21.1
CLEAR LAKE	MacKenzie Bay	29-Aug-11	19.8	21.2	20.5
CLEAR LAKE	Main Basin, deep spot	5-Jul-11	11.0	12.0	11.5
CLEAR LAKE	Main Basin, deep spot	4-Aug-11	19.8	16.4	18.1
CLEAR LAKE	Fiddlers Bay	5-Jul-11	11.6	13.6	12.6
CLEAR LAKE	Fiddlers Bay	4-Aug-11	17.0	18.4	17.7
CLEAR LAKE	Brysons Bay	8-Jul-11	11.0	14.4	12.7
CLEAR LAKE	Brysons Bay	4-Aug-11	15.8	17.8	16.8
FENELON RIVER	Cameron Lake outlet	24-May-11			10.0
FENELON RIVER	Cameron Lake outlet	7-Jun-11			9.0
FENELON RIVER	Cameron Lake outlet	14-Jun-11			12.0
FENELON RIVER	Cameron Lake outlet	23-Jun-11			7.0
FENELON RIVER	Cameron Lake outlet	6-Jul-11			6.0
FENELON RIVER	Cameron Lake outlet	12-Jul-11			12.0
FENELON RIVER	Cameron Lake outlet	19-Jul-11			7.0
FENELON RIVER	Cameron Lake outlet	26-Jul-11			7.0
FENELON RIVER	Cameron Lake outlet	10-Aug-11			10.0
FENELON RIVER	Cameron Lake outlet	15-Aug-11			8.0
FENELON RIVER	Cameron Lake outlet	24-Aug-11			13.0
FENELON RIVER	Cameron Lake outlet	6-Sep-11			4.0
FENELON RIVER	Cameron Lake outlet	13-Sep-11			10.0
KATCHEWANOOKA LAKE	S/E Douglas Island	31-May-11	10.0	10.4	10.2
KATCHEWANOOKA LAKE	S/E Douglas Island	5-Jul-11	13.8	15.6	14.7
KATCHEWANOOKA LAKE	S/E Douglas Island	2-Aug-11	18.4	17.0	17.7
KATCHEWANOOKA LAKE	S/E Douglas Island	6-Sep-11	21.2	18.8	20.0
KATCHEWANOOKA LAKE	S/E Douglas Island	11-Oct-11	14.2	14.2	14.2
KATCHEWANOOKA LAKE	Young Pt near locks	10-May-11	9.2	8.8	9.0
KATCHEWANOOKA LAKE	Young Pt near locks	31-May-11	11.0	10.0	10.5
KATCHEWANOOKA LAKE	Young Pt near locks	4-Jul-11	12.6	11.6	12.1
KATCHEWANOOKA LAKE	Young Pt near locks	2-Aug-11	16.0	16.4	16.2
KATCHEWANOOKA LAKE	Young Pt near locks	6-Sep-11	20.0	21.2	20.6
KATCHEWANOOKA LAKE	Young Pt near locks	4-Oct-11	15.6	15.6	15.6
LOVESICK LAKE	80' hole at N. end	8-May-11	10.0	8.8	9.4
LOVESICK LAKE	80' hole at N. end	26-Jun-11	18.6	33.2	25.9
LOVESICK LAKE	80' hole at N. end	3-Jul-11	20.8	20.0	20.4
LOVESICK LAKE	80' hole at N. end	27-Jul-11	22.2	22.6	22.4
LOVESICK LAKE	80' hole at N. end	6-Sep-11	24.2	41.0	32.6
LOVESICK LAKE	80' hole at N. end	11-Oct-11	13.4	14.0	13.7
LOVESICK LAKE	McCallum Island	8-May-11	11.8	12.8	12.3
LOVESICK LAKE	McCallum Island	27-Jun-11	17.4	17.0	17.2
LOVESICK LAKE	McCallum Island	3-Jul-11	19.2	19.6	19.4
LOVESICK LAKE	McCallum Island	27-Jul-11	22.2	20.0	21.1
LOVESICK LAKE	McCallum Island	6-Sep-11	21.2	22.0	21.6
LOVESICK LAKE	McCallum Island	11-Oct-11	13.0	12.6	12.8
LOWER BUCKHORN LAKE	Heron Island	24-Apr-11	10.2	11.2	10.7
LOWER BUCKHORN LAKE	Heron Island	17-Jun-11	19.4	19.0	19.2
LOWER BUCKHORN LAKE	Heron Island	5-Jul-11	22.6	19.8	21.2
LOWER BUCKHORN LAKE	Heron Island	18-Jul-11	24.0	23.4	23.7
LOWER BUCKHORN LAKE	Heron Island	2-Aug-11	23.4	22.6	23.0
LOWER BUCKHORN LAKE	Heron Island	25-Sep-11	18.4	19.6	19.0

LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	25-May-11	16.4	17.4	16.9
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	30-Jun-11	23.8	22.6	23.2
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	19-Jul-11	20.0	21.4	20.7
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	8-Aug-11	26.2	22.2	24.2
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	21-Aug-11	21.6	15.2	18.4
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	10-Oct-11	14.2	10.8	12.5
LOWER BUCKHORN LAKE	Deer Bay-centre	12-Apr-11	13.2	12.8	13.0
LOWER BUCKHORN LAKE	Deer Bay-centre	17-Jun-11	18.0	17.0	17.5
LOWER BUCKHORN LAKE	Deer Bay-centre	4-Jul-11	14.8	15.4	15.1
LOWER BUCKHORN LAKE	Deer Bay-centre	18-Jul-11	21.2	20.4	20.8
LOWER BUCKHORN LAKE	Deer Bay-centre	2-Aug-11	19.4	18.0	18.7
LOWER BUCKHORN LAKE	Deer Bay-centre	25-Sep-11	15.0	16.8	15.9
PIGEON LAKE	Middle, Sandy Pt/Boyd Is.	23-May-11	12.0	12.2	12.1
PIGEON LAKE	Middle, Sandy Pt/Boyd Is.	19-Jun-11	13.0	14.2	13.6
PIGEON LAKE	Middle, Sandy Pt/Boyd Is.	4-Jul-11	14.8	14.8	14.8
PIGEON LAKE	Middle, Sandy Pt/Boyd Is.	2-Aug-11	22.2	23.8	23.0
PIGEON LAKE	Middle, Sandy Pt/Boyd Is.	5-Sep-11	25.8	23.2	24.5
PIGEON LAKE	Middle, Sandy Pt/Boyd Is.	9-Oct-11	16.6	21.6	19.1
PIGEON LAKE	N-400m N of Boyd Is.	21-May-11	9.0	9.4	9.2
PIGEON LAKE	N-400m N of Boyd Is.	5-Jun-11	12.4	12.6	12.5
PIGEON LAKE	N-400m N of Boyd Is.	4-Jul-11	25.0	20.2	22.6
PIGEON LAKE	N-400m N of Boyd Is.	27-Jul-11	41.2	133.0	87.1
PIGEON LAKE	N-400m N of Boyd Is.	12-Sep-11	41.0	28.4	34.7
PIGEON LAKE	N end, Adjacent Con 17	23-May-11	11.2	11.4	11.3
PIGEON LAKE	N end, Adjacent Con 17	19-Jun-11	15.0	14.2	14.6
PIGEON LAKE	N end, Adjacent Con 17	4-Jul-11	13.8	14.8	14.3
PIGEON LAKE	N end, Adjacent Con 17	2-Aug-11	22.0	27.4	24.7
PIGEON LAKE	N end, Adjacent Con 17	5-Sep-11	23.2	29.2	26.2
PIGEON LAKE	N end, Adjacent Con 17	9-Oct-11	15.2	12.6	13.9
PIGEON LAKE	C 340 off Dead Horse Shoal	2-Jul-11	25.4	25.0	25.2
PIGEON LAKE	C 340 off Dead Horse Shoal	4-Jul-11	17.8	17.0	17.4
PIGEON LAKE	N-300yds off Bottom Is.	21-May-11	8.8	8.8	8.8
PIGEON LAKE	N-300yds off Bottom Is.	5-Jun-11	52.4	52.0	52.2
PIGEON LAKE	N-300yds off Bottom Is.	4-Jul-11	19.4	20.2	19.8
PIGEON LAKE	N-300yds off Bottom Is.	27-Jul-11	148.0	229.0	188.5
PIGEON LAKE	N-300yds off Bottom Is.	12-Sep-11	47.8	35.8	41.8
SANDY LAKE	Mid Lake, deep spot	21-May-11	6.2	7.6	6.9
SANDY LAKE	Mid Lake, deep spot	26-Jun-11	6.4	6.4	6.4
SANDY LAKE	Mid Lake, deep spot	27-Jun-11	7.6	9.6	8.6
SANDY LAKE	Mid Lake, deep spot	4-Aug-11	9.2	8.6	8.9
SANDY LAKE	Mid Lake, deep spot	2-Sep-11	6.8	6.0	6.4
SANDY LAKE	Mid Lake, deep spot	25-Sep-11	6.4	4.8	5.6
STONY LAKE	Burleigh locks chan.	8-Jul-11	17.8	16.8	17.3
STONY LAKE	Burleigh locks chan.	28-Jul-11	25.8	25.4	25.6
STONY LAKE	Gilchrist Bay	29-May-11	11.0	10.6	10.8
STONY LAKE	Gilchrist Bay	4-Jul-11	13.0	15.8	14.4
STONY LAKE	Gilchrist Bay	21-Aug-11	12.6	12.4	12.5
STONY LAKE	Gilchrist Bay	11-Sep-11	15.0	15.6	15.3
STONY LAKE	Gilchrist Bay	25-Sep-11	8.8	11.2	10.0
STONY LAKE	Mouse Is.	18-May-11	8.6	8.4	8.5
STONY LAKE	Mouse Is.	31-May-11	12.0	12.8	12.4
STONY LAKE	Mouse Is.	4-Jul-11	14.0	13.8	13.9

STONY LAKE	Mouse Is.	2-Aug-11	16.4	16.8	16.6
STONY LAKE	Mouse Is.	6-Sep-11	13.4	13.8	13.6
STONY LAKE	Mouse Is.	11-Oct-11	16.4	12.8	14.6
STONY LAKE	Hamilton Bay	18-May-11	6.4	15.4	10.9
STONY LAKE	Hamilton Bay	31-May-11	12.0	12.4	12.2
STONY LAKE	Hamilton Bay	4-Jul-11	13.2	12.6	12.9
STONY LAKE	Hamilton Bay	2-Aug-11	15.2	14.6	14.9
STONY LAKE	Hamilton Bay	6-Sep-11	12.4	11.8	12.1
STONY LAKE	Hamilton Bay	11-Oct-11	10.8	14.4	12.6
STURGEON LAKE	Muskrat Is. at Buoy C388	31-May-11	16.2	17.6	16.9
STURGEON LAKE	Muskrat Is. at Buoy C388	5-Jun-11	16.8	14.0	15.4
STURGEON LAKE	Muskrat Is. at Buoy C388	3-Aug-11	25.0	22.4	23.7
STURGEON LAKE	Muskrat Is. at Buoy C388	5-Sep-11	31.6	25.8	28.7
STURGEON LAKE	Muskrat Is. at Buoy C388	25-Sep-11	25.0	26.2	25.6
STURGEON LAKE	Sturgeon Point Buoy	31-May-11	14.4	15.8	15.1
STURGEON LAKE	Sturgeon Point Buoy	5-Jun-11	13.4	13.0	13.2
STURGEON LAKE	Sturgeon Point Buoy	3-Aug-11	16.8	19.4	18.1
STURGEON LAKE	Sturgeon Point Buoy	5-Sep-11	26.2	24.8	25.5
STURGEON LAKE	Sturgeon Point Buoy	25-Sep-11	19.6	20.0	19.8
STURGEON LAKE	S of Fenelon R-Buoy N5	31-May-11	14.0		14.0
STURGEON LAKE	S of Fenelon R-Buoy N5	5-Jun-11	13.6	13.6	13.6
STURGEON LAKE	S of Fenelon R-Buoy N5	3-Aug-11	14.2	14.0	14.1
STURGEON LAKE	S of Fenelon R-Buoy N5	5-Sep-11	15.2	14.0	14.6
STURGEON LAKE	S of Fenelon R-Buoy N5	25-Sep-11	12.8	13.2	13.0
UPPER STONEY LAKE	Quarry Bay	8-May-11	8.2	6.2	7.2
UPPER STONEY LAKE	Quarry Bay	31-May-11	6.0	6.4	6.2
UPPER STONEY LAKE	Quarry Bay	4-Jul-11	5.8	6.4	6.1
UPPER STONEY LAKE	Quarry Bay	4-Aug-11	8.0	8.0	8.0
UPPER STONEY LAKE	Quarry Bay	5-Sep-11	6.8	7.8	7.3
UPPER STONEY LAKE	Quarry Bay	11-Oct-11	4.8	6.4	5.6
UPPER STONEY LAKE	Young Bay	8-May-11	6.0	6.0	6.0
UPPER STONEY LAKE	Young Bay	31-May-11	6.8	6.8	6.8
UPPER STONEY LAKE	Young Bay	4-Jul-11	6.8	6.6	6.7
UPPER STONEY LAKE	Young Bay	4-Aug-11	8.0	8.6	8.3
UPPER STONEY LAKE	Young Bay	5-Sep-11	6.8	6.2	6.5
UPPER STONEY LAKE	Young Bay	11-Oct-11	6.2	6.0	6.1
UPPER STONEY LAKE	S Bay, deep spot	8-May-11	8.4	7.2	7.8
UPPER STONEY LAKE	S Bay, deep spot	31-May-11	8.6	8.8	8.7
UPPER STONEY LAKE	S Bay, deep spot	4-Jul-11	9.4	9.2	9.3
UPPER STONEY LAKE	S Bay, deep spot	4-Aug-11	10.4	11.6	11.0
UPPER STONEY LAKE	S Bay, deep spot	5-Sep-11	10.8	11.6	11.2
UPPER STONEY LAKE	S Bay, deep spot	11-Oct-11	6.2	5.8	6.0
UPPER STONEY LAKE	Crowes Landing	8-May-11	8.2	7.0	7.6
UPPER STONEY LAKE	Crowes Landing	31-May-11	7.4	11.4	9.4
UPPER STONEY LAKE	Crowes Landing	4-Jul-11	7.0	6.8	6.9
UPPER STONEY LAKE	Crowes Landing	4-Aug-11	9.2	8.6	8.9
UPPER STONEY LAKE	Crowes Landing	5-Sep-11	7.8	7.0	7.4
UPPER STONEY LAKE	Crowes Landing	11-Oct-11	6.0	9.4	7.7
UPPER STONEY LAKE	Mid Lake, deep spot	8-May-11	6.6	6.6	6.6
UPPER STONEY LAKE	Mid Lake, deep spot	31-May-11	7.6	6.0	6.8
UPPER STONEY LAKE	Mid Lake, deep spot	4-Jul-11	7.2	6.0	6.6
UPPER STONEY LAKE	Mid Lake, deep spot	4-Aug-11	8.4	11.0	9.7
UPPER STONEY LAKE	Mid Lake, deep spot	5-Sep-11	6.8	5.6	6.2
UPPER STONEY LAKE	Mid Lake, deep spot	11-Oct-11	5.4	14.8	10.1

WHITE LAKE (DUMMER)	S end, deep spot	30-May-11	15.8	15.4	15.6
WHITE LAKE (DUMMER)	S end, deep spot	29-Jun-11	13.4	14.2	13.8
WHITE LAKE (DUMMER)	S end, deep spot	26-Jul-11	14.6	15.6	15.1
WHITE LAKE (DUMMER)	S end, deep spot	18-Aug-11	11.6	14.0	12.8
WHITE LAKE (DUMMER)	S end, deep spot	25-Sep-11	10.6	9.4	10.0
WHITE LAKE (DUMMER)	S end, deep spot	11-Oct-11	9.8	10.2	10.0

2011 Secchi Depth Measurements

A higher Secchi depth measurement indicates clearer water. Generally, clearer lake water is preferred for recreation, so a trend toward lower clarity is something to watch for. In general, higher phosphorus reduces clarity. As well, the precipitation of calcium carbonate as a suspended particulate can reduce clarity in the warmer weather in hard-wate lakes, i.e., Scugog, Chemong and Sandy Lakes. Our lowest-phosphorus lake, Upper Stoney, has an average Secchi depth of 5.8 m, but higher-phosphorus lakes (downstream Sturgeon, mid-Pigeon) have average Secchi depths of 2.7 m. The largest change in clarity in the Kawartha Lakes in the last several decades occurred when zebra mussels arrived. These filter feeders removed algae from the lake, making the water much clearer, which was further assisted by reduced discharges from sewage treatment plants.

LAKE NAME	Site Description	Date	Secchi (m)
BALSAM LAKE	N Bay Rocky Pt.	2-Jun-11	5.0
BALSAM LAKE	N Bay Rocky Pt.	18-Jun-11	4.8
BALSAM LAKE	N Bay Rocky Pt.	3-Jul-11	4.8
BALSAM LAKE	N Bay Rocky Pt.	19-Jul-11	5.3
BALSAM LAKE	N Bay Rocky Pt.	1-Aug-11	5.3
BALSAM LAKE	N Bay Rocky Pt.	17-Aug-11	6.0
BALSAM LAKE	N Bay Rocky Pt.	29-Aug-11	4.8
BALSAM LAKE	N Bay Rocky Pt.	25-Sep-11	4.8
BALSAM LAKE	N/E end-Lightning Point	29-May-11	3.2
BALSAM LAKE	N/E end-Lightning Point	4-Jul-11	3.5
BALSAM LAKE	N/E end-Lightning Point	19-Jul-11	3.1
BALSAM LAKE	N/E end-Lightning Point	2-Aug-11	4.2
BALSAM LAKE	N/E end-Lightning Point	10-Oct-11	4.1
BALSAM LAKE	South Bay-Killarney Bay	26-May-11	3.5
BALSAM LAKE	South Bay-Killarney Bay	1-Jun-11	3.1
BALSAM LAKE	South Bay-Killarney Bay	5-Jul-11	3.1
BALSAM LAKE	South Bay-Killarney Bay	30-Jul-11	3.6
BALSAM LAKE	South Bay-Killarney Bay	6-Sep-11	3.6
BALSAM LAKE	South Bay-Killarney Bay	30-Sep-11	4.3
BALSAM LAKE	W Bay2, deep spot	8-May-11	3.0
BALSAM LAKE	W Bay2, deep spot	24-May-11	3.1
BALSAM LAKE	W Bay2, deep spot	5-Jun-11	3.1
BALSAM LAKE	W Bay2, deep spot	4-Jul-11	3.9
BALSAM LAKE	W Bay2, deep spot	18-Jul-11	3.0
BALSAM LAKE	W Bay2, deep spot	2-Aug-11	3.2
BALSAM LAKE	W Bay2, deep spot	18-Aug-11	4.3
BALSAM LAKE	W Bay2, deep spot	6-Sep-11	4.4
BALSAM LAKE	W Bay2, deep spot	22-Sep-11	4.5
BALSAM LAKE	W Bay2, deep spot	2-Oct-11	3.8
BALSAM LAKE	E of Grand Is	21-Jun-11	3.5
BALSAM LAKE	E of Grand Is	11-Jul-11	3.8
BALSAM LAKE	E of Grand Is	28-Aug-11	3.8
BALSAM LAKE	E of Grand Is	19-Sep-11	3.5
BALSAM LAKE	E of Grand Is	23-Oct-11	4.0

BIG CEDAR LAKE	Mid Lake, deep spot	21-May-11	4.5
BIG CEDAR LAKE	Mid Lake, deep spot	19-Jun-11	4.3
BIG CEDAR LAKE	Mid Lake, deep spot	3-Jul-11	4.3
BIG CEDAR LAKE	Mid Lake, deep spot	11-Jul-11	4.0
BIG CEDAR LAKE	Mid Lake, deep spot	19-Jul-11	4.2
BIG CEDAR LAKE	Mid Lake, deep spot	2-Aug-11	4.5
BIG CEDAR LAKE	Mid Lake, deep spot	16-Aug-11	5.0
BIG CEDAR LAKE	Mid Lake, deep spot	2-Sep-11	5.3
BIG CEDAR LAKE	Mid Lake, deep spot	10-Sep-11	6.5
BIG CEDAR LAKE	Mid Lake, deep spot	17-Sep-11	6.0
BIG CEDAR LAKE	Mid Lake, deep spot	29-Sep-11	6.5
BIG CEDAR LAKE	Mid Lake, deep spot	8-Oct-11	7.2
BUCKHORN LAKE (U)	Narrows, red buoy C310	12-May-11	3.0
BUCKHORN LAKE (U)	Narrows, red buoy C310	30-May-11	3.4
BUCKHORN LAKE (U)	Narrows, red buoy C310	12-Jun-11	2.7
BUCKHORN LAKE (U)	Narrows, red buoy C310	26-Jun-11	3.2
BUCKHORN LAKE (U)	Narrows, red buoy C310	10-Jul-11	3.6
BUCKHORN LAKE (U)	Narrows, red buoy C310	24-Jul-11	2.4
BUCKHORN LAKE (U)	Narrows, red buoy C310	6-Aug-11	2.4
BUCKHORN LAKE (U)	Narrows, red buoy C310	20-Aug-11	2.0
BUCKHORN LAKE (U)	Narrows, red buoy C310	3-Sep-11	2.4
BUCKHORN LAKE (U)	Narrows, red buoy C310	18-Sep-11	2.3
BUCKHORN LAKE (U)	Narrows, red buoy C310	1-Oct-11	2.6
CHEMONG LAKE	Poplar Pt.	8-May-11	2.6
CHEMONG LAKE	Poplar Pt.	18-Jun-11	3.0
CHEMONG LAKE	Poplar Pt.	27-Jun-11	2.7
CHEMONG LAKE	Poplar Pt.	11-Jul-11	2.3
CHEMONG LAKE	Poplar Pt.	29-Jul-11	2.5
CHEMONG LAKE	Poplar Pt.	16-Aug-11	2.5
CHEMONG LAKE	Poplar Pt.	21-Aug-11	2.8
CHEMONG LAKE	Poplar Pt.	23-Aug-11	2.4
CHEMONG LAKE	Poplar Pt.	9-Sep-11	2.9
CHEMONG LAKE	Poplar Pt.	20-Sep-11	2.9
CHEMONG LAKE	Poplar Pt.	6-Oct-11	2.9
CHEMONG LAKE	Poplar Pt.	10-Oct-11	2.9
CHEMONG LAKE	S. of Causeway	30-May-11	4.0
CHEMONG LAKE	S. of Causeway	28-Jun-11	3.0
CHEMONG LAKE	S. of Causeway	24-Jul-11	1.6
CHEMONG LAKE	S. of Causeway	29-Aug-11	2.6
CHEMONG LAKE	S. of Causeway	18-Sep-11	2.8
CHEMONG LAKE	S. of Causeway	7-Oct-11	3.0
CLEAR LAKE	Main Basin, deep spot	5-Jul-11	4.7
CLEAR LAKE	Main Basin, deep spot	4-Aug-11	3.1
CLEAR LAKE	Fiddlers Bay	5-Jul-11	3.7
CLEAR LAKE	Fiddlers Bay	4-Aug-11	3.2
KATCHEWANOOKA LAKE	S/E Douglas Island	5-Jun-11	4.6
KATCHEWANOOKA LAKE	S/E Douglas Island	21-Jun-11	5.1
KATCHEWANOOKA LAKE	S/E Douglas Island	5-Jul-11	5.0
KATCHEWANOOKA LAKE	S/E Douglas Island	18-Jul-11	4.7
KATCHEWANOOKA LAKE	S/E Douglas Island	2-Aug-11	3.7
KATCHEWANOOKA LAKE	S/E Douglas Island	15-Aug-11	3.8
KATCHEWANOOKA LAKE	S/E Douglas Island	6-Sep-11	3.8
KATCHEWANOOKA LAKE	S/E Douglas Island	11-Oct-11	5.4

KATCHEWANOOKA LAKE	Young Pt near locks	10-May-11	4.8
KATCHEWANOOKA LAKE	Young Pt near locks	31-May-11	4.8
KATCHEWANOOKA LAKE	Young Pt near locks	16-Jun-11	5.8
KATCHEWANOOKA LAKE	Young Pt near locks	4-Jul-11	6.0
KATCHEWANOOKA LAKE	Young Pt near locks	18-Jul-11	4.9
KATCHEWANOOKA LAKE	Young Pt near locks	2-Aug-11	3.4
KATCHEWANOOKA LAKE	Young Pt near locks	16-Aug-11	3.8
KATCHEWANOOKA LAKE	Young Pt near locks	6-Sep-11	3.5
KATCHEWANOOKA LAKE	Young Pt near locks	4-Oct-11	5.1
KATCHEWANOOKA LAKE	Young Pt near locks	17-Oct-11	4.0
KATCHEWANOOKA LAKE	Young Pt near locks	30-Oct-11	5.0
LOVESICK LAKE	80’ hole at N. end	8-May-11	5.5
LOVESICK LAKE	80’ hole at N. end	7-Jun-11	4.5
LOVESICK LAKE	80’ hole at N. end	5-Jul-11	5.0
LOVESICK LAKE	80’ hole at N. end	2-Aug-11	4.0
LOVESICK LAKE	80’ hole at N. end	7-Sep-11	4.0
LOVESICK LAKE	80’ hole at N. end	10-Oct-11	5.0
LOVESICK LAKE	McCallum Island	8-May-11	5.5
LOVESICK LAKE	McCallum Island	7-Jun-11	4.5
LOVESICK LAKE	McCallum Island	5-Jul-11	5.0
LOVESICK LAKE	McCallum Island	2-Aug-11	4.0
LOVESICK LAKE	McCallum Island	7-Sep-11	4.0
LOVESICK LAKE	McCallum Island	10-Oct-11	4.0
LOWER BUCKHORN LAKE	Heron Island	24-Apr-11	4.9
LOWER BUCKHORN LAKE	Heron Island	17-Jun-11	3.8
LOWER BUCKHORN LAKE	Heron Island	4-Jul-11	4.1
LOWER BUCKHORN LAKE	Heron Island	18-Jul-11	3.8
LOWER BUCKHORN LAKE	Heron Island	2-Aug-11	3.1
LOWER BUCKHORN LAKE	Heron Island	25-Sep-11	3.6
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	25-May-11	5.0
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	7-Jun-11	3.8
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	15-Jun-11	4.2
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	30-Jun-11	5.0
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	12-Jul-11	3.6
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	19-Jul-11	3.7
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	5-Aug-11	2.7
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	11-Aug-11	2.7
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	21-Aug-11	2.6
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	10-Oct-11	4.7
LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	21-Oct-11	4.5
LOWER BUCKHORN LAKE	Deer Bay-centre	24-Apr-11	4.4
LOWER BUCKHORN LAKE	Deer Bay-centre	17-Jun-11	4.1
LOWER BUCKHORN LAKE	Deer Bay-centre	4-Jul-11	3.9
LOWER BUCKHORN LAKE	Deer Bay-centre	18-Jul-11	3.8
LOWER BUCKHORN LAKE	Deer Bay-centre	2-Aug-11	3.1
LOWER BUCKHORN LAKE	Deer Bay-centre	25-Sep-11	3.5
PIGEON LAKE	Middle, Sandy Pt/Boyd Is.	23-May-11	2.7
PIGEON LAKE	Middle, Sandy Pt/Boyd Is.	19-Jun-11	2.9
PIGEON LAKE	Middle, Sandy Pt/Boyd Is.	4-Jul-11	3.0
PIGEON LAKE	Middle, Sandy Pt/Boyd Is.	2-Aug-11	2.2
PIGEON LAKE	Middle, Sandy Pt/Boyd Is.	5-Sep-11	2.0
PIGEON LAKE	Middle, Sandy Pt/Boyd Is.	9-Oct-11	3.3

PIGEON LAKE	N-400m N of Boyd Is.	9-May-11	3.5
PIGEON LAKE	N-400m N of Boyd Is.	4-Jul-11	3.0
PIGEON LAKE	N end, Adjacent Con 17	23-May-11	3.0
PIGEON LAKE	N end, Adjacent Con 17	19-Jun-11	2.8
PIGEON LAKE	N end, Adjacent Con 17	4-Jul-11	2.9
PIGEON LAKE	N end, Adjacent Con 17	2-Aug-11	2.1
PIGEON LAKE	N end, Adjacent Con 17	5-Sep-11	2.0
PIGEON LAKE	N end, Adjacent Con 17	9-Oct-11	3.3
PIGEON LAKE	C 340 off Dead Horse Shoal	15-Jun-11	2.7
PIGEON LAKE	C 340 off Dead Horse Shoal	4-Jul-11	3.0
PIGEON LAKE	C 340 off Dead Horse Shoal	2-Aug-11	1.9
PIGEON LAKE	N-300yds off Bottom Is.	9-May-11	3.1
PIGEON LAKE	N-300yds off Bottom Is.	4-Jul-11	2.8
SANDY LAKE	Mid Lake, deep spot	22-May-11	5.0
SANDY LAKE	Mid Lake, deep spot	2-Jul-11	5.0
SANDY LAKE	Mid Lake, deep spot	16-Jul-11	4.2
SANDY LAKE	Mid Lake, deep spot	2-Aug-11	4.7
SANDY LAKE	Mid Lake, deep spot	4-Sep-11	4.0
SANDY LAKE	Mid Lake, deep spot	25-Sep-11	4.8
STONY LAKE	Mouse Is.	18-May-11	4.2
STONY LAKE	Mouse Is.	31-May-11	4.1
STONY LAKE	Mouse Is.	4-Jul-11	4.1
STONY LAKE	Mouse Is.	2-Aug-11	4.0
STONY LAKE	Mouse Is.	6-Sep-11	3.9
STONY LAKE	Mouse Is.	4-Oct-11	3.8
STONY LAKE	Hamilton Bay	6-Sep-11	3.9
STONY LAKE	Hamilton Bay	4-Oct-11	4.0
STURGEON LAKE	Muskrat Is. at Buoy C388	5-Jun-11	3.4
STURGEON LAKE	Muskrat Is. at Buoy C388	3-Jul-11	3.6
STURGEON LAKE	Muskrat Is. at Buoy C388	3-Aug-11	2.2
STURGEON LAKE	Muskrat Is. at Buoy C388	6-Sep-11	2.1
STURGEON LAKE	Muskrat Is. at Buoy C388	29-Sep-11	2.3
STURGEON LAKE	Sturgeon Point Buoy	5-Jun-11	3.3
STURGEON LAKE	Sturgeon Point Buoy	3-Jul-11	3.6
STURGEON LAKE	Sturgeon Point Buoy	3-Aug-11	2.8
STURGEON LAKE	Sturgeon Point Buoy	6-Sep-11	2.3
STURGEON LAKE	Sturgeon Point Buoy	29-Sep-11	2.2
STURGEON LAKE	S of Fenelon R-Buoy N5	3-Jul-11	3.6
STURGEON LAKE	S of Fenelon R-Buoy N5	6-Sep-11	2.4
STURGEON LAKE	S of Fenelon R-Buoy N5	29-Sep-11	2.6
UPPER STONEY LAKE	Quarry Bay	8-May-11	5.3
UPPER STONEY LAKE	Quarry Bay	6-Jun-11	7.1
UPPER STONEY LAKE	Quarry Bay	4-Jul-11	6.8
UPPER STONEY LAKE	Quarry Bay	4-Aug-11	5.9
UPPER STONEY LAKE	Quarry Bay	6-Sep-11	5.7
UPPER STONEY LAKE	Quarry Bay	11-Oct-11	6.4
UPPER STONEY LAKE	Young Bay	8-May-11	5.7
UPPER STONEY LAKE	Young Bay	6-Jun-11	6.2
UPPER STONEY LAKE	Young Bay	4-Jul-11	6.1
UPPER STONEY LAKE	Young Bay	4-Aug-11	5.6
UPPER STONEY LAKE	Young Bay	6-Sep-11	6.8

UPPER STONEY LAKE	Young Bay	11-Oct-11	6.0
UPPER STONEY LAKE	Crowes Landing	8-May-11	5.5
UPPER STONEY LAKE	Crowes Landing	6-Jun-11	6.6
UPPER STONEY LAKE	Crowes Landing	4-Jul-11	6.5
UPPER STONEY LAKE	Crowes Landing	4-Aug-11	6.0
UPPER STONEY LAKE	Crowes Landing	6-Sep-11	6.4
UPPER STONEY LAKE	Crowes Landing	11-Oct-11	6.7
UPPER STONEY LAKE	Mid Lake, deep spot	8-May-11	5.5
UPPER STONEY LAKE	Mid Lake, deep spot	6-Jun-11	7.0
UPPER STONEY LAKE	Mid Lake, deep spot	4-Jul-11	6.0
UPPER STONEY LAKE	Mid Lake, deep spot	4-Aug-11	6.0
UPPER STONEY LAKE	Mid Lake, deep spot	6-Sep-11	5.7
UPPER STONEY LAKE	Mid Lake, deep spot	11-Oct-11	6.8
WHITE LAKE (DUMMER)	S end, deep spot	30-May-11	5.0
WHITE LAKE (DUMMER)	S end, deep spot	29-Jun-11	5.0
WHITE LAKE (DUMMER)	S end, deep spot	26-Jul-11	4.4
WHITE LAKE (DUMMER)	S end, deep spot	17-Aug-11	4.4
WHITE LAKE (DUMMER)	S end, deep spot	26-Sep-11	4.8
WHITE LAKE (DUMMER)	S end, deep spot	11-Oct-11	4.3

Robin Blake

Cattails by the ice in spring

Appendix G: Glossary

Algae – Simple, one-celled or colonial plant-like organisms that contain chlorophyll and do not differentiate into specialized cells and tissues like roots and leaves. Algae are the basis of the aquatic food web, converting the sun's energy into a form that can be used by all animals.

Anoxic – Depleted of oxygen; in our context this refers to deep areas of lakes that become depleted of dissolved oxygen usually in late summer, a condition that encourages the sediments to release phosphorus into the water.

Aquifer – Underground permeable rock (such as sandstone), gravel and/or soil that contains water; aquifers, often tapped by drilled wells, can extend for many square kilometers.

Benthic – Dwelling on the bottom of a water body, such as a lake or stream.

Biotypes – Genetically distinct groups, strains or lineages within a species of bacteria, plants, etc.; their differences may suggest different geographical origins, among other things.

Blue-green algae – See "cyanobacteria".

Chlorophyll *a* – Green pigment in plants and algae used in photosynthesis; considered a marker for algae when testing water.

Cyanobacteria – A family of algae that are very similar to bacteria; some can produce toxins, notably *Microcystis* and *Anabaena*, which are quite common in Ontario lakes.

***E.coli* bacteria** – Bacteria living in the intestines of warm-blooded animals such as birds, beavers and humans. While most are harmless, a few strains of *E.coli* can cause severe gastrointestinal illness. Drinking water and recreational water are tested for the presence of these bacteria, which may indicate contamination by fecal matter.

Hydrological year – A 'calendar' that corresponds to the different stages of the hydrological or water cycle. It begins on October 1 in the northern hemisphere, when the cycle is in balance; after that, precipitation fills up the underground aquifers until April 1 (mid-year in the cycle), when evaporation begins depleting the reserves, until October 1 when the cycle begins again.

Larvae – In insects (such as milfoil weevils), the grub-like or caterpillar 'childhood' stage that occurs between the egg and pupa stages.

Limiting nutrient – An often scarce but necessary nutrient within the environment that is, as a result, most influential in controlling the growth of a particular organism; it is often noted that phosphorus appears to be the limiting nutrient for algae and aquatic plants.

Nitrogen – A chemical element essential to life, comprising four-fifths of the atmosphere; nitrogen can be available to living organisms through the air, the decay of organic material and animal waste, and it is also, like phosphorus, a common ingredient in commercial fertilizers.

Parts per billion (ppb) – A measure of concentration, used for extremely small quantities, of one substance within another substance. One part per billion of phosphorus, for example, means one unit of phosphorus within a billion units of water, which corresponds to one minute in 2000 years, a single penny in $10 million, or one drop of water in an Olympic-sized swimming pool. For our purposes, micrograms per litre and parts per billion are equal.

Phosphorus – A chemical element that stimulates the growth of terrestrial and aquatic plants as well as algae. Phosphorus comes from atmospheric deposition, from surrounding organic and inorganic soils and certain bedrock types (especially soluble limestone), as well as from decaying vegetation. Much may also be coming from human sources such as agriculture, sewage treatment plants and urban stormwater runoff.

Photosynthesis – In green plants and algae, the process of turning carbon dioxide and water into carbohydrates, using sunlight as the energy source.

Planktonic – Free-floating living organisms in the water, either plant communities (phytoplankton) or tiny animals (zooplankton).

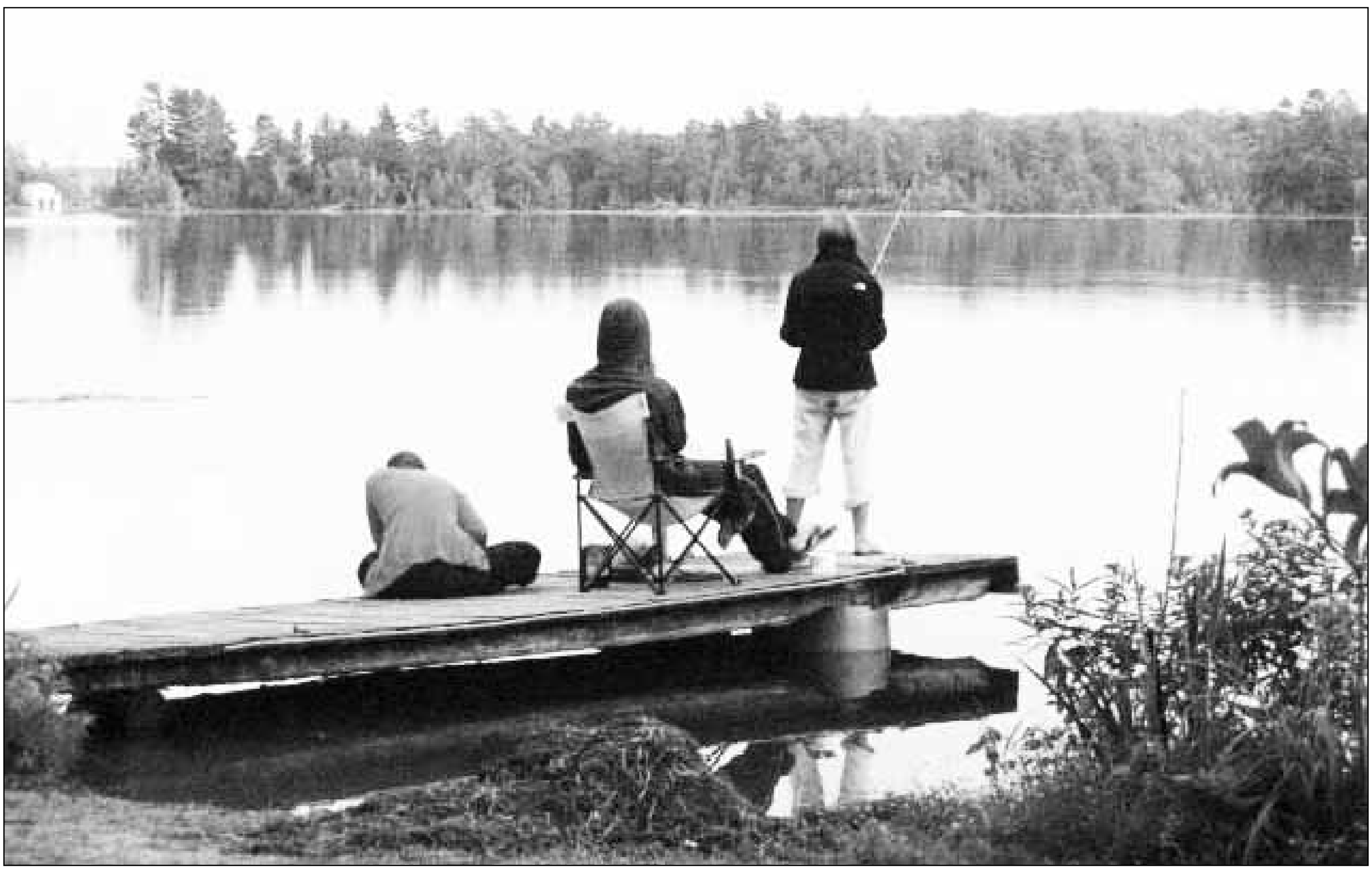
Pupa – The life stage between larva and adult in insects that undergo metamorphosis; the pupa is like a hard shell, protecting the organism as it develops the structures of the adult.

Riparian zone – The 'ribbon of life' connecting water bodies such as streams and lakes with the land; it serves as a transition habitat with functions such as hosting a variety of plants and animals in their life cycles, and shading and cooling nearshore aquatic habitats.

Safe swimming level – The Ontario Ministry of the Environment's stated level of 100 *E.coli* bacteria per 100 millilitres of lake or river water. At that level or higher, beaches are posted as unsafe for swimming.

Watermilfoil – Common aquatic plant in the Kawarthas. There are several varieties, including the native northern milfoil, the exotic Eurasian milfoil and a hybrid between the two. The invasive Eurasian milfoil and the hybrid can grow rapidly and take over certain areas.

Weevil – A small beetle; of the 60,000 species of weevils (some of which are destructive to crops or stored grain), the milfoil weevil is a native species that has specialized in grazing on milfoil; it is now being used to control beds of Eurasian milfoil.



Janet Duval

Sunset fishing after a perfect Kawartha day

Appendix H: Rainfall in the Kawarthas - Summer 2011

This chart shows rainfall at five sites in the Kawarthas during the summer of 2011. Rainfall over 10 mm is in **bold**. Gauge locations are Stony Lake (SL), south Balsam Lake (SB), southwest Sturgeon Lake (SWS), northeast Sturgeon Lake (NES), and Trent University (TU).

	Rainfall, mm							Rainfall, mm				
Date/11	**SL**	**SB**	**SWS**	**NES**	**TU**		**Date/11**	**SL**	**SB**	**SWS**	**NES**	**TU**
Jun25	0	0	0	0	0		Aug1	0	0	0	0	0
Jun26	0	0	0	0	0.3		Aug2	0	0	0	0	0
Jun27	0	8.4	0	**21.8**	0		Aug3	**23.4**	0	0	0	**28.2**
Jun28	7.6	0	0	0	**13.9**		Aug4	0	**52.2**	**51.7**	**42.6**	0
Jun29	0	0	2.5	0	0		Aug5	0	0.4	0	0	0
Jun30	0	**12.2**	0.4	**47.0**	0		Aug6	0	0	0	0	0.6
June Total		89.6	109.5	115.7	51.2		Aug7	3.2	0	0	0	**17.7**
June Avg.					78.9		Aug8	0	1.0	7	0	0
Jul1	0	0	0	0	0		Aug9	0	0	0	4.2	0.5
Jul2	0	0	0	0	4.1		Aug10	1.5	6.4	7.2	7.8	6.6
Jul3	0.5	0	0	0	0		Aug11	0	0	5.6	0	0
Jul4	0	0	0	0	0		Aug12	0	0	0	0	0
Jul5	0	0	0	0	0		Aug13	0	0	0	0	0
Jul6	0	0	6.2	1.5	1.2		Aug14	0.6	0	0	0	**10.0**
Jul7	0	1.8	0	0	0		Aug15	0	0	0	0	9.4
Jul8	0	0	0	0	0		Aug16	0	0	0	0	0
Jul9	0	0	0	0	0		Aug17	0	0	0	0	0
Jul10	0	0	0	0	0		Aug18	0	0	0	0	--
Jul11	0	0	0	0	0		Aug19	0	0	0	0	0
Jul12	0	0	0	0	0		Aug20	4.7	0	0	0	0.4
Jul13	0	0	0.4	0.6	0		Aug21	3.5	0	0	0	5.3
Jul14	0	0	0	0	0		Aug22	1.5	0	0	0	0
Jul15	0	0	0	0	0		Aug23	0	**19.5**	**20.7**	**18.2**	0
Jul16	0	0	0	0	0		Aug24	5.9	0.2	0	0.2	**14.5**
Jul17	0	0	0	0	0		Aug25	0	2.0	0	0	1.0
Jul18	**27.6**	**13.4**	**14.6**	**17.4**	**19.6**		Aug26	0	0	7.9	0	0
Jul19	0	0	0	0.4	0		Aug27	0	0	0	0	0
Jul20	0	0	0	0	0		Aug28	0	0	0	0	0
Jul21	0	0	0	0	0		Aug29	0	0	0	0	0
Jul22	0	0	0	0	0		Aug30	0	0	0	0	0
Jul23		0	0	0	0		Aug31	0	0	0	1.4	0
Jul24	0	0	0	0	0.4		**Aug Total**	44.3	81.7	93.1	74.4	94.2
Jul25	**34.4**	**51.9**	**48.6**	**35.8**	**25.5**		**Aug Avg.**					91.6
Jul26	0	0	2.7	3.8	4.0		Sep1	0	0	0	0	0
Jul27	0	0	0	0	0		Sep2	0	0	0	0	0
Jul28	0	0	0	0	0		Sep3	0	0	0	0	0
Jul29	**37.9**	**30.0**	**40.5**	**31.6**	**26.5**		Sep4	4.4	0	0	0	0
Jul30	0	0	0	0	0		Sep5	8.2	0	0	0	0
Jul31	0	0	0	0	0		Sep6	0	**21.6**	**40.8**	**20.7**	**11.6**
July Total	104.9	97.3	104.1	91.0	93.8		Sep7	0	0	0	0	0
July Avg.					68.4		Sep8	0	0	0	0	0
							Sep9	0	0	0	0	0

KLSA Spring and Fall Meetings Coming Up!

KLSA's spring meeting will be held on:

Saturday, May 5, 2012, 10 a.m.
Buckhorn Community Centre, 1801 Lakehurst Road, Buckhorn

A highlight of the spring meeting will be a presentation by Dr. Emily Porter-Goff on the two-year study of Algae in the Kawartha Lakes, supported by an Ontario Trillium Foundation grant.

KLSA's Fall Annual General Meeting will be held on:

Saturday, October 6, 2012, 10 a.m.
Lakehurst Community Hall, Lakehurst

The Annual General Meeting will include the election of the Board of Directors.

For further information, visit klsa.wordpress.com

We hope to see you at these meetings!

Bring your questions and comments! Bring your neighbours!

Find us on Facebook. What's new on your lake?
Share your findings; learn what others are doing.

Appeal to Readers

You can make a difference in this world

How? Pick an organization that's working for something you care about, and support it. KLSA cares about the future of our precious lakes. We hope you do too. Will you help? This year, KLSA is studying:

- **Algae** in the Kawartha Lakes
- A weevil that attacks **milfoil**
- Effluent from Kawartha **sewage treatment plants**
- And, as always, *E.coli*, phosphorus and turbidity in our lakes

Everything we learn is shared with the public in free print publications, online and at public events. Completely run by volunteers, KLSA provides excellent value for every dollar it receives and gratefully acknowledges every donor.

Please clip and mail to KLSA

❒ Here's a donation of $________

❒ This gift is from my business, or from my cottage or road association. (Cheque to KLSA.)

Personal donations of $40 or more qualify for a charitable tax receipt, issued by our friends at The Stony Lake Heritage Foundation. Individual donors please tick one box below:

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